

PROCEEDINGS OF THE
ATLANTIC STATES MARINE FISHERIES COMMISSION
ATLANTIC MENHADEN MANAGEMENT BOARD

The Westin Crystal City
Arlington, Virginia
February 5, 2020

Approved May 5, 2020

Proceedings of the Atlantic Menhaden Board Meeting February 2020

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INDEX OF MOTIONS

1. **Approval of Agenda** by Consent (Page 1).
2. **Approval of Proceedings of October 2019** by Consent (Page 1).
3. **Move to accept the Atlantic Menhaden single species, ecological reference points, and peer review reports for management use** (Page 25). Motion by Spud Woodward; second by Malcolm Rhodes. Motion carried (Page 25).
4. **Main Motion**
Move to adopt:
 1. **An Atlantic Menhaden ecological reference point F target equal to the maximum F on Atlantic menhaden that maintains Atlantic striped bass at its biomass target when striped bass is fished at its F target and all other ERP species as defined in the NWACS-MICE model are fished at their status quo F rates.**
 2. **An Atlantic Menhaden ecological reference point F threshold equal to the maximum F on Atlantic menhaden that maintains Atlantic striped bass at its biomass threshold when striped bass is fished at its F target and other ERP species as defined in the NWACS-MICE model are fished at their status quo F rates** (Page 29). Motion by Allison Colden; second by Cheri Patterson. Motion postponed.

Motion to Postpone (Page 31)
Move to postpone until after completion of the following task: task the Ecological Reference Points Workgroup with the following analysis to better understand the parameters and outputs of the example ERP. The Work Group is asked to present this analysis at the May ASMFC meeting.

 1. **Using the existing example ERP framework, modify the assumptions on the other species such that they are fished at their F-target as opposed to F2017. Reproduce figures 144-148.**
 2. **Using the existing example ERP framework, modify the assumptions on the other species such that they are fished at their F-threshold, as opposed to F2017. Reproduce figures 144-148.**
 3. **Using the existing example ERP framework, modify the assumptions on the other species such that bluefish and herring are fished at their F-target while spiny dogfish and weakfish are fished at their F-2017. Reproduce figures 144-148.**

Motion by Megan Ware; second by John Clark. Motion carried (Page 39).
5. **Motion to adjourn** by Consent (Page 39).

ATTENDANCE

Board Members

Megan Ware, ME, proxy for P. Keliher (AA)	John Clark, DE, proxy for D. Saveikis (AA)
Stephen Train, ME (GA)	Roy Miller, DE (GA)
Sen. David Miramant, ME (LA)	Craig Pugh, DE, proxy for Rep. Carson (LA)
Cheri Patterson, NH (AA)	Lynn Fegley, MD, proxy for B. Anderson (AA)
Ritchie White, NH	Russell Dize, MD (GA)
Dennis Abbott, NH, proxy for Sen. Watters (LA)	Allison Colden, MD, proxy for Del. Stein (LA)
Nichola Meserve, MA (Chair)	Ellen Bolen, VA, proxy for S. Bowman (AA)
Raymond Kane, MA (GA)	Bryan Plumlee, VA (GA)
Sarah Ferrara, MA, proxy for Rep. Peake (LA)	Pat Geer, VA, proxy for Sen. Mason (LA)
Conor McManus, RI	Steve Murphey, NC (AA)
Eric Reid, RI, proxy for Rep. Sosnowski (LA)	Jerry Mannen, NC (GA)
Justin Davis, CT (AA)	Mike Blanton, NC, proxy for Rep. Steinburg (LA)
Bill Hyatt, CT (GA)	Mel Bell, SC, proxy for R. Boyles (AA)
Jim Gilmore, NY (AA)	Malcolm Rhodes, SC (GA)
Emerson Hasbrouck, NY (GA)	Spud Woodward, GA (GA)
John McMurray, NY, proxy for Sen. Kaminsky (LA)	Doug Haymans, GA (AA)
Joe Cimino, NJ (AA)	Jim Estes, FL, proxy for J. McCawley (AA)
Russ Allen, NJ, proxy for T. Fote (GA)	Martin Gary, PRFC
Adam Nowalsky, NJ, proxy for Asm. Houghtaling (LA)	Derek Orner, NMFS
Kris Kuhn, PA, proxy for T. Schaeffer (AA)	Mike Millard, USFWS
Loren Lustig, PA (GA)	

(AA = Administrative Appointee; GA = Governor Appointee; LA = Legislative Appointee)

Ex-Officio Members

Amy Schueller, Stock Assessment Subcommittee Chair Matt Cieri, ERP Workgroup Chair
Michael Jones, MSU, Peer Review Panel Chair

Staff

Bob Beal	Katie Drew
Toni Kerns	Sarah Murray
Max Appelman	Kristen Anstead
Maya Drzewicki	

Guests

Karen Abrams, NMFS	Tony Friedrich, ASGA	Carl Lobue, TNC
Fred Akers, Great Egg Hbr, NJ	Pat Geer, VMRC	Chip Lynch, NOAA
Bill Anderson, MD DNR	Shaun Gehan, Gehan Law	Shanna Madsen, VMRC
Benson Chiles, Chiles Consult.	Angela Giuliano, MD DNR	Chris Moore, CBF
Matt Cieri, ME DMR	Joseph Gordon, PEW Trusts	Patrick Paquette, MSBA
Josey Cline, ASA	Zak Greenberg, Pew Trusts	Jim Rogers, VA
Jeff Deem, VMRC	Pam L. Gromen, Wild Oceans	Howard Townsend, NOAA
Kelly Denit, NMFS	Pete Himchak, Omega Protein	Mike Waine, ASA
Chris Dollar, TRCP	Jeff Kaelin, Lund's Fisheries	Kate Wilke, TNC
Paul Eidman, Menhaden Def.	Aaron Kornbluth, Pew Trusts	

The Atlantic Menhaden Management Board of the Atlantic States Marine Fisheries Commission convened in the Jefferson Ballroom of the Westin Crystal City Hotel, Arlington, Virginia; Wednesday, February 5, 2020, and was called to order at 8:30 a.m. by Chairwoman Nichola Meserve.

CALL TO ORDER

CHAIRWOMAN NICHOLA MESERVE: We have a three and a half hour agenda in front of us today. First, some introductions. I'm joined by an All-Star team up here this morning. For the Commission staff we have Max Appelman, Dr. Kristen Anstead and Dr. Katie Drew, and Sarah Murray.

We also have Dr. Amy Schueller as the Chair of the Menhaden Stock Assessment Subcommittee, Dr. Matt Cieri the Chair of the ERP Workgroup, and Dr. Mike Jones, Chair of the Peer Review Panel.

APPROVAL OF AGENDA

CHAIRWOMAN MESERVE: We'll look first to our agenda for approval. Are there any changes to be made to the agenda this morning?

Seeing none we'll consider that approved.

APPROVAL OF PROCEEDINGS

CHAIRWOMAN MESERVE: Up next are our proceedings from the October, 2019 meeting. Are there any modifications to be made to the proceedings? Seeing none we'll consider those approved as well.

PUBLIC COMMENT

CHAIRWOMAN MESERVE: Moving on to public comment. This is an opportunity for members of the public to comment on items that are not on the agenda today.

2019 SINGLE-SPECIES AND ECOLOGICAL REFERENCE POINT BENCHMARK STOCK ASSESSMENT AND PEER REVIEW REPORTS

CHAIRWOMAN MESERVE: Not seeing any hands in the audience we will move on to Item 4, the 2019 Single-Species and Ecological Reference Point Benchmark Stock Assessment and Peer Review Reports. There is one and a half hours for the presentations today. Each of the presenters, there are three, have been asked to try to stick to 20 minutes for their presentation, allowing for an additional ten minutes of Q & A.

After that this is an action item, so at the end of the presentations we will be looking for the Board to consider a motion to accept the 2019 assessments for management use. Before launching into Dr. Schueller's presentation, I would like to take a minute to provide the Board's deep appreciation to the many individuals that helped bring us to this point today, where we are potentially on the precipice of advancing the way we manage this important forage species.

In doing so, they have steered through waters previously uncharted by the ASMFC, and it has required a tremendous amount of work as documented by the 1,251 pages of the two combined stock assessments.

OVERVIEW OF SINGLE-SPECIES ASSESSMENT

CHAIRWOMAN MESERVE: We thank you for that and I'll now pass it over to Dr. Schueller to begin with the Single-Species Stock Assessment.

DR. AMY SCHUELLER: Good morning everybody. I'm going to walk through the Single-Species Assessment, trying to keep this brief, so it will be a rather quick whirlwind through the Single-Species Assessment this morning. I'm going to talk about the data that were used in the assessment, the major changes from the last assessment, the basics of the assessment itself, and then talk about stock status and future directions.

Just a basic run through of the data that were used for the assessment for life history information, for maturity we used the historical maturity data from the fishery dependent database, which was what was used for the last stock assessment. For natural

mortality we used an age-varying yet time-constant value.

This was a change for this assessment in that we scaled this estimate to some new values from some tagging data that were reanalyzed. Growth was estimated from the fishery dependent data. This is the same as what was done for the last assessment, and then fecundity information was updated based on some work that has come out of Rob Latour's lab, where they did some histological work to actually look at the fecundity of Atlantic Menhaden.

Also included in the data were the landings and age compositions for the reduction and bait fisheries. On this figure is reduction landings in thousands of metric tons in the gray bars, and the black line is the bait landings in thousands of metric tons. They each have their own respective axis.

Forty-nine fishery independent surveys were considered for this assessment from up and down the coast. These surveys were not specifically designed to sample menhaden, but were useful for menhaden, and I put in here potentially for other assessments. In order for the surveys to meet the threshold to be used they needed to meet specific criteria. Those are listed in the stock assessment document, but included things such as having a long enough time series, catching menhaden frequently, things like that.

These datasets that then made it through the criteria were used to create standardized indices. These indices accounted for differences in catchability due to factors such as time of year, or environment, et cetera, et cetera. A total of five indices were used in this stock assessment. The first on the top there in green is the young-of-the-year or recruitment index.

This is the recruitment index that we've used for several years in this assessment. The other one on that top graph is a MARMAP and EcoMon, it's a broken time series, so it's in blue

and orange. This is an ichthyoplankton survey, and this was matched with the spawning stock biomass, which is in fecundity for Atlantic menhaden. Then there are three on the bottom. Those three on the bottom all had associated length composition information, catch size information, and so these each represent a different segment of the population.

The red one is the SAD, Southern Adult Index, and that one is Age 1 index. The MAD, which is the middle one – that sort of grayish one – a Mid-Atlantic, Virginia, and Maryland Index, and that mostly represented Ages 2 and 3. Then there is the Northern Adult Index in orange there, and that was an index that had logistic selectivity, so our oldest ages are represented there. Major changes from the last assessment, two in particular, the first is the natural mortality. I've already mentioned that it is time constant but age varying here, which is exactly how it was set up for the last assessment. The big difference is that it was scaled to a value based on a reanalysis of the historical tagging data. There are two papers out by Liljestrang et al that detail that work, basically looking at tagging data with over a million tags and 100,000 recaptures, so a huge tagging study to look at, movement rates but also natural mortality.

The second major change for the assessment was for fecundity, and as I've mentioned this is work that came out of Rob Latour's lab. What they've determined based on histology is that Atlantic menhaden are indeterminate batch spawners, spawning every few days, and so they are creating eggs throughout the season and spawning throughout the season.

The fecundity estimates have increased quite a bit based on this new work. I should mention that that is very similar, or it is similar to Gulf menhaden and another menhaden species in Brazil that also demonstrate that indeterminate batch spawning. Other major changes for this assessment from the last one, there were two new fishery independent indices of relative abundance.

The Mid-Atlantic Adult Index or the MAD was included this time, in addition to the MAD and the SAD. Then we also had the inclusion this time of the MARMAP EcoMon Ichthyoplankton Index, with respect to fitting

to fecundity. A couple other changes, these are modeling changes more rather than data changes.

The first is a new likelihood component type was used for the multinomial data. In particular a Dirichlet multinomial was used, which allows for accounting for correlations in the composition data, but is weighted internally in the model rather than externally. We also had comments at the last review about the way we're looking at uncertainty analyses, and so this time we did our MCB, our Monte Carlo Bootstrap Analysis, which you guys have seen a number of times.

We did in addition to that an MCMC, a Markov Chain Monte Carlo Analysis, and that was just to look at different types of uncertainty across the different analyses. It gives some indication, each of them accounts for a different type of uncertainty, and so you can say if we're accounting for this type this is what the envelope looks like. If we're accounting for this type this is what it looks like.

That is detailed in the report if you want further information. Then the last change I'm going to bring up is how recruitment was forecasted in the projections. For this assessment we used a nonlinear time series analysis method, and basically it's a state space method looking at where recruitment has been.

In our year we're in now, where has recruitment been that has been similar in the past, and where did it go in the future from there and so predicting based on a state-space manifold. This is put in there. It still has quite a bit of uncertainty, but it's a little bit less than using the median with some deviations, which is what we've used in the past.

Basics of the assessment, base run I'm going to fly through this. Data were split into northern and southern regions. This was done for the last assessment. This helps us account for migration, fishery dynamics, and a tagging data. It better accounts for the population dynamics

of the species and for the fishery removals over time, meaning that the fleets are broken into the north and the south, and they have different age compositions, and so they are harvesting different ages. Here is a time series of recruitment that comes out of the assessment. This is recruitment in billions of fish over time.

Of course there is one big age class in 1958, which is one that we see all the time with this species, if you're familiar with it. As we run through this there has been three age classes that are larger in 2010, 2015, and 2016, and then 2017 is lower. This is biomass Age 1 plus in thousands of metric tons over time.

Started off, this assessment starts in 1955, so the beginning years of this had a higher biomass. We saw decline, especially after that 1958 year class is moving through, and then since then increasing. In the more recent years our values are similar to what was seen in the fifties in this assessment.

This is abundance numbers in billions of fish over time. The individual colored bars represent individual ages, and so red here which is the largest proportion of the numbers is Age 0, which we would expect, and then goes down from there through Ages 1 through 6 plus. This model is a 0 to 6 plus model.

I would say the thing that sticks out here again is that 1958 year class is that biggest bar, and then I would say that years more recently like 2010, 2015, and 2016 are similar to levels that we saw in the seventies and eighties. That was my run through the base run real quick. I'm going to talk about how uncertainty was characterized really quickly in the next couple slides.

The Stock Assessment Subcommittee did several sensitivity runs. These runs are not necessarily considered alternative states of nature; rather they are used to assess the impact of assumptions made on the model. Some examples of these runs included runs where we changed what the fishery selectivity looked like.

