APPROVED BY:
COMMITTEE CHAIRMAN

S-FFMC Menhaden Advisory Committee Minutes
Webinar
Tuesday, October 5, 2021

Chairman **Moncrief** called the meeting to order at 8:30 a.m. with the following in attendance via Webinar:

Members
Peter Himchak, Omega Protein, Tuckerton, NJ
Jason Adriance, LDWF, New Orleans, LA
Ben Landry, Menhaden Advisory Council for the Gulf of Mexico, Abbeville, LA
Ray Mroch, NOAA Beaufort Lab, Beaufort, NC
Trevor Moncrief, MDMR, Biloxi, MS
Scott Herbert, Daybrook Fisheries, New Orleans, LA
John Mareska, ADCNR/MRD, Dauphin Island, AL
Francois Kuttel, Westbank Fishing, LLC, Empire, LA
Chris Swanson, FWC, St. Petersburg, FL
Carey Gelpi, TPWD, Port Arthur, TX

Others
Amy Schueller, NOAA Beaufort Lab, Beaufort, NC
Skyler Sagarese, NOAA Fisheries, Miami, FL
Kim DeMutsert, USM GCRL, Ocean Springs, MS
Igal Berenshtein, NOAA Fisheries, Miami, FL; CIMAS, RSMAS, UM
David Chagaris - UFL - Gainesville, FL
Doug Butterworth – Univ. of Cape Town – South Africa
Benson Chiles, Chiles Consulting LLC, Atlantic Highlands, NJ
Ed Swindell, Marine Process Services, Hammond, LA
Chad Hansen, PEW Charitable Trust, Crawfordville, FL
Alison Johnson, NOAA Fisheries, Key West, FL
Robert Leaf, USM GCRL, Ocean Springs, MS
Brian Moore, National Audubon Society, Washington, DC
Genny Nesslage, UMCES, Cambridge, MD
David Rosenthal, NOAA, Miami, FL
Julie Brown, NOAA Fisheries, Miami, FL
Jerald Ault, Univ. of Miami, Rosenstiel School of Marine and Atmospheric Science
Bruce Pohlot, IGFA, Miami, FL
Beatriz Roel, Global Trust Certification Ltd, Ireland
Bob Allain, Global Trust Certification Ltd, Ireland
Vito Romito, Global Trust Certification Ltd, Ireland
Jaclyn Higgins, Theodore Roosevelt Conservation Partnership, Washington, DC
Chris Macaluso, Theodore Roosevelt Conservation Partnership, Washington, DC
Bradley O'Bier, NOAA Beaufort Lab, Beaufort, NC
Richard Fischer, Louisiana Charter Boat Association
Chad Corville, Miami Land Corporation

Staff

David Donaldson, GSMFC, Ocean Springs, MS
Steve VanderKooy, GSMFC, Ocean Springs, MS
Jeff Rester, GSMFC, Ocean Springs, MS
Debbie McIntyre, GSMFC, Ocean Springs, MS

Adoption of Agenda/Minutes

Moncrief reviewed the agenda with the group. **VanderKooy** noted that "Election of Chair" had been left off the agenda due, in part, to changes coming from NOAA which might complicate the election of the federal member and perpetual virtual meetings. **Mareska** suggested this item be added to the agenda anyway for discussion and *on motion by **Adriance** and second by **Mroch** this item was unanimously added to agenda.*

The minutes from the last virtual meeting on March 2, 2021 were reviewed. ***Mareska** moved to accept the minutes as written and with a second by **Mroch**, the minutes were approved.*

GDAR03 Gulf Menhaden Stock Assessment Update

Schueller presented the Gulf Menhaden Assessment Update. **Schueller** reviewed the inputs considered and the model setup. The results were presented along with a number of additional sensitivities and other uncertainty analyses. The bottom line is that the stock is neither overfished nor is overfishing occurring. Research recommendations included some which were high priority, i.e. stock structure and genetics; ecosystem based. **Schueller** provided everyone with the table of recommendations.

