

Monterey Bay Aquarium Seafood Watch®

Bay scallops

Argopecten irradians



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New York, Massachusetts/Northwest Atlantic

Towed dredges

Published May 1, 2017, Reviewed December 10, 2019 – see Appendix A for more information

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Disclaimer

Seafood Watch® strives to have all Seafood Reports reviewed for accuracy and completeness by external scientists with expertise in ecology, fisheries science and aquaculture. Scientific review, however, does not constitute an endorsement of the Seafood Watch program or its recommendations on the part of the reviewing scientists. Seafood Watch is solely responsible for the conclusions reached in this report.

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About Seafood Watch

Monterey Bay Aquarium's Seafood Watch program evaluates the ecological sustainability of wild-caught and farmed seafood commonly found in the United States marketplace. Seafood Watch defines sustainable seafood as originating from sources, whether wild-caught or farmed, which can maintain or increase production in the long-term without jeopardizing the structure or function of affected ecosystems. Seafood Watch makes its science-based recommendations available to the public in the form of regional pocket guides that can be downloaded from www.seafoodwatch.org. The program's goals are to raise awareness of important ocean conservation issues and empower seafood consumers and businesses to make choices for healthy oceans.

Each sustainability recommendation on the regional pocket guides is supported by a Seafood Watch Assessment. Each assessment synthesizes and analyzes the most current ecological, fisheries and ecosystem science on a species, then evaluates this information against the program's conservation ethic to arrive at a recommendation of "Best Choices," "Good Alternatives" or "Avoid." This ethic is operationalized in the Seafood Watch standards, available on our website here. In producing the assessments, Seafood Watch seeks out research published in academic, peer-reviewed journals whenever possible. Other sources of information include government technical publications, fishery management plans and supporting documents, and other scientific reviews of ecological sustainability. Seafood Watch Research Analysts also communicate regularly with ecologists, fisheries and aquaculture scientists, and members of industry and conservation organizations when evaluating fisheries and aquaculture practices. Capture fisheries and aquaculture practices are highly dynamic; as the scientific information on each species changes, Seafood Watch's sustainability recommendations and the underlying assessments will be updated to reflect these changes.

Parties interested in capture fisheries, aquaculture practices and the sustainability of ocean ecosystems are welcome to use Seafood Watch assessments in any way they find useful.

Guiding Principles

Seafood Watch defines sustainable seafood as originating from sources, whether fished¹ or farmed that can maintain or increase production in the long-term without jeopardizing the structure or function of affected ecosystems.

The following guiding principles illustrate the qualities that fisheries must possess to be considered sustainable by the Seafood Watch program (these are explained further in the Seafood Watch Standard for Fisheries):

- Follow the principles of ecosystem-based fisheries management.
- Ensure all affected stocks are healthy and abundant.
- Fish all affected stocks at sustainable levels.
- Minimize bycatch.
- Have no more than a negligible impact on any threatened, endangered or protected species.
- Managed to sustain the long-term productivity of all affected species.
- Avoid negative impacts on the structure, function or associated biota of aquatic habitats where fishing occurs.
- Maintain the trophic role of all aquatic life.
- Do not result in harmful ecological changes such as reduction of dependent predator populations, trophic cascades, or phase shifts.
- Ensure that any enhancement activities and fishing activities on enhanced stocks do not negatively affect the diversity, abundance, productivity, or genetic integrity of wild stocks.

These guiding principles are operationalized in the four criteria in this standard. Each criterion includes:

- Factors to evaluate and score
- Guidelines for integrating these factors to produce a numerical score and rating

Once a rating has been assigned to each criterion, we develop an overall recommendation. Criteria ratings and the overall recommendation are color coded to correspond to the categories on the Seafood Watch pocket guide and online guide:

Best Choice/Green: Are well managed and caught in ways that cause little harm to habitats or other wildlife.

Good Alternative/Yellow: Buy, but be aware there are concerns with how they're caught.

Avoid/Red Take a pass on these for now. These items are overfished or caught in ways that harm other marine life or the environment.

¹ "Fish" is used throughout this document to refer to finfish, shellfish and other invertebrates

Summary

This report covers bay scallop (*Argopecten irradians*) dredge fisheries in New York and Massachusetts. From 2009 through 2014, New York and Massachusetts accounted for 97.3% of bay scallop landings in the United States, and at least 75% of bay scallop landings are made in Massachusetts. Bay scallop ranges from the north shore of Cape Cod, Massachusetts south to Laguna Madre, Texas. The overall range of bay scallop is not continuous; the coastal environments of South Carolina and Georgia are not suitable for supporting many scallops. Bay scallop occurs in bays, sounds, and estuarine environments, and relies on eelgrass and other submerged aquatic vegetation to complete its life cycle. Compared to other mollusks, it is unusually short-lived; it reaches a maximum age of 1–2 years, and only spawns once in its life cycle. Bay scallop abundance in New York and Massachusetts is low compared to historical abundance prior to the 1980s. In the 1980s, bay scallop abundance decreased sharply due to brown tides. Bay scallop populations in New York and other coastal areas have yet to return to their historic levels. This is believed to be tied to the low densities of spawning stock, which result in low fertilization success, and to the loss of its optimal habitat, eelgrass beds—although bay scallop can survive and reproduce successfully on other submerged aquatic vegetation. Formal stock assessments are not conducted by either New York or Massachusetts for their bay scallop fisheries, but landings are significantly correlated to biomass. Bay scallop is relatively resilient to fishing pressure, because it is fished between when it spawns and when it experiences mortality during its second year. Overall, the low abundance of bay scallops drove the “Yellow” score for Criterion 1.

No complete data sets currently exist for bycatch in the bay scallop fishery, although Massachusetts requires reporting of any bycatch that is retained. But some local jurisdictions limit the amount of bycatch to a specified percentage of landings. Because bycatch rates were variable and may have been above the Seafood Watch assessment threshold of 5 percent, bycatch was analyzed using the Seafood Watch unknown bycatch matrices. Both finfish and benthic invertebrates drove the score of “Yellow” for Criterion 2 because of the moderate likelihood of their being caught and the moderate likelihood of mortality as bycatch.

New York and Massachusetts are able to regulate specific aspects of the bay scallop fishery on the state level, such as size limits, daily catch limits, season limits, and gear limits, but other management decisions, such as bycatch limits and habitat closures, are made at the local level. Because this is a small-scale fishery, the management techniques use an appropriate strategy that requires only minimal monitoring, including the seasonal fishery opening, local eelgrass protections and, in the case of Massachusetts, monitoring of species landed with bay scallops. The factors under the Criterion 3 score were all rated as “moderate.” This drove the overall Criterion 3 score of “Yellow.”

The bay scallop dredge fishery takes place on sandy areas adjacent to eelgrass habitat, and rarely on eelgrass habitat itself. Although dredging on eelgrass occurs rarely, dredging on eelgrass leads to dramatically decreased shoot densities and eelgrass biomass. Bay scallop depends on eelgrass and other submerged aquatic vegetation to successfully complete its life cycle, specifically when it settles out of the water column in the juvenile stage. Only larvae settling onto relatively stable eelgrass beds and other submerged aquatic vegetation appear to form reproductively significant populations; however, juveniles may use a variety of epibenthic substrates for attachment and do not depend solely on submerged vegetation. Eelgrass appears to be somewhat resilient to dredging activity in the winter months, when the scallop fishery is active. For this reason, Factor 4.1 is deemed “moderate” concern, and drives the overall score of “Yellow” for Criterion 4.

In summary, the wild-capture bay scallop fishery in New York and Massachusetts received a “Yellow” or “Good Alternative” ranking primarily because of the low abundance of bay scallop, the lack of information on catch composition in the fishery, and the fishery’s impacts to bay scallop habitat.

