

**ATLANTIC STATES MARINE FISHERIES COMMISSION**

**REVIEW OF THE INTERSTATE FISHERY MANAGEMENT PLAN**

**FOR ATLANTIC MENHADEN**  
*(Brevoortia tyrannus)*

**2018 FISHING YEAR**



Prepared by the Plan Review Team

Approved by the Atlantic Menhaden Management Board  
August 2019

**REVIEW OF THE ASMFC FISHERY MANAGEMENT PLAN AND STATE COMPLIANCE FOR  
ATLANTIC MENHADEN (*Brevoortia tyrannus*) FOR THE 2018 FISHERY**

**Management Summary**

<u>Date of FMP:</u>	Original FMP: August 1981
<u>Amendments:</u>	Plan Revision: September 1992 Amendment 1: July 2001 Amendment 2: December 2012 Amendment 3: November 2017
<u>Management Unit:</u>	The range of Atlantic menhaden within U.S. waters of the Northwest Atlantic Ocean, from the estuaries eastward to the offshore boundary of the Exclusive Economic Zone (EEZ).
<u>States With Declared Interest:</u>	Maine – Florida, including Pennsylvania
<u>Additional Jurisdictions:</u>	Potomac River Fisheries Commission, National Marine Fisheries Service, United States Fish and Wildlife Service
<u>Active Boards/Committees:</u>	Atlantic Menhaden Management Board, Advisory Panel, Technical Committee, Stock Assessment Subcommittee, Plan Review Team, Plan Development Team, Ecological Reference Point Work Group
<u>Stock Status:</u>	Not overfished, and overfishing is not occurring (2017 stock assessment update)

**I. Status of the Fishery Management Plan**

Atlantic menhaden management authority is vested in the states because the vast majority of landings come from state waters. All Atlantic coast states and jurisdictions, with the exception of the District of Columbia, have declared an interest in the Atlantic menhaden management program.

The first coastwide fishery management plan (FMP) for Atlantic menhaden was passed in 1981 (ASMFC 1981). The 1981 FMP did not recommend or require specific management actions, but provided a suite of options should they be needed. In 1992, the plan was revised to include a suite of objectives intended to improve data collection and promote awareness of the fishery and its research needs (ASMFC 1992).

Amendment 1 was implemented in 2001 and provided specific biological, ecological and socioeconomic management objectives for Atlantic menhaden (ASMFC 2001). No recreational or commercial management measures were implemented as a result of Amendment 1; however, subsequent addenda instituted a harvest cap<sup>1</sup> on the reduction fishery in the Chesapeake Bay, based on average landings from 2001-2005. Addendum I and V revised the biological reference points for menhaden and specified that stock assessments are to occur every three years (ASMFC 2004; ASMFC 2011).

Amendment 2, approved in 2012, established a 170,800 metric ton (mt) total allowable catch (TAC) for the commercial fishery beginning in 2013 (ASMFC 2012). This TAC represented a 20% reduction from average landings between 2009 and 2011. The 2009-2011 time period was also used to allocate the TAC among the jurisdictions. Additionally, the Amendment established timely reporting requirements for commercial landings and required states to be accountable for their respective quotas by paying back any overages the following year. Amendment 2 also included provisions that allowed for the transfer of quota between jurisdictions and a bycatch allowance of 6,000 pounds per day<sup>2</sup> for non-directed fisheries that operate after a jurisdiction's quota has been landed. The Amendment also reduced the Chesapeake Bay reduction fishery harvest cap by 20% to 87,216 mt.

Amendment 2 also established an episodic events set aside program. This program set aside 1% of the coastwide TAC for the New England states (Maine, New Hampshire, Massachusetts, Rhode Island, and Connecticut) to harvest Atlantic menhaden when they occur in higher abundance than normal. Technical Addendum I to Amendment 2 established a mechanism for New England states to use the set aside (ASMFC 2013). In order to participate in the program, a state must reach its individual quota prior to September 1, implement daily trip level harvester reporting, restrict harvest to state waters, and implement a daily trip limit no greater than 120,000 pounds/vessel. At its October 2013 meeting, the Board extended the episodic event set aside program through 2015, adding a provision that re-allocated unused set aside to the coastwide states based on the same allocation percentages included in Amendment 2. At its May 2016 meeting, the Board again extended the episodic events program until final action on Amendment 3 and added New York as an eligible state to harvest under the program.

At its May 2015 meeting, the Board established a TAC of 187,880 mt for the 2015 and 2016 fishing years. This represented a 10% increase from the 2013 and 2014 TAC. In October 2016, the Board approved a TAC of 200,000 mt for the 2017 fishing year, representing a 6.45% increase from the 2015 and 2016 TAC.

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<sup>1</sup> Addendum II to Amendment 1 initially implemented a harvest cap for 2006-2010 seasons; Addendum III revised the harvest cap amount before the 2006 season commenced; Addendum IV extended the harvest cap through 2013 at the same level established in Addendum III (ASMFC 2005; ASMFC 2006; ASMFC 2009; ASMFC 2009).

<sup>2</sup> Addendum 1 to Amendment 2 allows two licensed individuals to harvest up to 12,000 pounds of menhaden bycatch when working from the same vessel using stationary multi-species gear (ASMFC 2016). The intent of this Addendum was to accommodate cooperative fishing practices that traditionally take place in Chesapeake Bay.

At its February 2014 meeting, the Board passed a motion to manage cast net fisheries for Atlantic menhaden under the bycatch allowance for 2014 and 2015, with the states bearing responsibility for reporting. In November 2015, the Board approved a motion to continue the management of cast net fisheries under the bycatch allowance for 2016, and in February 2017, the Board extended management of the cast net fishery under the bycatch provision until implementation of Amendment 3.

