New England Fishery Management Council
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Eric Reid, *Chair* | Thomas A. Nies, *Executive Director*

MEMORANDUM

DATE: **September 2, 2022**

TO: **Council**

FROM: **Habitat Committee**

SUBJECT: **Review of Exempted Fishing Permit 19066 Final Report**

The Habitat Committee met on August 18, 2022 to discuss the final report for the project completed under Exempted Fishing Permit (EFP) 19066 (Jennings et al. 2022). The Committee reviewed an August 10, 2022 Habitat Plan Development Team (PDT) memo about the report which focused on the utility of this study for management of fishing gear impacts within the Great South Channel Habitat Management Area (HMA), and included an overview of project methods, research findings, how the results might be used to inform future management, and potential next steps. Members of the public as well as Coonamessett Farm Foundation (CFF) staff, who authored the report, provided input during the Committee meeting. The Committee noted that the PDT had evaluated draft progress reports related to this project, and the PDT chair commented that CFF had made some revisions to the report and analysis as recommended by the PDT. Meeting participants were reminded of the Council's research objectives for the HMA (see PDT memo for details) and that NOAA Fisheries, not the Council, is responsible for approval of EFPs.

Committee findings

Overall, the Committee agreed with the PDT's conclusions about this study, as described in the August 10 memo. The PDT concluded that this work does not support development of new exemption areas within the study area, in part because the study indicates that clam catches increase with increasing percent pebble-cobble substrate, which is of conservation concern, and in part because habitats throughout the study area are quite heterogenous and patchy on spatial scales that would make identification of discrete, lower vulnerability exemption areas difficult. The Committee agreed with the PDT that the study could be used to inform the design of future habitat mapping projects, which ideally should examine both sites where dredging occurs, and unfished locations, using a random sampling design.

The following conclusions are based on a lengthy discussion of the study including the PDT's report and are informed by public comments made during the Committee meeting.

1. The Council should clearly specify data and information needs that would support adjustments to management of the HMA.

The Committee acknowledged the importance of clearly articulating objectives for an HMA designation and objectives for research, reiterating these when needed. There was agreement that while HMA designation and research objectives have been communicated already, opportunities remain for the Council to more clearly articulate what information would be required for it to recommend modifications to the exemption area program. Specifically, the Committee suggested that the Council communicate what constitutes complex habitat, where fishing might not be acceptable, vs. areas of lower complexity that might be suitable for exemptions because impacts would be minimal and temporary.

2. EFPs are an important opportunity for learning, but EFP-based studies require thoughtful design.

The Committee agreed that projects conducted under exempted fishing permits could be used to gather information in support of the Council's research objectives.

As noted in the PDT's memo, most of the data collected during this study was fishery dependent, either catch composition of the tows, or imagery collected with cameras mounted on the dredge. The Committee supports using fishery independent methods for collecting habitat data as these approaches minimize impacts to the HMA and ensure that the data are independent of concurrent fishery impacts. Sampling techniques that were discussed included fishery-independent towed camera systems and acoustic echosounders.

A concern raised via the PDT's memo is that the spatial and temporal distribution of fishery-dependent sampling in this study was not random. The Committee agreed that it would be important for future projects to have a more clearly defined sampling strategy. The PDT noted that CFF's study provides information that could be used to design a follow up study. The Committee recommended that proposals for future studies clearly identify their sampling areas, and that ideally habitat mapping should encompass a broad sampling area. For example, acoustic mapping could be done both within and outside any compensation fishing areas.

The PDT expressed concerns about the ability to sample fish with dredge-mounted video. The Committee discussed that it might be useful to compare fish detections in dredge-mounted camera with detections in towed camera systems or baited underwater video. This would require comparing data collected with fishery dependent and independent gears from the same area and season.

3. The Committee acknowledged that research funding is limited, and that this reality will affect study designs. Compensation fishing is one funding solution but should be implemented strategically.

