New England Fishery Management Council
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MEETING SUMMARY

Habitat Plan Development Team

SMAST East, New Bedford, MA
September 14, 2017

The Habitat PDT met to discuss ongoing work, including the clam dredge framework, coral amendment, and updated fishing effects analysis.

Meeting Attendance

PDT members included Michelle Bachman (Chair), Jessica Coakley (webinar), Kiley Dancy, David Stevenson, Marianne Ferguson, Doug Potts, Travis Ford, Geret DePiper, Dave Packer, and Peter Auster. Alison Verkade (GARFO Habitat Conservation Division) and Eric Powell (Science Center for Marine Fisheries) were invited to participate in the meeting. Ms. Verkade has been working on the clam framework image analysis project, and Dr. Powell presented the results of a recent clam dredge survey on Nantucket Shoals to the team. Eight additional members of the public attended in person, and four attended via webinar.

Ms. Bachman welcomed members, guests, and other attendees to the meeting, and reviewed the agenda. All attendees introduced themselves. She noted that the Omnibus EFH Amendment 2 (OHA2) proposed rule is forthcoming, hopefully soon, and perhaps as early as this month.

Clam dredge framework

Dr. Eric Powell presented the results of an August 2017 hydraulic dredge survey in Nantucket Shoals. The survey was conducted by SCEMFIS-affiliated scientists and fishermen aboard the F/V Mariette (see press release here: http://scemfis.org/Press/Press_8_11_final.pdf). Dr. Powell's presentation focused on the distribution and relative abundance of small and large clams, as well as the relationship between clams and other species and substrate in the catch. The survey covered areas that are important to the commercial fishery but have not been part of the federal survey strata in the past. The survey overlapped the northern part of the Great South Channel Habitat Management Area (HMA), which was recommended by the Council in OHA2 and is pending implementation. An area west of the HMA was also surveyed, since it includes commercial fishing grounds and was identified as a location of concern by the Survey Design Working Group at the Northeast Fisheries Science Center.

Surfclams of various sizes, but no ocean quahogs, were captured. The area west of the HMA was found to have very high densities of very large clams, relative to other surfclam beds in the New

England and Mid-Atlantic regions. Further east within the study site, the surfclams were somewhat smaller, but also abundant. Surfclams experience high mortality rates if summer temperatures exceed approximately 21-22° C for a period of roughly two months. The large numbers of small clams in deeper waters suggests that clam populations in this area may be shifting offshore into areas with lower water temperatures. This offshore temperature-dependent shift has been documented in Mid-Atlantic beds. It is possible, although unlikely, that clams in deeper water are the same age as those in shallower water but are smaller simply because they grow more slowly. Clams sampled during the survey will be aged by the Virginia Institute of Marine Science to evaluate this possibility. Clam shells have low taphonomic rates (i.e. they take a long time to break down). The presence of large volumes of shells in some locations suggests long term surfclam occupancy of the study area.

In terms of geological substrate, both cobbles (2-6 inches), rocks (6-12 inches), and boulders (12+ inches) were encountered in the survey. Cobbles were quite common, and were caught in very high numbers during some tows. Rocks were common, but less abundant than cobbles, and boulders were rare. The cobbles tended to be concentrated in the eastern portion of the study site, overlapping the area where smaller surfclams were more abundant. Dr. Powell did not think that high surfclam abundance was related to high cobble abundance, but rather that surfclams distributions are more heavily influenced by water temperatures and independent of cobble abundance.

In terms of epifauna, some species were ubiquitous throughout the study site, including barnacles, hydroids, and bryozoans. Sponges were less common, and tunicates and anemones were rarely observed. Rockier, spongier habitats were most often encountered at the eastern edge of the study area in the deepest locations sampled. Mussels were very abundant at some sites, and were found attached to one another in mats. Both *Mytilus* sp. and *Modiolus modiolus* mussels were caught in the survey. Unfortunately, there was not time to sort the catch according to species, which would have been informative as the two types of mussels have different life histories and ecological roles. Urchins and crabs were often associated with mussel beds. There was little overlap between mussel beds and high densities of large surfclams, but some spatial overlap between mussels and small surfclams. Dr. Powell speculated that, like surfclams, mussel beds could be shifting spatially in response to changes in water temperature, but such shifts were not evident from the survey.

