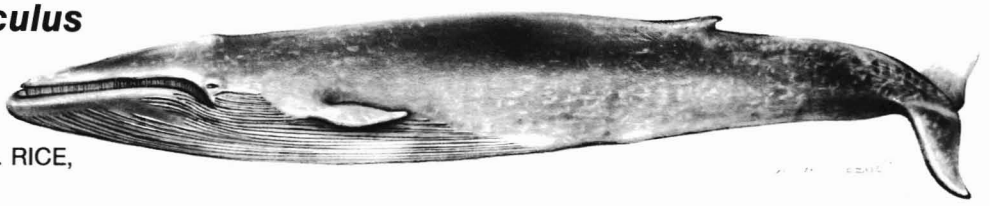
The Blue Whale, *Balaenoptera musculus*



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Introduction

The blue whale, *Balaenoptera musculus* (Linnaeus, 1758), is not only the largest of the whales, it is also the largest living animal, and may range in size to over 30 m (100 feet) and weigh up to 160 metric tons (t) (Mackintosh, 1942). Blue whales are entirely bluish-gray in color, except for the white undersides of the flippers. They are members of the family Balaenopteridae, all of which have fringed baleen plates rather than teeth. Baleen whales graze through swarms of small crustaceans known as krill, and capture the krill in their baleen as water is filtered through. Like most balaenopterids, blue whales exhibit no well defined social or schooling structure, and in most of their range they are generally solitary or found in small groups (Tomilin, 1957).

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Distribution and Migration

Blue whales are found in all oceans and undertake extensive north-south migrations each year, traveling from winter grounds in low latitudes to summer feeding grounds in the Arctic or Antarctic high latitudes. Since most whaling occurred on the high-latitude feeding grounds, the distribution of these whales in these areas is fairly well known.

In Antarctic waters, for example, blue whales and minke whales, *Balaenoptera acutorostrata*, are found in the coldest waters closest to the ice edge, with fin, *B. physalus*, and sei whales, *B. borealis*, distributed, respectively, in somewhat lower latitudes (Mackintosh, 1965). A distinct subspecies called the pygmy

