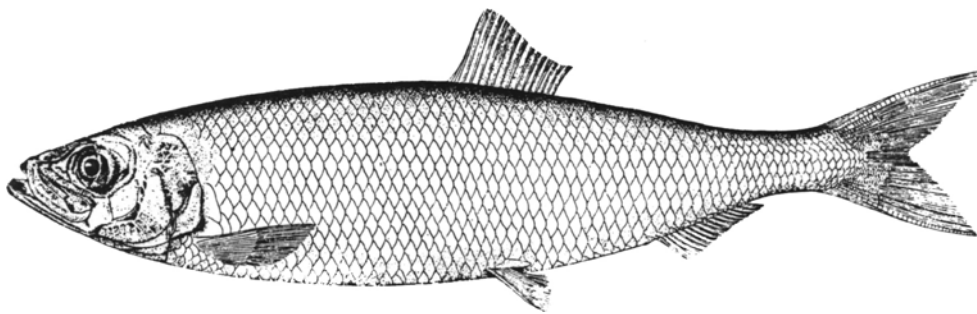


**2007 REVIEW OF THE FISHERY MANAGEMENT PLAN FOR
ATLANTIC SEA HERRING
(*Clupea harengus harengus*)**



Prepared by

The Atlantic Sea Herring Plan Review Team

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I. Status of Fishery Management Plan

| | |
|---------------------------------------|--|
| <u>Date of FMP Approval:</u> | November 1993 |
| <u>Amendments:</u> | Amendment 1 (February 1999) Amendment 2 (March 2006) |
| <u>Addenda:</u> | Addendum I (to Amnd. I) (July 2000) Technical Addendum #1a (to Amnd. I) (October 2001) Addendum II (to Amnd. I) (February 2002) Technical Addendum 1 (to Amnd. II) (August 2006) |
| <u>Management Unit:</u> | US waters of the northwest Atlantic Ocean from the shoreline to the seaward boundary of the EEZ, and from US/Canadian border to the southern end of the species range (Cape Hatteras, NC). |
| <u>States With Declared Interest:</u> | Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, and New Jersey |
| <u>Active Boards/Committees:</u> | Atlantic Herring Section, Advisory Panel, Technical Committee, Stock Assessment Subcommittee, Plan Development and Plan Review Team |

The Atlantic States Marine Fisheries Commission's (ASMFC) Amendment 1 to the Atlantic Herring Fishery Management Plan (FMP) was approved in 1999 establishing three management goals and eleven management objectives for the U.S. Atlantic herring (*Clupea h. harengus*) resource. Amendments I and II were developed in conjunction with the New England Fishery Management Council's (NEFMC) federal management plan. The goals and objectives can only be reached through the successful implementation of both the interstate and federal management plans. Management measures in both plans are designed to complement each other to minimize regulatory differences in fisheries conducted in state and federal waters. The management scheme relies on an overall total allowable catch (TAC) with effort control measures to avoid overfishing the resource. TACs are 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. State effort controls include specific days out of the fishery 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 adopted the same overfishing definition and biological reference points as the Council, which were created under guidelines stipulated in the revised Magnuson-Stevens Fishery Conservation and Management Act prior to the 2006 re-authorization. Both FMPs provide a process for determining the annual specifications for the fishery and by management area. Both plans contain institutional frameworks for developing and implementing future management action involving the Commission, the New England and Mid-Atlantic Councils, and (possibly)

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Canada; state and federal spawning closures/restrictions; and recommend measures intended to prevent damage to herring spawning habitat and egg beds.

In July 2000, the Section approved Addendum I to re-address the protection of spawning areas and change the due date for annual state compliance reports to February 1st. Because National Marine Fisheries Service disapproved the spawning closures for the federal waters of Management Area 1A (inshore Gulf of Maine), the Commission developed Addendum I to redefine the state waters spawning areas outlined in Amendment 1. Addendum I also includes measures designed to reduce the exploitation and disruption of herring spawning aggregations by imposing a landing restriction in state ports for herring caught in the spawning areas, except that some states allow a 20% tolerance for spawn herring (Maine and Massachusetts).

