NORTHERN RIGHT WHALE (*Eubalaena glacialis*): Western Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Individuals of the western northern right whale population range from wintering and calving grounds in coastal waters of the southeastern United States to summer feeding and nursery grounds in New England waters and northward to the Bay of Fundy and the Scotian Shelf. Knowlton *et al.* (1992) reported several long-distance movements as far north as Newfoundland, the Labrador Basin, and southeast of Greenland; in addition, recent resightings of photographically identified individuals have been made off Iceland, arctic Norway and in the old Cape Farewell whaling ground east of Greenland. The Norwegian sighting (in September 1999) represents one of only two sightings this century of a right whale in Norwegian waters, and the first since 1926. Together, these long-range matches indicate an extended range for at least some individuals and perhaps the existence of important habitat areas not presently well described. Similarly, records from the Gulf of Mexico (Moore and Clark 1963, Schmidly *et al.* 1972) represent either geographic anomalies or a more extensive historic range beyond the sole known calving and wintering ground in the waters of the southeastern United States. Whatever the case, the location of most of the population is unknown during the winter. Offshore (greater than 30 miles) surveys flown off the coast of northeastern Florida and southeastern Georgia from 1996 to 2001 had 3 sightings in 1996, 1 in 1997, 13 in 1998, 6 in 1999, 11 in 2000 and 6 in 2001 (within each year, some were repeat sightings of previously recorded individuals). The frequency with which right whales occur in offshore waters in the southeastern U.S. remains unclear.

Research results to date suggest the existence of 6 major habitats or congregation areas for western Atlantic northern right whales; these are 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. However, movements within and between habitats may be more extensive than is sometimes thought. Results from satellite tags clearly indicate that sightings separated by perhaps two weeks should not necessarily be assumed to indicate a stationary or resident animal. Instead, telemetry data have shown rather lengthy and somewhat distant excursions, including into deep water off the continental shelf (Mate *et al.* 1997). Systematic surveys conducted for the first time off the coast of North Carolina in winter of 2001 and 2002 sighted 8 calves, suggesting the calving grounds may extend as far north as Cape Fear. Four of the calves were not sighted by surveys conducted further south. One of the cows photographed was new to researchers, having effectively eluded identification over the period of its maturation (McLellan *et al.* 2004). The Northeast Fisheries Science Center is conducting an extensive multi-year aerial survey program throughout the Gulf of Maine region; this program is intended to better establish the distribution of right whales, including inter-annual variability in their occurrence in previously poorly studied habitats.

New England waters are a primary feeding habitat for the right whale, which appears to feed primarily on copepods (largely of the genera Calanus and Pseudocalanus) in this area. Research suggests that right whales must locate and exploit extremely dense patches of zooplankton to feed efficiently (Mayo and Marx 1990). These dense zooplankton patches are likely a primary characteristic of the spring, summer, and fall right whale habitats (Kenney *et al.* 1986, 1995). Acceptable surface copepod resources are limited to perhaps 3% of the region during the peak feeding season in Cape Cod and Massachusetts Bays (C. Mayo pers. comm.). While feeding in the coastal waters off Massachusetts has been better studied than in most areas, feeding by right whales has also been observed on the margins of Georges Bank, in the Gulf of Maine, in the Bay of Fundy, and over the Scotian Shelf. The characteristics of acceptable prey distribution in these areas are not well known. In addition, New England waters serve as a nursery for calves and perhaps also as a mating ground. NOAA Fisheries and Center for Coastal Studies aerial surveys in the spring of 1999, 2000, 2001 and 2002 found substantial numbers of right whales along the Northern Edge of Georges Bank, in Georges Basin, and in various locations in the Gulf of Maine including Cashes Ledge, Platts Bank and Wilkinson Basin. The predictability with which right whales occur in such locations remains unclear, and these new data highlight the need for more extensive surveys of habitats which have previously received minimal coverage.

Genetic analyses based upon direct sequencing of mitochondrial DNA (mtDNA) have identified five mtDNA haplotypes in the western Altantic northern right whale (Malik *et al.* 1999). Schaeff *et al.* (1997) compared the genetic variability of northern and southern right whales (E. australis), and found the former to be significantly less diverse, a finding broadly replicated from sequence data by Malik *et al.* (2000). These findings might be indicative of inbreeding in the population, but no definitive conclusion can be reached using current data. Additional work comparing modern and historic genetic population structure in right whales, using DNA extracted from museum and archaeological specimens of baleen and bone, is also underway (Rosenbaum *et al.* 1997, 2000). Preliminary results suggest that the eastern and western North Atlantic populations were not genetically distinct (Rosenbaum *et al.* 2000). However, the virtual extirpation of the eastern stock and its lack of recovery in the last hundred years strongly suggests population subdivision over a protracted (but not evolutionary) timescale. Results also suggest that, as expected, the principal loss of genetic diversity occurred during major exploitation events prior to the 20th century.

