MINKE WHALE (*Balaenoptera acutorostrata*): Canadian East Coast Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Minke whales have a cosmopolitan distribution in polar, temperate and tropical waters. In the North Atlantic there are four recognized populations — Canadian east coast, west Greenland, central North Atlantic, and northeastern North Atlantic (Donovan 1991). These four population divisions were defined by examining segregation by sex and length, catch distributions, sightings, marking data and pre-existing ICES boundaries; however, there is very little data from the Canadian east coast population.

Minke whales off the eastern coast of the United States are considered to be part of the Canadian east coast population, which inhabits the area from the eastern half of Davis Strait out to 45°W and south to the Gulf of Mexico. The relationship between this and the other three populations is uncertain. It is also uncertain if there are separate stocks within the Canadian east coast population.

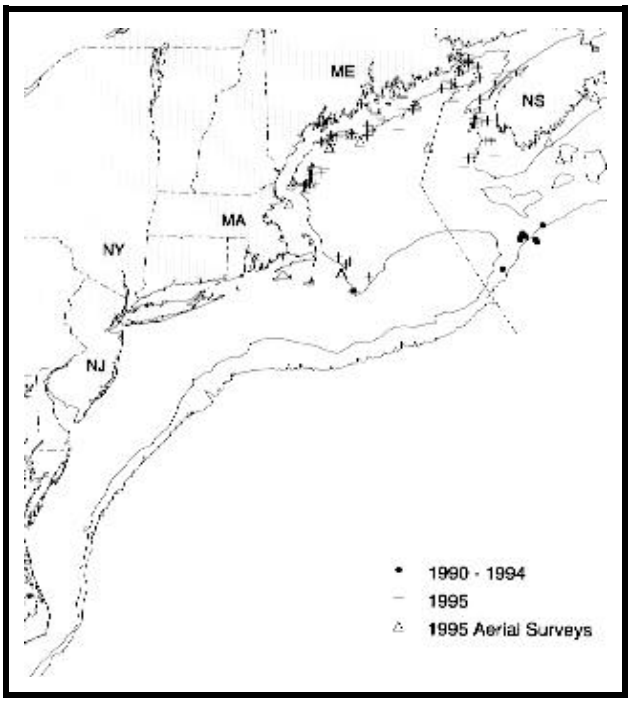

Figure 1. *Distribution of minke whale sightings from NEFSC shipboard and aerial surveys during the summer in 1990-1995. Isobaths are at 100 m and 1,000 m.*

The minke whale is the third most abundant large whale in the U.S. Atlantic Exclusive Economic Zone (EEZ). It is common and widely distributed (CeTAP 1982). There appears to be a strong seasonal component to minke whale distribution. Spring and summer are times of relatively widespread and common occurrence, and during this time they are most abundant in New England waters. During fall, in New England waters, there are fewer minke whales, while during winter, the species appears to be largely absent. Like most other baleen whales, the minke whale generally occupies the continental shelf proper, rather than the continental shelf edge region. Records summarized by Mitchell (1991) hint at a possible winter distribution in the West Indies and in mid-ocean south and east of Bermuda. As with several other cetacean species, the possibility of a deep-ocean component to distribution exists but remains unconfirmed.

POPULATION SIZE

The total number of minke whales in the Canadian East Coast population is unknown. However, three estimates are available for portions of the habitat — a 1978-1982 estimate (CeTAP 1982), a shipboard survey estimate from the summers of 1991 and 1992, and a shipboard estimate from June-July 1993 (Table 1; Figure 1).

A population size of 320 minke whales (CV=0.23) was estimated from an aerial survey program conducted from 1978 to 1982 on the continental shelf and shelf edge waters between Cape Hatteras, North Carolina and Nova Scotia (Table 1; CeTAP 1982). The estimate is based on spring data because the greatest proportion of the population off the northeast U.S. coast appeared in the study area during this season. This estimate does not include a correction for dive-time or g(0), the probability of detecting an animal group on the track line. This estimate may not reflect the current true population size because of its old age, and it was estimated just after cessation of extensive foreign fishing operations in the region.