Final Seafood Recommendations

SPECIES FISHERY	CRITERION 1: Impacts on the Species	CRITERION 2: Impacts on Other Species	CRITERION 3: Management Effectiveness	CRITERION 4: Habitat and Ecosystem	OVERALL RECOMMENDATION
Bay scallop Massachusetts/Northwest Atlantic Towed dredges United States of America	Yellow (2.236)	Yellow (2.644)	Yellow (3.000)	Yellow (2.739)	(2.640)
Bay scallop New York/Northwest Atlantic Towed dredges United States of America	Yellow (2.236)	Yellow (2.644)	Yellow (3.000)	Yellow (2.739)	(2.640)

Summary

In summary, the wild-capture bay scallop fishery in New York and Massachusetts received a **Good Alternative** ranking primarily because of the low abundance of bay scallop, the lack of information on catch composition in the fisheries, and the fisheries' impacts to bay scallop habitat.

Scoring Guide

Scores range from zero to five where zero indicates very poor performance and five indicates the fishing operations have no significant impact.

Final Score = geometric mean of the four Scores (Criterion 1, Criterion 2, Criterion 3, Criterion 4).

- **Best Choice/Green** = Final Score >3.2, and no Red Criteria, and no Critical scores
- **Good Alternative/Yellow** = Final score >2.2-3.2, and neither Harvest Strategy (Factor 3.1) nor Bycatch Management Strategy (Factor 3.2) are Very High Concern², and no more than one Red Criterion, and no Critical scores
- **Avoid/Red** = Final Score ≤2.2, or either Harvest Strategy (Factor 3.1) or Bycatch Management Strategy (Factor 3.2) is Very High Concern or two or more Red Criteria, or one or more Critical scores.

² Because effective management is an essential component of sustainable fisheries, Seafood Watch issues an Avoid recommendation for any fishery scored as a Very High Concern for either factor under Management (Criterion 3).

Introduction

Scope of the analysis and ensuing recommendation

This report covers bay scallop (*Argopecten irradians*) dredge fisheries in New York and Massachusetts. From 2009 through 2014, Massachusetts and New York accounted for 97.3% of the bay scallop landings in the United States, and at least 75% of bay scallop landings are made in Massachusetts (NOAA 2016a). The dredge fishery included 56% of the annual United States landings in 2014; 43% of the landings did not report a gear type, and rakes and other hand gears made up 1% of the landings (NOAA 2016a). The landings that did not report a gear type were likely made with dredges.

Species Overview

Bay scallop ranges from the north shore of Cape Cod, Massachusetts south to Laguna Madre, Texas (NCDMF 2015). The overall range of bay scallops is not continuous; the coastal environments of South Carolina and Georgia are not suitable for supporting many scallops (MacKenzie 2008b). Bay scallop occurs in bays, sounds, and estuarine environments, and relies on eelgrass and other submerged aquatic vegetation to complete its life cycle. Compared to other mollusks, bay scallop is unusually short-lived; it reaches a maximum age of 1–2 years, and only spawns once in its life cycle. Bay scallop is hermaphroditic, but only eggs or sperm are released at any one time, to prevent self-fertilization. Eelgrass or other submerged aquatic vegetation, such as macroalgae, are important in the bay scallop life cycle because they provide an above-sediment surface for attachment of juvenile bay scallops to grow for a short period before dropping to the seafloor (NCDMF 2015).

Between the mid-1870s to the mid-1980s, bay scallops supported large commercial fisheries in Massachusetts, New York, and North Carolina. Bay scallop landings first decreased sharply between 1980 and 1990, and again between 1992 and 1996. Landings remained low until 2004, and have begun to increase since then ((NOAA 2016a) and Figure 1). The initial decrease in landings in the 1980s is suspected to have been caused by brown tide events that caused mass scallop mortality in New York, and water quality degradation that damaged the scallops' eelgrass habitat; a second brown tide event in 1995 decimated bay scallop populations a second time ((Valiela et al. 1992), (MacFarlane 1999), and (Tettelbach and Smith 2009)).

Bay scallop fisheries are managed at the state level. In New York, the state sets a fishing season, size limit, catch limit, gear restriction, and open and closed areas for shellfish harvest, but local jurisdictions may add restrictions and require permits for the harvest of bay scallops in their jurisdictions (NYDEC 2016a). Similarly, in Massachusetts, the state sets a fishing season, catch limit, and minimum size, but additional management, regulations, and permitting are done by local jurisdictions (MEEA 2016a).

Although the bay scallop fisheries in New York and Massachusetts have partially recovered from the brown tide events of the 1980s and 1990s (NOAA 2016a), bay scallop in North Carolina never completely recovered from a red tide in 1987 and several hurricanes in the 1990s. The stock in North Carolina is now more susceptible to environmental events, predation from cownose rays, and fishing effort ((Myers et al. 2007), (University of North Carolina 2007) and (NCDEQ 2016)). The current status of the bay scallop fishery in North Carolina is depleted. Under a Bay Scallop Management Plan, the Division of Marine Fisheries in North Carolina closed both the commercial and recreational bay scallop season indefinitely to allow the population to increase. Therefore this report will not cover the bay scallop fishery in North Carolina (NCDEQ 2016).

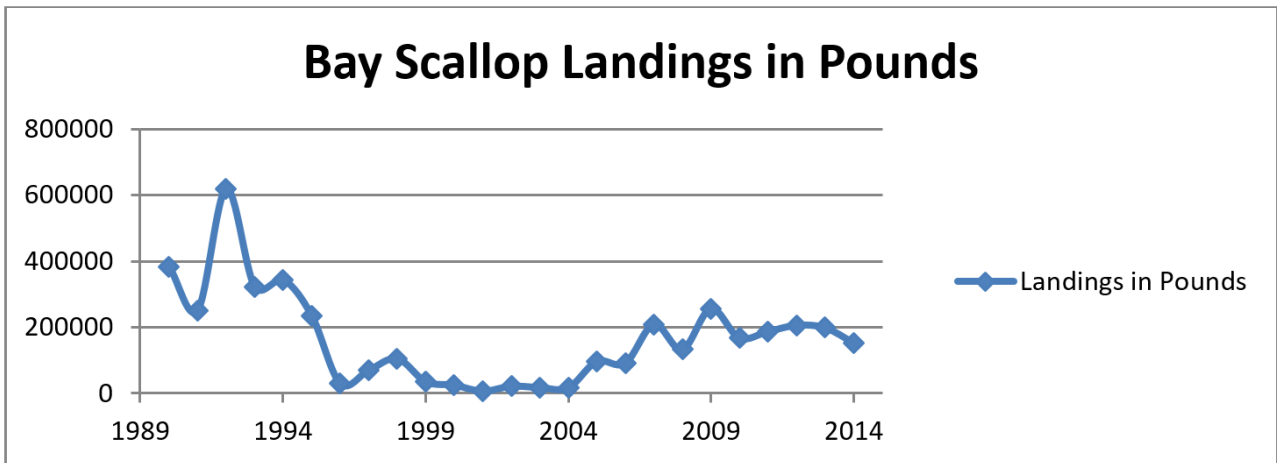


Figure 1 United States Bay Scallop Landings in Pounds (Source: NOAA 2016a)

Production Statistics

Bay scallop is only commercially fished on the East Coast of the United States; see above for a discussion of trends in commercial wild-caught bay scallop landings. A recreational fishery for bay scallops is active in Florida, but no commercial fishery is currently there (Stephenson et al. 2016). In addition to wild-caught scallop, two major aquaculture operations exist for bay scallop in the United States: one in Massachusetts and one in Florida. China is the largest source of imported farmed scallops into the United States; imports range from 4 million to 14 million kilograms of scallops (NOAA 2016b). Figure 2 below shows U.S. imports of scallops from 2006 to 2015 by country (NOAA 2016b).

