<u>Species Status Assessment</u>

Common Name: Green turtle **Date Updated:** September 2024

Scientific Name: *Chelonia mydas* **Updated by:** Katherine Lawson

Class: Reptilia

Family: Cheloniidae

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

The green turtle is a marine turtle that was originally described by Linnaeus in 1758 as Testudo mydas. In 1868 Marie Firmin Bocourt named a new species of sea turtle Chelonia agassizii. It was later determined that these represented the same species, and the name became Chelonia mydas. In New York, the green turtle can be found from July – November, with individuals occasionally found cold-stunned in the winter months (Berry et al. 1997; Morreale and Standora 1998). Green sea turtles found in NY are most commonly juveniles from the North Atlantic Distinct Population Segment (Seminoff et al. 2015). Green turtles are sighted most frequently in association with seagrass beds off the eastern side of Long Island. They are observed with some regularity in the Peconic Estuary (Morreale and Standora 1998). Green turtles experienced a drastic decline throughout their range during the 19th and 20th centuries as a result of human exploitation and anthropogenic habitat degradation (NMFS and USFWS 1991). In recent years, some populations, including the Florida nesting population, have been showing some signs of increase (NMFS and USFWS 2007). Trends have not been analyzed in New York; a mark-recapture study performed in the state from 1987 – 1992 found that there seemed to be more green turtles at the end of the study period (Berry et al. 1997). However, changes in temperature have lead to an increase in the number of cold stunned green turtles in recent years (NMFS, NY Marine Rescue Center).

I. Status

a. Current legal protected Status

i. **Federal:** Endangered, ESA Threatened N. Atlantic DPS **Candidate:** N/A

ii. **New York:** Threatened

b. Natural Heritage Program

i. **Global:** G3

ii. **New York:** S1N **Tracked by NYNHP?:** Yes

Other Ranks:

-IUCN Red List: Endangered

-Northeast Regional SGCN: RSGCN

-CITES Appendix I

Status Discussion:

Green turtles have been heavily exploited throughout the world, and the breeding populations of Bermuda and the Cayman Islands were wiped out. Because of declining populations, the green turtle was first listed under the Endangered Species Act in 1978. The Florida and Pacific coast of Mexico breeding populations were listed as endangered, while all other populations were considered threatened (NMFS and USFWS 1991). Green turtles seen in the mid-Atlantic and

Northeast U.S. are typically treated as endangered, although it is uncertain whether they nest in Florida or another area within the North Atlantic Distinct Population Segment nesting grounds (ENSP 2006; Seminoff et al. 2015). Although listed endangered globally, the North Atlantic DPS is listed as threatened under the ESA (Sparks and DiMatteo 2013). In the U.S., the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) have joint jurisdiction of this species.

Because the green turtle is highly migratory, it is also protected under several international treaties including the Convention on Migratory Species, the Specially Protected Areas and Wildlife Protocol of the Cartagena Convention, and the Inter-American Convention for the Protection and Conservation of Sea Turtles.

II. Abundance and Distribution Trends

Region	Present?	Abundance	Distribution	Time Frame	Listing status	SGCN?
North America	Yes	Increasing	Stable	Last 30 years		-
Northeastern US	Yes	Increasing	Stable	Late 1970s-2005		-
New York	Yes	Unknown	Unknown		Threatened	Yes
Connecticut	Yes	Unknown	Unknown		Threatened	Yes
Massachusetts	Yes	Unknown	Unknown		Threatened	Yes
New Jersey	Yes	Unknown	Unknown		Endangered	Yes
Pennsylvania	No	-	-			-
Vermont	No	-	-			-
Ontario	No	-	-			-
Quebec	Unknown	Unknown	Unknown			-

Column options
Present?: Yes; No; Unknown; No data; (blank) or Choose an Item
Abundance and Distribution: Declining; Increasing; Stable; Unknown; Extirpated; N/A; (blank) or Choose an item
SGCN?: Yes; No; Unknown; (blank) or Choose an item

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

The main monitoring that occurs for the species is entanglement and stranding response provided by The NY Marine Rescue Center (NYMRC) d/b/a The Riverhead Foundation and the Atlantic Marine Conservation Society (AMSEAS). Satellite tags were placed on a total of 12 green sea turtles that were rehabilitated after being cold stunned between 2007-2015. Ten of these individuals migrated south after being tagged, exhibiting expected movement patterns after being rehabilitated. This data also supports that rehabilitated individuals occupy similar habitats to non-rehabilitated individuals and exhibit typical diving behavior once released back into the wild

(Robinson et al. 2020). Strandings respondents in New York report turtle response data periodically to the NOAA Sea Turtle Stranding and Salvage Network (STSSN 2024).

NYSDEC helped to organize aerial surveys, targeted to survey large whale species, that were carried out in the NY Bight in 2017-2020. Sea turtles were also opportunistically sighted during these surveys. Due to the small size of sea turtles, it is almost impossible to confidentially confirm this species while in the air. Because of this, sea turtles are often grouped into an unidentified sea turtle group during these surveys. During the 3 years of the surveys, 424 sightings of 503 individuals were grouped into this unidentified category, none were identified as green sea turtles. Sea turtle sightings were highest during the summer followed by the fall and lowest during the spring and winter months (Tetra Tech and LGL 2020). NYSDEC also runs a citizen science program to collect sea turtle sightings from the public called Flipper Files. The New York State Energy Research and Development Authority (NYSERDA) ran aerial surveys from 2016-2019 prepared by Normandeau inc. that included data on sea turtle abundance (NYSERDA 2021). From 2016-2019, only one green sea turtle was recorded from aerial transects, though approximately 300 turtles were not able to be identified to species (NYSERDA 2021). The New York Department of State (NYSDOS) prepared an Offshore Atlantic Ocean Study in 2013 that modelled sea turtle abundance in New York based off of the North Atlantic Right Whale Consortium database, which details shipboard survey observations from 1978-2011 (NYSDOS 2013).

Due to the highly migratory behavior of sea turtles, many regional research efforts study them and include information for New York waters. The Atlantic Marine Assessment Program for Protected Species (AMAPPS), a multi-agency effort to survey protected species run jointly by NOAA, NMFS, BOEM, and the U.S. Navy, runs aerial surveys in New York waters. AMAPPS III (2020-2024) is currently running observations that include New York Waters (NEFSC and SEFSC 2021). The OBIS-SEAMAP database reports sighting records from a number of compiled sources, including AMAPPS, (NEFSC and SEFSC 2021), NYSERDA, Robinson (et al. 2020), New York Aerial Surveys, and more.

The U.S. Navy has developed a spatial density model for sea turtles off the Atlantic Coast that predicts monthly sea turtle presence in the Mid-Atlantic and elsewhere. The model applies a novel approach to using unspecific, hard-shell sea turtle sightings in mapping (Sparks and DiMatteo 2023).

Trends Discussion *(insert map of North American/regional distribution and status):*

Trends of green turtles in New York are poorly understood. Sadove and Cardinale (1993) estimated that there were “at least 100 turtles” in the New York Bight area each year. Berry et al. (1997) performed a mark-recapture study from 1986 – 1997 and recapture rates indicated that the number of green turtles appeared to be increasing in state waters over the study period. Stranding reports have been variable from year to year, with no significant trends being reported (DiGiovanni 2009; Figures 5 and 6). Whether the number of stranded individuals can be used as an estimator of population size is currently unknown.

Trend information that does exist indicates that green turtle populations are stable or increasing. NMFS and USFWS (2007) compiled information on nesting populations of green turtles from various nesting grounds in the western North Atlantic thought to be representative of their region. Nesting populations in Florida, the Yucatan Peninsula, Costa Rica, and Suriname are all listed as increasing, while the nesting populations in Venezuela and Brazil are stable (NMFS and USFWS 2007). Estimates for the Northwest Atlantic Regional Management Unit, a genetically distinct subpopulation, show an increasing trend in the number of green sea turtle nesting sites (Mazaris et al. 2017) and the North Atlantic distinct population segment (mainly from Florida) was found to increase by over 2000 individuals between 1989 and 2016 (Valdivia et al. 2019). In Florida, the number of nests has increased to an abundance of over 5,000 annual nests from the late 1980s to 2005 (NMFS and USFWS 2007). With changes in temperature it is expected that more green and other sea turtles will be seen in the New York area, as evidenced in increases in cold stunned animals (NMFS, Riverhead Foundation).

