Great South Channel Habitat Management Area Surfclam Exemption Program Review

Draft Report

Habitat Plan Development Team (PDT)

September 10, 2026

New England
Fishery Management Council

Executive Summary

Management Background

The New England Council's (Council) Omnibus Habitat Amendment 2 (OHA2) created, adjusted, or maintained a range of Habitat Management Areas (HMAs) throughout the New England Region, which, in combination with other fishery management measures applied throughout the region, minimize the effects of fishing on essential fish habitats (EFH) to the extent practicable. The Great South Channel HMA was implemented in April 2018 as a new closure to mobile bottom tending gear (MBTG). This HMA encompasses a large portion of Nantucket Shoals, an important area for the Atlantic surfclam fishery that is managed by the Mid-Atlantic Council. Recognizing the value of these shoals and HMA to the surfclam fishery, OHA2 included a one-year exemption for clam dredges through April 2019 to allow the Council time to establish an exemption program for this fishery (final rule). The exemption program, developed through the Council's 2018 Clam Dredge Framework and implemented in June 2020, established three areas within the Great South Channel HMA where vessels may fish for Atlantic surfclams or blue mussels with dredge gear (final rule). The Clam Dredge Framework also established two habitat research areas within this HMA; these are informal and not established in federal regulations.

Why is the Council Doing this Evaluation?

The Council voted in December 2025 to "conduct an evaluation of the Great South Channel HMA surfclam exemption areas" as a 2026 work priority, in response to surfclam industry and state of Massachusetts concerns with the fishing opportunities provided under the program (see correspondence here). The Massachusetts Division of Marine Fisheries (DMF) noted that during 2023-2024, 30% of surfclam landings came from state vs. federal waters, an increase over earlier periods. MA DMF was concerned that this shift in effort from federal to state waters could be impacting inshore habitats. MA DMF's correspondence highlighted the forthcoming availability of results from Coonamessett Farm Foundation's exempted fishing permit-based research project in the Great South Channel HMA and suggested that analysis of this project and prior results could inform an evaluation of surfclam and mussel harvest locations that would have minimal fish habitat impacts. The Council was also provided with correspondence between Nantucket Sound Seafood and MA DMF. Nantucket Sound Seafood noted their (and Intershell Seafood's) participation in EFP-based research since 2019. Nantucket Sound Seafood emphasized poor conditions in the Massachusetts surfclam industry, including recent large declines in surfclam revenues, production, and employment that affect multiple companies. The company noted that catches per unit of effort are lower in inshore areas and were concerned about overexploiting available clam beds due to the fishing industry's inability to access portions of the surfclam resource occurring within the Great South Channel HMA outside of the three exemption areas.

Objective and Scope of this Evaluation

The objective of this evaluation is to assess the effectiveness of surfclam exemption areas in the HMA from both habitat conservation and fishery perspectives, considering recent data and information. These perspectives are also evaluated against the Clam Dredge Exemption Framework's original problem statement and objectives. This report does not explicitly evaluate the effectiveness of the two research areas nor the habitat or surfclam resource conditions in

portions of the HMA outside of the three exemption areas, but it does consider the results of work conducted in the research areas to inform the exemption area evaluation. The Council will not modify the surfclam exemption program in 2026; 2026 work is focused solely on the evaluation of the program and any proposed changes to the exemption program could be considered as a future Council work priority.

Next Steps After the Evaluation is Completed

After receiving this report, the Council will consider whether changes to the clam and mussel dredge exemption program are warranted. If changes are needed, the Council would need to prioritize the development of a management action. The information in this evaluation report can be used by the Council to discuss tradeoffs between fishery access and habitat conservation should a future action be developed (see evaluation objectives section below). While the specific scope of any action would need to be determined by the Council, it could include reworking the exemption areas, adjusting seasonal restrictions on fishing, changing the configuration of research areas, or other measures. Any action to change the program would require analyses of specific alternatives considered and consultation with the Mid-Atlantic Council, which manages the surfclam fishery. Changes to fishing restrictions within HMAs can be developed through a framework to the New England Council's fishery management plans, as was done with the Clam Dredge Framework.

Summary of key findings of this evaluation

1. The Great South Channel HMA is highly dynamic environment, with high water flows along the seabed, strong currents, and notable sediment transport and reworking of sand waves in some areas due to natural disturbance. The Council's Fishing Effects Model assumes that background levels of natural disturbance influence seabed impact and recovery dynamics. Data from EFP 23073 demonstrate interannual variability in bedform positions and sediment characteristics with the Davis Bank East research area.

2. Seafloor habitats are heterogeneous throughout the Great South Channel HMA. Characteristics such as depth, sediment composition, and epifaunal diversity vary by location throughout the area. These differences were noted in the Clam Dredge Framework, based on an analysis of drop camera data. While sampled using different methodologies, the two EFP-based studies in Rose & Crown and Davis Bank East provide more recent and detailed data to confirm these findings. We continue to have less data about seafloor habitats in the McBlair, Old South, and Fishing Rip Exemption Areas relative to other areas of the Great South Channel HMA.

3. Multiple New England and Mid-Atlantic Council-managed species occur in the Great South Channel HMA, some of which have very high estimated densities in the HMA as indicated by species distribution models, which allow for inferences about species habitat use in areas where environmental data are available but fishery independent survey data are limited. These high-density species (EFH or cumulative density hotspots) include the following juvenile (J) and adult (A) life stages: Atlantic cod (J&A), Atlantic herring (J), Atlantic mackerel (J), Atlantic surfclam (all stages), black sea bass (J), bluefish (A), butterfish (J), little skate (J&A), longfin squid (J&A), pollock (J), sea scallop (all stages), scup (A), red hake (J), shortfin squid (J), spiny dogfish (A), summer flounder (A),

windowpane flounder (J&A), winter flounder (J&A), winter skate (J&A), and yellowtail flounder (J).

4. Atlantic cod is a species of conservation interest in the Great South Channel HMA. Structured habitats, including gravel and cobble habitats, in the HMA are believed to be important for newly settled juveniles, and species distribution models indicate high densities of juveniles and adults. Nantucket Shoals was historically known to be a cod spawning ground. However, the relative abundance of cod in the HMA, as well as their current use of the HMA for spawning, is uncertain. While some acoustic data have been collected just outside the HMA, these recordings have not yet been screened for cod spawning vocalizations, known as grunts. Cod are not well sampled by clam dredges or in drop camera surveys, the primary sampling methods used during the EFP projects. Baited underwater video deployment under the first EFP project did not collect data on cod as was intended but this part of the project was limited in scope.

5. Fishing Effects in the Great South Channel HMA peaked in 2016 and have declined since. Mean fishing effects are low, on average less than 1% across all model grids overlapping the Great South Channel HMA but are locally higher since some parts of the HMA are unfished.

6. The surfclam resource in the Great South Channel HMA is unsurveyed, and total harvestable biomass in the area is unknown. However, in recent decades, more landings have been coming from northern areas of the resource, such as Southern New England, which includes the Great South Channel HMA, and Georges Bank.

7. Surfclam distributions within the Great South Channel HMA are spatially heterogeneous, as indicated by the "East of Nantucket" Survey, which occurred around a decade ago, and by more recent EFP compensation fishing. Densities of harvestable surfclams were insufficient to support the full scope of compensation fishing planned within the Davis Bank East area under the recently completed EFP.

8. Between 2013 and 2025 (the last full year for which data can be reported), surfclam fishing effort, landings, and revenue declined within the Great South Channel HMA. Surfclam landings and revenues declined coast-wide over this same period, but landings and revenue from the Great South Channel HMA currently comprise a smaller fraction of coast-wide revenues than they did prior to the exemption program's enactment.

9. Despite the reduced contribution of the Great South Channel HMA to coast-wide surfclam landings and the continued importance of the northern fishing areas to the fishery, it remains challenging to separate the effects of spatial fishing restrictions under the exemption program from the effects of changing clam resource, given the lack of a dedicated surfclam resource survey in the HMA. At present, it is not possible to attribute the decline in landings in the HMA solely to the spatial fishing restrictions.

10. More data about the Great South Channel HMA are available as compared to when the Clam Dredge Framework was enacted, notably the updated habitat maps and surfclam fishery characterization from the two EFP projects in the Rose & Crown and Davis Bank

East, as well as the new species distribution models throughout the HMA. However, uncertainty remains around surfclam and habitat distributions, particularly in unsurveyed and unfished areas.

11. The current overall approach relies on relatively small, designated dredge exemption areas within a broader HMA that is closed to clam dredging. If the Council wished to modify the program but keep this overall approach, designing new or modifying existing targeted exemption areas to increase surfclam harvest while maintaining the conservation value of the HMA would be challenging given the data available. An alternative spatial approach could be more feasible. Public input would be an important part of redesigning the exemption program.

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Introduction and Background

Omnibus Habitat Amendment 2 (OHA2) and Creation of the Great South Channel HMA

OHA2 (NEFMC, 2016) reviewed and updated all EFH designations for New England Council-managed species, provided information and analyses to support all EFH technical review components required of Councils under federal regulations, reviewed and updated groundfish and habitat management areas including spawning areas, established a system of Dedicated Habitat Research Areas (DHRAs), and created provisions for future updates of these measures using framework actions. Rationale for creation of the Great South Channel HMA was specified in the Omnibus Habitat Amendment 2 FEIS. The primary goal addressed with this area and other habitat management area designations was to minimize the adverse effects of fishing on vulnerable seabed habitats, across all areas managed by the Council. OHA2 provided a one-year exemption for clam dredges in the Great South Channel HMA, which was otherwise closed to mobile bottom-tending gears (MBTG) in April 2018. The purpose of the one-year clam dredge exemption was to allow time for a more discrete exemption area or areas to be developed.

OHA2 was developed over a twelve-year period between 2004-2016 and became effective following publication of final regulations in April 2018. All OHA2 information is available online here; see Volume 3 for HMAs and other spatial management measures. Following completion of OHA2 in 2015, the Council began to develop a framework to establish an exemption program for surfclam fishing within the Great South Channel HMA. The framework was finalized by the Council in December 2018, roughly eight months after OHA2 went into effect. Clam Dredge Framework information is available online here. A detailed timeline of management activities, including links to related documents, is provided as Appendix A to this report.

Objectives of the Clam and Mussel Dredge Exemption Framework and Program

The Council specified a problem statement and purpose and need for the Clam Dredge Framework (NEFMC, 2019) as follows:

Problem statement: The surfclam/ocean quahog fishery will be granted a one-year exemption for the GSC HMA following implementation of OHA2, which will allow the Council to consider development of an access program for this fishery. The Council intends through this action to identify areas within the HMA that are currently fished or contain high energy sand and gravel that could be suitable for a hydraulic clam dredging exemption that balances achieving optimum yield for the fishery with the requirement to minimize adverse fishing effects on habitat to the extent practicable and is consistent with the underlying objectives of OHA2.

Purpose and need for action: The Council developed this framework to evaluate and possibly designate areas where hydraulic clam dredging might continue in the Great South Channel Habitat Management Area (GSC HMA). The purpose of the HMA is to minimize, to the extent practicable, the adverse effects of regional fisheries on essential fish habitat (EFH). This action is needed to identify areas where fishing for surfclams with hydraulic dredges would have only

minimal and temporary impacts on the habitats in the HMA. The purpose of this action is to evaluate potential suitable areas within the GSC HMA using metrics related to habitat and fishing characteristics, for example sediment type, area swept, and fishery revenues.

Objectives: Objectives for the exemption program were not specifically articulated in the Clam Dredge Framework. Based on the problem statement and purpose and need from the Council's framework that developed the exemption program, the implied objectives of the clam and mussel dredge exemption include:

1. Minimize, to the extent practicable, the impacts of fishing on essential fish habitats within the Great South Channel HMA.
    a. Provide protection for spawning cod
    b. Minimize the disturbance of complex habitats
2. Provide access to areas within the GSC HMA to create fishing opportunities and support achievement of optimum yield in the surfclam fishery.

Description of the Clam and Mussel Dredge Exemption Program

As described above, the Great South Channel HMA was designated via OHA2 as a closure to all MBTG[1], which are defined in the fishery regulations for the northeastern United States as "gear in contact with the ocean bottom, and towed from a vessel, which is moved through the water during fishing in order to capture fish, and includes otter trawls, beam trawls, hydraulic dredges, non-hydraulic dredges, and seines (with the exception of a purse seine)" (50 CFR 648.2). The exemption program establishes specific conditions under which the MBTG restrictions do not apply. A summary of the program is available from NOAA, here. The gear and monitoring program requirements are described here because the report will evaluate patterns of effort under the program including any issues or challenges encountered with reporting. The 5-minute VMS polling rate differs from that used on non-exemption surfclam trips but was deemed necessary to enforce these relatively small exemption areas sited near one another.

Fishing areas: The exemption program allows fishing in two year-round areas and one seasonal area, which are all within the GSC HMA (Map 1). These areas are McBlair (year-round), Old South (closed November 1-April 30, open May 1-October 31), and Fishing Rip (year-round).

Monitoring requirements: All vessels fishing in the exemption areas are required to use clam or mussel dredges and to request an annual letter of authorization (LOA) to fish under the exemption program. The purpose of the LOA is to identify the vessels interested in accessing the HMA to ensure that vessels have the necessary permits and a type-approved Vessel Monitoring System (VMS) unit capable of being triggered remotely by the NOAA Office of Law Enforcement (NOAA OLE) to send location positions every 5 minutes beginning when the vessel approaches the GSC HMA boundary. The VMS units for vessels participating in the program automatically send the vessel's location every 5 minutes any time the vessel crosses the

[1] These gear restrictions apply to any vessels using these gears within the HMAs, regardless of which fishery they are used in or which Council manages that fishery. The Clam Dredge Framework updated the New England Council's Atlantic Herring, Atlantic Sea Scallop, Monkfish, Northeast Multispecies, Red Crab, and Skate Complex Fishery Management Plans.

3-nm boundary line. Vessel operators must use their VMS system to declare into the GSC HMA fishery, and vessels can only fish within exemption areas during these trips. A trip-level declaration via VMS alerts NOAA OLE to monitor vessel speed and position in real time. Regulations are available here: https://www.ecfr.gov/current/title-50/part-648/subpart-Q#p-648.370(h)(2).

The exemption program offers flexibility in terms of fishing areas and fishing operations. Vessels are allowed to fish within multiple sub-areas per trip, accounting for any open and closed seasons, but clam or mussel dredges need to be on deck while transiting between areas. Hydraulic hoses used with clam dredges can remain in the water during transit between areas. There are no speed requirements when fishing or transiting. Vessels are encouraged to transit the closed portions of the HMA at higher speeds and report extended low-speed, non-fishing activities along the boundaries of the exemption areas to NOAA OLE.

Mussel dredging requirements: Any mussel dredge vessel fishing in the exemption areas within the GSC HMA is required to have a surfclam permit, because there is no federal mussel permit. The surfclam permit triggers VMS[2] and vessel trip report (VTR) requirements.

Objective of this Program Evaluation

As noted above, the objective of this report is to evaluate the effectiveness of the exemption areas in the HMA from both habitat conservation and surfclam fishery perspectives, considering recent data and information. Both perspectives are considered here because the areas were established to provide access to the surfclam resource while minimizing hydraulic dredge impacts to sensitive habitats, to the extent practicable. While some Council management programs have evaluation requirements established in federal fishery regulations, this exemption program does not; therefore, Council discussions, including those of Executive Committee and Habitat Committee, were used to establish the objective for this evaluation.

This report provides background on the exemption program, summarizes recent habitat and fishery data related to the Great South Channel HMA and exemption program, and examines tradeoffs that the Council could consider when discussing continuation or modification of the current exemption program in a future management action. Key questions include:

- Is the exemption program minimizing, to the extent practicable, the effects of fishing on essential fish habitats in the Great South Channel HMA?
    - How do EFH designations revised in 2025, or being revised during 2026, contribute to our current understanding of the value of the HMA as habitat for managed fish and shellfish species?
    - How much habitat disturbance is estimated to be occurring within the HMA now,

[2] A separate VMS declaration has been established for fishing in the exemption areas with mussel dredge gear. Additional requirements include: 1) mussel dredges may be no wider than 8 ft (2.4 m) measured at the widest point in the bail of the dredge; 2) vessels are not permitted to fish for, harvest, possess, or land any species other than mussels and sea urchins; and 3) vessels may not fish for, harvest, possess, or land any species other than mussels when on a declared mussel exemption trip. These requirements are consistent with the existing regulations associated with the Nantucket Shoals Mussel and Sea Urchin Dredge Exemption Area, which fully encompasses the clam and mussel dredge exemption areas.

as compared to pre-designation, based on the results of the Fishing Effects Model?
    - Is there any new information about cod spawning activities within or directly adjacent to the Great South Channel HMA and exemption areas that would help determine any seasonal presence of spawning cod? Are the area-based and seasonal restrictions on fishing within the Great South Channel protective of potential cod spawning activity? *Note that there are likely not sufficient area-based data to evaluate the effectiveness of the current restrictions on spawning cod.*
    - How has recent research impacted our understanding of habitats in the Great South Channel HMA, including habitat characteristics, spatial distribution, and change in quality and/or quantity over time because of fishing and/or natural disturbance?
- Is the exemption program effective in providing access to areas within the Great South Channel HMA to create fishing opportunities and support achievement of optimum yield in the surfclam fishery?
    - How much yield has been generated from the exemption areas and how has that changed over the course of the exemption program?
    - How many vessels and fishing businesses are participating in the exemption program and has this changed since the program was implemented?
    - Are all exemption areas being used? What are the patterns of fishing effort within the three exemption areas and the relative importance of each to surfclam fishery yield? For additional context, how has surfclam harvest from the research areas contributed to total yield from the Great South Channel HMA?

Research areas within the Great South Channel HMA and recent EFP-based projects

The Clam Dredge Framework (NEFMC, 2019) considered additional areas as potential exemption areas; two of these, Rose and Crown and Davis Bank, were adopted as research areas when the Council took final action on the framework in December 2018. Their purpose was to allow fishing activity under an exempted fishing permit (EFP), which could support the potential development of additional exemptions in the future. Information from projects conducted in these research areas is summarized and evaluated in this report to the extent that it informs evaluation of the exemption program. Specifically, the two projects described below collected data on habitats and surfclam resource conditions in the research areas, and the second project evaluated how habitat conditions change over time due to fishing and natural disturbance. Additional details about these studies are provided in Appendix A.

The Council adopted a list of research objectives for the GSC HMA in 2019, as follows:

- 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).
- Improve the Council's understanding of habitat stability including epifaunal persistence in relation to substrate type, tidal flows and storm events. 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.
- Improve the Council's understanding of why the GSC HMA is important to managed species, such as Atlantic cod.

In addition to describing these objectives and the Council's and NOAA's roles in the process, the research objectives document provides guidance on how data would ideally be collected (e.g., build on existing work with similar methodologies, emphasize statistical rigor, reassess habitat conditions over time to show spatiotemporal change, etc.).

Coonamessett Farm Foundation completed two research projects in the Great South Channel HMA under EFPs 19066 (2020-2022) and 23073 (2024-2026). Nantucket Sound Seafood (F/V Seafox) and Intershell (F/V Tom Slaughter) participated in the research, providing platforms for collecting data and conducting compensation fishing trips. A timeline of EFP-based research projects is provided at the end of this report (Table 10). No additional EFPs are currently available for public comment as of August 2026.

- **EFP 10966 (2020-2022):** This project used a forward-facing hydraulic dredge mounted camera to document substrate, habitat features, fishes, and invertebrates within the Rose & Crown research area. Spatiotemporal maps of biotic and abiotic habitat features were created using the data collected. Catch of surfclams per unit effort was documented and compared to the habitat information to better understand and characterize surfclam habitat type. The project also sought to document habitat preferences of Atlantic cod but was not fully successful in doing so, since baited underwater video sampling efforts were limited and BUV videos were not high enough quality for annotation.
    - **Council comment letters:** February 5, 2020, in support of issuing the EFP **(**link); October 19, 2022 general comments on future EFP-based research, developed based on review of EFP 19066 Final Report (link)
    - **Final EFP report with results:** June 15, 2022 (link)
    - **PDT memorandum on utility of Final EFP report** (link)

- **EFP 23073 (2024-2026):** EFP 23073 built upon EFP 19066, and incorporated methodological changes suggested by the Council such as separating fishing from habitat surveys and comparing surveyed areas through time. This project included multiple optical (drop camera) and acoustic (multibeam) surveys of a portion of the Davis Bank East research area, and compensation fishing in the Davis Bank East and Rose & Crown research areas. The optical survey generated data on the occurrence of different benthic substrate components (gravel, epifauna, shell hash) at each survey station. These were used to groundtruth backscatter data collected via the multibeam acoustic surveys.
    - **Final report:** August 20, 2026 (provided with September 2026 Council materials)
    - **PDT meeting summary:** August 4, 2026 (link)
    - **Council comment letters:** April 1, 2024 comments as GARFO considered initially issuing the EFP (link); July 1, 2025 related to EFP compensation fishing location adjustment (link); and June 1, 2026 related to EFP adjustment for extension (link)

The data collection methods and research locations differed across the two projects so the results cannot be compared directly, but both projects provide the Council with data on the occurrence of seafloor habitat types in selected portions of the Great South Channel HMA. Also, both projects provide information on the habitat types within which clam dredging occurred. Compensation fishing generated estimates of catch per unit effort that can be compared with other locations through to the northeast shelf. Compensation fishing data can also be used by the Council to better understand the spatial footprint of fishing activity for estimating fishing gear effects (i.e., to refine swept area estimates that are used in the Fishing Effects Model). The latter project (EFP 23073) also provides data on seafloor changes over time in the Davis Bank area. This addresses the Council research objective related to understanding habitat stability. Habitats and clam resource conditions through the Great South HMA are highly heterogeneous, so extrapolation of research results to other sections of the HMA should be done thoughtfully, as seafloor features and clam yield are not the same between different locations. Generally, the EFP-based project results are useful for understanding habitat conditions in parts of the HMA and for estimating tradeoffs between habitat impacts of dredging and fishery yields.

Exemption and research area map and coordinates

Map 1. Great South Channel Habitat Management Area, Clam and Mussel Dredge Exemption Areas (outlined in green and red), and Research Areas (outlined in black).

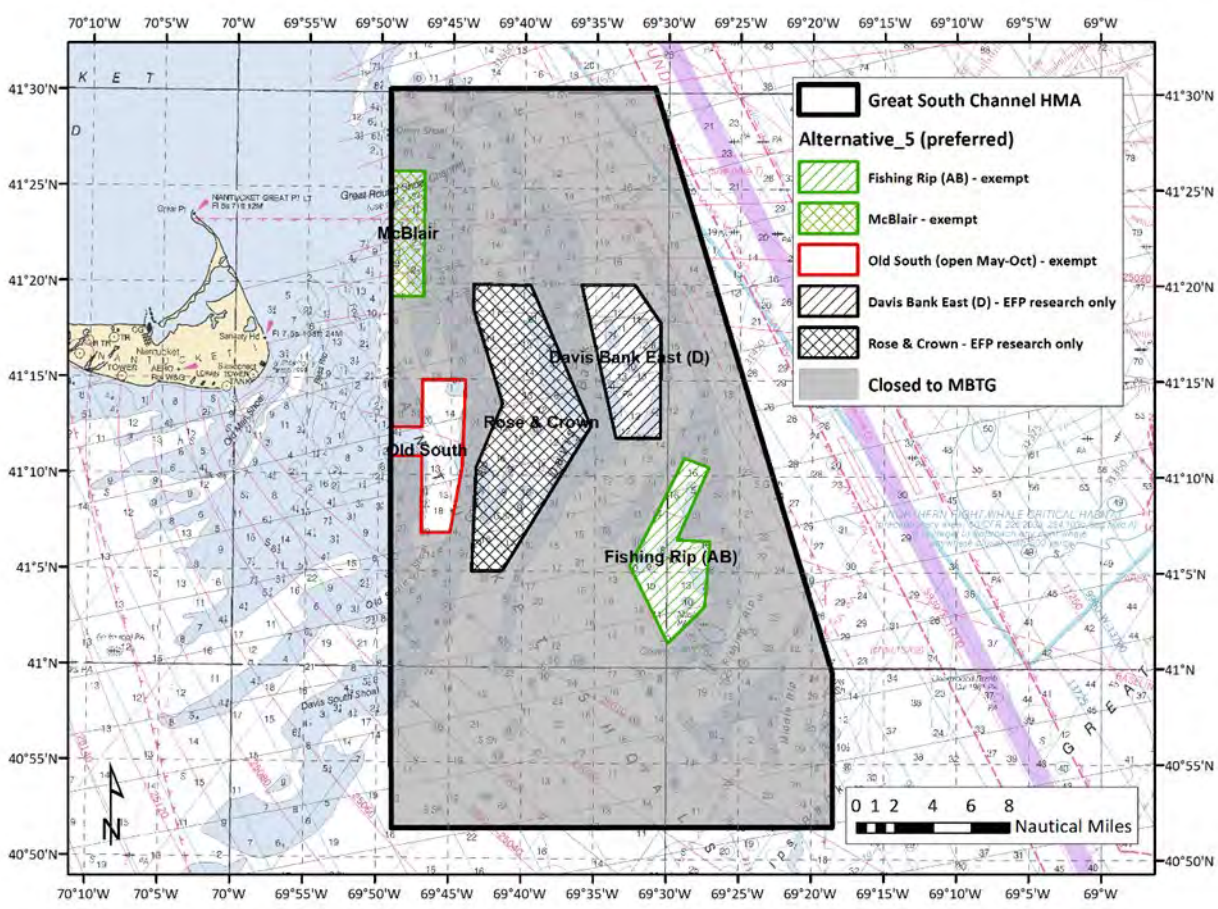


Table 1. Coordinates for research areas. Exemption area coordinates are available at 50 CFR 648.370(h)(2).

Area name	Point	Longitude	Latitude
Davis Bank East (research)	1	-69° 35.999' W	41° 20' N
	2	-69° 32.311' W	41° 19.988' N
	3	-69° 30.493' W	41° 18.009' N
	4	-69° 30.508' W	41° 11.997' N
	5	-69° 33.561' W	41° 12' N
Rose and Crown (research)	1	-69° 43.5' W	41° 20' N
	2	-69° 39.54' W	41° 19.949' N
	3	-69° 35.324' W	41° 12.601' N
	4	-69° 41.388' W	41° 5.009' N
	5	-69° 43.5' W	41° 5' N
	6	-69° 43.254' W	41° 10.431' N
	7	-69° 41.436' W	41° 13.773' N
	8	-69° 43.5' W	41° 18.711' N

Habitat and Managed Species Information since OHA2 and Clam Dredge FW

The objective of the exemption program is to minimize, to the extent practicable, the impacts of fishing on essential fish habitats within the Great South Channel HMA. Sub-objectives are to protect cod spawning and complex habitat from the impacts of fishing.

Habitat conditions on Nantucket Shoals

The candidate exemption areas evaluated in the Clam Dredge Framework were designed to encompass historically fished areas, as determined by a combination of VMS and logbook data from 2010-2017. No exemption areas were considered in the northeastern corner of the HMA, because during development of OHA2 this area was estimated to have more pebble, cobble, and boulder sediments than other portions of the HMA (OHA2 Vol. 4, Table 30). Most of this corner appears to have been lightly fished between 2010-2017, prior to the Great South Channel HMA designation (Clam Dredge Framework, Maps 23-24). The impacts analysis in the framework evaluated the extent to which fishing in the exemption areas with clam or mussel dredges might negatively impact seabed habitat structure and function and thus reduce their value to managed species.

