This document is the New England Fishery Management Council's five-year research priority list for 2021-2025, DRAFT UNDER DEVELOPMENT

Definition of Columns

Title	Name of the research priority.
Description, rationale, potential use	Why this is a Council research priority, what question this may address, and other information that would help researchers design research to address the need.
Rating	A sense of the timing of when the data or project results would be needed to inform the management process.
	URGENT (essential): Research that is essential for compliance with federal requirements, including National Standards, or that has been identified by management as necessary to aid decision-making. It is expected that a one- or two-year project would meet the information need. Postponement would have a significant impact on management.
	IMPORTANT (near term): Obtaining a new set of data or research result that is likely to aid in the evaluation of a near term or ongoing management goal. The research might involve a time-limited program or work that could continue indefinitely. Postponement will not have an immediate impact on fishery management; however, the information generated will likely inform near term (e.g., <5 year) Council actions.
	STRATEGIC (future needs): Research that is valuable but is not associated with an immediate need or near-term (e.g., <5years) Council action.
Status	Whether the there is research underway on this topic, if known.
FMP	Which FMP or FMPs the topic relates most directly to.
Species	Which species the topic relates most directly to.
Broad category	Overarching topic.
Cross-listing	What other research priority list the item may also be on, if known.
Notes	Any other helpful information on the topic.

No.	Title	Description, rationale, potential use	Rating	Status	FMP	Species	Broad categories	Cross-listing	Notes
1	Continue development of hydroacoustic surveys and other resource surveys of pelagic species to provide an independent means of estimating stock sizes and/or defining localized depletion (e.g., spawning survey for herring on GB).	Priority has two parts: to help evaluate status of resource with acoustic survey and to see if that tool could be useful for defining localized depletion.	Important (near term)	underway	Atlantic herring	Atlantic herring	Fish surveys	assessment, RSA	An RSA project looked at defining localized depletion (Stockwell et al., 2009), but the work was not completed due to issues securing research funds. It did test the utility of that survey technology. No other NEFSC efforts since. A 2013 S-K project on herring acoustic survey. See NEFMC (2019b) for details on a GB spawning survey. A survey to evalute the success/failure of localized depletion measures would need ot be designed very carefully to provide meaningful results.
2	Investigate availability and detectability of Atlantic herring in the NEFSC spring and fall trawl survey to evaluate how well the survey detects herring.	Evaluating how well the bottom trawl survey detects herring could be useful for assessing herring biomass and if it changes over time (i.e., depth preferences).	Important (near term)	underway	Atlantic herring	Atlantic herring	Fish surveys	unknown	2018 assessment evaluated depth preference. NEFSC compared acoustic data between bottom trawl surveys and dedicated herring surveys (Jech & Sullivan, 2014). Current assessments use estimates derived from acoustic data collected during the bottom trawl surveys. ~~Staff changes in Study Fleet have slowed the exploration of commercial data to inform topic, but should resume in 2020.~~ Work with the study fleet has resumed and may be considered in the 2022 assessment.
3	Efficiency estimation of NMFS trawl survey gear for monkfish, silver hake, and red hake; estimate efficiency based on gear configuration.	Identify any issues regarding the use of a constant catchability coefficient.	Strategic (future needs)	underway	Monkfish, Small-mesh multispecies	Monkfish, Silver hake, Red hake	Fish surveys	unknown	Absolute abundance and biomass indices are not used for small-mesh multispecies. Estimates have been made for monkfish and used in the 2019 assessments. Estimates for red hake are in a working paper for the red hake reseach track meeting in January 2020.
4	Develop a conversion factor between the survey results for the *R/V Albatross* and *R/V Bigelow* for wolffish.	Would improve wolffish stock assessment.	Important (near term)	unknown	Northeast multispecies	Atlantic wolffish	Fish surveys	unknown	This factor becomes less important as more years of *R/V Bigelow* data are used in assessments. NEFSC is using the ocean pout conversion for wolffish until the Albatross and Bigelow data can be split into separate series.
5	Conduct deep water (>200 m) surveys for red crab.	Would improve red crab stock assessment (it is a data poor stock).	Important (near term)	not begun	Red crab	Red crab	Fish surveys	assessment	The last assessment (2009) noted that a survey "is the most important research recommendation for red crabs." Existing and future surveys primarily to identify deep-sea coral habitats include many observations of red crab and can be shared with PopDy. No NEFSC work; could partner with OER.
6	Scallop surveys (rotational areas or other important areas).	Contribute to total and exploitable biomass estimates	Urgent (essential)	underway	Sea scallop	Scallops	Fish surveys	RSA	Priority added in 2020. Is a long-standing Scallop RSA priority; see RSA announcement for details.
7	Supplement existing surveys with fixed gear and/or advanced sampling techniques to facilitate sampling in inaccessible areas.	e.g., use of longline or pot/trap gear to sample within complex habitat areas.	Important (near term)	underway	Multiple	Multiple	Fish surveys	unknown	NEFSC/CRB funding a GOM longline survey.
8	Investigate stock definition, stock movements, mixing, and migration through tagging studies, DNA markers, morphological characteristics and other means for Atlantic herring.	To improve data on estimate of herring biomass and to support herring management under sub-ACL management by area.	Urgent (essential)	underway	Atlantic herring	Atlantic herring	Population dynamics	assessment, RSA	2018 assessment explored multi-stock model but data insufficient to estimate movement or relative stock composition. NEFSC has proposed conducting otolith microchemistry, but to date that has not been funded. NEFSC generic research on consequences of ignoring stock structure. Topic is still urgent as spatial dynamics may be important for the current low recruitment situation.

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9	Enhance herring fishery sampling (portside, at-sea observers and monitors) to track spawning activity on GB.	Increase number of samples and sample for spawning condition	Urgent (essential)	not begun	Atlantic herring	Atlantic herring	Population dynamics, Fishery performance & monitoring	unknown	Priority added in 2020. NEFMC (2019b) has details. This topic may be even more urgent if Maine sampling is no longer funded through ACCSP. Funds may expire in June 2022 unless extended. These data are essential for the assessment.
10	Further investigation into understanding the recent low recruitment of Atlantic herring and possible drivers.	Better understand the implications for the herring population (e.g., environmental, fertilization rates, egg condition)	Urgent (essential)	unknown	Atlantic herring	Atlantic herring	Population dynamics	unknown	Priority added in 2020. NEFSC is funding a CINAR project that plans to explore this topic in some detail (2021).
11	Understand the impacts of fishing gear on herring egg mats.	Better understand the implications for the herring population.	Strategic (future needs)	unknown	Atlantic herring, Multiple	Atlantic herring, Multiple	Population dynamics, Conservation engineering, Bycatch	unknown	Priority added in 2020.
12	Calculate and/or improve river herring and shad life stage-specific estimates of range-wide natural and human mortality rates, including fishing.	Would improve RH/S stock assessment.	Important (near term)	unknown	Atlantic herring	River herring, Shad	Population dynamics	TEWG	A TEWG synthesis is being prepared. NEFSC staff involved in shad assessment.
13	Collect information on the marine phases of river herring and shad specific to migrations at sea.	Improve RH/S stock assessment for: 1) river origin of individual catch in coastal/ocean (independent surveys, tagging) & in non-targeted ocean fisheries; & 2) marine survival.	Important (near term)	underway	Atlantic herring	River herring, Shad	Population dynamics	TEWG	Turner et al and Lynch et al published several papers on at-sea distributions.
14	Monkfish life history work focusing on age and growth, longevity, reproduction, and natural mortality.	Age-based assessment	Important (near term)	underway	Monkfish	Monkfish	Population dynamics	assessment, RSA	2018 Monkfish RSA project used histological protocol for age determination. Age validation is a NEFSC priority. NEFSC involved in Bank et al (2020).
15	Monkfish tagging and telemetry studies that focus on basic life history and habitat use.	Monkfish was proposed as a species to monitor to assess adverse & beneficial impacts of wind farm development in MA & RI-MA WEAs.	Strategic (future needs)	underway	Monkfish	Monkfish	Population dynamics, Habitat, Wind energy	RSA	RSA has funded tagging work in recent years partly tied with age validation work (eg: 2020 RSA project). No NEFSC work.
16	Further investigations into stock definition, stock movements, mixing, and migration through tagging studies, DNA markers, morphological characteristics and other means for groundfish (Atlantic cod, Atlantic halibut).	To improve the understanding of stock structure of Atlantic cod and Atlantic halibut, possibly make changes in the future to the stock boundaries.	Important (near term)	underway	Northeast multispecies	Cod, Halibut	Population dynamics	unknown	Multiple ongoing projects. Cod: SMAST, MA DMF, Cornell, UNH; TNC& GMRI (3 S-K projects); contributions to the Atlantic Cod Stock Structure Working Group. Halibut: TNC.
17	Investigate stock definition, movement, mixing, and migration through tagging studies, DNA markers, morphological characteristics and other means for silver hake and red hake.	This has always been an issue for stock assessments; climate change has added to the uncertainty.	Important (near term)	underway	Small-mesh multispecies	Silver hake, Red hake	Population dynamics, Climate change	unknown	Ashford et. al. studied red hake stock structure with elementary chemistry, life history and oceanography and will be reviewed at the red hake stock structure workshop for 2020 assessment.
18	Document fishermen's ecological knowledge for red hake.	As a low value species, landings and targeted fishing for red hake is uncertain. Knowledge of previous fisheries could have bearing on former red hake productivity.	Strategic (future needs)	underway	Small-mesh multispecies	Red hake	Population dynamics, Human dimensions	assessment	Priority added in 2020. This has been identified as a medium priority by the stock structure working group.
19	Genetic stock identification, natural tag analysis, and otolith microchemistry studies for red hake.	Needed to more definitively provide advice on red hake stock structures and future changes in the same.	Strategic (future needs)	not begun	Small-mesh multispecies	Red hake	Population dynamics	unknown	Priority added in 2020. These priorities have been identified as high priority by the stock structure working group.

