Revised 12/28/2010

FIN WHALE (*Balaenoptera physalus*): Northeast Pacific Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Within the U.S. waters in the Pacific, fin whales are found seasonally off the coast of North America and in the Bering Sea during the summer (Fig. 40). Recent information on seasonal fin whale distribution has been gleaned from the reception of fin whale calls by bottom-mounted, offshore hydrophone arrays along the U.S. Pacific coast, in the central North Pacific, and in the western Aleutian Islands (Moore et al. 1998, 2006,
Watkins et al. 2000, Stafford et al. 2007). Moore et al. (1998, 2006) Watkins et al. (2000), and Stafford et al. (2007) both documented high levels of fin whale call rates along the U.S. Pacific coast beginning in August/September and lasting through February, suggesting that these may be important feeding areas during the winter. While peaks in call rates occurred during late
summer, fall and winter in the central North Pacific and the Aleutian Islands, fin whale calls were seldom detected during summer months even though fin whales are regularly seen in summer months in the Gulf of Alaska (Stafford et al. 2007). In addition, fin whale calls were detected in the southeast Bering Sea using an instrument moored there from from April 2006 through April 2007, which showed peaks fin whale in call detections from September through November 2006 and also in February and March 2007 (Stafford et al. 2010). While seasonal differences in recorded call rates are in some cases consistent with the results of aerial surveys which have documented seasonal whale distribution, it is not known whether these differences in call rates reflect true seasonal differences in whale distribution, differences in calling rates, or differences in oceanographic properties (Moore et al. 1998). Some fin whale calls have also been recorded in Hawaiian waters in all months except June and July (Thompson and Friedl 1982; McDonald and Fox 1999). Sightings of fin whales in Hawaii are extremely rare: There was a sighting in 1976 (Shallenberger 1981), a sighting by Dale Rice in 1979 (Mizroch et al. 2009) and a sighting during an aerial survey in 1994 (Mobley et al. 1996).

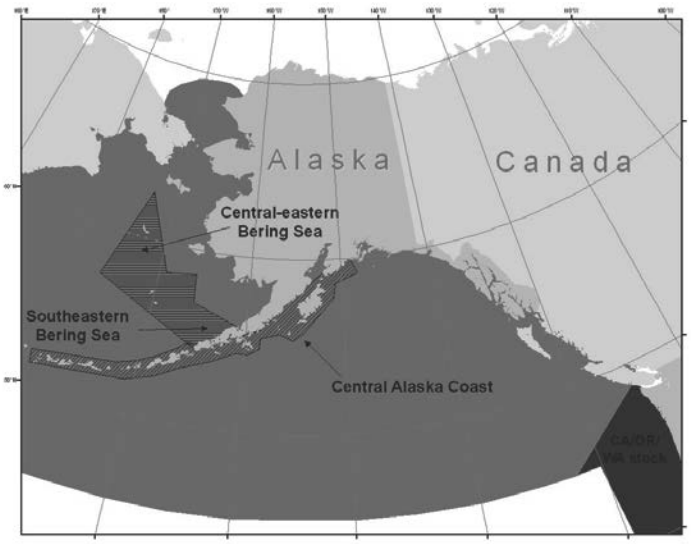

Figure 40. Approximate distribution of fin whales in the eastern North Pacific (shaded area). Striped areas indicate where vessel surveys occurred in 1999-2000 (Moore et al. 2002) and 2001-2003 (Zerbini et al. 2006).

Surveys in the central-eastern and southeastern Bering Sea in 1999 and 2000 and in coastal waters of the Aleutian Islands and the Alaska Peninsula from 2001 to 2003 resulted in new information about the distribution and relative abundance of fin whales in these areas (Moore et al. 2000, 2002; Zerbini et al. 2006). Fin whale abundance estimates were nearly five times higher in the central-eastern Bering Sea than in the southeastern Bering Sea (Moore et al. 2002), and most sightings in the central-eastern Bering Sea occurred in a zone of particularly high productivity along the shelf break (Moore et al. 2000).