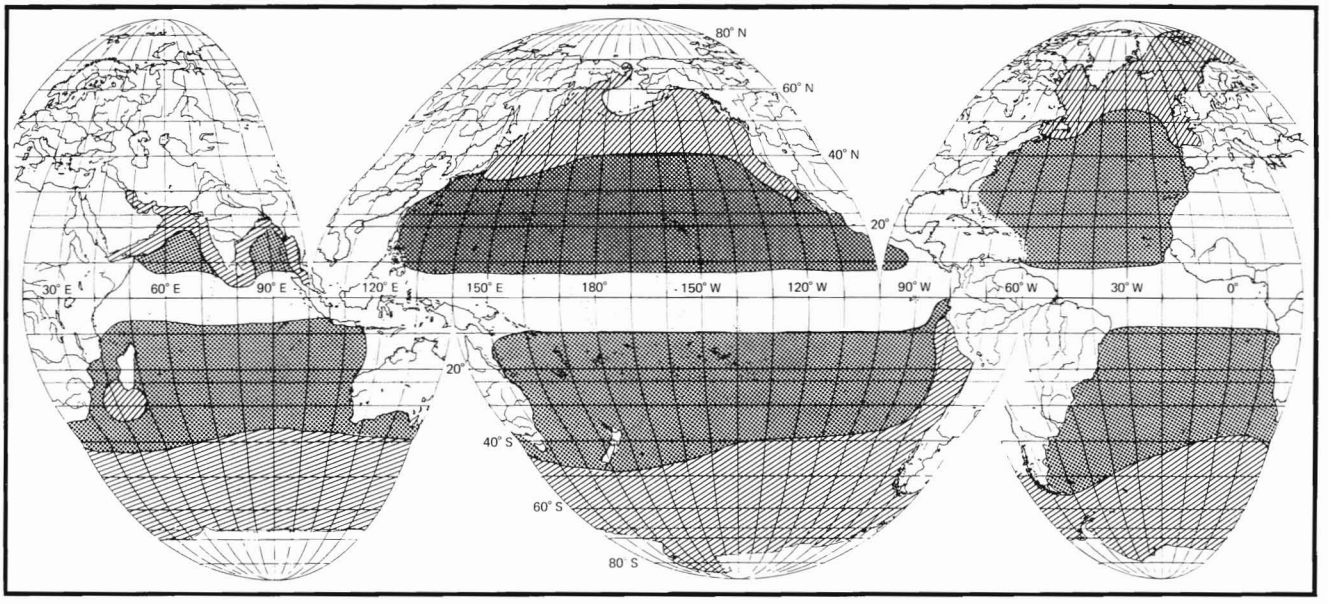
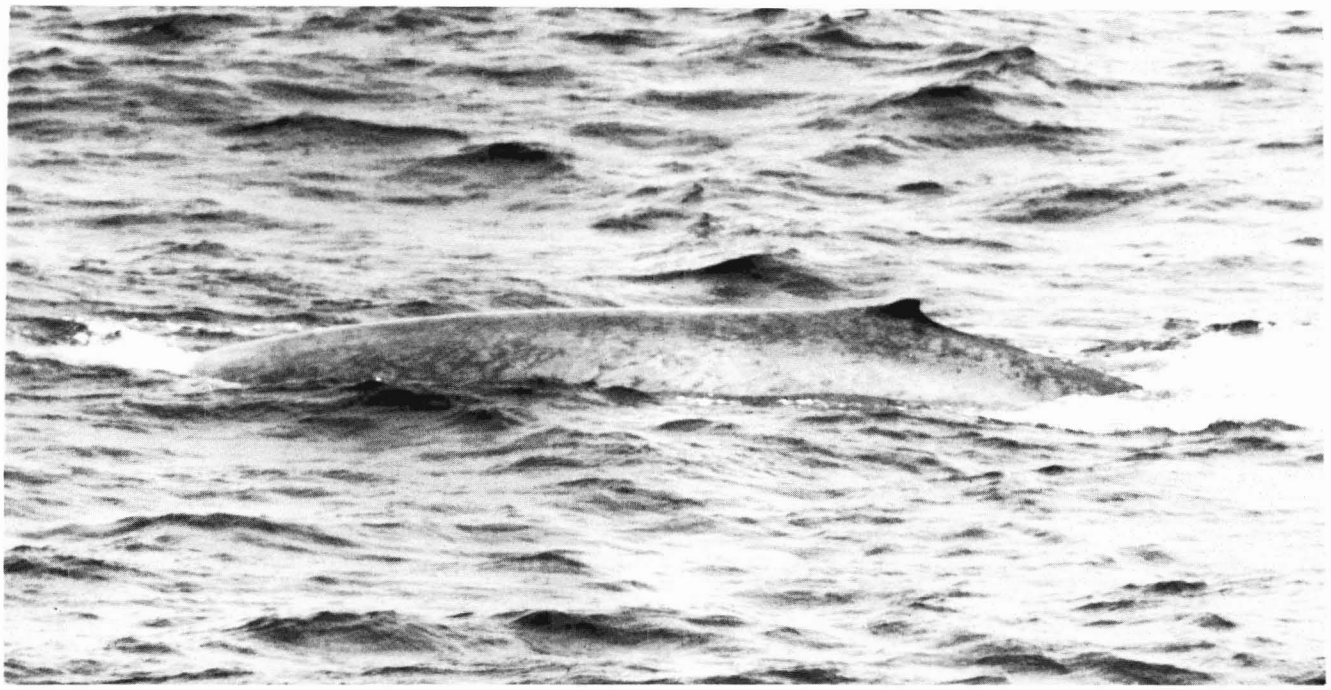


Figure 1.—Geographical distribution of the blue whale. Simple hatching indicates the summer feeding grounds. Stippling indicates distribution during autumn, winter, and spring; records are scarce during these seasons, and the distribution is, to a large extent, speculative.



A blue whale surfacing in the North Atlantic off Spain reveals its mottled back and small step-like dorsal fin. Photo by S. Mizroch.

blue whale, *B. m. brevicauda*, inhabits the southern Indian Ocean south to lat. 55°S (Ichihara, 1966).

The Northern Hemisphere distribution of blue whales is not as clear-cut. Jonsgård (1966) reports blue whales at the edge of the pack ice in the North Atlantic. Nishiwaki (1966), using catch statistics, fixes the northern limits in the North Pacific at the Aleutian Islands, although Sleptsov (1961) saw blue whales as far north as the Chukchi Sea.

The winter distribution of blue whales remains something of a mystery. Since blue whales migrate to and from winter grounds in the open ocean, away from coastlines where they may be observed, scientists have yet to delineate these areas in either the Northern or Southern Hemispheres (Jonsgård, 1966; Mackintosh, 1966). Summer and assumed winter distributions are shown in Figure 1.

Stock Identity

The stocks of blue whales can be grouped into four large geographic regions: The North Pacific, North Atlantic, northern Indian Ocean, and Southern Hemisphere. Within these large areas there are further stock separations.