The Committee acknowledged that organizations including CFF have not been able to secure funding for fishery independent work and that a lack of funding to conduct research that addresses Council objectives is a barrier to moving forward with consideration of management changes. Data collection paired with fishing, or compensation fishing combined with separate

scientific work provides funds for research through a set aside fee per bushel of catch. The Committee wondered if larger set asides might be a feasible way to fund additional fishery independent sampling or analysis. Alternative funding sources such as Saltonstall Kennedy grants or Council RFPs were also discussed.

The Committee suggested that fishery independent and dependent sampling be combined in future studies, recommending that for future projects effort focus more on fishery independent sampling, with fishery dependent sampling or separate compensation fishing completed as needed to financially support the work. The project currently being reviewed did include both fishery dependent and independent components, but there was less fishery independent work completed than originally envisioned.

Additional Committee discussion

The Committee also discussed management of the clam fishery vs. habitat management. The HMA is closed to mobile bottom-tending gears, except for the three exemption areas, to minimize fishing impacts on EFH for several NEFMC-managed species. NEFMC established the HMA and exemption areas via Omnibus Habitat Amendment 2 and a subsequent framework. Fishing in the exemption areas requires Vessel Monitoring System (VMS) declaration, and VMS polling every 5 minutes as established via the exemption area framework, but otherwise operations in the fishery are governed by the Mid-Atlantic Fishery Management Council's Surfclam and Ocean Quahog Fishery Management Plan. The Committee did not identify specific opportunities for the Mid-Atlantic Council regarding this issue but recognized that ongoing communication between the Councils and NOAA Fisheries would be important.

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Eric Reid, *Chair* | Thomas A. Nies, *Executive Director*

MEMORANDUM

DATE: **August 10, 2022**
TO: **Habitat Committee**
FROM: **Habitat Plan Development Team**
SUBJECT: **Habitat PDT Review of Exempted Fishing Permit 19066 Final Report**

The Habitat Plan Development Team (PDT) met on July 27, 2022 to discuss the final report for the project completed under Exempted Fishing Permit 19066 (Jennings et al. 2022). The PDT focused on the utility of this study for management of fishing gear impacts within the Great South Channel Habitat Management Area (HMA). This memo includes an overview of project methods, what the research does and does not show, how the results might be used to inform future management in the region, and potential next steps for evaluating fishing gear impacts within the HMA.

Introduction

The Great South Channel Habitat Management Area was implemented in April 2018 as a mobile bottom-tending gear closure. In 2019, the Council developed research objectives for focused habitat research in the HMA to enhance the Council's understanding of current conditions in the HMA (NEFMC 2019). The idea was that addressing these objectives would "allow the Council to prioritize sections of the HMA for mobile bottom-tending gear closure vs. dredge exemptions, contingent upon assessments of habitat vulnerability and function vs. utility as fishing grounds (page 4)." The objectives, listed below, were not intended to be accomplished through a single project.

1. Improve the Council's understanding of the distribution of living and non-living habitat features within the GSC HMA, including topography, substrate, epifauna, and infauna (i.e., develop habitat maps).
2. Improve the Council's understanding of habitat stability including epifaunal persistence in relation to substrate type, tidal flows and storm events.
3. Improve the Council's understanding of habitat vulnerability to mussel and clam dredges. Vulnerability includes both the nature of habitat/gear interactions (susceptibility) and recovery rates.

4. Improve the Council's understanding of why the GSC HMA is important to managed species, such as Atlantic cod.

An exemption program allowing clam and mussel dredges to operate in specific sections of the Great South Channel HMA was approved by the Council in December 2018 and implemented in June 2020. Under this program, three areas of the HMA are open to clam and mussel dredging: Fishing Rip, McBlair, and Old South. At the same time, the Council identified two additional areas, Rose and Crown and Davis Bank, as available for research conducted under an approved EFP. The study area for this project is a subset of the Rose and Crown research area (see figures 2 and 6 on pages 8 and 12, respectively, of the final report). Two locations within the study area were set aside as unfished control sites.

