

**2001 REVIEW OF THE FISHERY MANAGEMENT PLAN FOR
ATLANTIC SEA HERRING
(*Clupea harengus harengus*)**

Prepared by

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I. Status of Fishery Management Plan

The Atlantic States Marine Fisheries Commission's (ASMFC) Amendment 1 to the Atlantic Herring Fishery Management Plan (FMP) was approved in 1998 and established three management goals and eleven management objectives for the U. S. Atlantic herring (*Clupea h. harengus*) resource. Amendment 1 was developed in conjunction with the development of an FMP for federal waters by the New England Fishery Management Council (NEFMC). The goals and objectives can only be reached through the successful implementation of both the Commission's and Council's FMPs. Management measures in both plans are designed to complement each other in order to minimize regulatory differences in fisheries conducted in state versus federal waters. The management scheme relies on an overall total allowable catch (TAC) with effort control measures to avoid overfishing the resource. The TACs were developed for specific management areas to reflect the current state of knowledge concerning migratory behavior and mixing rates of the various sub-components of Atlantic herring. Effort controls include specific days out of the fishery in order to slow catch rates and extend the fishing season.

Amendment 1 defines overfishing and biological reference points based on an estimate of maximum sustainable yield (MSY) for the entire stock complex. In order to maintain consistency between Amendment 1 and the Council's FMP, the Commission's Atlantic Herring Section decided to adopt the same overfishing definition and biological reference points as the Council has under guidelines stipulated in the revised Magnuson-Stevens Fishery Conservation and Management Act (Table 1). Both FMPs provide a process for determining annual specifications for the fishery and by the different management areas. Both plans also contain institutional frameworks for developing and implementing future management action involving the Commission, the New England and Mid-Atlantic Councils, and (possibly) Canada, state and federal spawning closures/restrictions, and recommend a measures intended to prevent damage to herring spawning habitat and egg beds.

In the event that the stock becomes over-exploited in the future, adult and/or juvenile catch limits may be needed within individual areas according to guidelines developed by the Atlantic Herring Section (Section) and Plan Development Team (PDT), based on advice from the Atlantic Herring Technical Committee and the Atlantic Herring Advisory Panel. Any adjustments to Amendment 1 will need to be discussed and planned in conjunction with the New England Council's Herring Committee and Plan Development Team.

II. Status of the Stock

The U.S. Atlantic herring coastal stock complex includes two distinct spawning stocks which occupy discrete areas in the Gulf of Maine and on Georges Bank/Nantucket Shoals in the summer and fall. Fish belonging to these two components, and to smaller spawning populations within each, migrate to continental shelf waters south of Cape Cod after spawning, then move

northward in the spring to summer feeding grounds north and east of the Cape before eventually returning to their natal spawning grounds. Herring deposit eggs on gravel bottom in relatively shallow, tidally-mixed coastal waters and offshore banks.

The coastal stock complex which occupies the management area covered by Amendment 1 (Cape Hatteras, NC to New Brunswick, Canada) has grown rapidly since the early 1980's. Total stock biomass at the beginning of 1997 was estimated as 2.9 million metric tons (mt). This increase is due largely to the recovery of the Georges Bank/Nantucket Shoals components of the stock complex, which supported a large foreign fishery during the 1960's and early 1970's, but collapsed in the mid-70's as a result of over-exploitation. Current stock size estimates are twice what they were in the late 1960's. Annual fishing mortality rates exceeded 50% for a number of years following the collapse of the Georges Bank stock and have declined rapidly during the last ten years. The fishing mortality rate in 1997 was estimated to be less than 0.1 (there is an 80% probability that fishing mortality for age 3-7 herring is between 0.03 and 0.06).

Population size and fishing mortality rate estimates for the Atlantic coastal stock complex are based on a virtual population analysis that relies on catch at age estimates and spring and winter trawl survey abundance indices by age that are available since 1968 (trawl survey data are used to select the terminal fishing mortality rates for the VPA in a process that is called "tuning"). Fall trawl survey data for Atlantic herring cannot be used because they are too variable from tow to tow, the result of the aggregation of adults in certain locations, and their low abundance elsewhere, during the spawning season. Trawl surveys conducted in winter and spring, after spawning is over, are not prone to this problem, but adult herring belonging to different spawning stocks are mixed at this time of year (primarily in southern New England and the mid-Atlantic region) and cannot be distinguished from each other. For this reason, separate "tuned" VPA's for the two principal spawning stocks cannot be performed. Larval survey data collected every year between 1971 and 1994 were used in the past as a second tuning index for the stock complex VPA, but are no longer available.

