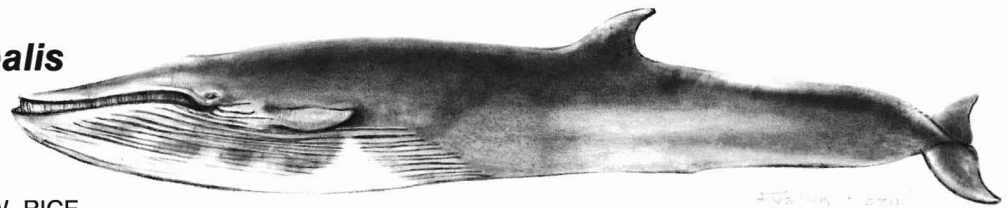


The Sei Whale, *Balaenoptera borealis*



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Introduction

The sei whale, *Balaenoptera borealis* Lesson, 1828, can range in length up to 18.5 m (60 feet), which makes it the third largest whale in the family Balaenopteridae, following the blue, *B. musculus*, and fin, *B. physalus*, whales. Sei whales are gray with a variable white area extending from the chin to the umbilicus. All the

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balaenopterids have fringed baleen plates instead of teeth, and feed on swarms of small zooplankton which they capture in their baleen as water is filtered through. Sei whales, like other baleen whales, do not have a well-defined school or social structure, and are generally found in small groups or as solitary individuals (Tomilin, 1957).

Distribution and Migration

Like most balaenopterids, sei whales are found in all oceans and migrate long distances north-south

from high-latitude summer feeding grounds to lower latitude winter areas (Fig. 1). Populations north and south of the Equator are presumed to be separate, as their migration schedules are 6 months out of phase.

Unlike most other balaenopterids, sei whales tend to be restricted to more temperate waters, and consequently are generally found within a smaller range of latitudes. Although there have been sporadic reports of sei whales close to the ice edge, this is thought to be uncommon (Jonsgård, 1966).