Atlantic menhaden are currently managed under the provisions of Amendment 3. Approved in November 2017, the Amendment continues to manage menhaden via single-species biological reference points until the review and adoption of menhaden-specific ecological reference points (ERPs) as part of the 2019 ecosystem-based benchmark stock assessment process (see *Section II*). In doing so, the Board placed the development of menhaden-specific ERPs as its highest priority and supports the efforts of the Ecological Reference Point Work Group to reach that goal. Amendment 3 also changes commercial quota allocations in order to strike an improved balance between gear types and jurisdictions, and to facilitate future growth opportunities. The Amendment allocates a baseline quota of 0.5% to each jurisdiction, and then allocates the rest of the TAC based on historic landings between 2009 and 2011. This measure provides fishing opportunities to states which had little quota under Amendment 2, while still recognizing historic landings in the fishery. States also have the option to relinquish all or part of its quota which is then redistributed to the other jurisdictions based on the historic landings period (2009-2011). The Amendment prohibits the rollover of unused quota; maintains the quota transfer process; maintains the incidental catch provision<sup>3</sup> and the episodic events program for the states of Maine – New York. Finally, the Amendment reduces the Chesapeake Bay cap to 51,000 mt, recognizing the importance of the Chesapeake Bay as nursery grounds for many species by capping recent reduction landings from the Bay at current levels.

In addition to its Amendment 3 deliberations, the Board set the TAC for the 2018 and 2019 fishing seasons at 216,000 mt (an 8% increase from 2017) with the expectation that setting of the TAC for subsequent years would be guided by menhaden-specific ERPs.

In 2018, the Board approved state implementation plans for Amendment 3 and postponed action indefinitely to find the Commonwealth of Virginia out of compliance for not implementing the Chesapeake Bay reduction fishery cap of 51,000 mt. In making its decision, the Board took into account the fact that reduction fishery harvest within the Chesapeake Bay has been below the cap level since 2012, including 2018 harvest (see *Section VII*). This action is contingent upon the Chesapeake Bay reduction fishery not exceeding the cap. If the cap is exceeded, the Board can reconsider the issue of compliance.

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<sup>3</sup> The bycatch provision under Amendment 2 was rebranded under Amendment 3 as the incidental catch and small scale fisheries provision. Under the provision, small-scale and non-directed gears, as defined in the amendment, may land up to 6,000 pounds of menhaden per trip per day after the quota in a given jurisdiction is met.

## II. Status of the Stock

Threshold reference points are the basis for determining stock status. When the fishing mortality rate ( $F$ ) exceeds the  $F$ -threshold, overfishing is occurring. When the reproductive output measure, in this case population fecundity ( $FEC$ ), falls below its threshold, then the stock is overfished, meaning there is insufficient egg production to replenish the stock.

Amendment 2 implemented maximum spawning potential (MSP) based reference points that relate current stock conditions as a percent of unfished conditions. Considering the modeling and data input changes that occurred in the 2015 Benchmark Stock Assessment, the Technical Committee (TC) and Peer Review Panel recommended new MSP-based reference points that are applicable to the results of the assessment (SEDAR 2015). These new reference points were accepted by the Board in 2015 and continue to be used under Amendment 3.

As recommended by the Peer Review Panel, and accepted by the TC, the values of the threshold and target fishing mortality reference points are calculated as the maximum and median geometric mean fishing mortality rate for ages-2 to -4 during the reference period of 1960-2012. These ages represent the fully selected fishing mortality rates depending upon the year and fishery (i.e., bait and reduction). The fecundity ( $FEC$ ) reference points match the  $F$  reference points meaning they are equal to the fecundity estimated when  $F$  reaches equilibrium at its target and threshold MSP levels, respectively.

According to the 2017 stock assessment update (ASMFC 2017), the fishing mortality reference points are  $F_{\text{target}} = F_{36\% \text{ MSP}} = 0.80$  and  $F_{\text{threshold}} = F_{21\% \text{ MSP}} = 1.85$ . Associated reference points for population fecundity are  $FEC_{\text{target}} = FEC_{36\% \text{ MSP}} = 99,467$  (billions of eggs), and  $FEC_{\text{threshold}} = FEC_{21\% \text{ MSP}} = 57,295$  (billions of eggs). Based on the 2017 stock assessment, overfishing is not occurring because fishing mortality for the terminal year (2016) is estimated to be  $F = 0.51$  ( $F_{48\% \text{ MSP}}$ ), below both the target and the threshold (Figure 1). Additionally, the stock is not overfished because fecundity for 2016 is estimated to be  $FEC = 83,486$  billion eggs, above the threshold but below the target (Figure 2). A benchmark assessment is expected to be completed and peer-reviewed in November 2019 at SEDAR-69.

### Progress of the Ecological Reference Point Work Group

The Ecological Reference Point Work Group (ERP WG; formerly known as the BERP WG) has been tasked with developing menhaden-specific ERPs. The intent of menhaden-specific ERPs is to provide a method to assess the status of menhaden not only in regard to their own sustainability, but also in regard to their interactions with predators and the status of other prey species. The benefit of this approach is that it allows fishery managers to consider the harvest of menhaden within a broad ecosystem context, which includes other fish, birds, mammals, and humans who utilize and depend on marine resources.

In 2017, the ERP WG held three workshops to review candidate ERP models. The candidate models include a Bayesian surplus production model with a time-varying population growth rate, a Steele-Henderson model which permits non-fisheries effects (predation and environment) to be quantified and incorporated into the single-species stock assessments, and

a multispecies statistical catch-at-age model in which single-species models are linked to provide a predator-prey feedback between the population models. An Ecopath with Ecosim model is also being evaluated for strategic planning purposes and exploring tradeoffs.

In 2018, the ERP WG held two data workshops to review all available data for menhaden, and other candidate predator and prey species for the ERP models. An Assessment Workshop was recently held in April 2019 to identify base runs for each of the models as well. Peer-review of the menhaden-specific ERP model(s) will coincide with the peer-review of the single-species benchmark assessment at SEDAR-69 in November 2019.

## **V. Status of the Fishery**

### Commercial

Total commercial Atlantic menhaden landings in 2018, including directed, incidental catch, and episodic event set aside (EESA) landings, are estimated at 421.5 million pounds (191,202 mt), approximately an 11% increase relative to 2017 (Table 1). The non-incidental catch fishery landings (directed landings plus landings under the EESA) total for 2018 is estimated at 418.3 million pounds (189,744 mt) and represents an 12% underage of the coastwide commercial TAC of 476.2 million pounds (216,000 mt). Landings from the incidental catch fishery are estimated at 3.21 million pounds (1,458 mt) and do not count towards the coastwide TAC.

