The Blue Whale, Pygmy Blue Whale, and the Antarctic or True Blue Whale

Introduction

The Northern Hemisphere blue whale, *Balaenoptera musculus musculus* Linnaeus 1758; the pygmy blue whale, *Balaenoptera musculus brevicauda* Ichihara 1966; and the true blue whale[65] , *Balaenoptera musculus intermedia* Burmeister 1871, are members of the Balaenopteridae family whose subspecies contain the largest animals ever known to have lived on Earth (Rice[12]). Adult blue whales can attain lengths of about 30 m and weigh up to 160 t in the Southern Oceans (Mackintosh, 1942). In the North Atlantic and North Pacific, their maximum lengths have been recorded at 27 m (True, 1904) and 26.8 m (Reeves et al., 1985), respectively. They are gray in color (appearing blue below the water surface) with distinct gray and white mottling, while their ventral surface is lighter in color. Their dorsal fin is relatively small (Fig. 23). Like other balaenopterids, they have fringed baleen plates instead of teeth and ventral grooves which allow for the filtering of large quantities of water during feeding on swarms of euphausiids.

Rice[12] recognizes the *B. musculus* subspecies based on body size and geographic distribution. *B. m. intermedia*, which occurs in the high latitudes of the Southern Oceans, is the largest (maximum length = 30 m), *B. m. musculus* of the Northern Hemisphere is slightly smaller (maximum length = 27 m), and *B. m. brevicauda* (pygmy blue whale) in the mid latitude waters of the southern Indian Ocean and north of the Antarctic Convergence is the smallest (Ichihara, 1966; Omura et al., 1970; Kato et al., 1995; Gilpatrick et al.[66]). Distinguishing between the subspecies is difficult at sea and, therefore, information on population size and distribution for each subspecies may be unreliable.

Distribution and Migration

Blue whale distribution is worldwide (Fig. 24). Presumably they follow a migration pattern of seasonal north-south movements between summering and wintering areas, but some evidence suggests that individuals in certain areas remain in low latitudes year-round (Donovan, 1984; Yochem and Leatherwood, 1985; Reilly and Thayer, 1990). The location of wintering areas is still somewhat speculative (Jonsgård, 1966; Mackintosh, 1966), whereas known summer feeding areas are in the relatively high latitudes. Migratory routes are not well known, mainly because blue whales occur primarily in the open ocean.

North Pacific

Blue whales are found along the coastal shelves of North America and South America in the Pacific Ocean (Rice, 1974; Clarke, 1980; Donovan, 1984). The IWC Scientific Committee recognized one blue whale stock in the North Pacific (Donovan, 1991). However, there is increasing evidence suggesting that more than one stock exists within this ocean basin (Ohsumi and Wada, 1974; Mizroch et al., 1984a; Barlow et al., 1994b; Braham[3]; Gilpatrick et al.[66]). One such tentative stock designation is for blue whales occuring during winter off Baja California and in the Gulf of California (Fig. 4). Photo-identification studies have shown that individuals from these concentrations travel in summer and fall to waters off California (Calambokidis et al.,1990; Barlow et al.,1997; Sears et al.[67]). Preliminary studies of these California/Mexico whales, based on body-length data from whaling records and aerial photogrammetry, indicate that they are morphologically distinct from blue whales of the western and central North Pacific (Gilpatrick et al.[66]).

Acoustic monitoring has resulted in blue whale vocalizations being recorded off Oahu, Hawaii, and the Midway Islands (Northrop et al., 1971; Thompson and Friedl, 1982), although sightings or strandings in Hawaiian waters have not been reported. Nishiwaki (1966) noted the occurrence of blue whales near the Aleutian Islands and in the Gulf of Alaska. However, as of 1987, there have been no blue whale sightings in these waters (Leatherwood et al., 1982; Stewart et al., 1987; Forney and Brownell[68]). No distributional information exists for the western North Pacific Ocean.

[65] *B. m. intermedia* is referred to in the literature by three common names: Antarctic blue whale, southern ordinary blue whale, and the true blue whale. To avoid confusion, this review refers to this subspecies as the "true" blue whale.