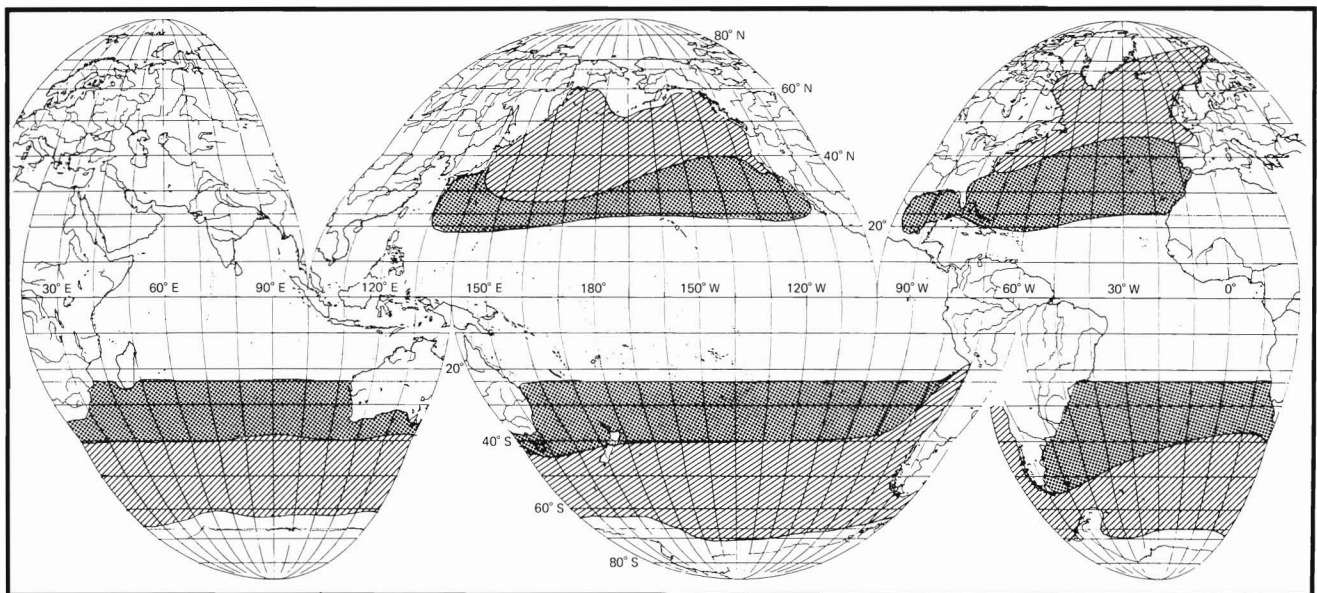
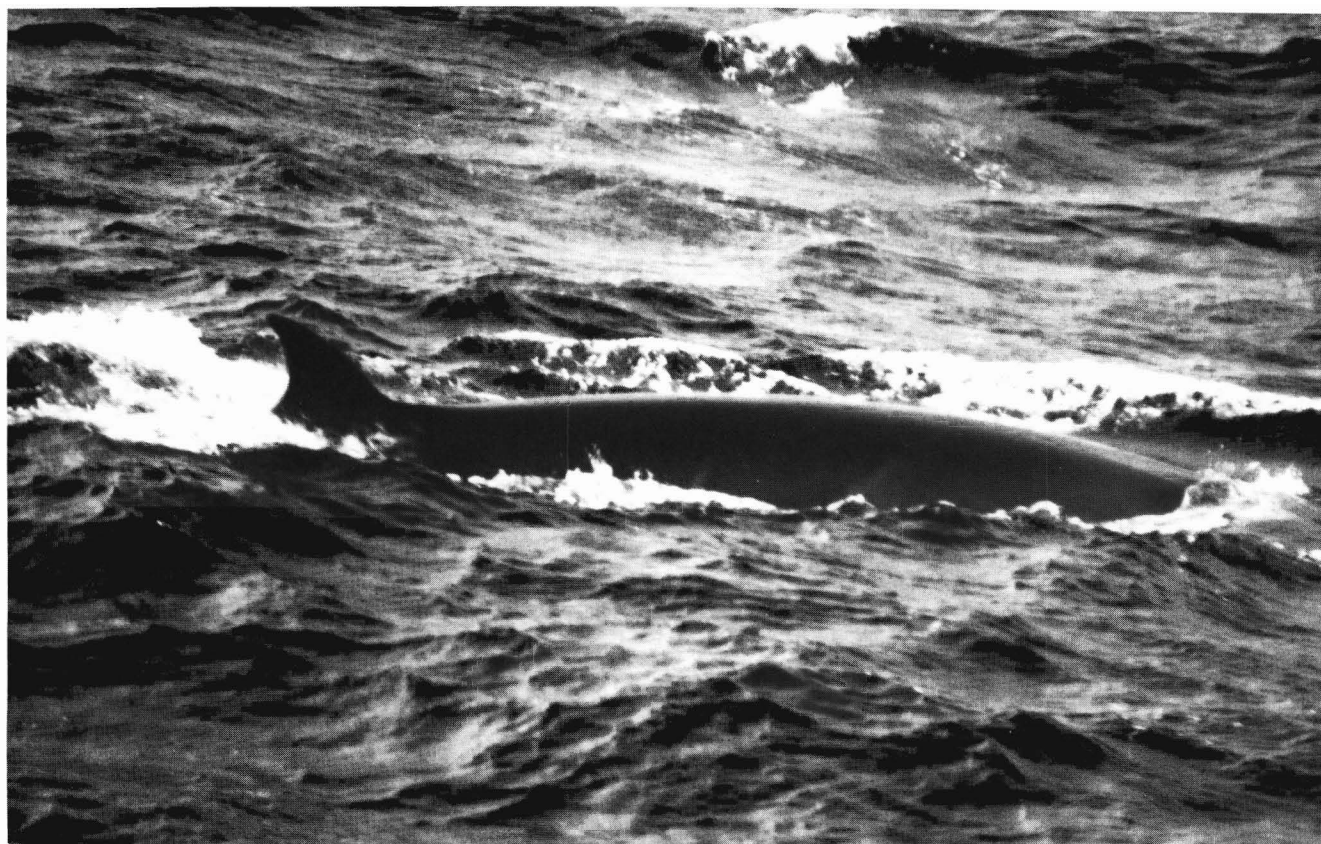


Figure 1.—Geographical distribution of the sei whale. Simple hatching indicates the summer feeding grounds. Stippling indicates distribution during autumn, winter, and spring; records are scarce during these seasons, and the distribution is to a large extent speculative.



