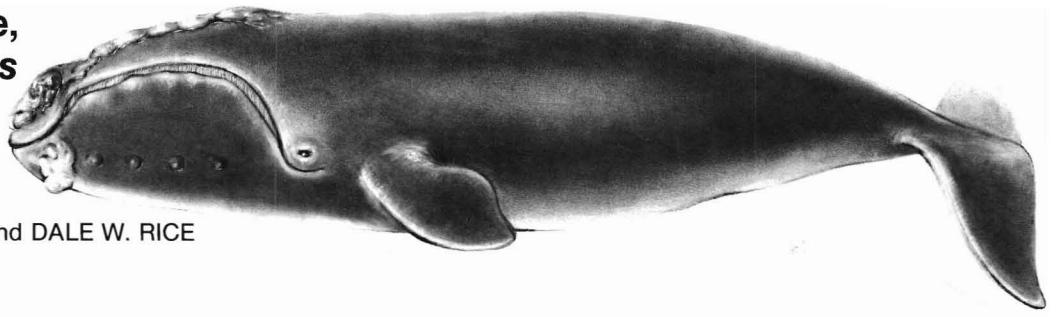
The Right Whale, *Balaena glacialis*



HOWARD W. BRAHAM and DALE W. RICE

Introduction

The right whale, *Balaena glacialis* Muller, 1776[1], also known as the black right whale, resembles the bowhead, *B. mysticetus*, in its robust build, narrow arched rostrum, and lack of a dorsal fin, but is readily recognized by the callosities on its rostrum and its scalloped lower lips. The right whale occurs in all the world's oceans from temperate to subarctic waters (Fig. 1). Seasonally, it is a coastal species; however, important feeding aggregations are reported well out to sea, especially in the North Pacific and South Atlantic. Like most other baleen whales, they spend the summer on high-latitude feeding grounds and migrate to more temperate waters during the winter calving and mating seasons.

The species was overexploited principally by European and Yankee whalers, but very little is known about the impact of whaling on the number and location of populations around the world. Nevertheless, several discrete breeding populations are hypothesized. The reproductive cycles of animals in the Northern and Southern Hemispheres are 6 months out of phase, and right whales from these regions, therefore, do not interbreed. This divides the species into at least three reproductively isolated populations, one each in the North Pacific, the North Atlantic, and the Southern Hemisphere; other stocks

The authors are with the National Marine Mammal Laboratory, Northwest and Alaska Fisheries Center, National Marine Fisheries Service, NOAA, 7600 Sand Point Way N.E., Bin C15700, Seattle, WA 98115.

[1]Some authors place the species *glacialis* in a separate genus, *Eubalaena* Gray, 1864 (e.g., Rep. Int. Whaling Comm., Spec. Issue 9).