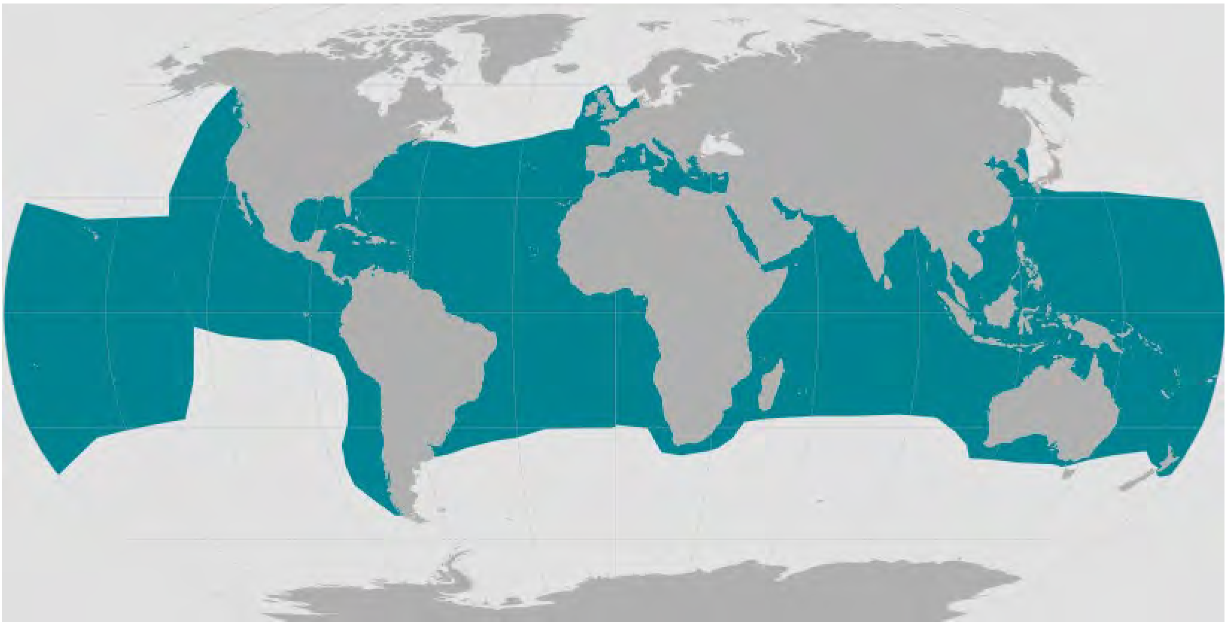

Figure 1. World map providing approximate representation of the green sea turtle's range (NOAA 2023).

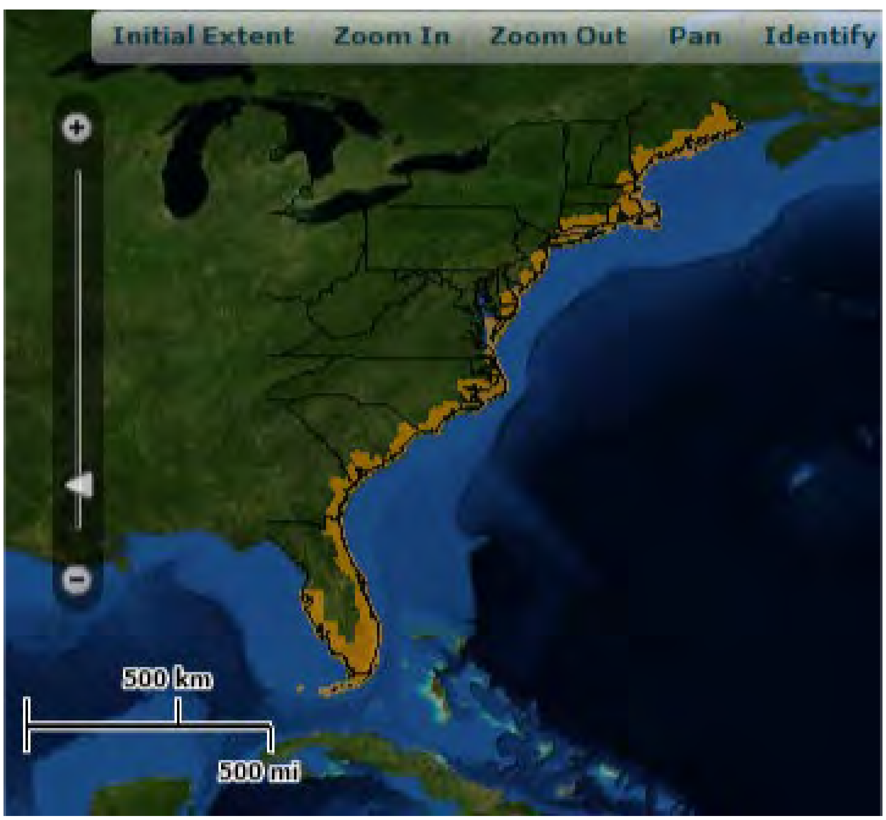

Figure 2. U.S. Atlantic range of the green turtle (USFWS 2012).

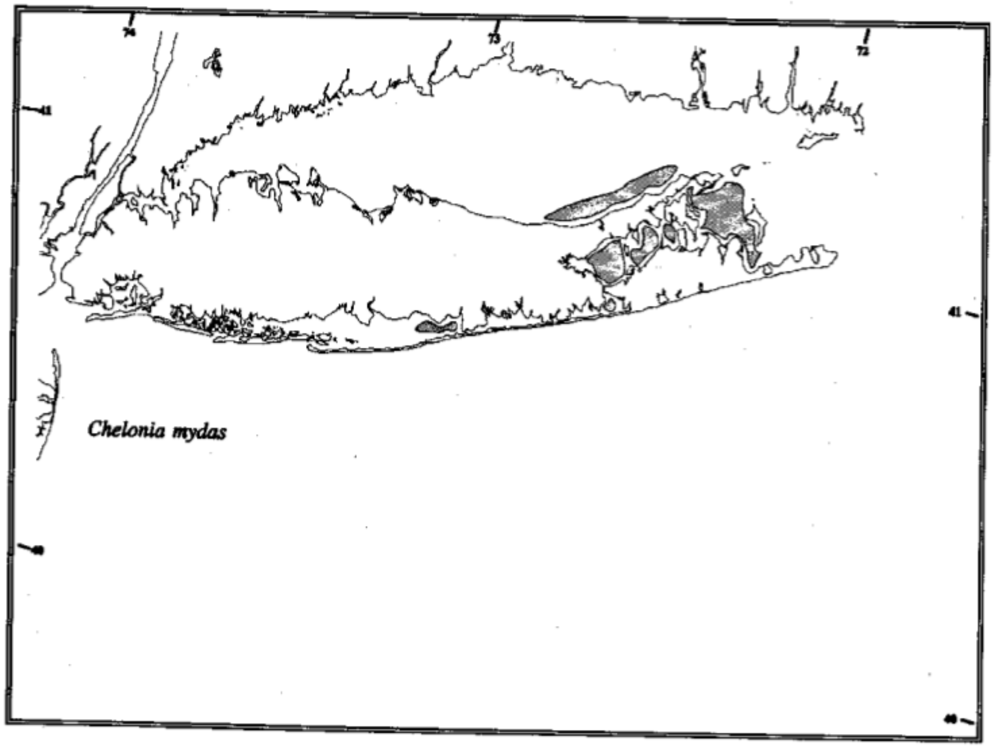

Figure 3. Areas where green turtles have been sighted in New York waters (Sadove and Cardinale 1993).

