Species Status Assessment

Class: Bivalvia
Family: Pectinidae
Scientific Name: *Argopecten irradians*
Common Name: Bay Scallop

Species synopsis:

The bay scallop, *Argopecten irradians*, is a short-lived marine bivalve common along the eastern coast of the United States. Their distribution in North America ranges from Cape Cod, Massachusetts to Laguna Madre, Texas (Fay et al. 1983). Three subspecies exist along this range with the New England and mid-Atlantic, *Argopecten irradians irradians* overlapping in southern New Jersey with *A.i. concentricus* (Fay et al. 1983). Bay scallops can live in a variety of habitats but eelgrass beds appear to be preferential, providing shelter from predators and, due to reduced water velocity, an accumulation of particulate matter on which they can filter-feed (MacKenzie 2008b, Fay et al. 1983, Peterson et al. 1984). Although never as large as oyster and clam fisheries, historically, bay scallops did support a thriving fishery in Massachusetts, New York, and North Carolina (MacKenzie 2008a). However, due to mass eelgrass die-offs in the 1930s and 1980s (from wasting disease and brown tide, respectively), bay scallop abundance and subsequent harvest plummeted (MacKenzie 2008a). Bay scallop populations in New York, and other coastal areas, have yet to return to their historic levels and this is believed to be tied to low densities of spawning stock (resulting in low fertilization success) and loss of their optimal habitat, eelgrass beds (Tettlebach and Smith 2009, Fonseca and Uhrin 2009).

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** NR **Tracked by NYNHP?** No

Status Discussion:
Throughout the twentieth century bay scallops have witnessed precipitous declines coinciding with loss of eelgrass beds. Populations in New York and other coastal areas have been unable to return to historic levels. Bay scallops currently have no state or federal protection status. Additionally, they have received a secure global 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: 1980s-present

b. Regional

i. Abundance

__X__ declining ____increasing ____stable _____unknown

ii. Distribution:

__X__ declining ____increasing ____stable _____unknown

Regional Unit Considered: Southern New England
Time Frame Considered: 1980s-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: _____1962-present_____
Listing Status: _____Not Listed_____ SGCN? __Yes__

(MacKenzie 2008b)

Rhode Island Not Present _____ No data _____

i. Abundance

__X__ declining ____ increasing ____ stable ____unknown

ii. Distribution:

__X__ declining ____ increasing ____ stable ____unknown

Time frame considered: _____1950s-present_____
Listing Status: _____Not Listed_____ SGCN? ____

(MacKenzie 2008b)

MASSACHUSETTS **Not Present _____** **No data _____**

i. **Abundance**

__X__ declining ____ increasing ____ stable ____unknown

ii. **Distribution:**

__X__ declining ____ increasing ____ stable ____unknown

Time frame considered: _____1985-present_____
Listing Status: _____Not Listed_____ SGCN? _____

(MacKenzie 2008b)

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

i. **Abundance**

__X__ declining ____ increasing ____ stable ____unknown

ii. **Distribution:**

__X__ declining ____ increasing ____ stable ____unknown

Time frame considered: _____1968-present_____
Listing Status: _____Not Listed_____ SGCN? _____

(MacKenzie 2008b)

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 ___X_____** **No data _____**

i. **Abundance**

____ declining ____increasing _____stable ____unknown

ii. **Distribution:**

____ declining ____increasing _____stable ____unknown

Time frame considered: _____
Listing Status: _____

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: _____1980s -present_____

(MacKenzie 2008b)

Monitoring in New York.

There are currently no monitoring activities or regular surveys specific to the bay scallop that are conducted by the NYSDEC. Both Cornell Cooperative Extension of Suffolk County and the Easthampton Town Hatchery monitor the abundance and spawning success of bay scallops which have been planted in New York waters (Tettlebach and Smith 2009; Rossi-Snook 2012).

Trends Discussion:

Bay scallops once supported a profitable commercial fishery in Massachusetts, New York, and North Carolina waters (MacKenzie 2000a). In the 1930s bay scallop populations and catch plummeted in conjunction with an eelgrass die-off in North American and Europe, due to "wasting disease" (Fonseca and Uhrin 2009). Although some populations were able to slightly recover over time, in the 1980s additional eelgrass die-offs occurred in the coastal waters of Long Island due to brown tide (Fonseca and Uhrin 2009). These brown tide events caused bay scallops in Long Island waters to come close to extirpation (Tettlebach and Smith 2009). Again in 1995, another brown tide event decimated bay scallop populations, and bay scallops have yet to significantly rebound in abundance (Tettlebach and Smith 2009). The lack of recovery is attributed to loss of habitat and low fertilization success (due to a small and insufficiently densely distributed spawning stock) (Tettlebach and Smith 2009). Bay scallop plantings and small spawner sanctuaries have seen some success and will hopefully contribute to the future self-sustainability of New York populations (Tettlebach and Smith 2009, Rossi-Snook 2012). In 2012, 34,480 bushels of bay scallops were commercially harvested from New York (NYSDEC 2012). Although higher than some previous years, particularly the late-1980s and early-1990s, this harvest number is still significantly lower than the peak commercial harvest in 1962 of 164,646 bushels (NYSDEC 2012).