The Clam Dredge Framework built upon sediment maps developed during OHA2, examining not just dominant sediment classification but also percent cover of different sediment types and epifauna distributions, specifically identifying locations where (1) areal coverage of pebble, cobble, and boulder sediments was less than 10% vs. greater than 10%, (2) where long-lived epifauna were present, and (3) where there was greater than 30% coverage of epifauna. This analysis was based on drop camera data collected at 474 station locations between 2006-2015; methods were summarized as Appendix A and the results were summarized in section 5.1 of the framework document. Complex habitats were evident in the Rose & Crown, Davis Bank East, and Fishing Rip areas and other parts of the HMA. The Clam Dredge Framework noted very high benthic boundary shear stress estimates on the shoals (roughly 1-4 n/m^2, Harris et al. 2012), which exceeds the critical stress threshold for sediment mobility most of the year (Dalyander et

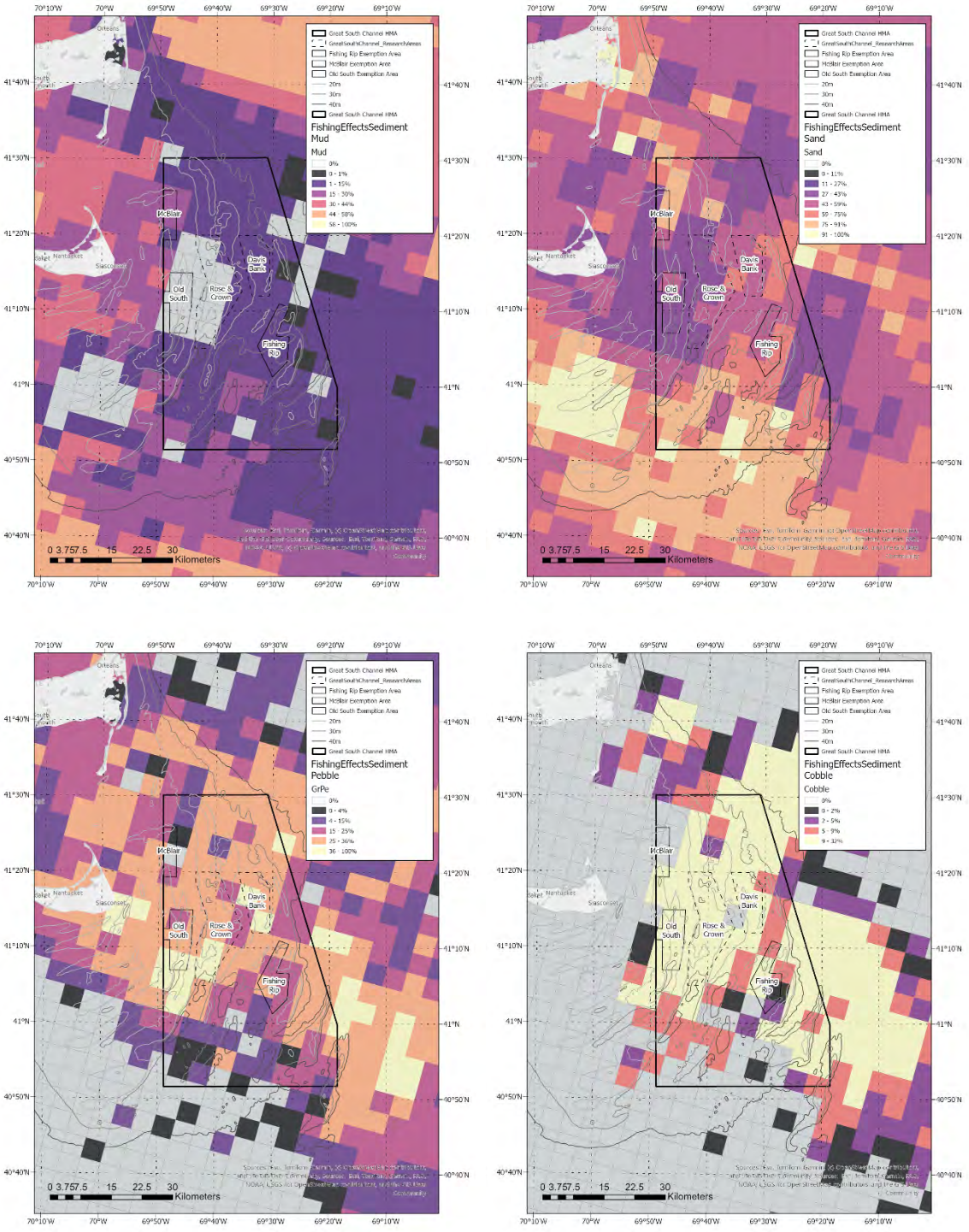
al. 2013).

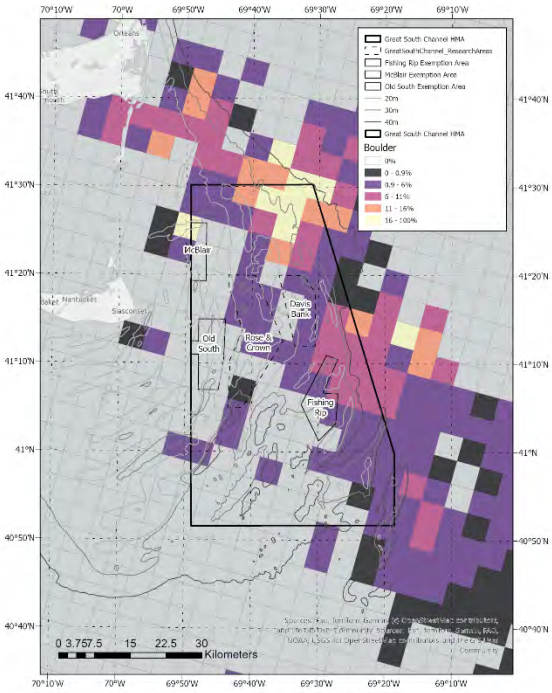
There were limitations to the image analysis included with the Clam Dredge Framework. Davis Bank East and Fishing Rip were not well sampled, and the McBlair and Old South areas were not examined at all in this analysis due to lack of data. Data were pooled across all years and an assessment of habitat change through time at specific locations was not possible given the data available. The imagery did show evidence of moving sand.

Generally, the Clam Dredge Framework analyses indicated that complex habitats occurred throughout the HMA, including in locations where clam dredging occurred between 2010-2017. The sediment data underpinning the Fishing Effects Model indicates that mud and boulder sediments are relatively uncommon in the Great South Channel HMA, and that sand, pebble, and cobble sediments predominate.

The two EFP studies provide new information on habitat conditions. EFP 23073 found that overall, the Davis Bank East research area is highly dynamic, with noted movement of bedforms between surveys. The substrate is heavily dominated by pebble-sized gravels in some locations and sand in other locations, with shell hash common in some areas. Cobble- and boulder-sized gravels were relatively uncommon in this part of the GSC HMA. Epifauna consisted mostly of hydroids, bryozoans, and barnacles. The optical survey generated data on the occurrence of different benthic substrate components (gravel, epifauna, shell hash) at each survey station. These were used to groundtruth backscatter data collected via multibeam surveys. The study found that the backscatter values in the Davis Bank East research area accurately discriminated between sand wave vs. gravel bottom but could not reliably identify areas with vs. without epifauna unless they were verified with the optical data. The multibeam data were used to compile bathymetry maps at a high 25-cm spatial resolution. By comparing the bathymetry maps over the three survey periods, the team found that sand waves generally migrated in a northeast to southwest direction and used the difference in bathymetry values to estimate net sediment movement into and out of the research area.

Map 2. Sediment distribution assumed in the Fishing Effects model. Color ramps vary by grain size. Continued on next page. Panels in order from left to right, top to bottom: Mud, Sand, Pebble (pebble-sized gravels), Cobble, and Boulder.

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McBlair
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Fishing Rip Exemption Area
Hotdog exemption Area
Old South Exemption Area
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30m
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Great South Channel HMA
Boulder
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0 - 0.9%
0.9 - 6%
6 - 11%
11 - 16%
16 - 100%
0 3.757.5 15 22.5 30
Kilometers

Species-specific habitat use within the HMA

A small number of Council-managed species were noted as occurring in the GSC HMA in the Clam Dredge Framework (NEFMC, 2019): Atlantic cod, winter flounder, windowpane flounder, yellowtail flounder, little skate, winter skate, and sea scallop. For each species and life stage, the degree of overlap with designated EFH, the species association with complex substrates, and whether one or more stocks was overfished were evaluated (Clam Dredge Framework, Table 4). The relative importance of candidate Habitat Management Areas to groundfish species was evaluated using hotspot analysis during OHA2 (OHA2, Vol. 5, Section 2). A challenge with this analysis is that large portions of the Great South Channel HMA overlapping Nantucket Shoals are not surveyed in fishery independent trawl surveys. Overlap with Mid-Atlantic Council managed species was not specifically considered in the Clam Dredge Framework analysis, but the impacts of Great South Channel HMA designation were assessed for these species in OHA2 (Vol. 5).

Beginning in late 2018, coincident with final Council action on the Clam Dredge Framework, the New England and Mid-Atlantic Councils began work on the Northeast Regional Fish Habitat Assessment (NRHA). This assessment included a detailed investigation of federal and state fishery independent survey data and development of species distribution models (SDM), amongst other elements. Work on NRHA wound down in mid-2022, and personnel involved in the assessment pivoted to focus on an EFH Review. During the review, both Councils collaborated to develop updated EFH designation methods based on species distribution model outputs paired with inshore survey and environmental data. Other EFH review elements included updated Fishing Effects modeling (see below).

Following completion of the EFH review in early 2025, both Councils began development of EFH designation actions to update their respective fishery management plans. The New England Council approved updated EFH designations for skates, Atlantic cod, Atlantic herring, and monkfish in September 2025. The framework document and EFH maps have been finalized and final NOAA approval and implementation are pending (NEFMC, 2025). Designations for all Mid-Atlantic species were approved by the Mid-Atlantic Council in April 2026; the amendment document and EFH maps have been finalized and final NOAA approval and implementation is pending (MAFMC, 2025). The New England Council's 2026 EFH Framework is currently in the final stages of development and is scheduled for final action in September. This action will update EFH maps for all remaining large mesh groundfish, small mesh groundfish, and scallops. Updated EFH designations for Atlantic salmon and Deep-Sea Red Crab are forthcoming, likely during 2027, but these two species do not occur in the GSC HMA.

Updated EFH information, including species distribution model outputs, can be used to understand which managed species are likely to occur in the GSC HMA and their relative abundance. Here, we address the following questions (Table 2), with the corresponding metrics for answering the questions based on recent information:

Table 2. Evaluation questions and metrics to understand species habitat use in the Great South Channel HMA

Question	Information source / metric
Which species (juveniles and/or adults) occur in the GSC HMA / on Nantucket Shoals?	Overlap of the updated EFH designation map for a given species and life stage and the GSC HMA
What is the relative importance of the GSC HMA as habitat for the species and life stages found in this area, as compared to other parts of the Northeast U.S. region?	Top 25% EFH density quantiles and top 25% cumulative density quantiles (i.e., relatively high predicted densities according to SDMs)
Based on updated EFH and SDM information, do exemption areas have higher degree of overlap of species vs. other parts of the HMA?	Magnitude of overlap of high species predicted density areas with exemption areas
Are there seasonal differences in habitat use within the HMA?	Differences in species distribution and predicted density between spring and fall seasons (seasons when the trawl survey is conducted)
Have there been shifts in species distribution onto/away from the shoals in the last ~10 years?	Products that indicate increase, decrease, or no change in density from 2002-2022 (SDM outputs, etc.)

Species distributions within the Great South Channel HMA

Because designated EFH is relatively generous / inclusive, overlap between the GSC HMA boundaries and the EFH map footprint is used to indicate whether the species occurs in the GSC HMA. Table 3 identifies whether a species has designated EFH within the GSC HMA.

The model outputs that form the basis of the EFH designation can be plotted using quantiles to show where higher densities of the species and life stages are predicted to occur. The 25%, 50%, and 75% quantiles (yellow, green, and blue) are combined to form the basis of the EFH map, and the 95% quantile (purple) reflects lower density areas. Areas with the lowest 5% of predicted density are not shown. Appendix B provides figures for most species which have designated EFH in the Great South Channel; quantile data for selected species were unavailable during preparation of this report and are not included.

The densities mapped here reflect a mean/maximum approach. All plots were developed by first calculating the mean density value in each model grid cell across 22 years and then selecting the maximum mean density value across all months or a seasonal subset of months. Maximum values within the year are used to provide a conservative estimate of where a species and life stage might be abundant across the seasons. The 25% quantile, shown in yellow, represents the highest predicted densities. Table 3 identifies whether this 25% “hotspot” quantile overlaps the HMA. Map 3 shows an example output for adult cod.

Another way to represent the model results is using cumulative quantiles. In these figures, the 25% quantile shows where the top 25% of fish (by counts, not weights) are estimated to occur.

These cumulative quantile plots provide a more focused look at which locations are expected to provide habitat for larger numbers of animals. Map 4 shows an example output for adult cod. The cumulative density hotspots for adult cod are generally outside the area shown on this map and are concentrated in the western Gulf of Maine.

Managed species habitat overlaps with the Great South Channel HMA are listed below and in Table 3, ordered from strongest overlap to least overlap. Maps are provided at the end of this document.

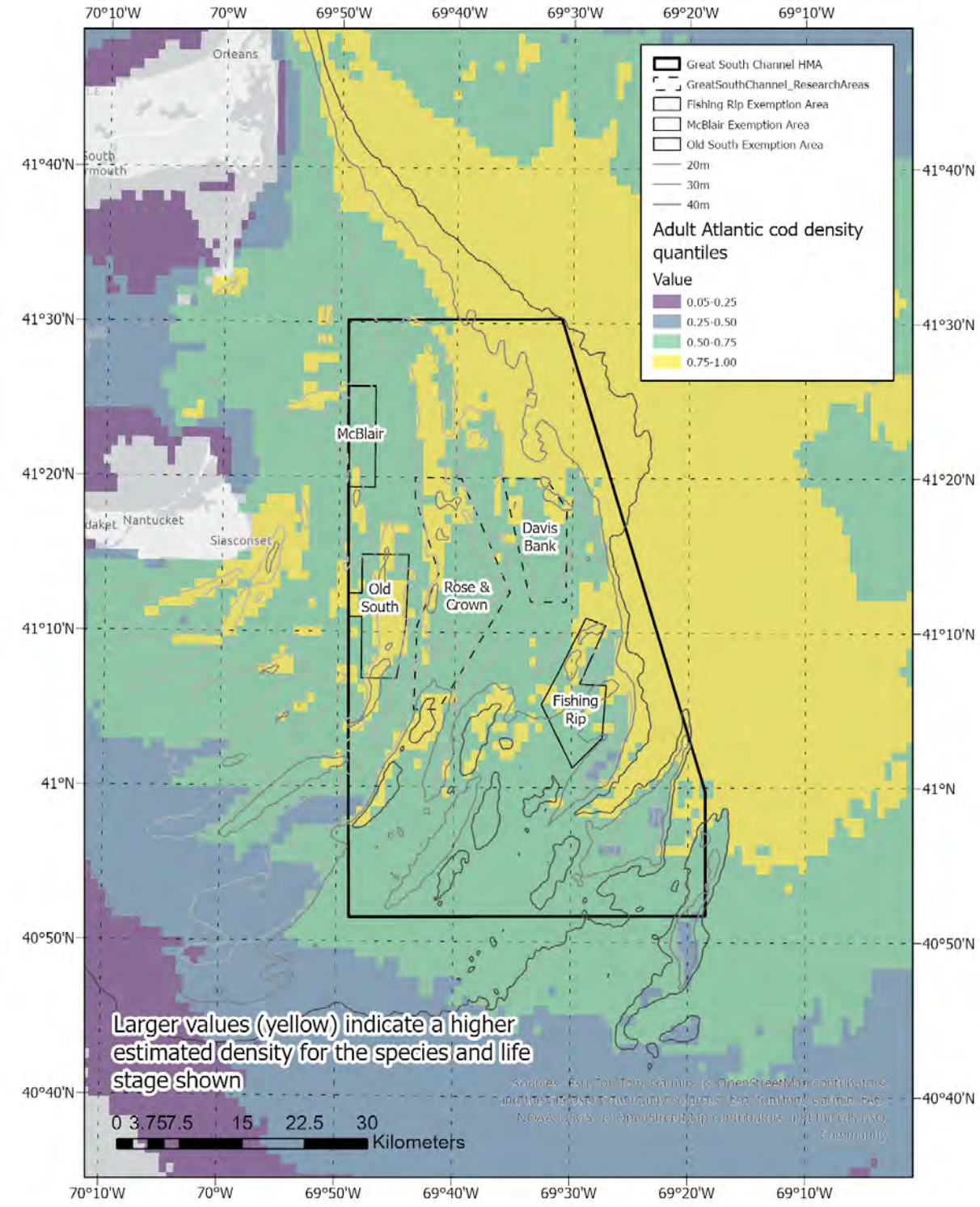
- **Species where cumulative hotspot (top 25%) density quantiles overlap with the HMA:** Butterfish (J), little skate (J&A), longfin squid (J), red hake (J), spiny dogfish (A), windowpane flounder (A), winter flounder (A), winter skate (J&A)
- **Species where EFH hotspot (top 25%) density quantiles overlap with the HMA:** species listed above, plus Atlantic cod (J&A), black sea bass (J), longfin squid (A), shortfin squid (J), pollock (J), scup (A), windowpane flounder (J), winter flounder (J), yellowtail flounder (J), Atlantic herring (J), Atlantic mackerel (J), Atlantic surfclam (all stages), bluefish (A), sea scallop (all stages), summer flounder (A)
- **Species where EFH is designated within the HMA:** species listed above, plus Atlantic wolffish (J), Atlantic herring (A), Atlantic mackerel (A), barndoor skate (J&A), black sea bass (A), bluefish (J), butterfish (A), haddock (J&A), monkfish (A), shortfin squid (A), ocean pout (J&A), ocean quahog (all stages), red hake (A), silver hake (J&A), spiny dogfish (J), white hake (J), yellowtail flounder (A)
- **Species where EFH is not designated within the HMA:** Acadian redfish, American plaice, Atlantic halibut, Atlantic wolffish (A), blueline tilefish, clearnose skate, golden tilefish, monkfish, offshore hake, pollock (A), rosette skate, smooth skate, summer flounder (J), thorny skate, white hake (A), witch flounder. **Refers to all life stages unless noted specifically; these species and lifestages are not included in tables below.**

Table 3. Species and life stage specific habitat use within the Great South Channel HMA, as indicated by species distribution models. An asterisk (*) indicates very minimal overlap. Species without an EFH designation in the Great South Channel HMA are not included in this table, but are listed in the text above. ** indicates species and life stages for which the cumulative hotspot data was not available at the time of report preparation.

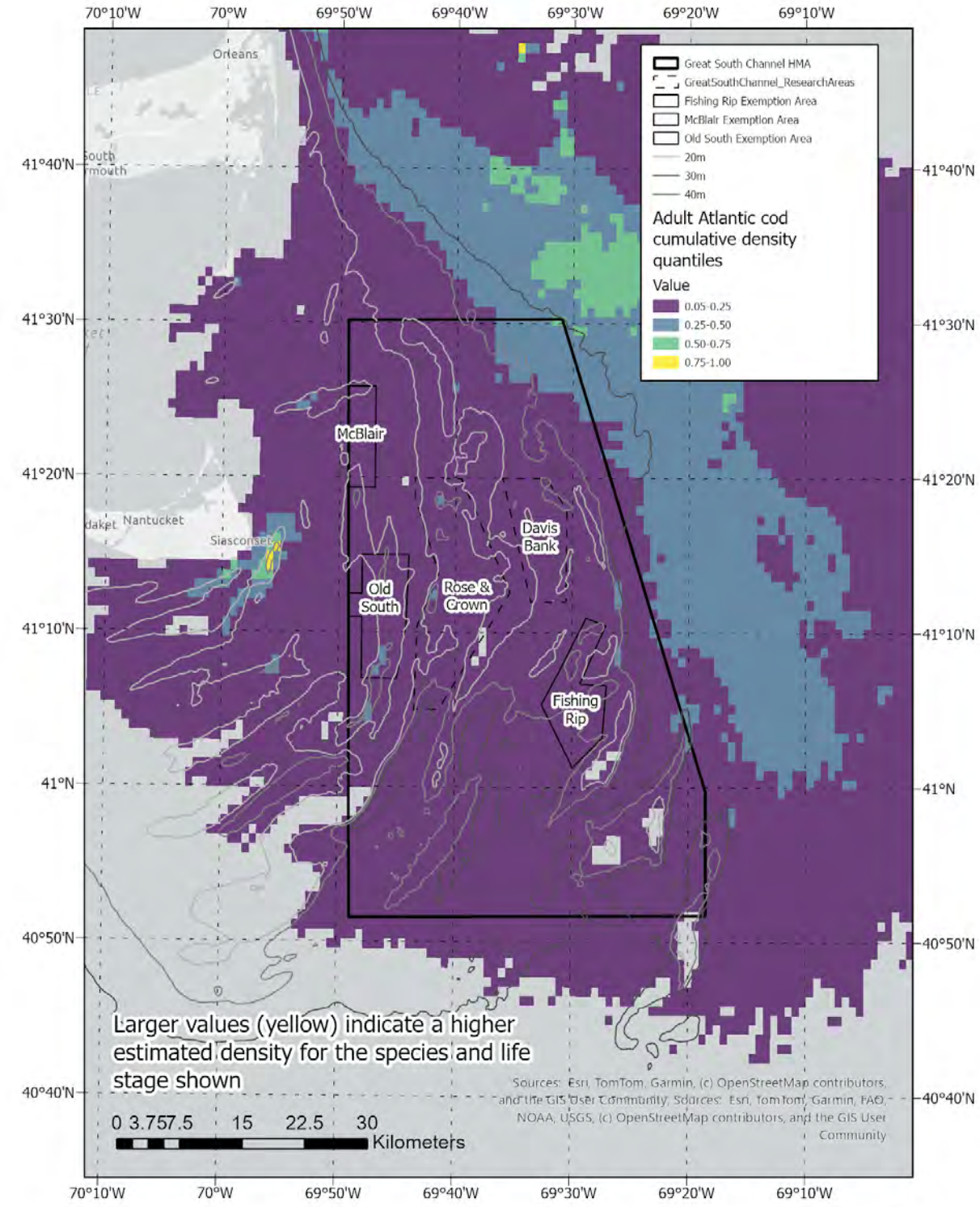
SPECIES	LIFE STAGE	EFH	EFH HOTSPOT (TOP 25%)	CUMULATIVE HOTSPOT (TOP 25%)	DEMERSAL OR PELAGIC
BUTTERFISH	Juvenile	Yes	Yes	Yes	Demersal
LITTLE SKATE	Adult	Yes	Yes	Yes	Demersal
LITTLE SKATE	Juvenile	Yes	Yes	Yes	Demersal
LONGFIN SQUID	Juvenile	Yes	Yes	Yes	Pelagic
RED HAKE	Juvenile	Yes	Yes	Yes	Demersal
SPINY DOGFISH	Adult	Yes	Yes	Yes	Demersal
WINDOWPANE FLOUNDER	Adult	Yes	Yes	Yes	Demersal
WINTER FLOUNDER	Adult	Yes	Yes	Yes	Demersal
WINTER SKATE	Adult	Yes	Yes	Yes	Demersal
WINTER SKATE	Juvenile	Yes	Yes	Yes	Demersal

SPECIES	LIFE STAGE	EFH	EFH HOTSPOT (TOP 25%)	CUMULATIVE HOTSPOT (TOP 25%)	DEMERSAL OR PELAGIC
SCUP	Juvenile	Yes	Yes	Yes*	Demersal
ATLANTIC COD	Adult	Yes	Yes	No	Demersal
ATLANTIC COD	Juvenile	Yes	Yes	No	Demersal
BLACK SEA BASS	Juvenile	Yes	Yes	No	Demersal
LONGFIN SQUID	Adult	Yes	Yes	No	Pelagic
NOTHERN SHORTFIN SQUID	Juvenile	Yes	Yes	No	Pelagic
POLLOCK	Juvenile	Yes	Yes	No	Demersal
SCUP	Adult	Yes	Yes	No	Demersal
WINDOWPANE FLOUNDER	Juvenile	Yes	Yes	No	Demersal
WINTER FLOUNDER	Juvenile	Yes	Yes	No	Demersal
YELLOWTAIL FLOUNDER	Juvenile	Yes	Yes	No	Demersal
ATLANTIC HERRING	Juvenile	Yes	Yes	**	Demersal
ATLANTIC MACKEREL	Juvenile	Yes	Yes	**	Pelagic
ATLANTIC SURFCLAM	All	Yes	Yes	**	Demersal
BLUEFISH	Adult	Yes	Yes	No	Pelagic
SEA SCALLOP	All	Yes	Yes	**	Demersal
SUMMER FLOUNDER	Adult	Yes	Yes*	No	Demersal
ATLANTIC WOLFFISH	Juvenile	Yes*	No	No	Demersal
ATLANTIC HERRING	Adult	Yes	No	No	Pelagic
ATLANTIC MACKEREL	Adult	Yes	No	No	Pelagic
BARNDOOR SKATE	Egg, Juvenile, Adult	Yes	No*	No	Demersal
BLACK SEA BASS	Adult	Yes	No	No	Demersal
BLUEFISH	Juvenile	Yes	No	No	Pelagic
BUTTERFISH	Adult	Yes	No	No	Pelagic
HADDOCK	Adult	Yes	No	No	Demersal
HADDOCK	Juvenile	Yes	No*	No	Demersal
MONKFISH	Adult	Yes	No	No	Demersal
NORTHERN SHORTFIN SQUID	Adult	Yes	No*	No	Pelagic
OCEAN POUT	Adult	Yes	No	No	Demersal
OCEAN POUT	Juvenile	Yes	No	No	Demersal
OCEAN QUAHOG	All	Yes	No	No	Demersal
RED HAKE	Adult	Yes	No	No	Demersal
SILVER HAKE	Adult	Yes	No	No	Demersal
SILVER HAKE	Juvenile	Yes	No	No	Demersal
SPINY DOGFISH	Juvenile	Yes	No*	No	Demersal
WHITE HAKE	Juvenile	Yes	No*	No	Demersal
YELLOWTAIL FLOUNDER	Adult	Yes	No*	No	Demersal

Map 3. Estimated adult Atlantic cod density – EFH quantiles. Hotspot densities (top 25%) shown in yellow.



Map 4. Estimated adult Atlantic cod density – cumulative quantiles. Hotspot densities (top 25%) shown in yellow.



Species distributions within exemption areas

Overlap with the exemption areas and species distributions was assessed qualitatively. Generally, depth in the HMA is shallowest in the northwest corner, where the McBlair exemption area is located, and deepest in the southeast corner, where no exemption areas occur. Shallower water species generally overlap the exemption areas, whereas species occurring only on the deeper eastern/southeastern edges of the HMA have less overlap.

Table 4. Overlap between exemption areas and designated EFH, EFH hotspots, and cumulative hotspots. See appendix for maps.

EXEMPTION AREA	DESIGNATED EFH	EFH HOTSPOT	CUMULATIVE HOTSPOT
MC BLAIR	Species in both hotspot columns, plus: Atlantic wolffish (J), Atlantic herring (J&A), Atlantic mackerel (J&A), barndoor skate (J&A), black sea bass (A), bluefish (J), butterfish (A), haddock (J&A), longfin squid (A), monkfish (A), shortfin squid (A), ocean pout (J&A), ocean quahog (all stages), red hake (A), silver hake (J&A), spiny dogfish (J), white hake (J), yellowtail flounder (A)	Species in cumulative hotspot column, plus: Atlantic cod (J&A), black sea bass (J), little skate (J), pollock (J), scup (A), shortfin squid (J), summer flounder (A), windowpane flounder (J), winter flounder (J), yellowtail flounder (J)	Butterfish (J), little skate (A), red hake (J), scup (J), spiny dogfish (A), windowpane flounder (A), winter skate (J&A)
OLD SOUTH	Species in both hotspot columns, plus: Atlantic wolffish (J), Atlantic herring (J&A), Atlantic mackerel (J&A), barndoor skate (J&A), black sea bass (A), bluefish (J), butterfish (A), haddock (J&A), longfin squid (A), monkfish (A), shortfin squid (A), ocean pout (J&A), ocean quahog (all stages), red hake (A), silver hake (J&A), spiny dogfish (J), white hake (J), yellowtail flounder (A)	Species in cumulative hotspot column, plus: Atlantic cod (J&A), black sea bass (J), bluefish (A), pollock (J), scup (A), shortfin squid (J), summer flounder (A), windowpane flounder (J), winter flounder (J), yellowtail flounder (J),	Butterfish (J), little skate (J&A), red hake (J), scup (J), spiny dogfish (A), windowpane flounder (A), winter flounder (A), winter skate (J&A)
FISHING RIP	Species in both hotspot columns, plus: Atlantic wolffish (J), Atlantic herring (J&A), Atlantic mackerel (J&A), barndoor skate (J&A), black sea bass (A), bluefish (J), butterfish (A), haddock (J&A), longfin squid (A), monkfish (A), pollock	Species in cumulative hotspot column, plus: Atlantic cod (J&A), bluefish (A), red hake (J), scup (J&A), shortfin squid (J), windowpane flounder (J), winter flounder (J), yellowtail	Little skate (J&A), longfin squid (J), spiny dogfish (A), windowpane flounder (A), winter flounder (A), winter skate (J&A)

EXEMPTION AREA	DESIGNATED EFH	EFH HOTSPOT	CUMULATIVE HOTSPOT
	(J), shortfin squid (A), ocean pout (J&A), ocean quahog (all stages), red hake (A), silver hake (J&A), spiny dogfish (J), summer flounder (A), white hake (J), yellowtail flounder (A)	flounder (J)	

Seasonal differences in habitat use

Difference is species distributions between fall and spring seasons is assessed by comparing the fall and spring model outputs (see Appendix D to each of the 2025 and 2026 EFH Frameworks). While this analysis should be considered preliminary, there are differences in species distributions across seasons that may be relevant to the design of management approaches for the HMA.

- 2025 EFH species (cod, herring, monkfish, skates): No differences in species overlap with the HMA across seasons, but some shifts in higher and lower density areas within the HMA
- 2026 EFH species (other large mesh groundfish, small mesh groundfish): No differences in species overlap with the HMA across seasons, but some shifts in higher and lower density areas within the HMA

Change in habitat use through time

Changes in distribution over time of select species were examined using species distribution models for the period 2002-2022. This evaluation focuses on species and life stages that have EFH hotspots or cumulative density hotspots in the Great South Channel HMA but could be expanded to include other species and life stages. While this analysis should be considered preliminary, it offers insights into which species are increasing or decreasing in density across their whole distribution, or with respect to the Great South Channel HMA.

