ATLANTIC STATES MARINE FISHERIES COMMISSION

REVIEW OF THE INTERSTATE FISHERY MANAGEMENT PLAN

FOR ATLANTIC MENHADEN
(*Brevoortia tyrannus*)

2022 FISHING YEAR

Prepared by the Plan Review Team
Approved October 17, 2023

Sustainable and Cooperative Management of Atlantic Coastal Fisheries

REVIEW OF THE ASMFC FISHERY MANAGEMENT PLAN AND STATE COMPLIANCE FOR ATLANTIC MENHADEN *(Brevoortia tyrannus)* FOR THE 2022 FISHERY

Management Summary

Date of FMP:	Original FMP: August 1981
Amendments:	Plan Revision: September 1992 Amendment 1: July 2001 Amendment 2: December 2012 Amendment 3: November 2017
Management Unit:	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).
States With Declared Interest:	Maine – Florida, including Pennsylvania
Additional Jurisdictions:	Potomac River Fisheries Commission, National Marine Fisheries Service, United States Fish and Wildlife Service
Active Boards/Committees:	Atlantic Menhaden Management Board, Advisory Panel, Technical Committee, Stock Assessment Subcommittee, Plan Review Team, Plan Development Team, Ecological Reference Point Workgroup
Stock Status:	Not overfished, and overfishing is not occurring relative to the current ecological reference points (2022 Single-Species 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 interest in the Atlantic menhaden management program.

The first coastwide fishery management plan (FMP) for Atlantic menhaden was passed in 1981. The 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.

Amendment 1, implemented in 2001, provided specific biological, ecological and socioeconomic management objectives. Addenda I and V revised the biological reference points for menhaden and specified that stock assessments are to occur every three years. Although Amendment 1 did not implement any recreational or commercial management measures, Addenda II through IV instituted a harvest cap on the reduction fishery in Chesapeake Bay. Specifically, Addendum II implemented a harvest cap for 2006-2010 fishing seasons; before its first year of implementation, Addendum III revised the cap amount to be the average landings from 2001 to 2005 (or 109,020 mt); and Addendum IV extended the provisions of Addendum III through 2013.

Amendment 2, implemented in 2012, established a 170,800 metric ton (mt) total allowable catch (TAC) for the commercial fishery beginning in 2013. This TAC represented a 20% reduction from average landings between 2009 and 2011. This Amendment also used the 2009-2011 period to allocate the TAC among 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 for non-directed fisheries that operate after a jurisdiction's quota has been landed. 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; the intent of this provision is to accommodate cooperative fishing practices that traditionally take place in Chesapeake Bay. The Amendment also reduced the Chesapeake Bay reduction fishery harvest cap by 20% to 87,216 mt.

Amendment 2 also enabled the Board to set aside 1% of the coastwide TAC for episodic events. Episodic events are times and areas where Atlantic menhaden are available in more abundance than they normally occur. Technical Addendum I to Amendment 2 established a mechanism for New England states from Maine to Connecticut[1] to use the set aside, which includes a qualifying definition of episodic events, required effort controls to scale a state's fishery to the set aside amount, and a timely reporting system to monitor the set aside. Any unused set aside quota as of October 31 is redistributed to jurisdictions on November 1 based on the Amendment 2 allocation percentages.

In 2015, the TAC was increased by 10% to 187,880 mt for the 2015 and 2016 fishing years. In 2016, the Board again increased the TAC by 6.45% to 200,000 mt for the 2017 fishing year.

Atlantic menhaden are managed under Amendment 3. Approved in November 2017, the Amendment maintained the management program's single-species biological reference points until the review and adoption of menhaden-specific ecological reference points (ERPs) as part of the 2019 benchmark stock assessment process. In doing so, the Board placed development of menhaden-specific ERPs as its highest priority and supports the efforts of the ERP Workgroup to reach that goal.

[1] At its May 2016 meeting, the Board added New York as an eligible state to harvest under the set aside.

Amendment 3 also changed commercial quota allocations in order to strike an improved balance between gear types and jurisdictions. The Amendment allocated a baseline quota of 0.5% to each jurisdiction, and allocated the rest of the TAC based on average landings between 2009 and 2011. This measure provides fishing opportunities to states that 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 2009-2011 landings period. The Amendment also prohibits the rollover of unused quota; maintains the quota transfer process; maintains the bycatch provision (which was rebranded as the 'incidental catch/small-scale fisheries' (IC/SSF) provision and applicable gear types were defined) and the episodic event set aside program (EESA) for the states of Maine – New York. Finally, the Amendment reduced 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.

State	Addendum 1 Allocations (%)
ME	4.80%
NH	1.19%
MA	2.12%
RI	0.81%
CT	0.33%
NY	0.84%
NJ	11.00%
PA	0.01%
DE	0.27%
MD	1.17%
PRFC	1.09%
VA	75.21%
NC	0.37%
SC	0.25%
GA	0.25%
FL	0.29%

Addendum I, implemented in 2023, modifies Amendment 3 by creating a three-tiered system for minimum allocations to the states, with Pennsylvania receiving 0.01%; South Carolina, Georgia, Connecticut, Delaware, North Carolina, and Florida receiving 0.25%; and the remaining states continuing to receive a minimum of 0.5%. Furthermore, the Addendum allocates the remainder of the TAC, excluding the 1% reserved for the EESA, on a state-by-state basis based on landings history of the fishery from 2018, 2019, and 2021. Regarding the IC/SSF provision, the Addendum codifies the ability for states to elect to divide their quotas into sectors, enabling individual sectors to enter into the provision at different times. Additionally, the Addendum removes purse seines as a permitted small-scale directed gear, thereby, prohibiting them from harvesting under the IC/SSF provision. Finally, the Addendum counts IC/SSF landings against the TAC and if IC/SSF landings cause the TAC to be exceeded, then the Board must take action to modify one or both of permitted gear types and trip limits under the provision.