### *Reduction Fishery*

The 2018 harvest for reduction purposes is estimated at 311.6 million pounds (141,317 mt), a 10% increase from 2017 and 5% above the previous 5-year average of 296.2 million pounds (134,373 mt) (Table 2; Figure 3). Omega Protein's plant in Reedville, Virginia, is the only active Atlantic menhaden reduction factory on the Atlantic coast.

### *Bait Fishery*

The coastwide bait harvest estimate for 2018, including directed, incidental catch, and EESA landings, is 110.0 million pounds (49,885 mt). This represents a 14% increase relative to 2017 and an 18% increase compared to the previous 5-year average (Table 2; Figure 3). New Jersey (46%), Virginia (27%), Maine (13%), and Massachusetts (5%) landed the four largest shares in 2018.

### *Incidental Catch and Small Scale Fisheries Landings*

Incidental catch landings in 2018 are estimated at 3.21 million pounds (1,458 mt), which is an 18% increase relative to 2017 but well below the time series average (Table 3). Three states reported incidental catch landings in 2018; Maine, New Jersey, and Virginia (Table 4). Maine accounted for 90% of total incidental fishery landings in 2018 (73% from purse seines and 17% from gill nets). 2018 also marked the lowest number of trips occurring under the provision since its inception (Table 4).

### *Episodic Events Set Aside Program (EESA)*

One percent of the TAC is set aside for episodic events. Episodic events are defined as any instance when a qualified state has reached its individual state quota prior to September 1, and

has information indicating the presence of unusually large amounts of menhaden in its state waters. The 2018 EESA quota was 4.48 million pounds (2,031 mt) and accounts for the 285,398 pound overage from the 2017 season. Maine declared participation in the EESA on July 23, 2018, and closed the fishery on August 11. The preliminary EESA landings estimate for 2018 is 4.64 million pounds (2,103 mt) which is 3.6% above the quota. Maine transferred 159,433 pounds of 2018 quota to reconcile the overage. The resulting EESA quota for 2019 is 4.76 million pounds. Table 5 details the EESA fishery by year.

### Recreational

Menhaden are important bait in many recreational fisheries; some recreational fishermen employ cast nets to capture menhaden or snag them with hook and line for use as bait, both dead and live. Recreational harvest is not well captured by the Marine Recreational Information Program (MRIP) because there is not a known identified direct harvest for menhaden, other than for bait. MRIP intercepts typically capture the landed fish from recreational trips as fishermen come to the dock or on the beach. However, since menhaden caught by recreational fishermen are used as bait during their trip, they are typically not a part of the catch that is seen by the surveyor completing the intercept.

The MRIP estimate of Atlantic menhaden harvest (A + B1) in 2018 is 3,457,987 pounds. This is an 8% decrease from 2017 (3,756,722 pounds), but a 9% increase when compared to the previous 5-year average (3,174,751 pounds).

## **VI. Status of Research and Monitoring**

### Commercial fisheries monitoring

Reduction fishery - The NMFS Southeast Fisheries Science Center Beaufort Laboratory in Beaufort, North Carolina, continues to monitor landings from the Atlantic menhaden purse-seine reduction fishery and collect biological samples. The Beaufort Laboratory processes and ages all reduction samples collected on the East Coast. In addition, the purse-seine reduction fishery continues to provide Captains Daily Fishing Reports (CDFRs) to the Beaufort Laboratory where NMFS personnel enter data into a database for storage and analysis.

Bait fishery - Per Amendment 3, states are required to implement a timely quota monitoring system in order to maintain menhaden harvest within the TAC and minimize the potential for overages. The SAFIS daily electronic dealer reporting system allows near real time data acquisition for federally permitted bait dealers in the Mid-Atlantic and Northeast. Landings by Virginia's purse-seine for-bait vessels (snapper rigs) in Chesapeake Bay are tabulated at season's end using CDFRs maintained on each vessel during the fishing season. A bait-fishery sampling program for size and age composition has also been conducted since 1994. The Beaufort Laboratory, and some states, age the bait samples collected. See *Section VII* for more information on quota monitoring and biological sampling requirements.

### **Atlantic menhaden research**

The following studies relevant to menhaden assessment and management have been published within the last year:

- Harrison, J.L., Naumenko, A. and Whitehead, J.C., 2018. Citizen Preferences for Ecosystem-based Fisheries Management: The Case of Atlantic Menhaden (No. 18-10). Department of Economics, Appalachian State University

Theses and Dissertations of Potential Interest:

- Liljestrand, Emily Morgan. 2017. Mortality and Movement of Adult Atlantic Menhaden during 1966-1969. Order No. 10618597 University of Maryland, College Park
- Siple, Margaret Clark. 2017. Implications of Demographic Diversity for Forage Fish, their Fisheries, and Ecosystems. Order No. 10680836 University of Washington

### **VII. Implementation of FMP Compliance Requirements for 2018**

All states are required to submit annual compliance reports by April 1.

#### *Quota Monitoring and Results*

Menhaden purse seine and bait seine vessels (or snapper rigs) are required to submit CDFRs. Maine, New York and Virginia fulfilled this requirement in 2018. New Jersey did not require purse seine vessels to fill out the specific CDFR but did require monthly trip level reporting on state forms that include complementary data elements to the CDFR. Rhode Island purse seine vessels must call in daily reports to RI DFW and fill out daily trip level logbooks. Massachusetts and Connecticut require trip level reporting for all commercial fishermen. Menhaden purse seine fisheries do not currently operate in all other jurisdictions in the management unit.

The Board approved timely quota monitoring programs for each state through implementation of Amendment 3. Monitoring programs are intended to minimize the potential for quota overages. Table 6 contains a summary of each state's approved quota monitoring system.