[66] Gilpatrick, J. W., W. L. Perryman, and R. L. Brownell. 1997. Geographic variation in North Pacific and Southern Hemisphere blue whales (*Balaenoptera musculus*). Unpubl. doc. SC/49/09, 33 p., submitted to Rep. Int. Whal. Comm.

[67] Sears, R., M. Berube, and D. Gendron. 1987. A preliminary look at the distribution and migration of blue whales (*Balaenoptera musculus*) in the northeast Pacific, based on the photo-identification of individuals (Abstr.). *In* Proceedings of the Seventh Biennial Conference on the Biology of Marine Mammals, 1987, Miami, Fla.

[68] Forney, K. A., and R. L. Brownell. 1996. Preliminary report of the 1994 Aleutian Island marine mammal survey. Unpubl. doc. SC/48/011, 15 p., submitted to Rep. Int. Whal. Comm.

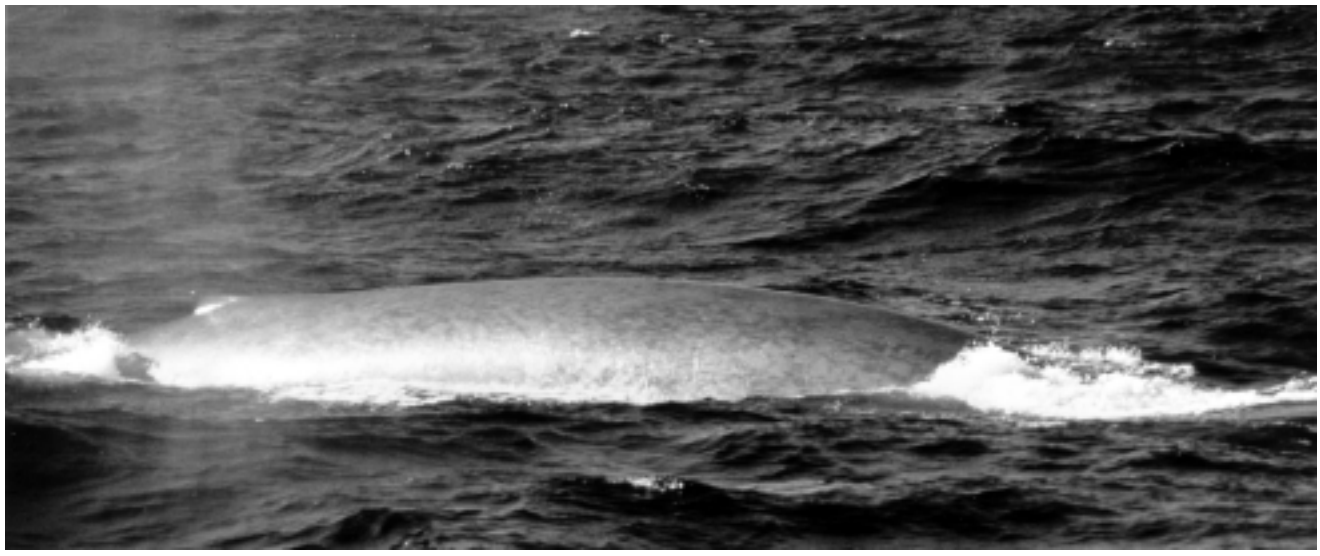

Figure 23.—A blue whale surfacing. Note the mottled coloration and very small dorsal fin. J. M. Waite, NMML Collection.

