Species Status Assessment

Common Name: Eastern Oyster **Date Updated: 10/15/2024**

Scientific Name: *Crassostrea virginica* **Updated by:** Chelsea Miller

Class: Bivalvia

Family: Ostreidae

Species Synopsis *(a short paragraph which describes species taxonomy, distribution, recent trends, and habitat in New York):*

The eastern oyster, *Crassostrea virginica*, is a sessile bivalve that is distributed along the eastern coast of the U.S. with a native range extending from Canada to Mexico. They have been introduced for aquaculture purposes to Japan, Great Britain, Australia, Hawaii, and the western coast of the United States (Sellers et al. 1984). Oysters live in brackish estuarine waters and are generally found clustered in oyster beds or reefs. Larval oysters often settle on adult oyster shells and remain in that location for the remainder of their life (Sellers et al. 1984). Historically, oysters supported a large commercial fishery in New York and throughout their range (NYSDEC 2005, BRT 2007). Eastern oyster abundance has declined throughout its range, including New York, resulting in declines in commercial harvest and the loss of ecological functions such as water filtration and habitat for fish and invertebrates (NYSDEC 2024, BRT 2007). Currently, most of the commercial oyster harvest in New York comes from aquaculture production (NYSDEC 2024). Some current threats to oysters in New York waters include poor water quality, a lack of suitable hard-structured habitat for larval settlement, and disease (BRT 2007, NYSDEC 2005). Oyster restoration efforts have been rapidly expanding across New York Harbor and the estuaries around Long Island over the past several years. Various restoration projects are being led by multiple non-governmental organizations (NGOs) and municipalities. Ongoing projects continue to expand upon feasibility and pilot scale approaches using reef substrate and adding juvenile oysters to restoration sites. The long-term goal of these efforts is to restore self-sustaining oyster populations. Research conducted by multiple universities support monitoring efforts of oyster restoration projects to inform current and future projects (Grizzle et al. 2024).

I. Status

a. Current legal protected Status

i. **Federal:** Not listed **Candidate:** No

ii. **New York:** Not listed

b. Natural Heritage Program

i. **Global:** G5

ii. **New York:** Not ranked **Tracked by NYNHP?:** No

Other Ranks:

-New York 2025 SGCN status: High Priority Species of Greatest Conservation Need

-IUCN Red List: Not ranked

-Northeast Regional SGCN: Not ranked

-COSEWIC: Not listed

Status Discussion:

Eastern oysters have not received any state or federal protection status. They have been given a globally secure rank (G5) and have not been ranked by New York's Natural Heritage program.

II. Abundance and Distribution Trends

Region	Present?	Abundance	Distribution	Time Frame	Listing status	SGCN?
North America	Yes	Declining	Declining	1900s – Present	Not listed	Yes
Northeastern US	Yes	Declining	Declining	1950s – Present	Not listed	Yes
New York	Yes	Declining	Declining	1950s – Present	Not listed	Yes
Connecticut	Yes	Declining	Declining	1997 - Present	Not listed	Yes
Massachusetts	Yes	Declining	Declining		Not listed	No
New Jersey	Yes	Declining	Declining		Not listed	No
Pennsylvania	No	-	-			-
Vermont	No	-	-			-
Ontario	No	-	-			-
Quebec	Yes	Unknown	Unknown		Not listed	-

Monitoring in New York *(specify any monitoring activities or regular surveys that are conducted in New York):*

There are currently no monitoring activities or regular surveys conducted by the NYSDEC that are specific to the Eastern oyster. In 1686, Governor Thomas Dongan, under King James II of England, established the various municipalities, or towns, across Long Island. When these towns were established, they were given jurisdiction over the natural resources of the area including ownership of the underwater lands in the surrounding bays and harbors (Dongan Patent 1686). Although the NYSDEC does not conduct regular monitoring activities or surveys for oysters and other bivalve species in Long Island's estuaries, some towns having ownership of those underwater lands do. The NYSDEC does collect harvest data from shellfish shippers as well as production reports from aquaculturists who grow shellfish. Although not a function of resource management but rather for public safety reasons, the NYSDEC also conducts water quality and biotoxin monitoring to regulate shellfish harvest areas (NYSDEC 2024).

