# Species Status Assessment

**Class:** **Mammalia**
**Family:** **Balaenidae**
**Scientific Name:** ***Eubalaena glacialis***
**Common Name:** **North Atlantic right whale**

**Species synopsis**:

The North Atlantic right whale, which was first listed as endangered under the Endangered Species Act in 1973, is considered to be critically endangered (Clapham et al 1999, NMFS 2013). The western population of North Atlantic right whales (NARWs or simply right whales) has seen a recent slight increase. The most recent stock assessment gives a minimum population size of 444 animals with a growth rate of 2.6% per year (NMFS 2013). It is believed that the actual number of right whales is about 500 animals (Pettis 2011, L. Crowe, pers. comm.).

At this time, the species includes whales in the North Pacific and the North Atlantic oceans (NMFS 2005). However, recent genetic evidence showed that there were at least three separate lineages of right whales, and there are now three separate species that are recognized. These three species include: the North Atlantic right whale (*Eubalaena glacialis*), which ranges in the North Atlantic Ocean; the North Pacific right whale (*Eubalaena japonica*), which ranges in the North Pacific Ocean; and the southern right whale (*Eubalaena australis*), which ranges throughout the Southern Hemisphere (NMFS 2005).

The distribution of right whales is partially determined by the presence of its prey, which consists of copepods and krill (Baumgartner et al 2003). Most of the population migrates in the winter to calving grounds from in low latitudes from high latitude feeding grounds in the spring and summer. A portion of the population does not migrate to the calving grounds during the winter and it is unknown where they occur during that season (NMFS website, NMFS 2013).

Mother/calf pairs and individual animals are spotted in New York waters each year, primarily from March – June (Sadove and Cardinale 1993). However, right whales have been found year round in the nearby waters of New Jersey (Whitt et al 2013). They were also present during all three seasons of the 2008-09 passive acoustics study conducted in New York (BRP 2010). Right whales are usually found in shallow, coastal waters off the south side of Long Island. They have also been sighted in Long Island Sound, Block Island Sound, Gardiners Bay and south shore inlets and bays (Sadove and Cardinale 1993). It is believed that right whales primarily use New York waters for migration purposes, as they rarely remain in the area for an extended period of time (Sadove and Cardinale 1993, NMFS 2005). However, a recent study in New Jersey waters found skim-feeding behavior which may indicate that right whales are feeding as they migrate through the mid-Atlantic (Whitt et al 2013).

## I. Status

### a. Current and Legal Protected Status

**i. Federal** Endangered **Candidate?** _____

**ii. New York** Endangered

### b. Natural Heritage Program Rank

i. **Global** G1

**ii. New York** SNA **Tracked by NYNHP?** Yes

**Other Rank:**

Depleted under the Marine Mammal Protection Act of 1972
Appendix I CITES species
Endangered under the Canadian Species at Risk Act

**Status Discussion:**

Right whales were first listed under the Endangered Species Conservation Act in June 1970 (35 FR 18319). When the Endangered Species Act was enacted in 1973, they were subsequently listed as endangered and also as depleted under the Marine Mammal Protection Act (MMPA). The original listing was for "northern right whales", which included right whales from both the North Atlantic and North Pacific oceans. In 2008, the northern right whale was separated into two distinct species, the North Atlantic right whale and the North Pacific right whale (73 FR 12024). They are currently considered a critically endangered species (Clapham et al. 1999, NMFS 2013).

A recovery plan was enacted in 1991, and revised in 2005 (70 FR 32293). A 5 year review was published in 2012 (77 FR 16538). Critical habitat was designated for the North Atlantic right whale in 1994 (59 FR 28805). The population is believed to be slightly increasing and to be hovering at around 500 individuals (Pettis 2011, L. Crowe, pers. comm.). However, calving frequency, growth rate and number of reproductive females remain causes for concern in the recovery of this stock (NMFS 2013). Additionally, human-caused serious injury and mortality remain above PBR and may also inhibit recovery (NMFS 2013).

## II. Abundance and Distribution Trends

### a. North America

#### i. Abundance

**____ declining __X__ increasing _____stable ____unknown**

#### ii. Distribution:

**____ declining ____increasing __X__ stable ____unknown**

**Time frame considered:** ____Slight increase of 2.4% from 1990 – 2007, slight increase of 2.6% after that (Waring et al. 2012, NMFS 2013)_____

### b. Regional

#### i. Abundance

**____ declining __X__ increasing _____stable ____unknown**

#### ii. Distribution:

**____ declining ____increasing __X__ stable ____unknown**

**Regional Unit Considered**:_____Northeast_____

**Time Frame Considered:** Increase of 2.4% from 1990 – 2007, increase of 2.6% after that (Waring et al. 2012, NMFS 2013)_____

**c. Adjacent States and Provinces**

**CONNECTICUT** **Not Present _____** **No data _____**

**i. Abundance**

**_____ declining _____increasing _____stable __X___unknown**

**ii. Distribution:**

**_____ declining _____increasing _____stable __X__unknown**

Time frame considered: _____Rare visitors. Trends have not been analyzed___

Listing Status: _____Not listed_____ SGCN? ___No____

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

**i. Abundance**

**_____ declining __X__ increasing _____stable __X__ unknown**

**ii. Distribution:**

**_____ declining _____increasing _____stable __X__ unknown**

Time frame considered: __The population using state waters varies greatly year to year, general population trend is increasing from 1990 -present (Waring et al. 2012, NMFS 2013).

Listing Status: ___Endangered_____ SGCN? ___Yes___

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

**i. Abundance**

**_____ declining _____increasing _____stable __X__ unknown**

**ii. Distribution:**

**_____ declining _____increasing _____stable __X__ unknown**

Time frame considered: ___Trends never analyzed for the species in NJ._____

Listing Status: ____Endangered_____ SGCN? ___Yes____

**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 __X__ increasing _____stable ____unknown**

Time frame considered: Was extirpated from the area by the early 1900s, but in the last 15 years there have been an increasing number of sightings. It is unknown if the actual abundance of right whales in the area is increasing or if they are just shifting their distribution.

Listing Status: Endangered

**RHODE ISLAND** **Not Present _____ No data _____**

i. **Abundance**

**____ declining ____increasing ____stable __X__ unknown**

ii. **Distribution:**

**____ declining ____increasing ____stable __X__ unknown**

Time frame considered: ___Trends never analyzed for the species in Rhode Island.

Listing Status: ___Endangered_____ SGCN? __Yes____

**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**

**____ declining ____increasing ____stable __X__ unknown**

ii. **Distribution:**

**____ declining ____increasing ____stable __X__ unknown**

Time frame considered: ___Trends for the state have never analyzed._____

Listing Status: ___Endangered_____ _____ SGCN? ___Yes___

**Monitoring in New York.**

From February 2008 – March 2009 Cornell University partnered with DEC and conducted passive acoustic monitoring for cetaceans in New York coastal waters (BRP 2010).

NOAA, NEFSC, Protected Species Branch conducts regular aerial and ship board surveys to determine the abundance and distribution of protected species in the North East. However, sampling, including scale of sampling, is not specific either to large whales in the New York Bight, nor is sampling year round. Mandatory ship reporting of right whales does exist.