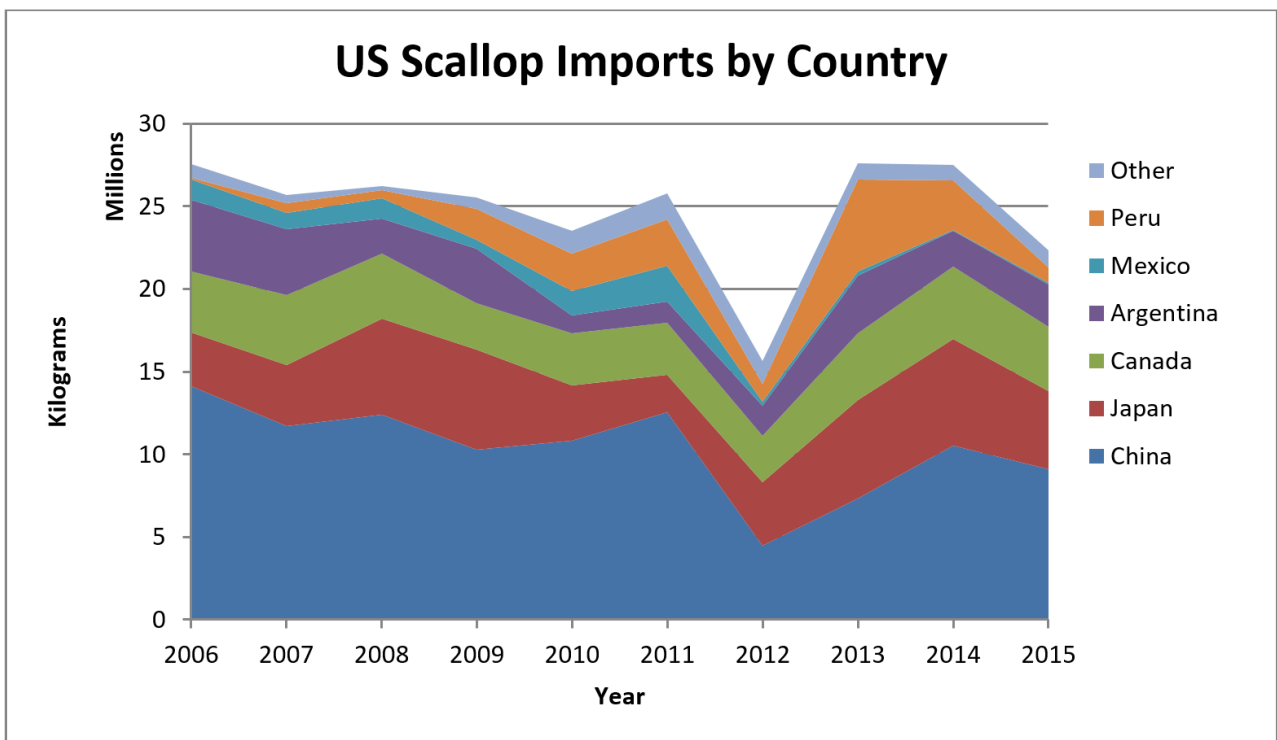


Figure 2 United States Scallop Imports by Country (Source: NOAA 2016b)

Importance to the US/North American market.

In general, about half of the United States' scallop consumption is imported; this includes bay scallop, sea scallop, calico scallop, and other scallop species. The leading foreign suppliers of scallop meats are China, Japan, and Canada (NOAA 2016b). The wild-caught scallop fishery supplies a smaller percentage of the bay

scallop meats available, but because the fishery occurs in the fall and winter in the northeast, it is an important source of income and economic activity to fishing communities during times that are otherwise slow (MacKenzie 2008a). Additionally, after restoration efforts, dockside revenues of the bay scallop fishery in Peconic Bays of Eastern Long Island New York increased by USD 2 million (Tettelbach et al. 2015).

Common and market names.

Bay scallop or scallop (FDA 2016)

Primary product forms

The only part of the bay scallop usually eaten in the United States is the adductor muscle, but in other countries, scallops are eaten with the roe attached to the adductor meat. Live scallop, which is eaten whole like clams or oysters, is increasingly popular as well (Pacific Seafood 2016). Bay scallop is smaller than sea scallop and its adductor muscle is cork-shaped (Cook's Country 2011). Bay scallop is available fresh or frozen (Pacific Seafood 2016) and is used in soups, stews, and stir-fries (Cook's Country 2011). Wild bay scallop from the northeast is more highly prized than bay scallop farmed elsewhere, such as China (Pacific Seafood 2016).

Assessment

This section assesses the sustainability of the fishery(s) relative to the Seafood Watch Standard for Fisheries, available at www.seafoodwatch.org. The specific standard used is referenced on the title page of all Seafood Watch assessments.

Criterion 1: Impacts on the Species Under Assessment

This criterion evaluates the impact of fishing mortality on the species, given its current abundance. When abundance is unknown, abundance is scored based on the species' inherent vulnerability, which is calculated using a Productivity-Susceptibility Analysis. The final Criterion 1 score is determined by taking the geometric mean of the abundance and fishing mortality scores. The Criterion 1 rating is determined as follows:

- Score >3.2=Green or Low Concern
- Score >2.2 and ≤3.2=Yellow or Moderate Concern
- Score ≤2.2=Red or High Concern

Rating is Critical if Factor 1.3 (Fishing Mortality) is Critical

Guiding Principles

- Ensure all affected stocks are healthy and abundant.
- Fish all affected stocks at sustainable level.

Criterion 1 Summary

BAY SCALLOP			
Region Method	Abundance	Fishing Mortality	Score
Massachusetts/Northwest Atlantic Towed dredges United States of America	1.00: High Concern	5.00: Low Concern	Yellow (2.236)
New York/Northwest Atlantic Towed dredges United States of America	1.00: High Concern	5.00: Low Concern	Yellow (2.236)

Criterion 1 Assessment

SCORING GUIDELINES

Factor 1.1 - Abundance

Goal: Stock abundance and size structure of native species is maintained at a level that does not impair recruitment or productivity.

- 5 (Very Low Concern) — Strong evidence exists that the population is above an appropriate target abundance level (given the species' ecological role), or near virgin biomass.
- 3.67 (Low Concern) — Population may be below target abundance level, but is at least 75% of the target level, OR data-limited assessments suggest population is healthy and species is not highly vulnerable.
- 2.33 (Moderate Concern) — Population is not overfished but may be below 75% of the target abundance

level, OR abundance is unknown and the species is not highly vulnerable.

- 1 (High Concern) — Population is considered overfished/depleted, a species of concern, threatened or endangered, OR abundance is unknown and species is highly vulnerable.

Factor 1.2 - Fishing Mortality

Goal: Fishing mortality is appropriate for current state of the stock.

- 5 (Low Concern) — Probable (>50%) that fishing mortality from all sources is at or below a sustainable level, given the species ecological role, OR fishery does not target species and fishing mortality is low enough to not adversely affect its population.
- 3 (Moderate Concern) — Fishing mortality is fluctuating around sustainable levels, OR fishing mortality relative to a sustainable level is uncertain.
- 1 (High Concern) — Probable that fishing mortality from all source is above a sustainable level.

