VIMS | William & Mary
Virginia Institute of Marine Science

*Office of Research and Advisory Services*

October 1, 2023

Senator J. Chapman Petersen
Chair, Senate Agriculture, Conservation, and Natural Resources Committee

Delegate R. Lee Ware
Chair, House Agriculture, Chesapeake, and Natural Resources Committee

Travis A. Voyles
Secretary of Natural and Historic Resources

Honorable Gentlemen:

Please find the attached report from the Virginia Institute of Marine Science in response to Senate Bill 1388 directing us to *develop plans for studying the ecology, fishery impacts, and economic importance of menhaden populations in the waters of the Commonwealth*. We appreciate you extending the deadline to October 1, as it allowed us to fulfill the charge of receiving input from the Menhaden Management Advisory Committee, which was not scheduled to meet before our initial deadline.

In developing the components of the proposed study, we worked closely with staff from the Virginia Marine Resources Committee and members of the Atlantic Menhaden Technical Committee of the Atlantic States Marine Fisheries Commission, representatives of the menhaden reduction and bait fisheries, as well as other stakeholders identified in the report. We are very pleased to report that our research recommendations are based on the unanimous consensus of this diverse stakeholder group.

A total of nine specific research programs are identified addressing the three topical areas specified in the bill. For each of these we have provided estimated timelines and costs. Should either the Administration or General Assembly choose to introduce a budget amendment to implement these studies, we will work with you to provide more detailed budget breakdowns and implementation schedules.

Please feel free to contact me (luck@vims.edu), if you have any questions or would like more information.

Sincerely,

Mark W. Luckenbach

Mark W. Luckenbach
Associate Dean of Research & Advisory Service
Professor of Marine Science

Cc: Senator Lynwood Lewis

# Atlantic Menhaden Research Planning

**Prepared by**

The Virginia Institute of Marine Science
William & Mary

**Prepared for**

J. Chapman Peterson
Chair, Senate Agriculture, Conservation, and Natural Resources

R. Lee Ware
Chair, House Agriculture, Chesapeake, and Natural Resources

Travis A. Voyles
Secretary of Natural and Historic Resources

**Submitted on**

October 1, 2023

VIMS | William & Mary
Virginia Institute of Marine Science

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# 1 Acknowledgments

Financial support for the stakeholder workshop was provided by the Virginia Institute of Marine Science (VIMS), William & Mary. Shanna Madsen, Virginia Marine Resources Commission (VMRC), Kristina Weaver, Institute for Engagement and Negotiation, University of Virginia, Mark Luckenbach (VIMS), and Cecilia Lewis (VIMS) were instrumental in the organization and execution of the stakeholder workshop. We thank the workshop attendees and members of the Menhaden Management Advisory Committee to the VMRC for their thoughtful and constructive contributions to this report. Rebecca Latourell (VIMS) assisted with report formatting and James Gartland (VIMS) and Caroline DeVries (VIMS) served as excellent workshop rapporteurs.

Please cite this document as:

Latour, R.J. and J. Gartland. 2023. Atlantic Menhaden Research Planning. Report submitted by the Virginia Institute of Marine Science, William & Mary to the Virginia General Assembly and the Secretary of Natural and Historic Resources, Gloucester Point, VA. 19pp.