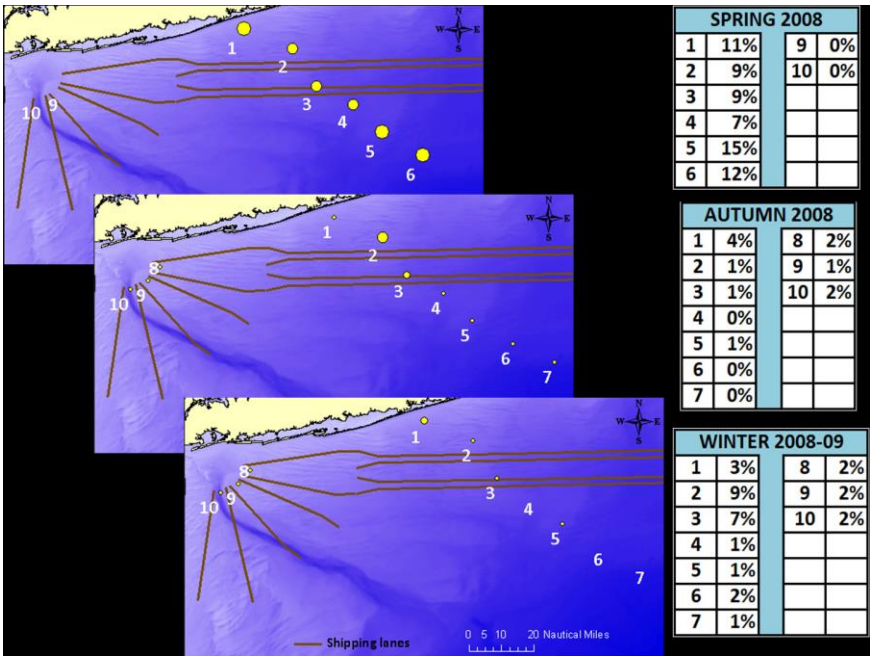
There are no current monitoring activities or regular surveys conducted by the State of New York or specific to large whales in the New York Bight. However, DEC, Marine Resources and Natural Heritage Program are currently in the planning stages to establish a regular monitoring program for large whales. The monitoring techniques and protocols have not yet been determined. There is currently funding for three years of monitoring.

**Trends Discussion:**

The western population of North Atlantic right whales were heavily exploited by whaling in the 1600s by colonists, though it is believed that the stock may have been greatly reduced even prior to that (Reeves et al 2001, Reeves et al 2007). Although it is pre-exploitation numbers are unknown, estimates predict a minimum abundance of about 1,000 individuals (Reeves et al. 1992). The minimum population estimate for 2005 was 361 individuals and for 2010 and 2011 estimates were 396 and 444 individuals respectively (Waring et al. 2012, NMFS 2013). Overall, the western population of North Atlantic right whales appears to be slowly recovering at an average rate of increase of 2.4% from 1990 – 2007 and 2.6% thereafter (Waring et al. 2012, NMFS 2013).

However, the actual rate of population growth has been largely variable, as there have been two periods of documented high mortality rates, one in the 1980s – mid-1990s and one from 2004 – 2005. In the early 1980s to mid-1990s, the survival probability declined from 0.99 to 0.94 and the population actually showed signs of decline (Caswell et al. 1999). In a 16 month period in 2004-2005, eight whales were found dead; six of these whales were females and three of these six were pregnant. Some experts consider population growth rates to have been flat or negative during the period from 1998-2000 possibly due to low calving rates (NMFS 2013).

From 1990 – 2007 the average calf production was 17.2 calves per year, which was up from an average of 11.2 calves/year from 1980 – 1992 (Waring et al. 2012). For the past decade, the average number of calves produced each year was up even more to 20. However, in 2012, only seven newborn calves were sighted in the southeastern U.S., and only one of those mom/calf pairs was resighted on their northern feeding grounds. The calving season looks more promising this year, with 20 mom/calf pairs sighted as of 03/01/2013 (L. Crowe, pers. comm.).




| SPRING 2008 | | | |
|---|---|---|---|
| 1 | 11% | 9 | 0% |
| 2 | 9% | 10 | 0% |
| 3 | 9% | | |
| 4 | 7% | | |
| 5 | 15% | | |
| 6 | 12% | | |

| AUTUMN 2008 | | | |
|---|---|---|---|
| 1 | 4% | 8 | 2% |
| 2 | 1% | 9 | 1% |
| 3 | 1% | 10 | 2% |
| 4 | 0% | | |
| 5 | 1% | | |
| 6 | 0% | | |
| 7 | 0% | | |

| WINTER 2008-09 | | | |
|---|---|---|---|
| 1 | 3% | 8 | 2% |
| 2 | 9% | 9 | 2% |
| 3 | 7% | 10 | 2% |
| 4 | 1% | | |
| 5 | 1% | | |
| 6 | 2% | | |
| 7 | 1% | | |

Figure 1. Seasonal presence of right whales in the New York Bight region. A) right whale presence during Spring (1 March – 14 May 2008), B) presence during Autumn (31 August – 2 Dec 2008), and C) presence during Winter (5 December 2008 – 3 March 2009). Tables to the right of each plot show the actual percentages of days with right whale detections during each season. From BRP 2010.

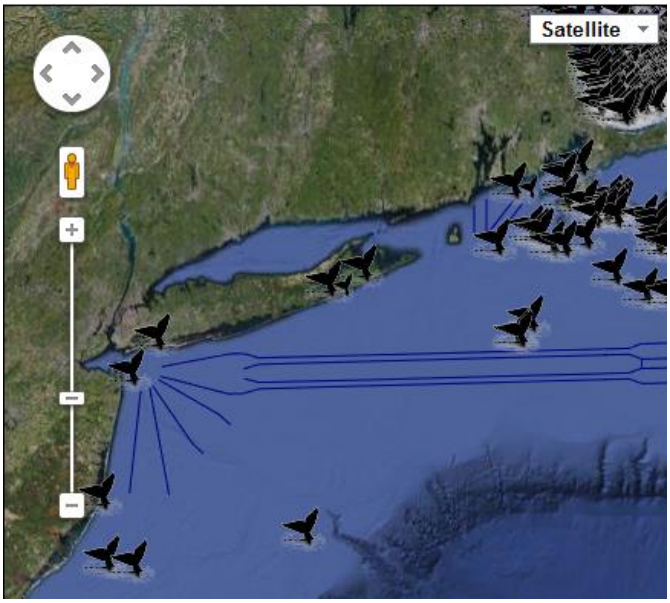


Figure 2. North Atlantic right whale sightings in the New York area from March 20, 2012 – March 20, 2013. Map adapted from NEFSC 2013.

