

# **Regional Habitat Assessment Prioritization for Northeastern Stocks**

Report of the Northeast Regional Habitat Assessment  
Prioritization Working Group (NE-RHAPWG)

**Northeast Fisheries Science Center and Greater Atlantic Regional Fisheries Office**

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## Introduction

The National Marine Fisheries Service (NMFS) developed the *Habitat Assessment Improvement Plan* (HAIP; NMFS 2010) to document habitat science needs within the agency. Recommendations issuing from this effort included the prioritization of stocks and geographic locations that could benefit from habitat assessments and the identification and prioritization of data inadequacies for stocks and their respective habitats as relevant to information gaps identified in the HAIP. The Habitat Assessment Prioritization Working Group (HAPWG) was formed in response to those recommendations, which in turn developed a habitat prioritization process to be carried out for stocks on a regional basis (NMFS 2011). The NMFS Southwest Region became the first to employ this prioritization process with to its regional fishery stocks (NMFS 2012). Their work served as a model for the northeast prioritization as presented in this report. Subsequently, the Northwest Region convened its Regional Habitat Assessment Working Group (NW-RHAPWG) and produced a joint document with its Southwest regional counterpart addressing these two regions (Blackhart 2015), which include a number of stocks whose ranges overlap between regions. More detailed accounts of the rationale for and history of this program can be found in the documents covering the preceding efforts (NMFS 2011, 2012, Blackhart 2015).

In keeping with the provisions of the Magnuson-Stevens Fishery Conservation and Management Act to identify and describe Essential Fish Habitat (EFH), to minimize adverse fishing impacts on EFH to the extent practicable, and that other actions to conserve and enhance EFH be identified, the NMFS Northeast Region embarked on its effort to develop a HAPWG prioritization. That effort began with the assembly of a northeast regional Habitat Assessment Prioritization Working Group (NE-RHAPWG: the authors of this report) in 2014, and culminated in a final set of ratings for northeast stocks in 2015. This report provides a summary of the NE-RHAPWG stock ratings with explanations of how those values were derived and commentary on specific rating criteria and the final outcome in general.

## Northeast Regional Stocks

Thirty-nine (39) fishery species were evaluated as part of this exercise. These species represent forty-nine (49) stocks managed under fourteen (14) Fishery Management Plans (FMPs) by two Fishery Management Councils (FMCs): New England (NEFMC) and Mid Atlantic (MAFMC) (Table 1, Figure 1). Atlantic salmon, which is covered under an FMP from the New England FMC, is not included, as it has been listed as Endangered under the Endangered Species Act and its fishery is closed. In addition, marine fisheries for sixteen (16) additional species or species complexes (Table 2) were not included because they are managed exclusively by individual northeastern states under guidance from the Atlantic States Marine Fisheries Commission (ASMFC). Estuarine and nearshore coastal stocks are also excluded because they are managed exclusively by northeastern states (e.g. blue crab, eastern oyster, bay scallop, hard clam, softshell clam, black drum, silver perch, and northern kingfish). There are also some deepwater fisheries in federally-controlled waters that as yet have no northeast FMP (e.g. black belly rosefish, blueline tilefish). As such, none of these are considered federally managed species, they do not appear on the Fish Stock Sustainability Index (FSSI) list, and are therefore not included in this

evaluation. Also excluded are stocks covered in the Consolidated Atlantic Highly Migratory (HMS) FMP (Atlantic Tunas, Swordfish, Sharks, and Billfishes). These include an additional twenty four (24) species and species complexes that are federally-managed by NMFS' Office of Sustainable Fisheries (OSF), Division of Highly Migratory Species Management. Among these are ten (10) FSSI stocks (all shark species) that occur in the northeast but are not exclusive to this northeast region (Table 3). Tunas, billfishes, and swordfish, although managed under the HMS program, are excluded from the FSSI due to the transboundary, international nature of their stock management.

The boundaries of the Northeast Region and its FMC jurisdictions are Cape Hatteras, North Carolina on the south and the Canadian border (Hague Line) to the northeast (Figure 1). Cape Hatteras also happens to be the southern boundary for all but one of the non-HMS Northeast FSSI stocks under consideration in this document. The bluefish stock is the one exception; bluefish swim around the cape during annual migrations. Thus coordination of data and management with the Southeast Region may only be a consideration with that stock along with some non-FSSI stocks that also move around the cape. By contrast, most stocks treated by the NEFMC straddle the U.S.-Canadian border, which cuts across two major geographic subregions providing habitats for those stocks: The Gulf of Maine and Georges Bank (Figure 1). Coordination of FSSI stock data and management with Canadian scientists and managers is the larger cross-boundary issue for the Northeast Region.

Table 1. Federally-managed (FMC) marine stocks in the Northeast Region. Abbreviations for stock ranges are as follows: CC - Cape Cod, GB – Georges Bank, GOM – Gulf of Maine, MA – Mid Atlantic Bight, SNE – Southern New England.

Sp. #	Stock	FMC	Fisheries Management Plan
1	Atlantic mackerel	Mid Atlantic	Atlantic Mackerel, Squid, Butterfish
2	Butterfish	Mid Atlantic	Atlantic Mackerel, Squid, Butterfish
3	Northern shortfin squid	Mid Atlantic	Atlantic Mackerel, Squid, Butterfish
4	Longfin inshore squid	Mid Atlantic	Atlantic Mackerel, Squid, Butterfish
5	Atlantic surfclam	Mid Atlantic	Surf Clam and Ocean Quahog
6	Ocean quahog	Mid Atlantic	Surf Clam and Ocean Quahog
7	Black sea bass	Mid Atlantic	Summer Flounder, Scup, Black Sea Bass
8	Scup	Mid Atlantic	Summer Flounder, Scup, Black Sea Bass
9	Summer flounder	Mid Atlantic	Summer Flounder, Scup, Black Sea Bass
10	Bluefish	Mid Atlantic	Bluefish
11	Tilefish	Mid Atlantic	Tilefish
12	Spiny Dogfish	NE & MA	Spiny Dogfish
13	American plaice	New England	Northeast Multispecies
14	Atlantic cod - GB	New England	Northeast Multispecies
14	Atlantic cod - GOM	New England	Northeast Multispecies
15	Atlantic wolffish	New England	Northeast Multispecies
16	Haddock - GB	New England	Northeast Multispecies
16	Haddock - GOM	New England	Northeast Multispecies
17	Atlantic halibut	New England	Northeast Multispecies
18	Ocean pout	New England	Northeast Multispecies
19	Pollock	New England	Northeast Multispecies
20	Acadian redfish	New England	Northeast Multispecies
21	White hake	New England	Northeast Multispecies
22	Windowpane - GOM/GB	New England	Northeast Multispecies
22	Windowpane - SNE/MA	New England	Northeast Multispecies
23	Winter Flounder - GB	New England	Northeast Multispecies
23	Winter Flounder - GOM	New England	Northeast Multispecies
23	Winter Flounder - SNE/MA	New England	Northeast Multispecies
24	Witch flounder	New England	Northeast Multispecies
25	Yellowtail flounder - CC/GOM	New England	Northeast Multispecies
25	Yellowtail flounder - GB	New England	Northeast Multispecies
25	Yellowtail flounder - SNE/MA	New England	Northeast Multispecies
26	Atlantic herring	New England	Atlantic Herring
27	Barndoor skate	New England	Skates

Table 1 (continued). Federally-managed (FMC) marine stocks in the Northeast Region. Abbreviations for stock ranges are as follows: CC - Cape Cod, GB – Georges Bank, GOM – Gulf of Maine, MA – Mid Atlantic Bight, SNE – Southern New England.

Sp. #	Stock	FMC	Fisheries Management Plan
28	Clearnose skate	New England	Skates
29	Little skate	New England	Skates
30	Rosette skate	New England	Skates
31	Smooth skate	New England	Skates
32	Thorny skate	New England	Skates
33	Winter skate	New England	Skates
34	Goosefish - GOM/N. GB	New England	Monkfish
34	Goosefish - S. GB/MA	New England	Monkfish
35	Offshore Hake	New England	Small Mesh Multispecies (whiting)*
36	Red hake - GOM/N. GB	New England	Small Mesh Multispecies (whiting)*
36	Red hake - S. GB/MA	New England	Small Mesh Multispecies (whiting)*
37	Silver hake - GOM/N. GB	New England	Small Mesh Multispecies (whiting)*
37	Silver hake - S. GB/MA	New England	Small Mesh Multispecies (whiting)*
38	Red deepsea crab	New England	Deep-Sea Red Crab
39	Sea scallop	New England	Atlantic Sea Scallop

\*The Small Mesh Multispecies “Plan” actually represents a series of exemptions to the larger Northeast Multispecies Plan. Management of small mesh fishery stocks is sufficiently different from that of other (large mesh) bottom species that the NEFMC treats them separately.