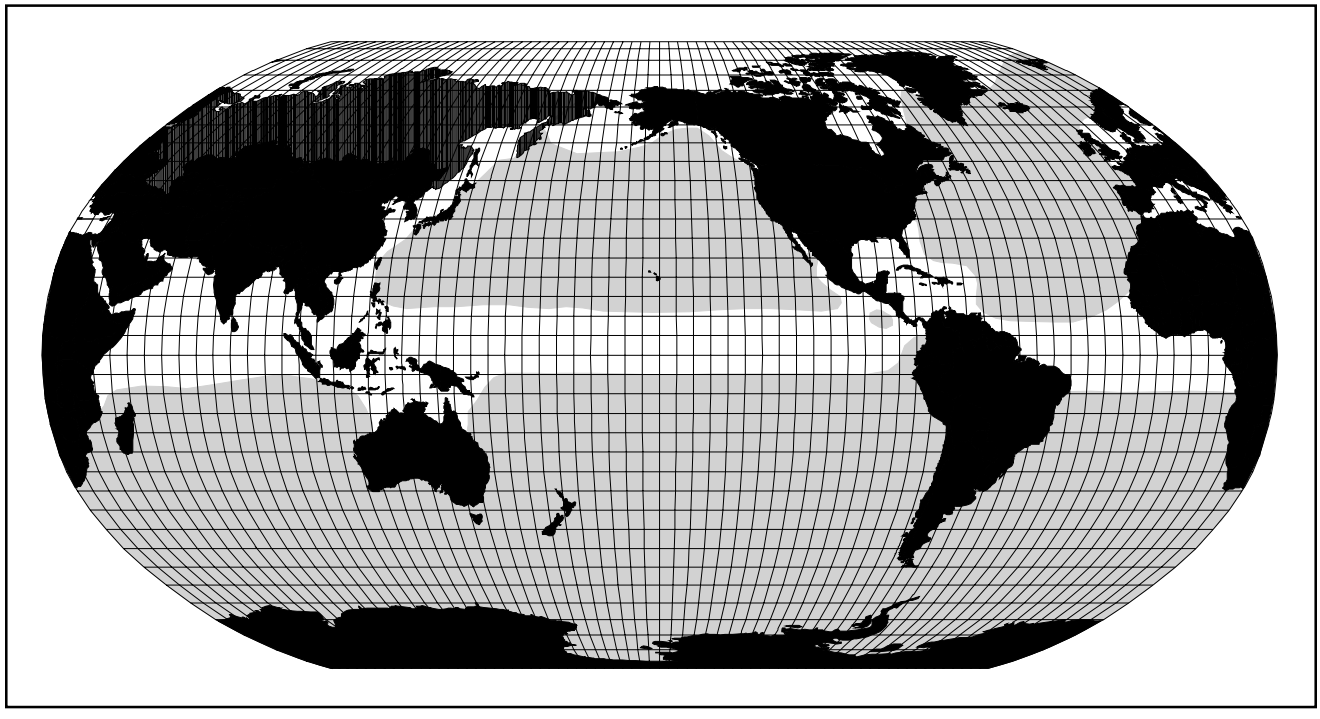

Figure 24.—Worldwide distribution of all blue whale species. Adapted from Mizroch et al. (1984a).

The Costa Rica Dome (centered roughly around lat. 9°N, long. 89°W) is a stationary eddy in the eastern tropical Pacific Ocean which appears to be an important year-round habitat for blue whales (Fig. 13) (Reilly and Thayer, 1990). Reilly and Thayer (1990) suggested four reasons for this year-round presence: 1) the standing stock of prey (i.e. euphausiids) that results from this highly productive area, 2) the aggregation of juvenile, nonmigratory whales, 3) the occurrence of a resident stock of Northern Hemisphere blue whales, or 4) temporal overlap, when both Northern and Southern Hemisphere whales utilize the area. Blue whales have been sighted in the Dome area in all seasons, but there is a peak in occurrence from June through November.

North Atlantic

Blue whales are found from the Arctic to at least the mid latitude waters of

the North Atlantic with occasional occurrences in U.S. Exclusive Economic Zone (EEZ)[69] waters (Yochem and Leatherwood, 1985; Wenzel et al., 1988; CeTAP[70]; Gagnon and Clark[71]). These whales are currently recognized as one stock by the IWC (Donovan, 1991).