The Commission approved Technical Addendum #1a (2001) to change the delineation of the Eastern Maine spawning boundary because the spawning aggregations were not adequately protected in 2000.

Addendum II was developed in conjunction with the Council's Framework Adjustment I to allocate the Management Area 1A Total Allowable Catch (TAC) on a seasonal basis. Addendum II also specifies the procedures for allocating the annual Internal Waters Processing (IWP) quota (more detail given in section IX).

Federal Amendment 1 was published in the Federal Register on March 12, 2007. Significant provisions include: changes to management area boundaries; authorization of a research set aside program; a provision allowing the establishment of harvest specs for up to three years; vessel monitoring system requirements; new permit specifications; a 5% bycatch set aside for each area; midwater trawl prohibition in area 1A from June 1 – September 30; and a 500 mt Area 1A set aside for west of Cutler fixed gear fishermen.

Regardless of coordinated development between the ASMFC (Amendment 2) and NMFS (Amendment 1) there remain some inconsistencies. The east of Cutler exemption in *section 4.3.2.4* of Amendment 2 was not adopted in federal Amendment 1 as it was found to be "inconsistent with National Standard 1 and 3 of the Magnuson-Stevens Act." Conversely, Amendment 1 contains a midwater trawl prohibition in Area 1A from June 1 – September 30, which is not included in the ASMFC's Amendment 2. It is unlikely that there are mid-water trawl vessels lacking federal permits.

Despite these minor inconsistencies, the essential management components are consistent between the federal Amendment 1 and ASMFC's Amendment 2. These provisions include identical management area boundaries, joint TAC specifications setting process between the New England Fishery Management Council and Atlantic States Marine Fisheries Commission and closure of an area when 95% of TAC is harvested leaving 5% as a bycatch allowance.

In November 2007, the NEFMC initiated an Amendment to improve catch/bycatch monitoring and address annual catch limits and accountability measures to ensure compliance with the reauthorized Magnuson Stevens Act. Scoping meetings for Amendment 4 were held during the

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summer of 2008. The NEFMC is working to complete the Draft Amendment 4 for public comment.

In December 2008, the ASMFC Atlantic Herring Section approved Draft Addendum I to Amendment 2 to the Interstate FMP for Sea Herring. Draft Addendum I was developed to explore new ways to control harvest, ensure a steady flow of herring throughout the season, and enhance harvesting predictability (due to fewer in-season days out modifications). Specifically, the Draft Addendum presents options to (1) distribute the Area 1A quota using bimonthly, trimester, or seasonal quotas with payback and overage options; (2) change days out regulations including how they are set and how they restrict fishing activity; and (3) modify the frequency of state reporting requirements. The public comment period ends on January 23, 2009 and the Section will vote on Draft Addendum I on February 3, 2009.

II. Status of the Stock

The U.S. Atlantic herring coastal stock complex includes two distinct spawning stocks that 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 component, 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.

Data from the NMFS winter, summer, and autumn trawl surveys show the coastal stock complex has grown rapidly since the mid 1980's (ranging from Cape Hatteras, North Carolina to New Brunswick, Canada). Total stock biomass at the beginning of 1997 was estimated to be about 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-1970's as a result of over-exploitation. Since the 1980's the spring and autumn trawl surveys increased significantly, and although variable, has remained high since that time. The surveys indicate the relative abundance to be high.

The NMFS offshore hydroacoustic surveys have shown an increasing biomass from 1999-2001. The 2002 estimate is significantly lower than the previous three years because the survey encountered "spent" Atlantic herring, indicating that spawning occurred earlier than the previous years. In 2003 and 2004, herring were intermittently available during spawning surveys in September and October. Herring were in various stages of maturity. The time series of offshore hydroacoustic surveys from 1999-2004 cannot be utilized at this time to estimate biomass/abundance or evaluate recent trends.

