Monterey Bay Aquarium
Seafood Watch

Environmental sustainability assessment of wild-caught bay scallop from Massachusetts and New York caught using towed dredges

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Species: Bay scallops (*Argopecten irradians*)
Location: Massachusetts and New York: Northwest Atlantic
Gear: Towed dredges
Type: Wild Caught
Author: Seafood Watch
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About Seafood Watch

Monterey Bay Aquarium's Seafood Watch program evaluates the environmental 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. 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.

Seafood Watch's science-based ratings are available at www.SeafoodWatch.org. Each rating is supported by a Seafood Watch assessment, in which the fishery or aquaculture operation is evaluated using the Seafood Watch standard.

Seafood Watch standards are built on our guiding principles, which outline the necessary environmental sustainability elements for fisheries and aquaculture operations. The guiding principles differ across standards, reflecting the different impacts of fisheries and aquaculture.

- Seafood rated Best Choice comes from sources that operate in a manner that's consistent with our guiding principles. The seafood is caught or farmed in ways that cause little or no harm to other wildlife or the environment.

- Seafood rated Good Alternative comes from sources that align with most of our guiding principles. However, one issue needs substantial improvement, or there's significant uncertainty about the impacts on wildlife or the environment.

- Seafood rated Avoid comes from sources that don't align with our guiding principles. The seafood is caught or farmed in ways that have a high risk of causing harm to wildlife or the environment. There's a critical conservation concern or many issues need substantial improvement.

Each assessment follows an eight-step process, which prioritizes rigor, impartiality, transparency and accessibility. They are conducted by Seafood Watch scientists, in collaboration with scientific, government, industry and conservation experts and are open for public comment prior to publication. Conditions in wild capture fisheries and aquaculture operations can change over time; as such assessments and ratings are updated regularly to reflect current practice.

More information on Seafood Watch guiding principles, standards, assessments and ratings are available at www.SeafoodWatch.org.

Guiding Principles

Seafood Watch defines sustainable seafood as originating from sources, whether fished[1] 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, Seafood Watch develops an overall recommendation. Criteria ratings and the overall recommendation are color coded to correspond to the categories on the Seafood Watch pocket guides and online guide:

Best Choice/Green: Buy first; they're well managed and caught or farmed responsibly.

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

Avoid/Red: Take a pass on these for now; they're caught or farmed 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 Massachusetts and New York. From 2009 through 2014, Massachusetts and New York 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 spawns only once in its life cycle; however, nub scallop, which is spawned later than classic bay scallop, may spawn twice.

Bay scallop abundance in Massachusetts and New York is low compared to historical abundance before 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. In New York, warming waters, poor environmental conditions, and parasites have also hampered recovery of the population. Formal stock assessments are not conducted at the state level by either Massachusetts or New York for their bay scallop fisheries, but landings are generally thought to be correlated to biomass. Data-limited assessments are conducted in some jurisdictions, such as adult scallop density surveys done in Nantucket, MA. 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 scallop drove the Yellow score for Criterion 1.

No complete data sets currently exist for bycatch in the bay scallop fishery, although Massachusetts requires the reporting of any bycatch that is retained. Some local jurisdictions limit the amount of bycatch to a specified percentage of landings. Local jurisdictions can also choose to implement stricter regulations than those stipulated at the state level. Because bycatch rates were variable and may have been above the Seafood Watch assessment threshold of 5%, 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.

Massachusetts and New York 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, the monitoring of species landed with bay scallops. Aside from enforcement, the factors under the Criterion 3 score were all rated as moderate for New York, and all but one were rated moderate for Massachusetts. 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 can lead to dramatically decreased shoot densities and eelgrass biomass. But recent research suggests that scallop

dredging impacts near and on eelgrass beds may be more minimal than previously thought. Bay scallop historically depended 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 a moderate concern and drives the overall score of Yellow for Criterion 4.

In summary, the wild-capture bay scallop fishery in Massachusetts and New York received a Yellow ranking, primarily because of the low abundance of bay scallop, the lack of formal stock assessments and bycatch/discards data collection, and the fishery's impacts to bay scallop habitat.

Final Seafood Recommendations

SPECIES | FISHERY	C 1 TARGET SPECIES	C 2 OTHER SPECIES	C 3 MANAGEMENT	C 4 HABITAT	OVERALL	VOLUME (MT) YEAR
Bay scallop | Northwest Atlantic | United States | Massachusetts | Towed dredges	2.236	2.644	4.000	3.000	**Good Alternative (2.902)**	30
Bay scallop | Northwest Atlantic | United States | New York | Towed dredges	2.236	2.644	3.000	3.000	**Good Alternative (2.701)**	2

Summary

The wild-capture bay scallop fisheries in Massachusetts and New York receive a Yellow rating, 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 Massachusetts and New York. 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. Updated landings by gear type are unavailable because NOAA no longer provides this level of information, but total landings remain higher in Massachusetts than New York.