Himchak asked about the terminology regarding assessment. He had heard that the word 'updates' should no longer be used but instead they were Operational Assessments. The term 'benchmark' was also replaced with Research Track. What would need to change in the data or information to have us move to a Research Track? **Schueller** stated that there is not currently anything that would warrant a Research Track moving forward unless the MAC is going to move in to the scientific assessment of more management-based reference points. **Adriance** noted that since we've now "dipped our toes" into ecosystem-based assessment with the sensitivities, would that warrant a Research Track? **Schueller** indicated we could still explore those models but if we want to include them in the base model, they would need to go through the full Research Track process. It would need to be a collaborative effort to review how the ecosystem-based models perform before the group could move fully into that approach. It would become a package of assessments which would include the single and multi-species models.

There was a short discussion about how predation is currently included in the estimates of natural mortality. **Schueller** explained that the Lorenzen estimate does assume some background predation but is not specific to the various predators in the system or their abundances and importance. **Chagaris** reminded the group that the ecosystem-based approach is able to adjust the prey needs in the environment and does not only look at the loss of fish due to 'death'. Their models actually separate out total mortality into fishing and predation mortality as well as other mortality including disease, hypoxia, and other environmental drivers. However, as we move forward, there will still be a need to evaluate the ecosystem models in tandem with the single species model so that we can maintain consistency with what is already being done.

Approval of Draft Assessment Report

VanderKooy shared the Stock Assessment Report (GDAR03) and indicated that only a few minor changes had been received from the group. Therefore, the draft report was ready for the MAC approval. **Himchak** asked who is on the next level of review. **VanderKooy** explained that the State-Federal Fisheries Management Committee (SFFMC) is the next step and then the full Commission.

Without further discussion, ***Adriance*** *moved to approve the report and move it to the SFFMC for their review and consideration.* ***Himchak*** *seconded the motion and Stock Assessment Report (GDAR03) was approved unanimously.* **VanderKooy** would forward to the SFFMC and the Commission for their review and approval in a few weeks.

Review of 2021 Gulf Menhaden Season

Mroch presented the 2021 landings through the end of August. He indicated that inclusion of the September landings would add another 34k mt. In general, landings were relatively low for April, May, and June but went up in July and then fell again in August. At that point, the fishery was well below the five-year average by about 23%. There were a number of tropical systems including Hurricanes Fred, Ida, and then TS Nicholas that came through in September, further impacting fishing days. The NOAA Lab is still catching up on data beyond September but, based on typical landings in the last two months of the season, we are likely on track for a projected total of around 388k mt. This is a 6.1% decrease from last year and an 18% decrease from the 5-year average.

Mroch reported that they have published the final results comparing the ageing of scales using modern microscopes versus the old Eberbach. They have confidence that the old machine can be replaced without issue. He also noted that port sampler electronic reporting beta test revealed some data continuity errors with the digital measuring boards that should be fixed with the next program update. Generally, electronic reporting is being pushed by NOAA and they may do a pilot study to work with others to improve electronic reporting and develop a software that can be universal in the fishery. **Kuttel** stated that Daybrook has been testing their own electronic reporting on three boats and they may be able to help. **Mroch** would reach out.

Update on the Atlantic Menhaden Fishery

Mroch reported that there is still only one factory on the Atlantic operating out of Reedville with six vessels, although there was at least one Virginia snapper boat that landed fish for reduction at the plant; all the logbooks are not in yet from Virginia and New Jersey however. The Atlantic landings through August have been around 80k mt which is an increase over 2020 though still low compared to the 5-year avg. The Atlantic has been relatively quiet this year without many disruptions to fishing.

Himchak noted that there are more vessels purse seine fishing from the ports in Maine and is confident there are more than two in New Jersey. **Himchak** will get with **Mroch** regarding the additional vessels fishing for menhaden on Atlantic.

Pre-Season Forecast Accuracy

Mroch continues to look at adding parameters to bring confidence level on the forecast up. One could be the inclusion of storm predictions but the problem is that NOAA Weather Service does not issue their tropical forecasts until later in the spring. **Mroch** will continue to look at the forecasting and see if there are any other ways to improve the predictions.