In August 2020, the Board formally approved the use of ERPs to manage Atlantic menhaden, with Atlantic striped bass as the focal species in maintaining their population. Atlantic striped bass was chosen for the ERP definitions because it was the most sensitive predator fish species to Atlantic menhaden harvest, so an ERP target and threshold sustaining striped bass would likely provide sufficient forage for other predators under current ecosystem conditions. For the development of the ERPs, all other focal species in the model (bluefish, weakfish, spiny dogfish, and Atlantic herring) were assumed to be fished at 2017 levels.

In November 2022, the Board approved a TAC for 2023-2025 of 233,550 mt, based on the ERPs. The new TAC represents a 20% increase from the 2021-2022 TAC level. Based on projections, the probability of exceeding the ERP fishing mortality target of 0.19 is 2% in 2023, 22% in 2024, and 28.5% in 2025.

II. Status of the Stock

In February 2020, the Board accepted the results of the Single-Species and Ecological Reference Point (ERP) Benchmark Stock Assessments and Peer Review Reports for management use. These assessments were peer-reviewed and approved by an independent panel of scientific experts through the 69th SouthEast, Data, Assessment and Review (SEDAR) workshop. The single-species assessment acts as a traditional stock assessment using the Beaufort Assessment Model (BAM), a statistical catch-at-age model that estimates population size-at-age and recruitment. According to the model, the stock is not overfished or experiencing overfishing relative to the current single-species reference points.

The ERP assessment evaluates the health of the stock in an ecosystem context, and indicates the fishing mortality rate (*F*) reference points for menhaden should be lower to account for the species' role as a forage fish[2]. The ERP assessment uses the Northwest Atlantic Coastal Shelf Model of Intermediate Complexity for Ecosystems (NWACS-MICE) to develop Atlantic menhaden ERPs. NWACS-MICE is an ecosystem model that focuses on four key predator species (striped bass, bluefish, weakfish, and spiny dogfish) and three key prey species (Atlantic menhaden, Atlantic herring, and bay anchovy). These species were chosen because diet data indicate they are top predators of Atlantic menhaden or are key alternate prey species for those predators.

The ERP assessment indicates the *F* reference points for menhaden should be lower than the single-species reference points, but it also concluded that the final ERP definitions, including the appropriate harvest level for menhaden, depend on the management objectives for the ecosystem (i.e., management objectives for both Atlantic menhaden and its predators). Accordingly, instead of proposing a specific ERP definition, the assessment recommends a combination of the BAM and the NWACS-MICE models as a tool for managers to evaluate trade-offs between menhaden harvest and predator biomass.

Atlantic menhaden are now managed by menhaden-specific ERPs as indicated above. The ERP target is the maximum *F* on Atlantic menhaden that sustains Atlantic striped bass at their biomass target when striped bass are fished at their F target, a measure of the intensity with which the population is being fished, is used to evaluate whether the stock is experiencing overfishing. The ERP threshold is the maximum F on Atlantic menhaden that keeps Atlantic striped bass at their biomass threshold when striped bass are fished at their *F* target. Population fecundity, a measure of reproductive capacity, is used to evaluate whether the stock

[2] it should be noted, however, that the conservative TAC the Board has set for recent years is consistent with the ERP *F* target provided in the ERP Assessment

is overfished. According to the 2022 single-species stock assessment update, the 2021 estimate of fecundity was above both the ERP FEC target and threshold, and the 2021 estimate of fishing mortality was below the ERP F target and threshold, indicating the stock was neither overfished nor experiencing overfishing. The next ERP benchmark stock assessment and single-species assessment update are underway and scheduled to be presented to the Board in 2025.

III. Status of the Fishery

Commercial

Total commercial Atlantic menhaden landings in 2022, including directed, incidental catch, and EESA landings, are estimated at 195,387 mt (430.8 million pounds), an approximate 0.15% increase relative to 2021 (Table 1). The non-incidental catch fishery landings (directed landings plus landings under the EESA) total for 2022 is estimated at 187,231 mt (412.8 million pounds) and represents approximately 96% of the coastwide commercial TAC of 194,400 mt (428.6 million pounds). Landings from the incidental catch fishery are estimated at 8,156 mt (18 million pounds) and do not count towards the coastwide TAC in 2022.

Reduction Fishery

The 2022 harvest for reduction purposes is estimated at 134,477 mt (296 million pounds), a 2% decrease from 2021 and 1.5% below the previous 5-year average of 136,473 mt (300.9 million pounds) (Table 2; Figure 3). Omega Protein's plant in Reedville, Virginia, is the only active Atlantic menhaden reduction factory on the Atlantic coast. In 2020, the reduction plant was shut down for 3 weeks due to the COVID-19 pandemic. Anecdotal reports indicate that in addition to the pandemic, bad weather may have also contributed to lower harvest.

Bait Fishery

The coastwide bait harvest estimate for 2022 from state compliance reports, including directed, incidental catch, and EESA landings, is 60,101 mt (151.6 million pounds). This represents a 3% increase relative to 2021 and a 10% increase compared to the previous 5-year average (Table 2; Figure 3). New Jersey (35%), Virginia (26%), Maine (20%), and Massachusetts (8%) landed the four largest shares in 2022.

