Good morning. Let’s go ahead and get started. I’d like to take this opportunity to first of all thank all of our panels for their participation today, but also to welcome everybody. Before we begin the panel discussion I wanted Rod to provide some quick background and context for the purpose of the panel and some of the work that we’ve done over the last couple of years as a council and at the SSC level to get to this point.

As you may recall, two and a half years ago the council formed subcommittee, an ecosystem subcommittee of our SSC. We gave them terms of reference and among those terms of references we asked them to give us scientific advice to help support the development of ecosystem level goals and objectives for the council that we could consider. We’ve often had discussions around these topics and highlighted the importance of having well defined goals and objectives related to this before moving forward with changes in our management programs.

We’ve asked them to do that. We also asked them to describe scientific advice that we could use to incorporate ecosystem structure and function into our management programs and decisions, specifically in a quarter setting process to account for ecological sustainability. Based on their advice, we have developed an ecosystem level goal statement and that is for the ecosystem guidance document that we’ve been working on and that goal statement reads as follows. It’s up on the board as you can see, but it’s to allow for ecologically sustainable utilization of living marine resources while maintaining ecosystem productivity structure and function. That’s a high-level objective that we developed based on their advice.

Following that, there have been a few more important steps along the way. Last year the Mid-Atlantic Council hosted the 4th National SSC workshop. That was the first opportunity for a national discussion by all eight regional SSCs about how each council is incorporating ecological considerations into their management programs or decision-making processes. It was also an assessment and management of Forage docs or the assessment and management of Forage docs is one of the highlighted focal points of the workshop.
Coming out of that discussion about Forage docs, there were several questions that were left open by the workshop and highlighted as areas that needed further discussion. One was a generic definition of forage species. They thought there would be some benefit to that. Also what special assessment and management considerations for forage species are appropriate? I think we’ll have a lot of talk about that today. The participants in that workshop nationally also agreed that additional work or discussion may be indicated relevant to some sort of national guidance or advice on these questions.

There is always a tension I think between asking for national advice and considering what’s appropriate at the regional level. Today I hope that our discussion will be focused on the Mid-Atlantic Regional Ecosystem. We’ll have some discussion about that and what might be appropriate in that context. At the end of the day I think that’s where we want to be operating. Since that National SSC Workshop, the council vetted to develop an ecosystem approach to Fisheries Management Guidance Document that’s similar to what the Pacific Council has done to non-regulatory umbrella type document that would guide council policy with respect to ecosystem considerations across existing fishery management plans.

We formed an ecosystem advisory fishery management working group to develop that document and that expertise across that working group is relatively broad. It includes assessment modeling, habitat, social and economic and fisheries managing. In terms of where this forage question fits in that document, I think it’s important to consider that the ecosystem approach fisheries management guidance document would include five important areas or components.

One would be Forage or low trophic level species considerations. A second would be species interactions, because this is not the end of the food web, it’s the beginning. We know there are a lot of complexities to that. There are a lot of very important species interactions that occur throughout the environment and the marine ecosystems. If you think about what we’ve heard over the last couple of years as we’ve gone out and had these small group meetings up and down the coast, constituents in every aspect of the fisheries did express significant interest in seeing us make progress on better incorporating ecosystem considerations into the management of fisheries, better incorporating those types of food web connections into the management of fisheries.

They had very different perspectives on that, but everybody wanted to see us make progress on that. This is one part of that discussion. There are other species interactions at higher trophic levels that are also important. That would be a second component of the document. Third would be incorporation of social and economic considerations in optimal meal specification. Fourth would be
effective systematic change in oceanographic conditions on abundance and distribution of fish docs and the relevance of that for fisheries management.

Finally the incorporation of habitat conservation and management objectives in the current management process. Today’s focus is going to be on science related to the assessment and management of forage species. There is a general consensus within the scientific literature that forage species are ecologically important and that that importance should be reflected in their management, but as you know there’s a wide range of methods for how to do that and of course there is a wide range of different types of ecosystems around the world and a lot of the literature that you see is international. Again operating under Magnus and operating in the Mid-Atlantic, what might be most appropriate?

I’m hopeful that today’s discussion will advance our understanding of how natural mortality, predation mortality, those factors that might be considered in the stock assessment go right back to these ecological objectives, how they relate back to reference points. I think we’ll have a broad discussion on that. We have trigger questions for the panelists that will probe at some of those issues from different angles and I look forward to a productive discussion on that, but again I’d like to thank our panelists for their participation today. John Boreman will be our moderator and I’ll turn it over to him. John?

John Boreman: Thank you Mr. Chairman. My name is John Boreman. I’m chair of the SSC for the Mid-Atlantic. Formerly with the National Fishery Service until 2008 and I’ve been enjoying life since then. I too want to thank the panelists for coming and I’ll just briefly introduce them. Their bios are on our website so you can read in-depth about their impressive backgrounds. First to my far left is Sarah Gaichas.

Sarah is an Ecosystem Modeler with the ecosystem Assessment Program at the Northeast Fisheries Science Center, coming from Northwest. She’s done a lot of work in the pacific area. Next to her is a Dr. Rob Latour who is a professor at Virginia Institute of Marine Science. Then we have Ellen Pikitch and Dr. Pikitch is executive director for the Institute for Ocean Conservation Science and a professor at the School of Marine and Atmospheric Sciences at Stony Brook. They don’t call them Sunni anymore, do they? It’s just Stony Brook.

Dr. Pikitch: You can just say Stony Brook University.

John Boreman: Stony Brook. Okay. Then next to her is Dr. E.D. Houde and E.D. is a professor, but I guess your new role is you’re Vice President for Education in the University of Maryland Center for Environmental Science. E.D. and Rob are members of the SSC and hopefully in the future we’ll have Ellen and Sarah on the SSC.
With that, I’d like to talk about what’s in store today. The main function of this workshop is to have a dialogue between the panelists and the council. This morning what we are going to do is have totally panel oriented presentations. Each panelist will present on a topic and then after the first two presentations we’ll have about half an hour to respond to trigger questions and discuss the implications of what was said during the presentations. Then we’ll take a break and then come back and the other two panelists will present and then we’ll have a second panel discussion, again stimulated by trigger questions or ideas or thoughts that came up during the presentations.

Then we’ll break for lunch and then after lunch Rich Seagraves I guess will discuss the results of the visioning project as it relates to ecosystems, what our stakeholders and partners out there think about ecosystems, science and ecosystems activities and issues as it relates to the fisheries in Mid-Atlantic. Then after that I’ll open it up for public comment, anything the public wants to say that hasn’t already been said. Welcome. Keep your comment short because we are still scheduled to finish at 3:00 this afternoon and some people have booked their flights around that.

This morning I will allow questions if we have time after each presentation, just for the purpose of clarity, if somebody didn’t understand something or wants a further explanation, but we don’t want to get into a discussion this morning. We want to stick with just the science presentations. This afternoon after the public comment we’ll open it up to have a dialogue between the council members and our panel.

We have trigger questions there but I’m sure based on experience with the council as I have, there’ll be lots of questions anyway. We don’t … probably won’t need trigger questions as questions will be coming forward. With that I’d like to begin and our first presenter is Dr. Ellen Pikitch. We can pull you up. Thank you.

Dr. Pikitch:  All right. Good morning everyone. Thank you for that introduction. It’s really a pleasure to be here and I think that this is a great time to be having this discussion. I’ve been asked to talk about the science behind what we now know about forage fish and how they ought to be managed. Just in the last few years there’s been a wealth of new science that’s come out. It’s really … again it’s a great time. We’ve known for a long time that forage fish are ecologically important, but that doesn’t necessarily easily translate into how they should be treated differently, if at all.

I’m going to say up front just in case it gets lost later on because there’s a lot to talk about, that not only is there a lot of new science, but that science is grounded in many different methodologies, including new data, new data
synthesis including field studies, modeling efforts of a variety of kinds. Really a very broad base of new science and this data and analysis clearly makes the case that forage fish need to be treated more carefully than other species. We need to trend carefully in order to conserve the ecological importance and the ecosystem as a whole.

I chaired a taskforce called The Lenfest Forage Fish Taskforce and I’m going to take you through some of our main findings and recommendations today. Again it’s a bit of a challenge to fit this all into a half an hour, but I’m going to do the best I can. Also so that you know E.D Houde on my right was also a member of The Lenfest Forage Fish Taskforce.

The Taskforce earlier on took on the task of defining what is a forage fish is and we pretty much had to do that and every group that grapples with this question needs to set the boundaries of what is and what isn’t a forage fish. We defined them as species that are crucial in food webs. They are often small bodied, often schooling pelagic species. They consist of species such as sardines, anchovies, sand eels, krill and herring. I put krill there to show that you don’t have to be a fish to qualify for our definition of forage fish as long as you play that ecological role. They feed on plankton and transfer energy to upper trophic levels mostly by being ... serving as prey for bigger fish and for other animals.

The other part of the definition is that in order to qualify as a forage fish for the Lenfest Taskforce, a species has to meet this criteria throughout its lifespan. There are species that may meet the criteria during its early life history, but as it grows it grows out of that role and we excluded those from the analysis. However, thinking ahead to the questions this might raise, the methods that we use could easily be used to apply to those species and we could talk about the details later.

Why has forage fish become such a big issue right now, lately? The latest statistics I have that about 37% of the world’s wild marine fish catch consist of forage fish. That’s a huge chunk of the wild marine fish catch and that’s different from what was the case not too long ago. In the ‘50s for example, the 1950s, about 8% of the catch by wave consisted of forage fish. It’s gone up greatly since then and every fish of evidence seems to point to the idea that it’s going to go up even more because the demand for the products is increasing. About 90% of the forage fish that are caught are processed into fishmeal and fish oil and much of that is used in aquaculture and in other activities. Only 10% of the catch is used for human consumption.

Forage fish are one of those groups of fish that led to the idea that the seas were so vast and limitless, that nothing we could do could ever hurt them. Here is a depiction of herring from the Baltic schools of herring. This is from the 1500s and
the idea was that they were so thick that an axe thrust into their midst would stand upright and you can see the axe there, but now we know that in fact these forage fish are highly variable. They’re sensitive to the environment and they are vulnerable to collapse.

Not only are they vulnerable to collapse, but some very major collapses have occurred and some of the notable ones I’ve listed on here. California sardines that turned Cannery Row from a fish canning activity to a tourist town proving anchovy collapse in the early ’70s. That took 10% of the world catch of fish in that one collapse. These are not only collapses, they’re really big collapses.

For these reasons the Lenfest Forage Fish Taskforce was put together and the objective was to develop consensus recommendations on sustainable management of forage fish which accounts for the vital role that these fish play in ocean ecosystems and we have 13 taskforce members, wide variety of disciplines and various telecasts, myself excluded of course.

What did this Taskforce do? We met over a period of over two years. We held workshops. We made site visits to some of the areas where forage fish fisheries were in action, including Peru. We reviewed theory and practice of forage fish management. We developed case studies on ecosystems where forage fish. There was a story to tell and a lesson to be learned about forage fish.

We assembled data on forage fish and their predators and the taskforce did develop a bunch of new science and we felt from the outset that this had to be done. Even though we are sitting here today and now we have much more than we did before, part of what we have today is due to the work of the Taskforce and part of it is due to other activities that were going on at exactly the same time that the Taskforce was working.

I don’t have time to go into all these case studies, but they are detailed in the report. Now this report is available for download, but we also have some paper copies in the back of the room as well as an executive summary and I think we probably have enough for council members of the hard copy.

Just to give you an example of how we use these case studies. In the Barents Sea, which is north of Norway, we looked at the Capelin Fishery, the history of the Capelin Fishery. One of the things that happened there was that the Capelin was fished pretty hard. Capelin collapsed. Cod, which fed on the Capelin subsequently collapsed, and it was decided to do things differently in the Barents Sea. What was decided is that there should be a minimum biomass threshold set for Capelin of 200,000 tonnes and that if the Capelin population falls below 200,000 tons, then all fishing must stop. That’s the meaning of a minimum biomass threshold.
Since adopting that rule, the Capelin came back and the cod came back and Capelin collapses attributable to fishing have not been repeated. Many fish stocks are now abundant. Unless something’s changed in the last few months, this is actually the healthiest cod fishery in the world, which is saying a lot given how unhealthy many cod fisheries are today. It’s an example of a threshold that was put in place to protect forage fish that led to a very positive effect, not just for the Capelin, but also for a predatory fish that was commercially important, the cod.

Here is some example where we use data that this data come from a 30 years study of Magellanic penguins and their prey that has been conducted off of Argentina in an area called Punta Tombo. One of our Taskforce members, Dee Boersma, is the P.I on the study. This illustrates, this and its 30 years of a very detailed analysis that the further that the adult penguins had to go to find food for their young, the less reproductive success they had. We try to make this somewhat complicated looking graph simpler. When the penguins could forage within 50 kilometers of their colony, then on average two chicks per next were fledged. Pretty high reproductive success.

When the distance had to increase to between 100 to 150 kilometers, only one chick would be produced on average and if the penguins had to go as far as 200 kilometers, then pretty much what you would see is a bust, no fledglings’ success. Again this is all data, data on Magellanic penguins, their reproductive success and how it relates to foraging distance, which reflects, could reflect forage abundance and or distribution, for example local depletion.

Another study that came out that was spearheaded by two of our Taskforce members and a number of other authors came out in Science in 2011 and the title is Global Seabird Response to Forage Fish Depletion - One-Third for the Birds. That gives you some idea of what this conclusion was. Let me go into a little bit more about this study. Here we had 14 seabird species that were examined in seven marine ecosystems and lots and lots of data went into the study. 

Altogether, 438 years of observation were used to put together this graph. What does this graph show? What you see on the X axis going from low to high as you move from left to right is the pro abundance. It’s getting higher as you end up to the right on the X axis. Again these were many different studies, many different species of prey. The data what we call normalized. They can all be looked at on the same scale. On the Y axis it looks at breeding success of the seabirds and again as you go from the bottom to the top, rating success improved.

What this study found is that when the amount of prey reached about one third of the unfished level, you saw a real cliff and try to point to it. This isn’t really
being very successful, but hopefully you can see it that where you see the vertical line that’s about one third and to the left of that you see a steep decline. Birds obviously reacted very strongly, particularly at these one third points. Now above that you see that the birds breeding success was fairly good, although it did continue to increase as prey abundance increased, not nearly at the rate as it declined left of that.

The conclusion there is that really you need to leave a minimum of one third for the birds to prevent the chance of a really huge decline. It’s not saying that you should manage these fish at one third BMSY. Those are two different things. Basically you want to stay far away from these thresholds, which is real biological thresholds. That should be considered as an absolute bottom limit for biomass.

Here is the general generic figure that we drew to show this concept of a minimum biomass thresholds, which you will hear me say repeatedly through the talk that we have to not only account for reducing the target fishing mortality rates, but we’ve also got to look at the bottom, the worst case scenarios and make sure it doesn’t get too bad because a decline in forage fish abundance means a decline in the predators and we recommend this really strongly that there be a minimum biomass threshold set for forage fish fisheries below which if that limit is reached, just like in the Capelin Fishery in the Barents sea, fishing has to cease.

Onto some of the other science. This is science that the Taskforce members conducted. One of the things we did, we wanted to look around the world at lots of different ecosystems and lots of different models and we were able to compile 72 what are called Ecopath models. It’s the most commonly used food web model in the world and these were not created by us. These were borrowed by us. Each model was created by a team of scientists in a location.

What we did was then borrow those models and use them to see what general patterns we might find that could influence forage fish management globally. The map shows the distribution of where the models were developed or what part of the world they describe and I think we got pretty decent global coverage with the exception of the Indian ocean, which is a problem in general for fisheries data.

This is to greatly simplify what is an Ecopath model. In fact it’s only showing one aspect, the ecological importance of forage fish. This is coming from ... this particular diagram is from the Humboldt Current off Peru and what it is showing is who eats the forage fish in that system in the boxes all around and how much of the diet consist of forage fish. For example, in the upper left, the seabirds in that system 95% of their diet consisted of forage fish in the Humboldt
ecosystem. These are species that are extremely dependent on forage fish for food.

Interestingly in this system there are also a number of species of fish, including the mackerels, tunas, dolphin fish that also are extremely dependent on forage fish as prey. 83% of the diet of those high-level predatory fish consisted of forage species. This is going to vary from ecosystem to ecosystem, but this is the kind of information that we got from each of the Ecopath models. We were able to find out what are the species that depend on these forage fish and to what degree do they depend on them.

To just try to summarize that in a nutshell, for all the ecosystems that we studied we found that 75% of them had at least one species of predator that was highly or extremely dependent on forage fish as prey. 29% had at least one predator for which 75% of its diet consisted of forage fish and 79% of the ecosystems had at least one species where its diet was 50% or more forage fish. These are highly ecologically important species.

We also wanted to look at economic importance and this is something where it was great to have 72 Ecopath models because we could look at the contribution. It’s not that hard to find. You can go to FAO statistics or other statistics and find out how much forage fish is landed and how much is that worth, but we were also able to look at the supportive role that forage fish play to other commercial fisheries. We could get this partly from the models and partly from a database on X vessel values that has been developed, again we tapped into.

Essentially the concept is that we calculated not just how much the value of the forage fish that hit the dock are worth, but also the species that they feed, the commercially important fishes that they feed, how much are those species worth. Not the total value, but just that value that is attributable to their consumption of forage fish.

This analysis was done for all those Ecopath models and again using this X vessel value database. This is what we found on a global basis that the direct value, the landed value of forage fish is $5.6 billion a year, but the supportive value of other commercially important species of fish is twice that of the value of the forage fish themselves or $11.3 billion. We came up with a total global commercial fisheries value of $17 billion a year.

We had no idea how this analysis would turn out. This was a very interesting result to the Taskforce. Also I want to point out that it is an underestimate of the total economic worth of forage fish because we only were able to get the databases on commercially important fish that depend upon forage fish. As you know, there are also important recreational fisheries that depend on forage fish.
and with some more time and additional work a similar analysis could be done and I’m sure that it would bump up this statistics quite a bit.

There is also ecotourism that depends greatly on the presence of sufficient quantities of forage fish etc. This again is just for the commercially important fishes alone. The value of forage fish and their supportive capacity is twice as great as what is currently the value of what’s currently being landed.

The Taskforce also took on a more complicated ecosystem modeling exercise and this is taking the Ecopath models and basically going the next step with them. In this Ecosim modeling again we borrowed models that other scientific groups had developed, had tested, were considered to be good models and we had 10 of them from 10 different systems. We tried to also get upwelling systems, estuaries, semi-enclosed seas. We had something special in these Ecosim models which some of the other modeling efforts haven’t had. We developed a new module that allows uncertainty about stock size to be incorporated in the modeling and that’s something that you don’t typically see in Ecosim modeling.

Again in a short period of time, my gosh, I have 10 minutes left, we found that from this modeling exercise again that not only are many predators highly dependent on forage fish as food, but that they decline when forage fish decline and that those that who had a higher proportion of forage fish in their diet were more susceptible to declines when forage fish declined. Makes perfect common sense, but here is the numbers bore that out, again speaking to the need for a minimum biomass threshold. One thing we did was to try to combine all the results of all the models and ask what level of biomass of forage fish if you took, were to take a random predator, take a random predator in the ocean.

If you wanted to be quite certain of avoiding a 50% decline in the abundance of that predator, how much forage fish would you have to have in the ocean to avoid that decline? What we found looking at this table is that seabirds were slightly more sensitive than other species, but actually each of the other species for the lowest consumption category, species that had between 0% and 25% of their diet consisting of forage fish, you needed to have a biomass of nearly 80% of be zero to be very sure that you could avoid a 50% decline in predator abundance. That’s a lot of forage fish that needs to be left in the ocean to provide enough food.

We also looked at different kinds of harvest strategies and we wanted to compare different fishing strategies and see how did they do. We used the term conventional and I apologize in advance, this isn’t necessarily the case here, but for conventional, the conventional strategy we looked at we said that the species
would be fished at exactly FMSY. Now that may not be conventional here for all species, but that’s what we used, so that’s what conventional means.

We also said that it would be conventional to leave at least 20% be zero in the water. I know that that is guidance in Federal Fishes Management, though it may not always be followed. We used that and those are the red bars that you see on that graph.

Then we used six different strategies, but the most precautionary of the six just to give you the greatest contrast had a fishing mortality rate of half FMSY. Half the conventional level and twice the minimum biomass thresholds or 40% BMSY. Those were the fishing strategies and the next graph I’m just going to compare these two, the two extremes that we looked at.

This is what we found. For the conventional strategy, the medium biomass decline of predators was 28%. That means half of the predators declined by 28% or more and half declined by 28% or less. There were quite a number of species that declined by a lot more than 28%, but this is again making it simple showing the medians. If you compare that with the precautionary strategy that we used, you see that it did reduce predator declines to a median of 11% decline.

I guess another important thing is to just point out, it didn’t eliminate predator declines to go to this very precautionary harvest strategy, it reduced it. If you’re going to fish forage fish, you’re going to have some impact on predators. That’s what this is telling us.

In the middle of this graph, you see the effect of these strategies on the forage fish themselves and interestingly, in a conventional strategy the forage fish would collapse 42% of the time. Now if you were only interested in the forage fish, I think most of you would agree that 42% chance of collapse is not a really desirable state of affairs and we define collapse here as falling below 10% of B zero, which is pretty standard in stock assessment modeling.

When you go to the precautionary strategy, there was a big reduction in collapses of the target species down to 6%. What happened to the yield for the conventional approach? The yield was about 87% of maximum sustained yields. It wasn’t 100%. Probably this is because of the model that we used. We allowed for uncertainty and variability and there was no free lunch here. When you go on a more precautionary approach, you catch fewer fish in this exercise. For the precautionary harvest strategy the yield was about 51% of maximum sustained yields.

Some of you may have heard about the study, another study that was commissioned by the Marine Stewardship Council. This is the Smith et al paper
that appeared late last year pretty much when we were wrapping up our taskforce, but we hadn’t quite finished. We were able to also look at these results. It was interesting that they also found in their paper that reducing fishing to half FMSY looked like a pretty good thing in terms of reducing impacts and that’s the highlighted section there, reducing impacts on dependent species in the marine environment.

It was interesting that we both independently came up with this 50% FMSY in many cases. Now in their study they used five models and their models were not all Ecosim models. There were a bunch of differences. They also didn’t have any uncertainty in their model. In their case they were still able to achieve 80% of maximum sustained yield, even with the 50% cut in fishing, but I would say that we don’t think that that’s really realistic based on the work that we’ve done.

Five minutes, okay here we go. I’m actually almost done. Our recommendations in terms of ecosystem based management is to focus on the predators and their needs, consider special and temporary management, cut forage fish fishing in half and leave twice as much fish in the ocean compared with conventional management in many ecosystems and tailor the management to available information.

I do want to explain what I mean by tailoring the information. What we mean is that we know we’re going to be confronted with some circumstances where there is a lot of information on an ecosystem, its predators and prey and in those cases the Taskforce felt the more you know, the more you can take, but there are also cases in the other end of the spectrum, the low information case. For those we recommended that if you don’t really know hardly anything about a species or its role in the ecosystem and there is no fishery at present, you should not initiate a fishery. If you already have a fishery going, you should immediately reduce the catches in that fishery to 20% of FMSY. The same logic holds for the minimum biomass thresholds. The more you know the less cautious you need to be.