Table 2. Non-federally-managed (ASMFC) marine stocks and stock complexes in the Northeast Region. Stocks are exclusively under state management and excluded from prioritization.

Species or Species Complex	
American eel	Red drum
American lobster	Shad & river herring*
Atlantic croaker	Spanish mackerel
Atlantic menhaden	Spot
Atlantic sturgeon	Spotted seatrout
Coastal sharks*	Striped bass
Horseshoe crab	Tautog
Northern shrimp	Weakfish

\*Stock complexes representing multiple species.

Table 3. Federally-managed highly migratory FSSI stocks in the Northeast Region. Highly migratory species were not included in prioritization.

Species	
Atlantic sharpnose shark	Finetooth shark*
Blacktip shark	Porbeagle shark
Blue shark	Sandbar shark
Bonnethead*	Scalloped hammerhead
Dusky shark	Shortfin mako shark

\*southeastern species, rare in the northeast

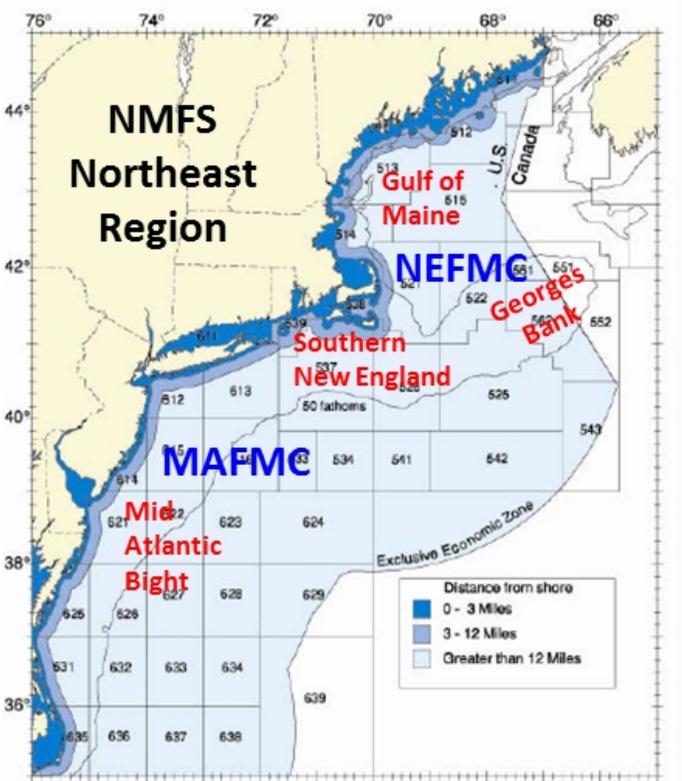


Figure 1. Map of National Marine Fisheries Service (NMFS) Northeast Region showing numbered statistical fisheries areas, general regions of management by Fisheries Management Councils (blue lettering), and locations of subregions (red lettering) used to identify some stocks. Abbreviations: MAFMC – Mid Atlantic Fishery Management Council, NEFMC – New England Fishery Management Council.

## Data Sources

Documents from a variety of sources were drawn upon in order to inform stock evaluations made in this report. Among them were the following:

FSSI species list:

[http://www.nmfs.noaa.gov/sfa/fisheries\\_eco/status\\_of\\_fisheries/historical\\_fssi\\_stocks.pdf](http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/historical_fssi_stocks.pdf)

NEFSC Essential Fish Habitat Source Documents:

<http://www.nefsc.noaa.gov/nefsc/habitat/efh/>

Fisheries of the United States 2013:

<http://www.st.nmfs.noaa.gov/Assets/commercial/fus/fus13/FUS2013.pdf>

Fisheries Economics of the United States 2012, New England and Mid Atlantic Chapters:

[http://www.st.nmfs.noaa.gov/economics/publications/feus/fisheries\\_economics\\_2012](http://www.st.nmfs.noaa.gov/economics/publications/feus/fisheries_economics_2012)

Northeast Regional Stock Assessment Workshop (SAW) Assessment Summary Reports and Stock Assessment Review Committee (SARC) Review Reports:

<http://www.nefsc.noaa.gov/saw/reports.html>

New England Fishery Management Council Fishery Management Plans, Amendments, and Framework Documents:

<http://www.nefmc.org/>

Mid Atlantic Fishery Management Council Fishery Management Plans and Amendments:

<http://www.mafmc.org/fishery-management-plans/>

National Marine Fisheries Service – 1<sup>st</sup> Quarter 2015 Stock Status Updates

[http://www.nmfs.noaa.gov/sfa/fisheries\\_eco/status\\_of\\_fisheries/archive/2015/q1\\_2015\\_stock\\_status\\_tables.pdf](http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/archive/2015/q1_2015_stock_status_tables.pdf)

Smith, B.E., Link, J.S. 2010. Trophic dynamics of 50 finfish and 2 squid species on the northeast US continental shelf. NOAA Tech. Memo. NMFS-NE-216. 21 pp.

NOAA Fisheries 2015 Draft Climate Science Strategy

[http://www.st.nmfs.noaa.gov/Assets/ecosystems/climate/documents/draft\\_NOAA%20Fisheries\\_Climate\\_Science%20Strategy\\_Jan\\_2015.pdf](http://www.st.nmfs.noaa.gov/Assets/ecosystems/climate/documents/draft_NOAA%20Fisheries_Climate_Science%20Strategy_Jan_2015.pdf)

## Scoring Approach

We chose to place all stocks on an equal footing with regard to evaluation. We did not attempt to perform within-FMP comparisons first, as did the Southwest or Northwest Regional Habitat Assessment Prioritization Working Groups (NMFS 2012, Blackhart 2015). Northeast stocks are not aggregated into multi-stock FMPs to the degree that west coast stocks are. Northeast FMPs range from the Northeast Multispecies (groundfish) management plan that treats 20 stocks encompassing 13 species to single stock FMPs like those for Sea Scallop, Atlantic Herring, Red Crab, Golden Tilefish, and Spiny Dogfish (Table 1). We did not have issues that the west coast working groups had with comparison of diadromous with fully marine species (none of our diadromous stocks are in the FSSI list). Thus, stock-by-stock comparison regardless of FMP for the entire suite of 49 northeast stocks made more sense. The idea of aggregating stocks by FMC jurisdiction was also considered, but did not make sense in terms of any commonality of ecological or management issues or even the geographical range of jurisdictions, which actually overlap broadly. ~~Strikethroughs~~ in the rubric text boxes in the following sections indicate text that has been altered from earlier versions.

Following a period of research of existing records and documents, the authors met in conference, discussed the rubrics for each criterion, discussed individual stock scores, and arrived at both the rubrics (scoring approaches) and scores by consensus. This was done by rating all stocks for each criterion one at a time. This technique provided the group with a sense of the stock-by-stock comparison for each criterion while avoided the temptation to rate “favorite” stocks highly across the board before proceeding to the next stock. It also allowed stocks of the same or similar species to be considered for similar values where data were lacking. Tallying final scores for each stock, ordering the list by total scores, and dividing the ordered list into low, medium, and high priority segments were the final steps.

## Filter Criteria

### Common Filter Criterion: FMP Stock Listed in the FSSI or is a Regional FMC Priority

*HAPWG Scoring Rubric:* To pass this filter for further consideration, a stock must be included in the management unit of a Federal FMP. The stock must also be included as one of the 230 stocks on the Fish Stock Sustainability Index (FSSI) list *or* be listed as a regional Fishery Management Councils’ priorities.

*Northeast Application:* Following the lead of the SW- and NW-RHAPWGs (NMFS 2012, Blackhart 2014), the NE-RHAPWG dropped the term “Research” from the description of FMC priorities, recognizing that priorities are based on a variety of issues. We also pluralized the term, as we are dealing with two separate councils in the northeast region. As all FMC-managed species in the northeast are FSSI-listed, all passed. This may change soon, as the MAFMC is considering assessing “Forage Species,” some of which are not currently managed but may be important to supporting managed species. This represents part of the MAFMC’s shift towards an

ecosystem approach to fisheries management. Whether this will result in more or different kinds of FMPs is not yet clear.