This project sought to address the following objectives. The project scope was scaled down from the initial proposal, generally through reductions in the fishery-independent components which were more costly to implement, and initial objectives and project goals[1] were adjusted.

1. Use dredge-mounted cameras to document substrate, habitat features (e.g., sand waves, mussel beds), fishes and invertebrates within the Rose and Crown area of the HMA.
2. Create spatiotemporal distributions of biotic and abiotic habitat features to be used to inform future management actions regarding the HMA.
3. Establish relationships between high clam CPUE and habitat complexity.
4. Determine spatiotemporal presence of Atlantic cod in this area.

The project described here represents the only EFP-based research that has been conducted in the research areas since they were implemented. No other EFP-based research is underway in the HMA.

Review of project methods

This project primarily used cameras mounted on a hydraulic dredge to characterize seabed substrates and organisms along tow paths while commercial fishing for surfclams, *Spisula solidissima*. Images extracted from the video data were annotated and benthic characteristics along the tow paths were mapped. Dredge catches were also documented, and included surfclams, substrate, mussels, and fish. In all, data were collected over seven seasons, and much of the analysis is presented by season. Surfclam, black sea bass, spiny dogfish, and flatfish catches were modeled based on data collected from the still images and other environmental covariates. In addition, a relatively small amount of fishery independent data was collected. During these trips, towed cameras were used to observe the seabed in multiple locations. These videos were annotated, and results are included in the final report.

[1] Earlier objectives of this study (as of September 2021): (1) Develop habitat maps of fished and unfished areas of the GSC HMA. (2) Characterize habitat types and benthic community structure in areas where dredging does and does not occur. (3) Identify areas of high clam catch per unit effort (CPUE) and low habitat complexity. (4) Evaluate the seasonal distribution of juvenile cod and other finfish in fished and unfished areas of the GSC HMA.

Sampling Design. Tow locations (Figure 9, page 16) were selected by the vessel captain based on areas where surfclams were expected to occur, rather than using a random sampling design. Using prior knowledge of the study area, the captain avoided towing unfishable areas due to the existence of large boulders (>5 ft diameter) and fishing in deeper waters where clams were not likely present (especially grid square 9). Areas were fished repeatedly within a trip, and then returned to at intervals during later trips, as is characteristic of the surfclam fishery. Tows were not independent of one another, but they did also not constitute repeated observations of prior tow paths over time (i.e., longitudinal sampling).

Video Annotation. The study area was divided into 19 grids (numbered 0-18) to facilitate analysis. A total of 218 tows were annotated (approximately 3 tows per season (n=4) per grid (n=19)). Annotated features are listed in Table 4 (page 17). The seabed was annotated as sand (no pebble or cobble), < 25% pebble-cobble, 25-50%, 51-75%, or greater than 75% pebble cobble. Percentages were estimated using visual assessment of each image by an annotator, with a digital grid overlay available for reference as needed. A subset of these tows (n=24) compared sediment composition across seasons on similar track lines within a heavily fished area (methods on page 14-15).

A different subset of annotated tows (n=24) was examined for previous signs of dredging/dredge tracks when tows were made on the same trip, one month apart, or several months apart (methods on page 13). The tows examined for this part of the study were not intended to follow the same path (which would have required more precise vessel positioning than was available), but rather crossed paths at angles. Since the tows are roughly straight lines, the sample size in terms of number of potential crossings is small.

Overall, annotated tows are distributed throughout the study area and appear to be a representative subset of all dredge tows (n=3,236), comparing the locations of all tows with annotated tows in Figure 9 (page 16). However, not all grids were sampled in all seasons, as shown in Figures 14 through 20, which adds an additional challenge to seasonal comparisons.

Data Analysis. Two types of sediment interpolations were generated. Across the entire study area, percent pebble-cobble data were pooled across all annotated tows and seasons and interpolated using Inverse Distance Weighting (IDW) to generate an estimated distribution of sediments (Figure 10 on page 18, also shown throughout Appendix D). Annotated tows were also grouped by season and year and interpolations were confined to a narrow radius of 58.6 m (the mean length of different substrate patches along a tow path) along and perpendicular to either side of the tow path (see Figures 14-20). Bar charts accompanying these seasonal maps summarize sediment composition by grid.