North Pacific

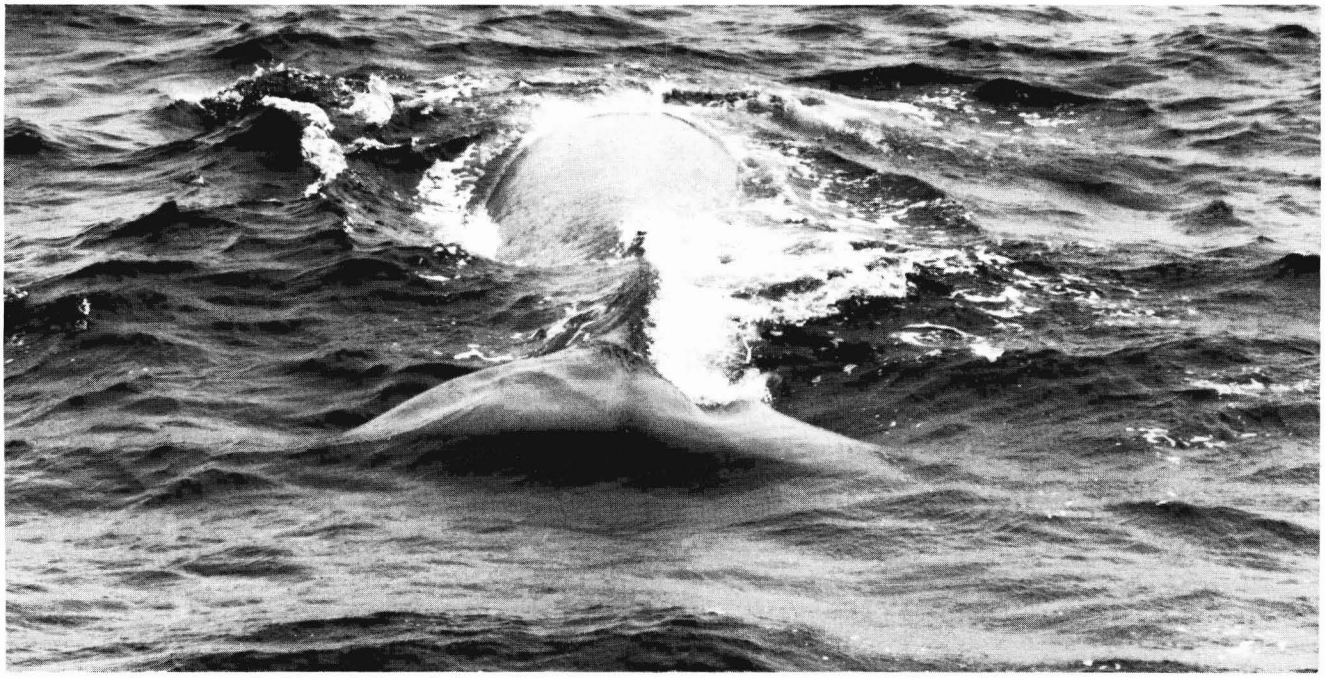
Blue whales have been hunted in Japanese and Korean waters, off Kamchatka, in the Aleutian Islands, and in smaller numbers off California and British Columbia, but very little is known of movements and stock boundaries of blue whales in the North Pacific. They are found from the Chukchi Sea south to the waters off Taiwan and Costa Rica (Rice, 1978; Leatherwood, et al., 1982), but there is no speculation as to stock units in this broad area, and the International Whaling Commission (IWC) has not set specific boundaries.

North Atlantic

Blue whales have been hunted off northern Norway, Svalbard (Spitsbergen), Iceland, the British Isles (primarily the Hebrides), and Newfoundland. The pattern of exploitation generally was of high catches in one location over a 10- to 15-year period, followed by a sharp decline in catches, after which time the industry moved to another location and repeated the pattern (Tønnessen and Johnsen, 1982). Jonsgård (1955) concluded that these localized depletions in blue whale stocks were a result of excessive hunting, and assumed some separation in stock units. No specific studies have been conducted to test this, however, and the IWC considers the North Atlantic stock as one unit for management purposes.

Northern Indian Ocean

Blue whales have been reported year-round in the Gulf of Aden, Persian Gulf, and Arabian Sea, eastward across the Bay of Bengal to Burma and the Strait of Malacca. Nothing is known of the seasonal movements of these animals. A temporarily stranded female gave birth to a calf in Trincomalee Harbour, Sri Lanka, in



Rear view of a blue whale surfacing off Spain, showing the broad lunate tail flukes. Photo by S. Mizroch.