Ecosystem Modeling Update

Tradeoffs Between Menhaden Fishing Effort and Predator Populations

Berenshtein reported that this project is sponsored by the RESTORE program and the goal is to integrate information on ecosystems, stressors, and predator prey interactions into assessments and management of fisheries in the Gulf of Mexico. The model uses Ecopath with Ecosim (EwE). The Ecopath mass-balanced snapshot includes inputs on biomass, mortality, consumption, diet, and fishery removals, applying the diet matrix developed by **Sagarese** et al. 2016. Ecosim, the time-dynamic component model spans 1980-2016 with 160 individual time-series from a variety of sources and produced model fits across the time-series based on the automatic EwE fitting routine as well as manual adjustments. F_{MSY} for a variety of predators which includes groups lumped into inshore coastal piscivores, demersal coastal invertebrate feeders, and large coastal sharks. An additional diagnostic is the forecast capacity analysis, in which the model forecasts a predicted time-span and compares it to the reference biomass data, specifically menhaden and shrimp examples provided here. The Gulf-wide EwE model performed well and correctly predicted the observed trend in biomass 74%.

For the current stock assessment, the group provided **Schueller** with a time and age specific series of natural mortality estimates, and these were implemented as sensitivity runs. As we saw earlier, M in the assessment and the estimate provided for the sensitivity run showed good correspondence to the base run.

Berenshtein then presented four management scenarios of fishing mortality and effort to look at the sensitivity to menhaden fishing on their predators. The four scenarios were no menhaden fishing at all, fishing at the minimum of the time-series, fishing at the model's terminal year (2016), and finally, fishing at the maximum historic level. They then looked at the correspondence between the dynamics of the menhaden and four of their primary predators, King Mackerel, Spanish Mackerel, Red Drum, and seatrout (*Cynoscion* spp.). This section shows the linear relationship between menhaden and King Mackerel first for the reference data ; then for the EwE model historical period results, which fall along the axis of the reference data; and lastly, the results of the four scenarios fall on realistic locations along this relationship, further indicating the credibility of the model. Similar analyses were then conducted for other Gulf menhaden predators, which showed similar dynamics.

The model predicts the response in the predator abundance to changing fishing pressure (fishing mortality and effort) on menhaden. Groups that are strongly depleted when Gulf menhaden fishing pressure increases could be because of fishing mortality (e.g., king and Spanish mackerels) and/or by-catch via fishing effort (e.g., large and small coastal sharks). For the top predators, as the fishing pressure on menhaden goes up, the mortality on predators increases and their biomass decreases. This reflects bycatch in the fishery affecting those predators. **Berenshtein** did note that the predators that rely less on menhaden were less affected by increased fishing effort. He pointed out that there are other factors in the system further complicating the model results including predator competition as well as trophic effects.

Berenshtein presented the computation of numerous ecological indicators (e.g., biomass of Gulf menhaden predators and trophic level of the catch) related to the change in Gulf menhaden fishing pressure. **Berenshtein** noted that these indicators can be applied as ecological reference points to

inform fisheries management and support EBFM.

In summary, the development and calibration of the US Gulf-wide EwE model presented here represents a substantial first step in supporting EBFM in the region and provides a useful tool to complement single-species stock assessment and fishery management decisions. The model represents a state-of-the-art EwE model in taxonomic resolution that spans key ecologically and economically important species and incorporates diverse datasets of reference time series used for model calibration, as well as integration of fleet bycatch across fisheries. The model will need to be updated on a regular basis with more current inputs as they are collected. Continual updates are important to ensure that the model is an accurate representation of the functioning of the true ecosystem.

Himchak wondered that when you consider the uncertainties in the diet, database, migration and other uncertainties, at what point are you able to essentially account for them all? Looking at the web of interactions in the Ecopath, it looks unsurmountable. **Berenshtein** responded that in his examples, they are not accounting for mortality due to red tides at this time. Those types of processes are not included because they can cause biases or inaccuracies in the model. **Chagaris** indicated that in the ecosystem modeling community, that is a real struggle to provide a full uncertainty analysis but there are things they can do in the model but the most important thing is to be sure that the output is something that is needed for the end users. With that, the modelers can work toward a more robust sensitivity around that metric.

Himchak asked if this model was similar to a RAM legacy data base. It has multiple species with biomass and it essentially pulls out many of the major components of their stock assessments. **Sagarese** answered that they have essentially done that with this model using the time series for biomass, the catches, and the fishing mortalities from the outputs from the stock assessments. The RAM database is a huge synthesis of all assessment models throughout the country; but they focused only on those assessments that were from the Gulf. They did have to use a few that were outside such as from HMS and ICCAT assessments when we did not have Gulf results to fill in the data gaps for highly migratory species.