No.	Title	Description, rationale, potential use	Rating	Status	FMP	Species	Broad categories	Cross-listing	Notes
20	Biology of red crab: growth rates; molt; reproductive cycles; maturity schedule; fecundity; sex ratios by depth & year; larval supply, transport & settlement; early juvenile distributions& abundance; esp. reproductive consequences of depleting large males.	Would improve red crab stock assessment.	Important (near term)	underway	Red crab	Red crab	Population dynamics	assessment	Red crab is a data poor stock. The last assessment report (2009) noted all of these topics as important. Stevens (2016) on maturity and fecundity, but growth rate research still needed.
21	Expand the body of knowledge on scallops in the Gulf of Maine bioregion.	Understanding growth, reproduction, natural mortality in GOM would address data gaps & assessment needs.	Strategic (future needs)	**underway**	Sea scallop	Scallops	Population dynamics	unknown	Priority added in 2020. Was a 2020/2021 Scallop RSA priority. Research on growth by Hodgedon et al. (2020). Surveys funded by Scallop RSA. Status changed from "unknown" to "underway".
22	Scallop life history work focusing on natural mortality, including all sources of non-harvest mortality such as predation, disease, and discard mortality.	Attention should be directed to the large mortality events ~~in the NLS-West area~~ to inform future management practices.	Important (near term)	underway	Sea scallop	Scallops	Population dynamics	assessment, RSA	Is a 2021/2022 Scallop RSA priority; see RSA announcement for details. As of the latest assessment (~~2018~~ 2020), discard mortality questions remain. The next research track assessment (benchmark) planned in 2024. Scallop Cte approved revision in May 2021.
23	Investigate age, growth, maturity, and fecundity of managed skate species (esp. thorny and rosette).	Thorny skate life history would help address rebuilding issues, but data on rosette is particularly lacking.	Important (near term)	underway	Skates	Skates	Population dynamics	assessment	Recent literature review may help. James (2018, 2019) found sexual maturation can lead to decreased frequency of band-pair formation resulting in age underestimation for species thought to produce annual band-pairs throughout their life cycle.
24	Investigate fine-scale spawning dynamics and the appropriate size and timing of spawning area closures.	Potential to adjust time-area closures for groundfish species or impact small-mesh multispecies exemption areas.	Important (near term)	underway	Multiple	Multiple	Population dynamics	unknown	Two S-K projects and Council-funded projects on cod and winter flounder spawning. NEFSC has supported a GMRI study.
25	Explore the sources of uncertainties in Atlantic herring and silver and red hake stock assessments, including retrospective patterns, and identify appropriate adjustments (e.g., data or modeling revisions) to resolve those patterns.	To improve data on estimate of herring and silver and red hake biomass.	Strategic (future needs)	underway	Atlantic herring, Small-mesh multispecies	Atlantic herring, Silver hake, Red crab	Stock assessment	unknown	Very large topic for all assessments, challenging to resolve. This could be explored during the Atlantic herring management track assessment.
26	Improve and standardize data collection methods for river herring and shad stocks.	Needed for management & assessment of RH/S (e.g., for catch caps). Useful beyond Herring FMP.	Urgent (essential)	underway	Atlantic herring	River herring, Shad	Stock assessment	TEWG	No NEFSC scientists working on this but are involved in ASMFC assessment.
27	Develop biological benchmarks used in RH/S assessment modeling and management.	Needed for management & assessment of RH/S (e.g., for catch caps). Useful beyond Herring FMP.	Urgent (essential)	underway	Atlantic herring	River herring, Shad	Stock assessment	TEWG	NEFSC scientists involved in ASMFC assessment.
28	Continue to explore uncertainties in groundfish stock assessments, including retrospective patterns; identify adjustments (e.g., data or modeling revisions) to resolve those patterns.	Would improve groundfish stock assessments.	Urgent (essential)	underway	Northeast multispecies	Groundfish	Stock assessment, Ecosystems	unknown	Council contracted J. Wiedenmann & O. Jensen at Rutgers work; NEFSC working on this issue (WKFORBIAS workshop, report in prep).
29	Aging and age-structured red hake assessment.	Needed to improve the red hake assessments.	Important (near term)	underway	Small-mesh multispecies	Red hake	Stock assessment	unknown	Priority added in 2020. Existing analytic stock assessments have performed poorly and have been rejected. These priorities have been identified as high to medium priority by the stock structure working group.
30	Develop guidance for rejecting stock assessments and next steps, including how to set new biological reference points if an assessment/model is rejected.	Would improve the stock assessment process.	Urgent (essential)	unknown	Multiple	Multiple	Stock assessment	unknown	Badly needed. NRCC has started efforts on BSIA. SMS stock assessments have been previously rejected & this issue could arise again in future assessments.

