# Species Status Assessment

**Class:** Bivalvia
**Family:** Ostreidae
**Scientific Name:** *Crassostrea virginica*
**Common Name:** Eastern oyster

**Species synopsis**:

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 (BRT 2007). Currently, most of the commercial harvest from New York, New Jersey, Connecticut and Massachusetts comes from aquaculture (J. O'Dwyer, pers. comm.). Some current threats to oysters in New York waters include poor water quality, a lack of suitable attachment sites, and disease (BRT 2007, NYSDEC 2005). Presently, The Oyster Restoration Research Project (ORRP) is researching the efficiency of artificially built reefs, and will hopefully one day be able to restore oyster reefs in the New York City/Hudson River area (Grizzle et al. 2011).

## I. Status

### a. Current and Legal Protected Status

i. **Federal** ____Not Listed____ **Candidate?** ____No____

ii. **New York** ____Not Listed____

### b. Natural Heritage Program Rank

i. **Global** ____G5____

ii. **New York** ____Not Ranked____ **Tracked by NYNHP?** __No____

**Other Rank:**

**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

### a. North America

i. **Abundance**

**__X__ declining ____increasing _____stable ____unknown**

ii. **Distribution:**

**__X___ declining ____increasing _____stable ____unknown**

**Time frame considered: _____1900s-present_____**

Much of the eastern coast is in decline but some populations in the south, particularly the gulf coast, are considered stable (BRT 2007).

**b. Regional**

**i. Abundance**

**__X__ declining ____increasing ____stable _____unknown**

**ii. Distribution:**

**__X__ declining ____increasing ____stable _____unknown**

**Regional Unit Considered:_____mid-Atlantic_____**
**Time Frame Considered: _____1950s-present_____**

## c. Adjacent States and Provinces

**CONNECTICUT Not Present _____ No data _____**

**i. Abundance**

**__X__ declining ____ increasing ____ stable ____unknown**

**ii. Distribution:**

**__X__ declining ____ increasing ____ stable ____unknown**

Time frame considered: _____1997-present_____
Listing Status: _____Not Listed_____ SGCN? ___Yes _____

(BRT 2007)

**MASSACHUSETTS Not Present _____ No data _____**

**i. Abundance**

**__X__ declining ____ increasing ____ stable ____unknown**

**ii. Distribution:**

**__X__ declining ____ increasing ____ stable ____unknown**

Time frame considered: _____
Listing Status: _____Not Listed_____ SGCN? _____

(J. O'Dwyer, pers.comm., BRT 2007)

**NEW JERSEY** **Not Present _____** **No data _____**

i. **Abundance**

**__X___ declining ____ increasing ____ stable ____unknown**

ii. **Distribution:**

**__X___ declining ____ increasing ____ stable ____unknown**

Time frame considered: _____
Listing Status: _____Not Listed_____ SGCN? _____

(J. O'Dwyer, pers.comm.)

**ONTARIO** **Not Present ___X_____** **No data _____**

i. **Abundance**

**____ declining ____increasing ____stable ____unknown**

ii. **Distribution:**

**____ declining ____increasing ____stable ____unknown**

Time frame considered: _____
Listing Status: _____

**PENNSYLVANIA** **Not Present ___X_____** **No data _____**

i. **Abundance**

**____ declining ____increasing ____stable ____unknown**

ii. **Distribution:**

**____ declining ____increasing ____stable ____unknown**

Time frame considered: _____
Listing Status: _____ SGCN? _____

**QUEBEC** **Not Present _____** **No data _____**

i. **Abundance**

**____ declining ____increasing _____stable __X__unknown**

ii. **Distribution:**

**____ declining ____increasing _____stable __X__unknown**

Time frame considered: _____
Listing Status: _____Not Listed_____

**VERMONT** **Not Present ___X_____** **No data _____**

i. **Abundance**

**____ declining ____increasing ____stable ____unknown**

ii. **Distribution:**

**____ declining ____increasing ____stable ____unknown**

Time frame considered: _____
Listing Status: _____ SGCN? _____

**d. NEW YORK** **No data _____**

i. **Abundance**

**__X__ declining ____ increasing ____ stable _____ unknown**

ii. **Distribution:**

**__X__ declining ____ increasing ____ stable _____ unknown**

Time frame considered: _____1950s-present_____

**Monitoring in New York.**

There are currently no monitoring activities or regular surveys conducted by the NYSDEC that are specific to the Eastern oyster (J. O'Dwyer, pers. comm.). 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 (J. O'Dwyer, pers. comm.).