Specifically, heatmaps were developed that show changes in model-predicted densities during March, April, May, September, October, and November across the 20-year period throughout the modeled region (i.e., trawl survey geographic range). These heatmaps illustrated whether the species and life stage showed an increasing, decreasing, or constant coastwide trend in predicted abundance, or if more seasonally or regionally mixed trends were evident. For mixed trends, we assessed whether the species estimated density had increased or decreased within the Great South Channel HMA. The magnitude of change varies by species and location but was not specifically addressed here. Future analyses using these models could investigate these trends in more detail. In addition, an ongoing Mid-Atlantic Council project should be useful for better understanding changes in the patterns of distribution for many managed species in the region.

Overall, there is evidence to suggest changes in densities for multiple species and life stages within the Great South Channel HMA. Table 5 highlights these trends for species and life stages with EFH or cumulative density hotspots specifically; below the table, we briefly expand on

species with mixed trends, including seasonal variation. The significance of these changes in terms of food web and other ecological relationships is not evaluated here. It would be reasonable for future analyses related to the HMA to further consider these shifts and their implications.

Table 5. Linear trends in species density estimated using species distribution models, 2002-2022. The magnitude of the increases and decreases varies by species. This analysis should be considered preliminary.

Relatively uniform coastwide trend		Mixed trends by location
Increasing trend in most areas coastwide	***Decreasing trend in most areas coastwide***	Black sea bass (J), Little skate (A), scup (A), Spiny dogfish (A), windowpane flounder (J&A), winter flounder (J&A), winter skate (J&A), yellowtail flounder (J)
Butterfish (J), little skate (J), longfin squid (J&A), red hake (J), shortfin squid (J)	Atlantic cod (J & A), bluefish (A), pollock (J)	

Discussion for mixed trend species and life stages:

- Black seabass juveniles show an increasing trend in the Mid-Atlantic Bight, but little to no change in estimated density is evident for the Great South Channel HMA region.
- Little skate adults show mixed trends coastwide, with increases in the HMA in the spring and decreases in the fall. The deeper margins of Georges Bank and the Great South Channel show increases in all months.
- Scup adults show no trend in the Great South Channel HMA in the spring, and an increasing trend in the fall.
- Spiny dogfish adults showed a decreasing trend in the Great South Channel HMA and in other areas of their range, but showed increasing trends elsewhere, including in deeper areas of the Great South Channel in the fall.
- Windowpane flounder juveniles and adults show an increasing trend in the Great South Channel HMA in both the spring and the fall, with a mix of increases and decreases in other locations.
- Winter flounder juveniles and adults show an increasing trend in the Great South Channel HMA in both the spring and the fall, with a mix of increases and decreases in other locations, including a decreasing trend in the fall in the shallower areas of Georges Bank south into Southern New England and the Mid-Atlantic Bight off New Jersey.
- Winter skate juveniles and adults show an increasing trend in the Great South Channel HMA in both the spring and the fall and in many other areas of their range, with neutral or decreasing trends evident in some months and areas.
- Yellowtail flounder juveniles show an increasing trend in the Great South Channel HMA in both the spring and the fall, with a mix of increases and decreases in other locations.

Species caught as bycatch in the research surveys

Some species were captured as bycatch in the Davis Bank and Rose & Crown research areas, in particular winter flounder, windowpane flounder, and unclassified skates, which could be little or winter skate (Jennings et al. 2026). Monkfish, summer flounder, black seabass, and barndoor skate were also caught during compensation fishing trips (Jennings et al. 2026). Since catchability of fishes in clam dredges is generally low, it is not possible to estimate abundance of these species on Nantucket Shoals from these data, but it does indicate that they are present in

parts of the GSC HMA. Additional fish observations were made using video, including a single Atlantic cod documented using baited underwater video. It would be interesting to compare EFP and model-based information on species distributions given the different methodologies and seasonal coverage of the summer EFP optical surveys vs. the spring and fall bottom trawl surveys.

Cod spawning on Nantucket Shoals

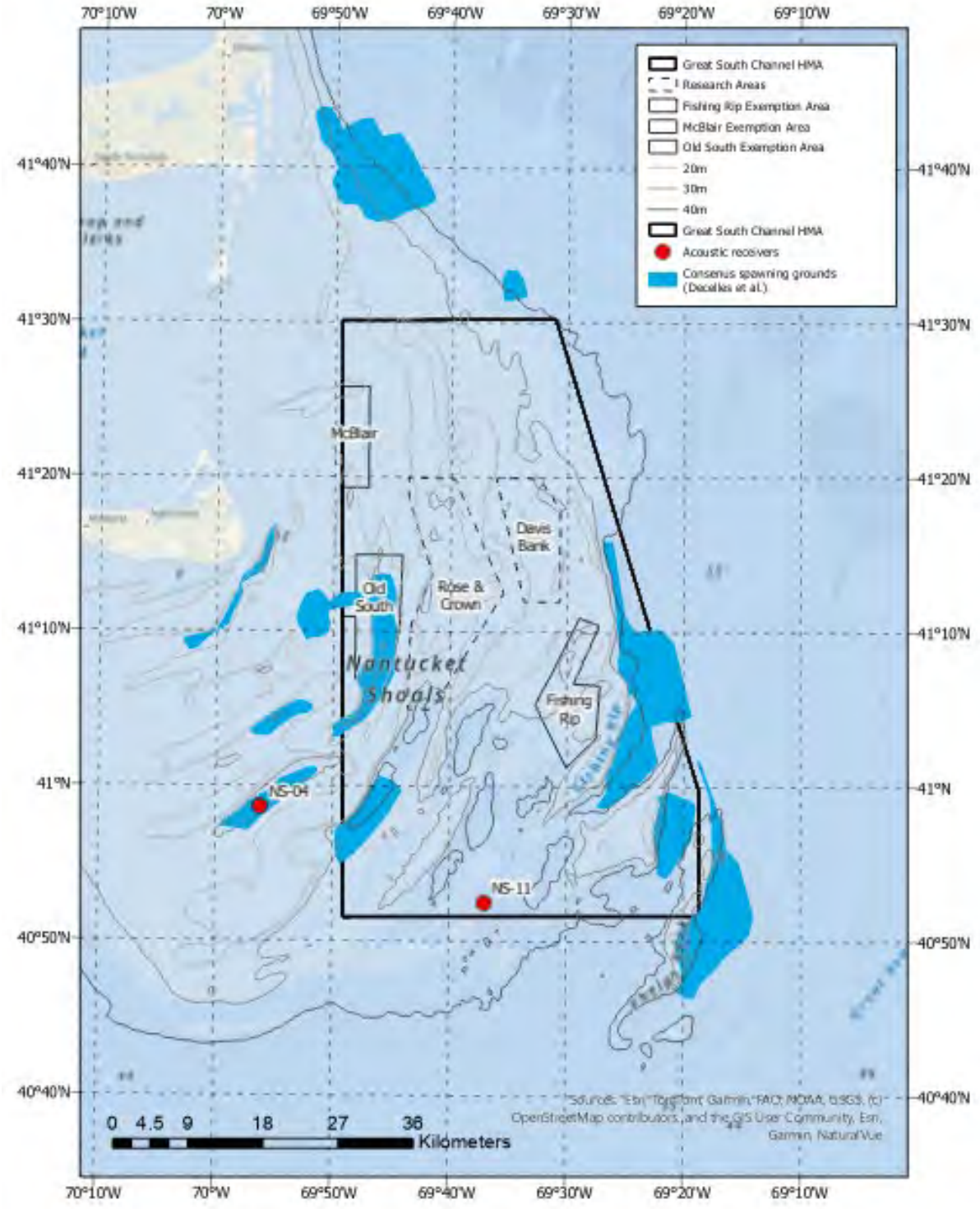
Nantucket Shoals is located within the Western Gulf of Maine cod stock area and was historically known to be a winter cod spawning ground, as identified using fisheries ecological knowledge (FEK, DeCelles, et al. 2017). Based on overlap with one of the FEK-identified spawning areas "Old South Shoal", the Old South surfclam exemption area was closed seasonally to limit disturbance to any cod that might be spawning in the area. It is unknown whether Atlantic cod presently use the Nantucket Shoals as a spawning ground.

Acoustic data, collected with fixed or mobile receivers, are a useful tool for understanding the distribution of spawning cod, because male cod produce vocalizations referred to as grunts during the spawning season. Recent work in the Southern New England region has analyzed acoustic data for these grunts as evidence that fish are aggregating to spawn in specific locations (Van Hoeck et al., 2023). Cod grunts have been detected on and around Cox Ledge, and cod in spawning condition were captured in the same area (SNE HAPC Framework, NEFMC 2023). Data collection using various types of fixed and mobile platforms has continued since the SNE HAPC framework was prepared, and remains ongoing. Of possible relevance to the GSC HMA and Nantucket Shoals, two fixed bottom receivers are located near the GSC HMA, NS-11 and NS-04 (see Figure 1 and Passive Acoustic Cetacean Map | NOAA Fisheries[3]). While data have been collected via receiver NS-4 that would enable detection of cod grunts, the data have not been analyzed to identify cod sounds. This analysis was requested of NEFSC staff, and they indicated that work can be completed before the end of 2026. Receiver NS-04 is located within the consensus cod spawning ground referred to as "The Fingers South". Unfortunately, no acoustic data was able to be recovered from NS-11.

The Southern New England HAPC Framework (NEFMC 2023) discusses the uses and limitations of these types of data for cod detection. "This sampling technique has a small spatial range[4] since cod grunts are somewhat quiet and cod need to be near receiver for grunt detection. Also, cod exhibit diel movements which could affect the likelihood of their sounds being detected by the receiver. (NEFMC 2023, p. 51)". Grunts detected in the receivers just outside the HMA would indicate that cod are aggregating to spawn near these receivers. An absence of grunts doesn't necessarily mean that spawning is not occurring in this region; it could merely indicate that cod are not vocalizing close to the receiver. In order to have a better chance of detecting spawning fish, the acoustic array would ideally have much broader coverage, perhaps combining fixed and mobile receivers as was done for Cox Ledge.

[3] The Passive Acoustic Cetacean Map website shows other types of acoustic data collection in the region, for example with gliders. Generally, acoustic data collection has focused on areas south and west of Martha's Vineyard.
[4] 5-25 meters, Anne Smith, NEFSC, personal communication, September 3, 2026

Figure 1. Locations of acoustic receivers in the vicinity of Nantucket Shoals (red circles). Data from receiver NS-04 could be analyzed for presence of cod. Locations of consensus cod spawning grounds are shown in blue.



Effects of fishing gear on habitats within the HMA

Since 2009, model-based estimates of fishing effects from bottom-tending gears have been generated at the scale of the Northeast region, across fisheries managed by both New England and Mid-Atlantic Councils and the Atlantic States Marine Fisheries Commission. Initial estimates were developed using the Swept Area Seabed Impact Model, which was created by the New England Council to support OHA2. The Clam Dredge Framework also relied on this model. The Clam Dredge Framework includes a discussion of the relationship between clam dredging and habitat types (see section 6.2.1.3, Vessel Behavior Relative to Complex Habitat). The Clam Dredge Framework notes that there is general correspondence between complex habitat features and clam dredging activity at the scale of kilometers, and that additional evaluation of fishing practices relative to fine scale habitat features would require tow by tow location information combined with finer scale habitat maps.

Fishing Effects Model Analysis

Since 2019 (i.e., following development of the Clam Dredge Framework), the New England Council has been using the Fishing Effects Model to estimate fishing gear effects on habitats. The Fishing Effects Model is like the earlier Swept Area Seabed Impact Model, but includes a revised vulnerability analysis for clam dredges, as well as updates to the substrate distribution map underpinning the model, and additional years of fishing effort data. The 2019 updates included effort data through 2027. Fishing Effects was most recently updated with new data for the 2025 EFH review and includes clam dredge data through 2022 (Bachman, et al. 2025). This covers the time before the area was closed, the months when the HMA was only fished under the research program, and roughly 2.5 years of the exemption program (June 2020 – December 2022).

As for the Swept Area Seabed Impact Model, habitat types in the Fishing Effects Model are based on sediment grain size (five classes, mud to boulder) and the intensity of water flow over the seabed (two classes, based on shear stress, in N/m^2 or depth, where shear stress estimates are unavailable. The Great South Channel HMA is considered high energy and includes all sediment types (Map 2), although mud and boulder are relatively rare. Features modeled in the Fishing Effects Model within the substrate and energy classifications found in the Great South Channel HMA include biogenic burrows, biogenic depressions, granule pebble, cobble, boulder, sediments, shell deposits, amphipods (tube-dwelling), anemones (actinarian and burrowing), ascidians, brachiopods, bryozoans, hydroids, macroalgae, mollusks (mussels and scallops), polychaetes (*Filograna implexa*, lacy tube worm, and other polychaetes), and sponges. Seabed structural features vary by grain size and, in some cases, by energy level (see Table 1 in Bachman et al. 2025).

Swept area is the basis for estimating the magnitude of impact from fishing in the Fishing Effects Model, which requires a table of total swept area (per gear type, per 25 km^2 grid, per month) as a model input Effort in all bottom-tending gear types is expressed in a common unit, km^2, to allow for comparison across fishing modes. Like the susceptibility and recovery parameters, which vary by gear type, these swept area estimates are also specific to each of six core gear types (bottom trawl, scallop dredge, clam dredge, demersal longline, gillnet, and trap). The starting point for generating this input table is to calculate estimated swept area at the sub-trip level.

For clam dredges, the model uses the following information. As the Fishing Effects Model is updated in the future, it would be useful to compare the methods above to the estimates of swept

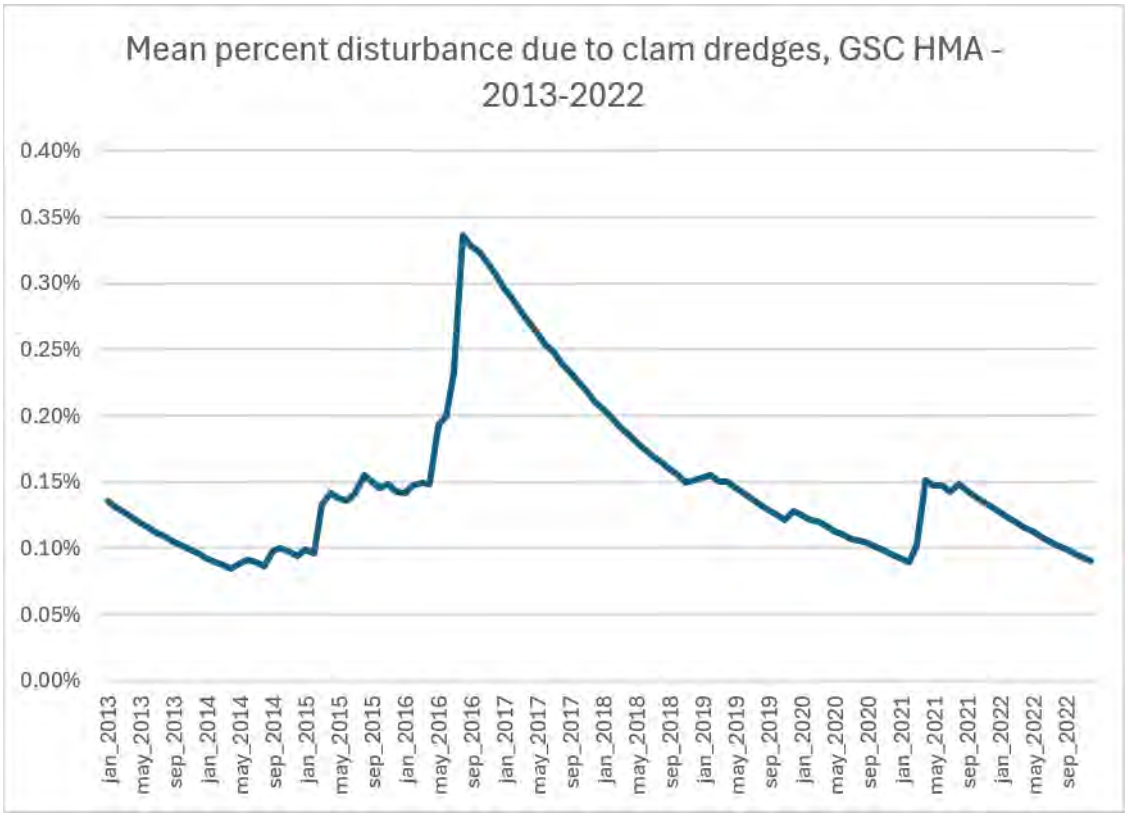
area generated during EFP projects, to ensure that the magnitude of area swept by clam dredge gear is as accurate as possible.

- Trips where gear is coded dredge, clam (DRC),
- Width of the tow path is based on VTR_gear_size, which is divided by 12 to convert from inches to feet, and then converted to km,
- Tow duration is from the VTR, soakhrs + soakmin,
- Number of tows is from the VTR, ntows, which indicates number of tows per trip, and
- Tow speed is assumed to be 2 knots.

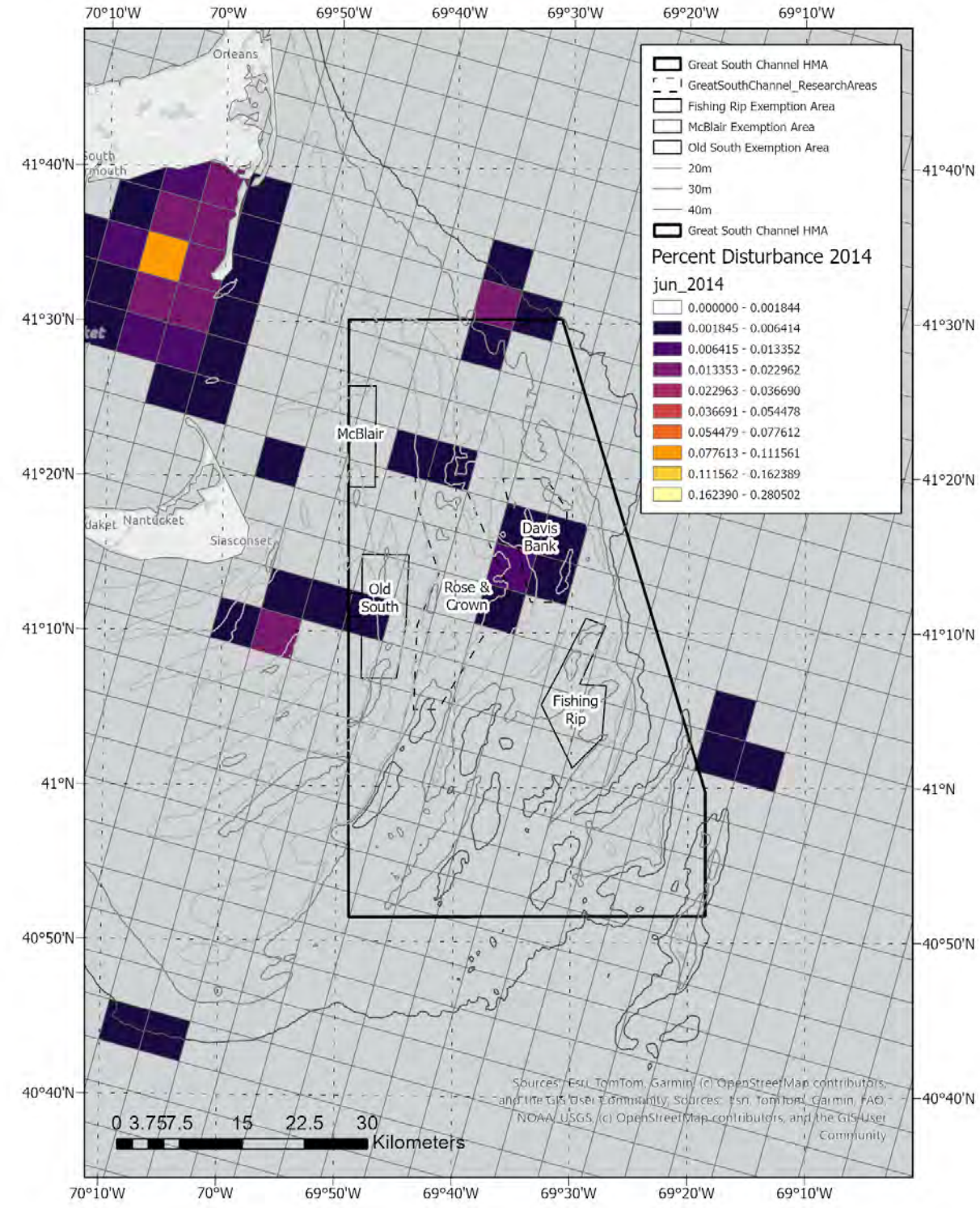
Total area swept per subtrip = (gear_qty*gear_size) * number of tows * soak time per tow * towing speed

Overall, regional scale estimates of habitat disturbance from clam dredges peaked around 2015 and have declined since. Generally, disturbance in the fishery is most pronounced off NJ and Long Island where fishing effort is concentrated, but localized areas of disturbance are evident in other parts of the region that are open/accessible to clam dredge fishing. Patterns are similar considering disturbance estimates overlapping the Great South Channel HMA only (Figure 2), which shows disturbance overlapping the HMA peaking in 2016 and declining thereafter. Average percent disturbance in the HMA is low, under 1%, across all years, but local values may be higher. Map 5-Map 9 show the spatial distribution of percent disturbance every two years in June.

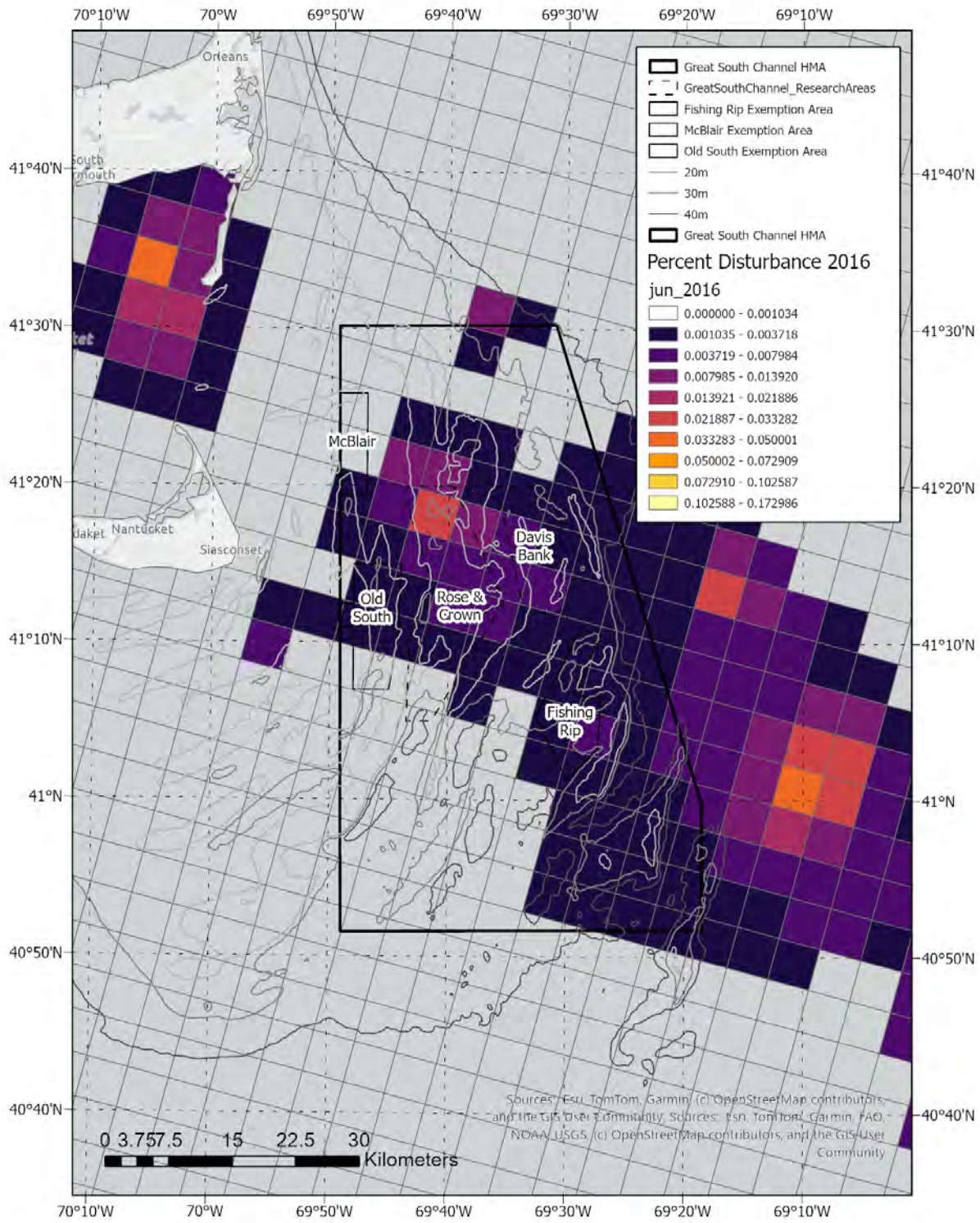
Figure 2. Mean percent disturbance estimating using the Fishing Effects Model within the Great South Channel Habitat Management Area.



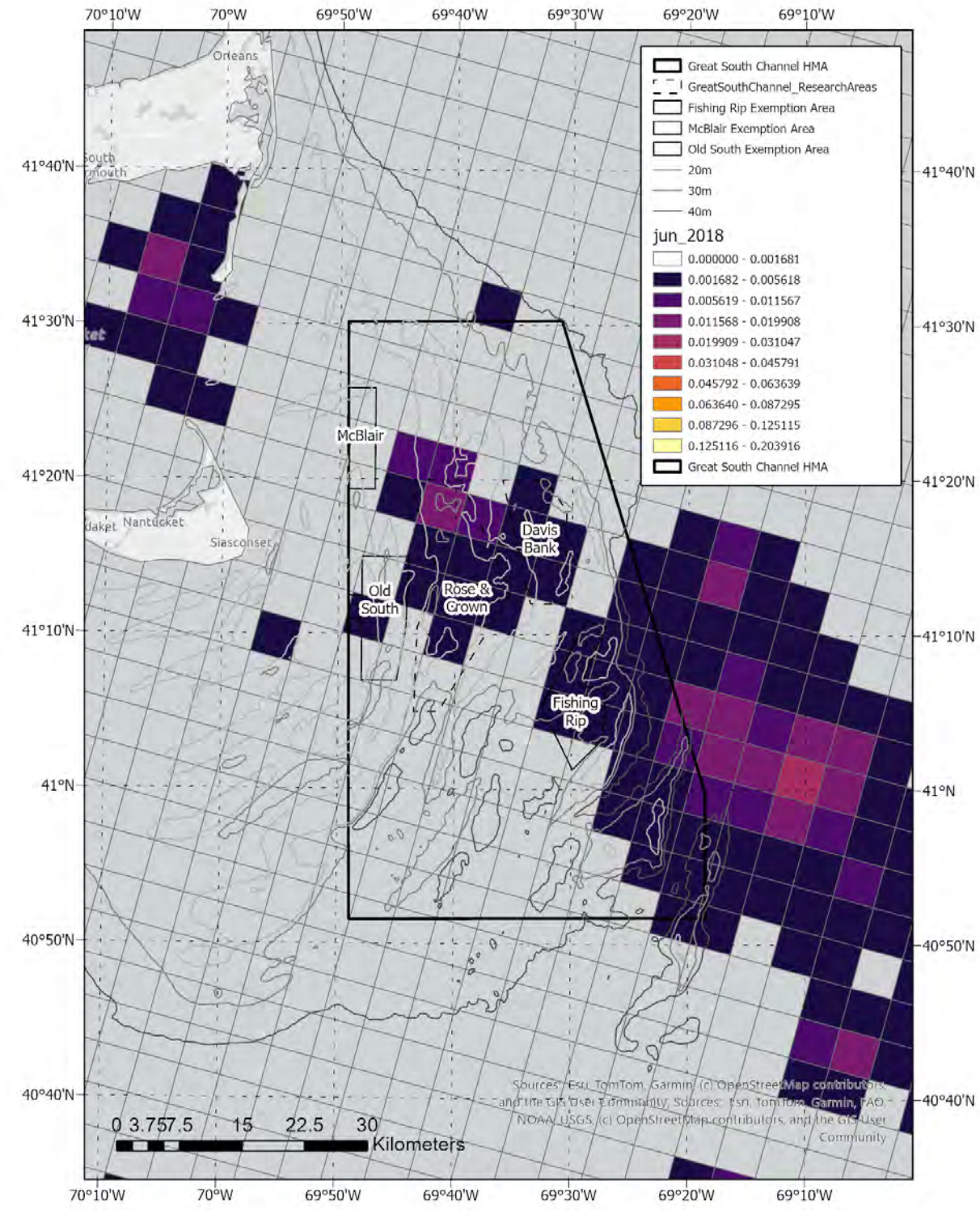
Map 5. Distribution of percent disturbance from clam dredges, June 2014.