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 scallop 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 typically spawns only once in its life cycle, during the warm months. But in Nantucket and Martha's Vineyard, "nub" scallop, which is spawned in the fall rather than the spring, is often able to reproduce twice during its life cycle, because it may live through two summers rather than one (Hall et al. 2015). Bay scallop is hermaphroditic, but only eggs or sperm are released at any one time, to prevent self-fertilization. Eelgrass and other submerged aquatic vegetation, such as macroalgae, are important in the bay scallop life cycle because they provide above-sediment surfaces for juvenile bay scallop to attach and grow for a brief period before dropping to the seafloor (NCDMF 2015).

Between the mid-1870s and the mid-1980s, bay scallop 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 began to increase in the following years, though this pattern has slowed in Massachusetts since the 2010s (see Figure 1) (NOAA 2023). 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){Tettelbach and Smith 2009}. Recent population decreases have affected New York's Peconic Bay, bringing these landings down since 2018 (Pasfield 2021).

Bay scallop fisheries are managed at the state level, although local jurisdictions can implement additional regulations. 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 scallop 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 Massachusetts and New York have partly 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 ray, and fishing effort (Myers et al. 2007) (University of North Carolina 2007)(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).

Production Statistics

Bay scallop is only commercially fished on the East Coast of the United States; see the preceding Overview of Species section for a discussion of trends in commercial, wild-caught bay scallop landings. A recreational fishery for bay scallop 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 scallop into the United States; imports range from 4 million to 14 million kg of scallop (NOAA 2016b).

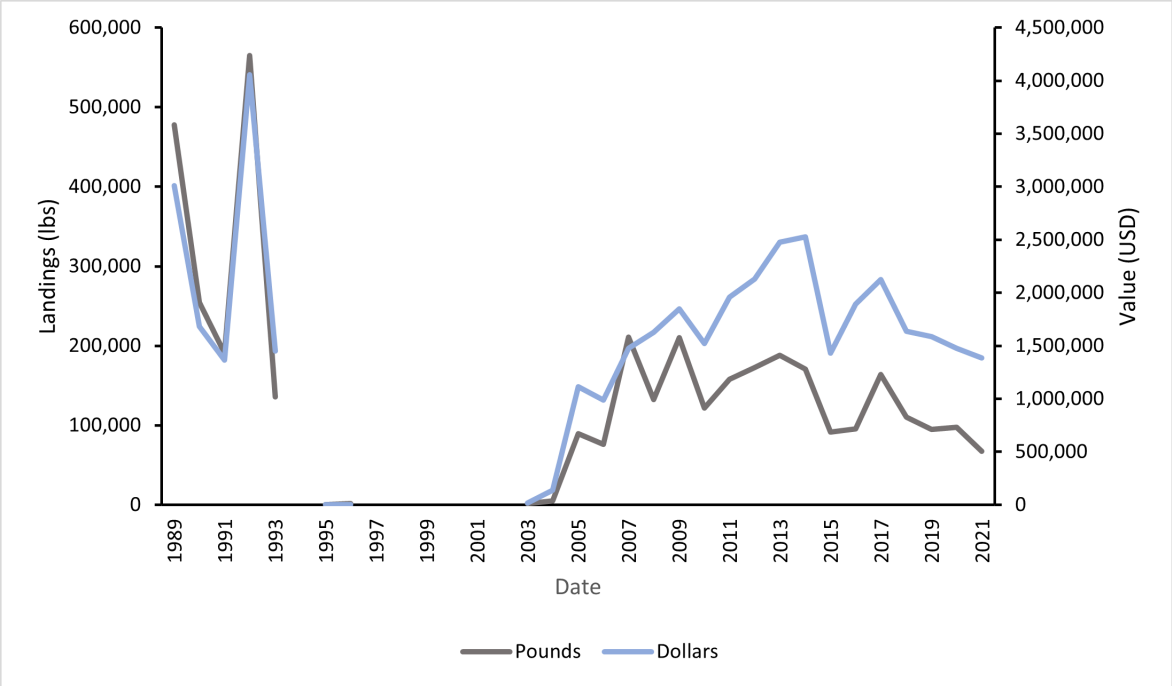

Figure 1: Massachusetts bay scallop landings (lbs) and value of landings (USD) from 1989 to 2021. Note that data were unavailable for 1994 and from 1997 through 2002. Data from NOAA Commercial Landings database.

