UPDATED RECOVERY PLAN FOR THE WESTERN NORTH ATLANTIC RIGHT WHALE, *EUBALAENA GLACIALIS*

Prepared by

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June 2001

D R A F T

PREFACE

Congress passed the Endangered Species Act (ESA) of 1972 (16 USC 1531 *et seq*) to protect species of plants and animals endangered or threatened with extinction. The National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service share responsibility for the administration of the Act. NMFS is responsible for most marine mammals including the northern right whale. This Plan was written at the request of the Assistant Administrator for Fisheries to promote the conservation of the northern right whales.

The goals and objectives of the plan can be achieved only if a long-term commitment is made to support the actions recommended here. Achievement of these goals and objectives will require the continued cooperation of the governments of the United States and other nations. Within the United States, the shared resources and cooperative involvement of federal, state, and local governments, industry, academia, non-governmental organizations, and individuals will be required throughout the recovery period.

DISCLAIMER

This plan identifies reasonable actions believed to be required to protect and promote recovery of North Atlantic right whales. The plan is not binding. U.S. government funds will be expended contingent upon appropriations, available resources, priorities and other constraints.

Draft recovery plans are not official government documents, and when released for public comment, they will not have been approved by NMFS or by any other agency. Therefore, draft plans do not necessarily represent the positions or policies of the United States Government or any other government. The conclusions and recommendations in this draft recovery plan are solely those developed by the authors, other NMFS scientists, and those consulted by the authors. In addition, the views expressed are not necessarily those of all individuals involved in the formulation of the plan. Draft plans will be subject to revision or modification following review.

This recovery plan represents the official position of NMFS only after it has been signed by the Assistant Administrator as approved. Approved recovery plans are subject to modification as dictated by new findings, changes in the species status, and completion of recovery tasks described in the plan.

ACKNOWLEDGMENTS

The authors thank Moira Brown, Scott Kraus, Michael Moore, Michael Payne, Yianna Samuel, Donna Wieting, and Sharon Young for their contributions to this plan.

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EXECUTIVE SUMMARY

North Atlantic right whales (*Eubalaena glacialis*) are among the rarest of all large whale species, and among the rarest of all marine mammal species. Although precise estimates of abundance are not available, it appears that (a) the eastern North Atlantic population is nearly extinct; and (b) the western North Atlantic population is on the order of a few hundred whales.

At least two populations of right whales, an eastern and a western population, occur, or have occurred, in the North Atlantic. Despite low abundance and known human activities resulting in right whale death and serious injury, the western North Atlantic stock is (with the possible exception of the poorly studied western population of the North Pacific right whale, *Eubalaena japonica*) the largest and the most robust in the Northern Hemisphere. Nonetheless, it is believed to contain only about 300 individuals and its abundance has either remained static or undergone only modest growth; indeed, recent work has suggested that it is currently in decline (Caswell *et al.* 1999).

Right whale populations were severely depleted by commercial whaling. More recently, direct and indirect impacts from human activities -- mostly in the form of vessel collisions and entanglement in fishing gear -- almost certainly have contributed to a lack of recovery in the North Atlantic.

There is reason for serious concern about the future of the western North Atlantic right whale population. Because the right whale is a long-lived species, extinction may not occur in the near future, but the possibility of biological extinction in the next century is very real. A number of proactive steps are needed by a variety of public and private entities.

Much attention has focused on right whales in recent years. Efforts to protect the western North Atlantic right whale population increased significantly in 1992-1993 following completion of the first Recovery Plan (NMFS 1991) and substantial annual increases in federal funding allocated toward recovery of the Endangered Species Act (ESA) listed species, including the right whale. Scrutiny and the number of restrictions of commercial fishing activities has also increased in the last decade as efforts have been made to reduce levels of fishing gear entanglement. In addition, NMFS has provided a number of consultations with other federal agencies under the ESA, and involvement in right whale recovery by those and other agencies has increased significantly. Nonetheless, in spite of these combined efforts, recovery appears to be slow or absent.

The ESA requires that recovery plans include (a) site specific management actions necessary to achieve the plan's goal for the conservation and survival of the species; (b) objective, measurable criteria which, when met, would result in a determination that the species be removed from the list; and (c) estimates of the time required and the cost to carry out measures needed to achieve the plan's goal and to achieve immediate steps toward that goal. The overall goal of this Plan is to promote the recovery of the western North Atlantic right whale to a level sufficient to justify removing it from the List of Threatened and Endangered Wildlife (List). This plan recommends the following recovery criteria: (a) the western North Atlantic right whale shall be considered endangered when, given current and projected conditions, the probability of extinction is greater than 1% in 100 years; (b) the western North Atlantic right whale shall be considered threatened when, given current and projected conditions, the probability of becoming endangered is greater than 10% in 20 years, and therefore, (c) removal from the List would occur when the stock no

longer meets the criteria for endangered or threatened. That is, removing western North Atlantic right whales from the List would occur when the probability of becoming endangered within the next 20 years is equal to or less than 10%. Another essential component of these criteria is addressing the five listing factors in any proposal to change the listing status of this population.

With regard to the western North Atlantic population, this plan identifies four recovery objectives. They are to (1) minimize sources of human-caused death, injury, and disturbance; (2) identify, characterize, protect, and monitor important habitats; (3) monitor the status and trends of abundance and distribution of the stock; and (4) coordinate Federal, State, international, and private efforts to implement the Recovery Plan. A number of specific tasks are identified under these objectives. A list of the tasks, their priority relative to recovery, and estimates of costs are provided in an appended recovery plan implementation schedule.

There is an immediate need to reduce or eliminate human-related death and injury in this population. At present, these result primarily from shipping and commercial fishing operations. Reliable information is needed on causes of, and means of reducing, fishing gear entanglement and ship strikes and to monitor the effectiveness of protection measures; and reliable information on the biology and ecology of these populations is also needed to aid in making knowledgeable management decisions.

To facilitate the recovery of this species, a commitment is needed to taking proactive steps to implement effective protective measures. NMFS believes that the plan should be a dynamic document, thus, many of the actions are focused on the relatively short-term. The intent is to provide guidance now. As new information is obtained, new actions should be identified and incorporated in the plan. The plan should be reviewed and the relative success of its actions in protecting right whales should be periodically assessed so that adjustments can be made or additional steps can be taken if population sizes are static or decreasing.

I. BACKGROUND

A. Species Description and Taxonomy

The North Atlantic right whale, *Eubalaena glacialis* (Müller 1776), is a large baleen whale. Adults are generally between 45 and 55 feet in length and can weigh up to 70 tons. Females are larger than males. Distinguishing features for right whales include a stocky body, generally black coloration (although some individuals have white patches on their undersides); lack of a dorsal fin, a large head (about 1/4 of the body length), strongly bowed margin of the lower lip, and callosities on the head region. Two rows of long (up to about eight feet in length), dark baleen plates hang from the upper jaw, with about 225 plates on each side. The tail is broad, deeply notched, and all black with smooth trailing edge.

The southern right whale is a separate, but closely related species, *Eubalaena australis* (Desmoulins 1822). The North Pacific right whale, *Eubalaena japonica* (Lacepede 1818), was until recently classified as *E. glacialis*. Initial classification of *E. glacialis* and *E. australis* was based upon a single morphological character in the orbital region of the skull analyzed in limited specimens from each hemisphere (Müller 1776). The Northern and Southern Hemisphere forms were subsequently separated based on skeletal and genetic data (Müller 1776; Schaeff *et al.* 1997). Recent genetic studies (Rosenbaum *et al*. 2000) provide strong evidence of separate specific status for North Atlantic and North Pacific right whales, and the authors accordingly have suggested changing the binomial for the North Pacific population. The set of taxonomic classifications put forth by these authors has been accepted by the International Whaling Commission and was recently accepted by NMFS. As a result, NMFS will be requesting a change to the List of Threatened and Endangered Wildlife to reflect the identification of three separate right whale species (a) the North Atlantic right whale *Eubalaena glacialis*; (b) the North Pacific right whale *Eubalaena japonica*; and (c) Southern right whale *Eubalaena australis*. These species designations will be used for the purposes of this plan, and a separate plan will be prepared for the North Pacific right whale.

B. Zoogeography

Right whales have occurred historically in all the world's oceans from temperate to subpolar latitudes. The pre-exploitation distribution of the northern right whale probably included the temperate and subarctic, coastal, and/or continental shelf waters of the North Atlantic Ocean. Post-exploitation distribution is much more limited.

Individuals in the western North Atlantic population range from wintering and calving areas in coastal waters off the southeastern United States to summer feeding and nursery grounds in New England waters and north to the Bay of Fundy and Scotian Shelf. However, occurrence of some individuals has been reported as far north as Newfoundland, the Labrador Basin, the southeast of Greenland (Knowlton *et al.* 1992), and Norway, and sightings have been reported as far south as the Gulf of Mexico (Moore and Clarke 1963; Schmidly *et al.* 1972).

Right whales are frequently found in coastal or shelf waters, although movements over abyssal depths are known (Scarff 1986; Mate *et al.* 1997). For much of the year, their distribution is strongly correlated to the distribution of their prey, which appears to be primarily Calanoid

copepods in the Northern Hemisphere. In both hemispheres, many right whales have been observed in the lower latitudes and more coastal waters during winter, where calving takes place; these animals migrate to higher latitudes during the spring and summer. In the North Atlantic Ocean and waters of the Southern Hemisphere, it appears that not all reproductively active females return to calving grounds each year (Kraus *et al.* 1986; Payne 1986); furthermore, the whereabouts of much of the population during winter remains unknown.

C. Protective Legislation

Right whales have been protected from commercial whaling by the International Whaling Commission (IWC) and its implementing convention since 1949. The species was protected by international agreement in 1935, but since neither Japan nor the Soviet Union signed this earlier agreement (Japan signed the Second Convention in 1938) these countries were theoretically free to kill right whales until passage of the 1949 International Convention for the Regulation of Whaling. In U.S. waters, northern right whales are protected by the Marine Mammal Protection Act (MMPA) and the Endangered Species Act (ESA). The northern right whale (which encompassed both the North Atlantic and North Pacific species) was listed as endangered under the Endangered Species Conservation Act in June 1970 (35 FR 8495), the precursor to the ESA. The species was subsequently listed as endangered under the ESA in 1973, and listed as depleted under the MMPA in the same year.

Despite this protection, recently released information (Yablokov 1994; Brownell *et al*. in press) indicates that Soviet whalers made substantial unreported catches of eastern North Pacific right whales in the 1960s, a take which likely dealt great damage to the recovery prospects of this remnant population. However, there is no evidence that illegal Soviet whaling occurred in the North Atlantic.

The ESA delegates authority to the Secretary of Commerce for protecting most endangered marine species, including right whales. The National Marine Fisheries Service (NMFS) has lead responsibility for developing and implementing a recovery program for this species.

II. NATURAL HISTORY

North Atlantic Right Whale Populations

1. Stocks and Rationale for Distinct Populations Segment of the North Atlantic Right Whale

At its 1983 right whale workshop, the IWC considered hypotheses regarding the distinctiveness of three right whale stocks in the North Atlantic: an eastern, central, and western stock. In the absence of direct evidence to refute or confirm that structure, the workshop agreed to a provisional division of eastern and western stocks.

From mitochondrial DNA (mtDNA) analysis, Schaeff *et al.* (1993) suggested that western North Atlantic right whales are a single breeding population that consists of three matrilines. Further work has identified two additional matrilines (Malik *et al.* 1999), and the five mtDNA haplotypes vary greatly in their present frequency within the population. Skin biopsy sampling has resulted in compilation of a DNA library of almost 300 North Atlantic right whales (i.e. the

majority of the population). When analysis of these samples is complete an assessment of the genetic variation of the population will be available and identification of stock structure may be further elucidated.

Rosenbaum *et al.* (2000) used mtDNA extracted from museum specimens of baleen to examine historic genetic structure in right whales. This work includes the only available analysis of eastern North Atlantic specimens, and suggests that the eastern and western populations were not historically distinct. The analysis also suggests that little genetic variation has been lost in the 20th century, although it is recognized that the greatest loss of variation is likely to have occurred well prior to this, during periods of major exploitation.

Western North Atlantic Right Whale Population as a Distinct Population Segment (DPS)

The joint policy of the US Fish And Wildlife Service and NMFS (USFWS-NMFS 1996) provides guidance for defining distinct population segments below the taxonomic level of a species for the purposes of listing, delisting, and reclassifying species under the Endangered Species Act of 1973 (ESA). Thus, following the guidance supplied by the joint policy statement, a stock or group of related stocks (population segment) of a marine mammal population may be considered a distinct population segment (DPS), or species, under the ESA if it is discrete and significant to the biological species as a whole. A population segment of a vertebrate species may be considered discrete if it satisfies either one of the following conditions:

1. It is markedly separated from other populations of the same taxon as a consequence of physical, physiological, ecological, or behavioral factors. Quantitative measures of genetic or morphological discontinuity may provide evidence of this separation.

2. It is delimited by international governmental boundaries within which differences in control of exploitation, management of habitat, conservation status, or regulatory mechanisms exist that are significant in light of section 4(a)(1)(D) of the Act.

Once a population segment is considered discrete, the following are some of the factors that can be considered in determining whether it is significant:

1. Persistence of the discrete population segment in an ecological setting unusual or unique for the taxon,

2. Evidence that loss of the discrete population segment would result in a significant gap in the range of a taxon,

3. Evidence that the discrete population segment represents the only surviving natural occurrence of a taxon that may be more abundant elsewhere as an introduced population outside its historic range, or

4. Evidence that the discrete population segment differs markedly from other populations of the species in its genetic characteristics.

As discussed above, genetic analyses indicate that the western North Atlantic population of right whales represents a single breeding population. Therefore, it can be considered a "discrete population segment." Further, the virtual extirpation of the eastern stock and its lack of recovery this century strongly suggests population subdivision over a protracted (but not evolutionary) timescale (Waring et al., 2000). Given that the eastern North Atlantic stock is almost certainly functionally extinct, clearly, the western North Atlantic population segment is "significant" under the DPS guidelines inasmuch as its loss would result in a significant gap in the range of the taxon, indeed, likely the loss of the species.

These factors qualify the western North Atlantic population as a DPS under the ESA, and this plan describes tasks necessary for recovery of the DPS. Because this DPS has been considered a population until now, the term "western North Atlantic right whale population" has been used in some parts of this plan when referring to published research.

2. Distribution and Habitat Use

The eastern North Atlantic stock was heavily exploited by whalers in the Bay of Biscay and Cintra Bay, as well as off coastal Iceland and the British Isles during the 14th through 16th centuries. It is possible that these whales migrated along the coast from northern Europe to the northwest coast of Africa. Today the distribution and migration patterns of this eastern stock, if it remains extant, are unknown. Whaling records also indicate that a third stock may have existed in the central Atlantic Ocean, which migrated from east of Greenland to the Azores or Bermuda (Reeves and Mitchell 1986).

The western North Atlantic right whale stock migrates along the eastern North American coast from Nova Scotia to Florida. Five areas of "high use" were identified in the Final Recovery Plan for the Northern Right Whale (NMFS 1991), and they are still key habitat areas for right whales:

1) coastal Florida and Georgia (Sebastian Inlet, Florida to the Altamaha River, Georgia),
2) the Great South Channel (east of Cape Cod),
3) Massachusetts Bay and Cape Cod Bay,
4) the Bay of Fundy, and
5) the Scotian Shelf, including Browns and Baccaro Banks, Roseway Basin and areas to the east

The first three of these areas were designated as northern right whale critical habitat in June 1994. Right whales occur off New England at various times, with a peak occurrence in winter/spring (Hamilton and Mayo 1990). Peak abundance occurs in the Great South Channel in spring (Kenney *et al.* 1995). In summer and fall, much of the population is found in Canadian waters (i.e., the Bay of Fundy and Scotian Shelf, with the former area being a major summer nursery ground) (Mitchell *et al.* 1986; Winn *et al.* 1986; Stone *et al.* 1990). Whales inhabiting the Roseway Basin/Browns Bank region were primarily adult males, whereas mother/calf pairs predominated in the Bay of Fundy. However, the former area appears to have been largely abandoned in 1993, and the population composition of the Bay of Fundy is currently much more mixed than it was previously.

Known wintering areas for this population are along the southeastern U.S. coast, where calving

occurs from December through March (Winn 1984; Kraus *et al.* 1986; Brownell *et al.* 1986; IWC 1986), and in Cape Cod Bay, where in 1998 whales were sighted from mid January to mid May (Brown and Marx 1998). However, a majority of the population is unaccounted for in winter (Kraus *et al.* 1986). Other wintering areas have been suggested, based upon sparse data; these include the Gulf of St. Lawrence (Lien *et al.* 1989), Newfoundland (Beamish 1981; Lien *et al.* 1989), Greenland, New York and New Jersey coastal waters (Mead 1986), Bermuda (Payne and McVay 1971), and the Gulf of Mexico (Mead 1986). Telemetry studies have revealed movement patterns of considerable length and duration (Mate *et al.* 1997; Slay *et al.* 1998).

Right whales have been sighted in waters off Massachusetts in most months (Watkins and Schevill 1982; Schevill *et al*. 1986; Winn *et al*. 1986; Hamilton and Mayo 1990). Most sightings occur between February and May, with peak abundance in late March. Schevill *et al*. (1986) reported 764 sightings of right whales between 1955 and 1981 in Cape Cod waters. More than 70 right whales were seen in one day in 1970. Hamilton and Mayo (1990) reported 2,643 sightings of 113 individual right whales in Massachusetts waters, with a concentration in the eastern part of Cape Cod Bay. A number of right whales, including cow/calf pairs, resided in Cape Cod and Massachusetts Bays during the summers of 1986 and 1987, which may have been related to shifts in abundance of prey in adjacent waters (Hamilton and Mayo 1990; Payne *et al*. 1990).

Information on residency times of individual whales in the bays is ambiguous, especially in light of recent satellite transmitter results indicating right whales tagged in the Bay of Fundy may travel long distances in the few days or weeks between sightings (Mate *et al.* 1997). Schevill *et al*. (1986) reported individual right whales residing in Cape Cod waters for no more than a few days. In 1976 they observed a cow and calf over a 7-week period, the longest residence time documented during observations between 1955 and 1981. Prior to summer 1986, Hamilton and Mayo (1990) reported observations of individual whales up to 12 times in a year, with the longest apparent residency being 89 days. Prior to 1986, 50 percent of individual right whales sighted by Hamilton and Mayo (1990) were seen in more than one year.

3. Feeding and Prey Selection

In the western North Atlantic, right whales feed primarily on copepods, with *Calanus finmarchicus* believed to be the major prey (Kraus *et al.* 1988; Wishner *et al.* 1988; Murison and Gaskin 1989). However, other zooplankters are also taken, including *Pseudocalanus*, *Centropages,* and even cyprids (Mayo and Marx 1990). There is no evidence for consumption of euphausiids, although given the inclusion of this taxon in the diet of right whales elsewhere it would be surprising if North Atlantic right whales were different in this regard. Unlike balaenopterid whales, right whales are skimmers; they feed by continuously filtering prey through their baleen while moving, mouth agape, through a patch of zooplankton.

Feeding occurs in spring through fall, and also in winter in certain areas (e.g. Cape Cod Bay; Mayo and Marx 1990). Oceanographic and bathymetric features, such as relatively cooler water temperatures and 100-200 m depths adjacent to steeply sloping bottom topography, also seem to be related to the utilization of certain areas for feeding (Winn *et al.* 1986; Clapham 1999).

4. Competition

It has been suggested that 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). In the North Atlantic, sei whales are sympatric with the right whales, and because both species feed on small zooplankton species, they may compete (Mitchell 1975). 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*). However, as noted by Clapham and Brownell (1996), assertions regarding interspecific competition are rarely well defined or ecologically based; while the potential for interference competition exists for right whales, direct evidence is essentially absent.

5. Reproduction

Most right whale nursery areas are in shallow, coastal waters. In the western North Atlantic, calving takes place between December and April (Kraus *et al.* 1993). In both the northern and southern hemisphere, females give birth to their first calf at an average age of nine years (Best *et al.* 1998; Hamilton *et al.* 1998a). Calves are 5.5-6.0m in length at birth (Best 1994). Gestation lasts from 357 to 396 days in southern right whales (Best 1994), and it is likely to be similar in the northern species. Weaning seems to be variable, and has been reported as 8 to 17 months in northern right whales (Hamilton and Marx 1995).

Standard reproductive rates for the western North Atlantic population have yet to be calculated, and this is complicated by the occurrence patterns of mature females, for whom the probability of sighting in studied habitats is dependent upon reproductive condition. The number of calves observed in this population since 1993 has varied from 1 (in 2000) to 30 (in 2001) (Knowlton *et al.* 1994; A. Knowlton, pers. comm.), but how these figures translate into standard birth rates is unclear. [In 2000, one new calf was observed; 30 calves, 26 believed surviving, were reported in 2001.] The calving interval for right whales is between 2 and 7 years, with means ranging from 3.12 (95% CI 3.05-3.17) to 3.67 years (95% CI 3.3-4.1) (Knowlton *et al.* 1994; Best *et al.* 1998; Burnell 1998; Cooke *et al.* 1998). However, in the western North Atlantic, there has apparently been a recent significant increase in the calving interval from 3.67 years for the period 1980 to 1992 (Knowlton *et al.* 1994) to 5.8 years for the period 1990 to 1998 (Kraus *et al*., in press). This longer calving interval is markedly different from that of southern right whale populations, whose mean calving interval is between three to four years, with modes generally around three years. The increase in the interval is of particular concern and, together with other perplexing biological parameters, may suggest the population is under rather unusual biological, energetic, or reproductive stress.

It is possible to calculate a theoretical maximum birth rate from knowledge of three parameters: sex ratio, proportion of females that are sexually mature, and mean interbirth interval. The sex ratio of the western North Atlantic population is known to be even (Brown *et al.* 1994), and recent work by Hamilton *et al.* (1998a) has suggested that 60% of females in this population are mature. Given a normal average interbirth interval of 3 years, the expected maximum annual birth rate should be approximately 0.10 (1.00/2/1.67/3). A longer interbirth interval (such as that suggested above), or a lower proportion of mature (or reproductively active) females, would decrease this rate accordingly.

6. Natural Mortality

Deaths resulting from human activities account for one-third of all known mortalities in the western North Atlantic right whale population (Kraus 1990). The extent to which natural factors, such as disease and predation, affect mortality rates is not known. Kraus (1990) used photo-identification data from the western North Atlantic population to calculate an average mortality rate of 17 percent per year in first-year right whales, while second- through fourth-year whales had an average mortality rate of 3 percent per year. Including all sources of mortality, both natural and anthropogenic, neonatal mortality, 27 percent of all western North Atlantic right whales die before reaching four years of age (Kraus 1990).

An unusually high number of right whale deaths occurred off the southeast United States from January through March 1996, when five deaths were reported. Of these, four were recovered and examined for cause of death. Of those recovered, one was killed by a ship strike, but the cause of death could not be determined for the remainder.

Various species of large sharks and killer whales (*Orcinus orca*) may represent significant predators for right whales, particularly for young or sick individuals. However, no such attacks have been observed in this DPS. Scars from killer whale attacks have been photographed on western North Atlantic right whales (Kraus 1990), although the level of killer whale attacks and the extent that they result in death is not known.

7. Abundance and Trends

The eastern North Atlantic population probably numbers only in the low tens of animals at best, and it is likely functionally extinct.

Based on a census of individual whales identified using photo-identification techniques, the western North Atlantic population size was estimated to be 295 individuals in 1992 (Knowlton *et al* 1994). Kraus *et al*. (in press) provided population size estimates based on a multi-year running total of catalogued animals, and based on these numbers the 1998 IWC right whale workshop accepted an estimate of about 300 individuals for this population (IWC 1998). Because of heterogeneity of capture probabilities (relating to either distribution of individuals and/or of sighting effort), calculation of an unbiased point estimate of abundance for this population is difficult, and population modeling approaches to estimating abundance are considered preferable by NMFS.

The estimated rate of increase for the western North Atlantic population from 1986-1992 was calculated at 2.5 percent (CV=0.12) using photographic identification techniques (Knowlton *et al.* 1994). Estimates by Kraus *et al*. (in press) were used to obtain an annual rate of increase (range -0.039 to +0.031) for each of the years 1987 to 1996. A regression estimate based on these data is probably negatively biased (r=0.01, SD=0.0232) because of reduced sampling effort in recent years. During the 1998 IWC right whale workshop, two alternative methods were used to obtain estimates of the rate of increase for this population. One provided an estimate of 1.59 percent (C.I. -0.0246, 0.0564) with the caveat that the result is for recent years. The second suggests that 4.3 percent is an upper bound to the population growth rate. With regard to the latter estimate, the report stated that

> "[a]lthough actual growth rates are likely to be considerably less than this, this figure

> serves to illustrate that the growth rate of the North Atlantic right whale is both low and substantially less than that of southern right whale populations."

In contrast, Southern Hemisphere right whale populations (those off Argentina, Australia and South Africa) are increasing at annual rates on the order of 7-8 percent (IWC 1998).

With regard to the western North Atlantic population, the IWC workshop report also stated that

> "Whereas it may have increased since protection in 1935...and may still be increasing at a modest rate (about 2.5 percent) in the 1980s (Knowlton *et al.* 1994), more recent data (near-failure of calf production from 1993-95, increased calving interval, and a relatively large number of human-induced mortalities) suggest that this modest recovery rate (by comparison to the Southern Hemisphere) may not have continued in the 1990s. North Atlantic parous females show an increase between 1985 and 1997 but with an apparent long-term oscillation in recruitment. These features together with the lack of significant increase in calving rates, support the need for age-structured models to account for the complexity of this population's dynamics. It is now unclear whether the population is declining, stationary or increasing and the best estimate of current population size is only 300 animals."

A recent modeling exercise, which calculated crude survival probability from photographically identified individuals (Caswell *et al*. 1999), found that these rates decreased from about 0.99 per year in 1980 to about 0.94 in 1994, and that population growth rate declined from about 5.3 percent in 1980 to about 2.4 percent in 1994. The model suggested further that, under current conditions, the population is headed for extinction and an upper bound on the expected time to extinction was 191 years.

III. EFFECTS OF HUMAN ACTIVITIES

Ship collisions and fishing gear entanglements are the most common known causes of anthropogenic mortality identified through right whale strandings in western North Atlantic right whales.

A. Vessel Interactions

The greatest known cause of mortality among right whales in the western North Atlantic is collision with ships. Out of 27 documented mortalities in the North Atlantic from 1970 through 1991, 22 percent were caused by ship propellers severing the tail stock, spine, or causing mortal wounds on the head region (NMFS 1991). From 1991 through the beginning of 1993, an additional 3 mortalities were reported in the North Atlantic as a result of collisions with vessels (Kenney and Kraus 1993). More recent data suggest that four additional deaths attributable to ship strikes occurred between 1993 and 1996 (Waring *et al*. 1999). Knowlton and Kraus (1998) reported a total of 15 right whale deaths attributed to ship strikes between 1970 and 1997; with a total of 6 ship strike deaths between 1993 and 1997; one occurred in 1999. From 1991-1996, the reported average mortality and serious injury rate due to vessel collisions was 1.3 per year (Waring *et al.* 1999). The low incidence (7 percent) of photographically identified whales showing scars and wounds from ship propellers compared to the high rate of ship propeller wounds in stranded animals indicates that most interactions between ships and whales are fatal to

the whale (Kraus 1990). It should be noted that the reporting of ship strikes may be elevated in recent years due to increased awareness of the severity of the problem.