Trends Discussion *(insert map of North American/regional distribution and status):*
Historically, New York had extremely abundant oyster reefs which supported a thriving fishery dating back to the 1800s. Areas in Great South Bay, Long Island Sound, Raritan Bay, Jamaica Bay, the Peconic Estuary, and the Hudson River all supported extensive oyster beds (NYSDEC 2005). Great South Bay was the most productive of these areas (BRT 2007). Oyster production in Great South Bay peaked from 1900 to 1910 but began to diminish after that due to a lack of seed supply from the eastern portion of the bay as well as from its supplemental sources, Connecticut and Long Island Sound (CTS 2011). As Moriches Inlet opened in Great South Bay, salinities increased, subsequently increasing predators such as the oyster drill (CTS 2011). In 1938, a hurricane further decimated these oyster grounds (CTS 2011). Up until the 1950s, New York still had a large statewide harvest of oysters with 1.2 million bushels reported in 1951 (NYSDEC 2024). Currently, very few naturally occurring oyster reefs occur around New York and most commercial activity is done through aquaculture. Oyster harvest has dramatically dropped, and the majority of landings now come from cultured oysters. Only 43,551 bushels of oysters were harvested in 2023, 84% of which were cultured. The contribution of wild harvest to New York's annual oyster landings has decreased dramatically in just a few years, from 62% in 2015, to just 16% in 2023 (NYSDEC 2024).

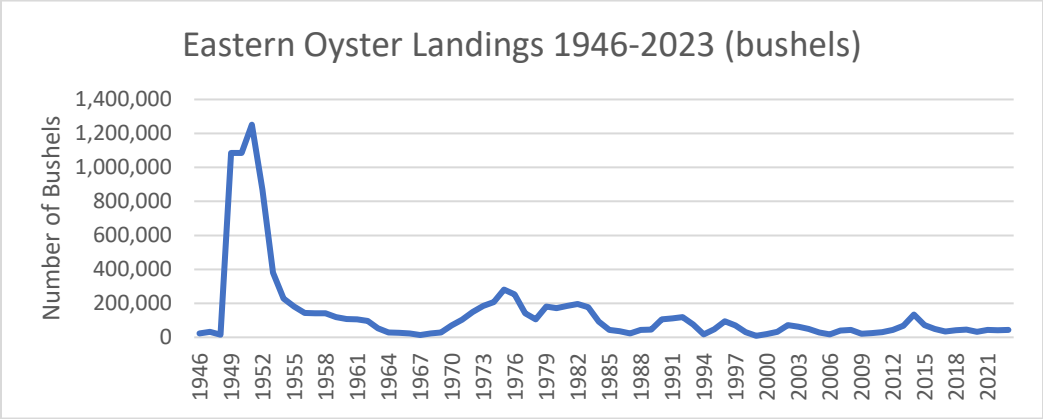

Figure 1. Eastern Oyster (*Crassostrea virginica*) Landings from New York, 1946-2023 (NYSDEC 2024).

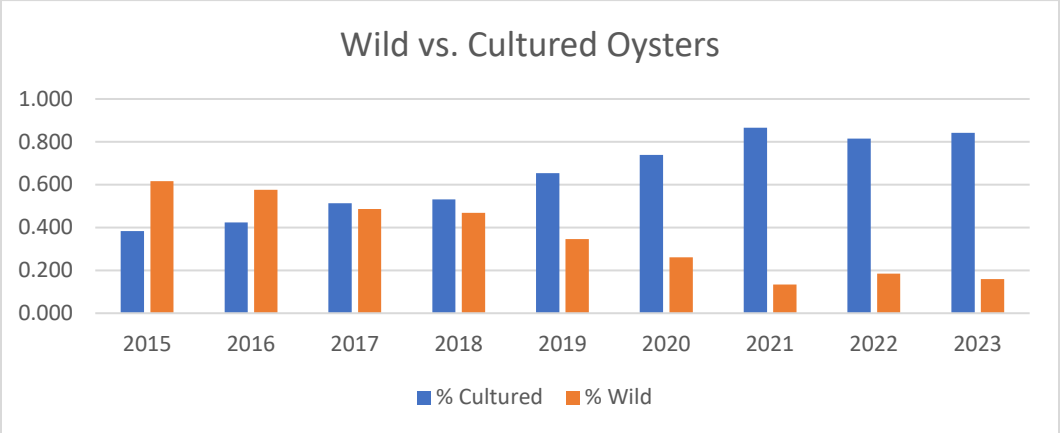

Figure 2. The trends of wild harvested oysters compared to cultured oysters (NYSDEC 2024).