The fishery selectivity for the base run is dome shaped, and we ran sensitivity runs with a flat top or asymptotic selectivity. We looked at inclusion of indices, and so basically taking an index out one at a

time to look at what the impact of that particular index is on the results of the assessment.

Just to add onto this, we also did sensitivity analyses to look at natural mortality and fecundity, which were two of the major changes for this assessment. In general the stock status was robust to model assumptions. What I mean by that was the stock status was the same as the base run. In addition to the sensitivity runs we also did the Monte Carlo Bootstrapping. This accounted for uncertainty in the model assumptions.

Specifically, I have such as here in natural mortality, but specifically we included uncertainty in natural mortality and uncertainty in fecundity. The end result there was the stock status was the same as the base run. An MCMC, the Markov Chain Monte Carlo was also run, and this accounted for uncertainty in model parameter estimates, and again the stock status was the same as the base run here. Okay stock status. Currently so in this assessment we're using the benchmarks from the last benchmark assessment and so the threshold is the maximum geometric mean fishing mortality during 1960 to 2012. It's a historical reference point. Then the target is the median geometric mean F during 1960 to 2012. These were intended as interim reference points, and moving forward towards ecosystem reference points, which Matt will be talking about in just a little bit here, and I'm sure you will all be talking about today and into the future.

This is a figure of the stock status related to the geometric mean fishing mortality rate, which is the black line here. The F threshold is the blue line, which is at 0.60, and that is that maximum geometric mean fishing mortality rate for 1960 to 2012. Then the orange line here is the F target, and that value is 0.22. That is that median geometric mean fishing mortality rate for Ages 2-4 during that time period.

Then I put F of 2017 that is the terminal year of the stock assessment. On here we're at 0.11, so we're below both the threshold and the target. This is the alternative fecundity-based reference point, and so these are the reference points associated with an F based reference point. The blue line is the fecundity threshold associated with F threshold.

The orange line is the fecundity target associated with the F target. Those values are in eggs there, and the 2017 fecundity value is 2,601,550, and I think this is in billions of eggs or something quadrillions. There are more zeros; we just didn't include them all. But what I want you to note here is that in the most recent years we have been above the threshold and bouncing around the target, and in 2017 we are above the target.

The stock status is not overfished and overfishing not occurring. The reference points were based on those historical performance reference points for the fishery. The sensitivity analyses and the uncertainty analyses that were run, in order to see if our assumptions impacted stock status, were robust and showed the same stock status as that of the base run.

Future directions, the Stock Assessment Subcommittee is generally asked what they think the timing of the next assessment should be, and so what we've traditionally put in here is an update in three years and a benchmark in six years. We also made several research recommendations, and in the past I've gone through these before. But in the interest of brevity I've shortened this here, and basically am going to say that there are several recommendations on data collection and assessment methodology in the document.

Some of those include things like looking at the adequacy of the sampling for the bait fishery composition data, doing MSE work, management strategy evaluation work, or a fishery independent survey for Atlantic menhaden, a coastwide adult one, which is our similar recommendations that we've made in the past. Then I put in here, so future directions. I put dependent upon the Board and ERPs, so we will wait to see what happens today and into the future. With that I have my questions slide.

CHAIRWOMAN MESERVE: Thank you, Dr. Schueller. Are there questions about the Single-Species Assessment? Dr. Davis.

DR. JUSTIN DAVIS: I wanted to ask a little bit about the method you mentioned for forecasting recruitment, the nonlinear time series method, and talk a little bit about how exactly that was used, how that is a deviation from how we've forecasted or handled recruitment in the past, and what some of the implications of that might be.

DR. SCHUELLER: Sure, so the way we've handled forecasting recruitment in the past is to use a median recruitment value from the time series, and then to select deviations from that. The uncertainty bounds on that were quite large. If you've been here and seen projections you know that those recruitment forecasts were broad. This go around, we used the nonlinear time series analysis. There is a paper by Ethan Deyle that is available if folks want to look at it.

It's basically saying if I am in this state space for my recruitment, what has happened historically and where did that go? It's basically saying if I'm here my expectation is to go here, or my expectation is to go either up or down or stay steady. It's giving a little bit more information on where we would actually expect recruitment to go, and we looked at how well it was forecasting recruitment by taking our recruitment time series, and then predicting each year of the last ten years, and then comparing it to where we actually were.

There is a figure in the report to demonstrate how well it did at predicting. There is no uncertainty around either of those lines in that figure, but I think if you take a look at it you'll see that it does a fairly good job predicting. It does narrow the uncertainty bounds for the recruitment predictions a little bit, not a ton, but some.

CHAIRWOMAN MESERVE: John Clark.

MR. JOHN CLARK: Thank you for the presentation, Dr. Schueller. We all received an e-mail about the natural mortality used in this, and I noticed in the summary it was mentioned that the natural mortality used in this assessment was much higher than used in the previous assessment. Could you just go over a little bit about why you used this, and whether it did have any impact on the results?

DR. SCHUELLER: The natural mortality rate this time around was based on a reanalysis of the historical tagging data. There is a large historical tagging dataset that was done in the late sixties, where the Beaufort Lab tagged over a million fish, and then they recaptured those fish, so it's a mark/recovery model.

It was done at a time where models such as the Brownie Mark Recovery Models weren't even available, so talking late sixties early seventies, and so those models didn't really come onto the scene until the late eighties. But nobody had picked those data back up and reanalyzed them with new techniques, and so that was what was done.

In addition to that Emily looked at how well we were actually able to estimate natural mortality from the data, because sometimes you model things and you think, oh I can really estimate this, but you're not doing such a great job. What she did was she looked at that and she was able to estimate it, so it was giving a good estimate. The value is higher than what we've used in the past. It is for; we've scaled it to Age 1.5. It increases, basically it's a scalar. Natural mortality is a scalar. If you looked at recruitment levels for this assessment versus the last assessment, you would notice the recruitment is higher this time on average. That is because of the natural mortality, and that is demonstrated in the sensitivity run that's in the assessment report. Anybody can feel free to add into that if they would like.

DR. KATIE DREW: I think the comments about natural mortality, it's certainly something that we took seriously and we've considered, because it is a change and it has an impact on the assessment. I think if you compare this to literature values or meta-analysis of other species it looks very different, but it's actually I think it's based on empirical data.

As Amy said, one of the largest and most comprehensive tagging studies ever conducted on the Atlantic Coast, and this is one of the few species that we do have an empirical value of M for. The Stock Assessment Subcommittee and the ERP Workgroup felt that this empirical value of M was a better estimate than a meta-analysis of a whole range of different species or literature, so it is essentially for other species it's better to use actual empirical data that we have on this species.

In addition, it's not that outrageously different from some of the answers you might expect, depending on how you pick and choose your life history or meta-analysis choice. I think the Stock Assessment Subcommittee recognized that this is a big change, and it is significantly different from some other species, but we felt this was the best available data for that.

CHAIRWOMAN MESERVE: Mel Bell.

MR. MEL BELL: Just following up on what both of you all just said. Would you say that you have a high degree of confidence in this natural mortality, as maybe previous natural mortalities? In other words, is your confidence on a scale of 0 to 5, do you guys rate it pretty high?

DR. SCHUELLER: It's best available science, and it's a huge tagging study. It's one of the biggest, if not the biggest in the world.

DR. DREW: I guess much more confidence than in alternative options for picking M for this species, so yes.

CHAIRWOMAN MESERVE: Lynn Fegley.

MS. LYNN FEGLEY: Just to follow on John Clark's question. With the high natural mortality that would lend itself to a recruitment-driven stock. Somewhere in the material, in these 2,000 pages, I think it was in a peer review. There was a commentary that because of the high natural mortality and this

recruitment driven nature that it's going to make it a lot harder.

Your projections are going to be a little more difficult, and they encourage the use of empirical methods to supplement monitoring stock status. I wondered if you could speak to that a little bit, and just understanding your confidence with the M rate. What is our confidence in the stock status that we're projecting, and do you think it's worth looking into empirical methods as well?

DR. DREW: Yes you are correct. That is certainly one of the comments that the Peer Review Panel made, and it's something we've seen with menhaden even before this is that this is a very fecund, a very prolific spawner. You have a ton of recruitment, but you also have a ton of natural mortality, which is what you would expect for a forage species.

Your ability to project out beyond say the couple of years that that year class makes up in the fishery, you're also operating on a very small number of year classes within that fishery, makes long term projections more complex. If you're trying to evaluate status it really does benefit the species to do frequent assessment updates to try and monitor the situation, and make sure that you're not basing management on 10 or 15 years- worth of projections.

CHAIRWOMAN MESERVE: Roy Miller, I believe I saw your hand.

MR. ROY W. MILLER: I wondered if I could just follow up a little bit on the previous discussion. Many or most of us received this e-mail late last week, without a lot of time to react to it from Dr. Jerald Ault at University of Miami. I assume that everyone up front also received the e-mail. Is there anything in that e-mail that should concern us, because if we took it at face value then he said we overestimated natural mortality, and in turn underestimated fishing mortality by subtraction. I just wondered if we can put that to rest, or if it is still a concern.

CHAIRWOMAN MESERVE: Staff is suggesting that we defer that question to part of the Peer Review Panel's response, so we'll take that up again, Roy. Are there

additional questions about the Single-Species Assessment? Thank you, Dr. Schueller.

OVERVIEW OF THE ECOLOGICAL REFERENCE POINT ASSESSMENT

CHAIRWOMAN MESERVE: We'll move on to Dr. Cieri and the overview of the Ecological Reference Point Assessment.

DR. MATT CIERI: My name is Matt Cieri; I'm with the Maine Department of Marine Resources, and I'm also the Chair for the Ecological Reference Points Working Group. Sorry I can't see the slide behind me without craning my neck, so if I'm off a slide just let me know. I'm just going to give you sort of an outline of where we're going today.

We're going to talk first about some introductory material. We're going to get into some of the model outputs and inputs. We're going to do some comparisons among the models that we examined, and then we're going to look in depth at this NWACS MICE tool, including some example ecological reference points.

We're going to give you some management advice. We're going to wrap it up with a summary and then some questions, just to give you guys a sort of preview of where we're heading today. Before we start off I really want to highlight the number of people that have worked on this project over the last few years.

Chances are, if you're a state director and you have a staff person you haven't seen for a while, he's been locked in the ASMFC meeting room in Arlington for weeks and weeks and weeks. It's been a concerted effort by a lot of different people. I'm not going to go through every single one of the terms of references. You guys have seen them, they're pretty lengthy. I am going to sort of go through two in particular that sort of framed our modeling as we've moved forward. The first was to develop models that take into account menhaden's role as a forage fish, and the second was to develop some methods that account for Atlantic

menhaden's role as a forage species. To accomplish this we used a suite of different models ranging from fairly simplistic to probably overly complex in examining the questions that were before us. These included things such as a surplus production model with a little bit of time-varying R.

A Steel-Henderson approach, which looked at surplus production in light of a striped bass index, a multi-species statistical catch at age, which was Jay McNamee's most of his like dissertation, to give you some context, and two ecopath/ecosim models, the NWACS models, including a MICE model and a full model.

The full difference between the two, both the NWACS MICE and the NWACS full is that one has a reduced set of predators and prey in it. The full model is a 96 pool model that covers everything from cod to skate to lots of other things up and down the U.S. east coast. We basically stripped down the full model to look at a more intermediary model that allowed us to do things more on the management timeframe.

We're going to talk about some model comparisons, including how do we take a look at each one of these models, how do we compare them? How do we make decisions based around them? The two criteria that we really looked at probably the hardest was model performance, how well do they line up in terms of biomass and exploitation, as well as how were they at basically giving you the answers that you want to your questions. You know what is their utility for management?

Before we get into the scary details of all of this stuff, I'm going to go through and basically give you a spoiler alert. The ERP Working Group recommends a combination of using this ecopath/ecosim NWACS model and the BAM model, to provide management advice moving forward on ERPs.

I'm going to talk a little bit about model input and outputs. The ERP Working Group identified a subset of ERP species to incorporate in this model. Basically we looked at a number of different important prey and predators within the ecosystem, the ones that are probably the most relevant for the questions that you

guys have at hand. It's important to note that not all models used all species.

For example that ecopath/ecosim model that I was talking about earlier. That full one had 96 pools. It had a whole bunch of different species that you guys probably aren't directly interested in when discussing menhaden. There are some models that don't use any of these predators information, simply because that is not the way they're structured.

That would be surplus production with time varying R for example. Some data were used in some models and not in others because of structural reasons. But our ERP species that we were looking at for most of the modeling approaches include two prey items, menhaden and Atlantic herring, predator species including bluefish, spiny dogfish and striped bass, as well as weakfish.

All of these species fortunately enough were benchmarked or update within 2017, so we had data that was readily available. It's nice when things actually work out. Just in case you're unfamiliar with where some of these species are in terms of their stock status. Striped bass as you know, was high in like the early 2000s to mid-2000s and has since declined over time. Bluefish saw a period where they were highly variable, but at least relatively high biomass through the 2010s, and has since declined. Spiny dogfish during the 2000s was at a low point has since rebuilt in the early 2010s, but has some hint of declining since. Weakfish has just pretty much been at a low stock size for the last few years. In going through each of the comparisons of each of our models, the interesting thing to note is that we have along the Y axis we have Age plus 1 biomass.

Along the X axis we have years. In black with the gray envelope is the single-species model, the BAM model and its estimate of plus 1 biomass. We also have a number of various modeling approaches that we used, and those include the EwE or the NWACS models, the full models, the stripped down version, the MICE

model, the multispecies statistical catch at age model, the VADER model, as well as our two surplus production approaches.

The takeaway message here is that believe it or not, all of them are pretty much in line. They all give us roughly the same answers, usually within the same scale. There are some differences, but as you can see, some of those differences are fairly minor, especially considering the uncertainty enveloped around the BAM single-species approach.

Likewise for exploitation rate, most of the exploitation rate since the 1980s has roughly been in line. There are some outliers earlier in the year, and we have to sort of remind everyone that the surplus production models generally tend to use a different dataset associated with them. Most of the multispecies models don't even start until the eighties, or a good portion of them, simply because they don't have any predator species in them, until we actually ended up getting MRFSS data.

The other way we sort of compared models back and forth was to look at the model performance. These include estimates of exploitation and biomass in ERP models. They are similar to each other. This isn't really surprising. Most of the models were using the same datasets among them, so it's good that they all give us roughly the same answer, and in fact for some of the ecopath/ecosim, some of the NWACS models, they actually use the output from the BAM single species as input to their approaches.

CHAIRWOMAN MESERVE: We're just going to take a two minute pause or so, I think there is a disconnect between the presentation that Dr. Cieri is working off of and what's being presented on the screen, so we're just going to make sure we're all on the same page.