BAY SCALLOP

Factor 1.1 - Abundance

MASSACHUSETTS/NORTHWEST ATLANTIC

Towed Dredges | United States Of America

NEW YORK/NORTHWEST ATLANTIC

Towed Dredges | United States Of America

High Concern

Bay scallop abundance in New York and Massachusetts is low compared to historical abundance prior to the 1980s. In the 1980s, bay scallop abundance decreased sharply due to brown tides. Bay scallop populations in New York and other coastal areas have yet to return to their historic levels. This is believed to be tied to the low densities of spawning stock, which result in low fertilization success and loss of its optimal habitat, eelgrass beds—although bay scallop can survive and reproduce successfully on other submerged aquatic vegetation ((NCDMF 2015) and (New York 2015)). Successful restoration efforts have occurred in New York ((MacKenzie 2008), (Carroll and Peterson 2013), (Tettelbach et al. 2013) and (Tettelbach et al. 2015)). Restoration efforts for bay scallop include reseeding scallops in high densities to allow for successful reproduction in the wild. The spat used for reseeding is collected from local wild populations and raised at a hatchery before dispersion (pers. comm., S. Tettelbach, Long Island University 2016). No stock assessments or target reference points are available at the state level for this fishery. The State of Massachusetts has begun collecting catch-per-unit-effort (CPUE) data, starting in 2010. The CPUE data is included in Table 3. Although these data are informative, they have only been collected for 6 years, and CPUE data collection started after the abundance was reduced substantially below pre-1980 levels, so it is insufficient to affect the abundance score. Because abundance is low and target reference points do not exist, bay scallop has been given a score of “high” concern for Factor 1.1.

Justification:

Table 3: Massachusetts Bay Scallop Fishery Landings and Effort Summary

MA Bay Scallop Fishery, Landings and Effort Summary, 2010-2015

YEAR	ACTIVE PERMITS	LIVE LBS	CPUE¹
2010	225	767,703	28.17
2011	240	894,137	39.38
2012	313	970,364	42.27
2013	275	1,075,301	46.87
2014	270	889,026	40.25
2015	212	557,920	29.94

SOURCE: Massachusetts Trip Level Reports, NMFS Vessel Trip Reports, Standard Atlantic Fisheries Information System Dealer Database

¹ CPUE = Live Lbs per Fishing Hour

Figure 3

Factor 1.2 - Fishing Mortality

MASSACHUSETTS/NORTHWEST ATLANTIC

Towed Dredges | United States Of America

NEW YORK/NORTHWEST ATLANTIC

Towed Dredges | United States Of America

Low Concern

No quantitative stock assessments are conducted for bay scallop in New York and Massachusetts, so estimates of fishing mortality are not available. Bay scallop is relatively resilient to fishing pressure, because the fishery only targets bay scallop that has previously spawned and has not yet experienced natural mass mortality during the winter of its second year ((MEEA 2016a) and (NYDEC 2016a)). Bay scallops that have spawned are distinguishable from those that have not by a “growth ring” that forms on the shell during the winter months when the scallop’s growth slows. Scallops that do not have the growth ring have not had a chance to reproduce the summer before, and are prohibited from being taken in both New York and Massachusetts. But New York allows for an unintentional bycatch of 2% juvenile scallops (New York 2016). Undersized scallops that are accidentally captured and placed back in the water are believed to have a very low mortality rate—substantially lower than the mortality rate of sea scallop discards—because the bay scallop dredge is much lighter than a sea scallop dredge, and the catch is usually processed in less than 5 minutes. Expert opinion estimates that accidentally captured undersized scallops experience a mortality of 1% or less (pers. comm., S. Tettelbach, Long Island University 2016).

Fishing effort data are unavailable in New York, but vessel trip tickets in Massachusetts provide both live pounds landed (this measurement includes the weight of the scallop shell) and number of hours fished. Table 3 in Factor 1.1 shows a summary of live pounds landed in Massachusetts as well as fishing effort. Data are available to the year 2010, and catch-per-unit-effort (CPUE) generally ranges between 28 live pounds per hour and 47 live pounds per hour (pers. comm., Massachusetts Division of Marine Fisheries Statistics Project 2016).

Given that bay scallop only has one reproductive cycle in a life-time and is only fished after spawning has occurred, it is likely that fishing mortality from all sources is at or below a sustainable level because removal by fishing does not affect this species’ reproductive capacity.

Criterion 2: Impacts on Other Species

All main retained and bycatch species in the fishery are evaluated under Criterion 2. Seafood Watch defines bycatch as all fisheries-related mortality or injury to species other than the retained catch. Examples include discards, endangered or threatened species catch, and ghost fishing. Species are evaluated using the same guidelines as in Criterion 1. When information on other species caught in the fishery is unavailable, the fishery's potential impacts on other species is scored according to the Unknown Bycatch Matrices, which are based on a synthesis of peer-reviewed literature and expert opinion on the bycatch impacts of each gear type. The fishery is also scored for the amount of non-retained catch (discards) and bait use relative to the retained catch. To determine the final Criterion 2 score, the score for the lowest scoring retained/bycatch species is multiplied by the discard/bait score. The Criterion 2 rating is determined as follows:

- Score >3.2=Green or Low Concern
- Score >2.2 and ≤3.2=Yellow or Moderate Concern
- Score ≤2.2=Red or High Concern

Rating is Critical if Factor 2.3 (Fishing Mortality) is Critical

Guiding Principles

- Ensure all affected stocks are healthy and abundant.
- Fish all affected stocks at sustainable level.
- Minimize bycatch.

Criterion 2 Summary

Only the lowest scoring main species is/are listed in the table and text in this Criterion 2 section; a full list and assessment of the main species can be found in Appendix A.

BAY SCALLOP					
Massachusetts/Northwest Atlantic Towed Dredges United States Of America					
Subscore:	2.644	Discard Rate:	1.00	C2 Rate:	2.644
Species Stock	Abundance	Fishing Mortality	Subscore		
Finfish	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)		
Benthic inverts	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)		

BAY SCALLOP					
New York/Northwest Atlantic Towed Dredges United States Of America					
Subscore:	2.644	Discard Rate:	1.00	C2 Rate:	2.644
Species Stock	Abundance	Fishing Mortality	Subscore		
Finfish	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)		
Benthic inverts	2.33:Moderate Concern	3.00:Moderate Concern	Yellow (2.644)		

No complete data sets currently exist for bycatch in the bay scallop fishery. New York collects landings data through records from scallop shippers using their monthly production figures, and Massachusetts only requires

reporting of catch that is retained, so any catch discarded at sea would not be reported. In New York, qualitative information from personal communications indicates that the most common bycatch species are knobbed whelks, channeled whelks, redbear and sulfur sponges, and quahogs (pers. comm., S. Tettelbach, Long Island University 2016). Table 6 shows bycatch species commonly landed with bay scallop in Massachusetts (pers. comm., Massachusetts Division of Marine Fisheries Statistics Project 2016). Bycatch rates in the bay scallop fishery are generally believed to be low (pers. comm., NOAA Northeast Fisheries Science Center 2016).

In both New York and Massachusetts, the state sets regulations for specific aspects of the fishery, such as fishing seasons and size limits, but does not limit bycatch to a specific percentage of the catch. Some local jurisdictions in New York and Massachusetts set bycatch limits for the bay scallop fishery, but the percentages of bycatch allowed in the total catch are variable. For example, in Nantucket, local fishing regulations prohibit any bycatch in excess of 5% of the total catch, but in Wellfleet, local regulations prohibit any bycatch in excess of 20% of the total catch ((Nantucket 2016a) and (Wellfleet 2015)). The Seafood Watch Criteria state that a bycatch species should be assessed under Criterion 2 if it makes up more than 5% of the total catch. Because the percentage of bycatch allowed in the bay scallop fishery is variable and is not always under 5% of the catch, bycatch is assumed to occur in the fishery. Main species present in bycatch were initially identified by using the Unknown Bycatch Matrices in Appendix 2 of the Seafood Watch Criteria (Seafood Watch 2016). The Unknown Bycatch Matrices identified sea turtles, finfish, and benthic invertebrates as species that should be investigated for analysis under Criterion 2. Finfish and benthic invertebrates were ultimately considered to be "main species" under Criterion 2 and are analyzed in the Criterion 2 assessment below.