In addition to the NMFS hydroacoustic surveys, there is also a complimentary inshore hydroacoustic survey conducted by Maine DMR and the Gulf of Maine Aquarium (now the Gulf of Maine Research Institute, GMRI). The inshore also indicated an increasing trend from 1999-2001, but experienced a drop in 2002. The timing of the spawning also impacted the 2002 biomass estimates for the inshore survey. The increasing biomass over the last several years is

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attributed to two large year classes, 1994 and 1998. The GMRI herring acoustic survey recently (March 2006) underwent an independent peer review and served as a formal assessment of the accuracy and precision of the survey to determine the viability of using the data in regional stock assessments.

Historical assessment information indicates that the Gulf of Maine stock was much smaller than the Georges Bank/Nantucket Shoals stock during the 1960's and 1970's. 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%. According to the 2006 TRAC assessment, the inshore component of the resource is estimated to represent 18% of the total stock biomass (range 10%-30%).

Overall, the Atlantic herring stock complex appears to have recovered to high levels and stabilized. The resource appears to have redistributed throughout much of its historical range and sampling suggests that the age structure of the stock has expanded, both of which are positive signs of a healthy, recovered stock. The Atlantic herring stock is not overfished and overfishing is not occurring. Fishing mortality rates have remained steady at approximately $F=0.11$ since 2002. Stock biomass (2+) increased steadily from about 105,000 mt in 1982 to nearly 1.3 and was estimated to be 1.0 million mt at the beginning of 2005. Biomass increases in the late 1990s were due to improved recruitment, especially from two very large year classes, 1994 and 1998 (Figure 2). Weights-at-age in the population declined in the late 1980s but have remained steady since 1995. Recruitment (at age 2) markedly improved in the late 1980s with several moderate year classes and three very large year classes (1994 cohort: 7.2 billion; 1998 cohort: 5.5 billion; and the 2002 cohort: 4.8 billion). Recruitment from the 1999-2000 and 2003 year classes all appear weaker than the long-term (1967-2005) average of 2.3 billion fish.

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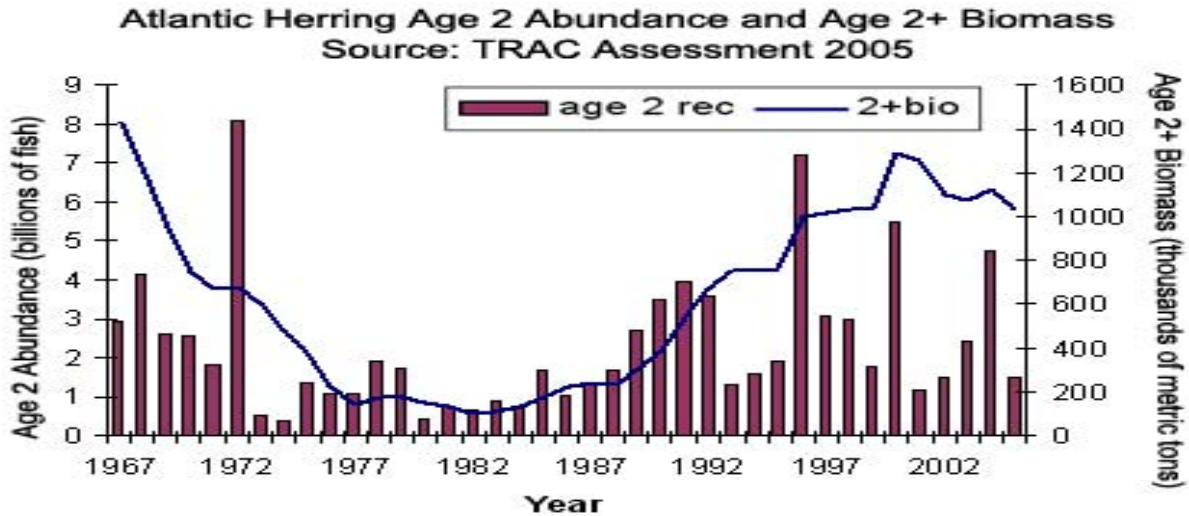


Figure 1. Age 2+ Biomass and Age 2 Abundance of the Atlantic Herring from 1965 to 2005.