VPA-derived population size and fishing mortality rate estimates for the stock complex are substantially over-estimated for the most recent years of the time series. To illustrate the nature of the problem, in 1995, the previous time an assessment of this resource was completed, the mean 1994 biomass was 3.6 million mt. In 1998, with the addition of three more years of catch at age and survey data to the analysis, the 1994 biomass estimate dropped by 2/3, to 1.1 million mt. Projected 1999 and 2000 spawning stock size estimates at different levels of fishing mortality (NEFSC 1998) are overly optimistic because they are based on an over-estimated 1997 stock size. A more realistic stock size estimate for the complex is 1.92 million mt, an estimate that was derived from a surplus production model that relies solely on total annual catch figures and trawl survey data (mean kg/tow for all ages combined). The results of this model were endorsed by the Overfishing Definition Review Panel that was convened to advise the New England and Mid-Atlantic Fishery Management Councils on overfishing definitions for 42 stocks managed by these two Councils (NEFMC 1998), but were not reviewed by the Stock Assessment Review Committee in the spring of 1998.

There is limited information currently on the relative size of the two principal spawning stocks that make up the stock complex. Historical assessment information indicates, however, that the

Gulf of Maine stock was much smaller than the Georges Bank/Nantucket Shoals stock during the 1960's and 1970's. With the recovery of the Georges Bank/Nantucket stock in recent years, the same situation is believed to prevail today. Analysis of NMFS fall trawl survey data gives some indication as to the relative size of each component. An examination of the fall trawl survey data by the 27th SAW (NEFSC 1998) resulted in estimates of minimum population size for each of the three areas for the time periods 1988-97 and 1993-97. Coastal Maine accounted for 27% of the population during 1988-97, and 26% in the more recent time period. Nantucket Shoals accounted for 63% of the population from 1988-97 and 57% during 1993-97. Georges Bank accounted for 10% of the biomass in 1988-97 and 17% in the recent period, a reflection of the increased amount of spawning on Georges Bank during the last five years. These data indicate that the Gulf of Maine spawning stock accounts for about 25% of the total spawning stock biomass and the Georges Bank-Nantucket Shoals stock for the remaining 75%.

Larval and bottom trawl surveys conducted by the National Marine Fisheries Service during the past 30 years clearly document the collapse of the offshore portion of the stock complex in the early 1970's and its recovery over the past ten years. Larval catch rates on Georges Bank and Nantucket Shoals were high in the early 1970's, then declined to very low levels until the late 1980's and early 1990's. Catch rates of herring in the spring bottom trawl survey south of Cape Cod started to increase in the mid-1980's and reached record high levels in 1996 and 1997. Catch rates of two year-old herring were particularly high in 1996, as were three year-olds in 1997, indicating that the 1994 yearclass is large and that the stock may continue to increase in size.

Despite the continued growth and large size of the stock complex, the fishery is still primarily conducted as a nearshore fishery in the Gulf of Maine, on the smaller Gulf of Maine spawning stock and migrants from the Georges Bank stock which occupy this area to some extent in the spring. Concerns have been expressed by the scientific community that current levels of exploitation could threaten smaller localized spawning populations in the Gulf of Maine.

Currently, the stock complex is large and underutilized. It may increase in size even further in the near future under current exploitation and recruitment patterns.

III. Status of the Fishery

Commercial fisheries for Atlantic herring along the U.S. east coast and in New Brunswick, Canada, only remove about 120,000 mt a year, or 4% of the population. Over 90% of the total commercial harvest is taken in the Gulf of Maine, primarily with purse seines and midwater trawls (mobile gear) and to a lesser extent with stop seines and weirs (fixed gear). Primary domestic uses of the resource are for canning and bait. Total wholesale value of canned herring products in Maine in 1996 was about \$100 million.

Under a provision of the Magnuson Fishery Conservation and Management Act, sales of herring to foreign processing ships operating in state internal waters have been conducted through the issuance of Internal Waters Processing (IWP) permits. These IWP sales continue to provide an alternative market opportunity for U.S. fishermen. In general however, the fishery remains market limited. The surplus adult biomass available for IWP allocation was 425,000 mt for the

fishing year July 1, 1996 through June 30, 1997. This amount was allocated among the ASMFC management areas with 106,250 mt for Area 1 (Gulf of Maine), 212,500 mt for Area 2 (southern New England and the Mid-Atlantic), and 106,250 mt for Area 3 (Georges Bank).

For the current fishing year (1996-97), the Commission's Atlantic Herring Section allocated 13,000 mt to Maine and 8,000 mt to Massachusetts for IWP operations and allocated the remaining tonnage of 85,250 mt to reserve. Rhode Island was allocated 42,000 mt in Area 2, with New York and New Jersey each receiving 5,000 mt. The remaining 160,500 mt was put in reserve. The logic for these decisions was that if a state's IWP(s) operation is successful (e.g., a foreign vessel is anchored in state waters and the fishery is strong), the reserve can be used. Additionally, the Section recommended an allocation of 20,000 mt for Area 3 in the event that a Preliminary Management Plan (PMP) could be developed in time to allow Joint Venture Processing on Georges Bank (A federal PMP was approved in the summer of 1996 which established a total joint venture processing limit of 40,000 mt in federal waters of Areas 2 and 3 only, with no more than 20,000 mt in Area 3. The federal PMP also removed Atlantic herring from the prohibited species list.).