Concern has been raised over the possible adverse effects of whale-watching activities on right whale aggregations, particularly in the western North Atlantic (i.e. Cape Cod Bay and lower Bay of Fundy). While adverse effects from this activity are possible, there are no data that conclusively establish adverse effects beyond the possibility of ship strikes, and recent minimum distance regulations are designed to reduce the threat of collision or harassment in U.S. Atlantic waters. That is, most effects from whale-watching activities are likely limited to behavioral changes or perhaps relatively small changes in distribution. Given the above-mentioned regulations on vessel approaches to right whales, the potential for temporary, perhaps relatively minor, effects has been reduced. However, relatively recent collisions between whale-watch boats and a humpback and a minke whale indicate that more lethal consequences are also possible. In addition, a recent growth in the number of high speed (capable of speeds >20 knots) whale watch ships, ferries and other high speed craft in areas where right whales occur represent an increased threat of collision with whales. Nonetheless, it may be necessary to examine the effects of whale watching on right whales and issue regulations and/or guidelines regarding the number of vessels, and their speed, manner and distances of approaches near whales.

B. Entrapment and Entanglement in Fishing Gear

Kraus (1990) estimated that 57 percent of right whales in the western North Atlantic bear scars and injuries indicating fishing gear entanglement. This figure was revised to 61.6 percent by more recent analysis (Hamilton *et al*. 1998b). The 1998 North Atlantic Stock Assessment Report (Waring *et al.* 1999) indicated NMFS monitored fisheries showed a mean annual mortality of 1.0 right whale from 1992 through 1996. Sources of interaction mainly lie with gill-nets, lobster pots, seine nets, and fish weirs (NMFS 1991). Gear entanglement was estimated to account for 7 percent of the known mortality in right whales in the western North Atlantic from 1970 through early 1993 (Kenney and Kraus 1993), and another known entanglement death in 1995 (Knowlton and Kraus 1998). These mortalities involved entanglements with fixed fishing gear. As a result of the 1997 NMFS review of stranding and entanglement records of large whales from 1990-1994, 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 the annual level of incidental mortality and serious injury of marine mammals relative to each stock's calculated Potential Biological Removal (PBR) level[1]. Two of the examined mortality records involved right whales. This classification has not changed to date.

Injuries and entanglements that are not initially lethal may result in a gradual weakening of entangled individuals, making them more vulnerable to some other direct cause of mortality (Kenney and Kraus 1993).

C. Habitat Degradation

A continued threat to the coastal habitat of the right whale in the North Atlantic is the undersea exploration and development of mineral deposits, as well as the dredging of major shipping channels. Offshore oil and gas activities have been proposed off the coast of the mid- and south-Atlantic U.S. (NMFS 1991). Right whales also frequent coastal waters where dredging and its associated disposal operations occur on a regular basis, such as along the southeastern U.S. coast.

The U.S. Army Corps of Engineers (ACOE) has responsibility/oversight for many of these dredging and disposal operations and has consulted with NMFS under Section 7 of the Endangered Species Act on these activities. As a result, engaging in dredging operations and related activities requires protective measures such as posting lookouts on dredge vessels and adherence to recommended precautionary guidelines for operations to reduce the risk of collision.

It is unknown to what extent these activities may impact right whales. It appears that whale behavior and the type of activity in which they are engaged influence right whale sensitivity to, and tendency to avoid, noise disturbance and vessel activity (Watkins 1986; NMFS 1991), but more studies are needed.

D. Noise

A review of impacts of noise of all types on marine mammals is given by Richardson *et al.* (1995). However, there have been no studies of the effects of anthropogenic noise on right whales, and the impact of noise from shipping or industrial activities on the communication, behavior and distribution of this species is unknown.

E. Contaminants

Contaminant data on right whales are restricted to data from biopsy-derived samples. These data appear to be relevant to the whole animal given that lipid-normalized contaminant burden is comparable between different blubber depths and locations in large whales (Gauthier *et al.* 1997). Data for right whales are limited to only two studies (Woodley *et al.* 1991; Moore *et al.* 1998). These data show a range of total PCB ng/g wet weight of 80 to 1000 ng/g, i.e. in the parts per billion range. No obvious geographic trends were evident in samples from South Africa, South Georgia, Cape Cod Bay USA and Bay of Fundy Canada (Moore *et al.* 1998). In contrast, most odontocete values were in the parts per million range (Aguilar and Borrell 1996). Organic chemical contaminants have been regarded as of less significance for mysticetes than odontocetes and are not considered primary factors in slowing the recovery of any stocks of large whale species (O'Shea and Brownell 1994). This is especially true for planktivorous baleen whales such as right whales, given their lower accumulated contaminant burdens as compared to other marine mammals. However, assessment of contaminant body burden ignores toxic non-halogenated aromatic hydrocarbons (polynuclear aromatic hydrocarbons: PAH) from crude oil and combusted fossil fuels that do not bioaccumulate. Such compounds are metabolized, induce their effects and are mostly excreted. Contaminant impact is therefore insufficiently assayed by blubber burden analysis of parent compound alone.

F. Military Operations

No evidence is available to conclusively link military activities in the North Atlantic to impacts on right whales. However, such activities in this ocean basin have the potential for disturbing, injuring, or killing these and other whales.

In early 1996, six right whale deaths were documented. Five of these (one attributed to a ship strike) occurred in waters adjacent to Southeast U.S. (SEUS) critical habitat. Navy facilities adjacent to the critical habitat use offshore areas for gunnery exercises. Because several of the

carcasses were found near a Navy gunnery range, it was suspected that some deaths were related to underwater explosions, and there was concern that Navy activities may have been involved in some deaths. However, no such link was established.

As described below (in Appendix A), the Navy has consulted with the NMFS on the potential effect of some of its operations on protected species. In addition, all Navy operations that introduce loud sounds into the marine environment are subject, under the MMPA, to application for and provision of small take letters of authorization from NMFS. As described in Appendix A, the Navy has made a number of significant modifications to its operations to facilitate protection of right whales in their critical habitat in the SEUS. It is important that open communication continue with regard to Navy operations and cooperative development of ways to mitigate possible environmental impacts of the operations.

G. Hunting

In the western North Atlantic, there has been little hunting of right whales this century; the last known catch occurred in 1951 at Trinity Bay, Newfoundland (Mead 1986). Catches in the eastern North Atlantic in the late 19th and early 20th centuries were made off Iceland, Scotland and Ireland (Collet 1909; Brown 1976); these catches were made largely by Norwegian whaling operations, and it is likely that they irreversibly damaged or extirpated this stock. Unlike in the North Pacific, there is no evidence that illegal Soviet whaling operations occurred in the North Atlantic.

H. Climate and Ecosystem Change

Interannual, decadal, and longer-time scale variability in climate can alter the distribution and biomass of prey available to right whales. For example, decadal scale climatic regime shifts have been related to changes in zooplankton in the North Atlantic (Fromentin & Planque 1996). Decadal trends in the North Atlantic Oscillation (Hurrell 1995) can affect the position of the Gulf Stream (Taylor *et al*. 1998) and other circulation patterns in the North Atlantic that may be important to right whales. The effects of climate-induced shifts in productivity, biomass, and species composition of zooplankton on the foraging success of right whales has received little attention. Such shifts in community structure and productivity may alter the distribution and occurrence of foraging right whales in coastal habitats, as well as affecting their productivity.

IV. RECOVERY CRITERIA

The overall goal of this Recovery Plan is to promote the recovery of the western North Atlantic right whale DPS to a level sufficient to justify declassification as a listed species under the ESA. This plan recognizes that the western North Atlantic right whale DPS is critically endangered and is therefore in need of urgent management action. In addition, NMFS recognizes that given the current status of this DPS and indications provided by the best available data, criteria for removing the DPS from the List of Threatened and Endangered Wildlife (List) will likely not be met for decades or longer.

In this plan, NMFS proposes new recovery criteria for right whales. They are derived from a workshop convened in February 2001 to develop de- and down-listing criteria for endangered large whale species. The criteria developed by the workshop are under review by NMFS and the

workshop report has not been completed at the time of this writing. Nonetheless, the workshop provided a set of recommended recovery criteria and conditions, and certain language for inclusion in this draft recovery plan for right whales. The workshop recommended criteria follow and are adopted, in draft, as part of this plan.

Criteria Justification

The workshop concluded that a general framework for recovery criteria for large whales should meet the following standards:

a. Criteria should be developed and applied at the DPS/subspecies level;
b. The risk of extinction should be used to define criteria;
c. Criteria should be probablistic;
d. A Population Viability Analysis (PVA) approach/philosophy should be used for developing criteria; and
e. Criteria must explicitly identify the acceptable risk and the time frame of consideration.

Workshop participants discussed three different types of thresholds or triggers that could be incorporated into recovery criteria for all large whale species: population size, effective population size, and some type of probabilistic threshold. Workshop participants agreed that the trigger for consideration of a change in listing status should be the probability that the species would or would not become extinct within a period of time that is relevant to management.

The workshop recommended that a probabilistic threshold describing the risk of extinction be included in all recovery criteria. This was clearly the preferred approach because:

1) It is the best, and perhaps only, way to evaluate the risk of extinction as required by the ESA.
2) Using population size as a trigger was not considered adequate because it failed to provide any information about the trend in population size or whether the population is under threat of extinction. The size of a population is only one component of an analysis of the risk of extinction for that population.
3) Using the effective population size[1] as a trigger was not considered adequate because it requires information on (or reasonable assumptions about) the proportion of mature individuals in a population. Not only would this be difficult to assess for many species of large cetaceans, but it could also be misleading because the proportion of mature animals in a population will be smallest when the population is increasing.

Therefore, the workshop recommended that a PVA approach should be used to determine the risk of extinction for conservation units of large cetaceans. Workshop participants recommended that a PVA approach should be used to determine the risk of extinction for conservation units of

[1] Effective population size (N*e*) is defined (Meffe and Carroll, 1997) as the functional size of a population, in a genetic sense, based on numbers of actual breeding individuals and the distribution of offspring among families. Ne is typically smaller than the census size of the population.

large cetaceans. A Bayesian approach to a PVA might be useful because both model inputs and outputs are probabilistic; however, workshop participants felt that the actual methods for conducting the PVA should be left up to the researchers doing the analyses.

Two parameters need to be specified to provide a probabilistic risk assessment: the time frame of reference and the desired degree of certainty of continued existence (Shaffer 1981, 1987). The increasing levels of risk represented by threatened and endangered status require a decrease in the time scale or an increase in the probability of extinction, or both.

The meager guidance provided by the ESA about endangered species is that they are species that are "in danger of extinction throughout all or a significant portion of their range". The guidance available from the scientific literature is that the highest level of risk (probability of extinction, P_{EX}) that is acceptable by most conservation biologists and population geneticists ranges from a 20% chance in 10 generations to a 1%, 5%, 10%, and 50% chance in 100 years to a 1% chance of extinction in 1,000 years (Shaffer 1981, 1987; Belovsky 1987; Soule 1987; Mace and Lande 1991; Thompson 1991). The norm, however, seems to be a ≥ 1 % chance of extinction in 100 years. If this is considered the maximum acceptable risk of extinction then it should probably be considered as defining the endangered criteria. Thus, the workshop recommended that a reasonable, conservative trigger for “endangered” would be: the species is endangered if the probability of becoming extinct is greater than or equal to 1% in 100 years.

The ESA defines threatened species as those which are likely to become endangered in the foreseeable future. This effectively ties the criteria for threatened status to the criteria for endangered status. Thompson (1991) defined a threatened species as one which has a 50% chance of becoming “endangered” in 10 years. Mace and Lande (1991) follow a somewhat different approach in setting "vulnerable" under the IUCN classification scheme (roughly analogous to threatened) independently of endangered status. Using their approach and the values in the literature, acceptable risk values for threatened would be $0.01 \leq P_{EX} < 0.05$ in 100 years. As such, criteria for “threatened” can be defined by either associating the threatened criteria with the endangered criteria (e.g., 50% chance of reaching endangered status in 10 years; Thompson 1991) or by increasing the acceptable level of risk (e.g., $0.01 \leq P_{EX} < 0.05$ in 100 years). After considerable discussion, participants agreed that it would be most appropriate to adhere to the guidance of the ESA by linking the “threatened” status of a species to its likelihood of becoming “endangered”. The majority of workshop participants recommended that species be considered threatened if the probability of becoming endangered was greater than or equal to 10% in 10-25 years; 20 years should be used as a general guideline. Participants also considered the applicability of the criteria used for Pacific salmon; that is to consider a species threatened if the probability of becoming endangered was 50% in 10 years. Many participants believed that using 50% was not consistent with the ESA, which specifies that threatened species are “likely to become endangered”; instead, using 50% indicates that there is an equal probability that species are or are not likely to become endangered. In addition, participants felt that 50% in 10 years was not adequately conservative considering the low rate of reproduction for large whales and the fact that it may take more than 10 years to simply detect a significant trend in the size of a marine mammal population.

The workshop selected 20 years as a general guideline because it was a reasonable length of time to carry out the following activities: determine the population abundance, determine the trends in abundance, determine what factors are negatively affecting the population, determine how to

alleviate those factors, and implement management actions that will assist in the recovery of the population. However, workshop participants indicated that the most appropriate approach would be to use 10-25 years, depending on 1) the precision of the data on population abundance and trend information for a particular species, 2) the time it takes the agency to respond to a potential change in status, and 3) the time it will actually take the species to recover. For some species, such as those for which the cause(s) of decline are unknown, it may be reasonable to use a longer time frame to ensure that there is an adequate buffer for research to document the extent and causes of the decline, and for management actions to take place.

Thus, criteria for de-listing would be that the species had a greater probability of persistence than that which would lead it to be listed as threatened (or endangered). That is, a listed species should be considered for de-listing if the probability of endangerment is < 10% in 20 years. However, prior to any consideration of de-listing, a right whale DPS will need to grow to substantially higher population levels and, where relevant, human-related mortality must be reduced to allow such population growth. Given the current small population sizes and low or negative rates of population growth, de-listing actions are not anticipated in the foreseeable future (e.g., decades or longer).

As indicated above, the workshop recommended that these criteria (and justification) be applied to the western North Atlantic right whale DPS and, thus, they have been incorporated into this draft recovery plan.

Criteria

Section 4(a)(1) of the ESA explicitly requires that any determination of the status of a species consider the following factors:

A) the present or threatened destruction, modification, or curtailment of its habitat or range;
B) overutilization for commercial, recreational, scientific, or educational purposes;
C) disease or predation;
D) the inadequacy of existing regulatory mechanisms; and
E) other natural or manmade factors affecting its continued existence.

The objective criterion to determine status will be a probability of extinction over a specified time period, as estimated using a robust method (such as Population Viability Analysis, PVA) that incorporates uncertainty and includes important risk factors, including (where relevant) the five factors noted above.

NMFS has determined that the western North Atlantic right whale is a Distinct Population Segment. Recovery criteria for this DPS are:

A right whale DPS shall be considered endangered when, given current and projected conditions, the probability of extinction is greater than 1% in 100 years.

A right whale DPS shall be considered threatened when, given current and projected conditions, the probability of becoming endangered is greater than 10% in 20 years.

De-listing would occur when the DPS no longer meets the criteria for endangered or threatened. Therefore, de-listing would occur when the probability of becoming endangered within the next 20 years is equal to or less than 10%.

The workshop noted that the relevant timeline for the latter two criteria is 20 years. A longer timeline was not recommended because substantial information has already been collected on right whale population size, trends in abundance, and sources of mortality. The profile of these species is sufficiently high that these types of data will likely be collected for the foreseeable future. Thus, it is unnecessary to add an additional level of conservatism by extending the timeline.

In the absence of suitably precise data for use in a PVA or similar model, surrogate measures may be substituted if they can be shown to give an equivalent probability of extinction or an equivalent probability of becoming endangered. Since population size and trend are important factors affecting the probability of extinction, the surrogate measures to consider should include these; however, they must be determined with adequate precision to ensure that the probability of extinction is less than 1% in 100 years.

Consideration of the Five Listing Factors

As noted above, section 4(a)(1) of the ESA requires that any determination of the status of a species consider possible threats (or reduction of threats) to a species in five areas (i.e., the five factors for listing). That is, threats to a species resulting from activities in one or more of the five areas is sufficient justification to add a species to the List. 50 CFR 424.11(d) provides that the same five factors must be considered in any de- or down-listing action. Thus, reasonable justification and data need to be provided indicating that significant threats, or inadequate protection, are not still posed in any one these areas. In this regard, addressing the five factors is a necessary component of the criteria identified here when considering de- or down-listing North Atlantic right whale DPS.

Whereas, it is essential to address each of the five factors when a proposed change in status is made, a brief summary of current knowledge on right whales in these subject areas is provided here, as well as indications of the types of information needed and determinations made if a proposal is made to de- or down-list right whales.

(A) The present or threatened destruction, modification, or curtailment of its habitat or range

In any de- or down-listing action, reasonable justification and data need to be provided that habitat destruction or degradation is not a factor in continued recovery of the DPS.

Unlike many terrestrial taxa, right whales and other cetaceans do not directly compete with a burgeoning human population for space (Clapham *et al.* 1999). Since humans do not permanently colonize marine environments, habitat loss (in the strict sense of the term) is not, at this time, believed to be a serious issue for most large whales. However, since right whales are often dependent on restricted waters adjacent to highly developed coastline, habitat degradation may not be a trivial matter for this species, and in fact threats can certainly arise from onshore and near shore activities.

Probably the most dramatic source of habitat degradation for baleen whales is spilled oil. Data on the effects of oil pollution on cetaceans are inconclusive, and the large baleen whales appear to be generally unaffected by oil *per se* (Geraci 1990, Loughlin 1994b). General concerns with regard to oil pollution are ingestion of contaminated prey, potential irritation of skin and eyes, inhalation of toxic fumes, and abandonment of polluted feeding habitat (Geraci and St. Aubin 1980, Geraci 1990). Currently, there is no oil exploration in the known major habitats of the North Atlantic right whale, but the possibility remains for the future.

The potential for additional habitat degradation comes from a variety of sources. The effect on critical behaviors (foraging, mating, nursing etc.) of noise pollution from shipping or oil and gas development is unclear, although various observations suggest that marine mammals can habituate well to even quite high levels of sound (Geraci and St. Aubin, 1980). Playback experiments on gray and bowhead whales indicate that whales will actively avoid a very loud sound source (Malme *et al.* 1983), but whether real-life sources (such as drilling platforms) negatively impact behavior to the point that it diminishes reproductive success and population productivity is unclear.

There are some suggestions that increased pleasure boat traffic disrupts behavior (e.g., in humpback whales, (Glockner-Ferrari and Ferrari 1990)). Such craft as parasails, jet skis and fast power boats can pose a threat to whales even if their operators are not intentionally focusing their attention on the animal itself. Pleasure boat traffic exists in various coastal areas, with little regulation or enforcement; however, its impact on right whales is unknown.

Dredging of harbors and port channels occurs in a number of locations in or near areas where right whales aggregate. Noise, ship traffic, disposal of dredge material and related activities may all serve to degrade right whale habitat. The overall effect is unknown. At present, efforts are made to reduce adverse effect on right whales, primarily by posting observers on ships transporting dredge spoils to reduce the risk of ship strikes. More information is needed to determine specific impacts, if any, from these activities.

A final source of possible habitat degradation for right whales is contaminants. The impact of pollutants on right whales is debatable. The subject is reviewed by O'Shea and Brownell (1994), who conclude that there is currently no evidence for significant contaminant-related problems in baleen whales. Although much more research needs to be conducted, existing data on mysticetes support the view that the lower trophic levels at which these animals feed should result in smaller contaminant burdens than would be expected in many odontocetes, which typically show burdens that differ from those of baleen whales by an order of magnitude (O'Shea and Brownell, 1994). There is currently no persuasive evidence for any of the problems that have been linked to excessive contaminant burdens in some terrestrial mammals, such as reproductive failure or immune system suppression (e.g. Mink, *Mustela vison*; Kihlström *et al.,* 1992). However, the manner in which pollutants negatively impact animals is complex and difficult to study, particularly in taxa (such as large whales) for which many of the key variables and pathways are unknown (Aguilar, 1987; O'Shea and Brownell, 1994). A more plausible potential problem is that of transgenerational accumulation (Colborn and Smolen 1996), but this remains unstudied in right whales or any other cetacean.

As noted above, these issues need to be carefully considered and effectively dismissed as adversely effecting right whales if a change in North Atlantic right whale status is proposed.

(B) Overutilization for commercial, recreational, scientific, or educational purposes

Right whales have not been the target of commercial hunting in the North Atlantic since 1935, and relatively few catches were made in the 20th century prior to that date. As noted elsewhere in this plan, there is no evidence that the illegal catches of whales by the USSR included any North Atlantic right whales.

With regard to recreational and educational use, problems may arise from boats whose operations are directed at the whales themselves, i.e. whalewatching from either commercial or private vessels. It is likely that large-scale unregulated whalewatching, involving numerous boats circling and pursuing a whale, will temporarily disrupt vital behavior such as feeding, courtship, and nursing. The impact of such harassment on the reproductive success of individuals has not been studied and is unknown, but continued exposure of any individual whale to such activity is probably relatively low. Currently, close approach by vessels within 500 yards is not permitted on North Atlantic right whales while they are in U.S. waters, although this activity is allowed in Canada.

Scientific activities on right whales frequently involve close approaches to the animals for the purpose of photographic, genetic, or behavioral sampling. These activities are controlled by permits in both U.S. and Canadian waters, and potential negative impact on the animals is considered in the permitting process. At present, there is little restriction to the number of scientific permits or the types of scientific activities undertaken, and efforts are needed to ensure coordination of research activities between U.S. and Canada and among researchers.

If de- or down-listing is considered for a right whale DPS, absolute assurances are needed that right whales are not being taken for commercial purposes. In addition, assurances are needed that whalewatching and scientific research activities are not affecting the continued recovery of right whales and will not affect recovery in the foreseeable future.

(C) Disease or predation

Unlike in some dolphins and pinnipeds, there have been no recorded epizootics in baleen whales. The only known case of a mass mortality was that of humpback whales in the southern Gulf of Maine in 1987/88. Geraci *et al.* (1989) provide strong evidence that these deaths resulted from consumption of mackerel whose livers contained high levels of saxitoxin, a naturally occurring red-tide toxin, the origin of which remains unknown. It has been suggested that red tide phenomena are somehow related to increased freshwater runoff from coastal development, a link that has led some observers to suggest that such events may become more common among marine mammals. However, there is currently no evidence linking red tide toxins to deaths or chronic health problems in right whales.

The occurrence of skin lesions on North Atlantic right whales has been documented in recent years, with an apparent increase in frequency culminating in a peak in 1995 when they were observed on 24% of photographed individuals (Marx *et al.* 1999). The origins and significance of

these lesions are unknown, and further research is required to determine whether they represent a topical or systemic health problem for the affected animals.

Current knowledge of natural predation on right whales is discussed elsewhere in this plan. Predation of right whales likely occurs by killer whales and large shark species, but the level is not documented. Neither assessing the level of predation, nor attempting to alter the level is likely feasible or recommended in any de-listing action. However, evidence of disease in right whales, particularly those that may be directly or indirectly linked to human activities, should be assessed. Any proposal to de- or down-list a right whale DPS needs to provide assurances that disease will not effect the continued recovery of the species.

(D) The inadequacy of existing regulatory mechanisms

Given that right whales are protected under both U.S. and Canadian law, and internationally by the International Whaling Commission, existing regulatory mechanisms appear to be adequate at this time. However, as noted above, death and serious injury resulting from ship strikes and entagnlement in fishing gear are likely significant factors in slowing recovery of this DPS. A total of 17 known right whale deaths have been attributed to collisions with ships from 1972-2001. Three right whale deaths have been attributed to fishing gear entanglement in the same period. The actual number of deaths from both sources may be higher inasmuch as not all carcasses are detected, reported, and recovered. Injuries and entanglements that are not initially lethal may result in a gradual weakening of entangled individuals, making them more vulnerable to some other direct cause of mortality. An estimated 60 percent of the western North Atlantic right whale DPS bears scars from fishing gear entanglement. (The level and extent of impact from these human activities are discussed more fully in the section on Effects of Human Activities, above, and steps needed to reduce or eliminate these threats are discussed in the Recovery Actions and Implementation section, below.) Therefore, it may be necessary to continue or enhance existing, or promulgate new regulations to reduce or eliminate these threats. As a result, prior to considering any de-listing action, regulations and regulatory mechanisms and the protection they provide, would need to be assessed and a determination made that regulations are adequate to protect western North Atlantic right whales from the threat of ship strikes and fishing gear entanglement.

(E) Other natural or manmade factors affecting its continued existence

Aside from the factors discussed here and elsewhere in this plan, no other natural factors are *known* to be negatively impacting the recovery of western North Atlantic right whales at this time. Among anthropogenic factors, ship collisions and entanglement in fishing gear are almost certainly inhibiting the recovery of this species. However, other factors may be identified later that directly or indirectly threaten the DPS, such as reduced productivity from contaminant loads, habitat degradation, including activities that disrupt food webs, or disrupt vital activities through coastal development, ship traffic, or undersea noise. Although unclear if these or any other factors are currently adversely effecting this right whale DPS, in any contemplated de- or down-listing action, the best available information (data) must be used, and justification provided, to ensure that these or any other factors will not inhibit ongoing population growth and recovery.

Conclusion

If de- or down-listing of western North Atlantic right whales is contemplated, threats represented in each of the five listing areas (factors) need to be addressed to ensure such threats are non-existent or insignificant and that existing legal structures are adequate to ensure continued recovery. At the time of this writing, there is currently no evidence that factors (A) through (D) are negatively impacting the reproductive success and productivity (and therefore the recovery potential) of western North Atlantic right whales, but further research is clearly warranted in many of the areas identified above to make that assessment with some level of certainty. In contrast, other anthropogenic factors identified under (E), notably ship strike and entanglements, are clearly threatening the recovery of this species.

V. RECOVERY ACTIONS AND IMPLEMENTATION

A. Goals and Objectives

As noted above, the western North Atlantic right whale DPS is critically endangered. Given the current status of this DPS, indications provided by the best available data, and criteria identified here for removing the DPS from the List of Threatened and Endangered Wildlife, removing the DPS from the List will likely not be met for decades or longer. Nonetheless, *the overall goal of this Recovery Plan is to promote the recovery of this DPS to a level sufficient to justify removing it from the List*. In the near term, actions are needed to reduce known sources of mortality while continuing to understand other factors and to adapt this plan in response to new information.

It is the intent of this Plan that all goals and objectives are to be achieved in a manner consistent with international law, especially the international law of the sea. In particular, all provisions of this Plan shall be applied consistent with the 1983 Presidential Proclamation on the Exclusive Economic Zone, the 1988 Presidential Proclamation on the Territorial Sea, and the 1999 Presidential Proclamation on the Contiguous Zone, and in accordance with generally recognized principles of international law, and with the treaties, conventions, and other agreements to which the United States is a party.

The objectives of this revised plan are as follows:

<u>Western North Atlantic Right Whale DPS</u>

Objective 1: Minimize sources of human-caused death, injury, and disturbance.

Objective 2: Identify, characterize, protect, and monitor important habitats.