III. Status of the Fishery

The following three paragraphs summarize the fishery prior to 2006. They are taken verbatim from the 2006 Transboundary Assessment Committee report summary.

Combined Canada/USA landings averaged 77,000 mt during 1978-1994. Landings increased during 1995-2001, averaging 123,000 mt, and peaking at 133,000 mt in 2001. Landings declined slightly during 2002-2005, and averaged 109,000 mt. During 1978-2005, the USA accounted for about 72% of the total landings, but during the most recent decade, this percentage increased to about 85%.

Landings by Canada averaged about 27,000 mt during 1978-1994, declined to an average of 19,000 mt during 1995-2001, and declined further to 14,000 mt during 2002-2005. Canadian landing have been dominated by the New Brunswick weir fishery, with small contributions from cove shutoff fisheries in southwest Nova Scotia and mid-water trawl landings on Georges Bank.

Landings by the United States averaged about 49,000 mt during 1978-1994, increased to an average of 103,000 mt during 1995-2001, and declined to an average of 95,000 mt during 2002-2005. During 1978-1982, USA landings were about equally split between the weir fisheries and purse seines. During 1983-1992, most USA landings were taken by purse seines but subsequently single mid-water and paired mid-water trawling have dominated the landings, with purse seining accounting for only about 10-15% of the total USA landings during 2000-2005. The USA Georges Bank mid-water trawl fishery began in 1994, peaked at 35,000 mt in 2001 and averaged about 13,000 mt during 1994-2005.

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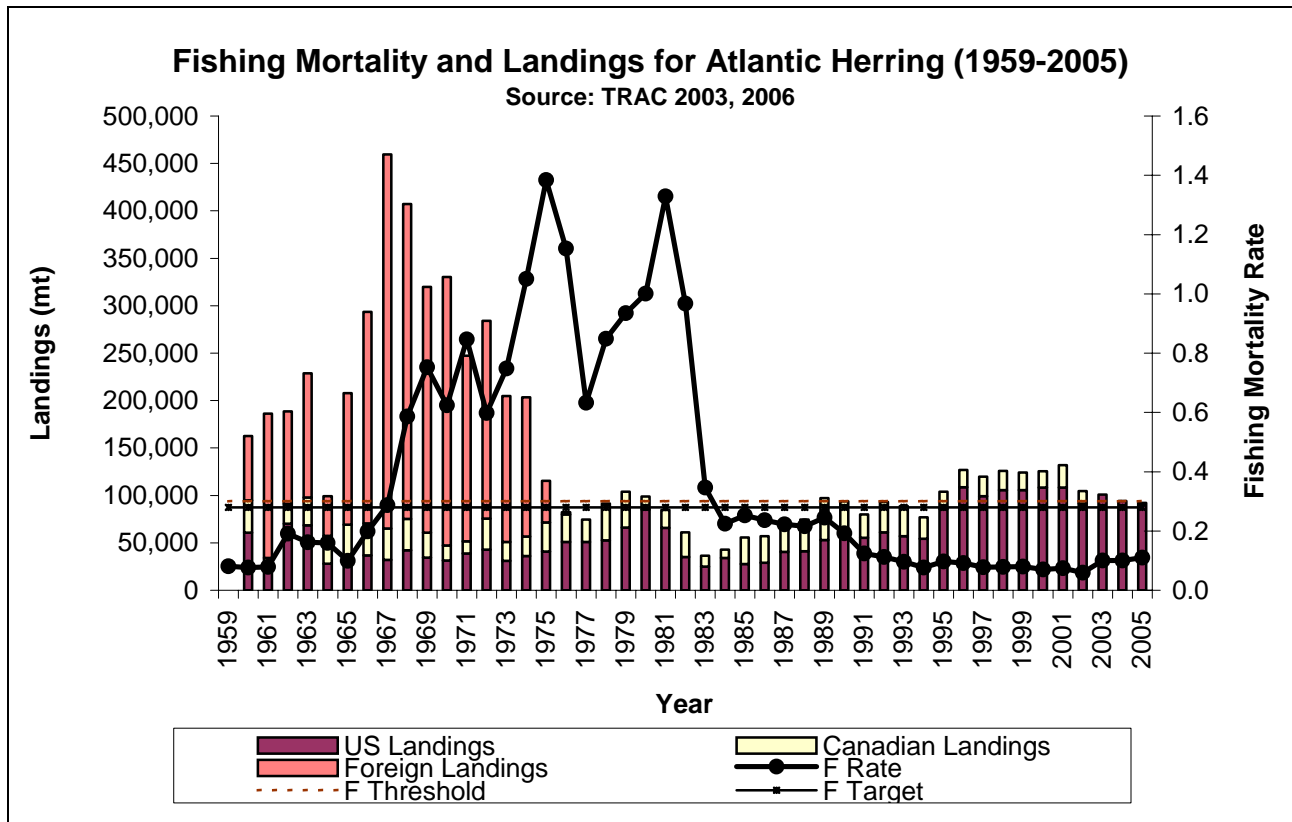