IV. Status of Assessment Advice

The most recent assessment of the Atlantic herring Coastal Stock Complex was completed in 1998 and reviewed by the SARC during the 27th SAW (NEFSC 1998). An analytical assessment (VPA-ADAPT methodology) of commercial catch-at-age was conducted. Catch data from US commercial fisheries, New Brunswick (Canada) fixed-gear fisheries, distant water fleets, IWP, and discards from U.S. mackerel JV fisheries were used to develop catch-at-age. Mean weights-at-age were determined from U.S. coastal fisheries only. Information on abundance and size of the spawning stock was taken from NEFSC spring and winter surveys of catch per tow disaggregated by age. In addition, an untuned VPA for the Gulf of Maine stock component has been developed and accepted by the SARC. This assessment indicates that this portion of the stock complex may currently be fully or over-exploited. Although fishing pressure on the stock complex can be increased, the SARC recommended that it be increased gradually due to the uncertainty in the current estimates of fishing mortality and spawning stock biomass. Additional sources of uncertainty include stock identification and resolution, the lack of an appropriate abundance survey for pelagic resources, and reliability of historical landings data.

V. Status of Research and Monitoring

(Not included in this review; see list of prioritized research and monitoring recommendations)

VI. Status of Management Measures and Issues

Atlantic herring have been managed on the U.S. east coast by means of an agreement between the states of Maine, New Hampshire, Massachusetts and Rhode Island which established annual three to four week spawning closures. The agreement was adopted in 1983 and endorsed by the ASMFC. The agreement replaced a federal management plan which was implemented in 1978 and withdrawn by the Secretary of Commerce in 1982 once it became clear that catch quotas for adult herring in the Gulf of Maine were not going to be enforced in state waters. In the absence of a federal FMP for Atlantic herring, it was then placed on the prohibited species list, which

eliminated directed fisheries by foreign nationals or joint ventures for herring in the U.S. Exclusive Economic Zone (EEZ) (see footnote 1).

With the development of IWP fisheries in the mid-1980's, it became clear that the 1983 interstate agreement was no longer adequate to manage the U.S. Atlantic herring resource. This agreement was not comprehensive enough to manage the resource, primarily because an allocation process was needed to equitably divide IWP shares between states receiving IWP applications. To address this problem the affected states, working through the ASMFC Atlantic Herring Section, developed an IWP allocation process which is now established as part of the present FMP. In addition, a second memorandum of understanding was circulated for signature to the states of Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York and New Jersey in 1983 to demonstrate the intent of these states to cooperatively manage Atlantic herring.

In addition to IWP's, there have been other changes in the fishery and in resource assessment procedures which require a new approach for managing this resource throughout its range. With the dramatic growth of the stock, particularly offshore and in southern New England and Mid-Atlantic coastal waters, more states have declared an interest in IWP opportunities and in the management of the resource. Indeed, as a transboundary stock, both the U.S. and Canada should develop complementary management objectives. In addition, assessment biologists from both countries should continue to work together to provide the best scientific advice for the entire resource.

For management purposes, the current FMP established three management areas within U.S. waters of the northwest Atlantic. Areas 1 and 2 include state and Federal waters north and south of Cape Cod, and Area 3 includes only federal waters on Georges Bank. A procedure is defined by which the ASMFC Herring Technical Committee, working with the NMFS, and if necessary, the Canadian Department of Fisheries and Oceans, will annually assess the coastal stock complex (defined as extending from New Brunswick to its southernmost extension on the U.S. Atlantic coast), estimate the total surplus adult biomass available for harvest, and recommend to the ASMFC Herring Section how much of the surplus to hold in reserve and how much to allocate for IWP harvest. The Section will act on these recommendations and divide the total IWP allocation between the three management areas and the individual states within each area, with no single area receiving more than 50% of the total. This FMP further recommends that each state ensure the monitoring of the IWP landings through the use of trained observers placed aboard IWP processing vessels or through the use of log books.

This FMP is an Atlantic States Marine Fisheries Commission plan. Since it is not a joint Council/Commission plan, it cannot be (nor is it intended to be) fully implemented in federal waters without the cooperation of the New England and Mid-Atlantic Fishery Management Councils, and the development and implementation of a federal FMP. However, until such time as a joint ASMFC/NEFMC FMP, or federal FMP is completed and adopted which will allow full management of the resource throughout the EEZ and state waters, the management authority embodied in this plan will reside with the ASMFC, and be implemented through the states' authority to regulate domestic landings of fish caught inside or outside of state waters. The existing ASMFC management plan does not place any new restrictions or controls on the domestic herring fishery.