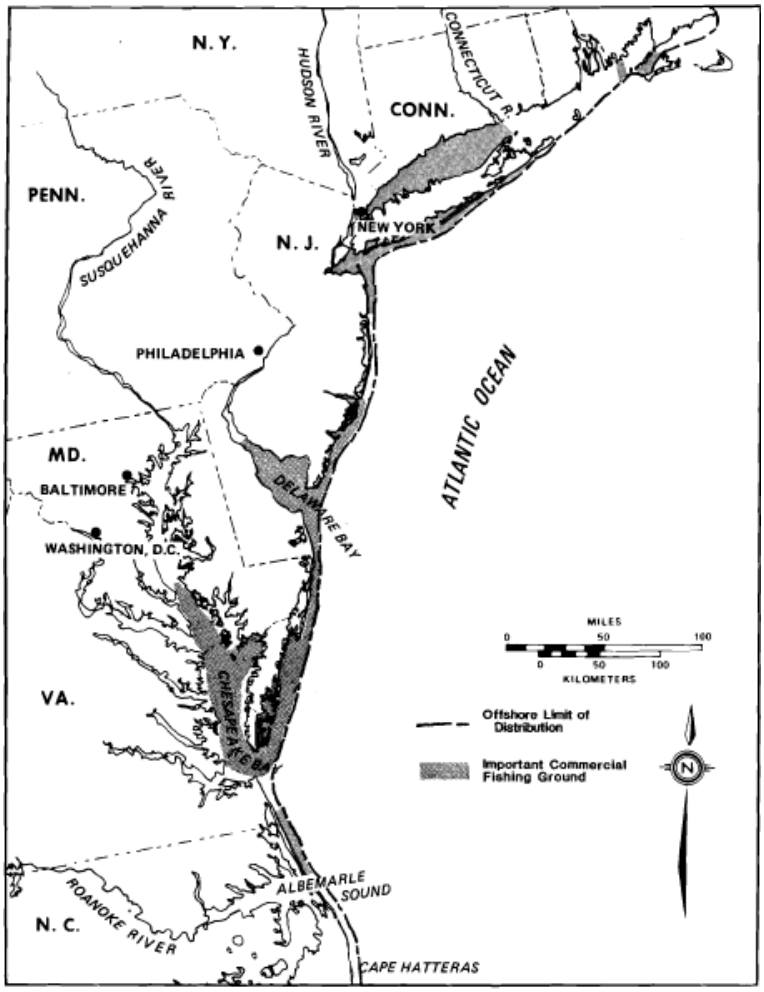

Figure 1. Mid-Atlantic distribution of the bay scallop, *Argopecten irradians* (Fay et al. 1983).