Sightings of blue whales occur most frequently off eastern Canada. During winter, they are found in the waters off Newfoundland. In summer, they are found in Davis Strait (Mansfield, 1985), in the Gulf of St. Lawrence (from the north shore of the St. Lawrence River estuary to the Strait of Belle Isle), and off eastern Nova Scotia (Fig. 6) (Sears et al.[67]).

In 1992, the U.S. Navy and its contractors conducted an extensive acoustic survey of the North Atlantic using the Integrated Underwater Surveillance System's (IUSS) fixed acoustic array (Clark, 1995). This study provided information on the seasonality and geographic distribution of several baleen whale species' vocalizations (Clark et al.[72]). Localizations of the sounds indicated concentrations of blue whales on the Grand Banks off Newfoundland and west of the British Isles. One blue whale was tracked acoustically for 43 days, during which time it traveled 1,400 n.mi in an area that included waters northeast of Bermuda to the southwest and west of Bermuda (Gagnon and Clark[71]).

Northern Indian Ocean

Blue whales have been reported year-round in the northern Indian Ocean. Sightings have been reported from the Gulf of Aden, Persian Gulf, Arabian Sea, and across the Bay of Bengal to Burma and the Strait of Malacca (Fig. 12, 14) (Mizroch et al., 1984a). The migratory movements of these whales are unknown.

Southern Hemisphere

Blue whales in the Southern Hemisphere are assigned to six stock areas designated by the IWC (Fig. 9) (Donovan, 1991). These areas are consistent with the presumed blue whale feeding locations, although reliable distributional information on blue whales is still scarce. Historical catch records indicate that the true blue whale and the pygmy blue whale may be geographically segregated (Kato et al., 1995; Brownell and Donahue[73]). The distribution of the pygmy blue whale is north of the Antarctic Convergence, while that of the true blue whale is south of the Convergence in the austral summer (Fig. 10) (Kato et al., 1995). True blue whales occur mainly in the relatively high latitudes. During summer, the true blue whale is found close to the ice edge (south of lat. 58°S) with concentrations between lat. 66–70°S and long. 60–80°E (Fig. 10) (Kasamatsu et al., 1996). No new information on wintering areas has been reported since Braham's 1991 status review[3]; therefore, there are no data to validate IWC stock designations in the Southern Hemisphere.

Current and Historical Abundance

North Pacific

Gambell (1976) provided a population estimate for the entire North Pacific of 1,600 blue whales (range = 1,400–1,900; no CV or CI provided) based on history of catches and trends in CPUE[22]. However, this estimate is likely no longer realistic. From ship-based line transect surveys off California in 1991–93 and off California, Oregon, and Washington in 1996, Barlow[74] estimated 1,927 (CV=0.16) blue whales for these areas. Off the coast of Oregon and Washington, no blue whales were sighted during an aerial survey in 1991 (Green et al.[75]) or during ship-based line transect surveys in 1996 (Barlow[74]). In the eastern tropical Pacific, Wade and Gerrodette (1993) estimated 1,415 (CV = 0.243) blue whales from ship-based line transect survey data. There are no statistically reliable population estimates for the eastern North Pacific north of the State of Washington or in the western North Pacific. Nonetheless, it appears that at a minimum there are currently over 3,300 blue whales in the North Pacific (Wade and Gerrodette, 1993; Barlow[74]).

According to calculations based on historic whaling data, there were an estimated 4,900 (no CV available) blue whales inhabiting the North Pacific prior to commercial exploitation (Gambell, 1976). Admittedly, estimates such as these are rather speculative.

North Atlantic

Braham[3] provided a population estimate for the entire North Atlantic of between 100 and 555 blue whales based on history of catches and trends in CPUE[22]. This estimate is not considered statistically reliable by the IWC. Ongoing photo-identification studies (since 1979) in the Gulf of St. Lawrence have cataloged over 320 individual blue whales (Sears et al., 1990). There is evidence from ship-based surveys west and southwest of Iceland that blue whale abundance has been steadily increasing since the late 1950's; and from 1979 to 1998 at a rate of 5.2% (CV = 0.22) per year (Sigurjónsson and Gunnlaugson, 1990). There is no statistically reliable estimate of blue whale abundance in the eastern North Atlantic.

