



April 29, 2024

Cate O'Keefe, PhD, Executive Director
New England Fishery Management Council
50 Water Street, Mill #2
Newburyport, MA 01950

Re: Atlantic Herring Amendment 10 Scoping Comments

Dear Dr. O'Keefe,

We are writing to provide scoping comments on Amendment 10 to the Atlantic Herring Fishery Management Plan. The Theodore Roosevelt Conservation Partnership's mission is to guarantee all Americans quality places to hunt and fish. Wild Oceans' mission is to keep the oceans wild to achieve a vibrant future for fishing by building coalitions and engaging in marine fisheries management using science, law and ecosystem-based solutions. Public access to the Atlantic herring resource is crucial to our missions, as herring serve as a vital forage base for the marine food web along the New England coast, augmenting our outdoor recreation economy and the coastal ecosystem overall.

Strong action is required to respond to years of overfishing and changing environmental conditions which have left Atlantic herring and the Northwest Atlantic's forage base in crisis. Amendment 10 measures must account for Atlantic herring's role as a keystone forage species in the ecosystem and strategically manage the fishery to meet management plan goals and the Magnuson-Stevens Act's National Standards and other requirements. New spatial and temporal restrictions in the directed Atlantic herring fishery are required to help rebuild Atlantic herring, contribute to optimum yield, reduce the incidental catch of river herring and shad, and minimize user conflicts.

We commend the Council for initiating Amendment 10 and its commitment to adaptive management that recognizes the diverse needs of New England fishing communities and other stakeholders. We recommend the following alternatives for consideration in Amendment 10, explained in further detail below, including relevant sub-options and related issues for analysis:

1. Reanalysis of the Amendment 8 boundaries to provide a baseline for analysis of other alternatives.
2. Spatial and/or temporal restrictions on midwater trawling in the nearshore zones of Areas 1B, 2, and 3 that consider high conflict areas, bycatch hotspots, and spawning grounds.

The Condition of the Atlantic Herring Resource and Northwest Atlantic Forage Base Must Be Factored into the Council's Analysis and Decision-Making for the Fishery.

Atlantic herring are considered overfished at 21% of their spawning stock biomass target.¹ We now know that overfishing occurred in several recent years and we are in a period of over 10 years of unprecedented low recruitment. The commercial fishery applied for federal disaster relief funding in 2019.² There are multiple significant sources of uncertainty within the models used to manage the fishery, in particular, the causes of such poor recruitment over time and the calculation of natural

¹ <https://repository.library.noaa.gov/view/noaa/48942>

² <https://www.fisheries.noaa.gov/national/funding-financial-services/fishery-disaster-determinations#97.-atlantic-herring.-2019>

mortality. These unknowns are a cause for management concern and provide a basis for a precautionary management strategy prompting, in part, the development of a stock rebuilding plan. While the Amendment 8 harvest control rule was implemented to support the rebuilding of the Atlantic herring resource, other critical factors remain at play that are not necessarily borne out in single-species stock assessment results.

One factor involves Atlantic herring's outsized role as forage in the Northwest Atlantic and an alarming and increasing lack of alternative prey as forage for coastal predators. Marine predators utilize a variety of forage species throughout their range according to a myriad of biological and ecological factors. Unfortunately, in the case of the New England forage base, prey availability is in crisis. In addition to the obvious lack of Atlantic herring in the water, Atlantic mackerel, commonly found overlapping with herring, are overfished. A rebuilding plan for mackerel was implemented in 2019, and the stock's failure to improve prompted a revised rebuilding plan with a 2032 deadline.³ River herring and shad, also once keystone species in the Northwest Atlantic, are severely depleted and remain at historically low population levels. These ecological considerations are critical to keep top of mind when deliberating management alternatives for the Atlantic herring fishery.