Unlike the SW- and NW-RHAPWGs, the NE-RHAPWG excluded the only Endangered Species Act (ESA)-listed FSSI species, Atlantic salmon, as fishing for it has been prohibited and its FMP is rendered void. Recovery efforts for that stock are underway under a joint framework that includes state (Maine), tribal, and federal agencies, including NMFS the U.S. Fish and Wildlife Service. Various river-associated stocks of anadromous sturgeon species (Atlantic and shortnose) are also listed as Endangered or Threatened in the northeast and elsewhere, but are neither FSSI species nor have they been the subjects of focused interest by the FMCs. Without the possibility of stock management via regulation of a fishery for ESA-listed species, the NE-RHAPWG determined that there was little point in making habitat assessments in support of stock assessments, whose conduct is driven primarily by FMCs mandate to regulate fisheries.

### **Theme-Specific Filter Criterion: Habitat Assessment Likely to Benefit Stock Assessment**

*HAPWG Scoring Rubric:* To pass this filter for further consideration, a stock must be likely to be assessed in the next 5 years, or be in the top quartile of stocks in the Stock Assessment Prioritization. Additionally, the stock's assessment must be likely to benefit from a habitat assessment (NMFS 2011).

*Northeast Application:* We did not have comprehensive prioritized lists for assessments from both FMCs to work from. Looking back at the last five years of assessments performed by the Northeast Fisheries Science Center, about half of the stocks had been assessed, some repeatedly (e.g. Gulf of Maine Atlantic cod and sea scallops). Assuming that the HAPWG process will probably sort out the importance of stocks to the stock assessment process in an order resembling prioritization by the FMCs, we passed all FSSI-listed species through this filter. In retrospect, this filter was not useful, as we were not able to evaluate it prior to the more detailed analysis for the scorable criteria.

### **Theme-Specific Filter Criterion: Habitat Assessment Likely to Inform EFH Science**

*HAPWG Scoring Rubric:* To pass this filter for further consideration, a habitat assessment for the stock must be likely to be conducted within a region's Essential Fish Habitat (EFH) 5-year review schedule. In addition, the habitat assessment for this stock must be likely to define EFH, refine EFH, or improve the understanding of adverse effects of fishing or non-fishing activities on EFH.

*Northeast Application:* As the Northeast Fisheries Science Center (NEFSC) has performed EFH reviews and updated EFH documents for all managed species on a regular basis, employment of this filter becomes a moot point. Here again the NE-RHAPWG has responded by passing all FSSI-listed stocks and allowing the HAPWG process to provide values for prioritization.

## Scored Criteria

### Theme-Specific Scorable Criterion: Benefits of a Habitat Assessment to Stock Assessment

*HAPWG Scoring Rubric:*

Score	Rubric
5	A habitat assessment for this stock is likely to result in an SAIP Level 5 stock assessment, an HAIP Tier 3 habitat assessment, or improve performance within an existing SAIP Level 5 or HAIP Tier 3 assessment.
4	A habitat assessment for this stock is likely to improve survey efficiency or efficacy, reduce sampling variability, or improve the analysis of fishery catch per unit of effort (CPUE) data that are likely to be used in a stock assessment.
1	A habitat assessment would provide new opportunities to develop stock assessment modeling or survey techniques that incorporate the relationships between habitat and population processes or data variability.

*Northeast Application:* As with the SW- RHAPWG (NMFS 2012), the NE-RHAPWG found no stocks meeting the highest score category (5) within this criterion and the distinctions between rubric scores 4 and 1 were somewhat subjective. Nevertheless, we found this to be a key question. One issue that came up in scoring some Georges Bank and Gulf of Maine stocks here and elsewhere was the ability to improve trans-boundary (U.S. – Canada) stock assessments. We already share stock data. Conducting habitat investigations to improve assessment of such stocks will require cooperation and/or collaboration with Canadian scientists and managers.

### Theme-Specific Scorable Criterion: Habitat Assessment Likely to Advance EFH Information

*HAPWG Scoring Rubric:*

Score	Rubric
5	A habitat assessment would likely provide an initial definition of EFH. <del>or an increase in understanding of adverse effects of fishing or non fishing activities on EFH.</del>
4	A habitat assessment would likely provide an increase in information sufficient to increase between EFH levels of knowledge.
1	A habitat assessment would likely provide an increase in information within the existing EFH level of knowledge.

*Northeast Application:* We agreed with the SW- and NW-RHAPWGs (Blackhart 2015 regarding wording changes for this criterion. Here, as with the previous scorable criterion, there were no rating values of 5. All northeast stocks have at least an initial EFH definition on large geographic scales and some sense of the probable effects of anthropogenic disturbance on EFH. EFH designations for all federally-managed species in our region are either level 1 (presence only) or level 2 (relative abundance). This leaves the subjective choice between the 4-point and 1-point rubrics. We felt that EFH levels for most of our stocks would increase with habitat assessment

that could narrow the scales and parameters of habitat definitions, hence most received values of 4. Exceptions included highly mobile squids, spiny dogfish, and pelagic fishes.

### Common Scorable Criterion: Fishery Status

*HAPWG Scoring Rubric:*

Score	Rubric
5	Stock is overfished, approaching an overfished condition, experiencing overfishing, or is in a rebuilding or recovery plan.
3	Stock is below 80% of BMSY.
2	Stock is fully exploited (i.e. $FMSY \geq FC \geq 0.75 * FMSY$ , or $ABC \geq Total\ Catch \geq 0.75 * ABC$ if no FMSY available).
1	Stock status is unknown, but credible information exists to suggest that the stock is at risk or vulnerable to overexploitation.
0	Stock is not overfished, not approaching an overfished condition, not experiencing overfishing, or otherwise showing any evidence of overexploitation. Or, if stock status is unknown, evidence does not suggest that the stock is vulnerable to overexploitation.

*Northeast Application:* This criterion was relatively easy for the NE-RHAPWG to score, as the rubrics were clear and unambiguous and the information to rate stocks readily available. Status scores were based on the most recent quarterly stock updates (see Data Sources above). Unlike SW-RHAPWG, we utilized the 0 values here and in subsequent criteria since we did not employ the theme-specific filters for Benefit to Stock Assessment and Informing EFH Science that might be seen as making this rating redundant. It seemed strange to some members that stocks of unknown status should be given a low score, since unknown status is itself a major source of controversy for FMCs attempting to set catch regulations. Nevertheless the NE-RHAPWG decided to maintain this order as it appeared previously (NMFS 2011, 2012), under the assumption that controversial status for this or other reasons would better be represented in FMC Priority scores.

### Common Scorable Criterion: Regional FMC Priority

*HAPWG Scoring Rubric:*

Score	Rubric
5	Research is identified for a stock by the regional FMC to address a pressing issue and satisfy the Federal requirements of the MSA.
3	Research is identified for a stock by the regional FMC to address ongoing needs to maintain existing of fishery management.
1	Research is identified for a stock by the regional FMC; however, it is not of immediate concern or necessary to manage a Federal fishery.
0	Stock is not identified as a priority by the regional FMC.

*Northeast Application:* In agreement with SW- and NW-RHAPWGs (Blackhart 2015), the NE-RHAPWG has removed the word “Research” from the name of this criterion in recognition of the fact that FMC priorities are not driven exclusively by research needs. We agreed on their simplification of the wording for the 3-point score, eliminating the words “to maintain existing” with regard to fisheries management, as models are often changed or improved incrementally beyond simple maintenance, but not necessarily addressing urgent needs. In general, stocks were assigned values based on expert knowledge of those of us who deal directly with the FMCs and/or attend FMC meetings. FMC concern is also evident from meeting agendas, reports, and press releases, and from NEFSC stock assessment workshop reports, all available on the internet.