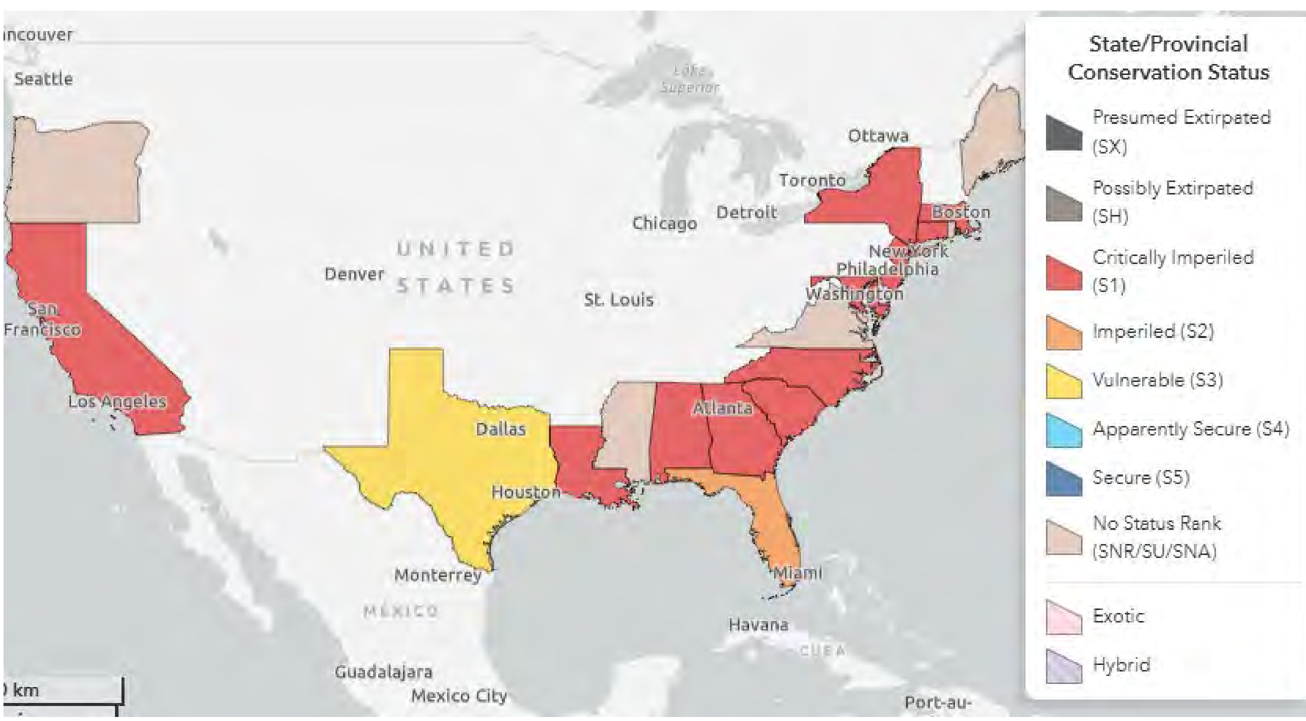

Figure 4. Conservation status of green turtle in North America (NatureServe 2024).

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

Green sea turtles are observed in strandings records from New York (Figure 5 and 6). Sea turtles tracked by the NYMRC included green turtles (Figure 6). Tagging records, as well as aerial survey records and fisheries observations are also available from OBIS-SEAMAP (Figure 8 and 9).

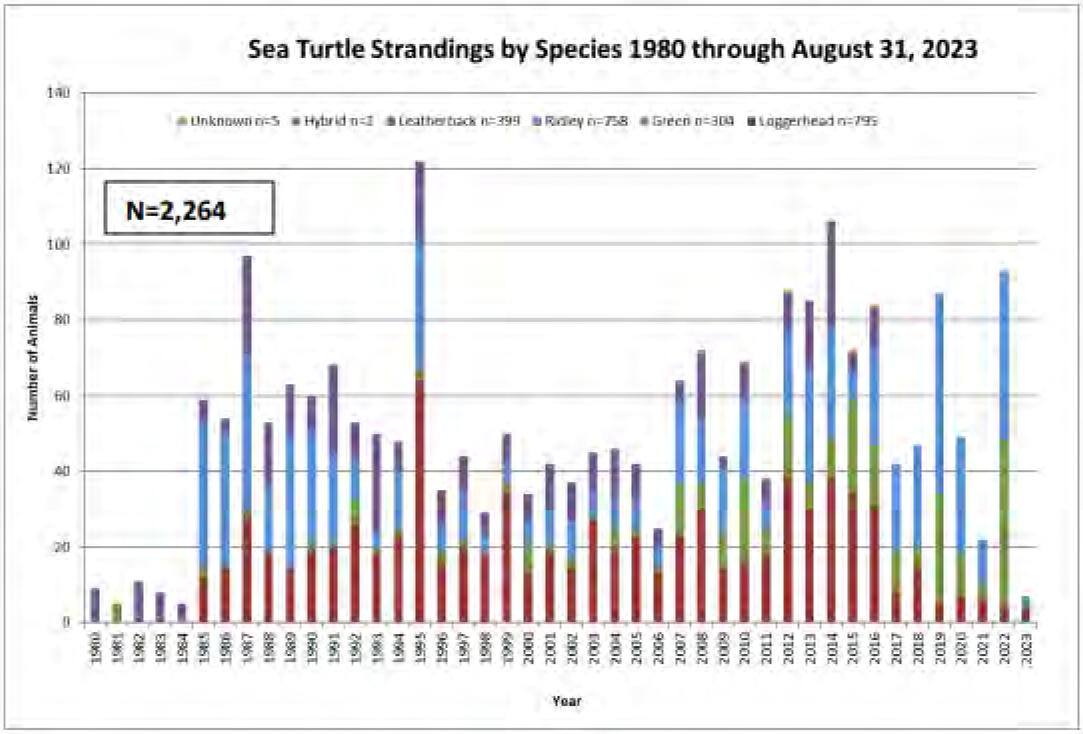

Figure 5: New York sea turtle strandings 1980 through August 31, 2023 by NY Marine Rescue Center (Montello et al. 2023).

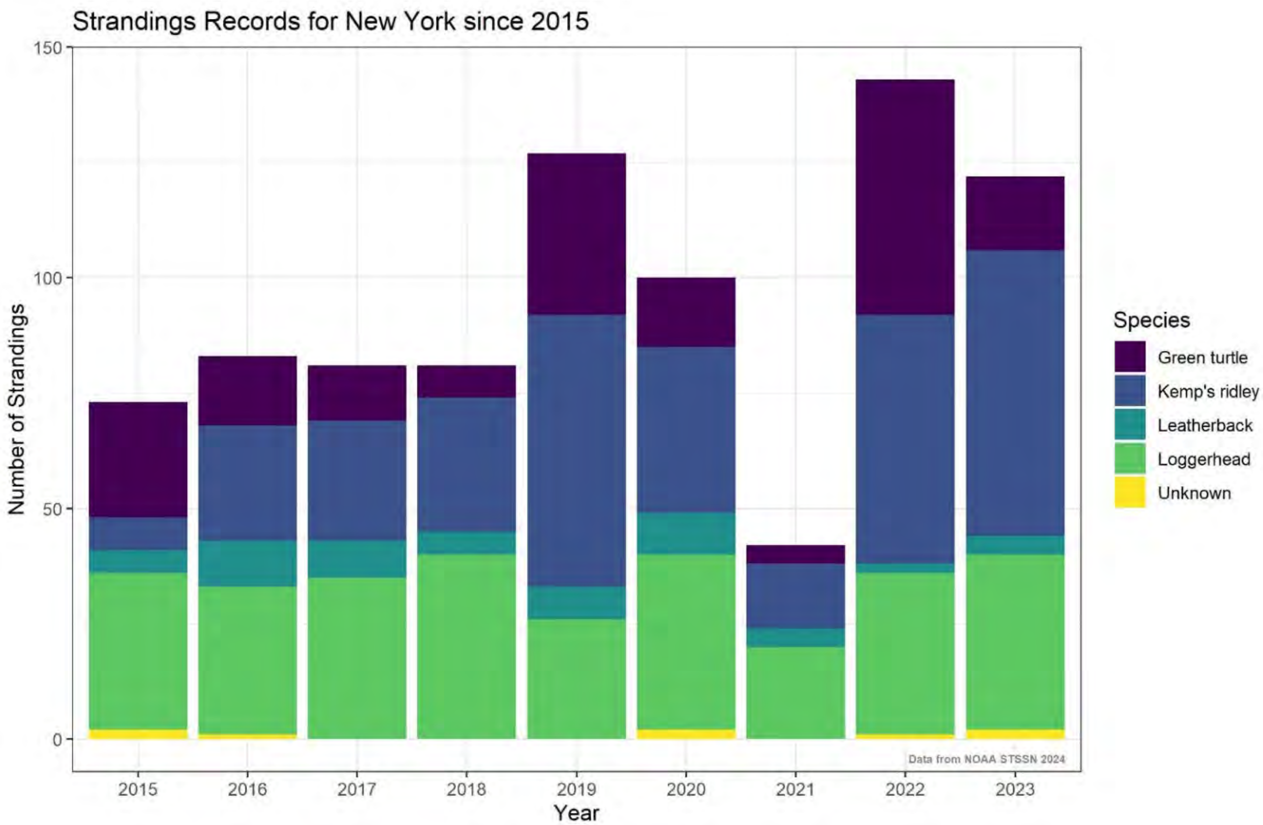

Figure 6. New York sea turtle strandings reported to NOAA Sea Turtle Stranding and Salvage Network (STSSN 2024), including data from NY Marine Rescue Center and the Atlantic Marine Conservation Society. Figure prepared by NYNHP.