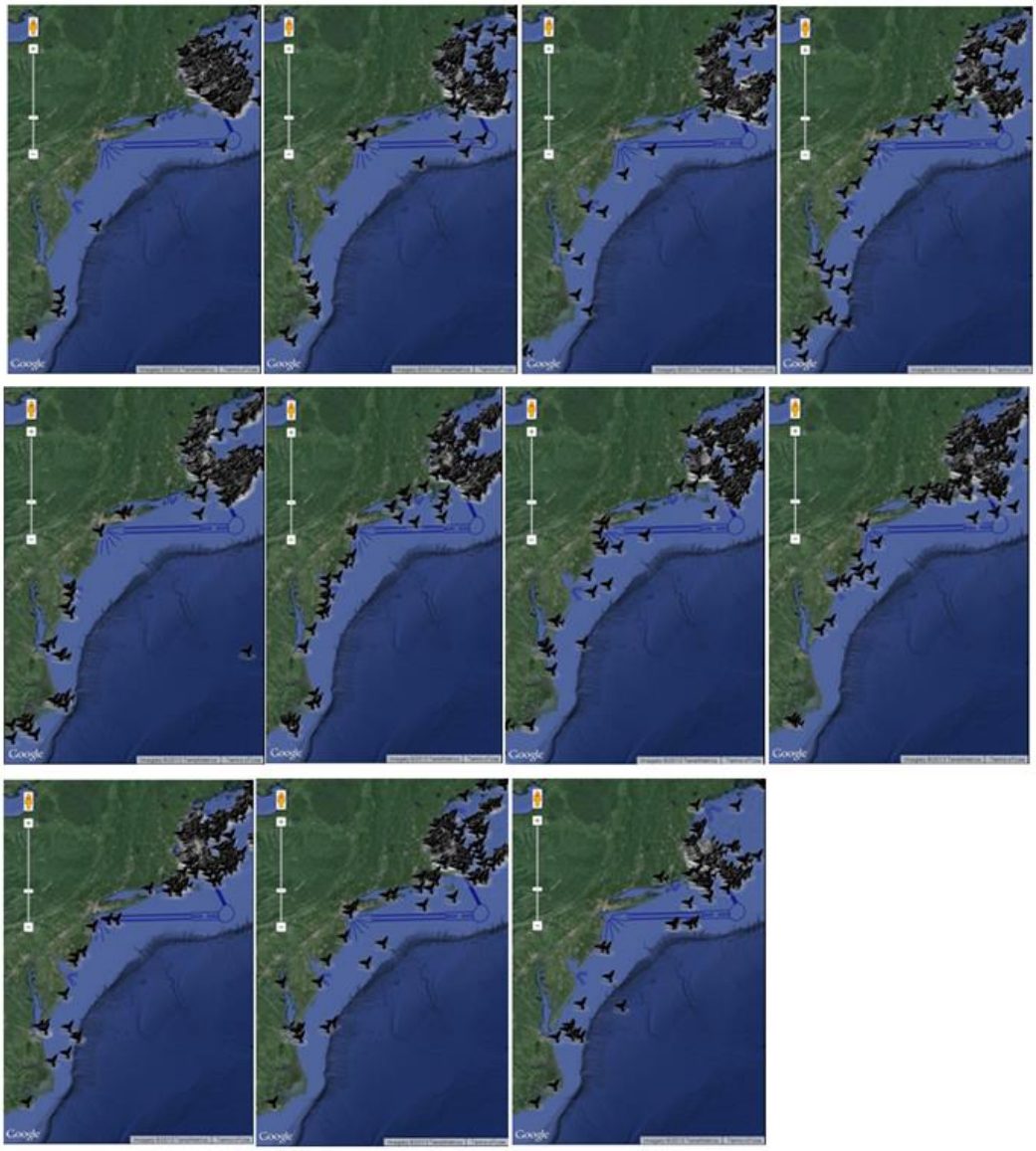


**Figure 3**. North Atlantic Right Whale Sightings in the NE reported to NOAA from 2003 (top) to 10/18/2013 (bottom). From: NOAA, Fisheries, NEFSC, Interactive North Atlantic Right Whale Sightings Map- http://www.nefsc.noaa.gov/psb/surveys/

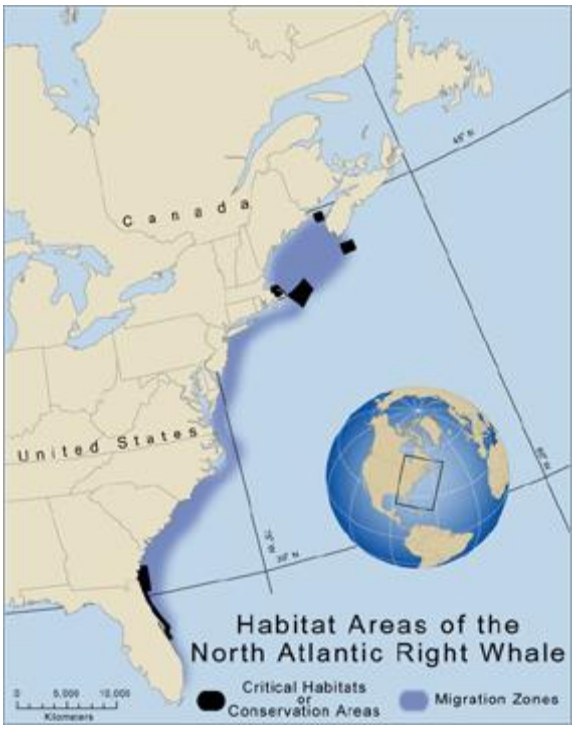


Figure 4. Range of the western North Atlantic right whale. Figure from NARWC 2013.

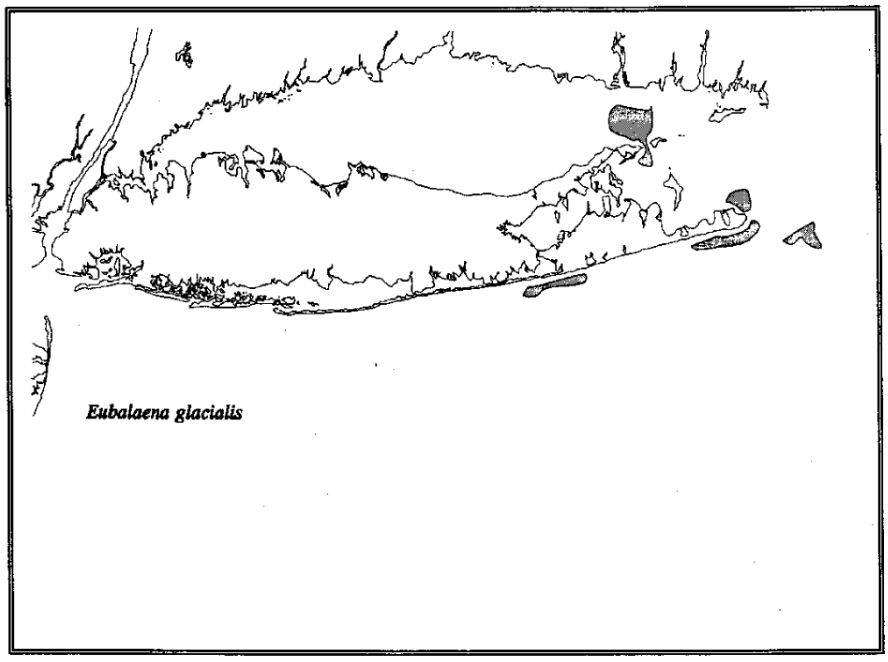


Figure 5. Locations of NARW sightings in New York from 15 years of sighting surveys by Okeanos Foundation from the 1970s – early 1990s. Shaded areas represent areas where right whales were spotted. Figure from Sadove and Cardinale (1993).