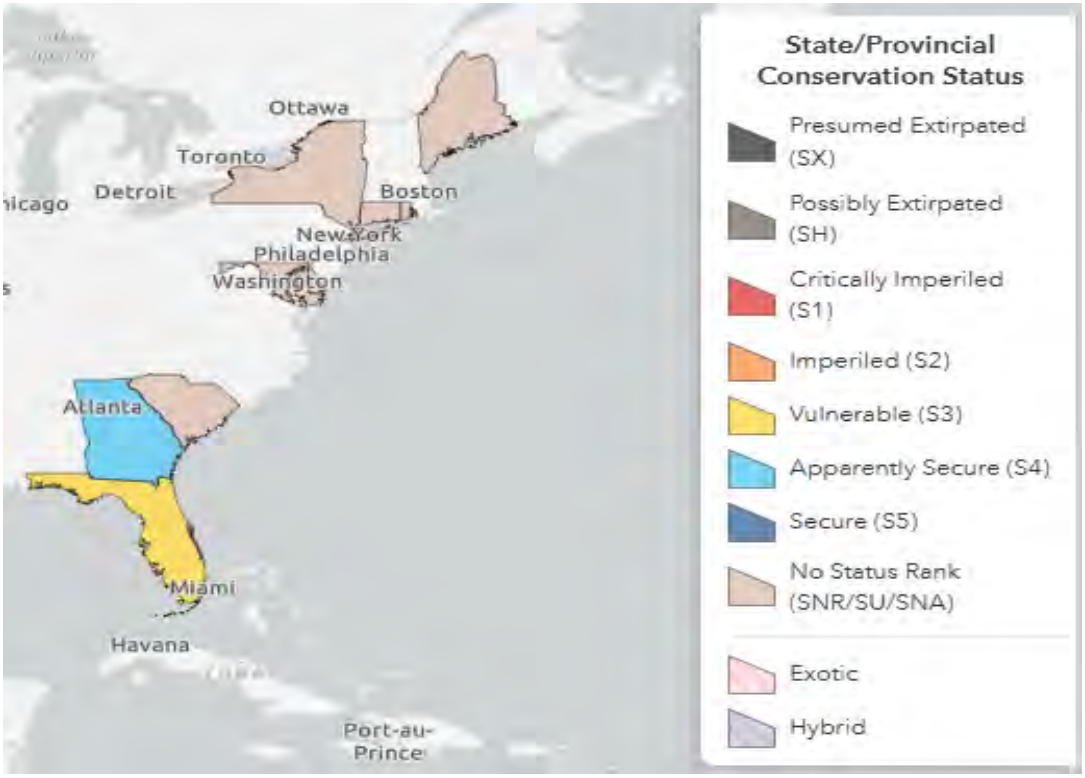

Figure 3. Conservation status of eastern oyster in North America (NatureServe 2024).

Overharvest was a main factor in the decline of the eastern oyster in New York and much of its range. Currently, disease, pollution, and lack of habitat are issues impeding the recovery of oyster populations (BRT 2007). The decline of oysters relative to their historic levels seems to be most pronounced in urbanized areas including the Hudson-Raritan estuary, southern Long Island, the Chesapeake Bay, and some areas in New England. However, it is important to note that much of this information comes from fisheries-dependent sources rather than abundance surveys (BRT 2007). Although the decline of oysters was realized relatively early and restoration efforts began in the 1800s, these efforts were generally to help ensure that there were future stocks for harvest. More recently, restoration efforts have been done for purposes of conservation and with the goal of restoring essential ecosystem services (BRT 2007).