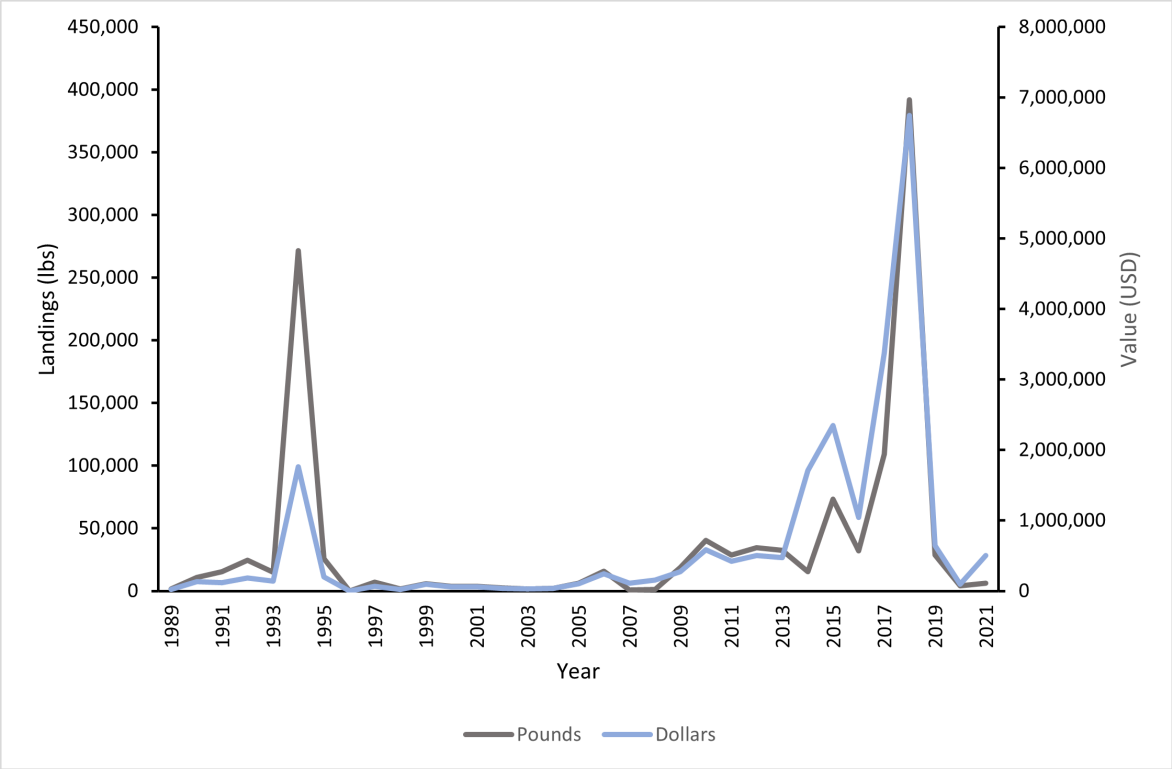

Figure 2: New York bay scallop landings (lbs) and value of landings (USD) from 1989 to 2021. Data from NOAA Commercial Landings database.

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 during the fall and winter in the northeast, it is an important source of income and economic activity to fishing communities at times that are otherwise slow {MacKenzie 2008a}. Bay scallop is also more reliably available during shellfish seasons because it is usually exempt from shellfish closures based on human health concerns, because only the adductor muscle is consumed. Also, after restoration efforts, dockside revenues of the bay scallop fishery in Peconic Bay of eastern Long Island, New York increased by USD2 million (Tettelbach et al. 2015). But the Peconic Bay population is now depleted due to climate change, low dissolved oxygen, a parasite, and poor environmental conditions that reduced the population in the early 2020s (Elbertz 2022).

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 clam or oyster, 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**
Northwest Atlantic | United States | Massachusetts | Towed dredges	1.000: High Concern	5.000: Low Concern	Yellow (2.236)
Northwest Atlantic | United States | New York | Towed dredges	1.000: High Concern	5.000: Low Concern	Yellow (2.236)

Criterion 1 Assessments

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 LowConcern) — Strong evidence exists that the population is above an appropriate target abundance level (given the species' ecological role), or near virgin biomass.*
- *3.67 (LowConcern) — Population may be belowtarget 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 below75% 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 (LowConcern) — Probable (>50%) that fishing mortality from all sources is at or belowa sustainable level, given the species ecological role, OR fishery does not target species and fishing mortality is lowenough 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 (Argopecten irradians)

Factor 1.1 - Abundance

Northwest Atlantic | United States | Massachusetts | Towed dredges

High Concern

Bay scallop abundance in Massachusetts is low compared to historical abundance before the 1980s (Mackenzie 2008a). In the 1980s, bay scallop abundance decreased sharply due to brown tides. Although population levels statewide are still low, Nantucket has experienced higher densities of seed scallops in 2021 and 2023 (Riley 2023, pers comm). Nantucket also measures adult scallop abundance, which showed a promising increase in 2023, but the population still requires restocking via larval releases and is not back to pre-1980 levels (Riley 2023, pers comm).