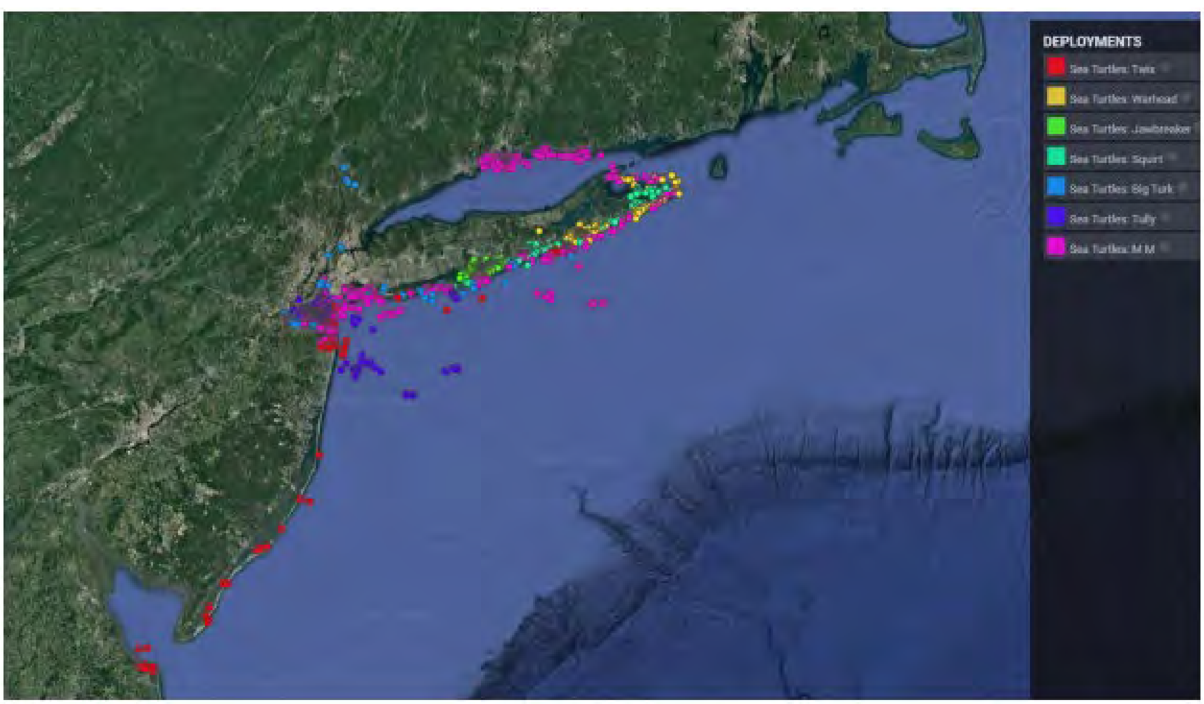

Figure 7: Movement pattern of 8 sea turtles tagged and released by NYMRC (Montello et al. 2023).

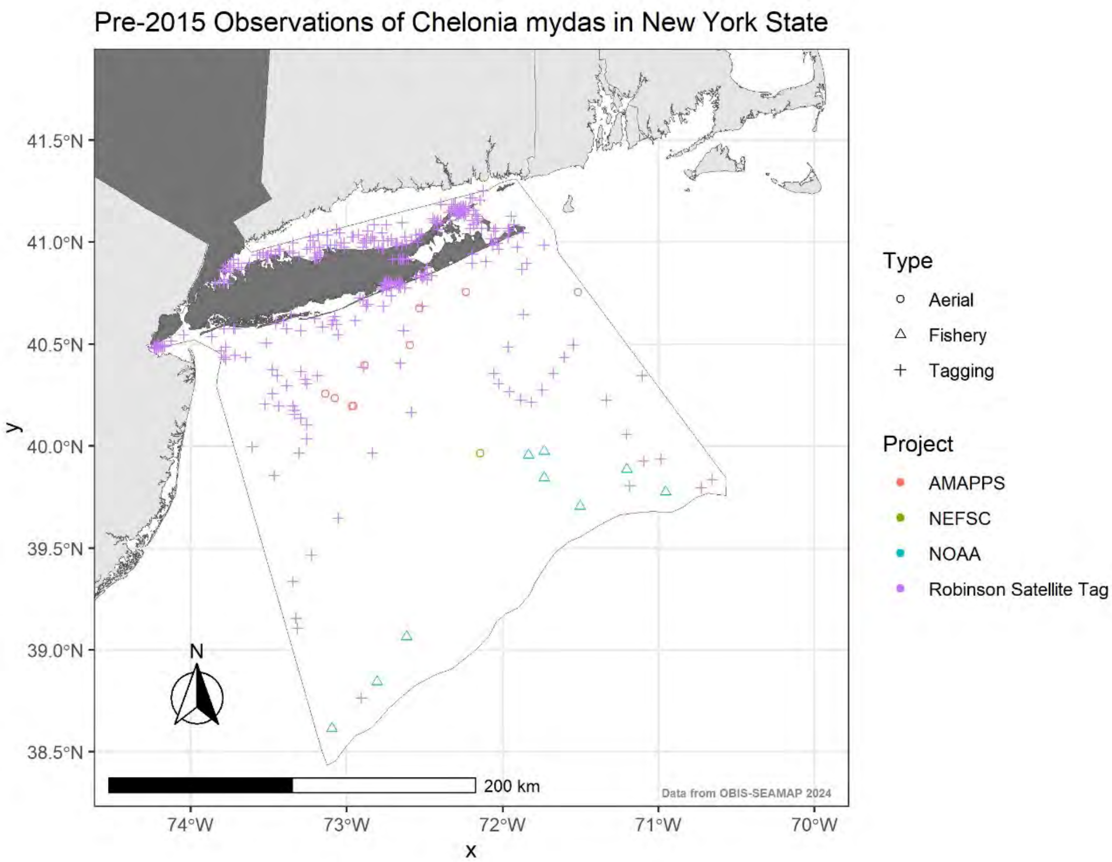

Figure 8. Observation of green sea turtles reported to OBIS-SEAMAP prior to 2015 (OBIS-SEAMAP 2024). Project data included from Atlantic Marine Assessment Program for Protected Species (AMAPPS), Northeast Fisheries Science Center (NEFSC), National Oceanic and Atmospheric Administration (NOAA), and Robinson et al. (2020). Figure prepared by NYNHP.

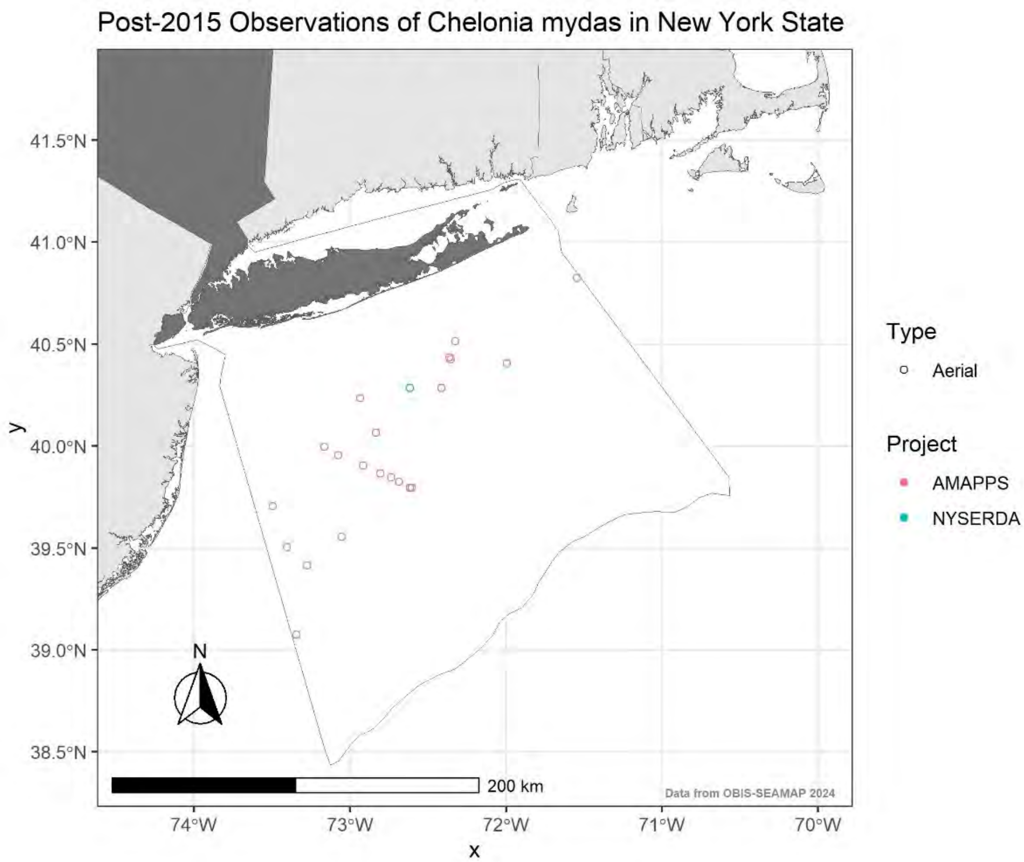

Figure 9. Observation of green sea turtles reported to OBIS-SEAMAP after 2015 (OBIS-SEAMAP 2024). Project data included from Atlantic Marine Assessment Program for Protected Species (AMAPPS) and New York State Energy Research and Development Authority (NYSERDA). Figure Prepared by NYNHP.