**Common Scorable Criterion: Habitat Disturbance, Vulnerability, and Rarity**

*HAPWG Scoring Rubric:*

<b>Additive Points</b>	<b>Rubric</b>	<b>Category</b>
+1	A large portion of the habitat of a fish stock is disturbed due to fishing activities. <del>or other direct anthropogenic events.</del>	1
+1	A large portion of the habitat of a fish stock is disturbed due to non-fishing anthropogenic activities. <del>as a result of natural disasters, and indirect anthropogenic events.</del>	2
<del>+1</del>	<del>The primary habitat of a life stage of a fish stock is vulnerable to disturbance based on a location that is accessible or heavily used, resulting in impacts to habitat.</del>	<del>3</del>
+1	The <del>primary</del> habitat of a fish stock is vulnerable or slow to recover from disturbance.	4
+1	The <del>primary</del> habitat of a fish stock is demonstrably rare.	5

*Northeast Application:* Here, NE-RHAPWG is in agreement with the SW-RHAPWG with respect to some, but not all wording changes. It makes good sense to separate fishing from non-fishing anthropogenic, and from natural disaster disturbances, which are very different in nature and are in very different realms with regard to control. Fishing-related disturbance is potentially under the control of the fisheries management bodies like the FMCs. Non-fishing (anthropogenic and natural) disturbances are regulated by other agencies such as U.S. EPA with consultation from the NMFS Regional Office. Natural disasters are by their nature unpredictable and not under anybody’s control. Therefore we agreed with the wording changes in the first two categories.

Once we changed categories 1 and 2, we did not find the distinction between categories 2 and 3 sufficiently clear to warrant separate ratings. Most anthropogenic activities create location-specific impacts based on accessibility and heavy use. We therefore decided to simply eliminate category 3.

We found that the use of “primary” in categories 4 and 5 to describe habitats was not called for, as “primary” is not defined and indeed even if we could separate stock habitats by some measure of their importance we do not necessarily know their functionality *a priori*. While primary

habitats (as judged by a stock's general use) may be the major source of stock productivity, could secondary (less productive) habitats serve as hedge against unusual conditions like shifts in forage species, climate, or natural disasters? Could secondary habitats be a source of stock resilience? For most stocks we simply do not know the answer to this question. Therefore we adopted the attitude that loss of habitat is loss of habitat, regardless of its perceived importance (primary) or lack thereof (secondary). Such distinctions are seen through the filter of stock sampling and modeling whose spatio-temporal scales may be very different from rates of migration and of environmental change.

Category 1 points were awarded to shelf demersal fisheries stocks (41 of them), whose habitats are likely to be disturbed by extensive bottom fishing. Pelagic stocks and slope and canyon stocks (e.g. deep sea red crab, offshore hake) were not awarded a point.

Category 2-3 (single value) and category 4 decisions were awarded based on expert opinions. Stocks receiving values of 1 numbered 13 and 21, respectively. Most of the stocks that received a point for category 2-3 inhabit inshore coastal and/or estuarine waters at some point during their life history where non-fishing activities pose the greatest threat to habitat quality or quantity.

Category 5 decisions were based on the needs of some life stage for habitat types know to be relatively rare, including rock, seagrass, and clay bottoms. Only 9 stocks received values of 1.

It has been suggested that because the total possible score for this criterion is 4 points rather than 5, as with other criteria that feature additive category points, that the importance of habitat disturbance, vulnerability, and rarity is thus under-represented and that additive values for the four existing categories ought to be given values of +1.25, rather than +1 so that the total value for the criterion would be 5 points rather than 4. We tried this and found that while scores and priority orders changed slightly, there were no changes in the final partition of stocks into low-, medium-, and high-priority Stock Assessment and Essential Fish Habitat groupings. Therefore, we decided not to change values to 1.25 in this document in order to avoid the complication of fractional scores.

### Common Scorable Criterion: Habitat Dependence

#### *HAPWG Scoring Rubric:*

Score	Rubric
5	<del>There is quantitative evidence that vital rates and productivity of a stock are dependent on particular physical habitat(s).</del> There is evidence that a particular life stage of the species/stock has a strong association with some form of structured habitat, or with a single substrate type (habitat specialist).
3	<del>There is a measurable difference, attributable to physical habitat quality and/or quantity, in a stock's density, population size, and/or an individual's condition factor.</del> There is evidence that a particular life stage of the species/stock has a strong association with two substrate types, and does not have a strong affinity with structured habitats.

1	<del>While uncertainty exists due to poor or conflicting data, there is a reasonable expectation for a measurable difference, attributable to physical habitat quality and/or quantity, in a stock's density, population size, and/or an individual's condition factor.</del> There is evidence that a particular life stage of the species/stock has a strong association with three or more substrate types, and not with structured habitats (habitat generalist).
0	<del>No evidence exists that a stock's density, population size, and/or an individual's condition factor is linked to physical habitat quality or quantity.</del> No life stage is associated with any kind of benthic habitat.

*Northeast Application:* Values were assigned based on how dependent the species/stock was on a single, easily defined physical bottom habitat type versus a variety of habitat types. While less inclusive than the original definitions, we found that it was much simpler to make distinctions using this scheme because of lack of data regarding stock density, population size and condition factor as related to habitat types for most stocks. A strong dependence on any kind of structured habitat (e.g. rocky reefs; cobble and boulder habitats; eelgrass, macroalgae, or other large attached epifauna; sand waves) or on a single sediment or substrate type resulted in a high score. An affinity with two habitat types and no strong dependence on structure produced an intermediate ranking, while a species/stock found on three or more habitat types without any dependence on structure produced a low score. Non-structured substrate types were considered to be soft sediment (silt, clay, and sand), coarse or “hard” substrate (gravel, boulder), “mixed” soft and hard substrate (e.g. sand with gravel or shell hash), and low relief biogenic habitat (e.g. mussel beds, amphipod tubes). As was the case with other rubrics, scoring was based on the habitat requirements of the most specialized life stage. Thus, species which deposit their eggs on a particular habitat type or with early stage juveniles that inhabit inshore eelgrass beds, for example, received high scores even if the adults occupy a wider variety of habitat types. As these rubrics depend on substrate, an exclusively benthic habitat attribute, pelagic stocks received 0 values.

### Common Scorable Criterion: Ecological Importance

#### *HAPWG Scoring Rubric:*

Additive Points	Rubric	Category
+1	The stock and is an important predator. Based on current data from the region, the stock consumes a high number of species (top quartile) <del>and is abundant (top two quartiles)</del> compared to other predators at that life stage.	1
+1	The stock is important prey. Based on current data from the region, the stock occurs in diets of a high number of species (top quartile) compared to other prey at that life stage.	2
+1	The stock has a high biomass. The stock currently has a high (top quartile) biomass in the best available metric, within the region of interest, and at a particular life stage.	3
+1	The stock is a habitat-altering species. It is known to create, modify,	4

	or maintain habitat functions.	
+1	Evidence exists that in the region of interest the stock was historically abundant, or an important predator, prey, or ecosystem engineer.	5

*Northeast Application:*

Category 1 – Food diversity alone, as this category rubric implies, seemed to us not to be the best way of characterizing importance as a predator. In agreement with the SW- and NW-RHAPWG (Blackhart 2015), the NE-RHAPWG felt that abundance, too, was important. There are a number of predatory species with broad diets, even in the top quartile, that are probably too rare to be considered important in that role in terms of overall ecosystem function. Unlike SW-RHAPWG (NMFS 2012), we did not consider high trophic order or piscivory to be critical. Nearly all stocks represent predators (phytoplankton-consuming bivalves are exceptions) and placing importance on trophic order among predators as a measure of ecological importance can be taken to imply top-down control of ecosystem structure. Rather, we felt that biomass consumption at any trophic level made more sense as a control scheme-neutral measure of predation. Lacking data on consumption for many species, we utilized stock biomass (in most cases spawning stock biomass) as a proxy. Therefore the value of 1 for this category was assigned to those stocks whose dietary diversity was in the first quartile ( $\geq 16$  taxa in the diet) and whose 10-year mean annual biomass is within the first two quartiles ( $>100,000$  metric tons). Stocks of the same species but differing geographic ranges were rated separately, since data for individual stocks regarding both food habits and stock biomass were available. Ten of the 49 northeast stocks qualified for values of 1.

Category 2 – Importance as prey was determined by species rather than by stock. The frequencies of occurrence of prey taxa were tallied for 50 predator species (includes both FSSI and non-FSSI species) from data provided in Smith & Link, 2010. FSSI prey species were extracted from this tally, and then sorted in the order of their frequency. Stocks representing those species that occurred in 20% or more of the 50 predator diets were assigned the value of 1. This breakpoint included one more species than if we had taken the top quartile, but the 20% cutoff served as a natural break in the data. Eleven of the 49 northeast stocks qualified for the value of 1.