**Trends Discussion:**

Historically, New York had extremely abundant oyster reefs which supported a thriving fishery dating back to the 1800s. Areas in Great South Bay (GSB), Long Island Sound, Raritan Bay, Jamaica Bay, the Peconics, 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 GSB 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 GSB, 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 and in 1950, 1.2 million bushels of oysters were reported as harvested (NYSDEC 2005). Since then oyster harvest has dramatically dropped with only 62,133 bushels harvested in 2003 and most recently only 34,354 bushels harvested in 2012 (NYSDEC 2012). Currently, very few naturally occurring oyster reefs occur around New York and most commercial activity is done through aquaculture. Some wild harvest does occur on the North shore of Long Island but landings data for wild and cultured are grouped (J. O'Dwyer, pers. comm.). More than 92 percent of the 2003 harvest originated from aquaculture rather than from wild oysters (NYSDEC 2005).

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).

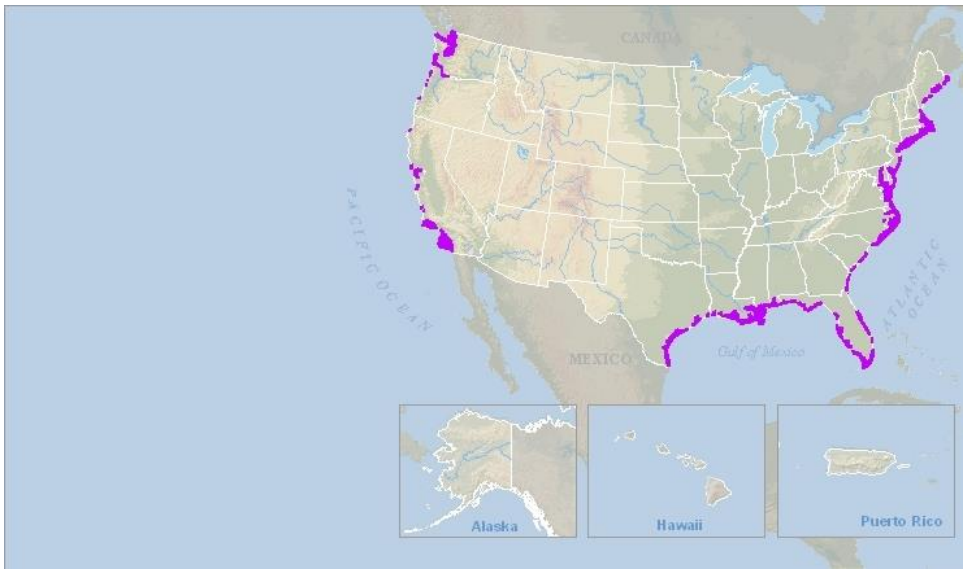


**Figure 1.** The United States coastal distribution of *Crassostrea virginica*, the eastern oyster (NOAA n.d.).

**III. New York Rarity, if known:**

| Historic | # of Animals | # of Locations | % of State |
|---|---|---|---|
| **prior to 1970** | _____ | _____ | _____ |
| **prior to 1980** | _____ | _____ | _____ |
| **prior to 1990** | _____ | _____ | _____ |

**Details of historic occurrence:**
Historically, oysters naturally occurred around Long Island in: Great South Bay, Long Island Sound, Raritan Bay, Jamaica Bay, Peconic Bay, and the Hudson River (NYSDEC 2005).

| Current | # of Animals | # of Locations | % of State |
|---|---|---|---|
| | _____ | _____ | _____ |

**Details of current occurrence:**
Currently, there are no naturally occurring reefs in Great South Bay, Long Island Sound, Raritan Bay, or the Hudson River. However, Mecox Bay, Southampton, East Hampton town waters, the Huntington-Northport Bay complex, and Mattituck Inlet all have stable oyster populations, although many of these towns supplement their natural populations with oysters from shellfish hatcheries (NYSDEC 2005).