(Whereupon a recess was taken.)

CHAIRWOMAN MESERVE: All right, intermission is over, we're ready to proceed. We're all looking at the same thing now, so turning it back to Matt.

DR. CIERI: This is what happens when you e-mail a presentation at 9:30 at night to staff. If you guys remember back in 2015, we had an Ecological

Management Objectives Workshop, in which you guys and stakeholders and other members of the public came together to sort of give us some direction as to where you guys wanted to go with ecosystem-based fisheries management. One of the things that you came up with were some fundamental objectives, and these included things such as sustaining menhaden to provide for fisheries, sustain menhaden for providing for predators, provide stability to all types of the fisheries, and to minimize the risk of sustainability due to changing environment or changing climate.

I will add in that one of the things I think is important that the group thought was important was that if we developed a tool to accomplish some of these things that that tool would be updated in a timeframe that you guys need for management. It's not really useful if it takes us five or six years to update a model, and you want to start sending yearly quotas, for example.

When comparing our models against your management objectives, I know you guys probably can't see most of the stuff on this slide. But along the top there are your fundamental objectives, including sustain menhaden to provide for predators, sustain menhaden for providing for fisheries, et cetera, et cetera.

You'll notice that two of the models, the VADER model, the statistical catch-at-age approach, and the NWACS model, the EwE model hit most of the boxes. They hit most of the things that you guys want measured, and address most of the concerns that you guys have, at least according to the EMO workshop.

You'll notice that none of the models do a really good job with environmental change, and that's simply because that hasn't been incorporated yet. For addressing management objectives, the VADER and the NWACS models were the only models that really provided feedback, or were capable of providing feedback on where

the predator populations were in response to menhaden.

But only the EwE approaches as currently formulated allow you to look at the menhaden population and its effect on the predator population, rather than just the removals by the predators on the prey, so as a two-way street. In providing management advice, this EwE approach allows us to explore the effects of menhaden harvest on the predator population.

However, the single species model is just better in capturing the dynamics, particularly short term of Atlantic menhaden. It has the ability to look at things such as selectivity, changes in fleet behavior, as well as recruitment pulses that you simply just don't get from a EwE or an NWACS approach.

Because the full EwE model is such a bear, in fact if you wanted it up there we would have had to have started last week. We decided to remove all but the most important predators and prey in the system, to give a sort of streamlined or a stripped down version that would allow you to make management decisions in a timely way.

Based on the comparisons between that full EwE NWACS full model, striped bass were reasonably good proxy as a sensitive group within that stripped down model. Given all that information, we're going to recommend moving forward with this EwE NWACS approach, as well as a single-species approach as a combined tool for providing management advice to you guys as you move forward for ERPs. Well, let's take a look at what this tool really is and how it works, as well as some examples. The first thing to start off with is that there is no right answer for targets and thresholds for Atlantic menhaden, in a sort of ecological context. Where you want your menhaden to be will depend on where you want your predator population to be.

Where do you want the predator population to be as well as the fisheries that are associated with them? The NWACS MICE model can illustrate the tradeoffs between menhaden F and predator biomass and predator F. Let's get in what we lovingly call the rainbow plot that we've been using. I know you guys

have probably had handouts to that effect with this figure on it.

What I want to sort of guide you through is that we have striped bass F on the Y axis going up, menhaden F on the X axis moving along. Darker colors basically are more striped bass, the purples and the blues moving to red, which are less striped bass is a good way of thinking about it. For each menhaden F and striped bass F there is a point, and this point actually ends up coming up into a line when you think about it.

You've got two lines on there, in one at biomass threshold. Basically this is your striped bass threshold level as currently stated in its FMP. Then you have its target. If you look at where you are with striped bass now, right there, what you'll see is across that entire horizon of menhaden F that you're not anywhere near your – well you're a little bit close to your B threshold – but nowhere near your B target for striped bass.

You also notice that there is no menhaden F that will get you to your B target, even if you set menhaden F to 0. Hopefully you guys are all with me, if you continue to fish at F at 2017. If you move striped bass F to its target level in this line, you'll see that you can actually achieve both your B target and your B threshold. Where you are between those is going to depend on where your menhaden F is.

This is where your menhaden F currently is and you can see that if you fish for menhaden at the current rate, with your striped bass at its F target that you end up achieving your B target. This next one is the F target for Atlantic menhaden, the single species one that Amy was just talking about. If you fish your striped bass at its F target, and you fish menhaden at its F target, you end up between your B target and your B threshold for striped bass.

This next line is the threshold for Atlantic menhaden. If you fished Atlantic menhaden at its threshold level and you fished striped bass at its target level, you don't achieve your B

threshold for striped bass. We ended up using striped bass, because we found that it was the most sensitive fish predator to menhaden harvest.

The NWACS full model found that striped bass and birds were fairly sensitive, but the understanding for us is if we were going to go forward and move through and sort of develop example ERPs that we would do so for striped bass, as that would probably allow for birds to respond similarly to striped bass.

We defined an ERP target and an ERP threshold. With the ERP target as an example, being the maximum F on menhaden that can sustain striped bass at its target, when striped bass are fished at its F target. Then to do a threshold, which would be the maximum F on menhaden that keeps striped bass at their B threshold, while striped bass are fished at their F target. To sort of give you a picture of what that kind of looks like. This is similar to the graph that I had before, except what you'll find is that on the Y axis we have striped bass as a ratio of B to B target.

That one line is that when striped bass is at its B target. The dash line that is below that line is when striped bass are at its threshold. As you can see, you can have different levels that would correspond to different menhaden fishing mortalities, in particular, if you look at the green solid line that is where we're proposing as an ERP target for this example.

That is where striped bass ends up hitting its B target, and that is the corresponding F for Atlantic menhaden. Likewise you can go to the threshold. As you move down towards the threshold that has a corresponding F associated with it for Atlantic menhaden. We're suggesting that to be an F threshold ERP for this example.

Interestingly enough, if you look at the gray which I hope you can see the gray line. That is where you currently are with your menhaden now. If you look at the other lines, the blue lines, those are your current single-species targets for Atlantic menhaden. What you can see is that your typical ERPs for Atlantic menhaden in this case for this example, are more conservative than your single-species reference points for Atlantic menhaden, and just to show you kind of what that looks like.

In this example the F reference point, this is a sort of side-by-side comparison between our F reference points for ERPs, as well as for single-species. For ERP that would in this example, would give us an F target of 0.19 with a threshold of 0.57. Correspondingly, your single species reference points are 0.31 and 0.86. The example ERPs are more conservative.

Your current F in 2017 is 0.16, and so not overfished, not overfishing, I'm sorry. Whether you're looking at either the single species or the ERP reference points as we've laid out, this already gives you just sort of a historical context of where menhaden have been relative to these ERP examples. What you can see is we've been usually far below the F reference point, the F threshold since about the 1980s.

More recently we've been right around that ERP F target, within the last probably, you know since probably the late 1990s we've been bouncing around that ERP F target. For some overall management advice, this tool we think will allow the Board and Commission to evaluate the tradeoffs between Atlantic menhaden F and predator biomass, in a quantitative and transparent way.

For next steps we're going to need some instructions from the Board on other scenarios that you would like to run. You'll notice if I go back into some of my other slides you'll see that we've done this sort of example ERP with all the other predators and prey in the system being fished at current levels.

Most of those are under FMPs, either by this group or by other groups, and therefore those are subject to change, and so we have some analysis that I'm sure Max will be showing in a bit that there suggested to run, in order to look at what the behavior for the ecosystem might be if, for example, you also rebuilt bluefish for example. Just to sort of sum up where we've been. You guys tasked us with developing a tool that can help examine some of the tradeoffs between menhaden removal and predator biomass. We've developed a tool

using both the BAM as a single-species model, and an ecopath/ecosim NWACS model to look at those kinds of tradeoffs for you.

We've provided an example ERPs that you can use to at least formulate where you might want to go in the future, and at least illustrate what kind of stuff you can get out of this tool that we've developed for you. For next steps, Max is going to talk a little bit about where we go from here or where you guys could potentially go from here, including some other analysis that we're going to suggest.

Before we wrap up completely, I really do, I know you saw this slide earlier. I really would like to highlight current and past staff who worked long and hard on this project. Those people totally deserve a raise. You know they heard the cats, they got us shipshape for the meeting, and they worked really, really hard on the documents and in some cases the analysis. With that I'll take any questions.

CHAIRWOMAN MESERVE: I bet there are no questions, right? Allison Colden.

DR. ALLISON COLDEN: First of all I just want to echo the statements of the Chair, and of you Dr. Cieri of gratitude to all of the hard work that the Technical Committee and ERP Workgroup have put into this. I think this is a tremendous body of work, and stepping into a completely uncharted territory. I'm really impressed with what you all have been able to come up with, in terms of presenting us with a model that is maybe not easy to understand on the first time around, but I think is a very thorough evaluation of what we were going for.

I have two questions I hope will be pretty brief. Matt, you mentioned that in the full model, the full EwE model, striped bass and birds were the most sensitive and so striped bass was sort of chosen as a proxy for that. Was striped bass also the most sensitive out of the species that were included in the MICE model, out of the predators that were included?

DR. CIERI: Yes. Striped bass far and away is the most sensitive predator pool that we have in either of the approaches.

DR. COLDEN: Okay, and another quick question. The 2017 F values that were used for the focal species, has there been any assessment updates or other information to update those Fs since that terminal year for any of the species that were included?

DR. CIERI: We haven't done so, but I'm sure those, if Katie can probably comment on striped bass and some of the others.

DR. DREW: Not for striped bass. Obviously we're working on management to bring that F down. Bluefish did do an assessment update that had a terminal year of 2018, so we were able to use their preliminary data through 2017 for this assessment to get done on time. In 2018 they found that their F had come down below the target, but the other species are unchanged since 2017.

DR. COLDEN: Okay, so the only one is bluefish.

DR. DREW: Yes at the moment.

CHAIRWOMAN MESERVE: Ritchie White.

MR. G. RITCHIE WHITE: Is the takeaway from a manager that understands very little of this whole process that the menhaden population and fishing mortality is exactly where we should be? Is that a reasonable observation, then I have a follow up if I may.

DR. CIERI: Yes in this example. As I suggested earlier, where you want to be is really a question for you of where you want to be. From the examples that we've given, based around what striped bass reference points are, then your F is lower than that. That said, changing any of your reference points for your other species, for example, would change what that answer is.

MR. WHITE: Follow up, thank you. I've noticed with the large volume of menhaden in the Gulf of Maine. Being on the water I've noticed a substantial change in predators coming in and feeding on the menhaden in very shallow

coastal waters, 15-20 feet, very common to have humpback whales, minke whales, great white sharks, makos, as well as striped bass.

I'm wondering whether watching that happen, it seems like the menhaden is staying in the same place for the whole summer, not seeming to move, staying in proximity to shore in the shallow water that that is easy access to the prey species. It seems like the prey species would be more successful in those circumstances than those schools being spread out in the deep water where prey would have to go look for them. Just curious as if that is anything that could be looked at in the future.

DR. CIERI: The full EwE model that we examined did incorporate a lot of different types of predators and prey into that particular system, into that modeling approach. But for here we're just going to focus in on the prey species and predator species that are probably the most relevant for your management activities.

DR. DREW: But just to add onto that. I think spatial and seasonal components are things that we would definitely like to work on in the future. But obviously that's much more data intensive, and the models aren't set up for that right now. But as we develop this tool further that kind of information, spatial seasonal information would be very important, not just in the Gulf of Maine but also in the Chesapeake Bay and other bays and estuaries along the coast.

CHAIRWOMAN MESERVE: Bill Hyatt.

MR. WILLIAM HYATT: You mentioned that striped bass and predatory birds were the most sensitive to your analysis, and then went forward with a focus on striped bass. I was wondering if you could just talk for a minute about what you did, what you know about the interaction with predator bird populations. I'm asking this because I think many of us in the room are getting e-mails on this subject from a constituency that is not amongst those that typically communicate with us. There is a lot of interest outside the immediate fisheries arena, so just if you could talk about that for a minute and what level of information you had, and analysis that was done relative to birds that would be helpful.

DR. DREW: That's a good question, and part of the reason obviously that birds are not. Well there are two main reasons. One is we don't have any management targets for birds in this arena, so it's hard for us to evaluate where birds should be. But more importantly birds are a very data limited species compared to say striped bass.

In this model we actually lump nearshore piscivorous birds into a group, so this includes things like osprey and cormorant as opposed to the larger seabird population like albatrosses that are further offshore. This includes the ones that hang out nearshore and are feeding in those nearshore coastal waters.

However, we don't have enough information to separate those out into separate species, so they are sort of all lumped together. We don't have good information on the trends of these populations. We don't have a lot of good information on their diet data. What proportion of these species diet is actually made up of menhaden?

We've done the best that we can with the literature that is available, but it's definitely a source of uncertainty here. In the full model their response over the range of scenarios that we looked at was very similar to striped bass, so that they sort of declined at a similar rate to striped bass as you increased menhaden fishing pressure.

If we can prevent that kind of a decline in striped bass with a given level of fishing mortality, it's likely to have similar benefits to the bird population, the nearshore piscivorous birds as a whole. However, there is a lot of uncertainty around that and that is definitely an area that we would want to do more research, as well as more modeling work in the future.

CHAIRWOMAN MESERVE: Lynn Fegley.

MS. FEGLEY: Thank you Dr. Cieri and the entire team. This is really brilliant, and I think you

guys should really be proud of what you accomplished, it's very exciting. It's difficult though. My brain is smoking trying to wrap my head around it all. I just wanted to ask about the target. The suggested target is the maximum F on menhaden that sustains striped bass at their biomass target, when they're fished at their F target. I'm assuming that's an equilibrium prospect, so it's over time that is what is going to happen. But what is the impact?

It does not mean there is 100 percent guarantee that we'll meet the striped bass target, biomass target right? If we're fishing everything right where it needs to be, there is still uncertainty as to whether we can actually get to that striped bass target. My question is if that were to happen, if we're not getting to that striped bass target, what is the feedback to the ERP for menhaden, if that makes any sense at all? In other words, if we're not quite achieving that striped bass target how do we resolve that? Does it affect the ERP or do we just keep going?

DR. CIERI: A lot of that depends on your level of risk. Each one of those points actually has an uncertainty envelope around it. What you do if you don't quite achieve the striped bass target, for example, you're currently fishing at an F that is lower than your ERP target now, and your striped bass is nowhere near its target biomass. How that all figures out, how that all comes together is based around sort of your risk. Do you keep fishing menhaden as a precaution when your predators aren't near their targets? That is sort of a management decision. Does that help?

CHAIRWOMAN MESERVE: Emerson Hasbrouck.