A population size of 2,650 (CV=0.31) minke whales was estimated from two shipboard line transect surveys conducted during July to September 1991 and 1992 in the northern Gulf of Maine-lower Bay of Fundy region. This population size is a weighted-average of the 1991 and 1992 estimates, where each annual estimate was weighted by the inverse of its variance. The data were collected during surveys designed to estimate abundance of harbor porpoises (Palka 1995). Two independent teams of observers on the same ship surveyed using naked eye in non-closing mode. Using

the product integral analytical method (Palka 1995) and DISTANCE (Buckland *et al.* 1993; Laake *et al.* 1993) the abundance includes an estimate of school size-bias, if applicable, an estimate of g(0), probability of detecting a group on the track line, but no correction for dive-time. Variability was estimated using bootstrap resampling techniques.

A population size of 330 minke whales (CV=0.66) was estimated from a June and July 1993 shipboard line transect sighting survey conducted principally between the 200 and 2,000m isobaths from the southern edge of Georges Bank, across the Northeast Channel to the southeastern edge of the Scotian Shelf (Table 1; Anon. 1993). Data were collected by two alternating teams that searched with 25x150 binoculars and were analyzed using DISTANCE (Buckland *et al.* 1993; Laake *et al.* 1993). Estimates include school size-bias, if applicable, but do not include corrections for g(0) or dive-time. Variability was estimated using bootstrap resampling techniques.

There are no estimates of abundance for this species in Canadian waters that lie farther north or east of the above survey's study area.

The best available current abundance estimate for minke whales is 2,650 (CV=0.31) as estimated from the July to September 1991 and 1992 shipboard line transect surveys because this survey is fairly recent and provided the most complete coverage of the known habitat.

Table 1. Summary of abundance estimates for Canadian East Coast minke whales. Month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
spring 1978-82	Cape Hatteras, NC to Nova Scotia	320	0.23
Jul -Sep 1991-92	N. Gulf of Maine and Bay of Fundy	2,650	0.31
Jun-Jul 1993	Georges Bank to Scotian shelf, shelf edge only	330	0.66

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best estimate of abundance for minke whales is 2,650 (CV=0.31). The minimum population estimate for Canadian East Coast minke whale is 2,053 (CV=0.31).

Current Population Trend

There are insufficient data to determine population trends for this species.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. Life history parameters that could be used to estimate net productivity include: females mature when 6-8 years old; pregnancy rates are approximately 0.86 to 0.93; thus, the calving interval is between 1 and 2 years; calves are probably born during October to March, after 10 to 11 months gestation; nursing lasts for less than 6 months; maximum ages are not known, but for Southern Hemisphere minke whales the maximum age appears to be about 50 years (Katona *et al.* 1993; IWC 1991).

For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a "recovery" factor (Wade and Angliss 1997). The minimum population size is 2,053 (CV=0.31). The maximum productivity rate is 0.04, the default value for cetaceans. The "recovery" factor, which accounts for endangered, depleted, threatened, or stocks of unknown status relative to optimum sustainable population (OSP) is assumed to be 0.5 because this stock is of unknown status. PBR for the Canadian east coast minke whale is 21.

ANNUAL HUMAN-CAUSED MORTALITY AND INJURY

Minke whales have been and are still being hunted in the North Atlantic. From the Canadian East Coast population, documented whaling occurred from 1948 to 1972 with a total kill of 1,103 animals (IWC 1992). Animals from other North Atlantic populations are presently still being harvested at low levels.

Minke whales takes have been observed in U.S. waters in the Japanese tuna longline, New England sink gillnet, Atlantic drift gillnet, bluefin tuna purse seine fisheries, and in fish traps and fish weirs; though all takes have not resulted in a mortality. A minke whale was caught and released in the Japanese tuna longline fishery in 3,000 m of water, south of Lydonia Canyon on Georges Bank, in September 1986 (Waring *et al*. 1990). Two minke whales were taken in the New England sink gillnet fishery. The take in July 1991, south of Penobscot Bay, Maine resulted in a mortality (Table 2), and the take in October 1992, off the coast of New Hampshire near Jeffreys Ledge was released alive. Four minke whale mortalities were observed in the pelagic drift gillnet fishery during 1995 (Table 2). One minke whale was reported caught in a bluefin tuna purse seine off Stellwagen Bank in 1991 and released uninjured .(D. Beach, NMFS NE Regional Office, pers. comm.). Read (1994) reported that a minke whale was found dead in a Rhode Island fish trap in 1976, and that a minke whale was trapped and released alive in a herring weir off northern Maine in 1990.