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 adult populations, then the collected spat is raised at a hatchery before dispersion (S. Tettelbach, personal communication 2016). In Nantucket, restoration efforts include larval releases (over 150 million larvae produced annually), spawning sanctuaries, and seed management (Riley 2023, pers comm). No stock assessments or target reference points are available at the state level for this fishery, though some local jurisdictions, such as Nantucket, conduct their own stock assessments via benthic density surveys. Nantucket has conducted annual assessments of adult and juvenile scallop density since 2006, which now allows managers to track restoration progress. Nantucket also has a biomass target in place for seed scallops. The state of Massachusetts has begun collecting catch-per-unit-effort (CPUE) data, starting in 2010. The latest available CPUE data are included in Figure 3. Although these data are informative, they have been collected for only 14 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, despite progress, the population remains depleted compared to historic (pre-1980) levels, bay scallop has been given a score of high concern.

Justification:

Landings are thought to correlate with biomass, but in some areas, such as Nantucket, the number of fishery participants has shrunk, contributing to overall reductions in landings.

MA Bay Scallop CPUE (Pounds per Hour Fishing), 2010-2020	
Year	CPUE
2010	28.17
2011	39.38
2012	42.27
2013	46.87
2014	40.25
2015	29.94
2016	34.04
2017	58.36
2018	45.13
2019	51.45
2020	45.72

Figure 3: CPUE (live lbs per fishing hour) of Massachusetts bay scallop (unpublished data from Massachusetts DMF).

Northwest Atlantic | United States | New York | Towed dredges

High Concern

Bay scallop abundance in New York is low compared to historical abundance before the 1980s (Mackenzie 2008a). 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 (DEC 2013). This is believed to be tied to climate change and 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)(New York 2015). Successful restoration efforts occurred in New York from the 2000s to 2010s {MacKenzie 2008}{Carroll and Peterson 2013}(Tettelbach et al. 2013)(Tettelbach et al. 2015), but a recent parasite and poor environmental conditions (climate change and low dissolved oxygen) in Peconic Bay have caused large adult die-offs since 2019, reducing adult bay scallop abundance by 90–100% in many Peconic Bay estuary areas (DEC 2020)(Tettelbach et al. 2023). The parasite does not seem to affect juvenile scallops, so only adults are part of the die-off (Pasfield 2021). The New York population has yet to recover from the combined impacts of disease and climate change, and the fishery received a federal disaster declaration in 2021 (Werkmeister 2021), although it is still operating.

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 adult populations, then the collected spat is raised at a hatchery before dispersion (S. Tettelbach, personal communication 2016). Scientists in New York are also now working on breeding scallops that will be more resistant to parasites and climate change impacts, in order to make the wild population more resilient to current threats (Elbertz 2022). No stock assessments or target reference points are available at the state level for this fishery. Because abundance is low, reference points for scallop do

not exist, and the population remains depleted, bay scallop has been given a score of high concern.

Factor 1.2 - Fishing Mortality

Northwest Atlantic | United States | Massachusetts | Towed dredges
Northwest Atlantic | United States | New York | Towed dredges

Low Concern

No quantitative stock assessments are conducted for bay scallop on a statewide basis in Massachusetts and New York, so estimates of total fishing mortality are unavailable. 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)(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 states, although 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 quite 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). In addition, in Nantucket, MA, temperature restrictions prevent fishing when temperatures may increase natural mortality in the scallop population. In New York, though the fishery is still operating, it is bringing in minimal harvest levels, as evidenced by it being declared a federal fishery disaster (Werkmeister 2021)(Elbertz 2022).

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. Figure 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 has only one reproductive cycle in a lifetime 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. Therefore, this factor is scored a low concern.

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 Crtitical

Guiding principles

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

Criterion 2 Summary

Criterion 2 score(s) overview

This table(s) provides an overview of the Criterion 2 subscore, discards+bait modifier, and final Criterion 2 score for each fishery. A separate table is provided for each species/stock that we want an overall rating for.