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31	Explore use of survey results from the *R/V Bigelow* as a separate index of abundance as the survey time series lengthens.	Would improve stock assessments. May be important for SMS stocks, although calibration studies were deemed sufficient for silver & red hakes.	Important (near term)	underway	Multiple	Multiple	Stock assessment	unknown	This is part of the benchmark assessment process already. The 2018 A. herring benchmark assess. was the first to do so for a NE species/stock.
32	Develop a gonad-based estimate of SSB and reference points for scallops.	Understand how gonad weight changes in space and time, when spawning is occurring, and the reproductive output. Need to develop a standard way to measure gonads (wet v. dry).	Important (near term)	unknown	Sea scallop	Scallops	Stock assessment, Population dynamics	unknown	Priority added in 2020.
33	Investigate different growth rates found in different scallop harvesting areas, particularly the Nantucket Lightship region.	Understand if growth rates are driven by local production	Important (near term)	**underway**	Sea scallop	Scallops	Stock assessment, Population dynamics	RSA	Priority added in 2020. Is a 2021/2022 Scallop RSA priority; see RSA announcement for details. VIMS (Rudders et al) funded through Scallop RSA, focus on NLS. Status changed from "unknown" to "underway".
34	Further comparison of assessment model configurations.	Comparison of models used for status determination (CASA, SYM), and for projections (SAMS).	Important (near term)	**underway**	Sea scallop	Scallops	Stock assessment	unknown	Priority added in 2020. RSA funded VIMS to look at age-based scallop model (Mann). NEFSC hired contractor to program GEOSAMS. Status changed from "unknown" to "underway".
35	Incorporate other surveys into stock assessments as appropriate.	Would improve stock assessments. Including industry-based surveys, state surveys, NEAMAP, collaborative surveys with industry and scientists.	Important (near term)	underway	Multiple	Multiple	Stock assessment	unknown	Used recently for GOM cod, witch flounder, and GB yellowtail flounder assessments. NEFSC plans to evaluate in management track process. Probably needed for small-mesh multispecies stocks.
36	How should the inshore and offshore components of the groundfish fishery be identified?	Investigate the modern groundfish fishery.	Important (near term)	unknown	Northeast multispecies	Groundfish	Fisheries management, Human dimensions	unknown	No NEFSC work.
37	Examine whether the current definition of the directed groundfish fishery (landing >1 lb. groundfish per year) is still appropriate.	Investigate the modern groundfish fishery and explore other definitions to identify whether the economic analyses for groundfish actions accurately capture the fishery.	Important (near term)	unknown	Northeast multispecies	Groundfish	Fisheries management, Human dimensions	unknown	No NEFSC work. Topic came up in the 2019 interviews of Council members (Williams et al 2020).
38	Evaluate the effectiveness of the groundfish ABC control rule for setting groundfish catch advice.	Use of groundfish ABC control rule has been difficult recently. Investigate: 1) the potential for using F-ramp procedures in control rules, & 2) when to use "Option C" & how to estimate ABC with it (for stocks that cannot rebuild to BMSY in the specified rebuilding period, even with no fishing, the ABC should be based on incidental bycatch, incl. lowering bycatch rate).	Strategic (future needs)	unknown	Northeast multispecies	Groundfish	Fisheries management	unknown	This was a Nov. 2016 SSC recommendation resulting from discussion of the Wiedenmann and Jenson work. The SSC felt that control rules for all FMPs should be investigated starting with groundfish. A MSE-like study may help.
39	Catch efficiencies by mesh size, when new minimum fish size regulations are implemented.	Investigate potential means to improve access to healthy stocks while minimizing impacts to stocks needing conservation.	Strategic (future needs)	unknown	Northeast multispecies	Groundfish	Fisheries management	unknown	Mesh size, possession limits, and small-mesh access areas should also be considered. No NEFSC work.
40	Options to broaden the definition of the sector system & increase flexibility in groundfish fishery operations (e.g., expanding the range of participants allowed to join sectors and the suite of permits and their associated allocations that can be used under sectors).	Investigate potential means to improve access to healthy stocks while minimizing impacts to stocks needing conservation.	strategic (future needs)	unknown	Northeast multispecies	Groundfish	Fisheries management	unknown	No NEFSC work.

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41	Research on organizational theory, collaboration and trust and its implications for the use of science in decision making and acceptance of management outcomes.	Could improve NEFMC and NMFS processes.	Urgent (essential)	underway	Multiple	Multiple	Fisheries management, Human dimensions	unknown	Priority added in 2020. See Ebbin (2004).
42	Analysis of previous actions implemented in the Herring FMP to determine if they have been effective and are meeting intended goals.	A MSE-like study may be appropriate.	Important (near term)	not begun	Atlantic herring	Atlantic herring	Fisheries management	unknown	Priority added in 2019.
43	Research and/or policy analysis study to move towards recommendations for how the Council addresses environmental justice, including the nexus with data collection and repeatability, and process recommendations for engagement.	Would improve ability to address public engagement requirements in various statutes and compliance with the EO 12898 on Environmental Justice.	Urgent (essential)	unknown	Multiple	Multiple	Fisheries management, Human dimensions	unknown	Priority added in 2020. Was a recommendation of the 2018 NEFMC program review.
44	Develop effective skate species identification methods for fishermen, dealers, and port samplers (e.g., inexpensive biochemical/genetic assay method, better training & morphological keys for juvenile skates and skate wings).	To improve data on species composition of landings and discards.	Strategic (future needs)	underway	Skates	Skates	Fisheries management	assessment	Reporting skate species landed has been required since FW 2, but it can be very difficult, particularly for juvenile skates. There are known data errors (e.g., landings of "smooth skates" where smooth skates are known to not occur). Some outreach & methods development. No NEFSC work.
45	Investigate the economic impacts of GB yellowtail flounder quotas on the scallop fishery, particularly how allocations of other fisheries impact rotational management.	Would improve the economic impact assemments of groundfish and scallop actions.	Urgent (essential)	underway	Northeast multispecies, Sea scallop	Scallops, Groundfish	Fisheries management, Human dimensions	unknown	Priority added in 2020.
46	Investigate monkfish age validation.	Resolve the age and growth issues that prevented the stock assessment model from being updated in the 2016 Operational Assessment.	Important (near term)	unknown	Monkfish	Monkfish	Fisheries management	assessment, RSA	Age validation is a NEFSC priority. NEFSC involved in Bank et al (2020).
47	Investigate monkfish discard mortality rate estimates across gear types.	Improve stock assessments	Strategic (future needs)	underway	Monkfish	Monkfish	Fisheries management	unknown	The assumed rate is currently set at 100%. Oustide of NEFSC expertise. RSA project on monkfish discard mortality in scallop gear (VIMS/UNE) showed potential for survival.
48	Research to elucidate modes of infection, transmission and distribution of scallop diseases and parasites that may adversely impact scallop health, meat quality and reproductive viability.	Special attention should be directed to conditions that may result in modifications to the scallop rotational area management strategy to maximize yield.	Important (near term)	underway	Sea scallop	Scallops	Fisheries management	unknown	~~Susan Ingalls has been funded through S-K in 2017.~~ Was a 2020/2021 Scallop RSA priority. RSA funded projects on gray meats (SMAST, CFF), and nematodes (VIMS/Rutgers). Oustide of NEFSC expertise.
49	Evaluate ways to control predation on scallops.	Managing to optimize yield/recruit; natural mortality events can impact short and long-term management.	Strategic (future needs)	not begun	Sea scallop	Scallops	Fisheries management	unknown	Oustide of NEFSC expertise, but scallop dredge survey has been monitoring sea star abundances since 2000.
50	Research to address potential implications of spat collection, seeding and relocation of scallops for enhancement purposes ~~in light of below average recruitment, anomalous slow growth, and unknown impacts of diseases and parasites.~~	Identify standards for future work. Explore ways to suppliment wild harvest in light of below average recruitment, anomalous slow growth, and unknown impacts of diseases and parasites.	Important (near term)	underway	Sea scallop	Scallops	Fisheries management	RSA	Is a 2021/2022 Scallop RSA priority; see RSA announcement for details. CFF has been funded in the past to do some of this work.~~Outside of NEFSC expertise.~~ Scallop Cte approved change May 2021.
51	Research that investigates the factors affecting scallop fishing power and estimates of how they relate to projections of landings per unit of effort.		Important (near term)	underway	Sea scallop	Scallops	Fisheries management	unknown	SMAST (Wright, Cadrin, O'Keefe) funded by RSA to complete LPUE work. It was presented to the SAW 65 workgroup. Current LPUE submodel of the SAMS forecasting model is updated. ~~and currently working well.~~