Currently, oyster restoration efforts in New York are occurring in New York Harbor, some of the Long Island Sound tributaries, the Peconic Estuary, and the South Shore Estuary. There are approximately 25 NGOs, universities, and municipalities involved in these restoration projects. Most of these projects consist of placement of spat-on-shell oysters in areas with suitable bottom while others consist of bags of shell and spat-on-shell oysters deployed into a reef structure, creation of shell mounds, use of various sizes of reef balls both with and without seeded oysters, and use of gabions filled with spat-on-shell. Cornell Cooperative Extension of Suffolk County (CCE) and East Hampton Shellfish Hatchery run shellfish gardening programs called the Suffolk Project in Aquaculture Training (SPAT) and East Hampton Shellfish Education and Enhancement Directive (EHSEED), respectively. These programs were created to teach individuals about shellfish restoration and aquaculture practices. Oysters grown through the shellfish gardening programs are used towards restoration projects.

In September 2017, former Governor Andrew Cuomo announced $10.4 million would be put towards the creation of the Long Island Shellfish Restoration Project (LISRP). This plan would establish five shellfish sanctuary sites in Nassau and Suffolk Counties, invest $7.25 million dollars in public hatcheries, purchase $3.15 million worth of adult hard clams to plant into the five sanctuaries, establish

the Shellfish Restoration Council, and create a NYSDEC one-stop-shop for permitting. At the completion of the project, approximately 48.7 million spat-on-shell were planted in Bellport Bay, 7.9 million in Huntington Harbor, 14 million in Hempstead Bay, 47.795 million in Shinnecock Bay, and 11.1 million in South Oyster Bay for a total of 129,495,000 oysters. The Shellfish Restoration Council was established to support and guide shellfish restoration efforts throughout the state's marine and coastal district. The Council was tasked with developing a New York State Shellfish Restoration Plan which is currently in progress (NYSDEC 2024).

Figure 4. The United States coastal distribution of *Crassostrea virginica*, the eastern oyster (NOAA n.d.).

III. New York Rarity *(provide map, numbers, and percent of state occupied)*

Details of historic and current occurrence:

Historically, oysters naturally occurred all around Long Island in Long Island Sound, the Hudson-Raritan Estuary, the South Shore Estuary, and the Peconic Estuary. Oysters and oyster reefs were once very abundant in New York waters. Currently, there are a few, small, naturally occurring populations in some of these areas. Wild harvest of oysters is supported by the north shore bays and harbors such as the Huntington/Northport Complex, Smithtown Bay, Port Jefferson Harbor, and Mattituck Creek and some of the south shore bays such as Mecox Bay and Moriches Bay. This information is all based on fishery-dependent reporting to the NYSDEC. Many of the municipalities around Long Island supplement their natural populations with oysters grown in shellfish hatcheries (NYSDEC 2024). There is a naturally occurring oyster population in the Hudson River, in the vicinity of the Governor Mario M. Cuomo Bridge (formerly the Tappen Zee Bridge). A multi-acre pilot oyster restoration project in the area noted the presence of live oysters. Unseeded reef substrate that was subsequently added to the river bottom saw natural recruitment throughout the project area (Grizzle et al. 2013 and Grizzle et al. 2023).

New York's Contribution to Species North American Range:

Percent of North American Range in NY	Classification of NY Range	Distance to core population, if not in NY
1-25%	Peripheral	

IV. Primary Habitat or Community Type *(from NY crosswalk of NE Aquatic, Marine, or Terrestrial Habitat Classification Systems):*

a. Size/Waterbody Type: Estuarine, brackish shallow subtidal, brackish intertidal

b. Geology: benthic geomorphology, shellfish bed

c. Temperature: -1.7°C - 36°C

d. Salinity: 5 - 30 ppt

Habitat or Community Type Trend in New York

Habitat Specialist?	Indicator Species?	Habitat/ Community Trend	Time frame of Decline/Increase
Yes	Yes	Declining	Early 20th century to Present

Habitat Discussion:

The eastern oyster is natively distributed along the eastern coast of North America, ranging from the Gulf of Saint Lawrence, Canada to Key Biscayne, Florida and extending into the Caribbean, as well as along the Gulf of Mexico to the Yucatan Peninsula (Sellers et al. 1984). They have been introduced for aquaculture purposes in Japan, Australia, Great Britain, Hawaii, and the western coast of the United States (Sellers et al. 1984, NOAA 2013). Shallow estuaries are optimal habitat with the preferential depth in mid-Atlantic waters cited as 0.6 to five meters (Sellers et al. 1984, BRT 2007). Both rocky and muddy bottoms are suitable substrates for oyster attachment, provided that the mud can support the oyster's weight (Sellers et al. 1983). The preferred attachment and settling site for larval oysters is upon adult oyster shells in oyster beds or reefs (Sellers et al. 1983). Since adult oysters are sessile, once settled they spend the remainder of their life at their original attachment site. Larval oysters, spat, and adults all have optimal water temperature and salinity ranges; however, adult oysters are much more tolerant of fluctuating conditions when compared to the other life stages (Sellers et al. 1983).