BAY SCALLOP			
REGION / METHOD	SUB SCORE	DISCARD RATE/LANDINGS	SCORE
Northwest Atlantic | United States | Massachusetts | Towed dredges	2.644	1.000: < 100%	Yellow (2.644)
Northwest Atlantic | United States | New York | Towed dredges	2.644	1.000: < 100%	Yellow (2.644)

Criterion 2 main assessed species/stocks table(s)

This table(s) provides a list of all species/stocks included in this assessment for each 'fishery' (as defined by a region/method combination). The text following this table(s) provides an explanation of the reasons the listed species were selected for inclusion in the assessment.

NORTHWEST ATLANTIC | UNITED STATES | MASSACHUSETTS | TOWED DREDGES			
SUB SCORE: 2.644	DISCARD RATE: 1.000	SCORE: 2.644	
SPECIES	ABUNDANCE	FISHING MORTALITY	SCORE
Bay scallop	1.000: High Concern	5.000: Low Concern	Yellow (2.236)
Benthic inverts	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Finfish	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)

NORTHWEST ATLANTIC | UNITED STATES | NEW YORK | TOWED DREDGES			
SUB SCORE: 2.644	DISCARD RATE: 1.000	SCORE: 2.644	
SPECIES	ABUNDANCE	FISHING MORTALITY	SCORE
Bay scallop	1.000: High Concern	5.000: Low Concern	Yellow (2.236)
Benthic inverts	2.330: Moderate Concern	3.000: Moderate Concern	Yellow (2.644)
Finfish	2.330: Moderate Concern	3.000: 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 whelk, channeled whelk, redbeard and sulfur sponges, and quahog (S. Tettelbach, personal communication 2016). Figure 4 in Factor 2.2 for Benthic Inverts shows the bycatch species commonly landed with bay scallop in Massachusetts (unpublished DMF data). Bycatch rates in the bay scallop fishery are

generally believed to be low (Northeast Fisheries Science Center, personal communication 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)(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, corals and other biogenic habitats, 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. Limited bycatch data from Massachusetts further support the inclusion of benthic invertebrates in Criterion 2. The seasonality of the bay scallop fishery suggests a limited overlap with many finfish species; however, a lack of complete bycatch/discards data requires that, out of caution, finfish be kept in Criterion 2 based on the UBM.

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 Massachusetts and New York seasonally: they move into the area as waters warm in the spring and leave by the end of November as water temperatures cool (E. Keane, personal communication 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)(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 (E. Keane, personal communication 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.

For corals and other biogenic habitats, bay scallop dredges are most likely to interact with seagrass beds. But these were ultimately excluded from Criterion 2 main species because scallop dredges are not operating directly on seagrass beds. Instead, dredges are primarily operating on sandy habitats near eelgrass beds. The small size of bay scallop fisheries also restricts their potential impacts on seagrass beds. Further, the Department of Marine Fisheries in Massachusetts has been studying the impacts of dredging on eelgrass since 2018, and initial findings show that eelgrass is not impacted by this experimental dredging (DFG 2020).

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)

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

Bay scallop (Argopecten irradians)

Factor 2.3 - Discard Rate/Landings

Northwest Atlantic | United States | Massachusetts | Towed dredges
Northwest Atlantic | United States | New York | Towed dredges

< 100%

The numerical score for Factor 2.3 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 plus 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). Nantucket is also thought to have discards below 5% of total catch, though discards are not required to be recorded or reported, so data to support this statement are not available (Riley 2023, pers comm). Because information on discard rates for bay scallop dredges is unavailable, 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 2.3 is scored 1, and the overall Criterion 2 score is not modified.

Benthic inverts (Unknown benthic invertebrate spp.)

Factor 2.1 - Abundance

Northwest Atlantic | United States | New York | Towed dredges
Northwest Atlantic | United States | Massachusetts | Towed dredges

Moderate Concern

Because bycatch composition in the bay scallop fishery is unknown, benthic invertebrates are 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}(D. Barnes, personal communication 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 (unpublished DMF data).

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 a moderate concern for benthic invertebrate bycatch (Seafood Watch 2016).

Factor 2.2 - Fishing Mortality

Northwest Atlantic | United States | New York | Towed dredges
Northwest Atlantic | United States | Massachusetts | Towed dredges

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 of the Seafood Watch Fisheries Standard 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 a moderate concern for benthic invertebrates (Seafood Watch 2016).

Justification:

Although some species included in the bycatch data table have had no landings in recent years, they may still be captured and discarded.