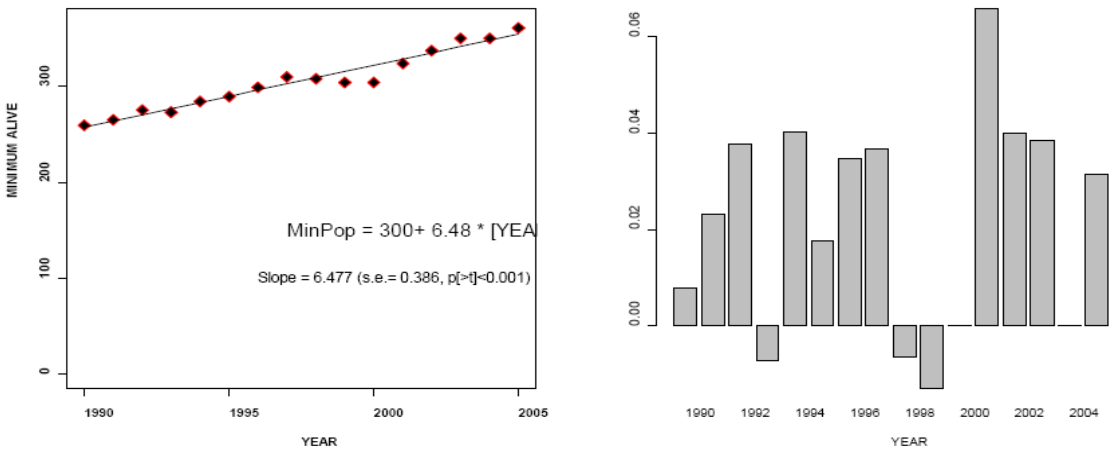



Figure 6. Minimum number alive (a) and crude annual growth rate (b) for cataloged North Atlantic right whales. Minimum number (N) of cataloged individuals known to be alive in any given year includes all whales known to be alive prior to that year and seen in that year or subsequently plus all whales newly cataloged that year. It does not include caves born that year or any other individuals not yet cataloged. Mean crude growth rate (line) is the exponentiated mean of loge [(Nt+1-Nt)/Nt ]for each year (t). Figure from Waring et al. (2012).

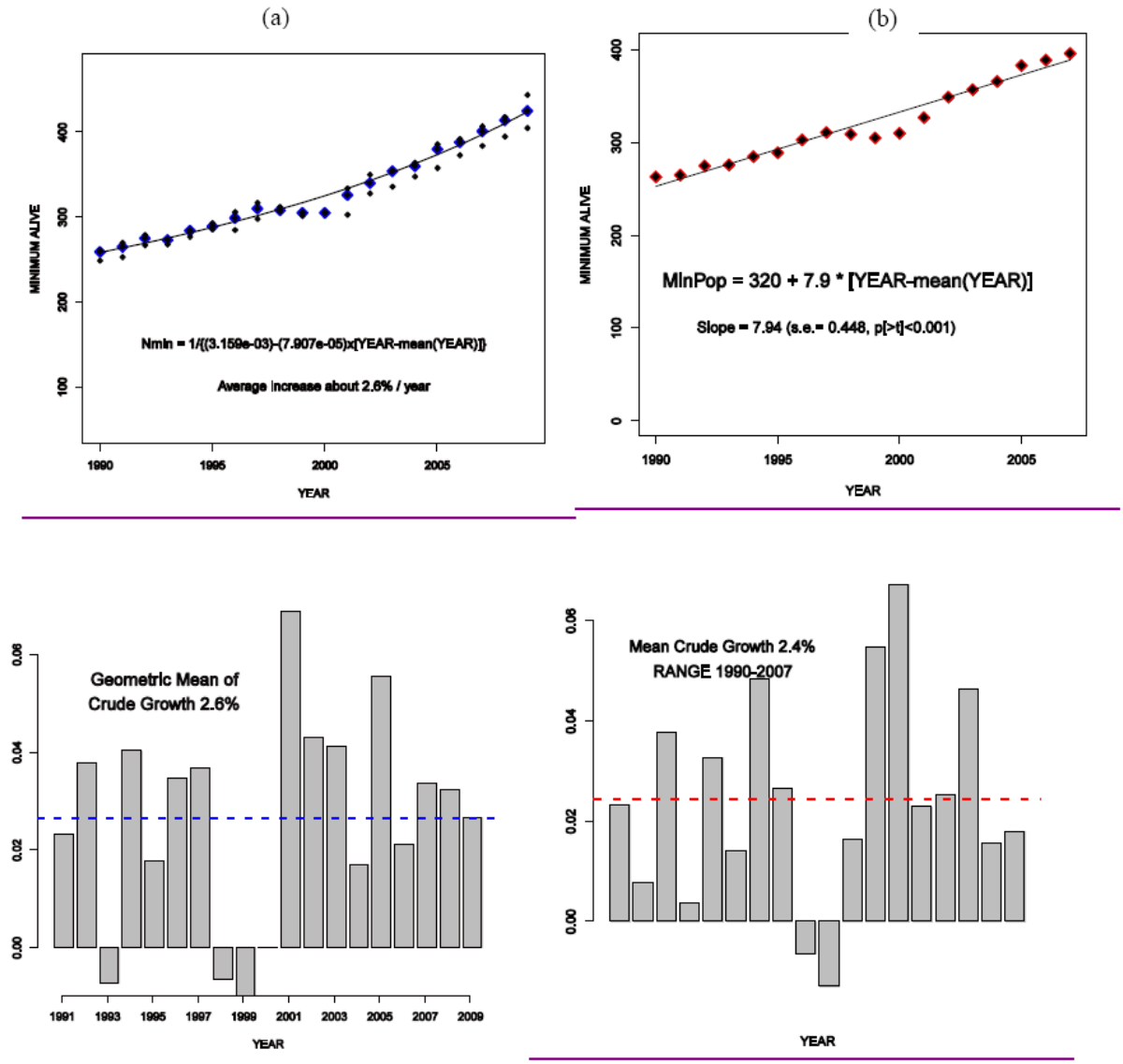



Figure 7. Minimum number alive (a) and crude annual growth rate (b) for cataloged North Atlantic right whales. Minimum number (N) of cataloged individuals known to be alive in any given year includes all whales known to be alive prior to that year and seen in that year or subsequently plus all whales newly cataloged that year. Catalogued whales may include some but not all calves produced each year. Bracketing the minimum number of cataloged whales is the number without calves (below) and that plus calves above, the latter which yields Nmin for purposes of stock assessment. Mean crude growth rate (dashed line) is the exponentiated mean of loge [(Nt+1-Nt)/Nt ]for each year (t). From NMFS (2013).