# 2 Executive Summary

Forage fishes play a critical role in marine food webs. These small and medium-sized species are a key food source for many larger fishes, marine mammals, and seabirds, thereby transferring energy from plankton to larger consumers. Historically, fisheries management decisions were aimed at maximizing yields while maintaining biological sustainability, and this philosophy was often applied without considering the ecology and economics of managed resources. Over the past two decades, however, this management philosophy has evolved to become conceptually more holistic, and in some cases, tactically rooted in ecosystem principles. In the mid-Atlantic and Chesapeake Bay region, the Atlantic menhaden is an ecologically important forage fish that has supported the largest fishery by volume on the Atlantic coast for over a century. Fueled by advancements in ecosystem-based fisheries science and management, the stock status of Atlantic menhaden and the potential ecosystem effects of high-volume fishery removals have been more critically evaluated in recent years, particularly in Chesapeake Bay. Although Atlantic menhaden science has been growing and evolving for decades, the available information focused specifically on fish that seasonally inhabit the bay is limited and many unresolved questions remain. For several years, environmentalists, conservation groups, and recreational anglers have expressed concern to elected officials, policy makers, and fisheries scientists about the health of Chesapeake Bay, and in particular, the impacts of Atlantic menhaden commercial fishing on the bay ecosystem. In response to these concerns, the Virginia General Assembly passed legislation during the 2023 session that directs the Virginia Institute of Marine Science (VIMS) to develop a plan for studying Atlantic menhaden in the waters of the Commonwealth. To achieve the legislative objectives, VIMS led a 1.5-day workshop that brought together a diverse group of stakeholders with varied perspectives on issues related to Atlantic menhaden. These stakeholders were asked to work collaboratively toward identifying and prioritizing research topics that address uncertainties and knowledge gaps pertaining to the ecology, fishery impacts, and economic importance of Atlantic menhaden. The workshop was highly successful and consensus among participants supported nine extremely relevant research recommendations. This report summarizes the rationale, methodology, appropriate research agencies, collaborative stakeholders, timelines, and costs associated with these research recommendations. Workshop participants also unanimously agreed that addressing these research topics would greatly enhance the information available to fishery managers charged with formulating robust harvest policies that acknowledge the ecological role of Atlantic menhaden in the Commonwealth and beyond.

# 3 Introduction

## 3.1 Background

Atlantic menhaden is a schooling pelagic fish distributed from Nova Scotia, Canada to Florida. Although maximum age has been estimated to be 10 years, fish older than age-6 are rarely observed. Reproduction occurs in the coastal ocean over a protracted timeframe (approximately Sep-Apr) and larvae are transported by tides and currents to estuarine nursery areas. Chesapeake Bay is believed to be the most important nursery for Atlantic menhaden along the US east coast, and studies have shown peak ingress of larvae into the bay occurs during winter months. Juveniles spend their first spring and summer in estuarine nurseries along the coast, and with the onset of fall, these fish migrate to coastal and ocean habitats in preparation for overwintering. Subadult and adult fish undergo extensive seasonal migrations and inhabit both estuarine and nearshore areas along the coast. Movements are age/size dependent such that older/bigger fish migrate farther distances. Atlantic menhaden use specialized gill rakers to filter seawater and feed on plankton; juveniles consume both phytoplankton and zooplankton while adults feed almost exclusively on zooplankton. A wide variety of species rely on Atlantic menhaden as a key prey resource, including many commercially and recreationally important finfishes like striped bass and bluefish, marine mammals such as bottlenose dolphin and humpback whale, and piscivorous seabirds like osprey, brown pelican, and bald eagle. As a result, Atlantic menhaden are a critical component of estuarine and coastal ocean ecosystems.

In addition to their ecological importance, Atlantic menhaden support the largest commercial fishery by volume (weight), on the US east coast. The majority of landings are taken by the purse seine reduction sector where fish are processed into fish meal and oil. In the 1950s, between 22 and 25 reduction factories operated along the US east coast from Maine to Florida, and during that time, reduction landings peaked at over 700,000 metric tons (mt; Figure 1). However, processing capacity in the reduction sector has systematically decreased over time such that only a single facility located in Reedville, Virginia is currently operational. As a result, reduction landings have been less than 200,000 mt since the early 2000s. Atlantic menhaden are also harvested by the comparatively smaller scale, coastwide, mixed gear bait sector for use in other commercial and