Table 7 contains state-specific quotas and directed harvest that occurred in 2018. The final quotas for 2018 account for 6.70 million pounds of quota relinquished by Delaware, South Carolina, and Georgia, and include an adjustment of eight in-season quota transfers; seven inter-state transfers and one state-to-EESA transfer. The quota transfers occurred as follows:

1. Connecticut transferred 1,000,000 pounds to Maine
2. New York transferred 1,000,000 pounds to Maine
3. Delaware transferred 150,000 pounds to Maine
4. Florida transferred 1,250,000 pounds to Maine
5. Maryland transferred 1,500,000 pounds to Maine
6. Virginia transferred 1,000,000 pounds to Maine
7. Maine transferred 500,000 pounds to Connecticut
8. Maine transferred 159,433 pounds to the EESA quota



These quota transfers were pursued to ameliorate overages, and therefore, no quota overages occurred in 2018. States may also relinquish all or part of its annual quota by December 1<sup>st</sup> of the previous year. Delaware and Georgia relinquished 4.36 million pounds of quota which was redistributed to the states according to the procedures outlined in Amendment 3 and is reflected in the 2019 Base Quota (Table 7). At their November 2017 meeting, the Board set the 2019 TAC at 216,000 mt (476.2 million pounds).

#### *Biological Monitoring Requirements*

Amendment 2 implemented monitoring requirements for non *de minimis* states as follows:

- One 10-fish sample (age and length) per 300 mt landed for bait purposes for ME, NH, MA, RI, CT, NY, NJ, and DE; and
- One 10-fish sample (age and length) per 200 mt landed for bait purposes for MD, PRFC, VA, and NC.

Table 8 provides the number of 10-fish samples required for 2018. These are based on the best available 2018 total bait landings data (including directed, incidental, and EESA landings) provided to the Commission by the states. In 2018, Massachusetts fell short of the eight required samples primarily due to the very short fishing season (the purse seine fishery was only open three weeks). The state was also unable to collect samples from bycatch in the Atlantic herring fishery or other fishery independent sources as was done in previous years. The state indicated plans to more intensely sample the primary purse seine fishery to ensure the sampling requirement is met in the future. All other jurisdictions met the biological monitoring requirements in 2018.

The PRT continued to discuss whether a sufficient number of samples are being collected from different gear types and regions, and whether additional sampling should be conducted from incidental catch fisheries. The 2019 benchmark provides an opportunity for the Technical Committee to evaluate age and length data from commercial bait fishery catches and respond to the PRT's comments.

#### *Adult CPUE Index Requirement*

Amendment 3 requires that, at a minimum, each state with a pound net fishery must collect catch and effort data elements for Atlantic menhaden as follows; total pounds landed per day, number of pound nets fished per day. These are harvester trip level ACCSP data requirements. In May of 2013, the Board approved North Carolina's request to omit this information on the basis that it does not have the current reporting structure to require a quantity of gear field by harvesters or dealers<sup>4</sup>. All other states with a pound net fishery met this requirement. New Jersey did note, however, that there appeared to be some confusion in the reporting of effort and that New Jersey personnel are working with industry to clarify the reporting requirement.

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<sup>4</sup> North Carolina continues to explore developing a proxy for this from existing information collected on permits. The current method estimates a maximum number of pound nets fished per day. A more specific pound net permit data set is being explored to further narrow data.

### *Chesapeake Bay Reduction Fishery Cap*

Amendment 3 implemented a 51,000 mt harvest cap for the reduction fishery in the Chesapeake Bay, which is roughly the average harvest from the Chesapeake Bay reduction fishery over the 5-year time period from 2012-2016. Reported reduction landings from the Chesapeake Bay for 2018 was about 32,000 mt which is below the Cap.

### *De Minimis Status*

To be eligible for *de minimis* status, a state's bait landings must be less than 1% of the total coastwide bait landings for the most recent two years. State(s) with a reduction fishery are not eligible for *de minimis* consideration. If granted *de minimis* status by the Board, states are exempt from implementing biological sampling as well as pound net catch and effort data reporting. The Board also approved a *de minimis* exemption for New Hampshire, South Carolina and Georgia from implementation of timely reporting. The states of Pennsylvania, South Carolina, Georgia, and Florida requested and qualify for *de minimis* status for the 2019 fishing season.

## **IX. Plan Review Team Comments and Recommendations**

### Plan Review Team Comments

Landings data suggest that Atlantic menhaden have become increasingly available to the Gulf of Maine fishery in recent years (2016-2018). In 2018, the state of Maine reported landings in excess of 14 million pounds, marking a 350% increase relative to the state's 2017 landings. Maine has requested additional quota through in-season transfers each year since 2016. In 2018, Maine tripled its base quota by securing 5.4 million pounds of additional quota to extend the directed fishery. Maine has also opted into the EESA fishery for three consecutive years and fully utilized the EESA quota in 2018. After closing the directed fishery and EESA the fishery, Maine landed an additional 2.9 million pounds in 2018 under the incidental catch provision. The recent increase in landings may also be attributed to the status and availability of other bait fish populations in the region (e.g., Atlantic herring), or social and economic factors.

The 2018 incidental catch fishery cannot be directly compared to previous years due to the implementation of Amendment 3 and the reallocation of the coastwide TAC. With the exception of Maine, however, it appears that the new allocations provided states sufficient quota to keep the directed fisheries open throughout the season. While total incidental catch landings increased in 2018 relative to 2017 (see comments regarding Maine's landings above), the number of trips occurring in 2018 were the lowest on record and the fewest number of states participated in the fishery since 2013 (the first year the provision was implemented).

The incidental catch provision in Amendment 3 states "after a quota allocation is met for a given jurisdiction, the fishery moves to an incidental catch fishery in which small-scale gears and non-directed gear types may land up to 6,000 pounds of menhaden per trip per day" (12,000 pounds per trip per day for two authorized individuals, working from the same vessel fishing stationary multi-species gear). The amendment does not give guidance for the incidental catch provision if a state subdivides its quota to different gear types or sectors. New Jersey and the Commonwealth of Virginia subdivide its quotas and has done so since the Commission

implemented state quotas in 2013. Virginia allocates its annual quota to three sectors: the reduction sector, the purse seine bait sector, and the non-purse seine bait sector. New Jersey allocates majority of its annual quota to the purse-seine fishery, and the remaining quota is allocated to all other gear types. Once the non-purse seine bait sector or “other gears” fishery has harvested its portion of the state’s allocation, the fishery moves into an incidental catch fishery regardless of whether the entire state’s quota has been harvested. This has resulted in Virginia and New Jersey reporting incidental catch landings when they have not met their overall quota allocation for a given year. Since the inception of the incidental catch provision, the PRT has reported landings following the closure of Virginia’s non-purse seine bait fishery and New Jersey’s “other gears” fishery as incidental catch. The PRT requests guidance from the Board if they would like to see this reported differently. The PRT recommends this issue be addressed in a future management document.