In U.S. waters, an entanglement database maintained by NE Regional Office for 1975-1992 includes 36 records of minke whales. The gear includes unspecified fishing net, unspecified cable or line, fish trap, weirs, seines, gillnets, and lobster gear. A review of these records is not complete, but preliminary summaries are reported below. An immature female minke whale, entangled with line around the tail stock, came ashore on the Jacksonville, Florida, jetty on 31 January 1990, and on 15 March 1992, a juvenile female minke whale with propeller scars was found floating east of the St. Johns channel entrance (R. Bonde, USFWS, Gainesville, FL, pers. comm.). The 1997 List of Fisheries (62FR33, January 2, 1997) reported seven minke whale mortalities and serious injuries have been attributed to the lobster fishery during 1990 to 1994.

In Canadian waters, information about minke whale interactions with fishing gear is not well quantified or recorded in most parts of Canada, though some records are available. The following were reported in Read (1994). Six minke whales were reported entangled in gillnets in Newfoundland and Labrador during 1989. One of these animals escaped towing gear, the rest died. Five minke whales were entrapped and died in Newfoundland cod traps during 1989. During 1980 and 1990, 15 of 17 minke whales were released alive from herring weirs in the Bay of Fundy. In 1990, ten minke whales were trapped in the Bay of Fundy weirs, but all were released alive. Due to the formation of a cooperative program between Canadian fishermen and biologists it is expected that in the future more minke whales will be able to be released alive (A. Westgate, pers. comm.). Salmon gillnets in Canada have taken a few minke whales. In Newfoundland in 1979, one minke whale died in a salmon net. Between 1979 and 1990, it was estimated that 15% of the minke whale takes were in salmon gillnets.

Accurate estimates of human-caused mortality are not available because it is likely that many entanglements, injuries, and mortalities go unobserved and/or unrecorded, and existing data are fragmentary. Total annual estimated average fishery-related mortality and serious injury to this stock in the Atlantic in fisheries observed by NMFS during 1990-1995 was 2.5 minke whales (CV = 0.97), though the total from all fisheries is unknown. After U.S. stranding records are audited an updated mortality and serious injury estimate will be made.

Fishery Information

Data on current incidental takes in U.S. fisheries are available from several sources. In 1986, NMFS established a mandatory self-reported fisheries information system for large pelagic fisheries. Data files are maintained at the Southeast Fisheries Science Center (SEFSC). The Northeast Fisheries Science Center (NEFSC) Sea Sampling Observer Program was initiated in 1989, and since that year several fisheries have been covered by the program. In late 1992 and in 1993, the SEFSC provided observer coverage of pelagic longline vessels fishing off the Grand Banks (Tail of the Banks) and provides observer coverage of vessels fishing south of Cape Hatteras.

As described, minke whale takes have been observed in U.S. waters in the Japanese tuna longline, New England sink gillnet, Atlantic drift gillnet, bluefin tuna purse seine fisheries, and in fish traps and fish weirs; though all takes have not resulted in a mortality.

Prior to 1977, there was no documentation of marine mammal by-catch in distant-water fleet (DWF) activities off the northeast coast of the U.S. With implementation of the Magnuson Fisheries Conservation and Management Act in that year, an observer program was established which has recorded fishery data and information of incidental by-catch of marine mammals. In 1982, there were 112 different foreign vessels; 16%, or 18, were Japanese tuna longline vessels operating along the U.S. east coast. This was the first year that the Northeast Regional Observer Program assumed responsibility for observer coverage of the longline vessels. Between 1983 and 1988, the number of Japanese longline vessels operating within the EEZ each year were 3, 5, 7, 6, 8, and 8, respectively. Observer coverage was 100%. No mortalities were observed, but one animal was released alive in September 1986 (Waring *et al.* 1990).