Objective 3: Monitor the status and trends of abundance and distribution of the western North Atlantic right whale DPS.

Objective 4: Coordinate Federal, State, international, and private efforts to implement the Recovery Plan.

Recovery Action Priorities

NMFS wishes to highlight the need to eliminate right whale mortality and serious injury from human activities. In light of its possibly declining status and associated high anthropogenic mortality, the immediate priority for the western North Atlantic DPS relates to reduction in anthropogenic mortality. The second priority level includes continued monitoring of the DPS to assess the impacts of anthropogenic mortality and management actions, as well as an assessment of threats which are less clearly established or understood, and intrinsic biological problems for which management actions may be of limited value. The third level encompasses threats which are not currently in existence, or for which there is little or no evidence.

The intent of the list that follows is to indicate that steps taken to reduce anthropogenic mortality need to be the highest priority and main focus of this plan. However, focusing on one task should not preclude the opportunity to simultaneously address others. Specific tasks within these overall goals may have differing priority rankings – priority assessments relative to recovering the DPS appear in the Implementation Schedule (the reader is referred to Appendix C for a list of priorities). If resources are limited, reducing mortality should be addressed first and foremost.

a. First Priority (immediate/urgent) – Actions essential for directly or indirectly arresting the possible decline in the DPS:

- *Reduction of mortality from ship strikes*
- *Reduction of mortality from entanglement*

b. Second Priority – Actions that provide additional information of importance to management, or which relate to possible intrinsic biological problems for which there is no management remedy, or which serve to address protection needs that are not as immediate as those listed above:

- *Assessment of status and trends in the DPS*
- *Continued field work to monitor the DPS*
- *Development of models or other means to reliably predict right whale distribution*
- *Maximize efforts to locate, secure, and collect data from dead whales*
- *Coordination of state, federal, international and private efforts*
- *Genetic studies*
- *Studies of Possible Reproductive Anomalies and Health Assessment*
- *Habitat protection*
- *Feeding/energetics studies*
- *Contaminant studies*

c. Third Priority – Issues for which there is either no current activity (i.e. possible future threats), or for which there is little current evidence of impact:

- *Industrial development (oil and gas etc.)*
- *Noise*
- *Whale-watch*

Site-Specific Management Measures

The range of western North Atlantic right whales includes the waters of two countries and numerous states and several Maritime Provinces. The distribution is largely coastal, but also includes offshore waters. Nonetheless, many recovery and research activities occur at local levels or are site specific.

This is a national recovery plan, but recovery actions and research and monitoring activities involve actions by state and federal agencies, private organizations, and in some cases local jurisdictions. For example, studies of the impact of coastal development and habitat degradation (e.g., under the Coastal Development section, task I.1.a; and under the Industrial Activities section, task I.4.a), and reducing or eliminating their adverse effects on right whales are coast-wide activities (e.g., under the Coastal Development section, task I.1.b; and under the Industrial Activities section, tasks I.4.b and I.4.c), but dredging and related activities are specific to certain ports. Similarly, response to stranded whales (under the Strandings section, tasks IV.A.1, IV,A.1.a, IV,A.1.b, IV.A.1.g, and IV.A.1.g.i) is coordinated nationally but response by local volunteers and agencies is critical to obtaining much needed data. Improving and implementing contingency plans for response to oil spills (e.g., under the Oil Spills section, tasks I.4.d) is primarily coordinated at the national level, but actual response needs to be conducted locally, with specific response responsibilities assigned at local levels. Further, the study of contaminants and their potential adverse effects on right whales (e.g., under Pollutants section, tasks I.3.a and I.3.b), in most cases, needs to be coordinated through national research plans, but monitoring of certain sites (the recently developed Massachusetts waste water treatment plant effluent or any other known effluent sites for example) are site specific activities. Most fishing regulations are regionally specific and fisheries need to be managed and regulations enforced regionally or locally.

As discussed in the Conservation Accomplishment section of this plan, the Northeast and Southeast Right Whale Recovery Plan Implementation Teams recommend and help organize recovery activities at the regional level and coordinate a number of state efforts. Among these activities are coordinating aircraft surveys and the relaying of whale sighting locations to mariners, helping to coordinate the storing of equipment caches for disentanglement, and coordinating responses to right whale strandings and carcass recovery.

B. Step-down Outline

1. **<u>Western North Atlantic Right Whale DPS</u>**

Objective 1: <u>Minimize sources of human-caused death, injury, and disturbance</u>.

I. Ship Strikes

A. *Reduce ship collisions with right whales.*

1. "Sighting Advisory System"

a. Continue and improve seasonal aircraft surveillance of right whale habitats and other elements of the "Sighting Advisory System" (also referred to as the “Early Warning System” - EWS) program.

b. Provide right whale sighting locations to mariners through broadcasts and other appropriate media.

c. Assess the effectiveness and efficiency of the survey programs in attaining the primary goal of reducing ship strikes. Annually review the survey program to identify ways to improve its effectiveness and efficiency. Promote identification and development of technology to improve detection. Eliminate the program when it is no longer effective or when a more effective alternative is developed.

d. While surveys continue to be used, standardize surveys and data collection to ensure data obtained from the surveys are of maximum use for subsequent analysis of whale distribution and abundance.

e. Establish a program for regular and timely analysis of aircraft survey data to determine seasonal whale distribution and abundance and to contribute to predictive modeling exercises of environmental correlates relative to whale distribution, whale distribution relative to ship traffic, and use in subsequent risk analysis.

f. Use acoustic detection technology (e.g., “pop-up” buoys), surveys, and other technologies as available to monitor right whale occurrence and distribution in waters off the mid-Atlantic states. Assess the need for protective measures in these areas.

2. *Vessel Traffic Management*

a. Assess the utility and feasibility of voluntary and mandatory ship routing measures in right whale habitat.

i. Assess the utility of ship routing changes in southeast U.S. critical habitat.

b. Assess the possibility of voluntary and mandatory speed restrictions in right whale habitat.

c. Using existing data on whale sightings and vessel locations, conduct risk assessment analyses of various ship routing or speed options to assess best set of vessel traffic management options by area.

d. Conduct studies of the potential economic impact of vessel management options.

e. Work with mariners and the shipping industry to establish voluntary or mandatory changes (e.g., speed and routing) in ship operations to reduce the likelihood of ship/whale interactions.

f. Assess whether these measures, other voluntary or mandatory protective measures, and other measures identified in this plan are reducing or likely reducing the occurrence of ship

strikes. If ship strikes continue at an "unacceptable" level, consider and recommend measures to eliminate vessel strikes.

g. Assess the feasibility of modifying intermodal transport system links that would reduce the number of vessels operating in right whale habitat during periods of high right whale use.

3. Education and Outreach

a. Establish regionally-based liaison positions to work directly, and maintain a dialog, with the shipping industry, discuss feasibility of various management measures, foster industry cooperation, and conduct related activities.

b. Develop programs and materials to educate mariners about right whales and to provide recommended practices to help avoid ship strikes.

c. Routinely review and update information about right whale habitat and high-use areas, right whale vulnerability to ship strikes, and related ship collision reduction measures on nautical charts, *Coast Pilots*, published *Notice to Mariners*, and other appropriate navigational aids.

4. Mandatory Ship Reporting Systems

a. Continue to implement mandatory ship reporting systems along the east coast of the United States.

b. To the extent possible, use incoming information from the reporting system for analysis of ship volume and routing studies with a view to assessing possible measures to reduce ship/whale interactions.

c. Periodically assess the effectiveness of existing ship reporting systems -- both with regard to their operation and capacity to reduce ship strikes -- and reporting areas, and consider implementing others or expanding the existing ones, as necessary.

d. Monitor compliance with the mandatory ship reporting system and take steps to improve compliance as necessary.

e. Continue and improve outreach efforts to educate the shipping community about the mandatory ship reporting system.

5. Critical Habitat

a. Analyze available data and collect additional whale sighting data as necessary to assess expanding or modifying the critical habitat boundaries. This is particularly relevant in the southeastern U.S.

b. If warranted, revise critical habitat boundaries.

6. Whale Detection Technology

a. Conduct studies of active acoustic (e.g., SONAR) and passive acoustic devices (e.g., "pop-up buoys"), and other underwater acoustic technologies to determine their feasibility and efficiency in detecting submerged whales.

i. If SONAR devices, passive listening, or other technologies are capable of detecting submerged whales, implement systems to use the devices to reduce ship/whale interactions. Conduct studies to assess the impact on marine mammals of acoustic pollution from proliferation of such SONAR devices, and determine whether potential cost exceeds potential benefit to right whales.

b. Assess the utility of such devices on relatively large scales: high whale use areas and times, or high ship use areas, or perhaps on regional scales.

c. Conduct studies of whale behavior relative to various types of "alerting" sounds that may warn sleeping, feeding, or courting whales to the presence of oncoming ships, and assess the desirability of deploying such devices in an environment already heavily polluted by noise.

d. Assess the feasibility of improved visual detection technologies.

e. Assess the feasibility and utility of using remote sensing to characterize right whale distribution patterns and use in predictive models of right whale distribution patterns near high ship traffic areas.

7. Geographic Information Systems (GIS)

a. Incorporate data from "whale alert" aircraft surveys, scientific survey data, other confirmed right whale sightings and ship traffic data obtained from the mandatory ship reporting system, in GIS for analysis of whale/ship interactions.

b. Establish or use existing GIS to (a) conduct analysis of environmental correlates for right whale occurrence and distribution, (b) prepare predictive models of where and when right whales are likely to occur, (c) determine times and areas in which right whales and heavy ship traffic are likely to occur, and (d) assess ways to minimize ship/whale interactions.

c. Identify and obtain data from additional sources (e.g., biological and physical oceanographic data, human activities) for GIS application and analysis.

8. Studies of the Effects of Ship Noise on Whale Behavior

a. Using benign techniques, conduct studies of whale responses to ship noise and to ships of various types and speeds.

9. Monitoring

a. Continue to review and evaluate stranding and photo-identification data for evidence of collision between ships and whales.

II. Entanglement in Fishing Gear

A. *Reduce injury and mortality caused by fisheries and fishing equipment*

1. Operations

a. Develop and implement strategies to modify fishing operations and gear to eliminate entanglement and assess the effectiveness of such strategies. If entanglements continue or increase, increasingly stringent steps should be taken to reduce entanglement rates.

i. Conduct research on alternative fishing methods.

b. Work with Canadian officials to develop means to reduce entanglement levels in the Bay of Fundy.

2. Gear

a. Conduct studies of gear modifications that reduce the likelihood of entanglement, effects of entanglements, and enhance the possibility of disentanglement. Such study might include, but should not be limited to, assessment of bio-degradable vertical lines, ways to reduce the number and length of vertical lines, increasing the visibility of vertical lines, and designing breakaway links for heavy gear.

b. Design and implement programs to incorporate gear modifications that reduce entanglement into the fisheries operations.

3. Reporting

a. Continue to prepare and distribute information on whale entanglement to fishermen and other mariners and encourage reporting of entanglements to the disentanglement network.

b. Continue, expand, and improve procedures for responding to reports of entangled whales.

c. Expand fisheries observer programs.

d. Continue to review, evaluate, and act upon reports from fishermen and fishery observers of interactions with right whales.

e. If evaluations indicate that reporting can/should be improved, implement improved systems for reporting.

4. Disentanglement

a. When possible, disentangle whales caught in fishing gear.

i. Create and maintain disentanglement equipment caches and make appropriate arrangements to get disentangling teams and equipment to entangled whales.

ii. Develop and train additional disentanglement response teams.

iii. Design and conduct studies on advanced disentanglement gear.

b. Identify and implement ways to improve disentanglement efforts.

5. Monitoring of Entanglement Rates and Evaluation of Protective Measures

a. Monitor entanglement-related survival and mortality rates.

b. Determine whether measures to reduce entanglement are effective.

c. Identify and implement steps to improve protective measures.

III. Education and Outreach

A. Providing Relevant and Timely Information

1. Continue and expand efforts to educate mariners and the shipping industry, and fishermen and the fishing industry, about right whale vulnerability to ship strikes and fishing gear entanglement.

a. Use all reasonable avenues to educate mariners and fishermen about the occurrence of right whales and their vulnerability to ship strikes and fishing gear entanglement. Such efforts should include, but not be limited to, development and distribution of brochures, placards, fliers, videos, articles in industry journals, and through direct liaison with the industry.

b. Ensure that right whale protective measures are incorporated and periodically updated in policy guidance documents of the International Safety Management Code and U.S. Coast Guard (USCG) training courses for vessel auditors and inspectors. In addition, efforts should be made to work with maritime academies (e.g., Kings Point, Massachusetts Maritime) to incorporate right whale protective measures into their curricula.

IV. Enforcement

A. Programs for enforcing regulations

1. Enforce fishing and shipping regulations.

a. Continue and improve programs to ensure that fishing and shipping regulations are enforced.

Objective 2: <u>Identify, characterize, protect, and monitor important right whale habitats</u>.

I. Protect Right Whale Habitat

A. Monitoring and Reducing Human Impact

1. Coastal Development

a. Conduct studies to determine the direct and indirect effects of activities and impacts associated with coastal development on the distribution, behavior, and productivity of right whales. The activities and impacts studied should include, but not be limited to, sewage outfall, dredging activities (and associated plumes), dredge spoils, dumping, habitat alteration, noise, and aquaculture activities, including effects on prey species as well as on right whales directly.

b. As feasible, take steps to minimize identified adverse effects from coastal development.

2. Anthropogenic Noise

a. Conduct studies to assess the direct and indirect effects of anthropogenic noise on the distribution, behavior, and productivity of right whales. Noise sources studied should include, but not be limited to, industrial and shipping activities, oceanographic experiments, military related activities, and other human activities.

b. Take steps to minimize identified adverse effects to right whales from anthropogenic noise.

3. *Pollutants*

a. Conduct studies to assess the sources and levels of anthropogenic pollutants and assess their possible adverse effects on right whales and their habitats. Such studies should focus on, but not be limited to, heavy metals, endocrine disrupters, immune suppressors, pathogens, and their exposure levels, pathways, and effects.

b. Take steps to minimize identified adverse effects from anthropogenic pollutants.

c. Conduct studies of individual health and body condition.

4. Oil and Gas Exploration and Development and other Industrial Activities

a. Conduct studies to assess possible adverse effects of oil, gas, and hard mineral exploration and development and other industrial activities.

b. Take steps to minimize identified adverse effects from oil, gas, and hard mineral exploration and development.

c. Monitor efforts to implement right whale-related protection measures in approved oil and gas exploration and development plans.

d. Assess and update, as necessary, existing contingency plans for oil and chemical spills in waters in which right whales occur. Local, regional, and national authorities should all participate in the development of integrated plans.

5. Whale-Watching

a. Conduct studies to assess the short- and long-term effects of whale-watching on right whales, notably with regard to high-speed vessels.

b. Assess the effectiveness of existing restrictions on whale watching activities to determine whether more restrictive measures are necessary or less restrictive measures could be permitted.

c. Continue and expand education/public awareness programs to ensure that commercial and recreational vessel operators are aware of applicable regulations and guidelines.

II. Right Whale Habitat

A. Characterize and Monitor Right Whale Habitat

1. Habitat Features

a. Compile or collect relevant physical, chemical, biological, meteorological, fishery, and other data to characterize features of important habitats and potential sources of human-caused destruction and degradation of critical habitats.

b. Monitor human activities to assess potential right whale habitat degradation.

c. Monitor essential habitat features to assess potentially detrimental shifts in these features.

d. Develop, implement, and monitor habitat protection strategies.

e. Monitor right whale habitat use patterns to assess shifts that might reflect disturbance or degradation of habitat.

f. Conduct comparative studies to more accurately characterize critical habitats, using known shifts in habitat use as opportunities to test distribution hypotheses.

g. Collaborate with Canadian authorities to protect important habitats and essential habitat features in Canadian waters.

h. Support Canadian efforts to protect known right whale habitat in Canada.

2. Conduct studies to improve knowledge of the diet, food requirements, feeding habits, and food resources of right whales

a. Compile and evaluate information on the known types, amounts, locations, and availability of right whale prey.

b. Review and refine energetic models to better understand right whale food

requirements and feeding strategies.

Objective 3: Monitor the status and trends of abundance and distribution of the western North Atlantic right whale DPS.

I. *Status*

1. Conduct a study or a workshop to determine the best methods for assessing right whale status and trends, and to establish the optimal level of effort required

2. Assess population size, survival rate and trends on a regular basis

a. At least once every three years, review and evaluate data on the status of the western North Atlantic right whale DPS. If needed, improve data collection and analysis methods.

b. As necessary, develop and implement other programs necessary for population monitoring.

II. Distribution

A. Surveys and Data Maintenance

1. Monitor right whale occurrence and habitat use pattern in known high-use areas

a. Continue to conduct annual winter surveys for right whales off the southeastern U.S. coast.

b. Continue to conduct annual summer surveys for right whales in the lower Bay of Fundy.

c. Continue annual spring surveys for right whales in the Great South Channel.

d. Continue to conduct annual winter/spring surveys for right whales in Cape Cod and Massachusetts bays.

e. Continue to conduct annual summer and fall surveys for right whales on the Scotian Shelf.

2. Conduct studies to locate unknown high-use areas for this population

3. Design and conduct surveys of likely wintering areas based on results of habitat and tracking studies, review of historical data, and results of predictive models

4. Continue to maintain a database of right whale sightings

III. Photo-identification Database

A. Data Maintenance and Analysis

1. Maintain and routinely update the right whale photo-identification catalog

2. Regularly and consistently review, evaluate, and update analyses of data in the right whale photo-identification catalog

3. Conduct studies to determine population structure using photo-identification data

IV. Strandings

A. Information from Dead Whales

1. Continue and improve program for necropsy of right whale carcasses

a. Review and, if needed, improve procedures for responding to reports of dead right whales and conducting necropsies to ensure that the most effective means are being used to extract scientific information from dead, stranded, and entangled right whales

b. Improve or, as necessary, develop and implement protocols for securing and retrieving floating right whale carcasses

c. To the extent possible, use necropsies to determine the cause of death and use such data to reduce the susceptibility to death from these causes

d. Analyze tissue collected from stranded right whales to determine and monitor contaminant levels

e. Analyze tissue collected from necropsies to improve knowledge about life history and reproductive parameters of right whales

f. Review, analyze, and summarize data on stranded right whales on a regular (at least annual) basis

g. Develop and implement a program for handling live-stranded right whales

i. Develop protocols for handling live-stranded right whales, including identification and securing of appropriate sites to effect rehabilitation

h. Establish reliable source(s) of funding for rescue, rehabilitation, necropsy, and tissue collection and analysis efforts.

V. Telemetry Studies

A. Evaluation of Tagging Techniques and Habitat Studies

1. Where feasible, most effective, and least intrusive, conduct radio and satellite tagging studies to increase knowledge of right whale habitat use, distribution, and habits.

a. Conduct studies to assess the most effective and least intrusive means of tagging right whales, including the possibility of using other taxa as models.

b. Continue and expand satellite-linked radio-tagging and tracking to better identify right whale movements and habitat use patterns

c. Conduct satellite tagging studies to determine routes and timing of migration between known high-use habitats

d. Continue and expand VHF radio-tagging studies to better assess daily and seasonal movements in high-use areas

V. Demography and Stock Structure

A. Genetic Studies

1. Conduct genetic studies to assess population structure, effective population size, current and historic genetic diversity and possible impacts on health and reproductive success. In addition, conduct genetics workshop to determine optimal methods for analysis of genetic data

VI. Reproduction and Health Assessment

A. Assessment of possible reproductive anomalies and individual health

1. Conduct studies to determine the cause(s) of anomalous or fluctuating reproductive rates.

2. If cause(s) of reproductive anomalies are linked to human activities, establish programs to mitigate or eliminate the sources of the impact.

3. Conduct studies to assess health at the individual and population level.

4. If studies indicate that poor individual or population health is linked to human activities, establish programs to mitigate or eliminate the sources of the impact.

Objective 4: <u>Coordinate Federal, State, international, and private efforts to implement the Recovery Plan.</u>

I. Continue international ban on hunting and other directed takes of right whales

II. Enforce right whale protection laws

III. Evaluate the effectiveness of the Northeast and Southeast Implementation Teams and implement improvements as warranted

IV. Coordinate with States involved in right whale activities to maximize protection measures.

V. Promote bi-lateral cooperative efforts with Canada to maximize protection for right whales, reduce human-related mortality and injury, report mortality events, promote protection of habitat, and to take other measures to enhance the recovery of right whales

1. Convene regular meetings with Canadian officials to facilitate bi-lateral cooperation on protective measures

2. Promote actions to enhance protection for known areas of importance, especially vessel and fishery interaction issues in Canadian waters

VI. *Periodically review and update the Right Whale Recovery Plan*

1. At least once every five years, review and evaluate recovery actions and prioritize needs

VII. *As appropriate, publish regulations to reclassify the western North Atlantic right whale DPS under the Endangered Species Act and the Marine Mammal Protection Act*

D. Narrative

Objective 1: *Minimize sources of human-caused death, injury, and disturbance.*

I. Ship Strikes

Collisions with ships are a known major source of serious injury and death in western North Atlantic right whales. About 60% of all living North Atlantic right whales bear scars of interactions with ships. A minimum of five known right whale deaths from ship strikes occurred between 1970 and 1993, six between 1993 and 1997, and one in 1999. Reducing the likelihood of these events is a major focus of this plan.

A. Reduce ship collisions with right whales

An overall strategy for reducing ship strikes must be developed. Such a strategy should include, but not be limited to, outreach and education programs for mariners, and systems of voluntary and mandatory measures for all major vessel types. It will, at minimum, incorporate the actions identified in this plan, and it should be a dynamic strategy that reflects the emergence of new information, any significant and unforeseen increase in ship strikes, and monitoring programs that assess the effectiveness of protective actions taken.

1. "Sighting Advisory System"

The whale alert program or so called " Sighting Advisory System " (SAS) (also referred to as Early Warning System- EWS) -- a network of aircraft surveys to detect the locations of right whales -- is far from perfect in detecting right whales. Even in good weather and daylight, only an estimated 25-30% of the whales in a given area are actually detected by the surveys. In addition, the surveys are expensive to conduct. Nonetheless, they have been demonstrated to

prevent some collisions, and they also lay important groundwork in mariner awareness of the issue. Programs such as these that raise industry awareness are necessary steps to implementation and acceptance of potential future protective measures. The program also provides sighting locations for other studies of right whale occurrence, distribution, relative abundance, and shifts in distribution. In addition, these surveys provide important data relative to calving. Consequently, some level of SAS survey effort is likely to be necessary and should be continued until viable alternatives are found.

a. Continue and improve seasonal aircraft surveillance of right whale habitats and other elements of the "sighting advisory system" program.

While there are drawbacks to the program, it should be continued until more effective alternatives are identified and implemented. It is apparent that the program is reducing ship strikes, at least to some degree. Therefore, at least for the present, it should be continued, but any identified problems should be addressed, when possible.

b. Provide right whale sighting locations to mariners through broadcasts and other appropriate media.

The system now provides whale sighting location information to mariners through USCG Broadcast Notice to Mariners (VHF and single side-band), NAVTEX (telex updates), and NOAA Weather Radio (VHF). This practice should be continued. The program should be evaluated to determine if other, more effective media would also be appropriate for relaying sighting location information. If additional media are identified, they should be used.

i. When possible, notify individual ships directly when their course is likely to bring them to or near a location where a whale was sighted by the aircraft.

On a number of occasions, aircraft survey crews have notified ships that are on a course to intersect a whale and have suggested course alterations. This practice should continue. Because of difficulties in communicating with some foreign captains in the past, an effort should be made to address this problem through outreach programs and other means of reaching the non-English speaking maritime community.

c. Assess the effectiveness and efficiency of the survey programs in attaining the primary goal of reducing ship strikes. Annually review the survey program to identify ways to improve its effectiveness and efficiency. Promote identification and development of technology to improve detection. Eliminate the program when it is no longer effective or when a more effective alternative is developed.

The sighting advisory system provides sighting data for subsequent analysis of right whale occurrence and is believed to be the best existing system for notifying mariners about ship strikes. However, the effectiveness of the program in achieving this latter goal must be rigorously assessed in the near future. Specifically, such a review should address three major questions: (i) Do mariners receive the broadcast information and is it received in a timely fashion? (ii) Do they act upon it in some manner (i.e. does it cause them to take action that they would not have taken in the absence of the information)? And (iii) How effective are these mariner actions in preventing collisions with right whales? If such a review finds value to the

program, it should be continued. However, the structure and methods of the program should be reviewed periodically to ensure that it is as effective as possible. Periodic reviews should include, but not be limited to, an evaluation of the location of survey lines, and an assessment of the most effective ways to provide timely and accurate reporting to mariners of the sighting information.

Because the program is expensive and relatively inefficient in locating whales, alternatives to the program should be sought. If viable and effective programs are found, the "sighting advisory system" should be replaced.

d. Standardize surveys and data collection to ensure data obtained from the surveys are of maximum use for subsequent analysis of whale distribution and abundance.

In conjunction with periodic reviews of the sighting advisory system, the survey program should be evaluated to ensure that data collection is standardized, including standardization between years, and between surveys (spatially and temporally) such that the data obtained are of maximum use to subsequent analysis of right whale distribution and population assessment.

e. Establish a program for regular and timely analysis of aircraft survey data to determine seasonal whale distribution and abundance, to contribute to predictive modeling exercises of environmental correlates relative to whale distribution, whale distribution relative to ship traffic, and use in subsequent risk analysis.

As survey methods and routes are standardized, the data derived should be used in analysis of right whale distribution and abundance. Also, as indicated elsewhere in this outline, these data also represent useful contributions to studies of oceanographic and environmental features that influence right whale distribution and identification of ways to reduce the occurrence of ship strikes. The data should also be made available to those maintaining right whale-related GIS.

f. Use acoustic detection technology (e.g., “pop-up” buoys), surveys, and other technologies as available to monitor right whale occurrence and distribution in waters off the mid-Atlantic states. Assess the need for protective measures in these areas.

Waters off the mid-Atlantic states are likely important migration corridors for right whales moving from feeding and nursery areas. Likewise, these may be areas in which human impact also occurs. Surveys, using aircraft/visual and/or acoustic technologies, should be done to assess the relative importance of this area for right whales, and whale distribution within the area. If human impacts are occurring – as it currently appears they are – then steps should be taken to establish protective measures in waters off the mid-Atlantic states.

2. Vessel Traffic Management

It is clear that every possible and feasible action should be taken to reduce the likelihood of ship strikes. Coordinated effort is needed to explore all possibilities of reducing the risk. Some actions, such as requiring reductions in ship speed in certain areas or modifying ship channels or routing patterns, are likely to cause economic hardship. While such measures are likely to be burdensome and contentious, they may be necessary if ship strikes continue to occur. However, there may be voluntary measures that mariners can take to reduce the possibility of a strike

occurring.

a. Assess the utility and feasibility of voluntary and mandatory ship routing measures in right whale habitat.

Studies are needed on the advantages and disadvantages -- both biological and economic -- of mandatory and voluntary right whale protective measures. It may be that if voluntary precautionary actions are taken by a significant number of ship captains, the occurrence of ship strikes will diminish. However, discussions with shipping industry representatives indicate that voluntary measures are not likely to be effective due to the intense competition inherent in the industry. These representatives indicate mandatory measures may be more reasonable and effective in protecting right whales in the long term. At present, there is not enough information to make informed decisions about such options, and studies are needed to determine the degree of risk/benefit associated with different vessel management scenarios. At present, it appears that routing measures may be most effective in the southeast U.S.

i. Assess the utility of ship routing changes in southeast U.S. critical habitat.