The PDT discussed what could be reasonably inferred about seabed habitat characteristics from a hydraulic dredge survey. There was concern that a dredge would not reliably sample epifauna, but Dr. Powell argued that any organisms that were large enough and in the path of the dredge should be retained in the gear and evident in the catch. Given that catchability rates of animals other than clams is not well understood, the PDT wondered if it was most appropriate to consider the epifauna results as an indicator of presence only, rather than trying to understand relative abundance of these features.

The PDT spent some time discussing the implications of an apparent shift in surfclams to deeper locations further from shore. The survey gear does not catch new recruits, but does capture age 3 and 4 clams at sizes of around 70-80 mm. Given the prevalence of small clams in the eastern part of the study area, the fishery will likely increase its activity at these eastern sites in the coming 5-

10 years. For reference, a density of 1 clam per m^2 is considered commercial density. Dr. Powell noted that the captains target larger or smaller animals on a trip depending on what processors are looking for, with larger clams valued for hand shucking and smaller clams acceptable for machine processing.

Ms. Bachman will communicate data needs to Dr. Powell in the coming weeks and he will provide a database for the PDT's use in developing alternatives. He noted that the data from this survey are similar to data from other federal surveys such that the results for this study area and the southern half of the Great South Channel HMA could be compared.

In addition to surfclam distribution, the PDT talked about fishery dependent data that could be used to evaluate tradeoffs associated with various access/exemption area alternatives. Logbooks (analogous to vessel trip reports) have been processed already using the confidence interval mapping approach (DePiper 2014[1]). For some gear types, vessel monitoring system data have been used to understand patterns of fishing effort (Muench et al. 2017)[2], but models have not been developed for the clam dredge fishery, and there is not an established speed filter for this gear type. A challenge is that clam tows are short relative to VMS polling rates (15-minute tows vs. hourly polling). The PDT will explore whether clam dredge VMS data can be used to evaluate tradeoffs associated with a range of alternatives.

Next, the PDT discussed the image analysis project that Alison Verkade has been working on. At present, 4 of 10 years of data are finalized, and the other years of data will be available in the coming weeks. Ms. Bachman will summarize data at the station level for mapping purposes. Rather than viewing the data as point estimates, it would be useful to interpolate the results. Further consideration of appropriate interpolation methods will be necessary, as many of these methods rely on continuous values (e.g. grain sizes ranging from 2-64 mm) rather than categorical data (i.e. complex vs. not complex). Most of the classifications the PDT would like to represent are categorical, i.e.: presence/absence of complex habitat, presence of cobble, presence of boulder, presence of >30% gravel cover, presence of long-lived epifauna. Ms. Verkade cautioned that while >30% epifauna cover was also noted in the data set, she was not confident that this metric was scored consistently across all images.

Beyond simply understanding how fishing activity, clams, and habitat types are distributed relative to one another and trying to design a spatial management framework that segregates clam dredging from complex habitats, the real question here is how clam dredge gear affects different habitat types, and how those habitats benefit fish stocks. The PDT decided that it would be helpful to look at fish survey data to determine occurrence, distribution, and relative abundance of groundfish and other stocks in and around the habitat management. The EFH survey geodatabase developed by Jeff Pessutti and others at NEFSC may be useful for this purpose.

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[1] DePiper, G. S. (2014). Statistically assessing the precision of self-reported VTR fishing locations. NOAA Technical Memorandum NMFS-NE-229**:** 16.

[2] Muench, A., DePiper, G.S., and Demarest, C. (2017). "On the precision of predicting fishing location using data from the Vessel Monitoring System (VMS)." Canadian Journal of Fisheries and Aquatic Sciences.