Figure 2. Fishing Mortality for the Atlantic Herring Stock Complex (1959-2005). $F_{target} = 0.30$, $F_{threshold} = 0.31$.

Table 1. Landings, 2+ biomass (thousands mt), Recruits (billions), F, and Exploitation Rate.
Source: TRAC 2006.

| | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | Avg ¹ | Min ¹ | Max ¹ |
|--------------------------|-------|-------|-------|-------|------|-------|------|-------|-------|-------|------------------|------------------|------------------|
| Canada Landed | 18 | 21 | 20 | 19 | 17 | 24 | 13 | 11 | 21 | 13 | 23 | 9 | 39 |
| USA Landed | 109 | 99 | 106 | 106 | 109 | 108 | 93 | 101 | 94 | 92 | 69 | 25 | 109 |
| Total Landed | 127 | 120 | 126 | 125 | 126 | 133 | 107 | 110 | 115 | 105 | 93 | 36 | 133 |
| 2+ Biomass | 999 | 1013 | 1034 | 1032 | 1291 | 1261 | 1094 | 1076 | 1122 | 1040 | 628 | 105 | 1432 |
| Age 2 Recruits | 7.223 | 3.068 | 2.978 | 1.768 | 5.52 | 1.158 | 1.52 | 2.411 | 4.768 | 1.483 | 2.3 | 0.409 | 8.086 |
| Fishing Mortality | 0.15 | 0.13 | 0.1 | 0.12 | 0.1 | 0.13 | 0.11 | 0.11 | 0.11 | 0.11 | 0.34 | 0.1 | 0.81 |
| Exploitation Rate | 14% | 12% | 10% | 12% | 10% | 12% | 10% | 10% | 10% | 10% | 29% | 10% | 52% |

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The majority of harvest in 2007 was taken by commercial fishermen. Commercial landings totaled 72,506 mt while recreational harvest (A + B1) accounted for only 40 metric tons.

Maine (45.1%) and Massachusetts (45.7%) accounted for approximately 91% of commercial landings in 2007. Rhode Island and New Jersey landed 4.7% and 3.8% respectively and all other states landed fewer than 1%.