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52	Research related to identifying the major sources of scallop management uncertainty and measuring their potential effects on future fishery allocations.	A MSE-like study may be appropriate.	Important (near term)	unknown	Sea scallop	Scallops	Fisheries management	unknown	A15 lists sources of mgmt. uncertainty. Scallop CTE wanted to look at carryover as a potential 2019 priority & the PDT would consider mgmt. uncertainty in this evaluation.
53	Investigate the feasibility of permit splitting across and within all FMPs.	Increase flexibility & reduce the barriers for new entrants to NEFMC fisheries, to achieve goals of FMPs. Explore why the decision was made to bind certain permits together and revisit to see whether it is still appropriate. Could involve MAFMC permits.	Important (near term)	unknown	Multiple	Multiple	Fisheries management, Human dimensions	unknown	This priority might be relevant for vessels in the small-mesh multispecies fishery, although effects of permit changes could have implications for the open access fishery. No NEFSC work.
54	Identify spawning components on a spatial and temporal scale for Atlantic herring and define whether localized depletion has negative impacts on spawning capacity.	Progress on acoustics and stock mixing herring research priories would help with this priority.	Important (near term)	unknown	Atlantic herring	Atlantic herring	Fishery performance & monitoring	unknown	NEFSC contributed data to related GMRI study.A very specific directed study would be needed to address this adequately.
55	Investigate Atlantic herring fishery fleet behavior and decision-making with respect to their relationship to population dynamics, closed areas, catch rates, etc.		Strategic (future needs)	not begun	Atlantic herring	Atlantic herring	Fishery performance & monitoring	unknown	Generally lower priority, not very clear what main objective is here. Could help evaluate current and future management measures. No NEFSC work.
56	Improve sampling for commercial groundfish catch at age data, e.g., cooperative NMFS-industry programs to supplement port agent activities, with emphasis on bycatch (incl. incidental catch).	Improve data for stock assessments	Strategic (future needs)	underway	Northeast multispecies	Groundfish	Fishery performance & monitoring	unknown	Work underway by the NEFSC Cooperative Research Biosampling Program.
57	Evaluate spatially-explicit changes in groundfish fleet behavior in response to restricted fishing in closed areas.	Impacts analysis of management actions.	Strategic (future needs)	unknown	Northeast multispecies	Groundfish	Fishery performance & monitoring	unknown	It is important to understand the effects of a key management tool, i.e. closed areas. No NEFSC work but Gini indices are calculated in some assessments.
58	Investigate groundfish discard mortality rate estimates across gear types (e.g., GB cod for the recreational fishery).	There are currently different mortality rates used for GB and GOM cod for the recreational fishery; the explanation for this difference is unclear.	Important (near term)	underway	Northeast multispecies	Groundfish	Fishery performance & monitoring	unknown	Recent Council-funded project and literature review by PDT changed discard mortality rates for wolffish, Atlantic halibut, and GOM haddock. Outside of NEFSC expertise.
59	Research the extent and composition bycatch, discards and discard survival in the large-mesh groundfish fishery (e.g., silver hake).	Could be used to design selective gear or area/season management and improve catch reporting.	Important (near term)	underway	Northeast multispecies, Small-mesh multispecies	Groundfish, Silver hake	Fishery performance & monitoring, Bycatch	unknown	Silver hake catches have been a fraction of the ACL, but we have reduced the southern whiting specifications by 38% due to declining biomass. Outside NEFSC expertise.
60	Continue to improve reporting accuracy, including accurate reporting of species and area fished.	Would improve catch reporting, including proper identification of key species, which are often misreported by fishermen (e.g. red/white hake; silver/offshore hake).	Important (near term)	underway	Multiple, Small-mesh multispecies, Northeast multispecies	Multiple, Offshore hake, Red hake, White hake	Fishery performance & monitoring	unknown	Work to support Amendment 23/Groundfish Monitoring for the commercial Fishery.

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61	~~Investigate discard mortality rates by gear type, area, season, depth, and bottom type for all seven skate species with an emphasis on overfished species (thorny skates) and alternative ways to estimate dead discards in the specifications process, e.g. forecasting; and examining trends in magnitude of discards.~~ Develop 1) new programs to estimate total skate discards (e.g., include skate species in the sampling protocol for Observers-ASM-IFM, but as a lower priority than sampling groundfish) and 2) more research to establish mortality rates for all the skate species/gear types that still use the assumed rate of 50%.	Improve data for specifications setting. There is still a 50% discard mortality assumption for barndoor, clearnose, rosette for all gear types; for little for gillnet and longline; for smooth and thorny for gillnet, longline, and scallop dredge; for winter for longline.	Important (near term)	**underway**	Skates	Skates, Smooth skate, Thorny skate	Fishery performance & monitoring	assessment	**ASM program primarily samples groundfish discards.** Outside of NEFSC expertise. Skate Cte approved change in May 2021. Status changed from "unknown" to "underway."
62	Collect data on discards of other clupeids in the A. herring and other fisheries; develop improvements to river herring/shad catch estimation methods in the A. herring fishery.	Improve monitoring and reduce bycatch.	Important (near term)	underway	Atlantic herring	River herring, Shad	Bycatch	TEWG	The PS program collects catch and discard data in the A. herring fishery. This could be expanded to other fisheries, but that is outside the scope of the current herring PS program. The process was peer reviewed and deemed sufficient for catch cap monitoring with no changes recommended. NEFSC using EM to look at slippage issues.
63	Continue River Herring Bycatch Avoidance Program in the Atlantic herring fishery and develop or evaluate innovative approaches for avoidance or monitoring river herring/shad catch in small mesh fisheries.	Approaches include: bycatch avoidance, environmental cues, electronic monitoring, portside sampling.	Important (near term)	underway	Atlantic herring	River herring, Shad	Bycatch	TEWG, RSA	Council maintained this as a research priority for 2019-2021 RSA. Ongoing research by Turner et al.
64	Identify gears and/or methods that would reduce bycatch and/or improve discard survival of unwanted catch, that may change the ratio of component catch species or improve size and species selectivity of gear for groundfish, monkfish, herring and skates.	Minimize bycatch	Urgent (essential)	underway	Northeast multispecies, Monkfish, Atlantic herring, Skates	Groundfish, Monkfish, Atlantic herring, Skates	Bycatch, Gear	RSA	Many projects, e.g., BREP 2018 award creating bycatch avoidance model for rec fishery; small-mesh belly panel to reduce flatfish. Four S-K projects on lobster trap bycatch & haddock trawls. 2013 S-K project on reducing sturgeon bycatch in monkfish gillnet. Outside of NEFSC expertise.
65	Research the extent and composition of discards and bycatch in the small-mesh multispecies fishery.	Could be used to design selective gear or area/season management.	Strategic (future needs)	not begun	Small-mesh multispecies	Small-mesh multispecies	Bycatch	unknown	MADMF is interested in additional experimental fisheries to evaluate gear selectivity. No NEFSC work other than data collection.
66	Evaluate barriers to marketing whiting and red hake, which could lower fishery discards and improve profitability.	Could help the industry to improve opportunities to market fish that might otherwise be discarded.	Important (near term)	not begun	Small-mesh multispecies	Small-mesh multispecies	Bycatch	unknown	No NEFSC work.
67	Improve estimates of red and silver hake discards from the northern shrimp fishery (if reopened).	Could be used to design selective gear or area/season management.	Strategic (future needs)	not begun	Small-mesh multispecies	Red hake, Silver hake	Bycatch	unknown	Priority was more important when northern red hake overfishing was occurring but could become important again if red hake biomass declines & northern shrimp fishery reopens.