Dr. Butterworth had two questions but was unable to participate directly due to an audio issue so he provided the questions in the chat. The questions and responses follow.

> **Butterworth**
> My two questions are as follows. First, in part following up from **Himchak**, the first test of a model is whether it fits the data (especially the abundance indices). Clearly for this model it does not fit for many species, but that could hardly be expected overall, and is not necessarily fatal. The key question would seem to be, given that the focus is on menhaden, whether the fits are reasonable for the species that are estimated to make the major predation impact on menhaden. If that is the case, perhaps we would rather put greater weight of fitting to data for those species without worrying too much about the rest. But importantly then, does this fit with your broader intent of moving beyond a single species approach, i.e. not to look for some "ecosystem wide" reference points, but rather focus on a much more limited set of questions such as only how fishing on menhaden impacts the abundance trends in those few species? The second question is related to your projections. Another key test of a model is its predictive ability. Have you/could you fit the model omitting the last five years of data, use it to predict

the following five years, and compare that with what then transpired? Obviously, there are non-trivial details to be addressed about how exactly one would "condition" such a test, but performance in such a test would provide the obvious and straightforward basis to determine the reliability of the model.

Sagarese
Great questions **Dr Butterworth**. In terms of Q1, most of the fits to biomass for the target groups that **Berenshtein** discussed look ok, such as small coastal sharks, Spanish mackerel, demersal coastal invertebrate feeders, sea trout, and pelagic coastal piscivores. Exceptions include the shark groups (blacktip, large coastal sharks) that we mentioned earlier and discuss more in the tech memo. In addition, age-0 trends are fairly uncertain given that the ecosystem model does not account for recruitment deviations, whereas stock assessment models do. The red drum group is complicated because we do not have a federal stock assessment nor an index throughout the Gulf of Mexico.

And in terms of Q2, **Berenshtein** discussed the forecast analysis that he performed which removed the last 5 years of data (2012-2016) and compared the results with a null model (constant from 2016)

Butterworth
Thanks. Briefly regarding Q1, my underlying thrust was to focus on something less than the "full model", more closely tied to the more central management questions, with hopefully the data fitting better for the predators emphasized in this process.

Chagaris
I can try to respond as well. 1) The motivation for the ecological sensitivity analysis was to identify the species most sensitive to menhaden harvest for the purposes of using those species as an "indicator" for developing an ecosystem-based reference point. Additionally, a MICE model could be developed that removes the unrelated groups and the uncertainty they bring to the model. Unlike Atlantic menhaden & striped bass, we do not have that single important predator-prey interaction. So, the decision on an ecosystem indicator for reference point development should incorporate stakeholder input. Yes, the observed data can be weighted to reflect uncertainty (cv), or as you suggest relevance to menhaden, we have only done the former here.

Butterworth
Regarding Q2, sorry if I missed that point in the presentation - What sort of CVs did you get on predicted trajectories for the major species?

Thanks - sounds like your motivations are in line with the reasons underlying my questions.

Adding a Spatial Component to Ecosystem Modeling

De Mutsert presented how her work has included a spatial component to the northern Gulf model and its effects on menhaden. The model includes environmental stressors driven by the Mississippi River watershed and the hypoxic zone which vary spatially and temporally resulting in variable menhaden mortality as well. The two studies related to this were on the effects of the hypoxic zone on fish and

fisheries and one on the large sediment diversions which impact the food web in the estuary. **De Mutsert's** first question was related to the effect on living resources of reductions in nutrient loading to reach the goal of the Hypoxia Task Force in Louisiana to limit the hypoxic zone to 5000 km^2. To explore this, an Ecopath/Ecosim model was built as a mass balance model with 66 groups. The model simulated the environmental factors such as DO, salinity, and temperature that changed over time. The model simulates how the environmental drivers and the river nutrients which are discharged into the Gulf of Mexico can set up the phytoplankton blooms and deaths and resulting hypoxia when the system becomes stratified in the summer and then breaks down going into winter. **De Mutsert** then applied fish and water quality monitoring data derived from the SEAMAP samples over the model area and used that to create response curves to environmental factors for the various groups. She is able to translate things like the optimal and suboptimal environmental factors like DO on the various species including menhaden. If the nutrient load is reduced by 40 to 50%, the model predicts the menhaden biomass as it responds to a reduced hypoxic zone. However, with the reduced nutrients, there is also a reduction in primary production which negatively effects the biomass of menhaden (secondary production) as a result.