Details of historic and current occurrence:

Historic occurrences are not well documented in New York. Sadove and Cardinale (1993) indicated that “at least 100” green turtles use the New York Bight region each year, based on surveys, reports and strandings from the 1970s to early 1990s. Mark-recapture data in a study from 1986 – 1997 indicated that the number of green turtles using state waters was increasing (Berry et al. 1997).

Using data submitted to OBIS-SEAMAP (2024), records post 2005 can be estimated from Aerial and Shipboard based projects. OBIS-SEAMAP was founded in 2002, and compiles data from many sources. The sampling effort and data submission is dependent on each individual project, so may represent an incomplete representation of records and species distribution (see Figure 10). For the period 2005 – 2014, OBIS-SEAMAP has records of 10 green sea turtles, and for 2015 – 2023, it has records of 22 sea turtles.

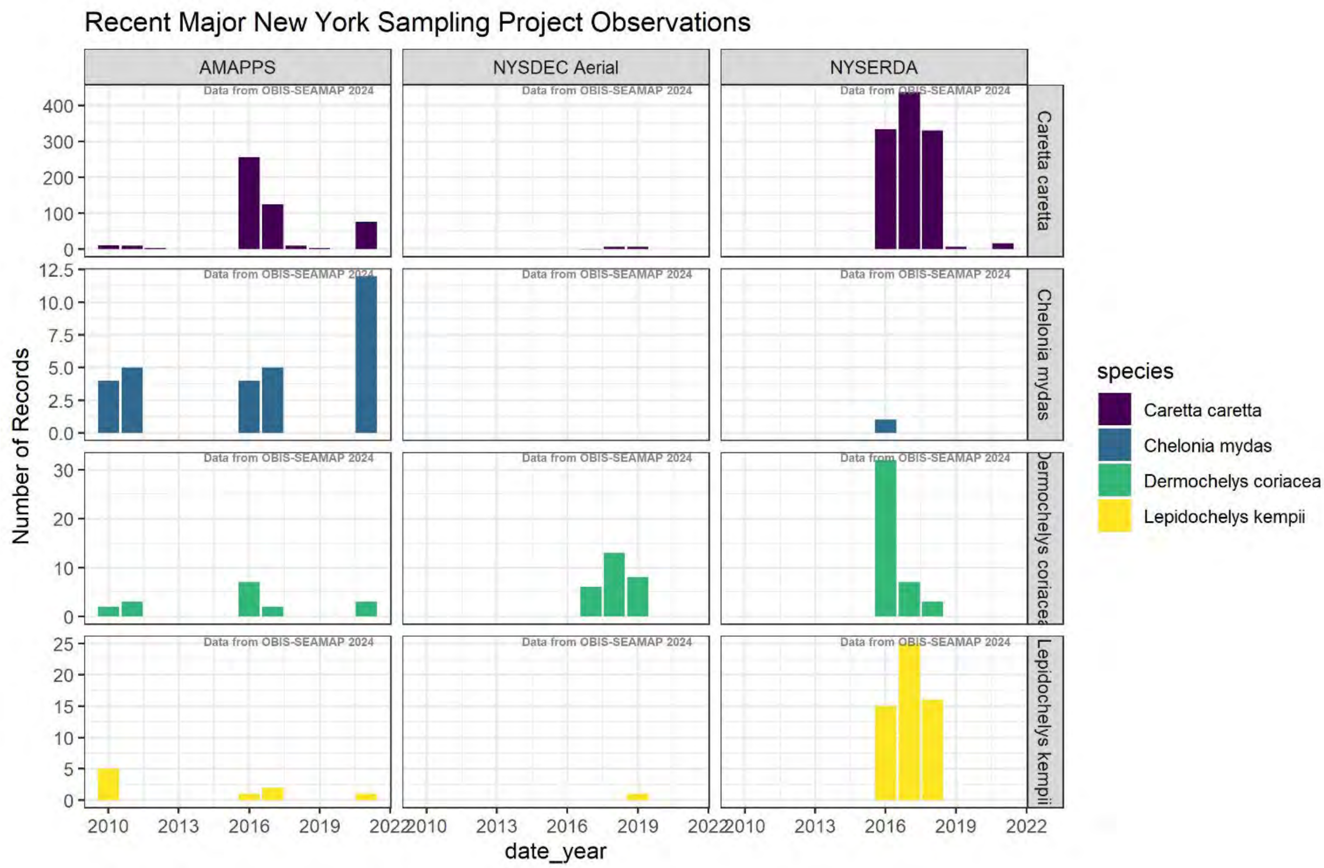

Figure 10. An example of biased record data for different years of sampling due to important survey project start dates. Only AMAPPS collected data prior to 2015, and NYSERDA was able to capture high numbers of sea turtles compared to AMAPPS during years they overlapped. Figure prepared by NYNHP.

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	

Column options
Percent of North American Range in NY: 100% (endemic); 76-99%; 51-75%; 26-50%; 1-25%; 0%; Choose an item
Classification of NY Range: Core; Peripheral; Disjunct; (blank) or Choose an item

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

a. Marine, Shallow Subtidal, Aquatic Bed

b. Pelagic

c. Marine Eelgrass Meadow

d. Estuarine, Brackish Shallow Subtidal, Aquatic Bed

e. Marine, Deep subtidal

Habitat or Community Type Trend in New York

Habitat Specialist?	Indicator Species?	Habitat/ Community Trend	Time frame of Decline/Increase
Yes	Yes	Unknown	

Column options
Habitat Specialist and Indicator Species: Yes; No; Unknown; (blank) or Choose an item
Habitat/Community Trend: Declining; Stable; Increasing; Unknown; (blank) or Choose an item

Habitat Discussion:

Green turtle hatchlings leave nesting beaches and move into convergence zones in the open ocean (Carr 1986). They spend an undetermined amount of time in these areas (Carr 1986). Once reaching a carapace length of ~20-25 cm, green turtles travel from the open ocean to benthic feeding grounds in relatively shallow, protected waters (NMFS and USFWS 1991). While on these feeding grounds, green turtles forage on algae, seagrasses, and invertebrates (NMFS and USFWS 2007

Green turtles, the majority being juveniles (Morreale et al. 1992, Reynolds and Sadove 1997), are found in New York during the months of July through November (Sadove and Cardinale 1993, Berry et al. 1997). Green turtles are found in some abundance throughout the Peconic Estuary (Berry et al. 1997). While they are seen free-swimming in the pelagic environment, their distribution in New York (see Figure 14 and Trends Discussion) has been found to correlate significantly with that of submerged aquatic vegetation (i.e., eelgrass beds), which they are likely feeding upon (Berry et al. 1997). In aerial surveys, the vast majority of species and the only green sea turtle observed was seen in ‘Zone 2’, or between 15 nautical miles offshore and 60m depth (NYSERDA 2021).

Eelgrass beds have declined drastically since the early 1900s. A wasting disease in the early 1930s led to the disappearance of ~90% of eelgrass beds along the U.S. Atlantic seaboard (Stephenson 2009). Brown tide blooms in the 1980s led to further declines in eelgrass beds throughout the Peconic Estuary (Stephenson 2009). It is believed that this area has lost over 80% of its historical (1930s) population of eelgrass (Figure 11 and Stephenson 2009). The Cornell Cooperative Extension (CCE) estimated that the Peconic Estuary boasted approximately 8,720 acres of eelgrass in 1930. In 2003, only 1,552 acres were documented (Figure 11).

The Peconic Estuary Program heads a Submerged Aquatic Vegetation Long-Term Eelgrass Monitoring Program that closely monitors eight eelgrass sites in the Peconic Estuary. There has been an overall decline in shoot density and coverage at the majority of these sites, with three sites no longer supporting eelgrass (Figure 12 and 13). Surveys of eastern Long Island Sound in 2002, 2006 and 2009 have documented trends in eelgrass extent on the northern section of Long Island (Figure 3). While the three areas surveyed have shown an increase in acreage and number of eelgrass beds (Tables 1 and 2), they represent a relatively small area of Long Island Sound (Figure 3). Increasing trends of eelgrass density continue post-2010, and ongoing monitoring is needed to see if restoration efforts can stabilize eelgrass habitat availability.