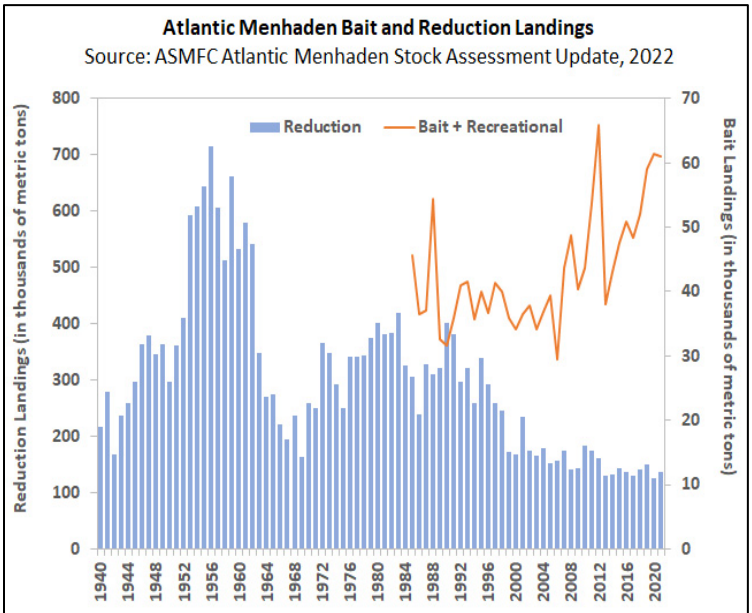


Figure 1. Atlantic menhaden landings for the reduction (bars, left y-axis) and bait (line, right y-axis) sectors, 1940-2021.

recreational fisheries. Due to decreased availability of other bait species such as Atlantic herring, bait landings of Atlantic menhaden have increased in recent years and presently comprise approximately 25% of the total coastwide landings. Collectively, these fisheries provide appreciable economic benefits for coastal communities in Virginia, particularly those in the Northern Neck.

Since Atlantic menhaden is a coastal species that inhabits nearshore areas extending across state boundaries, the Atlantic States Marine Fisheries Commission (ASMFC) holds authority for coastwide fisheries management. The ASMFC acts as a deliberative body and coordinates policy and sustainable stewardship of fisheries resources among the 15 Atlantic coast states. However, within the state waters of the Commonwealth, the Virginia Marine Resources Commission (VMRC) has management authority and can enact regulations provided they maintain compliance with the ASMFC Atlantic menhaden fishery management plan (FMP).

In 1981, the ASMFC established the first Atlantic menhaden FMP, and over the 20 years that followed, management regulations were modest with no annual quota levels or harvest caps. However, coincident with a national movement to consider ecosystem principles more formally in fisheries management, the ASFMC modified the FMP in 2001 to explicitly recognize the ecological importance of Atlantic menhaden. This new philosophy stimulated broader thinking about Atlantic menhaden as a key forage species and the potential impacts of fishery removals on ecosystem processes. Although landings during the 2000s were significantly lower than historic levels, the proportion from Chesapeake Bay had increased due to the concentration of purse seine fishing in the mid-Atlantic resulting from closure of surrounding reduction facilities. Concurrently, striped bass in the bay were showing signs of poor condition and skin lesions from the outbreak of mycobacteriosis, which is a subacute to chronic disease with reported prevalence levels greater than 60%. Taken together, managers and stakeholders began to express concern about 'localized depletion', or more specifically that reduction fishery removals in the bay were driving the local Atlantic menhaden abundance below the level necessary to maintain its role as a forage species. In response to these concerns, the ASMFC implemented a harvest cap on the reduction sector in Chesapeake Bay that limited removals to 109,020 mt, which was the average of the 2001-2005 reduction landings from the bay. The cap was a precautionary measure designed to limit expansion of reduction fishing in an ecologically important region. In 2012, the ASFMC established a coastwide total landings quota of 170,800 mt and lowered the bay cap for the reduction sector to 87,216 mt. Since that time, the coastwide quota has fluctuated modestly based on the results of stock assessments and ecological modeling activities, but in 2018, the bay cap was further reduced to 51,000 mt, which was again based on average reduction landings from the bay over the previous 5-year period.

Stock assessments designed to provide stock status information for Atlantic menhaden have been routinely conducted since the early 2000s, and results have predominantly indicated that the coastwide population is healthy. Notably, the 2019 and 2022 multispecies ecological assessments designed to account for Atlantic menhaden's role as a forage fish both indicated that the coastwide

stock was not overfished and was not experiencing overfishing. Despite these favorable determinations, recreational and environmental stakeholders continue to express concern over the health of Chesapeake Bay and the adequacy of Atlantic menhaden abundance to fulfill its ecological role within the estuary. This concern motivated stakeholders to lobby the Governor's Office during fall 2022, and members of the General Assembly during the 2023 legislative session for more conservative Atlantic menhaden regulations. One outcome of those lobbying efforts was Senate Bill 1388, which is an Act that directs the Virginia Institute of Marine Science (VIMS) to develop a plan for studying the ecology, fishery impacts, and economic importance of Atlantic menhaden in the waters of the Commonwealth.