Category 3 – Stock biomass values were based on average biomass (in most cases spawning stock biomass) for a 10-year period as reported in Stock Assessment Workshop (SAW) reports (see Data Sources section above) for each stock. The top quartile of stocks, which coincidentally represented stocks with 10-year average biomass values exceeding 100,000 metric tons, were assigned a value of 1.

Category 4 – Only one stock qualified as a habitat-altering: tilefish, based on its extensive burrowing of clay bottoms and outcrops and creation of a unique kind of complex benthic habitat in the process.

Category 5 – Historical importance was based on a comparison of stock biomass between the most recent stock assessment and the historical high in that value since the earliest reported stock biomasses in the SAW documents. In most cases those earliest biomass estimates date from

somewhere between 1960 and 2000. Rather than attempt to reconstruct the fisheries ecosystem from some earlier year in that period and determine what stocks were important in that year, we chose to view importance in the past in terms of the degree of decline in each stock since its historical high. In other words, we have defined historical importance in terms of the historical-demonstrated potential rather than for its actual ecological role under the assumption that large biomass is the best proxy indicator we have for large ecological value. No judgments were intended with regard to why a stock was once more abundant and hence presumably of greater ecological importance; additive points for this category were simply meant to indicate that the potential for expanded importance is there as demonstrated by historical biomass patterns. Likewise, no judgments were made on how important a stock may have been at its peak with regard to the larger marine ecosystem, which was seen as very difficult to judge without a major effort to model changes in ecosystem state. Our method provides only a relative measure of historical importance. With that understanding, any stock that has declined to less than twenty percent (20%) of its historic high value was considered to have been historically important as compared with its recent history and given a value of 1 for this criterion. Seventeen (17) of the 49 northeastern stocks qualified for this value.

### Common Scorable Criterion: Economics, Social, and Management Value

#### *HAPWG Scoring Rubric:*

<b>Additive Points</b>	<b>Rubric</b>	<b>Category</b>
+1	The economic impacts of the commercial industry for this stock are in the top quartile (25%) of FMP stocks in the region.	1
+1	The economic impacts of recreational fishing for this stock are in the top quartile (25%) of FMP stocks in the region.	2
+1	The commercial fishery for the stock has high resource management importance.	3
+1	The recreational fishery for the stock has high resource management importance.	4
+1	The stock has high social value such as cultural importance or strong localized effects on community viability, or is necessary for subsistence.	5

#### *Northeast Application:*

Category 1 and Category 2 – Scores in these categories were based on data extracted from Fisheries Economics of the United States 2012, New England and Mid Atlantic chapters (see Data Sources above). Unfortunately, these chapters do not deal with all FSSI stocks and some are lumped together into functional groups like squids (2 stocks), cod/haddock (4 stocks), and flounders (10 stocks). Even within the umbrella of the functional groups, all stocks may not be included; authors instead evaluated a limited number of key species or species groups. These species and species groups constitute a large majority of commercial catch value (85% of New England fisheries, 84% of Mid Atlantic fisheries), as well as the most important recreational fisheries. Of the 49 total northeast stocks being considered, values for twenty-two (22) stocks are

available in the report, described as nine (9) commercial fishery functional groups and eight (8) recreational fishery functional groups (some including single stocks and some multiple stocks).

The advantage to using this valuation source is that it provides a more complete economic picture of each fishery, including values for jobs, sales, income, and value added in addition to landing revenues for commercial fisheries. For recreational fisheries, trips, jobs, sales, income, and value added are included. Further, economic values are provided in a uniform format for all northeast coastal states. This is particularly important in the northeast region, where there are ten states and both commercial and recreational fisheries play large roles in fisheries for several stocks. The disadvantage in using this source comes from the lumping of stocks into functional groups. Where stocks were not treated individually (e.g. where 10 “flounder” stocks were lumped into a single functional unit in the commercial sector), the total economic value for flounder was parsed among the 10 stocks in proportion to their spawning stock biomass, under the assumption that expenditures per unit catch are similar for each and that catch is related to biomass. Use of spawning stock biomass instead of catch data was necessary as stock-specific catches were complicated by less well-documented recreational catches and the need to separate catches of the same species by regional stock. As a consequence, the use of spawning stock biomass is clearly a rough approximation.

Out of the 22 stocks with commercial fishery data available, the 12 most valuable (top quartile for the 49 stocks) were chosen from among these for a value of 1 for Category 1. For recreational fisheries, values for only 8 northeast stocks could be derived. Since there was no information on how many other stocks were subject to recreational fisheries, all 8 received a rating of 1 as representing the top quartile for all 49 stocks, even though it is clear that at least some of the northeast stocks are not subject to recreational fishing.

Category 3 – Resource management value for commercial fisheries was made on the basis of expert opinion from those of our group who interact regularly with the FMCs. Seventeen (17) stocks received values of 1 for this category.

Category 4 – Resource management value for recreational fisheries was likewise made on the basis of expert opinion from those familiar with FMC deliberations. Nine (9) stocks received values of 1 here.

Category 5 – High social value was also made on the basis of expert opinion. Values of 1 were provided for cod and haddock stocks (2 stocks for each species) because of the strong New England cultural traditions regarding these fisheries. Stocks with locally important recreational fisheries were also included: Black sea bass, scup, summer flounder, and winter flounder (2 nearshore stocks). Nine (9) stocks total received values of 1 for this category. Other northeastern fisheries fitting this category are non-FSSI stocks.

## Common Scorable Criterion: Climate Change Susceptibility

### *HAPWG Scoring Rubric:*

<b>Score</b>	<b>Rubric</b>
5	The stock is highly susceptible to climate change: Warming and/or ocean acidification (positive or negative response).
3	The stock is moderately susceptible to climate change: Warming and/or ocean acidification (positive or negative response).
1	Stock susceptibility to climate change is low.

Climate change has been emerging as a new ecosystem-level influence on stocks (see NOAA Fisheries Draft Climate Science Strategy in the Data Sources section above). At the time of our deliberations it was becoming evident to the NE-RHAPWG that climate change would impact stocks differentially and needed to be included as a factor potentially affecting both the values and hence the prioritization of stocks in terms of both stock assessment and essential fish habitat sciences. For this reason we included climate change susceptibility as an additional common scorable criterion with possible values ranging from 1-5. Given the emphasis on this issue, dedicating an entire scorable criterion to it provides a higher profile to the climate change than might otherwise be afforded by simply considering it under the Habitat Disturbance, Vulnerability and Rarity criterion as was done by the original HAPWG (NMFS 2011), which would provide only a yes-or-no value rather than a graded value and would only add 1 point at most to the total score.

More sophisticated efforts are currently underway to rate stocks according to climate change susceptibility, which can result directly from susceptibility to changing temperature or pH regimes or indirectly due to changes in ecological factors such as predation or competition wrought by redistribution of other species in response to temperature or pH changes. As indirect effects are more difficult to predict, the NE-RHAPWG has chosen to consider only direct factors: Temperature (warming) and pH (acidification).

Warming can have either positive or negative effects on stocks, particularly in the northeast where fishery stocks comprise a mix of species characteristic of both the Virginian (warm water) and Acadian (cold water) faunal provinces. Ocean acidification, on the other hand, is probably not favorable for any species, but molluscan shellfish stocks are probably most susceptible because of their need to produce carbonate shells. On these assumptions and on observations of stock range expansions or contractions that are suspected of being related to warming already underway, known ranges of temperature preference, and potential sensitivity to ocean acidification we invoked expert opinion to rate climate change susceptibility as high, medium, or low (values 5, 3, or 1).

## **Weighting**

The NE-RHAPWG did not see any need for pre-assignment of weighting factors. Final scores are thus simple sums of scorable criterion values.

## **Priority Categories**

Two cutoff schemes were considered for defining Priority Categories: One in which the lists for each theme was simply divided into thirds (14 – 19 stocks each for high, medium and low priorities after adjustments to avoid splitting tied scores between adjacent categories), and the other following the SW-RHAPWG formula (high priority = top 20% of scored stocks, medium priority = middle 30% of stocks, low priority = lowest 50% of stocks). We decided to use the more inclusive method of dividing the stock lists into roughly even thirds for each theme (Tables 4, 5).

Table 4. Northeast stock prioritization results for the Stock Assessment (SA) theme. Shading indicates priority category assignments: white – High, lighter gray – Medium, darker gray – Low.