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[69] The EEZ of a maritime country includes all waters of the continental shelf, continental slope, and extends roughly 200 n.mi from the coast seaward.

[70] CeTAP. 1982. A characterization of marine mammals and turtles in the mid and North Atlantic areas of the U.S. outer continental shelf. Cetacean and Turtle Assessment Program, Univ. R.I. Final rep. #AA551-CT8-48 to Bur. Land Manage., Wash., D.C., 538 p.

[71] Gagnon, C. J., and C. W. Clark. 1993. The use of U.S. Navy IUSS passive sonar to monitor the movement of blue whales (Abstr.). *In* Proceedings of the Tenth Biennial Conference on the Biology of Marine Mammals, 1993, Galveston, Tex.

[72] Clark, C. W., C. J. Gagnon, and D. K. Mellinger. 1993. Whales '93: the application of the Navy IUSS for low-frequency marine mammal research (Abstr.). *In* Proceedings of the Tenth Biennial Conference on the Biology of Marine Mammals, 1993, Galveston, Tex.

[73] Brownell, R. L., and M. A. Donahue. 1994. Southern Hemisphere pelagic whaling for pygmy blue whales: review of catch statistics. Unpubl. doc. SC/46/SH6 submitted to Rep. Int. Whal. Comm., 9 p.

[74] Barlow, J. 1997. Table 2. Minutes from the fifth meeting of the U.S. Pacific Scientific Review Group Meeting, October 1997, La Jolla, CA. Available from D. P. DeMaster, Natl. Mar. Mammal Lab., NMFS, NOAA, 7600 Sand Point Way N.E., Seattle, WA 98115.

[75] Green, G. A., J. J. Brueggeman, R. A. Grotefendt, C. E. Bowlby, M. L. Bonnell, and K. C. Balcomb. 1992. Cetacean distribution and abundance off Oregon and Washington, 1989–1990. Final rep. to Minerals Manage. Serv., Contr. 14-12-0001-30426, completed May 1992.

Figure 25.—Partly flensed blue whale awaiting further processing at an Alaska whaling station. University of Washington Special Collections, Lagen Collection, negative UW18185.

Based on whaling records, Gambell (1976) estimated that from 1,100 to 1,500 blue whales occured in the entire North Atlantic prior to commercial exploitation (Gambell, 1976), although according to the IWC's Scientific Committee this estimate is statistically unreliable.

Northern Indian Ocean

There are no estimates of current or historic abundance for this blue whale stock.

Southern Hemisphere

Since 1965, there have been only seven sightings of true blue whale calves in waters south of lat. 60°S (Braham[3]) despite IWC/IDCR surveys in these areas. The Scientific Committee agreed that, while a reliable estimate of abundance of Southern Hemisphere blue whales could not be developed because data on these stocks were incomplete, there were more than 500 blue whales in the Southern Oceans (IWC, 1990). More recently, the IWC calculated an abundance estimate of 1,255 blue whales (no CV available) by combining data from IWC/IDCR and Japanese Sighting Vessel (JSV) surveys from 1978 to 1988 (IWC, 1996a).

Prior to the start of Antarctic commercial exploitation in the early 1900's, there were an estimated 180,000 (range = 150,000–210,000) true blue whales in the Southern Hemisphere (Gambell, 1976). Based on a comparison of current and historic estimates, some researchers noted that southern blue whale stocks do not appear to be recovering from exploitation (Table 4) (Hatanaka and Komatsu[76]).

In the mid 1970's, the southern Indian Ocean's pygmy blue whale population was estimated at 5,000 individuals (no CV available) (Gambell, 1976). An estimated 10,000 (no CV available) pygmy blue whales inhabited this ocean historically (Gambell, 1976).

