FIN WHALE (*Balaenoptera physalus*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The Scientific Committee of the International Whaling Commission (IWC) has proposed stock boundaries for North Atlantic fin whales. Fin whales off the eastern USA, north to Nova Scotia and the southeastern coast of Newfoundland are believed to constitute a single stock under the present IWC scheme (Donovan 1991). However, the stock identity of North Atlantic fin whales has received relatively little attention, and whether the current stock boundaries define biologically isolated units has long been uncertain. The existence of a subpopulation structure was suggested by local depletions that resulted from commercial overharvesting (Mizroch *et al*. 1984).

A genetic study conducted by Bérubé *et al.* (1998) using both mitochondrial and nuclear DNA provided strong support for an earlier population model proposed by Kellogg (1929) and others. This postulates the existence of several subpopulations of fin whales in the North Atlantic and Mediterranean, with limited gene flow among them. Bérubé *et al.* (1998) also proposed that the North Atlantic population showed recent divergence due to climatic changes (*i.e.* postglacial expansion), as well as substructuring over even relatively short distances. The genetic data are consistent with the idea that different subpopulations use the same feeding ground, a hypothesis that was also originally proposed by Kellogg (1929).

Fin whales are common in waters of the US Atlantic Exclusive Economic Zone (EEZ), principally from Cape Hatteras northward (Figure 1). Fin whales accounted for 46% of the large whales and 24% of all cetaceans sighted over the continental shelf during aerial surveys (CETAP 1982) between Cape Hatteras and Nova Scotia during 1978-82. While a great deal remains unknown, the magnitude of the ecological role of the fin whale is impressive. In this region fin whales are probably the dominant large cetacean species in all seasons, with the largest standing stock, the largest food requirements, and therefore the largest impact on the ecosystem of any cetacean species (Kenney *et al.* 1997; Hain *et al*. 1992).

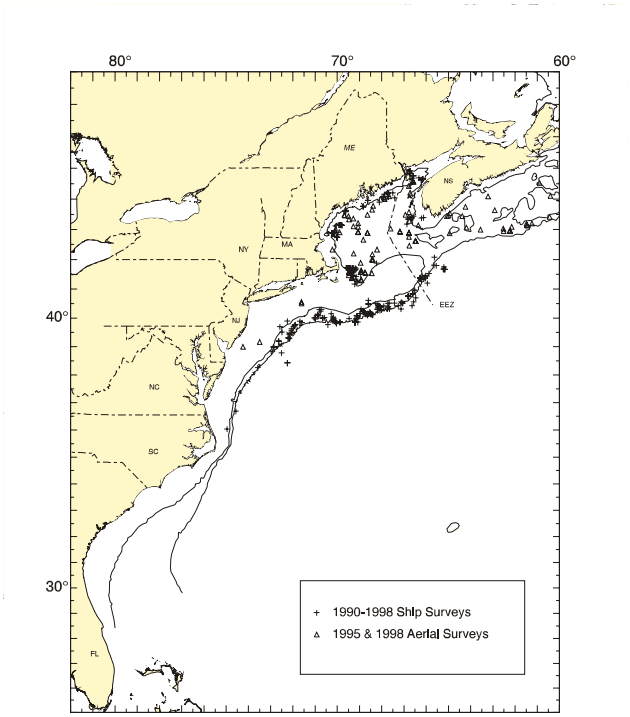

Figure 1. *Distribution of fin whale sightings from NEFSC and SEFSC shipboard and aerial surveys during the summer in 1990-1998. Isobaths are at 100 m and 1,000 m.*

There is little doubt that New England waters represent a major feeding ground for the fin whale. There is evidence of site fidelity by females, and perhaps some segregation by sexual, maturational or reproductive class on the feeding range (Agler *et al*. 1993). Seipt *et al*. (1990) reported that 49% of identified fin whales on Massachusetts Bay area feeding grounds were resighted within the same year, and 45% were resighted in multiple years. While recognizing localized as well as more extensive movements, these authors suggested that fin whales on these grounds exhibited patterns of seasonal occurrence and annual return that are in some respects similar to those shown for humpback whales. This was reinforced by Clapham and Seipt (1991), who showed maternally directed site fidelity by fin whales in the Gulf of Maine. Information on life history and vital rates is also available in data from the Canadian fishery, 1965-1971 (Mitchell 1974). In seven years, 3,528 fin whales were taken at three whaling stations. The station at Blandford, Nova Scotia, took 1,402 fin whales.