Whereas a variety of shipping industry management options in all areas should be assessed, ship activities in the southeast United States critical habitat warrant special consideration given the high level of traffic and the aggregation of mothers and calves that occur there. Hundreds of ship passages occur annually through SEUS right whale critical habitat in the entering ports of Jacksonville, Kings Bay, Mayport, Brunswick, Cape Canaveral, and Fernandina. One way to minimize the transit time and distance through the habitat is to require or encourage ships to approach and depart the coast on east-west headings through critical habitat, rather than at more oblique angles. There may be economic downsides to this as transit time and distance overall may be greater, and there may be resistance from the shipping community. Studies should be conducted to determine whether such a modification of ship traffic patterns into all major SEUS ports is likely to decrease the probability of ship strikes and to assess the advantages and disadvantages of such modifications of ships' courses. Regardless of whether the studies are done, requiring such routing changes should be considered.

All U.S. Navy ships are already using such courses; and the Navy is to be commended for those efforts. If changes in routing are required or encouraged, and all or nearly all commercial ships comply, it may be possible to closely survey and monitor smaller and more finite areas than are currently being surveyed under the existing sighting advisory system.

In conjunction with the decision to route ships along east-west channels when traversing right whale critical habitat, consideration should also be given to extending the channel further east. For example, the Jacksonville channel marker buoy would be moved further offshore to 81 degrees or 80 degrees 50’. Thus, ships exiting Jacksonville would come to the buoy at 81 degrees before fanning out for the more offshore route; and incoming ships would intersect the buoy at 81 degrees before making a westbound course for the destination port.

b. Assess the possibility of voluntary and mandatory speed restrictions in right whale habitat.

Ships moving at slow speeds may reduce the likelihood of right whale ship strikes. It is possible

that some actions, such as slowing the vessel in certain conditions and in certain locations, will not represent a significant economic hardship and ship captains may be willing to take such steps. If true, and if ship captains and agents are provided with such information along with information on the severity of the situation of right whales, it is possible that ship operators will voluntarily adopt such actions, particularly if they appreciate the benefit they may receive from the "positive press." However, as noted above, given the highly competitive nature of the industry voluntary speed restrictions may not be feasible. Therefore, if ship strikes continue it may be necessary to institute mandatory speed restrictions in an effort to reduce the likelihood of ship strikes. These possibilities should be assessed as well.

c. Using existing data on whale sightings and vessel locations, conduct risk assessment analyses of various ship routing or speed options to assess the best set of vessel traffic management options by area.

Risk assessment analysis – involving whale sighting locations to ship traffic patterns – can be an important tool in assessing the set of ship management options to reduce ship strikes. Such analyses should be specific to each region.

d. Assess the potential economic impact of vessel management options.

As noted above, it is possible that relatively minor adjustments to a ship operation may not induce insurmountable economic burdens; and studies are needed to determine economic burden of certain options. If economic burdens are small, the shipping industry may be amenable and open to making relatively simple modifications to ship operations that reduce the risk of ship strikes.

e. Work with mariners and the shipping industry to establish voluntary or mandatory changes (e.g., speed and routing) in ship operations to reduce the likelihood of ship/whale interactions.

If feasible voluntary measures are identified, efforts should be made to work with the shipping industry to implement them. If ship strikes continue, it may be necessary to implement mandatory speed or routing restrictions. Again, the industry should be involved in developing and implementing such measures.

f. Assess whether these measures, other voluntary or mandatory protective measures, and other measures identified in this plan are reducing or likely reducing the occurrence of ship strikes. If ship strikes continue at an "unacceptable" level, consider and recommend measures to eliminate vessel strikes.

Programs should be established to monitor the effectiveness of steps taken to reduce ship strikes. If ship strikes continue, increasingly stringent measures should be implemented.

g. Assess the feasibility of modifying intermodal transport system links that would reduce the number of vessels operating in right whale habitat during periods of high right whale use.

It may be possible to find ways to reduce the overall number of ships using right whale habitat at times when whales are present. An assessment, and perhaps alteration, of the ways in which

commercial goods are moved through various ports might reduce the overall number of ships traversing right whale habitat.

3. Education and Outreach

Each ship traversing or planning to traverse areas where right whales occur should be provided with as much information as possible on the vulnerability of right whales to ship strikes and precautions about avoiding right whales. Therefore, programs should be developed, or maintained and improved if they exist, to improve mariner awareness about this problem. Liaison and dialog with the shipping industry should be established to ensure the industry is aware of protective measures and to explore ways to further reduce the risk of ship strikes. In addition, navigational aids should include such information. Ships' captains in U.S. waters are required to carry and consult U.S. *Coast Pilots* and all mariners consult NOAA marine charts. These aids to the mariner should contain accurate and current information on the occurrence of right whales, the 500-yard no approach rule, critical habitat, precautionary measures on avoiding ship strikes, and other relevant information.

a. Establish regionally-based liaison positions to work directly, and maintain a dialog, with the shipping industry, discuss feasibility of various management measures, foster industry cooperation, and conduct related activities.

Communication between appropriate entities is a key element to addressing the problem of ship strikes. Positions should be established and filled with people with knowledge of, and contacts within, the industry to serve as liaison and be a conduit of information to and from the industry and management agencies. Further, this role will be critical to working with representatives of the industry and management agencies to assess the effectiveness of existing programs and explore new protective measures.

b. Develop programs and materials to educate mariners about right whales and to provide recommended practices to help avoid ship strikes.

Providing current, readily understood, and high-quality information to mariners about ship strikes is critical. A number of materials is already provided. Efforts should be made to ensure these are current and to have programs in place for their distribution.

c. Routinely review and update information about right whale habitat and high-use areas, right whale vulnerability to ship strikes, and related ship collision reduction measures on nautical charts, *Coast Pilots*, published *Notice to Mariners*, and other appropriate navigational aids.

Recent efforts have ensured that *Coast Pilots*, nautical charts, Notices to Mariners, and Sailing Directions contain information on critical habitat and the 500-yard no approach rule, and related information on right whale occurrence and precautionary measures that can be taken to avoid striking right whales. These documents should be reviewed annually to ensure that the information is accurate and current. If possible, other similar documents should be identified and similarly updated annually.

4. Mandatory Ship Reporting Systems

a. Continue to implement mandatory ship reporting systems along the east coast of the United States.

A Mandatory Ship Reporting (MSR) system proposed by NOAA and the USCG was adopted by the International Maritime Organization (IMO) in December 1998. It became operational in July 1999. The systems will operate in two areas: the Great South Channel off Massachusetts year round, and in the major calving ground off the Georgia/Florida coast (November – March). They require all commercial ships over 300 tons to report to a shore station when entering right whale habitat. In return, ships receive an automated message about right whales, precautionary measures for avoiding ship strikes, and locations of right whale sightings. The system is also expected to provide information about the movements of ships through right whale critical habitats; these data are essential to the planning of future mitigation measures.

b. To the extent possible, use incoming information from the reporting system for analysis of ship volume and routing studies with a view to assessing possible measures to reduce ship/whale interactions.

Incoming data from ships passing through right whale critical habitat should be assessed relative to right whale occurrence in the particular habitat, in order to aid in identifying additional steps that can be taken to reduce ship strikes.

c. Periodically assess the effectiveness of existing ship reporting systems and reporting areas -- both with regard to their operation and capacity to reduce ship strikes -- and consider implementing others or expanding the existing ones, as necessary.

While it is generally believed that the reporting systems help reduce the risk of ship strikes, the effectiveness of the systems in doing so needs to be assessed at least once every two years. In addition, assessments should be done to determine ways to improve the systems. For example, if effective in reducing the likelihood of ship strikes, consideration should be given to expanding the reporting areas or perhaps creating new reporting areas elsewhere.

d. Monitor compliance with the mandatory ship reporting system and take steps to improve compliance as necessary.

Early indications are that not all ships entering right whale critical habitat have reported to the systems, although doing so is mandatory under U.S. law. Lower than expected compliance rates are almost certainly linked to the fact the program is new. Compliance rates will likely improve, but mariners may also not be aware of the program, do not understand its significance, or do not know how to report. It is possible that ships entering U.S. ports for the first time or ships that do not frequent U.S. ports near right whale critical habitat (e.g., foreign flag ships) are not aware of the reporting systems. Regardless, steps should be taken to improve compliance by improving the outreach program and by considering issuing fines for ships that do not report. The USCG has recently begun (spring 2001) issuing a letter to non-reporting ships explaining that fines may be levied for ships that do not report.

e. Continue and improve outreach efforts to educate the shipping community about the mandatory ship reporting system.

A number of steps have been taken to "advertise" and explain the use of the system. For example, educational placards and other materials have been developed and are routinely distributed by NMFS and the USCG, and are made available at numerous shipping related venues. A web site has been created. In addition, ships that do not report are contacted by NMFS or the USCG transmitting a letter which explains the requirements and provides information on how and when to report. Nonetheless, relatively low compliance rates suggest more needs to be done.

5. Critical Habitat

a. Analyze available data and collect additional whale sighting data as necessary to assess expanding or modifying the critical habitat boundaries. This is particularly relevant in the southeastern U.S.

There are sighting data that suggest that right whales occur with some regularity, but not in high numbers, outside right whale critical habitat off the southeastern United States. These data and historic data should be analyzed to assess whether whales occur outside the critical habitat in sufficient number to warrant expansion of the size of the critical habitat.

Critical habitat designations off the northeast U.S. are probably adequate and appropriate at this time. However, the current boundaries should be assessed to determine if they are maximally useful. If modification of the boundaries is warranted, modification should be sought.

b. If warranted, revise critical habitat boundaries.

If the data and the analysis indicate that a modification of the critical habitat boundaries is beneficial, then they should be revised.

6. Whale Detection Technology

Existing or not-yet-developed technologies may be useful in reducing ship strikes by locating whales and using the information to alert mariners to whale locations. Promising technologies should be identified and experiments should be conducted to determine their effectiveness. If deemed effective in field trials, such technologies should be put into use as soon as possible. At the time of this writing, the most promising technologies are active acoustic (e.g., SONAR) devices, and passive listening systems to detect whales. More work than done to date needs to be done to explore the use of enhanced visual detection. Remote sensing systems may be useful in locating whales at the surface and "alerting" devices affixed to ships should be considered.

a. Conduct studies of active acoustic (e.g., SONAR) and passive acoustic devices (e.g., "pop-up buoys"), and other underwater acoustic technologies to determine their feasibility and efficiency in detecting submerged whales.

Existing SONAR devices, or ones under development, might be capable of detecting submerged whales. They may be particularly useful in areas where ship traffic routes are finite and clearly delineated to relatively small areas, such as shipping channels off the southeast United States. Limitations include cost and the capacity to differentiate whales from other biological features (e.g., fish schools) or oceanographic features (e.g., certain types of water masses). Trials should

be conducted to assess SONAR feasibility in this regard. However, use of such devices should be chosen carefully given possible adverse effects to other marine taxa and of increasing exposure of whales to noise.

Large-scale passive listening systems, such as the Navy's "Sound Surveillance System" (SOSUS) hydrophone arrays, have been used successfully to detect and track several large whale species over great distances by localizing their vocalizations. Smaller scale arrays may be useful in localizing right whales. “Pop-up buoys”, now being studied for detecting whales, and other passive listening systems may have promise. However, there are limitations. For example, preliminary indications are that right whales do not vocalize frequently in some settings and while engaged in some behavior. Also, right whales are distributed largely over the continental shelf where systems such as the SOSUS array are ineffective (for reasons related to bathymetry) in detecting right whales.

i. If SONAR devices, passive listening, or other technologies are capable of detecting submerged whales, implement systems to use the devices to reduce ship/whale interactions. Conduct studies to assess the impact on marine mammals of acoustic pollution from proliferation of such SONAR devices, and determine whether potential cost exceeds potential benefit to right whales.

As indicated above, if such devices are successful at detecting whales and potential benefit exceeds potential cost, they should be deployed as soon as possible. Information on detected whales should be promptly transmitted to transiting ships using existing procedures. However, they should be chosen and used judiciously as their use may have adverse effects on other taxa.

b. Assess the utility of such devices on relatively large scales: high whale use areas and times, or high ship use areas, or perhaps on regional scales.

If underwater acoustic devices effectively detect submerged whales with some relatively high level of probability, they should be assessed for wide-scale use to reduce the risk of ship strikes. It may be possible to deploy passive listening systems on fairly wide scales such as primary shipping lanes, or whale aggregation areas. It may be possible to deploy them seasonally in certain areas.

The use of SONAR devices, however, is likely to be problematic as (a) there may be potential for adverse effects to other taxa, (b) they increase the level of noise in the ocean, whereas a reduction is preferable, (c) the sound source may need to be substantial to increase the range of detection, and (d) deploying devices on ships may be difficult and expensive.

c. Conduct studies of whale behavior relative to various types of “alerting” sounds that may warn sleeping, feeding, or courting whales to the presence of oncoming ships, and assess the desirability of deploying such devices in an environment already heavily polluted by noise.

Three factors that likely contribute to the occurrence of ship strikes are that right whales (a) spend considerable time at the surface, (b) apparently spend relatively long periods of lowered sensory awareness while "rafting" at the surface, and (c) apparently can be so focused on vital activities (e.g., feeding, nursing, or courtship) that they do not notice or react to an oncoming ship. It may be possible to alert or warn the animals that a ship is approaching by activating an

alarm or acoustically offensive or painful warning device on the vessel. However, use of such devices should be done with extreme caution. The underwater world is already a very noisy place for animals that rely on sound for vital functions and the introduction of more noise should be considered very carefully. In addition, the idea of repeatedly deterring whales from a preferred habitat needs to be carefully considered. Also, equipping scores of ships with such devices would not only be costly and logistically complicated, but also might confuse or stress right whales. Therefore, carefully designed experiments should be carried out to assess right whale response to such devices.

d. Assess the feasibility of improved visual detection technologies.

Enhanced visual detection of whales at the surface from ships may reduce the risk of ship strikes. If feasible, enhanced visual detection technologies may be a relatively economical way to improve detection, and may be particularly useful in low light or poor visibility situations. Some technologies, such as night vision scopes and infrared cameras, have been studied for some whale species, but their utility has not been fully explored. Studies should be done to determine if improved visual detection technologies are plausible and, if so, programs should be established to deploy such devices.

e. Assess the feasibility and utility of using remote sensing to characterize right whale distribution patterns and use in predictive models of right whale distribution patterns near high ship traffic areas.

A number of remote sensing technologies, such as various types of satellite-based imagery, may have the capability to detect right whales, and such technologies that might be promising in this regard should be evaluated. If these techniques are able to detect right whales remotely, it may be possible to collect considerable quantities of such data in relatively short amounts of time. If so, right whale location data should be used in developing predictive models of right whale occurrence and distribution relative to oceanographic features and relative to shipping lanes. Also, sighting locations could then be transmitted in real time to mariners as areas to be avoided.

7. Geographic Information Systems (GIS)

a. Incorporate data from “whale alert” aircraft surveys, scientific survey data, other confirmed right whale sightings and ship traffic data obtained from the mandatory ship reporting system, in GIS for analysis of whale/ship interactions.

A GIS is most powerful when appropriate questions are asked and tested, and when the best available information is used. Seasonal surveys (both for the whale alert program and scientific assessment purposes) generate considerable data on right whale locations and ship traffic distribution in certain areas. These data should be analyzed using GIS or other appropriate systems; analysts should be prepared to provide periodic results of analysis of whale distribution relative to ship distribution in a timely manner. Such analyses may in turn lead to protective measures for right whales relative to ship traffic.

b. Establish or use existing GIS to (a) conduct analysis of environmental correlates for right whale occurrence and distribution, (b) prepare predictive models of where and when right whales are likely to occur, (c) determine times and areas in which right whales and heavy ship

traffic are likely to occur, and (d) assess ways to minimize ship/whale interactions.

When used to their full potential, GIS can be powerful tools for storing, displaying, and analyzing diverse data sets. In recent years, GIS have been used for sophisticated analysis in many disciplines. Establishing and maintaining a GIS, or a set of GIS, devoted wholly or largely to right whale and right whale related data would be useful in addressing specific biological questions and helping to identify protection measures. Individuals and entities with interest in creating such a system should be identified and efforts made to identify and secure databases relevant to right whale management.

Steps should be taken to ensure that appropriate data "coverages" are derived (or obtained) and verified. Among the most important of these are coverages of right whale sighting locations, both historic and recent. These data should be updated periodically – at least once every two years. Analysis of such data and trends in the data may provide information on local or large-scale shifts in right whale distribution. When combined with information on features that characterize right whale habitat, predictors about right whale habitat use and occurrence are likely to emerge. In addition, coverages of ship traffic patterns and distribution should be created and compared to whale sighting locations. When possible statistical analyses should be used; however, visual analysis alone may also reveal patterns worthy of further consideration.

c. Identify and obtain data from additional sources (e.g., biological and physical oceanographic data, human activities) for GIS application and analysis.

As noted above, the most current and complete data sets should be incorporated into GIS and GIS-related analyses. Therefore, relevant databases on physical and oceanographic data should be identified, and when possible, made available to GIS analysts. These should include, but may not be limited to, data on salinity; sea surface temperature; bathymetry indicators of basin-scale and smaller oceanic fronts; indicators of internal waves and other relatively localized fronts; chlorophyll or other indicators of primary productivity; right whale prey occurrence, abundance and density; and distribution of various marine vertebrate (e.g., sea birds) and invertebrate (e.g. copepods) species. In this regard, attempts should be made to link right whale distribution to environmental correlates.

8. Studies of the Effects of Ship Noise on Whale Behavior

a. Using benign techniques, conduct studies of whale responses to ship noise and to ships of various types and speeds.

A series of studies should be designed and conducted to examine whale response relative to approaching ships. Similar studies should be conducted on whale response to ships of various sizes and while traveling at various speeds. Such studies should consider, but not be limited to, quantification of noise levels fore, aft, and abeam of vessels of various size, class, and hull-design, and at various depths. There may be "acoustic shadows" directly in front of a ship and other noise magnification or nulling nodes at various distances from ships or at various depths. Assessments should be made about whether whales can detect ships and their interactions to the vessels.

9. Monitoring

a. Continue to review and evaluate stranding and photo-identification data for evidence of collision between ships and whales.

II. Entanglement in Fishing Gear

Entanglement in fishing gear is a known major source of injury and death in right whales. While entanglement is not always fatal, it can seriously disable a whale; and death can result from lengthy entanglements.

A. *Reduce injury and mortality caused by fisheries and fishing equipment*

All reasonable efforts should be made to reduce the likelihood of entanglement and to free or facilitate the freeing of whales caught in fishing gear. Activities being undertaken by the NMFS, under the auspices of the Atlantic Large Whale Take Reduction Plan (e.g., time/area closures, gear modification research), should be continued and closely monitored for their relative success. Options considered should include, but not be limited to, time/area closures, alternative gear, and gear modifications. The plan should be modified if it is ineffective in attaining its goals.
If unacceptable rates of entanglement continue, increasingly stringent measures should be put into place to lower the rate. As noted above, gear modification research should be continued and promising modifications used in fisheries. However, more stringent measures also should be considered. Consideration should be given, for example, to increasing the temporal and spatial scope of time/area fishery closures identified in the ALWTRP. It may become necessary to strongly curtail some fisheries in some areas.

1. Operations

a. Develop and implement strategies to modify fishing operations and gear to eliminate entanglement and assess the effectiveness of such strategies. If entanglements continue or increase, increasingly stringent steps should be taken to reduce entanglement rates.

i. Conduct research on alternative fishing methods.

The gear types most involved in the entanglement of right whales are lobster pots (and their accompanying lines), and set nets. Studies should be conducted on means to catch target species using alternative gear.

b. Work with Canadian officials to develop means to reduce entanglement levels in the Bay of Fundy.

Some right whale entanglements occur in Canadian waters. Therefore, Canada and the United States should ensure that all reasonable actions are being taken to minimize right whale entanglement and to ensure that protective measures complement each other. Bi-lateral meetings should be held periodically to assess the effectiveness of efforts to reduce entanglement and to exchange information on ways to improve protective measures.

2. Gear

a. Conduct studies of gear modifications that reduce the likelihood of entanglement, effects of entanglements, and enhance the possibility of disentanglement. These studies might include, but should not be limited to, assessment of bio-degradable vertical lines, ways to reduce the number and length of vertical lines, increasing the visibility of vertical lines, and designing breakaway links for heavy gear.

Current and ongoing research on possible modifications to fishing gear that facilitate an entangled whale to free itself once entangled should be continued and accelerated. The most effective and promising modifications should be implemented as soon as possible. The degree to which modifications allow entangled whales to free themselves should be closely monitored. Modifications that seem promising should be the subject of further research and implemented if deemed effective.

b. Design and implement programs to incorporate gear modifications that reduce entanglement into the fisheries operations.

When modifications are found to be effective in reducing entanglement, they should be implemented into fishing operations immediately.

3. Reporting

When an entanglement occurs or when an entangled whale is seen, it is vital that such information is relayed to the proper authorities in a timely manner. Therefore, programs directed at obtaining information about the location and circumstances of entangled whales should be continued and expanded.

a. Continue to prepare and distribute information on whale entanglement to fishermen and other mariners and encourage reporting of entanglements to the disentanglement network.

The fishermen themselves are essential to the process of reducing entanglements and freeing entangled whales; and their continued involvement should be encouraged. In this regard, ongoing efforts to "educate" fishermen about disentanglement efforts and the need to report entangled whales should be continued. This information dissemination program should be continued and evaluated periodically to ensure that it is as effective as it can be in reaching all relevant fishermen.

b. Continue, expand, and improve procedures for responding to reports of entangled whales.

Prompt response to reports of entangled whales is essential. Procedures need to be in place to ensure that response is swift. Efforts to increase the scope and improve the efficiency of the system should be ongoing.

c. Expand fisheries observer programs.

Observer programs are a good source of information on entangled right whales, but they can be exceedingly costly. Where feasible, such programs should be expanded to include more fisheries

and to provide increased coverage of fisheries that have observer programs. In addition, programs aimed at educating fishermen and observers about disentanglement efforts and needed follow-up actions should be expanded.

d. Continue to review, evaluate, and act upon reports from fishermen and fishery observers of fishery interactions with right whales.

As noted above, observer programs and programs designed to encourage fisher involvement should be evaluated to improve their effectiveness. Such evaluation should be ongoing. If deficiencies are identified, they should be addressed immediately.

e. If evaluations indicate that reporting can/should be improved, implement improved systems for reporting.

Ways to improve reporting may be identified. If so, they should be implemented immediately.

4. Disentanglement

As long as fisheries are allowed to continue and remain economically viable, some level of entanglement is likely to occur. That is, entanglement is nearly inevitable. Therefore, disentanglement readiness, contingencies, and programs are essential, and should always be a high priority, since prevention of even a single mortality may be significant to recovery.

a. When possible, disentangle whales caught in fishing gear.

Whenever feasible, and with maximum regard for human safety, efforts should be made to free every entangled whale. Therefore, clearly defined contingencies and strategies should always be in place.

i. Create and maintain disentanglement equipment caches and make appropriate arrangements to get disentangling teams and equipment to entangled whales.

An essential component of disentanglement plans is possession of and rapid access to the proper equipment. Therefore, additional key sites where such equipment caches are needed should be identified so that equipment used in disentanglement efforts can be prepared and stored in these additional locations and made readily accessible to respond to an entangled whale anywhere along the U.S. eastern seaboard. It is essential to ensure all elements of each cache are well maintained and replaced as needed and that any newly identified equipment which proves useful (e.g., newly developed tools or newly discovered uses for existing products) is added to each cache. Also, plans should be designed for getting qualified and well-equipped disentanglement teams to any entangled whale along the entire U.S. eastern seaboard.

ii. Develop and train additional disentanglement response teams.

Disentangling whales can be dangerous. Experienced, well-trained teams should be the only responders. Responding teams should be well-versed and experienced in disentanglement procedures. To better respond to entanglements and remote locations, additional disentanglement teams and personnel should be trained. Having several teams trained and prepared to respond

would allow multiple teams to respond, if entanglements occurred simultaneously or in separate locations, and perhaps allow for a more prompt response to remote locations. Efforts to expand disentanglement response to the entire U.S. east coast should be reviewed and upgraded if necessary to ensure coverage is adequate.

iii. Design and conduct studies on advanced disentanglement gear.

Existing disentanglement gear typically is "low-tech." However, it is possible that some methods or gear not currently used in such events may be useful in freeing a whale. Studies of possible advances in gear used for disentanglement should be done. If promising new advances are identified, they should be made available and used. They should be added to equipment caches.

b. Identify and implement ways to improve disentanglement efforts.

In the course of conducting disentanglements, ways to improve the chances of freeing a whale may become clear. If so, such improvements should be used in future events. Also, the principals in the disentanglement effort should meet periodically (at least annually), and in particular after each event, to discuss ways of improving the procedures used. Discussions should be held regarding the possible development of new, or refinement of existing, equipment, and ways to reduce response times.

5. Monitoring of Entanglement Rates and Evaluation of Protective Measures

It is imperative that any programs used to reduce fishing gear entanglement be monitored to determine their relative success. If monitoring studies indicate that scarring rates are not decreasing or other factors indicate that entanglement rates are not decreasing, additional and increasingly stringent protective measures should be identified and implemented.

a. Monitor entanglement-related injury and mortality rates.

Data on the number of observed or reported entangled whales should be routinely compiled and regularly (at least annually) analyzed to assess patterns or trends in entanglement rates and entanglement related mortality.

b. Determine whether measures to reduce entanglement are effective.

Steps should be taken to evaluate the effectiveness of measures to reduce the risk of entanglement. Clearly, deaths caused by entanglement are an indication that adequate protective measures are not being used. However, a large number of right whales carry scars from previous entanglement events. Therefore, scarring rates and trends in scarring rates – from photo-identification data -- are a means (albeit perhaps not particularly precise) of assessing the relative effectiveness of protective measures. These and other techniques should be used to routinely assess the effectiveness of measures used.

c. Identify and implement steps to improve protective measures.

If entanglement rates are not decreasing in spite of protective actions taken, those actions should

be re-assessed and revised to reduce entanglement rates. The goal is to reduce the rate to a number as low as possible; and if the rate is not dropping, the various approaches to reduce fishery interactions should be re-evaluated and subsequently changed to include new or modified protective measures.

6. Photo-identification Data Analysis

a. Review and evaluate stranding data and photo-identification data to monitor rates and effects of interactions with fishing gear, and assess effectiveness of mitigation measures.

One way to monitor the success of protective measures is through analysis of the individual photo-identification database for trends in scarring rates or evidence of new scars. Other sources of such information are dead and stranded whales, which should be examined for evidence of entanglement, as well as identified to individual where possible, to allow for comparison with animals in the scarification catalogue.

III. Education and Outreach

A. Providing Relevant and Timely Information

Educating ship operators, the fishing community and other mariners (including recreational users) about the occurrence and distribution of right whales, their vulnerability to ship strikes and entanglement and the steps that mariners can take to avoid right whales may be one of the simplest and most cost-effective ways of reducing the likelihood of these threats. Therefore, programs should be developed which describe a comprehensive outreach and education program. These programs should identify and describe the types of material, information and medium to be used, the expected target and expected outcome, and the expected number of people reached. They should also involve follow-up to determine if the expected effectiveness is being attained. Programs should be evaluated and improved periodically.