Historic Exploitation Patterns

In 1864, explosive harpoons and steam-powered catcher boats were introduced in Norway, allowing the exploitation of blue, fin, and sei whales, which are generally larger and faster than previously exploited humpback and right whales. Whalers in the North Pacific and Antarctic soon added this modern equipment to their arsenal. As this new technology spread and began to receive widespread use, blue whale populations began declining worldwide. Subsequently, the whaling industry shifted its effort away from declining blue whale stocks to other large whale species and then resumed hunting blue whales when they appeared more abundant. The result was a cyclical rise and fall, leading to severe depletion of blue whale stocks worldwide (Mizroch et al.[49]).

North Pacific

From 1889 until 1965, approximately 5,761 blue whales were taken from the North Pacific (Braham[3]). Evidence of a population decline can be seen in Japanese catch data. In 1912, 236 blue whales were caught, and from 1913 to 1965, the catch numbers declined continuously (Fig. 25) (Mizroch et al., 1984a). Since the IWC banned commercial whaling in the North Pacific in 1966, no blue whales have been reported taken from those waters.

North Atlantic

By 1882, Norway's whaling operations, which had originally focused on blue whales, began to take more fin whales due to the scarcity of the former (Mizroch et al., 1984a). The search for blue whales expanded to include waters off Iceland, the Faeroe Islands, Newfoundland, Svalbard (Spitsbergen), and the islands off the British coast (Fig. 6, 7, 18).

From the early 1880's through 1915, there were 6,000 blue whales taken

[76] Hatanaka, H., and M. Komatsu. 1993. International action plan for recovery of large whales—towards recovery of blue whales. Unpubl. doc. SC/45/SHBa27 submitted to Rep. Int. Whal. Comm., 3 p.

from land-based stations in Iceland (Sigurjónnson and Gunnlaugsson, 1990). In 1915, the Icelandic Parliament prohibited all land-based whaling due to the apparent depletion of blue and humpback whales. By 1935, whaling had resumed from one land-based station in western Iceland and continued for 5 years, a period in which 30 blue whales were taken. By 1952, fewer than 15 blue whales were taken per year by all Icelandic whalers (Mizroch et al., 1984a). The IWC provided complete protection to the blue whale in the North Atlantic in 1955, but whaling continued off the coasts of Iceland until 1960. From the close of World War II to 1960, 163 blue whales were taken off Iceland (Sigurjónsson and Gunnlaugsson,1990). Since 1985, there have been no reported takes of blue whales in the North Atlantic.

Southern Hemisphere

A total of 330,684 blue whales (all subspecies) were taken in the Southern Hemisphere between 1909 and 1967 (Braham[3]). Commercial harvest of blue whales amounted to a take of approximately 2,000–6,000 whales per year from 1914 to 1924 in this region. But when factory whaling ships were introduced in the late 1920's, the take increased to 12,734 in the 1928–29 season and to 29,410 in the 1930–31 season (Mizroch et al., 1984a). These ships allowed more efficient processing of whales at sea and led to the rapid decline of blue whale stocks in the Southern Hemisphere. By 1938 the number of fin whales being caught was more than twice the number of blue whales caught (14,923) in the Southern Hemisphere during the previous three decades (Mizroch et al., 1984a). Commercial hunting of blue whales in the Southern Oceans was banned by the IWC in 1967.

The recent release of withheld Soviet whaling records shows a discrepancy in the number of true blue whales originally reported caught by the U.S.S.R. in southern waters between 1947 and 1980 (Zemsky et al., 1995). Originally, a take of 3,651 true blue whales was reported to the IWC for this period, but the recently revealed data show that only 3,462 true blue whales were taken (IWC, 1995a). This is most likely due to the misidentification of pygmy blue whales in the original data and is a possible problem in the interpretation of catch data from other countries as well.

Current Exploitation

The current catch limit imposed by the IWC is zero for all blue whale stocks (IWC, 1995b).