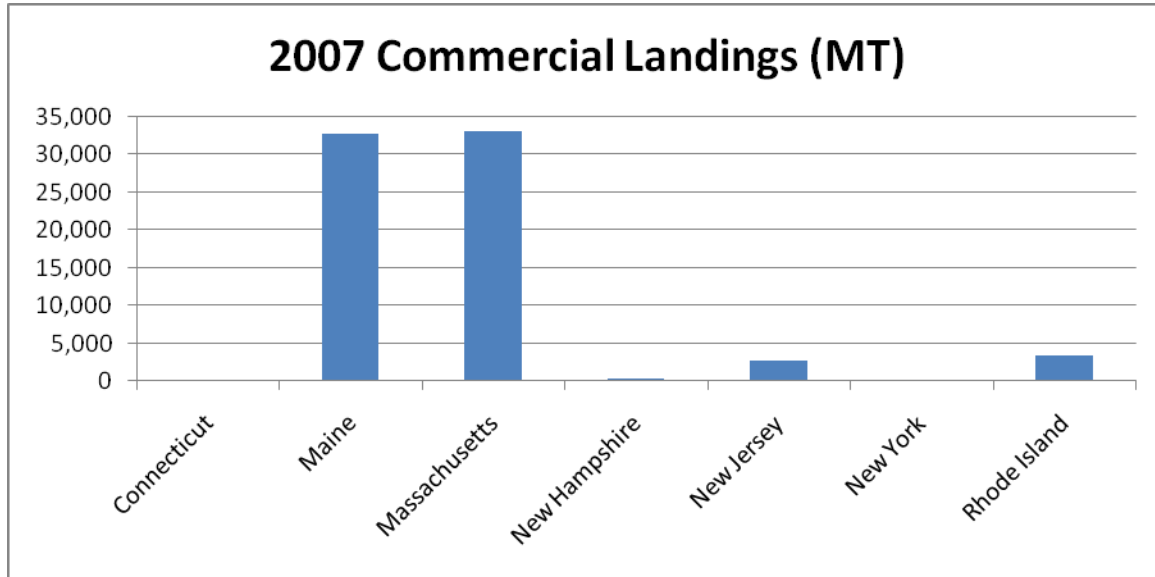


Figure 2. 2007 herring landings by state. Source: Personal communication from the National Marine Fisheries Service, Fisheries Statistics Division, Silver Spring, MD.

IV. Status of Assessment Advice

In February 2003, two stock assessments for the Atlantic herring complex were presented at the Transboundary Resource Assessment Committee (TRAC) meeting in St. Andrews, New Brunswick. The TRAC provides a forum for U.S and Canadian scientists to jointly peer review the results and interpretations of conclusions from new and revised assessment methodologies for the Atlantic herring complex. The TRAC reviewed two approaches to assess the stock status, a virtual populations analysis (used in previous herring assessments) and a forward projection model (FPM). The two models produced different estimates of current stock biomass, in part because of disparate model assumptions, uncertainties in input data sets, and weightings given to different data sets. While it was determined that the stock complex is not overfished and overfishing is not occurring (Figure 2), the TRAC could not reach consensus on the most appropriate model to assess this transboundary resource.

In attempt to gain some resolution on these discrepancies, the NEFMC referred the issue to its Scientific and Statistical Committee (SSC) for guidance on how to proceed with the development of the amendment. The SSC determined the current estimate of maximum sustainable yield in both the Commission and Council Herring FMPs (317,000 mt) to be too high and unlikely to be

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sustainable given historical landings and stock status data. The Committee advised the Council to exercise caution when setting the annual total allowable catch (TAC), specifically giving consideration to the risk to individual stock components when setting area-specific TACs. The SSC provided some guidance on resolving the discrepancies between the two assessments prior to the next peer review, discussed below.