A sei whale surfacing in Antarctic waters, showing the tall, sickle-shaped dorsal fin characteristic of this species.
Photo by G. Joyce.

In the North Pacific, sei whales winter in waters from lat. 20°N to lat. 23°N, and summer from lat. 35°N to 40°N (with a few individuals found at lat. 50°N) (Masaki, 1976). In the Antarctic, the summer distribution (inferred from catch statistics) is mainly from lat. 40°S to 50°S, and the winter distribution is as yet unknown. In the North Atlantic, the northern (summer) limit is thought to be lat. 72°N, although little is known of southern (winter) distribution (Jonsgård, 1966).

There is evidence of differential migration by reproductive class, with pregnant females leading waves of migration both into and out of the feeding grounds (Matthews, 1938; Gambell, 1968). Pregnant females also tend to be found in higher latitudes (Masaki, 1976).

Although sei whale feeding areas are fairly well defined in all oceans, the location of wintering areas remains to a large degree a mystery, since sei whales migrate in the open ocean and are difficult to observe from shore.

Stock Identity

Since most hunting (and hence research, which is usually conducted in association with whaling activities) occurs on feeding rather than breeding grounds, the groupings observed are generally feeding rather than breeding aggregations. The relationship of breeding groups to feeding groups is poorly understood.

North Pacific

At one time the International

Whaling Commission (IWC) considered the whales in the North Pacific as two stock units, but since the capture of sei whales was prohibited, the IWC considers only one stock unit for management purposes. Research indicates, however, that there may be at least three stocks found within this large area. Masaki (1976; 1977) suggests boundaries west of 175°W between 175°W and 155°W, and east of 155°W, based on mark-recapture studies, catch distribution, and differences in baleen plate morphology.

North Atlantic

The IWC recognizes the following stocks in the north Atlantic: Nova Scotia, Iceland-Denmark Strait, and northeast Atlantic. There is also an in-

dication, inferred from catches, mark recoveries, and migration patterns, of a separation between the Nova Scotia stock and the one off northeast Newfoundland and Labrador (Mitchell and Chapman, 1977). Schmidly (1981) speculates that a Gulf of Mexico/Caribbean stock exists, but this is questionable due to possible confusion with Bryde's whales, *Balaenoptera edeni* (Leatherwood and Reeves, 1983).

Southern Hemisphere

By convention, sei whales are considered to belong to six separate stocks in the Antarctic, based on the six IWC statistical areas developed using blue, fin, and humpback whale, *Megaptera novaeangliae*, data (Brown, 1962; Mackintosh, 1966). Mark-recovery data indicate links between sei whales in various areas, e.g., the Brazilian coast and the western half of Area II; the Natal coast of South Africa with the eastern half of Area III and the western half of Area IV; and the western and southeastern Australian coasts and Area IV (IWC, 1977). Other than this information, we know nothing of potential breeding areas in the Southern Hemisphere, and therefore cannot delineate breeding stocks. Consequently, sei whales are managed separately by IWC area.

Life History and Ecology

Feeding

During the summer, sei whales inhabit much the same range as fin whales in the higher latitudes and the cold currents on the eastern sides of the oceans, where food production is high. In general they range even farther offshore than fin whales, and tend to be nomadic. Sei whales specialize on copepods when available (mainly *Calanus tonsus*, *C. simillimus*, and *Drepanopus pectinatus* in the Antarctic; *C. cristatus*, *C. plumchrus*, and *C. pacificus* in the North Pacific; *C. finmarchicus* in the North Atlantic) (Nemoto, 1959; Kawamura, 1973, 1974). They are more euryphagous than fin whales,

however, and if copepods are absent, they feed on euphausiids, or krill, that congregate in dense shoals near the surface—notably *Euphausia superba* and *E. vallentini* in the Antarctic; *E. pacifica*, *Thysanoessa inermis*, *T. longipes*, and *T. spinifera* in the North Pacific; and *Meganctiphanes norvegica* and *T. inermis* in the North Atlantic. In some parts of the Northern Hemisphere, they also feed extensively on small schooling fishes such as anchovies, *Engraulis mordax*; sauries, *Cololabis saira*; and jack mackerel, *Trachurus symmetricus*.