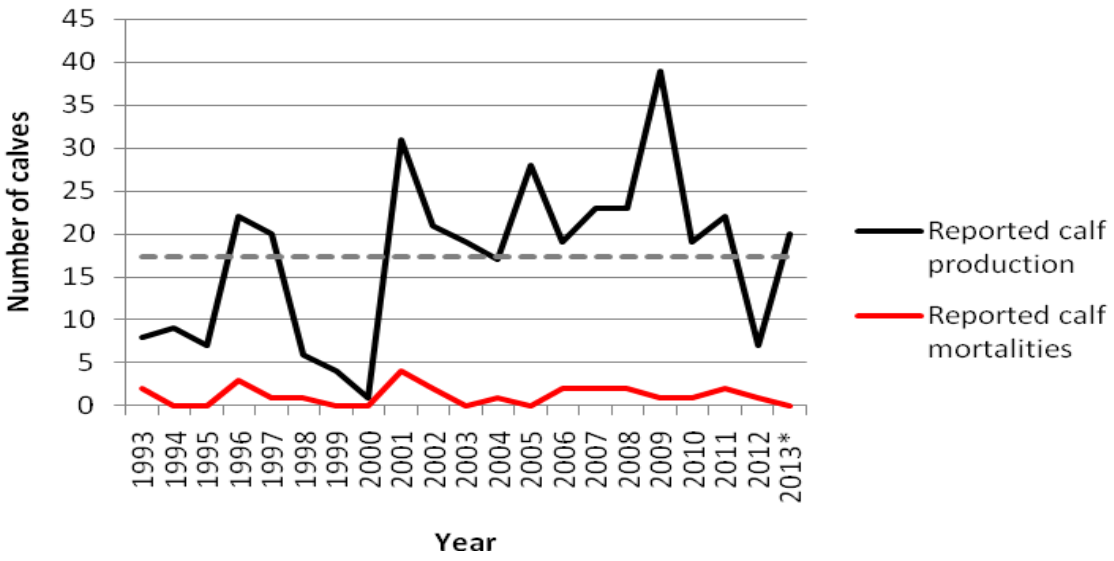



Figure 6. NARW calf production and calf mortality since 1993. The 2013 season includes sightings up to 3/01/2013. The calving season generally extends into April. Data from Waring et al. 2012 and L. Crowe, pers. comm.

**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:**

Unknown for New York. NARW have been infrequently sighted in state waters, although Sadove and Cardinale (1993) report sighting at least one NARW every year from the 1970s – 1993. All of these animals were either mom/calf pairs or solitary individuals, and the majority did not remain in the area for an extended period of time (Sadove and Cardinale 1993).

| Current | # of Animals | # of Locations | % of State |
|---|---|---|---|
| **444 is the minimum stock size, # are not known for New York** | | | |

**Details of current occurrence:**

Unknown for New York. There is no comparable data between historic and current occurrence of NARW in state waters. BRP (2010) detected right whales on 53 of 258 days of monitoring from 2008 and 2009. Abundance in state waters during this time period is unknown, though some information on presence and distribution was collected during this study. Much of the information for the state comes from opportunistic sightings (see Figures 1 and 2, Trends Discussion).

**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:** |
| **__X__ 1-25** | _____ |

**IV. Primary Habitat or Community Type:**

**1.** Pelagic

**2.** Marine, Deep Subtidal

**3.** Estuarine, Deep Subtidal

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

**____ Declining ____ Stable ____ Increasing __X__ Unknown**

**Time frame of decline/increase: _____**

**Habitat Specialist? _____ Yes __X__ No**

**Indicator Species? __X__ Yes _____ No**

**Habitat Discussion:**

North Atlantic right whales have historically been found in the eastern and western Atlantic. It is currently unknown if there is separation between these groups; they are currently considered to be the same species, but are often considered separate for management purposes (Kraus and Rolland 2007). A known male was tracked from Cape Cod to Norway and back again within the period of a year (Jacobsen et al. 2004), and other western North Atlantic right whales have been photographed in Iceland and Norway (Rosenbaum et al. 2000), indicating that there may not be any separation.

Like other species of baleen whales, female NARWs undergo a seasonal migration. They calve in the waters off of the southeastern United States. Some juveniles and non-reproductive females make the journey south with pregnant females (Kraus and Rolland 2007). The rest of the population is believed to remain up north for the entire year. Where the remaining right whales go for the late fall - winter period is poorly understood. Based on right whale biology, it is believed that this fall/winter area would be a mating ground. A recent discovery of relatively large (20+) numbers of right whales of both sexes in the Outer Fall/Jordan Basin region during this period has led to the belief that this area is used as a mating ground (Brown 2012). Whether there are other areas also used by right whales is unknown.

The areas of the coastal waters of the southeastern United States; the Great South Channel; Georges Bank/Gulf of Maine; Cape Cod and Massachusetts Bays; the Bay of Fundy; and the Scotian Shelf appear to be the major habitat areas for right whales. There is thought to be extensive travel within and between these habitats which may vary from year to year (NMFS 2013). In the spring, right whales are frequently found in Great South Channel and Massachusetts and Cape Cod Bay. In the summer and fall, most right whales are sighted in the Bay of Fundy and Roseway Basin (Kraus and Rolland 2007). About 2/3 of the known right whale population can be seen in one of these areas, where the remaining 1/3 go is unknown. Right whales are seen primarily in coastal and shelf waters (NMFS 2005). Their distribution appears to be driven primarily by prey, specifically the distribution of their preferred prey, *Calanus finmarchicus* (NMFS 2005).

Right whales are believed to use New York waters primarily for migration (Sadove and Cardinale 1993, NMFS 2005). Sadove and Cardinale (1993) reported that most sightings of right whales in state waters occurred between March and June. Whales were often spotted very close to shore; they are seen most frequently along the south shore of Long Island (Sadove and Cardinale 1993,

NEFSC 2013), and Sadove and Cardinale (1993) reported sightings within Long Island Sound, Block Island Sound, Gardiners Bay and south shore inlets and bays. However, recent studies conducted in New Jersey indicate that right whales may be feeding in the mid-Atlantic (Whitt et al 2013). This study also found year round presence of right whales in the mid-Atlantic as did the acoustic study conducted by Cornell in New York waters (Whitt et al 2013, BRP 2010). This may indicate that right whales are present in the mid-Atlantic more often than previously believed.

While the amount of pelagic ecosystem in New York is not changing at any substantial rate, its suitability may be. Changes in prey density may alter an area's suitability for occupancy by right whales. In addition, pollution (including noise pollution) may make a previously occupied area unsuitable for this species. Passive acoustic monitoring in the New York Harbor region and offshore of Long Island to the continental shelf edge found that there was the potential for acoustic masking of right whale calls due to high levels of anthropogenic noise (BRP 2010). It is possible that right whales may avoid these areas when noise levels are elevated. Additionally, climate change may alter prey distributions and abundance, though little is known about this due to the lack of research on zooplankton in state water and in the NY Bight in general. Further research needs to be done to identify whether these factors are altering habitat availability in New York waters.