Hain *et al*. (1992), based on an analysis of neonate stranding data, suggested that calving takes place during approximately four months from October to January in latitudes of the US mid-Atlantic region; however, it is unknown where calving, mating, and wintering for most of the population occurs. Results from the Navy's SOSUS program (Clark 1995) indicate a substantial deep-ocean component to fin whale distribution. It is likely that fin whales occurring in the US Atlantic EEZ undergo migrations into Canadian waters, open-ocean areas, and perhaps even subtropical or tropical regions. However, the popular notion that entire fin whale populations make distinct

annual migrations like some other mysticetes has questionable support in the data; in the North Pacific, year-round monitoring of fin whale calls found no evidence for large-scale migratory movements (Watkins *et al.* 2000).

POPULATION SIZE

Two estimates of abundance from line-transect surveys are available. An abundance of 2,200 (CV=0.24) fin whales was estimated from a July to September 1995 sighting survey conducted by two ships and an airplane that covered waters from Virginia to the mouth of the Gulf of St. Lawrence. Data collection and analysis methods used were described in Palka (1995).

A more recent estimate of 2,814 (CV=0.21) fin whales was derived from a 28 July to 31 August 1999 line-transect sighting survey conducted by a ship and airplane covering waters from Georges Bank to the mouth of the Gulf of St. Lawrence. Shipboard data were analyzed using the modified direct duplicate method (Palka 1995) that accounts for school size bias and *g(0)*, the probability of detecting a group on the track line. Aerial data were not corrected for *g(0)* (Palka 2000).

The latter abundance estimate is considered the best available for the western North Atlantic fin whale because it is relatively recent. However, this estimate must be considered extremely conservative in view of the known range of the fin whale in the entire western North Atlantic, the uncertainties regarding population structure and exchange between surveyed and unsurveyed areas, and aerial data having not been corrected for *g(0)*.

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 fin whales is 2,814 (CV=0.21). The minimum population estimate for the western North Atlantic fin whale is 2,362.

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. Based on photographically identified fin whales, Agler *et al*. (1993) estimated that the gross annual reproduction rate was at 8%, with a mean calving interval of 2.7 years.

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 (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 2,362. The maximum productivity rate is 0.04, the default value for cetaceans. The "recovery" factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP) is assumed to be 0.10 because the fin whale is listed as endangered under the Endangered Species Act (ESA). PBR for the western North Atlantic fin whale is 4.7.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The number of fin whales taken at three whaling stations in Canada from 1965 to 1971 totaled 3,528 whales (Mitchell 1974). Reports of non-directed takes of fin whales are fewer over the last two decades than for other endangered large whales such as right and humpback whales. There was no reported fishery-related mortality or serious injury to fin whales in fisheries observed by NMFS during 1997 through 2001. A review of NMFS records from 1997 through 2001 yielded an average of 2.0 human-caused mortalities per year – 0.6 per year resulting from fishery interactions/entanglements (USA waters, 0.2; Canadian waters, 0.2; Bermudian waters, 0.2), and 1.4 due to vessel collisions--all in USA waters (Table 1).

Fishery-Related Serious Injury and Mortality

No confirmed fishery-related mortality or serious injury of fin whales was reported in the Fisheries Observer bycatch database; therefore, no detailed fishery information is presented here. A review of the records of stranded, floating or injured fin whales for the period 1997 through 2001 on file at NMFS found three records with substantial evidence of fishery interactions causing mortality or serious injury (Table 1). There was a live fin whale sighted entangled on 6/24/97 with line wrapped over its back. The animal appeared emaciated, and scarring visible on the leading edge of the dorsal fin and the whale's left flank suggests this was a prolonged entanglement. Whether the entanglement initiated the whale's decline in health is unclear, but the chronic stress of the entanglement was likely lethal given the whale's depressed condition.