In autumn, sei whales migrate several thousand miles toward equatorial waters. During the winter they eat very little or fast for several months, living off their fat reserves (Mackintosh, 1965).

Reproduction

The reproductive strategy of sei whales is similar to that of most other balaenopterid whales. The mating season covers about 5 months during the winter. Most females ovulate only once, but if they do not conceive, they may ovulate two or three times during one season. The single calf is born after a gestation period of about 1 year, when it is about 4.4 m (14.5 feet) long. The calves are weaned on the summer feeding grounds when they are 6-9 months old, and have attained a length of about 9.0 m (30 feet). Both sexes attain sexual maturity between 5 and 15 years of age. Adult females bear a calf every 2 or 3 years. (Gambell, 1968; Masaki, 1976; Rice, 1977; Lockyer and Martin, 1983).

Natural Mortality

Important natural mortality factors are unknown. The sei whale is usually relatively free of ectoparasites, but is very often heavily infected with endoparasitic helminths; presumably this is because its diet is more catholic than that of the fin or blue whale (Rice, 1977). Some of these endoparasitic worms are frequently pathogenic, affecting especially the liver and kidneys. A disease of unknown origin affects 7 percent of the sei whales off California, and

causes them to shed their baleen plates; this greatly impairs their feeding ability. Predation on sei whales by killer whales, *Orcinus orca*, appears to be rare. Natural mortality rates are difficult to estimate, but appear to be about 7.5 percent per year in adults, perhaps somewhat greater in immature animals (Allen, 1980).

Exploitation and Population Size

History of Exploitation

The earliest exploitation of sei whales likely occurred in waters off northern Japan, starting around the middle of the 17th century. The Japanese method of capturing the nonbuoyant, fast-swimming rorquals (including sei, fin, and humpback whales) involved netting the animal before killing it, and then towing it to shore for processing for human consumption. Until the introduction of modern whaling in Norway in 1864, the Japanese were the only whaling nation that could effectively capture rorquals (Tønnessen and Johnsen, 1982).

North Pacific

Since modern whaling was introduced in Japan at the beginning of the 20th century, the sei whale has accounted for a large proportion of the total whale catch in Japanese waters. Catches ranged from about 300 to 600 per year from 1911 through 1955, and rose to 1,340 in 1959, remaining at high levels until a large drop in 1971. Sei whales off Japan were protected after 1975. Catches of sei whales by Japanese and Soviet fleets in the North Pacific and Bering Sea jumped from 260 in 1962 to over 4,500 in 1968 and 1969, after which catches declined rapidly. Whaling ceased after 1975 when this stock of sei whales was protected.

Except for harvests off British Columbia in the late 1950's through the mid-1960's, sei whale catches off the coasts of North America were fairly insignificant compared to fin and humpback whale catches. Catches in this region rose from 39 in 1958 to over 600 in 1964 and 1965, after