December 1946. The blue whales in this area probably constitute a separate stock and have never been hunted.

Southern Hemisphere

The main feeding areas in the Antarctic were separated into five (and later six) statistical areas by the IWC. These areas were developed based on distributions of humpback whale, *Megaptera novaeangliae* (Mackintosh, 1966), and may or may not indicate stock differences in other balaenopterids, such as blue whales. Mark-recapture experiments are inconclusive, and although many whales are recovered near where they were marked, some are recovered one or more areas away. Brown (1962) hypothesized that blue and fin whales disperse more on the feeding grounds than do humpback whales, and consequently there is overlap among various breeding stocks. Since blue whales, unlike humpbacks, have no well defined breeding areas, it is impossible to delineate the Southern Hemisphere breeding stock units. For management purposes, however, the IWC considers the whales in each of the IWC statistical areas to be separate stock units.

Life History and Ecology

Feeding

Most blue whales spend the summer in high latitudes and the cold currents on the eastern sides of the oceans, where food production is high. They often range offshore, but less so than fin whales, and tend to be nomadic. The blue whale is virtually monophagous, and feeds almost exclusively on euphausiids, or krill, that congregate in dense shoals near the surface—notably: *Euphausia superba*, *E. crystallorophias*, and *E. vallentini* in the Antarctic; *E. pacifica*, *Thysanoessa inermis*, *T. longipes*, and *T. spinifera* in the North Pacific; and *Meganyctiphanes norvegica* and *T. inermis* in the North Atlantic (Nemoto, 1959). The only exception appears to be off the coast of Baja California, where they have been seen feeding on shoals of the pelagic red crab, *Pleuroncodes planipes* (Rice, 1978).

Blue whales, like most other baleen whales, migrate several thousand miles toward equatorial waters in the autumn. During the winter they fast for several months, living off their fat reserves.

Reproduction

The basic reproductive cycle of the blue whale is biennial. Mating takes place over a 5-month period during the winter. Females appear to be seasonally monoestrous, but if they fail to conceive, they may ovulate two or three times during one estrous cycle. The single calf, born after a gestation period of about 1 year, measures about 7 m (23 feet) long. The calf is weaned late the following summer when it is about 7 months old and 16 m (53 feet) long. Both sexes attain sexual maturity at an age 5-15 years.

Natural Mortality

Important natural mortality factors are unknown. The blue whale is relatively free of ectoparasites and endoparasites (Rice, 1978). They do not even harbor the stomach worms, *Anisakis* sp., which are nearly ubiquitous in virtually all other cetacean species; presumably this is because blue whales do not eat fish, which are the host of the infective stage of the worms. Predation on blue whales by killer whales, *Orcinus orca*, is rare. Natural mortality rates have not been established, but may be considered to be similar to those of the fin whale—about 4 percent per year in adults (Allen, 1980).

Exploitation and Population Size

History of Exploitation

Large-scale exploitation of blue whales did not begin until the introduction of the explosive harpoon and the steam-powered catcher boat in Norway in 1864. This marked the beginning of the modern phase of whaling, in which whalers had the tools to hunt the faster swimming, less buoyant rorquals.

North Pacific

Although the Japanese did not enter the era of modern whaling until the turn of the century, they enjoyed some success catching rorquals (most likely other than blue whales) in earlier times using a sophisticated netting technique. Blue whale catches by the Japanese, using modern techniques, peaked in 1912 (236), declined substantially the next year (58), increased in 1914 (123), and declined thereafter until they ceased entirely when IWC regulations prohibited their capture after 1965 (Tønnessen and Johnsen, 1982).

Modern whaling off the Pacific coast of North America began in 1905 in Victoria, B.C., with a Norwegian crew contracted by Canadian businessmen. The early catches were mostly humpback whales, but some numbers of blue whales were also taken. According to Tønnessen and Johnsen (1982), the peak catch of blue whales (239) in the northeastern Pacific occurred off California in 1926. The catch of blue whales south of the Aleutians averaged about 50 a year until 1930. In these areas, as in the North Atlantic, catches rose, peaked, and declined in a fairly short period. During the late 1950's and early 1960's, Japan caught about 70 blue whales per year near the Aleutians, but by 1966 IWC regulations prevented the capture of blue whales.

North Atlantic

When modern whaling began in the North Atlantic, blue whales were the preferred species due to their great size. The first catches occurred off northern Norway in the late 1860's, but by 1882 whalers were catching more fin than blue whales, presumably because of declines in blue whale stocks (Committee for Whaling Statistics, 1931). This pattern was repeated as the industry expanded to Iceland, the Faroe Islands, Newfoundland, Svalbard (Spitsbergen), and islands off the British coasts. Catches of blue whales in each of these areas were generally high the first 5-10 years, after which catches of fin whales predominated for a few years, and then catches declined altogether, and the industry would move to another whaling ground.