## V. New York Species Demographics and Life History

**_____ Breeder in New York**

**_____ Summer Resident**

**_____ Winter Resident**

**_____ Anadromous**

**_____ Non-breeder in New York**

**_____ Summer Resident**

**_____ Winter Resident**

**_____ Catadromous**

**___ Migratory only**

**__X__ Unknown ***

** Believed to be primarily migratory, but recent studies indicate that waters may be used for more than migration.*

**Species Demographics and Life History Discussion:**

Female right whales give birth to one calf after a gestation period of approximately 12 months (Best 1994). The number of calves born in the population each year is highly variable, ranging from one to 39. This variation may be a result of nutrition, with good feeding years leading to good calving years (Moore et al. 2001). The average calving interval from 1980 – 2005 is just over three years (Kraus et al. 2007). Between 1998 and 2003, the average calving interval increased to over five years, before dropping back to three years in 2004 and 2005. Calves are nursed for approximately ten months and separate from the mother at around one year of age (Kraus et al. 2007).

Mating in NARWs appears to occur in the midst of large surface-active groups (SAGs) of up to forty or more individuals (Kraus et al. 2007). Females appear to call in males, who travel from distances up to several kilometers to participate in the SAG (Parks 2003, Kraus et al. 2007). The females are usually located in the center of the SAG, with males competing for "alpha" positions next to the female. The female spends the majority of the time avoiding copulation on her back, rolling over about once a minute to breathe and give males the chance to copulate (Kraus and Hatch 2001, Kraus et al. 2007). Females often mate with multiple males, and males achieve reproductive success via sperm competition (Brownell and Ralls 1986). SAGs occur at all times of the year, although right whale biology indicates that fertilization occurs in late fall/winter, indicating that

fertilization does not occur in the majority of SAGs (Kraus et al. 2007). It should be noted that not all SAGs are reproductive in nature, with all male and all female SAGs often occurring. They appear to also be important for socialization (Kraus et al. 2007).

The average age of first calving is ten years, although female NARWs have given birth to their first calf at as early as five years of age and as late as twenty-one years of age (Kraus et al. 2007). The age that males reach sexual maturity is unknown, as even juvenile males have been seen involved in surface-active groups (SAGs) that are indicative of mating (Kraus and Hatch 2001, Kraus et al. 2007). Most males who get close enough to actually mate with a female in a SAG are over ten years of age (Kraus et al. 2007). Paternity studies have shown that most males do not successfully reproduce until they are over fifteen years of age (Kraus et al. 2007).

As of November 2012, there were 103 living reproductive females (Knowlton et al. 2012). Additionally there are 13 females that have surpassed 17 years of age (at this time, 90% of female NARWs have given birth to at least one calf) but have not reproduced. One female has given birth to nine calves, which is the maximum number of calves born to one female (Knowlton et al. 2012). The maximum known reproductive span is 35 years (Knowlton et al. 2012). Two whales are currently described as being in senescence, although their ages are unknown (Kraus et al. 2007). One is a female who had a calf in 1976 and none since, and the other is the largest female in the population, and presumed to be among the oldest (Kraus et al. 2007). The longevity is unknown, although believed to be at least 60 – 70 years. In 1935, the last right whale, a calf, was hunted and killed in U.S. waters. Photographs of the event have revealed the mother of the calf to be Eg#1045. Hamilton et al. (1998) reasoned that, if the calf was her first calf and if she gave birth to the calf when she was ten years old, then Eg#1045 would have been 70 years old when last sighted. This is a minimum age estimate, and it is presumed that right whales can live even longer (Kraus and Rolland 2007). Closely related species of whales can live to 100 year or more (NMFS website).

Right whales often exhibit some degree of maternally driven site fidelity. For example, the calves of females who feed in the Bay of Fundy are often seen in subsequent years in the Bay of Fundy. However, this site fidelity is not strict, and NARWs are known to range over large distances. A male right whale was tracked from Cape Cod to the tip of Norway and back in the time span of about a year (Garrison 2007). A satellite tag placed on an entangled right whale broadcasted signals from South Carolina, far offshore to an area west of the Azores and around the Atlantic Ocean (Garrison 2007). Unfortunately, it was impossible to tell whether the tag was still attached to the whale or had broken free, but there is speculation that many right whales wander from their more “typical” habitats (Garrison 2007).

The sex ratio of NARWs is 50:50 (Brown et al. 1994). Juveniles comprise between 26% and 31% of the population, which is lower than expected for a population experiencing growth (Hamilton et al. 1998).

Around 50% of NARW mortalities are a result of human activities (Moore et al. 2007). Natural mortality in the species is poorly understood. Predation is believed to play some role, although it is

unknown how much. Killer whale rake marks have been documented on NARWs (Kraus 1990), and recently white sharks have been observed relatively frequently near NARWs in the southeastern United States (L. Crowe, pers. comm.). Neonatal mortality has been recognized as a source of natural mortality. High levels of *Giardia* and *Cryptosporidium,* parasites that can cause diarrhea, dehydration, weight loss and death in some animals, have been documented in right whales (Hughes-Hanks et al. 2005). Whether the parasites are causing disease in right whales is currently unknown. Several marine biotoxins occur in the same areas as right whales, raising concern that the species may be affected by harmful algal blooms (Rolland et al. 2007). Currently, no deleterious effects of marine biotoxins on right whales have been observed (Rolland et al. 2007). Combining both anthropogenic and natural mortality, Kraus (1990, 2002) estimated that 26-31% of right whales died in their first year of life, 10% in their second, 5% in their third, and at rates between 1% and 4% from ages 4 – 10. NARWs also exhibit very low levels of genetic variability, which raises concerns that the population could be more at risk from disease and contaminant effects, and there is some thought that these combined effects could play a role in the low reproductive rates of right whales (Kraus et al. 2007).

## VI. Threats:

Vessel collisions represent the leading cause of mortality to NARW; this has been the case since the 1970s (Reeves et al. 1978, Kraus 1990, Kraus et al. 2005, Moore et al. 2007). Right whales are often found in shallow, coastal waters that are heavily traveled by vessel traffic. Throughout their range, they tend to frequent areas in the vicinity of major shipping routes (outside of New York Harbor, Massachusetts Bay, the Bay of Fundy). The annual human-caused mortality of right whales is currently estimated at about 3 whales; two of these are attributable to vessel strikes (Waring et al. 2012). From 1970 – 2007, 75 NARW carcasses were reported (Knowlton and Brown 2007). At least 28 of these mortalities were a result of a vessel collision (Knowlton and Brown 2007). The vast majority (75%) of these collisions have occurred since 1991, where they represent 50% of the total known mortality of right whales over this time period (Knowlton and Brown 2007). Additionally, approximately 7% of the living population has "major wounds" attributable to ship strikes (Knowlton and Brown 2007). Serious injuries could eventually lead to mortality through infection or possibly decreased foraging efficiency. It is also possible that whales that recover from such injuries could experience decreased reproductive potential (Brown et al. 2009).

Entanglement in fishing gear has also been shown to be a major factor contributing to the slow recovery of NARWs (Knowlton et al. 2005). The majority of entanglements involve gear from fixed gear fisheries, such as gillnets and pot gear (Johnson et al. 2005). Fatal entanglements account for approximately 1 of the 3 NARW annual human-caused mortalities (Waring et al. 2012). From 1970 – 2007, at least 11% of the known right whale deaths were a result of entanglement in fishing gear (Knowlton and Kraus 2001, Brown et al. 2009). The actual number is estimated to be much higher, as many carcasses are not recovered. Many whales with severe entanglements are in poor condition, and thus are more likely to sink when dead (Brown et al. 2009). Moore et al. (2007) estimated that up to two-thirds of the annual right whale deaths (including deaths from entanglement and vessel collisions) go undetected.