Incidental Catch and Small-Scale Fisheries Landings

Incidental catch landings in 2022 are estimated at 8,156 mt (18 million pounds), which is a 46% increase relative to 2021 (Table 3). Maine, Massachusetts, and Virginia's non-purse seine bait fishery reported incidental catch landings (82% from purse seines and 10% from gill nets) in 2022 (Table 4). Maine accounted for 87% of total incidental fishery landings. The number of incidental catch trips (4,134) was the highest since 2015 (Table 4).

Episodic Events Set Aside Program

The 2022 EESA quota was 1,944 mt (4.29 million pounds). Maine began harvesting under the EESA program on June 21st and continued until their EESA fishery closed on June 28th. Massachusetts began harvesting under the EESA program on June 23rd and closed the fishery on July 8th. An estimated 1,992 mt (4.4 million pounds) of menhaden were landed under the

EESA fishery (Table 5), which is 104,723 pounds over the set aside quota. In January 2023, Massachusetts transferred 64,000 pounds to cover a portion of the overage (see Table 7), and the remaining 40,723 pounds was deducted from the 2023 set aside.

Chesapeake Bay Reduction Fishery Cap (cap)
Amendment 3 implemented a 51,000 mt harvest cap for the reduction fishery in the Chesapeake Bay. The cap for 2022 was set once again at 51,000 mt with harvest remaining under the limit in 2021. Reported reduction landings from Chesapeake Bay in 2022 were about 50,000 mt, under the cap by approximately 1,000 mt.

Recreational
Menhaden are important bait in many recreational fisheries; some recreational fishermen use cast nets to capture menhaden or snag them with hook and line for use as bait, both dead and alive. The Marine Recreational Information Program (MRIP) estimate for Atlantic menhaden harvest (A + B1) in 2022 is 5.7 million pounds (PSE of 16.6) which is a 119% increase from 2021 (2.6 million pounds).

Additionally, it is important to note recreational harvest is not well captured by 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 beach. However, since menhaden caught by recreational fishermen are often used as bait during their trip, they are typically not part of the catch that is seen by the surveyor completing the intercept.

Quota Transfers
There were 24 state-to-state transfers in 2022 (Table 8), an increase from 16 in 2021. Quota transfers were generally pursued to ameliorate overages. One of the purposes of the commercial allocation changes in Addendum I to Amendment 3 was to reduce the need for quota transfers, and the PRT will monitor the change in quota transfers after implementation in 2023.

IV. Status of Research and Monitoring

<u>Commercial fisheries monitoring</u>
Reduction fishery - The NMFS Southeast Fisheries Science Center Beaufort Laboratory in Beaufort, North Carolina, continues to monitor landings and collect biological samples from the Atlantic menhaden purse-seine reduction fishery. 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 to maintain menhaden harvest within the TAC and minimize the potential for quota overages. The Standard Atlantic Fisheries Information System (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 few years:

- Anstead, K. A., K. Drew, D. Chagaris, A. M. Schueller, J. E. McNamee, A. Buchheister, G. Nesslage, J. H. Uphoff Jr., M. J. Wilberg, A. Sharov, M. J. Dean, J. Brust, M. Celestino, S. Madsen, S. Murray, M. Appelman, J. C. Ballenger, J. Brito, E. Cosby, C. Craig, C. Flora, K. Gottschall, R. J. Latour, E. Leonard, R. Mroch, J. Newhard, D. Orner, C. Swanson, J. Tinsman, E. D. Houde, T. J. Miller, and H. Townsend. 2021. The path to an ecosystem approach for forage fish management: A case study of Atlantic menhaden. Front. Mar. Sci. 8: 607657.
- Chargaris D., K. Drew, A. M. Schueller, M. Cieri, J. Brito, and A. Buchheister. 2020. Ecological Reference Points for Atlantic Menhaden Established Using an Ecosystem Model of Intermediate Complexity. Front. Mar. Sci. 7:606417.
- Deyle, E., A. M. Schueller, H. Ye, G. M. Pao, and G. Sugihara. 2018. Ecosystem-based forecasts of recruitment in two menhaden species. Fish and Fisheries 19(5): 769-781.
- Drew, K., M. Cieri, A. M. Schueller, A. Buchheister, D. Chagaris, G. Nesslage, J. E. McNamee, and J. H. Uphoff. 2021. Balancing Model Complexity, Data Requirements, and Management Objectives in Developing Ecological Reference Points for Atlantic Menhaden. Front. Mar. Sci. 8: 608059.
- Liljestrand, E.M., M.J. Wilberg, and A.M. Schueller. 2019. Estimation of movement and mortality of Atlantic menhaden during 1966-1969 using a Bayesian multi-state mark recapture model. Fisheries Research 210: 204-213.
- Liljestrand, E.M., M. J. Wilberg, and A. M. Schueller. 2019. Multi-state dead recovery mark-recovery model performance for estimating movement and mortality rates. Fisheries Research 210: 214-233.
- Lucca, B. M., and J. D. Warren. 2019. Fishery-independent observations of Atlantic menhaden abundance in the coastal waters south of New York. Fisheries Research 218: 229-236.
- Nesslage, G. M., and M. J. Wilberg. 2019. A performance evaluation of surplus production models with time-varying intrinsic growth in dynamic ecosystems. Canadian Journal of Fisheries and Aquatic Sciences 76(12): 2245-2255.
- Schueller, A.M., A. Rezek, R. M. Mroch, E. Fitzpatrick, and A. Cheripka. 2021. Comparison of ages determined by using an Eberbach projector and a microscope to read scales from Atlantic menhaden (Brevoortia tyrannus) and Gulf menhaden (B. patronus). Fishery Bulletin 119(1): 21-32.