Stock	SA Score	Priority Category
Atlantic cod (GB)	32	High
Atlantic cod (GOM)	32	High
Winter flounder (SNE/MA)	30	High
Atlantic wolffish	29	High
Summer flounder	27	High
Winter flounder (GOM)	26	High
Black sea bass	25	High
Haddock (GOM)	24	High
Haddock (GB)	23	High
Yellowtail flounder (GB)	23	High
Yellowtail flounder (CC/GOM)	22	High
Acadian redfish	21	High
Sea scallop	19	High
Thorny skate	19	High
Atlantic surfclam	19	High
Windowpane (GOM/GB)	19	High
Witch flounder	19	High
Scup	18	Medium
Tilefish	18	Medium
Ocean pout	18	Medium
Red hake (GOM/N. GB)	18	Medium
Winter flounder (GB)	16	Medium
Yellowtail flounder (SNE/MA)	16	Medium
Windowpane (SNE/MA)	16	Medium
Butterfish	15	Medium

Stock	SA Score	Priority Category
Atlantic herring	15	Medium
American plaice	15	Medium
Longfin inshore squid	15	Medium
Atlantic halibut	14	Medium
Red hake (S. GB/MA)	14	Medium
Silver hake (S. GB/MA)	14	Medium
Ocean quahog	14	Medium
Atlantic mackerel	14	Medium
Pollock	14	Medium
White hake	13	Low
Winter skate	11	Low
Bluefish	10	Low
Red deepsea crab	10	Low
Silver hake (GOM/N. GB)	10	Low
Barndoor skate	10	Low
Goosefish (GOM/N. GB)	10	Low
Goosefish (S. GB/MA)	10	Low
Smooth skate	9	Low
Spiny dogfish	9	Low
Northern shortfin squid	8	Low
Rosette skate	7	Low
Clearnose skate	5	Low
Little skate	5	Low
Offshore hake	4	Low

Table 5. Northeast stock prioritization for the Essential Fish Habitat (EFH) theme. Shading indicates priority category assignments: white – High, lighter gray – Medium, darker gray – Low.

Stock	EFH Score	Priority Category
Atlantic cod (GB)	32	High
Atlantic cod (GOM)	32	High
Winter flounder (SNE/MA)	30	High
Winter flounder (GOM)	29	High
Atlantic wolffish	29	High
Black sea bass	27	High
Yellowtail Flounder (GB)	26	High
Haddock (GOM)	24	High
Summer flounder	23	High
Haddock (GB)	23	High
Thorny skate	22	High
Yellowtail flounder (CC/GOM)	22	High
Windowpane (GOM/GB)	22	High
Ocean pout	21	High
Red hake (GOM/N. GB)	21	High
Acadian redfish	21	High
Sea scallop	19	Medium
Atlantic surfclam	19	Medium
Windowpane (SNE/MA)	19	Medium
Witch flounder	19	Medium
Scup	18	Medium
Tilefish	18	Medium
Atlantic halibut	17	Medium
Red hake (S. GB/MA)	17	Medium
Silver Hake (S. GB/MA)	17	Medium

Stock	EFH Score	Priority Category
White hake	16	Medium
Winter flounder (GB)	16	Medium
Yellowtail flounder (SNE/MA)	16	Medium
American plaice	15	Medium
Longfin inshore squid	15	Medium
Winter skate	14	Medium
Ocean quahog	14	Medium
Pollock	14	Medium
Red deepsea crab	13	Low
Silver hake (GOM/N. GB)	13	Low
Barndoor skate	13	Low
Butterfish	12	Low
Smooth skate	12	Low
Atlantic herring	12	Low
Atlantic mackerel	11	Low
Rosette skate	10	Low
Goosefish (GOM/N. GB)	10	Low
Goosefish (S. GB/MA)	10	Low
Northern shortfin Squid	8	Low
Clearnose skate	8	Low
Little skate	8	Low
Bluefish	7	Low
Offshore hake	7	Low
Spiny dogfish	6	Low

## Observations and Lessons

The identities, order, and scores of high category and first few medium category stocks are nearly identical when comparing prioritization lists for the Stock Assessment (SA; Table 4) and

Essential Fish Habitat (EFH; Table 5) theme lists. In other words, according to the HAPWG prioritization scheme, those stocks that can benefit most in the stock assessment theme are also those that can benefit most in terms of EFH science; improved habitat science is likely to benefit both stock assessment and EFH science. The close correspondence between lists diverges beyond their midpoints. A similar pattern is evident in the SW- and NW-RHAPWG stock priorities. This pattern is not surprising given the number of scorable criteria that are shared by both themes and the way that unshared SA and EFH criteria (Benefits to Stock Assessment and Likelihood of Advancing EFH Information) play increasingly important roles where the shared criteria values are low. This is so because the unshared criteria invariably produced values of either 1 or 4, with no intermediate values. This results in a *de facto* weighting effect for these criteria that is more prominent for lower priority cases than for higher ones. This is not a serious impediment to the use of the HAPWG process because its primary purpose is to distinguish the high priority stocks rather than to order low priorities.

It has been pointed out to NE-RHAPWG that no pelagic species are represented among the high priority stocks. Indeed, four (butterfish, Atlantic herring, longfin inshore squid, and Atlantic mackerel) appear in the medium category in the SA list, and the remaining ones (bluefish and northern shortfin squid) appear in the low category for SA (Table 4). All of the pelagic stocks except longfin inshore squid are in the low category in the EFH list (Table 5). While northeast FSSI stocks are heavily dominated by demersal and benthic species, the chances of the few pelagic stocks among them all receiving relatively low values on the priority scales through a random process is small. The chance of this being a random outcome is even lower if one considers that similar patterns are evident in the SW- and NW-RHAPWG priorities. No pelagic stocks (including highly migratory species) appear on the high priorities in either list, except for anadromous salmon stocks in the NW.. This pattern raises concern that something inherent in the HAPWG evaluation scheme or the manner of its application to date is biasing the results in favor of demersal and benthic stocks and/or against pelagic stocks.

In order to examine the reason for this pattern within the Northeast regional analysis, we devised a table to compare values of the nine scorable criteria set forth in the NE-RHAPWG prioritization scheme (Table 6). While these results by no means represent a rigorous statistical treatment, they do suggest where there are differences that may or may not be the result of biases. Maximum scores for non-pelagic stocks exceed those for pelagic stocks for 7 of the 9 scorable criteria and median scores show the same inequality in 2 out of 9 cases. Since prioritization is driven by high scores the inequalities in maximum values are of greatest interest. Below are some possible explanations regarding these:

- Likely to Inform EFH Science – The NE-RHAPWG specifically assigned a low value (1) to pelagic fishes and squids (see Theme-Specific Scorable Criterion: Habitat Assessment Likely to Advance EFH Information section above) under the assumption that pelagic habitats are too ubiquitous or too dynamic for typical EFH definition beyond simple geographical range limits. This was a deliberate bias in our regional application of the HAPWG criterion, and that application may need revisiting as more information becomes available regarding the needs and behavior of pelagic species.

Table 6. Comparison of criterion scores comparing non-pelagic with pelagic stocks. Values in **bold font** indicate measures where non-pelagic stock scores exceed pelagic stock scores.

Criteria	Non-Pelagic (n = 43)			Pelagic (n = 6)		
	max	median	min	max	median	Min
<b>Benefit to Stock Assessment</b>	4	4	1	4	4	1
<b>Likely to Inform EFH Science</b>	<b>4</b>	<b>4</b>	1	<b>1</b>	<b>1</b>	1
<b>Fishery Status</b>	<b>5</b>	2	0	<b>2</b>	2	0
<b>FMC Priority</b>	5	3	0	5	3	0
<b>Hab Disturbance, Vulnerability, Rarity</b>	4	<b>2</b>	0	<b>2</b>	<b>1</b>	0
<b>Habitat Dependence</b>	5	<b>3</b>	0	5	<b>0</b>	0
<b>Ecological Importance</b>	<b>3</b>	1	0	<b>2</b>	2	1
<b>Economic, Social &amp; Management Value</b>	<b>5</b>	0	0	<b>2</b>	1	0
<b>Climate Change Susceptibility</b>	<b>5</b>	<b>3</b>	1	<b>3</b>	<b>1</b>	1

- Fishery Status – This value is based on metrics that are applied uniformly to all stocks. There is no indication of bias here. It is not likely subject to bias. No pelagic stocks in the northeast are in overfished condition or below 80% BMSY. Some non-pelagic stocks are in these conditions, hence their higher maximum scores.
- Habitat Disturbance, Vulnerability, and Rarity – Low values were assigned here partly out of a sense that pelagic habitats are not greatly disturbed by fishing or other anthropogenic activity, pelagic species can easily escape localized disturbances, any temporary disturbance quickly dissipates without the need for long recovery periods, and pelagic habitat is ubiquitous, so there is no issue of rarity. It is likely that some of this thinking in the application of the criterion results from lack of data regarding how pelagic species respond to habitat disturbances like changes in water column structure and anthropogenic acoustic, visual, and olfactory “noise”. This criterion should probably also be revisited as more information becomes available.
- Habitat Dependence – High values (5) were assigned to Atlantic herring and longfin inshore squid here because the eggs are deposited on specific substrates (structured bottom and gravel, respectively). However, we did assume that adults of all pelagic species demonstrated no habitat preference. Here again, the lower median value may simply reflect a lack of existing data on habitat responses that convinced us to change the rubrics to reflect association with benthic habitat attributes. The fact that there is no evidence to suggest that stock density, population size or individual condition is linked to habitat conditions does not mean that these relationships do not exist. It simply means we are not aware of them. This possibility raised a question about whether it is better to give high ranks to stocks whose habitat dependence is quite clear or to those for which it is not obvious, but may well exist. The question remains open.