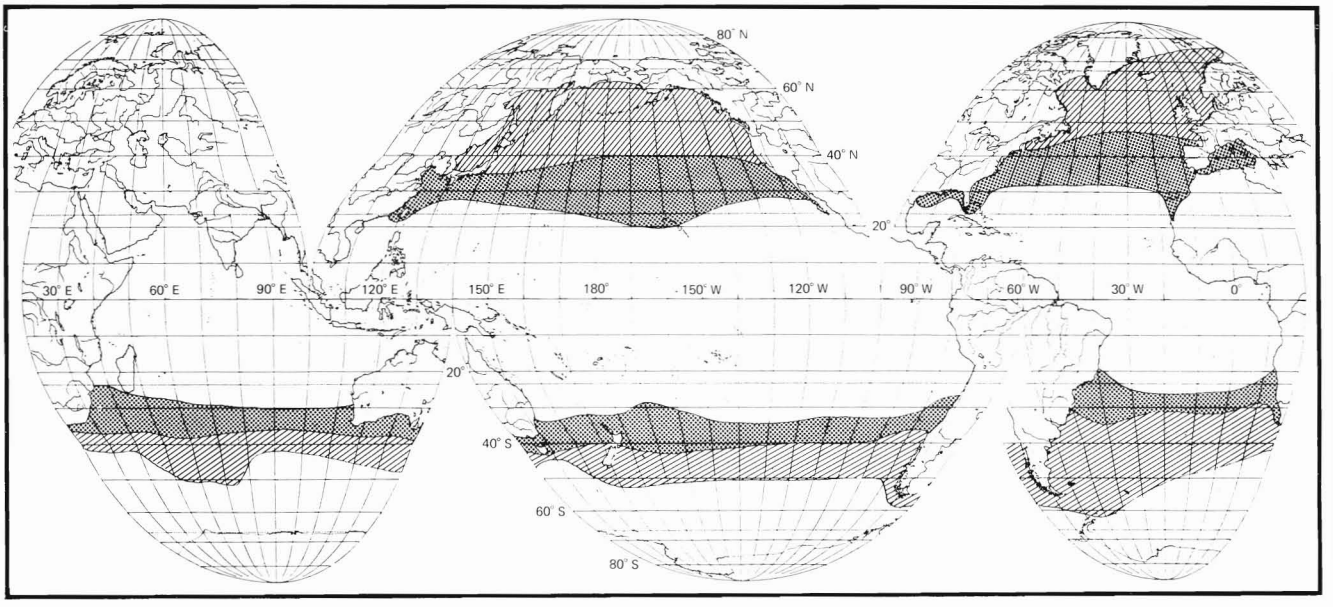


Figure 1.—Geographical distribution of the right whale. Simple hatching indicates the summer feeding grounds. Stippling indicates distribution during autumn, winter, and spring; records are scarce during these seasons, and the distribution is to a large extent speculative.

within these regions are presumed. These stocks may not interbreed, but some overlap on their summer feeding grounds.

Although the right whale has been protected from whaling under international agreement since 1931, there is little evidence of recovery in most areas, unlike other baleen whales so protected. This suggests that it might be the most vulnerable to human intervention of all great whales. For example, their behavior of moving into coastal habitats during the sensitive calving season probably makes them particularly vulnerable to nearshore development.

Distribution and Migration

Right whales are found in temperate waters above lat. 25° during the late autumn to early spring calving and mating season, and in higher latitudes, usually above lat. 40° during the spring to autumn feeding season. No overlap in distribution occurs between Northern and Southern Hemisphere populations in tropical waters; hence the stocks are geographically isolated. Right whales rarely occur in the polar pack ice.

North Atlantic

The International Whaling Commission (IWC, In press, a) currently recognizes three stock areas for right whales in the North Atlantic: One each on either side of the 30°W meridian from the southern tip of Greenland (Cape Farewell) south, and the third area within lat. 60-62°N, long. 33-35°W from Greenland to Iceland. Some question remains as to whether this third unit might be confused with a bowhead whale stock area, since the data are primarily from the early whale fishery for bowheads.

Current data support the hypothesis that right whales in the western North Atlantic principally occur in coastal waters from Florida to Labrador. A few sightings have been made in the Gulf of Mexico (Moore and Clark, 1963) and Bermuda to the south, and from early whaling records they once occurred as far north as south Davis Strait, Canada (IWC, In press, a). Right whales apparently spend the winter months (January-March) along the southeast coast of the United States from Florida to North Carolina, most beyond sight of land. They then move into coastal waters of Massachusetts, Maine, southeast Nova Scotia, and Labrador, traveling north from spring to early autumn (Winn and Price, In press).

Calving appears to occur in late winter. On the basis of the size of calves seen in the Bay of Fundy, Kraus and Prescott[2] estimate that calving occurs from February to April. The peak numbers of right whales seen in spring are off Cape Cod in April, but few are seen there in summer (Schevill, et al., In press). Most summer sightings are from southeast Canadian waters (Reeves et al., 1978); many likely occur well offshore during summer and autumn based on 19th-century whaling records (IWC, In press, a).

The southward autumn migration (from about October through December) presumably occurs farther offshore than in spring, and the period of migration is shorter (Winn and Price, In press). This is consistent with reports of the movement of right whales off South Africa (Best, 1981). However, definitive information on the movements is generally lacking and the available information is based on scattered historical whaling and sightings records reviewed by Schevill et al. (In press), and Winn and Price (In press).