Generalized linear mixed modeling (GLMM) was used to estimate the relationship between surfclam, black seabass, dogfish, and flatfish catches and substrate/environmental variables.

Discussion of project conclusions

Habitat complexity

Overall, the study found that complex habitat is widespread throughout the project area, clam dredges operate in areas with complex pebble-cobble bottom, and the habitat is very heterogenous, even on small spatial scales (on average 58.6 m between and along habitat patches). Specifically, percent pebble-cobble coverage varied within and between annotated tows, as shown in Figures 14-20. A table of average lengths of substrate patches by season and percent pebble-cobble coverage were included in a follow-up exchange with the project team. This table will be included in an updated version of the final report. The substrate patch sizes indicate a high level of heterogeneity of the area on a scale of tens of meters. These findings of habitat complexity and heterogeneity are consistent with prior data collected from SMAST (NEFMC 2018).

The PDT has some concerns about the methods that make the results difficult to use for understanding habitat complexity. The study was intended to characterize habitat characteristics and heterogeneity in areas that were dredged commercially. Areas with fewer clams or large boulders were generally avoided, fishing locations were not evenly distributed or randomized, and tows were not independent from each other. This sampling approach limits the ability to understand the characteristics of unfished areas and accurately map all habitats within the project area. In addition, the final report groups observations by season and attempts to differentiate between each. Any seasonal changes noted in the report could be a consequence of differences in fishing location or variations in the effects of bottom disturbance caused by earlier clam dredging during the project. For these reasons, perceived differences may be due to differences in the areas sampled or fishing related impacts, and not due to real shifts in benthic characteristics over time. Note that while only 7% of the tows were annotated, we believe that annotating additional tows would not have appreciably improved the resulting habitat maps and seasonal comparisons, given the sampling approach.

Clam and fish abundance and distribution

For surfclams, the GLMMs found that clam catch significantly increases with increasing percent pebble-cobble coverage (pages 17-19, Figure 11, project objective 3). Swept area, season, and tidal stage variables also significantly influenced catch estimates.

For fishes, the study documented high abundances of dogfish and black seabass in the annotated images, especially during summer and fall. The PDT was not surprised by these findings and expects that these species are more attracted to the dredge and the lights on the baited underwater video compared to other species like cod. Season, swept area, and mussel clump coverage predicted both black seabass and dogfish abundance, and diel phase was also a significant predictor for dogfish. Flatfish abundance (windowpane and yellowtail combined) was also modeled; the report seems to indicate that only season was significant. The presence of these and other species in annotated images are shown in Appendix D.

The PDT feels that there are substantial limits to the conclusions that can be drawn about fish distribution and abundance using the video data. The fish bycatch data are interesting, but the ability to detect different species of fish in the dredge-mounted video is uncertain. Depending on their behavior with respect to the dredge gear or lights, fish may leave the tow path before they can be observed on the video. Certain species like black seabass are generally attracted to structured habitats (Watanabe et al. 2021), and this species was frequently observed in the imagery.

However, unobserved or rare species in the videos may occur or be more prevalent in the study area than indicated by the video data. The discussion section describes cod observations in the video data (pages 37-38), acknowledging that cod accounted for only 6 of the 2,114 fish observed in the video annotations. The Atlantic cod spatiotemporal presence question (project objective 4) was not adequately addressed, given uncertainties of the sampling methods (an active clam dredge), lack of any studies to determine avoidance, and low sample size.

How can this be used for management?

The research demonstrates that clam fishing interacts with complex habitat, which is ubiquitous throughout the project area, and there was a positive relationship between clam catch and percent pebble-cobble substrates in the GLMM. Assuming the Council's objective is to minimize the adverse impacts of fishing on complex habitat, we recommend that these results cannot be used to design future exemption areas in the Rose and Crown area of the HMA.