Most recently, the Transboundary Resources Assessment Committee met in May 2006 at the Northeast Fisheries Science Center in Woods Hole, Massachusetts. The purpose of this meeting was to review and incorporate any new information from survey indices and the fisheries, revisit the model formulation issues and recommend a suitable approach upon which to base management advice for Atlantic herring. The major findings from this benchmark stock assessment were:

- Combined Canada and USA herring landings increased from 106,000 mt in 2002 to 110,000 mt in 2003, increased further to 115,000 mt in 2004, and declined to 105,000 mt in 2005.
- Stock biomass (2+) increased from about 105,000 mt in 1982 to about 1.3 million mt in 2000. Subsequently, biomass has declined slightly and was 1.0 million mt in 2005.
- Recruitment at age 2 increased in the late 1980s with several moderate year classes. In the past decade, three very large year classes have been produced (the 1994, 1998, and 2002 cohorts).
- Fishing mortality (age 2+) declined from peak values above 0.70 in the 1970s to an average of 0.30 during the mid-late 1980s. Fishing mortality declined to 0.15 in 1991 and has remained at about 0.1 since 2002.
- Assuming that fishing mortality in 2006 is equal to that in 2005 ($F=0.11$) produces a catch in 2006 of 105,000 mt (the same catch as in 2005). The resulting SSB in 2007 would be 952,000 mt, a decline of about 6%. Assuming average recruitment in 2006 through 2008, continuing to fish at $F=0.11$ in 2007 would generate a catch in 2007 of 99,000 mt and SSB in 2008 would be 901,000 mt.
- The relative proportion of the inshore component of the overall herring stock complex was 18% based on the average proportion from three different data sources (commercial acoustic survey biomass estimates; morphometric studies; and NEFSC autumn survey swept biomass estimates).

V. Status of Research and Monitoring

Under Amendment 1, states are not required to conduct fishery independent surveys for Atlantic herring.

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VI. 2007 Management Measures and Issues

Section 5.1.1.1 of Amendment 1 to the Interstate Fishery Management Plan for Atlantic Sea Herring list state regulatory requirements as

1. Each jurisdiction must enact spawning area restrictions that are at least as restrictive or more than those in Section 4.2.1.
2. Each jurisdiction shall prohibit the landing of herring from a management area or subarea when the TAC has been attained in that area or sub-area (*Section 4.2.8.2*);
3. Each jurisdiction shall prohibit directed fishing for herring in state waters when the TAC has been attained in that area or sub-area (*Section 4.2.8.2*);
4. Each jurisdiction shall prohibit the landing of herring to an Internal Waters Processing (IWP) operation, which were harvested from an area or sub-area closed to directed herring fishing (*Section 4.2.15*);
5. Each jurisdiction shall require that (daily) herring landings from fixed gear fisheries be reported on a weekly basis, in order to monitor progress toward attaining the TAC (*Section 4.2.15*); and
6. Each jurisdiction shall annually provide a report on any mealing activity of herring occurring in their state, specifically, the amount in weight of herring processed into meal or like product, biological sampling results, and location of catch by NMFS statistical area or Management Area. Each state's required Atlantic herring regulations and management program must be approved by the Section. States may not implement any regulatory changes concerning Atlantic herring, nor any management program changes that affect their responsibilities under this Amendment, without first having those changes approved by the Section.

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VII. State Compliance

Table 2 State Compliance Matrix

✓ refers to whether the report addressed the compliance requirements listed in Section VI.

dm the state of New York requests *de minimis* status.

dna (does not apply) refers to restrictions that would not apply to a state.

| Report Content ^a | ME | NH | MA | RI | CT | NY | NJ |
|-----------------------------|----------|------------|------------|----|------------|-----------|----------|
| Date Rec'd | 2/2/2008 | 1/23/2008 | 8/14/2008 | | 1/30/2007 | 1/31/2008 | 2/1/2008 |
| 1 | ✓ | ✓ | ✓ | ? | <i>dna</i> | <i>dm</i> | ? |
| 2 | ✓ | ✓ | ✓ | ? | ✓ | <i>dm</i> | ? |
| 3 | ✓ | ✓ | ✓ | ? | ✓ | <i>dm</i> | ? |
| 4 | ✓ | ✓ | ✓ | ? | ✓ | <i>dm</i> | ? |
| 5 | ✓ | ✓ | ✓ | ? | <i>dna</i> | <i>dm</i> | ? |
| 6 | ✓ | <i>dna</i> | <i>dna</i> | ? | <i>dna</i> | <i>dm</i> | ? |

All states *who submitted reports met all compliance requirements for 2007. NY and RI compliance is unknown.* Some regulations did not apply to all states such as spawning closures, fixed gear fishing reporting requirements (no fixed gear fishermen), and mealing reports.