The three substantiated records provide a minimum annual rate of serious injury and mortality of 0.6 fin whales from fishery interactions. While these records are not statistically quantifiable in the same way as the observed fishery records, they give a minimum estimate of the frequency of entanglements for this species. In addition to the records above, there are four records within the period that lacked substantial evidence of the severity of the entanglement for a serious injury determination, or that did not provide the detail necessary to determine if an entanglement had been a contributing factor in the mortality.

Table 1. Summarized records of mortality and serious injury likely to result in mortality, Western North Atlantic fin whale stock, January 1997 - December 2001. Causes of mortality or injury, assigned as primary or secondary, are based on records maintained by NMFS.

Date	Report Type	Sex, age, ID length	Location	Assigned Cause: P=primary, S=secondary		Notes
				Ship strike	Entang./ Fsh.inter	
6/24/97	serious injury	unknown	20 mi east Nantucket Island, MA		P	line wrapped over back; whale emaciated; scarring indicative of prolonged entanglement
8/4/97	mortality	16.8 m female	Eastham, MA	P		exhumed skeleton with broken jaw, cracked scapula partially healed
3/21/98	mortality	16.9 m female	Salvo County, NC	P		large hematoma, disarticulated spine and numerous broken vertebrae
9/28/98	mortality	unknown	Digby Neck, Nova Scotia		P	gear wrapped through mouth and ten wraps on tail stock
2/10/99	mortality	15.5 m male	Virginia Beach, VA	P		large external wound, extensive fractures to vertebral column, hemorrhaging
11/5/99	mortality	16.2 m male	Elizabeth, NJ	P		large wound anterior of the blowhole, severed left flipper, shattered bones
12/11/00	mortality	10.9 m female	New York harbor	P		hemorrhage and fractured bones on right side
1/2/01	mortality	18.1 m female	New York harbor	P		dorsal abrasion marks, hematoma
2/1/01	mortality	14.5 m female	Port Elizabeth, NJ	P		Very fresh carcass hung on ship's bow
9/19/01	mortality	10.7 m unknown	off Bermuda		P	Extensive fresh entanglement marks

Table notes:

1. The date sighted and location provided in the table are not necessarily when or where the serious injury or mortality occurred; rather, this information indicates when and where the whale was first reported beached, entangled, or injured.
2. National guidelines for determining what constitutes a serious injury have not been finalized. Interim criteria as established by NERO/NMFS (62 FR 33, Jan. 2, 1997) have been used here. Some assignments may change as new information becomes available and/or when national standards are established.
3. Assigned cause based on best judgement of available data. Additional information may result in revisions.

Other Mortality

After reviewing NMFS records for 1997 through 2001, seven were found that had sufficient information to confirm the cause of death as collisions with vessels (Table 1). One record (8/4/97) had been omitted from previous reports, but is inserted here following an examination of the exhumed skeletal remains which found a broken jaw and cracked scapula which had partially healed. The partial healing indicates the whale was alive at the time of the incident.

The above records constitute an annual rate of serious injury or mortality of 1.4 fin whales from collisions with vessels. NMFS data holdings include four additional records of fin whale collisions with vessels, but the available supporting documentation was insufficient to determine if the whales sustained mortal injuries from the encounters.

STATUS OF STOCK

The status of this stock relative to OSP in the US Atlantic EEZ is unknown, but the species is listed as endangered under the ESA. There are insufficient data to determine the population trend for fin whales. The total level of human-caused mortality and serious injury is unknown. The records on hand at NMFS represent coverage of only a portion of the area surveyed for the population estimate for the stock. Despite this, 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 a zero mortality and serious injury rate. This is a strategic stock because the fin whale is listed as an endangered species under the ESA. A Recovery Plan for fin whales has been prepared and is currently awaiting legal clearance.

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