MR. EMERSON C. HASBROUCK: Thank you to the entire team up there. I don't have a specific question, but Matt toward the end of your presentation one of your slides included a table that listed target and threshold and the values under ERP and single species. Could you just put that back up for a couple of minutes? Thank you.

DR. DREW: Just to clarify on this table, which I think Matt mentioned but just to remind everybody is the single species in this is the full F, whereas the Single-Species Assessment is reporting that geometric mean over Ages 2, 3, and 4, which are the main ages in the

fishery so the numbers are a little different, but they mean the same thing in the framework.

It's just that we translated them to the full F scale, because that is sort of what the EWE model was most directly comparing them to. If you look at these numbers and they're different from what the single species says, yes but that is because they are measuring slightly different things, but the interpretation is the same here.

CHAIRWOMAN MESERVE: Thanks for that clarification. John Clark.

MR. CLARK: Thank you for the great work on this, Matt. Could you elaborate a little bit more about the striped bass being the most sensitive species, because you know just looking at the landings of menhaden, they were much higher in the 2000s when the striped bass stock had reached pretty much a historical high population level.

In terms of what striped bass eat, we were very concerned about whether the striped bass were having a role in the collapse of weakfish in Delaware Bay during the 2000s, and we did a lot of stomach content work. As in other studies we found yes, when bunker are available that is what they will target, but when bunker are not available they will eat what's there.

We found condition factor didn't really vary much when they were eating sand eels. They only time I saw really a problem was when they were filled with lady crabs this one winter. You need to just go a little deeper into why striped bass would be so sensitive at this point, when in the past as I say, the population of striped bass was much higher, and bunker seemed to be lower, and yet they were both going in those directions.

DR. CIERI: In sort of the modeling approach that we took, striped bass were the most sensitive out of the ones that we looked at. I think if you were to compare this to some other ecosystems, they would suggest that striped bass are not as sensitive as for example other

stocks in those systems. Our striped bass tend to be the most sensitive of all the predators that we've looked at, but their population status doesn't really depend that heavily on where menhaden are, for example. Sensitive in this case is a relative term with this particular ecosystem.

CHAIRWOMAN MESERVE: Go ahead, John.

MR. CLARK: If I could just follow up then. With some of the other models like the VADER model, would that take into account stomach content and the proportion of the diet that is attributable to menhaden for striped bass, and are you still looking at that model?

DR. CIERI: We are, and in fact that is one of the recommendations that it was going to come out from the Peer Review Panel is that we continue to explore the VADER and the statistical catch at age approaches as we move forward into the future.

CHAIRWOMAN MESERVE: Steve Train.

MR. STEPHEN TRAIN: I have to simplify this stuff in my head. I don't come from a science background, so maybe you can help me, Matt on this. It looks like by doing single species management on menhaden we backed into a situation that is going to work fine in multispecies, because the numbers are right there now.

That is fortunate. It wasn't planned, but it has worked out. My question is if the population of striped bass currently is what it is. If we had more menhaden in the water, would it help it grow or do we need the population of striped bass to increase first? I'm using striped bass because you did, it could be any other species or does that population need to be higher before we have to adjust our numbers? Which one comes first?

DR. DREW: I think the key to understand is that you have to adjust all of them at once. Right now part of the reason, striped bass is experiencing overfishing, and as the heat map showed that rainbow plot showed, if you don't adjust the striped bass fishing mortality nothing you do to menhaden will bring that population back. I think we need to adjust both of them together.

The Board took action that they deliberately chose not to fish at the single-species target, and as a result set a quota that was lower than what the single-species management suggested that we could achieve, and as a result it seems that we sort of as you said backed into a good situation for these species. However, so if we can maintain menhaden there that is going to benefit these predator species. But we also have to take action on these predator species in order to help them rebuild from a fishing perspective.

CHAIRWOMAN MESERVE: Follow up.

MR. TRAIN: Essentially if we say, all right the menhaden matters the most. We have to take care of this, take care of everything else. If we keep increasing it without managing the other, we can't manage the other ones just by having menhaden more populace. We've still got to step in and do something with them. This isn't going to solve all the problems.

DR. CIERI: That was the plot that I show that there was no, like at your current F level for striped bass there was no menhaden F level that would rebuild striped bass back to its target. You could set your menhaden at 0 fishing and your striped bass won't come back.

CHAIRWOMAN MESERVE: Megan Ware.

MS. MEGAN WARE: I'll echo all of the congratulations to you guys. I know this is a ton of work, so congratulations! Just two questions, my first one is really quick for that handout we got are that menhaden F units, they are different so one is BAM units and one is the ERP units? Is that correct? We should look at these figures separately, not compare them?

DR. DREW: Right. The rainbow plot was done that's the average F that corresponds to kind of the current status of the geometric mean average from BAM, and then the curved plot that is not rainbow is the full F, the equivalent

full F from the BAM, as opposed to the average F.

MS. WARE: My other question was I was hoping someone could talk about kind of the relationship between herring and menhaden in the MICE model. Reading through it sounded like there was like a prey switching toggle, for a better term, but after that I got a little confused. I was hoping someone could explain that.

DR. CIERI: Again, herring are an ultimate prey item allowing the predators to switch from one to the other when one is vulnerable, depending on the stock sizes. Currently just like as we've talked about for Atlantic herring. Atlantic herring are actually at a fairly low stock size.

They don't contribute as much to the diets of some of the predator species, as well as the fact that they don't overlap a lot for example with weakfish. They are an alternate prey item, depending on the relative ratios or the relative sizes of the population between menhaden and Atlantic herring. Does that help?

MS. WARE: Yes. The herring biomass is included in the calculation for the example ERP, so changes in herring biomass would also impact these numbers.

DR. CIERI: Correct, and as we'll go through a little bit later there are some alternative analysis that we can do based around whether or not herring are rebuilding or not rebuilding, and you'll see those.

CHAIRWOMAN MESERVE: We do want to make sure we get to that. I have four more people, five on the list, and then I would like to move to Dr. Jones' presentation, and there will be more time to talk about this and continue to get a better understanding of this. Let's move to Adam Nowalsky.

MR. ADAM NOWALSKY: Thank you very much, very informative, lots of good work here. I might be jumping ahead. There is going to be a discussion tomorrow by the Commission on a larger scale about what the implications of this are for species of other management. However, I think that discussion tomorrow will be predicated on the decisions we make here today with regards to what we accept for management use. In looking at the other species plots that are included in the assessment report, near

where this striped bass, menhaden, rainbow plot is, there were two additional rainbow plots there, one that incorporated bluefish biomass to B target, and also one for weakfish B to B threshold. In both of those charts if I interpret them correctly, regardless of what the menhaden F values are, striped bass F values would have to approach 1.5 to get either of those other species to a B to B target ratio of 0.5 or weakfish B to B threshold target of 0.5.

What it's suggesting is we would have to fish striped bass through the roof to help those other species from the information that's here, regardless of menhaden. I'm hoping you could give some advice on how to use the rest of this information as we do multispecies management.

DR. CIERI: That information in there was assuming that you keep your predator Fs at the same level, well at the 2017 level. What it is suggesting is that you don't get much of a rebound in some of those other stocks if you keep overfishing them. Like for example, for bluefish. We can give you that sort of context of what that looks like for menhaden and for striped bass.

But those other predators are also subject to their own removal rates by their fisheries. That gives you the idea that you need to manage for those species and not just striped bass and menhaden for weakfish, for example. Those were all done assuming that you had status quo 2017 fishing mortality.

DR. DREW: To add on to that I think we included those plots because they do contain important information, which is that at the extremes of these fishing mortalities there is interaction in the predators alone. The point of that plot is that even if you only change menhaden and striped bass, you're still influencing the bluefish or the weakfish population dynamics, and that because there is interplay between bluefish and striped bass, they are competitors and in fact they also prey on each other's juveniles.

You are correct in saying that we need to evaluate how all of these interact together, and to determine down the road what the best set of reference points for these are as a single species. I think we can definitely come back and show you some example plots for bluefish, where you fish bluefish at their target so that they are no longer experiencing overfishing in these scenarios, and see how striped bass F and menhaden F interact with those for the bluefish and weakfish. But definitely there are interactions beyond a single predator and a single prey in these models.

CHAIRWOMAN MESERVE: This discussion will definitely continue under the next agenda item when we get there and staff's presentation that is going to be talking about the long term plan, and how the Menhaden Board functions with the other species. Let's move to Allison Colden.

DR. COLDEN: I'll pass.

CHAIRWOMAN MESERVE: Conor McManus.

DR. CONOR McMANUS: Matt, just on the biomass trends plot for the different models. It seemed that for the NWACS models the interannual variability through time was smaller than the BAM. Is that attributed to the fact that the BAM captures more of the population dynamics of menhaden, or would you attribute that to the feedback mechanisms within the NWACS models?

DR. CIERI: It's how the models handle it. For example, the EwE, the NWACS model is more that uses sort of stanzas for ages, so it will lump multiple ages together, and so you don't get that kind of spiky year class affect that you would normally see for something like the BAM, where it will show you good and bad year classes and changes in biomass accordingly. It's a little bit more smeared because it's more of a biomass sort of approach. Does that answer your question?

DR. McMANUS: Yes.

CHAIRWOMAN MESERVE: Ritchie White, pass, last before we go to Dr. Jones presentation will be Malcolm Rhodes.

DR. MALCOLM RHODES: This may not be the time to bring it up, but first of all I wanted to thank you and your group for all the work you've done. It is fun to see this germinal idea that started six or eight years ago be brought to this point to be proofed, and to be where we're at, at this point. My only question to you now is kind of the housekeeping question.

I understand that your expectation going forward is we'll have two models to look. Going forward will your group, I know there is a lot of overlap between the two models. Will it create a lot of extra burden on the subcommittee to provide those materials in a timely manner? That may be something we're coming to as we move forward.

MR. MAX APPELMAN: I'll take a stab at that. Obviously these models are very intensive. It's somewhat unclear how much time would really go into updating these models, but in a nutshell the ERP Workgroup would take on most of the work. When it comes to menhaden specific TAC setting processes that would also be vetted through the TC, but sort of you still have, you can think of the ERP Workgroup as sort of becoming the Stock Assessment Subcommittee in this new realm, and everything passing through the TC for menhaden specific tasks.

DR. CIERI: Just as a follow up. A reminder that we built this sort of streamlined EwE NWACS model with this question in mind, to make something that is more updateable, so the species that are included do have information that we can pull off the shelf, so to speak to allow us to update it in a more timely manner. But of course it always will be a little bit more work than simply running one model.

PRESENTATION OF PEER REVIEW REPORT

CHAIRWOMAN MESERVE: Thank you and Dr. Jones when you're ready we'll pull up that presentation.

DR. MIKE JONES: Thank you Chairperson Meserve, thank you to the Commission for

inviting me here to address this group today. It's a real pleasure for me. Some of you may recall that I also chaired the Peer Review Panel for SEDAR 40 the last time there was a benchmark assessment, and it's really extraordinarily interesting and rewarding for me to be back here having seen how much progress has been made on a variety of fronts, with regards to the Atlantic menhaden. I myself am from the Midwest. I have really nothing to do with menhaden, but I have worked on a whole lot of different fishery management issues, including multispecies fishery management issues. This is a fascinating and exciting problem to be connected to. The peer review process had to look at two assessment reports that you've just heard about this morning, it was a lot to read.

We held a workshop in Charleston in early November, and our scientific review focused on evaluating the data, the models, the sensitivity analysis and the overall quality of the assessments for both the single-species assessment and the ecological reference point assessments. The Peer Review Panel had five members, myself as Chair, Sarah Gaichas, Daniel Howell, Ken Frank and Laurence Kell. The last three being representatives of the Center for Independent Experts.

We were very fortunate to have Dr. Sarah Gaichas as part of the review team. Many of you may know Dr. Gaichas; she is from Woods Hole and has really solid expertise in food web modeling and multispecies analysis. That was a great help for our work. I'm going to try to go through this summary of the peer review pretty quickly to leave more time for questions.

I'm going to be kind of short on details here, but try to capture the main points of the review. First overall findings with regards to the Single-Species Assessment, the Panel concluded that the BAM model, the assessment model is a mature, well developed stock assessment model that the conclusions that this Stock Assessment Subcommittee reached were defensible, and that their examination of uncertainty with regard to the model was very thorough.

We agreed with the conclusion that Atlantic menhaden are currently neither overfished nor

experiencing overfishing, and we agreed that the reference points that are in place right now, I think they are referred to as interim reference points, are entirely appropriate, at least until we move forward with the development of ecological reference points.

With regards to the ERP Assessment, just to sort of reiterate what several of you said in your comments after Matt's presentation. It was very, very impressive to see the breadth of examination of candidate models that the ERP Working Group confronted or looked at. The Panel agreed with their recommendations about the preferred models for further work being the single species BAM model as well as the reduced complexity ecosystem model called NWACS MICE.

Importantly, we felt like the analysis that the ERP group had done had reached a stage of credibility and thoroughness that it is time for the conversation to shift back to managers, about what to do with these analytical tools, if you will, to inform the management decisions that you will continue to have to make. Now I'm going to quickly go through the terms of reference for the two reviews. The first for the single-species review, the Panel was supportive of the choices that the SAS made with regards to the data to include in their model.

We did note that the survey data that exists tend to be light on information on larger, older fish. As you know all of the fishery independent surveys that are used in this assessment are not targeted at menhaden, they are sort of opportunistically used. The models are kind of sensitive, and one of the sensitivity analyses showed this, to the uncertainty we have about the relative abundance of older menhaden in the fishery. One of the recommendations on that obviously was to try to add surveys that would represent larger and older fish, and we also made a technical recommendation about considering an alternative analytical method for combining the survey data, and I can elaborate on that more if you have questions.

With regards to the assessment models, as I already said, we concluded that the model that their using, the catch-at-age model is a well-established, mature model. We concluded that the major changes that Dr. Schueller talked about earlier with regards to how their modeling fecundity and natural mortality were defensible and justified, and again I can speak more to that if there are questions later.

We did note that the way these models work is they use these complicated statistical fitting routines to try to estimate things like abundance from the data, and we did notice that the models had trouble sometimes finding a good answer, if you will. One of our recommendations was that there could be some more work by the SAS to evaluate the stability of their stock assessment model estimates.

We didn't consider this to be a serious issue, but there were a few results that they presented that were a bit troubling in that regard. But we did conclude that the model is an appropriate tool for providing management advice. We were appreciative of the thorough and extensive efforts that the SAS went through to examine the sensitivity and uncertainty, with regards to the model.