There has not been a change in overall amount of pelagic and shallow subtidal ecosystem; however, the changes in eelgrass abundance and density could potentially represent a change in habitat suitability. It is known that eelgrass beds in the state have been in decline since the 1930s, but it is not known whether green turtle use of state waters also declined during this period as habitats potentially became less suitable because of reduced foraging areas. In addition, pollution (including noise pollution) may make a previously occupied area unsuitable for this species.

Further research needs to be done to identify whether these factors are altering habitat availability in New York waters.

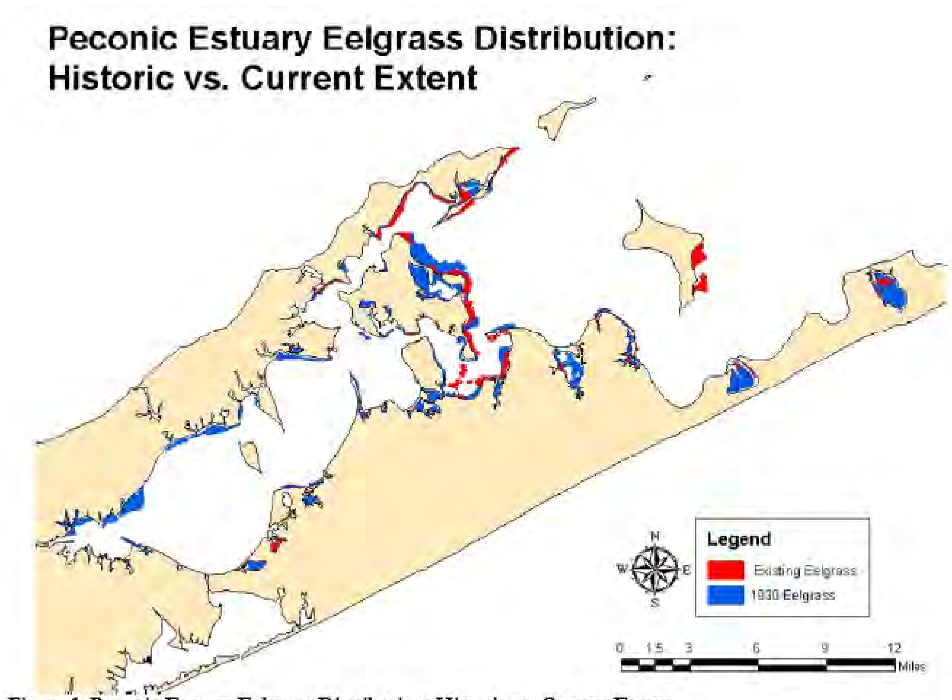

Figure 1: Peconic Estuary Eelgrass Distribution: Historic vs. Current Extent
Approximately 1,552 acres of existing eelgrass documented by Tiner, et al, 2003, using 2000 aerials, as compared to approximately 8,720 acres of 1930 eelgrass.
Source: CCE

Figure 11: Peconic Estuary Eelgrass Distribution, Historic vs. Current Extent (Figure from Stephenson 2009)

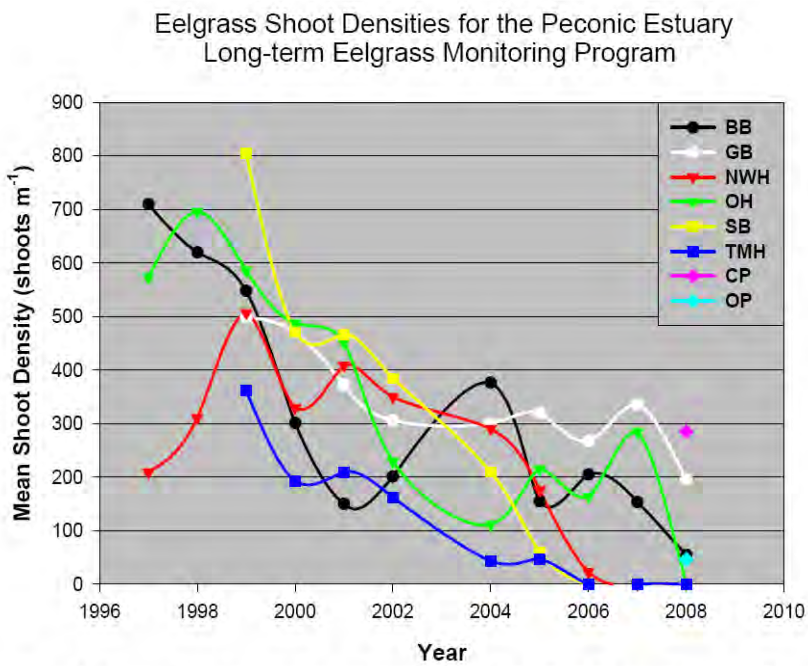

Figure 2: Eelgrass Shoot Densities for the Peconic Estuary Long-Term Eelgrass Monitoring Program
Density at the 8 monitored beds continue to decline; many reference sites and stations supporting little if any eelgrass. BB= Bullhead Bay, Southampton; GB= Gardiners Bay/Hay Beach, Shelter Island; NWH= Northwest Harbor, East Hampton; OH= Orient Harbor, Southold; SB= Southold Bay, Southold; and, TMH= Three Mile Harbor, East Hampton; CP= Cedar Point, East Hampton; OP= Orient Point, Southold.
Source: CCE

Figure 12: Eelgrass shoot densities for the Peconic Estuary Long-term Monitoring Program Figure from Stephenson (2009)

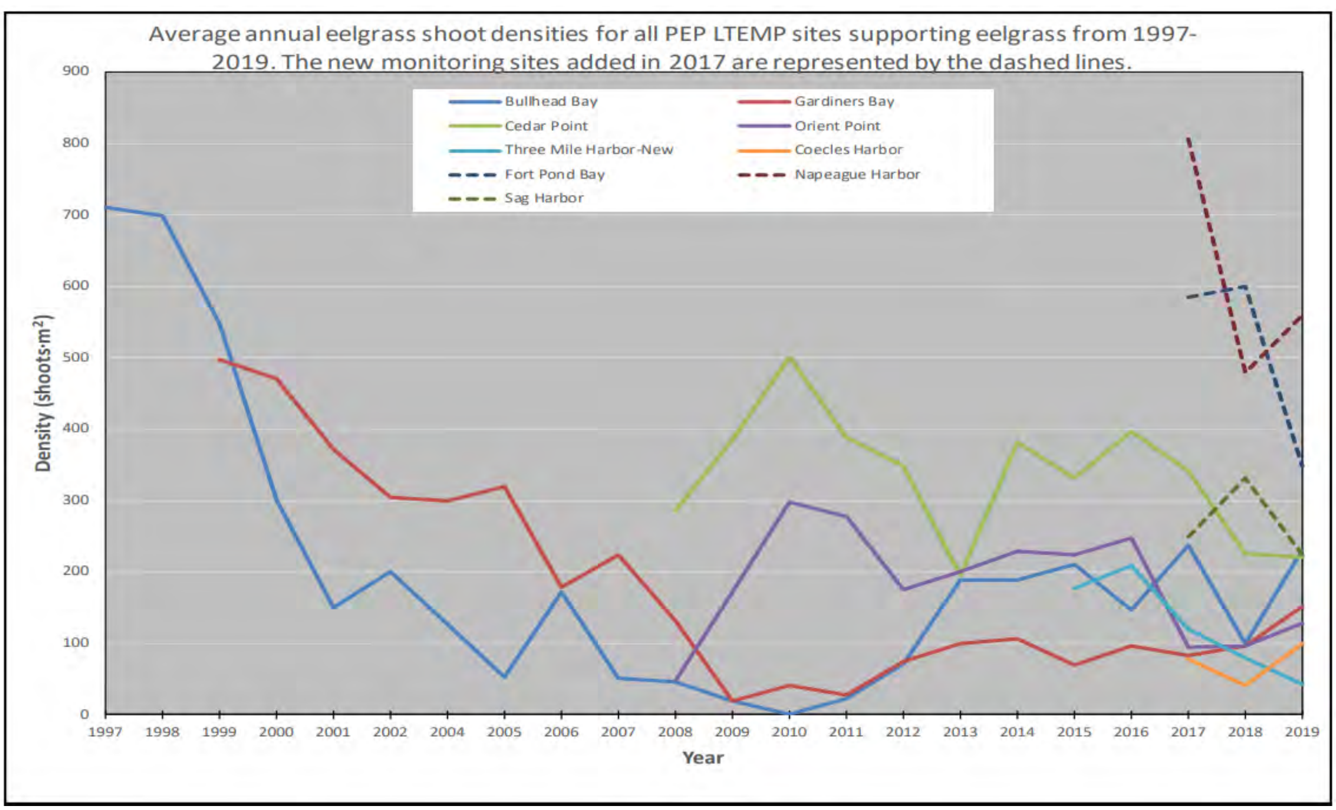

Figure 13. Eelgrass shoot densities for Peconic Estuary Long-term Monitoring Program 1997 – 2019. Figure from Pickerell and Schott (2019).