To date, skin biopsy sampling has resulted in the compilation of a DNA library of almost 300 North Atlantic right whales. When work is completed, a genetic profile will be established for each individual, and an assessment provided on the level of genetic variation in the population, the number of reproductively active individuals, reproductive fitness, the basis for associations and social units in each habitat area, and the mating system. Tissue analysis has also aided in sex identification: the sex ratio of the photo-identified and catalogued population does not differ significantly from parity. Analyses based on both genetics and sighting histories of photographically identified individuals also suggest that approximately one-third of the females with calves population utilizes summer feeding grounds other than the Bay of Fundy. As described above, a related question is where individuals other than calving females and a few juveniles overwinter. One or more additional wintering and summering grounds may exist in unsurveyed locations, although it is also possible that "missing" animals simply disperse over a wide area at these times. Identification of such areas, and the possible threats to right whales there, is recognized as a priority for research efforts.

POPULATION SIZE

Based on a census of individual whales identified using photo-identification techniques combined with the assumption of mortality of whales not seen for 7 years, the western North Atlantic stock size was estimated to be 295 individuals in 1992 (Knowlton *et al.* 1994); an updated analysis using the same method gave an estimate of 299 animals in 1998 (Kraus *et al.* 2001). Because this was a nearly complete census, it is assumed that this represents a minimum population size estimate. However, no estimate of abundance with an associated coefficient of variation has been calculated for this population. Calculation of a reliable point estimate is likely to be difficult given the known problem of heterogeneity of distribution in this population. An IWC workshop on status and trends of western North Atlantic right whales gave a minimum direct-count estimate of 263 right whales alive in 1996 and noted that the true population was unlikely to be substantially greater than this (Best *et al.* 2001).

Historical Abundance

An estimate of pre-exploitation population size is not available. Basque whalers may have taken substantial numbers of right whales at times during the 1500's in the Strait of Belle Isle region (Aguilar 1986), and the stock of right whales may have already been substantially reduced by the time whaling was begun by colonists in the Plymouth area in the 1600's (Reeves and Mitchell 1987). A modest but persistent whaling effort along the coast of the eastern U.S. lasted three centuries, and the records include one report of 29 whales killed in Cape Cod Bay in a single day during January 1700. Based on incomplete historical whaling data, Reeves and Mitchell (1987) could conclude only that there were at least some hundreds of right whales present in the western North Atlantic during the late 1600's. In a later study (Reeves *et al.* 1992), a series of population trajectories using historical data and an estimated present population size of 350 were plotted. The results suggest that there may have been at least 1,000 right whales in this population during the early to mid-1600's, with the greatest population decline occurring in the early 1700's. The authors cautioned, however, that the record of removals is incomplete, the results were preliminary, and refinements are required. Based on back calculations using the present population size and growth rate, the population may have numbered fewer than 100 individuals by the time international protection for right whales came into effect in 1935 (Hain 1975, Reeves *et al.* 1992, Kenney *et al.* 1995). However, too little is known about the population dynamics of right whales in the intervening years to state anything with confidence.

Minimum Population Estimate

The western North Atlantic population size was estimated to be 299 individuals in 1998 (Kraus *et al.* 2001), based on a census of individual whales identified using photo-identification techniques. A bias that might result from including catalogued whales that had not been seen for an extended period of time and therefore might be dead, was addressed by assuming that an individual whale not sighted for five or more years was dead (Knowlton *et al.* 1994). It is assumed that the census of identified and presumed living whales represents a minimum population size estimate. The true population size in 1998 may have been higher if: 1) there were animals not photographed and identified, and/or 2) some animals presumed dead were not.