A second factor is the persistent incidental catch of river herring and shad species within the commercial Atlantic herring fishery, mainly by midwater trawl and small-mesh bottom trawl vessels. Habitat obstruction and incidental catch are widely accepted to be the primary drivers of these species' rebuilding capacity, and while significant investments have been made to open historic riverine habitat for these stocks, runs have remained low for nearly all river systems.⁴ A notable exception to these trends can be found in Maine rivers, likely prompted in significant part by the marked differences in the management of the Atlantic herring fishery in the Gulf of Maine compared to the rest of New England (to be detailed further below). The incidental catch of river herring and shad by trawling fleets has been documented extensively in the literature and can be monitored and managed according to the species' natal regions with various management tools.⁵

A critical part of Amendment 8 was the explicit spatial restrictions on the midwater trawl gear in the herring fishery; 12 miles along the entire New England coastline and 20 miles off the back of Cape Cod. That 'buffer zone' was developed to account for the above-mentioned two factors, which are difficult to manage simply by calculating the total allowable catch each season. As a critical, if not the most critical forage fish in the Northwest Atlantic coastal ecosystem, Atlantic herring must be managed through a holistic, ecosystem-based approach, which considers what, when, and where predators are eating herring in the water ecologically, as well as what, when, and where people are utilizing herring economically and socially within that same system. This lens should guide fishery managers in what actions to take to attain optimum yield and is not only vital to sustainable Atlantic herring management, but obligatory under the Magnuson-Stevens Act.⁶ Please see Appendix 1 at the end of this letter for a more detailed explanation of the relevance of optimum yield to Amendment 10 action and the Atlantic herring fishery management plan.

Fairness and Equity are Critical When Allocating Access to the Atlantic Herring Resource.

³ https://static1.squarespace.com/static/511cdc7fe4b00307a2628ac6/t/63bdce4b3923fe0fbc6cb52/1673383503636/Mackerel-Rebuilding-2_2023-01-10.pdf

⁴ https://asmfc.org/images/Shad_RH/RiverHerringTable_2019.jpg

⁵ <https://cdnsiencepub.com/doi/full/10.1139/cjfas-2022-0144>

⁶ Magnuson-Stevens Act National Standard 1 – Optimum Yield (600.310): <https://www.ecfr.gov/current/title-50/chapter-VI/part-600/subpart-D/section-600.310>

Atlantic herring are currently managed through several spatial and temporal measures that seek to ensure the economic sustainability of the directed fishery while addressing some of its impacts on the ecosystem and other user groups. The Council has a long history of establishing closed areas that are designated for conservation purposes, including various groundfish closed areas, habitat management areas, and habitat research areas. The Council's Purse Seine/Fixed Gear-only area implemented in Amendment 1, effective for Herring Management Area 1A from June 1 through September 30 each year, has proven successful in helping to protect the nearshore Gulf of Maine forage base, improving Maine's river herring and shad runs, and sustaining related fishing and ecotourism businesses.

We strongly encourage the Council to institute new spatial management measures that will protect the nearshore New England ecosystem from the impacts of the directed herring fishery and help rebuild and sustain the Atlantic herring resource. These measures should, at minimum, include new restrictions on midwater trawling, tailored by Atlantic herring management areas, designed to ensure adequate forage is left for predators, protect spawning grounds, reduce river herring and shad incidental catch, and reduce conflicts between the directed fishery and other fishermen and stakeholders that rely on a robust forage base left in the water. Midwater trawlers are the largest fishing vessels in New England and are capable of fishing offshore, thus allocating them access to the offshore Atlantic herring resource to achieve required nearshore conservation of Atlantic herring and other fishery resources impacted by midwater trawling is fair and equitable.

The Council must purposefully address user conflicts with the directed herring fishery through Amendment 10. User conflicts include direct gear conflicts, as well as those created through loss of access to the herring resource between the directed herring fishery and other important user groups, including commercial and recreational fisheries, whale watching, and tourism. Most of these conflicts occur between the midwater trawl fleet and recreational and commercial fishermen, including Atlantic herring purse seiners. User conflicts with small mesh bottom trawls also occur where their activity is concentrated, particularly as these vessels have a high incidence of river herring and shad bycatch.

In order to develop spatially explicit management alternatives that meet Amendment 10's purpose and need, we recommend that the PDT perform a map overlay analysis of landings data within the Atlantic herring fishery by gear type and relevant data layers, including, but not limited to: known river herring and shad bycatch hotspots, Atlantic herring spawning grounds, other habitat management and closure areas, and areas with high user group traffic (commercial and recreational fisheries, whale watching locations, and tourism areas). Once the PDT spatially determines where areas with high conflicts and/or hotspots with increased ecological impacts are located, we recommend that the PDT display these results to the public through heat map visualizations, so the public can understand where the areas of greatest concern are. These overlays should be categorized by herring management area to make it easier for the public to visualize and comment upon their preferred management alternatives using available data, and to improve the Council's ability to tailor its spatial and temporal management measures in a manner that efficiently contributes to optimum yield for all herring resource user groups of the herring resource and the Northeast coastal ecosystem. In this way, confidential data can be displayed in aggregate among other data sources, and the public and managers will have access to the best available information to determine management priorities by area.