Figure 14. Location of eelgrass beds in eastern Long Island sound as surveyed by the USFWS in 2009. Darker blue area represents New York waters (Tiner et al. 2009).

Table 1. Acreage and number of three eelgrass beds on the northern tip of Long Island as documented on surveys of eastern Long Island Sound (see Figure 3 for approximate locations of beds). Data sources: Tiner et al. (2010) and Tiner et al. (2007).

Year	Sub-basin	Acres of high density (number)	Acres of medium density (number)	Acres of low density (number)	Total acres (number)
2006	Fishers Island	4.1 (12)	190.4 (25)	6.8 (5)	201.3 (42)
	North Shore	0	18.1	6.8	24.9
	Plum Island	0	9.5	0	9.5
2009	Fishers Island	149.0 (11)	191.3 (33)	5.6 (3)	345.9 (47)
	North Shore	5.0 (3)	5.5 (2)	0	10.5 (5)
	Plum Island	7.6 (1)	0	0	7.6 (1)

Table 3. Changes in acreage and number of eelgrass beds in New York from surveys of eastern Long Island Sound conducted in 2002, 2006, and 2009 (see Figure 3 for approximate location of beds). + represents a gain, while – represents a loss. Source: Tiner et al. (2010).

Sub-basin	2002 - 2006 Acreage Change	2002 - 2006 Change in # of Beds	2006 - 2009 Acreage Change	2002 - 2009 Change in # of Beds
Fishers Island	+7.8	+11	+22.5*	+5
North Shore	+9.2	+1	-14.4	+2
Plum Island	+9.5	+1	-1.9	-0-
Total	+26.5	+13	+6.2*	+7

*Two large beds totaling 122.1 acres on the south side of Fishers Island could be seen on the 2009 imagery while they were not visible on 2006 imagery due to environmental conditions. Field inspections in 2006 had located robust beds in this area and recorded their occurrence as points since the beds could not be accurately delineated on the imagery. Consequently, for the 2009 report, we did not treat this acreage as a gain because robust beds were noted in this area in 2006 and their boundaries could not be established.

V. Species Demographics and Life History

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

Column options
First 5 fields: Yes; No; Unknown; (blank) or Choose an item
Anadromous/Catadromous: Anadromous; Catadromous; (blank) or Choose an item

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):*

The lifespan of green turtles is unknown but thought to be 70 or more years (NMFS 2013; NOAA 2024). A green sea turtle in the New England Aquarium has been in captivity since 1970 and is believed to be around 95 years old in 2024 (NEAQ 2013).

In the southeastern U.S., green sea turtles nest from June through September (Ehrhart and Witherington 1992). Females return to the same beaches year after year, although they may lay eggs at several different beaches within a season. Females lay eggs nocturnally at up to nine nests within a season. The average number of nests per female per season is about three; the nests are generally laid at intervals of about two weeks. Clutch size is around 75 – 200 eggs, which incubate for about 45 – 75 days before hatching (NatureServe 2013). Green turtle eggs exhibit temperature dependent sex determination, with eggs incubated below a critical temperature being males, and those incubated above a critical temperature being females (Spotila et al. 1987). Eggs often hatch at night.

It is believed that newly hatched green turtles travel to offshore areas, where they forage for several years (NMFS 2013). Once juveniles reach a certain length (carapace of ~20-25 cm), the majority move into nearshore foraging areas (NMFS and USFWS 2007). These foraging areas can be up to 3,000 km away from nesting beaches (NatureServe 2013). It is at this juvenile stage that green turtles are found in New York and other Northeastern waters (Morreale and Standora 1998).

Green turtles reach sexual maturity anywhere between 25 – 35 years of age (NMFS 2013; NOAA 2024). Females return to natal beaches to deposit eggs (Carr et al. 1978, Meylan et al. 1990). Females nest at 2, 3 or 4 or more year intervals (NMFS and USFWS 2007, NatureServe 2013, NMFS 2013). Reproductive longevity is estimated to range from 17-23 years (Carr et al. 1978, Fitzsimmons et al. 1995, Chaloupka et al. 2004), and females may deposit between 900 – 3,300+ eggs in her lifetime (NMFS and USFWS 2007). Male reproductive behavior is largely unknown, although it is believed that they return to nesting grounds every year to mate (NMFS and USFWS 1991). It is now known that adult green turtles return to the same foraging grounds each year after nesting (Godley et al. 2002, Broderick et al. 2006, NMFS and USFWS 2007), and have specific home ranges that include feeding and resting areas within the major foraging grounds (Seminoff et al. 2002, Godley et al. 2003, Makowski et al. 2006, Seminoff and Jones 2006, Taquet et al. 2006). Some percentage of green turtles remain in pelagic habitats and rarely, if ever, enter nearshore foraging areas (Pelletier et al. 2004, NMFS and USFWS 2007).

Eggs and hatchlings are predated upon by a variety of species, including raccoons, feral hogs, foxes, crabs, and ants (NMFS and USFWS 1991). Raccoons may take up to 96% of all nests on certain beaches (NMFS and USFWS 1991). Severe storms and erosion also destroy some nests (NMFS and USFWS 1991).

Juveniles and subadults have been found to have lower survival rates than adults (NMFS and USFWS 2007). This may be partially accounted for by increased levels of predation on younger turtles. Sharks, killer whales, bass and grouper are all known to prey upon green turtles to some extent; tiger sharks appear to be the principal predator (Stancyk 1982).

Disease is known to have a relatively large effect on many green sea turtle populations. Fibropapillomatosis (FP) causes the growth of tumors that can block the vision in turtles and lead to decreased swimming and foraging capabilities (Herbst 1994, NMFS and USFWS 2007). As many as 62% of the green turtles in Florida are affected by FP (Schroeder et al. 1998).

Sea turtles are vulnerable to dramatic changes in temperature. While green turtles are believed to migrate out of New York waters in late summer, some may be feeding in shallow waters and still be in the area when water temperatures drop significantly (Morreale and Standora 1998). When this happens, sea turtles can fall victim to a process known as cold-stunning. This is a hypothermic state that can result in the turtle drifting at sea in a lethargic state. Cold-stunning often results in mortality, unless the turtles wash ashore and are rescued by stranding groups.

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

One of the major threats to sea turtle populations in New York is fisheries interactions. Sea turtles can become trapped in pound nets, longline fisheries, trap fisheries, trawl fisheries, purse seines and gill nets. Turtles trapped in gear can drown or suffer serious injuries as a result of constriction by lines (NMFS and USFWS 1991). Additionally, turtles can be hooked by longline gear, which can cause injury and reduced feeding capabilities. Trawlers that are not outfitted with Turtle Excluder Devices (TEDs) can entrap and drown sea turtles. Additionally, dredges can destroy habitat and crush or entrap sea turtles (NMFS and USFWS 1991). In New York, Morreale and Standora (1998) reported that commercial fisherman were responsible for 84% of all 317 live turtles captured in a mark-recapture study from 1987 – 1992. 93% of these captures were in pound nets; sea turtles were also caught in trawls and entangled in lobster pot lines and gill nets (Morreale and Standora 1998).

Climate change is believed to have major effects on sea turtles throughout their range. Extreme temperature changes could lead to increased numbers of cold-stunned sea turtles; it is also possible that changing temperatures could lead to conditions that are more favorable for sea turtles. There have been a record high number of cold-stunned sea turtles found this winter throughout the Northeast; it is believed that this could be a result of climate change (L. Bonacci, pers. comm, Riverhead Foundation, pers, comm.). Between 1998 and 2019, 176 green sea turtles have been cold-stunned in New York state waters, with an increase in the number of strandings in later years (Montello et al. 2022). Typically, cold-stunned turtles are recovered in New York between November and December (Montello et al. 2022). Additionally, climate change is believed to be associated with rising water temperatures, as well as changes in ice cover, salinity, oxygen levels and circulation (IPCC 2007). These changes are likely to cause shifts in range and abundance of different species of algae, plankton and fish (IPCC 2007). These shifts could alter the suitability of New York habitat (as well as habitat in other parts of sea turtles' ranges) for occupancy by sea turtles. Conditions at nearshore foraging areas have been shown to impact the timing of green turtle reproduction (Limpus and Nicholls 1987, Solow et al. 2002), and thus could have large effects on green turtle population dynamics. Changing currents as a result of climate change could affect sea turtle migration and survival of oceanic-stage juveniles (NMFS and USFWS 2007).