Current Population Trend

The population growth rate reported for the period 1986-1992 by Knowlton *et al.* (1994) was 2.5% (CV=0.12), suggesting that the stock was showing signs of slow recovery. However, work by Caswell *et al.* (1999) has suggested that crude survival probability declined from about 0.99 in the early 1980's to about 0.94 in the late 1990's. The decline was statistically significant. Additional work conducted in 1999 was reviewed by the IWC workshop on status and trends in this population (Best *et al.* 2001); the workshop concluded based on several analytical approaches that survival had indeed declined in the 1990's. Although heterogeneity of capture could negatively bias survival estimates, the workshop concluded that this factor could not account for all of the observed decline, which appeared to be particularly marked in adult females. Another workshop was convened by NOAA Fisheries in September 2002, and after reviewing several approaches to survival estimation reached similar conclusions regarding the decline in this population (Clapham 2002).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

During 1980-1992, 145 calves were born to 65 identified cows. The number of calves born annually ranged from 5 to 17, with a mean of 11.2 (SE=0.90). The reproductively active female pool was static at approximately 51 individuals during 1987-1992. Mean calving interval, based on 86 records, was 3.67 years. There was an indication that calving intervals may have been increasing over time, although the trend was not statistically significant (P=0.083) (Knowlton *et al.* 1994).

Since that report, total reported calf production in 92/93 was 8; 93/94, 9; 94/95, 7; 95/96, 22; 96/97, 20; 97/98, 6; 98/99, 4; 99/00, 1; 00/01, 31; 01/02, 21; and 02/03, 19 [mean 13.6 SE=2.9)]. However, this total calf production should be reduced by reported calf mortalities: 2 mortalities in 1993, 3 in 1996, 1 in 1997, 1 in 1998, 4 in 2001 and 2 in 2002. During 2002, 2 mortalities and 1 serious injury involved what were likely calves from 00/01. Of the three calf mortalities in 1996, available data suggested one was not included in the reported 24 mother/calf pairs, resulting in a total of 25 calves born. Eleven of the 21 mothers in 1996 were observed with calves for the first time (i.e., were "new" mothers) that year. Three of these were at least 10 years old, 2 were 9 years old, and 6 were of unknown age. An updated analysis of calving interval through the 1997/1998 season suggests that mean calving interval increased since 1992 from 3.67 years to more than 5 years, a significant trend (Kraus *et al.* 2001). This conclusion is supported by modeling work reviewed by the IWC workshop on status and trends in this population (Best *et al.* 2001); the workshop agreed that calving intervals had indeed increased and further that the reproductive rate was approximately half that reported from studied populations of E. australis. The low calf production in subsequent years (4 in 1999 and only 1 in 2000) gives added cause for concern, although a record 31 calves were born in 2001. A workshop on possible causes of reproductive failure was held in April 2000 (Reeves *et al.* 2001). Factors considered included contaminants, biotoxins, nutrition/food limitation, disease and inbreeding problems. While no conclusions were reached, a research plan to further investigate this topic was developed.

The annual population growth rate during 1986-1992 was estimated to be 2.5% (CV=0.12) using photo-identification techniques (Knowlton *et al.* 1994). A population increase rate of 3.8% was estimated from the annual increase in aerial sighting rates in the Great South Channel, 1979-1989 (Kenney *et al.* 1995). However, as noted above, more recent work indicated that the population was in decline in the 1990's (Caswell *et al.* 1999, Best *et al.* 2001).

An analysis of the age structure of this population suggests that it contains a smaller proportion of juvenile whales than expected (Hamilton *et al.* 1998a, Best *et al.* 2001), which may reflect lowered recruitment and/or high juvenile mortality. In addition, it is possible that the apparently low reproductive rate is due in part to unstable age structure or to reproductive senescence on the part of some females. However, data on either factor are poor; senescence has been demonstrated in relatively few mammals (including humans, pilot whales, and killer whales) and is currently undocumented for any baleen whale.

POTENTIAL BIOLOGICAL REMOVAL

Potential biological removal (PBR) is specified as the product of minimum population size, one-half the maximum net productivity rate and a "recovery" factor for endangered, depleted, threatened stocks, or stocks of unknown status relative to OSP (MMPA Sec. 3. 16 U.S.C. 1362, Wade and Angliss 1997). The recovery factor for right whales is 0.10 because this species is listed as endangered under the Endangered Species Act (ESA). However, in view of the population decline indicated by recent demographic analyses (Caswell *et al.* 1999, Best *et al.* 2001), the PBR for this population is set to zero.