#### Management Recommendations

- The PRT recommends that the *de minimis* requests from Pennsylvania, South Carolina, Georgia, and Florida, be approved.
- The PRT recommends that the incidental catch fishery provision issue readdressed in a future management document.

## **IX. Literature Cited**

- Atlantic States Marine Fisheries Commission (ASMFC). 1981. Fishery Management Plan for Atlantic Menhaden. 146 pp.
- ASMFC. 1992. Fishery Management Plan for Atlantic Menhaden 1992 Revision. 170 pp.
- ASMFC. 2001. Amendment 1 to the Interstate Fishery Management Plan for Atlantic Menhaden. 146 pp.
- ASMFC. 2004. Addendum I to Amendment 1 to the Interstate Fishery Management Plan for Atlantic Menhaden. 52 pp.
- ASMFC. 2005. Addendum II to Amendment 1 to the Interstate Fishery Management Plan for Atlantic Menhaden. 30 p.
- ASMFC. 2006. Addendum III to Amendment 1 to the Interstate Fishery Management Plan for Atlantic Menhaden. 6 p.
- ASMFC. 2009. Addendum IV to Amendment 1 to the Interstate Fishery Management Plan for Atlantic Menhaden. 5 p.
- ASMFC. 2011. Addendum V to Amendment 1 to the Interstate Fishery Management Plan for Atlantic Menhaden. 17 pp.
- ASMFC. 2012. Amendment 2 to the Interstate Fishery Management Plan for Atlantic Menhaden. 114 pp.
- ASMFC. 2013. Technical Addendum I to Amendment 2 to the Interstate Fishery Management Plan for Atlantic Menhaden. 4 pp.
- ASMFC. 2016. Addendum I to Amendment 2 to the Interstate Fishery Management Plan for Atlantic Menhaden. 12 pp.
- ASMFC. 2017a. Amendment 3 to the Interstate Fishery Management Plan for Atlantic Menhaden. 111 pp.
- ASMFC. 2017b. Atlantic Menhaden Stock Assessment Update. Prepared by the ASMFC Atlantic Menhaden Stock Assessment Subcommittee. 180 pp.
- Southeast Data, Assessment, and Review (SEDAR). 2015. SEDAR 40 – Atlantic Menhaden Stock Assessment Report. SEDAR, North Charleston SC. 643 pp.

Table 1. Directed, bycatch, and episodic events set aside landings in pounds for 2018 by jurisdiction. NA = not applicable; C = confidential

State	Directed	Incidental Catch	EESA
ME	6,537,294	2,900,169	4,636,020
NH	C	-	-
MA	5,715,608	-	-
RI	722,388	-	-
CT	821,360	-	-
NY*	909,908	-	-
NJ	50,250,542	204,240	NA
DE	162,838	-	NA
MD	3,112,159	-	NA
PFRC	3,323,014	-	NA
VA	340,965,634	110,281	NA
NC	712,599	-	NA
SC	C	-	NA
GA	-	-	NA
FL	247,260	-	NA

Table 2. Atlantic menhaden reduction and bait landings in thousand metric tons, 1985-2018

	<b>Reduction Landings (1000 mt)</b>	<b>Bait Landings (1000 mt)</b>
<b>1985</b>	307	26.6
<b>1986</b>	238	21.6
<b>1987</b>	310	25.5
<b>1988</b>	278	43.8
<b>1989</b>	284	31.5
<b>1990</b>	343	28.1
<b>1991</b>	330	29.7
<b>1992</b>	270	33.8
<b>1993</b>	310	23.4
<b>1994</b>	260	25.6
<b>1995</b>	340	28.4
<b>1996</b>	293	21.7
<b>1997</b>	259	24.2
<b>1998</b>	246	38.4
<b>1999</b>	171	34.8
<b>2000</b>	167	33.5
<b>2001</b>	234	35.3
<b>2002</b>	174	36.2
<b>2003</b>	166	33.2
<b>2004</b>	183	34.0
<b>2005</b>	147	38.4
<b>2006</b>	157	27.2
<b>2007</b>	174	42.1
<b>2008</b>	141	47.6
<b>2009</b>	144	39.2
<b>2010</b>	183	42.7
<b>2011</b>	174	52.6
<b>2012</b>	161	63.7
<b>2013</b>	131	37.0
<b>2014</b>	131	41.6
<b>2015</b>	143	45.8
<b>2016</b>	137	43.1
<b>2017</b>	129	43.8
<b>2018</b>	141	49.9
<b>Avg 2013-2017</b>	134	42.3

Table 3. Incidental fishery landings by state in pounds, 2013-2018. Only states that have reported incidental catch landings are listed. Average total incidental catch landings for the time series is 4.29 million pounds.

State	2013	2014	2015	2016	2017	2018
ME	-	-	-	506,145	699,874	2,900,169
RI	16,100	98,533	69,947	39,540	135,748	-
CT	-	-	10,469	-	123,666	-
NY	-	324,857	769,312	281,017	807,392	-
NJ	-	625,643	240,922	195,523	-	204,240
DE	75,928	111,944	91,543	20,823	29,285	-
MD	2,864,298	2,200,662	1,949,577	995,698	-	-
PRFC	1,087,410	1,112,343	455,350	105,669	670,447	-
VA	268,215	2,231,708	2,102,529	325,692	-	110,281
FL	64,790	125,772	301,963	111,165	263,643	-
<b>Total</b>	<b>4,376,741</b>	<b>6,831,462</b>	<b>5,991,612</b>	<b>2,581,272</b>	<b>2,730,055</b>	<b>3,214,690</b>

Table 4. Total incidental landings (pounds), number of trips, and number of states reporting landings in the incidental catch fishery, 2013-2018.