There are approximately 349 vessels (full and part time) in the New England multispecies sink gillnet fishery (Walden 1996). Observer coverage in trips has been 1%, 6%, 7%, 5%, 7% and 5% for years 1990 to 1995 (Table 2). The fishery has been observed in the Gulf of Maine and in Southern New England. One mortality was observed in this fishery in 1991. Estimated fishery-related mortality and serious injury attributable to this fishery was ten minke whales (CV = 0.97) in 1991 (Northridge 1996). Annual estimated average fishery-related mortality and serious injury to this stock in the Atlantic during 1990-1995 attributable to the New England sink gillnet fishery was 1.7 minke whales (CV = 0.97) (Table 2).

The estimated total number of hauls in the Atlantic pelagic drift gillnet fishery increased from 714 in 1989 to 1,144 in 1990; thereafter, with the introduction of quotas, effort was severely reduced. The estimated number of hauls in 1991, 1992, 1993, 1994 and 1995 were 233, 243, 232, 197 and 164 respectively. Fifty-nine different vessels participated in this fishery at one time or another between 1989 and 1993. In 1994 and 1995 there were 12 and 11 vessels, respectively, in the fishery (Table 2). Observer coverage, expressed as percent of sets observed, was 8% in 1989, 6% in 1990, 20% in 1991, 40% in 1992, 42% in 1993, 87% in 1994 and 99% in 1995 (Table 2). Effort was concentrated along the southern edge of Georges Bank and off Cape Hatteras. Examination of the species composition of the catch and locations of the fishery throughout the year, suggested that the drift gillnet fishery be stratified into two strata, a southern or winter stratum, and a northern or summer stratum. Minke whales were caught in this fishery only in 1995. Estimates of the total by-catch, for each year from 1989 to 1993, were obtained using the aggregated (pooled 1989-1993) catch rates, by strata (Northridge 1996). Estimates of total annual by-catch for 1994 and 1995 were estimated from the sum of the observed caught and the product of the average bycatch per haul and number of unobserved hauls as recorded in SEFSC logbooks. Variances were estimated using bootstrap re-sampling techniques. Estimated annual fishery-related mortality and serious injury (CV in parentheses) was 0 for 1989 to 1994 and 4 (0) for 1995; estimated average annual mortality and serious injury related to this fishery during 1991-1995 was 0.8 minke whales (CV=0.00).

The Canadian groundfish gillnet fishery is important and widespread. Many fisherman hold groundfish gillnet licenses but the number of active fisherman are unknown. In 1989, approximately 6,800 licenses were issued to fishermen along the southern coast of Labrador, and northeast and southern coast of Newfoundland. In the Gulf of St. Lawrence, there were about 3,900 licenses issued in 1989, while in the Bay of Fundy and southwestern Nova Scotia 659 licenses were issued.

The Atlantic Canadian and Greenland salmon gillnet fishery is seasonal, with the peak from June to September, depending on the location. In southern and eastern Newfoundland, and Labrador during 1989, there were 2,196 gear units used, where each gear unit consist of a net 91 m long. There is no effort data available for the Greenland fishery. However the fishery was stopped in 1993 as a result of an agreement between the fishermen and North Atlantic Salmon Fund (Read 1994). There was no reported fishery-related mortality or serious injury to minke whales in this fishery.

There were 3,121 cod traps operating in Newfoundland and Labrador during 1979. That number was estimated to have grown to about 7,500 in 1980. The cod trap fishery in Newfoundland closed in 1993 due to the depleted groundfish resources.

In U.S. and Canadian waters the herring weir fishery occurs from May to September each year along the southwestern shore of the Bay of Fundy, and scattered along the western Nova Scotia and northern Maine coasts. In 1990 there were 180 active weirs in western Bay of Fundy, and 56 active weirs in Maine (Read 1994). There was no reported fishery-related mortality or serious injury to minke whales in this fishery in U.S. Atlantic EEZ waters .