1. Continue and expand efforts to educate mariners and the shipping industry, and fishermen and the fishing industry, about right whale vulnerability to ship strikes and fishing gear entanglement.

a. Use all reasonable avenues to educate mariners and fishermen about the occurrence of right whales and their vulnerability to ship strikes and fishing gear entanglement. Such efforts should include, but not be limited to, development and distribution of brochures, placards, fliers, videos, articles in industry journals, and through direct liaison with the industry.

b. Ensure that right whale protective measures are incorporated and periodically updated in policy guidance documents of the International Safety Management Code and USCG training courses for vessel auditors and inspectors. In addition, efforts should be made to work with maritime academies (e.g., Kings Point, Massachusetts Maritime) to incorporate right whale protective measures into their curricula.

The USCG has an important role in helping to educate ship operators about the vulnerability of right whales to ship strikes, inasmuch as USCG personnel are in frequent contact with vessel operators. The USCG-implemented International Safety Management Code is a useful vehicle

through which mariners can be educated about right whales. Implementation of the code involves regular portside boardings of selected ships, and the exchange of vessel- and human-safety related issues. A large number of mariners can be reached by including information on guidelines for avoiding ship strikes in material that is distributed. In this regard, the information that is distributed, and materials used to train inspectors and auditors should be periodically updated and steps should be made to ensure that current and appropriate information is being distributed. This information should be updated at least once every two years, and the program for getting such information out assessed and, if necessary, improved on the same schedule.

Education of mariners about right whale conservation issues should begin in school. The curricula at maritime academies, including NOAA and USCG academies, and other marine related schools, should include information on the status of right whales, their vulnerability to ship strikes, and measures in place or being contemplated to protect the species.

IV. Enforcement

A. Programs for enforcing regulations

1. Enforce fishing and shipping regulations.

a. Continue and improve programs to ensure that fishing and shipping regulations are enforced.

A number of fishing and shipping regulations have been instituted in recent years and a number of additional regulations are being contemplated at the time of this writing. These include, but are not limited to, vessel approach regulations, fishing gear and time/area restrictions as implemented through the Atlantic Large Whale Take Reduction Plan, and the Mandatory Ship Reporting system. However, regulations are only effective if they are adhered to. Generally, compliance has been good, but can be improved. Steps need to be taken, and resources provided, to ensure that these and future regulations are enforced.

Objective 2: <u>Identify, characterize, protect, and monitor important right whale habitats</u>.

I. Protect Right Whale Habitat

A. Monitoring and Reducing Human Impact

A number of human activities may adversely affect right whale habitat. These include (in order of severity of potential impact) (a) coastal development (e.g., dredging); (b) anthropogenic noise; (c) contaminants; and (d) oil and gas exploration and development.

There are few data regarding the possible indirect adverse effects of these types of human activities on right whales. However, it is possible that certain activities that degrade right whale habitat may be slowing population recovery. Studies are needed to determine if various activities are impacting right whales and right whale productivity.

1. Coastal Development

a. Conduct studies to determine the direct and indirect effects of activities and impacts associated with coastal development on the distribution, behavior, and productivity of right whales. The activities and impacts studied should include, but not be limited to, sewage outfall, dredging activities (and associated plumes), dredge spoils, dumping, habitat alteration, noise, and aquaculture activities, including effects on prey species as well as on right whales directly.

b. As feasible, take steps to minimize identified adverse effects from coastal development.

2. Anthropogenic Noise

A number of human activities result in the introduction of substantial amounts of noise into the sea. No ocean basin is free of noise from human activities. Among the various sources, noise from ships may be the greatest and most ubiquitous. The level of sound from ships, virtually non-existent 100 years ago, has gradually but significantly increased in recent decades.

Numerous studies have been conducted on the effects of some types of noise on marine mammals. The results are equivocal. That is, the effects may be more dependent on the species and activity of the individuals than on the type, character, or amplitude of the sound. When engaged in vital behavior, such as feeding or courtship, whales may be relatively unresponsive to loud sounds. For example, in several studies bowhead whales showed little overt reaction when exposed to industrial noise (Richardson *et al*. 1995). However, many, perhaps all marine mammal species, are highly dependent on sound for such things as locating conspecifics, perhaps locating prey, and sensing their environment. It is highly likely that marine mammals, including right whales, are adversely affected by anthropogenic noise, regardless of whether scientific studies have sufficient resolution to detect such disturbance.

a. Conduct studies to assess the direct and indirect effects of anthropogenic noise on the distribution, behavior, and productivity of right whales. Noise sources studied should include, but not be limited to, industrial and shipping activities, oceanographic experiments, military-related activities, and other human activities.

Studies are needed to assess potential adverse effects of underwater noise (including ship noise) on right whales, including, but not limited to, disturbance of intraspecific communication, disruption of vital functions that are mediated by sound, distributional shifts, and stress from chronic or frequent exposure to loud sound.

b. Take steps to minimize identified adverse effects to right whales from anthropogenic noise.

If studies demonstrate that right whale productivity or behavior is significantly affected by anthropogenic sounds, steps should be taken to reduce or eliminate the loud sound sources.

As indicated above, noise from ships may be a significant, but largely overlooked, sound source adversely affecting whales. Although a logistically and economically difficult issue to address, strategies to reduce ship noise should be designed if the studies indicate that ship noise significantly effects right whale productivity or behavior.

3. Pollutants

a. Conduct studies to assess the sources and levels of anthropogenic pollutants and assess their possible adverse effects on right whales and their habitats. Such studies should focus on, but not be limited to, heavy metals, endocrine disrupters, immune suppressors, pathogens, and their exposure levels, pathways, and effects.

Anthropogenic contaminants may affect reproductive functions, suppress immune systems, or otherwise affect the health or productivity of right whales. Although there are no studies making such links in large whales, there is a possibility that such relationships exist. Therefore, studies should be conducted to determine if uptake and assimilation of contaminants are inhibiting the reproduction or productivity of right whales.

Where possible, actions should be taken and studies planned in the near-term to assess contaminant levels. For example, right whale tissue should be routinely provided to the National Marine Mammal Tissue bank for subsequent analysis of contaminant loads. In addition, to the extent possible, comparative studies should be conducted between systems (e.g., Southern Ocean) and taxa (e.g., bowhead and southern right whales) in which contaminants might be suspected as being particularly high or low, and where the adverse effects of high contaminant levels might be implicated in health or reproductive anomalies. Right whale researchers globally should be encouraged to assume a unified approach to conducting and reporting necropsies, and tissue sample collection, with regard to sampling for contaminant analysis in particular.

Blubber and other tissue samples have been archived from at least nine recent necropsies and are currently stored by the U.S. Fish and Wildlife Service and the Woods Hole Oceanographic Institute. These tissues should be reviewed for suitability, and selected samples analyzed for PCBs, pesticides, and dioxins. These samples should be analyzed to assess the way that the samples represent systemic burden in right whales and how this may differ from other mysticetes. Such analysis will also allow better interpretation of cytochrome P450 1A data that should also be generated from available fixed tissue samples - both dermis and internal organs where preserved. Histology samples suitable for this are available from many of the necropsies conducted in recent years.

In addition, right whale prey aggregations in the Gulf of Maine, Bay of Fundy, and Cape Cod Bay should be sampled and analyzed for PAH compounds and other contaminants, as compared to reference samples from Georges Bank (offshore New England). Further, copepod samples should be analyzed from these three regions, and compared with similar analyses conducted on krill and copepod samples from selected southern right whale feeding habitat, such as South Georgia. Such samples could be obtained in collaboration with the British Antarctic Survey annual krill survey.

b. Take steps to minimize identified adverse effects from anthropogenic pollutants.

If studies indicate that contaminants in the marine environment are adversely affecting right whales, steps should be taken to reduce the sources of such contaminants.

c. Conduct studies of individual health and body condition.

It is possible that frequent or chronic exposure to adverse effects of human activities, or accumulation of contaminants results in stress or reduced "health" of individuals. Also, reduced habitat quality could be affecting the health of individuals or the productivity of the population. In studies of land mammals and humans, fertility was shown to be affected by an insufficiency or excess of body fat. Measurement of body fat thickness is becoming practical at sea. It appears that there may be little seasonal variation in blubber thickness in individual right whales, however there may be variation in blubber thickness between those that are and are not reproductively successful. Further research on this question is needed. In addition, studies should be done to better understand reproductive and systemic health in right whales. Such research should focus on both biopsy and necropsy samples.

4. Oil and Gas Exploration and Development and other Industrial Activities

a. Conduct studies to assess possible adverse effects of oil, gas, and hard mineral exploration and development and other industrial activities.

A number of studies have been conducted on the effects of oil and gas exploration and development, and associated seismic surveys and ship and aircraft disturbance on some large whale species, notably bowhead whales. There are data on gray whale response to seismic sounds. However, no such studies have been conducted on the potential adverse effects on right whales. Additionally, seismic survey equipment has undergone recent developmental changes which alter many aspects of the sound characteristics and scope of their projection, making comparisons between the new and old systems difficult, if not impossible. While there are no known plans to lease areas for oil and gas exploration and development where North Atlantic right whales occur, the demand for oil may drive a future need. Therefore, before such plans are implemented, studies should be conducted on the potential adverse effects of these activities. As needed, studies should also be conducted on the potential effects of hard mineral exploration, and other industrial activities on right whales.

b. Take steps to minimize identified adverse effects from oil, gas, and hard mineral exploration and development.

If the studies reveal that adverse effects are likely, steps should be taken to restrict or prohibit such activities.

c. Monitor efforts to implement right whale-related protection measures in approved oil and gas exploration and development plans.

If areas where right whales occur are leased for mineral exploration and development, and mitigative or prohibitive measures are implemented, monitoring studies should be conducted to determine if the protective measures are effectively protecting right whales from adverse effects.

d. Assess and update, as necessary, existing contingency plans for oil and chemical spills in waters where right whales occur. Local, regional, and national authorities should all participate in the development of integrated plans.

Considerable quantities of oil and gas are moved by tanker in and near right whale habitat. The

possibility of a spill is significant. While the overall effects of spilled oil on cetaceans is equivocal, it is likely that the direct or indirect (e.g., prey) effects would be substantial. Therefore, local, regional, state, and federal authorities should work cooperatively to, as needed, update existing contingency plans already developed under the National Contingency Plan and to assess existing plans for adequacy in protecting right whales and their habitats. Authorities need to ensure the plans are integrated at various levels and that communication channels and spill response chains of command are clearly understood. Contingency plans should include, but not be limited to, strategies for containing and collecting spilled oil, monitoring the effects on whales in the area, stepped-up programs to detect oil and oil derivative uptake levels by sampling living and dead whales, and monitoring the effects on the distribution, abundance, and behavior of whales in the vicinity of the spill. NMFS is the lead agency in establishing appropriate guidelines for monitoring the effects on whales. It should also include clear specifications for which agencies, organizations, and personnel are responsible for responding to a spill.

5. Whale-Watching

While the close approach of any boat has the potential to disturb a marine mammal and may result in a collision, there are few data or indications that whale-watching activities effect whale behavior. However, the industry is expanding and increased boat activities may effect whales in ways not presently apparent. Many, but not all, commercial whale-watch boat operators are among the most careful boaters with respect to whales and whale behavior. Some individuals of some large whale species are attracted to whale-watch vessels. Also, individual identification photographs obtained by naturalists on whale-watch boats represent important contributions to the study of right whales. In addition, there is the added advantage of whale-watching of exposing the general public to whales, especially if there is a conservation message contained in the information provided by naturalists. The 500-yard no approach regulation has greatly curtailed whale-watching of right whales. Nonetheless, there is potential for adverse effects of whale-watching including the disturbance of vital behavior such as feeding and courtship inasmuch as boats may still watch from distances greater than 500 yards, whale watching may still occur in Canadian waters, and whale watch vessels pass into and through right whale habitat. At the time of this writing, NMFS is preparing a proposed rule with regard to whale watch, thrill craft and other vessels for certain areas and will propose developing regionally specific guidelines for operating these craft.

There are good indications that circling or low-altitude aircraft change the behavior of some large whale species, such as bowhead whales. This is particularly true of repeated passes. Therefore, circling, low altitude flight, and repeated passes by aircraft near right whales should be prohibited.

a. Conduct studies to assess the short- and long-term effects of whale-watching on right whales, notably with regard to high-speed vessels.

Studies should be conducted on the potential adverse effects of whale-watching. The studies should be carefully designed with appropriate controls, and caution should be used in conducting studies from boats inasmuch as the study vessel itself may cause disturbance. If the studies demonstrate that whale-watch vessels have adverse behavioral effects, steps should be taken to limit or eliminate watching of right whales. In addition, recent collisions between whale-watch boats and a humpback and a minke whale have raised concern about the impact of whale-

watching activities on large whales. Regulations should be considered, and guidelines developed regarding vessel speed near whales, and manner and distances of approaches.

The recent proliferation of high-speed whale-watch ships and ferries, particularly in the waters off the northeast U.S., represents a threat to right whales. The use of such craft should be closely monitored and if likely adverse effects are detected, use of the craft should be curtailed.

b. Assess the effectiveness of existing restrictions on whale watching activities to determine whether more restrictive measures are necessary or less restrictive measures could be permitted.

If regulations are issued to limit whale-watching, the effectiveness of the restrictions should be closely monitored. If monitoring studies indicate that the measures are not effective in deterring disturbance of whales, further restrictions should be considered.

c. Continue and expand education/public awareness programs to ensure that commercial and recreational vessel operators are aware of applicable regulations and guidelines.

Every feasible effort should be made to educate whale-watch vessel operators about safe distances and maneuvering relative to whales. In addition, efforts should be made to educate recreational vessel operators about approach regulations and guidelines. Trained naturalists should accompany each commercial whale watch trip and programs should be established to train naturalists. Conservation messages should be an essential component of information provided to whale-watchers by naturalists and whale-watch boat operators.

II. Right Whale Habitat

A. Characterize and Monitor Right Whale Habitat

1. Habitat Features

Reducing direct and indirect threats to right whale habitat is integral to recovery. Information is needed on environmental factors that influence right whale occurrence and distribution. In addition, adequate protective measures are needed to reduce or eliminate human-related impacts to right whale habitat.

a. Compile or collect relevant physical, chemical, biological, meteorological, fishery, and other data to characterize features of important habitats and potential sources of human-caused destruction and degradation of critical habitats.

Features of right whale habitat and environmental correlates of right whale distribution should be identified. Therefore, studies should be done to identify physical and biological determinants of right whale occurrence. That is, baseline data are needed on important components of the habitats. These should include, but should not be limited to, studies of relevant physical, chemical, biological, meteorological, prey species, fishery, marine vertebrate, and other data to characterize essential features of right whale habitats. Such information might be obtained through compilation and analysis (especially GIS-based analysis) of existing databases and through directed field studies. In addition, studies should be done of potential adverse effects of

human activities on right whales.

b. Monitor human activities to assess potential right whale habitat degradation.

A number of human activities may affect right whale recovery through direct or indirect adverse effects on right whale habitat. These include, but are not limited to, fishing, commercial shipping and other vessel traffic, oil exploration and development and other industrial activities, oil spills, release of organochlorines, heavy metals and other contaminants into the marine environment, municipal effluents, noise pollution, and dredging. Such activities may involve direct and indirect disturbance of key prey species, disturb right whale use of a particular habitat, or otherwise degrade the habitat. Therefore, studies are needed to assess the potential adverse effects of these activities on right whale habitat.

c. Monitor essential habitat features to assess potentially detrimental shifts in these features.

After baseline data are obtained and analyzed, ongoing studies should be done to determine if shifts are occurring in critical habitat components. Again, if shifts are detected and they are linked to human activities, actions should be taken to modify the activity to reduce or eliminate the causative agent.

d. Develop, implement, and monitor habitat protection strategies.

If studies reveal that important right whale habitats are affected by human activities, steps should be taken to mitigate the effects or reduce or eliminate the source of the impacts. In addition, monitoring studies should be done to assess the effectiveness of protective measures that are put into place.

e. Monitor right whale habitat use patterns to assess shifts that might reflect disturbance or degradation of habitat.

Right whale distribution and habitat use should be assessed periodically through surveys and, among other things, GIS analysis. Shifts in distribution or habitat use should be flagged as potentially resulting from anthropogenic sources of habitat degradation or disturbance. If studies reveal that changes to right whale habitat use are directly or indirectly linked to human activities, steps should be taken to limit or modify the activities.

f. Conduct comparative studies to more accurately characterize critical habitats, using known shifts in habitat use as opportunities to test distribution hypotheses.

Hypotheses should be formulated and tested regarding right whale habitat use and shifts in habitat use. Such testing should involve studies comparing current habitat use to past use, thereby providing an assessment of human-related shifts in distribution or habitat use.

g. Collaborate with Canadian authorities to protect important habitats and essential habitat features in Canadian waters.

Right whale range is transboundary. Protective measures should dove-tail with measures being

taken by the government of Canada. To the extent possible, such measures should include, but not be limited to, efforts to mitigate or reduce adverse effects from fishing activities, commercial shipping and other boat transits, the release of contaminants into the marine environment, oil spills, oil and gas exploration and development and other industrial activities, and activities that introduce loud noises into the marine environment. Bi-lateral cooperation should be mediated by regular contact and information exchange between appropriate government officials and periodic meetings. Periodic high-level bilateral meetings should be considered.

h. Support Canadian efforts to protect known right whale habitat in Canada.

Canada has established several conservation areas to protect right whales. To the extent that the protection of additional areas is sought, the United States should support and endorse such efforts. In addition, to the extent possible, U.S. and Canadian legislation and regulations should be used in concert to reduce threats to right whales.

2. Conduct studies to improve knowledge of the diet, food requirements, feeding habits, and food resources of right whales

Like most animals, right whale distribution and habitat use is highly correlated to prey abundance and availability. However, studies are needed to better understand the relationship between right whale occurrence and prey abundance, density and distribution. Models and relevant field testing should be used to predict right whale occurrence relative to prey occurrence and density. This work may be tied to broader-scale modeling to predict right whale distribution from environmental variables (see Clapham 1999).

a. Compile and evaluate information on the known types, amounts, locations, and availability of right whale prey.

Efforts to recover right whale populations will be closely linked to efforts to ensure that prey stocks are not adversely affected. In addition, an ability to predict prey occurrence will likely aid in predicting right whale occurrence; and shifts in prey abundance and density will likely lead to shifts in right whales' occurrence. If prey abundance or distribution is adversely affected by human activities, right whales will likely be affected as well. Therefore studies are needed (or expand on existing or past studies) to identify right whale prey species, occurrence, abundance, density, and availability. Such information may be derived from existing data or complement past or ongoing studies. However, it may also be necessary to conduct additional directed studies to address such questions.

b. Review and refine energetic models to better understand right whale food requirements and feeding strategies.

Models of right whale energetics have been devised, but they are somewhat crude and do not include the latest information. Existing models should be revised or new ones developed to predict and better understand energy requirements (i.e., levels of energy intake required to sustain individuals and populations) of right whales. Such information will help to determine if right whales are at carrying capacity and whether the existing environment (including possible human influences) can sustain right whales.

Objective 3: Monitor the status and trends of abundance and distribution of the western North Atlantic right whale DPS.

Accurate and periodic assessments of western North Atlantic right whale abundance and trends in abundance are essential to any right whale recovery efforts and assessing the relative effectiveness of protective measures. Monitoring studies should be conducted periodically (at least once every three years). Additional protective measures should be implemented if studies indicate that the population size is static or decreasing.

I. Status

1. Conduct a study or a workshop to determine the best methods for assessing western North Atlantic right whale status and trends, and to establish the optimal level of effort required

Considerable effort has been expended on gathering data on right whales, and this information represents a vital foundation for continued assessment of the population. Nonetheless, there is a need to review assessment methods in light of recent developments in the fields of biology and statistics. In addition, an assessment of the level and distribution of survey effort required to achieve optimal assessment results is essential to ensure that field work is as efficient and as cost-effective as possible.

2. Assess population size, survival rate and trends on a regular basis

Western North Atlantic right whale abundance should be estimated annually or biennially (depending upon the results of the study or workshop recommended above). The individual photo-identification database is perhaps the best source of information by which abundance can be estimated, but analytical methods and field effort should be designed for optimal results. Also, the techniques themselves used to determine abundance, status and trends need to be evaluated and, if needed, new or preferable techniques proposed. Population modeling should be conducted to assess status, trends, abundance, and vital rates (including reproduction and survivorship), but all such models must be biologically realistic.

a. At least once every three years, review and evaluate data on the status of the western North Atlantic right whale DPS. If needed, improve data collection and analysis methods.

Periodically, at least once every three years, the data should be evaluated to determine if they are as accurate and comprehensive as possible. If the evaluation indicates that the quality of the data, or the methods used for data storage or analysis could be improved, steps must be taken to improve data quality.

b. As necessary, develop and implement other programs necessary for population monitoring.

As noted above, the photo-identification database contains data best-suited for assessments of population size and trends in abundance. However, if superior assessment techniques are identified, or if alternative methods of analysis are identified, they should be used. The goal is to use the best possible and most accurate means of assessment.

II. Distribution

B. Surveys and Data Maintenance

1. Monitor right whale occurrence and habitat use pattern in known high-use areas

To obtain the best possible information on right whale occurrence, abundance, and distribution, surveys in the following geographic areas should be conducted at appropriate intervals. Methods for surveys in the areas should be standardized and consistent.

a. Continue to conduct annual winter surveys for right whales off the southeastern U.S. coast.

b. Continue to conduct annual summer surveys for right whales in the lower Bay of Fundy.

c. Continue annual spring surveys for right whales in the Great South Channel.

d. Continue to conduct annual winter/spring surveys for right whales in Cape Cod and Massachusetts bays.

e. Continue to conduct annual summer and fall surveys for right whales on the Scotian Shelf.

2. Conduct studies to locate unknown high-use areas for this population

The whereabouts of much of the right whale population is unknown during a portion of the year. The location of the majority of right whales in winter is unknown, and substantial portions of the population are unaccounted for at other times. In addition, a significant number of mothers observed in the southeastern U.S. do not take their calves to the Bay of Fundy during summer; whether they migrate to a second, unknown nursery area, or possess a more scattered distribution in shelf or other waters, is unclear. In these various unidentified locations, right whales may be exposed to threats from human activities. Therefore, identifying and studying such areas would be very valuable, and studies should be conducted to determine the location of such areas. For example, historical data indicate and recent data confirm that right whales use waters off mid-Atlantic states to some extent at least in some years. Surveys should be conducted for a number of years to determine the extent of right whale occurrence in these areas of high vessel traffic and fishing effort. Satellite tracking studies may be useful in determining where these areas occur, but other methods should also be considered as appropriate. These include review of historical records, and the use of predictive models based on environmental data.

3. Design and conduct surveys of likely wintering areas based on results of habitat and tracking studies, review of historical data, and results of predictive models

When currently unknown habitats are identified, studies should be conducted to learn more about residency times, migration routes, and the demographics of the whales using these locations. Such studies should be based on ship or aircraft surveys or through satellite tracking studies. The habitats should be characterized and any human activities likely to adversely affect the whales

identified and addressed appropriately.

4. Continue to maintain a database of right whale sightings

Any assessment of right whale abundance and distribution is dependent upon reliable and current information about sighting locations. Therefore, the existing (and historic) sighting database should be maintained. As feasible, efforts should be made to ensure that all right whale sighting information is included in the database.

III. Photo-identification Database

A. Data Maintenance and Analysis

As indicated elsewhere in this plan, the individual photo-identification database is one of the most valuable sources of information by which status and trends in abundance can be estimated. Whereas, violation of certain assumptions may complicate the use of "mark-recapture" types of analyses, photo-identification data provide minimum population values, trends in such values, survivorship, and other information. The database and its resulting catalog should be maintained and routinely updated with new photographs. The ways in which data are stored, analyzed, and made available to researchers should be assessed periodically (at least every three years) to identify ways to improve these processes.

1. Maintain and routinely update the right whale photo-identification catalog

The catalog of individually identified whales should be maintained and kept current, new additions processed as quickly as is feasible, and all researchers or other field workers encouraged to make timely submissions of all photographs of right whales.

2. Regularly and consistently review, evaluate, and update analyses of data in the right whale photo-identification catalog

The photo-identification catalog is an important tool for study of western North Atlantic right whale demographics. It is essential that the database be mined for specific types of analyses and to address specific questions. Neither a backlog of processing photographs for cataloging nor delays in providing photographs to the database should be factors in limiting critical analysis. For these reasons, the process for handling photographs, maintaining the database, the types and quality of analyses should be assessed, and improved as needed, at least once every three years.

3. Conduct studies to determine population structure using photo-identification data

IV. Strandings

A. Information from Dead Whales

1. Continue and improve program for necropsy of right whale carcasses.

The existing program supported by NMFS and, in general, carried out by contractor and a dedicated group of volunteers – the Marine Mammal Stranding Network – is quite good and

should be continued. Response to a stranding is generally quick and sampling thorough. However, there may be ways to improve the system. For example, it may be possible to identify steps to increase response or improve coordination of tissue sampling and disseminating data. Reliable sources of funding need to be established to ensure that every carcass is necropsied.

a. Review and, if needed, improve procedures for responding to reports of dead right whales and conducting necropsies to ensure that the most effective means are being used to extract scientific information from dead, stranded, and entangled right whales.

Each right whale carcass represents an important opportunity for scientific investigation of the cause of death, and for addressing questions on life history, and such matters as contaminant loads. Delays in attempts to secure or examine a carcass can result in the loss of valuable data, or even of the carcass itself. Every possible effort should be made to respond to and recover as much data as possible from each right whale carcass. The Stranding Network coordinator should work with appropriate agencies, organizations, and individuals to ensure that, when a right whale carcass is reported it is rapidly secured and: (i) a necropsy is performed as rapidly and as thoroughly as possible by qualified individuals selected to gather information regarding the cause of death; (ii) samples are taken and properly preserved for studies of genetics, toxicology, and pathology; and (iii) funding is available to notify and transport appropriate experts to the site rapidly and to distribute tissue samples to appropriate locations for analysis or storage. In addition, the coordinator should work with stranding networks and the scientific community to develop and maintain lists of tissue samples requested by qualified individuals and agencies, and ensure that these samples are collected routinely from each carcass and stored in appropriate locations or distributed to appropriate researchers.

b. Improve or, as necessary, develop and implement protocols for securing and retrieving stranded or floating right whale carcasses

The detection and reporting of dead right whales, whether stranded or floating at sea, need to be encouraged in every way possible. The Large Whale Recovery Program coordinator and the National Marine Mammal Stranding Network coordinator should continue working with representatives of local, state, and federal agencies, private organizations, academic institutions, and regional and national stranding networks to facilitate efficient coverage and information exchange. In areas where protocols do not exist, they should be developed. The responsibilities of all relevant agencies, organizations, and individuals should be clearly defined. Contingency plans should be developed for retrieval of right whale carcasses along the entire U.S. east coast, including the identification and securing of sites to bring carcasses ashore, conduct necropsies, and dispose of waste.