MA Bay Scallop and Bycatch landings by gear, species, and year, 2016-2020

GEAR	COMMON_NAME	2016	2017	2018	2019	2020
DREDGE	CLAM, ARK, BLOOD	26,605	6,264	20,681	22,202	7,419
	CLAM, QUAHOG, NORTHERN	0	988	0	*	*
	CLAM, SOFT	0	0	*	0	0
	MUSSEL, BLUE	*	0	0	0	0
	OYSTER, EASTERN	1,270	*	2,800	3,464	4,993
	SCALLOP, BAY	458,068	812,171	553,945	463,703	483,991
	WHELK, CHANNELED	*	*	147	521	120
	WHELK, KNOBBED	0	*	*	*	0

Data Source(s): MA Trip Level Reports, NMFS Vessel Trip Reports

*CONFIDENTAIL

Figure 4: Landed bycatch species in Massachusetts from 2016 to 2020 (in live lbs).

Finfish (Unknown finfish spp.)

Factor 2.1 - Abundance

Northwest Atlantic | United States | New York | Towed dredges
Northwest Atlantic | United States | Massachusetts | Towed dredges

Moderate Concern

Because specific bycatch composition in the bay scallop fishery is unknown, finfish are assessed as a group, 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 (S. Tettelbach, personal communication 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 windowpane flounder (NEFSC 2007b)(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 a moderate concern for finfish bycatch.

Factor 2.2 - Fishing Mortality

Northwest Atlantic | United States | New York | Towed dredges
Northwest Atlantic | United States | Massachusetts | Towed dredges

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 a moderate concern for finfish (Seafood Watch 2016). Some species found in sandy bottom habitat have an unknown overfished status, such as the windowpane flounder (NOAA Fisheries 2020). But bycatch rates in the bay scallop fishery are generally believed to be low (Northeast Fisheries Science Center, personal communication 2016), and the catch is processed quickly, usually in less than 5 minutes (S. Tettelbach, personal communication 2016).

Factor 2.3 - Discard Rate/Landings

Northwest Atlantic | United States | Massachusetts | Towed dredges
Northwest Atlantic | United States | New York | Towed dredges

< 100%

The numerical score for Factor 2.3 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 plus 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). Nantucket is also thought to have discards below 5% of total catch, though discards are not required to be recorded or reported, so data to support this statement are not available (Riley 2023, pers comm). Because information on discard rates for bay scallop dredges is unavailable, 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 2.3 is scored 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.

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:

Criterion 3 Summary

FISHERY	MANAGEMENT STRATEGY	BYCATCH STRATEGY	RESEARCH AND MONITORING	ENFORCEMENT	INCLUSION	SCORE
Northwest Atlantic | United States | Massachusetts | Towed dredges	Highly effective	Moderately Effective	Moderately Effective	Highly effective	Moderately Effective	**Green (4.000)**
Northwest Atlantic | United States | New York | Towed dredges	Moderately Effective	Moderately Effective	Moderately Effective	Highly effective	Moderately Effective	**Yellow (3.000)**

Criterion 3 Assessment

SCORING GUIDELINES

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 manages 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.

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.

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.

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.

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.

Factor 3.1 - Management Strategy And Implementation

Northwest Atlantic | United States | Massachusetts | Towed dredges

Highly 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, management plans, and gear restrictions, may be set by local jurisdictions. Local jurisdictions may also alter the daily catch limit. Local jurisdictions may set these regulations through their own fishery management plans, such as Nantucket's shellfish FMP, which focuses on wild population enhancement, understanding predator impacts, improving shellfish population structures, and incorporating adaptive management (Nantucket Shellfish Management Plan Committee 2012).

Size Limit: No minimum size, but the scallop must have a well-defined annual growth ring. Some local jurisdictions also have rules in place for nub scallop, which is smaller than other bay scallop because it is spawned later in the year. In Nantucket, for example, there is a minimum size in place for nub scallop with a growth ring of 10 mm or less (Riley 2023, pers comm). Nub scallops are able to contribute to the overall wild scallop population during their second season, so it is important that they are not overharvested.

Seasonal Closure: Fishing for bay scallop is prohibited from April 1 to September 30 each year. In Nantucket, if temperatures drop to levels that may cause scallop strandings, fishing efforts are temporarily closed and scallops may be moved to healthier areas (Riley 2023, pers comm).

Daily Catch Limit: The statewide limit is 10 bushels per day, including annual shells (DMF 2021). Some local jurisdictions have more restrictive limits; e.g., Nantucket's limit is 5 bushels per day.

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, though these closures do not always apply to bay scallop because of the manner in which it is consumed (Riley 2023, pers comm).