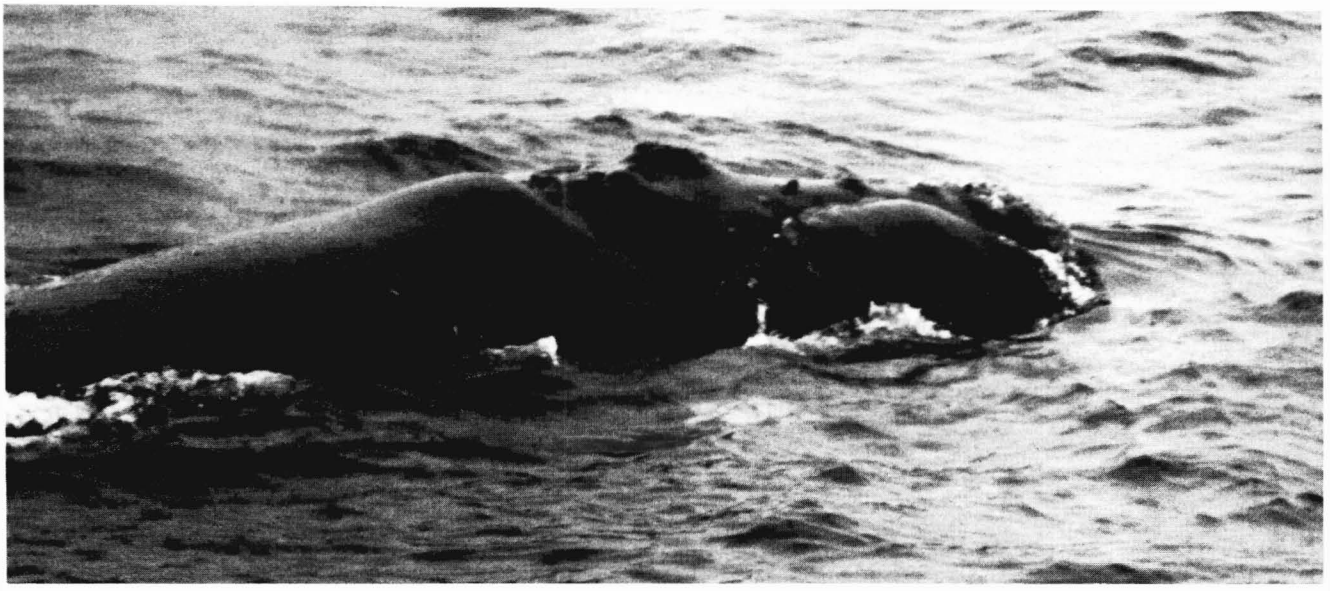
Current records of right whales in the eastern North Atlantic are far fewer, and their seasonal movements are not known. Whaling records back to the 16th century indicate that right whales were taken from off Cape Farewell to Iceland (although this may have been more a bowhead fishery); off North Cape, Norway; and off the British Isles. Important winter hunting grounds, and thus presumed calving areas, were in the Bay of Biscay of northwest Spain and western France, and Cintra Bay (lat. 23°N, long. 16°15′W) off northwest Africa.

North Pacific

Wintering areas for right whales in the North Pacific are unknown. Migration patterns are also largely unknown, except that northward movements from temperate and subarctic waters occur in spring, with the species occurring on summer feeding grounds generally between lat. 50°N and 63°N (Omura, 1958). Some early whaling records reported by Maury (1852) and Townsend (1935), as well as Japanese sighting data during the 1960's and 1970's, support the hypothesis that right whales are distributed all across the North Pacific north of lat. 35°N, with important concentrations in the Gulf of Alaska, eastern Aleutian Islands-southcentral Bering Sea, Okhotsk Sea, and coastal Japan. Although the evidence is certainly not definitive, the IWC (In press, a) has tentatively divided the North Pacific into two stock areas for purposes of reporting statistics.

Right whales in the western North Pacific occur from waters off Japan north into the Okhotsk Sea and western Bering Sea. There is no clear data to support the idea that more than one stock occurs in this area, or whether there is a continuum into the eastern North Pacific, but right whales were formerly abundant from Japan and the east China Sea to the Okhotsk Sea from late winter to summer (Klumov, 1962; Omura, 1958). The likely calving/mating area was south and west of Japan and in the east China Sea and Formosa Strait, predominantly from December to March (Omura, 1958). Right whales were taken off the Bonin Islands at lat. 27°N, long. 137°W (about 300

[2]Kraus, S. D., and J. H. Prescott. 1982. The North Atlantic right whale (*Eubalaena glacialis*) in the Bay of Fundy, 1981, with notes on distribution, abundance, biology and behavior. Unpubl. manuscr., 105 p. New England Aquarium, Central Wharf, Boston, MA 02110. (Prepared for the World Wildlife Fund, Washington, D.C., and the Northeast Fisheries Center, National Marine Fisheries Service, NOAA, Woods Hole, Mass., under Contract NA-81-FA-C-00030.)