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68	Identify gears and/or methods that would reduce bycatch and/or improve discard survival of unwanted catch of red hake discards in small mesh fisheries.	Could be used to design selective gear or area/season management.	Urgent (essential)	not begun	Small-mesh multispecies	Red hake	Bycatch, Gear	unknown	This priority is very important because southern red hake is overfished and the Council is initiating action, although research results are unlikely to be available in time. The Council has tasked the PDT to begin analysis of observer data to identify ways to reduce discards in a future action. Outside NEFSC expertise.
69	Commercial scallop dredge catch efficiency.	improve scallop size selectivity, reduce scallop damage, reduce non-target species bycatch, and to reduce fuel consumption.	Important (near term)	underway	Sea scallop	Scallops	Bycatch, Gear	RSA	Priority added in 2020. Is a 2021/2022 Scallop RSA priority; see RSA announcement for details. N-Viro (CFRF), modified cutting bar (NFI, CFF) work has been funded recently.
70	Identify and evaluate methods to reduce the impacts of the scallop fishery with respect to bycatch of small scallops and non-target species.	Could include seasonal and spatial patterns.	**Urgent (essential)**	underway	Sea scallop	Scallops	Bycatch, Gear	RSA	Priority added in 2020. Is a 2021/2022 Scallop RSA priority; see RSA announcement for details. Scallop Cte approved status change from "important" to "urgent".
71	Research and development of fishery dependent data collection systems that support scallop management.	In-season, near real-time data collection at haul level would inform fishing operations (e.g., bycatch avoidance) and more real-time management.	Important (near term)	underway	Sea scallop	Scallops	Bycatch, Fishery performance & monitoring	unknown	Priority added in 2019. NEFSC/FSB deploys IFS observers on 5-15% of all LA and LAGC scallop trips and record haul level data for ≥50% of the tows.
72	Identify ~~"hot spots"~~ areas, conditions, or behaviors (both fishing and species-specific) where ~~within the scallop fishery using data on observed take of~~ sea turtle interactions with scallop dredge gear are more likely to occur ~~and other suitable information~~.	Need data on observed turtle interactions for other fisheries or fishery surveys in the area where the scallop fishery operates.	Strategic (future needs)	underway	Sea scallop	Scallops	Protected species, Bycatch	unknown	~~No observed takes of turtles in a scallop dredge in several years.~~ CFF has done turtle research for many years. Some NEFSC work on Scallop RSA projects. Scallop Cte approved edit May 2021.
73	Develop gear modifications or fishing techniques that may reduce or eliminate the threat of sea turtle interactions without unacceptable reductions in target retention in all fisheries.		Strategic (future needs)	underway	Multiple	Multiple	Protected species, Bycatch	unknown	MADMF (2016) studied leatherback behavior off Cape Cod to help reduce entanglements. CFF (2017) studies turtle bycatch reduction. NEFSC comparative TED study in longfin squid fisher; report passed NEFSC review. Ongoing contract for work in gillnet fishery and with larger vessels in squid fishery.
74	Investigate turtle behavior and its potential impact on the scallop fishery in the Mid-Atlantic and Georges Bank (via satellite tagging or other means).	Understand seasonal movements, vertical habitat utilization, & status and range of the population in response to climate change.	Important (near term)	unknown	Sea scallop	Scallops	Bycatch, Climate change, Protected species	RSA	Priority added in 2020. Is a 2021/2022 Scallop RSA priority; see RSA announcement for details. RSA funded work in 2021 (CFF - 2 projects).
75	Policy evaluation of bycatch management, incl. possible implementation of a 100% retention policy to minimize discarding and ecosystem effects.		Important (near term)	unknown	Multiple	Multiple	Bycatch	unknown	This issue is important for all species with a significant amount of discards, including silver and red hakes. No NEFSC work.
76	Data collection efforts for improved social and economic impact analyses, as well as cost-benefit analysis, for all fisheries, but particularly groundfish and Atlantic herring.	Some of this is done; fixed cost data is a particular need. The data is needed in user-friendly formats.	Urgent (essential)	underway	Northeast multispecies, Atlantic herring, Multiple	Groundfish, Atlantic herring, Multiple	Human dimensions	unknown	2013 and 2017 S-K projects on groundfish communities. For herring, some work was done for the IFM amendment. NEFSC SSB data collection continues (e.g., crew survey, income survey). Topic came up in the 2019 interviews of Council members (Williams et al 2020).
77	Evaluate the socioeconomic impacts and consequences of area rotation on the scallop fishery, including potential distributional effects and impacts on other fisheries.	A MSE-like study may be appropriate.	Important (near term)	not begun	Sea scallop	Scallops	Human dimensions	unknown	~~2019 Scallop RSA priority to conduct MSE. Also related to 2018 priority of follow-up to OHA2.~~ Topic came up in the 2019 interviews of Council members (Williams et al 2020). **2021 Council work priority.**

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78	All fisheries: (1) the vessels, firms, organizations, and communities involved; (2) capacity use and fixed costs; (3) stakeholders besides directed fishery participants; (4) dealers and processors (e.g., dependence on fishery, location, costs, earnings, employment); and (5) market dynamics (e.g., relationships between fishermen, buyers, and processors; and end users).	For use in Council actions: describing the potentially impacted human communities and potential impacts.	Urgent (essential)	underway	Multiple	Multiple	Human dimensions	unknown	Priority added in 2019. See also the needs identified in the Groundfish Catch Share Program Review (Swasey et al., 2020). Topic came up in the 2019 interviews of Council members (Williams et al 2020). Some work underway by NEFSC.
79	Improve quantification of economic impacts from restricted fishing in closed areas and small-mesh exemption areas (lack of access to other areas).	Could develop a spatially-explicit fleet behavior model. A MSE-like study may be appropriate.	Important (near term)	unknown	Multiple	Multiple	Human dimensions	unknown	
80	Evaluate other human dimensions data sources to supplement NEFSC crew/industry survey data.	Work to address challenges of sample size, repeatability, reliability, etc. in economic, sociological, an other human dimensions research.	Urgent (essential)	unknown	Multiple	Multiple	Human dimensions	unknown	Priority added in 2020.
81	Advance efforts to incorporate new data and concepts into the development, review, and update of social science indicators.	Opportunity to further connect work underway across the NEFSC SSB with other work at NEFSC and with other related indicators work (i.e. NOAA-BEA ocean economy report, NOAA E-NOW, Stimpson Center CORVI, etc.).	Urgent (essential)	unknown	Multiple	Multiple	Human dimensions	unknown	Priority added in 2020.
82	Investigate the value (existence, use, option) of deep-sea corals ~~and evaluate tradeoffs between coral protection and fishing.~~ Estimate coral recovery rates, and how they relate to intermporal tradeoffs around fishing and coral protection.	Would support consideration of new or modified coral protection zone designations. Typically existence value is assessed with willingness to pay surveys.	Important (near term)	unknown	Multiple	Multiple	Human dimensions, Habitat	unknown	DSCRTP funding ~~in 2022~~ could help (planning 2022 or 2023, funding fo three years afterward). European literature on existence value of *Lophelia ;* see also O'Connor et al 2020, Ankamah et al 2020. Continued NEFSC analyses of past surveys; characterizing habitats & contributing to DSCRTP national coral database. Intermittent funding for cruises from outside NEFSC in the meantime. Habitat Cte change in May 2021.
83	Within a variety of habitat types, quantify the degree of seabed contact for fishing gears and their component parts, particularly groundfish trawls (e.g., chain vs. roller sweeps, modified ground cables (e.g. shortened, raised), semi-pelagic doors). Better quantify gear dimensions (width) estimate swept area more accurately.	Would support refinements to the Fishing Effects (SASI) model, specifically the discrimination of impacts between different types of trawls, and facilitate the design of gear-restriction vs. closure area management approaches.	Strategic (future needs)	unknown	Northeast multispecies	Groundfish	Habitat	unknown	Fishing Effects (SASI) model was updated in 2018-2019 but did not tackle this issue. Outside of NEFSC expertise.
84	Characterize and evaluate current and potential HMAs and HAPCs.	Identify nursery and over-wintering habitats of species vulnerable to habitat alteration by fishing gear (e.g., scallop dredge).	Important (near term)	underway	**Multiple**	**Multiple**	Habitat	unknown	**Revision from Habitat/Scallop PDT:** Scallop RSA funded Scott Gallagher at WHOI to compete 3 years of BACI work in the EGB HAPC. Final report completed; additional analyses ~~forthcoming~~ provided to Habitat PDT April 2021. Habitat PDT working on Northern Edge white paper. ~~Potential for~~ Clam dredge-mounted video work in GSC HMA; HABCAM and SMAST drop camera data could be applied. Importance of inside/outside comparisons of fish condition (e.g., Sherwood & Grabowski 2015). ~~NEFSC participating in Northeast habitat assessment.~~ FMP changed from "scallop" to "multiple".