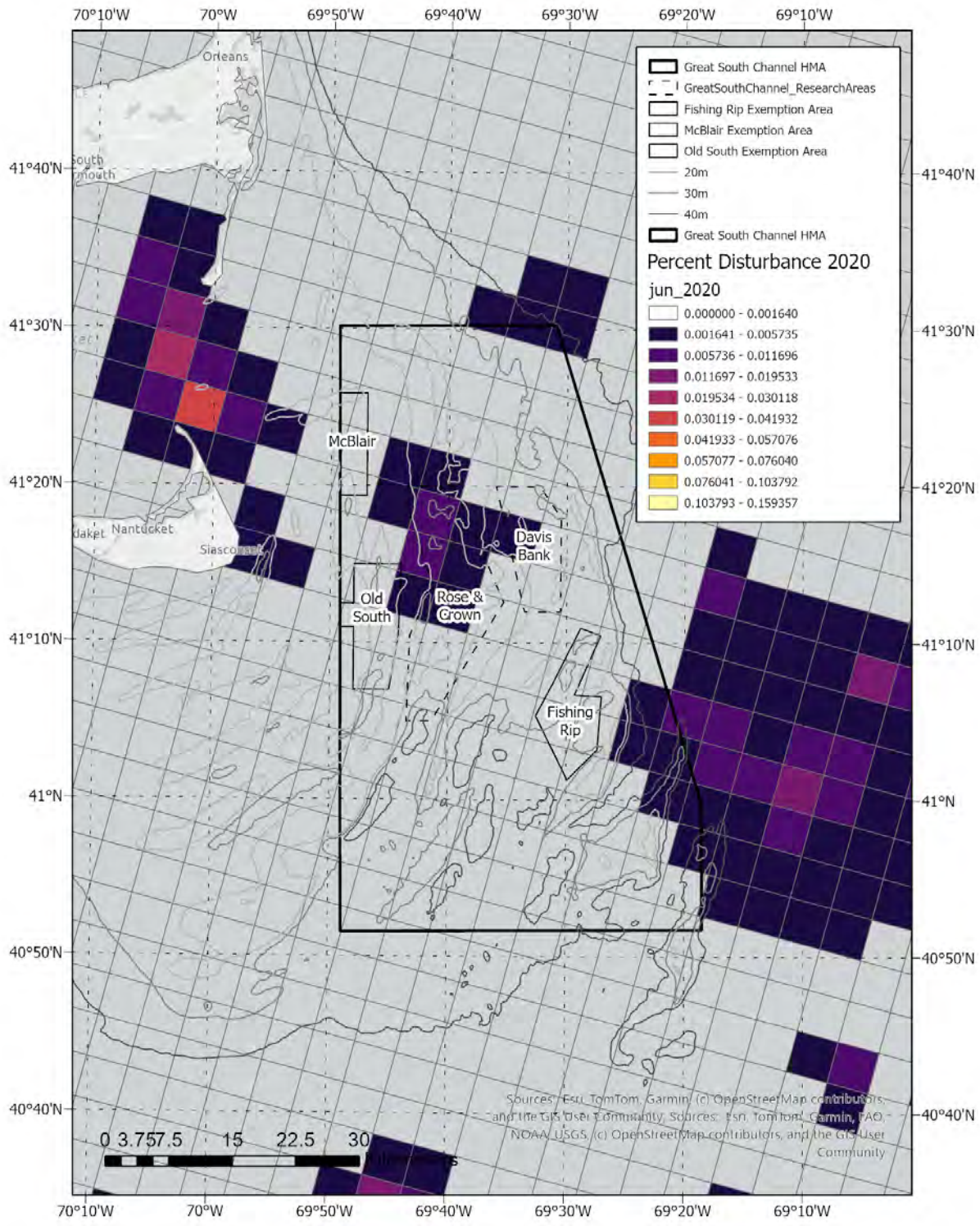
Map 6. Distribution of percent disturbance from clam dredges, June 2016.



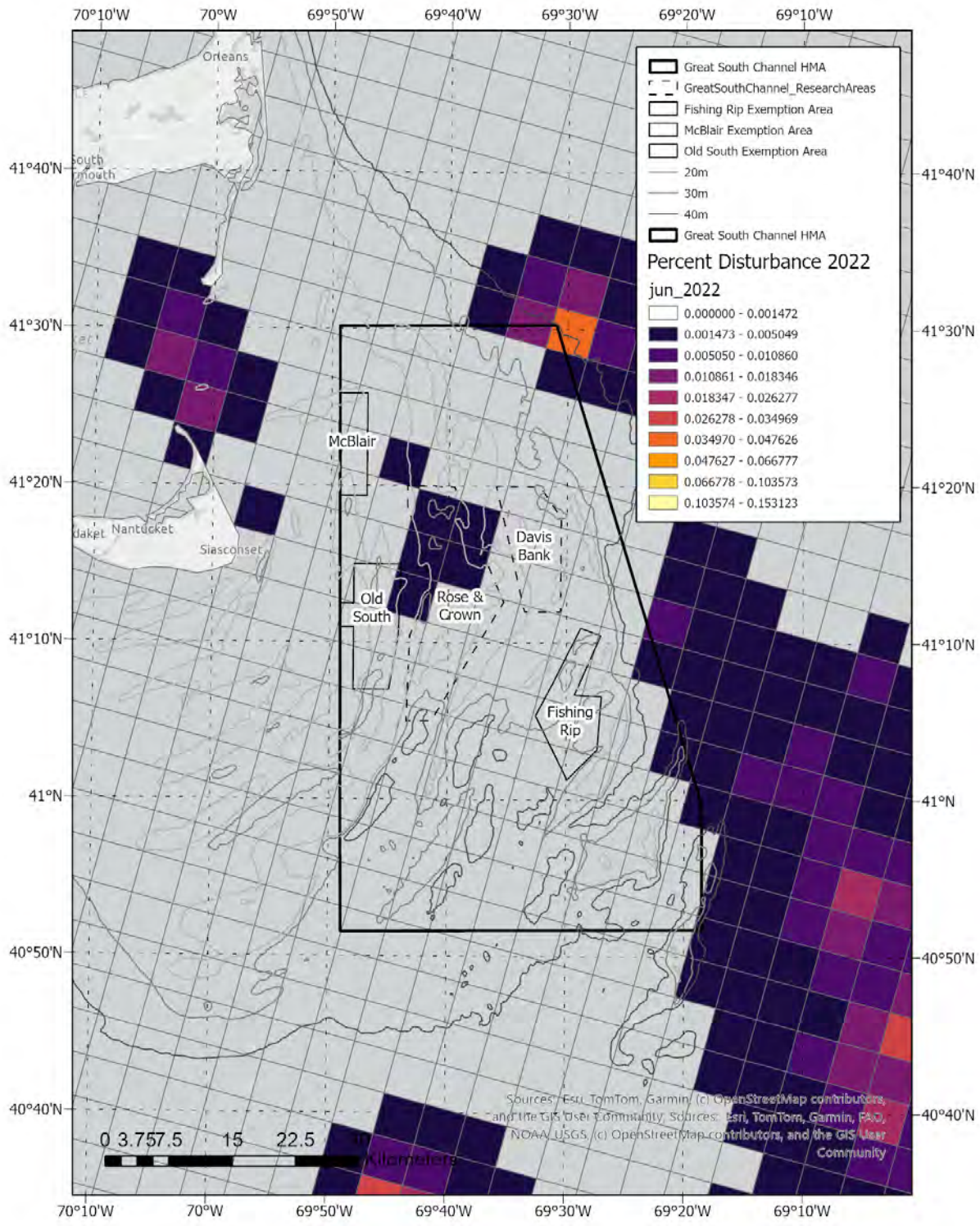
Map 7. Distribution of percent disturbance from clam dredges, June 2018.



Map 8. Distribution of percent disturbance from clam dredges, June 2020.



Map 9. Distribution of percent disturbance from clam dredges, June 2022.



Exempted Fishing Permit-based research findings on fishing effects

EFP 23073 included an analysis of fishing effects. The project assessed changes over time at a subset (n=14) drop camera stations located in the vicinity of 177 observed tows. The results indicated that natural sediment redistribution is the dominant factor governing substrate change over time at these stations, but some localized biological responses were detected (Jennings et al., 2026, p. 2). The analysis compared individual habitat variables at the paired stations, using distance to observed fishing tows as a continuous variable to indicate exposure of a station to fishing effects. Closer to tow locations, there was less encrusting bryozoan cover or hydroid cover, and greater occurrence of other (i.e., non-clam) shells.

Surfclam resource conditions on Nantucket Shoals

The Clam Dredge Framework relied on the East of Nantucket Survey (Powell et al. 2018) to understand the condition of the surfclam resource on Nantucket Shoals. Powell et al surveyed the Nantucket Shoals in 2017 using a smaller commercial vessel and a stratified random hub and spoke survey design. The survey documented the size classes and abundance of clams in different locations within and just west of the Great South Channel HMA. The Clam Dredge Framework referenced the survey report to describe spatial heterogeneity in clam distribution by size in the HMA. The report also noted the large size of clams in the Nantucket Shoals region. VMS data from ten years of clam dredging was also used during the development of the Clam Dredge Framework to understand the distribution of fishable clam beds on Nantucket Shoals and to define exemption area boundaries.

Results of the East of Nantucket survey were published following completion of the Clam Dredge Framework in 2018. This body of work focused on the benthic communities within which surfclams occur (Powell et al. 2019) and on shifts in the distribution of surfclams within the Nantucket Shoals region and the response of surfclams to warming conditions (Powell et al. 2020). Powell et. al (2020) documented smaller, younger, surfclams in deeper waters of Nantucket Shoals, with a more mature size frequency in shallower areas of the shoals, suggesting that in recent years surfclams have begun to colonize deeper areas. Other recent work (Timbs et al. 2019, Hofmann et al. 2018) has examined resource-wide shifts in the surfclam resource and responses to climate change.

MAFMC summarized the current status of the surfclam resource based on the most recent stock assessment. Overall, as of 2023, the surfclam resource was not overfished and overfishing was not occurring (NOAA 2024, summarized in Atlantic Surfclam Fishery Information Document, MAFMC 2026). Spawning stock biomass has continued to decline and was 95% of the target in 2023 (NOAA 2024, summarized in MAFMC 2026). Biomass estimates are not available for the Nantucket Shoals region specifically, and the area is not surveyed by the Northeast Fisheries Science Center dredge survey. This is for safety and operational reasons as the shoals are too shallow and challenging for larger vessels to fish.

Fishery dependent data from EFP 23073 (Jennings et al., 2026) provides the most detailed current information on surfclam size frequencies and areas of relatively higher catch rates within the Davis Bank East and Rose & Crown areas of Nantucket Shoals. During EFP 23073, compensation fishing effort needed to shift from Davis Bank East to Rose & Crown to complete the compensation fishing trips needed to fund the research. This indicates lower than expected

catch rates in Davis Bank East. When vessels returned to Rose & Crown, they fished in the same areas as under EFH 19066, which indicates persistence of productive clam beds at these locations over the 4-5 years between projects. Note that the compensation fishing was done using standard commercial fishing gear, without any sort of liner to retain small clams, so it is not suitable for understanding locations of recent surfclam recruitment. Clams harvested during compensation trips were generally large, with a median value of around 160 mm (Jennings et al. 2026, Figure 17a). Historical estimates of surfclam length frequency by area and year are available in the 2017 stock assessment, and are variable in time and space[5].

Surfclam Fishery Information

The objective of the exemption program is to provide access to areas within the Great South Channel HMA to create fishing opportunities and support achievement of optimum yield in the surfclam fishery. This section summarizes effort, revenue, and surfclam harvest from the Great South Channel HMA, in the context of the northeast regional surfclam fishery.

Methods

Data on surfclam fishing effort, landings, and revenues from within the Great South Channel HMA were provided by staff from GARFO's Analysis and Program Support Division. Three time periods were evaluated. Given the implementation dates of OHA2 and the Clam Dredge Framework regulations combined with EFP-based access, partial access to fishing grounds occurred during some years, as noted below.

- Pre-closure: January 2013-March 2019. This represents the period prior to designation of the Great South Channel HMA in April 2018, combined with the one-year period after designation when clam dredge vessels were allowed to continue fishing.
    - *The northeast corner of the HMA closed to clam dredging prior to the rest of the HMA, beginning in April 2018.*
- Total closure: April 2019-May 2020. This represents the time between the one-year clam dredge exemption and the implementation of the exemption program.
    - *During calendar year 2019, the GSC HMA was open to clam dredging January 1 through April 18, and closed April 19 through December 31.*
- Exemption program: June 2020-May 2026. This is the period during which the exemption program was in effect. The exemption program is ongoing, but data were compiled in May 2026.
    - *During calendar year 2020, the area was closed January 1 through June 17, and the new exemption areas were open to dredging June 18 through December 31. Fishing occurred in the Rose & Crown research area during 2020-2022 under EFP 19066.*

Data provided are from CAMS[6] and include any trips that declared surfclams or ocean quahogs

[5] See Figures 22-28: https://apps-nefsc.fisheries.noaa.gov/saw/sasi_files.php?year=2020&species_id=17&stock_id=6&review_type_id=3&info_type_id=5&map_type_id=&filename=2017_Atlantic_Surfclam_Assessment.pdf

[6] NOAA's Catch Accounting and Monitoring System database

(coded as “SCO-XXX-XXXXXX") and/or landed any surfclams. Permit and date were matched to VMS point locations to estimate which areas were fished during each trip. The VMS GPS ping rate varies over time both due to equipment and due to changes in regulations; rates prior to June 2020 and outside the Great South Channel HMA are every 60 minutes, unless a surfclam vessel also holds a scallop permit, which requires more frequency pings. Rates inside the Great South Channel HMA beginning in June 2020 are every 5 minutes. The analysis excluded any points with greater than two hours since the last ping because the location of actual fishing would be excessively uncertain.

To determine the landings, fishing effort (days fished), and revenue from the various areas of interest (outside the HMA, inside the HMA, and inside specific exemption areas within the HMA), the seconds since last ping by each area within each trip were summed and converted to a fraction of the total seconds since last ping for the trip. The total landings, fishing effort, and revenue from that trip were then multiplied by these fractions to apportion values to the various areas. A vessel can fish in multiple areas within a trip including outside of the GSC HMA entirely. Effort was the days fished as reported by the VTR (number of tows x mean tow time, converted from hours, minutes, and seconds to days).

Information about surfclam fishing at regional scales was summarized based on the 2026 Mid-Atlantic Fishery Management Council Fishery Information Document (MAFMC 2026).

Effort, landings, and revenues

Within the Great South Channel HMA

Landings, fishing effort (days fished), and revenue were summed across trips to estimate totals for each year-month-area and year-month-HMA. These values were then used to calculate mean monthly landings, fishing effort, and revenue for each time period of interest (Table 6). Monthly values provide a way to compare across time periods which vary in duration (6 years 2 months, 1 year 1 month, and 5 years 11 months). Total landings, fishing effort, and revenue were also summed by year within the entire GSC HMA to allow for an annual time series and comparison to previous analyses (Table 7). Finally, mean monthly landings, revenue, and days fished were summarized by exemption area or research area within the GSC HMA (Table 8). The numbers of dealers and permits are provided in each table to show changes in participation in the fishery over time and as management regimes changed.

There are differences between the pre-closure, full closure, and exemption program periods across all metrics, with higher number of bushels, revenues, and days fished in the pre-closure period as compared to the full closure and exemption program periods (Table 6). Within the pre-closure period and considering only years where clam dredging was allowed year-round (i.e., excluding 2019), number of bushels, revenue, and effort declined between 2013 and 2018 (Table 7). Number of bushels, revenue, and days fished during the first full year of the exemption program (2021) were approximately 20% of the values estimated during 2018, the last full year the area was fully open to clam dredging (17.8%, 24.5%, and 22.9%, respectively). Number of bushels, revenue, and effort during 2025 were higher than in 2021, but were still much lower than the pre-closure period.

Note that some harvest is estimated to have occurred during the total closure periods from the Old South and Rose & Crown Areas. Rose & Crown was fished under EFP 19066 during this time (104 fishing trips, 3,236 tows for the entire EFP period, June 2020-February 2022). No

harvest should have come from the Old South area during the total closure period, but this area runs along the western edge of the Great South Channel HMA and is within a few miles of clam beds that lie outside the HMA. The VMS ping rates were less frequent (every 30 or 60) minutes during this period, depending on permits held by the vessel, as compared to the current 5-minute rate, so effort occurring outside the GSC HMA may have been inferred to the Old South area during the closed period. These beds west of the HMA continue to be fished today (Allen Rencurrel, Nantucket Sound Seafood, personal communication), so it seems reasonable to assume that the fishing estimated in Old South occurred west of the HMA, near the exemption area. Also, ten-minute squares west of Nantucket Shoals are considered important fishing areas over the last decade (MAFMC 2026, Figures 7 and 8).

A larger number of permits and dealers participated in the GSC HMA fishery in the pre-closure period as compared to the full closure and exemption program periods (Table 6), with some variability in participation between years (Table 7). Between 16 and 23 vessels fished in each exemption area during the pre-closure period. During the post-closure exemption program period, fewer than 3 to 7 vessels fished in each area.

The different exemption and research areas vary in terms of their value to the fishery (Table 8), with the consistently lowest number of bushels, revenue, and effort associated with the McBlair exemption area, and the consistently highest values associated with the Rose & Crown research area. The Davis Bank research area and Fishing Rip and McBlair exemption areas were intermediate between the two. Estimates by area cannot be reported for individual years due to data confidentiality.

Relationship to the coastwide fishery

In 2025, 55 non-Maine vessels harvested surfclam and/or ocean quahog; between 2015-2025 this number ranged from a low of 54 vessels to a high of 70 vessels (MAFMC 2026, Table 3). Thus, <10% of the vessels in the fishery participated in the Great South Channel HMA fishery in the years since the exemption program was developed. Some of these 55 vessels are more focused on surfclams, and others on ocean quahogs, but some vessels switch between harvesting surfclams and quahogs, so the total number of federal vessels reported in their Fishery Information Document is aggregated across the two species. A total of 13 dealers reported purchasing surfclams and/or ocean quahogs in 2025 (MAFMC 2026). Ports in MA and NJ handle the most volume and value of surfclams and ocean quahogs (MAFMC 2026).

Surfclam quota is managed under a limited access privilege program (LAPP), where Individual Transferable Quota shares are fished using a cage tag system. Surfclam quota can be harvested from any part of the region, except for any gear restricted areas and environmental or public health closure areas. Data are summarized by location in the Fishery Information Document (Southern Virginia, Delmarva, New Jersey, Long Island, Southern New England, and Georges Bank); the Great South Channel HMA is considered part of Southern New England.

Regionwide surfclam quota has been a constant value of 3.4 million bushels (bu) since the early 2000s. Generally total surfclam landings are lower than the quota and have declined since the early 2000s. Between 2017 and 2025, landings declined from 2.2 million to 1.2 million bu (MAFMC 2026), which represents 65% and 36% of the constant quota value, respectively (MAFMC 2026, Table 1). Since the mid-1980s, the New Jersey region has generated the largest fraction of surfclam landings. Since 2017, most landings continue to come from the New Jersey region, but harvests from Delmarva, Long Island, Southern New England, and Georges Bank are

also important (MAFMC 2026, Figure 4). Surfclam landings from the SNE region increased starting in 2010 but declined to values more in line with the late 1980s beginning in 2022 (MAFMC 2026, Figure 4).

Based on data compiled for this report, harvests from the Great South Channel HMA contributed 14% of total surfclam landings during 2017, 11% during 2018, and declined to between 3-5% for the period 2019-2025, coinciding with the establishment of the Great South Channel HMA and exemption program.

Landings per unit effort (LPUE), estimated as bushels landed per hour fished, have declined overall since the 1980s, but have been relatively flat over the past decade (MAFMC 2026, Figure 5). While this is the overall trend, LPUE varies by region and through time as effort shifts into new areas, such as SNE or Georges Bank. SNE LPUE peaked in the early 2000s at around 300 bu/hr fished but has declined in the last decade. Mean bushels per hour fished are currently below 50 bu/hr for the fishery overall (MAFMC 2026, Figure 5). EFP 23073 compensation fishing generated higher catch rates of 52.2 ± 25 bu/hr and 80 ± 40 bu/hr for the Davis Bank East and Rose & Crown areas, respectively.

Table 6. Mean monthly values of landed bushels, revenue in ex-vessel value (not adjusted for inflation), and effort as days fished for the entire Great South Channel Habitat Management Area for each period from 2013 - 2026. Dealer and permit numbers indicate the total unique number of each reflected in the data set for that period.

Time period	Mean bushels per month	Mean revenue per month	Mean days fished per month	Total number of dealers	Total number of permits
Pre-closure (01/2013-03/2019)	33,463	$561,619	32.8	15	28
Total closure (04/2019-05/2020)	2,810	$60,066	1.9	3	7
Exemption program (06/2020-05/2026)	5,050	$150,294	5.2	7	11

Table 7. Annual calendar year totals of landed bushels, revenue in ex-vessel value (not adjusted for inflation), and effort as days fished for the entire Great South Channel Habitat Management Area from 2013 - 2026. Confidential data with < 3 vessels and/or dealers is denoted with an asterisk (*). Note that multiple management regimes were in effect during 2019 and 2020, and the HMA was closed to fishing except via an EFP between April 2019 and May 2020. Dealer and permit numbers indicate the total unique number of each reflected in the data set for that period.

Year	Bushels	Revenue	Days fished	Total number of dealers	Total number of permits
2013	513,770	$7,223,408	427.5	7	16
2014	519,011	$7,682,965	475.0	9	16
2015	411,945	$6,774,191	369.4	8	14
2016	418,501	$7,435,840	508.1	11	18
2017	316,808	$6,206,759	383.8	8	15
2018	244,100	$4,935,444	222.9	4	13
2019	99,569	$2,162,305	86.2	3	8
2020	73,167	$1,814,967	69.7	3	5

2021	43,436	$1,211,090	51.0	3	5
2022	*	*	*	*	*
2023	*	*	*	*	*
2024	*	*	*	*	*
2025	52,962	$1,578,278	66.1	5	6
2026	*	*	*	*	*

Table 8. Mean monthly values of landed bushels, revenue in ex-vessel value (not adjusted for inflation), and effort as days fished for each of the exemption and research areas within the GSC HMA for each period from 2013 - 2026. Confidential data with < 3 vessels and/or dealers is denoted with an asterisk (*). Dealer and permit numbers indicate the total unique number of each reflected in the data set for that period.

Area type	Area	Time period	Mean bushels per month	Mean revenue per month	Mean days fished per month	Total number of dealers	Total number of permits
Research	Davis Bank East	Pre-closure	4,451	$70,975	4.2	13	19
	Davis Bank East	Total-closure	0	0	0.0	0	0
	Davis Bank East	Exemption program	1,889	$56,200	2.0	3	3
	Rose & Crown	Pre-closure	13,638	$231,399	13.3	13	23
	Rose & Crown	Total-closure	5,243	$105,164	4.7	3	5
	Rose & Crown	Exemption program	4,569	$134,110	3.4	3	4
Exemption	McBlair	Pre-closure	688	$12,809	0.8	8	16
	McBlair	Total-closure	0	0	0.0	0	0
	McBlair	Exemption program	*	*	*	*	*
	Old South	Pre-closure	5,027	$87,855	5.1	13	21
	Old South	Total-closure	1,891	$43,030	1.2	3	4
	Old South	Exemption program	3,457	$102,792	3.7	4	7
	Fishing Rip	Pre-closure	4,131	$58,632	3.5	8	16
	Fishing Rip	Total-closure	0	0	0.0	0	0
	Fishing Rip	Exemption program	3,247	$97,043	3.7	3	4

Discussion

Key findings of this evaluation

Since the Clam Dredge Framework was completed by the Council in 2018 and implemented by NOAA Fisheries in 2020, we have gained some new information about the Great South Channel HMA and the Nantucket Shoals area. However, there are no straightforward answers for how the Council should balance tradeoffs between surfclam yield and habitat conservation.

Habitat conditions on Nantucket Shoals

New information has contributed to our understanding of the distribution of benthic habitats in certain areas of the Great South Channel HMA and the change over time in those benthic habitats. In particular, the two EFP-based projects looked in detail at substrate and biotic habitat features occurring within the Rose & Crown and Davis Bank East areas, respectively. Findings from the EFP-based projects support substrate analyses from OHA2 and the Clam Dredge Framework which show that the Great South Channel HMA has a wide variety of seafloor habitats and substrate types including fine muddy sediments, sand, granule-pebble, cobble, and boulders. While mud and boulder sediments are rare, the HMA is dominated by sand, granule-pebble, and cobble sediments. Numerous species, particularly their juvenile life stages are known to utilize these moderately complex cobble/pebble habitats (see below). Additionally, the second and more recent EFP project tracked change in sediments through time in Davis Bank East by comparing fine-scale bathymetry maps between multiple time points to estimate the migration of sand bedforms across the HMA. The project found that sand waves generally migrated in a northeast to southwest direction and estimated net sediment transport to be relatively high. As such, the HMA, particularly in Davis Bank East, is characterized by a natural high-disturbance regime driven by strong tidal currents and wind-driven waves. Finally, these projects also investigated epifaunal characteristics, e.g., the prevalence and distribution of common species like hydrozoans and bryozoans and rarer species such as mussels that only occur in some locations including parts of Rose & Crown.

Overall, the findings from the EFP-based project align with findings from the earlier data from the regional drop camera and sediment grab samples, that were used as inputs to the fishing effects model. Given the heterogeneity in habitat types across the HMA, it is not possible to assume that the seafloor characteristics of other areas of the HMA are exactly similar to areas that are already studied, including the Rose & Crown and Davis Bank East research areas, but acoustic data could be helpful for understanding habitat features in other areas of the HMA, if collected in the future.

Managed species habitat-use within the HMA

An important new source of information for managed species habitat use in the Great South Channel HMA and throughout the Northeast region is a complete set of species distribution models that predict areas of higher densities for all species managed by the New England and Mid-Atlantic Management Councils. These models provide information about predicted occurrence and relative density of species during the spring and fall seasons sampled by the Northeast Fisheries Science Center, state, and regional fishery independent trawl surveys, as well as the environmental predictors that influence those distributions and the range of predictor values that are most important. This report describes managed species' habitat use in

successively narrower categories using model-predicted density quantiles. In particular, this report highlights species and life stages where the top 25% EFH hotspot and the top 25% cumulative abundance hotspot overlap with the Great South Channel HMA, as these are areas expected to contain the highest predicted densities and cumulatively contribute to the top 25% of the model-predicted population, respectively.

Within the Great South Channel HMA, there are ten species and life stage combinations where the cumulative abundance hotspot overlaps with the HMA and an additional sixteen combinations where the EFH hotspot overlaps with the HMA. Many of these species exhibit preferences for the relatively complex habitats with sand, gravel, cobble, shell hash, or live bivalve substrates, including emergent epifauna, found in the HMA by the two recent EFP projects. In particular, species with hotspot overlaps and matching substrate preferences (as noted in their EFH text descriptions; NEFMC 2025, NEFMC 2026, MAFMC 2026) include the following: butterfish juveniles, little skate, red hake juveniles, spiny dogfish adults, windowpane flounder, winter flounder, winter skate, Atlantic cod, black sea bass juveniles, shortfin squid pre-recruits (juveniles), pollock juveniles, scup adults, yellowtail flounder juveniles, Atlantic surfclam, bluefish adults, Atlantic sea scallop, and summer flounder adults. Several pelagic species with hotspots overlapping the HMA may not exhibit as strong preference for the specific habitat types in the HMA as they may spend less time near the bottom; these include Atlantic herring juveniles (preferring fine sediments and areas with lower tidal energy), both life stages of longfin squid, and Atlantic mackerel juveniles. On the other hand, pelagic, highly migratory species like bluefish exhibit preferences for habitat types in the HMA perhaps due to availability of prey species that more directly rely on these habitats.

Species distribution model outputs also provided an opportunity for preliminary analysis of temporal aspects to managed species' habitat use in the HMA. Generally, while there were no differences in seasonal (i.e., spring vs. fall) habitat use for New England species (see Appendix D to each of the NEFMC 2025 and 2026 EFH Frameworks for map comparisons), there did appear to be trends over the ~20-year modeled period (2002-2022) for select species, focusing on those with EFH or cumulative abundance hotspots overlapping the HMA. These generally fell into two categories: (1) species with a relatively uniform coastwide trend and (2) species with locally or regionally varying trends. For example, for juveniles of butterfish, little skate, red hake, and shortfin squid, along with both life stages of longfin squid, model outputs predicted an increasing trend throughout their geographic ranges from 2002-2022. In contrast, both life stages of Atlantic cod, adult bluefish, and juvenile pollock saw a coastwide decreasing trend over this same period. Species with mixed trends included black sea bass juveniles, little skate adults, scup adults, spiny dogfish adults, windowpane flounder, winter flounder, winter skate, and yellowtail flounder juveniles; these species may warrant further exploration into location-specific change over time. While these analyses should be taken as preliminary, they highlight potential species that may currently be reliant on portions of the HMA and where changing oceanographic conditions and shifting distributions may alter the extent of their habitat use. More in-depth analyses, where fishery-dependent and -independent data permit, on these species' abundance trends in the HMA are recommended to support any management adjustments to the HMA following the Council's review of this report.

Cod spawning on Nantucket Shoals

Within the Southern New England region but beyond the HMA boundaries, there is new information about the use of specific locations for cod spawning. While many of these data have

been collected around 100 km west of the HMA and Nantucket Shoals in the Southern New England Cod Stock Area, cod on Nantucket Shoals are considered part of the Gulf of Maine and Cape Cod winter spawning population, and they share a spawning season with Southern New England Cod. Although there are a small number of acoustic receivers just inside of or just outside of the boundary of the Great South Channel HMA, those data have not yet been analyzed to understand the possible presence of cod during their spawning activity in the winter. Note that an absence of cod grunt detections in the winter months could reflect the low density of acoustic receivers rather than an absence of cod, because cod need to be very close to a receiver to be heard. Federal fishery independent trawl surveys have poor coverage of Nantucket Shoals generally, and do not occur during the winter months. Overall, the use of the Great South Channel HMA by spawning cod remains uncertain.