Because of the highly vulnerable status of sea turtles, additional literature review was done to determine whether sea turtles interact with the bay scallop fishery and should be analyzed under Criterion 2. Sea turtles are found in New York and Massachusetts seasonally: they move into the area as waters warm in the spring and leave by the end of November as water temperatures cool (pers. comm., E. Keane, NOAA Sea Turtle Bycatch Reduction Specialist 2016). The bay scallop fishery is open from October 1 to March 31 in Massachusetts (although some local jurisdictions open their seasons later) and from the first Monday in November to March 31 in New York ((MEEA 2016a) and (NYDEC 2016a)). There is some temporal overlap in October and November, between when sea turtles are present in the area and when the bay scallop fishery operates. But there are no known documented interactions between sea turtles and the dredges used in the bay scallop fishery (pers. comm., E. Keane, NOAA Sea Turtle Bycatch Reduction Specialist 2016). Because sea turtles do not interact with the bay scallop fishery, they are not considered "main species" under Criterion 2 and will not be analyzed further.

Criterion 2 Assessment

SCORING GUIDELINES

Factor 2.1 - Abundance

(same as Factor 1.1 above)

Factor 2.2 - Fishing Mortality

(same as Factor 1.2 above)

FINFISH

Factor 2.1 - Abundance

NEW YORK/NORTHWEST ATLANTIC

Towed Dredges | United States Of America

MASSACHUSETTS/NORTHWEST ATLANTIC

Towed Dredges | United States Of America

Moderate Concern

Because specific bycatch composition in the bay scallop fishery is unknown, finfish are being assessed as a group, as per the guidance in the Seafood Watch Fisheries Criteria. Bay scallop is primarily found and fished in sandy areas near eelgrass meadows (MacKenzie 2008a). Historically, fishing for bay scallop in New York generally occurred in deeper water than eelgrass beds, and currently, with reductions in the extent of eelgrass, the fishery occurs almost exclusively outside of eelgrass habitat (pers. comm., S. Tettelbach, Long Island University 2016). Fish species that may occur in sandy-bottom habitat include smooth dogfish, striped bass, white perch, winter flounder, windowpane flounder, clearnose skate, little skate, and winter skate (Virginia Institute of Marine Science 2017).

The grouping of finfish listed above is largely made of species that are not identified by Seafood Watch as "highly vulnerable taxa." Some species found in sandy-bottom areas are overfished or are depleted and vulnerable to incidental take, such as the winter skate and windowpane flounder ((NEFSC 2007b) and {NEFSC 2015}). Because of the timing of the fishery and the small dredge size, these species are not likely to occur as bycatch in the fishery. Therefore, Factor 2.1 is scored as "moderate" concern for finfish bycatch

Factor 2.2 - Fishing Mortality

NEW YORK/NORTHWEST ATLANTIC

Towed Dredges | United States Of America

MASSACHUSETTS/NORTHWEST ATLANTIC

Towed Dredges | United States Of America

Moderate Concern

Finfish were scored as a group using the guidance provided by the Seafood Watch Fisheries Standard. The bycatch score from the Unknown Bycatch Matrices in Appendix 2 of the Seafood Watch Fisheries Standard for finfish is 3, so Factor 2.2 is scored as "moderate" concern for finfish (Seafood Watch 2016). Some species found in sandy bottom habitat are overfished or are depleted and vulnerable to incidental take, such as the winter skate and windowpane flounder ((NEFSC 2007b) and (NEFSC 2015)). But bycatch rates in the bay scallop fishery are generally believed to be low (pers. comm., NOAA Northeast Fisheries Science Center 2016), and the catch is processed quickly, usually in less than 5 minutes (pers. comm., S. Tettelbach, Long Island University 2016).

Factor 2.3 - Modifying Factor: Discards and Bait Use

Goal: Fishery optimizes the utilization of marine and freshwater resources by minimizing post-harvest loss. For fisheries that use bait, bait is used efficiently.

Scoring Guidelines: The discard rate is the sum of all dead discards (i.e. non-retained catch) plus bait use divided by the total retained catch.

RATIO OF BAIT + DISCARDS/LANDINGS FACTOR 2.3 SCORE

<100% 1

>=100

0.75

NEW YORK/NORTHWEST ATLANTIC

Towed Dredges | United States Of America

MASSACHUSETTS/NORTHWEST ATLANTIC

Towed Dredges | United States Of America

< 100%

The numerical score for Factor 2.4 is used to modify the overall Criterion 2 score if a fishery has high rates of discards or catch that is used for bait. A score of 1 means that discards and bait use are low, and the Criterion 2 score is unaffected. A score of 0.75 means that discards and bait use are high, and the Criterion 2 score is modified down to account for the discards. Discard information is not directly available for the bay scallop dredge fisheries in New York and Massachusetts; however, the ratio of bait + discards/landings is likely well below 100% because some local jurisdictions do not permit bycatch in excess of 20% of landings ((Wellfleet 2015) & (Nantucket 2016a)). Because information on discard rates for bay scallop dredges is not available, this report assumes that the discard rate is similar to the discard rate for sea scallop dredges. Sea scallop dredges have an overall discard rate ranging from 26% to 28.3%, which is also well below 100% ((Harrington et al. 2005) & (Kelleher 2005)). Therefore, Factor 2.4 is scored as 1, and the overall Criterion 2 score is not modified.

BENTHIC INVERTS

Factor 2.1 - Abundance

NEW YORK/NORTHWEST ATLANTIC

Towed Dredges | United States Of America

MASSACHUSETTS/NORTHWEST ATLANTIC

Towed Dredges | United States Of America

Moderate Concern

Because bycatch composition in the bay scallop fishery is unknown, benthic invertebrates are being assessed as a group, per the guidance in the Seafood Watch Fisheries Criteria. Bay scallop is primarily found and fished in sandy areas adjacent to eelgrass meadows (Mackenzie 2008a) (pers. comm., D. Barnes, New York Division of Marine Resources 2016). Other invertebrate species landed with bay scallop include blood arc clam, northern quahog clam, soft clam, blue mussel, eastern oyster, channeled whelk, and knobbed whelk (pers. comm., Massachusetts Division of Marine Fisheries Statistics Project 2016).

The grouping of benthic invertebrates is made primarily of species that are not identified by Seafood Watch as "highly vulnerable taxa," so Factor 2.1 is scored as "moderate" concern for benthic invertebrate bycatch (Seafood Watch 2016).

Factor 2.2 - Fishing Mortality

NEW YORK/NORTHWEST ATLANTIC

Towed Dredges | United States Of America

MASSACHUSETTS/NORTHWEST ATLANTIC

Towed Dredges | United States Of America

Moderate Concern

Benthic invertebrates were scored as a group using the guidance provided by the Seafood Watch Fisheries Standard. The fishing mortality score from the Unknown Bycatch Matrices in Appendix 2 for benthic invertebrates is 1. But because of the low quantities of invertebrates landed with bay scallop in Massachusetts, and similar quantities expected from New York, the fishing mortality score has been revised to 2. Therefore, Factor 2.2 is scored as “moderate” concern for benthic invertebrates (Seafood Watch 2016).