ANNUAL HUMAN-CAUSED SERIOUS INJURY AND MORTALITY

For the period 1999 through 2003, the total estimated human-caused mortality and serious injury to right whales is estimated at 2.6 per year (U.S. waters, 1.6; Canadian waters, 1.0). This is derived from two components: 1) non-observed fishery entanglement records at 1.6 per year (U.S. waters, 0.8; Canadian waters, 0.8), and 2) ship strike records at 1.0 per year (U.S. waters, 0.8; Canadian waters, 0.2). Note that in the 1996 and 1998 stock assessment reports, a six-year time frame was used to calculate these averages. A five-year period has since been used to be consistent with the time frames used for calculating the averages for other species. Beginning with the 2001 Stock Assessment Report, Canadian records were incorporated into the mortality and serious injury rates of this report to reflect the effective range of this stock. It is also important to stress that serious injury determinations are made based upon the best available information; these determinations may change with the availability of new information. For the purposes of this report, discussion is primarily limited to those records considered confirmed human-caused mortalities or serious injuries.

Background

The details of a particular mortality or serious injury record often require a degree of interpretation. The assigned cause is based on the best judgment of the available data; additional information may result in revisions. When reviewing Table 1 below, several factors should be considered: 1) a ship strike or entanglement may occur at some distance from the reported location; 2) the mortality or injury may involve multiple factors; for example, whales that have been both ship struck and entangled are not uncommon; 3) the actual vessel or gear type/source is often uncertain; and 4) in entanglements, several types of gear may be involved.

The serious injury determinations are most susceptible to revision. There are several records where a struck and injured whale was re-sighted later, apparently healthy, or where an entangled or partially disentangled whale was re-sighted later free of gear. The reverse may also be true: a whale initially appearing in good condition after being struck or entangled is later re-sighted and found to have been seriously injured by the event. Entanglements of juvenile whales are typically considered serious injuries because the constriction on the animal is likely to become increasingly harmful as the whale grows.

"Serious injury" was defined in 50 CFR part 229.2 as an injury that was likely to lead to mortality. We therefore limited the serious injury designation to only those reports that had substantiated evidence that the injury, whether from entanglement or vessel collision, was likely to lead to the whale's death. Determinations of serious injury were made on a case by case basis following recommendations from the workshop conducted in 1997 on differentiating serious and non-serious injuries (Angliss and DeMaster 1998). Injuries that impeded the whale's locomotion or feeding were not considered serious injuries unless they were likely to be fatal in the foreseeable future. There was no forecasting of how the entanglement or injury may increase the whale's susceptibility to further injury, namely from additional entanglements or vessel collisions. This conservative approach likely underestimates serious injury rates.

With these caveats, the total estimated annual average human-induced mortality and serious injury incurred by this stock (including fishery and non-fishery related causes) was 2.6 right whales per year (U.S. waters 1.6; Canadian waters, 1.0). As with entanglements, some injury or mortality due to ship strikes almost certainly passes undetected, particularly in offshore waters. Decomposed and/or unexamined animals (e.g., carcasses reported but not retrieved or necropsied) represent "lost data", some of which may relate to human impacts. For these reasons, the figure of 2.6 right whales per year must be regarded as a minimum estimate.

Further, the small population size and low annual reproductive rate suggest that human sources of mortality may have a greater effect relative to population growth rates than for other whales. The principal factors believed to be retarding growth and recovery of the population are ship strikes and entanglement with fishing gear. Between 1970 and 1999, a total of 45 right whale mortalities were recorded (IWC 1999, Knowlton and Kraus 2001). Of these, 13 (28.9%) were neonates that are believed to have died from perinatal complications or other natural causes. Of the remainder, 16 (35.6%) were determined to be the result of ship strikes, 3 (6.7%) were related to entanglement in fishing gear (in two cases lobster gear, and one gillnet gear), and 13 (28.9%) were of unknown cause. At a minimum, therefore, 42.2% of the observed total for the period, and 50% of the 32 non-calf deaths, were attributable to human impacts (calves accounted for three deaths from ship strike).

Young animals, ages 0-4 years, are apparently the most impacted portion of the population (Kraus 1990). Finally, entanglement or minor vessel collisions may not kill an animal directly, but may weaken or otherwise affect it so that it is more likely to become vulnerable to further injury. Such was apparently the case with the two-year-old right whale killed by a ship off Amelia Island, Florida, in March 1991 after having carried gillnet gear wrapped around its tail region since the previous summer (Kenney and Kraus 1993). A similar fate befell right whale #2220, found dead on Cape Cod in 1996.

For waters of the northeastern USA, a present concern not yet completely defined, is the possibility of habitat degradation in Massachusetts and Cape Cod Bays due to a Boston sewage outfall, which came on-line in September 2000.