Again, to reiterate a point I made earlier, the sensitivity analysis, one of the main take homes from that was highlighting the importance of perhaps improving the assessment in the future by having better survey data for older fish. But importantly with the conclusions, we agreed with the conclusions of the SAS that the stock status conclusions were robust to the uncertainties that they looked at.

We did suggest, much to the annoyance of Dr. Schueller and some of the other SAS folks that we would like them to continue to try to find ways to integrate the two methods of uncertainty analysis that they used. Dr. Schueller referred to an MCB method and an MCMC method that were sort of tackling two different parts of uncertainty. We suggested that they continue to struggle with trying to integrate those two into one.

With regards to the assessment results we agreed with their conclusions about stock status. As I mentioned earlier, we agreed that the current

reference points seem like appropriate ones for single species management, given what we know about menhaden at this point. But obviously we would recommend that you plan for replacement of those reference points with ecological reference points.

We did have some suggestions about, there was some discussion earlier about prediction uncertainty, or future prediction uncertainty, and we had some suggestions about evaluating other methods for assessing the prediction skill. We generally supported what the SAS had to say about research on data collection in the future, and again not to belabor this point too much, emphasize how valuable it would be to have an assessment tool that would inform you more about the older menhaden in the population. We wanted to emphasize, and I'm going to repeat this later that the idea of doing a so called management strategy evaluation, this was talked about in CR-40 as well, is a great idea. But this could become a monster, and so we urge that the Technical Team to think very carefully about how to go about doing a management strategy evaluation so as not to make it a burden for management decision making in the future, and also to integrate it with a multispecies approach.

That is it for summary of the single species, no one more, sorry. Timing, really little to say there other than we agree with the recommendations with regards to timing, recognizing that if you are moving towards a multispecies integrated management strategy for menhaden, and the species that prey upon it that that may imply something about the coordination of the timing of benchmarks, for the various species that would be playing into that.

With regards to the ecological reference points, there are a lot of data that informed the analysis that the ERP Working Group worked on. We were in general support of the choices that they made for data to include. One decision they had to make for some of the analyses was to include a data series the

Reduction CPUE Index that was not used in the Single-Species Assessment, and we thought about that a little bit, and agreed that this was the appropriate decision for them to make for the types of models that they were trying to fit.

We also felt that they were making the best possible use of the admittedly limited diet information that we have for informing models like the NWACS MICE model. We recommended that despite sort of feeling like they've done the best they can with the data that are available that in the future, because these diet data are spotty, are difficult to come by, especially for some of the species that haven't been looked at closely in the model so far.

There might be research priority for looking at new novel ways to get at diet information, and I mentioned DNA metabarcoding as one of those, and I could elaborate on what that gobbledygook is if you're interested. If there is going to be continued work with the multispecies catch-at-age model, and I'll refer to that later.

There probably needs to be more comprehensive evaluation of the spiny dogfish data that would feed into that. Importantly, I mentioned that these ecosystem models use a lot of data from a lot of different sources, and in contrast to the stock assessment model, the catch-at-age model, it is less straightforward how the data inform the models.

There can be a lot of sort of subjective decisions about what you're going to do with the data sources. What that means is that it's really important that you have what I call here a data pedigree, some means of being able to go back and say this is the data that we used, this is how we used it. That is probably a pretty important thing if these ecosystem models are going to inform your management going forward.

We were really impressed with the thoroughness and the breadth of evaluation of alternative models that they used to consider menhaden as a forage species. In the end we agreed with their recommendation to use the single-species model BAM and the reduced EWE or NWACS MICE model as the tools for development of the ERPs in the short term. But we also recommended that they continue to consider

using this multispecies catch-at-age model, if that model could be developed to the point where it did effectively include predator/prey dynamics in ways that it doesn't currently. It would be a viable alternative to the EwE model as a tool for evaluating ERPs, but it's not at that stage yet. Again, having been involved in SEDAR 40, having participated in the Management Objectives Workshop in 2015, I was incredibly impressed with how far this group has gone, in terms of thinking about translating those needs that were expressed then into analysis and tools to set the stage for a serious discussion about ecological reference points.

As has already been discussed, the examples that were in the report and that Matt talked about in his presentation, Dr. Cieri talked about in his presentation, should really be viewed by the rest of you as an illustration of how you go about doing this, not the answer. There is a lot more thinking that has to go into developing a set of reference points that effectively consider the many interactions that are potentially important for the management of menhaden.

It's time to begin this dialogue between the technical experts and managers. Maybe you would argue that that dialogue began a long time ago. I should rephrase that. It's time to continue in earnest the dialogue between the technical people and managers to develop these reference points. The uncertainty analysis, sensitivity analysis for the ERP report kind of focused on the NWACS MICE model because of the preference that the Working Group was leaning towards to use that going forward.

Importantly, at the Review Panel meeting we asked them to do an additional sensitivity analysis about how robust their conclusions were to different assumptions about the magnitude of predation mortality on menhaden, particularly from striped bass. They went ahead and did that in real time while we were there, and persuaded us that the model is pretty robust to uncertainty about that.

I mentioned earlier that the diet data aren't fantastic, so there is uncertainty about the relative magnitude of predation mortality imposed by these predators, so that was useful and encouraging. If this multispecies-catch-at-age model is going to be used in the future, they need to think about doing more sensitivity analysis if that modeling has been done so far.

Right now with regards to stock status the Single-Species Assessment is the best tool you have for determining where the menhaden population is relative to your objectives. But obviously the conversation today and for the last few years has been about moving towards an ecological reference point.

This is my last slide. The Panel generally agreed again with the recommendations of the Working Group, with regards to future research activities. In our Peer Review report there are a number of specific recommendations for things they might want to consider doing, particularly with novel interpretations of diet data and things like that.

Again, as I said at the end of my comments on the single species review, we do favor the idea of using a tool like a management strategy evaluation to explore management alternatives, but this has to be done with caution, because it can explode on you. But it is a really valuable tool for looking at the tradeoffs that you're going to have to be looking at, with regards to setting management targets for the different species that interact within this sort of menhaden complex. I think that is my last slide, yes it is. At this point I'm happy to take questions.

CHAIRWOMAN MESERVE: Thank you, Dr. Jones. Under questions, I guess I would first like to return to Roy's question earlier about natural mortality. You heard Dr. Jones say that the decision by the SAS was both defensible and justified, so I guess I just want to make sure Roy that you had the answer to the question that you asked earlier, or if you have any follow up about the natural mortality value.

MR. MILLER: It seems like it's all we can do with that.

CHAIRWOMAN MESERVE: Jim Estes.

MR. JIM ESTES: You all did a really good job. I don't understand probably 10 percent of what you did, but

the 10 percent that I understand is I'm pretty impressed. I would like to dig a little bit deeper into what Roy asked about, and that is because I expect that we are going to have some stakeholders.

We know how we do things is that we have stakeholders that have impressions about what they want to see when our scientists do some things, and they sometimes are a little bit biased on how they see it. I want to tell you what my understanding of the natural mortality issue is. First of all I do believe that debate is very important in science, and I think that we have gotten a little bit away from that in some scientific areas.

I appreciate Dr. Ault sending his e-mail. But let me tell you what my understanding of it is, and if I am wrong then please correct me. First of all, after I read what he wrote it kind of did not erode my confidence in what you all did, and the basis of that is this. I think he was comparing two things that are not the same.

In his e-mail he questions natural mortality, and he had a graphic in his e-mail that showed that the natural mortality that we are using for menhaden was much higher than the natural mortalities that are estimated from theoretical things like maximum age, and he had a graphic on there.

But I believe that for estimating the maximum age of those various species that he had that he's looking at mortality over the life of the species. In menhaden, I think I heard a little bit earlier that we were looking at natural mortality between Age 1 and 2. Well those are not the same things, they are not comparable.

I think we would expect to see, especially for a fish that is eaten by a lot of other fishes that the natural mortality of those fish would be much higher when they were younger than when they are older. That is the basis for my kind of rejecting his debate. Am I accurate in the way I look at this?

DR. DREW: Yes, I think that is definitely. The graph is a little misleading in that he is plotting the Age 1.5 natural mortality over where the Age 10 natural mortality or a fish that lived sort of the maximum Age 10 mortality would be. That is a little, it is still higher than what you would predict using these life-history-based analyses, although FEMS recent re-estimation of Hoenig's life-history-based parameters also did increase that natural mortality. Those other graphs, well the plots are probably a little outdated as well, and it should be higher. I think an addition to keep in mind is you know those species are generally not forage fish species on that plot.

It's not just a matter of how long does that species live, but the size of the species, its role in the ecosystem, and you wouldn't necessarily expect, even if menhaden do live to 10 or 12 years old, 10 being the maximum age we've seen in the population. You wouldn't expect them to have the same natural mortality as something as large as a bluefish or a grouper that reaches a very large maximum size, whereas menhaden are preyed on throughout their entire lifespan.

DR. CIERI: I think it's important to remember that most of those other stock assessments use estimates of M based on life history approaches. Whereas in menhaden the big difference is that we have a tagging analysis of over a million fish. It's actually based on data, not on theoretical life history, how long are you going to live, but on actual data that we gather while doing it.

CHAIRWOMAN MESERVE: Eric Reid.

MR. ERIC REID: I have to ask this question, it's a crazy question. It goes to a point John Clark raised earlier that you know it seems like when menhaden are in a pretty good place, striped bass, bluefish, some other fish are maybe not in such a good place, which is where we are right now. That leads me to ask the question. What is the consideration of menhaden as a predator of the larval stages of all our problem children?

DR. DREW: It's a good question. As you know, menhaden are filter feeders as adults, so they're filtering whatever is in there out. They also as

juveniles themselves are feeding directly on larvae, eggs, and other zooplankton. There is the potential for them to feed on certainly other predator species.

However, I would also say that while menhaden are high now, fishing mortality on those other predator species has also been high. Yes, as the striped bass population was increasing it was also experiencing increasing fishing mortality, and in addition the recruitment on striped bass had dropped, so we were in a period of high F and low recruitment for striped bass that contributed to the decline we see now.

I think it emphasizes the fact that the Menhaden Board can put these other predator species in a position to succeed, by providing enough forage for them to maintain a strong, healthy population and not to increase natural mortality. But it cannot counteract the effects of overfishing or of periods of low recruitment or other environmental hazards to striped bass and weakfish.

It's theoretically possible that menhaden are in there sucking everything up. I don't know if we have the data. I would suggest that we focus on F on striped bass first, and then worry about the fishing effects of menhaden. But yes, it is a very complex system and there is a lot going on here.

CHAIRWOMAN MESERVE: I believe that Dr. John Hare might have something to add to the discussion on natural mortality, so I'll ask him to come to the public microphone.

DR. JON A. HARE: It's an observation, just making it from the perspective of the Science Center Director, where we do a lot of stock assessments. I am not going to speak to the specific issue. If I heard the conversation correctly this morning, the stock assessment group used a natural mortality rate that was in a peer reviewed paper, and then they used that in their assessment, and then that assessment was peer reviewed.

You have a scientific process, which is working forward. Scientifically peer reviewed, empirical-based estimate of natural mortality that was used in an assessment, which was then scientifically peer reviewed. I think we from the Science Center perspective, we put a lot of value on that peer reviewed process.

Now I certainly have a huge amount of respect for Dr. Ault. He is a stock assessment scientist, has worked in a number of different regions. His sort of contribution to the conversation is highly valued. I think comparing, or sort of as a research recommendation for menhaden or for the general community, as we get more empirical based observations of natural mortality based on tagging.

In menhaden's case it was traditional tagging, largest tagging database tagging effort undertaken perhaps. But with electronic tags there are more of these empirical based natural mortality rates being calculated. I think a research recommendation could be to compare and think about how these empirical estimates of natural mortality compare to these more life history based maximum age, maximum size type estimates.

But I just wanted to reflect that what the menhaden assessment is using is a peer reviewed estimate in the primary scientific literature, and then a peer reviewed stock assessment value. I think there is a lot of value in the peer reviewed system, so thank you very much for the opportunity to comment.

CHAIRWOMAN MESERVE: Thank you, Dr. Hare, coming back to the Board, Justin Davis.

DR. DAVIS: I'm curious about the VADER model. We heard a couple times this morning that that is a model that we shouldn't walk away from that we should continue to look into. What is the perceived or enhanced utility or different utility we would get out of that model versus the NWACS model, and what will it take to get there, to get that model to the point where it might be ready for management use?

DR. JONES: Well I think the first thing I have to do is fire Jason McNamee so he can go back to continue to work on it from his current job. The appeal from the

Peer Review Panel's point of view of the VADER model is that like the BAM model, it is sort of directly informed by stock assessment data for the species that are included in the model, as opposed to in these ecopath with ecosim or EwE food web models. Where not to get into details, there is a little bit more of an art to fitting those models and making them agree with the data that you have. It also has an attractive feature, if you can make it work that you can be as Dr. Schueller has with the BAM model, you're able to be a lot more formal and rigorous with regards to uncertainty, which helps you to address these issues of risk that people were talking about earlier. The main deficiency of that model right now is that there is sort of more work to do on the defining the connections between the predators and they prey.

The model is doing a pretty decent job of simultaneously modeling the dynamics of all of the predator species and the prey species, but it's kind of weak on how those interact. That comes back to this diet information. I think that in terms of a data, the data need that would best improve the prospects for using this model is better diet information.

It's just hard. They are challenging technically, it is challenging to build a single-species-statistical-catch-at-age model. There aren't very many examples of multispecies-statistical-catch-at-age models. You're kind of at the cutting edge of assessment modeling. But I think the merits of it, in terms of a somewhat more objective, the greater ability to say something about uncertainty with regards to the things that you're trying to estimate, may justify the recommendation that it's highly worthy of continued exploration.

CHAIRWOMAN MESERVE: Follow up?

DR. DAVIS: Just as a follow up, since you brought up diet data as one of the major deficiencies for that model. Could you talk a little bit about meta-barcoding, which you brought up earlier in your presentation?

DR. JONES: Well I'm not a geneticist, so first that caveat, but basically the idea, and you've probably heard about this, read maybe popular articles about it, about being able to take stomach contents of predators, and instead of just putting them under the microscope and saying oh that's a menhaden and that's a herring.

You actually analyze the DNA that is in the stomachs of the predators, and the DNA meta-barcoding is kind of a label on the DNA that is species specific, and allows you to say that we found this much DNA of species X and this much of species Y, which raises the question of was that because you found menhaden DNA in the stomach, does that mean that were 10 menhaden in the stomach or one?

There are questions like that. But it's being used, and there are other tools too, things related to fatty acid profiles in stomachs and so on. There are various tools that are being used by ecosystem scientists to get a better handle on diet that use tools that don't involve just the old way of cutting open stomachs, and looking at the stomach contents under the microscope.

