

Appendix M. Additional Large Whale Information

North Atlantic Right Whales

Two populations of the North Atlantic right whale (*Eubalaena glacialis*), an eastern and a western, are typically recognized (IWC 1986). However, animals are sighted so infrequently in the eastern Atlantic, it is unclear whether a viable population still exists (NMFS 1991a). The descriptions contained within this document focus on the western North Atlantic population of right whales, which occurs in the proposed action area.

Current Protections for North Atlantic Right Whales

The North Atlantic right whale is protected and listed as endangered under the Endangered Species Act. Under the ESA, a Recovery Plan was published in 1991 and revised in 2005. The most recent 5-year status review was completed in September 2012. Based on an analysis of the best scientific and commercial data available and after taking into consideration current population trends and abundance, demographic risk factors affecting the continued survival of the species, and ongoing conservation efforts, NMFS determined that the North Atlantic right whale is in danger of extinction throughout its range because of: (1) overutilization for commercial, recreational scientific, or educational purposes; (2) the inadequacy of existing regulatory mechanisms; and (3) other natural and manmade factors affecting its continued existence.

The North Atlantic Right Whale is also protected under the Marine Mammal Protection Act. Under the jurisdiction of the MMPA, NMFS implemented the Atlantic Large Whale Take Reduction Plan (ALWTRP) to reduce injuries and deaths of large whales due to incidental entanglement in fishing gear. The ALWTRP is an evolving plan that changes as NMFS learns more about why whales become entangled and how fishing practices might be modified to reduce the risk of entanglement. It has several components including restrictions on where and how gear can be set; research into whale populations and whale behavior, as well as fishing gear interactions and modifications; outreach to inform and collaborate with fishermen and other stakeholders; and a large whale disentanglement program.

Other Threats to North Atlantic Right Whales

- *Decreased Reproductive Rate:* Healthy reproduction is critical for the recovery of the North Atlantic right whale (Kraus et al. 2007); however, some suggest that the population has been affected by a decreased reproductive rate (Best et al. 2001, Kraus et al. 2001). Possible factors affecting the North Atlantic right whale reproductive rate include reduced genetic diversity (and/or inbreeding), contaminants, biotoxins, disease, and nutritional stress (see sections on Reduced Genetic Diversity, Environmental Contamination, Biotoxins, Disease, and Food Limitations for information on those topics).
- *Reduced Genetic Diversity:* The dramatic reduction in the North Atlantic right whale population believed to have been caused by commercial whaling may have resulted in a loss of genetic diversity which could affect the ability of the current population to

successfully reproduce (see section on Reduced Genetic Diversity). (i.e., decreased conceptions, increased abortions, and increased neonate mortality). One hypothesis is that the low level of genetic variability in this species produces a high rate of mate incompatibility and unsuccessful pregnancies (Frasier et al. 2007). Analyses are currently underway to assess this relationship further as well as the influence of genetic characteristics on the potential for species recovery (Frasier et al. 2007). Studies by Schaeff et al. (1997) and Malik et al. (2000) indicate that North Atlantic right whales are less genetically diverse than South Atlantic right whales (*Eubalaena australis*). However, several apparently healthy populations of cetaceans, such as sperm whales and pilot whales, have even lower genetic diversity than observed for western North Atlantic right whales (IWC 2001).

- *Environmental Contamination*: Similarly, while contaminant studies have confirmed that North Atlantic right whales are exposed to and accumulate contaminants, researchers could not conclude that these contaminant loads were negatively affecting North Atlantic right whale reproductive success since concentrations were lower than those found in marine mammals proven to be affected by polychlorinated biphenyls (PCBs), and dichlorodiphenyltrichloroethane (DDT) (Weisbrod et al. 2000). Another suite of contaminants (i.e., antifouling agents and flame retardants) that have been proven to disrupt reproductive patterns and have been found in other marine animals, have raised new concerns (Kraus et al. 2007). Recent data also support a hypothesis that chromium, an industrial pollutant, may be a concern for the health of the North Atlantic right whales and that inhalation may be an important exposure route (Wise et al. 2008).
- *Biotoxins*: Impacts of biotoxins on marine mammals are also poorly understood, yet data is showing that marine algal toxins may play significant roles in mass mortalities of large whales (Rolland et al. 2007). Although there are no published data concerning the effects of biotoxins on North Atlantic right whales, researchers are now certain that North Atlantic right whales are being exposed to measurable quantities of paralytic shellfish poisoning toxins and domoic acid via trophic transfer through the presence of these biotoxins in prey upon which they feed (Durbin et al. 2002, Rolland et al. 2007).
- *Nutritional Stress*: Data indicating whether North Atlantic right whales are food-limited are difficult to evaluate (Kraus et al. 2007). North Atlantic right whales seem to have thinner blubber than right whales living in the southern Atlantic ocean (i.e., south of the equator) (Kenney 2002, Miller et al. 2011). Miller et al. (2011) suggests that lipids in the blubber are used as energetic support for reproduction in female North Atlantic right whales. In the same study, blubber thickness was also compared among years of differing prey abundances. During a year of low prey abundances, North Atlantic right whales had significantly thinner blubber than during years of greater prey abundances. The results suggest that blubber thickness is indicative of North Atlantic right whale energy balance and that the marked fluctuations in the North Atlantic right whale reproduction have a nutritional component (Miller et al. 2011).