Clam dredge fishing effects within the HMA

Impacts of clam dredge fishing on the habitat management area are on average low, as estimated by the Fishing Effects Model. Percent disturbance in the HMA in recent years has been less than 1% as a mean value across the 132 5-km^2 fishing effects model grids that overlap the HMA. This estimate averages unfished and fished model grids, which means fished areas have higher localized disturbance rates from dredge gear. It is important to note that the Fishing Effects Model makes a fundamental assumption that there is a seafloor habitat resilience within highly dynamic environments such as Nantucket Shoals, vs. less naturally disturbed areas.

Surfclam resource and fishery conditions on Nantucket Shoals

Unfortunately, the Great South Channel HMA suffers from a lack of systematic federal survey information for surfclams. This has long been the case because the NEFSC does not send survey vessels into the Nantucket Shoals region owing to complex topography, shallow depth, and potential safety concerns. The only relatively recent survey available of the Shoals occurred about a decade ago (the East of Nantucket Survey) and can be used to indicate overall clam distributions as of the time of the survey. Generally, larger and smaller clams are heterogeneously distributed throughout the HMA, which may be due to increases in more recent settlement in deeper waters due to changing ocean conditions.

Fishery dependent data from the EFP-based projects provide high-resolution information about the location of compensation fishing, as well as effort and harvest metrics (tow duration, yield, and size of harvested clams) within small, selected areas of the HMA. Of note, LPUE for the compensation fishing areas is high relative to average coastwide values. This underscores the importance of these grounds to the surfclam fishery. Fishing in areas with high LPUE is desirable as it results in larger yields with less fishing time and associated variable costs (e.g., fuel).

The two EFP-based projects demonstrated variable success in conducting compensation fishing within the Davis Bank East and Rose & Crown areas. Generally fishing was conducted efficiently, and yields were high, but researchers and their fishing partners needed to reconfigure the spatial design of their compensation fishing program throughout the latter part of the EFP research. This indicates that there is some uncertainty in our understanding of clam distributions within the HMA, even based on prior knowledge of experienced captains.

There have been marked declines in the harvest of clams from the HMA based on the commercial data from the surfclam exemption and research compensation fishery. Leaving aside

the Davis Bank East and Rose & Crown research areas, which are not part of the exemption program, those declines are even more marked because a relatively large proportion of the landings from the recent years come from those two research areas. There have also been declines in surfclam landings throughout the entire Northeast region, but the magnitude of decline is greater within the Great South Channel HMA. The Clam Dredge Framework did predict that there would be declines in harvests under the exemption program relative to the area being fully open to clam dredging, but the magnitude of that reduction was uncertain at the time. With the fishery dependent data from the exemption and research fishing since 2019, we now have a clearer understanding of the realized loss in surfclam yield from the Nantucket Shoals fishery.

Attainment of objectives of the exemption program

The objectives of the exemption program were inferred from the problem statement for the Clam Dredge Framework:

1. Minimize, to the extent practicable, the impacts of fishing on essential fish habitats within the Great South Channel HMA.
2. Provide access to areas within the GSC HMA to create fishing opportunities and support achievement of optimum yield in the surfclam fishery.

Overall, these objectives are being partially met.

In terms of minimizing the impacts of fishing on habitats, percent disturbance estimates from the Fishing Effects Model at the scale of the HMA are low (less than 1%, averaging across all model grids overlapping the HMA), and would likely be considered minimal. Disturbance was low during the pre-exemption period through 2022, the last year for which estimates are available.

Current use of the Great South Channel HMA for cod spawning is unknown, given currently available surveys and other sources of data. The Old South Exemption Area is closed during the cod spawning season, which would be protective of any spawning that is occurring.

The Great South Channel HMA is a highly dynamic environment, with ongoing reworking of sediments and sediment transport. EFP 23073 clearly documented these dynamics within the Davis Bank East area. These tidal- and storm-driven flows interact with fishing gear effects to influence seabed characteristics. EFP 23073 did not detect differences in sediment characteristics at survey stations close to and further away from fishing tows. Some slight but significant differences in epifaunal abundance were noted, with stations closer to tows having less encrusting bryozoans and hydroids, and more non-surfclam shell debris. It would be interesting to repeat this work in other areas of the HMA with different seabed habitat components, such as mussel beds or boulders, which were largely absent from the Davis Bank East study area. Overall, there was minimal ability to detect fishing effects beyond background disturbance within Davis Bank East.

The surfclam fishery is generating yield from the exemption areas, although in lower amounts as compared to the pre-closure period. Landings would likely be higher if vessels had access to other areas of the HMA, since the exemption and research areas together do not encompass all historical clam fishing grounds on the Nantucket Shoals and there are likely to be productive tows within areas that are currently closed to fishing. Potential yield that could be obtained from the HMA absent any restrictions on fishing are unknown, given the lack of fishery independent

surveys of the area and thus lack of biomass estimates. Surfclam landings are declining coast-wide, and landings are less than the allocated quota.

This report documents both research area and exemption area effort, landings, and revenues, and shows the relative importance of the research areas, in particular the Rose & Crown area, in terms of the overall yield from HMA. Without access to these areas, declines in yield from Nantucket Shoals would be even more pronounced. Research Area compensation fishing lies outside formal exemption program; the areas are not designated in federal regulations and access requires an approved EFP.

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Appendix A: Management and research timelines

Management history

Table 9. Management timeline for the Great South Channel HMA, 2004-2026.

Date	Action
2004	The Council began work on Omnibus Essential Fish Habitat Amendment 2 (OHA2) link
December 2014	Mid-Atlantic Council submitted comments to the New England Council requesting that, "sub-areas comprised predominantly of sand substrate be identified as clam management areas within the broader proposed habitat closure areas encompassing Nantucket Shoals, Georges Shoals, and Cultivator Shoals." These areas were intended for clam dredge fishing access.
April 2015	The Council took final action to recommend the Great South Channel Habitat Management Area (GSCHMA) for habitat protection. The Council recommended the Northeast corner of the area be closed to all dredges and bottom trawls, and the remainder of the area be closed to bottom trawls and scallop dredges with a 1-year exemption for clam dredges. That year would allow for consideration of a different program for clam dredges to access portions of GSCHMA. link
June 2015	The Council took final action on remaining portions of OHA2 link
January 2016	The Council submitted the OHA2 FEIS to NOAA Fisheries link
September 2015	The Council initiated a framework to identify clam dredge fishery access areas within the GSCHMA. The Council considered multiple sources of information about habitats, managed resources, and fisheries during framework development, including a Science Center for Marine Fisheries analysis of clam dredge survey data.
October 2017	OHA2 FEIS was finalized link
November 2017	OHA2 proposed rule was published link
January 2018	NOAA Fisheries approved most of the recommendations contained in OHA2 including the designation of the GSCHMA and one-year exemption for clam dredges link
April 9, 2018	OHA2 was implemented by NOAA Fisheries, which prohibited the use of mobile bottom-tending gear within the GSCHMA, except for the surfclam fishery which was granted a 1- year exemption, with the exception of the northeast corner.
December 4, 2018	The Council completed work on the Clam Dredge Framework which identified three exemption areas inside the Great South Channel HMA. The Council also recommended designation of two research areas in the GSCHMA, with the following commitment: "The Council will develop a prioritized list of research needs concerning Rose and Crown and Davis Bank East. The intent is to work towards an exempted fishing permit program for these areas, which will support the potential development of additional exemptions in the future."
February 28, 2019	The Council submitted the draft Clam Dredge Framework and environmental assessment to NOAA Fisheries.
April 9, 2019	The one-year clam dredge fishery exemption in the GSCHMA expired. Clam dredges were unable to operate in the GSCHMA until rulemaking occurred on the Clam Dredge Framework.
June 12, 2019	New England Council approved a research plan for the GSCHMA. link

Date	Action
July 23, 2019	The Council submitted the final version of the Clam Dredge Framework to NOAA Fisheries.
June 18, 2020	NOAA Fisheries published the final rule for the clam dredge framework, allowing surfclam and mussel dredging in the three exemption areas in the GSCHMA.
December 2021	The Mid-Atlantic Council recommended that the Councils prioritize a leadership level discussion about the Great South Channel Habitat Management Area.
January 13, 2022	The New England Council was contacted to provide support for an emergency action request made to the Secretary of Commerce. link
January 2022	Meeting between chairs, executive directors, and staff of MAFMC and NEFMC. link
January 2022	New England Council declined to provide support for emergency action request, but asked the Habitat Committee to review the final report on EFP 19066 when available. link, link
May 7, 2025	Petition for Rulemaking to Reopen the Great South Channel Habitat Management Area to the Atlantic Surf Clam Fishery in response to Executive Order 14276 link
November 2025	The Council received a request from Monte Rome to reevaluate the science used to support the closure of the GSC HMA and identification of clam exemption areas. MADMF requested Council support for a 2026 management priority to evaluate revisions to the Atlantic surfclam exemption fishery in the GSC HMA.
December 2025	The Council requested a review of the GSC HMA surfclam exemption program occur during 2026.

Timeline of EFP-based research projects

Table 10. Timeline of EFP-based surfclam/habitat research projects in the Great South Channel HMA, 2019-2026.

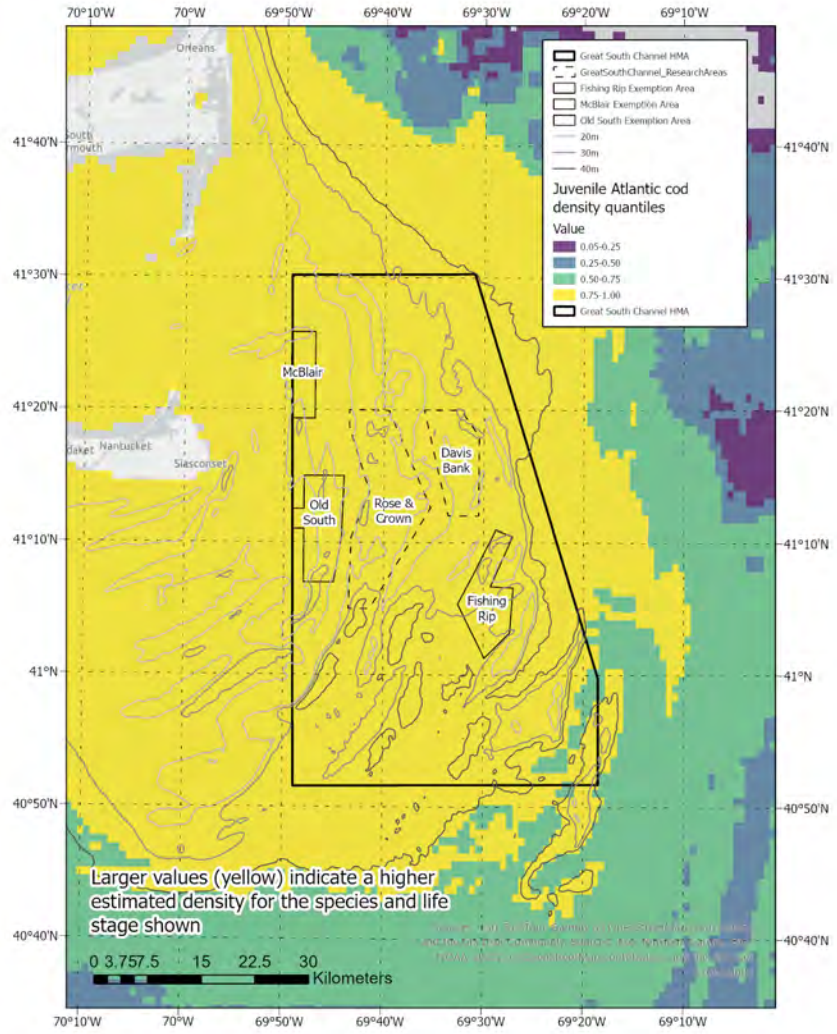
Date	Action
May 2019	CFF submitted an Exempted Fishing Permit (EFP) application to NOAA which included fishing / dredge-mounted camera work within a 74 mi^2 area in Rose and Crown and a 32 mi^2 area in Davis Bank. After several meetings NOAA agreed to a “phased" approach, where they would conduct their proof of concept EFP in a sub area (23 km^2) of Rose and Crown and that any future expansion would only be considered after NOAA reviewed a Phase I report.
June 12, 2019	New England Council approved a research plan for the GSCHMA. link
January 27, 2020	NOAA Fisheries published a Federal Register notice of CFF’s EFP request. As previously agreed to, this permit would enable use of dredge mounted cameras in a 23 km^2 section of Rose and Crown area.
February 5, 2020	The Council provided comments on the EFP request to NOAA Fisheries. link
May 26, 2020	NOAA Fisheries notified the Council that they intended to issue EFP 19066 to CFF. The EFP was valid through May 2021 and authorized 4 vessels.
December 2020	CFF provided a progress report on EFP 19066 to the Habitat PDT. The report included summary data from 34 commercial trips.

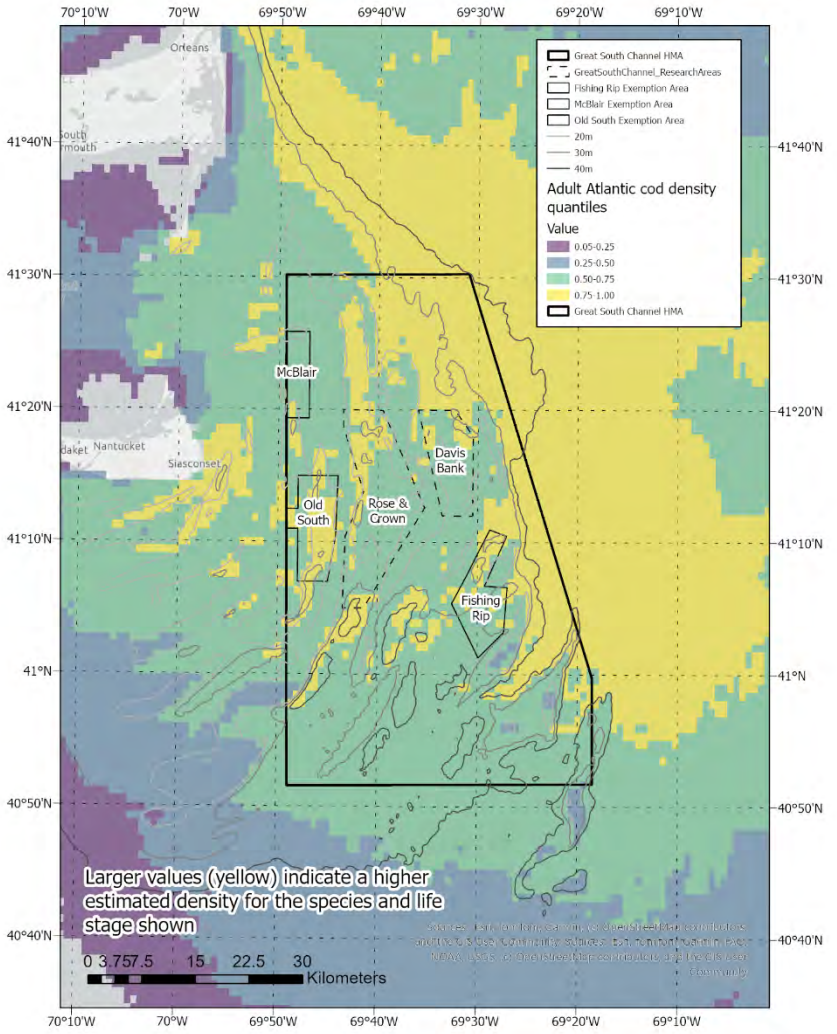
	NOAA offered a six-month extension of EFP 19066 if needed. CFF had stated they needed more time to generate funds to complete the Phase I data analysis and report.
January 25, 2021	The Habitat PDT discussed the progress report. link
March 2021	CFF requested an EFP for Phase II of the project from NOAA. This phase included the 27 km^2 area in Rose and Crown and an expanded area of 39.7 km^2 in Davis Bank. CFF also requested to increase the vessel list from four to eight. New England Council staff reviewed a version of the Phase II project description and provided some informal feedback to CFF staff.
May 2021	NOAA sent a letter to CFF stating that they could not move forward with the Phase II request, noting that the transition to Phase II would be based on how well the data collected during Phase I addressed the Council's research priorities for the HMA.
August 2021	NOAA issued CFF a 6-month extension of the Phase I EFP. No changes were made to the vessel list or sampling area/methods. NOAA noted that any expansion of the project would require CFF to submit a complete report of Phase I data and that the report would be reviewed by NOAA, the Council, and the Habitat PDT.
October 2021	NOAA received a request from CFF for second project, related to but distinct from EFP 19066. It included a request to continue their project into the Fishing Rip exemption area and an expanded fishing area of 100 km^2 in Rose and Crown, in addition to the 23 km^2 already allowed under EFP 19066. The request included 10 participating vessels.
November 22, 2021	NOAA replied to CFF noting the research area for 19066 was approved under a determination that the potential habitat impacts would be limited in scope and duration due to the research being conducted in a small area by four commercial vessels. The new request involved a more than four-fold increase in area and an increase to 10 vessels. NOAA noted that they could not make a proper evaluation of the utility of the dredge-mounted camera to characterize habitat, fishery interactions, and potential habitat impacts without the completion and evaluation of the Phase I report from the 19066 EFP. NOAA offered to consider an EFP for the work CFF proposed in the Fishing Rip exemption area.
January 2022	Council declined to provide support for an emergency action request, but asked the Habitat Committee to review the final report on EFP 19066 when available. link, link
February 4, 2022	EFP 19066 expires
July 2022	The Council and NOAA received the final report on EFP 19066. link
August 2022	The Habitat Committee discussed the PDT's evaluation of the final report. link
October 2022	The Council sent a letter and memo to GARFO commenting generally on future EFP-based research in the GSCHMA, given results of the EFP issued to CFF in 2020. Generally, this letter was in support of carefully designed EFPs and acknowledged that compensation fishing might be a necessary source of funds. link
October 2022-January 2023	CFF requested another EFP to complete additional work, but GARFO denied the request in December. CFF responded to GARFO's denial letter in January. link
March 2023	The Habitat AP and Committee received updates on the status of the recent EFP request.

April 2024	Council sent a letter to GARFO with issues for GARFO to consider when evaluating issuance of a second EFP for the GSCHMA to CFF. The Council's letter did not directly support or oppose issuing the EFP. The Council endorsed the approach of mapping large areas of the HMA, noted that in general compensation fishing may required as a source of funding, and expressed concerns about the possible number of compensation trips and the compensation rate (15% ex-vessel for research). link
January 2025	The Council and NOAA received a progress report received on EFP 23073 including a presentation from CFF staff.
July 2025	The Council sent a letter to GARFO endorsing a shift in compensation fishing from the Davis Bank area to the Rose and Crown area under EFP 23073, so that the research project can be completed. link
October 2025	The Council and NOAA received a second progress report received on EFP 23073.
March 31, 2026	EFP 23073 expires
July 31, 2026	The Council received the draft final report from EFP 23073. The Habitat PDT discussed the report with CFF staff on August 4, 2026. An updated version of the report was provided on August 20.

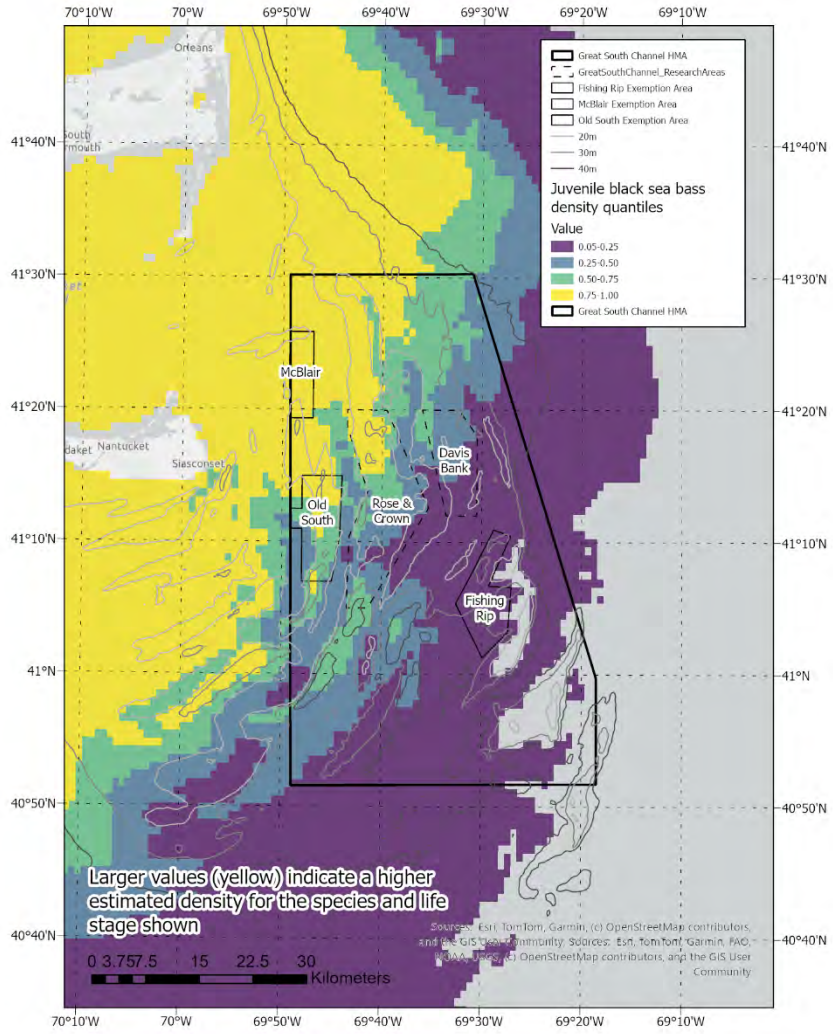
Appendix B: Managed species habitat overlaps with the Great South Channel HMA

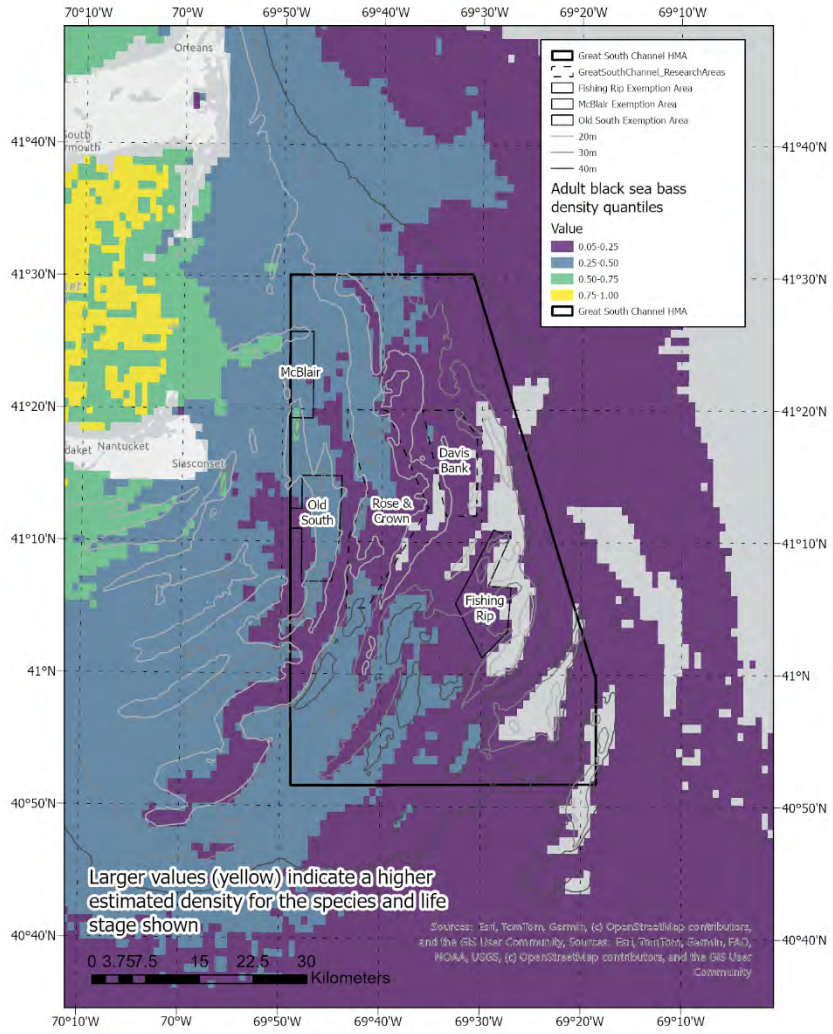
The model outputs that form the basis of the EFH designation were plotted using quantiles to show where higher densities of the species and life stages are predicted to occur. The 25%, 50%, and 75% quantiles (yellow, green, and blue) are combined to form the basis of the EFH map, and the 95% quantile (purple) reflects lower density areas. Areas with the lowest 5% of predicted density are not shown.