VII. Current State-by-State Implementation of FMP Compliance Requirements as of August 1, 2000

VIII. Recommendations of FMP Review Team

Regulatory Recommendations

No changes to Amendment 1 are recommended until after the New England Council's Atlantic Herring FMP is implemented and the impacts of both plans can be evaluated as a whole.

Amendments

No amendments are planned at this time.

Research and Monitoring Recommendations

Identify known herring spawning areas. Establish critical spawning habitat areas or special management zones to protect spawning aggregations of herring and/or demersal egg masses (1).

Develop a long-term strategy for assessing individual spawning stocks as a basis for more effective management of any heavily exploited portion(s) of the stock complex. Evaluate the merit of acoustic surveys and other techniques to achieve sub-stock complex monitoring (1).

Develop economic analyses necessary to evaluate the costs and benefits associated with different segments of the industry (2).

Pursue the development of a dedicated pelagic survey technique utilizing hydroacoustic and trawling methods to provide another direct and independent means of estimating stock sizes. Collaborative work between NMFS, DFO, state agencies, and the herring industry on acoustic surveys for herring should be encouraged (2).

Reinvestigate the estimation of age-3 herring, the natural mortality rate assumed for all ages, the use of catch-per-unit-effort tuning indices, and the use of NEFSC fall bottom trawl survey tuning indices in the analytical assessment of herring (2).

Develop new approaches to estimating recruitment (i.e. juvenile abundance) from fishery-independent data (3).

Consider using NEFSC fall survey mean weights at age as the spawning stock mean weight at age in the estimation of biological reference points. Evaluate alternative catch weights at age (3).

Investigate alternative methods of estimating mean weight at age used to determine the age composition of U.S. and Canadian landings from the coastal stock complex (3).

Conduct a retrospective analysis of herring larval and assessment data to determine the role larval data plays in anticipating stock collapse and as a tuning index in the age-structured

assessment (3).

Continue resource monitoring activities, especially larval surveys to indicate the relative importance of individual spawning areas and stocks and the degree of spawning stock recovery on Georges Bank and Nantucket Shoals (4).

Develop socio-economic analyses appropriate to the determination of optimum yield (5).

Evaluate the concept of a minimum biologically-acceptable level biomass (MBAL) for the herring coastal stock complex. Determine the adequacy of present methods and data to determine MBAL if appropriate (5).

Evaluate the concept of a fixed spawning stock size or spawning target for the herring coastal stock complex. Determine the adequacy of present methods and data to set a target if appropriate (5).

Investigate the effects of averaging maturity rates over blocks of years to help smooth some of the interannual variability in the calculation of spawning stock biomass (5).

Consider potential discards if fishing mortality increases in the future (6).

Additional Un-prioritized Research Needs

Possible effects of density-dependence (e.g. reduced growth rates at high population size) on parameter estimates used in assessments should be examined.

Potential changes in catchability within spring bottom trawl survey indices should be investigated.

Investigate the validity extremely high recruitment in recent years.

Identified Management Issues

Assure that the Clean Water Act (Section 319) Non-Point Source Plans and coastal Non-Point Pollution Control Plans are developed and implemented such that adverse impacts of non-point source pollutants on Atlantic herring are minimized.

Strengthen enforcement of sewage discharge, or National Pollutant Discharge Eliminations System (NPDES) permit effluent limits from treatment plants, and ensure proper maintenance and operation of domestic septic systems.

Implement effective oil and toxic chemical spill prevention and control programs to prevent accidental release, and prioritize cleanup plans to protect areas where Atlantic herring spawn or areas inhabited by Atlantic herring at different stages of their life history.

Establish and enforce vessel “non-discharge zones”, and promote education of recreational boaters to reduce contamination of nearshore waters from chronic fuel spills and waste disposal.

Prohibit dredging activities, including disposal of dredge spoil, in areas where herring are known to deposit eggs.

Assist industrial siting councils in siting new power plants so that impingement and entrainment of Atlantic herring are minimized.

Organize annual US-Canada workshops to coordinate stock assessment activities and optimize cooperation in management approaches between the two countries.

Notes:

The Maine Department of Marine Resources, a group of herring industry members, and the Gulf of Maine Aquarium Development Corporation are working to develop a list of herring research priorities for the Gulf of Maine. A proposal is being developed to seek funding for larval and acoustic survey work, and possibly some tagging studies. Similar discussions are taking place among a group of U.S. and Canadian herring industry representatives and government fisheries scientists.