The recommended alternatives for analysis are spatial and temporal measures which would limit primarily midwater trawl gear, but also in some cases small mesh bottom trawl gear. This spatial and temporal management would complement the fishery management plan's harvest control rule, as the

Amendment 8 buffer zone was intended, and meet the purpose and need for Amendment 10 action: to help the fishery attain optimum yield, rebuild Atlantic herring, protect the ecosystem, and reduce user conflicts with the directed herring fishery.

Recommended Alternatives for Analysis

We have prioritized the following temporal and spatial factors when developing our recommendations for potential alternatives for Amendment 10 action below:

- Temporal (to be analyzed by management area according to each parameter): timing of peak Atlantic herring spawning and timing of peak river herring and shad bycatch incidents.
- Spatial (to be analyzed by management area): location of herring spawning grounds and egg mats, areas with high user conflicts, river herring and shad bycatch hotspots.

Amendment 8 Inshore Midwater Trawl Restricted Area

The Council should analyze reinstatement of the Amendment 8 boundaries within each management area. This was a compromise alternative that provided significant benefits to Atlantic herring, river herring and shad and also helped to reduce user conflicts while it was in place. However, while this provides a baseline for analysis, we agree with the Council that the seaward boundary of restrictions to midwater trawling should be tailored by management area to better protect each area's specific resources and, or user conflicts.

Area 1A

Area 1A purse seine / fixed gear only area restrictions are a good case study for a proactive and successful management strategy to help rebuild the herring resource and lower the negative impacts of the industrial midwater trawl fleet on associated species and other herring user groups. No herring landings are allowed before June 1 to protect the Gulf of Maine spawning stock, with additional sub-restrictions between the summer and fall months. Area 1A also has different gear-specific restrictions, for example between the midwater trawl and purse seine fleets, which aid in lowering the incidental catch of river herring and shad. These restrictions have clearly been successful after their implementation, because less than 10% of river herring and shad incidental catch has come from the Gulf of Maine midwater trawl catch cap area over the last 10 years.⁷ Maine's runs have been increasing, likely due in significant part to lowered interactions with the midwater trawl fishery, providing a stark contrast to runs in Southern New England, whose nearshore areas are not afforded the same holistic protections from the directed herring fishery.

We recommend that the Council consider the success of the specific management strategies in place in Area 1A when developing alternatives for other management areas where most of the problems are occurring. We also recommend that the Council update and analyze the relevant data including but not limited to spawning, river herring and shad run timing, and recreational and commercial fishing, and consider extending the Area 1A purse seine / fixed gear only area to include additional months prior to or after the current restrictions take effect annually, i.e., May and/or October. As the Council is aware, the Gulf of Maine is changing rapidly due to climate impacts, thus the timing of the Area 1A Purse Seine Fixed Gear Only Area restrictions should be reviewed and adjusted as appropriate.

⁷ https://www.greateratlantic.fisheries.noaa.gov/ro/fso/reports/Mackerel_RHS/Mackerel_RHS.htm

Area 1B and Area 3

Approximately 4% of the total ACL for Atlantic herring is allocated to Area 1B. Historically, most landings from this management area are caught off the back side of Cape Cod between 3-20 miles from shore, which prompted the 20-mile extension of the original Amendment 8 12-mile buffer zone.⁸ Nearly 40% of the herring ACL is allocated to Area 3, however, which is also prosecuted in nearshore waters in a similar manner, and also received enhanced spatial protections in the Amendment 8 buffer zone. Using recent and historic (reflecting when the herring resource was at healthier population levels) landings data and the above-mentioned map overlay analysis, the Council should develop spatial restrictions for the heavily-trafficked sections of Areas 1B and 3 by the midwater trawl fleet, based on known conflict zones between the midwater trawl fleet and other user groups who utilize those areas and river herring and shad incidental catch. This nearshore area off Cape Cod is where the most incidental catch of river herring and shad and user conflicts are known to occur within Areas 1B and 3 (Figure 1).⁹ This region includes the river herring and shad Cape Cod midwater trawl catch cap area, which was closed after only 23 days during the 2024 season. While that closure area overlaps between both management units and the specific spatial data for landings aren't made public, it is clear the Cape Cod catch cap area is heavily utilized in lieu of the offshore areas within Area 3, since the catch cap area was closed before the Area 3 sub-ACL was reached.