- Ecological Importance – The metrics for these scores apply equally to all stocks and are probably not biased. Lower values for pelagic northeast stocks are warranted.
- Economic, Social and Management Value – Here again the metrics for the scores apply equally to all stocks and do not appear to be biased.
- Climate Change Susceptibility – None of the six pelagic stocks appeared to be under imminent by the primary climate change issues (warming, acidification) and, with the exception of Atlantic mackerel (Overholtz et al. 2011), have been shown to be experiencing historical changes in geographic range. Hence, lower values are warranted for these stocks and do not reflect any bias against pelagic stocks in general.

Seven of nine criteria contain values in which non-pelagic stocks have higher corresponding values than for pelagic stocks. Of these seven there is evidence of bias against pelagic species in three criteria: 1) Likelihood of Informing EFH Science; 2) Habitat Disturbance, Vulnerability, and Rarity; and 3) Habitat Dependence. Rather than out of any deficiency in the HAPWG processes, these biases all arise out of a lack of data on how pelagic species respond to variations and changes in local environmental (habitat) conditions. In other words, it is the manner in which we have been applying the process that results in lower values for most pelagic stocks. We assume that as a consequence of their mobility and the dynamism of their environments that pelagic stocks do not respond to or are not limited by local conditions or that those conditions do not constitute a habitat as such, and thus we dismiss the importance of some criteria, resulting in lower overall scores. This is perhaps an area for improvement to consider as the data needed to challenge these notions becomes available.

## Conclusion

In addition to providing a basis for proceeding with habitat research, the HAPWG process has proved valuable in uncovering how we might improve that process. As incorporating habitat into stock assessment remains a goal within NMFS, the HAPWG process needs to be ongoing, with periodic updates to refine stock prioritization decisions based on a better understanding of habitat values. While the process as we have performed it has its difficulties and shortcomings, it is adequate to proceed and aid in stock assessments given our current understanding.

## References

- NMFS (National Marine Fisheries Service). 2010. Marine fisheries habitat assessment improvement plan. Report of the National Marine Fisheries Service Habitat Assessment Improvement Plan Team. U.S. Dep. Commerce, NOAA Tech. Memo. NMFS-F/SPO-108, 115 p.
- NMFS (National Marine Fisheries Service). 2011. Habitat Assessment Prioritization. A Report by the Habitat Assessment Prioritization Working Group. Internal report, NMFS White Paper. Office of Science and Technology, NMFS, NOAA. Silver Spring, MD. 41 p.
- NMFS (National Marine Fisheries Service). 2012. Regional habitat assessment prioritization for California stocks. Report of the Southwest Regional Habitat Assessment Prioritization Working Group. Internal report, NMFS White Paper. Office of Science and Technology, NMFS, NOAA. Silver Spring, MD. 20 p.
- Blackhart, K. 2014. Habitat assessment prioritization for West Coast stocks. Report of the Northwest and Southwest Regional Habitat Assessment Prioritization Working Groups. Internal report, NMFS White Paper. Office of Science and Technology, NMFS, NOAA. Silver Spring, MD. 199 p. Corrected edition, December 2014.
- Overholtz, W.J., Hare, J.A., Keith, C.M. 2011. Impacts of interannual environmental forcing and climate change on the distribution of Atlantic mackerel on the U.S. northeast continental shelf. *Marine and Coastal Fisheries: Dynamics, Management, and Ecosystem Science* 3:219-232. DOI: 10.1080/19424120.2011.578485.
- Smith, B.E., Link, J.S. 2010. Trophic dynamics of 50 finfish and 2 squid species on the northeast US continental shelf. NOAA Tech. Memo. NMFS-NE-216. 21 pp.

**APPENDIX A**  
**NORTHEAST SCORING SPREADSHEET (raw scores)**  
**in three parts**

Scoring Spreadsheet Part 1. Filter criteria and scorable criteria for Benefits to Stock Assessment, Likelihood to Advance EFH Information, Fishery Status, FMC Priority, and Habitat Disturbance, Vulnerability, and Rarity.

Theme	Filter Criteria			Scorable Criteria								
	Both	SA	EFH	SA	EFH	Both	Both	Both				
	FSSI Stock or FMC Priority	Likely to Benefit Stock Assessment	Likely to Inform EFH Science	Benefits to Stock Assessment	Likely to Advance EFH Info	Fishery Status	FMC Priority	Habitat Disturbance, Vulnerability, and				
1								2-3	4	5	Total Score	
<b>TOTAL POSSIBLE SCORE</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>4</b>
Atlantic Mackerel	1	1	1	4	1	2	3	0	0	0	0	0
Butterfish	1	1	1	4	1	2	5	0	1	0	0	1
Longfin Squid	1	1	1	1	1	2	3	1	0	0	0	1
Illex Squid	1	1	1	1	1	1	3	0	0	0	0	0
Atlantic Surfclam	1	1	1	4	4	1	1	1	0	0	0	1
Ocean Quahog	1	1	1	4	4	0	1	1	0	0	0	1
Bluefish	1	1	1	4	1	0	0	0	1	0	0	1
Black Sea Bass	1	1	1	4	4	2	5	1	1	1	1	4
Scup	1	1	1	4	4	0	1	1	1	1	0	3
Summer Flounder	1	1	1	4	4	0	3	1	1	1	1	4
Golden Tilefish	1	1	1	4	4	0	3	1	0	1	1	3
Atlantic Herring	1	1	1	4	1	0	0	1	1	0	0	2
Sea Scallop	1	1	1	4	4	0	3	1	0	0	0	1
Red Crab	1	1	1	1	4	0	1	0	0	1	0	1
Redfish	1	1	1	4	4	2	3	1	0	1	0	2
American Plaice	1	1	1	4	4	3	0	1	0	0	0	1
Atlantic Cod (GB)	1	1	1	4	4	5	5	1	0	1	1	3
Atlantic Cod (GOM)	1	1	1	4	4	5	5	1	0	1	1	3
Halibut	1	1	1	1	4	5	3	1	0	0	0	1
Haddock (GB)	1	1	1	4	4	2	3	1	0	1	1	3
Haddock (GOM)	1	1	1	4	4	5	3	1	0	1	1	3
Ocean Pout	1	1	1	1	4	5	3	0	0	1	1	2
Offshore Hake	1	1	1	1	4	0	0	0	0	0	0	0
Pollock	1	1	1	4	4	0	1	0	1	1	0	2
Red Hake (Northern)	1	1	1	1	4	2	3	1	1	1	0	3
Red Hake (Southern)	1	1	1	1	4	0	1	1	1	1	0	3
Silver Hake (Northern)	1	1	1	1	4	0	3	1	0	1	0	2
Silver Hake (Southern)	1	1	1	1	4	3	3	1	0	1	0	2
White Hake	1	1	1	1	4	5	1	1	1	0	0	2
Windowpane Flndr (GOM/GB)	1	1	1	1	4	5	3	1	0	0	0	1
Windowpane Flndr (SNE/MA)	1	1	1	1	4	0	3	1	0	0	0	1
Winter Flounder (GB)	1	1	1	4	4	2	1	1	0	0	0	1
Winter Flounder (GOM)	1	1	1	1	4	5	5	1	0	1	0	2
Winter Flounder (SNE/MA)	1	1	1	4	4	5	5	1	0	1	0	2
Witch Flounder	1	1	1	4	4	5	1	1	0	1	0	2
Yellowtail Flndr (CC/GOM)	1	1	1	4	4	5	3	1	0	0	0	1
Yellowtail Flndr (GB)	1	1	1	1	4	5	5	1	0	0	0	1
Yellowtail Flndr (SNE/MA)	1	1	1	4	4	0	1	1	0	0	0	1
Barndoor Skate	1	1	1	1	4	3	3	1	0	0	0	1
Clearnose Skate	1	1	1	1	4	0	0	1	1	0	0	2
Little Skate	1	1	1	1	4	0	0	1	1	0	0	2
Rosette Skate	1	1	1	1	4	3	0	1	0	0	0	1
Smooth Skate	1	1	1	1	4	5	0	1	0	0	0	1
Thorny Skate	1	1	1	1	4	5	5	1	0	0	0	1
Winter Skate	1	1	1	1	4	5	0	1	1	1	0	3
Monkfish (Northern)	1	1	1	4	4	0	1	1	0	0	0	1
Monkfish (Southern)	1	1	1	4	4	0	1	1	0	0	0	1
Spiny Dogfish	1	1	1	4	1	1	0	1	0	0	0	1
Atlantic Wolffish	1	1	1	4	4	5	5	1	0	1	1	3