DR. DREW: One of the big issues that we run into with all of these diet studies is that the largest component of the diet is unidentified fish. That doesn't really help us, and I think these techniques help us get a better understanding of what that unidentified fish actually is.

CHAIRWOMAN MESERVE: A question of staff. Does it follow naturally, and considering the research recommendations, does it follow naturally from the assessment that the Technical Committee will be looking at the list of research recommendations, and coming up with a plan for the types of things that they can address on that list prior to the next assessment?

MR. APPELMAN: It's a good question. Typically when we embark on the next benchmark assessment, we evaluate the research recommendations that have been provided. What kind of progress have we made? Certainly the TC starts having interactions about that list up until then to see what might be the crux of a next benchmark. If we haven't made progress on that

what kind of impacts is that going to have? The dialogue will definitely continue.

CHAIRWOMAN MESERVE: I think that would be particularly useful for things where you have just thinking about the inadequacy of older aged fish. That is something we have to start to correct before you get into the assessment. I think Sarah may have a comment on that.

MS. SARAH MURRAY: Yes, I just wanted to time it all so that we have the overarching ASMFC research recommendations, and that that feeds into things like recommendations for funding and for projects outside of it. Obviously the TC isn't going to be able to create a survey to handle diet data for us, but that will also be put on a list.

CHAIRWOMAN MESERVE: Great, thank you. Last we're going to go to Lynn Fegley.

MS. FEGLEY: It's possible that this question should be forwarded to the next section. But Dr. Jones, thank you for your review. The slide that's up, you did mention that the example ERP that we were given is an example and it's not *the* answer, and that an MSE would be a worthwhile approach.

But you urged, as it says there, caution so it doesn't explode. After what happened yesterday with striped bass, I think there is a propensity for things to explode. I wonder with your experience, you know as we're trying to grapple with this incredible information we've been given, do you have any sage counsel on how? What do you do to craft an MSE that doesn't explode? That's a really big question, but I am curious if you have any counsel.

DR. JONES: I guess the only advice, which is perhaps a bit, well no it is solid advice is engage people who have done this before. There is a caveat on that in that in that you could argue that what we're advocating that the Technical Committee do here is something that no one has done before in some sense.

But for example, the Northeast Fisheries Science Center recently, a couple years ago did an MSE for Atlantic herring, not really a perfect analog to what we're sort of advocating for here. But some hard won experience from the scientists that were involved in that would be really valuable. There are people all over the world now who are grappling with this very same question for a whole bunch of other species.

I think that would be the first piece of advice I would give is that you reach out to those who have already been down this path a little bit for advice. The other thing that I would emphasize, which is probably a little bit less about avoiding the thing exploding, but maximizing the likelihood that whatever you do will actually have an impact on management is don't just assign the Technical Team, Technical Group or whatever they're called to do this, and then report back. The MSE process has to involve managers, because otherwise you'll end up with something that is scientifically intriguing, and the managers won't want to have anything to do with it, because they will have no ownership of it. In my experience working with MSE type exercises in other jurisdictions. What has really caused them to make a difference has been the involvement of managers, as well as scientists in that process.

CONSIDER ACCEPTANCE OF 2019 STOCK ASSESSMENTS AND PEER REVIEW REPORTS FOR MANAGEMENT USE

CHAIRWOMAN MESERVE: We have bumped up against our allotted time for our discussion on this. I would like to thank each of our presenters for their efforts, and taking all of our questions, helping us to work through some of the details of the assessments. Certainly there are more questions.

But, I hope that the Board is in a position that we could look now for a motion to accept the 2019 Benchmark Stock Assessments and Peer Review Reports for management use. Motion is by Spud Woodward, thank you, seconded by Malcolm Rhodes, just give staff a moment to get that on the board.

We have a motion to accept the Atlantic menhaden Single-Species ERP and Peer Review Reports for management use. Is there any discussion on the

motion? Seeing none, is there any opposition to the motion? We will consider that approved by consent. Do people need a couple minute break before we move on to management discussions? It sounds like a good idea. Okay let's try to be back in five minutes, 10:35.

(Whereupon a recess was taken.)

CONSIDER MANAGEMENT RESPONSE TO 2019 BENCHMARK STOCK ASSESSMENTS

CHAIRWOMAN MESERVE: We are back to Item 5 on the agenda, which is to consider management response to 2019 Benchmark Stock Assessments. You know we may have just gone through the easy part it would seem. Now we have to talk about how we're going to use the assessments, and appropriate them into the management program. Staff, well Max and Katie, is going to start us off with a presentation that has been alluded to that is going to look at some of the short and long term considerations, and I think Max is up first.

MR. APPELMAN: Yes, we took the liberty of putting a few slides together to help focus discussion on; you know where do we go next with all this information? The first thing I wanted to sort of rein in is that there are a sort of short term and long term goals that the Board has been grappling with.

The short ones being what Madam Chair just brought up, you know identify ERPs for menhaden, and try to incorporate those into the management program in a timely fashion. But there are also these long term discussions that are going on, continuing to pursue the full realized implementation of ecosystem-based fishery management.

Starting discussions at this Board, but of course initiating higher level discussions with the Policy Board or the Commission as a whole, this has been talked about a little bit already today. But these two things can be done in tandem. You're not parking one on the shelf necessarily.

You can focus on the short term and continue discussions on the long term. Just a recap from the reports this morning, you know there is no one right ERP for menhaden, because the final harvest level is really dependent on the objectives that this Board and other management boards have for the ecosystem. How do you want the menhaden fishery to look like? How do you want the biomass in this fishery to look like?

How do you want the predator biomasses and their fisheries to look like? These all play in to hone in on that right answer. The ERP Workgroup has provided this tool, the BAM model along with the NWACS MICE model, to sort of evaluate the trade-offs of the different assumptions or the different objectives, and find that sweet spot. This is where I'm actually going to transition to Katie, and she'll go over the example and some other potential examples that we might want to look at.

DR. DREW: As a reminder, this was the example that the ERP Workgroup developed for this assessment, where the maximum F on Atlantic menhaden that would sustain striped bass at their biomass target when you fished striped bass at their F target was defined as the target. Then similarly, you could define a threshold as the maximum F on menhaden that would sustain striped bass at their threshold, when they're fished at their F target.

However, in this example it's assumed that all of the other species, both the predator and the alternative prey species, are being fished at 2017 levels. Basically, start the model where we stopped and project forward. Obviously there are implications for where you keep those other predators in this ecosystem, because as we discussed earlier with bluefish and weakfish, there is competition effects, there is interaction effects between these predators, as well as between the predators and menhaden.

What we want to do is recommend sort of a set of additional scenarios to explore. We can go to the next slide and look at some potential other scenarios. In this case I've laid out four scenarios. We've already done the first one. That is where you fish striped bass at their F target, and keep everything else at status quo.

This status quo means that bluefish is experiencing overfishing, and weakfish meanwhile is below its target, as is spiny dogfish. Another option to consider would be Option 2 here, where you fish everything at their F target, and see where the population ends up and see what the values of menhaden are.

That is, do we need to leave more menhaden in the ocean if we're rebuilding all of these predator species, or in the case of spiny dogfish fishing them down to their F target to their biomass target, where they're currently above the threshold right now. Another option would be to look at what happens if you fish everything at the F threshold, and try to keep these species at their F threshold or their F targets?

That is, if you increase fishing mortality on striped bass, you have to leave more menhaden in the water to keep them at the same biomass, because it's a tradeoff between fishing mortality on striped bass, and natural mortality that comes from not enough menhaden, so if you can balance those two you can keep them at a specific, in theory, in these long term projections at your biomass target or your biomass threshold. While the Striped Bass Board may strive to get striped bass back to their target is that possible? Is it more likely that we would be fishing closer to the threshold? These are kind of scenarios that the Board should examine. The fourth one here is an example where we're saying let's fish striped bass and bluefish and Atlantic herring at their F targets, and fish weakfish and spiny dogfish at their status quo values, because status quo for weakfish represents a relatively low F and a high natural mortality, and it's unlikely that management is going to do anything about that into the future.

In addition, we're sort of underfishing spiny dogfish right now because of market pressure and market demand, so that even if we try to increase fishing pressure on spiny dogfish it doesn't seem like there is a lot of room for that

to move. Is it more realistic to keep them at this current status quo scenario?

These are just four scenarios that we think will help the management board sort of bound the problem. The overall finding that your ERP reference points need to be lower than your single species reference points is not likely to change. But there become questions of, well what is the exact value? Is it 0.19, is it 0.20, and how does that translate into quota and management recommendations?

We would like to provide some additional scenarios for you to look at to help you understand the bounds of this problem, and understand how our assumptions about what's going to be happening with this ecosystem into the future actually play out for your reference points. What we're looking for from the Board is some guidance to make sure that these scenarios are what you're really looking for.

Are these proposed scenarios acceptable to you? Are you satisfied with focusing the analysis on the existing FMP values, or should other values be considered? That is we're really focusing on what's in the FMPs right now rather than saying what should the reference point for striped bass be? What should the reference for bluefish be?

That helps limit the problem, but it does limit our ability to fully evaluate the tradeoffs here, and is there any other scenarios that the Board would like to see to help them understand this problem, to help them understand these tradeoffs better? We can bring these proposed scenarios back to the Board in May. Additional work, and possibly a couple of extra scenarios that the Board would like to see, if you guys go crazy and request ten different scenarios that is going to take a little longer.

But we can definitely bring sort of a limited suite of analyses back to the table in May, and show you some of the things that we've already shown you, so those heat map plots, those rainbow plots for multiple different species, and analysis of where all of these predators and prey end up relative to their targets, and so on in May. Max is going to take over to talk about kind of how that actually translates into management.

MR. APPELMAN: Right, so bringing it back to the short term and long term timelines. The Board has the ability to change the reference points through Board action; you know at a majority vote at this meeting or any future meeting, or through adaptive management those being the addendum and amendment processes. The difference here is time, timelines. Board actions are pretty quick, addendums and amendments take a little bit longer. There is also varying levels of public input in the adaptive management process. But also again, there are these bigger discussions, longer term discussions that the Board can continue to make progress on. Talking about MSE, we've had some conversation about that already.

Do we want to have higher level discussions at the Commission with the Policy Board, or talk about how we might integrate multispecies decision making. That is really all we have to set the stage for your discussion, but I guess Madam Chair, it's yours to rein in.

CHAIRWOMAN MESERVE: Questions to just what staff has said about process? Lynn.

MS. FEGLEY: I just had one quick question for Katie, because I'm confused. Bluefish, did I understand you to say we're overfishing bluefish right now, and is there a target for bluefish?

DR. DREW: All good questions. In the current ERP model, because we only went through 2017, in this scenario bluefish is experiencing overfishing and was overfished. The most recent stock assessment update for bluefish went through 2018, and was no longer experiencing overfishing. Bluefish does not have an F target.

The assessment looked at using 0.9 times FMSY as a potential target. We would probably continue that for this analysis. There is also no biomass target for bluefish. They use one-half the BMSY proxy as a threshold. However, we could redefine sort of a target as the BMSY proxy for bluefish. But those are things that the

Board could certainly consider or think about when we bring that back.

CHAIRWOMAN MESERVE: Questions? I guess there are questions. John Clark.

MR. CLARK: As long as you have that table up there, Katie. If you look at the species altogether, is one or another going to be kind of the choke point that sort of would set the reference point lower? I mean how are you going to consider them in total to come up with a single unique reference point?

DR. DREW: That's a good question. As I said, we've sort of focused on striped bass here because we know it's the most sensitive to the menhaden levels. Bluefish could probably sustain a larger menhaden fishing mortality and still remain at its target or threshold, whereas that would cause striped bass to start to decline.

I think that would be one of the things we would look for is what is the combination of F that keeps the most sensitive predator at its target or at its threshold? However, there is certainly the possibility that there is no magic number for menhaden that would keep all of them at their target together.

Obviously, we talked a little bit about the interactions between some of these species, in terms of bluefish and weakfish and striped bass. Well, all of these are competitors for menhaden, but they also prey on each other, especially as juveniles, and so that fishing one species more aggressively will benefit another species. There is a tradeoff there. We can come back. What we'll show you is basically where do all of these predators fall out relative to their target under different menhaden scenarios, and under different single species F scenarios, so that you can sort of help evaluate what is the best ecosystem that we can get out of this fishing mortality rate for menhaden? You guys unfortunately are the ones who are going to have to decide what best is. But we can definitely use the existing reference points as sort of a framework or a starting point for evaluating where we should go.

CHAIRWOMAN MESERVE: Jim Estes.

MR. ESTES: This sounds probably, like even to me it does, probably an ignorant question. But I fear not. We talked a little bit yesterday about performance. We're going to step across the door into a new world here. How do we evaluate this very complicated thing to see if it is performing like we want it to?

DR. CIERI: Well obviously we're going to be updating this sort of approach while we're doing updated assessments for menhaden, so we'll be able to look at the behavior as we go through the update process, just like we would for menhaden always. Does that make sense?

CHAIRWOMAN MESERVE: Ritchie White.

MR. WHITE: Looking at this chart, I'm trying to think how we integrate our lack of ability to make final decisions on herring, dogfish and bluefish. How does that work into this system?

DR. DREW: I'll jump in and then we can sort of talk about this; is number one we are going to talk about this at the Policy Board, because it's true that you guys have no control. Well, some of you are the same people, but we all understand that the Striped Bass Board is the one who is making the decisions about striped bass, how you manage striped bass, how you get to the striped bass F target. The Menhaden Board doesn't really have a say in that process.

If we fish at our F target for menhaden, our ERP target for menhaden, and striped bass does not recover. Is that a failure on the Menhaden Board or is that a failure on the Striped Bass Board, or is that a problem with a larger ecosystem or biological problem that we're missing that knob to turn? It is a question that I think the Policy Board is going to have to figure out.

However, I think the Menhaden Board can sort of take this first step as thinking of it as we will put these species in a position to succeed, on the basis of what menhaden can do for them and for the ecosystem. It's up to the rest of the boards to make sure that fishing mortality on

those other species is not going to conflict with our ability to provide forage for them.

MR. WHITE: Follow up.

CHAIRWOMAN MESERVE: Go ahead Ritchie, follow up.

MR. WHITE: I was meaning more that the Service and the Council is involved in some of these species more than we are. In other words, we kind of get to adopt what they do. How do we integrate that if we're going down the road on striped bass let's say, and they want to expand dogfish, for an example? It then interferes with our striped bass management. How do we work that?

DR. DREW: That is a Policy Board discussion. We think of this as this is a series of steps. Right now we're ready to take the first step in ecosystem-based management, which is trying to consider menhaden's role as a forage fish when we set quotas for menhaden. There are a number of steps that are going to have to come after this.