Vessel collisions are believed to cause more immediate mortalities than entanglements, but fisheries interactions more frequently result in drawn-out deaths, decreased productivity, and decreased survival (Brown et al. 2009). Over 75% of the known right whale population have scars indicative of at least one entanglement (Knowlton et al. 2005). Additionally, it is estimated that between 14% and 51% of known right whales are involved in entanglements annually (Knowlton et al. 2005). Reproductive females that are carrying gear or have serious injuries from entanglements were significantly less likely to calve again. Females that experienced a moderate or severe entanglement had a significantly longer calving interval than those with no or minor entanglement wounds (Knowlton et al. 2012).

There is some evidence that females may be particularly at risk from human activities. Mother/calf pairs, which migrate from the southeastern U.S. to the Bay of Fundy, are often found in coastal waters heavily trafficked by ships and fishing gear (Fujiwara and Caswell 2001). Additionally, the pairs spend significantly more time at the surface than other demographic groups of right whales, putting them at increased risk of ship collisions (Fujiwara and Caswell 2001). Known deaths from entanglement and ship strikes from 2005 - 2009 are biased towards females (Brown et al. 2009). Human impacts were responsible for the loss of at least 12%, and potentially as much as 37%, of the female population between 1980 and 2012 (Knowlton et al. 2012). These numbers are particularly concerning for the population, as the death of a reproductive female also represents a loss of the potential calves the female would produce.

Stranding and entanglement response and outreach in New York are currently provided by Riverhead Foundation. They respond to all marine mammal strandings; however, they are not authorized to disentangle large whales. The nearest group authorized by NOAA to perform such entanglements is the Rhode Island Division of Fish and Wildlife. In an attempt to reduce large whale entanglements, Cornell Cooperative Extension has begun a “ghost” gear removal project. Working with the DEC’s Crustacean Unit and commercial fishermen, the project has removed 4,881 abandoned lobster traps from Long Island Sound as of June 21, 2012.

Climate change has led to temperature and current shifts throughout the North Atlantic Ocean. These changes could lead to shifts in distribution of right whales as occupied habitats may become unsuitable and previously unsuitable habitats may become occupied. Certain studies have shown that the productivity of ocean basins may be altered by shifts in the climate (Quinn and Neibauer 1995, Mackas et al. 1989). Prey species may be affected; copepods, the main prey of NARWs, have already exhibited signs of a shift in distribution as a result of climate change (Hays et al. 2005). The distribution of right whales is believed to be strongly driven by the distribution of their prey, so it can be assumed that these shifts have the potential to alter right whale habitat use (NMFS 2005, Brown et al. 2009). Additionally, calving success has been linked to nutrition in NARWs, with fewer calves being produced after poor feeding seasons (Angell 2005). It has already been suggested that climate change is affecting the distribution of right whales in the Gulf of Maine and the calving rate of the population (Kenney 1998a, 1998b). The effects of climate change on both right whales and their prey need to be further researched, but the potential effects are large.

NARWs, like other cetaceans, rely on sound for communication. There has been recent concern over the effects of increasing ocean noise level on cetaceans. Ross (1987,1993) estimated that the ambient noise level in the oceans rose 10 dB from 1950 – 1975 because of shipping; background noise has been estimated to be increasing by 1.5 dB per decade at the 100 Hz level since propeller-driven ships were invented (National Research Council 2003). The oceans are getting progressively louder, and the waters off of New York are no exception (BRP 2010). Acoustic monitoring in the New York Bight region in 2008 and 2009 found elevated levels of background noise (due in large part to shipping traffic) (BRP 2010).

High levels of noise could have several effects on marine mammals. Exceptionally loud noises, usually active military sonar, have led to temporary and permanent threshold shifts and even death by acoustic trauma in certain species of cetaceans (Richardson et al. 1995). More commonly, anthropogenic noise can cause avoidance of an area and alterations in behavior (Richardson et al. 1995). Right whales have been shown to increase both the amplitude and frequency of their calls as a result of increased underwater noise (Parks et al. 2007, 2010). There are concerns that this could cause the whales to expend more energy (Parks et al. 2007, 2010). Additionally, Rolland et al. (2012) found a decrease in fGC stress levels in NARWs using the Bay of Fundy that correlated with a decrease in shipping traffic after 9/11, suggesting that elevated noise levels could cause increased stress. While it is currently unknown how this stress may affect NARWs, chronic elevations of GC in other vertebrates have been shown to have detrimental effects on growth, reproduction, and immune response (Sapolsky et al. 2000, Romero and Butler 2007, Romero and Wikelski 2001, Pride 2005). Right whales are found most commonly in coastal waters, where there are often high levels of recreational and other vessel activity. Whether increased levels of vessel noise are enough to drive right whales from an area is currently unknown. There is also the potential that certain levels of anthropogenic noise could decrease the distance right whales calls can be heard, or potentially mask them entirely (Richardson et al. 1995). This could have detrimental effects in a large, solitary species that relies in part on sound for communication, foraging, and navigation (Rolland et al. 2012). The acoustic monitoring by BRP (2010) found the potential for the masking of whale calls in the NARW frequency range in the New York Bight region.

The threats from alternative energy development, such as offshore wind, are largely due to anthropogenic noise. There is a proposal to install a wind farm off of Long Island, potentially the largest wind project in the county (Long Island- New York City Offshore Wind Project 2013). NARWs are often found in shallow waters that are suitable for wind farms, raising concern that this species may be more affected than other baleen whales with a more offshore distribution (Madsen et al. 2006). Construction of an offshore wind farm requires pile-driving to install the foundations. Pile-driving produces high levels of intense noise, and is generally considered the largest threat to marine mammals when talking about wind farms (Madsen et al. 2006). Although no studies exist on right whale reactions to pile-driving, avoidance behavior has been documented in bowhead whales (*Balaena mysticetus*, a close relative of the right whale) responding to airgun use (Richardson et al. 1986). Operational wind turbines produce more constant, low levels of noise (Madsen et al. 2006). While these levels are generally not considered loud enough to disrupt

marine mammal hearing, this is the potential for behavioral effects. No studies on wind turbines currently exist for right whales or any other baleen whales, but Nowacek et al. (2004) documented avoidance responses of NARWs to a tonal signal that was similar in frequency and amplitude to the sound produced by wind turbines. This level is also similar to noise produced by dredging and drilling, and thus there is the potential that these activities could alter right whale use of an area (Madsen et al. 2006).

It is currently believed that contaminants such as organochlorines, organotins, and heavy metals do not negatively impact humpback whales and other baleen as much as other marine mammals (O'Shea and Brownell 1994). Humpback whales feed at a low trophic level, and so there is little chance for the bioaccumulation of toxins that occurs in many of the odontocetes (toothed whales). While no significant effects of contaminants has yet been documented, it is possible that exposure has long-term effects such as reduced reproductive success and/or long-term survival. Gaskin (1987) raised the concern that the Bay of Fundy and Gulf of Maine, both important areas for the majority of the NARW population, are semi-enclosed. Percy et al. (1997) documented concerning levels of a large number of contaminants in the Bay of Fundy.