A right whale surfacing showing the arched lower lip and the rough, horny callosities on the head. Photo by G. Joyce.

miles (500 km) southeast of Japan) in February (Rowntree et al., 1980). This may be the southern extent of their distribution; the northern recent record (two animals) occurred in summer 1982 at about lat. 60°48′N, long. 175°18′W (Brueggeman[3], U.S. Department of the Interior[4]).

The most important whaling ground for right whales in the eastern North Pacific was off Kodiak Island in the Gulf of Alaska. Right whales were also taken in the eastern Aleutians Islands area and off the coast of Canada and southeast Alaska, principally in summer. Evidence of large calves seen in the Gulf of Alaska in summer supports the notion that parturition occurs in late winter-early spring, presumably further south. There is no evidence to date that right whales either gave birth in or occupied coastal waters of the eastern North Pacific. Although coastal whaling for the gray whale, *Eschrichtius robustus*, and humpback whale, *Megaptera novaeangliae*, was extensive along the west coast of North America, only about 45 records of right whales exist below lat. 50°N (Scarff, In press), lending support to the hypothesis that right whales found on summer grounds in the eastern North Pacific may either 1) migrate from the western North Pacific or 2) winter in pelagic waters of the east and central North Pacific (Maury (1852) showed right whales well out to sea above lat. 35°N and east of long. 180° in February and March). The southern record for right whales along the North American Pacific coast is off Baja California at lat. 26°39′N, long. 113°40′W where two whales were seen about 8 km (5 miles) offshore on 11 March 1965 (Rice and Fiscus, 1968).

Southern Hemisphere

Right whales range throughout the southern oceans, particularly off South Africa, the southeast coast of South America, New Zealand, Australia, and in the south Indian Ocean. Specific migration patterns are not well understood, but the whales move north in late autumn along coastal routes and south to pelagic feeding areas in spring. The movements of offshore groups of whales are also unknown, but based upon limited historical whaling records, they are likely similar to those of coastal animals: Seasonal north-south movements. A survey of the current understanding of stock identity is reviewed by the IWC (In press, a).

Right whales occur seasonally in pelagic waters of the southwest Atlantic Ocean along the southeast coast of South America from Brazil (e.g., False and Brazil Banks) to southern Argentina, and east to the Falkland Islands. This latter area was referred to as the Tristan and Pigeon grounds (long. 10°W-30°W) by early whalers. The whales' distribution continues east to the southern coast of Africa where a distinct stock from those west of long. 20°E occurs. The area west of long. 20°E is tentatively called the Greenwich Stock area; that east of long. 20°E is called southeast African Stock area.

Right whales concentrate along the southeast coast of Argentina (about lat. 43°S at Peninsula Valdes) in

[3]J. J. Brueggeman, Envirosphere Company, 400 - 112th N.E., Bellevue, WA 98004, pers. commun.

[4]U.S. Department of the Interior. 1983. Navarin Basin lease offering (March 1984). Final Environmental Impact Statement. Unpubl. manuscr., Minerals Management Service, Alaska Outer Continental Shelf Region, U.S. Department of the Interior, P.O. Box 101159, Anchorage, AK 99510.

September and October (calving season), but are seen as early as June and as late as February. During this northward movement or migration, some individuals apparently continue north into Brazilian waters (Payne[5]). These animals are closely associated with coastal areas, such as bays and estuaries, as are those located off South Africa. The southward spring migration probably begins in about November, off Brazil and Argentina.

Along the south coast of South Africa (at about lat. 34°S), right whales occur primarily between June and November, having moved north from presumably subantarctic feeding areas, but are greatest in number during August and September (Best, 1981; Rice et al., In press). This inshore component may represent only one segment of the population, principally cows with calves and unaccompanied adults (Best, In press). As with the South American coast, right whales are essentially absent during the summer months when they are thought to be feeding in subantarctic waters. Based on 13 records, Japanese sighting surveys report right whales in Antarctic waters between lat. 60°S-65°S in January (Kasamatsu, In press).