Right now these scenarios basically only include the existing reference points for these species. How can we bring this Board into conversations about those reference points with other boards here at the Commission, with our federal and state partners? That is a discussion for the Policy Board. I think the discussion for this board is how do you want to take the next steps before or after that conversation happens?

CHAIRWOMAN MESERVE: I would like to focus the Board's attention on that shorter term goal, and looking at the example ERP that has been provided, and the alternatives that have been suggested for development. I would look to the Board to help provide some direction as to potential paths we could take with those. Allison Colden.

DR. COLDEN: If it pleases the Chair I have a motion that I would like to offer to sort of move us in that direction.

CHAIRWOMAN MESERVE: Go ahead, please. We'll get staff I believe has a copy of it to bring up.

DR. COLDEN: Another one of these very long motions, but in effect it is, to adopt the example ERP that we saw today. There is probably a necessity for me to read this into the record, right? **Okay, so move to adopt an Atlantic menhaden ecological reference point F target equal to the maximum F on Atlantic menhaden that maintains Atlantic striped bass at its biomass target when striped bass is fished at its F target and all other ERP species as defined in the NWACS MICE model.**

Can we call it that, are fished at their status quo F rates. And two, an Atlantic menhaden ecological reference point F threshold equal to the maximum F on Atlantic menhaden that maintains Atlantic striped bass at its biomass threshold, when striped bass is fished at its F target and other ERP species as defined in the NWACS MICE model are fished at their status quo F rates. If I can get a second I'm happy to speak to that.

CHAIRWOMAN MESERVE: Seconded by Cheri Patterson. Go ahead, Allison.

DR. COLDEN: You know given the presentation that we just saw there may be some folks around this table who think that this motion is a little premature. But the reason I have sort of put this forward is I think what the Workgroup has given to us in this example ERP, and as it's been described in the assessment report and the discussion today. It's sort of a really viable option as a first step, in the short term towards implementing larger ecosystem-based fisheries management for menhaden through this Commission. The example ERP as we've discussed focuses on striped bass. The most sensitive species in the model, and also currently reflects our best approximation of the reality of what's going on with those other species in the ecosystem. I think it can be valuable to look at some of those other scenarios that have been put forward by the Workgroup, and maybe discussed by others. The one thing that I did want to caution us again though is going down a rabbit hole.

There are near infinite combinations, I believe, especially if we start stepping out of the framework that of using management objectives as defined by the species respective boards. I think that in the short term this presents a viable option for us to dip our toe in that pool of ERPs, while we continue to have these really important discussions about process and model development and refinement as we move forward through the Policy Board and other discussions that we have here.

CHAIRWOMAN MESERVE: Discussion on the motion?
Justin Davis.

DR. DAVIS: I guess I'm trying to wrap my head around the part at the end of both of those bullets there, the status quo F rates. Certainly I'm assuming bluefish is included in the ERP species, and we know that we took action this year with bluefish to try to reduce F. I'm wondering, I guess I'm trying to wrap my head around what that means.

If you adopt a menhaden ecological reference point that should be adequate to maintain striped bass at say its target, while we're fishing the other species at status quo F. What does it mean when we then relax F on one of those species? Does that mean that that menhaden reference point is now more conservative than it needed to be or less?

Because as you relax F theoretically those other predators should become more abundant and exert more predatory demand on menhaden, so now you need more menhaden than you thought, because there is now competition or is it that now there is more room for natural mortality to increase for those predators, because you've relaxed F?

Although you don't want overall mortality to stay the same, just trying to get the population, I'm trying to work all this through, what it means that we're essentially setting a reference point here where we're allowing for fishing these other species at their status quo F rate, but not allowing for reductions of F, which are likely to occur at least for one of those species in the near term.

DR. CIERI: Welcome to our world. I think on some level you can sort of see where some of these reference points would go. But this is the example that we have so far. If you want to see other things, we've done that. We're going to be able to do that for you in May. It's going to be an interesting discussion for you guys as you move forward. But you know you can go with the sort of bite size approach that we've suggested to you so far.

MR. APPELMAN: I was just going to add onto that. I think the example scenarios that were up on the screen can sort of show you what you're getting at and something if tasked we could bring that to you in May of different F assumptions on these predators. How does that change the outputs of the model? How does your ERP value change when you fish your predators at different levels? You know what does that mean for menhaden harvest? I think that is something that we can show you if tasked.

CHAIRWOMAN MESERVE: Ritchie White. Bryan Plumlee.

MR. J. BRYAN PLUMLEE: I want to step back for just a minute and ask a question that I probably should have raised earlier, and I think in response to Eric. You asserted this but I need a little more clarification. There is a conclusion that we cannot get to the acceptable F target for striped bass without independent striped bass management, no matter what you do with menhaden. That is a very firm conclusion, probably the only firm conclusion I've heard. Is it similar in that we cannot without increasing the availability of menhaden reach the acceptable striped bass F target from where we are? Have we decided that?

DR. DREW: Good question. This is I think where the additional scenarios come in a little bit. Right now if we manage to bring striped bass F target down to its F target, and we continue to fish menhaden where we've been fishing it right now, which is approximately

close to the ERP target because of that large buffer we've put in.

Then yes, in the long term you would expect striped bass to rebuild to its target, as long as you're also keeping those other species, those focal species at their current sort of average into the future. We haven't explored what would happen if you bring all of those other species to their targets or to their thresholds, but there is the potential kind of in the long term to rebuild striped bass under this specific scenario, yes.

CHAIRWOMAN MESERVE: Megan Ware.

MS. WARE: I guess speaking to the motion. I'll start by I agree with the sentiment about kind of adopting ecosystem reference points as a high priority for this Board. Certainly throughout the development of Amendment 3 we heard a lot of public comment in support of that so I do want to acknowledge that.

I think this is also a lot of information to process, and it's important to understand and explore the assumptions and parameters in this ecosystem reference point. I'll also note that the Policy Board is starting their discussion tomorrow as has been mentioned, about incorporating ecosystem management kind of into the Commission framework.

I think that's an important discussion to be having concurrently. With that I would like to make a motion to postpone, and I think the staff has my language. I'll read this into the record. If I get a second I'll kind of speak to the specifics. But move to postpone until after completion of the following task. Task the Ecological Reference Point Workgroup with the following analysis to better understand the parameters and outputs of the example ERP. The Workgroup is asked to present this analysis at the May ASMFC meeting using the existing example ERP framework.

Modify the assumptions on the other species such that they are fished at their F target as opposed to their F 2017 rate, and then reproduce Figures 144 - 148. Using the existing example ERP framework modify the assumptions on the other species such that they are fished at their F threshold, as opposed

to F 2017. Again, reproduce Figures 144-148. Using the existing example ERP framework, modify the assumptions on the other species such that bluefish and herring are fished at their F target, while spiny dogfish and weakfish are fished at their F 2017, again reproduce Figures 144-148.

CHAIRWOMAN MESERVE: Is there a second to the motion, John Clark? Megan, if you would like to speak to your motion.

MS. WARE: Yes just a few things. I would like to highlight that this analysis is intended to come back in May, so I don't want this to seem like this is kicking the can down the road. I think this is kind of doing our due diligence in what's been provided to us, and doing it in a timely fashion. Then these three bullet points I believe are what was on the screen for the table that staff presented. That's kind of what I'm trying to get at.

CHAIRWOMAN MESERVE: John, did you want to speak to the motion as a seconder?

MR. CLARK: Yes thank you, Madam Chair. I thank Megan for this motion. I agree that the ERP approach is very interesting and we're proceeding in that way. But we're looking at reference points that are approximately 40 percent lower than our single species reference points, where menhaden are not overfished and overfishing is not occurring. I just think we, as Megan pointed out, should take a little time to look further into this before we make that our new management target and threshold.

CHAIRWOMAN MESERVE: There are a number of individuals who had raised their hand on the prior motion, and I'll go to them. Adam Nowalsky.

MR. NOWALSKY: A question I have right now is what does it mean to this Board and ultimately the public, in terms of harvest levels by adopting the ERP reference points now, in May, sometime this year? We've given advice that

we should be using the BAM and the ERP together in some capacity.

I'm not clear on how we're going to do that especially if they give us slightly differing advice. If we adopt the ERP reference points as the first motion suggests today, or bring that motion back up in May after this other work is done? What is that actually going to mean, in terms of specifications on menhaden specifically?

MR. APPELMAN: Thanks for that question. I think the process for TAC setting, fishery specifications wouldn't change all that much. You're now just using a different F target for menhaden to run those projections and find the TAC that achieves that under certain probabilities, whatever guidance is given from the Board. The TAC setting process wouldn't change.

CHAIRWOMAN MESERVE: Follow up Adam.

MR. NOWALSKY: What that would suggest is when we set TACs that staff would, or TC would run a series of projected TACs based on both the BAM reference points and ERP reference points that we adopt, and then we would select whichever number we want to, or would we first have to decide whether we want to see only ERP based TACs or only BAM based TACs?

MR. APPELMAN: The projections would be done using an extension of the BAM model, is my understanding. Anyone can jump in if I'm wrong. But the first step would be to identify your ERP definition, which corresponds to a value, which we would then use for the BAM model to make projections and provide a suite for the Board to consider, TAC options for the Board to consider.

CHAIRWOMAN MESERVE: Allison Colden.

DR. COLDEN: I had forgotten I raised my hand, but I do have a question. You know I think that if I am reading these correctly, these are the scenarios put forward by the ERP Workgroup for modeling, is that correct?

CHAIRWOMAN MESERVE: Correct. In the table it was part of staff's presentation.

DR. COLDEN: Sure, and I think it goes back to a larger question of process and what is appropriate action for this Board versus the Policy Board versus some other configuration that the Commission decides is appropriate moving forward. But in my viewpoint, some of these scenarios that were put forward I think can be very informative in framing sort of the spectrum of possibilities that exist.

You know all F target, all F threshold can sort of put bounds on things, and give us information that would be useful. But I think it's really important to maintain some sort of semblance of connection to the reality of where things are. I think we can hope that we fish all of our predators at their F target, and I hope that that is our general goal at this Commission.

But it seems to me that that is not currently where we are. The assessment report did mention that they chose the striped bass F target because there was this pending action that we went through yesterday at the Striped Bass Board to make that happen in the 2020 fishing season. I'm just sort of trying to grasp at what helpful, actionable information these scenarios will get us if they are sort of including an implicit judgment on the objectives of the other species, which I feel like should be better left to those other species boards.

MR. APPELMAN: I'll take part of that and hopefully people up at the table can help me out here. I think the Board is going to grapple with the right assumptions of where the environment really is versus how these separate management programs aim to achieve various targets. It can be somewhat reactive in assuming.

Right, making an assumption that the different management programs are going to act accordingly to achieve their F targets, or I guess the alternative is that this management board makes a different assumption, which is what some of these scenarios are trying to do. We might never see F at the F target for this particular species management program. It's

really on the Board to hone in on the appropriate assumption, balancing what the ecosystem currently looks like or might look like in a short term versus referring to the targets and threshold that have already been identified in those programs.

DR. CIERI: It's important to understand that like when we went back and we were doing this modeling approach, we basically left everything at status quo, with the exception of striped bass, one, because it was more sensitive, but we also didn't know where the management of those other species was going.

Since we've done that decisions have been made on some of those species, including bluefish, like Atlantic herring can't be overfished, I mean can't have overfishing occurring, because it's also a federally managed species, the same thing for spiny dogfish. There are some differences between the examples ERP we've given, and again what reality is currently right now.

CHAIRWOMAN MESERVE: Follow up Allison.

DR. COLDEN: I just wanted to follow up and acknowledge that we heard this morning that bluefish in particular has had a management change. I do think that could be something important to look at within the context of the existing ERP framework. I'm not sure about sort of the status of herring management action. But you know that is one that we have already discussed has had some changes since then, so that would be the one scenario I think could be valuable.

MR. APPELMAN: Sorry, we were kind of side barring over here as you were going, Allison. But I just want to point out that Example Number 3 on this motion is getting to your point about setting bluefish at their F target, more creating the current environment that we would expect out there for the predators that are involved in this particular model, if that helps at all.

CHAIRWOMAN MESERVE: Bill Hyatt.

MR. HYATT: My comment has been largely addressed by the substitute motion, but you know the worst possible outcome would be for us to adopt new reference points, go through scenario planning, get

results that are significantly different and that appear to be all over the map. Absent any sort of reassurance that in fact those scenarios are going to result in subtle changes, rather than significant changes. I would support this substitute motion.

CHAIRWOMAN MESERVE: Steve Train to the motion, pass, Jim Gilmore.

MR. JAMES J. GILMORE: I support the substitute motion. Not opposed to the initial motion, but for I think some of the comments that have already been made. There is a lot of information there we've gone through. I think the download speed from my computer just for the assessments took like many, many minutes.

Going through this stuff is, and again I commend all you guys, this has been an incredible amount of great work. But we're kind of looking at. I understand, I'm going to brag. I think I understand 15 percent of this. Jim, you said 10. I really have to get a better comfort level before we start adopting these formally. There is the scientific part of it, but then there is also other points have been raised by Ritchie about the interactions with different species boards and things like that so the management practicalities of this I really have got to digest a little bit better before we start, you know putting this into full swing. Again, we're at a fishing mortality for menhaden where we're not in any risk right now.

It's actually I guess below, because of whatever accident we had in terms of our conservatism or whatever. I think a little more time to go through this and to get some better analysis, I think is the way to go right now. We are going to get there. But I think at this point we're a little bit premature, so I support the motion and hopefully we get to May we'll be in a better place to start discussing implementation.

CHAIRWOMAN MESERVE: Joe Cimino.

MR. JOE CIMINO: I support the motion to postpone, going all the way back to Justin's

questions about bluefish. For those of you that were here late last night, you know why I'm taking bluefish seriously. My question is to the ERP Working Group and then I guess also to staff. We have two extremes, and then we have maybe a management scenario that makes no sense in these examples.

Are you putting that up there for us as a way forward that you think that you can achieve in the very near future say, getting us examples by May? Are there other things that you think you should be looking at? Then my question to staff is if you feel this is the very next step, but during this process between now and May, is there a way to communicate back to the Board that we've now realized there are other than just looking at target and threshold for everything, there are other things we would like to explore?

DR. CIERI: I think this certainly frames the uncertainty in the possibilities. Other options, you could certainly see how you would go in between some of these particular options. You know you half rebuild you know weakfish or whatever. You can certainly do something as more of sort of an integral approach. As far as whether or not, you know you could run a million scenarios. I think it's important to sort of hem them down to the stuff that you think is vitally important. As far as communicating with us in the timeline, I'll let staff deal with that particular issue.