Deep-sea coral amendment

The PDT discussed the June 2017 ROPOS ROV dives in the canyons and in Jordan Basin. One result of this cruise to highlight for the Council is the high densities of *Lophelia pertusa* encountered on dives R2007 and R2008. While *L. pertusa* forms reefs in some areas, that is not occurring here. It may be that carbonate saturation depth is influencing the distribution of the species in New England. Dr. Auster noted that the effects of carbonate saturation on coral survival are species specific. Oceanographic factors driving coral distribution, while interesting, are probably not immediately relevant to decisions about coral zone designations.

Ms. Bachman confirmed that the Council does not intend to reconsider decisions for the Gulf of Maine sites. Their June 2017 final recommendations for the Gulf of Maine included mobile bottom-tending gear closures at Mt. Desert Rock and Outer Schoodic Ridge, and a research area in Jordan Basin, without any gear restrictions. The PDT discussed developing a focused list of research needs for the Jordan Basin area. It seems best to consider both funding possibilities and research capacity in terms of technology and organizations that might be willing to do this sort of work when developing such as list, so that the Council has a realistic sense of what might be accomplished. Dr. Auster noted that recent work by Amanda Demopoulos and Catherine Coykendall builds on earlier results that indicated that OSR and WJB sites cluster together genetically, and may constitute a metapopulation. One suggestion for the research needs list was side scan maps that can be used to assess fishing gear tracks relative to coral habitats. It would be important to map areas with a range of effort densities and bottom types.

Recent fishing effort data is currently being assembled to evaluate the Option 7 broad zone boundary. Because the boundary is based partly on evidence of mobile bottom-tending gear use, it seems important to have high-quality data that is as recent and comprehensive as possible. Staff have discussed that it would be ideal to have recent years of VMS data. Both the Northeast Ocean Data Portal and data previously used by the PDT have gaps. The portal data used to develop Option 7 originally only includes VMS data with specific declaration codes, which misses certain types of effort, for example the directed whiting fishery. The data sets used previously by the PDT are more comprehensive, and fishing/non-fishing was estimated using models that match VMS, VTR, and observer data, but data sets only run through 2012. Staff at NEFSC are working on updated VMS data sets. While fishing vs. non-fishing will be estimated with a speed rule, and not with a generalized additive model, these datasets will at least include recent years, and will include all bottom trawl VMS, regardless of declaration code, by linking to trip report data. Unfortunately, it is not possible to pull together post-2012 model-based data over the short or medium-term. Because Option 7 focuses on mobile bottom-tending gears, trawls will be the focus of these new data sets.

Once all the recent effort data are compiled, Ms. Bachman will develop spatial interpolations of the VMS polls. This can be done for both the speed-filtered data and for the model-based 2007-2012 data. The Option 7 boundary will then be evaluated using these spatial interpolations, to ensure that the boundary is appropriately conservative of existing fishing grounds while protecting coral habitats, according to the decision criteria agreed to by the Council in June. After the PDT reviews the result, detailed maps and coordinates will be distributed to the public and can be discussed at a Habitat Advisory Panel meeting, before the PDT finishes the impacts analysis and provides the results to the Habitat Committee and Council for a management recommendation. In June, the Council's motion on the broad zones suggested that they were looking for a combination approach, which would integrate a bottom-tending gear closure of the 600 m minimum zone (Option 6) with a mobile bottom-tending gear closure of the shallower Option 7 zone. Red crab gear would be exempt throughout. In the amendment document, the PDT will analyze Options 6 and 7 separately, and then develop a discussion of the combined impacts of both areas, should they be implemented together.

Updated fishing effects analysis

The Council will be updating its fishing effects model this year and next, working with Alaska Pacific University. APU will revise existing Fishing Effects code and workflows to generate seafloor maps and adverse effects outputs relevant to the northeast. APU will also conduct sensitivity analysis and document their work in a white paper. Sediment and fishing effort data, as well as susceptibility and recovery parameters, will be provided by the PDT. To generate fishing effort data, the PDT will need to update gear width and contact parameters.