There are at least five putative stock areas in the South Pacific and Indian Ocean: Off Chile, New Zealand, Campbell Island, Australia (southwest and southeast possible subdivisions), and central Indian Ocean-southeast Africa (possibly 2-3 subdivisions) (IWC, In press, a). The Chilean stock is considered provisional as there is a lack of sightings between New Zealand and Chile between long. 90°W and 130°W. Based on separate catch histories and the distribution of right whales at about the same time of year (mid-May to September), right whales off the east coast of New Zealand (Cawthorn, In press) and around Campbell Island (about 300-500 n.mi. south of New Zealand) are tentatively considered separate stocks. Right whales occur throughout waters of south Australia, especially in southeast and southwest Australia and Tasmania, principally from midwinter (July) to early spring (September) (Bannister, In press). It is thought that they migrate to the north from Antarctic waters, with the south coast of Australia being the north end of their range. Based on early whaling records, the western extent of this right whale stock area designation is about long. 90°E in the Indian Ocean. The stock areas and movements of right whales in the southern Indian Ocean (Central Indian group(s)) are known only from early whaling records. These suggest that perhaps up to three possible stocks occur within the area bounded by lat. 50°S-40°S and long. 50°E-80°E, near the Crozet, Kerguelen, and Amsterdam island groups.

[5]R. S. Payne, Center for Long Term Studies, Weston Road, Lincoln, MA 01773, pers. commun.

Life History and Ecology

Feeding

During the summer, right whales inhabit cool temperate waters where they feed primarily on calanoid copepods, called "brit" by whalers. Right whales are specialized as "skimmers" that feed by swimming slowly with their mouths wide open through the swarms of copepods. They usually feed below the surface, but sometimes feed at the surface, raising their rostrum above water (Watkins and Schevill, 1976). The main species of copepods on which they feed are *Calanus cristatus* and *C. plumchrus* in the North Pacific, and *C. finmarchicus* in the North Atlantic (Collett, 1909; Klumov, 1962; Omura et al., 1969). Food habits have been little studied in the Southern Hemisphere, but in addition to species of *Calanus* they sometimes consume "lobster-krill," the pelagic postlarval stage of the crustacean *Munida gregaria* (Matthews, 1932). Euphausiids, or "krill," are also eaten sometimes, including *Euphausia pacifica* in the North Pacific, *Thysanoessa inermis* in the North Atlantic, and *E. superba* in the Southern Hemisphere.

Reproduction

Few data are available on reproduction in right whales (Best, 1981; Klumov, 1962; Matthews, 1938; Omura et al., 1969; Whitehead and Payne, 1981). As with other baleen whales, their reproductive cycle is synchronized with their feeding cycle and annual migration.

The gestation period is probably about 1 year. Females enter shallow coastal bays to give birth to their single calves. The calving season is during the winter—January to April in the Northern Hemisphere and July to October in the Southern Hemisphere. Calves average 5.5-6.0 m (18-20 feet) long at birth. They are probably weaned by the time they are 12 months old, when they are about 8.0 m (26 feet) long, but may remain with their mother through the winter following their year of birth. Right whales apparently do not attain sexual maturity until they are at least 8 years old. Body length of females at sexual maturity is 12.5-15.5 m (41-51 feet), and that of males is probably about 1 m less (there may be geographical variation in this feature). Mature females usually bear a calf only once every 3 years (IWC, In press, a).

Best (1981) and R. S. Payne (footnote 5) state that based on some 10 years of study of right whales off South Africa and Argentina, respectively, these right whale stocks appear to be growing at a rate of about 7 percent per year. This suggests a high rate of reproduction, with the ratio of calves to adults in the neighborhood of 15-25 percent. However, as Best and Payne point out (IWC, In press, a), few juveniles are seen, indicating that they are studying only a portion of the population. In addition, most mature females (as well as adult males) are not seen every year, but may return with a calf every 2 or 3 years. As the reproductive cycle between presumed successive births is at least 3 years (estimated to average 3.26 years, (IWC, In press, a)), the net recruitment is probably much lower than 7 percent.

The IWC (In press, a) attempted to resolve this issue, and through a series

The whaling station which operated at Kyuquot, Vancouver Island, from 1919 until World War II. Source: Historical Photography Collection, University of Washington Libraries, Seattle.

of modeling exercises at the special workshop on right whales, concluded that to achieve population growth rates greater than 5 percent, survivorship would have to be much higher than thought by the scientists present. This exercise pointed out that while there are many inconsistencies in the available data, as well as in using certain assumed but contested parameters (e.g., survivorship and annual calf proportion), recruitment rates in right whales are probably lower than suggested by the apparent growth of the South African and Argentine populations, and that indeed net recruitment is likely among the lowest of the large baleen whales. Empirically, this seems to be supported by the apparent low rate of recovery of all right whales (including bowheads) in this century.