To sum that up, the Taskforce felt very strongly that a lack of complete information should not be used as an excuse for inaction, that there should be well basically when you know more, then you will have the means and the ability to predict better the consequences of your action and it may be possible take higher catches. There are benefits of this approach, not just focusing on what the cuts and catches might be here. There are benefits of the approach and they’re not just benefits to the ecosystem.

We also ... if we move down this road, we’ll be reducing the risk of forage fishery collapse. We might even increase the catch of and the value of commercially important other species of fish as we showed in that analysis. We’re providing
incentives in the management approach for increased knowledge. There are definitely a lot of advantages in moving forward. Finally before I get yanked off, I will say that you don’t need an ecosystem model to take into account the recommendations of the Taskforce. We are all in the approach that enables you to take on our advice no matter how little you know about the ecosystem itself. Thanks very much.

John Boreman: Actually you did it in exactly 30 minutes. Very good.

Dr. Pikitch: Okay. Not too bad then.

John Boreman: Yeah, which means you have no time for questions, but we may have time after the next presentation. I’ll turn it over now to Dr. E. D Houde.

Dr. Houde: This is forward?

Dr. Pikitch: Right.

Dr. Houde: This is ...

Dr. Pikitch: That’s the laser.

Dr. Houde: Yeah. Thank you.

Dr. Pikitch: That doesn’t really work.

Dr. Houde: Again, I also would also like to thank the Mid-Atlantic Council for inviting me to participate in this panel discussion. As Ellen noted, I had an opportunity to sit on the Lenfest Forager Panel, but I have been on the SSC at the Mid-Atlantic Council for many years and Rick told you quite a lot already about what the Mid-Atlantic Council’s goals and objectives are with respect to ecosystem based management and developing a plan for it.

The forage fish are high on the list of things that the council would like to achieve. I suspect that my talk today is going to overlap to some extent some of the things that Ellen has already said and also some of the things that probably Sarah and Rob will say, but what I’m going to try to do is put much of what I’m talking about this morning into the context and interest of the Mid-Atlantic Council and the Mid-Atlantic ecosystem and species that are involved.

This is a picture of the Northwest Atlantic Ocean, the coastal shelf ecosystems and it’s five, that is the mid-Atlantic for southern New England. It’s a productive coastal zone as is that coastal zone all the way up the northwest Atlantic, has major productive fisheries. Important points that it’s connected to southern New
England and Georges Bank so that managing species in isolation in the Mid-Atlantic sometimes is going to be a challenge or not possible. It’s also connected to the South Atlantic and shelf ecosystems, not shown well here, but certainly true. It’s bounded by the Gulf Stream and the production and productivity of these systems are strongly seasonal.

I really want to point out all that yellow color in there in the mid-Atlantic, it is the land of estuaries, big estuaries and the estuary productivity that relates to fishes certainly is important. Of course the forage fish that all of us know a lot about in the Mid-Atlantic that’s estuary independent is the Manhattan and you can see the Chesapeake Bay and Delaware Bay and Long Island Sound highlighted there as productive regions.

This comes out of the status report the Northeast Fishery Center. I suspect Sarah is going to show you this too, but I’m not certain of that, but it looks at the productivity of the northwest Atlantic shelf from Satellite imagery. The bright colors, the yellows and reds of course represent highly productivity and it’s looking at primary production at the top which is the amount of carbon fixed into living material in that area for ... on an annual basis. The bottom figure, chlorophyll A is a measure of the photo of a planked in microscopic algae biomass present in the water.

As you can see, the color levels on the mid-Atlantic region may be a little bit lower on the shelf than in the Georges Bank and Southern New England area, but they’re really quite high and on average they’re almost the same during the year, although the ranges and seasonal changes are not as extreme in the Mid-Atlantic, but you also can see in the land of estuaries in the mid-Atlantic, those bright red colors, which suggest again that the high productivity of those estuaries plays an important role in the connectivity to the mid-Atlantic ecosystem.

You think it’d be easy to define what the forage fish species are in any ecosystem and I guess I would sit on the side thinking it’s relatively easy, but I can tell you that the Lenfest Forage Taskforce took almost a full day to define what we thought forage fish were and forage species, but these are the ones that at least I think are important in the Mid-Atlantic that we want to consider in this workshop and further on as the council addresses ecosystem based management and forage fish management.

I might have some of this wrong. I’ve got some question marks in here, but Butterfish is the fish that the SSC is talking about all the time. It’s a forage species, but it has a directed fisheries as a retained by-catch and a discarded by-catch and trying to determine what the appropriate fishing level on Butterfish is has been a challenge. Atlantic mackerel is in that category, the Atlantic cod
where some people would argue that it is a forage fish, others perhaps not, but it certainly is an abundant shore live species that could qualify.

Both squids in the mid-Atlantic, I would say that the Mid-Atlantic Council probably should consider them forage species. The Atlantic herring is supposed to be in the Mid-Atlantic, but mostly managed and fished in the New England Area and managed by that council. Atlantic Menhaden of course is primarily managed by the Atlantic States Marine Fishery Commission as an issue of coastal species, but it has a lot of its life story, biology and dynamics associated with what’s going on on the shelf ecosystem in the domain of the Mid-Atlantic Council.

The river herrings, we all know the problem here, they are not fished any longer, but we hope they’re not retained in by-catch and they certainly are in the discarded by-catch and this is an issue coast wide, but also an important issue in the Mid-Atlantic. These are estuary independent species, Shads and river herrings that are declining coast wide and whether our management actions that the Mid-Atlantic Council could take is something that I’m sure has already been discussed and needs further work on the council’s part.

Sand lance, these are very abundant species and important prey for lots of species, not fished to my knowledge, not included in by-catch. Interesting statistics that you don’t see any longer. It’s been forgotten that when the herring collapsed in New England in the Gulf of Maine in the 1970s that there was an outburst of sand lance so that the sand lance took up that space in the ecosystem that the herring had occupied and when the herring came back the sand lance went back to some lower level. Can you look at functional groups in ecosystems and manage under that the presumption.

There are other species out there that aren’t managed, aren’t fished that we don’t know much about, round herring. I would guess that many of you in this room don’t even know what a round herring is. Its scientific name is Etrumeus teres. It’s fished off South Africa. It’s fished off Japan. It’s on global, in the Gulf of Mexico. I know that having been involved in the biomass estimates, it’s in the hundreds of thousands of tons, but it lives offshore, lives in moderately deep and isn’t fished, but it’s found in the stomachs of some predators.

Sardines, in the Mid-Atlantic we don’t have many sardines, but as climate changes threat herrings, Spanish sardines, scaled sardines and other fishes are likely to begin to be found. Certainly the thread hearing is found now in the system and I suspect they’re going to become more important as the years ago by.
Anchovies, at least three species occur the Mid-Atlantic, none of them fished. One of them, the little bay anchovy which is about three inches long and weighs two grams is almost certainly the most abundant fish in the Northwest Atlantic coastal ecosystem, found from Cape Cod all the way down through the Yucatán and its important prey for lots of predators. I ask at the bottom, who are the major predators? That’s the good question and I think in the Mid-Atlantic we really don’t a very good handle on the predators and the amount of predation, the predation demand.

This is a piece of science questions, but managers are going to have to address some of these questions in a way at least where we’ve indexed predator abundance and are able to index their potential predatory demand and consumption and I’m just presuming we’re going to get back to that as we get into discussion. I’m not going to go into any detail here. Ellen looked at what is a forage fish. This is just to show you that the scientific and statistical committee of the Mid-Atlantic Council also looked at this in some details.

I personally agree that they’re small shoring species that feed on plankton, that are abundant, that their biomasses numbers go up and down drastically, sometimes on a decade basis. Those of you who are familiar with fish like the Japanese sardine and the California sardine and the Peru anchovy and though of the dynamics of these species, that they are important to predators and they vary greatly in abundance. Ellen of course, talked a lot about these things.

This table shows that they often exhibit high variation in inter-annual recruitments. That’s true, but when you look at this carefully they probably don’t vary in recruitments any more than many other species. Haddock that most of you are familiar with, vary a thousand-fold from year to year in their recruitments. Also the forage fish that I’ve looked at are in the 10 to 20 fold range variability in recruitment which makes them as average in that respect.

Science subcommittee of the Mid-Atlantic Council also has looked at how one might consider managing forage fish and this flow diagram put together by Jason Link looked at by the Scientific and Statistical committee with input. This is the second and third version of this flow diagram. It’s been put in front of the council. The council had considered it. It has not rejected it, but has taken no action on it at this time, but basically it asks questions and with yes or no answers. It categorizes fish and if it’s a forage fish, as you come down toward the middle part of this diagram, you have to begin to make serious decision about how you might manage this. Many of these decisions are related to questions of how much buffering capacity should you add into your management plan to consider the important role of forage fish species and should you adjust the overfishing limits and the yield recommendations based on those criteria.
Stepping into Rob’s world here I’m sure, but for the forage species that are found in the Mid-Atlantic, the mackerel, squids and butterfish in particular, but it could be … this could be for any forage fish. They require some kind of a modification of the council risk policy if we want to protect the ecological role of forage fish in the ecosystem. Can the Mid-Atlantic Council develop a forage policy? I’ll go through this control rule diagram. It’s very familiar to some of you I’m sure, but on the Y axis essentially is a measure of the fishing mortality or exploitation rate and on the X axis is a measure of the biomass relative to the biomass that would support maximum sustainable yield.

The two lines to the left, the dashed and the solid dark lines indicate what the council has approached managing typical and what they call atypical, meaning fish with more questions about the dynamics and stock assessments. It’s based on what we call a hockey stick type rule in which if the biomass falls below a certain level, then the fishing mortality rate declines until some limit is reached here almost near the intersection of the Y and X axis where fishing would go to zero.

I think that the Lenfest people or the Marine Stewardship Council and many of us would look at a control rule that had that kind of picture as one that wasn’t very precautionary if it really didn’t reach zero until it was down at that very low level. For forage fishes you might want to modify that. We might want to have a higher biomass relative to the biomass at BMSY that’s present. What that number would be, Ellen has given you some numbers that would suggest what it might be to be very safe and also you might want to go on the hockey stick rule as fishing mortality declined towards zero and reached zero at a much higher biomass level, biomass threshold or limit than you would for more typical kinds of species, but what are those numbers? That’s the question.

I’m going to briefly take a look at what some other councils have done, really just the North Pacific Council and the Pacific Fishery Management Council. You can read what I have up here. I’ve highlighted a few things in red that’s important, but in the north … sorry about that. The North Pacific Council, I reckon its ecosystems and fisheries as certainly the biggest fisheries in North America and in the world, among the biggest in the world, but they’re not very pertinent to what we’re doing in the mid-Atlantic for me. There are fisheries that weren’t heavily exploited until recently.

The forage fishes, people have recognized their importance there and in many cases they’re off limits to fishing in the North Pacific and the Barents Sea and Gulf of Alaska, but what has been found out, the science has definitely shown that the M2 predation mortality term incorporated in stock assessments is important and an increasing number of multi species assessments are being conducted there and models being developed. Now the plan development teams
and the SSC are evaluating trends in M2 due to predation when setting their ABCs for target species and then they reduce the ABCs below the maximum allowed when warranted based upon the row of fish as prey and predator diets.

M is important, the natural mortality rate and the North Pacific Council’s science has shown this. The science that’s going on in the Northwest Atlantic by the Northeast Fisheries Science Center and now I think bears that out and I think we’re going to hear something about that. Also there are time area restrictions that the North Pacific Council institutes because of the large numbers of breeding sea mammals and sea birds that they need to protect and to protect their productivity. Some of them are either threatened or endangered, making the regulations and rules that they’ve put in place more essential. I’m not sure that we have the same situation here in the Mid-Atlantic. There are no big bird fisheries. There are no big marine mammal fisheries and time space management. It might have benefits, but this needs to be discussed. It’s not as clear as in the North Pacific.

The Pacific Fishery Management Council and the work they’ve done, some of you know that they’ve just released a fishery ecosystem plan this week, but prior to that plan they’ve also developed the Coastal Pelagic Species Fishery Plan. It includes sardines, mackerel, anchovy, jack mackerel, squid and several species of krill. They’ve decided that the krill won’t be fished so that the fishing mortality on Krill is zero. Sardine and chub mackerel are what they call actively managed species. Others are monitored. There is some management and monitoring and if the catches exceeded some minimum threshold levels that have been set up, they would more actively manage them.

Amendment 13 in 2011 modified their control rules and they now maintain a default harvest control rule for the monitored stocks, but also in their active monitoring of the sardine and mackerel have developed a policy by which they manage the stocks that I’m going to show you, but there are days they contain a cutoff biomass in their reference points. Cutoff is defined as biomass level below which directed fishing is prohibited.

Ellen talked about these biomass limits. The California sardine and the mackerel have these cutoff limits now instituted. She also mentioned that this is in effect in other fisheries around the world. There’s the Barents Sea Capelin that she mentioned has a 200,000 tons cutoff limit below which no fishing takes place and see if they’ve been very successful in both managing the Capelin fishery and also the cod fishery that depends on it. She didn’t say anything about the marine animals and birds. I don’t know. I think in the Barents Sea they depend upon Capelin, but they also collapsed when the Capelin collapsed and they’ve recovered when that management was instituted.
The Pacific sardine cutoff is 150,000 metric tons at present. This is how it works and it’s something to think about in the Mid-Atlantic is to manage species control rule. The fishing limit is the biomass estimate times fishing mortality rate at MSY times the distribution. The distribution factor accounts for sardines and mackerel there, that some percentage of the population lives in Mexican or Canadian waters. It’s the fraction of the stock that lives in U.S waters.

The ABC is the biomass times some buffer times the FMSY time’s distribution. Of course deciding on what the appropriate buffer is, is the trick, but it’s going to reduce of course the amount that can be caught and the able Actual Catch Limit, ACL is then going to be less than or equal to the ABC, rather typical control rule.

The hardest goal then is to find this the biomass estimate minus the cutoff times the fraction which is an exploitation rate that when we decide on to put in there times the distribution. Then the annual, the catch target is the hardest goal or ACL, whichever is less. They also put a maximum catch level on these actively managed species and the maximum catch has a lot of utility to make sure that there are ... it accounts for the uncertainty in estimating the biomass. It also levels out the catch from year to year, tends to discourage increase, big increases in effort if these populations increase quickly to level things out. There are a number of reasons that they put in their plan that justify the maximum catch.

The council is proceeding to develop more rules and initiatives with respect to forage fishes and I’m not going to say much more about this, except there are a number of species that are found in almost any ecosystem. This is an upwelling ecosystem off of California in the North pacific. The Lenfest people and the Marine Stewardship Council noted that it’s in upwelling systems and high latitude systems where the rules of forage fishes tend to be the most critical of all. They probably have more species of concern than we might have here in the Mid-Atlantic. That doesn’t mean we don’t have some.

The National Workshop Rick mentioned IV which was held here on the East Coast looked at ecosystem based fishery management and forage fish issues and some of the conclusions they made were pretty clear and I think we’re going to address them in this workshop, that we need better ways to estimate forage biomasses. Need better ways to estimate predator demand. That may be an even bigger challenge.

Determining M2, the component of natural mortality that’s related to predation certainly is important. As we just saw in the Pacific Management Council, determining ecosystem forage buffers versus single species buffers to account for uncertainty and to build into risk policies that the council has are needed.
Lenfest and the Marine Stewardship Council have given some advice on how to do some of these things.

These were questions that I had as I was putting this talk together and I’m just going to leave them up there in front of you for a minute, but you can see there are a number of things that need to be considered. What are the appropriate indicators and reference points for forage fish? We have some help from Lenfest and others of course. Are there any rules of thumb? I can tell you that the butterfish the last time around the SSC used some rules of thumb to sets its recommended ABC and ACL on butterfish.

Predator demand, the index from stock assessment of predators. Is it possible to adjust the amounts of forage fish that one would catch from indexed abundance of predators? Do we really have to have actual abundance estimates? Are there some indices in ecosystem state available that say something about the state of the ecosystem and its relationships to predators and prey that we need to take into account? Energetics modeling has a potential I think to help us estimate predator demand.

Ecosystem modeling, we’ve already heard some about. We know it’s important. How do we build it into developing forage fish management in the Mid-Atlantic? Are there regulations or decisions that managers can make in the short term? Ellen showed you another graph from this paper by Cury et al, but it’s a dramatic ... it shows dramatic effects on birds, sea birds. The left figure shows ecosystems. The right figure individual species of birds. As Ellen mentioned, prey biomass forage fish essentially on the X axis and the breeding success of the birds on the Y axis and the advice, leave one third for the birds is clear.

Birds suffer greatly from reductions in forage fish. There’s no doubt here. Way back in the 1960s we learned this in the Humboldt Current when the Peru anchovy came under heavy fishing. Even before it collapsed in 1972 and 73, the bird population which is a combination of Gannets, Pelicans, Boobies, Cormorants, Penguins, lots of things, went from about 22 million birds to 4 million birds in a decade and has never recovered. That’s where it sits. Is that tradeoff worth it? Have we compromised the long term productivity of the ecosystem?

Let’s put this up here for you. This is a diagram that I’ve put together for Atlantic Menhaden which shows the complexities of the Menhaden life history and factors that act on Menhaden. Of course Menhaden is not managed actively by the Mid-Atlantic Council, but look at the things that are in the upper left corner. Menhaden spots offshore and it’s the Mid-Atlantic offshore ecosystem that supports the early life history of Menhaden. Does the Mid-Atlantic Council have any responsibility or role in the management of Menhaden? Certainly we know
that some predators that are managed by the Mid-Atlantic Council are dependent upon Menhaden. There’s an interest in this.

Ecosystem state indicators. There are lots of these and I just put this one up as an example. It looks at the size spectrum that I put together for Chesapeake Bay a number of years ago. Clearly says that the slope of that line here depicted as minus 1.03 should be minus 1 and I had thought it would be much steeper because of heavy fishing on big things at the lower right corner and because of high productivity of phytoplankton on the left side the eutrophication, but in fact the Chesapeake ecosystem appears to be relatively balanced in the sense that this ecosystem indicator would see. Yeah, we know that there are lots of things that aren’t good about the Chesapeake Bay. It says something about pelagic productivity, this indicator, but it’s not sufficient to say a lot about the status of the ecosystem.

I’m going to finish here just with this slide to let us think about, search again in my experiences with Menhaden, this is an allocation question. What is a fair allocation? These are the questions of course that the council has to take up for its species that it will manage, forage species. We have to keep the predators in mind. We’ve already learned this morning that the birds are very susceptible to changes in forage biomass numbers and what is the best path forward? Thanks.

John Boreman:       Thank you, Ed.
Howard King: To the first presentation, one we didn't ... Oops, pardon me. One of the remaining thoughts was that if you do reduce the take of forward species, you may increase the abundance of commercial species. It seemed like the presentation itself contained more certainty about that to me, and that seems a little iffy at the end. There is a direct relationship. It must be quantitative.

Ellen Pikitch: Again, that was a global analysis, and I would say it's very likely that you would increase the commercial value of other fisheries. Again, it's going to ... If you zero in on the Mid-Atlantic region, I don't know what would happen and how much of a difference it would be. You'd have to really look at your particular situation.

One thing I want to say. It's kind of a clarification about the birds, because some people have said, "Who cares about birds?" I'm not sure. I mean in most of the models the birds were more sensitive, a little bit more sensitive; not all that much. I think the reason that we're so certain about the sensitivity of birds, is that many of them are nesting on the land, and scientists can go up, day after day, and see how many eggs were laid and how many actually hatch and how many of the chicks survive.

Those are things that are much more difficult to do for striped bass, sharks, and things like that. We don't have the ability to observe them as easily. Yes, definitely, birds are definitely sensitive, and we have excellent data to show that. They are also easier to study, their reproductive success.

Dr. Boreman: Lee Anderson.

Lee Anderson: Yes, I would like to thank the presenters so far, and I'm looking forward to the others ones. As we bring it in towards what we're doing, I look at our role. We have the Magnuson Act. The Magnuson Act tells us we're supposed to work with these fish to do a number of things; maximize the benefit to the fishery.

Ellen, one thing you said which was quite nice, I didn't know you really cared that much about economics. You were talking about when they ... When you do ... One of your slides said that if you do the conservative, precautionary approach,
the yield could go from 87% of MSY to 51% of MSY. You said something about opportunity. That's what I interpreted you to say. That is a cost. We're giving this up, and I think that's important. That's a good lesson to learn here; what I would like to hear more as we go on into this.

Sure, everything you said makes sense, and there are issues. The bird populations are going to go up. The breeding success is going to go up and all this, but how does that really relate to our job of managing the fisheries for the benefit of the nation, when we know there can be significant effects on the opportunity cost of fish on the plate; good protein for people to eat.

Dr. Boreman: I think we should wait til this afternoon and get into that,

Lee Anderson: All right.

Dr. Boreman: That's something to keep in mind, that's for sure. Yeah, Peter?

Peter Himchak: Yes, thank you, Dr. Boreman. The graphic on the value of the forage fisheries, in context with the more for the value of the harvest of the predator species; I don't see in there the issue of the value of the forage harvest, in so far as its value as bait. For say, menhaden would be bait for crabs, lobsters, or Atlantic herring. They are not... Lobsters and crabs are not predators on the bait but their value as a fishery is huge, so would not that component, that economic aspect, wouldn’t that make the forage species that much more valuable in terms of its harvest?

Ellen Pikitch: Sorry, I'm not sure how you account for things here, but I would think that if menhaden is caught, and it's landed, then it's in the statistics that we used. Then if it happens to be used for bait, then it's used for bait, if it's used for other things. Is that true?

Peter Himchak: Yeah, it's landed value as bait is included, but what about the value of the lobster fishery that relies on herring and menhaden as bait? There is a significant economic advantage coming out of the ecosystem that's kind of missed in both of the bars I think.

Ellen Pikitch: Yeah, we looked at ... We didn't look at that. Using these fish as bait isn’t that prevalent globally. Again, when you do a big global analysis, you don't get every nuance that might apply everywhere. Ninety percent of that, of the forage fish globally, is reduced to fish meal and fish oil, and nearly 10% is used for human
consumption. That bait slice is really small. It may be bigger here. You could, again, if you want, you could do a Mid-Atlantic specific economic analysis, and that would help elucidate that.

Again, I want to point out that that analysis that we did, that was something that we could do on a global basis with the models that we had, with the databases that we had easily at hand. It shows that, yeah, you may be giving up some things. This is back in answer to Lee. You may be giving up something in terms of the yield of the direct forage fish species, but you expect that that would result in a greater yield of other commercially important species that depend upon those species as food.

Rick Robins: Thank you. John, I have a question for each of the first two presenters. For Ellen, I would just ask. You cited four different specific collapses of forage fish populations. I think one was Peru, one California, and some of those specific species have strong associations with upwellings. Were those collapses strongly associated with intensive fishing and depletion through fishing, or was it a combination of that and major changes in environmental conditions? Were they more isolated?

Ellen Pikitch: I know something about the Peruvian 1972 collapse. There was a big investigation of that. That was such a big deal globally. The answer is that it was both. What you had there, you had an el nino year, and it did tend to contract the distribution of the anchovies. That they were easier to catch, easier to get at. It brought them into a smaller area, so it made them more vulnerable to fishing and easier to fish a lot of them.

There was also a lot of sciences said, "Hey, you've got to cut back on fishing." The warnings were ignored. What you saw there was a case of hitting the fish while they were down. in many cases you see that there are environmental factors, but fishing does play a role when it's intense as well; even when environment is important.