Fishery-Related Serious Injury and Mortality

Reports of mortality and serious injury relative to PBR as well as total human impacts are contained in records maintained by the New England Aquarium and the NMFS Northeast and Southeast Regional Offices (Table 1). From 1999 through 2003, 8 of 13 records of mortality or serious injury (including records from both USA and Canadian waters) involved entanglement or fishery interactions. The reports often do not contain the detail necessary to assign the entanglements to a particular fishery or location. Over time, however, additional sightings of entangled whales often provide the information needed.

Although disentanglement is either unsuccessful or not possible for the majority of cases, during the period 1999 through 2003, there were at least six documented cases of entanglements for which the intervention of disentanglement teams averted a likely serious injury determination. On 6/5/99, a two-year-old female, #2753, was found with a line through the mouth and trailing a Norwegian ball and highflyer. The nature of the entanglement would likely not have allowed the whale to shed the gear, and over a prolonged period, the rope's chafing likely would have caused systemic infection. Another two-year-old female, #2710, was sighted on 7/21/1999 wrapped in Canadian pot gear. A line passed through the mouth and around at least the right flipper. This entanglement would have become more constrictive as the whale grew. On 7/9/00, #2746, a three-year-old of unknown gender was seen with a line running through either side of the mouth and bridled behind the blowholes, while another portion of the line pinned the left flipper to the whale's flank. A nine-year-old female, #2223, was sighted on 8/18/00 with line tightly wrapped across her back, running through the mouth, and possibly wrapped on the left flipper. Subsequent sightings prior to the disentanglement revealed that the line across the back was beginning to tighten. On 7/20/01, #2427, a seven-year-old male was sighted off Portsmouth, New Hampshire, with line wrapped tightly around the rostrum and through the mouth. The whale was disentangled later that day, and subsequent resightings indicated that the injuries were healing. However, observers also noted that the whale's baleen was damaged, and that the whale was holding its head high out of the water and not diving nearly as frequently as other whales in the area. Lastly, an unidentified right whale was disentangled off Campobello Island, Canada on 7/09/03. The gear was tentatively identified as US lobster gear and other unknown gear.

In January 1997, NMFS changed the classification of the Gulf of Maine and U.S. Mid-Atlantic lobster pot fisheries from Category III to Category I based on examination of stranding and entanglement records of large whales from 1990 to 1994 (62 FR 33, Jan. 2, 1997).

Bycatch of a right whale has been observed by NMFS Sea Samplers in the pelagic drift gillnet fishery, but no mortalities or serious injuries have been documented in any of the other fisheries monitored by NOAA Fisheries. The only bycatch of a right whale documented by NMFS Sea Samplers was a female released from a pelagic drift gillnet in 1993.

In a recent analysis of the scarification of right whales, a total of 61.6% of the whales bore evidence of entanglements with fishing gear (Hamilton *et al.* 1998b). Further research using the North Atlantic Right Whale Catalogue has indicated that, each year, between 10% and 28% of right whales are involved in entanglements (Knowlton *et al.* 2001). Entanglement records maintained by NMFS Northeast Regional Office (NOAA Fisheries, unpublished data) from 1970 through 2000 included at least 72 right whale entanglements or possible entanglements, including right whales in weirs, entangled in gillnets, and trailing line and buoys. An additional record (M. J. Harris, pers. comm.) reported a 9.1-10.6m right whale entangled and released south of Ft. Pierce, Florida, in March 1982 (this event occurred during a sampling program and was not related to a commercial fishery). Incidents of entanglements in groundfish gillnet gear, cod traps, and herring weirs in waters of Atlantic Canada and the U.S. east coast were summarized by Read (1994). In 6 records of right whales becoming entangled in groundfish gillnet gear in the Bay of Fundy and Gulf of Maine between 1975 and 1990, the right whales were either released or escaped on their own, although several whales have been observed carrying net or line fragments. A right whale mother and calf were released alive from a herring weir in the Bay of Fundy in 1976. For all areas, specific details of right whale entanglement in fishing gear are often lacking. When direct or indirect mortality occurs, some carcasses come ashore and are subsequently examined, or are reported as "floaters" at sea; however, the number of unreported and unexamined carcasses is unknown, but may be significant in the case of floaters. More information is needed about fisheries interactions and where they occur.