## 3.2 Senate Bill 1388

*An Act to direct the Virginia Institute of Marine Science to develop plans for studying the ecology, fishery impacts, and economic importance of menhaden populations in the waters of the Commonwealth; report.*

[S 1388]

Approved March 22, 2023

Be it enacted by the General Assembly of Virginia:

1. *§ 1. That the Virginia Institute of Marine Science (VIMS) shall develop plans for studying the ecology, fishery impacts, and economic importance of menhaden populations in the waters of the Commonwealth. Such plans shall (i) include anticipated methodologies, timelines, and costs; (ii) identify relevant stakeholders for participation; and (iii) state whether VIMS is the most appropriate entity to perform the study. In developing the plans, VIMS shall collaborate with and receive input from the Menhaden Management Advisory Committee established in § 28.2-208.2 of the Code of Virginia and the Atlantic Menhaden Technical Committee of the Atlantic States Marine Fisheries Commission and other relevant stakeholders.*

*VIMS shall, no later than September 1, 2023*, provide a report on its findings to the Chairmen of the Senate Committee on Agriculture, Conservation and Natural Resources and the House Committee on Agriculture, Chesapeake and Natural Resources and the Secretary of Natural and Historic Resources.*

* Extension granted to October 1, 2023

### 3.3 Atlantic Menhaden Workshop

VIMS recognized that Senate Bill 1388 presented a unique opportunity to bring together stakeholders with diverse backgrounds and varying perspectives on issues surrounding Atlantic menhaden for a collaborative meeting to identify and prioritize future research topics. Accordingly, VIMS held a stakeholder workshop on August 8-9, 2023, on the campus of William & Mary in Williamsburg, Virginia. The goals of the workshop were to: 1) identify common goals ('fundamental objectives') and topic ideas around a forward-looking research agenda for studying the ecology, fishery impacts, and economic importance of Atlantic menhaden in the waters of the Commonwealth, 2) prioritize research topic ideas considering shared goals and feasibility, and 3) build greater understanding and collaboration across stakeholder groups. Approximately 20 attendees representing the reduction and bait sectors, recreational anglers, state and federal agencies, academia, the ASMFC Atlantic Menhaden Technical Committee, and an NGO participated in the workshop (Section 5). A professional facilitator from the Institute for Engagement and Negotiation, University of Virginia, guided the workshop proceedings and coordinated the discussion (Section 6). All recommendations stemming from the workshop were arrived at through a consensus building approach. Overall, the workshop was highly collaborative and productive, and what follows is a prioritized summary of Atlantic menhaden research topics identified within the themes of ecology, fishery impacts, and economic importance.

## 4 Research Priorities

### 4.1 Ecology

Research on the biology and ecology of Atlantic menhaden has been ongoing since the 1950s. Early work focused on fundamental topics such as timing and occurrence of eggs and larvae, age determination, maturity and reproduction, population size structure, and movement patterns along the coast. These studies provided valuable baseline insights and served as motivation for many subsequent research projects aimed at refining or expanding upon this historical information. Although the breadth and depth of research on Atlantic menhaden has grown considerably over time, previous research efforts did not differentiate between estuarine and coastal habitats because the home range of Atlantic menhaden spans the entire east coast. However, contraction of the reduction sector to a single processing facility in Virginia combined with increased public concern about potential fishing impacts on ecosystem processes in Chesapeake Bay have motivated many bay-centric questions. Accordingly, the following ecological research topics are proposed.

1) Title: Estimate the seasonal abundance of Atlantic menhaden in Chesapeake Bay

Rationale: Although the routinely conducted coastwide Atlantic menhaden stock assessment provides estimates of total population size, the underlying analytical framework is not able to resolve abundance estimation at more

refined spatial scales, such as Chesapeake Bay. This is because the goal of this modeling effort is to assess the sustainability of all reduction and bait fishing activities across the full range of Atlantic menhaden. Developing a spatially-explicit version of the coastwide modeling framework that isolates Chesapeake Bay would allow estimation of bay-specific abundance and survival over time. Annual abundance and survival estimates for the bay would allow fishery removals to be formally assessed with respect to the standing stock of Atlantic menhaden and its ability to provide ecological functions. Bay-specific estimates could then be linked to environmental variables to assess how Atlantic menhaden respond to changing physical conditions.