Theses and Dissertations of Potential Interest:

- McNamee, J. E. 2018. A multispecies statistical catch-at-age (MSSCAA) model for a Mid-Atlantic species complex. University of Rhode Island.

V. Implementation of FMP Compliance Requirements

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

Quota Results

The Board set the TAC at 233,550 mt (514.9 million pounds) for 2023-2025 based on the adopted ERPs. 1% is set aside for episodic events. States may relinquish all or part of its annual quota by December 1st of the previous year. Delaware relinquished one million pounds of quota, which was redistributed to the states according to procedures outlined in Addendum I to Amendment 3 and is reflected in the 2023 Preliminary Quota in Table 7.

Table 7 also contains 2022 state-specific quotas and directed harvest. The final quotas for 2022 account for 1.2 million pounds of quota relinquished by Delaware, state-to-state transfers (Table 8), and transfers to the EESA. Based on preliminary 2022 landings, PRFC and Connecticut both had overages in part due to quota that was transferred to other states. In August 2023, Virginia transferred quota back to PRFC to account for their overage. Connecticut's overage was deducted from their 2023 quota.

Quota Monitoring

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.

Menhaden purse seine and bait seine vessels (or snapper rigs) are required to submit CDFRs. Maine, New York, and Virginia fulfilled this requirement in 2022. 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 DMF and fill out daily trip level logbooks. New Hampshire also does not require the specific CDFR, but does require daily, trip-level reporting from dealers and monthly trip-level reporting from harvesters. Massachusetts requires trip level reporting for all commercial fishermen. Menhaden purse seine fisheries do not currently operate in all other jurisdictions in the management unit.

Biological Monitoring Requirements

Amendment 3 maintains biological sampling requirements for non *de minimis* states as follows:

- One 10-fish sample (age and length) per 300 mt landed for bait purposes for Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, and Delaware; and
- One 10-fish sample (age and length) per 200 mt landed for bait purposes for Maryland, Potomac River Fisheries Commission, Virginia, and North Carolina

Table 9 provides the number of 10-fish samples required and collected for 2022. These are based on the best available 2022 total bait landings data (including directed, incidental, and EESA landings) provided to the Commission by the states. In 2022, Maine fell short of the requirement, collecting 35 of the 39 required samples. Connecticut also collects bait samples from the Long Island Sound Trawl Survey, which produced 190 age samples and 881 length samples over 190 tows.

The PRT continued to discuss whether a sufficient number of age and length samples are being collected from different commercial gear types as well as regions, and whether substituting samples from fishery-independent sources is appropriate for meeting the requirement. The Stock Assessment Subcommittee will evaluate the biological sampling as part of the 2025 single-species assessment update.

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 did not have the current reporting structure to require a quantity of gear field by harvesters or dealers. In recent years, NC DMF staff have worked to develop a proxy method to estimate effort but this approach likely would not work for developing an adult CPUE index.

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 previously 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 2022 fishing season.

VI. Plan Review Team Recommendations and Notable Comments

<u>Management Recommendations</u>
- The PRT recommends that the *de minimis* requests from Pennsylvania, South Carolina, Georgia, and Florida, be approved.
- The PRT recommends that the Technical Committee be tasked with evaluating the biological sampling requirement to be readdressed in a future management document or stock assessment.

VII. Literature Cited

Atlantic States Marine Fisheries Commission (ASMFC). 2022. Atlantic Menhaden Stock Assessment Update. Prepared by the ASMFC Atlantic Menhaden Stock Assessment Subcommittee. 127 pp.

Southeast Data, Assessment, and Review (SEDAR). 2015. SEDAR 40 – Atlantic Menhaden Stock Assessment Report. SEDAR, North Charleston SC. 643 pp.

SEDAR. 2020. SEDAR 69 – Atlantic Menhaden Benchmark Stock Assessment Report. SEDAR, North Charleston SC. 691 pp. available online at: http://sedarweb.org/sedar-69

SEDAR. 2020. SEDAR 69 - Atlantic Menhaden Ecological Reference Points Stock Assessment Report. SEDAR, North Charleston SC. 560 pp. available online at: http://sedarweb.org/sedar-69

Table 1. Directed, bycatch, and episodic events set aside landings in 1000s of pounds for 2022 by jurisdiction. Source: 2022 ASMFC state compliance reports for Atlantic menhaden. NA = not applicable; C = confidential

State	Directed	Incidental Catch	EESA
ME	7,574	15,602	2,647
NH	4,987	-	NA
MA	8,087	595	1,743
RI	617	-	-
CT	299	-	NA
NY	1,177	-	NA
NJ	46,889	-	NA
DE	53	-	NA
MD	3,357	-	NA
PFRC	3,569	-	NA
VA	331,081	1,784	NA
NC	539	-	NA
SC	C	-	NA
GA	0	-	NA
FL	152	-	NA

Table 2. Atlantic menhaden reduction and bait landings in thousand metric tons, 1988-2022.