Other Mortality

Ship strikes are a major cause of mortality and injury to right whales (Kraus 1990, Knowlton and Kraus 2001). Records from 1999 through 2003 have been summarized in Table 1. For this time frame, the average reported mortality and serious injury to right whales due to ship strikes was 1.0 whale per year (U.S. waters, 0.8; Canadian waters, 0.2). In 2004, two ship strike mortalities had been confirmed at the time of this writing. The first was found on 2/7/04 on Virginia Beach, VA, with major blunt trauma to the head and body. The second was reported struck by a troop transport ship off the Chesapaeke Bay entrance, and then seen again alive in the same area with a severed fluke on 11/17/04. It washed ashore dead on 11/24/04 in Ocean Sands, NC. Both of these events involved adult females carrying calves.

In 2000, two right whales were sighted in the Bay of Fundy with large open wounds that were likely the result of collisions with vessels. Right whale #2820, a male of unknown age, was first seen injured on 7/9/00. He was sighted intermittently throughout the remainder of that summer, and was seen again in the Bay of Fundy in 2001. The second whale, #2660, is a five-year-old female who was sighted with a wound on the left side of her head, just forward of the blowholes. She has not been resighted since. Although both of these injuries have a gruesome appearance, in the absence of a chronic stressor (i.e., entangling fishing gear), they are not likely to be fatal.

Table 1. Confirmed human-caused mortality and serious injury records of northern right whales, January 1999 through December 2003.						
Date	**Report Type**	**Length, sex, age, ID**	**Location**	**Assigned Cause: P=primary, S=secondary**		**Notes**
				Ship strike	**Entang./ Fsh inter**	
4/20/99	mortality	27+ yr. old female #1014	Cape Cod, MA	P		Fractures to mandible and vertebral column, abrasion and edema around right flipper
5/10/99	mortality	Adult female #2030	80mi east of Cape Cod, MA		P	Constricting sink gillnet gear created deep, extensive lacerations
3/01/00	serious injury	Adult male #1130	6mi east of Manomet, MA		P	Line apparently constricting left flipper; flipper discolored; abnormal cyamid distribution; bullet buoy trailing, line weighted down between whale and buoy
3/17/01	mortality	Male calf	Assateague, VA	P		Large fresh propeller gashes on dorsal caudal and acute muscular hemorrhage
6/8/01	serious injury	Adult male #1102	58mi east of Cape Cod, MA		P	Entangling line deeply embedded; whale showing numerous signs of poor health including emaciation, skin discoloration, and abnormal cyamid distribution
6/18/01	mortality	female calf	Long Island, NY	P		Dorsal propeller wounds, sub-dermal hemorrhage
11/3/01	mortality	Adult male #1238 14 m	Magdellen Islands, Canada		P	Thoroughly wrapped up in gear, whale seen alive and well five months earlier
7/6/02	mortality	11.0m (est) female #3107	off Briar Island, NS Canada		P	carcass ashore on Nantucket, MA; caudal peduncle severely lacerated where entangled
8/22/02	serious injury	Adult female #1815	Scotian Shelf, Canada		P	line tightly wrapped around head and tail stock
8/22/02	mortality	12.6m female 1"y.o.	off Ocean City, MD	P		large laceration on dorsal surface
8/30/02	serious injury	#3210 age & sex unknown	off Cape Cod, MA		P	line tightly wrapped around rostrum, resighted in 2004 in poor condition
1/14/03	serious injury	Adult female #2240	Jacksonville, FL		P	Body condition poor, gear possibly ingested
10/02/03	mortality	Adult female #2150	off Digby, NS	P		Large fracture in skull, sub-dermal hemorrhage

STATUS OF STOCK

The size of this stock is considered to be extremely low relative to OSP in the U.S. Atlantic EEZ, and this species is listed as endangered under the ESA. The northern right whale is considered one of the most critically endangered populations of large whales in the world (Clapham *et al.* 1999). A Recovery Plan has been published and is in effect (NMFS 1991), and a revised plan is under review. Three critical habitats, Cape Cod Bay/Massachusetts Bay, Great South

Channel, and the Southeastern U.S., were designated by NMFS(59 FR 28793, June 3, 1994). The NMFS ESA 1996 Northern Right Whale Status Review concluded that the status of the western North Atlantic population of the northern right whale remains endangered [Note that 'northern right whale' is nomenclature that is now outdated in the scientific literature but not yet modified in rule makings. Scientific literature recognizes north Atlantic and north Pacific right whales as two distinct species]; this conclusion was reinforced by the International Whaling Commission (Best *et al.* 2001), which expressed grave concern regarding the status of this stock. The total level of human-caused mortality and serious injury is unknown, but reported human-caused mortality and serious injury has been a minimum of 2.6 right whales per year from 1999 through 2003. Given that PBR has been set to zero, no mortality or serious injury for this stock can be considered insignificant. This is a strategic stock because the average annual fishery-related mortality and serious injury exceeds PBR, and because the North Atlantic right whale is an endangered species. Relative to populations of southern right whales, there are also concerns about growth rate, percentage of reproductive females, and calving intervals in this population.