Although traditional biomass and fishing mortality-based reference points are not in place, Massachusetts jurisdictions do set their own population targets. In Nantucket, larval releases and seed stocking are conducted annually with the goal of achieving the optimal seed scallop density level of 100 seeds per square meter (Riley 2023, pers comm). Bay scallop adult density per square meter is used as a proxy for spawning stock biomass (SSB) and is measured annually through benthic surveys, but an optimal adult density has not been defined. Management aims to restore and keep the population at an SSB that will support the commercial and recreational fisheries while maintaining the wild population. Further, management will move seed scallops based on temperature conditions and growth success in order to help achieve maximum adult population levels, with a goal of a potential biomass that will support 60 scallop fishers harvesting for the entirety of each fishing season (Riley 2023, pers comm). Adult population sizes are tracked via efforts such as ecological benthic surveys. In Nantucket, the results of these surveys can be used by managers to increase or decrease bushel

limits for fishers (Riley 2023, pers comm).

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 before being fished. Although traditional quantitative stock assessments and reference points are not used, biomass targets are in place, and management has the ability to adjust fishing pressure based on proxy measurements of current stock size. Therefore, Factor 3.1 is rated highly effective.

Northwest Atlantic | United States | New York | Towed dredges

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 follow.

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

Seasonal Closure: Fishing for bay scallop 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 wide. The use of mechanical means to retrieve a dredge is prohibited. The use of dredges is prohibited on Sunday. The size limit is exempted for bay scallop cultured under a marine hatchery, on-bottom, or off-bottom culture permit from the New York Department of Environmental Conservation. Cultured scallop is subject to a separate set of laws and regulations (NYDEC 2016a)(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)(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 before 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 moderately effective.

Factor 3.2 - Bycatch Strategy

Northwest Atlantic | United States | Massachusetts | Towed dredges
Northwest Atlantic | United States | New York | Towed dredges

Moderately Effective

As discussed under Criterion 2, there are no data on catch composition in the bay scallop fisheries. 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 fisheries. But regulations in some local jurisdictions do set bycatch rates ranging from 5% to 20% (Wellfleet 2015) (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 (Northeast Fisheries Science Center, personal communication 2016). Therefore, the New York and Massachusetts bay scallop fisheries have been rated moderately effective for Factor 3.2.

Factor 3.3 - Scientific Research And Monitoring

Northwest Atlantic | United States | Massachusetts | Towed dredges
Northwest Atlantic | United States | New York | Towed dredges

Moderately Effective

The states of New York and Massachusetts do not conduct stock assessments for bay scallop, 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) (Tettelbach et al. 2015). Also, researchers have been assessing general bay scallop population size in New York since 2005 (S. Tettelbach, personal communication 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 (Northeast Fisheries Science Center, personal communication 2016). Because 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 moderately effective for Factor 3.3.

Factor 3.4 - Enforcement Of Management Regulations

Northwest Atlantic | United States | Massachusetts | Towed dredges
Northwest Atlantic | United States | New York | Towed dredges

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)(Southold 2016). Shellfish constables also delegate oversight duties to others in management and oversee propogation programs for shellfish restoration efforts. The capacity to report compliance is appropriate to the scale of the fishery. Therefore, Factor 3.4 is rated highly effective.

Factor 3.5 - Stakeholder Inclusion

Northwest Atlantic | United States | Massachusetts | Towed dredges
Northwest Atlantic | United States | New York | Towed dredges

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. Nantucket is one jurisdiction that has a local shellfish advisory board and a nonprofit group that are consulted concerning user conflicts and shellfish management plans. The management process for bay scallop is transparent across jurisdictions and includes stakeholder input, but there is not always a mechanism in place to effectively address user conflicts. Therefore, the New York and Massachusetts bay scallop fisheries are 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

FISHERY	FISHING GEAR ON THE SUBSTRATE	MITIGATION OF GEAR IMPACTS	ECOSYSTEM-BASED FISHERIES MGMT	SCORE
Northwest Atlantic | United States | Massachusetts | Towed dredges	Score: 2	+1	Moderate Concern	**Yellow (3.000)**
Northwest Atlantic | United States | New York | Towed dredges	Score: 2	+1	Moderate Concern	**Yellow (3.000)**

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 - Impact of Fishing Gear on the Habitat/Substrate

Northwest Atlantic | United States | Massachusetts | Towed dredges
Northwest Atlantic | United States | New York | Towed dredges

Score: 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 scallop. Running a dredge over eelgrass meadows leads to an immediate decrease in shoot densities and biomass of eelgrass (Fonesca et al. 1984){Fonseca and Uhrin 2009}. Research has shown a recovery of eelgrass biomass one month after dredging activity, but this eelgrass recovery does not translate to a return of juvenile bay scallop 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 scallop to attach successfully and continue its life cycle. The Massachusetts Department of Marine Fisheries has begun research to examine the effects of scallop dredging on eelgrass beds, with preliminary results suggesting minimal impacts, but this work is ongoing (DFG 2020)(DFG 2021). Further, bay scallop is fished during the winter, when eelgrass is dormant. Because the majority of fishing activity occurs in sandy habitat, and eelgrass is dredged infrequently in this fishery, Factor 4.1 is scored a 2.