Using some slides provided by Brad Harris and John Olson, Ms. Bachman explained the model to the PDT. PDT questions and feedback (Appendix 1) will be provided to the APU team. She noted that the model update is envisioned as a long-term effort. Thus, while we should endeavor to make key changes now, there will be additional opportunities to revise data sets and parameters in the future.

Sediment data: We will provide base grid data/point data for the substrate map that underlies the model, and APU will process those data according to an established approach, which is somewhat different from SASI and could perhaps be further modified if desired by the PDT. Although we generally have better substrate data than the North Pacific, there are issues with geologic coverage here too. The PDT wondered if we should consider alternate ways of interpreting the sediment data, rather than using the dominance approach. Sediment classification could have fundamental effects on how we assess impacts. The PDT wondered if HabCam or multibeam data could be incorporated, in addition to recent USGS and SMAST data.

Energy: The North Pacific FE model ignores high/low energy and uses the same susceptibility and recovery parameters regardless of depth or flow in a location. The PDT suggested keeping this element in FE Northeast, but revisiting the high/low energy classification used in SASI. One suggestion was to use depth/sediment provinces, where carbon delivery rates would be likely to vary. Carbon delivery would be expected to affect growth and recovery rates. A next step here will be to identify relevant regions.

Fishing effort: The plan for generating monthly fishing effort datasets for FE Northeast is to turn Geret's VTR-based revenue or catch maps into swept area maps. Because observer data are only available for a small percentage of trips, information such as distance towed or gear dimensions are not known for most trips. Gear contact with the seabed would always need to be assumed as these data are not collected even by observers. Thus, to estimate area swept per trip, we will need to specify gear width, gear contact, and total distance towed for each fishing trip. Obviously, these parameters will vary by gear type, but might also vary according to target species or region. Thus, trips will be grouped into métiers and then gear width, contact, and distance towed parameters will be assigned to each category. at the trip level. The North Pacific version of FE models about 75 different métiers. SASI originally used ten: otter trawl, squid trawl, shrimp trawl, raised footrope trawl, sink gillnet, demersal longline, trap/pot, hydraulic clam dredge, limited access scallop dredge, and general category scallop dredge.

Grid resolution: FE uses a 5 km grid, whereas SASI uses a 10 km grid. The sediment data in the northeast may support a much finer resolution, perhaps 1 km. The difference now is that the VTR model handles the likely spatial spread of each trip, so we can select a SASI grid to match the resolution of the sediment. It seems that there might be interaction between the grid resolution and how we decide to classify sediment. We should look at the modifiable areal unit problem literature and ask if APU considered this literature when determining their grid size. Another possibility might be an unstructured grid that reflects local data density. This could become problematic in areas where the sediment map is very poorly resolved but fishing effort varies spatially.

Susceptibility/recovery: Susceptibility in FE is treated the same as in SASI, where the initial swept area is reduced by a percentage. The range of percentages that might apply to a given fishing event and feature combination is taken directly from the susceptibility matrix for that gear. The PDT wondered if it would make sense to have different susceptibility parameters by season.

A future direction for FE is to model in three versus two dimensions. Accounting for water column depth and gear position within the water column will allow for specific gear types to encounter some features but not others depending on how far about the seafloor the gear is flown. For example, gear that is generally flown a foot above the seabed might not contact smaller species of sponges, but might still contact long sea whips. In this example, the sponge susceptibility parameter would go to zero, while the sea whip parameter would remain as specified in the original gear effects matrix.

FE assumes exponential recovery. The shape of this function implies that much of a feature’s recovery occurs over the time frames specified in the gear effects matrices, but that some recovery will not occur for many, many years. Generally, participants in the FE process agreed that this functional form is more realistic than a linear one. The PDT will seek clarification on whether the susceptibility parameters are applied the same way in FE and SASI.