Climate change could have significant effects on green turtles in other parts of their range as well. More nests could be destroyed as a result of the increasing abundance and severity of storms along the nesting range. Rising sea levels could cause major problems on low-lying nesting beaches. Additionally, there is concern that rising temperatures could skew hatchling sex ratios towards a strong female bias (NMFS and USFWS 2007). Higher sand temperatures have been documented at at least one nesting site (Hays et al. 2003).

Coastal development can lead to destruction or degradation of sea turtle habitat. Eelgrass beds used by green sea turtles may be destroyed as a result of such development and ecosystem alterations development can exacerbate. Green turtles can occasionally be taken into the cooling systems of coastal power plants, where they are submerged and drown (NMFS and USFWS 2007). The construction of seawalls, rock revetments, groins, jetties, and sand bags degrades sea turtle nesting habitat (NMFS and USFWS 1991). Additionally, bright lighting near beaches can disorient hatchlings, and cause them to move towards the light rather than the ocean (Ehrhart 1983; Mann 1977; McFarlane 1963; Philibosian 1976). This misorientation can lead to increased risk from predators, entrapment in vegetation, dessication, and being hit by vehicles (NMFS and USFWS 1991).

Sea turtles may occasionally be hit by vessels, which can cause mortality and severe injury. This has been documented to be a major problem in Florida (Singel et al. 2003), and it is likely to occur more often than reported throughout the range (NMFS and USFWS 2007). Seminoff et al. (2002) found that boat traffic excluded green turtles from preferred coastal foraging areas, which could have negative effects on the population.

PCBs, mercury, copper, and other heavy metals have been found in the tissues of green turtles (Al Rawahy et al. 2006; Lewis 2006; Miao et al. 2001; Presti et al. 1999). The effects of these contaminants on green turtles is currently unknown, but there is concern that elevated levels could lead to immunosuppression and hormonal imbalances (NMFS and USFWS 2007). Oil spills are known to directly affect marine turtles (Yender and Mearns 2003), and could also lead to immunosuppression and chronic health issues (Sindermann et al. 1982). Immunosuppression by contaminants and habitat degradation is believed to be a major cause of FP (George 1997), although there is evidence that it is not a requirement for the development of tumors associated with the disease (Work et al. 2001). Finally, juvenile sea turtles can experience biointoxication from harmful algae blooms which may cause mortality.

Sea turtles could ingest or become entangled in marine debris, which can reduce food intake and digestive capacity and cause injury or mortality (Bjorndal et al. 1994, Sako and Horikoshi 2002). Pelagic juveniles are most threatened by entanglement, and experts consider marine debris to be a greater threat to sea turtles then climate change and exploitation (Duncan et al. 2017). Ghost gear entanglements cause mortality and can negatively impact populations.

The effects of anthropogenic noise on sea turtles are poorly understood. Studies have shown that sea turtles exposed to certain levels of low frequency sound may spend more time at the surface and/or move out of the area (O’Hara and Wilcox 1990; Lenhardt et al. 1983). Samuel et al. (2005) found elevated noise levels, primarily from boat traffic, in the Peconic Bay Estuary system in New York during the sea turtle activity season. They suggest that continued exposure to these sound levels could potentially lead to behavioral effects on sea turtles using the area (Samuel et al. 2005). The authors also suggest that similar sound levels should be expected in other coastal foraging and nesting areas. Sea turtles have been found to change swimming patterns and orientation in response to air guns, which are frequently used in oil and gas exploration (O’Hara 1990). The impact of anthropogenic noise on sea turtles requires future research, but surveyed experts report a belief that seismic surveys could pose a threat to turtles (Nelms et al. 2016).

Threat Level 1	Threat Level 2	Threat Level 3	Spatial Extent	Severity	Immediacy	Trend	Certainty
1. Residential and Commercial	1.1 Housing & Urban Areas	1.1.1 Dense housing & urban areas (destruction/alteration of nearshore foraging areas from coastal development)	Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.
1. Residential and Commercial	1.2 Commercial & Industrial Areas	1.2.1 Commercial & industrial areas (destruction/alteration of nearshore foraging areas from coastal development)	Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.
1. Residential and Commercial	1.3 Tourism & Recreation Areas	-	Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.
3. Energy Production & Mining	3.1 Oil & Gas Drilling	3.1.2 Offshore oil development (oil spills)	Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.
4. Transportation & Service Corridors	4.3 Shipping Lanes	4.3.1 Shipping (ship strikes)	Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.
5. Biological Resource Use	5.4 Fishing & Harvesting Aquatic Resources	5.4.2 Commercial fishing (bycatch and entanglement)	Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.
6. Human Intrusions & Disturbance	6.1 Recreational Activities	6.1.4 Recreational boating	Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.
7. Natural System Modifications	7.3 Other Ecosystem Modifications	7.3.1 Shoreline alteration (shoreline stabilization)	Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.
7. Natural System Modifications	7.3 Other Ecosystem Modifications	7.3.1 Shoreline alteration (sea walls)	Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.
9. Pollution	9.2 Industrial & Military Effluents	-	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.
9. Pollution	9.4 Garbage & Solid Waste	-	Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.

9. Pollution	9.6 Excess Energy	9.6.3 Noise pollution	Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.
11. Climate Change	11.1 Habitat Shifting & Alteration	-	Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.
11. Climate Change	11.3 Changes in Temperature Regimes	11.3.3 Gradual temperature change (cold-stunning)	Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.

Table 2: Threats to green sea turtles.

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:

The green turtle is listed as a threatened species in New York and is protected by Environmental Conservation Law (ECL) section 11-0535 and the New York Code of Rules and Regulations (6 NYCRR Part 182). A permit is required for any proposed project that may result in a take of a species listed as Threatened or Endangered, including, but not limited to, actions that may kill or harm individual animals or result in the adverse modification, degradation or destruction of habitat occupied by the listed species. It is also protected as a federally-listed threatened species.

In addition, Article 17 of the ECL works to limit water pollution, and Article 14 presents the New York Ocean and Great Lakes Ecosystem Conservation Act. This act is responsible for the conservation and restoration of coastal ecosystems "so that they are healthy, productive and resilient and able to deliver the resources people want and need." Both of these help to protect the habitat of the green turtle. Whether they are adequate to protect the habitat is currently unknown.

The Peconic Estuary Program put together an Eelgrass Management Plan for the Peconic Estuary in 2009 (Stephenson 2009) in an effort to help conserve eelgrass beds, which are used by green turtles in New York (Berry et al. 1997).

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

NY Marine Rescue Center should continue to carry out stranding and entanglement response for sea turtles. The Rescue Center rescues and rehabilitates injured and cold-stunned individuals. Before being released, rehabilitated sea turtles are sometimes given a satellite tag, which helps expand our knowledge on movements and habitat use. 12 individuals were released with satellite tags after being rehabilitated and the data showed they acclimated back to the wild quickly after being released (Robinson et al. 2020). At least 177 sea turtles of any species have been released from New York Rescue operators (Innis et al. 2019). Placing PIT tags and/or satellite tags on as many individual turtles as possible will help to further our knowledge on green turtle life history, and this practice should be encouraged. It is critical to determine where New York green turtles travel to and nest to help reduce the threats to the population during other stages of its life.

Long-term surveys to monitor the population of green turtles in New York should be implemented. Sea turtle use of state waters was fairly well established by studies throughout the 1980s and 1990s, but not much work has been done in recent years. Monitoring would allow researchers to garner a better idea of population trends and habitat use of this species in the State, and see if shifts in use have occurred. Additionally, further research into the effects of the various threats listed above on the green turtle population in the State should be encouraged. Bycatch rates should be closely monitored, and research into reducing these rates would be beneficial.

In a report from the New York Bight Sea Turtle Workshop (Bonacci-Sullivan 2018), the following research and management recommendations were made: 1) Collect baseline data on presence and residence time; 2) Targeted nearshore aerial and vessel surveys; 3) reconsideration of size limits for tagging due to importance of juvenile turtles; 4) Collect information on the impact of the pound net fishery; 5) create a sea turtle nesting response plan; 6) support stranding-response programs; and 7) increase outreach efforts.

Education on this species and the importance of reporting ship strikes and entanglements is encouraged. Conservation actions following IUCN taxonomy are categorized in the table below.

Action Category	Action	Description
B.3 Outreach	B.3.1.4.0 Public outreach and information	Awareness & Communications
C.10 Institutional Development	C.10.2.0.0 External support and organizational development	Alliance and Partnership Development

Table 3: Recommended conservation actions for green sea turtles.

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