Factor 4.2 - Modifying Factor: Mitigation of Gear Impacts

Northwest Atlantic | United States | Massachusetts | Towed dredges
Northwest Atlantic | United States | New York | Towed dredges

+1

The numerical score for Factor 4.2 is used to modify the initial score discussed in Factor 4.1. The stronger the habitat protection, the higher the Factor 4.2 score. See the Scoring Guidelines for a description of the scores available for Factor 4.1. 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, eelgrass is typically dormant) 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 one 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 (D. Ewart, personal communication 2016)(D.

Grunden, personal communication 2016). Dredges used for bay scallop also differ from less environmentally friendly sea scallop dredges. Bay scallop dredges are small and lightweight, creating a low impact design that “minimize[s] potential damage to eelgrass beds” (USFWS 2015). Because there are gear modifications, a compatibility finding of no significant adverse impact on eelgrass, local restrictions on where dredges can be used, and timing restrictions that limit impacts to eelgrass, Factor 4.2 is deemed to have highly effective mitigation and receives a score of 1.

Factor 4.3 - Ecosystem-based Fisheries Management

Northwest Atlantic | United States | Massachusetts | Towed dredges
Northwest Atlantic | United States | New York | Towed dredges

Moderate Concern

Bay scallop plays an important role in the ecosystem because of its food web position and ability to filter bacteria and algae out of water (Elbertz 2022). Policies are not in place to protect species’ ecological roles. But detrimental food web impacts are not likely, because scallop is fished just before it experiences natural mortality during the second year and, as mentioned under Factor 4.1, scallop is fished during the fall and winter months, when impacts to eelgrass are lower. Some reserach is done on scallop predators; for example, the Nantucket Shellfish Management Plan includes a goal of increasing understanding of shellfish predators via predator surveys and predator removal studies (Nantucket Shellfish Management Plan Committee 2012). Spatial closures in the bay scallop fisheries are not typically focused on ecosystem functioning, but are done for other reasons. For these reasons, management of the ecosystem and food web impacts of the fisheries is deemed a moderate concern.

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Appendix A: Review Schedule

The State of North Carolina historically had a bay scallop fishery that is not currently active as a result of 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 2022. As of 2022, the bay scallop continues to be a depleted species of concern in North Carolina, and in 2021, although one area was open to commercial harvest, no harvest was reported (NCDEQ 2022). The next scheduled comprehensive FMP review for North Carolina bay scallop will occur in 2025.

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: https://deq.nc.gov/about/divisions/marine-fisheries/managing-fisheries/fishery-management-plans#BayScallop-8715. The website lists Jeffery Dobbs as the contact for bay scallops. His email is Jeffery.Dobbs@ncdenr.gov.

Appendix B: Updates to Bay Scallop 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 that the final ratings are no longer accurate.

Appendix C: Updates to Bay Scallop Report

Updates to the December 10, 2019 report were made on June 3, 2024:

The Overall Rating for bay scallop maintained a Yellow rating. Two score changes were made within individual criterion, and these and language updates are outlined as follows.

Updates included:

- Criterion 1: Added language to reflect recent developments in the New York bay scallop population, which has severely declined due to parasitic infection and warming waters from climate change. Also added language to reflect the most recent scallop seed numbers from Nantucket, which suggest that the adult population will do well in 2023/2024.
- Criterion 2: Updated bycatch data from Massachusetts to reflect more recent landings of bycatch species. Also updated the language in the answers for finfish—winter skate had been used as an example of an overfished species, but the population is no longer overfished, so this reference was removed.
- Criterion 3: Updated a link to Massachusetts scallop fishing regulations. Massachusetts also received a new score of highly effective for Factor 3.1, based on updated information and regulatory changes from Nantucket.
- Criterion 4: Added information about recent research from Massachusetts that examined dredging impacts on eelgrass beds. Also added context for bay scallop's ecosystem role. Factor4.2 was upgraded from +5 to +1 based on a USFWS compatibility finding that bay scallop dredges do not have adverse environmental impacts because of their light weight and the habitat they are used on.
- Updated the Executive Summary language accordingly.
- Updated Appendix A for the North Carolina fishery, which remains closed based on the 2022 FMP review.