Justification:

Table 6: Massachusetts Bay Scallop Fishery, Common Bycatch Species Landings

MA Bay Scallop Fishery, Common Bycatch Species Landings (Live Lbs), 2010–2015

SPECIES	2010	2011	2012	2013	2014	2015
Blood Arc Clam	0	*	1,697	6,698	4,479	17,443
Northern Quahog Clam	1,138	4,288	1,456	2,068	995	1,078
Soft Clam	111	*	208	*	*	337
Blue Mussel	542	202	1,315	2,139	0	*
Eastern Oyster	*	34,750	16,849	10,989	7,432	52,398
Channeled Whelk	*	0	*	418	174	857
Knobbed Whelk	0	*	0	*	198	*

SOURCE: Massachusetts Trip Level Reports, NMFS Vessel Trip Reports

*Confidential

Figure 4

Factor 2.3 - Modifying Factor: Discards and Bait Use

Goal: Fishery optimizes the utilization of marine and freshwater resources by minimizing post-harvest loss. For fisheries that use bait, bait is used efficiently.

Scoring Guidelines: The discard rate is the sum of all dead discards (i.e. non-retained catch) plus bait use divided by the total retained catch.

RATIO OF BAIT + DISCARDS/LANDINGS	FACTOR 2.3 SCORE
<100%	1
>=100	0.75

NEW YORK/NORTHWEST ATLANTIC

Towed Dredges | United States Of America

MASSACHUSETTS/NORTHWEST ATLANTIC

Towed Dredges | United States Of America

< 100%

The numerical score for Factor 2.4 is used to modify the overall Criterion 2 score if a fishery has high rates of discards or catch that is used for bait. A score of 1 means that discards and bait use are low, and the Criterion 2 score is unaffected. A score of 0.75 means that discards and bait use are high, and the Criterion 2 score is

modified down to account for the discards. Discard information is not directly available for the bay scallop dredge fisheries in New York and Massachusetts; however, the ratio of bait + discards/landings is likely well below 100% because some local jurisdictions do not permit bycatch in excess of 20% of landings ((Wellfleet 2015) & (Nantucket 2016a)). Because information on discard rates for bay scallop dredges is not available, this report assumes that the discard rate is similar to the discard rate for sea scallop dredges. Sea scallop dredges have an overall discard rate ranging from 26% to 28.3%, which is also well below 100% ((Harrington et al. 2005) & (Kelleher 2005)). Therefore, Factor 2.4 is scored as 1, and the overall Criterion 2 score is not modified.

Criterion 3: Management Effectiveness

Five factors are evaluated in Criterion 3: Management Strategy and Implementation, Bycatch Strategy, Scientific Research/Monitoring, Enforcement of Regulations, and Inclusion of Stakeholders. Each is scored as either 'highly effective,' 'moderately effective,' 'ineffective,' or 'critical'. The final Criterion 3 score is determined as follows:

- 5 (Very Low Concern) — Meets the standards of 'highly effective' for all five factors considered.
- 4 (Low Concern) — Meets the standards of 'highly effective' for 'management strategy and implementation' and at least 'moderately effective' for all other factors.
- 3 (Moderate Concern) — Meets the standards for at least 'moderately effective' for all five factors.
- 2 (High Concern) — At a minimum, meets standards for 'moderately effective' for Management Strategy and Implementation and Bycatch Strategy, but at least one other factor is rated 'ineffective.'
- 1 (Very High Concern) — Management Strategy and Implementation and/or Bycatch Management are 'ineffective.'
- 0 (Critical) — Management Strategy and Implementation is 'critical'.

The Criterion 3 rating is determined as follows:

- Score >3.2=Green or Low Concern
- Score >2.2 and ≤3.2=Yellow or Moderate Concern
- Score ≤2.2 = Red or High Concern

Rating is Critical if Management Strategy and Implementation is Critical.

GUIDING PRINCIPLE

- The fishery is managed to sustain the long-term productivity of all impacted species.

Criterion 3 Summary

Fishery	Management Strategy	Bycatch Strategy	Research and Monitoring	Enforcement	Stakeholder Inclusion	Score
Fishery 1: Massachusetts/Northwest Atlantic Towed dredges United States of America	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective	Yellow (3.000)
Fishery 2: New York/Northwest Atlantic Towed dredges United States of America	Moderately Effective	Moderately Effective	Moderately Effective	Highly Effective	Moderately Effective	Yellow (3.000)

Criterion 3 Assessment

Factor 3.1 - Management Strategy and Implementation

Considerations: What type of management measures are in place? Are there appropriate management goals, and is there evidence that management goals are being met? Do managers follow scientific advice? To achieve a highly effective rating, there must be appropriately defined management goals, precautionary policies that are

based on scientific advice, and evidence that the measures in place have been successful at maintaining/rebuilding species.

MASSACHUSETTS/ NORTHWEST ATLANTIC

Towed Dredges | United States Of America

Moderately Effective

The State of Massachusetts sets a size limit, seasonal closure, and daily catch limit for the bay scallop fishery. Additional regulations, such as bycatch limits, may be set by local jurisdictions. Local jurisdictions may also alter the daily catch limit.

Size Limit: No minimum size, but the scallop must have a well-defined annual growth ring.

Seasonal Closure: Fishing for bay scallops is prohibited from April 1 to September 30 each year.

Daily Catch Limit: 10 Bushels per day, including annual shells (MEEA 2016a).

In addition, the state or local jurisdictions may close areas to the harvest of shellfish to protect public health. Shellfish may only be taken from areas not subject to closures.

Measures that are expected to be effective at protecting the breeding stock are in place, and it is unlikely that the fishery is having serious negative impacts on retained populations. The requirement of an annual growth ring ensures that the bay scallops have reproduced prior to being fished. But there is a need for increased precaution in management, particularly the increased use of scientific information (including quantitative stock assessments and associated biomass targets) to determine when management of the fishery needs to change. The lack of biomass targets means that management is unable to respond quickly to biomass declines. Therefore, Factor 3.1 is rated as "moderately effective."

NEW YORK/ NORTHWEST ATLANTIC

Towed Dredges | United States Of America

Moderately Effective

The state of New York sets size limits, seasonal closures, daily catch limits, and gear restrictions for the bay scallop fishery. Additional restrictions, such as bycatch limits or stricter daily catch limits, may be set by local jurisdictions. Details on these regulations are included below.

Size Limit: 2-¼ inch from mid-hinge to mid-bill and an annual growth ring. Unintentional or unavoidable take of bay scallops below this size must be limited to 2 percent of the total catch.

Seasonal Closure: Fishing for bay scallops is prohibited from April 1 to the first Monday in November.

Daily Catch Limit: 10 bushels per person, or 20 bushels per boat per day (with two or more persons on the boat); there is no overall total allowable catch limit.

Gear Restrictions: Dredges are allowed, but may only be up to 36 inches in width. Use of mechanical means to retrieve a dredge is prohibited. Use of dredges is prohibited on Sunday. The size limit is exempted for bay scallops cultured under a marine hatchery, on-bottom, or off-bottom culture permit from the New York Department of Environmental Conservation. Cultured scallops are subject to a separate set of laws and regulations ((NYDEC 2016a) and (New York 2016)).

In addition, the state closes areas to shellfish collection to protect public health. All shellfish may only be taken from areas designated by the Department of Environmental Conservation as certified, or open, for harvest ((NYDEC 2016a) and (NYDEC 2016b)).

Measures that are expected to be effective at protecting the breeding stock are in place, and it is unlikely that the fishery is having serious negative impacts on retained populations. The requirement of an annual growth ring ensures that the bay scallops have reproduced prior to being fished. But there is a need for increased precaution in management, particularly the increased use of scientific information (including quantitative stock assessments and associated biomass targets) to determine when management of the fishery needs to change. The lack of biomass targets means that management is unable to respond quickly to biomass declines. Therefore, Factor 3.1 is rated as “moderately effective.”