Fishing effort overlap: The FE model assumes that fishing events overlap by a certain amount in each grid cell. The North Pacific team used actual tow paths to assess the rate of overlap between fishing effects. The PDT wasn’t clear on how this assumption about overlap affects the way the model works.

Steep and deep habitats: The FE model makes different assumptions about recovery rates in specific steep and deep locations where cold-water corals are likely to occur (steep and deep was indicated by the presence of cobble or boulder habitat below a certain depth). We may consider different spatial approaches than a depth/sediment rule, for example based on areas of very steep slope, and/or by drawing a buffer around dive transects where corals were observed, because coarse sediment is not well mapped in deep areas of New England.

Finally, the PDT discussed the integration of FE and EFH. This work is ongoing in the North Pacific, and involves looking for habitat reduction in areas of core EFH. Assessment scientists then review the FE outputs to see if there are any reasons to expect that fishing effects are influencing life history parameters. If yes, then the issue would be elevated to the Council for possible mitigation of the adverse effects.

Other business

No other business was discussed. The meeting adjourned at approximately 4:30 p.m.

Table 1 – Follow up items from September 14, 2017 PDT meeting

Task	Name(s)	Due date
Identify date to review coral background in document. Include Martha Nizinski if possible.	Michelle Bachman (with Peter Auster and Dave Packer)	9/22/17
What is the level of VMS coverage in the fluke fishery? See if other NEFSC analysts have addressed this question already	Geret DePiper	Prior to Committee meeting (10/4/17)
Fishing effort VMS maps (model-based and speed-filtered; compare to data portal)	Michelle (with Geret)	ASAP; complete before scheduling AP meeting
Revise Option 7 boundary; develop detailed charts of boundary and compare to other options	Michelle (for PDT review)	ASAP; complete before scheduling AP meeting
Human community analysis of revised Option 7	Geret, Rachel Feeney	After AP meeting; before Committee meeting
Coral, EFH, PR impacts of revised Option 7	Michelle	After AP meeting; before Committee meeting
Review impacts analysis and other sections of EA document (consider overlaps in timing with herring amendment)	Entire PDT; Marianne Ferguson for NEPA compliance	TBD; in advance of final Committee and Council meetings on amendment
Contact Eric about Nantucket Shoals clam survey data	Michelle	9/22/17
Complete clam framework image analysis data sets	Alison Verkade	10/2/17 if possible
GIS point data for image analysis	Michelle	10/6/17
Identify mapping/interpolation approaches for image analysis	Michelle and Kathryn Ford	10/13/17
Obtain fish distribution data for clam framework	Dave Stevenson	10/13/17
Forward PDT questions about FE model to APU team (give PDT a few days to review list first)	Michelle	9/25/17

Appendix 1. PDT questions and comments about Fishing Effects model

1. Can FE be linked to Ecopath/Ecosim/Ecospace? http://ecopath.org/
2. What are the steps to develop the seafloor map? Can multibeam data that includes sediment interpretations be included in the map?
    a. PDT wants to ensure that any sediment mapping approaches will represent ecological realities.
3. Can sensitivity analysis be used to evaluate different sediment mapping approaches?
4. It seems important to keep the energy parameters as part of the model when transitioning from SASI to FE.
    a. Depth and flow will affect recruitment, recovery rates, and rates of carbon delivery.
5. How were sub-regions identified in the FE model? What factors do we need to consider? Are there other regional modeling frameworks we should be congruent with?
6. How was the model grid size determined for the FE model? Since fishing effort distribution is already modeled spatially in the northeast, it seems like the right approach here is to focus on a resolution that will capture the spatial variations in the seabed data, and then crack the fishing effort data at that grid size. A 1 km grid might come close to resolving seabed features. Could an unstructured grid be used to reflect underlying data quality?
7. Can we try various grid resolutions and compare the results? Did the APU team consider the modifiable areal unit problem literature when selecting their grid size?
8. Can seasonal variation susceptibility parameters be incorporated into the model?
9. PDT needs more explanation of how fishing effort overlap works in the model, and what the ecological implications/assumptions are.