Methodology: Developing seasonal estimates of abundance for Atlantic menhaden in Chesapeake Bay would require a two-pronged approach. First, extant catch and effort data for the reduction and bait sectors would need to be acquired, analyzed, and introduced into an appropriate spatial population modeling framework. Second, the fisheries-dependent information would need to be supplemented with survey data collected according to a scientifically valid sampling design. Since Atlantic menhaden are very difficult to sample using traditional fish survey methods due to their surface oriented, schooling behavior, it would be necessary to implement a survey that uses novel, technologically advanced instrumentation. This could include partnering with the reduction sector to charter airplanes for aerial surveys and/or relying on ship based hydroacoustic surveys using, for example, a Simrad EK80 scientific echosounder. Survey frequency would need to be no less than twice monthly from March to November to adequately sample the seasonally changing abundance of Atlantic menhaden in Chesapeake Bay.

Collaborators: Reduction and bait sectors, recreational anglers, NGOs

Agency: Virginia Institute of Marine Science with support from the University of Maryland Center for Environmental Science

Timeline: 3 years

Cost: $1,100,000

2) Title: Evaluate movement rates of Atlantic menhaden between the Atlantic coast and Chesapeake Bay

Rationale: In the late-1960s, the National Marine Fisheries Service initiated a large-scale Atlantic menhaden tag-recovery study. Teams of scientists from 12 coastal states tagged fish over several years. In total, over 1 million fish were injected with individually numbered ferromagnetic tags, which were then passively recovered by magnets installed in reduction fishery plants located from Maine to Florida. Historic and recent analyses of these data have provided informative, broad-scale assessments of seasonal movement patterns along the Atlantic coast. However, in addition to the age of the data, the spatial structure does not permit evaluating fine scale movements between coastal and estuarine environments. Understanding contemporary seasonal movement rates of Atlantic menhaden among coastal habitats and Chesapeake Bay would provide important insight into the residence time of fish in the estuary, which in turn, helps address the ecological benefits Atlantic menhaden provide to the bay. Additionally, linking movement rates to environmental drivers would allow identification of factors that influence occupancy of different habitats.

Methodology: Reproducing the ferromagnetic tagging study would be very challenging for several reasons: 1) the high volume of annual Atlantic menhaden landings would require tagging several hundred thousand fish to ensure a reasonable tag-recovery rate, and personnel is limited, 2) the access to ocean fish for tagging is restricted due to the reduction sector being one company with few, fully subscribed purse seine vessels, and 3) harvest of Atlantic menhaden during a purse seine trip is often a mixture of ocean and bay caught fish, which does not allow assignment of the recapture location of a tagged fish to either the coast or estuary. However, acoustic tagging technology has evolved in recent years and tag sizes have become increasingly smaller to accommodate studies of juvenile fish movement. These smaller tags hold promise for Atlantic menhaden, and pairing them with strategically positioned hydroacoustic receivers would yield information on coastal and estuarine movements and residence times.

Collaborators: Reduction and bait sectors

Agency: Virginia Institute of Marine Science

Timeline: 3 years

Cost: $330,000

3) Title: Assess impacts of predator demand and consumption of Atlantic menhaden

Rationale: It is well understood that Atlantic menhaden is a key forage species for many finfishes, marine mammals, and seabirds. Some finfish and osprey diet composition data are available for Chesapeake Bay and the Atlantic coast, however, across the full spectrum of known Atlantic menhaden predators and times and areas where predator-prey interactions occur, major data gaps remain. Expanding fieldwork, data collection, and analyses aimed at quantifying consumption of Atlantic menhaden more comprehensively would aid assessment of predatory demand and impacts. Modeling work could also provide insight into how Atlantic menhaden abundance influences the demographic rates and dynamics of finfish predators and osprey populations.

Methodology: Extant finfish (> 50 species) and osprey diet data would serve as the basis for this analysis, however, these data would be augmented with newly collected samples from additional predators, regions, and seasons. Sample acquisition will be achieved through collaboration with recreational anglers (stomachs of landed fish) and other fish survey programs, as well as from targeted bottom trawl survey cruises offshore during winter. Information on the diet composition of marine mammals would be acquired through collaborations with academic colleagues and NGOs. Data from all sources would then be combined into a single statistical analysis designed to yield a time-series of predator consumption of Atlantic menhaden in Chesapeake Bay and beyond. Dynamic predator-prey models will be constructed for key finfish predators and osprey to explore Atlantic menhaden abundance regulates predator population dynamics.