MR. APPELMAN: I think we put these examples together sort of low hanging fruit. There are a million and one differing combinations that the ERP Workgroup could provide, and that is a very, very daunting task, so we put a few that are in line with the example that has already been provided.

I do see a bit of feedback going on back and forth potentially with the Board and the ERP Workgroup. Say we come back in May and realize that this is satisfying. We don't really need to explore this particular subset of runs anymore, or maybe we need to add to this list. I think that can definitely happen.

CHAIRWOMAN MESERVE: Bob Beal.

EXECUTIVE DIRECTOR ROBERT E. BEAL: Just a quick question, thank you Madam Chair. Is this a reasonable amount of work between now and the

May meeting? Given the personalities at the front of the table, I assume a couple hands would have shot up. I just want to make sure that this is something that the group thinks you guys can do.

If there are some additional options I think, not speaking for the Board, but I would assume there is some latitude for the group to explore some hybrids, or something in the middle of these options. As you guys work through these if there is something that you feel would be very informative for the Board in May, I don't know if anyone would object to giving you guys the latitude to go ahead and you know explore some middle of the road options, and those sorts of things. But mostly I just want to make sure this is doable by the May meeting.

DR. DREW: Yes, we selected this sort of very limited. We didn't want to give you guys like complete free rein and say, give us all of your ideas. We picked a select few that we thought would be very informative, stay within the bounds of existing FMPs, which does sort of limit what you can do, but also is doable by the ERP group in time for May. If you guys want to start adding onto this list, I think we would definitely have to sort of pull back a few things, depending on how far down the road you went. But this is doable by the May meeting.

CHAIRWOMAN MESERVE: Mel Bell.

MR. MEL BELL: I think as a new guy I was just struggling with a process question here. It seemed like perhaps the Menhaden Board was making a decision or a commitment on the part of other boards, and you mentioned the Policy Board discussion. I think that is probably how that gets ironed out.

But I guess what we're basically doing here is we're going to set some level for menhaden, and then that sort of drives. That fixes that in place, and then that kind of drives the potential for the other parts of the train to come in and work. But I do think we need to take the first step, it's just how you take that first step.

I mean I agree, you know you take that first step with the long term in mind, but that first step is kind of critical. I was kind of getting hung up in process I think, of how this worked. But I would trust staff and you guys to advise us properly on that just so we're not mis-stepping. But it did seem like we were perhaps making a decision in committing other boards to play along with it, so that was it.

MR. APPELMAN: Yes, I'm going to throw the ball back in the Board's court. I mean it is on the Board how they want to move forward with these different short and long term goals I keep referring to. The way that they identify an ERP, and the way they incorporate into the management program is purely a Board decision, what is a pace that you're comfortable with?

What kind of level of public input are you comfortable with, those sorts of things, and how again the longer term, how we integrate other management boards. These decisions are another thing we can move forward on at the Board's pace. It's really on you guys to decide what is the best way to move forward? We put together sort of thoughts from staff's perspective on how to take small bites at it in the short term.

CHAIRWOMAN MESERVE: John McMurray.

MR. JOHN G. McMURRAY: I had a question about John Clark's comments. Clearly I'm misunderstanding something here. I would trump Jim and say I understand maybe 5 percent of all this. John, you said that we're looking at menhaden reference points that are approximately 40 percent lower. I don't understand that because we were just told that at the current F target we could rebuild striped bass to target. Maybe somebody could clarify that for me.

DR. DREW: It's not at the single species F target, it's at the current F level that menhaden is experiencing, because our quota is set so much lower than you would expect if you were fishing at F target.

MR. McMURRAY: Follow up.

CHAIRWOMAN MESERVE: Go ahead.

MR. McMURRAY: Okay thank you, I understand that now, but the point is we don't really have to take any real management action if we adopt this now, and it seems to me like there is no reason to wait until May. If I'm reading this correctly there is not even a commitment to act on it in May, we're just looking for more analysis.

I'm looking at this in a context of what we've heard from the public. I mean it took 20 years to get here, and it certainly appears like we're kicking the can down the road. It just seems like this is a real good time to do this, and quite frankly I'm not really understanding why we're not.

CHAIRWOMAN MESERVE: As a motion to postpone the original motion would automatically come back to the Board in May, provided these analyses are completed. It's not kicking it down indefinitely. That motion would return. Ritchie White.

MR. WHITE: I think the discussion at the Policy Board; we clearly need that to figure out the long term. But the short term Striped Bass Board and Bluefish Board already gave direction to the Menhaden Board. They are already going down the road of trying to rebuild stocks. It's going to need menhaden. We're just reacting. I think this will just react to what those boards have already done. I don't see it as gee; we have to go to these other boards to like get permission. This would be our reaction to that.

CHAIRWOMAN MESERVE: Right, each of these examples is working within the constructs of the existing objectives for those other species, but there could be the larger Policy Board discussion if we want to deviate from those. Steve Murphy, did you have your hand up earlier?

MR. STEVE MURPHY: A few years ago I was watching a Senate Budget Hearing, and somebody stood up and held up a big budget and said, we're going to vote for this and we'll

read it and find out what's in it later. I just think, I agree with the substitute motion. I think it's important to be deliberative on this. I'm excited about plowing new ground. I think that is an important step. My take home from this is the conservative management approach that we took on menhaden was a good idea. But I would like to sort of understand this more fully in depth, because I sort of go down the road of now what.

I look at species like spot and American eel, and I'm like okay now if you want to put that into this same scenario, those conservative types of approaches also apply. I support the substitute motion to come back and look at this in May. I really don't see it as kicking the can down the road. I just see it as us having more time to deliberate, and sort of go back and sort of discuss this with staff and stakeholders.

CHAIRWOMAN MESERVE: Thank you, Spud Woodward.

MR. A. G. "SPUD" WOODWARD: I guess I've got a question. This is going to be more process related. In the scenarios that is put up here in going forward with this. Is it going to require that we do synchronized assessments on all these species so that you have the same time series of data analyzed, in order to evaluate, as Jim was saying earlier, performance of this approach to actually accomplish any of these goals?

DR. DREW: We would need synchronized assessment schedules of the key predators in the ERP species, in order to update the ERP model on the same timeframe as the menhaden model. Conceivably we could, if they are a year or two off we could have say one species sends in 2017, and the rest end in 2018.

It's not the end of the world for the NWACS MICE model. That model really benefits from the long term projections, rather than trying to figure out exactly where you are in '17 versus '18. That is where the BAM model really shines. We would want these predator and prey species to be as up to date as possible when we do the ERP, and so thinking about that going forward is also something we would bring up with the Policy Board.

DR. CIERI: One of the things to keep in mind is while it would be really great to have these completely in lockstep; it's probably not going to really be the case. But this is a broad issue that you could probably bring to the Policy Board, and have the Policy Board sort of push that off onto the Assessment Science Committee, to think about ways of actually scheduling the assessments and the updates for the most appropriate use.

DR. SCHUELLER: I just wanted to chime in, but that is something we'll definitely bring to the attention of the Assessment Science Committee. I also wanted to note that we did look at the schedule for three years ahead, when we were thinking that we might be doing an update, and we're not in terrible shape in terms of when the timing of those other assessments are scheduled at the moment. Some of them are tentative, but when we looked at it, it wasn't as if we were all off at the moment. We're in decent shape on that end right now.

CHAIRWOMAN MESERVE: Mike Millard.

MR. MIKE MILLARD: I hope this question makes sense, but I can't guarantee it. What I'm trying to get at is the added value or the added information that this motion is proposing. We've been told that striped bass were the most sensitive species to the menhaden management. I'm wondering if that works in reverse.

This motion is suggesting that we go put on pause, and then we go to these other species and tweak the dials a little bit, and see what that does to the ERP. In the context that these other species are less sensitive to menhaden management, does that mean also that tweaking those dials on these species will produce less of an influence on the ERP? In other words is what we're asking, which looks like a lot of work to me, I don't know. Are we likely to get a great deal more information or new information out of that with these species?

DR. DREW: That is the question I think. Yes, striped bass is the most sensitive species. I don't think we will be seeing a change that is as significant as say the difference between the example ERP and the single species. However, I think the question that Justin brought up earlier is relevant here, which is that if you allow bluefish to rebuild.

Do you need to leave more menhaden, and have a lower menhaden F in order to sustain both striped bass fishing at its F target and bluefish at its F target? Right now bluefish is overfished. If we allow that to rebuild is that going to compete more for menhaden?

Is that going to prey more on striped bass, and require a lower menhaden F to sustain the population, or is bluefish's sort of lack of sensitivity to menhaden mean that if we sustain striped bass that excess menhaden is still available to bluefish, and they can succeed and remain at a good level even at that same level? I think that is kind of what this set of analyses would help provide some information on, which is how sensitive are these reference points to long term predator F rates, long term predator conditions?

CHAIRWOMAN MESERVE: Lynn Fegley.

MS. FEGLEY: I wanted to speak in favor of the substitute motion, and I wanted to just say that speaking in favor of this motion is not in the spirit of kicking the can down the road. I think this is vitally important that we get to these ERPs, but it is in the spirit of transparency.

I think that we and our public, who have been anticipating this, will feel better when we bound this problem, and we can see what the sensitivity of those ERP values actually is. I very much support this effort. Also, I just want to say that I think we also need to think in the short term, because we're going to face this adopt question in May. I think we're postponing the motion that is the motion on the table.

When we adopt, does that mean that we are then bound by the triggers in Amendment 3? In other words, does that mean that if we're now fishing according to an ERP, and we exceed that and we're overfishing, I think the trigger says we have to reduce F to the target? I'm just trying to understand how the

mechanics of the Plan would work, in terms of holding us accountable to what we adopt.

MR. APPELMAN: I think that would be my interpretation. These ERP reference points are F reference points, so we would be adopting new F targets and thresholds for menhaden, and therefore the triggers associated with the F target and threshold for menhaden would still be in play. These ERPs don't create new biomass targets and thresholds for menhaden, so those triggers might be stagnant.

CHAIRWOMAN MESERVE: Follow up Lynn.

MS. FEGLEY: We can monitor. If we're fishing under an ERP value that value can be monitored by running the BAM model and looking at the full F is that correct? We don't need to run the MICE model to measure the status of where we are relative to the ERP. The full F in the BAM, so let's say hypothetically we adopted. It's two years down the road, we're still in the long term, we're trying to get to that long term goal, and we can see where we are relative to the ERP just by running the BAM and looking at full F?

MR. APPELMAN: That is my understanding, but at some point there would want to be a reevaluation of the ERP value as the other biomasses in this system have changed. You want to update those data points and run the MICE model to see if our ERP targets have changed. But you're right. The F estimates for menhaden are coming from the BAM model.

DR. CIERI: One of the reasons that we built the MICE model the way we built the MICE model was to allow it to be updated every time you update Atlantic menhaden. We'll be running the MICE model, but also as we go through a benchmark process we'll look at the full EwE model, to make sure that those component parts in the MICE model are still running along in the same thing. I think that has been the entire point. But you're exactly correct. Once you base the reference points for the short

term, we would be using the BAM single species model.

MR. APPELMAN: Yes, I just want to add to this conversation a little bit, just so we understand, so everyone understands. We have the BAM model is producing F estimates for the menhaden time series, which are then plugged into this EwE MICE model, the NWACS MICE model, which then produces an F value, which goes into the projections model, which is an extension of the BAM, for lack of a better term. That is sort of where the F is moving through the systems and resulting in. It's just dependent on the projections model in the end.

CHAIRWOMAN MESERVE: Eric Reid and then Allison Colden. Then I would like to call the question on the motion.

MR. REID: Right now we're working with one example, and it has been said that in any example there is a lot of moving parts. Me personally, I would like to see a few more examples of what that all looks like, because I'm not alone in getting my head wrapped around it as well. Of course the people who understand 100 percent of this model have suggested to us that they want to do this, and they're telling us to tell them to do it. I don't know why we're having this giant conversation about it.

But that's what I got out of it, and they were suggesting to us and they were being nice, because we're not listening to them. That is my second reason. Okay, I'm good. You said you can do it. I heard you the first time. Let's do it. We're not kicking the can down the road, we're informing ourselves better on what this new puzzle looks like, and I need that so I support the motion.

CHAIRWOMAN MESERVE: Allison Colden.

DR. COLDEN: I'll be brief. Basically, you know I'm sympathetic to those around the table who want more time and want to see more. I just want to in the universe of infinite possibilities that could result from this approach moving forward, just want to encourage everyone to think about what comes in May and after May, and what it would take. These are the low hanging fruit, right, so what would it take for us to get

to the hypothetical place of yes for adopting ERPs, either between now and May or whatever happens in May moving forward, so just wanted to finish up with that.

CHAIRWOMAN MESERVE: Dennis, I did see your hand. I would ask if the Board is ready to vote. Go ahead, Dennis.

MR. DENNIS ABBOTT: I support the motion. But my question is in sitting here thinking, and predator/prey relationships, striped bass/menhaden. Is any of this going to be helpful to us in managing the issue of the Chesapeake Bay Cap?

DR. CIERI: Yes real quickly. No. These are coastwide models built on population perspectives. Smaller, individual areas or timeframes such as in-seasons aren't really possible in this sort of approach, simply because that requires just way more data than we really have.

MR. ABBOTT: Thank you that was the answer I expected.

CHAIRWOMAN MESERVE: Is the Board ready to vote on the motion? **It has been read into the record without any changes, so is there a need to caucus? Seeing none; all those in favor please raise your right hand. Those opposed please raise your hand, any null votes or abstentions. The motion carries unanimously.**

We have fifteen minutes left in our allotted time. Staff did present a couple questions for the long term goals. We started to have some of that conversation. We are aware that there is a Policy Board discussion tomorrow that is going to be talking about this. The staff's questions were, do we want some long term considerations or pursue MSE or to initiate dialogue with the Policy Board.

If there is anything particular that this Board wants to ask the Policy Board we could talk about that now, or we could wait to see how the Policy Board discussion goes tomorrow. It's many of the same people around this table. I

guess I'm looking to the Board for some guidance as to how into the details we want to go on this topic right now. David Miramant.

SENATOR DAVID MIRAMANT: No more than 15-minutes worth.

CHAIRWOMAN MESERVE: My sense is that people are a bit exhausted right now, and that maybe we should move this discussion to the Policy Board, unless there is any specific input that we have at this point.

ADJOURNMENT

CHAIRWOMAN MESERVE: That will be my approach, which brings us to Other Business. Is there any other business to come before the Menhaden Board? Seeing none; is there a motion to adjourn?

Thank you, and I will look forward to the May meeting where I'll be sitting over there, and Spud Woodward will be up here. Meeting is adjourned.

(Whereupon the meeting adjourned at 11:45 a.m. on February 5, 2020)