	Reduction Landings (1000 mt)	Bait Landings (1000 mt)
1988	278	43.8
1989	284	31.5
1990	343	28.1
1991	330	29.7
1992	270	33.8
1993	310	23.4
1994	260	25.6
1995	340	28.4
1996	293	21.7
1997	259	24.2
1998	246	38.4
1999	171	34.8
2000	167	33.5
2001	234	35.3
2002	174	36.2
2003	166	33.2
2004	183	34.0
2005	147	38.4
2006	157	27.2
2007	174	42.1
2008	141	47.6
2009	144	39.2
2010	183	42.7
2011	174	52.6
2012	161	63.7
2013	131	37.0
2014	131	41.6
2015	143	45.8
2016	137	43.1
2017	129	43.8
2018	141	50.2
2019	151	58.1
2020	125	59.6
2021	137	58.4
2022	134	60.1
Avg 2017-2021	136	54.0

Table 3. Incidental fishery landings by state in 1000s of pounds, 2013-2022. Only states that have reported incidental catch landings are listed. Average total incidental catch landings for the time series is 8.3 million pounds.

State	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
ME		-	-	506	5,374	2,995	10,751	13,605	11,771	15,602
MA								49	174	595
RI	16	99	70	40	136	-	-	-	C	-
CT	0	-	10	-	124	-	-	-	C	-
NY	0	325	769	281	807	-	-	282	310	-
NJ	0	626	241	196	-	204,240	-	20	C	-
DE	76	112	92	21	29	-	-	-	-	-
MD	2,864	2,201	1,950	996	-	-	-	-	-	-
PRFC	1,087	1,112	455	106	670	-	-	-	-	-
VA	268	2,232	2,103	326	-	110,281	-	-	-	1,784
FL	65	126	302	111	264	-	-	-	-	-
Total	4,377	6,831	5,992	2,581	7,404	3,215	10,751	13,957	12,336	16,152

Table 4. Total incidental landings (1000s of pounds), number of trips, and number of states reporting landings in the incidental catch fishery, 2013-2022.

Year	Landings (1000s of pounds)	Number of Trips	Number of states landing
2013	4,377	2,783	6
2014	6,831	5,275	8
2015	5,992	4,498	9
2016	2,581	2,222	9
2017	7,407	2,108	7
2018	3,310	1,224	3
2019	10,751	3,113	1
2020	13,957	3,565	4
2021	12,336	3,099	6
2022	17,980	4,134	3
Total	85,522	32,021	

Table 5. Episodic Events Set-Aside (EESA) fishery quota, landings, and participating states by year. *The 2018 EESA quota was reduced due to an overage in 2017. The 2018 EESA overage was paid back in full by the state of Maine. **The 2021 overage was covered by quota transfers in 2021 and 2022, and there will be no deduction for the 2022 fishing year. ^The 2022 overage was partially covered by a quota transfer and the remainder was deducted from the 2023 set aside.

Year	States Declared Participation	EESA Quota (MT)	Landed (MT)	% EESA Quota Used
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%
2019	ME	2,160	1,995	92.4%
2020	ME & MA	2,160	2,080	96.3%
2021**	ME, MA, RI	1,944	2,213	113.8%
2022^	ME, MA	1,944	1,992	102.4%

Table 6. State quota reporting timeframes in 2021. The **bold** text indicates which reporting program (dealer or harvesters) the states use to monitor its quotas. Blue text indicates changes from 2020.

State	Dealer Reporting	Harvester Reporting	Notes
ME	monthly	**daily/weekly**	Harvesters must report same day during directed and episodic event trips; harvesters report daily trips weekly for trips <6,000 lbs. Harvest reports are used for quota monitoring.
NH	**daily**	monthly	Exempt from timely reporting. Implemented daily, transaction level reporting for state dealers.
MA	**weekly**	monthly/daily	Harvesters landing greater than 6,000 lbs must report daily
RI	**twice weekly**	quarterly/daily	Harvesters using purse seines must report daily
CT	**weekly/monthly**	monthly/daily	CT operates as directed fisheries until 90% of the quota is harvested. Then operates at the 6,000 pound bycatch trip limit.
NY	**Weekly**	monthly	Capability to require weekly harvester reporting if needed
NJ	**weekly**	monthly	All menhaden sold or bartered must be done through a licensed dealer
DE	—	**monthly/daily**	Harvesters landing menhaden report daily using IVR
MD	monthly	**monthly/daily**	PN harvest is reported daily, while other harvest is reported monthly.
PRFC	—	**weekly**	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	—	**monthly/weekly/daily**	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	**monthly (combined reports)**		Single trip ticket with dealer and harvester information submitted monthly. Larger dealers (>50,000 lbs of landings annually) can report electronically, updated daily.
SC	**monthly (combined reports)**		Exempt from timely reporting. Single trip ticket with dealer and harvester information.
GA	**monthly (combined reports)**		Exempt from timely reporting. Single trip ticket with dealer and harvester information.
FL	**monthly/weekly (combined reports)**		Monthly through the FWC Marine Fisheries Trip Ticket system until 75% of quota is projected to have been met, then weekly phone calls to dealers who have been reporting menhaden landings until the directed fishery is closed.

Table 7. Results of 2022 quota accounting in pounds. The 2022 landings do not include landings from the incidental catch fishery because they do not count towards the TAC. A majority of the 2022 episodic events set aside (EESA) quota was used by Maine with the remainder used by Massachusetts. The 2023 base quotas account for the redistribution of relinquished quota by Delaware (1 million pounds) and for the implementation of Addendum I to Amendment 3, which modified the quota allocation process.