Collaborators: Recreational anglers and NGOs

Agency: Virginia Institute of Marine Science and William & Mary

Timeline: 2 years

Cost: $770,000

## 4.2 Fishery Impacts

The fish community of Chesapeake Bay is very dynamic. Residence time for most fishes inhabiting the bay is less than six months because of the extreme seasonal changes in water temperature. Species found in northern regions enter the bay during the colder months while those associated

with southern regions utilize the bay during the warmer months. Despite the rapidly changing fish community, Chesapeake Bay has a rich history of supporting diverse fisheries that target a range of species. Although this fishing history is an important cultural aspect of the Commonwealth, limited attention has been directed toward characterizing patterns and changes in fishing practices in the bay over time for both the commercial and recreational sectors. Analyses of fishing strategies can reveal information on patterns of availability of target species over time and space. Since this type of information can aid efforts to evaluate fishery impacts on natural resources, the following research topics are proposed.

1) Title: Analyze spatiotemporal patterns in Atlantic menhaden commercial fishing effort in Chesapeake Bay

Rationale: Since commercial fishers typically set gear in areas that are expected to hold fish, fishing effort data contains information about the availability of target species over time and space. In the case of Atlantic menhaden, a thorough analysis of reduction and bait fishing effort data in Chesapeake Bay would provide key information on the seasonal and spatial distribution patterns of fish, and most importantly, insight regarding potential changes in those distributional patterns. Additionally, linking fishing locations with environmental variables would also yield insight into fine scale Atlantic menhaden availability, movements, and habitat utilization.

Methodology: Quantifying long-term patterns of the Atlantic menhaden fisheries in Chesapeake Bay would require the acquisition of commercial catch and effort data at relatively fine spatial and temporal scales. These data could then be incorporated into an appropriate spatiotemporal model, which would yield insight into changes that have occurred with the fishery, as well as into possible shifts in habitat usage by Atlantic menhaden in the bay. Linking these model outputs to an array of environmental covariates could uncover potential drivers of any spatial or temporal changes observed.

Collaborators: Reduction and bait sectors

Agency: Virginia Institute of Marine Science and Virginia Marine Resources Commission

Timeline: 2 years

Cost: $192,000

2) Title: Assess the possibility of localized depletion of Atlantic menhaden in Chesapeake Bay

Rationale: A significant concern routinely voiced by stakeholders is whether Atlantic menhaden fishery removals from the bay are detrimental to the overall health of the estuary. The term 'localized depletion' refers to a situation where fishery removals are concentrated in a relatively small area compared to the home range of the target species, the scale of those removals exceeds the threshold required to sustain normal ecosystem processes, and replenishment of harvested biomass does not occur rapidly. In general, localized depletion is a challenging concept to address in fisheries science, particularly for highly mobile species that engage in seasonal migrations. At a minimum, four types of information are needed to address this issue for Atlantic menhaden: 1) tabulated harvest removals from Chesapeake Bay annually, 2) estimates of abundance in the bay each year, 3) annual estimates of fish residence time in the bay, and 4) yearly movement rates between the coastal Atlantic and the bay. A more comprehensive understanding of predation impacts and how Atlantic menhaden abundance affects the dynamics of predator populations would also be beneficial. Therefore, formally addressing localized depletion cannot be accomplished unless research is conducted to address topics 1-3 in the Ecology section above.

Methodology: Addressing localized depletion would involve synthesizing the results of topics 1-3 in the Ecology section above.

Collaborators: Reduction and bait sectors, recreational anglers, NGOs

Agency: Virginia Institute of Marine Science

Timeline: 2 years

Cost: Included in costs for Fishery Impacts topic 1

3) Title: Quantify changes in the recreational fisheries in Chesapeake Bay

Rationale: Chesapeake Bay supports many forms of recreation for the citizens of the Commonwealth and beyond, and recreational fishing consistently ranks as one of the most popular pastimes. Many fish species that seasonally inhabit the bay are prized targets of recreational anglers, including striped

bass, cobia, bluefish, sea trout, and summer flounder. Several of these species and others routinely targeted by anglers have strong linkages to Atlantic menhaden as forage, so it is likely that patterns in recreational fishing effort reflect information about the availability of target species, and by extension, Atlantic menhaden. Additionally, a comprehensive analysis of recreational fishing participation, effort, and success would yield indicators on the viability of this industry and its role as an economic driver for the Commonwealth.