Rick Robins: John, if I could follow up? Thank you for that. When you listed the Mid-Atlantic species that might be thought of as forage, it was a long list; some of which are fished and some of which are not fished. Do you think it would be appropriate to think of those in terms of complexes or groups of species, given the fact that the higher trophic level fish in the offshore environment may be preying across, basically, a basket of those species?
Ed Houde: I think that they may have to be looked at in both contexts. Putting a cap on forage fishing for instance, the total amount of forage fish once we would define them appropriately, might be one way to assure that some minimum amount of forage remains in the sea. Some people think that that would be a good way to approach the problem.

I don't think you can avoid the single species problem; at least for those individual species that have targeted fisheries and are most important in the ecosystem. Probably because of things that we've just said, they go up and down. As Ellen has said, there's usually a strong association with heavy fishing when they collapse or go down, but there almost always is some association with a change in the environment, either a precipitous one or a long-term one. Everybody now has heard about the North-Atlantic oscillation and things like this, so we know that climate change is going on. Some of these are operating on decadal basis. If you don't have the fishing mortality rate set appropriately and the climate changes, you risk a collapse.

That's what happens in the Bering Sea, to Cape Land. It's strongly climate related, and when they didn't reduce fishing, things collapsed. I think that not all species will respond the same to a given change in climate. I don't think you can get away from at least understanding how the key species in the system operate.

Dr. Boreman: Now we'll hear from the public after lunch. I think we've got to move on into our trigger questions now.
John Boreman: ... and we had the Lenfest definition, which I thought was a lot less complex than the definition that the SSC came up with, which was a whole laundry list of qualifiers for what is a forage fish. Is it practical to come up, at this point can we come up with a definition for forage for the Mid-Atlantic that’s hopefully simpler than the one the SSC has come up with and stick with it, so when we come up and then we could develop our list of forage species and move on to the next step. I’ll just throw that out to the panel.

Ed, yeah?

Ed Houde: Anyone, Sara or Rob, why not contribute at this point? It’s been ... Sara right along maybe it’s your chance to say something if you like?

Sara Gaichas: I think the one comment I would have is the general definitions are good to have everyone have the same transparent understanding of where you’re coming from but I actually thought the list that Ed showed got closer to the definition for this region because it’s specific and you know those species, you know what their role is in the ecosystem. It might be useful to have that general definition in the back of your head, but probably for what you need to do here having the specific list of species and how they are related to each other is a practical approach to achieve the same thing.

John Boreman: Ellen?

Ellen Pikitch: Yes, I don’t see why. Yes, basically just in the same way that this council decides on lots of other things you couldn’t charge the SSC or whatever body listed does it with coming up with a consensus definition of forage fish for this region and bring it forward. Why not?

Ed Houde: I think I agree with that idea. I think that the SSC could do that. Jan, you’re right, the definition we’ve had I guess I’d call it inclusive. The characteristics and criteria that we listed there don’t apply to all of the species that the SSC ultimately might include in its forage group. I know that Lenfest on the first day that we met we decided to exclude squids. I think we even came back to that in the second meeting, as I remember, but I’m guessing that here in the Mid-Atlantic knowing the importance of squid in the fisheries and also the importance in supporting growth in production of a number of predators both on the shelf and in the ocean ecosystem off the Mid-Atlantic that squid probably is going to qualify. In
California, krill were put into their forage fish category. I think some six species as I recall are lumped in there. Obviously, I think the krill is very important and they don’t want them in a directed fishery. I don’t know that we have other organisms like that in the Mid-Atlantic, maybe others on the panel do and could say something but I’m not aware.

John Boreman: Yes Rob?

Rob Latour: I can’t really comment on that, Ed, but I guess I want to follow up a little bit on what Sara said and what you’re mentioning here. That is the definition of forage may not be, there may not be one if it’s all. I think that the definition takes on different phases, different forms when it becomes applied to different regions with different specific objectives.

The question of whether to include squid in the definition, as Ed outlined, I think is very germane to how the definition may play pit in the Mid-Atlantic. Yes, these are very important organisms to the ecosystem functioning and ecosystem structure here as may not be elsewhere. As we develop the definition I think we need to understand the domain of the council’s management objectives and principles. Does the council wish to take into consideration species outside of its immediate management requirements but that are important to the ecosystem for which the species it manages are parts off, and address those types of questions.

Marrying the definitions with some guidance from the council I think would be the way to go.

John Boreman: Yes, sure.

Ellen Pikitch: On the squid issue and the Lenfest taskforce, we did debate that quite a bit and many different species of squid and they play different roles in different ecosystems and in some ecosystems squid are the major predators. Basically, we decided to have a more narrow definition of forage fish because they wanted us to apply globally. For all these models that we brought together either we’re in the forage fish group or out, we had to have a hard line and we decided to leave them out. It doesn’t have to apply here if biologically, ecologically or for other reasons you decided that they should be included here.

John Boreman: I guess something that we may want to put in the parking lot for discussion this afternoon is Rob’s comment and I think it’s following along what Ellen presented. That is how many species outside of our Mid-At species that are forage that Ed listed up there; for example the round herring or species like that. Menhaden, it’s not managed by the Mid-Atlantic council per se but its an important forage species. How broad should the SSC be expanding its scope, how
Ed, you want to respond?

Ed Houde: I respond to that too because what it also implies is that the Mid-Atlantic council can't do some of these things alone. It’s going to have to collaborate, cooperate and work with, and the example is the Menhaden with the Atlantic States Marine Fisheries Commission.

I know that that collaboration and cooperation already is strong but if we start talking broadly about ecosystem based management and forage fish being important part of that it’s going to require even closer work together between the two institutions.

John Boreman: Let’s move on to the next question that’s up there, what are key considerations when determining appropriate buffers to manage forage species to achieve ecosystem level objectives?

In here I would qualify that, what are key considerations maybe that we should have in the Mid-Atlantic region, rather than just globally but what ... Ellen might have a working knowledge of the Mid-Atlantic as much as Rob and Ed and Sara? Are there special things that we need to think about in the Mid-Atlantic region? One consideration that I see is that it’s an extremely variable system, in terms of temperatures and seasonality. We have a temporary residence moving through that we’re trying to manage. Bluefish, are only here part of the year, scup and species like that. It makes it difficult to manage but looking at ecosystem based management it’s not as stable as one would like; as constant. The variations in temperature, water temperature alone across the year are probably some of the greatest that you see in any ecosystem around the world, any marine ecosystem.

Do we have any reactions to that trigger question from the panel? Sara?

Sara Gaichas: One thing to consider I think in addition to the variability that you’re mentioning which is a unique and important characteristic of the Mid-Atlantic system is if there are particular species, there are predators that need additional protection or warrant concern and look at who their prey are. I mean that is certainly something that happened in the North Pacific when I worked for the Alaska Fisheries Science Center and that drove a lot of the focus on additional management measures for some of the commercial species that were fed on by endangered species. Hopefully you don’t have any endangered species issues to
deal with here that were quite as bad as what were there. That could be an important consideration that would also allow you to focus on one or two high priority species rather than having to consider everything at once. That’s just one suggestion.

John Boreman: How about seabirds in the Mid-Atlantic? Is that as big an issue as you would find like in the Gulf of Maine or the North Pacific? Is there any information about seabird predation? Ellen?

Sara Gaichas: I think it would be fair to say that our knowledge of seabird predation is lower than a lot of our other major species categories. One thing we have done in our ecosystem assessment program is we’ve just gotten a seabird specialist to work with us. What we’re hoping to be able to do is answer some of these questions but I don’t think we know that yet, and someone more familiar can certainly pitch in.

John Boreman: Ellen.

Ellen Pikitch: You’re right. I don’t have as much of a working knowledge of the species here and what are the hot species, but in terms of other sensitive species groups to think about the ones that turned out besides seabirds to be very sensitive, some marine mammal populations including whales. I’m sure you got some of those, that transit through and spend some time in this region.

Also elasmobranchs, sharks, and rays, skates and rays, they also tended to be like the third most sensitive species groups behind seabirds and marine mammals.

John Boreman: Does that include dogfish?

Ellen Pikitch: I don’t know. [Laughs]

John Boreman: Rob?

Rob Latour: Excuse me sir, please. I’m trying to recollect; maybe Ed can help me. The osprey situation in Chesapeake Bay is positive in the sense of there’s more ospreys being sensist and the trajectory of the population is increasing. I want to say that there’s been a notable change in the distribution of nest locations and it’s correlated with the menhaden, stock abundance to be quite honest. Birds aren’t able to nest in their traditional locations because of the lack of forage. There are some dynamics that are playing out that may not be translated into the global metric of abundance, but what are the secondary effects of nest distribution changes in those sorts of questions?

The second comment, those are just to put our hands on an example. The second comment about elasmobranchs or mammal or whatever, would be how able is the council to interact with the groups that are more responsible for some of
these species or critters. There’s a logistical problem here, you’ve got different management regimes, you’ve got different management jurisdictions, you’ve got different maybe institutionally speaking or institutionally specific management objectives and if you kind of embark in this road, it strikes me that you need to be working infrastructurally at the same time and scientifically in order to sort of overcome some of these issues. It’s getting together with, groups having more of these kind of visioning ideas and visioning workshops. Real hands on like how are we going to do this, are we all on board, is this a global objective across management agencies. Then within your own sectors maybe you drill down even deeper into the specifics regarding the species you must be responsible but I can’t be lost, I think that’s an element of this whole process.

John Boreman: Again, this is just for the panel. We’re finished with the Q&A part. I’m sorry, but that’s how we’re trying to handle this and the trigger questions. You get your chance after lunch. You’ll have all afternoon to interact with the panel. I’m going to skip the next. We only have about five minutes left for this discussion. I’m going to skip the next question basically because I don’t understand it. Sorry, Rich. I go right to number four here, what trade-offs would the Council face if it adopts exploitation policies or control rules for forage species. Just get a sense of what we’re talking about here, what we need to basically give up as a Council in order to accommodate the types of recommendations that the Lenfest and Marine Stewardship Council are putting forward.

Ed?

Ed Houde: I think we already started to address these questions and Ellen’s answer. Tradeoffs sometimes may mean that we’re going to expect perhaps reduce yield of the forage fish and whether we expect reduce yields of the predators is an open question but the models and such would suggest that we’d have increased predator productivity and that the value of these predators is higher. It would require analysis, but there would be tradeoffs in the directed fishing on forage fishes but perhaps now no loss value in the total fisheries.

It would require I think quite a lot of analysis to know specifically what might happen in the Mid-Atlantic.

Ellen Pikitch: Yes, also I think from what I do know that there are important recreational fisheries here as well as the commercial fisheries and in the same way that the commercial fisheries, biomass would increase, you’d expect the recreational species that depend on forage fish to also increase if you left more forage fish in the water. You might want to make a special effort to be able to do an economic analysis that’s region specific on the recreational species. Which again is something that we weren’t able to do on a global scale within the time constraints of the Lenfest study.
John Boreman: Sara?

Sara Gaichas: I'd just like to echo the previous two comments about analysis. I think when I first saw these questions I thought I don't even want to touch that without actually doing an analysis. What I'm hoping to show later on this morning is that we have quite a few tools developed to do this type of analysis. I think if we get some input from the council on what sorts of objectives you would like to see several of the ecosystems in multispecies models that we've already developed could start to address this. We're also trying to make linkages with economics group and link up some of those models as well because that's been more difficult in the past.

What I would hope is that I would come off of some of these discussions would be, we would get some direction on the type of analysis you'd like to see specifically for this question because obviously tradeoffs would be an important part of what the decisions are here.

Ellen Pikitch: I'd like to answer question three. Ed you said you didn't understand, but and I think it's important it helps summarize also the scientific results. The range of exploitation rates that the Council should consider. They should be much less than FMSY for all forage fish species and the highest they should be, this is again, I'm reiterating the Lenfest advice which is actually identical to the MSC advice for well-managed, for the ones that are going to meet the MSC criteria. Basically a 0.75 FMSY is the highest that either group would advocate and that would only be for the best known, best understood, extremely well studied situations.

In our case we would not only have a good understanding of the target species biology but also as well in the ecosystem and all the things that depend on it. It's a high bar and it's a double bar really to get to into the high information tier. You have to know about the target species and its ecosystem both to get into that high level. For more typical species that you might consider to be well managed, from a single species prospective but you don't really know very much about the ecosystem consideration, then the Lenfest taskforce recommended an F of no greater than half FMSY.

Again, for the ones you know very little, extremely little, even about the target species then we're saying either don't fish at all or you fish at a very low level, 0.2 FMSY if there's a fishery in action. That's the guidance that we're giving and it varies depending on the knowledge base.

Ed Houde: Some people think that forage fish and their propensity to collapse hadn't been studied much until recent years but in fact Ray Beverton in 1990 published a paper and Ken Patterson in 1992 published a paper in which they look globally at the fishing mortality rates and exploitation rates under which forage fish collapsed. They concluded that forage fish collapsed just about as frequently as
other kinds of fish but they also concluded that some of the relatively simple rules of thumb apply. That a fishing mortality rate should not exceed the natural mortality rate. In fact it should be a lot less than the natural mortality rate.

Patterson said 0.67, no higher than 0.67, or you would see them collapse. When Lenfest and our group realized this data, it actually, they’re more sensitive than that to be relatively certain that forage fish stocks won’t collapse you probably shouldn’t fish them more than about 0.5 the natural mortality rate. That would be quite an extreme measure for the way most forage fish fisheries are managed.

Rob Latour: I was going to echo the same sentiment and instead of focusing on exploitation I think we need to build total mortality rate into our thinking. That’s basically the essence of what Patterson has published and Beveryton’s paper. It’s not about F and biomass as reference points. It’s possibly about total mortality now.

Ellen Pikitch: Yes, definitely Ed contributed quite a bit to the taskforce on these references and it’s in the report. I encouraged you to read the report in your spare time. I’ve been told that it’s pretty readable. The only thing that I wanted to say is when I gave those numbers, of 0.75 et cetera, so going on another step is that we would advocate against holding the fishing mortality rates steady no matter what the population is doing. I think that that came through pretty clearly when we talked about the minimum biomass thresholds but also embodied in our advice is that as if a fish population starts to fall then the fishing mortality rate should be dropped accordingly. You don’t want to wait until you’ve reached the edge of the cliff to then take action. You want to be very gradually doing that. It seems like the Mid-Atlantic Council if ... Ed showed about those graphs. I forgot what you referred to them is, the Risk Policy, right. It seems like you’re doing that already. You’re not keeping fishing mortality rate fixed; you are varying it and reducing it when stocks go down and you can increase it when they go up.

That’s another element that I think is important to keep within your exploitation policy for forage fish.

Jon Boreman: With that I think we’ll take a break. I thank again the panel and we’ll reconvene at 10:30 for the second set of talk and more discussion. Thank you

Ellen Pikitch: Thank you.
Fishery Forage Workshop
Latour Presentation
April 11, 2013
Embassy Suites Raleigh Crabtree
Raleigh, NC

John Boreman: Okay, we lost a few members of the Council. Hopefully they'll come back.

I just want to mention again that this is a topic that so far the SSC has spent two and a half years discussing so we are trying to squeeze it into six hours here. This afternoon, we'll have an open session with the council members to have dialogue with the panel, get your questions answered, and talk about policies and concepts, and what's going to happen to fisheries, and so on and so forth.

This morning, we'd just like to focus on the presentations themselves and discuss the science aspects, and then this afternoon we'll get into the council side of things, how the council might want to react to all this. With that, I'll introduce Professor Latour now, and he'll be our next speaker.

Rob Latour: Thanks John. Thanks everyone for the invitation to present. I probably have been asked to be here largely because I've been on the SSC for a while. I've also been part of the SUN Committee or the Scientific Uncertainty Committee. Some of us have been heavily involved in the ABC control rule, the development of the council risk policy, and that sort of stuff.

I think I got tasked with talking about approaches and strategies from that vantage point, and when we had a conference call with the panelist a week or two ago, I swear to God, I think I got the hardest job on the panel. I admittedly struggled with putting together some slides here. What I hope to convey are just some starting points for discussions, some starting point for thinking about how this might happen, and some things to consider as we move forward.

I can't figure this out, is this left right, up and down. [Crosstalk 00:02:13] My computer doesn't change. There you go. I pushed it very naively and I just said, okay if I Google "Ecosystem based fisheries management" what comes up? I Google imaged. The nice thing is that, I'm sure the programmers at Google will be please to know that 2.3 million things came up in 0.19 seconds. The point is, there's a lot of stuff, a lot of stuff. I've just lifted three figures here because we try to conceptualize things pictorially.

The upper left figure is a simpler one in my view, it's closer to my home. It deals with the Menhaden striped bass interaction and it tries to depict the ecosystem relationships, superimpose upon that our fisheries, nutrient loading, industry, agriculture, coastal development, and then there's a question mark over the
cloud there for climate drivers and I think we could probably have removed the question mark and say climate drivers are vitally important especially in the Mid-Atlantic.

Drop down to the northeast shelf regional ecosystem, you've got closures, you've got area closures, you've got corals, you've got agriculture again, run-off, fisheries yield, habitat loss. The point is it's incredibly complex. It's overwhelming, it's mind boggling, it's undoubtedly very difficult to wrap your brain around, and get to some starting point of where you might want to be. The photo on the right is perhaps put together by a better artist, but it's very elegant with respect to the Gulf of Alaska in showing the physical stenography, chemical stenography, climatology, etc.

What happens after that, we take these photos and we put them into diagrams, we get these nice flow diagrams, and they can be simple or complex. They're suppose to show the flow of operations, they're suppose to show how we might proceed operationally and we've got concentric squares, in one case here dealing with where the species are, and then the human dependencies, the economic dependencies, the governance dependencies, and the community dependencies that sort of presume those. All is a function of bio-masses of the marine ecosystem. Other approaches are the more food web style flow diagrams. Again the point is, this is the information that the general public or the naive person might start to see if they did a simple Google search.

I guess my plea or suggestion begins here. I was reading a paper that just came out a couple of months ago in Conservation Letters, the title and authors are here, it's Natalie Ban and colleagues. It came about from a conference last summer in Rio de Janeiro regarding the bio-diversity, and conservation, and sustainable use of the high seas. The purpose of the paper is to summarize gaps in management, or is the management structure sufficient to achieve these goals.

This photo here or this diagram, indicates sort of the components of the pie or the circle or the wheel, and progress made to date based on analyses of all these management systems. You'll see on the right there are involving stakeholders. I'm sorry, the center of the circle is zero progress all the way out to the edge, is a hundred percent progress. The first element is involving stakeholders and they are at the seventy five or so percent level which is pretty good, probably; identifying context, defining goals, collecting data.

The right side of the figure is the divisioning that you're doing; I think there's progress there. There's data collection, so I don't think we can cry that there's not enough data anymore. We have data, we need to do things with it. On the
left side though, where less progress has been made; determining the objectives and analyzing data gaps, implementation, and of course evaluation thereafter.

Now this is with solely different objectives than yours, bio-diversity and conservation of the high seas, but you could probably scratch out some of these and put, instead of collect bio-diversity data, you collect predation data on forage fishes or something to that effect. I would argue that the same general pattern of progress would transcribe to ecosystem approaches to fisheries management. We have some of the involvement underway, we have data in hand. Really we need to build the system, and building the system means defining the objectives and linking those objectives with operational tactics.

That's really my global comment to you is, I think we need to approach this like building the system, rebuilding a management system that has scientific components to it. The heavy lifting, unfortunately, has to happen with you in defining your objects. These objectives start globally at the ten thousand foot level, but they need to be drill down to be something very specific. We want to manage forage fishes for this reason, blah, blah, blah. I borrowed from Jason Link's book a lot of words here, I'll walk you through them. I think terminology is important to understand; ecosystem base fisheries management, ecosystem base management, ecosystem approaches, what are the subtle differences.

At the top of the management gradient you can think as the uber ecosystem management, it's the catch all, it's the unattainable, holy grail. Why is it technically infeasible because it means managing humans in all facets of life on earth. Infeasible, fair enough. If we drop down to the second and third, these are sometimes, as Jason says, used interchangeably, but they are very different in my mind and I wanted to highlight those differences to try to give you a groundwork for where you might think you might want to start.

What's ecosystem based management versus ecosystem approaches to management. The ecologist in me says one is a top down viewpoint and one is the bottom up viewpoint. Ecosystem based management basically says your holistically managing the ecosystem, the top down effect. Ecosystem approach to managements means maybe you are starting at the bottom and you are building in ecosystem concepts, or ecosystem philosophies.

In the bottom two are similarly interchangeable, but they have the word fisheries in there. They are segregating out fisheries from the entire ecosystem, but it still does top down, are we going to manage fisheries basing ourselves with all interactions in the ecosystem itself, or are we going to start where we are, as I sort of view it, and build in ecosystem philosophies. I highlight these two, not to tell you what you should do, but to maybe guide you that this could be a starting point. What we're basically talking about here is taking the current
infrastructure, current management system, and building an ecosystem concepts. In my view, that amounts to ecosystem approaches.

Again, we are building a system. These were concepts for management philosophy and objective definition, what has to go in tow, in parallel, are data and modeling strategies. We have to have these in sync. Again Jason laid out some ideas here, I've added a few things of my own, but there's an analytical gradient, there's a data gradient. On the left hand side of the gradient, we have pure single species assessments, this is not new to anybody, this is our standard operating procedures in many respects. As we move from that on the left to right where you have entire ecosystem model, there's a lot of stops along the train tracks in between, maybe some of those stops are places we could be moving toward in the near term.

Moving from a single species assessment to simply coordinating multiple single species assessments, doing it intelligently, so that, in other words, the species that you are coordinated assessments for are happening in sync with respect to time because they are linked within the ecosystem. We're getting information, timely information, most up-to-date information about species that are important for food web linkages, or other processes.

Single species assessments with explicit M2 or climate drivers, so breaking out of the box of the traditional and adding in formalized ways of measuring, or accounting for predation, or formalize process driven models for climate. Then we can maybe get to a multi-species assessment where we actually formally assess two or more species at the same time. You hit a bit of a road block in my view because no matter what part of that little scale you're on, you're still likely to have single species traditional benchmarks coming out of them. These are biological reference points that will be FMSY, BMSY; your tools for reference will still be largely the same because you have single species core philosophy in mind, and you're just adding more complexity to it, but the outputs will be similar.

Keep that in mind, even just move along this gradient doesn't mean you're going to, all of the sudden, have a whole different management regime of benchmarks. When you flip the switch and actually start getting into guild definition within ecosystems; forage guilds, predator guilds, mammals, birds. There are analytical tools there where you can try to get guild biological reference points or ecological reference points. I think we are a long, long way away from that personally, analytically. The point is to give you an idea where the science options might be. We need to match the science in modeling objectives with the management objectives so that there's synchrony, but to recognize that the information coming out of these modeling objectives, even if we move toward
multi-species stuff, isn't going to be largely un-different from what we currently have, routinely.

When we talk about foraged fishes, we have to talk about natural mortality, right? It's really what the ... that's the business end of this whole deal. From a foraged stock perspective, more intentions needs to be focused on natural mortality.

How is M treated analytically? I've laid out four options here, there's probably more, you might could collapse a few of these. All the way on the left is the guesstimate and this is not something that is infrequent in the assessment framework, in the assessment world. The whole 0.2 thing evolved from a guesstimate because why do we guess at M and why is it acceptable to be guess at M. These are non-fishing related mortalities in aquatic ecosystems; they're virtually impossible to observe. The contrast with terrestrial observation capabilities, Ellen brought out, is very valid. We can't observe natural deaths very effectively. We don't have any information about it. Traditionally, it's hard to do.