**New York's Contribution to Species North American Range:**

| % of NA Range in New York | Classification of New York Range |
|---|---|
| ____ 100 (endemic) | ____ Core |
| ____ 76-99 | __X__ Peripheral |
| ____ 51-75 | ____ Disjunct |
| ____ 26-50 | Distance to core population: |
| __1__ 1-25 | _____ |

## IV. Primary Habitat or Community Type:

**1.** Estuarine, Brackish Shallow Subtidal, Benthic Geomorphology, Shellfish Bed

**2**. Estuarine, Brackish Intertidal, Benthic Geomorphology, Shellfish Bed

**Habitat or Community Type Trend in New York:**

**__X__ Declining ____Stable ____ Increasing ____Unknown**

**Time frame of decline/increase: ___early 20th century-present_____**

**Habitat Specialist? __X__ Yes _____ No**

**Indicator Species? __X__ Yes _____ No**

**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. New York Species Demographics and Life History

**__X__ Breeder in New York**

**__X__ Summer Resident**

**__X__ Winter Resident**

**____ Anadromous**

**____ Non-breeder in New York**

**____ Summer Resident**

**____ Winter Resident**

**____ Catadromous**

**____ Migratory only**

**____Unknown**

**Species Demographics and Life History Discussion:**

*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 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 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:

Several diseases are known to affect eastern oyster populations in New York by causing mortality and inhibiting restoration efforts (NYSDEC 2005). *Perkinsus marinus*, or Dermo is an intracellular parasite that is prevalent in oysters' hemocytes. Since the 1990s, Dermo has been present in oyster populations in the Long Island Sound (Sunila n.d., a). This disease is transmitted from oyster to oyster, and is released into the water column as the tissues of infected dead oysters disintegrate (Sunila n.d., a). The free-swimming zoophore phase is then ingested by living oysters, thus allowing for the continuation of Dermo's parasitic lifecycle (Sunila n.d, a). 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), *Haplosporidium nelsoni* is another disease which affects eastern oysters in New York waters. The infection is first present in the oyster's gill tissue, subsequently spreading into the digestive track, and ultimately infecting all tissue (Sunila n.d.,b ). The mechanism by which this disease is transmitted is unknown, yet it does not appear to be transmitted from oyster to oyster (Sunila n.d., b). In the Long Island Sound eastern oysters become infected in mid to late June with the initial infection lasting until November (Sunila n.d., b). After this initial infection period, the oysters die within a month (Sunila n.d.,b ). MSX is suppressed from low salinities as well as low temperatures (Sunila n.d.,b ). *Roseovarious* oyster disease (ROD)—previously known as Juvenile Oyster Disease (JOD)—is a disease mainly affecting hatchery-reared seed oysters from Maine to New York (Sunila n.d., c). Associated syndromes of this disease include: mortality, slowed growth, brown rings on the internal portion of the shell, and unequal shell growth (Sunila n.d., c ). 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).

Ocean acidification as a consequence of increasing concentrations of carbon dioxide ($CO_2$) 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 $C0_2$ 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?**

**_____ No ____ Unknown**

**__X__ Yes**

There are several recreational and commercial harvest regulations in place for oysters in New York waters. Oysters may be taken throughout the year. As with other shellfish, oysters are subject to shellfish harvesting area closures. Areas in which oysters are harvested must be certified by the DEC, but primarily for public safety reasons. Recreational fishermen are restricted to half a bushel

per day; however, one bushel (combined volume) of clams, oysters, and mussels is limited per day. Oysters that are harvested must be at least three inches at the longest diameter (NYSDEC 2013).

**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). 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. Presently, The Oyster Restoration Research Project (ORRP) combines efforts from the Hudson River Foundation, the NY/NJ Baykeeper and the New York Harbor School to test the efficiency of artificially built reefs, and hopefully restore oyster reefs in the New York City/Hudson River area (Grizzle et al. 2011).

## VII. References


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