REFERENCES

Aguilar, A. 1986. A review of old Basque whaling and its effect on the right whales of the North Atlantic. Rep. Int. Whal. Commn., Special Issue 10: 191-199.

Angliss, R. P., and D. P. DeMaster. 1998. Differentiating serious and non-serious injury of marine mammals taken incidental to commercial fishing operations: report of the serious injury workshop 1-2 April 1997, Silver Spring, Maryland. NOAA Tech. Memo. NOAA Fisheries-OPR-13.

Best, P.B., J.L Bannister, R. L. Brownell Jr., G.P. Donovan, (eds.) 2001. Right whales: worldwide status. J. Cetacean Res. Manage. (Special Issue) 2. 309pp.

Caswell, H., S. Brault, and M. Fujiwara. 1999. Declining survival probability threatens the North Atlantic right whale. Proc. Natl. Acad. Sci. USA 96: 3308-3313.

Clapham, P.J. (ed.) 2002. Report of the working group on survival estimation for North Atlantic right whales. Available from the Northeast Fisheries Science Center, 166 Water Street, Woods Hole, MA 02543.

Clapham, P. J., S. B. Young and R. L. Brownell, Jr. 1999. Baleen whales: conservation issues and the status of the most endangered populations. Mammal Review 29: 35-60.

Hain, J. H. W. 1975. The international regulation of whaling. Marine Affairs J. 3: 28-48.

Hamilton, P. K., A. R. Knowlton, M. K. Marx and S. D. Kraus. 1998a. Age structure and longevity in North Atlantic right whales *Eubalaena glacialis* and their relation to reproduction. Marine Ecology Progress Series 171: 285-292.

Hamilton, P. K., M. K. Marx, and S. D. Kraus. 1998b. Scarification analysis of North Atlantic right whales (*Eubalaena glacialis*) as a method of assessing human impacts. Final report to the Northeast Fisheries Science Center, Contract No. 4EANF-6-0004.

IWC. 1999. Report of the workshop on the comprehensive assessment of right whales worldwide. J. Cetacean Res. Manage. 1 (supplement): 119-120.

Kenney, R. D., M. A. M. Hyman, R. E. Owen, G. P. Scott, and H. E. Won. 1986. Estimation of prey densities required by western North Atlantic right whales. Mar. Mamm. Sci. 2(1): 1-13.

Kenney, R. D. and S. D. Kraus. 1993. Right whale mortality: a correction and an update. Mar. Mamm. Sci. 9:445-446.

Kenney, R. D., H. E. Won, and M. C. Macaulay. 1995. Cetaceans in the Great South Channel, 1979-1989: right whale (*Eubalaena glacialis*). Cont. Shelf Res. 15: 385-414.

Knowlton, A. R., J. Sigurjonsson, J. N. Ciano, and S. D. Kraus. 1992. Long-distance movements of North Atlantic Right whales (*Eubalaena glacialis*). Mar. Mamm. Sci. 8(4): 397-405.

Knowlton, A. R. and S. D. Kraus. 2001. Mortality and serious injury of North Atlantic right whales (*Eubalaena glacialis*) in the North Atlantic Ocean. J. Cetacean Res. Manage. Special Issue 2: 193-208.

Knowlton, A. R., S. D. Kraus, and R. D. Kenney. 1994. Reproduction in North Atlantic right whales (*Eubalaena glacialis*). Can. J. Zool. 72: 1297-1305.

Knowlton, A.R., M.K. Marx, H.M. Pettis, P.K. Hamilton and S.D. Kraus. 2001. Scarification analysis of North Atlantic right whales (*Eubalaena glacialis*): monitoring rates of entanglement interaction. Report to the National Marine Fisheries Service. Available from: New England Aquarium, Central Wharf, Boston, MA 02110.

Kraus, S. D. 1990. Rates and potential causes of mortality in North Atlantic right whales (*Eubalaena glacialis*). Mar. Mamm. Sci. 6(4): 278-291.

Kraus, S. D., P. K. Hamilton, R. D. Kenney, A. Knowlton and C. K. Slay. 2001. Reproductive parameters of the North Atlantic right whale. J. Cetacean Res. Manage. (Special Issue) 2: 231-236.