Year	Landings (pounds)	Number of Trips	Number of states landing
<b>2013</b>	4,376,741	2,783	6
<b>2014</b>	6,831,462	5,275	8
<b>2015</b>	5,991,612	4,498	9
<b>2016</b>	2,581,272	2,222	9
<b>2017</b>	2,730,055	2,093	7
<b>2018</b>	3,214,690	1,224	3
<b>Total</b>	<b>25,725,832</b>	<b>18,095</b>	

Table 5. Episodic Events Set-Aside (EESA) fishery quota, landings, and participating states by year. \*the 2018 EESA is reduced due to an overage in 2017. The 2018 EESA overage was paid back in full by the state of Maine.

<b>Year</b>	<b>States Declared Participation</b>	<b>EESA Quota</b>	<b>Landed (MT)</b>	<b>% EESA Quota Used</b>
2013		1,708	-	-
2014	RI	1,708	134	7.8%
2015	RI	1,879	854	45.5%
2016	ME, RI, NY	1,879	1,728	92.0%
2017	ME, RI, NY	2,000	2,129	106.5%
2018*	ME	2,031	2,103	103.6%



Table 6: State quota reporting timeframes in 2018. The **bold** text indicates which reporting program (dealer or harvesters) the states use to monitor its quotas.

State	Dealer Reporting	Harvester Reporting	Notes
ME	monthly	<b>monthly/daily</b>	Harvesters landing greater than 6,000 lbs must report daily during episodic event
NH	<b>weekly</b>	monthly	Exempt from timely reporting. Implemented weekly, trip level reporting for state dealers.
MA	<b>weekly</b>	monthly/daily	Harvesters landing greater than 6,000 lbs must report daily
RI	<b>twice weekly</b>	quarterly/daily	Harvesters using purse seines must report daily
CT	<b>weekly/monthly</b>	monthly	CT operates as directed fisheries until 90% of the quota is harvested. Then operates at the 6,000 pound bycatch trip limit.
NY	<b>Weekly</b>	monthly	Capability to require weekly harvester reporting if needed
NJ	<b>weekly</b>	monthly	All menhaden sold or bartered must be done through a licensed dealer
DE	—	<b>monthly/daily</b>	Harvesters landing menhaden report daily using IVR
MD	monthly	<b>monthly/daily</b>	PN harvest is reported daily, while other harvest is reported monthly.
PRFC	—	<b>weekly</b>	Trip level harvester reports submitted weekly. When 70% of quota is estimated to be reached, then pound netters must call in weekly report of daily catch.
VA	—	<b>monthly/weekly/daily</b>	Purse seines submit weekly reports until 97% of quota, then daily reports. Monthly for all other gears until 90% of quota, then reporting every 10 days.
NC	<b>monthly (combined reports)</b>		Single trip ticket with dealer and harvester information submitted monthly. Larger dealers (>50,000 lbs of landings annually) can report electronically, updated daily.
SC	<b>monthly (combined reports)</b>		Exempt from timely reporting. Single trip ticket with dealer and harvester information.
GA	<b>monthly (combined reports)</b>		Exempt from timely reporting. Single trip ticket with dealer and harvester information.
FL	<b>monthly/weekly (combined reports)</b>		Monthly until 75% fill of quota triggers implementation of weekly.

Table 7. Results of 2018 quota accounting in pounds. The 2018 landings do not include landings from the incidental catch fishery because they do not count towards the TAC. The 2018 episodic events set aside (EESA) quota was exceeded by 159,433 pounds, and was paid back by Maine (the pay back was deducted from Maine’s final 2018 quota). The 2019 quotas account for overages which occurred in the 2018 fishery and the redistribution of relinquished by Delaware (2.0 million pounds) and Georgia (2.4 million pounds). \* includes redistributed relinquished quota for that year and any overages from the previous season. ^includes inter-state transfers and transfers to the EESA quota.

State	2018 Base Quota*	Returned Set Aside	Transfers^	Final 2018 Quota	Overages	2019 Base Quota*
ME	2,439,114	Set Aside Exceeded by 159,433 pounds (paid back by ME)	5,240,567	7,679,681	-	2,438,677
NH	2,357,315		2,357,315	-	2,357,314	
MA	6,027,724		6,027,724	-	6,045,252	
RI	2,366,618		2,366,618	-	2,441,380	
CT	2,432,640		(500,000)	1,932,640	-	2,432,238
NY	3,270,675		(1,000,000)	2,270,675	-	3,265,806
NJ	52,013,736		52,013,736	-	51,749,064	
PA	2,357,183		2,357,183	-	2,357,183	
DE	415,940		(150,000)	265,940	-	416,467
MD	9,002,733		(1,500,000)	7,502,733	-	8,967,312
PRFC	5,102,086		5,102,086	-	5,087,456	
VA	376,543,328		(1,000,000)	375,543,328	-	374,548,891
NC	4,540,560		4,540,560	-	4,528,923	
SC	10,000		10,000	-	2,357,183	
GA	0		0	-	-	
FL	2,443,819		(1,250,000)	1,193,819	-	2,443,357
<b>TOTAL</b>	<b>471,323,470</b>				<b>471,164,037</b>	-

Table 8. Biological monitoring results for the 2018 Atlantic menhaden bait fishery.

State	#10-fish samples required	#10-fish samples collected	Age samples collected	Length samples collected	Gear/Comments
ME	21	21	210	210	purse seine
MA	8	3	30	51	30 purse seine, plus 21 midwater trawl lengths
RI	1	4	43	43	floating fish traps
CT	1	1	13	13	
NY	2	4	41	41	cast net
NJ	76	127	1270	1270	118 purse seine, 9 "other gears"
DE	1	1	10	10	gill net
MD	7	16	188	688	pound net ^
PRFC	7	9	90	90	pound net
VA	67	87	870	870	pound net (18), gill net (64), haul seine (5)
NC	2	2	20	20	gill net
<b>Total</b>	<b>193</b>	<b>275</b>	<b>2785</b>	<b>3306</b>	