Table 2. Summary of the incidental mortality of minke whales (*Balaenoptera acutorostrata*) by commercial fishery including the years sampled (Years), the number of vessels active within the fishery (Vessels), the type of data used (Data Type), the annual observer coverage (Observer Coverage), the mortalities recorded by on-board observers (Observed Mortality), the estimated annual mortality (Estimated Mortality), the estimated CV of the annual mortality (Estimated CV) and the mean annual mortality (CV in parentheses).

Fishery	Years	Vessels	Data Type [1]	Observer Coverage [2]	Observed Mortality	Estimated Mortality	Estimated CVs	Mean Annual Mortality
New England Multispecies Sink Gillnet	90-95	349	Obs. Data Weighout	.01, .06, .07, .05, .07, .05	0, 1, 0, 0, 0, 0	0, 10, 0, 0, 0, 0	0, .97, 0, 0, 0, 0	1.7 (.97)
Pelagic Drift Gillnet[3]	91-95	1994=12[4] 1995=11	Obs. Data Logbook	.20, .40, .42, .87, .99	0, 0, 0, 0, 4	0, 0, 0, 0, 4.0 [5]	0	0.8 (0)
TOTAL								2.5 (.97)

[1] Observer data (Obs. Data) are used to measure bycatch rates, and the data are collected within the Northeast Fisheries Science Center (NEFSC) Sea Sampling Program. NEFSC collects Weighout (Weighout) landings data, and total landings are used as a measure of total effort for the sink gillnet fishery. Mandatory logbook (Logbook) data are used to measure total effort for the pelagic drift gillnet fishery, and these data are collected at the Southeast Fisheries Science Center (SEFSC).

[2] The observer coverage for the sink gillnet fishery is the number of trips, and for the pelagic drift gillnet fishery the unit of effort is a set.

[3] For 1991-1993, pooled bycatch rates were used to estimate bycatch in months that had fishing effort but did not have observer coverage. This method is described in Northridge (1996). In 1994 and 1995, observer coverage increased substantially, and bycatch rates were not pooled for this period (Bisack, in prep.).

[4] 1994 and 1995 shown, other years not available on an annual basis.

[5] One vessel was not observed and recorded 1 set in a 10 day trip in the SEFSC mandatory logbook. If you assume the vessel fished 1.4 sets per day as estimated from the 1995 Sea Sampling data, the point estimate may increase by 0.42 animals. However, the SEFSC mandatory logbook data was taken at face value, and therefore it was assumed that 1 set was fished within this trip, and the point estimate would then increase by 0.03 animals.

Other Mortality

Minke whales inhabit coastal waters during much of the year and are subject to collision with vessels. In one record in the NE Regional Office marine mammal stranding database, on 7 July 1974, the necropsy suggested a vessel collision.

Because minke whales inhabit coastal waters during much of the year, they may be affected by pollution. For example, the levels of polychlorinated biphenyls in blubber from minke whales in the St. Lawrence estuary in Canada were high (Gaskin 1985).

Indirect impacts on prey species are also possible. Fish in the diet of minke whales include herring, capelin, cod, pollock, salmon, mackerel and sand lance. All of these species, except sand lance, are commercially harvested; and cod and pollock are considered as fully exploited or overexploited (NMFS 1993). Consequentially, the abundance and distribution of minke whales may be affected by the commercial fishing of the above fish and squid species.

STATUS OF STOCK

The status of minke whales, relative to OSP, in the U.S. Atlantic EEZ is unknown. The minke whale is not listed as endangered under the Endangered Species Act (ESA). In Canada, the Cetacean Protection Regulations of 1982,

promulgated under the standing Fisheries Act, prohibit the catching or harassment of all species of cetaceans. There are insufficient data to determine the population trends for this species. The total fishery-related mortality and serious injury for this stock is not less than 10% of the calculated PBR and, therefore, cannot be considered to be insignificant and approaching zero mortality and serious injury rate. This is not a strategic stock because estimated fishery-related mortality and serious injury does not exceed PBR and the minke whale is not listed as a threatened or endangered species under the ESA.

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