In the peak years, catches of blue whales numbered well over 300 per year in the North Atlantic, but by the post-World War I years, catches began to average only 40-50 per year. By 1952, catches fell to 15 or less per year, and the capture of blue whales in this area was banned entirely in 1960.

Southern Hemisphere

Whaling in the Southern Hemisphere began in 1904, and early catches were predominantly humpback whales. By 1913, however, humpback whale catches had begun to decline, and the blue and fin whale catches began to increase. In 1925, the first floating factory ship able to process whales on board was introduced in the Antarctic, enabling the industry to process whales wherever they were found. Since catcher boats were no longer limited to operating near land stations or moored factory ships, blue whale catches, which had ranged from about 2,000 to 6,000 per year from 1914 through 1924, suddenly increased from 12,734 in 1928-29 to 29,410 in 1930-31.

Although the scale was different, the general pattern of exploitation in the Antarctic was the same as everywhere else. By 1936-37, only 14,304 blue whales were taken, and by 1937-38 the fin whale catch (28,009) was nearly double the blue whale catch (14,923) (Fig. 2). Afterward, the blue whale catch declined steadily until it ceased with the ban on blue whale catches in 1967.

Current and Pre-exploitation Stock Sizes

Gambell (1976) evaluated various rough estimates of current and pre-exploitation blue whale stock sizes and presented the following summarized figures:

	Pre-exploitation stock	*Current stock*
N. Atlantic	1,100-1,500	100
N. Pacific	4,900	1,600 (1,400-1,900)
S. Hemisphere Antarctic blue	180,000 (150,000-210,000)	5,000
pygmy blue	10,000	5,000

Management

There has been little new information on blue whale abundance since hunting ceased in 1967. While there have been numerous sightings of blue whales off Mexico (Baja California) during the last several years, there are little or no useful census data for population assessment.

Blue whale populations have not been assessed by the IWC since the mid-1970's. Estimates of the

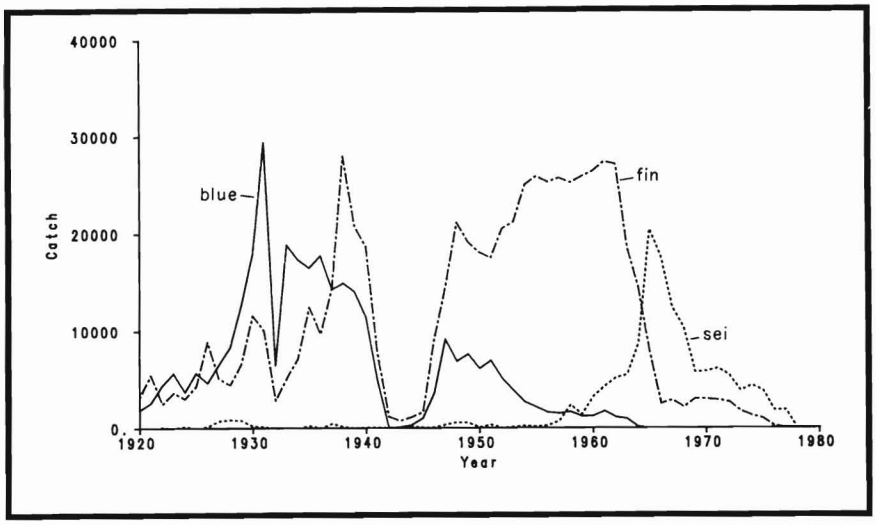


Figure 2.—Catch of blue, fin, and sei whales in the Antarctic, 1920-75 (from the Bureau of International Whaling Statistics).

biological parameters of blue whales are probably no longer current and therefore may have little or no validity at present. In addition, there are no useful indices of abundance covering the period since blue whale hunting ceased in 1967. Although there are occasional sightings of blue whales, there have been no recent surveys to assess the stocks. The few sightings in the Southern Hemisphere indicate that they are still at very low levels relative to their estimated pre-exploitation population size. Given the relative scarcity of blue whales based on opportunistic sightings, the low population estimates relative to their initial abundance, and the low intrinsic rate of increase noted for this and other baleen whale populations, to date, there is no evidence that the blue whale stocks in the Southern Hemisphere and North Pacific are recovering. A local stock of blue whales appears to be doing well in the Gulf of St. Lawrence and is the object of whale-watching trips.

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