Specifically, this project provides ample evidence that habitat in this section of Rose and Crown is very heterogeneous at scales of tens of meters and that clam catches are distributed throughout the area. Thus, it is not possible to identify discrete zones for fishing (at kilometer scales[2]) where interactions with complex habitats are not likely to occur. If the spatial heterogeneity (patch sizes) were larger within other sections of the HMA, then it might be possible to establish discrete management areas elsewhere in the HMA. Identifying suitable areas would require future work.

Data from this project reaffirm the need for additional mapping in other areas of the HMA. Patterns of habitat and clam catch may differ from what was observed in the project area, for example other areas of the HMA may be "less complex" and have different substrate patch sizes or different clam catch rates in complex habitats. The Council has not defined a threshold for what is considered "less complex" habitat where clam dredging impacts might be minimal/temporary and thus exemptions might be suitable. Related to this work, there was some exploratory towed camera fishery independent sampling on Davis Bank that indicates larger substrate patch sizes, but the sample size was too small to draw clear conclusions.

This project was not designed to evaluate gear impacts, habitat recovery rates vs. natural disturbance, or habitat stability over time, although these are elements of the Council's research

[2] The existing exemption areas are a few kilometers across at their narrowest points, and no closer than approximately 1 km to one another. Exemption area size and dimensions were discussed when the exemption framework action was developed in the context of enforceability.

objectives. Information on the impacts of clam dredging and the recovery of affected habitats would inform future decision making. A properly designed study is needed to understand initial impact and recovery relative to natural disturbance when considering any fishing access in the future. Although many of the grids were fished repeatedly across the seven seasons (see Figure B1, Appendix B, page iii), the data are not longitudinal in the sense that specific dredge paths were revisited at multiple time points and pre-dredge habitat data were not obtained for comparison over time.

Sediment transport certainly occurs on Nantucket Shoals; however, it is not possible to draw conclusions from this project about natural and dredge-induced ecosystem dynamics since tow tracks were not re-occupied over time and pre-dredge habitat data were not collected. The study does document that mussel beds and other epifauna occur throughout the area which indicates habitat stability at longer term time scales. There are cascading questions about ecological function over time (e.g., the ecological function of mussel beds for fish in the area), but this project was not designed to address these types of questions.

Possible next steps

Council research objective 1 (habitat mapping) was partially addressed. While the study provides information on the distribution of complex habitats and epifauna, given the limitations of the sampling approach, habitat maps that document the distribution of these features within the project area were not generated. Nonetheless, the PDT agreed that this project provides a useful starting point from which to consider a future habitat mapping program within the Great South Channel HMA.

- This work demonstrates the high heterogeneity of benthic habitat types within the HMA, suggesting that a broad scale acoustic survey is needed for mapping the HMA.
- Patch size estimates would be helpful for guiding future sampling.
- The data collected during this project could be used for power analyses to determine how many random samples are needed to characterize an area using imagery.

Related to future habitat mapping, the PDT noted that fishery-dependent data collection is not ideal as a sampling method given that it is biased towards locations where clams are more abundant and the act of fishing alters the habitats sampled (i.e., future mapping should not be done with clam dredges).

Council research objectives 2-4 (stability re-epifaunal persistence, vulnerability to mussel and clam dredges, and importance to species such as cod) remain unaddressed. These questions could be addressed by mapping the HMA to the greatest spatial extent possible with acoustics and non-invasive visual methods. A rigorous before-after-gradient study of recovery in fished areas would also be helpful in evaluating fishing gear impacts to the habitats within the HMA. Ultimately, a baseline habitat map and fishery independent random sampling design is needed to evaluate changes in habitat distribution over time and relative to fishing activity.

Additional modeling to explore the relationship between surfclam catch rate and environmental covariates would be interesting and might inform prosecution of an exemption area fishery,

however the report authors indicated that compilation of environmental covariates for non-annotated tows would be quite time consuming.

References

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