Offshore Area 3 herring landings are consistently located right along the Georges Bank spawning grounds, which is cause for management concern, because the two individual herring stocks – Gulf of Maine and Georges Bank – and their respective spawning areas, are not given the same level of protections from harvest by the directed fishery.¹⁰ With that in mind, the Council should conduct an in-depth analysis and consider alternatives for each of these management areas that would protect the discrete spawning components of the Atlantic herring resource, with spatial and/or temporal restrictions on midwater trawling to most efficiently protect essential fish habitat and promote rebuilding. To this end, the Council should consider protections for the Jeffrey's Ledge and Nantucket Shoals herring spawning grounds, which are located on the western edge of Area 1B, along with the Nantucket Shoals and Georges Bank spawning grounds, located across Area 3. Protections from September-December during peak spawning activity would greatly enhance overall recruitment. Again, the spawning protections in place in Area 1A could be replicated for those respective boundaries.

Area 2

We recommend analyzing and considering alternatives to restrict midwater trawls based on the same factors for Area 2 analysis as with Areas 1B and 3, using the same rationales. We urge the Council to prioritize the directed herring fishery's impacts to river herring and shad populations in their examination of Area 2, in particular. A 2021 Mid-Atlantic Council report identified four persistent river herring and shad bycatch hotspots using observer data for three time periods ranging from 2008 to 2019 (Figure 1).¹¹ This timeframe precedes implementation of the Amendment 8 buffer zone, thus indicating what bycatch could look like in its absence. When compared to the 12-mile Amendment 8 buffer zone, it is clear that it provided river herring and shad populations were considerable protection.

⁸ <https://apps-nefsc.fisheries.noaa.gov/read/socialsci/fishing-footprints/>

⁹ [Mid-Atlantic Fishery Management Council Maps for River Herring](#), Prepared by National Marine Fisheries Service (June 2021).

¹⁰ <https://afspubs.onlinelibrary.wiley.com/doi/10.1577/M06-267.1>

¹¹ [Mid-Atlantic Fishery Management Council Maps for River Herring](#), Prepared by National Marine Fisheries Service (June 2021).

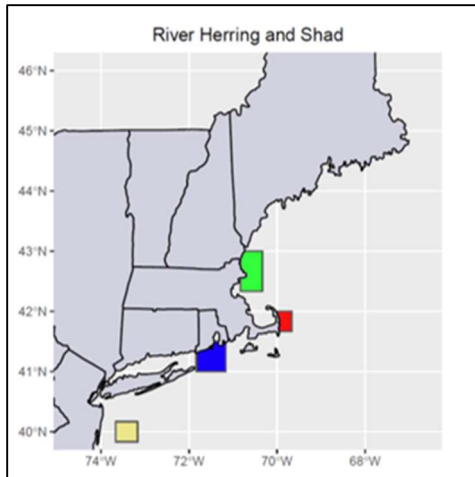


Figure 1: Map of New England coast indicating river herring and shad bycatch hotspots.^{9, 11}

In addition to the midwater trawl fishery's impacts in this area, the Council should consider the impacts of the small-mesh bottom trawl fishery, which operates at higher intensity in the nearshore areas off Long Island and Block Island Sounds.¹² In developing management measures to address river herring and shad incidental catch in Southern New England, the Council should take a balanced approach that considers both the management plan's conservation objectives and the socioeconomic interests of stakeholders that depend on healthy river herring and shad populations. River herring and shad stocks in Southern New England are severely depleted at, or near, all time low populations levels and need focused conservation measures within the fishery. For this reason, the Council should also analyze and consider an alternative (or as an option under the aforementioned Area 2 proposed alternative) that includes spatial and/or temporal restrictions in the small-mesh bottom trawl fishery because the incidental catch of river herring and shad with this gear in this area is known to be high. Unfortunately, there has been no observer coverage in Southern New England for either trawl fleet since 2018. Monitoring has indicated that for the past 10 years, 75% of the river herring and shad catch cap has been landed by both trawl fleets in Southern New England.¹³ This has caused a management challenge where the data used to monitor the river herring and shad catch caps for each fleet are not adequate, in addition to the obvious issues with using historical landings data, not representative of current landings nor biological data, to set the river herring and shad catch caps for the Atlantic herring fishery.