De Mutsert also is able to test a change in the menhaden population resulting from the fishing fleet specifically looking at the cost to sail to chase menhaden from the three plants. As menhaden are moved due to expansion of the hypoxic zone, the cost incurred by the fleet to access them is affected. When the schools are pushed further from shore to avoid the zone, the costs to the fleet increase. A reduction in the zone could help the fleet catch them more economically.

Generally, the model results in variation from year to year with some groups increasing while others decrease, but the approach she is now taking allows menhaden and other groups to become individual agents in the Ecospace model and effectively become an individual-based model inside Ecospace which can account for conditions on each species. The model is currently calibrated in time but not in space but will be completed next year. At that point, a suite of nutrient level combinations can be run to look at the tradeoffs across all the species. They are developing an ArcGIS dashboard which will serve as a decision tool for managers to explore how the changes in nutrient loads and other inputs might affect the production in the ecosystem and the results on the various species of interest.

A second Ecospace model was developed to explore the effects of river management for nutrient load and sediment deposition on fish and shellfish. The diversions are intended to return historic flooding on the delta which is currently starved for sediments and nutrients in an effort to mitigate land loss. The effect on menhaden has shown that, as the diversions are opened for floods, the marsh habitat which is preferred for juvenile menhaden would increase and biomass would increase although the fish would move away from these areas due to the reduced salinity from the freshwater. Upon closing of the diversions, the menhaden would return. Other species like largemouth bass biomass would increase in the freshwater release zones obviously. These are primarily redistributions of biomass in the model, not necessarily mortality. The application of the model indicates that upper diversions would be more effective in the systems as the biomass of species impacted by lowered salinity and reduced primary production (due to increased turbidity) is lower in the upper estuaries to begin with, so total biomass is less affected. Diversions lower, or further downstream, in the system could negatively affect those species (menhaden, shrimp, oysters) by reducing primary production and creating lower quality food sources as well as less optimal salinity habitats.

Report on Texas Cap for 2021

Gelpi and **Mroch** reported that no menhaden were harvested from Texas waters in 2021.

Review of Port Sample Acquisition and Processing in 2021 and 2022

Mroch stated that this year has been complicated due to COVID but he has contact with samplers and all is going well. It looks like next year is set for continuing with these samplers as well.

Marine Stewardship Certification of Gulf Menhaden Updates

Himchak stated that they have started the surveillance for Gulf Menhaden MSC Certification. Industry will start its part of the audit with an open meeting on October 18th and close on October 26. A number of the MAC members will likely be contacted by the surveillance team over the next couple weeks.

NOAA Observer Steering Committee

Kuttel explained that this group has met a number of times. NOAA has ordered observers to assess the techniques in a proof of concept by placing them on alternative platforms or small boats. They will observe fishing and are putting cameras on one of the fleet's steamers to record interactions with marine mammals and turtles in the wild. They will be deploying floating models of turtles to determine if and how they may end up in the nets. Because of COVID, NOAA staff will be able to participate but there will be two observers and two drone pilots who will spend next week testing out the protocols. This will setup how the project will run next year.

Other Business

VanderKooy stated that election of Chair should be addressed but we do have the option to keep **Moncrief** since this year has been so unusual with COVID. The federal partner is next on the rotation, but **Mroch** will be moving to a new position at NOAA and he recommended that **Moncrief** continue. **Moncrief** was agreeable to the idea. ***Mroch*** *made a motion to maintain* ***Moncrief*** *as Chair until the October 2022 election. The motion was seconded by* ***Adriance*** *and passed unanimously.*

Adjourn

With no further business to discuss, *on motion by* ***Landry*** *and second by* ***Mroch****, the meeting was adjourned at 12:08 p.m.*