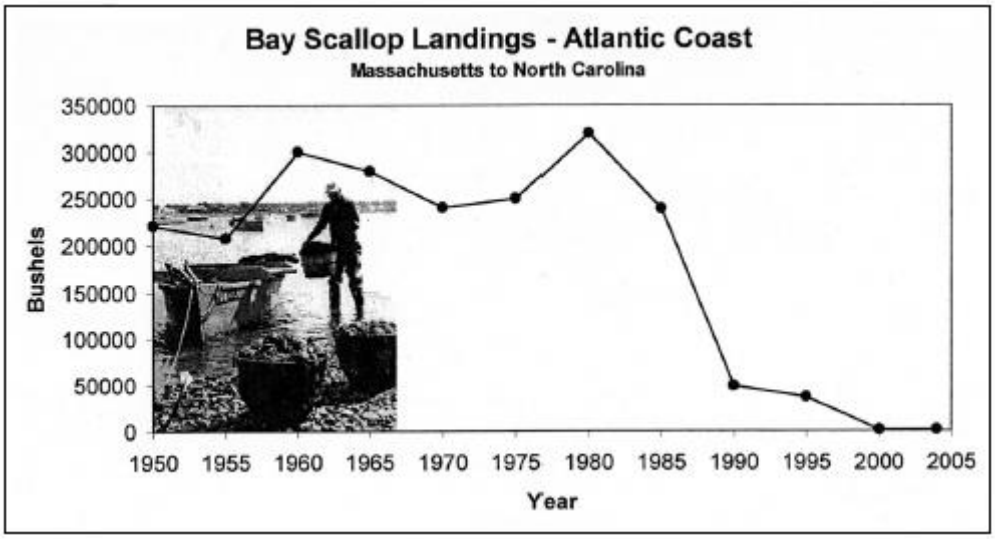

Figure 2. The landings of bay scallops (in number of bushels) from Massachusetts to North Carolina (Mackenzie 2008a).

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, bay scallops were harvested on Long Island from: Peconic Bay, Gardiners Bay, Oyster Bay Harbor, Lloyds Harbor, Huntington Bay, Northport Harbor, Great South Bay, Mecox Bay, and Shinnecock Bay. Since the 1930s scallops have not been present in Oyster Bay following the eelgrass die-off (MacKenzie 2008b).

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

Details of current occurrence:
Currently, bay scallops are primarily harvested from Little Peconic Bay, Great Peconic Bay and Gardiners Bay. Bay scallops are still harvested in Great South Bay's western end, between Jones and Fire Island Inlets, in years when they are present (MacKenzie 2008b).

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, Intertidal, Aquatic Bed/Benthic Geomorphology, Shellfish Bed

2. Estuarine, Brackish Shallow Subtidal, Aquatic Bed/Benthic Geomorphology, Shellfish Bed

3. Estuarine, Deep Subtidal, Aquatic Bed/Benthic Geomorphology, Shellfish Bed

4. Marine Eelgrass Meadow

Habitat or Community Type Trend in New York:

__X__ Declining ____Stable ____ Increasing ____Unknown

Time frame of decline/increase: _____1930s-present_____

Habitat Specialist? __X__ Yes _____ No

Indicator Species? __X__ Yes _____ No

Habitat Discussion:

Bay scallops are found on the Atlantic coast from Cape Cod, Massachusetts to the Gulf of Mexico near Texas. Their distribution is primarily estuarine or near-coastal usually being found no more than three miles offshore (Fay et al. 1983). Bay scallops can live on a variety of substrates but eelgrass beds appear to be preferential habitat (Fay et al. 1983). Not only does this habitat protect bay scallops from predation during all life stages, but is an optimal place to feed and grow due to a reduction in water velocity and subsequent accumulation of food material in these beds (Mackenzie 2008b, Fay et al. 1983; Peterson et al. 1984). Spawning in or near eelgrass beds is also thought to significantly increase concentrations of gametes thus ultimately resulting in an increased chance of fertilization (MacKenzie 2008b). Fay *et al.* (1983) cites a preferential depth of 0.3 to 10 meters, with bay scallops being found as deep as 18 meters. Various life stages of the bay scallop have preferential salinities and temperatures at which they function optimally (Fay 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:

Bay scallops are relatively short-lived, becoming sexually mature at one year, and generally do not live for more than two years. Timing at which maturity is reached is based on age rather than size, resulting in a range of sizes for mature scallops (Fay et al. 1983). As protandrous hermaphrodites, bay scallops first function as males and then females. They alternate the release of sperm and eggs during spawning events and as a consequence of this pattern, bay scallops do not generally self-fertilize (Fay et al. 1983). Fecundity is considered high in bay scallops with millions of eggs released during a season (Mackenzie 2008b), and Tettlebach and Smith (2009) citing a fecundity of five million eggs. Since bay scallops are short-lived they generally only spawn once during their life. Spawning time varies throughout the scallop's geographic range. In and around Long Island, peak spawning typically occurs when water temperatures begin to increase, generally in June and July (Fay et al. 1983). Formation of the gametes, or gametogenesis, and spawning events are both linked to water temperature and food availability (Fay et al. 2009).

Fertilized eggs quickly begin to develop with 15 to 20°C being an optimal temperature for cellular cleavage to begin. Within a day or two the embryos develop into veliger larvae (Fay et al. 1983). In hatcheries, larval scallops grow only when fed specific phytoplankton species, thus larval survival is linked to the presence or absence of these species. Predation and water temperature are also factors affecting larval survival (MacKenzie 2008b). Bay scallops reach their "spat," or juvenile phase in about ten to 14 days after fertilization. On average it takes two weeks to go from

fertilization to juvenile settlement, but this can take anywhere from ten to 19 days depending on water temperature and food availability (Fay et al. 1983).