The guesstimate was made, the guesstimate was held constant over age of the stock being assessed, and it was held constant over time. Undoubtedly, insufficient treatment accepted over time because you have no other choice. If you were lucky maybe you had access to a study where there's an empirically derived single species estimate, maybe from a [inaudible: 00:13:19] study or something alongside the assessment, so you can actually hang your hat on a rational estimate for M. More than likely these weren't age varying and they weren't time varying, either.

Nowadays, with longstanding diet data collection programs encompassing most of the coast, we're starting to get a handle on estimating consumption so we can talk about M2, this natural mortality rate due to predation. Half the time or most of the time, the M2's we develop are based on a partial suite of predators, not the full suite of predators, the seabirds aren't there, the mammals aren't there, not all of the fishes are there. We have a handle on M2 and maybe its relative trends overtime, but we do not have an absolute because not all the predators are there.

All the way to the right would be, I don't know, euphoria. You have everything modeled well, all the predators are there, the birds, the mammals, everybody and you got a decent estimate of M2.

Chris Zeman: Just what is M2?

Rob Latour: M alone, all natural mortality, all non-fishing sources of mortality. M2 would be the fraction of that, that's due to predation.
Chris Zeman: M2 is a component of M?

Rob Latour: Yup.

Chris Zeman: Okay.

Rob Latour: What this gradient illustrates, in my view, is basically nothing more than an accounting exercise and how well you are accounting for things. The estimate on the left, the guesstimate of M? It's an accounting for all these processes: predations, senescence, diseases, blah, blah, blah. It's a poor accounting job. As you move to the right, we're improving our accounting, we're improving our understanding of what M is, but were still accounting for loses. That's a key thing to keep in mind.

Where are we now? Libra, we're under Magnuson we have this mandate, we have this law, we have to operate under it, it's very true. Current management objectives are really focused on the compliance with Magnuson-Steven's act; avoid over-fishing. The way we are doing this is traditional single species approaches. Current assessment objectives I think are matched fairly well. We go to the analyst and the modeling teams, these are, outputs from these modeling efforts are over-fishing limits, or MSY like, maximum fishing mortality rate type things. Those are being estimated routinely. In some cases, the distribution of that estimate to incorporate uncertainties being empirically derived. There's a nice relationship here, but it's still single species oriented.

As you know, the control rule that the council's operating under here is sort of illustrated in these two pictures, we have an OFL or over-fishing limit distribution, we specified either through the assessment process, or through some other ad-hoc means. With that, OFL and the council risk policy probability tolerance for fishing, we derived an ABVC and move forward. Where we want to go, that's where we are, where we might want to go is changing the management objectives a little bit. We still need compliance with Magnuson-Steven's act, but we may want to think about ecosystem approaches to fishery management. Effect of fisheries on other fisheries, effect of fisheries on ecosystems, building that in.

That's going to change the requirements of the assessments to do it, I think, in a comprehensive way. We're going to have to change the way the assessments are conducted. This can be analytical change, this can be changes in the outputs asked or derived and that needs to be done in a cooperative way, I think. Maybe we need coordinated, simple steps, coordinated single species assessments. More formal efforts to estimate M2's, this predation mortality thing for foraged stocks. More climate driving built into the operational assessments because, as
we know, forage fishes are highly susceptible, high variation climate, stock recruitment functions are driven largely by climate. Maybe we can get to multi-species models, it could be possible.

An operational question for you, can this harmony evolve together. I think it is required. I think you need to be thinking about it as well, but the degree of this harmony will undoubtedly manifest into scientific ... the degree into which the harmony is achieved will modulate the scientific uncertainty that SSC's deal with and what basically ABC setting will involve as we go forward. One thing we discussed over breakfast is maybe the terms of reference are the portal into synchronizing the management objectives with the assessment outputs. Maybe the terms of reference are what ... the way we can do that, I will read to you, Term of Reference from the Butterfish Assessment in 2009 that dealt with predation. "Evaluate the magnitude trends and uncertainty of predator consumptive removals on butterfish and associated predation mortality estimates, and if feasible, incorporate said mortality into the models of population dynamics."

That's an evaluation or described term of reference, that's not an integrate term of reference, there's a difference. The term of reference there, what the analysts are responding to is, they will evaluate and describe, to the best of their ability, predation mortality on butterfish. The term of evidence does not force them to integrate that predation mortality into the assessment in the overall population dynamics and maybe there's a change that needs to be made, if the management objectives are going to move forward in that regard.

Here's a proposal, not fully vetted, not fully well thought out, but an idea could be within our current ABC control rule policy, link p-star, the tolerance for probability of our fishing to the treatment of M in the stock assessment, for forage fish stocks. Maybe the ABC is based on p-star base minus some F of M gradient. I don't want to specify how much should be decremented, but imagine it, like, some reduction in the p-star; the tolerance of over-fishing, probability of tolerance over-fishing, as a function of how well M is handled within the stock assessment. If it's a guesstimate, maybe that's the maximum amount of decrement. If it's well treated, maybe there's no loss in the p-star, but it's perhaps, it's a starting point to think about driving the science and driving the thinking about the role of predation mortality for foraged stocks.

I can see this potentially plausible for levels one, two, and three assessments. Level one assessment being the best, level two having a little bit more uncertainty, level three quite variable, usually no over-fishing limit distribution there. This could potentially work as a starting point for discussion, for three of the four levels of assessments.
Level four is an ad-hoc approach all the way around. We have very little information. We have a failed assessments perhaps. We have no stock status, so there we kind of fall back on rules of thumb or general proxies. Maybe there, if we have an OFL or an OFL proxy maybe the ABC is just some percentage of that, translated into catch where the X percent is increased because of the rule of forage, for that particular stock. It's hard to say, and I don't want to go beyond conceptual ideas here. I will say that any of these sort of control rule application and development, it really should be based in a well described scientific rationale for it, which means, in addition to changing the objectives of the management, perhaps changing the ways in which assessments are done, or the outputs of assessments. We really need evaluation of these strategies, I think, to make them sort of stand up on their own two feet.

I guess this is just sort of a comment to suggest, process is important, operations are important, but Science needs to be in there too, and to a degree that could be supported, I think would be helpful. Little bit more close to home with respect to the control rule, I'm reminded of the atypical life history that we've defined for the council risk policy. The definition is here: it results in the greater vulnerability to exploitation, so we have a stock that has greater vulnerability to exploitation, and the life history has not been fully addressed through the stock assessment process.

Maybe foraged stocks can be thought of as all atypical. Vulnerability exploitation isn't necessary the phraseology I would attach to that, but perhaps that's code for, we need to be careful in managing these stocks, we need to be overly conservative or more precautionary, however you'd like to say it because of their important ecosystem services role. Is p-star 0.35 which is the atypical level enough, is p-star less than 0.35 appropriate, as Ed's figure noted, and I think it makes more sense than mine here. Should the hockey stick shift to the right so that the corner of the stick is not on B over BMSY equal to one, but at something higher so that we are consciously maintaining a biomass above BMSY. These are operational decisions that could be made and that could guide, guidance for making decisions about ABC setting for foraged stocks.

A comment about accounting versus managing. I think we get into a circular argument about what M is doing. If we fully account for all the sources of M effectively and scientifically isn't that adequate and my answer to that is, that's adequate accounting, that is to say, we've described the historical predation demand that may has been played out over the last thirty or forty years or whatever time frame of the assessment is. We can feel good about our accounting there because we are accurate and we're doing a good job, but that's not necessarily managing, right?
Managing means you're making decisions about ... maybe there's even more biomass we want to leave in the water because of secondary effects to predator stocks. Even though we have accounted for the demand, the management philosophy would say, well we might want to grow this other stock that depends on this forage fishing. Even though we have accounted for the all loses due to predation, we still may want superimpose an additional buffer because of a perceived secondary benefit. That's where the managing comes in, I think.

Right now, we're not accounting to the degree we might want to, but then we also need to be managing too, to a degree that is consistent with our objectives; so there's a difference. It all boils down to the bottom equation there. The sum of the MSY is at the single species level is almost uniformly greater than the sum of the MSY of the system. As we talked about this morning, I think Ellen and Ed did a nice job describing, there's tradeoffs here, they're going to have to happen. These are going to be difficult tradeoffs. The evidence points to, for forage fish management to be more precautionary, to leave more fish in the water, allow them to fulfill their services.

That's basically the summary. I can't emphasize enough the notion of building the system collectively. You've got multiple institutions, we rely on the northeast center a great deal for assessment infrastructure. Management is occurring, of course, within the Mid-Atlantic Council. There needs to be coordination. Now, the ASMSC may need to be involved for species outside of Mid-Atlantic jurisdiction, but in the ASMSC jurisdiction there needs to be a well coordinated, constructed management system and an accompanying scientific system. Make your objectives as detailed as possible. Push the envelope with detailed objectives.

Ecosystem approach to fisheries management and maybe a plausible starting point, it's not ecosystem based fisheries management, but perhaps the way to go for the new term is to push the envelope on incorporating ecosystem structures into our analysis and ecosystem structures and roles into our management advise. Modifying p-star seems like the most obvious decision, how to actually do that, I think, takes some thinking and some discussion. Remember with M, it's an accounting exercise of where the fish are going in the ecosystem, that doesn't mean you're managing. Management can go beyond that. In fact, it has to if you're truly doing sort of an ecosystem based management philosophy.

Thanks.

John Boreman: Thank you Robert. Finished right on ...
Rob O'Reilly: The idea of multispecies management seems to have evolved quite a bit from the 80's of Hartman and Branch. At the same time, I'm just wondering whether you're thinking that that's a direction to make more solid at this time; to work a little bit more on that. I think you're still part of the multispecies modeling phrase from FC, and I can't tell you I'm up on all that.

It would seem that by doing that, you get a better understanding, maybe, of the ecosystem approach that you talked about at the very end. Like your comments on that, you know to get a good solid basis with some of the species that are in a functional group.

Rob Latour: Yeah, so my comment, I mean my answer, will be a description of what's happening. You brought up the technical committee for ASMFC on multispecies. In the old days ... I thought I was going to get away from Menhaden, but I can't. In the old days, Menhaden M was point four five over all ages, over all times. What we've now been able to do through efforts involving multispecies modeling is at least ... I put into the ... We've addressed a partial suite of predation impacts and we've come up with age varying estimates of M, and even time varying estimates of M. An M, an M2, excuse me, a predation natural mortality rate for each age in the assessment and each year in the assessment. It's far from point five; point four five, excuse me.

While that multispecies model isn't quite at the point where it's the one going forward for management, it has happening in parallel with the assessment that multispecies work has been very informative into improving our accounting of how natural morality might be playing out over time and age for Menhaden. I think moving those two in parallel is an important way to go forward, and at some point, when the science is mature enough, I think they can converge and become a single entity moving forward for management.

John Boreman: Okay, let's move on to Sarah's presentation.
Sara Gaichas: -and the types of information that we actually do have and I’ll give you the bottom line right now. This is a data rich system and you have a lot of analytical tools. That I do not think will be your constraint, but you can decide for yourself after I’ve gone through the presentation. I’ve been asked to tell you about five different things and I’ll just give you this quick outline here. Many of them are related, so it shouldn’t be too much jumping around but I’ll go over the current state of the models and the data, some bridges from single species to multispecies types of assessments which everyone has been talking about already. I’ll just show some examples that have already been done in the northeast.

I’ll talk a little bit about other approaches that you might want to take. This idea of an aggregate biological reference point we’ve done some scientific work on that and so there’d be a lot more to do but I can give you an example. I’ll finish up with some changes in the ecosystem. I can’t go through a lot of this but luckily Ed did show at least one of the slides that I would have wanted to have shown so that was good. I’ll finish with just what might be the information needs just for forage species management.

Current state of the models and data, I am going try to focus this on your needs for forage management. Because we like big complicated plots especially when you do ecosystem modeling I want to just start off with this one, probably this is an adjacent linked plot as well, of the types of models that we actually have built already and this is in the tech memo, I think, that was one of your background documents. Maybe the very first one for this session.

Everything that’s square is a developed ecosystem level of model and everything that’s hexagon is a decision point that sort of divides them from each other. Whether they’re mechanistic or not, whether they have primary production in them or not, my goals and to go through all of these exhaustively but just to give you an idea that we do have quite a few models and that they’re differently structured. It’s not like we’re focusing on one model type and then a lot of different small variations on it.

We’re trying to get a lot of different model structures and the reason for that is we have a lot of uncertainty about the marine ecosystem which I think everyone also on the panel has already expressed to you. Another reason for having a lot of models, besides the fact that we are modelers and we actually enjoy making
these things, is a bit more to go towards giving a better advice, I’m just going to give you an example from a completely different field here.

This is the National Hurricane Center’s. They produced sort of postmortem on their predictions for Hurricane Sandy if you will. One of the interesting things in this document that just came out in February was an analysis of the models that they use for predictions. Hurricane prediction is based quite a bit on complex models just like you would need for ecosystem predictions. They use suites of models, they use ensembles of models, not just one suite of model but multiple different models.

The reason for that is models are right and wrong in different ways depending on the assumptions that you put into them. They’re not always right, they’re not always wrong, and they need to know a variety of different ways that this system could behave. The two plots that you’re seeing here are two different sets of models, one based in Europe, one based in the U. S., that were showing predictions for the path of Hurricane Sandy before the storm had even passed Cuba. Everything in color there is a model prediction.

Five days out one set of models was saying this storm is going out to sea, no worries for the U. S. East Coast. Another set of models was showing pretty strong evidence that it could turn and hit the Mid-Atlantic States. The prediction at that time from the Hurricane Center basically split the difference, because we didn’t have information on which of these models is right. If we did we would use the right one.

There are five-day out envelope there which is probably pretty hard to see from the back, is just showing the storm going straight up possibly towards the coast, possibly towards the sea. Later that same day they were actually able to … a lot of the models started to turn and they were able to make this prediction that the storm would hit the East Coast of the U. S. That’s five days out, that’s a long time for a hurricane. The reason there, and they were pretty much were dead on in their predictions for the storm, and you want five days lead time when the storm decides it’s going to hit the major population center of the United States.

These guys have been working for a long time on this multi model inference, assembling of models, putting together disparate models not just one type and making prediction and it’s still a human who’s making the predictions in the end but it’s based on an awful lot of information that’s coming in from international groups from a lot of data collection.

The reason for that is of course the predictions are very important. There’s a lot of methods for doing this and what we’d like to do for the entire region, the whole Northeast Shelf, is to be able to do something like multi model inference and the ecosystem case. I’ll show you a brief and perhaps easier to read list of
some of the models that we’ve got developed right now in order from less to more complexity. What I want to highlight here is a project that we’re just starting to try to do multi model inference with several types of these models from an empirical model, nonlinear time series type model, all the way through some aggregate and multispecies production models and size-based models.

In blue would be what we would call our tactical assessment models and in green highlighted there are what we’re calling virtual test beds, because you don’t just use models and assume they’re right. We want to use a much more complex model to simulate the world and the data coming out of it, put that data into our assessment models and actually see how they perform. This is standard practice with a lot of modeling. It’s already done for a lot of the assessment models. We need to move it up to the ecosystem scale. I’ll just give you a taste of what some of these models are that we have already and then some later examples will show some that are in development.

The first one is a multispecies production model, and I do apologize for the equation before lunch but it’s actually not too bad. The nice thing about this model is you can write the whole model in one equation and it’s got processes in it that include how does my biomass change? It’s basically what’s happening with \( dN/dt \) there. It can change by increasing through little \( r \), that’s the intrinsic growth rate of a population. That has swept up just like Robert is talking about \( M \). That swept up all the things that make a population increase; recruitment, growth, everything. Over on far end of the equation there, how can my population go down? Well, I can be caught or I can be eaten by predators, and the big section in the middle in parenthesis there is I could have competition with other species in the system.

This is a fairly simple model that actually incorporates a lot of the processes that you might want to look at for competition and predation for forage species and yet it’s a pretty simple model. This one has been parameterized for the entire coastal region, so that’s the list of the species there. You can see that it goes all the way from Mid-Atlantic to gulf main reef. We can parameterize this for just subsections though.

On the other hand of the complexity spectrum, we have the Atlantis model and not every region in the world has an Atlantis model because it does take so long to develop these things. This model is really spatial, I’m showing the footprint of it there so you could ... the Mid-Atlantic is a separate entity and so are inshore and offshore and so are depth zones. We have 45 functional groups in this model which are intended to incorporate all of the species in the ecosystem. We have 18 fishing fleets which are intended to encompass all of the types of fishing that actually happen on the Northeast U. S. Coast. I’m not going to show you the
equations for this, because it would take us a couple of days to go through all the equations for a model like this.

This model is not one that you fit to data and make tactical decisions out of. What you use in Atlantis model for is this simulation, this virtual test bed idea. The main idea, and Beth Fulton is the developer. She’s in Australia. She has worked extensively with Jason Link and some of the other folks who built this model for this region. The idea here is you start with objectives, like Rob said, so that’s what we need from the councils. The model itself then will stimulate what’s going on in the ecosystem starting with the sun and going all the way up through the fisheries and in the simulation cycle is fishing from the industry

Also we simulate our monitoring systems, we simulate our assessment systems, the management systems, implementation back into the industry and it all interacts back with the ecosystem. The idea here is a closed loop management strategy evaluation. The type of information you get out of this is exactly the tradeoffs that we were just talking about in the earlier set of trigger questions. If this is set up right and you have the right processes in here, and there is an economic component to this model that’s been developed in the model software that we need to develop further in this region. You can start to ask questions about tradeoffs between management strategies and you have some sense of what you know because you’ve built the world. You’re not testing them in the real world, you’re testing them in the model, but it gives you some sense of what the tradeoffs might be and then you can go to a more detailed tactical model to actually ask some of the same questions.

We’ll also be using this to test some of the models, so that assessment component there. That’s where you’d plug in your multispecies production model or some of your simpler models and ask how well they perform in the system.

In between something simple like a production model and something incredibly complex like Atlantis are food web models. These are really useful to figuring out what you want to do with forage species. I’ll spend a little time on this. This model is for the Mid-Atlantic. This was developed in 2006. The picture I’m showing you here is just one way of visualizing a food web. It’s not very pretty, but we tried to make it pretty by coloring it and so what I’ve done here is, you go from low to high trophic levels in this.

You have here your primary producers, your phytoplankton, and also things like your benthic detritus cycle on the bottom of this plot. The blue color there is basically the pelagic food web and that is where most of your forage species that we’re talking about here are going to show up. The green is the benthic food web where a lot of your invertebrates and things like that are. You see the colors start to blend as you go up in trophic levels because of course there’s a lot of species
that inhabit the pelagic realm that might eat off the bottom and vice versa. In fact, one of the interesting things I find about this, I don’t know if this is going to work, that’s hard to see, but this very small box down here that’s coming right off primary producers, that’s scallops and clams. They live on the bottom but they’re getting a lot of that primary production in this system and they’re obviously vitally important to the fishery here.

One thing we can do is visualize how different components of this food web interact with each other. Here I am, I’m trying to do this on my computer. Let’s do it up here. There’s the fishery now. The lines are indicating the 90% most important flows to the fishery in this ecosystem. Since you can’t read that, no way, from the back of the room, they are basically from demersal piscivores, commercial small pelagics, other small pelagics, and from this filter feeding clams and scallops down the bottom. Everything else that’s in color is in some way caught by the fishery, perhaps as bycatch in a tiny amount, but they’re not important flows here. You can start to visualize unless of course the fall effects of all the fisheries in the system. You can spin them out and we’ve done that in other projects.

The interesting thing here is small pelagics are essential in the food web and they are caught in the fishery there. The other interesting thing that you can do with the food web model is you can say, “Who are the predators and prey of those commercial small pelagics, these forage fish that you are interested in managing?”

Now, stained in red are everything that is a predator including the fishery off to the side there. In light blue is everything that’s prey to small pelagics. In purple, those scripts are both. They both preyed on and are preyed on by your forage species in this model. Again, the ones joined by lines are the most important flows. The most important predators of your small pelagics in the Mid-Atlantic, that would be the fishery, that would be toothed whales, that would be medium pelagics. Some of those piscivorous guys, probably your Spanish mackerel and things like that, demersal piscivores and your demersal omnivores. A lot of your ground fish are feeding on those guys. Those are important predatory flows.

What are they feeding on? Copepods, zooplankton, just like the forage fish definition that everybody shown, and also some crustaceans off the bottom and larval and juvenile fish. The larval and juvenile fish interaction is a very interesting one that can cause complications in a lot of ecosystems. When you look at forage fish, I think the [berrency 00:12:56] is a good example of that. Anyway this food web models can give you an idea of where you are.

This one that’s already built is very aggregated, so that small pelagics commercial group that’s including herring, mackerel and butterfish right now. The next couple of slides I want to show that we do have data at the end of the individual

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species level, so we can drill down to more specific food webs. This kind of ugly looking thing does not involve a model. This is a plot of the data. That’s just the food habits data for the whole Northeast Shelf for a five-year period of time. I think it’s the spring survey from 2000 and 2005. Each of those dots in there is a species. The lines between them are connections just based on who’s in whose stomach.

I’m going to zoom in on this box here just to show you an example of the type of information we can get. There is herring. That’s a really big point because so many other species are joined to it. It’s an important forage species. The thickness of the lines indicates some of the more important interactions of basically who’s in whose stomachs more often. You’ve got dogfish way out on the right hand side of that plot with a lot of lines to it. It’s an important predator. You can see there’s a lot of variation just in the data, and so we can get down to individual species here and start to ask some of the questions that would be important for forage fish management. The other thing that I would like to point out is we have this data for over 40 years in this region.

I worked in Alaska. Alaska has a very impressive dataset for food habits. This one is much, much better. This is probably one of your best datasets you’re going to have in the world for working with fish. If the fish interactions are the primary concern in the Mid-Atlantic then we have quite a bit of information to address them already. That sort of is a quick overview of models and data. I’m going to go now to this bridge from single to multispecies modeling and the food web is one way to make that bridge. This is an example of work from the Gulf of Alaska that I worked on. The main message here is that food web when you build it it’s an accounting tool, just like Rob was saying. It can allow you to partition what is mortality from predation and what is from fishing, which is the key question here with forage fish.

In Alaska, I took just a few examples out of a big food web that I made for the Gulf of Alaska looking at both target and bycatch species, and so we have a skate and then a pacific halibut. The skates are not targeted there unlike here. The halibut are obviously. Predation mortality is there in a pink color and fishing mortality is in the blue. Those two species are dominated by fishing mortality as you might expect for something that’s a predator. The argument here being maybe you don’t need to worry about your predation mortality in the assessment for those species. On the other side of the fence there are Pollock, an important commercial species in the Gulf of Alaska, and squid which are not commercially fished there, both of whom are dominated by predation mortality.

The main point of this study was to say, “We can use these food webs to focus in on the ones where we would want to include predation mortality in assessments.” Lo and behold, I published this in 2010 and Jason had already done
it here for the whole Northeast Coast by ecosystem a couple of years earlier, so this information already exists in this region. I know it’s impossible to read that there but basically the grey is partitioning out the fishing mortality from the predation mortality which is in white. Other mortality in the food web model you don’t account for things like dying of old age or disease or leaving the system and that’s what other mortality winds up being, but you do get a picture of total mortality from a food web model.

You can see that the top corner, that’s most of your pelagics groups across the entire region. The fourth bar in each one of those is the Mid-Atlantic bight and what you can see is for just about everything except for those medium piscivorous pelagics which are getting into predatory fish, just about everybody’s dominated by predation mortality, so yes, they would meet the criteria and of what you’d want to include predation mortality in an assessment.