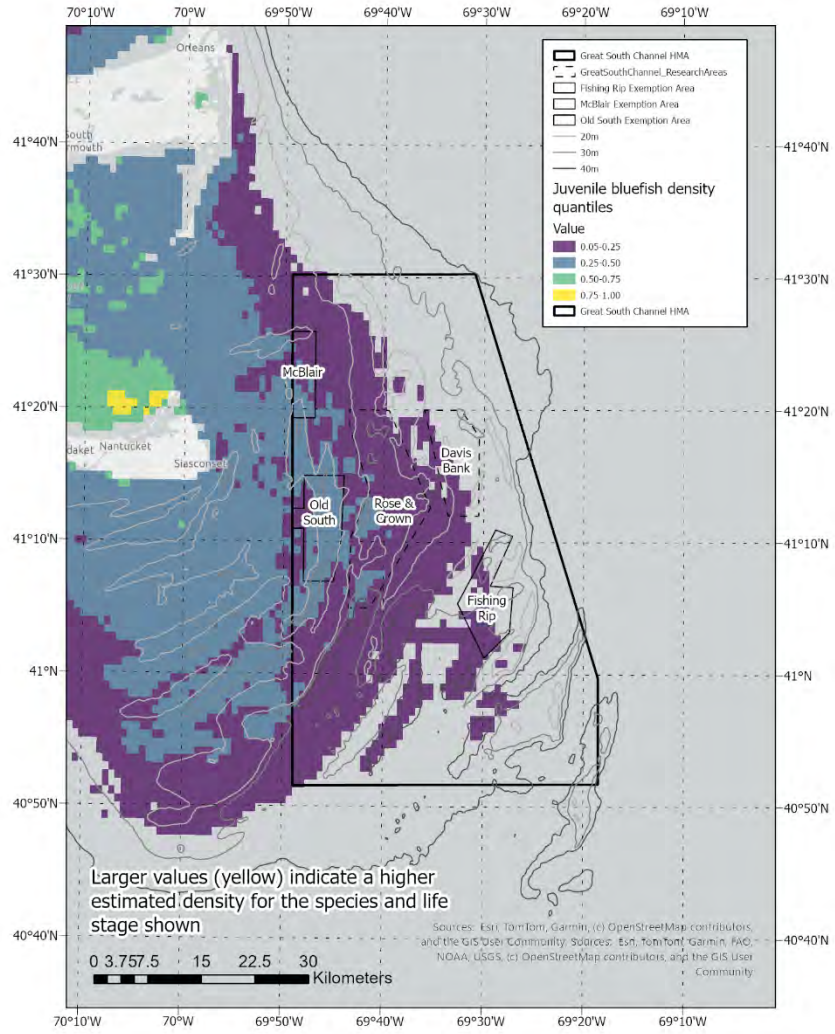


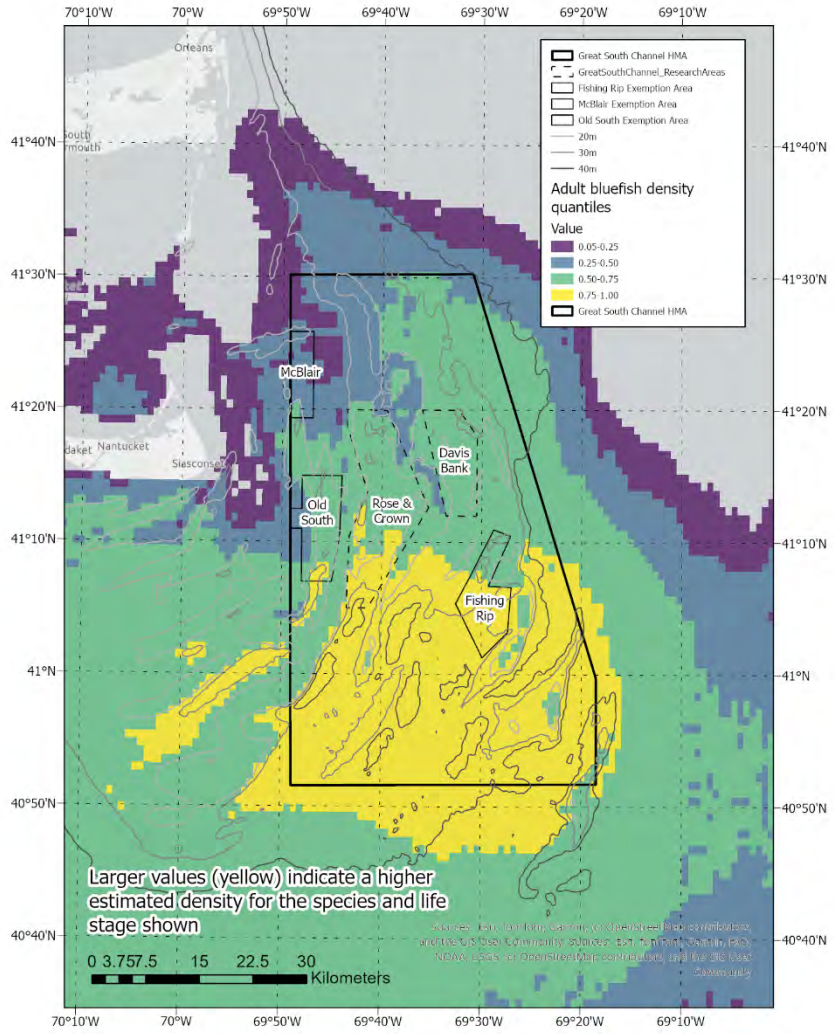
Atlantic cod



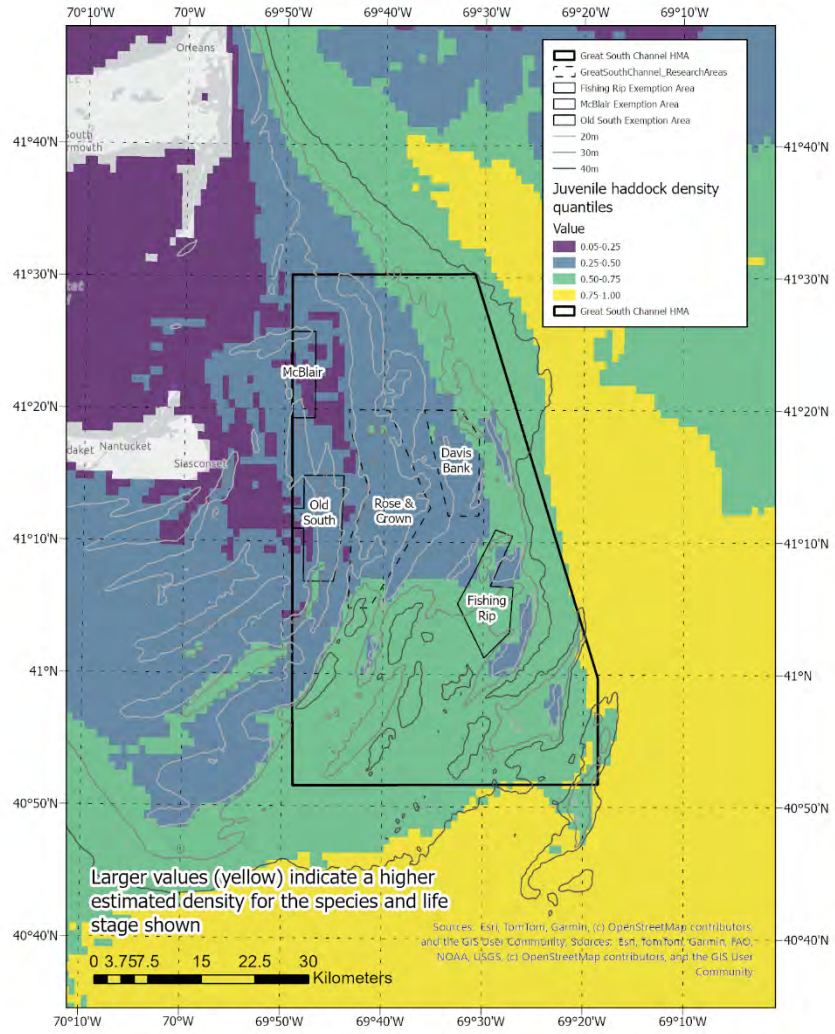


Black sea bass





Atlantic bluefish


Great South Channel HMA
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Fishing Rip Exemption Area
McBlair Exemption Area
Old South Exemption Area
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Juvenile haddock density quantiles
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0.05-0.25
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Great South Channel HMA
McBlair
Davis Bank
Old South
Rose & Crown
Fishing Rip
Larger values (yellow) indicate a higher estimated density for the species and life stage shown
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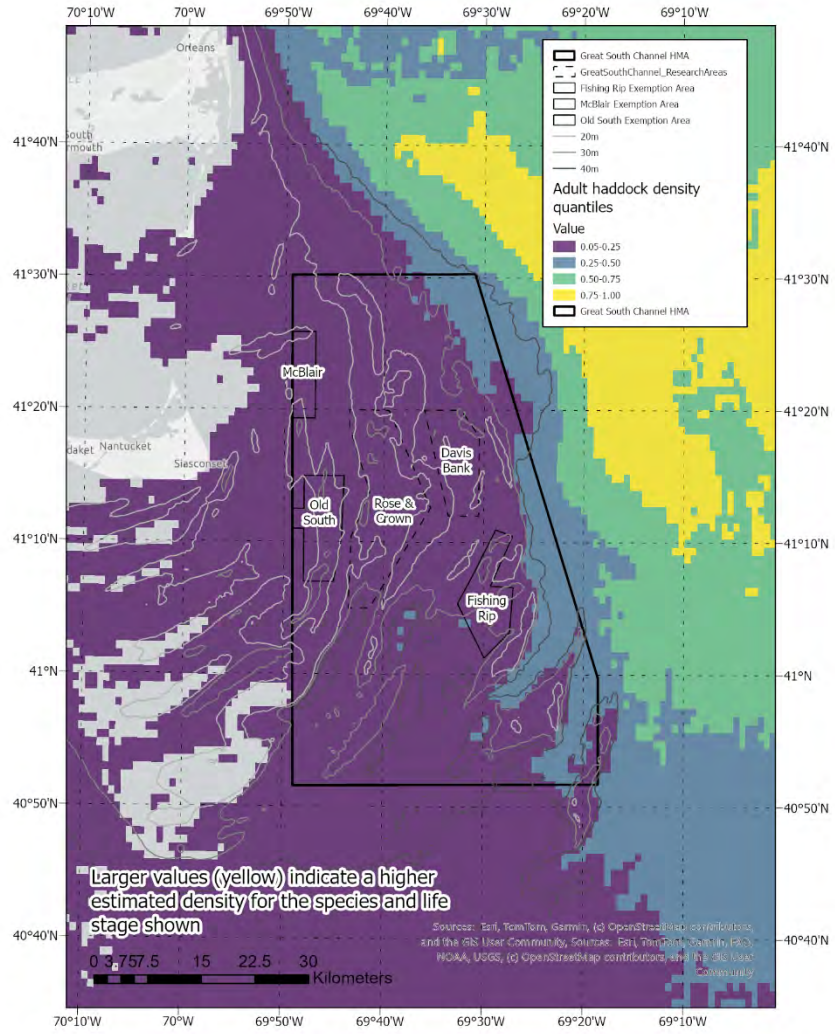
Kilometers
Sources: Esri, TomTom, Garmin, (c) OpenStreetMap contributors, and the GIS User Community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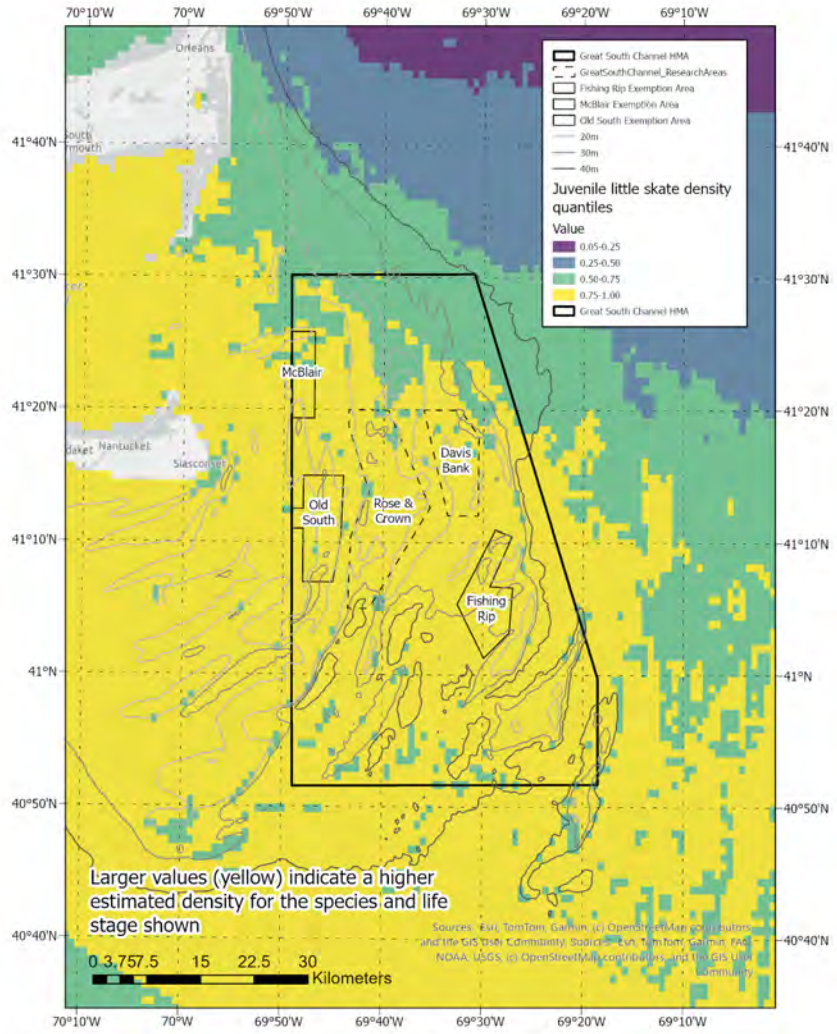

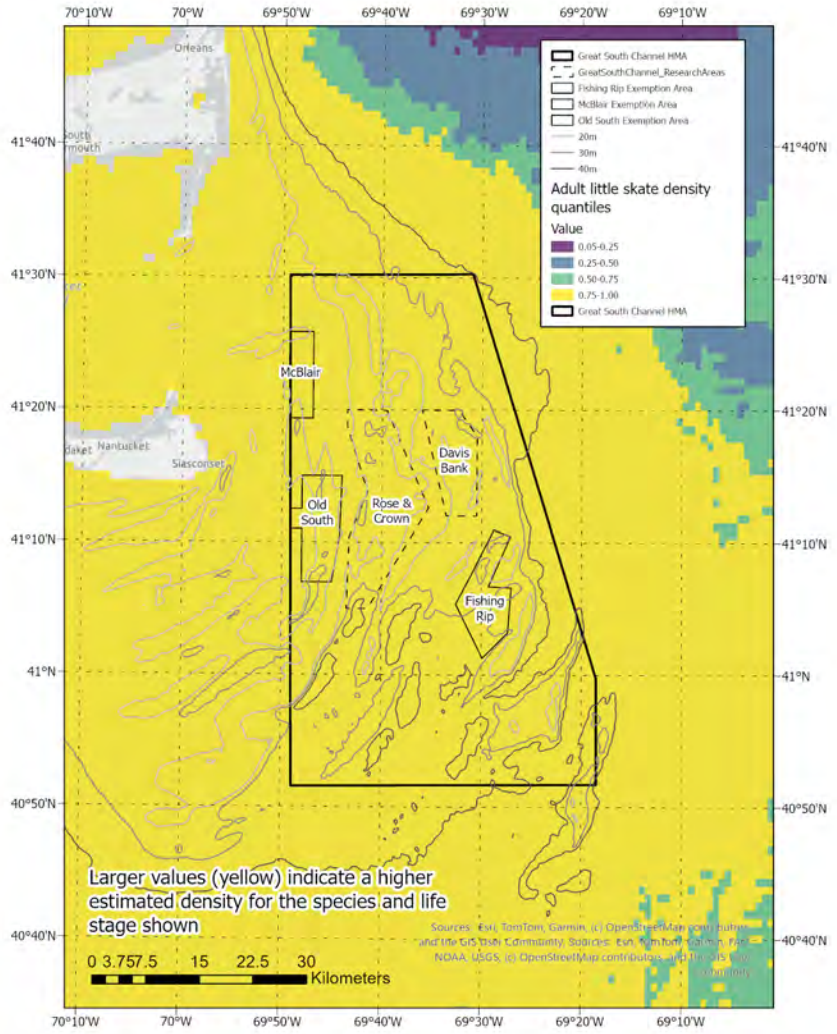

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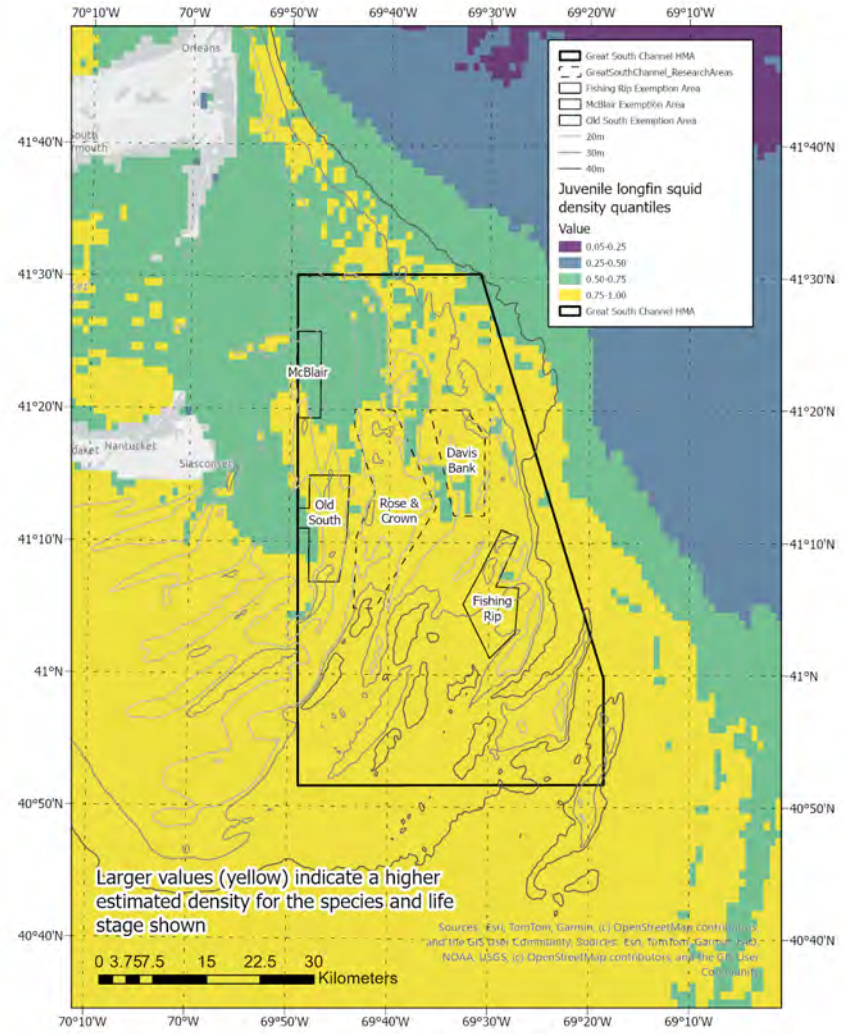
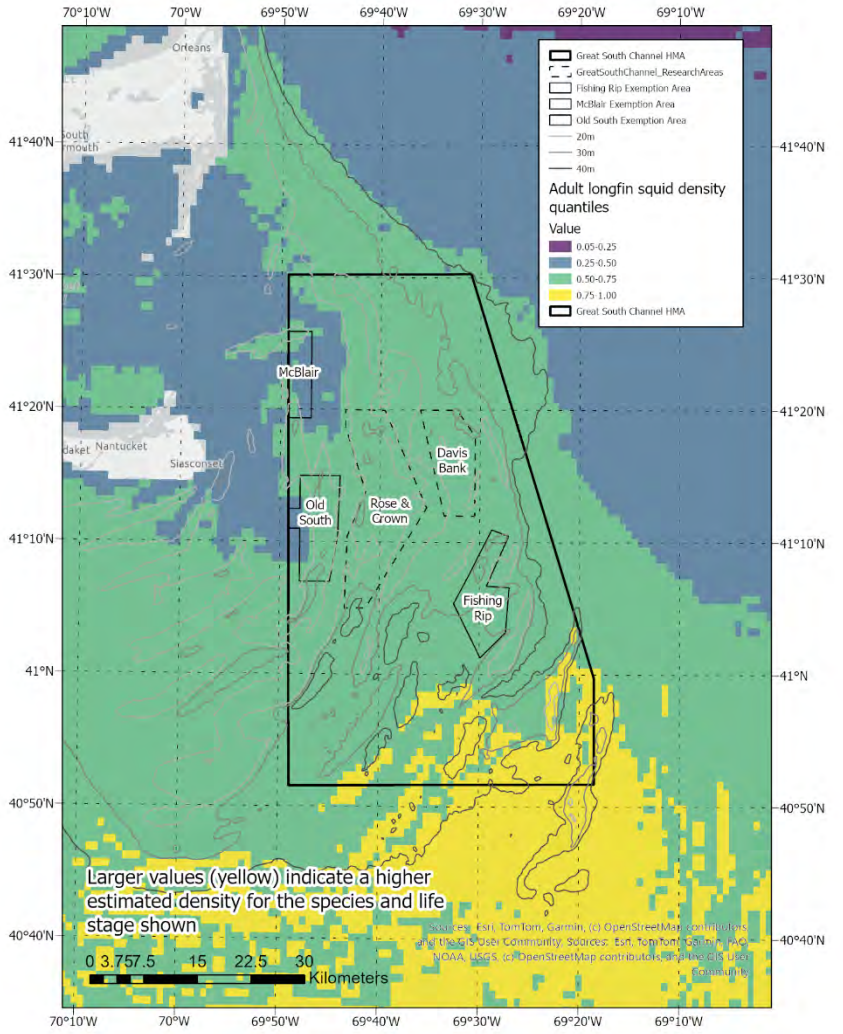
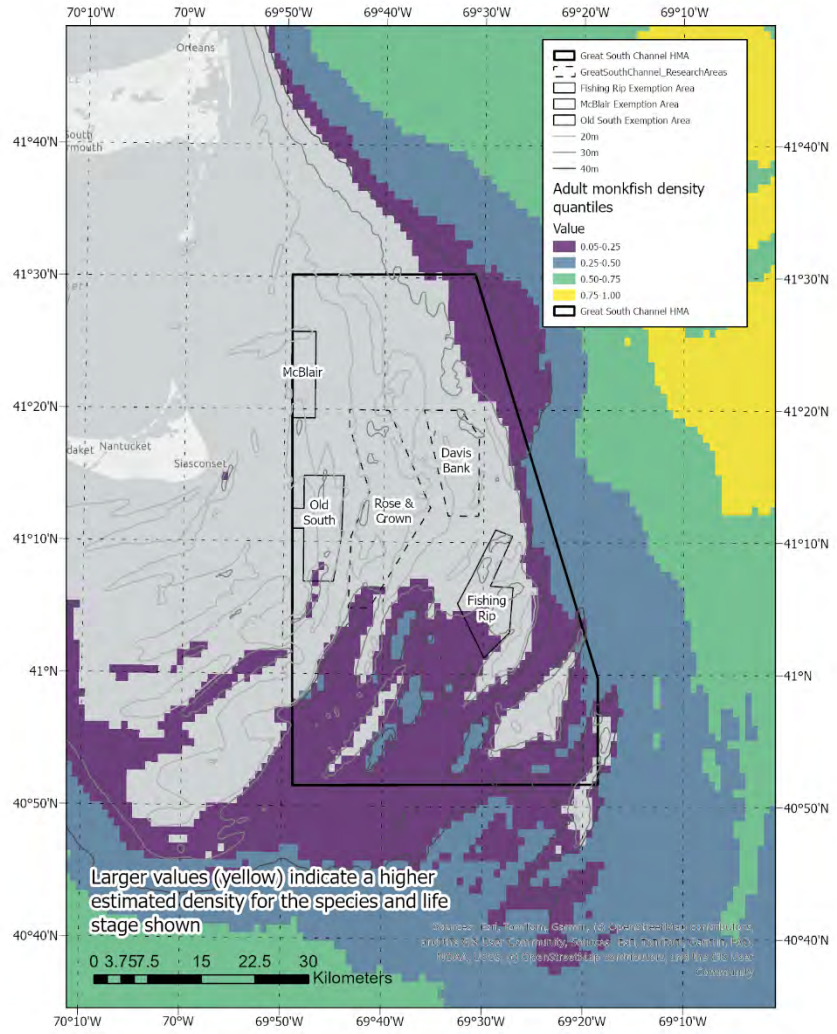




Longfin squid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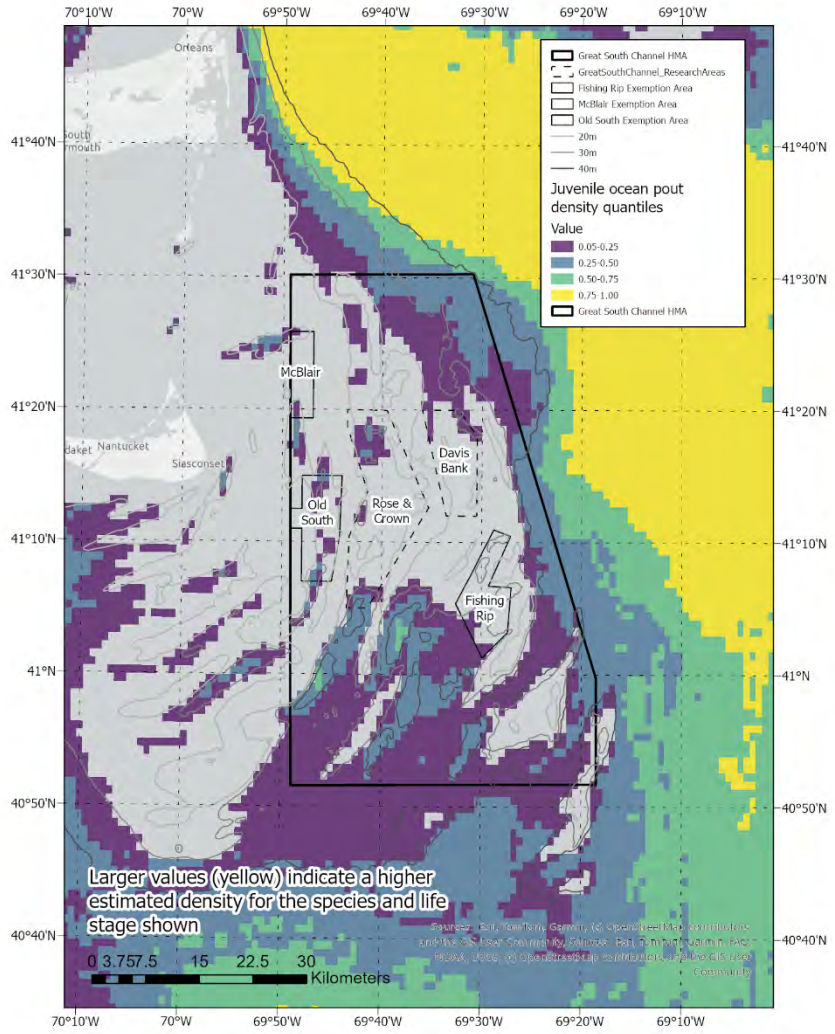
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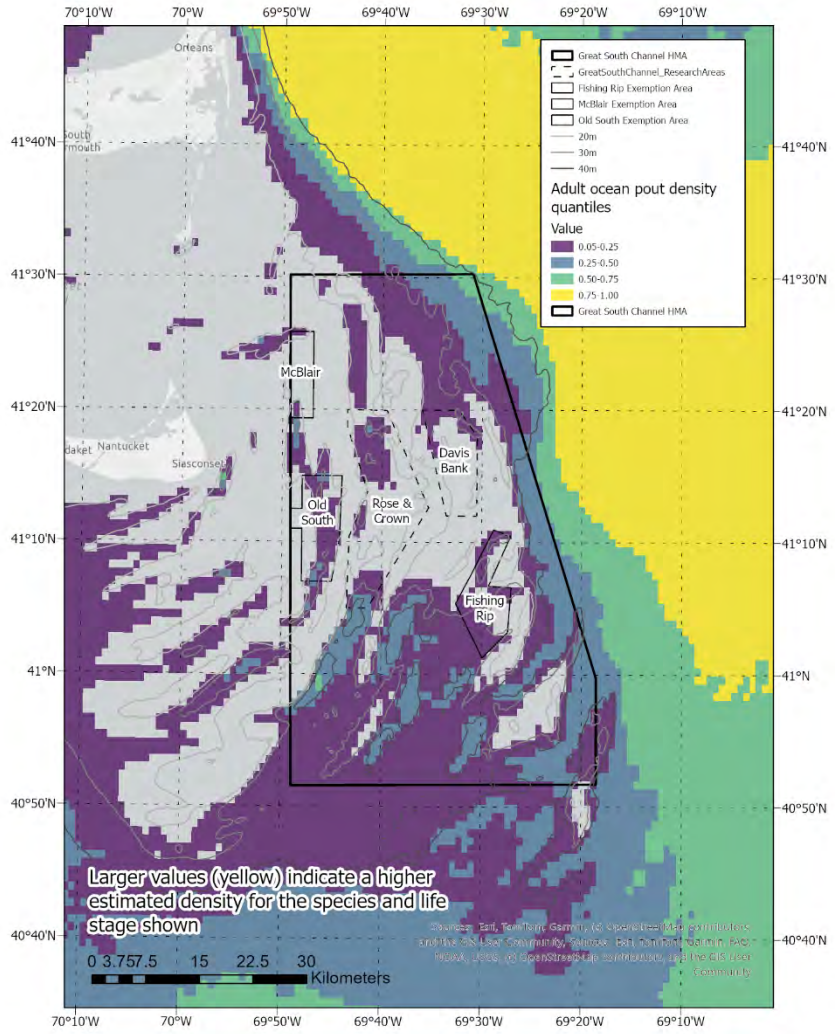
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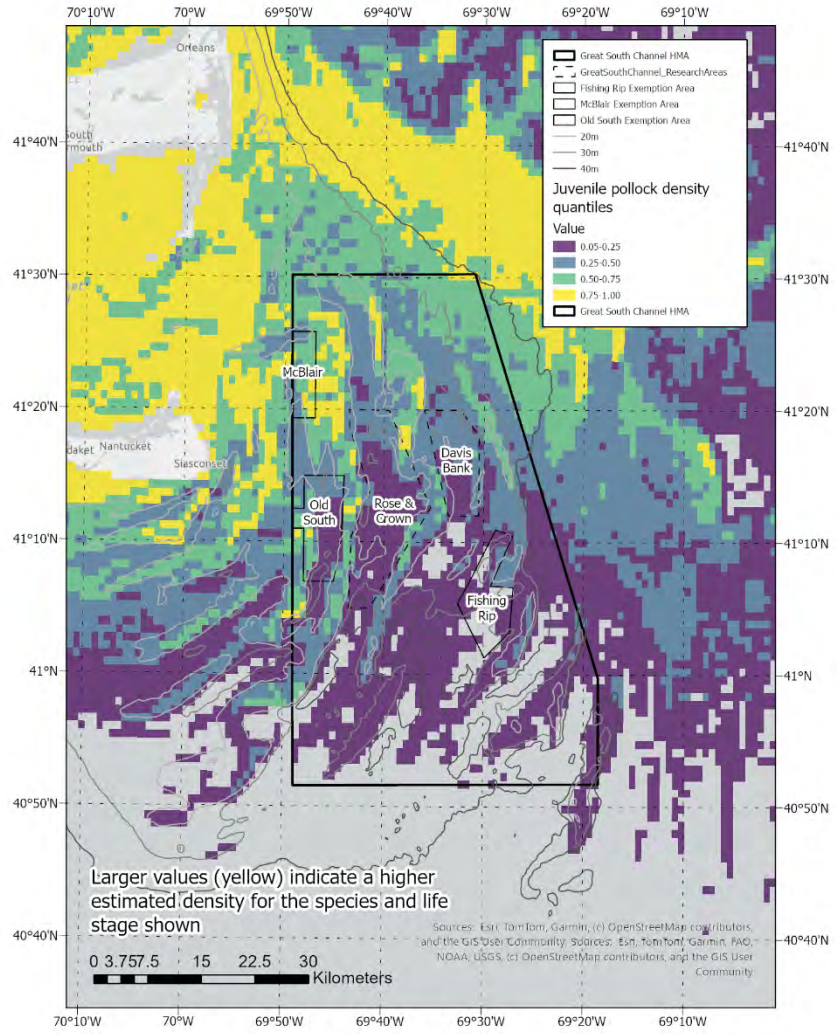
Ocean pout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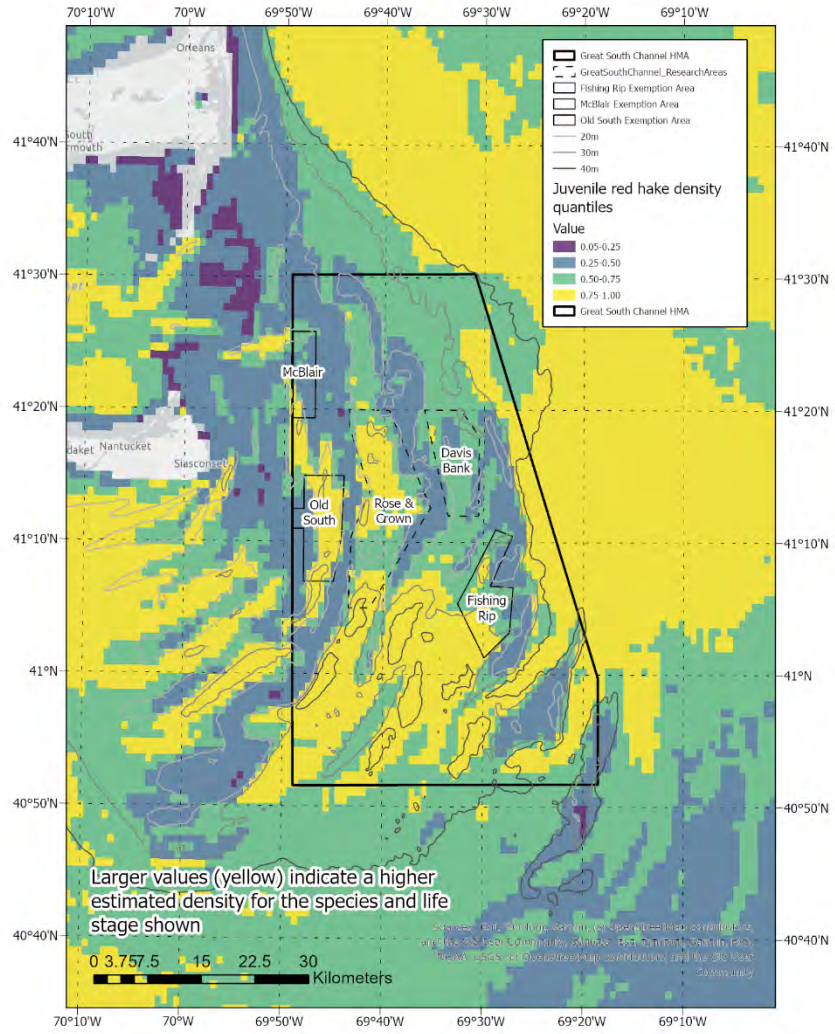
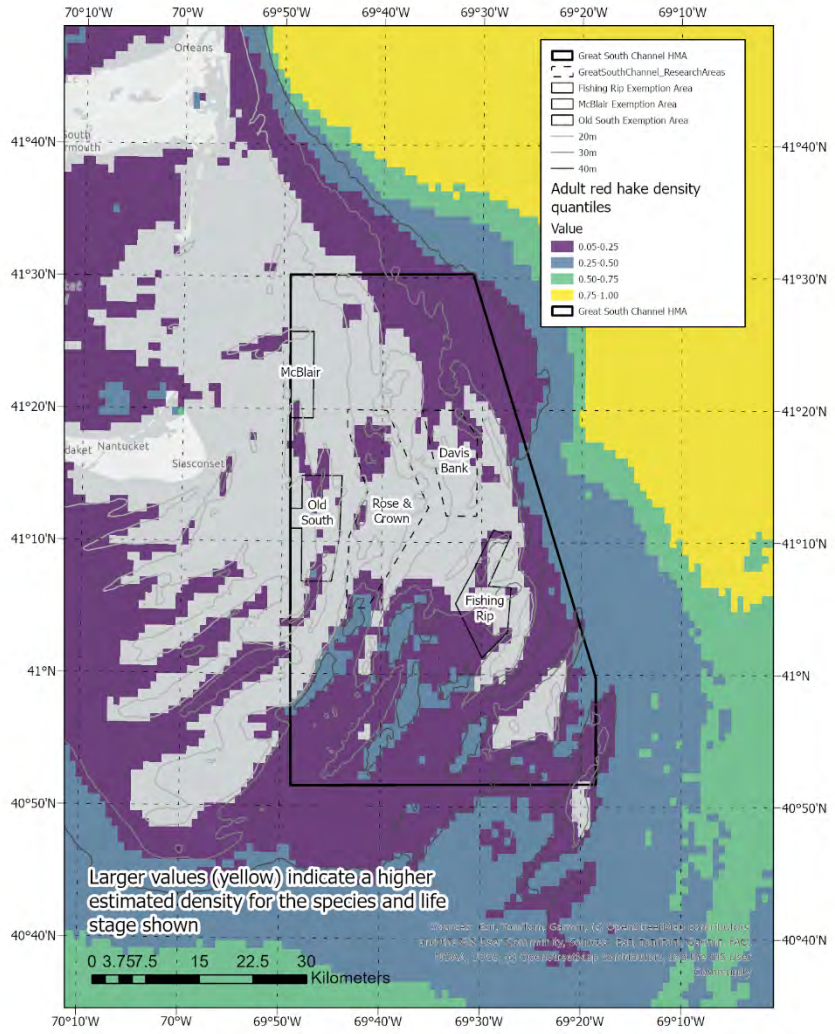
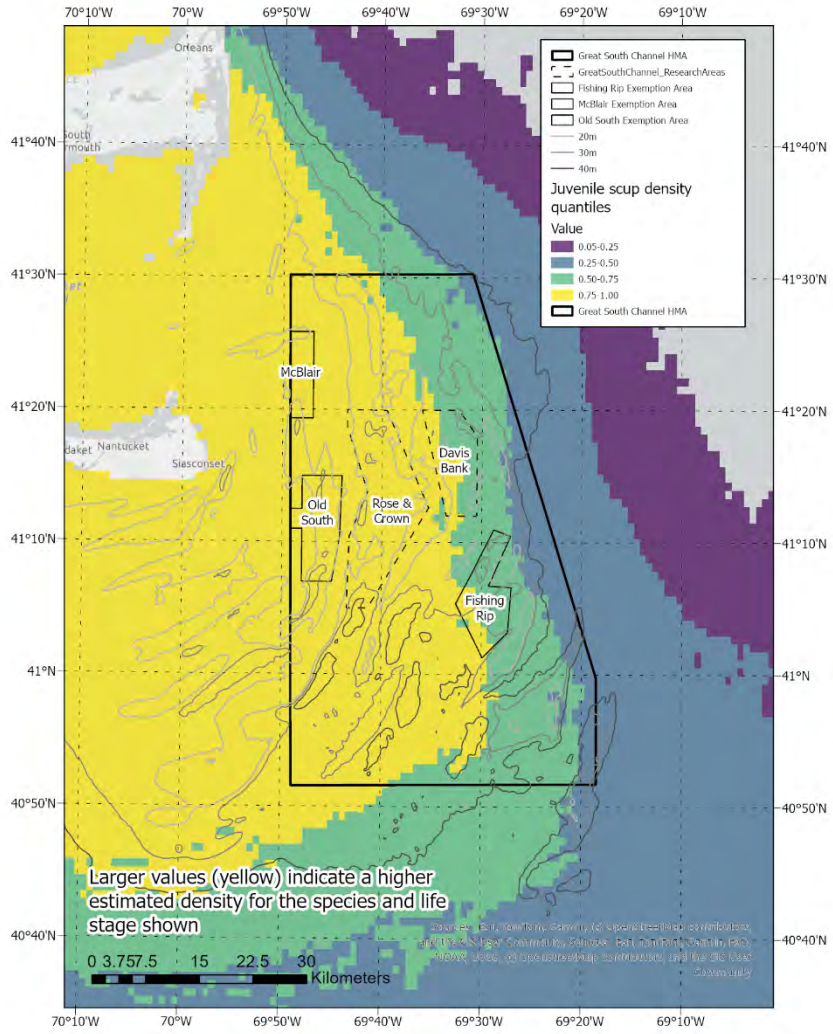
GreatSouthChannel_ResearchAreas
Fishing Rip Exemption Area
McBlair Exemption Area
Old South Exemption Area
20m
30m
40m
Juvenile pollock density quantiles
Value
0.05-0.25
0.25-0.50
0.50-0.75
0.75-1.00
Great South Channel HMA
Larger values (yellow) indicate a higher estimated density for the species and life stage shown
0 3.757.5 15 22.5 30
Kilometers
Sources: Esri, TomTom, Garmin, (c) OpenStreetMap contributors, and the GIS User Community Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, (c) OpenStreetMap contributors, and the GIS User Community