Life History and Ecology

Feeding

Blue whale distribution is likely linked to nutritional requirements (Reilly and Thayer, 1990; Schoenherr, 1991; Kawamura, 1994). Areas of cold, upwelling currents (i.e. eastern sides of the oceans) provide large quantities of euphausiid crustaceans (krill) which is a primary prey item of blue whales. Areas of dense prey aggregations may be seasonal, year-round, or strongly influenced by the occurrence of El Niño Southern Oscillation (ENSO) events (Reilly and Thayer, 1990; Schoenherr, 1991; Gendron and Sears, 1993). The krill species on which these whales rely include: *Euphausia pacifica, Thysanoessa inermis, T. longipes,* and *T. spinifera* (Schoenherr, 1991) in the North Pacific; *Meganyctiphanes norvegica* and *T. inermis* in the North Atlantic; and *E. superba* (Kawamura, 1994), *E. crystallorophias,* and *E. vallentini* in the Antarctic (Nemoto, 1959). Off the Pacific coast of Baja California, blue whales have been reported to feed on concentrations of the pelagic red crab, *Pleuroncodes planipes* (Rice, 1978b). However, blue whales have been observed between February and April within the Gulf of California feeding on surface swarms of *Nyctiphanes simplex*, a euphausiid species (Sears, 1990; Gendron and Sears, 1993). Sears (1990) regarded the latter species as the principal prey of blue whales in the region.

Some researchers have speculated that a critical factor influencing blue whale recovery in the Southern Hemisphere may be interspecific competition with minke and nonwhale krill predators (Fraser et al., 1992). However, no conclusions can be made about this type of competition until further behavioral and distributional information is collected, especially with a focus on ecosystem requirements of baleen whales (Kawamura, 1994; Clapham and Brownell, 1996).

Reproduction

Both male and female blue whales reach sexual maturity at 5–15 years of age. Females give birth to a single 7–8 m calf every 2 or 3 years after a gestation period of approximately 12 months (Mizroch et al., 1984a). Calves are weaned late the following summer at around 7 months and at a length of about 16 m (Mizroch et al., 1984a; Anonymous, 1994a). However, it must be noted that these reproductive parameters are not current, because the IWC has gathered little new information since 1967 (Mizroch et al., 1984a).

Natural Mortality

Nothing is known of natural mortality in blue whales. They appear to be relatively free of ecto- and endoparasites (Rice, 1978b). Lampreys are found attached to the dermal surface of large whales in warmer waters. The killer whale, *Orcinus orca*, may prey on blue whales, but, this may be rare. It is possible that immature or weakened animals may become targets for killer whales under certain conditions (Tarpy, 1979). Natural mortality rates are unknown, but they are likely to be similar to those of the fin whale—about 4% per year in adult whales (Allen, 1980).

Human-related Mortality

Fisheries Interactions

There are no reports of fisheries-related mortality or serious injury in any of the blue whale stocks. However, Barlow et al. (1997) noted that a conflict may exist in the offshore drift gillnet fishery in the North Pacific (i.e. off California). Blue whale interactions with fisheries may go undetected because the whales are not observed after they swim away while carrying fishing gear. Fishermen report that large blue and fin whales usually swim through the nets without entangling and with very little damage to the net (Barlow et al., 1997). In U.S. North Atlantic waters, the total mortality and serious injury from fisheries-related incidents is considered insig-

Table 12.—Factors possibly influencing the recovery of blue whales under the ESA (1973)§4 (a)(1),1992 Amend. (northern Indian Ocean and Southern Hemisphere data are not available).

Factors	North Pacific	North Atlantic
1. Present or threatened destruction or modification of habitat	Offshore oil and gas development	Offshore oil and gas development; noise from vessel traffic
2. Overutilization for commercial, recreational, scientific, or educational purposes	Whale watching, scientific research, photography, and associated vessel traffic	Whale watching, scientific research, photography, and associated vessel traffic
3. Disease or predation	Unknown	Unknown
4. Other natural or man-made factors	Vessel collisions; entanglement in fishing gear (e.g. offshore drift gillnet)	Vessel collisions

nificant, but blue whale/fishery interactions have not been thoroughly investigated for impacts (Waring et al., 1998).