Additional River Herring and Shad Considerations

Addressing the bycatch of river herring and shad at sea in the Atlantic herring fishery is not only necessary from an ecological perspective, but from an economic perspective as significant public and private resources have been allocated to river herring and shad recovery through habitat restoration, dam removals, and water quality improvements, particularly in the Southern New England region. Adequately addressing the at-sea impacts of the midwater trawl and small-mesh bottom trawl fisheries on river herring and shad runs would not only make those efforts worthwhile but also augment the base of the marine food web for countless species, help our coastal and riverine ecosystems flourish, and help revitalize coastal communities' social and cultural traditions that are based on healthy river herring and shad runs. Rebuilding the forage base in the Northwest Atlantic means not only rebuilding the Atlantic

¹² <https://apps-nefsc.fisheries.noaa.gov/read/socialsci/fishing-footprints/>

¹³ https://www.greateratlantic.fisheries.noaa.gov/ro/fso/reports/Mackerel_RHS/Mackerel_RHS.htm

herring stock, but our vital river herring and shad stocks as well. For these reasons, we also recommend that the Council develop and consider a stand-alone river herring and shad protection alternative, which would apply to all management areas and could also overlay other alternatives. The alternative should provide spatial/temporal restrictions to midwater and small-mesh bottom trawl gear based on the river herring hotspot analysis and map referenced above, updated with additional data and analysis as appropriate. In addition, the Council should consider the 2023 Roberts, et.al. paper “Developing a subseasonal ecological forecast to reduce fisheries bycatch in the Northeast U.S.”¹⁴ as the basis for developing a mandatory bycatch avoidance program that could supplement seasonal hot-spot closures to help protect river herring and shad.

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It is imperative that through the Amendment 10 scoping process all stakeholder input be considered, and that a reasonable range of alternative actions be developed that will help the fishery achieve optimum yield, minimize bycatch, protect essential fish habitat, rebuild the resource, and minimize user conflicts with the directed fishery fleet. We appreciate the opportunity to provide these comments.

Sincerely,

Jaclyn Higgins, Forage Fish Program Manager
Theodore Roosevelt Conservation Partnership

Roger Fleming, Attorney
o/b/o Wild Oceans

¹⁴ K.E. Roberts, et. al., “Developing a subseasonal ecological forecast to reduce fisheries bycatch in the Northeast U.S.” Progress in Oceanography, Volume 213, 2023,

Appendix 1

Background

Management measures developed by the Council and implemented by NMFS must comply with all applicable Federal laws and Executive Orders. Management measures must comply with ten National Standards specified in the Magnuson-Stevens Act (MSA). Amendment 10 action would combine with the management measures taken in the Amendment 8 process, which established an Acceptable Biological Catch (ABC) Control Rule in conjunction with an Inshore Midwater Trawl Restricted Area. The primary purpose of Amendment 8 was to explicitly account for herring's role in the ecosystem and to address the biological and ecological requirements of the Atlantic herring resource, while also minimizing possible detrimental biological impacts on predators of herring and associated socioeconomic impacts on other user groups. Because the Midwater Trawl Restricted Area was vacated in 2022, the spatial element of the Amendment 8 management measures, which served to minimize user group conflict arising from midwater trawl vessels harvesting herring overlapping with other user groups (i.e., commercial fisheries, recreational fisheries, ecotourism) that rely on herring as forage, has been left unfulfilled. The restricted area measure also served to provide inshore conservation benefits to the herring resource and associated species such as river herring and shad by overlapping with known herring spawning zones and river herring and shad bycatch hotspots. Optimum yield was attained in the Atlantic herring fishery through the implementation of the previous Restricted Area, insofar as it allowed the Council to provide the greatest benefit to the Nation by incorporating economic, ecological, and social factors into the management framework.

As it is the case that no spatially explicit allocation measures are in place in the Atlantic herring fishery that address user group conflicts in combination with herring's conservation status, the Council has decided to prioritize reestablishing similar restrictions, to align the Atlantic herring fishery management plan (FMP) with the MSA guidelines which must be considered when attaining Optimum Yield in a fishery (National Standard 1).