Right whales may die at sea, but not be detected or reported. Mariners, including Navy and Coast Guard personnel, commercial and recreational boaters, and fishermen might observe carcasses at sea but not recognize the importance of their observation. This was highlighted by a recent (2001) incident in which a South Carolina mariner observed and photographed the carcass of a right whale calf floating off the coast of Myrtle Beach, South Carolina. The incident was not reported until nearly a month later, too late to retrieve the carcass. Mariners must be educated about the importance of retrieving such carcasses so that as much information as possible can be gleaned from them.

c. To the extent possible, use necropsies to determine the cause of death and use such data to reduce the susceptibility to death from these causes

Assessment of the causes and frequency of mortality (either natural or human-caused) is important to understanding population dynamics and the threats that may impede the recovery of western North Atlantic right whales. Accordingly, the efficiency of efforts to detect and investigate right whale deaths should be maximized.

d. Analyze tissue collected from stranded right whales to determine and monitor contaminant levels

As noted earlier, certain contaminants if found in particularly high levels, may lower productivity in right whales by inhibiting reproductive functions, increasing susceptibility to disease, or through other mechanisms. To monitor contaminant levels and possible changes in levels and to possibly assess likely effects on the population, programs should be developed to collect appropriate tissues from dead and stranded individuals. Also, all existing samples need to be located and analyzed. Proper and standardized techniques should be used to store and analyze the tissue for various anthropogenic contaminants. The program (i.e., the tissue to be collected, the storage and data analysis methods) should be designed and carefully implemented in conjunction with the National Marine Mammal Stranding Network Coordinator and the Marine Mammal Stranding Network.

If contaminant levels are found or suspected that may result in inhibiting reproductive functions or productivity, a program should be developed immediately to identify the origins of the contaminants and to eliminate or reduce the sources.

e. Analyze tissue collected from necropsies to improve knowledge about life history and reproductive parameters of right whales

f. Review, analyze, and summarize data on stranded right whales on a regular (at least annual) basis

Current and complete data on stranding events and the data derived from them is essential to ongoing protective measures. Summaries should include, but not be limited to, timely assessments of the cause of death and, where applicable, the type(s) of fishing gear involved if fishing operations resulted in the death of the animal.

g. Develop and implement a program for handling live-stranded right whales

Rehabilitation of live-stranded right whales will likely be feasible in very limited circumstances. For example, rehabilitating a fully mature adult is probably nearly impossible given the size of the animal and difficulties involved in transporting and caring for it. It may be possible to rehabilitate and release a live-stranded calf if it were in sufficiently good shape at the time of the stranding. In some cases, euthanasia may be more appropriate.

i. Develop protocols for handling live-stranded right whales, including identification and securing of appropriate sites to effect rehabilitation

Attempting and effecting a rehabilitation requires advance planning including decisions regarding, but not limited to, appropriate facilities, logistics, and equipment to be used. These are likely to be regionally specific. Such matters should be worked out in advance, with responsibilities clearly understood.

h. Establish reliable source(s) of funding for rescue, rehabilitation, necropsy, and tissue collection and analysis efforts.

As noted above, collection of information from right whale carcasses is essential to recovery efforts. Therefore, identifying and committing to predictable sources of funding for completing these tasks is also critical.

V. Telemetry Studies

A. Evaluation of Tagging Techniques and Habitat Studies

1. Where feasible, most effective, and least intrusive, conduct radio and satellite tagging studies to increase knowledge of right whale habitat use, distribution, and habits.

Telemetry studies may be the most useful tool for answering questions about right whale ecology, habitat use, movements and migrations. For example, identifying and eliminating human impacts to right whales may be possible only by determining heretofore unidentified high use areas. Also, information on whale location is valuable in defining habitat use patterns and may, in real time, directly reduce fishing and shipping industry interactions. However, the possible risks, if any, inherent to such studies (e.g., possible adverse effects from infection or other harm to the whale) are not clearly known and need to be assessed. In any case, the benefits derived from conducting such studies need to clearly outweigh any potential negative impact. If deemed appropriate, carefully designed and executed, and minimally intrusive, studies should be done to address unknowns about right whale habitat use patterns, movements, migrations, and areas of aggregation.

a. Conduct studies to assess the most effective and least intrusive means of tagging right whales, including the possibility of using other taxa as models.

Whereas there are no known risks to telemetry studies of large whales, as noted above, implanted tags have the potential to cause infection or have other adverse effects. Telemetry studies have the potential to provide important, perhaps vital, information for the protection of right whales, and should be regarded as an important tool in doing so. However, the benefits must outweigh any possible negative impact. Studies should be conducted to determine if adverse effects result from tagging studies. Other closely related but more abundant large whale taxa may serve as valuable surrogate subjects for such study.

b. Continue and expand satellite-linked radio-tagging and tracking to better identify right whale movements and habitat use patterns.

Improved knowledge of right whale locations, movements, and habitat use provided through telemetry studies may provide important information reducing human impacts. Such studies should be conducted assuming individual health risks are deemed to be insignificant or non-

existent.

c. Conduct satellite tagging studies to determine routes and timing of migration between known high-use habitats

Comments above under IV.A.1.a and IV.A.1.b. apply here as well.

d. Continue and expand VHF radio-tagging studies to better assess daily and seasonal movements in high-use areas

Comments above under IV.A.1.a and IV.A.1.b. apply here as well.

VI. Demography and Stock Structure

A. Genetic Studies

1. Conduct genetic studies to assess population structure, effective population size, current and historic genetic diversity and possible impacts on health and reproductive success. In addition, conduct genetics workshop to determine optimal methods for analysis of genetic data

Genetic studies have the potential to provide extremely valuable information on population structure, abundance, genetic variability, effective population size and social structure. In the case of the western North Atlantic right whale, since much of the population has been biopsy sampled, it should be possible to obtain a level of detail which is unthinkable for most mammalian populations. Past and ongoing work has used mitochondrial and microsatellite DNA to investigate the genetics of this population. This work should be continued and expanded to include additional microsatellite loci in order to provide a detailed characterization of the population, and to assess effective population size and the degree of inbreeding.

VII. Reproduction and Health Assessment

As noted above, calf production in the western North Atlantic right whale DPS has fluctuated rather widely in the last two decades (a range of one calf in 2000 to 30 calves in 2001). In addition, the mean calving interval is apparently increasing. The variation and relatively low overall productivity may be directly or indirectly linked to human activities.

A. Assessment of possible reproductive anomalies and individual health

1. Conduct studies to determine the cause(s) of anomalous or fluctuating reproductive rates.

There are no known reasons for the variation in productivity, however, contributing factors may include ecosystemic fluctuations (e.g., prey density or availability), individual health, habitat degradation, or disturbance from human activities. Studies need to be conducted to determine, if possible, the causes of this variation and to identify reasons for possible anomalies.

2. If cause(s) of reproductive anomalies are linked to human activities, establish

programs to mitigate or eliminate the sources of the impact.

Low productivity may be directly or indirectly linked to contaminants, disturbance, habitat degradation or other factors resulting from human activities. If such factors are related to low right whale productivity or reproductive anomalies, programs should be established to reduce or eliminate the impact to right whales.

3. Conduct studies to assess health at the individual and population level.

As noted above, reproductive anomalies may be linked to poor individual health, which may in turn be linked to poor nutrition, disturbance or disruption of vital activities by human activities, or other factors. In addition, recently reported skin lesions in some individuals may be linked to poor health and caused by some heretofore unidentified etiological agent. Therefore, studies need to be conducted to assess right whale health both at the individual level and the population level, particularly as they pertain to reproduction.

4. If studies indicate that poor individual or population health is linked to human activities, establish programs to mitigate or eliminate the sources of the impact.

Human activities such as the release of toxic effluents, disturbance from vessels or whale watching activities, alteration of habitat or food webs may directly or indirectly cause lowered health and productivity in right whales. If poor health is linked to human activities, programs need to be established to reduce or eliminate their impact to right whales.

Objective 4: <u>Coordinate Federal, State, international, and private efforts to implement the Recovery Plan</u>.

I. Continue international ban on hunting and other directed takes of right whales

Directed hunting in the past is the reason for the current dismal status of right whales. Although western North Atlantic whales are no longer a target of whaling, the hunting of western North Atlantic right whales should not be permitted to resume under any circumstances. The population is too small to sustain any type of directed take. Also, even if a sustained growth and apparent recovery were to occur, hunting should not be permitted, as this population is clearly vulnerable to extirpation and has not demonstrated an ability to sustain commercial levels of take in addition to all the other sources of right whale mortality present in the environment.

II. Enforce right whale protection laws

Existing legislation and its implementing regulations that protect right whales should be enforced by the appropriate entities. It is necessary to establish and conduct monitoring programs to determine the level of compliance with these laws. If there are indications that violations of such regulations are not being enforced, efforts should be made to improve enforcement regimes. Appropriate agencies should be encouraged to obtain and provide adequate resources needed to ensure regulations are adequately enforced.

III. Evaluate the effectiveness of the Northeast and Southeast Implementation Teams and

implement improvements as warranted

The recovery plan implementation teams are charged with providing advice to, and support of, recovery activities, particularly those undertaken by NMFS. The mandate, goals, responsibilities, membership, and effectiveness of these teams should be evaluated, and ways to make them more effective should be identified. Specific terms of reference and objectives should be identified for each team, together with tasks, priorities and a timetable for their completion. Team membership and activities should subsequently be revised accordingly.

IV. Coordinate with States involved in right whale activities to maximize protection measures

A number of State programs include significant and rigorous right whale protective measures. Such programs need to be fostered and steps taken to ensure they dovetail with other State and Federal programs. Although some inter-agency coordination takes place in right whale recovery plan implementation teams and to some extent through the Atlantic Large Whale Take Reduction Team, increased efforts need to go into, for example, having regular meetings with State representatives.

V. Promote bi-lateral cooperative efforts with Canada to maximize protection for right whales, reduce human-related mortality and injury, report mortality events, promote protection of habitat, and to take other measures to enhance the recovery of right whales

1. Convene regular meetings with Canadian officials to facilitate bi-lateral cooperation on protective measures

Western North Atlantic right whale distribution is transboundary. Successful protective measures involve cooperative bilateral efforts between NMFS, the Canadian Department of Fisheries and Oceans and other responsible and interested entities. Canada has prepared a right whale recovery plan and efforts should be made to ensure that the Canadian and U.S. plans dove-tail, and that efforts are being taken cooperatively. One way to achieve this goal is to convene regular meetings between the two nations and develop follow-up actions.

2. Promote actions to enhance protection for known areas of importance, especially vessel and fishery interaction issues in Canadian waters

Bi-lateral protection measures and cooperative steps identified in periodic bi-lateral meetings should be acted upon.

VI. Periodically review and update the Western North Atlantic Right Whale Recovery Plan

1. At least once every five years, review and evaluate recovery actions and prioritize needs

This plan should be reviewed and revised at least once every five years. The activities identified in this plan should be reviewed to determine if they are being successfully implemented. If high priority actions are not being pursued, steps need to be taken to ensure that they are. If appropriate, new actions and priorities should be identified and implemented.

VII. As appropriate, publish regulations to reclassify the western North Atlantic right whale DPS under the Endangered Species Act and the Marine Mammal Protection Act

When the established criteria are met, steps should be taken to de- or down-list the DPS.

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APPENDIX A. CONSERVATION ACCOMPLISHMENTS

Designation of Critical Habitat:

As noted earlier, there are five well-known habitats used annually by Western North Atlantic right whales, including 1) coastal Florida and Georgia, 2) the Great South Channel, east of Cape Cod, 3) Cape Cod and Massachusetts Bays, 4) the Bay of Fundy, and 5) Browns and Baccaro Banks, south of Nova Scotia. The first three areas occur in U.S. waters and were designated by NMFS as critical habitat in June 1994 (59 FR 28793).

Actions authorized, funded, or carried out by federal agencies that may impact habitat elements identified as integral to critical habitat designation must come under consultation procedures as defined in Section 7 of the Endangered Species Act (ESA), regardless of the presence of right whales at the time of impacts. Impacts to these areas which may affect prey availability and quality of nursery areas must be considered when analyzing whether habitat is adversely modified or destroyed.

Establishment of Regional Recovery Plan Implementation Teams:

The ESA provides authority to the Secretary of Commerce to establish teams to, among other things, review recovery activities and provide recommendations to NMFS on improving such activities. Two such teams have been formed: one in the southeastern United States and one in the northeastern United States.

Southeastern U.S. Implementation Team (SEIT) for the Right Whale Recovery Plan: In August 1993, the Southeastern U.S. Right Whale Recovery Plan Implementation Team was formed. The team consists of representatives from the Georgia Department of Natural Resources (currently, Vice Chair); Florida Fish and Wildlife Conservation Commission (formerly the Florida Department of Environmental Protection, and the current chair); NMFS/Southeast Fisheries Science Center and Southeast Regional Office; Navy; Georgia Ports Authority; Canaveral Port Authority; Glynn County Commission, Glynn County, GA; University of Georgia; U.S. Army Corps of Engineers; U.S. Environmental Protection Agency (EPA); Port of Fernandina, Fernandina, Florida; and the US Coast Guard (USCG).

Since its inception, the SEIT has met regularly and has been active in a number of areas. Among other things, the SEIT was instrumental in developing a system of aircraft surveys and communication systems that alert mariners to the presence of right whales in the SEUS in real time. On numerous occasions in recent years, aircraft observers were able to contact and divert ships on direct courses for right whales.

Two agencies represented on the Team, the Georgia Department of Natural Resources and the USCG, implemented a local Notice to Mariners broadcast about right whale calving grounds. This notice is broadcast four times daily by the USCG on VHF radio. A slightly longer version is published in the local Weekly Notice to Mariners. This notice may also be published daily along with the tides and weather in regional newspapers, and is carried by the Army Corp of Engineers as a part of its annually distributed tide charts. The Annual Notice to Mariners also provides the same information.

The SEIT has coordinated a number of efforts to educate mariners about the threat of ship strikes in right whale habitat. For example, the Team or its participating agencies have developed brochures and pamphlets on whales, manatees and turtles, which are being distributed regionally. As a group, the Port Authorities prepared a series of posters, distributed by the harbor pilots when they board a vessel for navigation, which describe the times right whales are in their waters.

A quarterly newsletter was developed to help increase the effectiveness of recovery efforts. The newsletter is edited by members of the Team. Contribution to the newsletter is open to anyone actively involved in right whale conservation efforts, and has included ship operators, harbor pilots, port authorities, fishermen, educators, scientists, managers, policy makers, non-governmental organizations and other concerned citizens. Relevant information from areas other than the southeastern calving areas (e.g., Bay of Fundy field season summaries) are also included. The first newsletter was published in August 1994 and has been published regularly since.

In addition, the Team has addressed and/or provided recommendations to NMFS regarding right whale research in the SEUS, additional measures to reduce the possibility of ship strikes, development of safe operating procedures for large vessels transiting right whale habitat, minimum vessel approach distances, and restrictions of hazardous fishing gear in right whale calving areas.

The Northeastern Implementation Team (NEIT) for the Right Whale Recovery Plan: The Northeast Implementation Team (NEIT) was established in 1994. The Team is coordinated by the National Marine Fisheries Service, Northeast Regional Office. The Team was created to implement recovery tasks for both the North Atlantic right whale and the humpback whale. Composition of the Team consists of a diverse group of individuals representing major federal and state agencies whose activities could affect the survival of these endangered large whale species. It also includes other non-governmental organizations such as academic researchers, conservation organizations, as well as interested private individuals. Presently, membership consists of representatives from: Canada's Department of Fisheries and Oceans, Maine's Department of Marine Resources, Marine Mammal Commission, Massachusetts' Coastal Zone Management, Massachusetts' Division of Fish and Wildlife, MIT Sea Grant, Massachusetts' Port Authority, NMFS, New England Fishery Management Council, Stellwagen Bank National Marine Sanctuary, U.S. Army Corps of Engineers, USCG, U.S. Navy and U.S. EPA. The Maine Department of Marine Resources and the U.S. Navy are the latest Team members, joining the Team in 1998.

Some accomplishments of the Team include completion of a status report and plan of activities for protecting right and humpback whales in Massachusetts and Cape Cod Bays in cooperation with the EPA, and implementation of a monitoring program for one of the largest waste water treatment plants in the United States.

The Team has two Technical Advisory Groups, a scientific group and a shipping industry group. The scientific group provides expertise on the biology and behavior of whales while the shipping industry group provides guidance on vessel and port operation.

The Team established two subcommittees, one on ship strikes and one on habitat. The Habitat Subcommittee that was originally established at the Team inception languished and was reestablished in March 1997. The Habitat Subcommittee has placed emphases on identifying human impacts to right whale habitats and critical elements of those habitats to facilitate the Team's goal of protecting areas critical to right whale recovery.

Among other things, in 1997, the Habitat Subcommittee proposed the development of a right whale habitat model for the entire east coast. Two meetings were conducted to determine the scope of work necessary for the task and to develop a preliminary list of the model's elements, including one for the Great South Channel area. The predictive model could be used as a management tool, if it were successful in identifying whale occurrence. This information would be used to aid shipping traffic in avoiding right whales.

With regard to ship strikes, a joint effort was initiated in 1998 by resource shareholders of the northern U.S. east coast to produce an avoidance training/education video targeted at merchant mariners. Agency members include, the USCG, U.S. Navy, Canadian Department of Fisheries and Oceans, International Fund for Animal Welfare, Gulf of Maine Council, and the Massachusetts Environmental Trust. The video was completed May 1999. An initial distribution plan included vessels utilizing major ports in or adjacent to critical habitat area along the eastern seaboard.

A special Ship Strike Subcommittee workshop was held, May 11, 1998, to discuss concerns about increasing numbers of high-speed vessels operating off New England and potential interactions with whales. The meeting was co-sponsored by NOAA's Stellwagen Bank National Marine Sanctuary, New England Aquarium and the NEIT. The impetus of the meeting was the launching of a new high-speed ferry between Bar Harbor, ME and Yarmouth, Nova Scotia. One outcome was the creation of a working group to determine whale concentration in the Bay of Fundy. The owner of the high-speed vessel agreed to enter into a partnership agreement to fund an analysis, including GIS plots, of the occurrence of endangered large whales on or near the ferry route. Analysis will examine the times and areas of potential interactions. Likewise, Bay Ferries (owner and operator of a high speed ferry service) agreed to have an observer on board to record whale observations.

Another joint effort, started in May 1999, is developing a program to identify voluntary measures mariners could take to reduce the likelihood of ship strikes. A funding partnership was established among the NMFS, the NEIT, Georgia Department of Natural Resources, Marine Mammal Commission, and the Canadian Department of Fisheries and Oceans. The SEIT voted in October 2000 to have the NEIT Shipstrike Subcommittee co-chairs represent the SEIT as part of the national committee to develop options to prevent collisions between ships and right whales. The SEIT also nominated a member to serve as co-chair on the committee.

Steps Taken to Reduce the Threat of Fishing Gear Entanglement:

Take Reduction Teams:

The 1994 amendments to the MMPA required NMFS to establish teams comprised of stakeholder groups to determine ways to reduce serious injury and mortality of strategic stocks of marine mammals, including threatened or endangered species. The Take Reduction Team assists

NMFS in developing a Take Reduction Plan. The immediate goal of the Take Reduction Plan is to reduce incidental mortality or serious injury to the marine mammal stock's potential biological removal level (PBR) within six months of the plan's implementation. The longer term goal is to reduce serious injuries and mortality to an insignificant level approaching a zero mortality and serious injury rate (Zero Mortality Rate Goal, or ZMRG).

Atlantic Large Whale Take Reduction Team and Plan: In August 1996, NMFS formed the Atlantic Large Whale Take Reduction Team to address the incidental take of humpback, fin, minke, and northern right whales in the following fisheries: the Gulf of Maine/U.S. mid-Atlantic lobster trap/pot fishery, the mid-Atlantic coastal gillnet fishery, the southeastern U.S. Atlantic shark gillnet fishery, and the Gulf of Maine sink-gillnet fishery. The Team prepared a plan, and although the Team reached agreement on a number of needed actions, it failed to reach consensus on all measures. Nonetheless, the plan was forwarded to NMFS in February 1997.

NMFS reviewed the plan and issued a proposed rule in April 1997 to implement the plan. The proposed rule involved substantial reduction of some fishing operations and limits to the time and geographic area of others. The basic elements of the proposed plan included (1) a gear marking system to better determine the source of lines found on entangled whales; (2) formation of a gear advisory group to identify and evaluate gear design features that would reduce entanglement risks for whales; (3) expanded support for whale disentanglement teams; and (4) a complex network of areas in which lobster and gillnet fisheries would be seasonally closed or subject to restrictions on their gear by requiring them to select from various sets of gear design requirements.

The proposed rule was contentious, and while undergoing public comment, it was heavily criticized by members of the general public and members of Congress for its restrictions to several commercial fisheries. In considering these comments, NMFS revised the gear regulations in an interim final rule published in July 1997 with most requirements taking effect January 1, 1998.

NMFS implemented the Team's plan under the interim rule. Being implemented are (1) formation of a fishing gear advisory group; (2) research on potential fishing gear modifications to determine ways to reduce entanglement and facilitate release following entanglement; (3) a fishermen outreach and education program; (4) expansion of the disentanglement network; (5) hiring a large whale coordinator in Maine (a state in which much of the gear restrictions were heavily opposed); (6) continuation and refinement of the NE aircraft survey program; (7) time/area closures in areas of right whale concentration; (8) time/area – specific restrictions on gear deployment (e.g. selection of gear from choices of more "whale friendly" gear); and (9) observer requirements. The intent of the plan is to achieve the long-term goals of the MMPA for all large whale species under the plan: reducing serious injuries and mortality to a level approaching zero mortality and serious injury rate (ZMRG).

In February 1999, NMFS published a final rule implementing the final take reduction plan. The final plan included only minor modifications to the interim rule, and activities and restrictions are essentially the same as those identified above. Concurrent with issuance of the final rule, NMFS re-convened the Take Reduction Team, which recommended that NMFS delay implementation of the gear-marking portion of the rule until a better regime could be developed. NMFS published an amendment to the rule in April 1999, moving the effective date of that

portion of the rule from 1 April 1999 to 1 November 1999.

The plan has been revised and a new set of gear modifications was issued on December 21, 2000 (65 FR 80368). Also, additional seasonal closures and "dynamic area closures (depending on certain density of whales) are being contemplated at the time of this writing.

Atlantic Offshore Cetacean Take Reduction Team and Plan: In May 1996, NMFS established the Atlantic Offshore Cetacean Take Reduction Team to address incidental take of several marine mammal species in offshore fisheries, primarily the offshore driftnet fishery for swordfish and the longline fishery for tunas. Marine mammals taken in these fisheries include large whales, common dolphins (*Delphinus delphis*), white-sided dolphins (*Lagenorhynchus acutus*), pilot whales (*Globicephala* spp.) and various species of beaked whales. The team submitted a draft Plan to NMFS in November 1996. Among other things, the Team proposed various measures to protect right whales that primarily involved restrictions or modifications of the drift gillnet and longline operations. In October 1997, NMFS released a draft environmental assessment of the proposed rule.

Based in part on the Team's recommendations and concerns about right whale, the offshore drift gillnet fishery for swordfish, shark and tuna has been closed. Two of the three fisheries which were the focus of this Team's efforts (the drift gillnet and pair trawl fisheries for swordfish, tuna, and shark) no longer exist, and the third fishery (the pelagic longline fishery targeting the same species) has been substantially altered by a series of closures enacted for purposes of target species and billfish bycatch species management. Therefore, NMFS decided to dissolve the Team until such time as sufficient data are available on marine mammal bycatch in the pelagic longline fishery under the new management regime. However, no right whale interactions have been documented in this fishery.

Efforts to disentangle right whales and obtain information from stranded whales:

Disentanglement Response and Network:

The 1991 recovery plan called for establishment of a marine mammal disentanglement program. NMFS established a team of scientists from the Center for Coastal Studies and the New England Aquarium to respond to all marine mammal entanglements, with an emphasis on right and humpback whale entanglements. The program was purely voluntary when it originated in 1984 and remained voluntary until a contract with NMFS was established in September 1995. The contract for 1996-1998 was restricted both by availability of NMFS resources and in scope. In 1999 and 2000, a contract was provided by NMFS to cover all disentanglement activities. In 2001, the activities were covered by several sources and, at the time of this writing, attempts are being made to secure NMFS funding for the foreseeable future.

Emergency response involves: (1) multi-agency and multi-organization communication to locate, monitor, and safely disentangle marine mammals; (2) development and maintenance of an entanglement database and providing data to users; and (3) development of regional protocols and plans, including outreach to the general public. When whales become entangled, judgements must be made as to the efficacy and merits of disentanglement. Experience indicates that disentanglement is best undertaken by trained and experienced personnel, with appropriate protocols for the procedure as well as the associated data collection.

The current disentanglement effort consists of one primary team and basic field support in the Bay of Fundy, Gulf of Maine, the mid-Atlantic, and Georgia/Florida. The program covers nearshore disentanglement events along the eastern seaboard, although the team has the capability to be deployed in some offshore locations. There are other limitations; for example, the northern Gulf of Maine/Bay of Fundy and Georgia/Florida field stations are operational only when biologists are conducting seasonal whale research, and even then disentanglement response relies on the timely transfer of the team and their equipment to the entanglement site. In the southeast U.S., trained biologists are available to assist and disentanglement equipment caches have been established at key locations.

In the last 15 years, an average of about four to eight right whales are reported entangled each year in U.S. and Bay of Fundy waters. Of these, numerous whales have been completely or partially disentangled. A number of lightly entangled whales freed themselves before intervention could occur. However, one right whale was severely entangled and in October 1999 died as a result of the entanglement. Another, reported in 1998, was completely disentangled but had sustained major injuries from a prior entanglement, and is believed to have died even though all gear was removed

List of Fisheries:

Under the MMPA, NMFS is required to develop a List of Fisheries that classifies all U.S. commercial fisheries into one of three categories based on the level of marine mammal deaths and serious injuries that occur incidental to the fishery[1]. A notable change made to the 1997 List was combining the New England inshore and offshore lobster pot fisheries into one fishery, and a change in its classification from a category III (remote likelihood of serious injury or mortality) to a category I (frequent serious injury or mortality) status. The re-classification resulted from entanglement records indicating that 0.2 right whales per year are seriously injured or killed incidental to the Atlantic lobster pot fishery, and carries with it ramifications of potential additional regulation, *e.g.*, additional observer coverage and the requirements to form a Take Reduction Team if total human-related mortality exceeds PBR. Because of the status of the right whale population, this level of impact is considered significant. This classification will continue in 2001.

Efforts to Reduce Mortality or Disturbance from Ship Activities:

Vessel Approach Regulations:

Disturbance to whales was identified in the 1991 recovery plan as one of the principal human-related factors impeding right whale recovery. Often where human activities co-occur with right whales off the U.S. east coast, there is potential for disturbance of right whales.

[1] Category I: Total annual mortality and serious injury of a stock in a given fishery is greater than or equal to 50 percent of the calculated PBR level of that stock. Category II: Total annual mortality and serious injury of a stock and a total annual human-related mortality and serious injury of that stock across all fisheries exceed 10% of the PBR level in a given fishery is greater than 1 percent and less than 50 percent of the PBR level of that stock. Category III: Total annual mortality and serious injury of a stock in a given fishery is less than or equal to 1 percent of the PBR level for that stock.

To minimize human-induced disturbance NMFS published a proposed rule in August 1996 restricting vessel approach to right whales (61 FR 41116). These regulations proposed to prohibit all approaches within 500 yards (460m) of any right whale, whether by vessel, aircraft or other means. Exceptions exist for emergency situations and where certain authorizations are provided. The regulations are consistent with Massachusetts' approach regulations for right whales.