V. Species Demographics and Life History

Breeder in NY?	Non-breeder in NY?	Migratory Only?	Summer Resident?	Winter Resident?	Anadromous/ Catadromous?
Yes	(blank)	No	Yes	Yes	(blank)

Species Demographics and Life History Discussion *(include information about species life span, reproductive longevity, reproductive capacity, age to maturity, and ability to disperse and colonize):*

Crassostrea virginica has a reported maximum lifespan of 20 years, with some Gulf of Mexico specimens being aged at 25 to 30 years (Buroker 1983, BRT 2007). Older oysters are rare and ones that reach these ages are likely found in areas undisturbed by fishing gear (BRT 2007). All oysters begin life as males, with some switching to females later in life. There is some evidence that this switch may be reversed in some individuals (BRT 2007). Size at which oysters reach sexual maturity varies based on latitude and location within estuaries although they are thought to mature relatively quickly.

Blue Ocean Institute (n.d.) cites maturity as males being reached at 50 mm, which is typically four to 12 weeks after settlement. Spawning is initiated by males and the presence of sperm and its associated pheromones in the water stimulates females to begin spawning (Sellers et al. 1984). Although fecundity estimates are not certain, oysters are considered highly fecund with Sellers *et al.* (1984) citing fecundity estimates that range from 15 to 115 million eggs per female per spawning season, with the number of eggs produced linked to the size of the oyster.

Fertilized eggs develop into larvae within six hours and remain in the water column for two to three weeks. After this time period the larvae seek a solid surface for attachment. Once a suitable attachment site is found a droplet of liquid cement, secreted through their foot attaches the larvae to the settlement site (i.e. an adult oyster shell). Growth rate is directly related to phytoplankton abundance and was higher in salt ponds when compared to tidal creeks, where phytoplankton are generally less abundant (Sellers et al. 1984).

Predators include whelk, starfish, and various crab species. As the oyster grows and shells increase in strength, vulnerability to predation decreases, although, all oyster life stages, including adults, are vulnerable to predation by oyster drills (Sellers at al. 1984). Larval stages are subject to predation from filter feeders such as rotifers and ctenophores (BRT 2007).

VI. Threats *(from NY 2015 SWAP or newly described)*

Threat Level 1	Threat Level 2	Threat Level 3	Spatial Extent	Severity	Immediacy	Trend	Certainty
5. Biological Resource Use	5.4 Fishing & Harvesting Aquatic Resources	-	Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.
7. Natural System Modifications	7.3 Other Ecosystem Modifications	-	Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.
8. Invasive & Other Problematic Species	8.2 Problematic Native Plants & Animals	-	Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.
9. Pollution	9.1 Domestic & Urban Wastewater	-	Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.
9. Pollution	9.3 Agricultural & Forestry Effluents	-	Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.
11. Climate Change	11.2 Changes in Geological Regimes	11.2.1 Changes in pH of habitats	Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.

Table 1: Threats to eastern oyster.

Several diseases are known to affect eastern oyster populations in New York by causing mortality and inhibiting restoration efforts (NYSDEC 2005). Dermo is a disease caused by a single-celled, intracellular, Protozoan parasite, *Perkinsus marinus,* that infects the blood cells of an oyster. Since the 1990s, Dermo has been present in oyster populations in the Long Island Sound. It is not harmful to humans. This disease is transmitted from oyster to oyster and is released into the water column as the tissues of infected dead oysters disintegrate. The free-swimming zoophore phase is then ingested by living oysters, thus allowing for the continuation of Dermo's parasitic lifecycle. This disease proliferates most rapidly in warm, high salinity waters (Sunila n.d., a). When exposed to pollutants, preexisting infections of Dermo were enhanced, and susceptibility was increased in non-infected specimens (Chu and Hale 1994).