State	2022 Base Quota*	Returned Set Aside	Transfers^	Final 2022 Quota	Overages	2023 Base Quota*
ME	2,194,303		5,380,000	7,574,303		24,510,314
NH	2,121,582		3,070,000	5,191,582		6,052,530
MA	5,417,812		2,956,000	8,373,812		10,838,902
RI	2,196,719		-1,460,000	736,719		4,147,882
CT	2,188,548		-2,110,000	78,548	220,704	1,472,767
NY	2,933,580		-	2,933,580		4,298,217
NJ	46,267,280		1,850,000	48,117,280		56,172,891
PA	2,121,464		-1,300,000	821,464		50,974
DE	974,821		-870,000	104,821		375,998
MD	8,029,511		-2,500,000	5,529,511		5,947,968
PRFC	4,561,747		-1,000,000	3,561,747	7,703**	5,547,444
VA	334,781,533		4,310,000	339,091,533		384,164,855
NC	4,062,537		-2,950,000	1,112,537		1,892,146
SC	2,121,464		-2,120,000	1,464		1,274,601
GA	2,121,464		-2,000,000	121,464		1,274,352
FL	2,198,486		-1,320,000	878,486		1,490,464
Total	**424,292,851**			**424,292,851**		**509,740,712**

*Includes redistributed relinquished quota for that year and any overages from the previous season.

**Resolved through quota transfer from VA.

^Includes inter-state transfers and transfers to the EESA quota.

Table 8. State-to-state transfers of menhaden commercial quota for the 2022 Fishing year.

Transfer Date	ME	NH	MA	RI	CT	NY	NJ	PA	DE	MD	PRFC	VA	NC	SC	GA	FL
6/6/2022		750,000			(750,000)											
6/27/2022	2,580,000				(550,000)			(600,000)					(880,000)	(550,000)		
6/27/2022							1,850,000		(500,000)				(600,000)	(750,000)		
6/29/2022				360,000	(100,000)								(160,000)	(100,000)		
7/1/2022	480,000															(480,000)
7/7/2022												370,000		(370,000)		
7/7/2022			2,380,000		(350,000)			(400,000)					(560,000)	(350,000)	(400,000)	(320,000)
7/8/2022									(370,000)			370,000				
7/8/2022	600,000														(600,000)	
7/18/2022			500,000							(500,000)						
7/18/2022		1,000,000								(1,000,000)						
7/20/2022												1,000,000			(1,000,000)	
8/9/2022												320,000				(320,000)
8/17/2022										(500,000)		500,000				
8/17/2022	500,000									(500,000)						
9/14/2022		300,000			(300,000)											
9/16/2022		300,000						(300,000)								
9/16/2022											(1,000,000)	1,000,000				
9/22/2022	220,000		140,000	(360,000)												
9/27/2022		200,000														(200,000)
9/29/2022												750,000	(750,000)			
10/12/2022		400,000		(400,000)												
11/2/2022		120,000		(60,000)	(60,000)											
12/15/2022	1,000,000			(1,000,000)												
Total	5,380,000	3,070,000	3,020,000	(1,460,000)	(2,110,000)	-	1,850,000	(1,300,000)	(870,000)	(2,500,000)	(1,000,000)	4,310,000	(2,950,000)	(2,120,000)	(2,000,000)	(1,320,000)

Table 9. Biological monitoring results for the 2022 Atlantic menhaden bait fishery.
*Age samples are still being processed

State	#10-fish samples required	#10-fish samples collected	Age samples collected	Length samples collected	Gear/Comments
ME	39	35	350	350	31 from purse seine; 4 from gillnets
NH	8	8	80	80	Purse Seine
MA	16	17	170	170	16 purse seine; 1 rod & reel
RI	1	1	10	10	Otter Trawl' 39 additional FI samples available
CT	1	1	10	10	Long Island Sound Trawl Survey - 167 tows in 2022; collected 190 age/881 length samples
NY	2	14	141	141	cast net, seine net
NJ	65	90	*	900	Purse Seine
	6	-	*	-	Other Gears
DE	1	1	10	10	Gill net
MD	8	20	325	1,132	Pound net
PRFC	8	19	190	190	pound net
VA	6	1	10	10	Pound Net
	10	68	679	679	Gill Net
NC	1	7	71	1,236	gillnet
Total	**172**	**282**	**2046**	**4918**	