Just for contrast, the other plot on the bottom is showing things like highly migratory species over all the way to the left. The one that’s all black, that’s baleen whales. Not a lot out there eating up our baleen whales, at least that we know of, and our food web models most of their source of mortality are other. Again, these are the things, until you get to the odontocetes, the toothed whales, then you are starting to see predation mortality probably from sharks, so if you’re doing the assessment there we’re not dealing with marine mammal assessments, fortunately but you may want to think about it.

Anyway, the idea is that this information already exists for all of the systems on the U. S. East Coast. How do you get predation into an assessment? There’s plenty of examples of this as well, and the most examples that I had were of herring although it happened obviously in other places with menhaden. I would show the herring examples because they show a progression of complexity in ways that this could be done.

Bill Overholtz published a paper back in 2008 just showing some of these time series where he included consumption as basically another fishery. Let’s treat the predators as another removal, and this was included in a not fully age structured model so a little bit different than the models that are used for herring assessments but just as a proof of concept. He showed that over the time series here from 1959 up to about it looks like early 2000, there was a switch between the landings being dominant and the consumption being dominant. Likewise there was a switch between fishing mortality, the dotted line on the bottom plot being dominant early in the time series as a source of mortality whereas predation mortality dominated later in the time series. Out of his analysis you can see that when you include the time bearing predation mortality it can make a difference and the source of total mortality actually switched from fishing to predation for herring according to this analysis.
Now, much more recent analysis was in the actual herring assessment done by Jon Deroba and the working group just last year. I’ll take a little time to walk you through this because I think it’s a good example of what everyone was just talking about and in particular what Rob just spoke about in terms of trying to get this information into assessment. It’s a nice illustration of how it can be done and also what some of the issues are going to be that people run into.

On the bottom corner there, the colorful graph, that’s the estimate of consumption of herring coast wide, and this is the coast wide assessment. All the different colors there are different predators. The thing about herring in this system is there isn’t one dominant predator of herring. There are many predators of herring and you have to be able to figure out what’s going with the biomass of each of those predators and the diet of each of those predators.

The diet is fairly well on hand. The biomass becomes the issue because it’s estimated by different methods. Some of those predators have full stock assessments, others of those predators have just a survey biomass index and some of those biomass indices are not considered as reliable as others. To build this total consumption time series there’s some technical issues that need to be dealt with but this was the best shot at it. I think it’s fair to say from this that there was a big change in the consumption of herring over time starting in the early 70s there. At the beginning of the time series it was an immediate dropdown and then it became very high starting in about mid90s and has fluctuated quite a bit since. The uncertainty in this is one thing that needs to be addressed and I’ll come back to that later. The top plot there is showing what effect this can have in the model and this is an example of consumption as basically interpreted from the natural mortality rates that are used in the model.

The light blue line there is if they had assumed just that constant natural mortality rate but what they did do in this model is assume it was not constant over all ages. That’s why it varies a little bit you’re seeing a change in the age structure in the population in the light blue line. Essentially that is slightly better than ballpark estimate but it didn’t quite get to the level that you would get if you had the consumption in there.

The solid black line is the estimate of mortality just from fish, which is from this plot below. In this assessment they did go through and try to put in also the mortality from mammals and birds to the extent possible highly migratory species as well, so things that are not in our database. That is done in a less quantitative way because we have less quantitative data on those. The attempt to do that boosted up to that orange line there.

In the assessment one run actually did include this as a removal to sort of modeling it as a fishery and it worked fairly well, although there were some dissatisfaction and some technical ways that it was working in particular with the
characterization of uncertainty in the time series. It’s sort of the middle of the road solution here was to change the actual M in the model. Now, we’re talking about the global M again, but make it time bearing so that it reflected this large shift in consumption that was coming from the data. That is the dotted line that you see there. Essentially a multiplier was added to M after a certain point in the time series that boosted it up and it actually mimics the consumption time series fairly reasonably but it does it in a way that was a bit more stable in the model.

I think this is a nice example of a progression towards including predation mortality but one that isn’t the full on M2 treatment that you would get from a multispecies model. It is one that does attempt to account for this consumption, this clear change in the consumption data where there seems to be more predation mortality on herring now than there was in the past. That’s what went into the current herring assessment, so just as an example.

There’s a couple of other things I want to talk about here that would involve multispecies assessments. These are single species assessments. One thing you can do, there’s a published multispecies model that was given to you in the briefing book by Tyrell, et al. The advantage here is now you’ve got multiple forage species so you can have herring and mackerel. This one again was coast wide not just Mid-Atlantic.

You also can look at time series of consumption by the predators. You can start to address which predators are preying on whom and how has that changed over time. That’s one advantage of trying to do a multispecies model. Yes, they are more data intensive, but for a particular species in the northeast region we actually have quite a bit of data again. That’s why you see examples of multispecies models showing up in this region.

The last example that I’m going to show you is the model that’s in progress right now. This is the one that I’m in charge of building. Now is your chance to tell what you want in it. The idea here is to try to come up with more of a tactical assessment tool. One that is built on sort of the framework of single species assessment right now which will do things like have structured population dynamics statistical parameters has to mention will come out with biological reference points that councils are used to using. It will also incorporate things like species interactions and tradeoffs, environmental effects on some of these key processes like growth and maturation and recruitment, and will to some extent put this populations and fisheries in space. Not fully spatial like Atlantis because that’s incredibly complex but at least to the level of Mid-Atlantic versus Georges Bank or something like that or possibly smaller space. Of course, we have to do all of these under budget constraints like we always do, so no jet packs allowed.

The current state of this thing, and its codenamed Hydra, I don’t know if you know your Greek mythology. This was the monster that Heracles had to kill and it
had all these heads. It had 10 heads, so we’re starting with 10 species, it seemed appropriate. The thing was Heracles cut off one head and two more would pop up in its place. It’s just a nice metaphor for what we may be facing here, but eventually he did kill it. That’s the good news. Anyway, it’s intended to include both fish and invertebrates. It does estimate size specific predation mortality. It will be spatial. Currently, it’s parameterized for just one area. It is size-structured not age-structured and that’s so we can include more species. Species that are not currently aged, we would actually be able to include in this model, and a lot of processes in the ecosystem are size-based not age-based. A fish doesn’t look for a fish of a certain age to eat, it looks for a fish of a certain size. I think we can take advantage of that here.

There’s an emphasis on reproductive biology so we can evaluate things like changes to fecundity or maturity that are due to, say, changes in temperature and it’s all going to be implemented. It is implemented currently in AD Model Builder which is the stock assessment package of choice. It takes care of a lot of your estimation features in a statistically appropriate framework. We will speed through the rest of this. Anyway, that’s what’s in development now.

Quickly to look at the level of functional groups I’m going to give you an overview of some work that was done comparing multiple ecosystems using that simple production model that I showed you at the beginning. The main question that I’m going to address here, what would be an appropriate species aggregation when you’re trying to balance a yield objective with, say, a conservation objective which we all do have. Species aren’t allowed to drop below a certain level, that’s called overfished.

What we did in this model was we simulated a 10 species system and in this case it did happen to be Georges Bank and the system was simulated with species interactions in it. What you’re seeing is your yield curve for each of 10 species including species interactions. Then they ask what would happen if you just look at the whole complex of species and that’s the plot in the bottom. The yield from the whole complex is the red line but then you have to ask, “At each level of yield have you started losing species? Are they collapsing? Are they going below the level where you want them?” Of course yes, eventually, if you fish hard enough you’ve driven everybody down, but the peak of the yield curve is somewhat past where species have started to collapse.

What we’ve suggested in this analysis was you could find a point where you had no species collapsed, move the F back to that for a precautionary reduction and ask how much of your group yield you have lost. For this particular simulation with 10 species on Georges Bank we were still at about 95% of them, that’s why. We ask now how can we construct a bunch of different aggregations and see
what effect that would have on yield versus collapse? If we want to have no-collapse species how much yield can we actually get out of each aggregation.

Here is where the comparative stuff came in. We actually compared Georges Bank with the Gulf of Alaska. The short story is the dark bars have no loss in yield, so we actually did have some species aggregates that were put together well enough that you would get no species collapses and still be able to get the maximum multispecies yield out of them. Now, these species were very similar in a lot of their properties. You had others in Georges Bank where you could get down as low as maybe 80% of yield, which is still fairly good.

The Gulf of Alaska was a slightly different story. The difference between these two systems is the way they parameterized. The Gulf of Alaska had a much more dominant predation signal. The Georges Bank system was much more dominated by competition. This is where knowledge of the interactions in your ecosystems can make a real difference to how you want to manage things in aggregate. You have to be a bit more careful when building your complexes in the Gulf of Alaska if you don’t want to lose a lot of yield without collapsing species was the bottom line from that.

Very quickly, I cut this pretty short because I figured I’d be running out of time. The changes in the ecosystem, I think everybody here knows that there’s a lot of changes in the Mid-Atlantic, you’re seeing species coming in, a lot of changes in ranges but the picture that brought this home to me the most was this one. This was, observed sea surface temperature trend from 1900 to 2011 across the whole North Atlantic and North Pacific. The boxes are the areas that are managed basically by Fishery Management Councils.

I came from Alaska where everyone is very concerned, appropriately, with climate change because their sea ice up there and it melts and it’s very obvious when things change. What I’d like to point out is that most of the fisheries that are actually happening down here in the Southeast Bering Sea where yes, there’s change but it’s not that severe. Look at where we are, it’s happening faster here than any other region in the country I think. The changes are larger and they’re more significant and it’s throughout the whole Northeast Shelf. This is something that I think we’re all going to need to consider whether it’s forage management, single species management, anything. It’s really all happening here. I think this is clear from a lot of the stuff that’s in the ecosystem status report, so I won’t repeat most of that, but I do encourage you to look at it. It’s online and it’s very easy to access, just going to talk briefly about the fish communities.

Over on the right hand side is a change in composition of fish communities on the whole shelf as indicated by weighted temperature preferences. What this is saying is each fish has sort of a central temperature it likes to live in and we can ask, weight that by biomass and ask how has the whole community changed.
Coast wide we have seen a shift on, autumn is upper, spring is the lower, this is from a survey data. We’ve seen a shift in the whole community across the whole coast towards warmer water species, dominance of warmer water species. It doesn’t mean the cold water ones are gone, it just means they’re reduced. The other thing we’ve seen are shifts, of course, in the major species categories. Up in the top corner here in blue are elasmobranchs, ground fish in yellow, small pelagics, in pink, and others are in green. That’s coast wide, but you can see this increase in elasmobranch and small pelagics, that’s probably not news to anybody.

The ground fish have come down from a height, come up a bit and stabilized. When you look at just the Mid-Atlantic bight region you’ll actually see a general increase in the biomass in this region. That’s in red in this lower plot here. I think that’s largely driven by dominance of elasmobranchs and small pelagics. It’s an interesting situation here if you start to manage forage fish, which are small pelagics, but you have quite a bit of predators which are elasmobranchs.

Last thing I’m going to get to here, last two slides, are information needs. I think I already mentioned there’s quite a bit of data in this region, especially for fish diets. I think you’re in really in good shape there. There are still work that can be done for quantifying the uncertainty in consumption estimates specifically for putting into stock assessments and the herring example from last year illustrates that nicely.

This is a solvable problem though. This is something that I think we can get together as analyst, look at some methods and figure out what would be the best way to quantify this uncertainty through incorporation and through stock assessment. The other thing we need to work on are these upper trophic level predators: mammals, birds, highly migratory species. It can be put in there in a less quantitative way right now. Maybe that’s just the way we need to move forward, but we are working with someone and to other folks to see if we can do better.

That’s kind of it for data needs. I think we’re actually in pretty good shape. You can [inaudible 00:32:25] addressing some of these forage stuff in an ecosystem context. Obviously, there’s need for economic data and everything else once you get to evaluating the tradeoffs. Analytically we have models, we have tools and they can be parameterized specifically for Mid-Atlantic region, issues, species, and the changes in the environment here. I think what we need are some ideas about alternative management strategies that you would like to see tested and also what the primary objectives would be. That kind of comes back to what Rob was saying.

The other thing we can do is risk analysis. We’ve been looking into this quite a bit for looking not just at where the highest priority data gaps might be but where
are going to be your highest priorities for management, where is the biggest risk, to not meeting the objectives that you set.

I’m just going to leave you with a couple of questions that I think this is what we’re here for. How should we include predation in forage fish management? There’s obviously several options. They can go into single species assessments. We’ve already got examples of that. You can use multispecies assessments. We’re working towards developing those so we’d be able to meet possible future needs or present needs, and/or, as Rob was just saying, it can be an adjustment to your policy. If you don’t have the assessment information there’s many options and it’s really up to you. Then I think the very next question when you’re dealing with species interactions is going to be how do we deal with these tradeoffs and you’re talking about multiple predators, multiple fisheries. I think we already have the data and some of the tools to begin to address these two. It’s just a matter of how does the council want to deal with this, what sort of policy level objectives will you have. That’s what we need from you and that’s all I’ve got. Thank you. (Applause)

John Boreman: I didn’t see her breathe once in 30 minutes. Wow. Thanks, that’s a lot of information. Good questions, I think some of those reflect the trigger questions that we have for discussion this afternoon.

Let’s forego any questions on the presentation, just write them down and maybe we can come back this afternoon if we have time. Let’s get right into our panel discussion on the last two talks.

The first trigger question we have is, “Why is the assumption of constant natural mortality not sufficient to allow forage stocks to fulfill their role(s) within ecosystem?

Basically, my experience with Jason has been that we had been assuming a constant natural mortality rate, which is M, so called M factor, in assessments for many years. Now it seems that when we start to account for predation related mortality, or M2, the M seemed to be getting bigger, the overall mortality rate. I’m thinking of mackerel for example at M1 from 0.2 to 0.35 because we’re now accounting for predation related mortality. I’ll just throw that out there, but I’d like to hear a response from the panel on this topic here. The value, there was a tradeoff. If you assume a constant M, you don’t have to do all this work. Any comments of the panel on that? Robert?

Rob Latour: Sometimes I come up with a simple analogies. I’m going to try it here, maybe this makes sense with me, maybe it doesn’t. This is a situation where you are balancing your checkbook, in my mind. If you’re diligent and you write down every little expense down to the penny you can have a great understanding of where your money is going. If you’re like me and forget to get receipts and don’t
pay attention half the time maybe you don’t have a great balanced checkbook. Not balancing the checkbook adequately means you run the risk of overdrafting, a much higher risk of overdrafting, than if you’re paying attention closely.

That’s really what M is all about. The traditional approach of assuming a value basically means we don’t really know, we don’t know where the things are going, we don’t know how we’re spending our money, we’re just going to put a figure out there and hope it’s okay. Being more diligent about it, I think we recognize M changes with the age of animals, we recognize M has changed with time, and being better accountants means reducing the risk of overdrafting or running stocks into a collapsing situation.

In my simple mind that’s kind of how that shapes up. As the evidence and sciences evolves we’re seeing more and more cases where M is not constant. It’s inadequate to make that assumption. We’re not doing a good job with our accounting and then superimposing climate drivers and changing temperatures means we can expect to see even more changes in the future. We have to move to a paradigm where M is treated more time bearing, age bearing, more dynamic in our analysis, I think.

Ed Houde: I agree with everything you said. Can you give us an example of where poorly estimating M or using the constant M has resulted in a bad outcome?

Rob Latour: Dare I say cod? I don’t know. It’s hard to give you an example, Ed, because the post-collapse analysis that have been done for many of the global fisheries in my view all center around analyzing fishery dynamics. They don’t center around analyzing ecosystem dynamics. In most cases we’ve been probably too conservative, sorry, that should not be conservative, or too low with our treatment events especially for forage stocks. The degree to which that choice has impacted collapse separate from ... it’s difficult to separate from how fishing behavior and fishing activity and fishing landings, I think, lead to collapse. The two are intimately related, obviously. I think the evidence that consumption by even limited suites of predators for many forage stocks are on par same order as landing is telling and often exceeds landings is telling when in fact all of our assessment models treat F or lead to estimates of F way above what M is. That’s it.

Ed Houde: Just a follow up, I think that not estimating M well is part of the capelin story and its collapse, although there were a lot of other elements, I think that not estimating M well alone is probably not the only critical thing that we’re missing in managing forage fish or other fish for that matter. Also maybe I’m getting ahead of ourselves in going into the afternoon, but there would be some generalities about estimating M in particularly forage fish but other fish as well, we can draw right now. Maybe Sara knows this, but it’s been my impression as I’ve read literature over 40 years that whenever you have estimates of natural
mortality in age zero fish meaning beyond the larval stage or others between 0.01 and 0.03 per day. That’s where they are and whether they are tropical fish or fish from high latitude, is that kind of information good enough to begin to put into models to manage fish.

John Boreman: Sara?

Sara Gaichas: I can take a small crack at that. That’s a huge question obviously. There’s been a lot of workshop on estimating M I think within the agency as well as other places. I think they do come to similar conclusion, especially for their early life stages of course. The natural mortality there is gigantic. I mean, why would something have 38 million eggs if it didn’t expect to lose most of them. I think it’s increasingly clear when you put together a food web model you can start to account for that stuff. Just like Rob said, it’s like balancing your checkbook.

There’s nothing magical about the food web model. It’s really just an accounting exercise. You can start to get a sense for the scale of those things if you have that type of information and I think scale is the important thing. We probably don’t want, it doesn’t matter if we’re off in the third decimal place on M. It does matter if were off by in order of magnitude or if we’re not scaling it correctly with the other sources of mortality that we do have control over. I think part of it too is knowing what you can and can’t control. I think the Gulf of Alaska Pollock modeling that I was doing was a bit different from what was assumed in the stock assessment by showing that predation mortality was about eight times higher than fishing mortality and the stock assessment was assuming an M more of 0.3 or something like that.

It wasn’t as much an issue for the assessment or for management because they kept things pretty much under control there. The issue was when you started looking at other species in the system, halibut were a major predator on Pollock, and their size and age and population were dropping just as the Pollock assessment was dropping. If you put back in that natural mortality you’re basically showing that the fishing mortality was sustainable but the total mortality wasn’t, and that’s why the population was dropping. It gets more complicated, I think. It’s a necessary question with these animals that have much more predation mortality than fishing mortality.

John Boreman: Okay, let’s move on to the next question then. To address special management of forage species, should the Council increase the biomass target or maintain current MSY based Biological Reference Point and add buffers. I guess a corollary to this is how do we avoid double counting for ecosystems, for forage predation effects? If it’s incorporated in the assessment is there a need also for the council to incorporate it in a risk policy I know we avoid that double accounting for it?
Ellen?

Ellen Pikitch: I’ll jump right in. My personal opinion is that the council should increase B target and it should add buffers to them. Let me give you some of the rationale for why I think so. One is [inaudible 00:44:26] task force, we had 13 scientists grapple with these issues for nearly three years and come to a consensus on what needs to be done. While I do think that individual councils in individual areas would want to take that advice and maybe do more fine tuning of it for the region, I think that you also know the big picture. What of the international standards going to be for forage fish management? Of course my hope is that the Lenfest recommendations will be taken on board an international level. We’ve talked with the FAO at the last scoping meeting and they offered and adapted language basically supporting the need to treat forage fish differently.

The U.N. has taken it up and will take it up again this year. The MSC, basically, if you want your fisheries, any of the fisheries in the Mid-Atlantic to be eligible for certification by the Marine Stewardship Council they’re going to need to comply with the newly adapted new standards for forage fisheries which, like I say, pretty much identical to the Lenfest recommendations for that high information tier group. Again, while there are many other things that ought to be considered, I would suggest a system where the councils move quickly to come into some kind of recognition of the new recommendations out there that are on international scale and then as time progresses, you might then modify that further.

John Boreman: Rob?

Rob Latour: Changing B target means, and supposing you’re increasing it, means you’re making a conscious decision to leave more fish in the water, that’s it. A decision you’re making because you believe that that’s an important thing to do. Changing the buffer deals with the uncertainty associated with achieving those levels. They are two different things and they may need to both happen but just keep them separate. Changing B target means we need more biomass than MSY principles would suggest for all the rationale we’ve been discussing. P-star, maybe that’s the same as the current default, maybe that needs to change, but that’s the degree of management uncertainty that you’re thinking about might be in place with whatever the stock is that’s being harvested. They’re two separate but may necessarily have to happen both.

John Boreman: Yes, I think, and Richie can correct me if I’m wrong, that the idea here is do we leave more fish in the water or do we take fewer fish out of the water, which is either increasing your B target or increasing the buffer between the OFL and the ABC, that’s the question. I’m hearing kind of you need to do both. Will they both achieve the same thing?

Yes, Rich?
Rich Seagraves: Yes, I think what I was trying to get out of here is one way to achieve increase in the biomass is to stick with the current MSY base reference points and then buffer down from that. Your target is BMSY, officially, with an FMSY associated exploitation rate and then through some policy decision. We do have the calculations and then we’ll just take less fish. The question is will you arrive at the same end point if you were to change the actual reference point from the start to achieve a higher biomass? Do they achieve the same thing is really what I was trying to get at. I hear your point Rob about the biomass … okay, and it’s a simple question, will we reach the same endpoint with a two different strategies?

Ellen Pikitch: It’s possible that mathematically you’ll end up with the same catch minutes both ways. I mean you could do it both ways. The way that you’re talking about just modifying the buffers could be like a really quick fix. In one case could qualify for Marine Stewardship Council certification, and the other you wouldn’t. The Marine Stewardship Council is going to want to see that you have taken a step down from an MSY target. They’re not going to interpret changes in buffers that way. It’s not just the Marine Stewardship Council. If you’re interested in aquaculture. Aquaculture standards are now looking at the sustainability of the species that are being grown up into fish meal and fish oil in terms of whether the species will qualify under aquaculture certifications. Again, one is a quick fix, they may mathematically turn out to be the same but philosophically I think that the approach where you actually modify your goal is something that’s going to be, I think, a better choice in the long run.

Ed Houde: It seems to me that you can achieve the same goal, I mean you stay with your calculations of reference points based on MSY the same, but you do it in a more precautionary way, and then you could calculate what that meant in terms of a buffer. Wouldn’t that be true? You would know, if you stuck with the MSY based reference points but made them more conservative in terms of the F levels that you would recommend. At least you would model or calculate the expected buffer would be by being more conservative.

John Boreman: I’m going to insert a question here probably … as I see ecosystem approaches to fisheries management if we move in that direction we’re going to be seeing an across the board reduction in our ABCs for all our species? Is that what we’re talking about?

Ed Houde: Why all?

John Boreman: All the forage species, correct?

Ellen Pikitch: It looked like some of your potential forage species aren’t even fished yet, so I don’t know if you have ABCs or not. If you had a well-managed under the same species criteria, forage fish fishery, you would be reducing the catches.
John Boreman: That’s what I thought about 10 years ago when this first came out at the bill. Can we move on the next question here? At what level in the OFL-ABC-OY continuum is special management consideration for forage species best handled. At the stock assessment level or as an OY consideration? Both or something in between, I guess.

Crickets. Ellen?

Ellen Pikitch: Yes, I think the question the way that it’s written, sorry for not catching this earlier, I think the ecosystem consideration needs to be handled at both the assessment level and at the management level and that these are different. I think that Rob made a really good, I think you said it very well when you said accounting is one thing and management is another thing. The stock assessment is really the accounting issue. You’re trying to take all the information you have and come up with the best idea about what is the current status of the ecosystem and the species in it and what would happen if you did one thing or another? It’s the accounting issue. Starting to use more of these ecosystems models, again, I Sara did a great job of describing the spectrum of models that go beyond single species to production models and then to food web model, and then to things as complex as Atlantis models.