Multinucleated sphere unknown (MSX) is another disease which affects eastern oysters in New York waters. It is caused by a single-celled, spore-forming, Protozoan parasite, *Haplosporidium nelsoni*. MSX is not known to be harmful to humans. The infection is first present in the oyster's gill tissue, subsequently spreading into the digestive track, and ultimately infecting all tissue. The mechanism by which this disease is transmitted is unknown, yet it does not appear to be transmitted from oyster to oyster. In the Long Island Sound eastern oysters become infected in mid to late June with the initial infection lasting until November. After this initial infection period, the oysters die within a month. MSX is suppressed from low salinities as well as low temperatures (Sunila n.d., b).

Roseovarius oyster disease (ROD)—previously known as Juvenile Oyster Disease (JOD)—is a disease mainly affecting hatchery-reared seed oysters from Maine to New York since 1988. The disease is caused by a marine α-proteobacterium *Roseovarius crassostrea*. Associated syndromes of this disease include mortality, slowed growth, brown rings on the internal portion of the shell, and unequal shell growth. Detection of symptoms usually precedes mortality by just one week (Sunila n.d., c).

Due to the lack of naturally occurring oyster reefs in New York waters, there are insufficient suitable attachment sites for juveniles. This lack of suitable habitat poses a significant problem by limiting the recruitment and viability of oyster populations (NYSDEC 2005). Reasons for the decline of suitable habitat include but are not limited to destruction through fishing gear, dredging for navigational and construction purposes, non-replacement of shucked oyster shells (cultch), storm destruction, and disturbances from recreational boating (BRT 2007). Shucked oyster shells have historically been and are still currently being used for many purposes including construction, road building, and landscaping (BRT 2007).

Nutrient-loading into water systems can cause a variety of problems for oysters, and other species living in these habitats. Eutrophication can cause excessive blooms of phytoplankton, ultimately resulting in hypoxic or anoxic conditions during algal decomposition. The occurrence of harmful algal blooms (HABs) can also be enhanced through eutrophication in turn causing mortality and inhibiting oyster growth and survival for all life stages of the oyster. Increases in phytoplankton result in an increase in filter-feeding predators such as ctenophores and coelenterates which can then feed on larval oysters. Phytoplankton communities can be altered dramatically resulting in a lack of optimal food on which oysters can feed and grow (BRT 2007).

Increased concentrations of carbon dioxide (CO_2) are causing ocean acidification which is a problem for organisms that synthesize calcium carbonate exoskeletons and shells, including the eastern oyster (Barrett et al. 2011). Talmage and Gobler (2009) have found that *Crassostrea virginica* had lowered growth and delayed metamorphosis when exposed to the CO_2 levels that are projected to occur in the future.

Additional threats include sedimentation, power plants, and heavy metal contamination. Sedimentation from erosion, storms (i.e. hurricanes), dredging, or boating can negatively affect oyster beds. Oyster eggs and larvae are particularly susceptible to smothering by silt and other suspended sediments (BRT 2007). One study has shown that heavy metals cause temperature tolerance in oysters to significantly decrease, resulting in increased physiological stress (Lannig et al. 2006). Entrainment of oyster larvae in the cooling systems of power plants can cause mortality, ultimately resulting in a loss of recruitment to the population (BRT 2007).

Are there regulatory mechanisms that protect the species or its habitat in New York?

Yes: ü **No: _____** **Unknown: _____**

If yes, describe mechanism and whether adequate to protect species/habitat:

There are several recreational and commercial harvest regulations in place for oysters in New York waters. Those municipalities having ownership over the underwater lands in certain bays and harbors have implemented additional regulations in some cases, which are more restrictive. New York State regulations allow oysters to be taken throughout the year. However, in the towns of Babylon, Brookhaven, and Islip, the harvest of oysters is not allowed between May 15 and August 31, and in the town of Southold harvest is not allowed between May 1 and August 31 (Babylon, Brookhaven, Islip, Southold Town Codes). As with other shellfish, oysters are subject to shellfish harvest area closures. Areas in which oysters are harvested must be certified by the Department for public health and safety reasons. Additional harvest area closures include sanctuaries and management areas established by municipalities which prohibit the harvest of shellfish. Ten out of the twelve municipalities on Long Island have established sanctuaries or management areas on the underwater lands they own. New York State and town regulations prohibit the harvest of any shellfish between sunset and sunrise. NYS requires a permit for commercial shellfish harvesters with a $50 fee (NYSDEC 2024). All municipalities require a permit for both commercial and recreational shellfish harvesters with varying fees and you must be a resident of the town issuing the permit. New York State regulations restrict recreational oyster harvest to half a bushel per day with one bushel (combined volume) of clams, oysters, and mussels allowed per day. Municipalities have varying harvest limits for both recreational and commercial harvesters. For recreational harvesters, these regulations include no more than ¼ bushel per day (Towns of Babylon and East Hampton), no more than ½ bushel per person or 1 bushel per vessel per day (Town of Southold), no more than ½ bushel combined of any shellfish per day (Town of Shelter Island), no more than 100 oysters per day (Town of Brookhaven), and no more than 500 oysters per day between May 15 and August 31 (Town of Huntington). For commercial harvesters, these regulations include no more than 2,000 oysters per person or no more than 4,000 per vessel per day (Towns of Brookhaven and Southold), no more than 7,500 total for all species per day including no more than 1,000 per day between May 15 and August 31 and no more than 7,500 between September 1 and May 14 (Town of Huntington), no more than one peck per day (Town of Shelter Island), no more than five bushels per day (Town of Smithtown), and no more than three bushels per day (Towns of East Hampton and Oyster Bay). Oysters that are harvested must be at least three inches at the longest diameter (NYSDEC, Towns of Babylon, Huntington, Islip, Shelter Island, and Southold) or five inches length plus width (Towns of Brookhaven, Smithtown, and Oyster Bay). There is a size exemption for cultured oysters that are cultivated under a marine hatchery, on-bottom, or off-bottom culture permit issued by NYSDEC (NYSDEC 2024). New York State regulations prohibit harvesting oysters by mechanical means on state or public bay bottom. Approved harvest methods include hand harvest using tongs and rakes, or dredging by sail can occur on state lands. The Towns of Babylon, Brookhaven, Islip, Riverhead, and Oyster Bay regulations state harvest can only be done by tongs and rakes without mechanical power.

The Town of Huntington allows the harvest of oysters with sail dredging for commercial purposes only, but not between May 15 and August 31, and harvesters can have no more than one dredge or scrape aboard the vessel. Other regulations include no harvest of shellfish on Sundays (Town of Babylon), no rake head larger than fourteen inches measured perpendicularly to the teeth, having not less than one inch of clear space between teeth, and a straight handle not to exceed ten feet in length onboard the vessel for recreational harvesters (Town of Huntington), possessing a sorting/measuring device designed to size shell stock (Town of Huntington), no taking of shell (Town of Hempstead), and shell removed from the water shall be returned within ten minutes (Town of Oyster Bay).

Describe knowledge of management/conservation actions that are needed for recovery/conservation, or to eliminate, minimize, or compensate for the identified threats:

Currently, wild oyster populations in New York waters will remain unviable without conservation and restoration efforts (BRT 2007, NYSDEC 2005). Restoration projects that aim to introduce hard substrate and multiple age classes of oysters to a site should continue, with annual post-construction monitoring to assess oyster performance and associated changes to biodiversity needed. These projects can provide insight into year-to year population growth and mortality trends and inform target stocking densities needed to achieve net positive population growth. A current baseline abundance estimate for eastern oysters in New York water would aid in assessing year-to-year trends. Continued research on the causes of common or novel diseases and their overall effects on eastern oysters should occur. Regulations on usage, disposal, and possible redistribution of cultch to key areas could help facilitate the recruitment of juvenile oysters, thus increasing their natural abundance. Continued research on restoration efforts will help determine what types of restoration are most successful and most likely to help increase population sizes. Presently, NGOs continue to design, install, and monitor the efficacy of oyster habitat restoration projects, and hopefully restore self-sustaining oyster reefs in the Long Island area.

Action Category	Action	Description
A.2 Direct Species Management	A.2.2.1.0 Reintroduce Species	
B.3 Outreach	B.3.1.0.0 Outreach, Communication, and Distribution	
C.6 Design and Plan Conservation	C.6.2.0.0 Conserve specific land or seascapes	
C.6 Design and Plan Conservation	C.6.5.1.3 Develop a conservation, management, or restoration plan for protected private land	

Table 2: Recommended conservation actions for eastern oyster.

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