Modeling work by Caswell et al. (1999) and Fujiwara and Caswell (2001) suggests that the North Atlantic Oscillation (NAO), a naturally occurring climatic event, affects the survival of

mothers and the reproductive rate of mature females, and it also seems to affect calf survival (Clapham et al. 2002). Greene et al. (2003) described the potential oceanographic processes linking climate variability to the reproduction of North Atlantic right whales. Climate-driven changes in ocean circulation have had a significant impact on the plankton ecology of the Gulf of Maine, including effects on *Calanus finmarchicus*, a primary prey resource for North Atlantic right whales. Researchers found that during the 1980s, when the NAO index was predominately positive, *C. finmarchicus* abundance was also high; when a record drop occurred in the NAO index in 1996, *C. finmarchicus* abundance levels also decreased significantly. Greene et al. (2003) examined right whale calving rate patterns since the early 1980s and found that major multi-year declines in right whale calving rates have tracked major multi-year declines in *C. finmarchicus* abundance since 1982.

- *Interspecific Competition:* Interspecific competition with either sei whales (*Balaenoptera borealis*) or planktivorous fish may limit northern right whale prey consumption (Mitchell 1975; Kraus et al. 1988; Payne et al. 1990). There is also speculation about competition with certain species of fish in the Gulf of Maine, including sand lance (*Ammodytes* spp.), herring (*Clupea* spp.), Atlantic mackerel (*Scomber scombrus*), river herrings (shad, blueback; *Alosa* spp.), menhaden (*Brevoortia tyrannus*), and basking sharks (*Cetorhinus maximus*). While the potential for interference competition exists for right whales, direct evidence is essentially absent. As noted by Clapham and Brownell (1996), assertions regarding interspecific competition are rarely well defined or ecologically based.
- *Climate Change:* There is a large and growing body of literature on past, present, and future impacts of global climate change, exacerbated and accelerated by human activities. Some of the likely effects commonly mentioned are increased frequency of severe weather events, changes in sea temperatures and salinity (due to melting ice and increased rainfall), ocean currents, and ocean acidification. NOAA's climate information portal provides basic background information on these and other measured or anticipated effects (see <http://www.climate.gov>)

North Atlantic right whales currently have a range of sub-polar to sub-tropical waters. An increase in water temperature would likely result in a northward shift of range, with both the northern and southern limits moving poleward. The northern limit, which may be determined by feeding habitat and the distribution of preferred prey, may shift to a greater extent than the southern limit, which requires ideal temperature and water depth for calving. This may result in an unfavorable effect on the North Atlantic right whale due to an increase in the length of migrations (Macleod 2009), or a favorable effect by allowing them to expand their range. However, a northward shift in the suitable calving grounds off the southeast United States based on optimal temperatures would involve calving in waters that are generally rougher and thus more hazardous for newborn calves.

Global climate change may affect the marine plankton species—a vital food source of North Atlantic right whales. Studies have demonstrated adverse impacts from ocean acidification via a reduction in the ability of marine algae and free-swimming zooplankton to maintain protective shells, as well as a reduction in the survival of larval marine species (Lewis et al. 2013). A

decline in the marine plankton could have serious consequences for the marine food web upon which North Atlantic right whales rely.

Global climate change may affect the timing and extent of population movements, abundance, recruitment, distribution, and species composition of prey (Learmonth et al. 2006). Changes in distribution including displacement from ideal habitats, decline in fitness of individuals, population size due to the potential loss of foraging opportunities, abundance, migration, community structure, susceptibility to disease and contaminants, and reproductive success are all possible effects that may occur as the result of climate change (Macleod 2009). Global climate change may also result in changes to the range and abundance of competitors and predators, which will also indirectly affect marine mammals (Learmonth et al. 2006). However, more information is needed to better determine the full and entire suite of impacts of climate change on North Atlantic right whales (Learmonth et al. 2006).

Humpback Whales

Current Protections for Humpback Whales

In June 1970, humpback whales were designated as “endangered” under the Endangered Species Conservation Act (ESCA). In 1973, the Endangered Species Act (ESA) replaced the ESCA, and continued to list humpbacks as endangered. Also, under the MMPA, threats to humpbacks are mitigated by regulations implementing the Pacific Offshore Cetacean Take Reduction Plan and the ALWTRP. NMFS implemented the ALWTRP to reduce injuries and deaths of large whales due to incidental entanglement in fishing gear. The ALWTRP is an evolving plan that changes as NMFS learns more about why whales become entangled and how fishing practices might be modified to reduce the risk of entanglement. It has several components including restrictions on where and how gear can be set; research into whale populations and whale behavior, as well as fishing gear interactions and modifications; outreach to inform and collaborate with fishermen and other stakeholders; and a large whale disentanglement program.

Other Threats to Humpback Whales

Humpback whales, like other baleen whales, may be adversely affected by habitat degradation, habitat exclusion, acoustic trauma, harassment, or reduction in prey resources attributable to commercial fishing, coastal development, vessel traffic, and other influences. However, explicit evidence of these influences is limited. Changes in humpback distribution in the Gulf of Maine have been found to be associated with changes in herring, mackerel, and sand lance abundance associated with local fishing pressures (Payne et al. 1986). Likewise, there are strong indications that a mass mortality of humpback whales in the southern Gulf of Maine in 1987/1988 was the result of the consumption of mackerel whose livers contained high levels of a red-tide toxin (Geraci et al. 1989). It has been suggested that red tides are related to increased freshwater runoff from coastal development, but there are insufficient data to link these effects directly with humpback whale mortality (Clapham et al. 1999).