Natural Mortality

Important natural mortality factors are unknown. Barnacles and three species of cyamids or "whale-lice" often grow on the skin, and three kinds of parasitic worms have been found in the intestines (Delyamure, 1955), but all of these appear to be nonpathogenic. Predation on right whales by killer whales, *Orcinus orca*, appears to be quite rare.

Natural mortality rates have been estimated to be about 4.0 percent per year in adults, and are probably greater in immature animals. However, current estimates of mortality rates in large baleen whales are in question (IWC, In press, b).

Exploitation and Population Size

History of Exploitation

Right whales are large and slow-swimming, often congregate in nearshore waters, have a thick layer of blubber, and float when killed. These attributes make them easy and profitable prey for whalers (hence their name, the "right" whale). Thus they were the first species of great whale to become the object of a commercial fishery.

The Basques living on the shores of the Bay of Biscay in northern Spain and southwestern France began a right whale fishery as early as the year 1059. This fishery flourished until the early 1600's. The Basque whalers subsequently ventured farther afield, and after 1528 they regularly voyaged to the Grand Banks off Newfoundland, and later, the Gulf of Saint Lawrence, Canada (Jenkins, 1921).

American colonists began shore-based whaling for right whales in the early 1600's at many places along the Atlantic seaboard—notably in the vicinity of Massachusetts and Long Island. This fishery persisted until the early years of the 20th century.

In the early 1600's, commercial whale fisheries were also instituted in Japan. Right whales were an important component of their catches. This shore fishery has persisted to the present day, although right whales are no longer killed.

The American high-seas whale fishery was inaugurated in 1712 (Starbuck, 1878). This fishery was directed primarily toward sperm whales, *Physeter macrocephalus*, but right whales were also an important species. At first the fishery was confined to the Atlantic Ocean, and voyages usually lasted only a few months. Following the American Revolution, the high-seas whale fishery expanded rapidly. U.S. vessels began regular voyages to the Pacific Ocean in 1791, and to the Indian Ocean in 1830. These voyages routinely lasted 3 or 4 years. Several other nations—notably France and England—also engaged in the high-seas whale fishery, but to a lesser extent than the United States. Between 1804 and 1876, U.S. whalers killed an estimated 193,522 right whales worldwide (this figure includes an unknown, but small, proportion of bowhead whales). U.S. whaling reached its zenith in 1840, when 735 vessels were engaged in the fishery. The highest annual catch of right whales was reported in 1846, when U.S. vessels delivered to port the oil of an estimated 6,134 animals. During the latter half of the 19th century, the pelagic whale fishery rapidly declined owing to the severe depletion of right whale populations and to the substitution of petroleum for sperm oil.

During the heyday of the pelagic fishery, numerous shore whaling stations were established in Australia, New Zealand, and South Africa, and their prime target was the right whale.

By the time the modern whale fishery with its harpoon cannons and steam-powered catcher boats com-

A large right whale (lying on its back) on the flensing platform of the former whaling station at Akutan in the Aleutian Islands. Some of the 8-foot long baleen plates are protruding from the left side of the mouth. Source: Historical Photography Collection, University of Washington Libraries, Seattle.

menced in the late 1800's, right whales were so rare worldwide that they were almost never encountered. The modern fishery concentrated on blue, *Balaenoptera musculus*; fin, *B. physalus*; and humpback, *Megaptera novaeangliae*, whales which the old-style hand-harpoon fishery had largely ignored.

Current and Initial Stock Sizes

No one has attempted to estimate original population sizes, and there are perhaps too few data to do this with any precision. Based on the recorded catch figures for right whales, and on original population density estimates of other baleen whales, we suggest that the original population size of the right whale was on the order of 100,000 to 300,000, of which about two-thirds were in the Southern Hemisphere, and the remainder in the North Atlantic and North Pacific.