Factor 3.2 - Bycatch Strategy

Considerations: What type of management strategy/measures are in place to reduce the impacts of the fishery on bycatch species and when applicable, to minimize ghost fishing? How successful are these management measures? To achieve a Highly Effective rating, the fishery must have no or low bycatch, or if there are bycatch or ghost fishing concerns, there must be effective measures in place to minimize impacts.

MASSACHUSETTS/NORTHWEST ATLANTIC

Towed Dredges | United States Of America

NEW YORK/NORTHWEST ATLANTIC

Towed Dredges | United States Of America

Moderately Effective

As discussed under Criterion 2, there are no data on catch composition in the bay scallop fishery. But Massachusetts has begun to collect data on bycatch species that are retained and landed. The states of New York and Massachusetts do not set bycatch limits for the bay scallop fishery. But regulations in some local jurisdictions do set bycatch rates ranging from 5% to 20% ((Wellfleet 2015) and (Nantucket 2016a)). The analysis in Criterion 2 did not identify any impacts to threatened or endangered species, and bycatch rates are generally believed to be low (pers. comm., NOAA Northeast Fisheries Science Center 2016). Therefore, the New York and Massachusetts bay scallop fisheries have been rated as “moderately effective” for Factor 3.2.

Factor 3.3 - Scientific Research and Monitoring

Considerations: How much and what types of data are collected to evaluate the fishery’s impact on the species? Is there adequate monitoring of bycatch? To achieve a Highly Effective rating, regular, robust population assessments must be conducted for target or retained species, and an adequate bycatch data collection program must be in place to ensure bycatch management goals are met.

MASSACHUSETTS/NORTHWEST ATLANTIC

Towed Dredges | United States Of America

NEW YORK/NORTHWEST ATLANTIC

Towed Dredges | United States Of America

Moderately Effective

The states of New York and Massachusetts do not conduct stock assessments for bay scallops, but landings data are collected. Landings data may relate more closely to bay scallop abundance than to abundance of other species because of the bay scallop’s short life cycle, but state-regulated analyses are not done to assess how landings relate to bay scallop biomass. But researchers working in bay scallop restoration have studied

the relationship between spawning stock size and density and larval recruitment, and between benthic juvenile abundance and fisheries landings. There is a significant relationship between benthic juvenile abundance and fisheries landings ((Tettelbach et al. 2013) and (Tettelbach et al. 2015)). Additionally, researchers have been assessing general bay scallop population size in New York since 2005 (pers. comm., S. Tettelbach, Long Island University 2016). In addition, no bycatch monitoring or assessment occurs in the bay scallop fishery in New York, and incomplete bycatch monitoring occurs in Massachusetts, although bycatch rates are generally believed to be low (NOAA Northeast Fisheries Science Center pers. comm., 2016). Since this is a small scale fishery and bycatch is generally low, management relies on an appropriate strategy that requires only minimal monitoring, including the seasonal fishery opening, local eelgrass protections and, in the case of Massachusetts, monitoring of species landed with bay scallops. Therefore, the New York and Massachusetts bay scallop fisheries have been rated as “moderately effective” for Factor 3.3.

Factor 3.4 - Enforcement of Management Regulations

Considerations: Do fishermen comply with regulations, and how is this monitored? To achieve a Highly Effective rating, there must be regular enforcement of regulations and verification of compliance.

MASSACHUSETTS/NORTHWEST ATLANTIC

Towed Dredges | United States Of America

NEW YORK/NORTHWEST ATLANTIC

Towed Dredges | United States Of America

Highly Effective

Bay scallop fishers must obtain a permit from the states of New York and Massachusetts. In New York, fishers may also have to obtain a permit from the local jurisdiction where fishing occurs, and in Massachusetts they are required to obtain a local permit ((NYDEC 2016c) & (MEEA 2016b)). Local jurisdictions have shellfish constables, wardens, or marine units in their police forces that enforce permit requirements and fishing regulations ((Nantucket 2016b) and (Southold 2016)). The capacity to report compliance is appropriate to the scale of the fishery. Therefore Factor 3.4 is rated as “highly effective.”

Factor 3.5 - Stakeholder Inclusion

Considerations: Are stakeholders involved/included in the decision-making process? Stakeholders are individuals/groups/organizations that have an interest in the fishery or that may be affected by the management of the fishery (e.g., fishermen, conservation groups, etc.). A Highly Effective rating is given if the management process is transparent, if high participation by all stakeholders is encouraged, and if there a mechanism to effectively address user conflicts.

MASSACHUSETTS/NORTHWEST ATLANTIC

Towed Dredges | United States Of America

NEW YORK/NORTHWEST ATLANTIC

Towed Dredges | United States Of America

Moderately Effective

Changes to the regulations managing bay scallops in New York or Massachusetts would have to go through a formal government rulemaking process, which allows for stakeholder input. The management process for bay scallops is transparent and includes stakeholder input, but there is no mechanism in place to effectively address user conflicts. Therefore, the New York and Massachusetts bay scallop fishery is rated “moderately effective” for Factor 3.5.

Criterion 4: Impacts on the Habitat and Ecosystem

This Criterion assesses the impact of the fishery on seafloor habitats, and increases that base score if there are measures in place to mitigate any impacts. The fishery's overall impact on the ecosystem and food web and the use of ecosystem-based fisheries management (EBFM) principles is also evaluated. Ecosystem Based Fisheries Management aims to consider the interconnections among species and all natural and human stressors on the environment. The final score is the geometric mean of the impact of fishing gear on habitat score (factor 4.1 + factor 4.2) and the Ecosystem Based Fishery Management score. The Criterion 4 rating is determined as follows:

- *Score >3.2=Green or Low Concern*
- *Score >2.2 and ≤3.2=Yellow or Moderate Concern*
- *Score ≤2.2=Red or High Concern*

GUIDING PRINCIPLES

- Avoid negative impacts on the structure, function or associated biota of marine habitats where fishing occurs.
- Maintain the trophic role of all aquatic life.
- Do not result in harmful ecological changes such as reduction of dependent predator populations, trophic cascades, or phase shifts.
- Ensure that any enhancement activities and fishing activities on enhanced stocks do not negatively affect the diversity, abundance, productivity, or genetic integrity of wild stocks.
- Follow the principles of ecosystem-based fisheries management.

Rating cannot be Critical for Criterion 4.

Criterion 4 Summary

Region Method	Gear Type and Substrate	Mitigation of Gear Impacts	EBFM	Score
Massachusetts/Northwest Atlantic Towed dredges United States of America	2	+0.5	Moderate Concern	Yellow (2.739)
New York/Northwest Atlantic Towed dredges United States of America	2	+0.5	Moderate Concern	Yellow (2.739)

Criterion 4 Assessment

SCORING GUIDELINES

Factor 4.1 - Physical Impact of Fishing Gear on the Habitat/Substrate

Goal: The fishery does not adversely impact the physical structure of the ocean habitat, seafloor or associated biological communities.

- *5 - Fishing gear does not contact the bottom*
- *4 - Vertical line gear*
- *3 - Gears that contacts the bottom, but is not dragged along the bottom (e.g. gillnet, bottom longline, trap)*

and is not fished on sensitive habitats. Or bottom seine on resilient mud/sand habitats. Or midwater trawl that is known to contact bottom occasionally. Or purse seine known to commonly contact the bottom.

- *2 - Bottom dragging gears (dredge, trawl) fished on resilient mud/sand habitats. Or gillnet, trap, or bottom longline fished on sensitive boulder or coral reef habitat. Or bottom seine except on mud/sand. Or there is known trampling of coral reef habitat.*
 - *1 - Hydraulic clam dredge. Or dredge or trawl gear fished on moderately sensitive habitats (e.g., cobble or boulder)*
 - *0 - Dredge or trawl fished on biogenic habitat, (e.g., deep-sea corals, eelgrass and maerl)*
- Note: When multiple habitat types are commonly encountered, and/or the habitat classification is uncertain, the score will be based on the most sensitive, plausible habitat type.*

Factor 4.2 - Modifying Factor: Mitigation of Gear Impacts

Goal: Damage to the seafloor is mitigated through protection of sensitive or vulnerable seafloor habitats, and limits on the spatial footprint of fishing on fishing effort.