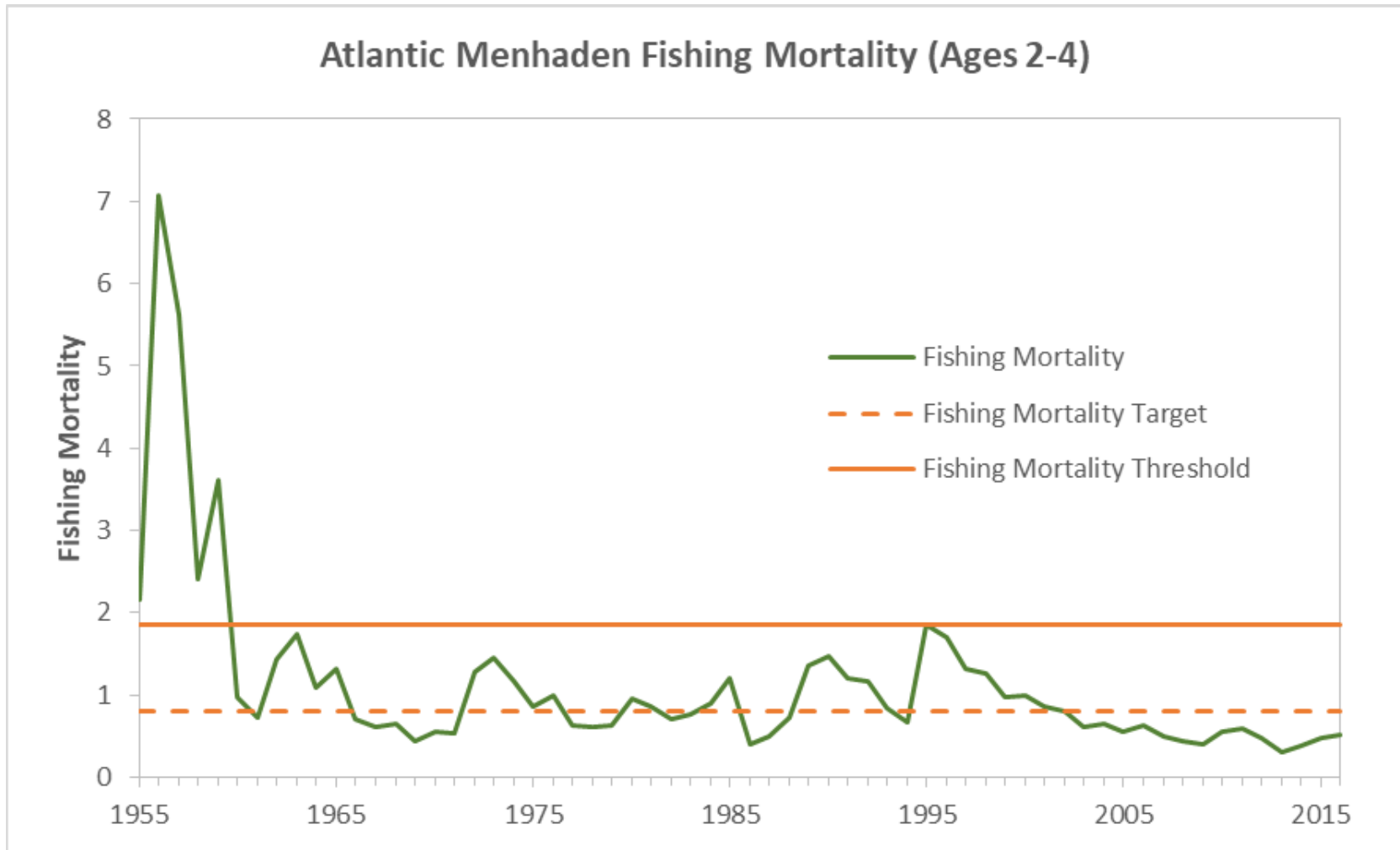


Figure 1. Fishing mortality, 1955-2016. The fishing mortality reference points are  $F_{\text{target}} = F_{36\% \text{ MSP}} = 0.80$  and  $F_{\text{threshold}} = F_{21\% \text{ MSP}} = 1.85$ .  $F_{2016} = 0.51$ . Source: ASMFC 2017b.