Current population size is also poorly known. There are roughly 3,000 right whales left in the Southern Hemisphere, 100-200 in the North Pacific, and a few hundred in the North Atlantic, for a world total of perhaps 3,000 to 4,000 (Gambell, 1976). The world population of right whales appears to have been reduced by at least 95 percent, and perhaps by as much as 99 percent during the first several centuries of exploitation. There are indications that some local stocks are beginning to increase slightly (see the section on Reproduction), but even with complete protection, recovery (if any) has been exceedingly slow and may take at least a century.

Management

The chief management problem is the usurpation of the right whales' nearshore calving grounds by coastal development and concomitant vessel traffic, pollution, and oil spills. The most significant present concern is for habitat protection and the potential problems associated with oil and gas development on the outer continental shelf along the east coast of the United States (Cetacean and Turtle Assessment Program[6]), in particular

[6]Cetacean and Turtle Assessment Program. 1982. A characterization of marine mammals and turtles in the mid- and north Atlantic areas of the U.S. outer continental shelf. Unpubl. manuscr., 450 p. plus appendices. Graduate School of Oceanography, University of Rhode Island, Kingston, RI 02881. (Prepared for the U.S. Department of the Interior's Bureau of Land Management under Contract AA551-CT8-48.)

Georges Bank, and along the west coast of the United States where right whales are likely to occur in or adjacent to at least six petroleum lease areas, primarily in Alaska (Braham et al., 1982; Morris et al., 1983; U.S. Department of the Interior, footnotes 4 and 7).

Because of their low population numbers, their habit of using coastal waters, and apparent low reproduction, right whales are likely the most vulnerable of all the great whales to habitat incursion and deterioration. Removal (death resulting from collision with tankers, oil spills, etc.) of just a few individuals from depressed populations would have a significant effect on recovery. Concern for other results of coastal developmental activities, such as pollution, is justified as well, since right whales migrate into coastal waters at least in the western Atlantic to feed on abundant prey, often nearshore (e.g., Cape Cod and Bay of Fundy).

Conclusions

It is clear that all stocks of the right whale were severely depleted as a result of commercial whaling. Some, like the northeast Pacific stock, if an identifiable breeding unit, have not recovered and may be nearing extinction, similar to that of the fate of the western Pacific gray whale and the Spitsbergen stock of bowhead whales. Other populations, such as those off Argentina and South Africa, have recently increased. But generally, insufficient data exist to give a precise determination of future growth for any stock. In addition, this species' penchant for coastal habitats, such as the eastern seaboard of the United States, where industrial and other nearshore development activities occur, could create potential obstacles to recovery.

[7]U.S. Department of the Interior. 1982. St. George Basin. Final Environmental Impact Statement. Unpubl. manuscr., Minerals Management Service, Alaska Outer Continental Shelf Region, U.S. Department of the Interior, P.O. Box 101159, Anchorage, AK 99510.

Literature Cited

Bannister, J. L. In press. Southern right whales: Current status off Australia from 20th century sightings. Rep. Int. Whaling Comm., Spec. Issue 9.

Best, P. B. 1981. The status of right whales (*Eubalaena glacialis*) off South Africa, 1969-1979. S. Afr. Dep. Agric. Fish., Invest. Rep. 123, 44 p.

_____. In press. Current status of right whales off South Africa. Rep. Int. Whaling Comm., Spec. Issue 9.

Braham, H. W., G. W. Oliver, C. Fowler, K. Frost, F. Fay, C. Cowles, D. Costa, K. Schneider, and D. Calkins. 1982. Marine mammals. *In* M. J. Hameedi (editor), Proceedings of a synthesis meeting: The St. George Basin environment and possible consequences of planned offshore oil and gas development, p. 55-81. U.S. Dep. Commer., NOAA, Off. Mar. Pollut. Assess., Outer Cont. Shelf Environ. Assess. Program, Juneau, Alaska.

Cawthorn, M. W. In press. Current status of right whales off New Zealand - 20th Century sightings and trends. Rep. Int. Whaling Comm., Spec. Issue 9.

Collett, R. 1909. A few notes on the whale *Balaena glacialis* and its capture in recent years in the North Atlantic by Norwegian whalers. Proc. Zool. Soc. Lond. 1909:91-98.

Delyamure, S. L. 1955. Gel'mintofauna morskikh mlekopitayushchikh v svete ikh ekologii i filogenii (Helminthofauna of marine mammals (ecology and phylogeny)). Izd. Akad. Nauk SSSR, Moscow, 517 p. [In Russ., Transl. by Isr. Program Sci. Transl., 1968, 522 p. Avail. U.S. Dep. Commer., Natl. Tech. Inf. Serv., Springfield, Va., as TT67-51202.]