Methodology: Data on recreational participation, effort, and harvest would be acquired from the Virginia Marine Resources Commission and the NOAA Marine Recreational Information Program. Spatiotemporal patterns in these data would be quantified following the analytical approach outlined in topic 1 of the Fishery Impacts section above.

Collaborators: Recreational anglers

Agency: Virginia Institute of Marine Science and Virginia Marine Resources Commission

Timeline: 2 years

Cost: Included in costs for Fishery Impacts topic 1

## 4.3 Economic Importance

Fisheries systems include both fish and people. Consequently, fisheries management should include biological, socioeconomic, and governance considerations. Historically, management policies and governance focused on biological sustainability and aimed to maximize continual harvests. Nowadays governments, NGOs, community-based organizations, and foundations are working to manage fisheries that achieve both ecological sustainability and human well-being outcomes. This transformation has been partially achieved for Atlantic menhaden in that ASMFC now uses ecological reference points that explicitly reflect the predation needs to guide the process of setting coastwide total landings quotas. While this ecosystem-approach to management philosophy represents a major step forward, lacking is comparable progress evaluating the socioeconomic impacts and tradeoffs of management policies for Atlantic menhaden. Accordingly, the following economic research topics are proposed.

1) Title: Assess the economic impacts of management decisions on Atlantic menhaden fisheries and related industries

Rationale: Fisheries management decisions are frequently based on achieving biological sustainability. However, it has been recognized that biological objectives can often be met through several different management policies, each of which vary in their socioeconomic impacts. The socioeconomic effects of competing policies are often not quantified, which hinders the evaluation of tradeoffs among management options. Atlantic menhaden fisheries support hundreds of jobs in the Commonwealth and products derived from the reduction and bait sectors are utilized by an array of businesses located in Virginia as well as throughout the U.S. and internationally. Thus, management measures implemented for Atlantic menhaden fisheries have cascading effects in local economies and beyond. Assessing these effects would allow fisheries managers to more holistically consider the tradeoffs associated with regulatory options.

Methodology: Using the results of a contemporary economic impact analysis (see topic 2 below), evaluate the economic effects of candidate management strategies on the Atlantic menhaden commercial fisheries in Chesapeake Bay, as well as the associated secondary and tertiary industries.

Collaborators: Reduction and bait sectors, recreational anglers, NGOs

Agency: Virginia Institute of Marine Science

Timeline: 3 years

Cost: $308,000

2) Title: Conduct a contemporary assessment of the social and economic importance of Atlantic menhaden in the Chesapeake Bay region

Rationale: Socioeconomic studies of the Atlantic menhaden fisheries have been conducted in the past, and while they can serve as a baseline framework, changes in the fisheries, regulatory structure, and the economy over the last two decades have made prior work less relevant today. Additionally, previous studies have generally been narrowly defined and of limited use in assessing management tradeoffs. Developing a framework to provide updated economic impact analyses using contemporary methods has been identified as an important priority. Further, there has been expressed interest in quantifying the economic impacts and importance of these fisheries to the Northern Neck, particularly since a large portion of the reduction sector workforce comes from underserved communities.

Methodology: Standard socioeconomic data will be compiled from the reduction and bait sectors to develop an economic impact model for the Atlantic menhaden fisheries in the Chesapeake Bay region. Additionally, non-market valuation methods will be used to quantify the economic importance of Atlantic menhaden to the recreational sector.

Collaborators: Reduction and bait sectors, recreational anglers

Agency: Virginia Institute of Marine Science and Virginia Marine Resources Commission

Timeline: 2 years

Cost: Included in costs for Economic Importance topic 1

3) Title: Quantify the bioeconomic impact of Atlantic menhaden fishery removals from the Chesapeake Bay to those from the Atlantic coast

Rationale: Recreational and environmental stakeholders routinely advocate for a ban on purse seine fishing in Chesapeake Bay. Such a restriction would force all harvesting activities to occur in the coastal ocean which has both biological and economic consequences. Biologically, Atlantic menhaden in the bay are generally younger and thus have a lower reproductive output when compared to the older fish in the ocean. Therefore, harvesting exclusively in the ocean has the potential to reduce the reproductive capacity of the population. Economically, fishing in the ocean would incur additional costs, safety concerns, and lost fishing opportunities due to weather. Conversely, increased local availability of menhaden in Chesapeake Bay could improve recreational angler outcomes and associated value. Quantifying these bioeconomic impacts would allow fisheries managers to evaluate tradeoffs associated with the establishment of a marine protected area in Chesapeake Bay.