Vessel Collisions

It is possible that mortality from ship strikes affects all blue whale stocks. Additional mortality due to vessel strikes likely goes unreported because the bodies of injured or killed animals did not strand or investigations of stranded animals did not reveal the trauma of a ship collision.

In 1980, 1986, 1987, and 1993, ship strikes have been implicated in the deaths of blue whales off California (Barlow et al., 1997). In addition, several photographically identified blue whales from California waters were observed with large scars on their dorsal areas that may have been caused by ship strikes. In the California/Mexico stock, annual incidental mortality due to ship strikes averaged 0.2 whales during 1991–95 (Barlow et al., 1997). However, the effect that this type of mortality or injury may have on the status of blue whale stocks is currently unknown.

More recently, in March 1998 a juvenile male blue whale was reportedly struck and killed by a commercial vessel and was carried on the bow of the vessel into Narragansett, R.I. The necropsy of this whale indicated that death occurred as a result of a ship strike, including bone fractures at several locations along one side of the animal's body (Anonymous, 1998). The PBR level[37] for the western North Atlantic blue whale is currently 0.6 whales per year (Waring et al., 1998). Clearly, if vessel collisions occur frequently, blue whale recovery in U.S. Atlantic waters will be affected. However, the frequency of such mortalities is poorly documented.

Noise Disturbance

Studies have shown that blue whales respond to the sound created by approaching vessels in a variety of ways, depending on the behavior of the animals at the time of approach and on speed and direction of the approaching vessel. Blue whales involved in feeding react less rapidly and with less obvious avoidance maneuvers than those not involved in feeding (Richardson et al., 1995). Within the St. Lawrence River estuary, heavy recreational and commercial vessel traffic from several sources (e.g. industrial freight, whale watching) may affect summering blue whales. Studies in the St. Lawrence River showed the most evident reactions to these vessels occurred when boats made fast, erratic approaches or sudden changes in direction or speed (Edds and MacFarlane, 1987; MacFarlane[77]).

Noise disturbance from seismic exploration apparently does not affect blue whales in any significant manner. When noise pulses from air guns were produced off Oregon, blue whales in the area continued vocalizing at the same rate as before the pulses, suggesting they were undisturbed by the noise (McDonald et al., 1993).

Classification Status

The blue whale was listed as endangered under the ESA in 1973 and given protection under the MMPA. All blue whale stocks in U.S. waters are listed as endangered (Anonymous, 1994a). Internationally, all blue whale stocks are classified as "Protected Stocks" by the IWC. Under this designation, the IWC recognizes that these stocks are 10% or more below their maximum sustainable yield (MSY) levels (IWC, 1995b).

The accuracy and availability of abundance estimates and stock identity has not improved since Braham's 1991 status review[3], with the exception of the blue whales that occur off California and Mexico. The IWC has suggested long-term acoustic surveys and satellite tracking in addition to visual survey methodology to better evaluate the density and distribution of blue whales in the Southern Hemisphere (IWC, 1996a). These suggestions are also applicable to stocks in the Northern Hemisphere. In addition, genetic analysis holds promise for distinguishing between true and pygmy blue whales in the Southern Hemisphere (IWC, 1996a).

The factors possibly influencing the status of blue whales are summarized in Table 12. A Recovery Plan for blue whales has been prepared by the NMFS in which measures to protect and monitor the recovery of this species are identified (Anonymous, 1998). At this time, however, any reevaluation of blue whale status awaits the collection of more reliable information on stock structure, distribution and migration patterns, trends in abundance, causes of mortality, and factors influencing the recovery of blue whale stocks, as well as the development of objective delisting criteria. Therefore, until such information is available, the classification status of all blue whale stocks should remain unchanged. However, abundance in the California/Mexico region of the eastern North Pacific may be increasing to approximately 30% of its preexploitation levels. If new abundance trend data indicate that such increases continue, blue whales in this region may be candidates for a consideration to downlist from endangered to threatened.

[77] MacFarlane, J. A. F. 1981. Reactions of whales to boat traffic in the area of the confluence of the Saguenay and St. Lawrence Rivers, Quebec. Unpubl. doc., 50 p.