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85	Evaluate habitat recovery following impact by fishing gear (scallop dredges ~~or,~~ **trawls,** clam dredge, fixed gears), and long-term or chronic effects of fishing on marine resource productivity.	Would help develop or revise spatial management for habitat protection. This includes examining gear impacts on seabed habitats in Northeast US waters that account for effort, season, sedimentary character and biological community.	Strategic (future needs)	underway	**Multiple**	**Multiple**	Habitat	unknown	Linking the state of impacts and recovery to managed species could begin by reviewing seafloor images. Re corals, potential to document trawling impacts using existing database of images and/or use these to document baseline conditions in new DSC closures. Estimating effects on resource productivity is more difficult. ~~Recent meta-analysis paper. Ongoing~~ RSA-funded project Northern Edge Georges Bank (~~WHOI/~~Gallager et al). Also Cau et al. (2020), Steves et al. (2020), Sciberras et al. (2018), Sullivan et al. (2006), Sullivan et al. (2000). FMP changed from "scallop" to "multiple".
86	Identify & evaluate methods to reduce the habitat impacts of scallop & clam dredge fishing, incl. evaluating variability in dredge efficiency across habitats, times, areas.	Would support development of gear-restriction vs. closure area management approaches.	Strategic (future needs)	underway	Sea scallop	Scallops	Habitat	unknown	What are the benefits of modified gear? What are the effects of gear on EFH for other species, e.g., what are the effects of trawl gear on scallop recruitment? Importance of considering impacts in specific settings. Bethoney et al (ongoing) on the N-Viro dredge. Miller et al. (2019) estimated a lower efficiency on hard bottom (27%) than sand/soft bottom (40%). Some international research (see #83).
87	Understand relationships between managed species & their geological, biological, & physical habitats; assess spatial & seasonal variation in habitat use & fisheries productivity. Specifically: (1) Concurrent spatial data on recruitment, growth & reproduction of managed fish & shellfish across habitats & environments. (2) Links between habitat characteristics & primary prey species, through a concurrent assessment of habitat characteristics & prey species occurrence. (3) links between habitat types (e.g., space/time variation of shelter & prey) & the productivity of managed species.	Research to help analyze and evaluate the benefits of spatial management alternatives for habitat. This work could help refine EFH designations. Ideally, these results will contain spatially-explicit data incl. species abundance at different life-history stages, measures of species condition (or survivorship, growth rate, or similar metric linked to variation in productivity across the landscape) and the characteristics of concurrently sampled habitat features, substrates and associated prey.	Urgent (essential)	underway	Multiple	Multiple	Habitat	unknown	This is the cornerstone of habitat management and important for habitat management in an ecosystem plan. The work should explicitly explain data limitations defining essential fish habitat, given the original sampling design and spatial and temporal scales of sampling. Planned NHRA habitat suitability and species distribution modeling work will support this priority; suggest using NHRA results to generate field-testable hypotheses. Some NEFSC work underway.
88	Studies that would inform assessments of the effects of fixed gears on seabed habitat components.	Extent of fixed gear movement along the seabed during setting, soaking, and hauling is unknown. Would support refinements to SASI/Fishing Effects model. Important for deep-sea corals.	Strategic (future needs)	underway	Multiple	Multiple	Habitat	unknown	Schweitzer & Stevens paper on trap gears. Consider impacts to coral & sponge habitats specifically, possibly using Jordan Basin as study site. No NEFSC work underway.

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89	Targeted studies following the 2013-2015~~9~~ Northeast region deep-sea coral research in the Gulf of Maine and in the offshore canyons and seamounts that focus on defining areas/habitat conditions that support coral and sponge "garden" habitats. Studies of growth, reproduction, population connectivity and particularly their functional role as fish habitat are needed. Develop more sophisticated, higher-resolution models that predict coral presence/absence or relative abundance, not just likelihood of occurrence or habitat suitability.	Would facilitate future revisions (boundary changes, or additions of new areas) to deep-sea coral management zones in the Gulf of Maine and canyons/slope.	Strategic (future needs)	underway	Multiple	Multiple	Habitat	unknown	Need more general DSC surveys, to groundtruth & improve the habitat suitability model & lessen the need for it. Would give a handle on DSC biodiversity, biogeography, & genetics (or population connectivity). During discussion of the Jordan Basin coral DHRA, NEFMC wanted study on effects of mobile trawl gear. Potentially a separate topic. Additional funding through the DSCRTP coming for the northeast region in ~~2022~~ 2023 or 2024 for three years~~; will likely lead to work~~. June 2019 Northern Neighbors cruise ~~(report in prep)~~. Continued updates to DSCRTP database. Continued data analyses & specimen studies from previous surveys; characterizing habitats & contributing to DSCRTP national coral database. Intermittent funding for cruises coming from outside NEFSC in the meantime. Future modeling work requires NOS expertise. Habitat Cte approved change in May 2021.
90	Refine estimates of benthic boundary shear stress at the seabed/water column interface and ground truth critical shear stress thresholds across seasons and depths (i.e., are seabed sediments stable/unstable at various levels of flow, as predicted by models, what are effects of variation in biological attributes that influence disturbance via shear stress).	Would support refinements to SASI/Fishing Effects model. When possible, use data from sensors deployed on the seabed to ground truth modeled estimates.	Strategic (future needs)	unknown	Multiple	Multiple	Habitat	unknown	Possible to look at this issue using existing seabed imagery? Two hypotheses - high stress results in unstable communities, and hgh stress leads to animals adapted to those conditions. Understanding this (i.e., sheer stress) might also be important for deep-sea coral habitat suitability modeling and perhaps other biological components of the benthos. Outside NEFSC expertise.
91	Geological and biological sampling using acoustic, video, and grab sampling in the Gulf of Maine and Southern New England region to improve spatial resolution of habitat distributions and characterize temporal (e.g., interannual, seasonal) variability. Include targeted sampling of benthic community structure (infauna and epifauna) in representative substrate types (e.g., mud, sand, gravel, cobble, and boulder in high and low energy environments) across multiple environmental settings.	This is an important priority for habitat management in an ecosystem plan. Would improve support for spatial management intended to target specific habitat types for protection. Some areas of the GOM are very sparsely sampled for benthic habitat characteristics. SNE includes habitat management areas of particular interest (i.e., Great South Channel HMA) as well as offshore wind development sites. Could also help with aquaculture citing.	Urgent (essential)	underway	Multiple	Multiple	Habitat, Wind energy, Aquaculture	unknown	Habitat mapping is a foundation for many other studies. Acoustic mapping is underway in GOM for deep-sea corals (US/CAN collaboration using ROPOS platform). Such mapping also being discussed in Great South Channel/Nantucket Shoals region. Data related to this priority exist in SNE region related to offshore wind projects ~~but have not been provided to fisheries managers~~ but note that the spatial resolution of benthic data to support wind development is too coarse to resolve habitat features at sub-meter scales (important to use these data appropriately). ~~Should coordinate with BOEM/developers, through ROSA and other means.~~ Note NOAA/Ørsted MOA on data sharing. See substrate mapping report for NY Bight (BOEM funded NCCOS project). INSPIRE Environmental study at BIWF. ~~New~~ Updated NMFS habitat mapping recommendations were given to BOEM ~~Jan 2020~~ March 2021. BOEM habitat characterization studies; HabCam images could be analyzed. RODEO environmental studies program (Carey et al., 2020).