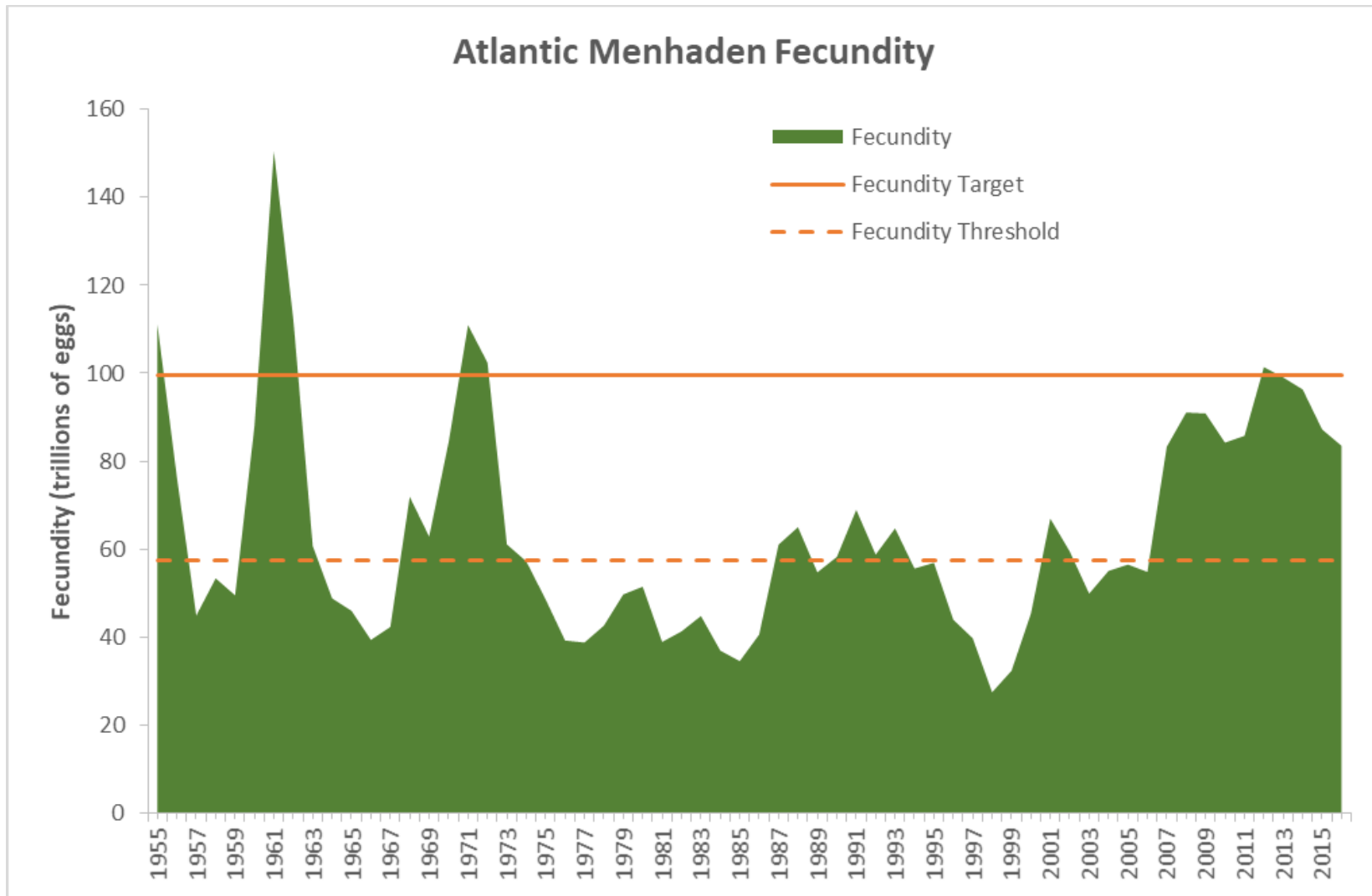


Figure 2. Atlantic menhaden fecundity, 1955-2016. The reference points for population fecundity are  $FEC_{target} = FEC_{36\%MSP} = 99,467$  (billions of eggs), and  $FEC_{threshold} = FEC_{21\%MSP} = 57,295$  (billions of eggs).  $FEC_{2016} = 83,486$  billion eggs.

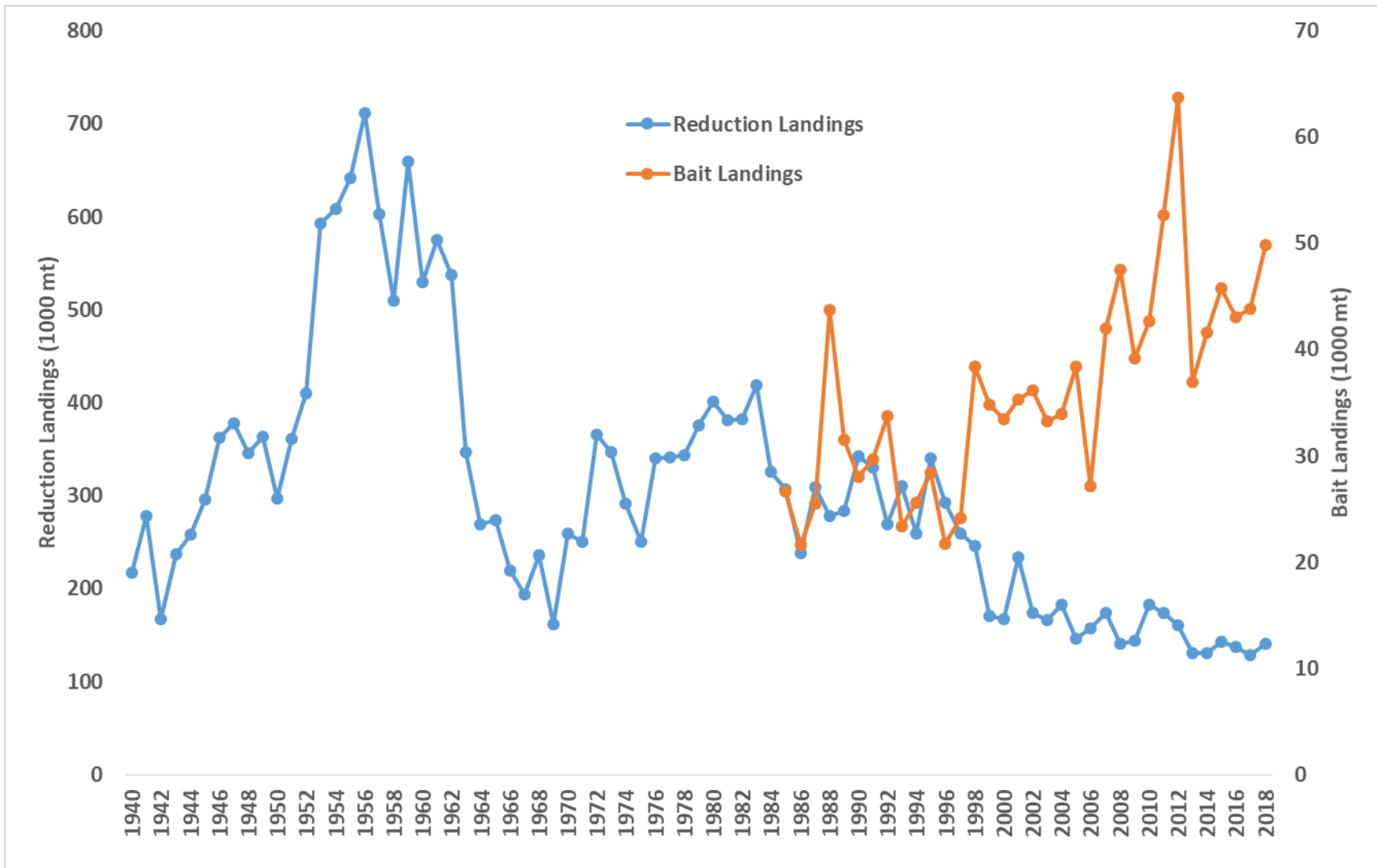


Figure 3. Landings from the reduction purse seine fishery (1940–2018) and bait fishery (1985–2018) for Atlantic menhaden. Note: there are two different scales on the y-axes.