Scoring Spreadsheet Part 2. Habitat Dependence and Ecological Importance.

Theme	Scorable Criteria						
	Both	Both					
	Habitat Dependence	Ecological Importance					Total Score
1		2	3	4	5		
<b>TOTAL POSSIBLE SCORE</b>	<b>5</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>5</b>
Atlantic Mackerel	0	0	1	1	0	0	2
Butterfish	0	0	1	0	0	1	2
Longfin Squid	5	0	1	0	0	0	1
Illex Squid	0	0	1	0	0	0	1
Atlantic Surfclam	5	0	0	1	0	0	1
Ocean Quahog	3	0	0	0	0	0	0
Bluefish	0	1	0	1	0	0	2
Black Sea Bass	5	0	0	0	0	0	0
Scup	1	0	1	1	0	0	2
Summer Flounder	3	1	0	0	0	0	1
Golden Tilefish	5	0	0	0	1	0	1
Atlantic Herring	5	0	1	1	0	0	2
Sea Scallop	3	0	1	0	0	0	1
Red Crab	5	0	0	1	0	0	1
Redfish	5	0	0	1	0	1	2
American Plaice	3	0	0	0	0	0	0
Atlantic Cod (GB)	5	1	0	0	0	1	2
Atlantic Cod (GOM)	5	1	0	0	0	0	1
Halibut	1	0	0	0	0	0	0
Haddock (GB)	3	1	0	1	0	0	2
Haddock (GOM)	3	0	0	0	0	1	1
Ocean Pout	5	0	0	0	0	1	1
Offshore Hake	1	0	0	0	0	1	1
Pollock	5	0	0	1	0	0	1
Red Hake (Northern)	5	0	1	1	0	1	3
Red Hake (Southern)	5	1	1	0	0	1	3
Silver Hake (Northern)	1	0	1	0	0	1	2
Silver Hake (Southern)	1	1	1	0	0	1	3
White Hake	3	0	0	0	0	0	0
Windowpane Flndr (GOM/GB)	5	0	0	0	0	0	0
Windowpane Flndr (SNE/MA)	5	0	0	0	0	1	1
Winter Flounder (GB)	3	0	0	0	0	0	0
Winter Flounder (GOM)	3	0	0	0	0	1	1
Winter Flounder (SNE/MA)	3	0	0	0	0	1	1
Witch Flounder	5	0	0	0	0	1	1
Yellowtail Flndr (CC/GOM)	5	0	0	0	0	0	0
Yellowtail Flndr (GB)	5	0	0	0	0	0	0
Yellowtail Flndr (SNE/MA)	5	0	0	0	0	1	1
Barndoor Skate	1	0	0	0	0	0	0
Clearnose Skate	1	0	0	0	0	0	0
Little Skate	1	0	0	0	0	0	0
Rosette Skate	1	0	0	0	0	0	0
Smooth Skate	1	0	0	0	0	0	0
Thorny Skate	1	0	0	0	0	1	1
Winter Skate	1	0	0	0	0	0	0
Monkfish (Northern)	1	1	0	0	0	0	1
Monkfish (Southern)	1	1	0	1	0	0	2
Spiny Dogfish	0	1	0	1	0	0	2
Atlantic Wolffish	5	0	0	0	0	1	1

Scoring Spreadsheet Part 3. Economic, Social and Management Value, Climate Change Susceptibility, and total final scores for SA and EFH themes

Theme	Scorable Criteria							Both Climate Change Suscept	Total Score- SA theme	Total Score- EFH theme
	Both						Total Score			
	Economic, Social and Management Value									
Stock	1	2	3	4	5	Total Score				
<b>TOTAL POSSIBLE SCORE</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>5</b>	<b>5</b>	<b>39</b>	<b>39</b>	
Atlantic Mackerel	0	0	0	0	0	0	3	14	11	
Butterfish	0	0	0	0	0	0	1	15	12	
Longfin Squid	1	0	0	0	0	1	1	15	15	
<i>Illex</i> Squid	1	0	0	0	0	1	1	8	8	
Atlantic Surfclam	1	0	0	0	0	1	5	19	19	
Ocean Quahog	0	0	0	0	0	0	5	14	14	
Bluefish	0	1	0	1	0	2	1	10	7	
Black Sea Bass	0	1	1	1	1	4	3	27	27	
Scup	0	1	1	1	1	4	3	18	18	
Summer Flounder	1	1	1	1	1	5	3	23	23	
Tilefish	0	0	0	1	0	1	1	18	18	
Atlantic Herring	1	0	0	0	0	1	1	15	12	
Sea Scallop	1	0	1	0	0	2	5	19	19	
Red Crab	0	0	0	0	0	0	1	10	13	
Redfish	0	0	0	0	0	0	3	21	21	
American Plaice	1	0	0	0	0	1	3	15	15	
Atlantic Cod (GB)	1	0	1	0	1	3	5	32	32	
Atlantic Cod (GOM)	0	1	1	1	1	4	5	32	32	
Halibut	0	0	0	0	0	0	3	14	17	
Haddock (GB)	1	0	1	0	1	3	3	23	23	
Haddock (GOM)	0	0	1	0	1	2	3	24	24	
Ocean Pout	0	0	0	0	0	0	1	18	21	
Offshore Hake	0	0	0	0	0	0	1	4	7	
Pollock	0	0	0	0	0	0	1	14	14	
Northern Red Hake	0	0	0	0	0	0	1	18	21	
Southern Red Hake	0	0	0	0	0	0	1	14	17	
Northern Silver Hake	0	0	0	0	0	0	1	10	13	
Southern Silver Hake	0	0	0	0	0	0	1	14	17	
White Hake	0	0	0	0	0	0	1	13	16	
GOM/GB Windowpane	0	0	1	0	0	1	3	19	22	
SNE/MA Windowpane	0	0	1	1	0	2	3	16	19	
GB Winter Flounder	1	0	1	0	0	2	3	16	16	
GOM Winter Flounder	0	1	1	1	1	4	5	26	29	
SNE/MA Winter Flounder	1	1	1	1	1	5	5	30	30	
Witch Flounder	0	0	0	0	0	0	1	19	19	
CC/GOM Yellowtail	0	0	1	0	0	1	3	22	22	
GB Yellowtail	0	0	1	0	0	1	5	23	26	
SNE/MA Yellowtail	0	0	1	0	0	1	3	16	16	
Barndoor Skate	0	0	0	0	0	0	1	10	13	
Clearnose Skate	0	0	0	0	0	0	1	5	8	
Little Skate	0	0	0	0	0	0	1	5	8	
Rosette Skate	0	0	0	0	0	0	1	7	10	
Smooth Skate	0	0	0	0	0	0	1	9	12	
Thorny Skate	0	0	0	0	0	0	5	19	22	
Winter Skate	0	0	0	0	0	0	1	11	14	
Northern Monkfish	1	0	0	0	0	1	1	10	10	
Southern Monkfish	0	0	0	0	0	0	1	10	10	
Spiny Dogfish	0	0	0	0	0	0	1	9	6	
Atlantic Wolffish	0	0	1	0	0	1	5	29	29	