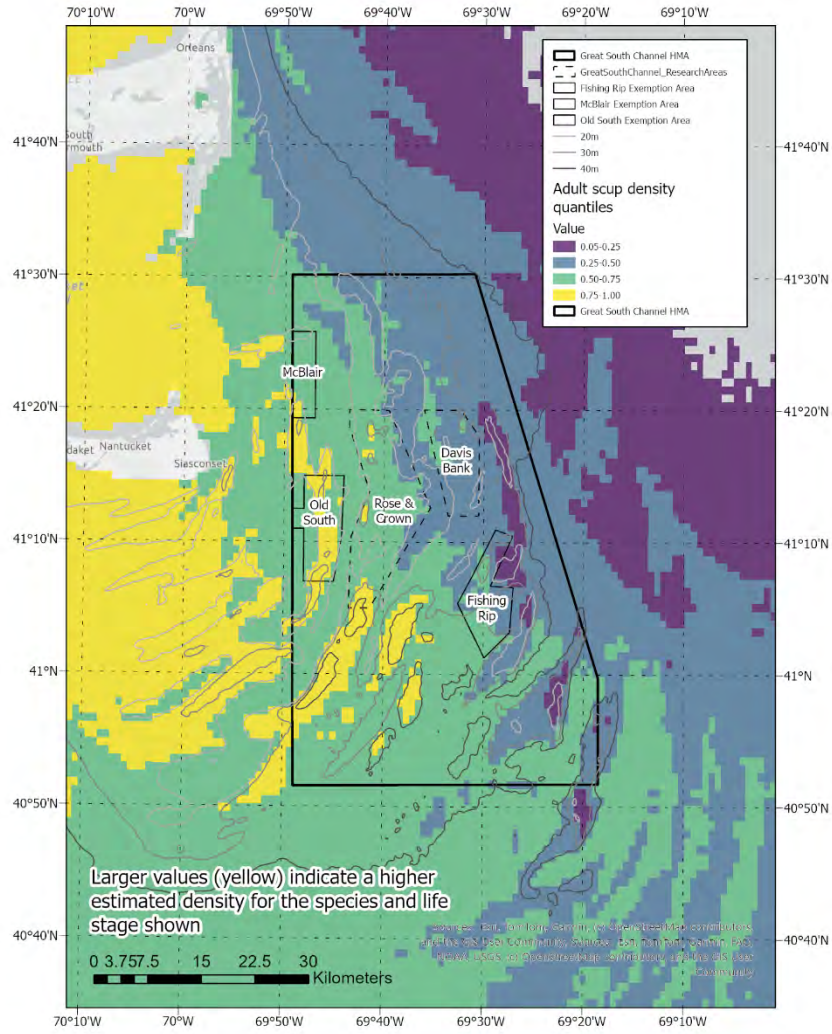
Pollock


Great South Channel HMA
GreatSouthChannel_ResearchAreas
Fishing Rip Exemption Area
McBlair Exemption Area
Old South Exemption Area
20m
30m
40m
Juvenile red hake density quantiles
Value
0.05-0.25
0.25-0.50
0.50-0.75
0.75-1.00
Great South Channel HMA
McBlair
Davis Bank
Old South
Rose & Crown
Fishing Rip
Larger values (yellow) indicate a higher estimated density for the species and life stage shown
0 3.757.5 15 22.5 30
Kilometers

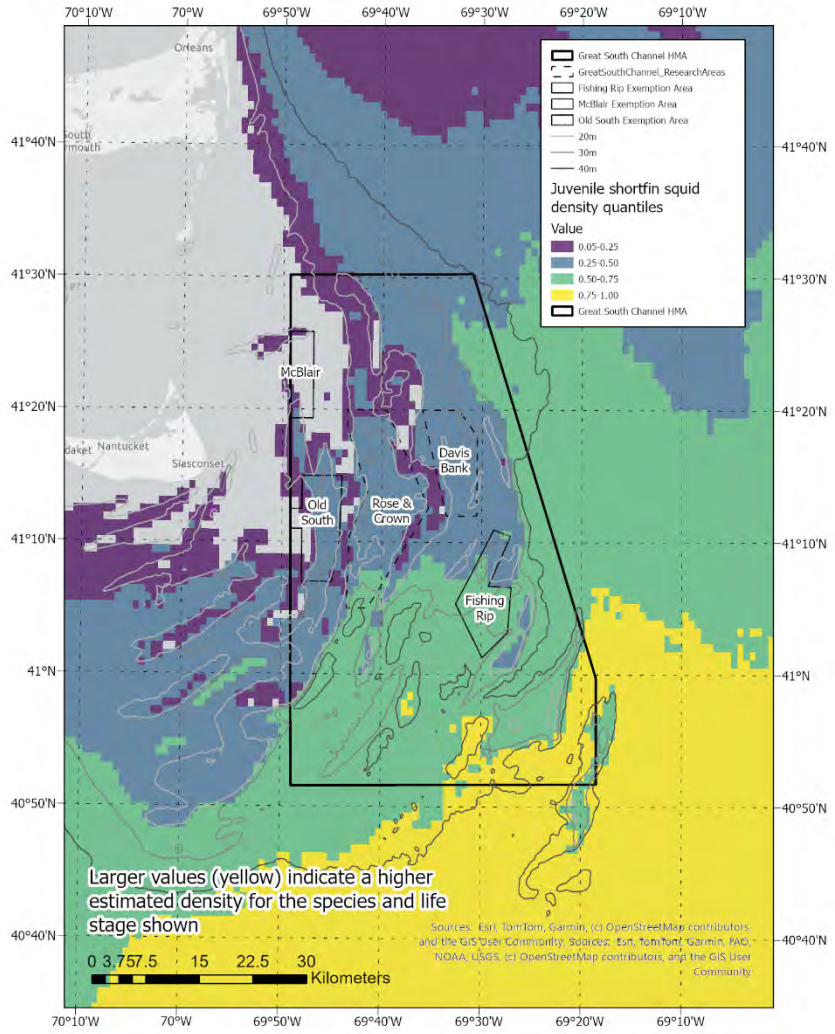

Great South Channel HMA
GreatSouthChannel_ResearchAreas
Fishing Rip Exemption Area
McBlair Exemption Area
Old South Exemption Area
20m
30m
40m
Adult red hake density quantiles
Value
0.05-0.25
0.25-0.50
0.50-0.75
0.75-1.00
Great South Channel HMA
McBlair
Davis Bank
Old South
Rose & Crown
Fishing Rip
Larger values (yellow) indicate a higher estimated density for the species and life stage shown
0 3.757.5 15 22.5 30
Kilometers

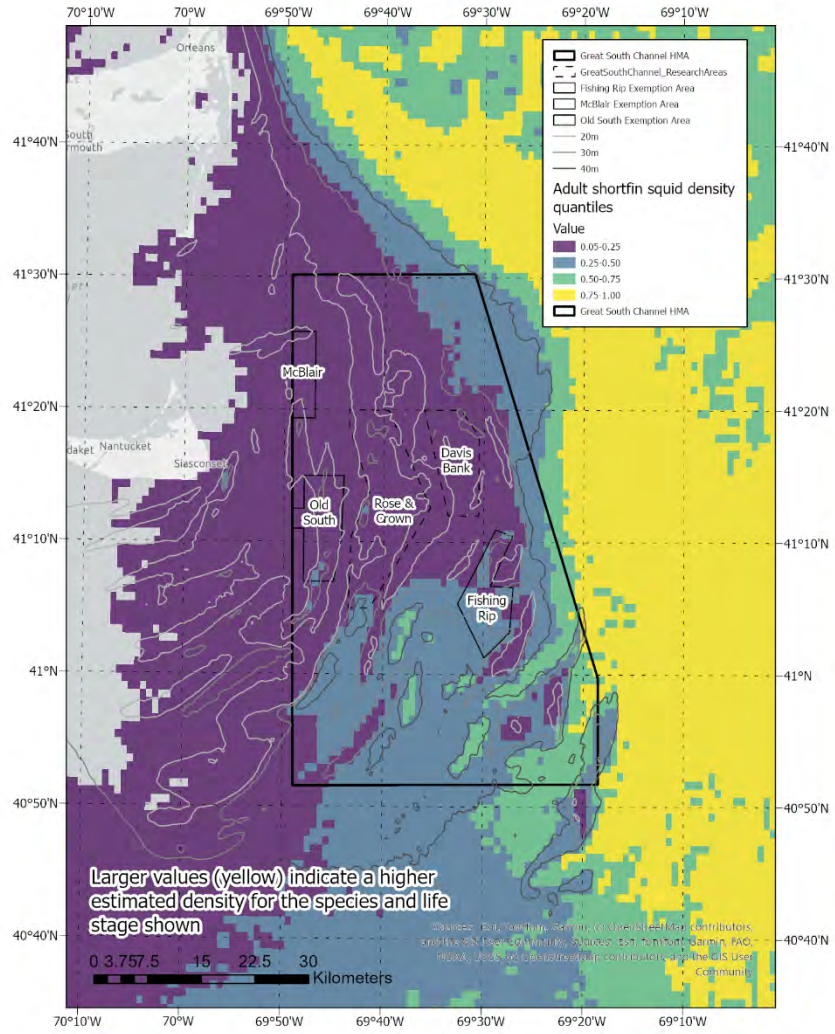
Red hake


Great South Channel HMA
GreatSouthChannel_ResearchAreas
Fishing Rip Exemption Area
McBlair Exemption Area
Old South Exemption Area
20m
30m
40m
Juvenile scup density quantiles
Value
0.05-0.25
0.25-0.50
0.50-0.75
0.75-1.00
Great South Channel HMA
McBlair
Davis Bank
Old South
Rose & Crown
Fishing Rip
Larger values (yellow) indicate a higher estimated density for the species and life stage shown
0 3.757.5 15 22.5 30
Kilometers

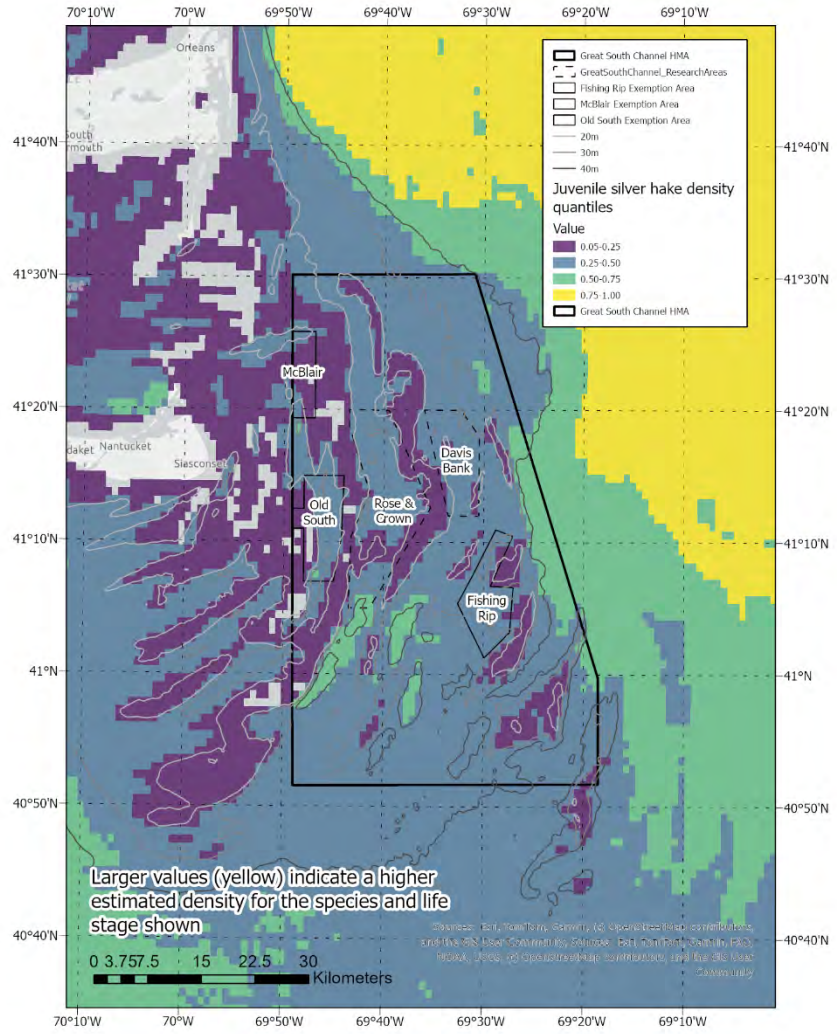

Great South Channel HMA
GreatSouthChannel_ResearchAreas
Fishing Rip Exemption Area
McBlair Exemption Area
Old South Exemption Area
20m
30m
40m
Adult scup density quantiles
Value
0.05-0.25
0.25-0.50
0.50-0.75
0.75-1.00
Great South Channel HMA
McBlair
Davis Bank
Old South
Rose & Crown
Fishing Rip
Larger values (yellow) indicate a higher estimated density for the species and life stage shown
0 3.757.5 15 22.5 30
Kilometers

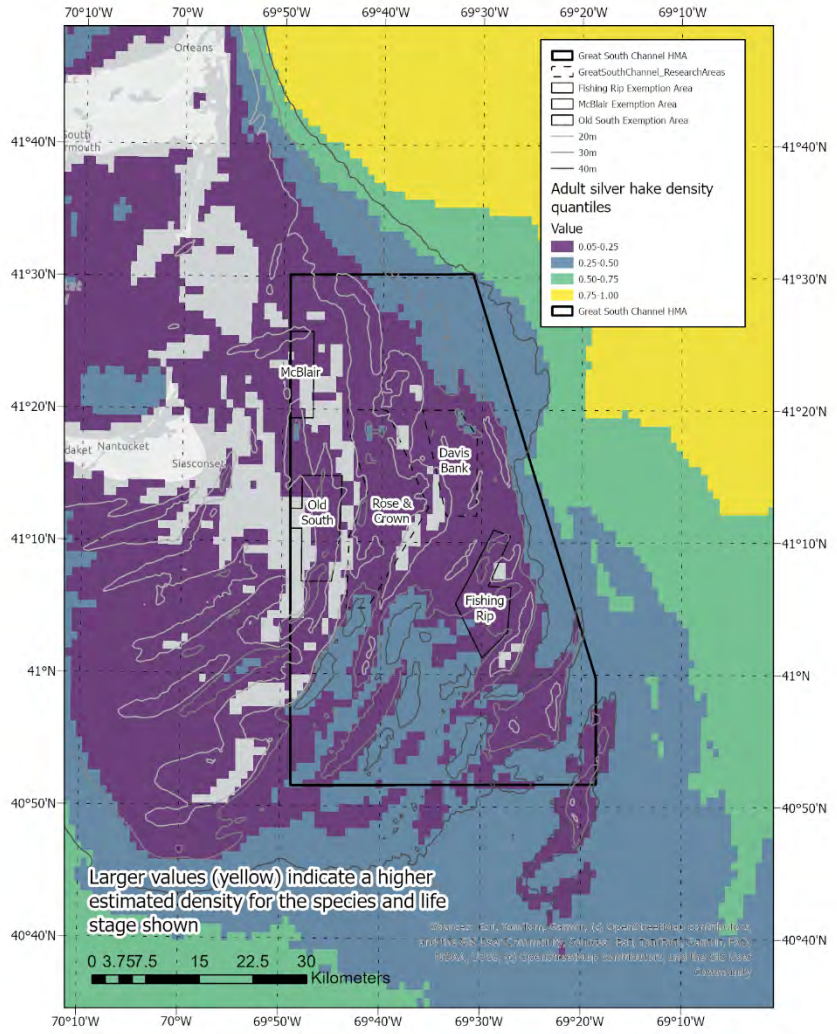
Scup



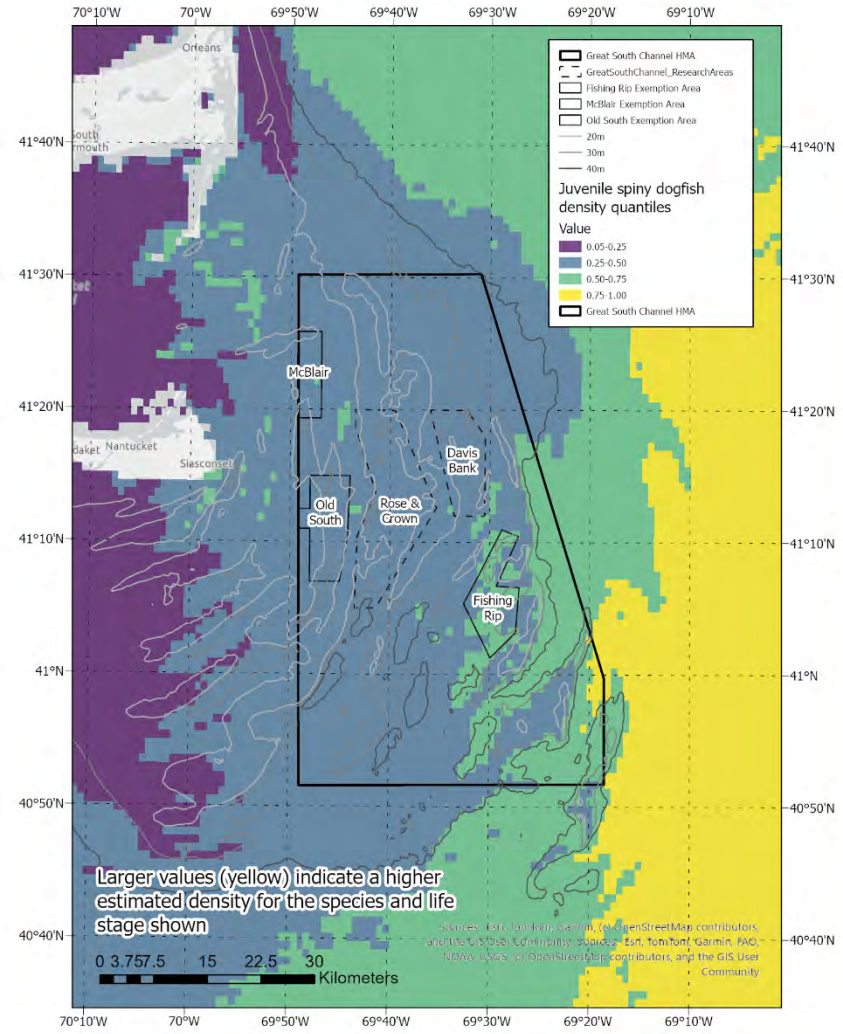


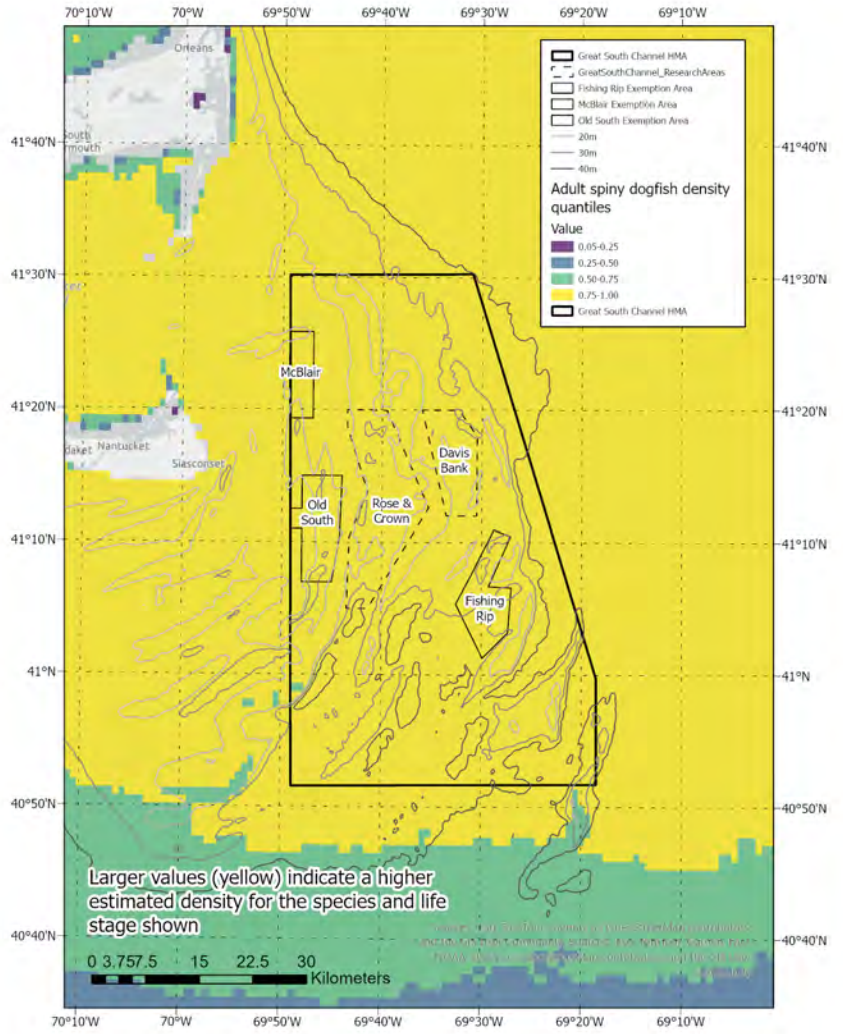
Shortfin squid


Great South Channel HMA
GreatSouthChannel_ResearchAreas
Fishing Rip Exemption Area
McBlair Exemption Area
Old South Exemption Area
20m
30m
40m
Juvenile silver hake density quantiles
Value
0.05-0.25
0.25-0.50
0.50-0.75
0.75-1.00
Great South Channel HMA
McBlair
Davis Bank
Old South
Rose & Crown
Fishing Rip
Nantucket
Siasconset
Orleans
Larger values (yellow) indicate a higher estimated density for the species and life stage shown
0 3.757.5 15 22.5 30
Kilometers
70°10'W
70°W
69°50'W
69°40'W
69°30'W
69°20'W
69°10'W
41°40'N
41°30'N
41°20'N
41°10'N
41°N
40°50'N
40°40'N