- *+1 —>50% of the habitat is protected from fishing with the gear type. Or fishing intensity is very low/limited and for trawled fisheries, expansion of fishery's footprint is prohibited. Or gear is specifically modified to reduce damage to seafloor and modifications have been shown to be effective at reducing damage. Or there is an effective combination of 'moderate' mitigation measures.*
- *+0.5 —At least 20% of all representative habitats are protected from fishing with the gear type and for trawl fisheries, expansion of the fishery's footprint is prohibited. Or gear modification measures or other measures are in place to limit fishing effort, fishing intensity, and spatial footprint of damage caused from fishing that are expected to be effective.*
- *0 —No effective measures are in place to limit gear impacts on habitats or not applicable because gear used is benign and received a score of 5 in factor 4.1*

Factor 4.3 - Ecosystem-Based Fisheries Management

Goal: All stocks are maintained at levels that allow them to fulfill their ecological role and to maintain a functioning ecosystem and food web. Fishing activities should not seriously reduce ecosystem services provided by any retained species or result in harmful changes such as trophic cascades, phase shifts or reduction of genetic diversity. Even non-native species should be considered with respect to ecosystem impacts. If a fishery is managed in order to eradicate a non-native, the potential impacts of that strategy on native species in the ecosystem should be considered and rated below.

- *5 — Policies that have been shown to be effective are in place to protect species' ecological roles and ecosystem functioning (e.g. catch limits that ensure species' abundance is maintained at sufficient levels to provide food to predators) and effective spatial management is used to protect spawning and foraging areas, and prevent localized depletion. Or it has been scientifically demonstrated that fishing practices do not have negative ecological effects.*
- *4 — Policies are in place to protect species' ecological roles and ecosystem functioning but have not proven to be effective and at least some spatial management is used.*
- *3 — Policies are not in place to protect species' ecological roles and ecosystem functioning but detrimental food web impacts are not likely or policies in place may not be sufficient to protect species' ecological roles and ecosystem functioning.*
- *2 — Policies are not in place to protect species' ecological roles and ecosystem functioning and the likelihood of detrimental food impacts are likely (e.g. trophic cascades, alternate stable states, etc.), but conclusive scientific evidence is not available for this fishery.*
- *1 — Scientifically demonstrated trophic cascades, alternate stable states or other detrimental food web impact are resulting from this fishery.*

Factor 4.1 - Physical Impact of Fishing Gear on the Habitat/Substrate

MASSACHUSETTS/NORTHWEST ATLANTIC

Towed Dredges | United States Of America

NEW YORK/NORTHWEST ATLANTIC

Towed Dredges | United States Of America

2

The bay scallop dredge fishery takes place on sandy areas adjacent to eelgrass habitat. Occasionally, a dredge may run over eelgrass habitat while fishing for bay scallops. Running a dredge over eelgrass meadows leads to an immediate decrease in shoot densities and biomass of eelgrass ((Fonesca et al. 1984) and (Fonseca and Uhrin 2009)). Research has shown a recovery of eelgrass biomass a month after dredging activity, but this eelgrass recovery does not translate to a return of juvenile bay scallops to the previously dredged area (Bishop et al. 2005). Eelgrass protections under law focus on impacts to eelgrass from construction, rather than impacts to eelgrass from fishing activity. Bay scallop depends on eelgrass and other submerged aquatic vegetation to successfully complete its life cycle—specifically, when it settles out of the water column in the juvenile stage. Only larvae settling onto eelgrass beds and other submerged aquatic vegetation appear to form reproductively significant populations; however, juveniles may use a variety of epibenthic substrates for attachment and do not depend solely on submerged vegetation (NCDMF 2015). Therefore, submerged aquatic vegetation is ideal for juvenile bay scallop habitat, and when it is degraded, even for short periods from dredging, it affects the ability of juvenile bay scallops to attach successfully and continue their life cycle. Because the majority of fishing activity occurs in sandy habitat, and eelgrass is dredged infrequently in this fishery, Factor 4.1 is scored as 2.

Factor 4.2 - Modifying Factor: Mitigation of Gear Impacts

MASSACHUSETTS/NORTHWEST ATLANTIC

Towed Dredges | United States Of America

NEW YORK/NORTHWEST ATLANTIC

Towed Dredges | United States Of America

+0.5

The numerical score for Factor 4.1b is used to modify the initial score discussed above in 4.1a. The stronger the habitat protection, the higher the 4.1b score. See the Scoring Guidelines for a description of the scores available for Factor 4.1b. The timing of the bay scallop fishery limits the impacts to eelgrass, because eelgrass does not grow as quickly in the winter (during the fishing season) as in the spring and summer months (New York 2009). In addition, a study by Bishop et al. (Bishop et al. 2005) found that eelgrass biomass had fully recovered from bay scallop dredging a month after the dredging ended. Local jurisdictions close areas of eelgrass to dredging to protect the habitat, or require gear modifications such as removing the “teeth” from the dredge to minimize impacts to the seafloor (pers. comm., D. Ewart, Town of Tisbury, Massachusetts 2016, pers. comm., D. Grunden, Town of Oak Bluffs, Massachusetts 2016). Because there are gear modifications, local restrictions on where dredges can be used, and timing restrictions that limit impacts to eelgrass, Factor 4.1b is deemed to have moderate mitigation and receives a score of 0.5.

The overall score for 4.1 (the sum of Factors 4.1a and b) is 2.5.

Factor 4.3 - Ecosystem-Based Fisheries Management

MASSACHUSETTS/NORTHWEST ATLANTIC

Towed Dredges | United States Of America

NEW YORK/NORTHWEST ATLANTIC

Towed Dredges | United States Of America

Moderate Concern

Policies are not in place to protect species' ecological roles. But detrimental food web impacts are not likely, because the scallops are fished just before they experience natural mortality during their second year and, as mentioned under Factor 4.1, they are fished during fall and winter months when impacts to eelgrass are lower. Spatial closures in the bay scallop fishery are done to protect human health rather than ecosystem functioning. For these reasons, management of the ecosystem and food web impacts of the fishery is deemed "moderate" concern.

Acknowledgements

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Seafood Watch would like to thank the consulting researcher and author of this report, Holly Wyer, as well as Dr. Stephan Tettelbach of Long Island University, James Churchill of Woods Hole Oceanographic Institution and an anonymous reviewer for graciously reviewing this report for scientific accuracy.

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Appendix A: Updates to Bay Scallops Report

This report was reviewed for any significant stock status and management updates to the fishery on December 10, 2019. None were found that would indicate the final ratings are no longer accurate.

Appendix B: Review Schedule

The State of North Carolina historically had a bay scallop fishery that is not currently active due to the scallops not meeting biomass targets. North Carolina has a Bay Scallop Fishery Management Plan that is reviewed every 5 years. The most recent review was completed in 2015, and the next review is anticipated to occur in 2020. Scoping to see whether an update to Seafood Watch's bay scallop assessment is needed should be done around 2020 or 2021, primarily to assess whether North Carolina's bay scallop fishery is open and available for Seafood Watch to assess.

For additional background information, North Carolina also produces annual stock status reports for their fisheries; a link to the bay scallop stock status report is available here: <http://portal.ncdenr.org/web/mf/36-bay-scallops-ssr-2016>. The website lists Jeffery Dobbs as the contact for bay scallops. His email is Jeffery.Dobbs@ncdenr.gov.