Following public comment, an interim final rule was published in February 1997 codifying the regulations. With certain exceptions, 50 CFR 224.103(b) prohibits both boats and aircraft from approaching any right whale closer than 500 yards. Exceptions for closer approach are provided when (1) compliance would create an imminent and serious threat to a person, vessel, or aircraft; (2) a vessel is restricted in its ability to maneuver around a 500 yard perimeter of a whale; (3) a vessel is investigating or involved in the rescue of an entangled or injured right whale, or (4) the vessel is participating in a permitted activity, such as a research project. If a vessel operator finds that he or she has unknowingly approached closer than 500 yards, the rules require that a course be steered away from the whale at slow safe speed. The interim final rule still stands, and may stand indefinitely, as there are no plans to issue a final rule.

Aircraft Surveys:

Aircraft Surveys in the Southeastern United States: To help reduce the possibility of ship strikes, the southeast implementation team developed a system to alert area ship traffic to the presence of right whales. As noted earlier, the Team and its member agencies and organizations developed advice for vessel operators on ways to detect and avoid right whales, and distributed brochures, fliers, videos and other information on right whales and the threat that vessel traffic poses to them. The central feature of the system has been a jointly funded aerial survey program designed to obtain accurate, current information on the locations of whales. Continuously updated sighting information from survey teams is immediately relayed to area mariners to help them avoid encountering whales.

Surveys were initiated in the waters off the SEUS in fall 1993 and have continued each year since. Survey lines occur at 3 nautical mile intervals throughout, and seaward as well as to the north and south of, critical habitat. Sighting locations are passed from the aircraft to centralized locations operated by the USCG and Navy. These groups in turn provide the information through a number of real time media, including USCG Broadcast Notice to Mariners, NAVTEX (the USCG international communication system), and NOAA Weather Radio. If a survey locates whales within a specified distance of a navigational channel, vessels would be required to proceed at minimum safe operational speeds and communicate locations so other vessels can avoid the whales. Design and execution of the survey program has been a cooperative effort by a number of federal and state agencies. Support and personnel are provided by the USCG, the Navy, the Army Corps of Engineers, the States of Georgia and Florida, and NMFS. In recent years, the Navy has become the central repository and dispenser of sighting location information used for the communication network. This procedure will be continually reviewed and improved by the SEIT.

Aircraft Surveys in the Northeastern United States: Using the SEUS aircraft survey program as a model, efforts were initiated in 1997 to develop a similar program in Cape Cod Bay (CCB) and the Great South Channel (GSC) in late winter and early spring. The program is a cooperative effort by NMFS, the USCG, Massachusetts Division of Marine Fisheries, the

Massachusetts Environmental Trust, the Center for Coastal Studies, the Navy and MASSPORT (the Boston port authority), the Stellwagen bank National Marine Sanctuary, National Weather Service, the US Army Corp of Engineers, Cape Cod Canal, Wheelock College, and New England Aquarium. Representatives from these groups meet regularly for coordination of the program.

In 1997-1999, surveys supported by NMFS and the State of Massachusetts were conducted to cover peak abundance periods and were flown principally between January and March in CCB, and in the GSC between January and early July and in several other key areas, as well. Sources of information for the survey network include: (1) weekly survey flights by USCG helicopters; (2) marine mammal lookouts posted during USCG vessel operations and from USCG pilots; (3) ship-based sightings by the Center for Coastal Studies during their studies of right whale feeding and behavior in CCB and when they are responding to reports of whale entanglements; and (4) research and other ships operated by the NMFS and the State of Massachusetts.

Sightings from aerial survey platforms, right whale researchers, and multiple sources are reported to NMFS' Northeast Regional Office. NMFS confirms the reports and synthesizes them. These data are plotted using a GIS with sightings grouped and 'circled' with a buffer zone. These right whale sighting advisories, or 'alerts', are disseminated to cooperators via an automated facsimile system and posted to several web page locations. The USCG issues Broadcast Notices to Mariners and via NAVTEX. NOAA Weather Radio provides geographic and positional data on the sightings periodically; the Cape Cod Canal Traffic Controllers contact ships and provide positions and a radius for each sighting. Each sighting report generally has a 24-hour life unless it is updated later in the day. Shipping agents, pilots and port authorities disseminate the information by voice or paper copy of the faxed advisories to inbound and outbound shipping traffic as appropriate. Maps, positions and radii, and reporting source information are posted to the Wheelock College, Whalenet, website. Historic sighting advisory reports are also maintained on this site. Several other web pages including NMFS's Northeast Fisheries Science Center (NEC), NMFS's Northeast Regional Office (NER) and the Massachusetts Executive Office of Environmental Affairs port have the most current maps and link to the more complete Whalenet site. A NMFS Inquiry Line maintained at the NER provides right whale sighting information and copies of the right whale faxes if requested by callers. Notifications to individual ships, commercial fishing and military vessels are made by voice from the aircraft when observed vessels are transiting close to a whale. In addition, these surveys have provided sightings of entangled and floating right whales, and provide photo identification data for numerous studies. The NEIT Ship Strike Sub Committee initiated action to have information on right whales and related advisory text added to the Cape Cod Canal tide tables in 1998 and 1999.

Current plans are to continue the surveys into the foreseeable future. A partnering document has been prepared to identify cooperative efforts in support of the program with NMFS, the USCG, the Massachusetts Department of Fisheries and Wildlife, the Center for Coastal Studies, the National Weather Service, the Army Corps of Engineers, Wheelock College, the Stellwagen Bank National Marine Sanctuary, the New England Aquarium, the Massachusetts Environmental Trust, the Massachusetts Port Authority, and the Navy. The 1997 Partnering Document included 12 partners. In 1998, several other groups such as shipping agents pilots, whale watch vessel operators and a high-speed ferry operator were added as cooperators. The partnering document will be prepared each year and an increasing number of cooperators is expected each year.

It should be noted, however, that while dedicated aircraft surveys may be the best available means to attempt to alert mariners about the presence of right whales, these programs have a number of limitations. For example, they are costly to implement. It is possible that these are resources that might be better spent on other activities. Also, the surveys are limited by weather and surveys can be conducted only in daylight and under the best of survey conditions. In addition, it is likely that, even under good conditions, many whales are missed by observers, especially since only those whales at or near the surface can be seen. Nonetheless, until effective alternatives are identified, the surveys are expected to continue.

Updating Navigational Publications:

To help ensure safe navigation in coastal waters in the United States, the National Ocean Service publishes and periodically updates nautical charts and a series of regional books called *U.S. Coast Pilots*. These are basic references on regional environmental conditions, navigation hazards, and rules. In U.S. waters, all ship's captains are required to carry *Coast Pilots*.

Efforts in 1997 and 1998 were directed at updating information contained in the *Coast Pilots*. *Coast Pilots* covering the entire eastern United States have been or will soon be updated to include information on the status of right whales, the times and areas that they occur, the threats posed to whales by ships, and advice on measures mariners might take to avoid hitting right whales. For example, it notes that mariners should not assume that whales will avoid oncoming vessel, and suggests that lookouts be alert for right whales in critical habitats, that mariners listen for broadcasts reporting recent right whale sightings locations, and that reduced speeds be used when near whales or traveling in key habitats at night or during other conditions of poor visibility. Also, updated information regarding right whale critical habitat and regulations about approaching right whales will be published on nautical charts when they are re-printed. Efforts to ensure that these navigational aids were updated to include information on right whales was done cooperatively by the NEIT and SEIT, the International Fund for Animal Welfare, the Marine Mammal Commission, and NMFS.

Starting in late 1997, NMFS provided language similar to that included in the *Coast Pilots* about right whale vulnerability to ship strikes to the National Imagery and Mapping Agency (NIMA), which annually publishes a *Notice to Mariners*. The information appeared in the January 1998 issue, and has been updated annually since. NMFS also provided information to NIMA for inclusion in their international navigation publication, *Sailing Directions*, which discusses and provides precautions primarily focused on right whale habitat in Canadian waters. This publication is updated annually.

A Mandatory Ship Reporting System:

In late-1997 and early-1998, NMFS and the National Oceanic and Atmospheric Administration, the USCG, and the International Fund for Animal Welfare jointly developed a proposal for submission to the International Maritime Organization (IMO) requesting implementation of a mandatory ship reporting system in right whale habitats. The proposal received endorsement from the USCG, the Marine Mammal Commission, and other agencies and organizations. It was submitted by the USCG to, and endorsed by, the IMO in December 1998 and the system became operational in July 1999. The system obligates all commercial ships greater than 300 gross tons to call into a shore-based station (primarily by satellite-linked communication), thereby

prompting a return message which describes right whale vulnerability to ship strikes, provides information on how collision could be avoided, and right whale sighting locations. Information from reporting ships is compiled in a data base. Thus, the system provides information on right whales directly to mariners as they enter right whale habitat, and provides a means to obtain information on ship traffic volume and routes to assist in identifying measures to reduce future ship strikes. It is currently being jointly funded by the USCG and NMFS, and administered primarily by the USCG.

International Safety Management Code:

The International Fund for Animal Welfare and the NEIT identified to NMFS an opportunity to educate mariners through routine safety inspections of domestic and foreign vessels for vessel operation and human safety while in U.S. waters. In late 1997, NMFS and the USCG began a dialog about the incorporation of protected marine species issues, including northern right whales, in required safety manual documents developed by ship owners and companies. By late 1998, the USCG had included language in policy documents regulating the implementation of the International Safety Management Code, and was providing protected marine mammal information in its training courses for inspectors and auditors.

Educational Materials and Outreach:

A number of agencies and organizations have collaborated on developing brochures, pamphlets, and informational papers to educate mariners about the vulnerability of right whales to ship strikes. NMFS has published magazine articles directed to the shipping industry. Also, as noted above, a video on this subject was prepared and is being distributed to the shipping industry.

Strandings and Necropsies:

Given the importance of obtaining life history data and information on the sources of human impacts, and the limited opportunities to collect these data, gathering the maximum amount of information from stranded whales is essential. In cooperation with local and state participants NMFS coordinates the U.S. Marine Mammal Stranding Network which responds to hundreds of strandings each year. Generally, response to, and data collection from, stranded right whales has improved substantially in recent years, although there is also room for improvement. Standardized protocols have been developed to help ensure that the best possible information is collected from each event. However, the protocols and the systems used to gather and analyze data should be reviewed and steps taken to ensure that maximally useful data are obtained.

Coordination of federal agency recovery activities under the Endangered Species Act:

Under section 7 of the ESA, federal agencies are required to ensure that any action they authorize, fund, or carry out is not likely to adversely affect a threatened or endangered species or "appreciably diminish the value of critical habitat for both the survival and recovery of the species." Much of the recovery activities for all endangered and threatened species are implemented through consultations between NMFS and other federal agencies. As a result of these consultations, NMFS issues a Biological Opinion on each activity, which indicates if the activity is likely to jeopardize the continued existence of the species throughout all or a portion of its range and, if so, provides reasonable and prudent alternatives to the activity. Regardless of

whether the activity might jeopardize the continued existence of a listed species, all actions which may affect listed species are required to implement reasonable and prudent measures to minimize effects of the action on the species of concern.

Significant points of the most recent consultations between NMFS and the USCG and the U.S. Navy follow. Additional consultations, between NMFS's Office of Protected Resources and NMFS's Office of Sustainable Fisheries (on the issuance of fishery management plans), are also discussed in the following section.

Consultation with the U.S. Coast Guard:

The USCG and NMFS have cooperated informally for many years. For example, since 1993, USCG ship and aircraft operators have provided reports of numerous "floaters", carcasses adrift at sea. Also, USCG vessels have been available to transport researchers and disentanglement teams to stranded and entangled whales, and vessels and aircraft have been deployed to photo-document or when possible, recover floaters. As noted elsewhere in this document, the USCG has been an active participant in regional recovery plan implementation teams and has contributed to aircraft surveillance and sighting location communication systems. This effort also involves NMFS staff providing training and materials to USCG vessel and aircraft personnel. In addition, as noted above, the USCG is working jointly with NMFS to administer the Mandatory Ship Reporting system.

In 1991 and in 1993, USCG vessels collided with and killed right whales. In addition, a USCG vessel struck a humpback whale in 1995 and potentially had an interaction with a humpback whale in 1997. These events triggered ESA Section 7 consultations with NMFS.

On September 15, 1995, NMFS issued a Biological Opinion on USCG vessel activities which concluded that the programs implemented since the 1993 incident were adequate to reduce the probability of another ship strike. That factor, combined with available information indicating a small but steady 2.5 percent population growth rate, resulted in a determination that continued vessel activities may adversely affect, but would not jeopardize the continued existence of the right whale population. However, on November 7, 1995, the USCG reinitiated consultation. The new Biological Opinion, issued in June 1996, rendered a different (jeopardy) conclusion. This conclusion was based on the increased level of known mortality and the potential magnitude of those impacts to the population, including the possibility that the northern right whale might have been experiencing a population decline; the potential biological removal figure for the northern right whale and its small population size; the lack of any measurable recovery progress for the northern right whale; and the cumulative sources of human-induced mortality.

The June 1996 Biological Opinion provided the USCG with reasonable and prudent alternatives, stating that the USCG must significantly reduce the possibility of vessel collisions with right whales, including those by non-USCG vessels where the agency has the authority to act. If implemented fully and in a timely manner, the alternatives would significantly reduce the USCG's potential to cause injury or mortality to a right whale and, therefore, would avoid the likelihood of jeopardizing the continued existence of right whales. The following are significant measures put forth by both the 1995 and 1996 opinions, considered necessary to ensure that USCG vessel operations were not likely to jeopardize the north Atlantic right whale:

- When and where possible, routine transits should avoid right whale habitats when whales are aggregated there. During standard operations, USCG vessels should maintain minimum distances of 500 yards from right whales and 100 yards from other large whale species.

- All USCG vessels must post dedicated lookouts during all transits, both emergency and non-emergency, that occur within 20nm of shore in addition to posting lookouts during transits in all right whale high-use areas. Also vessel operators should take necessary precautions to avoid whales.

- All dedicated lookouts must have completed a marine mammal training program. This requirement should be standardized and made part of USCG qualification criteria for bridge watch standers. The training should also increase the effectiveness of the agency in whale watch enforcement actions and in providing disentanglement assistance.

- From mid-December through March in the SEUS, broadcasts reporting right whale sightings should be transmitted as quickly as possible over all practicable means to as wide a distribution of vessels possible. The message should advise mariners within 15 nautical miles (nm) of the sighting to operate at the slowest safe speed, exercise caution, and keep a watch for right whales.

- The USCG should continue its active participation in regional recovery plan implementation teams, and provide support for aerial surveys during periods of high use in the different regions.

- The USCG must provide information to commercial and recreational vessel operators that is geared to avoiding collisions with endangered whales. It should include information to identify whales, what the operator can do to avoid causing them harm, critical habitat and high-use areas, and regulations applicable to the protection of right whales. Operators must be instructed to report all collisions or sightings of dead right whales immediately. Also, the USCG will work with appropriate agencies to ensure that publications commonly used by U.S. mariners for voyage planning purposes (i.e., the *Coast Pilot* and *Sailing Directions*) include information useful to avoiding vessel collisions with endangered whales. In addition, the USCG must continue to provide timely information on endangered whale sighting locations to commercial vessels coming into major ports in both the New England and Georgia/Florida critical habitats. The USCG must develop, in cooperation with NMFS, a plan to alert commercial traffic through port pilots, Captain's of the Port, Vessel Traffic Service, and others who are aware of the expected arrival time of ships in the various ports, and request them to relay this information to shippers.

The USCG once again entered into consultation following the July 1997 interaction with a humpback whale. NMFS issued a Biological Opinion on 18 May 1998, which provided a non-jeopardy decision (contingent upon implementation of all previous requirements of the 1995 and 1996 Biological Opinions) and provided a number of conservation recommendations. Among other things, NMFS recommended that the USCG:

- evaluate all its authorities to identify opportunities to take affirmative actions to conserve threatened and endangered species in fulfillment of section 7(a)(1) of the Endangered Species Act;

- assess mission requirements such as full power trials so that they can be scheduled during times of year and in areas where/when they present the least hazard to endangered and threatened species;
- periodically review compliance with the speed guidance it has issued, including interviews and surveys of Commanding Officers as part of a monitoring program to evaluate their knowledge or understanding of the speed guidance;
- provide assistance in identifying, reporting, marking and towing right whale carcasses to a location for necropsy;
- initiate the Gulf of Mexico operations and "marine event" consultations within 6 months of issuance of the Biological Opinion;
- continue training courses for USCG lookouts; develop information on critical habitats, marine sanctuaries, and endangered species migration routes, feeding areas, and breeding areas for use by mariners and boaters; distribute information geared toward cautioning commercial and recreational vessel traffic about collisions with right whales as part of the USCG Vessel Documentation and Inspection Program; educate mariners about right whales and other protected marine species through International Safety Management code policy documents; modify training courses for safety auditors and inspectors and USCG personnel responsible for safety inspections and ensure that these courses are being modified to include information on right whales and other protected marine species; and
- assist in development and implementation of the mandatory ship reporting system.

In general, the USCG has made a strong and active effort to implement the reasonable and prudent alternatives and conservation recommendations identified in the Biological Opinions.

Consultation with the U.S. Navy:

In the first three months of 1996, six right whale deaths were documented. Five of these occurred in waters adjacent to SEUS critical habitat. Navy facilities are adjacent to the critical habitat and use offshore areas for gunnery exercises. Because several of the carcasses were found near a Navy gunnery range, it is possible that some deaths may have been related to underwater explosions and there was concern that Navy activities may have been involved in some deaths. Given the serious concern over the status of right whales, the Navy and NMFS began convening meetings in mid-February 1996. Although there was no clear evidence linking the right whale deaths to the Navy's activities, the Navy formally initiated consultation with NMFS in March 1996 on the potential impacts of their gunnery and air-dropped ordnance operations in waters off the SEUS. The purpose of this consultation was to ensure that the Navy was taking all appropriate measures to protect right whales and to determine, if possible, the cause(s) of death of the whales. The scope of the consultation was expanded to include all Navy vessel and aircraft activities related to training in the consultation area. NMFS issued a (non-jeopardy) Biological Opinion on these specific Navy activities in May 1997.

Among the protective or mitigative measures considered prior to issuance of the Biological Opinion were: moving gunnery and ordnance activities well outside critical habitat and

contiguous high-density areas; limiting the scope of naval activities in critical habitat and adjoining areas to those that occur at a slow, safe speed; moving other activities that require higher vessel speeds away from the critical habitat and adjoining areas; limiting vessel traffic in these areas to the extent possible; and providing dedicated lookouts for surface ships while operating in critical habitat.

By early-1996 (prior to issuance of the Biological Opinion) the Navy had already taken steps to alter its operations to minimize potential impact to right whales. These measures included (a) instructing all Navy ships entering or leaving port to follow an east-west course (*i.e.*, the shortest route) through critical habitat; (b) altering most Navy ship operations to use moderate speed (10-15 knots) in the critical habitat when no right whales were present and slower speeds when whales were near the ship; (c) providing special training in whale identification for lookout and bridge watch personnel and directing ship officers to stay well clear of whales; (d) committing to continued participation in regional sighting advisory systems; and (e) moving gunnery and aircraft bombing training sessions at least 50nm from shore. These and other protective measures remain in effect.

Consultations on Various Fisheries:

American Lobster Fishery: In December 1996 a Biological Opinion was issued following a consultation on fishing conducted under the American Lobster Fishery Management Plan. The opinion concluded that operations under the current Fishery Management Plan (FMP), including anticipated management actions over the next six months, were likely to jeopardize the continued existence of the northern right whale, but were not likely to jeopardize any other endangered or threatened species under NMFS jurisdiction. The reasonable and prudent alternatives identified in the opinion led to the publication of an emergency interim regulation under the authority of the MMPA (62 FR 16108, April 4, 1997) that restricted the use of lobster pot gear in CCB critical habitat from 1 April to 15 May, and in the GSC critical habitat from 1 April to 30 June. The State of Massachusetts implemented a similar closure in CCB critical habitat in state waters. These closures remain in effect until gear modifications or alternative fishing practices are approved that minimize the risk of entanglement or reduce the likelihood that an entanglement will result in serious injury or mortality.

The opinion also tasked NMFS with analyzing fishing effort in relation to whale distribution. NMFS analysis in coordination with the states, has begun to assess fishing effort, but models to predict shifts in effort have not yet been developed. This alternative is a long-term measure, which, in combination with the closures as short-term measures, and in combination with an expanded disentanglement response network capability, brought the impact of the fishery to below the jeopardy threshold for right whales.

Under the Atlantic Coastal Cooperative Fishery Conservation and Management Act, NMFS is working with the Atlantic States Marine Fisheries Commission to develop a new management strategy for the lobster fishery. However, it is not known when this plan will become effective.

Northeast Multispecies Groundfish Fishery: Consultation was undertaken on fishing conducted under the Multispecies FMP. A Biological Opinion, issued in December 1996, concluded that actions under this FMP were likely to jeopardize the continued existence of the northern right whale, but were not likely to jeopardize any other endangered species under NMFS jurisdiction.

The alternatives included short-term measures to prevent jeopardizing right whales, with longer term solutions expected later. As a result of the alternatives identified in the opinion, NMFS worked with the New England Fishery Management Council to develop regulations under the authority of the Magnuson-Stevens Fishery Management and Conservation Act (62 FR 15425, April 1, 1997). The regulations closed federal waters to multispecies gillnet gear in parts of the following right whale critical habitat areas: CCB from 27 March 1997 to 15 May 1997, and from 1 January to 15 May in subsequent years; and the GSC from 1 April to 30 June, annually. Concurrently, the State of Massachusetts prohibited gillnets from critical habitat in CCB within state waters from 1 January to 15 May. In addition, other closures are in effect under the multispecies plan for purely fishery management reasons and for protection of harbor porpoises (*Phocoena phocoena*).

Atlantic Fisheries for Highly Migratory Species: The Atlantic Pelagic Fishery for swordfish, tuna and shark was reviewed under an intra-agency consultation to address the potential for right whale entanglement in gear used in these fisheries. The resulting Biological Opinion concluded that continued operation of the southeastern Atlantic gillnet fishery for shark which occurs when right whales are present in SEUS critical habitat was likely to jeopardize the continued existence of the right whale. One report potentially linking a right whale mortality to the shark driftnet fishery occurred off Florida. The marks on a freshly wounded right whale calf were consistent with gillnet gear; and the shark fishery was the only gillnet fishery operating in the area at the time. Therefore, one of the primary alternatives was closure of shark driftnet operations in SEUS critical habitat and adjacent waters from November 14- March 31, consistent with the Atlantic Large Whale Take Reduction Plan. In another incident, a right whale was observed entangled in a swordfish driftnet in the northeast. However, the Biological Opinion concluded that the probability of an interaction with this fishery in the offshore area, where the northeast segment of this fishery generally operates, is remote since right whale occurrence in these areas is infrequent. Also, the whale involved in the incident had already been compromised by a previous entanglement in lobster gear. However, it noted that the winter/spring, mid-Atlantic component of this fishery had the greatest potential of the northern components to entangle right whales because the fishery was operating on the shelf edge which is much closer to shore in the mid-Atlantic. Therefore, the opinion also recommended closure of the winter pelagic driftnet fishery for swordfish, tuna, and sharks to protect right whales. Other recommendations included educational workshops for fishermen, implementation of a limited access system, and 100 percent observer coverage (an observed take would close the fishery). The conclusions of this opinion led to an emergency closure of the fishery from December 1996 to June 1997; the closure was subsequently extended for six months. NMFS issued an amended opinion in August 1997 to evaluate the impacts of this fishery on endangered and threatened species. This amended opinion again recommended closure of the mid-Atlantic (winter) pelagic driftnet fishery for swordfish, tuna, and shark. NMFS issued a rule extending the closure, under authority of the ESA, to August 1998.

In January 1999, NMFS published a final rule to prohibit the use of driftnets in the pelagic swordfish and tuna fishery. NMFS expressed concerned about the high marine mammal bycatch level in this fishery and the difficulty in managing such a limited fishery under bycatch reduction constraints. In October 1998, NMFS issued a proposed rule to prohibit pelagic driftnets in the Atlantic tunas fishery and the final rule published in 1999.

American Lobster Fishery, Multi-species Groundfish Fishery, Monkfish Fishery, and Spiny

Dogfish Fishery: In May 2000, NMFS requested consultation on Fisheries Management Plans for the (a) American Lobster Fishery, (b) Multi-species Groundfish Fishery, (c) Monkfish Fishery, and (d) Spiny Dogfish Fishery. The requests for consultation were made because of several right whale entanglements in 1999, one resulting in the death of a right whale; two additional right whale deaths in the recent years, one in which fishing gear was implicated as a contributing factor; and new information provided by the International Whaling Commission regarding modeling results indicating that the western North Atlantic right whale population may be declining. In the Biological Opinions resulting from the consultations, NMFS concluded that the prosecution of the fisheries under the management plans was likely to jeopardize the continued existence of the western North Atlantic right whale, but not likely to jeopardize the continued existence of humpback, fin, sei, blue, and sperm whales. The Opinions, issued on 14 June 2001, identified reasonable and prudent alternatives for execution by NMFS included:

- developing and implementing annual restrictions to fishing operations aimed at minimizing interactions between fisheries and right whales, with rules issued to do so by 30 September 2001;
- implementing a "dynamic area management" program to supplement annual restrictions with temporary closures at times and in places where right whales aggregate, with the final strategy to be implemented with a rule no later than 31 December 2001;
- expanding gillnet gear modification research program and extension of gear modification requirements to include waters off mid-Atlantic and southeast states, and expansion; and
- assessing the effectiveness of the measures identified in the alternatives such that levels of entanglements or scarring (i.e., indications of entanglement) that increased or remained the same as levels from previous years would constitute evidence that the measures identified in these reasonable and prudent alternatives were not effective in reducing right whale injuries or deaths.

APPENDIX B. GLOSSARY AND LIST OF ABBREVIATIONS

ACOE – Army Corps of Engineers

ALWTRT – Atlantic Large Whale Take Reduction Team

CCB – Cape Cod Bay

CCS – Center for Coastal Studies

DFO – Department of Fisheries and Oceans (Canada)

DOS – Department of State

EEZ – Exclusive Economic Zone

EPA – Environmental Protection Agency

ESA – Endangered Species Act

EWS – Early Warning System

FMP – Fishery Management Plan

GIS – Geographic Information Systems

GSC – Great South Channel

IFAW – International Fund for Animal Welfare

IMO – International Maritime Organization

IWC – International Whaling Commission

MA – Massachusetts

MET – Massachusetts Environmental Trust

MMC – Marine Mammal Commission

MMPA – Marine Mammal Protection Act

MMS – Minerals Management Service

MSR – Mandatory Ship Reporting

NEA – New England Aquarium

NEC – Northeast Fisheries Science Center

NEIT – Northeastern Implementation Team

NER – Northeast Region Office

NESDIS – National Environmental Satellite Data and Information Service

NIMA – National Imagery and Mapping Agency

NIST – National Institute of Standards and Technology

NMFS – National Marine and Fisheries Service

NOAA – National Oceanic and Atmospheric Administration

NOS – National Ocean Service

PAH – Polynuclear Aromatic Hydrocarbons

PCB – Polychlorinated Biphenyls

SBNMS – Stellwagen Bank National Marine Sanctuary

SEIT – Southeastern Implementation Team

SEUS – Southeast United States

SOSUS – Sound Surveillance System

USDA – U.S. Department of Agriculture

USCG – U.S. Coast Guard

USN – U.S. Navy

APPENDIX C. RIGHT WHALE RECOVERY PLAN IMPLEMENTATION SCHEDULE

An implementation schedule is used to direct and monitor implementation and completion of recovery tasks. Priorities in column 2 of the following implementation schedule are assigned as follows:

Priority 1 – An action that must be taken to prevent extinction or to identify those actions necessary to prevent extinction.