One of the different ways, potentially, that it can be done but that doesn’t solve in and of itself your management question. Your management question is really where the objectives that the Mid-Atlantic council has for the management of its fisheries and those objectives have to satisfy the national standards that the U.S. has set up as well as international standards. Those are separate questions. I guess my answer is these ecosystem considerations have to occur at both places, and in one case it’s fixing the accounting to make it more realistic of the way that ecosystems really works. The other is modifying the management to take into account the fact that species are interrelated and you can’t just fish forage fish in isolation of the ecosystem. It’s going to have an impact and the ramifications have to be taken account of in management.

John Boreman: Okay. Ed?

Ed Houde: Yes, it true that the stock assessment is accounting but it does produce, if the information does produce reference points or at least candidate reference points that can be turned into management. I’m just guessing that that was what was on Rich’s mind because he’s saying can we get the answers from the stock assessment and reference points that come out of that or does it take a lot more of the council deliberating to get OY. That’s where, of course, all the tradeoffs and consideration of buffers to maintain that ecosystem in some state that we’d like to see it so the stocks would interact and come in. I think it’s going to take some of both.
Ellen Pikitch: Yes. I agree with you on that, Ed. It doesn’t have to take a lot of time. It’s just because it takes changes in assessment and changes in OY. In fact the Lenfest recommendations, while they take into account all the ecosystem modeling work that we did and all the ecosystem studies that we examined, they are stated in terms of single species reference points for forage fish. We did that intentionally so that it would be easy to take them on.

John Boreman: Rob?

Rob Latour: One of the thought processes; we’re in a state of transition. We’re not strictly in single species operational mode, but we’re definitely not to ecosystem operational mode, so we’re in transition. It’s reasonable to take this concept into consideration at multiple levels until the transition is complete under the notion that the transition is to an operational framework that gives us what we want in one cohesive way. Yeah, we’re taking steps at each level or at each step that you take I think this consideration has to be brought into the process.

Sara Gaichas: To follow up on all of that, which I agree with, I think although it will be important to get this into the assessment level. There will be plenty of tradeoffs that will not be addressable at the assessment level. There will be discussion and decisions that will have to be made at the management level as well, no matter how much you put into the assessments, I think. Even the multispecies assessment can’t answer the questions of which of these two predators do you want to make sure you live more forage fish for? That’s going to be a decision that needs to get made at another level. I mean as analysts we can give you multiple options especially if you give us some idea of what some of the preferred options might be, but certainly an assessment can’t answer that question.

John Boreman: Okay, Ellen Yes?

Ellen Pikitch: Sorry, I don’t usually do this. Just again to inject that it probably will take time to move the assessments along in the Mid-Atlantic framework but again I would really suggest that the Mid-Atlantic council not wait. There are things that you could do right now with the advice that is out there that’s been given right now. Again, for too long I’ve been in the fisheries management, science fisheries assessment business for a long, long time, and I’ve seen a lot of things happen because people were waiting for the perfect information or better information and including some collapses of fisheries. I’d hate to see that happen again.

We shouldn’t be using lack of certainty, lack of the best information, as an excuse for not moving forward now. I think there’s plenty of information to do something now.
That’s an excellent segue into our afternoon discussion because you hit on several of our trigger questions for discussion with the council this afternoon and that is what steps can the council start taking now to make a difference in ecosystem approaches. With that I’m going to end the morning session and we will reconvene at 1:00, not 1:15 but 1:00. There’s a buffet downstairs so you should be able get back here easily within an hour. We’ll see you back here at 1:00. Thank you.
John Boreman: We only have a couple of hours since our panel's going to start leaving right around three o'clock, so I want to make this afternoon because as I said, we can talk for months about this topic, so we need to condense it into two hours. Again, we're going to start with a presentation from Rich about the Visioning Project, then I'd like to open it up for public comment but I want to limit public comment. I don't ... Because that could go on the rest of the afternoon if we're not careful. But limited the...each public comment to about, just a couple of minutes and basically 15 minutes overall we'll give that, because we need to get on with the substance of the workshop and that is...not the substance, but the purpose is to have the interaction between our experts here and the members of the Council. So I want to spend most of the next two hours on that. So with that warning Rich...give it away.

Rich Seagraves: Thank you, Mr. President. I will be very brief actually. I'm going to give you just a brief overview of the results of our Visioning Project as they relate to stakeholder input relative to forage issues. Mary Clark has presented a...across the whole range of management issues and so forth that were obtained through the Visioning Project, but I'm going to focus just on the forage stuff. Okay, so we engaged in an Visioning Project, this of course the Council's is all well aware of, whereby we're trying to engage our stakeholders to build trust, improve relationships, and also to solicit their input on regulations and management issues from their particular perspective. This was done...the online survey with 1253 responses.

They're also port meetings and focus groups; 14 with the commercial fishing interests...five with recreational...one the ENGO. We also received 12 letters...position letters and so basically in terms of overall stakeholder input, all through...the results are broken down by commercial, recreational, and ENGOs...the way that Mary Clark...and again...I'm reporting on some of the information that Mary put together of our staff. So all three of those stakeholder groups recognize the importance of forage species, and that was kind of a universal message as well as species interactions through predator-prey dynamics and so they are certainly in a related... however, the concerns and perspectives of each group differed. From the commercial side, there was concern that the conversation i.e., rebuilding of some predatory species of fish...examples being bluefish, dogfish, and striped bass may be having adverse
impacts on forage stocks and other important fisheries like summer flounder and weakfish.

So the concern from the commercial side was more about rebuilding of predator species having negative impacts on forage species. They also were pretty adamant and this again, was a universal plea for the Council to consider predator-prey dynamics and the intricacies of that more in our management process. Recreational stakeholder group with a different perspective...one of their primary concerns was excessive pressure on forage species due to the number of predators and commercial overfishing of forage fisheries was negatively impacting their fisheries and that the focus on rebuilding all forage species to ensure recreational opportunities for the future.

So again, there was interest and recognition of importance of forage species, but from a different perspective, and finally, the ENGO summary that was concerned of ongoing depletion of forage species is a major concern and also, that many forage species within our ecosystems are to remain unmanaged. The second again, the kind of universal theme was recognition. The predator-prey dynamics need to be more fully integrated into the management plans and that the counsel really needs to develop some sort of ecosystem plan that provides a framework for incorporating these ecosystem considerations into the process.

So just a quick summary then was the conservation of forage species was recognized as important objective by all three stakeholder groups and that predator-prey dynamics obviously is a part of that was recognized very important. That the strategies to deal with those issues depend on stakeholder perspective count with however you're sitting on. So that's just a quick overview and I know we've got...we only got two hours and that was really the summary of what we got out of the Visioning Project specific to this. There's a lot, lot, more with climate change, species distribution change...all those sorts of things that were addressed by stakeholders and we'll get into those in subsequent meetings. That's it, Mr. President.

John Boreman: I like that. Only until September 12th...then I'm back to your average SSC member. Thanks, Rich for that. Okay, now I'd like to open it up for anybody off on the public who would like to make a statement or address the Council. Yes? Yes, please. Mic's there. State your name and so on for the record.

Bob Lorenz: My name is Bob Lorenz and I'm a recreational fisherman and citizen here in North Carolina, and I just want to take a moment to tell you I really applaud this effort that you're starting to look at to address some of these macro issues in fisheries and not always getting out of...I've seen this commerce...Council do this when we're always in the allocation battles between the user groups, so I applaud you for that and I do applaud this Council for some of the outreach you've done to some of us in North Carolina in the past week in getting to us in
the recreational fisheries. After seeing Dr. Evan's presentation, I'd like to strongly recommend that you can go forward with some of the economic analysis and the economic value added of the recreational fishing industry. I think you'll find intensive notes that is out there.

There's a lot out there that...of economic value added from our activities and I looked at things like you've supported and global economic impact and I think you'd find that very great from what some of us do. I can tell you from personal experience, there's virtually no recreational fishing trip. I embargo on here in the marine fisheries and spend less than $50.00 and sometimes it's as much as $300.00. For a percent of the time, I'll go myself, but the other 60% of the time, there might be three or four other people who spend a covert amount, so there's a lot of economic value added there and what you'll find with us is unlike some fisheries...the recreational fisheries...we can stand out on our own for user fees and licenses and appropriate taxes and user fees.

There's virtually no recreational industry that can't pay for itself. So we don't require things like money from general funds from the State or the Federal government as a subsidy to our activities and also nothing about that against the commercial fisheries because I'm a part of the commercial fisheries and I love driving commercial fishing operations; that fiscal responsibly with the sustainable fisheries and some of this...a little bit about the forage fish need us to mar the predator species which is what we target in our activity that adds more of that economic value added and I'm kind of looking forward to what's happened after 20 years of... as a recreational...I love the [Chesapeake Bay 00:08:42] organizations that are working with the conservation associations having gone 25% menhaden reduction in ACL and I like it. There are some of us that may have 33 or 40 and I know this Council had nothing. Didn’t necessarily do that, but I know a lot of you were e-mailed a lot and I think that’s a great move forward and an interesting plus. We use forage fish and I go out often with my longfin squid with me. At the end, we throw that back into the environment. At the end of the day that feed goes back into the ecosystem and we go home. Thank you very much and thanks for what you're doing.

John Boreman: Thank you. Any other comments? Yeah, Laurie?

Laurie Steele: I was having a couple of questions if that's okay regarding Dr. Pikitch’s presentation. I just made a couple of notes this morning and I wanted to just ask a couple of questions. Regarding the case studies in the Lenfest report and the modeling. The species that were evaluated...the forage species that were looked at in the Lenfest report...how was national mortality treated in those assessments and were they all traditional assessments with a static natural mortality or were any of them...do any of them apply a time and age varying natural mortality that accounted for predation?
Ellen Pikitch: So now again, most of the models that we used...in fact, pretty much all the models that we used, we took...we borrowed them from other investigators and we didn't modify them in anyway. So if those models varied natural mortality, then they varied natural mortality and if they didn't, they didn't. So we didn't take any kind of a position on that and we weren't in a position to really modify the models.

Laurie Steele: Okay, so I mean, did any of them use any aging time varying with natural mortality?

Ellen Pikitch: Do you want to... Yeah. Why don't you speak to them, Moe?

Moe ?: I'm on the stock assessment subcommittee for Lennock Menhaden and that was one of the case studies in the report and over the last several years we worked very hard to make M and age and time varying quantity in the assessments, so there's one example where that is in play. I'm not as well familiar with the assessments in the other case studies, but I just thought it added that one.

Ellen Pikitch: Yeah, I believe in the cases of Humboldt Ecosystem model; there's definitely a time varying component which is meant to reflect the El Nino, La Nina pattern that you see there. That it was climate-driven and that's all that I can really think of.

Laurie Steele: Okay, I'll ask the rest of my questions offline. Thank you.

John Boreman: Thank you, Laurie. Any other member want to comment? Jason?

Jason Didden: Just one quick idea that I had. Several times this morning a lot of the kind of discussions about reducing from MSY or different targets and just keep in mind, what we're seeing right now, we have no fishing reference points for either the squids or mackerel or butterfish. So we're kind of now in...right now, we're in an ad hoc approach so given we don't have any fishing reference...mortality reference points for these...in this kind of ad hoc world we live in right now and how all this relates to that situation, I think is a good thing to keep in mind also.

John Boreman: Well, I'm sure the center's working on that and they'll have reference points for us next year...a couple of years from now. But yeah, you're right. Those are level four species in those cases. The reason why they're level four is because there are no acceptable reference points coming out of an assessment or there is no assessment of them. It's an ad hoc.

Female ?: Did you need to say something?

Ed Houde: Go ahead. I suspect that most people here understand that it's not...it's at what we call an ad hoc approach but there are in fact proxies and numbers that the SC has put forward as the you know, NFC staff. So it's...
John Boreman: I got Laurie, but Doug...do you want to come up in the back?

Doug?: Yeah.

?: Can you go ahead? Sorry.

John Boreman: He had his hand up first.

Patrick Paquette: Thank you. Patrick Paquette...recreational fishing advocate from Massachusetts and thank you very much because in 2009...I married my best friend and we decided for our honeymoon...we were going to fish our way from Cape Cod to seventh tip of Crook Island and we spent about three weeks doing that. In every single major fishing...sport fishing destination between the two...in almost every state that's represented at this table and by far, the number one issue that recreational anglers that I knew and charter captains and sport fishermen and everybody was talking about was what was wrong with the bait supply in the east coast. I mean, it was just an overwhelming theme for the entire community.

So to see this become a national topic is really important to me. So it's a question...it may be anticipated in some of the questions you're going to deal with, but I'm hoping or I'd like to hear if the panel has any opinions that would be a few...we're about to enter into a period of Madison Stevens reauthorization conversations. There's a lot of people that believe that some categories of forage species should not be managed to maximum sustainable yield from a strictly commercial value perspective and I'm wondering if there's any opinions on this panel about that particular subject, because this is...it's one of the questions that I believe is likely to be coming up over the next year.

John Boreman: Anybody want to respond to that? I guess if there are opinions, they're not going to be shared. Gloria?

Gloria Steele: I'm just briefly and I'm not sure. Hopefully, there's a relatively brief answer to this question. In the Lenfest report, I was a little bit unclear on how some of the recommendations were derived. Specifically, some of the recommended management actions regarding 20% of unfished biomass, 30%, 40%...and I'm just wondering where is the basis for these specific recommendations? Did these come out? Is there a scientific basis to support these percentages? Are these based on past observations or are these in a...I don't mean to use the word that I already somewhat arbitrary numbers in terms of the thresholds?

Ellen Pikitch: Ed, you can chime into if you want, but they're definitely based on the science that's in the report. It's based on the science and the findings in the report and
we tried to make that clear in the section of the report that deals with findings...recommendations, one following from the other. So for example, with the Eco Sim modeling that I described, we looked at six different harvest strategies and they varied in how big the F was relative to FMSY.

They also varied in terms of the minimum biomass thresholds and then we observed how did the ecosystem do and I showed the summary in one of the graphs I presented near the end of my presentation, what we call the conventional strategy versus the most precautionary. So very much, it's based on science. A lot of it is based on modeling, but also welding all these different lines of evidence. We didn't strictly base it on the modeling. We also based it on what we saw from the empirical studies. For example, one third for the birds or the studies on birds in [Umtombo 00:18:32] and very much it was a consensus. You know we sat with the results and tried to bring them all together as a group. We reached consensus on what we thought made the most sense given all the findings.

Ed Houde: Yeah, I think that Ellen is right here. Some of the results I think where the end of the report, were the stacked graphs. You look at the FMSY and then a 50% FMSY and a different biomass targets. You know, they're part of the output of a continuum of different inputs into the models to give you a sense of what the outcome would be at these different reference levels.

John Boreman: Jeff Kaelin?

Jeff Kaelin: Thank you, John. I guess I'll raise the debate. I wasn't going to say anything today because I don't know where to start. I think it's important to point out, we don't fish at FMSY in New England. We're taking 75%. That's a controllable here plus buffers, herring...same thing. You know, one of the introductory statements in the paper was to identify the problem. I'm still trying to figure out what the problem is in the region. We're not seeing a collapse. We have long term yields from Atlantic herring. We don't see an ecosystem trouble and the idea that we're going to have the science do to them, too and we did a pretty good job of...I think Sarah did a good job of identifying how the herring assessment went and there were people in the room that couldn't stand the fact that our yields actually increased. Frankly, we had had to go back to the SSC. I think that shows you that we're doing the job here in the region and I don't think we get enough credit for that. Certainly, we don't get any credit for what we've been doing.

I've been in fishery since 1972 from the pure environmental trust on Lenfest. There's no support for what we do here and I just...I'm a little bit dismayed about the idea that we're going to take M2 out of the science level and then come back here and do another forage buffer. I don't understand what the
problem is that would reduce yields to that extent. We think we're under fishing in the region now and we think we're doing a pretty good job with that. So those are some of my comments and I don't want to get personal about it, but if we're going to continue to be engaged in the assessment process in the region...be specific about the information that's in front of us and continue to be involved in the SSC. I wish that Lenfest would have a little more engagement on what's actually happening here. The kinds of sacrifices we made over decades to ensure the long term sustainabilities of stocks and that's my comment. Thank you.

John Boreman: Thank you, Jeff. Ken Hinman.

Ken Hinman: Yeah, very quickly....just...I don't want the Lenfest report to be taking all the attention or the heat. I wanted to...the real consensus came up. I would mention that within the Lenfest taskforce, I’ve been working on the issue of developing ecological reference points for at least 10 years now and I see a consensus emerging among everybody that I’ve seen really trying to address this and come up with some reference points. In 2009, we put together a paper that presented the SSC on ecological reference points for menhaden and we looked at...up to that that point what had been done in this area starting with the National Marine Fisheries Services and guidelines of just broadly saying that the MSY...that the discussion should be maintained above the MSY of how much above we saw that beginning with calamari with Antarctic crow...that they had this predator, [Cartelian 00:22:49] of 75%.

I think what they did was basically was the last question that Ed Hood asked, what is a fair allocation and they pretty much took the half way right between the population that maximizes yields to fishery. The population that maximizes yields to the predators and they split the difference. Arbitrary...maybe. Five years later, the ENFAO put out it's technical guidelines for responsible fishing on ecosystem approaches. They recommended that countries maintain at least 75% of the unfished biomass for key or selected prey species. Since then, there had been two scientific studies using models...what everybody's waiting for. Let's use science to determine this and I think it's very telling that the study which was commissioned by the Marine Stewardship Council came up with pretty much the same area as the target of 75% of unfished biomass, just as Lenfest did.

Smith's paper has 12 coauthors from all over the world including scientists from the National Marine Fishery Service, but on this...Ellen said the Lenfest has 13 taskforce people, so these are reasons we're aware of where people have tried to work with this and tried to answer it. Beginning with the allocation question. Where are all the sciences that emerged and everybody is coming out and about the same place. I think there is a consensus that’s been reached and I don't think that can be dismissed...and I don’t think we should just be trying to dismiss Lenfest because of who funded it or anything like that because of the Maine
Stewardship Council...It's a very conservative body and what they funded came out with the same results. I just want to make that clear.

John Boreman: Thank you. All right, I'm going to...

Ellen Pikitch: Okay.

John Boreman: Okay, if you want.

Ellen Pikitch: Just to comment on Ken's comments...if you look at the Lenfest report, you'll see that...so basically we tried to synthesize anything that we could find out there and many of the examples that he mentioned are in...are discussed in our report and we didn't start from square one. We looked at...again, we looked at what was out there. What had been done and thought about before. Thanks.

John Boreman: Okay, Jeff. I see your hand up but you're a Council member; so I just want to close the public comment session now. So that'll be it. I don’t see other hands up in the back so now we'll just turn it over to have the Council and it's time to stomp the stars here. See if you could get him to say, “I don't know.”

Ellen Pikitch: That's easy.

John Boreman: That's easy, huh.

Ellen Pikitch: That's easy.

John Boreman: Okay, but go ahead, Jeff.

Jeff Deem: Usually takes a little longer before I get cut off, but I have a question for Ellen Pikitch, that's what I said, yeah.

Ellen Pikitch: Pikitch.

Jeff Deem: Okay, I would appreciate that...From the Council perspective with respect to the... one third for the birds. What level...what's the optimum level number of birds? What are we trying to do? Give them unrestricted reproductive capability by having enough forage? Or how should we look at that?

Ellen Pikitch: So you know, we grapple with that issue...that the task for us and what's the criteria for our predators. How big should they be and how much of a decline is of concern? And again, all these things we talk about at length and then we said, "Why should we reinvent the wheel when there already are international standards about that?" So we decided to use the IUCN criteria for all the different species. That’s the International Union for the Conservation of Nature. They’re very similar to what societies use. In fact society's criteria for listing under societies follow from the IUCN criteria.
Basically, to give you the simple definition...it does get complicated because IECN has many different categories of being threatened or endangered. There’s threatened; there’s near-threatened...there’s threatened with extinction. There’s...and then there’s extinct. So I believe that the first category vulnerable to extinction would result from a 50% decline in abundance and under IECN criteria. That's why we decided to just follow...we just finalized in criteria and you have a species that has declined by 50% as a result of forage fishing, then the task force considers that to be a concern. It didn’t make sense to us to have forage fishing driving species into such a dangerous zone. Now the details are...there are some variation around this 50% in the IECN criteria, but we can talk maybe may be offline about that other than spend the time right here.

John Boreman: Yes, Chris?

Chris ?: Thank you. I guess, just a question for the panel in general. As far as back to the first question defining of what forage fish... yeah, I think there's definitely some that we can all agree that yeah, they're definitely a forage fish, but there that there’s some that it's based on whatever criteria you use, it may or may not fall in that category and I think that was discussed a little bit this morning. There’s discussions about why some were left off the list and why some were on. I guess the question of that is on a couple of species that are commonly found along the Atlantic coast. The different mullet species and also the hickory American shad. Where would they fall in as far as being classified as a forage fish and the reason I ask that is some of Dr. Houde’s examples where some fish that certainly get eaten by a lot of things, but also eat other things, too. I know it's kind of hard to draw a line in the sand there, but I just kind of wanted...the panel starts on a couple days at least as I’ve mentioned. Thank you.

Ed Houde: You're right. It's not easy to make a decision on what a forage fish is. Some of us said at the outset that we spend hours and days you know, trying to categorize animals and into... As we go through their life history, many of them change. The history and those that would prey become predators. That occurs at a very small size for some animals. Mackerel is another one that this Council will probably want to consider as to whether it should be a predator or a prey. Mullet...we talked to other people about mullet today. People wanted me to give them an opinion of whether I thought mullet was a prey species. You know, it has many characteristics so that one could make the argument for mullet; I’m sure eats very low on the food chain.

It's abundant, eaten by lots of predators. On the other hand, it's not typical showing ecologic species that we're usually thinking about when we talk about forage fish. That he talked a lot about coral and squid being put into the forage fish category by many people and I think here in the mid-at Atlantic... The squid certainly would be worthy of consideration as a forage fish. Some of though, this
categorization has come down to of course, come down to Council policy and Council policy doesn't have to be, fed by science. The policy could come down and the science follows it. But of course, so you would like to think that science somehow is going to shape the policy when the Council makes these decisions.

Rob Latour: Yeah, I can echo some of that. You can make a case for many species I think, so my response to you is, where do they fall in the domain of importance with regard to what your objectives are? We've been talking a lot about forage fish as pelagic schooling [clovea 00:32:15] forms. What about a spot? It's a small little bending fish. Flounders love them. Big flounders especially love them. They transfer the gouge energy up through the food web. Get some of the same criteria. So you can make a case for lots of different organisms at multiple different levels. Are spot...the importance for you, you know, probably not, Flounder are, though. So there’s a linkage that very good bio data that estuaries that shows a montage of egg shift from flounder to gray fishes. So I think it just goes back to the idea of what's your domain? What’s your concern and then start building the house from that point of view rather than try to come up with a definition. Not fitting everything under that definition.

Ellen Pikitch: Yeah, I skipped...initially responded because I don't know about the life histories of some of the species that you mentioned, but just going back to the Lenfest forage definition, we ended up picking our definition because again, we’re doing something for a global audience and we wanted to choose a definition where people would say, “Yeah, that's definitely a forage fish. Pretty much anything that meets our criteria I think, you know, virtually anyone would agree that’s a forage fish and it is throughout its lifetime. So you know, we avoided having people pick at some of the species that we included by picking that more narrow definition...but we did recognize that a lot of species to fill the run of the forage fish which are part of their lifespan.