Juveniles typically settle and attach to seagrass blades by means of byssal threads. Juveniles do not do well in areas of high silt, thus they settle above the seafloor (i.e. attached to the ends of seagrass blades) to avoid predators and increase survivorship. Juvenile bay scallops can settle on a variety of substrates but eelgrass beds appear to be preferential habitat. Juveniles primarily move by use of their foot until they reach adulthood. Although bay scallops retain their foot throughout adulthood, they rely on swimming as their main form of locomotion. This free-swimming behavior is seen in many members of the scallop family and is a unique trait amongst bivalves (Fay et al. 1983).

Year-to-year recruitment of bay scallops is erratic and cannot be directly predicted from the adult spawning population (MacKenzie 2008b). Since bay scallops only spawn once during their life, recruitment is dependent on the success of the previous year's spawn (NYSDEC 2005). A variety of predators exist for the various life stages of *A. irradians*. Predators include green crabs, blue crabs, oyster drills, tautog, scup, northern puffer, herring gulls, and other birds (MacKenzie 2008b, Fay et al. 1983).

VI. Threats:

Habitat loss, primarily loss of eelgrass beds, is a major threat facing bay scallops in New York waters, and throughout their range. Bay scallop harvest rates plummeted after eelgrass die-offs in the 1930s and 1980s (MacKenzie 2008a). Wasting disease and harmful algal blooms, such as brown tide were the major contributors to these die-offs (Fonseca and Uhrin 2009). Currently, turbidity caused from sediment runoff, along with point and non-point source nutrient loading are believed to be preventing eelgrass recovery (Fonseca and Uhrin 2009). Additionally, eelgrass can be physically destroyed by a number of factors including various types of fishing gear, dredging, recreational boating, and the building of bulkheads, marinas, and docks (NYSDEC 2009). Since bay scallops depend on eelgrass beds for protection from predators as well as for an optimal feeding habitat, trying to restore bay scallop populations without focusing on restoration of eelgrass beds will most likely prove futile.

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 bay scallop (Barrett et al. 2011). When studied under the concentrations of CO_2 that are projected to occur in the future, *A. irradians* experienced delayed metamorphosis and decreased larval survivorship and size (Talmage and Gobler 2009). It is hypothesized that those bivalves which are able to survive and adapt will have decreased shell strength, potentially making them more vulnerable to predation and disease and ultimately making it difficult to rebuild wild stocks in the Long Island Sound and other areas (Barrett et al. 2011).

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

_____ No ____ Unknown

__X__ Yes

New York currently has several recreational and commercial restrictions in place for the harvest of bay scallops. One bushel per day is permitted for recreational harvest. For commercial harvest ten bushels per person or 20 bushels per boat are allowed to be taken. There is a 2 ¼ inch size limit, as measured from the hinge to the mid bill, and an annual ring must be present. Dredges are allowed but have a maximum length restriction. It is prohibited to use dredges on Sunday or to use any mechanical means to retrieve one's dredge. Bay scallops that are cultured under the proper permits from the NYSDEC are exempt from size limits. Bay scallops may only be harvested from the first Monday in November through the 31st of March. Primarily for public safety purposes, shellfish, including bay scallops, may only be taken from NYSDEC certified areas (NYSDEC 2013).

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

The successful conservation of bay scallops in New York relies heavily on restoring eelgrass beds. Cornell Cooperative Extension of Suffolk County's eelgrass program focuses on plantings and restoration efforts on Long Island to help mitigate the continued loss of this habitat. Many of the noted threats are affecting eelgrass habitat, which in turn is affecting bay scallop abundance.

The continued proper management of bay scallop harvest is important even if bay scallops are to rebound to historic levels. This species' year-to-year recruitment fluctuates greatly and depends on the previous year's spawning success (MacKenzie 2008b). It is important to ensure that the short-lived scallop has an opportunity to spawn in order to increase chances of successful fertilization.

With low densities of spawners, in order for the population to rebound, natural mortality must be reduced (i.e. reduction of predators) or the spawning stock must be boosted (Tettlebach and Smith 2009). The designation of spawner sanctuaries may help to increase the chance of successful fertilization and subsequent recruitment (NYSDEC 2005). The Easthampton Town Hatchery and Cornell Cooperative Extension have both seen success at sites where harvest was limited and densities of spawners were high (Rossi-Snook 2012, Tettlebach and Smith 2009). Continued success of these programs will hopefully result in self-sustaining bay scallop populations in New York waters.

VII. References

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