Priority 2 – An action that must be taken to prevent a significant decline in population numbers or habitat quality, or to prevent other significant negative impacts of extinction.

Priority 3 – All other actions necessary to provide for full recovery of these species.

Funding is estimated according to the number of years necessary to complete the task once implementation has begun. The provision of cost estimates is not meant to imply that appropriate levels of funding will necessarily be available for all right whale recovery tasks. Also, identification of cost estimates does not assign responsibility for providing support to NMFS or any other agency or group. The costs associated with the various recovery tasks listed below are for those to be implemented in U.S. waters only. Costs associated with promotion of international action have not been estimated.

Western North Atlantic Right Whale Population Implementation Schedule

Recovery Plan Task	Priority	Duration (yrs)	Agencies/Organizations Involved	Fiscal Year Cost Estimates (thousands of dollars)				
				FY 1	FY 2	FY 3	FY 4	FY 5
Minimize sources of human-caused death, injury, and disturbance								
Ship Strikes								
Sighting Advisory System								
I.A.1.a. Continue seasonal aircraft surveillance of right whale habitats and other elements of the "early warning system" program.	1	ongoing	ACOE, NMFS, States, USCG, USN	600/#	600	600	600	600
I.A.1.b. Provide right whale sighting locations to mariners through broadcasts and other appropriate media.	1	ongoing	ACOE, NMFS, States, USCG, USN	*	*	*	*	*
I.A.1.b.i. When possible, notify individual ships directly when their course is likely to bring them to or near a location where a whale was sighted by the aircraft.	1	ongoing	NMFS, States, USCG, USN	*	*	*	*	*
I.A.1.c. Assess the effectiveness and efficiency of the survey programs in attaining the primary goal of reducing ship strikes. Annually review the survey program to identify ways to improve its effectiveness and efficiency. Promote identification and development of technology to improve detection. Eliminate the program when it is no longer effective or when a more effective alternative is developed.	2	annual ongoing	NEIT, NMFS, SEIT, States	*	*	*	*	*
I.A.1.d. Standardize surveys and data collection to ensure data obtained from the surveys are of maximum use for subsequent analysis of whale distribution and abundance.	2	1	NEIT, NMFS, SEIT, States	*	*	*	*	*
I.A.1.e. Establish a program for regular and timely analysis of aircraft survey data to determine seasonal whale distribution and abundance, to contribute to predictive modeling exercises of environmental correlates relative to whale distribution, whale distribution relative to ship traffic, and use in subsequent risk analysis.	2	3	NMFS, States	*	*	*	*	*
I.A.1.f. Use acoustic detection technology, surveys, and other technologies as available to monitor right whale occurrence and distribution in waters off the mid-Atlantic states. Assess the need for protective measures in these areas.	1	4	NMFS, States	100	150	80	80	80
Vessel Traffic Management								

I.A.2.a. Assess the utility and feasibility of voluntary and mandatory ship routing measures in right whale habitat.	1	1	DFO, MMC, NEIT, NMFS, SEIT, States, USCG	60	25	-	-	-
I.A.2.a.i. Assess the utility of ship routing changes in southeast U.S. critical habitat.	1	1	MMC, NEIT, NMFS, SEIT, USCG	50	25	-	-	-
I.A.2.b. Assess the possibility of voluntary and mandatory speed restrictions in right whale habitat.	1	1	DFO, MMC, NEIT, NMFS, SEIT, USCG	-	15	-	-	-
I.A.2.c Using existing data on whale sightings and vessel locations, conduct risk assessment analyses of various ship routing or speed options to assess best set of vessel traffic management options by area.	2	1	DFO, MMC, NEIT, NMFS, SEIT, USCG	40	25	-	-	-
I.A.2.d. Conduct studies of the potential economic impact of vessel management options.	1	1	DFO, NEIT, NMFS, SEIT, USCG	50	25	10	-	-
I.A.2.e. Work with mariners and the shipping industry to establish voluntary or mandatory changes (e.g., speed and routing) in ship operations to reduce the likelihood of ship/whale interactions.	2	3	NMFS, NEIT, SEIT, USCG	40	40	30	20	20
I.A.2.f. Assess whether these measures, other voluntary or mandatory protective measures, and other measures identified in this plan are reducing or likely reducing the occurrence of ship	1	3	NEIT, NMFS, SEIT, USCG	40	30	20	20	20
I.A.2.g. Assess the feasibility of modifying intermodal transport system links that would reduce the number of vessels operating in right whale habitat during periods of high right whale use.	2	2	NMFS, NEIT, SEIT, USCG, States	10	50	30	20	*
Education and Outreach								
I.A.3.a. Establish regionally-based liaison positions to work directly, and maintain a dialog, with the shipping industry to maintain a dialog with the industry, discuss feasibility of various management measures, foster industry cooperation, and conduct related activities.	2	1	NMFS, NEIT, SEIT, States, USCG	150	150	150	150	150
I.A.3.b. Develop programs and materials to educate mariners about right whales and to provide recommended practices to help avoid ship strikes.	2	2	ACOE, NMFS, NEIT, SEIT, States, USCG	50	50	30	30	30
I.A.3.c. Routinely review and update information about right whale habitat and high-use areas, right whale vulnerability to ship strikes, and related ship collision reduction measures on nautical chart, *Coast Pilots*, published *Notice to Mariners*, and other appropriate navigational aids.	2	ongoing	DFO, NIMA, NMFS, NOS, USCG	*	*	*	*	*
Mandatory Ship Reporting System								
I.A.4.a. Continue to implement mandatory ship reporting systems along the east coast of the United States.	1	ongoing	NMFS, USCG	+	200	180	150	150

I.A.4.b. To the extent possible, use incoming information from the reporting system for analysis of ship volume and routing studies with a view to assessing possible measures to reduce ship/whale interactions.	2	ongoing	NMFS	75	60	60	60	60
I.A.4.c Periodically assess the effectiveness of existing ship reporting systems and reporting areas -- both with regard to their operation and capacity to reduce ship strikes -- and consider implementing others or expanding the existing ones, as necessary.	2	every two years	NMFS, USCG	25/#	25	20	20	20
I.A.4.d. Monitor compliance with the mandatory ship reporting system and take steps to improve compliance as necessary.	2	ongoing	NMFS, USCG, NEIT, SEIT	20	20	20	10	10
I.A.4.e. Continue and improve outreach efforts to educate the shipping community about the mandatory ship reporting system.	2	ongoing	NMFS, USCG, NEIT, SEIT	30	20	15	10	10
Critical Habitat								
I.A.5.a. Analyze available data and collect additional whale sighting data to assess expanding or modifying the critical habitat boundaries.	1	2	NEIT, NMFS, SEIT, States	70/#	50/#	*	*	*
I.A.5.b. If warranted, revise critical habitat boundaries.	1	3	NMFS, States	*	*	*	*	*
Whale Detection Technologies								
I.A.6.a. Conduct studies of active acoustic (e.g., SONAR) and passive acoustic devices (e.g., "pop-up buoys"), and other underwater acoustic technologies to determine their feasibility and efficiency in detecting submerged whales.	1	4	NMFS, USN	80	100	100	80	-
I.A.6.a.i. If SONAR devices, passive listening, or other technologies are capable of detecting submerged whales, implement systems to use the devices to reduce ship/whale interactions. Conduct studies to assess the impact on marine mammals of acoustic pollution from proliferation of such SONAR devices, and determine whether potential cost exceeds potential benefit to right whales.	1	5	NMFS, USN	100	150	200	150	150
I.A.6.b. Assess the utility of such devices on relatively large scales: high whale use areas and times, or high ship use areas, or perhaps on regional scales.	2	5	NMFS, NOS, USN	80	100	80	-	-
I.A.6.c. Conduct studies of whale behavior relative to various types of "alerting" sounds that may warn sleeping, feeding, or courting whales to the presence of oncoming ships, and assess the desirability of deploying such devices in an environment already heavily polluted by noise.	3	4	NMFS, USN	30	30	25	-	-

I.A.6.d. Assess the feasibility of improved visual detection technologies.	2	3	NMFS, USN	30	30	20	-	-
I.A.6.e. Assess the feasibility and utility of using remote sensing to characterize right whale distribution patterns and use in predictive models of right whale distribution patterns near high ship traffic areas.	2	3	NESDIS, NMFS, NOS, USN	80	80	-	-	-
Geographic Information Systems (GIS)								
I.A.7.a. Incorporate data from "whale alert" aircraft surveys, scientific survey data, other confirmed right whale sightings and ship traffic data obtained from the mandatory ship reporting system, in GIS for analysis of whale/ship interactions.	2	ongoing	NEIT, NESDIS, NMFS, SEIT, States	*	*	*	*	*
I.A.7.b. Establish or use existing GIS to (a) conduct analysis of environmental correlates for right whale occurrence and distribution, (b) prepare predictive models of where and when right whales are likely to occur, (c) determine times and areas in which right whales and heavy ship traffic are likely to occur, and (d) assess ways to minimize ship/whale interactions.	2	3	NESDIS, NMFS, NOAA, USN, States	100	100	80	80	80
I.A.7.c. Identify, and obtain data from, additional sources (e.g., biological and physical oceanographic data, human activities) for GIS application and analysis.	3	3	NEIT, NESDIS, NMFS, NOAA, SEIT, States	40	15	10	-	-
Ship Noise and Whale Behavior								
I.A.8.a. Using benign techniques, conduct studies of whale responses to ship noise and to ships of various types and speeds.	1	3	NMFS, USN	60	80	50	-	-
Monitoring								
I.A.9.a. Continue to review and evaluate stranding and photo-identification data for evidence of collision between ships and whales.	2	ongoing	NMFS, States	10/#	10	5	5	5
Entanglement in Fishing Gear								
Operations								
II.A.1.a. Develop and implement strategies to modify fishing operations and gear to eliminate entanglement and assess the effectiveness of such strategies. If entanglements continue or increase, increasingly stringent steps should be taken to reduce entanglement rates.	1	3	ALWTRT, NMFS, States, USCG	*	*	*	*	*
II.A.1.a.i. Conduct research on alternative fishing methods.	1	3	ALWTRT, NMFS, States	80	70	50	20	*
II.A.1.b. Work with Canadian officials to develop means to reduce entanglement levels in the Bay of Fundy.	1	ongoing	DOS, NMFS	*	*	*	*	*
Gear								

II.A.2.a. Conduct studies of gear modifications that reduce the likelihood of entanglement, effects of entanglements, and enhance the possibility of disentanglement. Such study might include, but should not be limited to, assessment of bio-degradable vertical lines, ways to reduce the number and length of vertical lines, increasing the visibility of vertical lines, and designing breakaway links for heavy gear.	1	2	ALWTRT, NMFS, States	350/#	250	220	100	85
II.A.2.b. Design and implement programs to incorporate gear modifications that reduce entanglement into the fisheries operations.	1	3	NMFS, States	100/#	80	60	30	30
Reporting								
II.A.3.a. Continue to prepare and distribute information on whale entanglement to fishermen and other mariners and encourage reporting of entangled whales to the disentanglement network..	1	ongoing	ALWTRT, NMFS, States, USCG	15/#	20	15	5	5
II.A.3.b. Continue, expand, and improve, procedures for responding to reports of entangled whales.	1	ongoing	ALWTRT, NMFS, States, USCG	*/#	*	*	*	*
II.A.3.c. Expand fisheries observer programs.	2	5	ALWRT, NMFS,	180	250	300	350	350
II.A.3.d. Continue to review, evaluate, and act upon reports from fishermen and fishery observers of fishery interactions with right whales.	2	ongoing	NMFS, States, USCG	*/#	*	*	*	*
II.A.3.e. If evaluations indicate that reporting can/should be improved, implement improved systems for reporting.	2	3	ALWTRT, NMFS, States	15	15	10	10	10
Disentanglement								
II.A.4.a. When possible, disentangle whales caught in fishing gear.	1	ongoing	NMFS, USCG	400/#	400	300	200	200
II.A.4.a.i. Create and maintain disentanglement equipment caches and make appropriate arrangements to get disentangling teams and equipment to entangled whales.	1	ongoing	NMFS, USCG	35/#	20	15	15	10
II.A.4.a.ii. Develop and train additional disentanglement response teams.	1	3	ALWTRT, NMFS	60/#	60	50	50	30
II.A.4.a.iii. Design and conduct studies on advanced disentanglement gear.	1	3	NMFS	15	10	5	-	-
II.A.4.b. Identify and implement ways to improve disentanglement efforts.	1	2	NMFS, States	15	20	20	15	15
Monitoring of Entanglement Rates and Evaluation of Protective Measures								
II.A.5.a. Monitor entanglement-related survival and mortality rates.	2	ongoing	NMFS, States	15	15	15	10	10
II.A.5.b. Determine whether measures to reduce entanglement are effective.	1	2	NMFS	50/#	50	30	30	30
II.A.5.c. Identify and implement steps to improve protective measures.	1	2	NMFS	50	80	100	100	100

Education and Outreach								
III.1.a. Use all reasonable avenues to educate mariners about the occurrence of right whales and their vulnerability to ship strikes. Such efforts should include, but not be limited to, development and distribution of brochures, placards, fliers, videos, and articles in industry journals, and through direct liaison with the industry.	1	ongoing	ACOE, NEIT, NMFS, NOS, SEIT, States, USCG, USN	10	25	35	40	25
III.1.b. Ensure that right whale protective measures are incorporated and periodically updated in policy guidance documents of the international Safety Management Code and Coast Guard training course for vessel auditors and inspectors.	1	ongoing	NMFS, USCG	*	*	*	*	*
Enforcement								
IV.1.1. Continue and improve programs to ensure that fishing and shipping regulations are enforced.	1	ongoing	NMFS, States, USCG	100	100	120	120	140
Identify, characterize, protect, and monitor important right whale habitats								
Protect Right Whale Habitat -- Monitoring and Reducing Human Impact								
Coastal Development								
I.1.a. Conduct studies to determine the direct and indirect effects of activities and impacts associated with coastal development on the distribution behavior, and productivity of right whales. The activities and impacts studied should include, but not be limited to, sewage outfall, dredging activities (and associated plumes), dredge spoils, dumping, habitat alteration, noise, and aquaculture activities, including effects on prey species as well as on right whales directly.	2	4	ACOE, NEIT, NMFS, SEIT, States	140	140	140	100	100
I.1.b. As feasible, take steps to minimize identified adverse effects from coastal development.	2	5	ACOE, NMFS	*	*	*	*	*
Anthropogenic Noise								
I.2.a. Conduct studies to assess the direct and indirect effects of anthropogenic noise on the distribution, behavior, and productivity of right whales. Noise sources studied should include, but not be limited to, industrial and shipping activities, oceanographic experiments, military related activities, and other human activities.	3	4	NMFS, USN	80	120	120	100	60
I.2.b. Take steps to minimize identified adverse effects to right whales from anthropogenic noise.	2	5	ACOE, MMS, NMFS, USN, USCG	*	*	*	*	*
Pollutants								

I.3.a. Conduct studies to assess the sources and levels of anthropogenic pollutants and assess their possible adverse effects on right whales and their habitats. Such studies should focus on, but not be limited to, heavy metals, endocrine disrupters, immune suppressors, pathogens, and their exposure levels, pathways, and effects.	2	5	EPA, NEIT, NIST, NMFS	35	50	80	80	80
I.3.b. Take steps to minimize identified adverse effects from anthropogenic pollutants.	2	ongoing	EPA, NMFS	30	20	20	15	10
I.3.c. Conduct studies of individual health and body condition.	2	4/ ongoing	NMFS	120	200	200	180	150
Industrial Activities								
I.4.a. Conduct studies to assess possible adverse effects of oil, gas, and hard mineral exploration and development and other industrial activities.	3	4	EPA, MMS, NMFS	-	-	60	80	-
I.4.b. Take steps to minimize identified adverse effects from oil, gas, and hard mineral exploration and development.	3	5	MMS, NMFS	*	*	*	*	*
I.4.c. Monitor efforts to implement right whale-related protection measures in approved oil and gas exploration and development plans.	3	5	MMS, NMFS	-	5	15	15	15
I.4.d. Assess and update, as necessary, existing contingency plans for oil and chemical spills in waters in which right whales occur. Local, regional, and national authorities should all participate in the development of integrated plans.	3	2	MMS, NMFS, NOS, States, USCG	80	60	30	20	15
Whale Watching								
I.5.a. Conduct studies to assess the short- and long-term effects of whale-watching on right whales, notably with regard to high-speed vessels	3	4	NMFS, States	15	25	25	5	-
I.5.b. Assess the effectiveness of existing restrictions on whale watching activities to determine whether more restrictive measures are necessary or less restrictive measures could be permitted.	3	5	NMFS, States	*	*	*	*	*
I.5.c. Continue and expand education/public awareness programs to ensure that commercial and recreational vessel operators are aware of applicable regulations and guidelines.	1	ongoing	NEIT, NMFS, SEIT, States, USCG	10/#	5	5	5	5
Characterize and Monitor Right Whale Habitat								
Habitat Features								
II.A1.a. Compile or collect relevant physical, chemical, biological, meteorological, fishery, and other data to characterize features of important habitats and potential sources of human-caused destruction and degradation of critical habitats.	2	ongoing	NESDIS, NMFS, NOS	10	15	20	25	20

II.A1.b. Monitor human activities to assess potential right whale habitat degradation.	2	ongoing	ACOE, MMS, NEIT, NMFS, SEIT, States	10	20	15	10	10
II.A1.c. Monitor essential habitat features to assess potentially detrimental shifts in these features.	2	ongoing	NMFS, States	15	20	15	15	15
II.A1.d. Develop, implement, and monitor habitat protection strategies.	2	ongoing	ACOE, EPA, MMS, NMFS, States	15	25	30	30	20
II.A1.e. Monitor right whale habitat use patterns to assess shifts that might reflect disturbance or degradation of habitat.	2	ongoing	NMFS, NOS, States	25	25	25	25	25
II.A1.f. Conduct comparative studies to more accurately characterize critical habitats, using known shifts in habitat use as opportunities to test distribution hypotheses.	2	4	NMFS	15	15	15	15	15
II.A1.g. Collaborate with Canadian authorities to protect important habitats and essential habitat features in Canadian waters.	2	ongoing	DFO, DOS, NMFS	*	*	*	*	*
II.A1.h. Support Canadian efforts to protect known right whale habitat in Canada.	2	ongoing	DFO, NMFS	20	20	25	25	30
Prey and Feeding								
II.2. Conduct studies to improve knowledge of the diet, food requirements, feeding habits, and food resources of right whales.	2	4	NMFS	25	20	20	15	15
II.2.a. Compile and evaluate information on the known types, amounts, locations, and availability of right whale prey.	2	4	NMFS	5	10	5	-	-
II.2.b. Review and refine energetic models to better understand right whale food requirements and feeding strategies.	2	5	NMFS	5	5	5	-	-
Monitor the status and trends of abundance and distribution of the western North Atlantic right whale stock								
Status								
I.1. Conduct a study or a workshop to determine the best methods for assessing right whale status and trends, and to establish the optimal level of effort required.	2	2	NMFS	-	15	-	-	-
I.2. Assess population size, survival rate and trends on a regular basis.	2	ongoing	NEIT, NMFS, SEIT	10	10	10	10	10
I.2.a. At least once every three years, review and evaluate data on the status of the western North Atlantic right whale stock. If needed, improve data collection and analysis methods.	2	ongoing	NMFS	10	-	-	20	-
I.2.b. As necessary, develop and implement other programs necessary for population monitoring.	2	ongoing	NMFS	10	10	10	10	10
Distribution								
Surveys and Data Maintenance								

II.1.a. Continue to conduct annual winter surveys for right whales off the southeast U.S. coast.	1	ongoing	ACOE, NMFS, States, USCG, USN	350	350	370	400	400
II.1.b. Continue to conduct annual summer surveys for right whales in the lower Bay of Fundy.	1	ongoing	DFO, NMFS	80/#	100	100	120	150
II.1.c. Continue annual spring surveys for right whales in the Great South Channel.	1	ongoing	NMFS, USCG, States	180/#	180	180	200	200
II.1.d. Continue to conduct annual winter/spring surveys for right whales in Cape Cod and Massachusetts bays.	1	ongoing	NMFS, USCG, States	180/#	180	180	200	200
II.1.e. Continue to conduct annual summer and fall surveys for right whales on the Scotian Shelf.	1	ongoing	NMFS	50/#	70	70	90	100
II.2. Conduct studies to locate heretofore unknown high-use areas for this population.	1	3	NMFS	80	170	170		
II.3. Design and conduct surveys of likely wintering areas based on results of habitat and tracking studies, review of historical data, and results of predictive models.	2	4	NMFS	30	50	50	20	
II.4. Continue to maintain a database of right whale sightings.	2	ongoing	NMFS	100/#	100	100	110	110
Photo-Identification Database								
III.1. Maintain and routinely update the right whale photo-identification catalog.	2	ongoing	NMFS	80	80	80	80	80
III.2. Regularly and consistently review, evaluate, and update analyses of data in the right whale photo-identification catalog.	2	ongoing every 2 yrs	NMFS	20	20	20	25	20
III.3. Conduct studies to determine population structure using photo-identification data.	2	3	NMFS	20	50	60		
Strandings								
Information from Dead Whales								
IV.A.1. Continue and improve program for necropsy of right whale carcasses	1	ongoing	NEIT, NMFS, NOS, SEIT, States	100	80	80	60	50
IV.A.1.a. Review and, if needed, improve procedures for responding to reports of dead right whales and conducting necropsies to ensure that the most effective means are being used to extract scientific information from dead, stranded, and entangled right whales.	1	2	NEIT, NMFS, NOS, SEIT, States	50	40	*	*	*
IV.A.1.b. Improve or, as necessary, develop and implement protocols for securing and retrieving stranded or floating right whale carcasses.	2	3	NEIT, NMFS, NOS, SEIT, States	40	30	20	*	*
IV.A.1.c. To the extent possible, use necropsies to determine the cause of death and use such data to reduce the susceptibility to death from these causes.	2	ongoing	NEIT, NMFS, NOS, SEIT, States	5	5	10	10	10
IV.A.1.d. Analyze tissue collected from stranded right whales to determine and monitor contaminant levels.	2	ongoing	EPA, NIST, NMFS	10	20	15	10	10

IV.A.1.e. Analyze tissue collected from necropsies to improve knowledge about life history and reproductive parameters of right whales.	2	ongoing	NMFS	10	10	10	10	10
IV.A.1.f. Review, analyze, and summarize data on stranded right whales on a regular (at least annual) basis.	2	ongoing	NMFS	5	5	10	10	15
IV.A.1.g. Develop and implement a program for handling live-stranded right whales.	1	ongoing	NMFS	50	50	50	50	50
IV.A.1.g.i. Develop protocols for handling live-stranded right whales, including identification and securing of appropriate sites to effect rehabilitation	2	2	NMFS	25	10	*	*	*
IV.A.1.h. Establish reliable source(s) of funding for rescue, rehabilitation, necropsy, and tissue collection and analysis efforts.	2	2	NMFS	*	*	*	*	*
Telemetry Studies								
Evaluation of Tagging Techniques and Habitat Studies								
V.A.1. Where feasible, most effective, and least intrusive, conduct radio and satellite tagging studies to increase knowledge of right whale habitat use, distribution, and habits.								
V.A.1. a. Conduct studies to assess the most effective and least intrusive means of tagging right whales, including the possibility of using other taxa as models.	1	4	NMFS, USN	100	80	70	20	*
V.A.1. b. Continue and expand satellite-linked radio-tagging and tracking to better identify right whale movements and habitat use patterns	2	5	NMFS, USN	150	150	150	80	45
V.A.1. c. Conduct satellite tagging studies to determine routes and timing of migration between known high-use habitats	2	5	NMFS, USN	90	80	80	80	70
V.A.1. d. Continue and expand VHF radio-tagging studies to better assess daily and seasonal movements in high-use areas	2	5	NMFS, USN	25	35	50	30	30
Demography and Stock Structure								
Genetic Studies								
VI.1. Conduct genetic studies to assess population structure, effective population size, current and historic genetic diversity and possible impacts on health and reproductive success. In addition, conduct genetics workshop to determine optimal methods for analysis of genetic data.	3	5	NMFS	12 (work-shop)	+	15	20	15
Reproduction and Health Assessment								
VII.A. Assessment of possible reproductive anomalies and individual health								
VII.A.1. Conduct studies to determine the cause(s) of anomalous or fluctuating reproductive rates.	2	5	EPA, NMFS, States, USDA	100	120	120	150	100

VII.A.2. If cause(s) of reproductive anomalies are linked to human activities, establish programs to mitigate or eliminate the sources of the impact.	1	5	EPA, MMS, NMFS, NOS, States, USCG, USDA	50	80	80	80	80
VII.A.3. Conduct studies to assess health at the individual and population level.	2	5	EPA, NMFS, States, USDA	120	180	180	200	200
VII.A.4. If studies indicate that poor individual or population health is linked to human activities, establish programs to mitigate or eliminate the sources of the impact.	1	5	EPA, MMS, NMFS, NOS, States, USCG, USDA	50	80	80	80	80
Coordinate Federal, State, international, and private efforts to implement the Recovery Plan								
I. Continue international ban on hunting and other directed takes of right whales.	1	ongoing	IWC, NMFS, DOS	*/#	*	*	*	*
II. Enforce right whale protection laws.	1	ongoing	NMFS, USCG	180/#	200	250	250	300
III. Evaluate the effectiveness of the Northeast and Southeast Implementation Teams and implement improvements as warranted.	3	1	NEIT, NMFS, SEIT	*	*	*	*	*
IV. Coordinate with States involved in right whale activities to maximize protection measures	1	ongoing	NEIT, NMFS, SEIT, States					
V. Promote bi-lateral cooperative efforts with Canada to maximize protection for right whales, reduce human-related mortality and injury, report mortality events, promote protection of habitat, and to take other measures to enhance the recovery of right whales.	2	ongoing	DFO, DOS, NMFS, USCG	*	*	*	*	*
V.1. Convene regular meetings with Canadian officials to facilitate bi-lateral cooperation on protective measures.	2	ongoing	DFO, DOS, NMFS, USCG	*	*	*	*	*
V.2. Promote actions to enhance protection for areas of importance, especially vessel and fishery interaction issues in Canadian waters.	1	ongoing	DFO, DOS, NMFS, USCG	*	*	*	*	*
VI.1. At least once every five years, review and evaluate recovery actions and prioritize needs.	1	ongoing	DFO, NEIT, NMFS, SEIT	*	*	*	*	*
VII. As appropriate, publish regulations to reclassify the western North Atlantic right whale stock under the Endangered Species Act and the Marine Mammal Protection Act.	3	ongoing	NMFS	*	*	*	*	*

* No direct cost associated with this task
\+ Task already completed
\# Task already underway