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

**_____ No** **____ Unknown**

**__X__ Yes**

The right whale is protected in the United States by its status as a federally Endangered species. In addition, the right whale (along with all other marine mammals) receives federal protection under the Marine Mammal Protection Act of 1972 (MMPA). The right whale is protected internationally from commercial hunting under the International Whaling Commission's (IWC) global moratorium on whaling. The moratorium was introduced in 1986, and is voted on by member countries (including the United States) at the IWC's annual meeting.

Right whales are also protected under the Environmental Conservation Law (ECL) of New York. The right whale is listed as a state endangered species in New York. Section 11 – 0535 protects all state-listed endangered and threatened species and makes it illegal to take, import, transport, possess or sell any listed species or part of a listed 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 right whale. Whether they are adequate to protect the habitat is currently unknown.

The North Atlantic Large Whale Take Reduction Plan identified floating groundline used in the trap and pot fisheries as an entanglement threat for large whales. It is often difficult to determine which fishery entangling gear is from; however, 53% of identified entanglements on North Atlantic right whales and humpback whales examined by Johnson et al. (2005) involved trap and pot gear. The

National Marine Fisheries Service subsequently passed a new law making it mandatory for all pot and trap fisheries to switch over to sinking groundline by 2008. The effectiveness of this measure is currently being analyzed (NMFS 2013). To encourage compliance by fishermen, DEC's Marine Endangered Species and Crustacean Unit partnered with the Cornell Cooperative Extension of Suffolk County and initiated gear buyback programs, which removed 16.9 tons of floating rope from New York's commercial lobster fishery. Further analysis is required before it is known if any real reduction in large whale entanglement has occurred as a result of the switch from floating to sinking groundline. A

Two mid-Atlantic seasonal management areas lay within New York waters (see figure below). From November 1 to April 30 each year, vessels 65 ft or greater must travel at 10 knots or less when traveling through these areas. If right whales are sighted in an area at any time of the year, mariners must report the location to NMFS. If right whales appear to be concentrating in an area, NMFS can enact Dynamic Management Areas (DMAs). Vessels are asked to either avoid this area or reduce their speed to 10 knots or less when inside the DMA, however, these restrictions are not mandatory. While it has been estimated that whale strikes by vessels traveling at less than 11.8 knots were 50% less likely to be lethal than strikes at greater speeds (Vanderlaan and Taggart 2007), Silber and Bettridge (2012) found that compliance to the speed restrictions is low (although improving), and documented no significant decrease in ship strike mortalities and serious injuries in right whales as a result of the restrictions. However, other studies have shown more of a benefit. Conn and Silber (2013) found that ship strike mortality for right whales is likely reduced by 80-90% by vessel speed restrictions. Further analysis on the effectiveness of this measure is being conducted and enforcement is a known issue (NMFS 2013). It should also be noted that this Ship Strike Rule has a sunset clause and will expire on December 9, 2013 unless it is renewed (NMFS 2013).

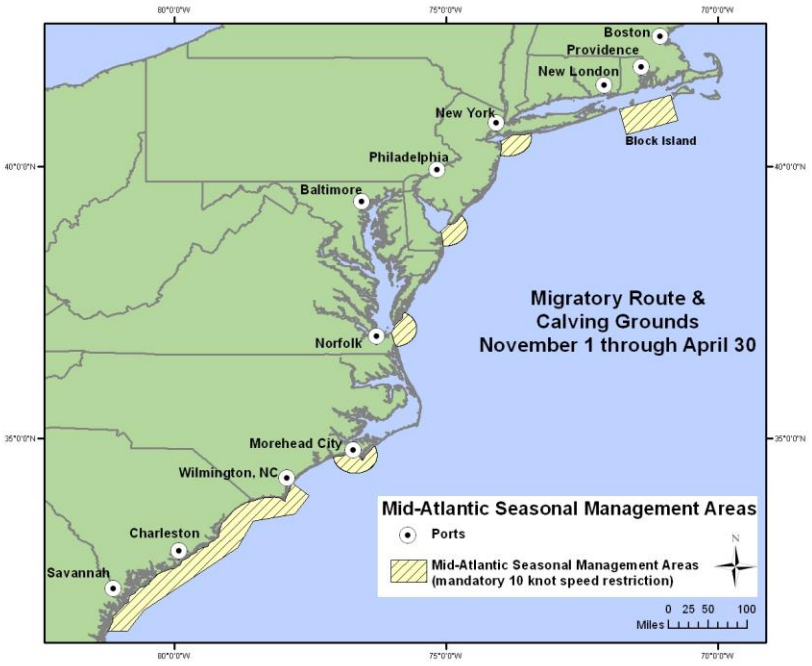



Figure 7. Location of Seasonal Management Areas (SMAs) in the mid-Atlantic. Figure from NEFSC 2013.

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

An increased understanding of right whale distribution, abundance and habitat use in New York waters would be beneficial when developing management and conservation strategies. Long-term surveys and monitoring strategies should be developed to determine which areas of state waters are important to right whales, and when they use these habitats. Related to this little is known about current zooplankton distribution and abundance in New York state water and the New York Bight. Because recent studies indicate that right whales may at least sometimes be feeding during migration. Therefore, knowledge about prey distribution may enable predictions about right whale distribution, making this an important area of research.

If right whale use of state waters is better understood, it would be possible to attempt to limit known threats in these areas. For example, wind farms and any drilling or construction activities could be done in areas not frequented by right whales. Additionally, a thorough analysis on right whale sighting locations and shipping routes could be conducted. If right whales are consistently being sighted within shipping lanes, it may be possible to divert vessel traffic from the area. Shipping lanes in the Bay of Fundy were rerouted once it was shown that right whales were found frequently within the Bay of Fundy Traffic Separation Scheme (Knowlton and Brown 2007, Mate et al. 1997, Vanderlaan et al. 2008). Since the scheme was amended, Vanderlaan et al. (2008) estimates that the probability of a vessel/whale interaction in the outbound lane has been reduced by around 90%.

Near real-time acoustic monitoring of right whales is currently being used off of the coast of Massachusetts in an effort to reduce vessel collisions. When a right whale is detected, an alert goes out to all large shipping vessels in the area, and a speed restriction goes into place. Similar monitoring in New York could help reduce ship collisions with right whales.

One of the largest problems with the current regulations protecting right whales from vessel collisions is lack of compliance, especially in Dynamic Management Areas (DMAs). Silber and Bettridge (2012) recommend either expanding or recreating the Seasonal Management Areas (SMAs) to include recurring DMAs, or making DMA speed restrictions mandatory. While this is a federal regulation, increased understand of right whale use of New York waters could help improve the SMAs, or New York could develop their own regulations for vessels when right whales are in the area. Additionally, increased education of New York mariners would be beneficial to spread awareness of the plight of the NARW, as well as the regulations that should be followed.

Other areas of needed research are looking at the frequency of occurrence of entanglements in fishing gear and reducing the potential for these interactions. Also, the potential effects of wind farms, contaminants, climate change and effects of ocean noise on right whale behavior.

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