The Amendment 8 ABC Control Rule established a region-wide catch level that better addresses ecosystem needs at a broader scale than prior control rules, but it does not currently address spatial or temporal consideration of the role of Atlantic herring as forage throughout the region. Through a range of spatially and temporally explicit gear restrictions, area closures, and possession limits, the Council seeks to fully address gaps left in the fishery management plan after the Amendment 8 Inshore Midwater Trawl Restricted Area was vacated in 2022. Spatially and temporally explicit management measures are needed to minimize user conflicts attributed to the Atlantic herring fishery, which were also identified throughout the Amendment 8 process and in prior actions, for the herring FMP to comply with National Standards 1 (Optimum Yield) and 4 (Allocation). Allocative measures must provide not only for fairness and equity in allocation of fishing privileges, but also for the promotion of conservation of the managed resource. In the case of a critical forage fish such as Atlantic herring, management measures must also account for users of the resource that rely on its availability in the ecosystem, namely coastal communities and participants in the coastal economy, in addition to the ecosystem itself.

Addressing this issue requires the development of an amendment to the Atlantic herring FMP to fully consider and analyze an appropriate range of management alternatives.

Atlantic Herring FMP¹⁵

In setting specifications for the number of fish caught annually in the Atlantic herring fishery, within the FMP, optimum yield (OY) is defined as less than or equal to ABC minus the expected Canadian catch (C) from the stock complex, not to exceed maximum sustainable yield (MSY). While this calculation is the primary management measure used to allocate catch within the fishery, through the creation of a Total Allowable Catch (TAC), based on OY, in addition to the calculated amount of catch, OY must also consider relevant economic, social, or ecological factors. Additional management measures within the FMP serve to prevent overfishing of the Atlantic herring stock while also distributing fishing effort throughout the stock's range. These include the spatial and temporal regulations already in place within the fishery today, including but not limited to: the development of management areas and subsequent seasonal/harvest restrictions based upon two distinct spawning stocks, state-based time/area/gear restrictions, and Habitat Management Area (HMS)-based restrictions, among others.

Varied management measures across time and space throughout the range of the Atlantic herring resource serve to amplify the stated goals and objectives of the FMP by implementing a well-rounded management strategy which achieves OY for the fishery and prevents overfishing, while also providing the greatest overall benefit to the Nation. This includes considerations for opportunities for optimal food production from other commercial fisheries within the seafood industry and opportunities for enhanced recreational opportunities, both of which rely on an adequate biomass of the Atlantic herring resource as forage for their own targeted species, in various ways across seasons and regions.

As such, key objectives of the Atlantic herring FMP that are explicitly achieved through spatial and temporally focused management measures, and that would benefit from additional measures under Amendment 10 management action, include:

- “2) To prevent the overfishing of discrete spawning components consistent with the national standards.
- 3) To avoid patterns of fishing mortality by age which adversely affect the age structure of the stock.
- 4) To provide adequate protection for spawning herring and prevent damage to herring egg beds.
- 6) To implement management measures in close coordination with other Federal and State FMP's.
- 8) To achieve full utilization from the catch of herring, including minimizing waste from discards in the fishery.

¹⁵ NEFMC Atlantic Herring Fishery Management Plan: https://d23h0vhs26o6d.cloudfront.net/herring_FMP.PDF

10) To promote the utilization of the resource in a manner which maximizes social and economic benefits to the nation, and taking into account the protection of marine ecosystems.”

MSA National Standard 1 – Optimum Yield¹⁶

The definition of OY under National Standard 1 of the MSA is: “Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield (OY) from each fishery for the U.S. fishing industry.” Below are the relevant factors within the MSA which are used to determine OY in its entirety, inclusive of spatial and temporally explicit regulations, in addition to the numerical calculation of the number of fish harvested annually.

“*Assessing OY.* An FMP must contain an assessment and specification of OY. The assessment should include: a summary of information utilized in making such specification; an explanation of how the OY specification will produce the greatest benefits to the nation and prevent overfishing and rebuild overfished stocks; and a consideration of the economic, social, and ecological factors relevant to the management of a particular stock, stock complex, or fishery. Consistent with Magnuson-Stevens Act, the assessment and specification of OY should be reviewed on a continuing basis, so that it is responsive to changing circumstances in the fishery.”