Malik, S., M. W. Brown, S. D. Kraus, A. Knowlton, P. Hamilton and B. N. White. 1999. Assessment of genetic structuring and habitat philopatry in the North Atlantic right whale (*Eubalaena glacialis*). Can. J. Zool. 77: 1217-1222.

Malik, S., M. W. Brown, S. D. Kraus and B. N. White. 2000. Analysis of mitochondrial DNA diversity within and between North and South Atlantic right whales. Mar. Mamm. Sci. 16: 545-558.

Mate, B. M., S. L. Nieukirk and S. D. Kraus. 1997. Satellite-monitored movements of the northern right whale. J. Wildl. Manage. 61: 1393-1405.

Mayo, C. A. and M .K. Marx. 1990. Surface foraging behaviour of the North Atlantic right whale, Eubalaena glacialis, and associated zooplankton characteristics. Can. J. Zool. 68: 2214-2220.

McLellan, W. A., E. Meagher, L. Torres, G. Lovewell, C. Harper, K. Irish, B. Pike, and A. D. Pabst. 2004. Winter right whale sightings from aerial surveys of the coastal waters of the US Mid-Atlantic. Presented at the 15th Biennial Conference on the Biology of Marine Mammals.

Moore, J. C. and E. Clark. 1963. Discovery of right whales in the Gulf of Mexico. Science 141(3577): 269.

NMFS [National Marine Fisheries Service]. 1991. Recovery plan for the northern right whale (*Eubalaena glacialis*). Prepared by the Right Whale Recovery Team for the National Marine Fisheries Service, Silver Spring, Maryland, 86 pp.

Read, A. J. 1994. Interactions between cetaceans and gillnet and trap fisheries in the northwest Atlantic. Rep. Int. Whal. Commn., Special Issue 15: 133-147.

Reeves, R.R., R. Rolland, and P. Clapham (eds.). 2001. Report of the workshop on the causes of reproductive failure in North Atlantic right whales: new avenues of research. NOAA-NOAA Fisheries-NEFSC Ref. Doc. 01-16. 46p. Available from: NOAA Fisheries, Northeast Fisheries Science Center, 166 Water St., Woods Hole, MA 02543.

Reeves, R. R. and E. Mitchell. 1987. Shore whaling for right whales in the northeastern United States. Contract Report No. NA85-WCC-06194, Southeast Fisheries Science Center, Miami, FL, 108 pp. Available from: NOAA Fisheries, Southeast Fisheries Science Center, 75 Virginia Beach Dr., Miami, FL, 33149.

Reeves, R. R., J. M. Breiwick and E. Mitchell. 1992. Pre-exploitation abundance of right whales off the eastern United States. Pages 5-7 *in:* J. Hain (ed.). The right whale in the western North Atlantic: A science and management workshop, 14-15 April 1992, Silver Spring, Maryland. NOAA-NOAA Fisheries-NEFSC Ref. Doc. No. 92-05. 88 pp. Available from: NOAA Fisheries, Northeast Fisheries Science Center, 166 Water St., Woods Hole, MA 02543.

Rosenbaum, H.C., M. Egan, P.J. Clapham, R.L. Brownell Jr. and R. DeSalle. 1997. An effective method for isolating DNA from non-conventional museum specimens. Mol. Ecol. 6: 677-681.

Rosenbaum, H.C., M.S. Egan, P.J. Clapham, R.L. Brownell Jr., S. Malik, M.W. Brown, B.N. White, P. Walsh, and R. DeSalle, 2000. Utility of North Atlantic right whale museum specimens for assessing changes in genetic diversity. Conservation Biology 14: 1837-1842.

Schaeff, C. M., S. D. Kraus, M. W. Brown, J. Perkins, R. Payne and B. N. White. 1997. Comparison of genetic variability of North and South Atlantic right whales (*Eubalaena*) using DNA fingerprinting. Can. J. Zool. 75: 1073-1080.

Schmidly, D. J., C. O. Martin and G. F. Collins. 1972. First occurrence of a black right whale (*Balaena glacialis*) along the Texas coast. Southw. Nat. 17(2): 214-215.

Wade, P. R., and R. P. Angliss. 1997. Guidelines for assessing marine mammal stocks: Report of the GAMMS Workshop, April 3-5, 1996, Seattle, Washington. NOAA Tech. Memo. NOAA Fisheries-OPR-12. U.S. Dept. of Commerce, Washington, D.C. 93 pp.