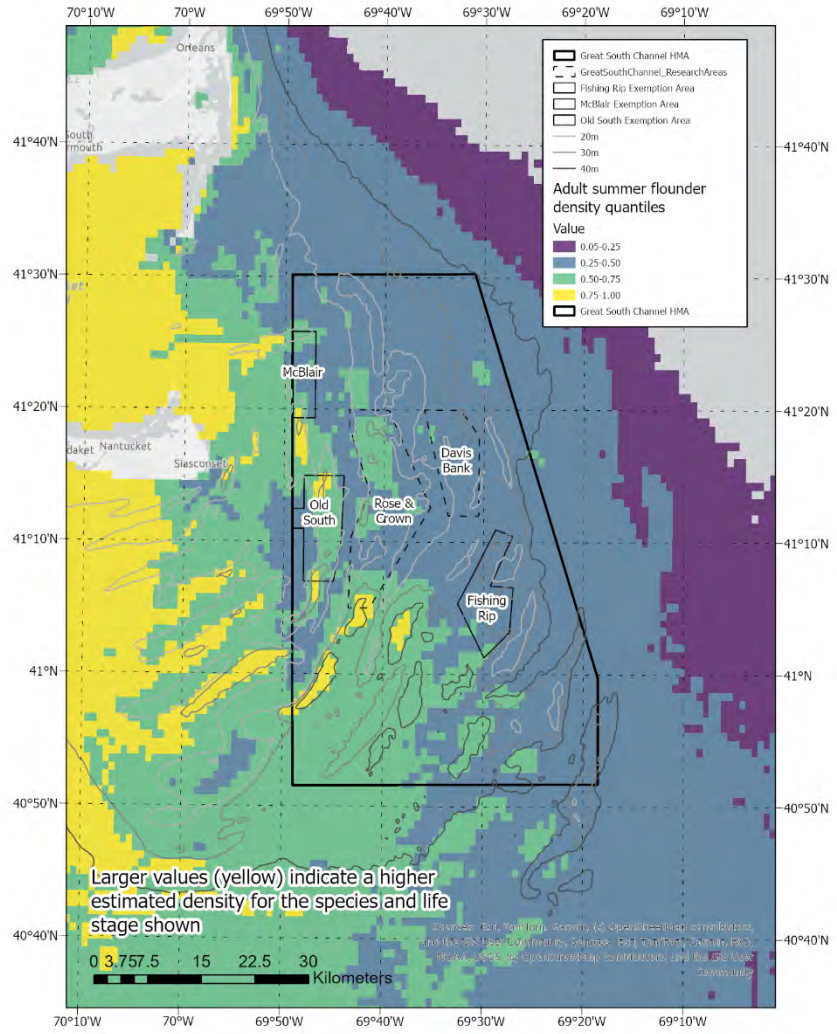

Great South Channel HMA
GreatSouthChannel_ResearchAreas
Fishing Rip Exemption Area
McBlair Exemption Area
Old South Exemption Area
20m
30m
40m
Adult silver hake density quantiles
Value
0.05-0.25
0.25-0.50
0.50-0.75
0.75-1.00
Great South Channel HMA
McBlair
Davis Bank
Old South
Rose & Crown
Fishing Rip
Nantucket
Siasconset
Orleans
Larger values (yellow) indicate a higher estimated density for the species and life stage shown
0 3.757.5 15 22.5 30
Kilometers
70°10'W
70°W
69°50'W
69°40'W
69°30'W
69°20'W
69°10'W
41°40'N
41°30'N
41°20'N
41°10'N
41°N
40°50'N
40°40'N

Silver hake

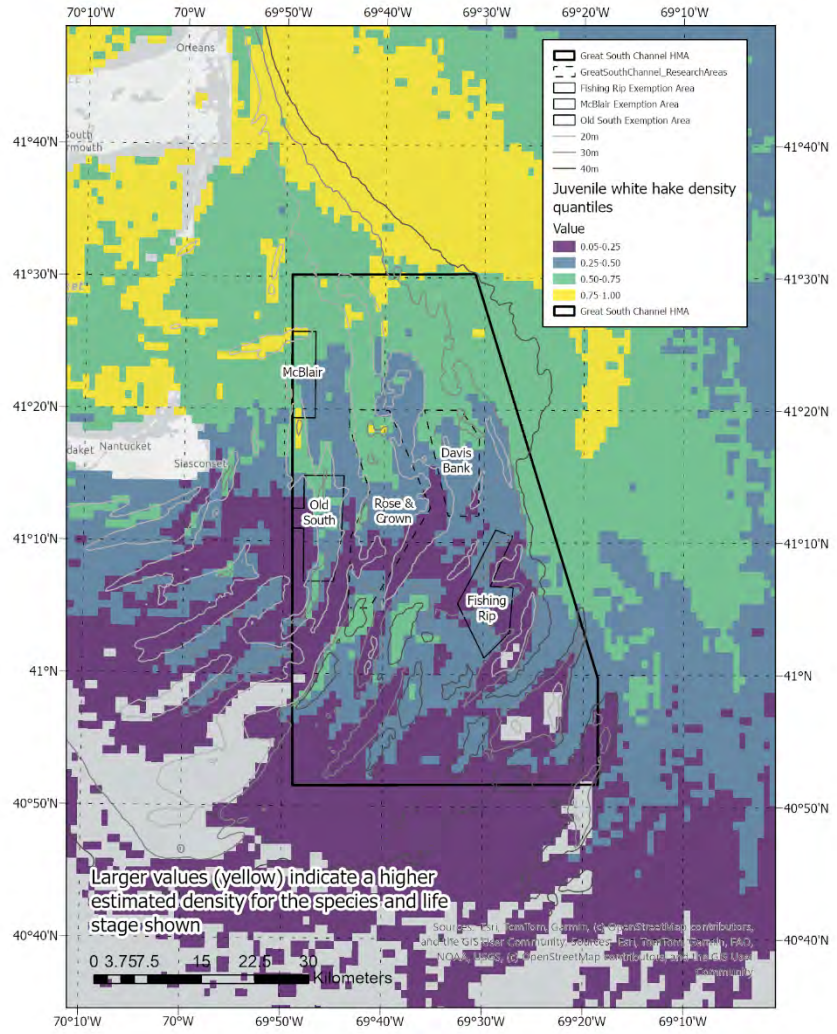




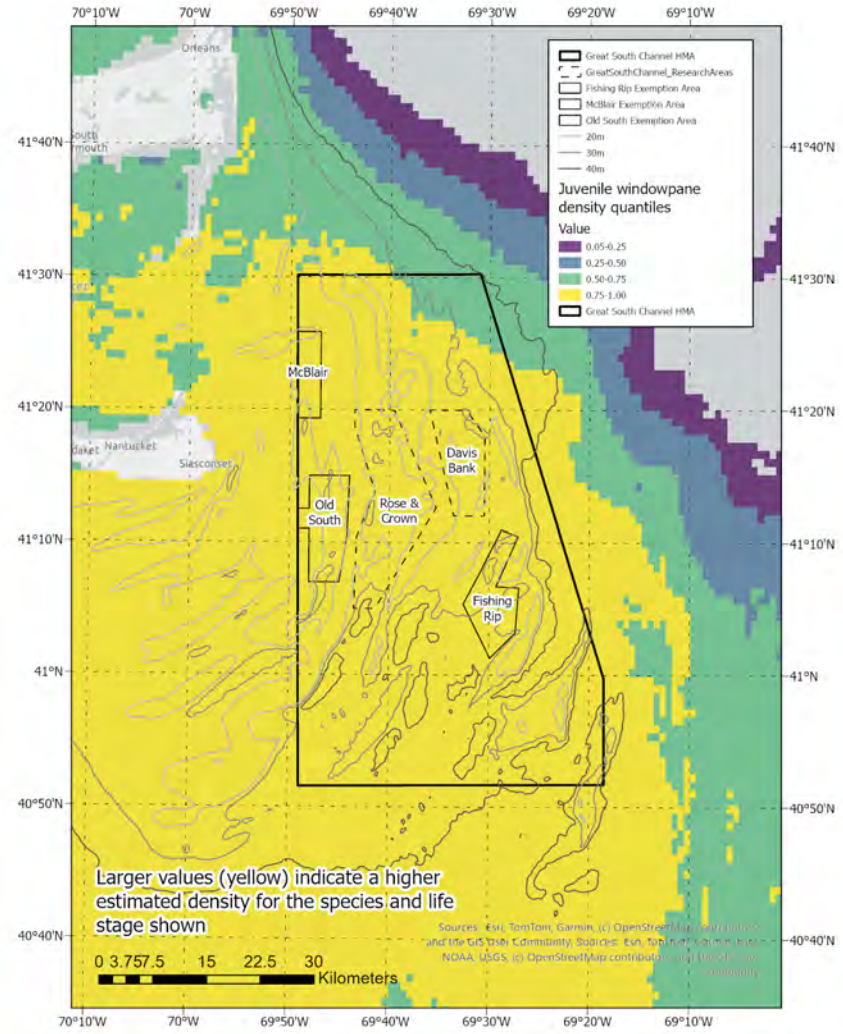
Spiny dogfish

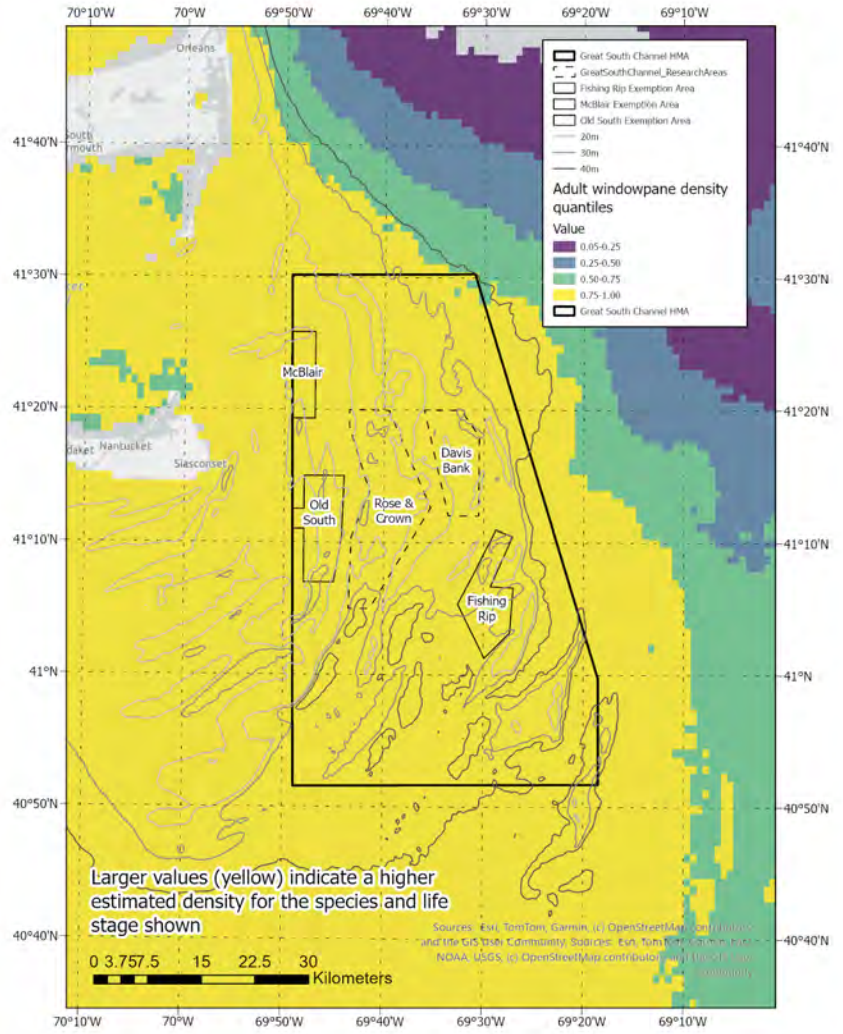


Summer flounder

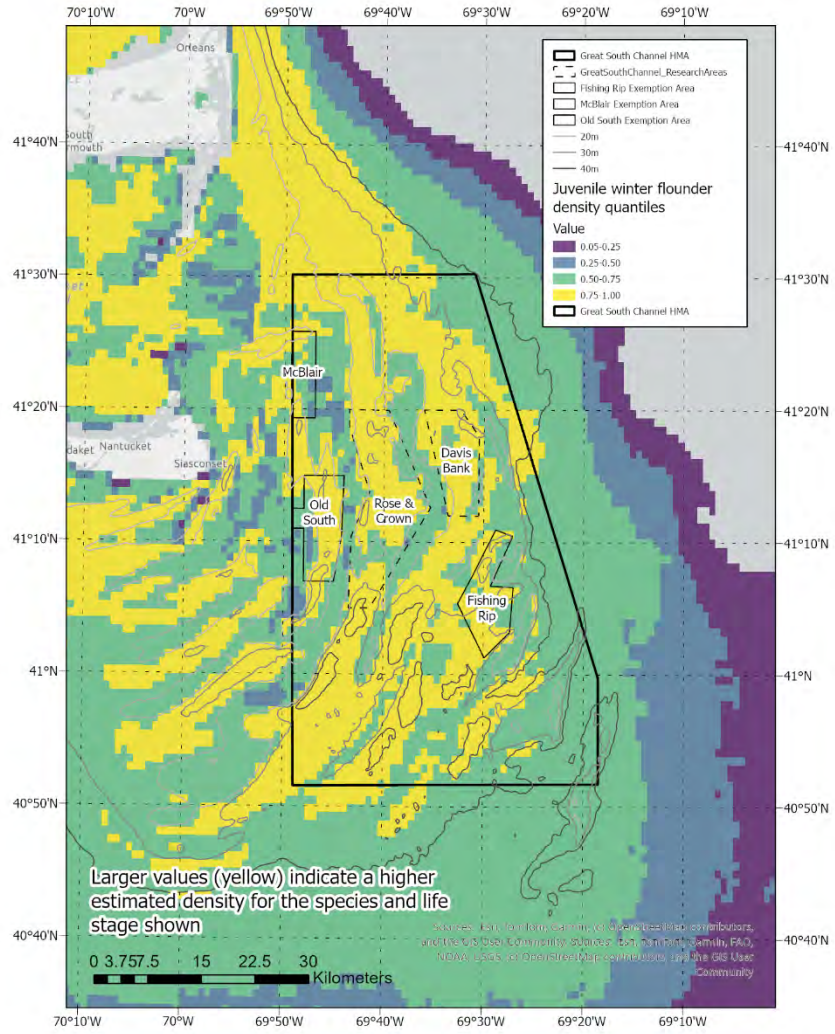

Great South Channel HMA
GreatSouthChannel_ResearchAreas
Fishing Rip Exemption Area
McBlair Exemption Area
Old South Exemption Area
20m
30m
40m
Juvenile white hake density quantiles
Value
0.05-0.25
0.25-0.50
0.50-0.75
0.75-1.00
Great South Channel HMA
McBlair
Davis Bank
Old South
Rose & Crown
Fishing Rip
Nantucket
Orleans
Larger values (yellow) indicate a higher estimated density for the species and life stage shown
0 3.757.5 15 22.5 30
Kilometers
70°10'W
70°W
69°50'W
69°40'W
69°30'W
69°20'W
69°10'W
41°40'N
41°30'N
41°20'N
41°10'N
41°N
40°50'N
40°40'N

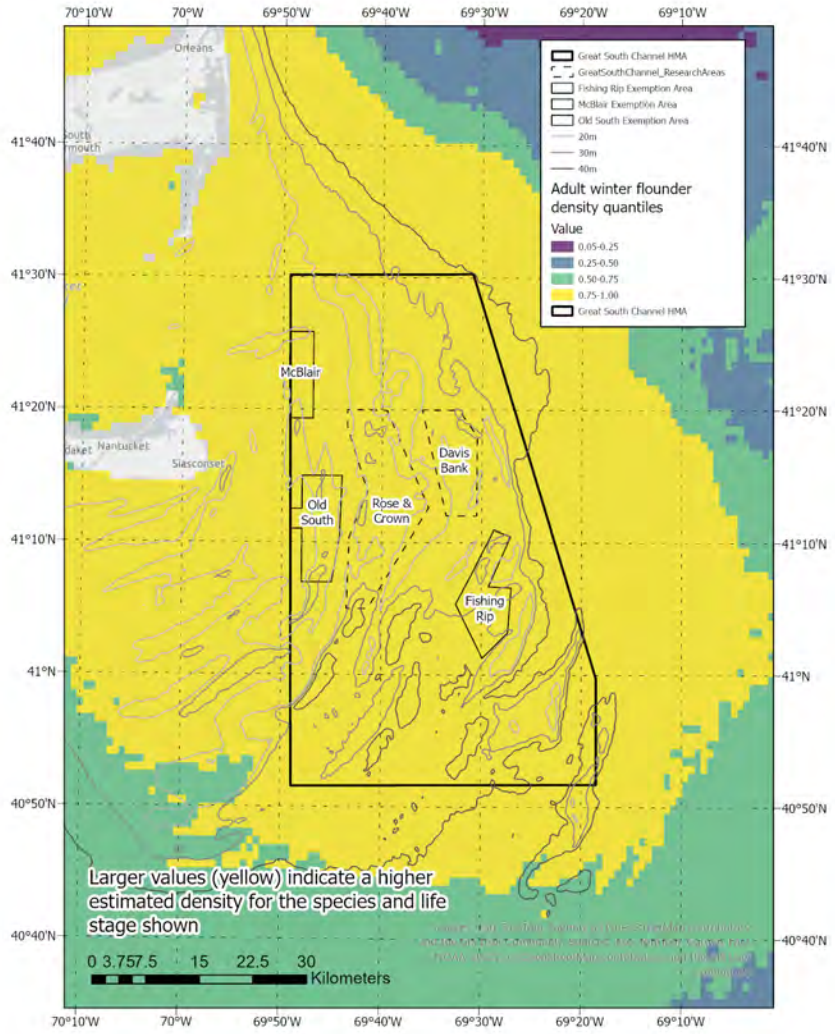
White hake



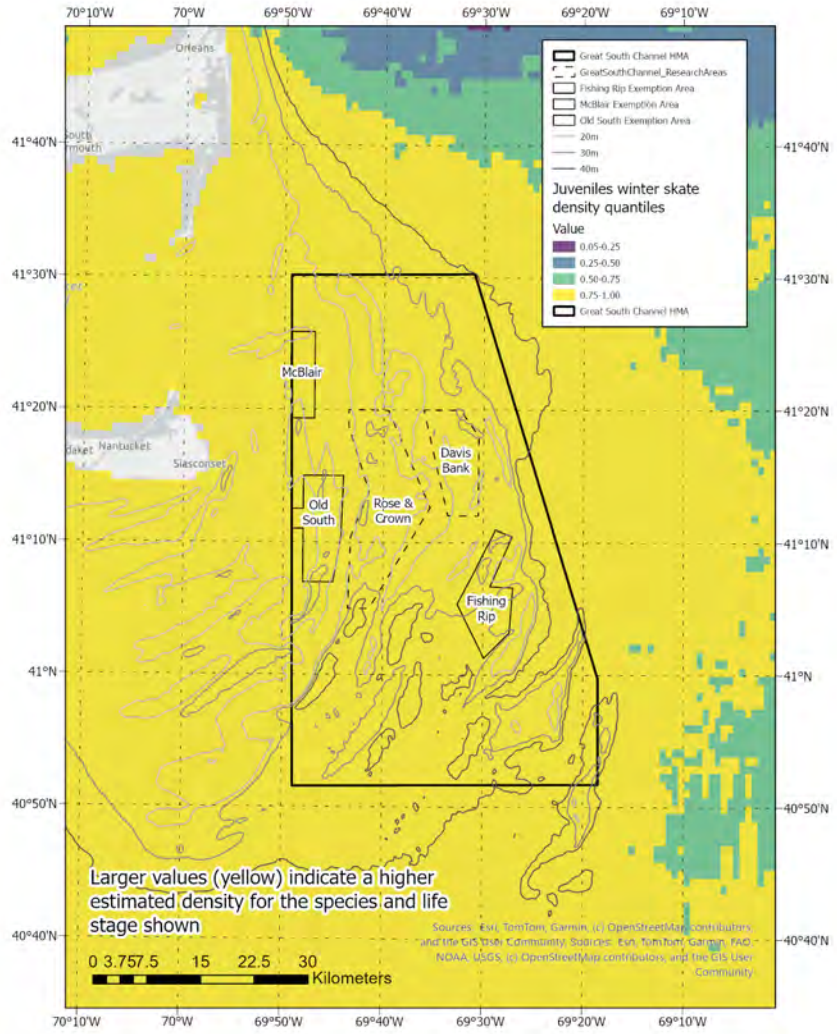


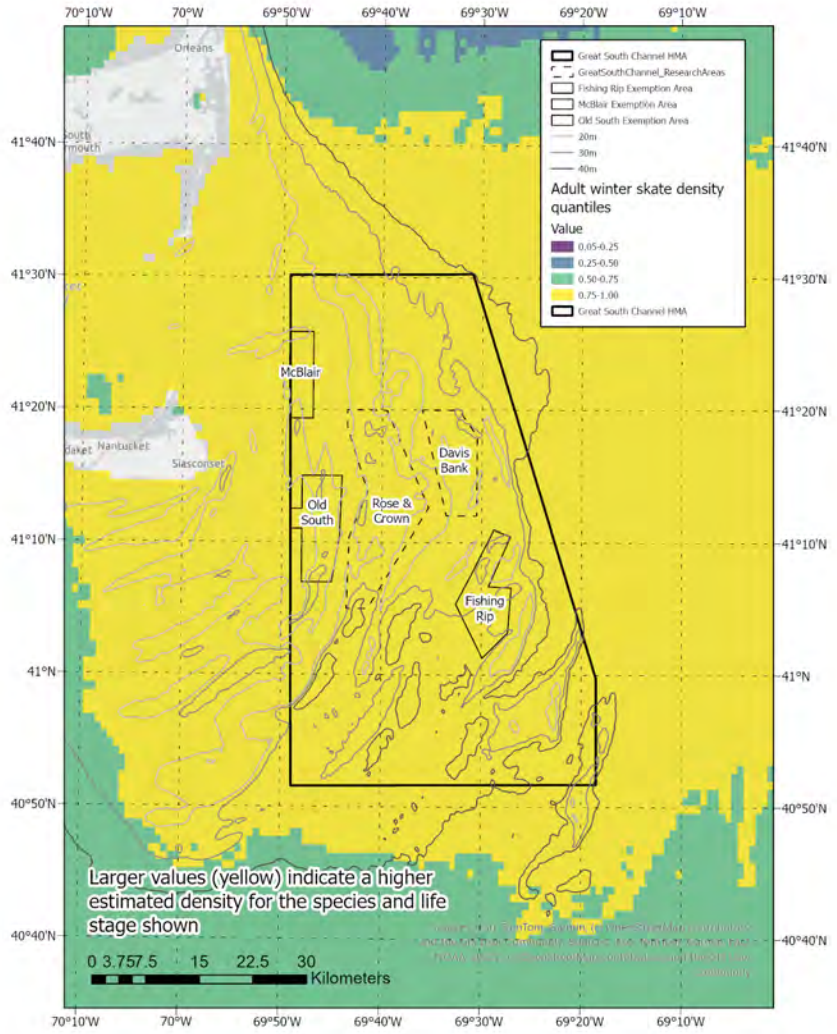
Windowpane flounder



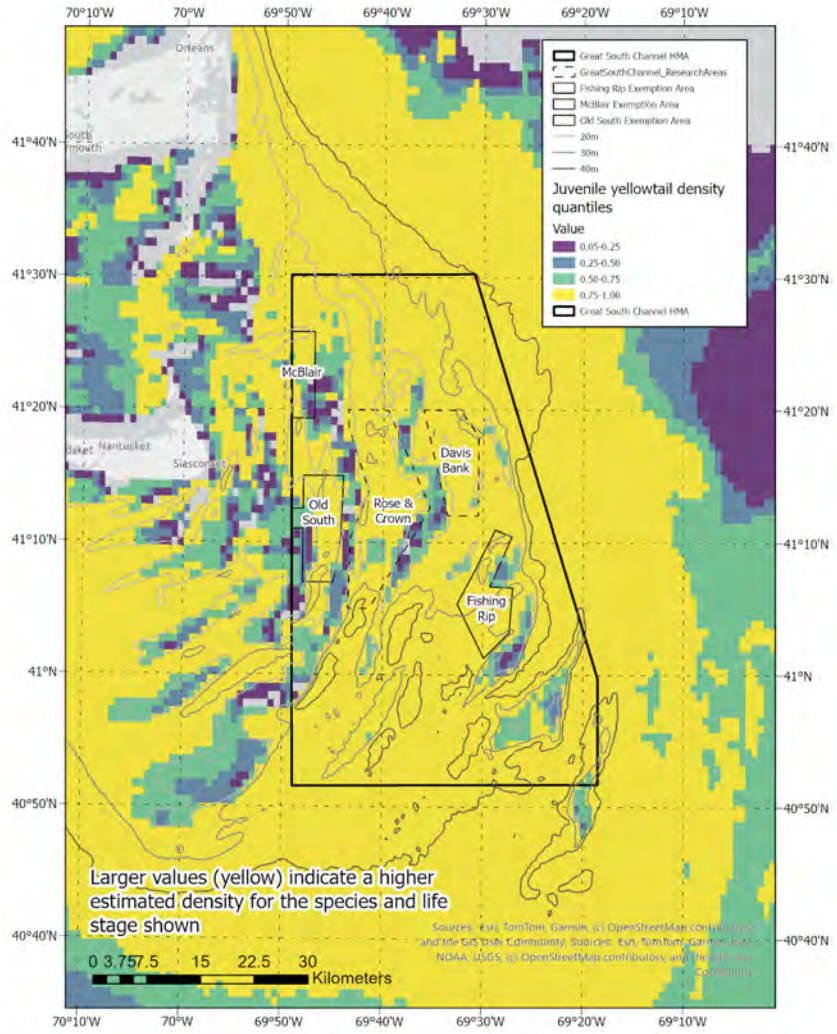


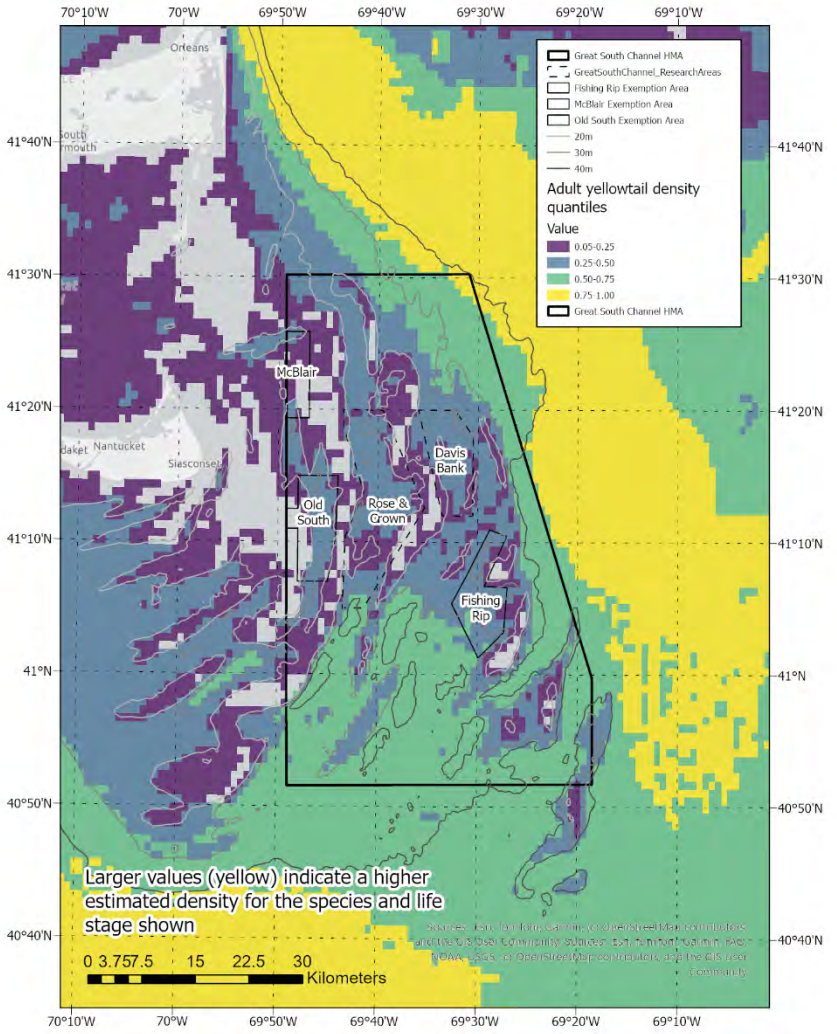
Winter flounder





Winter skate





Yellowtail flounder