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92	Synthesize predator/prey information on A. herring, silver hake & other forage fish, fill data gaps; investigate role of forage fish in the Northwest Atlantic ecosystem & their importance for other managed species; assess the relative importance of herring vs. other forage as prey & predator in the ecosystem (e.g., competition with right whales & juvenile cod for *C. finmarchicus*).	Information is needed to develop ecosystem management tools and approaches. Silver hake plays a central role in the ecosystem as predators as adults and prey as juveniles. **Predation by haddock on herring egg mats.**	Important (near term)	underway	Atlantic herring, Small-mesh multispecies	Atlantic herring, Small-mesh multispecies	Ecosystems	unknown	Amendment 8 MSE and 2018 herring assessment looked at some of this but not all. For example, the food web model explored in MSE. Deroba et al (2019). NEFSC working on long-term ecosystem research. Richardson et al (2011) on haddock predation. Suca et al (2021) on sand lance and shifting prey. Deroba (2018) on stomach contents of predators. Silva et al (2021) on collocation of sand lance and top predators. PDT added description.
93	Quantify predator/prey relationships that are important to the development of management strategy evaluations.	Information is needed to develop ecosystem management tools and approaches.	Important (near term)	underway	Multiple	Multiple	Ecosystems	unknown	NEFSC Food Habits Program and evacuation rate studies.
94	Study trophic interactions of monkfish predation on other species and monkfish cannibalism; recognize the need to incorporate monkfish into prey assessments.		Strategic (future needs)	underway	Monkfish	Monkfish	Ecosystems	RSA	NEFSC Food Habits Program and evacuation rate studies underway, through insufficient to estimate predation rates.
95	Improve herring, ecosystem and economic models.	For future herring MSE work.	Important (near term)	underway	Atlantic herring	Atlantic herring	Human dimensions, Population dynamics, Ecosystems	unknown	Priority added in 2020. NEFMC (2019a) has details. This primarily requires NEFSC time, or contract.
96	Icthyoplankton monitoring	Data is needed to assess changes in predation and effects on productivity	Important (near term)	underway	Multiple	Multiple	Ecosystems, Population dynamics	unknown	Priority added in 2020. Failures to obtain full spatial coverage during recent EcoMon plankton surveys contribute to uncertainty about recent shifts in spawning activity.
97	Evaluate whether stock status of some species is increasing the rebuilding timeline of groundfish stocks.	Information is needed to develop ecosystem management tools and approaches.	Urgent (essential)	underway	Northeast multispecies	Groundfish	Ecosystems	unknown	Bell et al. (2017) on winter flounder rebuilding.
98	Investigate effectiveness of seasonal and year-round spatial management (e.g., sms exemption areas and seasons) to achieve goals such as: improved yield, mortality reduction, spawning protection, bycatch avoidance/reduction, and ecosystem protection and improvement.	Investigate potential means to improve access to healthy stocks while minimizing impacts to stocks needing conservation. Information is needed to develop ecosystem management tools and approaches. A MSE-like study may be appropriate.	Important (near term)	unknown, underway	Multiple, Northeast multispecies, Small-mesh multispecies	Multiple, Groundfish, Small-mesh multispecies	Ecosystems, Fisheries management	unknown	SMAST finished EFP on this, SMS PDT has not seen results yet. It is related to the MADMF study in SMA 1, presented to NEFMC RSC, in which there was no evidence of reduced discard rates by opening the season early. Bycatch was >5% threshold, mainly from high haddock catch. This was analyzed by the PDT last year. Spatial management is an important tool for managing target & non-target effects of targeting sms (e.g., bycatch, environment).
99	Monitor trends in non-target, ecosystem components.	Information is needed to develop ecosystem management tools and approaches.	Strategic (future needs)	underway	Multiple	Multiple	Ecosystems	unknown	See NEFSC Ecosystem Status Reports.
100	Develop and enhance industry-based oceanographic data collection (e.g., physical, primary productivity, habitat metrics, including seasonal variation in these metrics).	Information is needed to develop ecosystem management tools and approaches.	Strategic (future needs)	underway	Multiple	Multiple	Ecosystems	NEFSC	Possible application for industry data trust (RODA project). Study Fleet and eMOLT programs collecting some data.

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101	Better understand species responses to climate change (e.g. distribution, productivity, recruitment) and how these changes may affect fisheries (e.g., South Atlantic stocks moving north, scallop distribution, silver and red hake stocks).	Information is needed to build resiliency into FMPs and surveys, and to account for possible new interactions between fisheries and fish species. It could potentially explain why some species are not rebuilding (e.g., thorny skate). Consider changes at the species level, and accounting for interactions between species.	Urgent (essential)	underway	Multiple	Multiple	Ecosystems, Habitat, Climate change, Human dimensions	unknown	Priority added in 2019. ~~Ongoing~~ Northeast Fish and Shellfish C~~c~~limate V~~v~~ulnerability A~~a~~ssessment (Hare et al. 2016) ~~work,~~ Rutgers modeling work (e.g., Morely et al. 2016). NHRA ~~linkage~~ habitat suitability models (results in 2022) will incorporate climate forecasts. NEFSC work in Northeast groundfish and Climate Program Office programs. NEFSC habitat modeling work underway for thorny skate. Kleisner et al (2016, 2017) included skate species. Research by Chang et al (NMFS FATE project), Lehnert et al. (2019).
102	Research ecosystem operational advice: synthesize existing data, modelling, and meta-data analysis, incl. environmental variability and climate change; relationship between habitat and fishery resource productivity (incl. impact of fishing on functional value of habitat); trophic interactions and their implications; managing mixed species fisheries; function and effectiveness of closed area management.	Information is needed to develop ecosystem management tools and approaches.	Important (near term)	underway	Multiple	Multiple	Ecosystems, Climate change, Habitat	unknown	This integrates other habitat research priorities, including the importance and role of quality habitat on recruitment and juvenile productivity & survival. A 2017 S-K project on "choke" species in a changing climate. Data on the trophic interaction of skates with other benthic species would be helpful. Several NEFSC projects underway. Topic came up in the 2019 interviews of Council members (Williams et al 2020).
103	Evaluate potential resilience of managed species to climate change and ecosystem change by preservation of forage diversity.	Information is needed to develop ecosystem management tools and approaches. Relevant to silver hake, which serves as a key part of the ecosystem as forage.	Important (near term)	underway	Multiple, Small-mesh multispecies	Multiple, Small-mesh multispecies	Ecosystems, Climate change	unknown	Work underway with Northeast groundfish (Saba FY19 funds to incorporate Cobalt into Atlantis ecosystem model) could address some of these issues.
104	Evaluate the fishability of offshore windfarms (fixed or floating) and aquaculture sites ~~(fixed or floating)~~, including related fishing displacement and how this affects spatial management of fisheries.	Information is needed to allow the Council to accurately articulate concerns about these projects.	Urgent (essential)	underway	Habitat	Multiple	Wind energy, Fishery performance & monitoring, Aquaculture	unknown	Priority added in 2019. Ongoing work: Rutgers/USM/ODU/ VIMS study on surfclam/ocean quahog fishery, RODA ~~project~~ Fisheries Knowledge Trust, ASMFC ~~pilot on lobster VMS~~ Electronic Tracking Pilot Program (recent update: http://www.asmfc.org/files/Meetings/79AnnualMeeting/AmericanLobsterBoard.pdf), ongoing Rutgers (D. Munroe) project on wind development impacts on scallop fishery (2020 RSA). ~~NEFSC planning work.~~ State of Maine floating OSW research wind farm (lease application in development) has this issue as part of their research agenda. Habitat Cte approved edit in May 2021.