Gambell, R. 1976. World whale stocks. Mammal Rev. 6(1):41-53.

IWC. In press, a. Report of workshop on the status of right whales. Rep. Int. Whaling Comm., Spec. Issue 9.

_____. In press, b. Report of the Sub-Committee on Other Protected Species and Aboriginal Whaling. Rep. Int. Whaling Comm., Vol. 35.

Jenkins, J. T. 1921. A history of the whale fisheries. H. F. and G. Witherby, Lond., 373 p.

Kasamatsu, F. In press. Sightings and natural markings of three southern right whales in the waters south of 60°S near Antarctic Peninsula in 1982 and 1983. Rep. Int. Whaling Comm., Spec. Issue 9.

Klumov, S. K. 1962. Gladkie (Yaponskie) kity Tikhogo Okeana (The right whales in the Pacific Ocean). Tr. Inst. Okeanol. Akad. Nauk SSSR 58:202-297. [In Russ.]

Matthews, L. H. 1932. Lobster-krill, anomuran crustacea that are food of whales. Discovery Rep. 5:467-484.

_____. 1938. Notes on the southern right whale, *Eubalaena australis*. Discovery Rep. 17:169-182.

Maury, M. F. 1852. Whale chart of the world. [The wind and current charts], Ser. F, Wash., D.C.

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

Morris, B. F., M. S. Alton, and H. W. Braham. 1983. Living marine resources of the Gulf of Alaska, a resource assessment for the Gulf of Alaska/Cook Inlet proposed oil and gas Lease Sale 88. U.S. Dep. Commer., NOAA, Natl. Mar. Fish. Serv., NOAA Tech. Memo. NMFS F/AKR-5, 232 p.

Omura, H. 1958. North Pacific right whales. Sci. Rep. Whales Res. Inst., Tokyo 13:1-12.

_____, S. Ohsumi, T. Nemoto, K. Nasu, and T. Kasuya. 1969. Black right whales in the North Pacific. Sci. Rep. Whales Res. Inst., Tokyo 21:1-78.

Reeves, R., J. Mead, and S. Katona. 1978. The right whale, *Eubalaena glacialis* in the Western North Atlantic. Rep. Int. Whaling Comm. 28:303-311.

Rice, D. W., and C. H. Fiscus. 1968. Right whales in the southeastern North Pacific. Nor. Hvalfangst-Tidende 57(5):105-107.

Rice, F. H., L. A. Carter, and G. S. Saayman. In press. The behavior and movements of right whales (*Eubalaena australis*) off the coast of South Africa, 1977-1982. Rep. Int. Whaling Comm., Spec. Issue 9.

Rowntree, V., J. Darling, G. Silber and M. Ferrari. 1980. Rare sighting of a right whale (*Eubalaena glacialis*) in Hawaii. Can. J. Zool. 58:309-312.

Scarff, J. E. In press. Historic and present distribution of the right whale (*Eubalaena glacialis*) in the eastern North Pacific south of 50°N and east of 180°. Rep. Int. Whaling Comm., Spec. Issue 9.

Schevill, W. E., W. A. Watkins, and K. E. Moore. In press. Status of (*Eubalaena glacialis*), off Cape Cod. Rep. Int. Whaling Comm., Spec. Issue 9.

Starbuck, A. 1878. History of the American whale fishery from its earliest inception to the year 1876. U.S. Comm. Fish Fish., Part 4, Rep. Comm. 1875-1876, Append. A., 779 p.

Townsend, C. H. 1935. The distribution of certain whales as shown by logbook records of American whaleships. Zoologica (N.Y.) 19(1):1-50.

Watkins, W. A., and W. A. Schevill. 1976. Right whale feeding and baleen rattle. J. Mammal. 57:58-66.

Whitehead, H., and R. Payne. 1981. New techniques for assessing populations of right whales without killing them. *In* Mammals in the seas, Vol. 3, General papers and large cetaceans, p. 189-209. Food Agric. Organ. U.N., Rome, FAO Fish. Ser. 5, Vol. 3.

Winn, H. E. and C. A. Price. In press. A model (scheme) of the annual activities of the northern right whales in the western North Atlantic. Rep. Int. Whaling Comm., Spec. Issue 9.