In the future, it would be possible if you had more of the luxury of time and the depths to do it instead of looking as a species in a single box in your assessment...in your models which is often done today. You can look at size-structured models and each structured models. Then you can have a species that certain parts are forage fish and certain aren’t and do the modeling that way. So these are questions that can be addressed down the road and you can have a species that sometimes is. Certain parts is lifecycle and sometimes isn’t acting primarily as a forage species.

Ed Houde: The mid-Atlantic of course, doesn’t have any big direct fisheries at what we called forage fish accept the 180 which was managed by the Council. But in generally, we really see big forage fish fisheries tend to be in high latitudes, but mostly in ecosystems and ecosystems that often been described as what is called wasp wasted. So at the bottom of the food chain, you’ve got lots of things
supporting just a couple of fish. Usually anchovy and sardine and these things can produce millions of times a year. Some times yields 5 to 10 million tons a year, but so the energy is filtering up into that anchovy and a sardine and a maybe one or two other species. Then there’s a slew of predators eating at the top. So it’s relatively easy to define you know, the prey there. Most of the energy is passing through a couple of species and they are the key forage species. We also can look at it from the top down. What are the predators that this Council or other councils are indirectly supporting? What are the key predators and what are their key foods? The key foods might be considered to be the forage and they might be spot, not sardines. I've got Peter Himchak.

Peter Himchak: Hi, Mr. President. I’m looking for balance, okay? So in only in presentations this morning, we’re meeting the needs of the predators. That I have no… I mean that’s accepted. It would…Lenfest didn’t have any guidance on how long and how high a predator’s abundance has to be before it’s at a balance and I’ll give you an example. I'm glad that Tommy's not here. The striped bass morning stock biomass has been over the SSB for 15 years. As high as 60 million pounds over. The most recent year, it’s over by 20 million pounds. We have a plate of spiny dogfish that I hope we don’t go back to the SSB’s back in the early 2000s, but again, it would seem to me that and this is taboo at…when they talk about fish and striped bass.

But that’s seriously. In a balanced ecosystem, can you really justify having a surplus of 60 millions of time and because that directly impacts what many aid can be taken, so at some point look in the modeling, you have to look at your predator abundance. There aren't too many that have super abundances. There aren't that many stocks in that state of affairs but these two in particular, and what I’d recommend as required reading for our June Council meeting is the Lenfest case study on predation long fin squid and spiny dogfish. There are some specification for long fin Squid in June, and then spiny dogfish in September and if to satisfy the needs of the spiny dogfish…essentially, you’re taking out the example that’s given 3,000 metric tons to from the industry and by extrapolation.

I think I’m part of the industry because I like to consume squid, so do I have to give up three million pounds…three million metric tons to spiny dogfish? So again, I think there’s a problem in constantly feeding the predators and is when you consider forage fish, somebody has to start looking at some guidance in the striped bass example. I mean, it's great to keep satisfying their dietary needs but you know, there are other fisheries that are suffering because of this. So we hadn’t talked about matching down predators yet today and I mean that’s...I brought it up because again, I'm trying to see balance and everything you say and all the modeling and predatory needs and that's a science but you know,
what about if there was a component that's really suppressing the lower levels. That has to be addressed. That's a policy decision, I guess.

Ed Houde: I have to make a couple of comments. I can't fully address it, Peter but I believe that the striped bass being at 60 million pounds is probably viewed by many people along the coast of the United States as a great achievement. So it’s sector problem and so a policy decision has been made by the management agency to try to the audit their...and hold it high. So it’s a policy decision, not necessarily something that's at odds with the science that we know until we...stakeholders and the policy people who are directing management from the agency decide to so something else without lots of striped bass.

Striped bass eat lots of menhaden. They are potentially one of the reasons of menhaden abundance that we've seen historically. Once modeling study based on biogenesis modeling about a decade ago suggest that the population which was about the same size a decade ago. About as much striped bass as did the fishery was taking. So striped bass probably are a big factor in controlling the Menhaden abundance. Many people would say it would be a good thing to rebuild menhaden to support the striped bass since the policy seems to support all those striped bass. The policy seems to be to keep all this striped bass.

Rob Latour: If you're comfortable with where your predator population is, and you’re comfortable that you've met the demand...predatory demand, there’s nothing that says that the buffer for being a forage stock can’t be zero theoretically. Meaning that you don't apply...you don't apply an exasperated buffer. You would just go into operating procedure. It's not intended to be a one way street. I think it can be a two way street...but the value on top predatory fish is placed by the recreational sector, the commercial sector, the management community because of the economic drivers underlying those I think is much higher historically that it has been so with the forage fishes unless they're driving an economically driven process so it's really a policy issue of where you place your value. I think the value has historically been placed based on the predatory fishes and so we needed to make sure we're maintaining those high biomasses for rebuilding if they’re not high. But the system can work in both directions. There’s nothing that says you can’t. Finding out where the value is I think is the challenge.

Ellen Pikitch: So discover what we did the Lenfest report. It did not say...there's no rule on that that the predators get as big as possible. There's nothing like that. What we did was we came up with different harvest strategies that we wanted to evaluate and compare and then we looked at how the ecosystem responded species by species. I’d have to say, having looked at many of these model runs that having a super abundance, I really can't remember seeing it. It's definitely the exception rather than the rule in the models. So what we found is that most species of
predators have one of two responses. One was...they didn't respond at all to certain forage uses going down and those were predators that didn't eat much large fish as represented in their diet.

Or perhaps they ate a different species. Than the one they happen to be testing at the moment. And then others declined quite a bit. The bigger problem that we had was that many of the predators snapshot in time and then outline these harvest rules. They were already gravely depleted from what their struggle abundance had been. So when we say that the average predator biomass declined by a median of 28%. That was from the starting point. That starting point in most cases is below some historical level. You know, what I would say again, let's not re-invent the wheel in terms of where the predator populations should be. So as an example...there already are guidelines for fishes under the Magnuson Act in the U.S., populations ought. Fish populations the other day, The Marine Mammal Protection Act states what's an optimum sustainable population for marine mammals and how you calculate that. So I would say use those as your things. I mean there are a lot of these national- international standards that would that basically say how the predator populations ought to be.

John Boreman: Okay, Howard King.

Howard King: Thank you. My ponderable of the question relates to what Peter brought up. We've heard for some years about the parents who abundance of spiny dogfish and some of the information you presented today and you presented a lot of information and very worthwhile. I was amazed to see with the consumption rate I think for spiny dogfish was for instance, we graphs that showed consumption has shifted as spiny dogfish is a highly significant predator, competitive with ground fish. Some years ago we thought that dogfish were overfished and in need of rebuilding, eliminated the commercial fishery. Later found out that was not the case, so commercial fishermen reinstated, but the market to disappear. So it seems like this is a typical situation to have a super abundance...that's my term. Not anyone else's. A super abundance of Spiny dogfish. So, now we’re faced with this and just wondering what created this situation. The backing off commercial fishing. The production perhaps of coastal shark populations. What might we expect for the next 10 or 15 years on spiny dogfish?

Ed Houde: I don't know and I don't know enough about is assessment science that went on years ago. Whether there was a fault or science and that the dogfish really were at such low abundance as was thought or whether this was a fault of management or whether it's even a fault. But yeah...

Rob Latour: Thank... Thanks, Ed.
John Boreman: Back to you, Rob.

Rob Latour: You're essentially challenging the assessment’s accuracy which is fair to do, but if we believe it, the future would predict a reduction in dogfish abundance because of their life history, there’s a long period of low recruitment and that... those recruits...those cohorts have populated through the life cycle such that we would expect a reduction in their abundance in the next 10 or so years. But you bring up a bigger issue and that is, if the assessment’s missed the mark in a risk-prone way, we see collapse and that's catastrophic and we do everything we can to avoid that, but it's equally reasonable to plot...to postulate the other way. They miss it in a gross underestimate; overly conservative ...we see a less dramatic result that’s nevertheless may not be desirable. I mean, it’s a fair question.

John Boreman: Follow up there, Howard.

Howard King: Yes, I dare it wasn’t challenging, criticizing the assessment. I mean, it’s not perfect. The stock assessments are not perfect, but we’re faced with this situation. Spiny dogfish probably have relatively few predators. What might we expect beyond what you said in the next 10 or 15 years and can other ground fish recover appreciably in the presence of so many dogfish? Yes? I really don't expect an exact answer because nobody knows this, but it looks like were in an uncomfortable situation with dogfish.

Mary Beth Tooley: Thank you Mr. Chairman. Some of my comments actually feed right off of what Howard had said and I think there’s a need to define the problem for the mid-Atlantic. I mean, what is the problem we're trying to solve and what’s our current state? I think if we look at the ecosystem status report from the Northeast Science Center, we could see that pelagics in the region are quite high as are spiny dogfish and I think we all know that over time, we have impacted species composition in the Northeast quite significantly, and you need to sit down and say, “Okay. Well, this is what we have today and where would we like to go and do we have the ability to do it or not?” Because I think we have some constraints in the Magnuson Act. I think though also, you need to consider incorporating the social and I think, was intentional, but these comments earlier today need to be part of the discussion. Tradeoffs need to include the human environment and I think we also have a situation where we have conflicting goals as well. I mean, what are the impacts of maintaining large biomass of prey species in the environment.

Atlantic herring and the recent assessment...I mean, there are references more than once to carrying capacity. That stock has been at a high level since a crash in the late 70s or in the early 80s and it has been maintained at this high level for some time. We don't have the upwelling examples that are in the Lenfest paper relative to sardines, but that’s not the case here. I mean, the crash here was clearly over fishing and to what heavy removals. If you maintain a high biomass
of herring and John, you say it more than once and I think he said it more than once. They compete with the same food source as white whales do. So then you have your competing goals with different legislation.

So I think those are all things that need to be considered and the one last thing I would say is that this assumption that maintaining high levels of forage fish is going to rebuild other stocks that are dependent on them for forage is not the experience that we’ve had in New England. We have a lot of over fish species and we have high prey abundance at the same time. We have not seen the system react and certainly, there’s a lot of things going on with ground fish in the Northeast that are not related to prey, but I think that’s a loose assumption that certainly in our experience, really has not worked.

John Boreman: You want to respond, Sara?

Sara Gaichas: I’d just like to follow up on that and say, I think you’re right about that and I think without doing some analysis specific to the system, we shouldn’t make any assumptions about the direction it would go if we tried to manipulate different levels of biomass at different trophic levels. One example I can give from Alaska is kind of the other end. Getting back to some of the other comments...there’s this thing called Arrowtooth flounder out there which is predatory species. Not much commercial value...extremely high biomass. It eats Pollock. There were several questions. Hey, could we just subsidize the fishery on these things because they’re not profitable to catch right now and would we get more Pollock?

So we did some analysis of that and I think the thing...when you look at a fairly complex ecosystem is...more forage wouldn’t necessarily give you exactly the fish that you want and less predators wouldn’t necessarily give you the forage that you want either. So what we found was even an 80% reduction in the Arrowtooth flounder when you consider the uncertainty that we had in the system, wouldn’t necessarily increase your Pollock and would have repercussions on some of the other species. So I just...I think you’re on the right track if you want to answer these questions in the system. I think it’s important to look at the information for this system.

Ed Houde: I would just point out...I agree with Sara and I believe many of you have comments, but we do have to keep in mind that herring and mackerel were fished down to very low level in the 1970s and it was fishing that drove them down. Presumably, this had an effect on predators. At the time, the predators also were being fished very heavily, so that may have ameliorated the situation a bit actually as far as the forage fish are concerned. Now we have lots of forage fish. We also have lots of other predators that haven’t been mentioned much here yet, but the U.S. and most countries have policy decisions that they're not going to fish marine mammals or many other protected species. If we didn't
have those big biomasses of herring and menhaden, they would be even more pressure on the predators that we like. The fish on those stocks. There's a lot of things going on in the system that I think argue for having a healthy, big forage fish base.

John Boreman: I got...no. I got to go in order so...unless it’s to this point.

Male ?: All right I'll ask the question later.

John Boreman: Okay, I got you on the list though. You're already on the list. Rick? Rick Robins...you’re next.

Rick Robins: Thank you, Mr. President. I have a question for the panel that relates to both practicability and expectations and so, I’m thinking in the context of our goal statement for ecosystem management...right now, it's to allow free...ecologically sustain a realization of living marine resources by maintaining ecosystem productivity structure and function. That structure and function, I think, can be summed up in terms of resilience. That’s something we’ve been driving at in our discussions with the SC in the past and recognizing that if us... I think if we set out to try to reengineer the ecosystem, we'll never do it. We’ll fall short. We’ll fail. We can't recreate the ecosystem that was here when Captain John Smith sailed up the James River. The system state has changed. It’s been substantially altered by all sorts of processes. So my question is...going back to this objective, is that...is it reasonable to think that through accommodation of making progress on the assessment side to incorporate some of these considerations?

You know the assessments, and through accommodation of management actions and objectives that we can either maintain or enhance study consistent structure and function in the context of fisheries management. And adding onto that...can we do that in the context of changing environmental conditions, because in the mid-Atlantic, as you saw in that very presentation that Sarah put up. I mean, there’s a very significant change in ocean temperatures and that has a lot of impact. I think there are going to be some very strong environmental drivers that we experience in the system because of that. So, just a question of practicability and I want to understand how your input on that might help us shape our expectations.

Sarah Gaichas: Well, I'll take a quick stab at this and let other people follow-up with better ideas. I think, one thought that I have is by better accounting for a lot of processes that we do know are going on. I would hope that we could give better advice to the Council because there are going to be processes that there is no control over, right? So being able to account for the things you can't control and try to take them into consideration when managing the things that you can, which is basically fishing mortality. Where and when...how much. I think it can
lead to better decisions even though it wouldn’t always be the thing...like it won’t get you ideal system out of it. I think you're absolutely right.

I don't think we should imagine we can engineer the ecosystem or farm it or get it to some optimal state that we’d be happy with, especially under environmental change. I think it's more a matter of, is there a way to look more broadly and make sure that the management actions that you’re taking are...how will they be able to meet your objectives under these conditions? To really have a better understanding of the conditions and there may be some objectives that will come in...more into conflict under the changing conditions, but at least you'll know about them. I mean, I think that might be the advantage here. It won't be all good news and happy and let's have a party and we can maximize everything and I think everyone knows that. Hopefully, it would lead to better decision-making in the circumstances that you’re handed.

John Boreman: I think it goes back to Lee’s point this morning about understanding what the tradeoffs are and I think that’s one of the main roles of the modeling is to...so the Council, when they’re making decisions, know what the tradeoffs...what’s...who's going to be the winners and losers out there as far as we can tell through the modeling. Anybody else respond? Rob?

Rob Latour: With regard to the goal statement...when I read those kind of goal statements, it’s almost like I speak a second language because what I translate those into is, what do we want to avoid? I think we can put our hands on those things a lot more than we can say, maintain the ecosystem functioning. We don’t really understand to the fullest extent what ecosystem functioning is, so how can we maintain it? So one strategy can be operationally...what can we do to ensure we’re going to avoid XYZ scenario or outcome? From there, build up to and hopefully use sort of in a backward way, get through your initial positively spoken goal statement.

Ellen Pikitch: So again, I’m a bit of a novice when it comes to the mid-at Atlantic, but from what I see, the presentation this morning and particularly Ed’s presentation...it seems as if you’re already operating under this Council risk policy idea. So that’s already embodied in the way that you go about doing your business. You know, the way...I think the way that most of us live our lives is that when... if you want to take...if you take too much of a risk, then you don't need any resilience if something unexpected happens. When you think you may be facing even more unpredictable, unexpected things happening, then you probably want to have more of a buffer.

Again, you already got that in your system. So I think you’ve already got a basic framework and modifying it should build you resilience as well as being able to incorporate all the latest thinking, some of which just basically reiterates old thinking, but gives more status or more evidence behind it. I really like to go off
that edge with the...how he would potentially modify that risk policy for forage fish with bringing up the know biomass threshold and having the...also shifting over to the right. I wish I could just draw this thing, but you know, you guys saw it. The graph...shifting it so that it reaches its maximum at a level above the MSY. I think it's a great idea. It would be a really good start. It would fit in with what you're already doing.

John Boreman: Okay, I've got Jason, Rob, Dewey, Lee, and we'll get to Chris. So Jason...no? Okay. Rob O'Reilly.

Rob O'Reilly: I have a lot of questions but I'm going to really just focus on bringing a couple of them to bear on the idea of assessments and listening to everyone today, I'm curious about the panel's thought on how assessments will change even for the predators. So typically, there are now assessments that are based on “F” on fully recruited ages. For example, that seems to be the standard and one thing that Chris Batsavage said, I think it’s kind of interesting because not only spot, I was thinking about weakfish and weakfish are known as part of the multispecies modeling a second place in Chesapeake Bay for many years. Weakfish also, if you don't know, are in pretty abysmal shape as far as the stock goes. Sort of... I think, from what evidence tells us the role of a pretty good prey species might be the idea for that natural mortality that increased rapidly after the 2002 time period, let's say. So what I'm trying to find out is, just using weakfish as a species that is both prey and predator... trying to do an assessment... how should that be done and in the future, how would assessments change because of what you're doing with forage species?

How does that change the stock assessment landscape? Rob made a comment earlier in the day about decouple “F” and biomass and start looking at “Z”. Start looking at total mortality. I still haven't figured that out as far as where the benefits might be for that unless assessments become population assessments, because otherwise, it’s almost like a scaler. If you’re really not sure of them and just by going by “Z”, you've essentially just added that into “F”. So maybe I do have a few too many questions, but I think central one is, how should assessments look in the future... in the near future to incorporate not only the forage situation and the coupling with predators, but also the way we look at predators because a lot of you probably realize that there’s some information in... that's suggest s that the way fisheries management operates...maybe it's not in the correct direction that you're essentially promoting, taking the stable fish out of the population and leaving the unstable component where the age pyramid suggests there are more of those and a lot less stable fish. So, if I could get you some response on the way assessments might change in the face of what you've been talking about today. I’d be real happy with that.
Sara Gaichas: That is a very good and very difficult question. To answer specifically, I think...but especially for the species with dual roles as predators and prey, I think it's a really important one. One mode of modeling that's been sort of, promoted recently is this sort of idea of intermediate complexity in model where you would have your species of concern. Kind of at the center, but you would look at sort of the inputs from prey and you would look at the top down effects of predators. Not necessarily all modeled in full detail, but you could try that, but that would be a lot more labor-intensive.

That could be one way of bringing it in. So you might have...say, a time-bearing “M” that was based on something to do with the predators and you might have some kind of function that affects recruitment say...or growth that could be based on something with the prey. I mean, I think there’s sort of, simpler ways to put this into assessment models and there’s more complex ways and all of them would have to go through the same level of assessment review that we have right now which would be substantial.

Especially since they would be new, so I wouldn't expect to see anything like that show up in the assessment process say, next year, but I think if the Council were interested in something like this...putting that out there...that's the type of thing that we're going to be trying in the multispecies models we’re doing. Just simple functions that would say, how does this...how does growth change if you have a change in prey that you’re not modeling? We’re experimenting with that right now, but I think it needs a lot more analytical work to sort of stand up to the scrutiny that is currently given to stock assessments. I don't know if you had anything to add.

Rob Latour: It gets at my...kind of, early recommendation that we build that system together. If you’re going to build your management objectives to go in ecosystem approach, the scientific side has to come with it. Which means in this case, the assessment. So what I would envision or I would suggest is not to completely abandon everything that’s been done all those years, but to bring alongside the main course assessment which may be very single-minded...single-species minded. These alternatives and use them to inform that primary assessment. At some point, I envision those sort of secondary alternatives that come along side to actually go ahead of the main...take over the lead and become the primary. It's a long, arguably protracted process, but at some point, the baton is going to be handed off and I think the multispecies assessments will become the standard operating procedure. We can't be an abrupt change. So in the near term, I see assessments going the traditional way, but to the degree we can bring alongside things that have ecosystem considerations modeled explicitly and I think that's the way to go.

John Boreman: Okay...Dewey?
Dewey Hemilright: Thank you. A couple of things I just wanted to just ask about is...in North Carolina, we have of extremely large, over-winning population of cormorants. I don't know how to estimate how many, but I know that blacken the sky a lot. You see them in the springtime coming up behind the last of the little, small trout...the quakers...feeding on them, but it's a massive population. What type of reduction or stock assessment or bird assessment would be done to reduce that population that's definitely feeding on something that's not treading water? So, that's kind of one question there, but I had a couple others that had to do with the ecosystem approach. Not only for forage, but there's a lot for me to take in listening to the presentations here, but I tend to talk about things I know on the ocean that I see is the spiny dogfish population.

The amount of what they eat and the different things, and seeing them eating crackers and Menhaden with an extremely large population. You also have the large coastal sharks that in today's time...I've done a lot of shark fishing in my time and the science in place to do the observers of tracking about the abundance of large coastal sharks is pretty much slim to none, what's left out there. You have basically no more directive fishery. You have what I call, a guinea pig fishery for the observation of it in a few certain areas, but nowhere near to track the abundance of all the...what's out there. The trout's another one. The species of trout and the different things that feed on that. It's almost like...I can't get my hands on it. How do you talk about the ecosystem and everything out there and yet you don't have a handle on the populations. What it boils down to when I see reductions, even though I know the laws of Magnuson and everything else...I see reductions in our fishing.

A reduction is my fishing... it's not risk adverse, but it could be because somebody didn’t do a...observe a program to see the abundance of sharks or something else that's lacking and best available is extremely difficult for me because you can have nothing and it passes on the best available. So a lot of these approaches, I would hope in the near future when you have panels put together that you would include some fisherman. Not that they would understand it, but to buy into this and that's what it has to be a buy-in...a lot of it does with the fishers and users. It helps a little if one cannot sit through it. Not that I'm advocating myself to sit through something like this, but there's a magnitude out there that we're not even covering in our observations in our fisheries. How can we go from unknown out here almost? Not unknown, but just the abundance that the fishers see...to go all of a sudden go put into these models which I don't understand that neither.

I try to read up on some of them, but to plug it in...to put it out there, because it does affect our livelihood and we're one part of that livelihood, but the better in the cormorants is...I mean, maybe somebody should propose a bag limit. That's something that's got to be tackled. I mean, there's hundred of thou...I don't
know how to count, but there’s a ton and they’re winning in North Carolina and they’re diving. They’re feeding. They’re around our inlets which tell you that when the tides come back and forth with different fish that come in, they’re feeding on something. So that’s my comment. One other comment...those comments about a great achievement of striped bass is a good...is achievement, but the only problem with it, they should open it up in all the ocean. The EEZ where it was before, not just a small area. If it's such a great achievement, put it back over through its range and that would be a total man’s mixed success. Thank you.

Ed Houde: Those...a lot of things that you brought up to...your last point though. You opened up the striped bass...if it's so an abundant. I asked the same question. It’s a policy question. The Council and ASMFC had decided not to do it. It’s not a science question. We know a lot about striped bass. The policy is not to the do it. Cormorants...cormorants haven’t just increased in North Carolina. They’ve increased everywhere across the United States, including in the Great Lakes and small fresh water systems. Why is that? Most birds have declined. Even Europe...cormorants on the increase. It just seems that they’re one of those animals that likes to live with people.