Methodology: Develop a spatially-explicit, bioeconomic simulation model for Atlantic menhaden in Chesapeake Bay and the coastal ocean. Results from past stock assessments and topics 1-3 in the Ecology section would inform the biological component of the model, while results from topics 1-2 in this section would guide the economic component. Once developed, the impacts of a variety of harvest policies could be quantified, including declaring the Chesapeake Bay a marine protected area.

| | |
|---|---|
| Collaborators: | Reduction and bait sectors, recreational anglers, NGOs |
| Agency: | Virginia Institute of Marine Science |
| Timeline: | 2 years |
| Cost: | Included in costs for Economic Importance topic 1; highly dependent on achieving Ecology topics 1-2 |

# 5 Workshop Participants

| Participant | Affiliation |
|---|---|
| Robert Latour | Virginia Institute of Marine Science |
| Mark Luckenbach | Virginia Institute of Marine Science |
| Cecilia Lewis | Virginia Institute of Marine Science |
| Kristina Weaver | Institute for Engagement and Negotiation, University of Virginia |
| Jim Gartland | Virginia Institute of Marine Science |
| Caroline DeVries | Virginia Institute of Marine Science |
| Andrew Scheld | Virginia Institute of Marine Science |
| Shanna Madsen | Virginia Marine Resources Commission, ASMFC Atlantic Menhaden Technical Committee member - Virginia |
| Amy Schueller | NOAA Beaufort Laboratory |
| Genevieve Nesslage | University of Maryland Center for Environmental Science |
| Michael Wilberg | University of Maryland Center for Environmental Science |
| Bryan Watts | William & Mary |
| Montgomery Deihl | Ocean Harvesters |
| Peter Himchak | Omega Protein |
| Ross Kellum | Kellum Maritime, LLC |
| Frederick Rogers | Rogers Bait Company |
| Bruce Vogt | NOAA Chesapeake Bay Office |
| Lynn Fegley | Maryland Department of Natural Resources |
| Alexei Sharov | Maryland Department of Natural Resources ASMFC Atlantic Menhaden Technical Committee member - Maryland |
| Allison Colden | Chesapeake Bay Foundation |
| Steve Atkinson | Virginia Saltwater Sportfishing Association |

# 6 Workshop Agenda

**Menhaden Workshop: Identifying Shared Goals for Future Research**

August 8-9, 2023

Leadership Hall
Alumni House, William & Mary

Meeting Purpose

1. Identify common goals ("fundamental objectives") and topic ideas around a forward-looking research agenda studying the ecology, fishery impacts, and economic importance of menhaden populations in the Commonwealth (S 1388)
2. Prioritize research topic ideas considering shared goals and feasibility
3. Build greater understanding and collaboration across stakeholder groups

Day 1 Agenda

| | |
|---|---|
| 9:00 – 9:30 | Coffee/Networking |
| 9:30 – 10:00 | Opening Remarks and Introductions |
| 10:00 – 11:00 | Overview of Research Context |
| 11:00 – 11:15 | Break |
| 11:15 – 11:30 | Overview of Dialogue Process |
| 11:30 – 12:30 | Generate Ideas for Research Topics |
| 12:30 – 1:30 | Lunch |
| 1:30 – 2:30 | Generate Ideas for Research Topics |
| 2:30 – 2:45 | Break |
| 2:45 – 4:15 | Develop Foundational Objectives for Future Research |
| 4:15 – 4:45 | Closing Day 1 |

| Day 2 Agenda | |
|---|---|
| 9:00 – 9:30 | Day 2 Kickoff |
| 9:30 – 10:00 | Discussion: Considerations for Research Feasibility |
| 10:00 – 10:45 | Evaluating Research Topics |
| 10:45 – 11:00 | Break |
| 11:00 – 11:45 | Resources for Implementing Research |
| 11:45 – 12:10 | Next Steps |
| 12:10 – 12:30 | Closing the Workshop |