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105	Develop habitat suitability modeling capability for purpose of exploring climate effects on fisheries stock distribution and abundance.	Habitat suitability modeling is and has already been used to predict deep-sea coral distributions in the NE. Can adapt the models to support other habitat research such as predicting habitat effects related to aquaculture expansion and potential offshore wind energy areas. Monthly modeling could predict when and where seasonal migrations (versus summer residence) may be affected by climate change and when and where interaction with offshore wind construction activities and permanent habitat alterations may occur so as to better facilitate mitigation plans. Work can support the Northeast Regional Habitat Assessment including the nearshore and offshore tasks. The higher resolution of these models is well suited for better delineation of EFH.	Important (near term)	underway	Multiple	Multiple	Ecosystems, Habitat, Wind energy, Climate change, Aquaculture	unknown	Priority added in 2019. ~~Work underway at NMFS Sandy Hook Lab for the Mid-Atlantic. To date, 3 habitat suitability models (i.e., Species Distribution Models including Generalized Additive Model, Random Forest, & Maximum Entropy) have been compared for accurate predictability of species distributions.~~ The climatology database is being updated & integrated with the latest high-resolution global climate model of NOAA's Geophysical Fluid Dynamics Lab. The new models are being used for current & historic habitat suitability predictions instead of previous climate models to produce improved species response curves. UMaine modeling sea scallop & lobster distributions. NHRA linkage. Priority particularly relevant for silver & red hake stocks. 2021 ICES workshop and related report - WKPHM.
106	Evaluate impact of offshore wind development and aquaculture ~~(e.g., the effects of noise from pile-driving, seismic testing)~~ on behavior, ~~and~~ reproductive success, and survivorship of managed fish and shellfish species (e.g., scallops).	Information is needed to assess impacts of offshore development on marine fishery resources. Could include: impacts on scallop larval settlement, growth, reproduction, fishing opportunities, etc.	Urgent (essential)	underway	Habitat, Sea scallop	Multiple, Scallops	Wind energy, Habitat, Population dynamics, Fisheries management, Aquaculture	unknown	Priority added in 2019. Was 2019 Scallop RSA priority. Very active area of research. Complex issue, beyond first order effects. What information is needed at baseline? Consider short term mitigation options during construction. What about resource changes (e.g., increases in BSB habitat, loss of sand habitats)? BOEM-funded: Acoustics: Behavioral effects of sound sources from offshore renewable energy construction on the black sea bass (*Centropristis striata*) & longfin inshore squid (*Doryteuthis pealeii;* NSL #AT-17-02; NEFSC & WHOI, 2021). MIT/WHOI study on longfin inshore squid (Jones et al. ~~(~~2020). SMAST-WHOI 2019 RSA project: Assessing Potential Impacts of Offshore Wind Facilities on Regional Sea Scallop Larva & Early Juvenile Transport; ~~BOEM awarded hydrodynamics study to DHI (Dec 2019) – determining which species to model but scallops are candidate.~~ BOEM-funded DHI study 'Hydrodynamic Modeling and Particle Tracking in the U.S. Mid-Atlantic Bight.' ~~Rutgers 2020 RSA project: Economic impacts on scallop fishery.~~ Habitat Cte approved edit in May 2021.
107	Assess how changes in fisheries-independent surveys that cannot access areas in fixed or floating wind farms and aquaculture sites for sampling will affect stock assessments and the impact of additional uncertainty in management advice. Also consider effects on fishery-dependent data collection.	Information is needed to plan for necessary changes in survey efforts (potentially including novel survey methods) so that adequate assessment of fishery resources can be maintained post-development.	Urgent (essential)	underway	Multiple	Multiple	Wind energy, Fish surveys, Stock assessment, Aquaculture	unknown	Priority added in 2019. NEFSC working group funded by BOEM for project: Development of a Strategy to Evaluate NEFSC Fishery Resource Surveys Affected by Offshore Wind Development. Also a scallop survey working group TOR. Opportunity for ROSA. Consider GOM issues too; focus on cod. ~~NEFSC WGEval started; work planned.~~ This is a likely issue for assessing silver & red hake biomass indices, which are currently used to determine status.

No.	Title	Description, rationale, potential use	Rating	Status	FMP	Species	Broad categories	Cross-listing	Notes
108	Will specific changes to FMPs be able to mitigate impacts of wind farm and aquaculture placement on either fishermen or on resource areas (e.g., Demarcation Line adjustments, management and/or habitat boundary adjustments)?	Need to understand how fisheries management approaches and offshore wind development intersect, and how fisheries management could be adapted to react to offshore wind development. A MSE-like study may be appropriate.	Important (near term)	unknown	Multiple	Multiple	Wind energy, Fisheries management, Ecosystems, Habitat, Human dimensions	unknown	Priority added in 2019. ~~Related study: Understanding Potential Economic Impacts to Surfclam/Ocean Quahog Commercial Fishing from Offshore Wind Energy Facility Construction and Operation (AT-19-03). Consider short term mitigation options during construction. What about resource changes (e.g. increases in BSB habitat, loss of sand habitats)?~~
NEW	Increase understanding of scallop spatial population structure and population dynamics, including processes such as connectivity, source-sink dynamics		Strategic (future needs)	unknown	Scallops	Scallops	Population dynamics	unknown	Scallop Cte approved adding priority in May 2021.

Definitions of acronyms

ABC	Acceptable Biological Catch
ACL	Annual Catch Limit
BACI	Before After Control Impact
BOEM	Bureau of Offshore Energy Management
BREP	Bycatch Reduction Engineering Program
BSIA	Best Scientific Information Available
CFRF	Commercial Fisheries Research Foundation
CRB	Cooperative Research Branch
CTE	Committee
DSC	Deep-sea corals
DSCRTP	NOAA's Deep Sea Coral Research and Technology Program
DHRA	Designated habitat research area
EFH	Essential Fish Habitat
EFP	Exempted Fisheries Permit
EM	electronic monitoring
FSB	Fisheries Sampling Branch
GARFO	Greater Atlantic Regional Fisheries Office
GB	Georges Bank
GOM	Gulf of Maine
HAPC	Habitat Area of Particular Concern
HMA	Habitat Management Area
IFM	Industry-funded monitoring
IFS	Industry-funded scallop
LA	Limited Access
LAGC	Limited Access General Category
LPUE	Landings per unit effort
MADMF	Massachusetts Division of Marine Fisheries
MSE	Management Strategy Evaluation
MWT	midwater trawl
NEAMAP	Northeast Area Monitoring and Assessment Program
NEFSC	Northeast Fisheries Science Center
NHRA	Northeast Regional Habitat Assessment
NMFS	National Marine Fisheries Service
OER	Office of Ocean Exploration and Research
OHA2	Omnibus Habitat Amendment 2
PDT	Plan Development Team
PS	Port-side
RH/S	River herring and shad
RODEO	**Real-time Opportunity for Development Environmental Observations**
RSA	Research-Set-Aside
RSC	Research Steering Committee
SASI	Swept Area Seabed Impacts
S-K	Saltonstall-Kennedy Grant Program
SMS	Small-Mesh Multispecies
SSB	Social Sciences Branch
SSC	Scientific and Statistical Committee
TEWG	Technical Expert Working Group
WEA	Wind Energy Area
WGEval	Working Group Evaluation
WKFORBIAS	Workshop on Catch Forecasts from Biased Assessments

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Priorities that have been deleted from the list by the NEFMC, starting in 2020.

Year deleted	Title	Description, rationale, potential use	Rating	Status	FMP	Species	Broad categories	Cross-listing	Notes
2020	Evaluate the benefits of skate species-specific management.	A MSE-like study may be appropriate.	Strategic (future needs)	unknown	Skates	Skates	Fisheries management	unknown	In August 2017, the SSC said that the current approach seems to be working (except for thorny). Species-specific management is impossible until species identification improves. Effort on thorny is controlled via the possession limit restriction.
2020	Research the extent and composition of discards and bycatch in the skate and monkfish fisheries.		Strategic (future needs)	unknown	Skates, Monkfish	Skates, Monkfish	Fishery performance & monitoring	assessment	The directed skate and monkfish fisheries are small, and these species are usually caught incidentally in other fisheries. No NEFSC work, though data being collected.