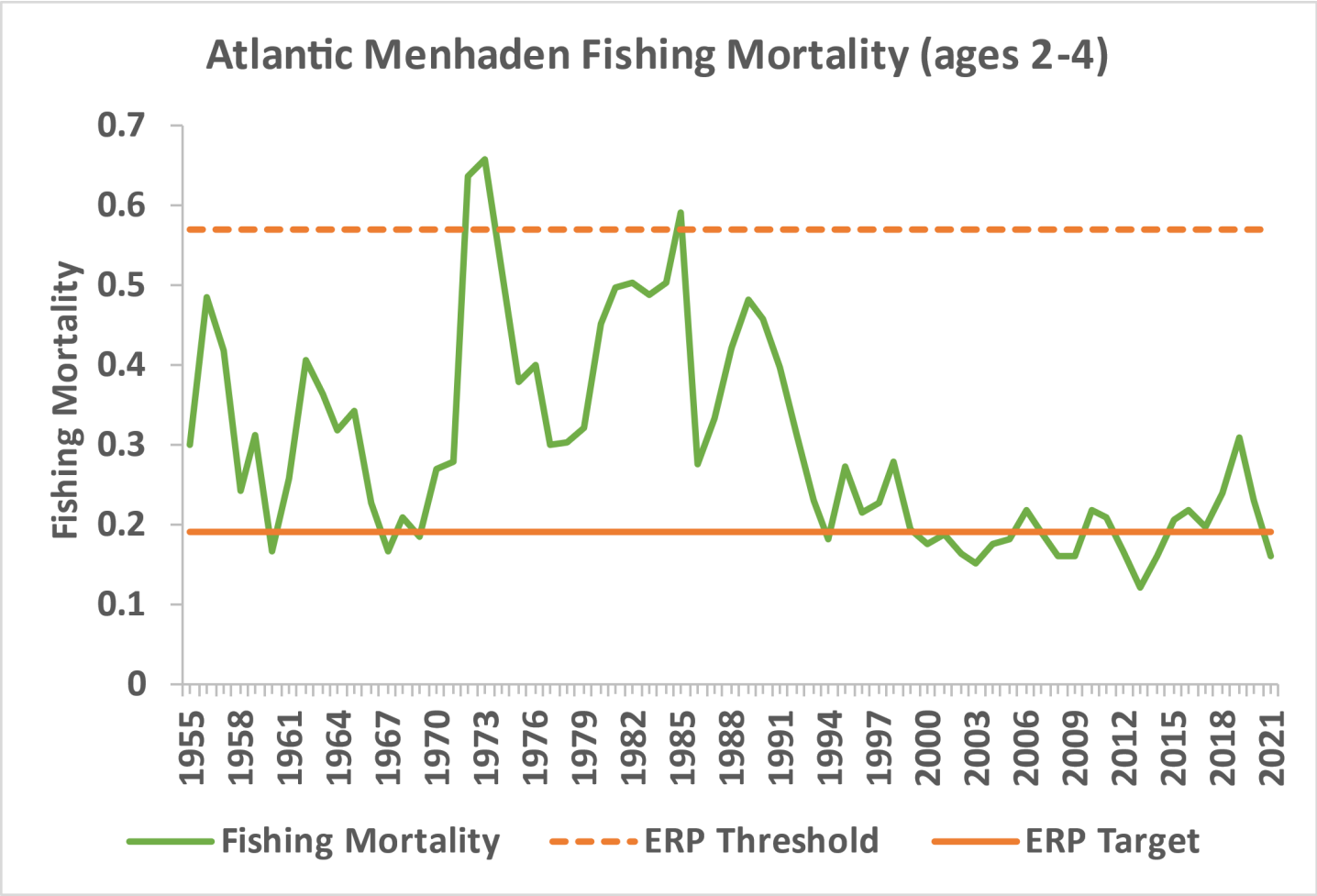

Figure 1. Fishing mortality, 1955-2021. The ERP fishing mortality reference points are F_{target} = 0.19 and $F_{threshold}$ = 0.57. F_{2017} = 0.16. Source: ASMFC 2022.