At least with what people do...I mean, I can’t say anything beyond that because I have not read deeply into it. They’re on increase everywhere. Some other birds are positively influenced by human activity. A few, but most aren't. Most birds...like sea birds...those that eat fish are on the decline, so I can’t answer that. You said a lot of other things that laments. I think about the lack of science and lack of information and some of that’s true. All of us like to be skeptical to an extent about what to accept and believe in modeling, but modeling is a good tool to try to understand certainly directionality of things and what the expectations of trends would be in many cases and I think it’s what we need. It's just not possible to put fleets of survey vessels out on the water to do some of the things that might we like to do.

Sarah Gaichas: Yeah, I think to that last point, I agree and I can tell you from modeling projects I’ve done in Alaska that when we lack the information, it becomes very, very obvious when you try to build a model. So you’re left with a couple of options. You can leave something out of the model entirely, which I really don’t think is a good option when it’s a major interactive system or whether it’s a fishery or an animal. Where you can put in a placeholder until you get better data and what I think a real use of these models can be is in more of an interactive mode in an environment like this where if there’s a Council priority and we’re asked to go and parameterize models to try to address the question, we find, hey...we’re missing information on this whole fleet out here.
That’s where we have the opportunity to may be work with that fleet and try to get some of that information in, because believe me, as a modeler, I'd much rather have your information than have nothing to work with. So it seems we can see some of these as opportunities. It means we won’t get the answer right away and absolutely, we don't have the money for big, expensive new surveys right now, but if there are people who are interested in working together, I mean, there's ways for it. There’s examples of projects like that already in the mid-Atlantic.

Rob Latour: I was just going to add to this. I’ve tested in the menhaden world quite a bit. It's data-rich and in some respects, it’s data-poor in many other and the skepticism that the Industry has is justifiable and it somehow placed onto me as the stock assessor person, as something that I should fix or how can you do that? How can you put lousy data in and garbage in and garbage out? I just want to let you know that we don’t like it, either. We want better data. We want better models. We want better everything, it’s just the state of nature and no progress is not a viable option.

So stopping everything and saying we throw our hands up today and we can't do it...I mean, that’s just not possible. So we do it, but it doesn't mean that we're not upset about it. It doesn't mean that we’re not skeptical of ourselves. So we share your concerns. We share all the same feelings...just from a different lens. We’re the nerdy analysts that do the computer modeling, so we’re not happy our models don't do what we want them to do. You’re not happy because you see the data and it doesn't...maybe it’s not congruent with your own observations. The bottom line is, we share skepticism...just from a different point of view. Don't lose sight of that, please.

John Boreman: To me, model is just a scientific hypothesis. It’s an elaborate one, but it’s still just a hypothesis that you're going to go out and test. Lee Anderson?

Lee Anderson: Thank you, Mr. President. I've been waiting for a while because you told us to hold our questions after...before lunch, so I’ve been waiting and it’s grown a little, but it’s still the same thing. I do appreciate everybody...the presentations and I especially must say, was pleased with Sarah's presentation issues addressing the...kind of the flipside of what I was talking about is that your hydro model seems to give us some information...potentially five us information on these tradeoffs. All I have to say is, Bill...don't play with us. Don't tell us about the Hydro model and then keep it under wraps. Let's get that puppy. Even with our asesse, let's use it.

Let's make sure we’re asking questions so that you’re there and perhaps you can join or SCC...works with our committees. The...but the other thing that I really want to say is that we can get that information and I was very I intrigued with this. As Council members, then we have an obligation on the other side. If she
can tell us...and she was telling us at lunch about... a little bit about the tradeoffs between halibut and Pollack and Alaska. If we can give some kind of a tradeoff between our species, we still have to know, do we like that tradeoff? Is that the one that we want? So there's two sides to this tradeoff analysis and I hope we remember that there's going to be a lot of work for the SC as we go forward. Thanks again.

**John Boreman:**  Chris Zeman.

**Chris Zeman:** Thank you. I have a couple questions. One thing is, I just want to point this out. The main like, species of fish remains with an MSY proxy, so it's a crude spawning potential ratio. Does that have any impact in terms of your recommendations? The second question I have is the more important question. More the Information about how to address let' say, spatial...just localized depletions or inshore, offshore concentrations. I mean, is there a general goal to have sort of abundance throughout the region and also during the certain seasons where the energy needs are higher, like winter versus summer?

**Sarah Gaichas:** I know I'm not directly involved in this work right now, but I have talking with John Manderson who's working with butterfish specifically, the seasonality and the movements that you're talking about and they do complicate things considerably. Especially when you try to look at the survey next and they're moving seasonally at different times of year and the surveys happen at the same time. So that's definitely a big issue. One of the reasons the model that I'm developing is meant to be spatial is to try to address some of these questions, but I have a feeling it may not still be at quite the right scale to get at things like a very localized depletion or a really small scale dynamics.

That is another question. It's a whole other level where even the survey data is probably not quite at the right scale for that yet and so it's going to take I think a bit more innovation projects...cooperative projects with people on the water and a lot of interaction to look more at those types of scales because that's not...I think, the scale that most of our sampling was designed at. So we can look at spatial scale to a certain extent right now. I think when we get to really find scale stuff; we still are going to need to be a bit more creative with getting more information. You guys probably know.

**Rob Latour:** What is localized depletion? Is it the removal of biomass from a sea grass bed or an es...or a sub-estuary, main estuary, or the entire estuary? I mean, it's a matter of scale and again, it goes back to be what's the policy that you're envisioning for maintaining the stuff biomass distribution. So I don't mean to be rhetorical. I don't mean to be pushing back on you, but I think that has to be entered into the conversation some.
Chris Zeman: If I may just follow up, and that question follows because I mean, your recommendation is really at a...you should be saying, you’re MSY at this level versus this level and that MSY is usually applied across a region from New York to North Carolina or even broader. So there really isn’t any consideration spatial abundance or...I see that as a gap. We might be complying with MSY, but then all our...all the herring, whatever is up in New England...they’re not here or menhaden, whichever. Those are the kind of things...that really what was the question was focusing on.

Ellen Pikitch: Yeah, in terms of the spatial question, I think you need to look at the predator again. The predator needs and the predator life history. So one reason birds seem to be so sensitive is that many of them...for example, you go and look at penguins. Penguins tend to have a breeding colony area and it’s in a certain place because the habitat there is suitable but if you do a localized depletion for them. It needs localized depletion of their prey within a certain distance of these colonies. There are other predators that might be able to move around quite a bit and it really doesn’t matter whether there’s localized depletion of prey because the predator themselves are more mobile.

The other question you asked is what would a proxy for MSY do to recommendations? Again, for the Lenfest task force, we would say that a proxy reflects the fact...the fact that you're using a proxy probably means that you have a lot less information about the system than you would if you had some other kind of estimate and if you’re in a low information tier, we would say that you need to be more cautious. That means that you have to leave more biomass of forage fish in the water and have that fishing mortality rate be lower. So those would be the consequences of proxy-based MSY estimates.

Ed Houde: Of course the Council’s risk policy and the work the SCC does reflect that. When we have what we call tier 4 assessments which means the proxies and setting of, in our case, ABC or catch limits is more conservative. I think the Council also works that way.

Rob Latour: On reference points, I think it resists the temptation to lump them all into the same category. SBR, for example, comes to mind. That’s born out of a philosophy of tying back to a version of biomass, if you can even estimate that...which is very different than MSY philosophy. So, if you're using SPR, you must have reasoning for doing so and so you know, it can be RE’d as a proxy for MSY, but it's not really. It’s a different way of thinking about establishing a reference value. So we need to drill down on what sort of subfamilies of reference points there are and understand their behavior a little bit with respect to this forage issue, I think.

Jeff Deem: I have a two-step question for Dr. Ellen, if I may. You mentioned earlier that the overall predators were down. Is that total stock biomass per predators? Or is
that by specific species such as trout? Or trout are down and rock fish are up. Bluefish are down. How did that number ...where did that come from?

Ellen Pikitch: It came from looking at the models and in the models you can see... so basically we took the models...the models, not only, they basically stayed out at where the ecosystem is at this point in time. What you can do...that point in time comes with fishing in most cases. What you can do is turn fishing off in the model and see where would those species end up? So it gives you an idea of what their abundance would be in the absence of fishing. What it is today and how depleted they might be. In some cases, we actually went back to the literature. So usually for the ten models that we looked at in a lot of depth, we would go back to the literature on the individual species to see independent of the model; the two scientists have to say about the status of the species now. In many cases, we...also we looked at things like the IECN red list. Is this species listed on the red list and if so, in what category of endangered is it? So that’s how we learn about other species for that statement I made.

Jeff Deem: All right. So if it's individual species and the average of those is down, then it's not necessarily a forage issue. It’s... we could...there is no more forage for us to do as Pete suggested and cut down the number of the rock fish to allow the number of trout to come back up. Whereas, if the overall biomass of predators was down, that might imply that there’s not enough forage there to support any reasonable number of predators and give us the flexibility to switch around from one to another. Am I...

Ellen Pikitch: You’re right. I mean, just because something is down, doesn’t mean it’s because the forage base is down. There could be all kinds of reasons why.

Jeff Deem: So we might have flexibility to...if we can do that or to shift effort from one species to another.

Ellen Pikitch: Sure.

John Boreman: Thank you. I have Jason, Mary Beth, and John Bullard.

Jason Didden: Some times I've thought about this in kind of two ways. One is avoiding the collapse of a forage stock and because they’re forage, there may be some additional, potential for that kind of collapse. Then also, their kind of role to support all the other species and if...so here's kind of the question for the panel is if that's kind of what you’re looking at and say, you’re looking at squid or say, long fin squid... does the decision of how precautionary to be with that species need or should take into account some the overall level of forage out there. If there are three other species that are high levels...well, the fact that squid are a little lower shouldn’t impact...may not impact the the predators as much, but if you get in a situation where multiple are low, well then, one additional will be in
lower...could have more of an impact. So if you're thinking about it from that...supporting all these other fisheries, the decision for one need to kind into account the overall forage bases out there.

Rob Latour: Are all prey equal?

Jason Didden: Of course not, but somewhat interchangeable probably.

Rob Latour: So I think that’s where the case-by-case comes in. So if your primary prey which has the most energy content and which is the most growth potential for your predators is the one that’s down. That should cause more concern than if...no offense to the inverts, but if the crabs are down or whatever...because there’s not as much energy content as this compared to fishes, so I think you need to ask deeper questions. The policy developed needs to reflect deeper thought regarding some of those questions. It can’t just provide a basic sort of summary statement that’s...that guarantees that prey-switching will occur or predators will be generalists because none of those things are really true.

Sarah Gaichas: Yeah, and I think it is a really good question, though because you probably can't assume to complete interchangeability of forage species. That would be a non-conservative approach. On the other hand, having the context of what the total forage base is in the ecosystem, I think, can be very useful for making management decisions. Especially if each year you need to adjust things or make different decisions about different fisheries. So I think it would be useful to know... to have that information, but yeah, I would caution against assuming things are interchangeable.

Rob Latour: A simple request now that some of the center’s gone, right? Why can't we get surveys in to see non-managed or non-assessed species? As just general...that are known to be important prey types or important forage members. These are first level kind of, data summaries of the by-catch, if you will, survey. We never see that information though. We don't know anything about some of the trends of sand lands outside of the ecosystem analysis that may be happening. But on a routine basis, this could be informative.

John Boreman: To follow that...what Sarah just said...maybe we should have the status of the forage...the ecosystems report every year.

Sarah Gaichas: We’re doing that in Alaska actually, but it was a subject of debate because forage fish technically, could not have an assessment because they were off the table. The ones that they managed as actually forage fish where there were no fishery allowed. So...but they do currently do that right now and the
information isn't the best on non-fished species, but it does enter into the process, so it is something that could be considered here.

Ellen Pikitch: So responding to the original question... I interpreted it a little differently than the other panelists. Maybe I was wrong, but I agree that you can't assume that predators can switch to an alternative prey species, but if their favorite prey is reduced... but it can't be a good thing for a predator that depends on a prey to have other potential prey also reduced. At least if you have multiple forage species, you have the potential for there to be prey switching and the potential for that predator to find something else to get by with. I think that's why when one of the things that's used to be taken on the quickest, both at the Pacific Council level, the California recent forage policy is the idea of not starting new fisheries on forage fish that have not yet had a fishery. It's the idea of preserving some resilience in the system when some of the forage species...or one of the forage species is being hit at pretty high levels. So again, you can't guarantee the predator will switch, but predators have been known to switch and it can't be a good thing to basically fish hard on all of the prey.

John Boreman: Mary Beth?

Mary Beth Tooley: Thank you. I had a question for the panel relative to buffers and it seems like in some people’s minds, buffers are appropriate in the case where you have a stock assessment with a constant M of .2 for example. That when you get to either the SC or perhaps the Council that, a buffer might be appropriate. Yet we do know that when you incorporate a higher M at varying ages that you’re actually...you increase biomass. So that's a totally different biomass estimate than you have with a .2, which doesn't mean that by increasing M, that you can take more out of the system...that there’s greater surplus production. But it just seems to me that in the standard M2 and then an additional buffer...that it’s like...it’s double counting, where if you went back and increased the M, you’d have a higher biomass. I hope I said that in a way that was clear, but I'm just curious if anybody would want to respond to that.

Sarah Gaichas: I think it comes down to what Rob said earlier which is that, if you can separate the purpose of...sort of the reference point and the buffer, ideally, you get the reference point where you want it because that’s your policy, but then the buffer is because of uncertainty, right? Scientific uncertainty. So I think in that case, it wouldn’t necessarily be double counting. I think if the buffer were put in there because maybe the assessment wasn’t covering any...everything that you wanted it to, then I think you would be in the range of double counting because now the buffer is trying to do two things instead of just one. I don't know. Someone in the SC could probably speak to that better, but it helps. I think to clarify the purpose of the buffer from the purpose of the reference point from a policy standpoint maybe.
Ed Houde: Yeah, I’m not going to give you satisfactory answers either, but buffers often are put in place to reflect past history of performance of the stock. We know for instance, that stock levels kick and collapsed in the Bering Sea, so the minimum biomass or buffer is a reflection of that and something similar to that, although I don’t know the exact answer to it. It’s put in place for the California sardine, so it reflects the past history of the fishery. Rich, do you know the answer for that? The California sardine? Okay, I knew the number, too but I didn’t know how it was derived.

Mary Beth Tooley: So this chair...if I could just follow up briefly. There seems to be two different things whether or not you want to maintain a minimum biomass threshold which is, I assume, to keep adequate levels of recruitment coming into the fishery and the spawning stock biomass versus whether you wanted to have a buffer for a forage. So my question was really relative to adding a buffer for forage without incorporating it into the assessment. It appears to be having...would have to me...it seems like double counting. Well, you just described would not. That would be a buffer for a different reason or just trying to maintain a minimum as a spotting stock biomass does. That’s different.

John Boreman: John Bullard?

John Bullard: To the panel, I’m John Fuller. I’m the regional administrator, and not a scientist which will become immediately apparently as this question. I want to thank the panel for coming and spending a day with us, and I thank the Mid-Atlantic Council, Dr. Borman and our chairman, and Rich Seegrace for allowing us to learn about...ahead of the curve. If you can ever get ahead of curve in this business...on this important issue...forage fish. I mentioned this to Rick at lunch as for selfish reasons, as the regional office, we serve both the mid-Atlantic and the New England region. Obviously, this issue pertains to both...all regions for that matter. I’d love to see both management councils tackling this and hope that we might discuss this at the NRCC in a couple of weeks. I talked to Bill Karp about this. They’re hosting it, I believe, and so perhaps we can bring that up as a topic of discussion. I also talked to Rick at lunch about next steps. What to do with this information? I think Ellen said, you want to...don't wait for perfection, just get in...jump into the pool. Take steps and Rick was talking about low hanging fruit...about how do we...how does the Council start to translate this into policy steps and I think it’s very important for us to do that.

As I look at the tables...first of all, I wanted binoculars for most of them, but if the point you were trying to make was this is complex... point made. You did a great job on that. Especially Sarah...you especially, and I think that I...it occurs to me that the relationship...the very complex relationship between predator and prey... you were presenting it. I hope this is fair, almost in a static relationship. Very, very complex as a static relationship and this Council is going to have an
incredibly difficult job even understanding this is as a static relationship, as those incredibly complex squares and hexagons demonstrate. Then you add climate change and warming oceans and predators and preys moving at different rates and now all of sudden PowerPoint isn't going to work. We're going to need video and all those things are going to go in motion. We're all going to get motion sickness at the next presentation because all those things are going to move. The point I'm trying to make inadequately...not as well as guys do...is that we really have to start to get the policy.

Start doing the policy implications now even though we think it's really complex in a static framework because everything is going to go in motion. It already is in motion. Fishermen who are out there. The Deweys of the world who are out there already see it in motion and all these things that we think are complex relationships are going to become even more complex as they all go in motion and so as we start with low hanging fruit, with the simpler ones and get our feet wet with the simpler relationships in predator-prey and we get practiced at it, build our confidence up with that and then get the more difficult ones under the belt, then we'll get better at it. As the Mid-Atlantic Council with the more difficult ones, but it is important for us to get in and do this. Not worry too well that we get it right the first time, but just get in and do this because this is going to get more and more complex. It is really important and this session I think is so important to inform us and to encourage us. Again, I just want to thank the leadership of the Mid-Atlantic Council for setting the stage because I think this is really necessary.

John Boreman: John, thanks for those remarks because that basically is the essence of the trigger questions we had for the afternoon. That we still need to get to in our last 10 minutes.

John Bullard: But I would like to...thanks for not cutting me off, too John.

John Boreman: I was tempted. I was tempted, but that is a good segway again into our trigger questions and the summon substance of those questions as... all right, what are the next steps we should be taking here? What is the low hanging fruit? You...John, you suggested to start working on a policy statement. Let's attack the policy side or the policy debates we should be having at the Council level. Look at our visioning document and the feedback and kind of put all that together. Maybe look at the...to the SSC to suggest some policy statements along the lines of maybe what was showing on risk...the risk policy. How we might want to alter that to...for the forage, but I'll just throw that open for comments from anybody including the Council members if people want to talk about it. What should be...this is nice. We can all go home feeling that we defined the problem again but I want to get some solutions out the door, too. What are we going to do next? Rick?
Rick Robins: Thank you, Mr. President. So in terms of next steps and I think Rob Letour laid out an important line of thinking. At one point in his presentation when he talked about the relationship of science to management and how there's a potential for a disconnect where...at least in terms of identifying objectives on the management side, we may get ahead of the science side. So it does seem very important to me reflecting on that, that we move forward both elements. That is the policy and management side and the science side. I'm really glad that the science center was here for this morning’s panel discussion because we did have an opportunity to discuss some at lunch.

It seems like one of the most obvious steps coming out of this would be, to work with the center with respect to the assessment process and how these enhancements might be incorporated into the assessments because to the extent that they can be accounted for...that we can get either more...estimates of natural mortality and predation mortality and more fully reflect the state of the system and what's actually going on. I think that would be an important step forward and that would be resolved on the scientific side. But there’s also the policy and management side. What do you want to manage for? Those are discussions that we will still have to have. I think it’s important that both of those move forward. I think the...on the assessment side, we can work quickly and go through with refuge, the science center to address some of those considerations because as Rob pointed out, that needs to be explicitly incorporated in the terms of reference, but institutionally, that starts in the science center.

We have to take a...consider how to integrate their ecosystems group into their population dynamics group around that specific question, because that would be a specific institutional undertaking. The science center would have to take up, but I think that's a...in terms of low hanging fruit, that John referenced, I think that’s certainly one example of that. Jason pointed it out earlier today that as we talk about conceptually how to approach these things, the reality is in practical terms, a lot of these low trophic level fisheries in the mid-Atlantic don't have reference points. So we're operating on an ad hoc basis and we have already...our scientific and statistical committee has already incorporated some of the concepts that were canvassed earlier today by the panel in terms of forage species management. So when they set the butterfish quota last time, they utilized the Patterson method that was referenced in one of the papers for small pelagics and that method of setting the quota below the natural mortality rate formed part of the basis for their so decision making process.

So some of these concepts are already being incorporated on the decision-making side, but I think we have to move forward to identify the why and the how and the where. The why part of this relates to the management objectives...what we're trying to accomplish. Rob pointed out earlier that it's important to drill those objectives down to an operational level because the broad objective
we have right now is a 30,000 foot apple pie type objective. It’s hard to argue against it, but it’s hard to implement it, too because it's not specific... it's not operational. That's something that I think will...as we move forward with the development of the ecosystem approach guidance document that that will continue to develop those objectives that we can then break down and begin to consider from a policy standpoint and management standpoint on how would we implement them.

What methods would we use and again, on the...in terms of where, I think the outstanding questions are, what best resides in these stock assessment and what best resides either in the termination ABC or optimum yield and if you want to consider on that side of the equation, that’s where you might invoke control rules or other specific management objectives or methods. The rage of possibilities is quite wide. I think listening to the case studies we heard about today and the examples... there's a lot we can do. There’s a broad range of possibilities, but they ought to be driven and informed by goals and objectives and that’s something that we haven't had in the past specific to the ecological aspects of our management. Something that I hope that we’ll be able to lay out as we move forward with this ecosystem approach guidance document. So that...that's how I see things right now, John.

John Boreman: So that's a pretty good summary of our discussions. I don't know...should we... we're getting close to the end Rich.

Rich Seagraves: So...But first let me thank the panelists for coming out here... really did a great job of directly addressing everything that I asked in record time. It was an awful lot to ask. We squeezed a lot of information and on the Council, we appreciate their indulgence. Those were the next steps. I think Rick did a great job summarizing where we need to go with this. We have formed an ecosystem approach to Fisheries Management Working Group. I will synthesize the discussion here and some of the major points that Rick just highlighted. I think the big thing is setting up a framework or altering the framework that we’re currently operating under to bring in the forage species and considerations. The next step we're going to move to is then the bigger issue which started up to move into that direction with species interactions in a more general sense. We thought it was too much to do it all in one. I'm convinced that definitely would have been. It's tough not to talk about both, so now let’s...with the next key considerations and certainly climate change or changes in ocean depth.

Systematic changes in temperature and other oceanographic features and try to come up with a system that allows us to adopt and deal with those sorts of the changes. Also, high on the radar screen... the social and economic aspects of the tradeoffs that were talked about today. The effects on fisheries, climate change...all these things need to be integrated into this discussion. We’re trying
to break it down into manageable units. So next step would be to take the synthesis of this and some of the ideas I think even in the direction of advancing the assessments in lockstep with policy is a great idea and something that we intended to do. So we will work with our ecosystem EFM working group to kind of...maybe draft up some policy and assessment framework...ideas would advance the cause and stay tuned because we'll be moving into the other areas of EAFM, as I outlined. That's all I had.

John Boreman: The president will turn it back to the chair.

Rick Robins: And John, in my comment I didn't want to cut off any additional Council discussion on the trigger questions if there is any before we break up. Any members have anything else they’d like to add at this point? Okay, I’d like to join Rich in thanking the panelists. I’d also like to thank Rich and John Borman for facilitating this and a tremendous amount of work went into these presentations. I think this morning’s panel presentations in particular, were very though-provoking. At the outset, I said I hope we would have a better understanding coming out of this about the relationship between all these different issues and how they relate back to reference points and management and the regional ecosystem and I think they definitely cleared that bar by a wide margin. So, I would like to thank all the panelists for their input and I look forward to the next steps. So with that, we adjourn, and thank you all very much.