- “*Determining the greatest benefit to the Nation.* In determining the greatest benefit to the Nation, the values that should be weighed and receive serious attention when considering the economic, social, or ecological factors used in reducing MSY, or its proxy, to obtain OY are:
 - The benefits of food production derived from providing seafood to consumers; maintaining an economically viable fishery together with its attendant contributions to the national, regional, and local economies; and utilizing the capacity of the Nation's fishery resources to meet nutritional needs.
 - The benefits of recreational opportunities reflect the quality of both the recreational fishing experience and non-consumptive fishery uses such as ecotourism, fish watching, and recreational diving. Benefits also include the contribution of recreational fishing to the national, regional, and local economies and food supplies.
 - The benefits of protection afforded to marine ecosystems are those resulting from maintaining viable populations (including those of unexploited species), maintaining adequate forage for all components of the ecosystem, maintaining evolutionary and ecological processes (*e.g.*, disturbance regimes, hydrological processes, nutrient cycles), maintaining productive habitat, maintaining the evolutionary potential of species and ecosystems, and accommodating human use.”
- “*Economic, Ecological, and Social Factors.* Councils should consider the management objectives of their FMPs and their management framework to determine the relevant social, economic, and ecological factors used to determine OY. There will be inherent trade-offs when determining the objectives of the fishery. The following is a non-exhaustive list of potential considerations for social, economic, and ecological factors.

¹⁶ Magnuson-Stevens Act National Standard 1 – Optimum Yield (600.310): <https://www.ecfr.gov/current/title-50/chapter-VI/part-600/subpart-D/section-600.310>

- *Social factors.* Examples are enjoyment gained from recreational fishing, avoidance of gear conflicts and resulting disputes, preservation of a way of life for fishermen and their families, and dependence of local communities on a fishery (*e.g.*, involvement in fisheries and ability to adapt to change). Consideration may be given to fishery-related indicators (*e.g.*, number of fishery permits, number of commercial fishing vessels, number of party and charter trips, landings, ex-vessel revenues etc.) and non-fishery related indicators (*e.g.*, unemployment rates, percent of population below the poverty level, population density, etc.), and preference for a particular type of fishery (*e.g.*, size of the fishing fleet, type of vessels in the fleet, permissible gear types). Other factors that may be considered include the effects that past harvest levels have had on fishing communities, the cultural place of subsistence fishing, obligations under tribal treaties, proportions of affected minority and low-income groups, and worldwide nutritional needs.
- *Economic factors.* Examples are prudent consideration of the risk of overharvesting when a stock's size or reproductive potential is uncertain, satisfaction of consumer and recreational needs, and encouragement of domestic and export markets for U.S. harvested fish. Other factors that may be considered include: The value of fisheries, the level of capitalization, the decrease in cost per unit of catch afforded by an increase in stock size, the attendant increase in catch per unit of effort, alternate employment opportunities, and economic contribution to fishing communities, coastal areas, affected states, and the nation.
- *Ecological factors.* Examples include impacts on EC species, forage fish stocks, other fisheries, predator-prey or competitive interactions, marine mammals, threatened or endangered species, and birds. Species interactions that have not been explicitly taken into account when calculating MSY should be considered as relevant factors for setting OY below MSY. In addition, consideration should be given to managing forage stocks for higher biomass than B_{msy} to enhance and protect the marine ecosystem. Also important are ecological or environmental conditions that stress marine organisms or their habitat, such as natural and manmade changes in wetlands or nursery grounds, and effects of pollutants on habitat and stocks.”

“Specifying OY. If the estimates of MFMT and current biomass are known with a high level of certainty and management controls can accurately limit catch, then OY could be set very close to MSY, assuming no other reductions are necessary for social, economic, or ecological factors. To the degree that such MSY estimates and management controls are lacking or unavailable, OY should be set farther from MSY.

- The OY can be expressed in terms of numbers or weight of fish, and either as a single value or a range. When it is not possible to specify OY quantitatively, OY may be described qualitatively.
- The determination of OY is based on MSY, directly or through proxy. However, even where sufficient scientific data as to the biological characteristics of the stock do not exist, or where the period of exploitation or investigation has not been long enough for adequate understanding of stock dynamics, or where frequent large-scale fluctuations in stock size diminish the

meaningfulness of the MSY concept, OY must still be established based on the best scientific information available.”