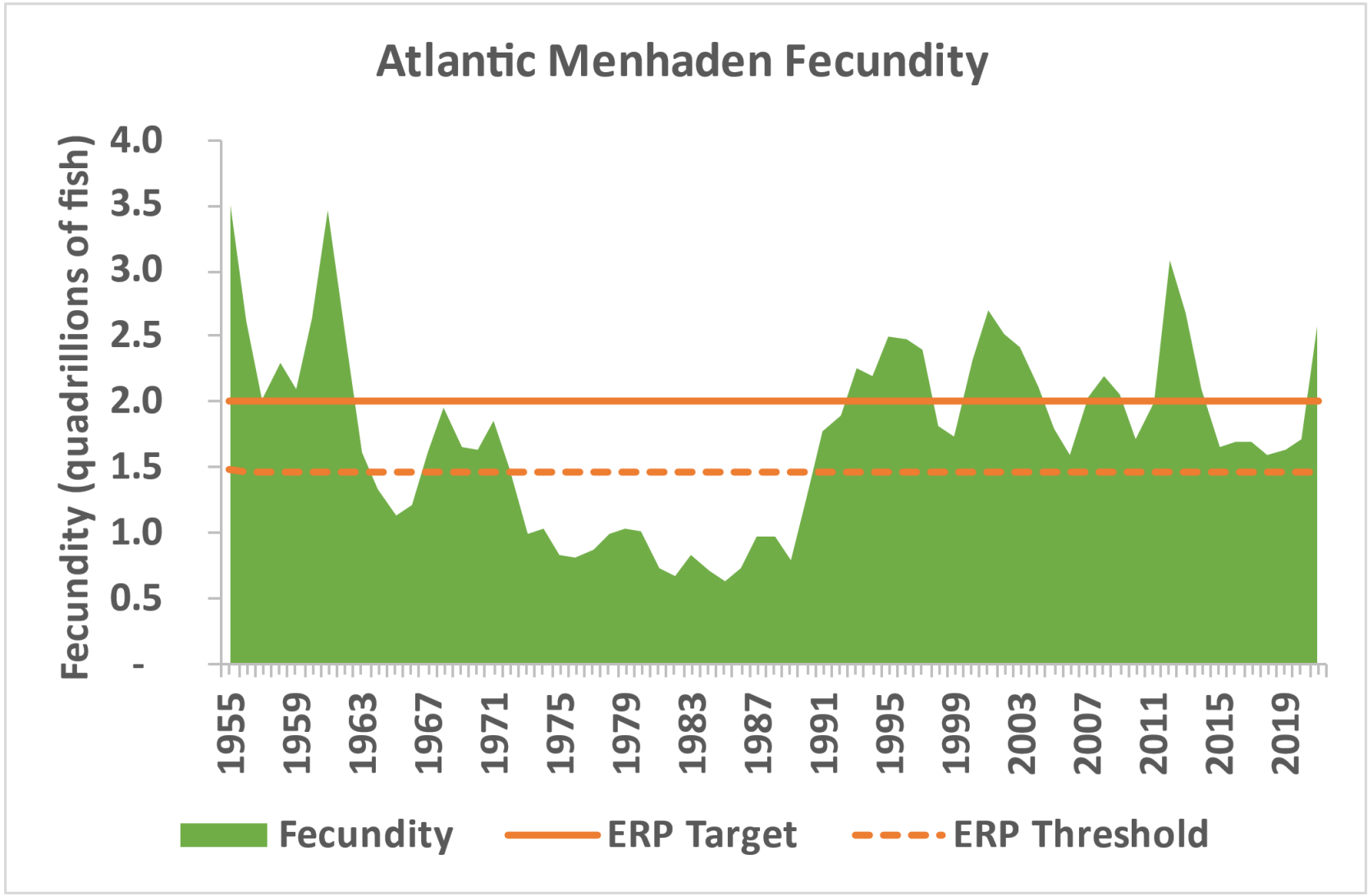

Figure 2. Atlantic menhaden fecundity, 1955-2021. The ERPs for population fecundity are FEC_{target} = 2,003,986 (billions of eggs), and $FEC_{threshold}$ = 1,492,854 (billions of eggs). Source: ASMFC 2022.

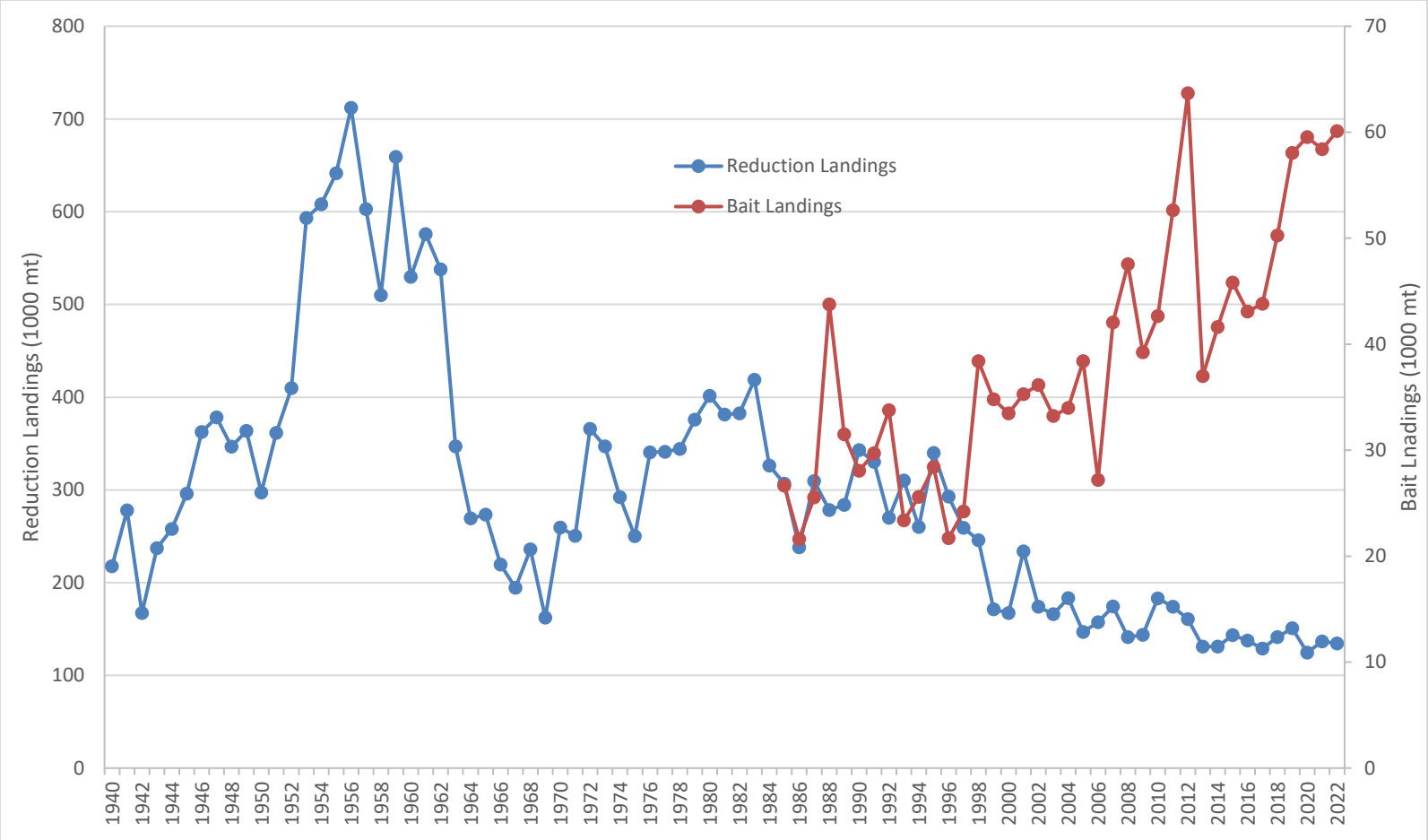

Figure 3. Landings from the reduction purse seine fishery (1940–2022) and bait fishery (1985–2022) for Atlantic menhaden. Note: there are two different scales on the y-axes.