De minimis

No states requested *de minimis* status.

VIII. Law Enforcement Report

The 2006 Atlantic Herring Law Enforcement Report (Appendix A) indicated that there were very few problems with herring compliance and enforcement. Possession of spawn herring was the major issue addressed in the report. Maine and Massachusetts both had reports of vessels landing significant amounts of spawn herring, but under the new ‘Zero Tolerance’ spawning regulations enacted January 1, 2007 (see ‘Amendment 2’ below) percent spawn herring will no longer be an issue.

IX. Amendment 2 and Technical Addendum 1

Amendment 2 and Technical Addendum 1 to Amendment 2 became effective January 1, 2007. These documents alter several herring regulations as follows.

- Days out: States will meet to discuss “days out” (*Amendment 2 4.3.1*); not officially required prior to Amendment 2.
- Zero tolerance spawning closures: No directed herring fishing during spawning closures (*Technical Addendum I*); language was debated in the past.
- Internal Waters Processing (IWP): Prohibition of IWP in state waters (*Amendment 2 4.3.3*); IWP was previously allowed.

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- East of Cutler Exemption: Fixed gear fishermen fishing east of Cutler may still fish during closures (*Amendment 2 4.3.2.4*); Previously restricted by 1A TAC.
- West of Cutler Exemption: 500 mt set aside for fixed gear fishermen in 1A operating west of Cutler until November 1 (*Amendment 2 4.3.4*); Previously restricted by overall 1A TAC.

X. PRT Recommendations

The Plan Review Team recommends the following:

1. All states who submitted reports meet or exceed the regulatory measures in the FMP.

XI. Future Compliance Issues

None.

XII. Research and Monitoring Recommendations

High Priority

- Continue to utilize the inshore and offshore hydroacoustic and trawl surveys to provide an independent means of estimating stock sizes. Collaborative work between NMFS, DFO, state agencies, and the herring industry on acoustic surveys for herring should continue to be encouraged.
- Tagging and morphometric studies to explore uncertainties in stock structure and the impacts of harvest mortality on different components of the stock. Although tagging studies may be problematic for assessing survivorship for a species like herring, they may be helpful in identifying the stock components and the proportion of these components taken in the fishery on a seasonal basis.
- Develop a strategy for assessing individual spawning components to better manage heavily exploited portion(s) of the stock complex, particularly the Gulf of Maine inshore spawning component.
- Study the ecological role of Atlantic herring (predator/prey relationships) throughout the management range (Gulf of Maine and George's Bank). Re-evaluate Atlantic herring natural mortality by age and the response to changing predator population sizes through an ecosystem based assessment.
- Continue commercial catch sampling of Atlantic herring fishery to ACCSP/ME DMR protocols.
- Organize annual US-Canada workshops to coordinate stock assessment activities and optimize cooperation in management approaches between the two countries.
- Examine the root causes of the discrepancy between Forward Projection and ADAPT assessments.
- Investigate bycatch and discards in the directed herring fishery.

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Medium Priority

- Conduct an otolith methods workshop to address aging differences between DFO, NMFS and ME DMR readers after age 5.
- Investigate possible density-dependence reduced growth rates affecting both the entire complex and inshore subcomponent.

Low Priority

- Develop socio-economic analyses appropriate to the determination of optimum yield.
- Consider potential discards if fishing mortality increases in the future.
- Develop economic analyses necessary to evaluate the costs and benefits associated with different segments of the industry.