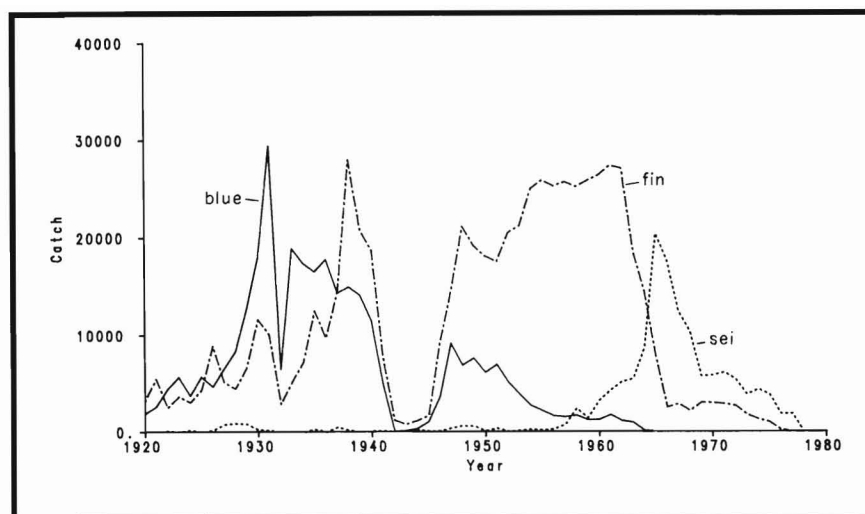


Figure 2.—Catch of sei, fin, and blue whales in the Antarctic, 1920-75 (from the Bureau of International Whaling Statistics).

which the catch dropped to 14 by 1968. Catch of sei whales in this region stopped entirely after 1971.

North Atlantic

When modern whaling began in Norway in the late 1800's, blue whales and then fin whales were the preferred species, although a few sei whales were taken late each season after the larger rorquals had migrated out of the area. As blue and fin whale stocks declined, however, sei whale catches gained in importance. In the early years, most sei whale catches occurred in waters off Norway and Iceland, although substantial catches were taken off Nova Scotia from 1967 to 1972. Currently, the Icelandic stock is the only one harvested in the North Atlantic.

Southern Hemisphere

Antarctic exploitation began in 1904, but in the early years whalers preferred humpback, blue, and fin whales. As stocks of these other whales declined, catches of sei whales began to increase, rising rapidly in the late 1950's and early 1960's (Fig. 2). Sei whale catches peaked at over 20,000 in 1964, declining rapidly to

under 2,000 by 1976, and stopping entirely after sei whales were protected in 1977.

Current and Pre-exploitation Stock Sizes

North Pacific

Ohsumi and Fukuda (1975) estimated that the pre-exploitation population of sei whales in the North Pacific was about 45,000 whales, with a current (1967) range of from 22,000 to 37,000.

North Atlantic

Mitchell (1974) estimated the current (1966) population of sei whales to be 1,856 off Nova Scotia and 828 in the Labrador Sea. According to the Cetacean and Turtle Assessment Program¹, there may be as many as 2,273 sei whales in U.S. Atlantic coastal waters.

¹Cetacean 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. manuscript, 450 p. Graduate School Oceanogr., Univ. Rhode Isl., Kingston, RI 02881. (Prep. for U.S. Dep. Int., Bur. Land Manage. under Contr. AA551-CT8-48.)

Southern Hemisphere

Estimates of early and current sei whale population sizes (Table 1) were reported at the IWC Special Meeting on Southern Hemisphere Sei Whales (IWC, 1980).

Management

Sei whales have been especially difficult to assess as evidenced by the number of special meetings on Southern Hemisphere sei whales held by the IWC since the early 1970's. During the 1960's and early 1970's, it was thought that Southern Hemisphere sei whales were at or near their unexploited levels during the late 1950's. Later evidence suggested that sei

Table 1.—Estimates of early and current sei whale population sizes by IWC statistical area in the Antarctic.

Area	Population est.	
	1930	1979
I	6,900	1,600
II		
III	22,400	1,100-1,200
IV	14,700	5,700
V	11,200-12,300	1,100-2,900
VI	7,900-8,100	300-360

whales were increasing prior to the 1950's, and that they were at their "initial" size early in this century. However, this later evidence has also been questioned so that the true situation is unclear. The basic indices of abundance used to assess sei whales have been sightings per unit of effort and catch per unit of effort. Often, these two indices have resulted in substantially different estimates for the same stock area. In the Southern Hemisphere, sei whale catches peaked during the mid-1960's as preference shifted from fin to sei whales and then dropped to low levels during the 1970's. In the North Pacific, there have been no sei whale catches since 1976; Iceland, however, still takes some sei whales in the North Atlantic.

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