The following information was considered in classifying stock structure based on the Dizon et al. (1992) phylogeographic approach: 1) Distributional data: geographic distribution continuous in winter, possibly isolated in summer; 2) Population response data: unknown; 3) Phenotypic data: unknown; and 4) Genotypic data: unknown. Based on this limited information, the International Whaling Commission considers fin whales in the North Pacific to all belong to the same stock (Mizroch et al. 1984), although those authors cited additional evidence that supported the establishment of subpopulations in the North Pacific. Further, Fujino (1960) described eastern and western groups, which are isolated though may intermingle around the Aleutian Islands. Discovery mark recoveries (Rice 1974;

Mizroch et al. 2009) indicate that animals wintering off the coast of southern California range from central California to the Gulf of Alaska during the summer months.

Mizroch et al. (2009) provided a comprehensive summary of whaling catch data, Discovery mark recoveries, and opportunistic sightings data and found evidence that suggests there may be at least 6 populations of fin whales: 2 that are migratory (eastern and western North Pacific) and 2 to 4 more that are resident year-round in peripheral seas such as the Gulf of California, East China Sea, Sanriku-Hokkaido and possibly in the Sea of Japan. It appears likely that the two migratory stocks mingle in the Bering Sea in July and August, rather than in the Aleutian Islands as Fujino (1960) concluded (Mizroch et al. (2009). During winter months, fin whales have been seen over a wide geographic area from 23°N to 60°N, but winter distribution and location of primary wintering areas (if any) are poorly known and need further study. It appears likely that the two migratory stocks mingle in the Bering Sea in July and August, rather than in the Aleutian Islands as Fujino (1960) concluded. As a result, stock structure of fin whales remains uncertain.

For management purposes, three stocks of fin whales are currently recognized in U.S. waters: 1) Alaska (Northeast Pacific), 2) California/Washington/Oregon, and 3) Hawaii. New information from Mizroch et al. (2009) suggests that this structure should be reviewed and updated, if appropriate, to reflect current data. The California/Oregon/Washington and Hawaii fin whale stocks are reported separately in the Stock Assessment Reports for the Pacific Region.

POPULATION SIZE

Reliable estimates of current and historical abundance for the entire Northeast Pacific fin whale stock are currently not available. Two recent studies provide some information on the distribution and occurrence of fin whales, although they do not provide estimates of population size. A survey conducted in August of 1994 covering 2,050 nautical miles of trackline south of the Aleutian Islands encountered only four fin whale groups (Forney and Brownell 1996). However, this survey did not include all of the waters off Alaska where fin whale sightings have been reported, thus, no population estimate can be made. Passive acoustics were used off the island of Oahu, Hawaii, to document a minimum density estimate of 0.081 fin whales/1,000km^2 from peak call rates during the winter (McDonald and Fox 1999). This density estimate is well below the population density of 1.1 animals/1,000 km^2 documented off the coast of California (Barlow 1995, Forney et al. 1995) but does indicate the presence of at least a few fin whales in waters off of Hawaii.

A visual survey for cetaceans was conducted in the central-eastern Bering Sea in July-August 1999 and in the southeastern Bering Sea in June-July 2000 in cooperation with research on commercial fisheries (Moore et al. 2002). The survey included 1,761 km and 2,194 km of effort in 1999 and 2000, respectively. Aggregations of fin whales were often sighted in 1999 in areas where the ship's echosounder identified large aggregations of zooplankton, euphausiids, or fish (Moore et al. 2000). One aggregation of fin whales which occurred during an offeffort period involved greater than 100 animals and occurred in an area of dense fish echosign. Results of the surveys in 1999 and 2000 in the central-eastern Bering Sea and southeastern Bering Sea provided provisional estimates of 3,368 (CV = 0.29) and 683 (CV = 0.32), respectively (Moore et al. 2002). These estimates are considered provisional because they have not been corrected for animals missed on the trackline, animals submerged when the ship passed, and responsive movement. However, the provisional estimate for fin whales in each area is expected to be robust as previous studies have shown that only small correction factors are needed for this species. The Moore et al. (2002) estimate for 1999 is different than that of Moore et al. (2000) because it covers the southeastern Bering Sea as well as the central-eastern Bering Sea. Additionally, the region covered by Moore et al. (2000) did not have consistent effort and thus could be inaccurate. This estimate cannot be used as an estimate of the entire Northeast Pacific stock of fin whales because it is based on a survey in only part of the stock's range. Dedicated line transect cruises were conducted in coastal waters of western Alaska and the eastern and central Aleutian Islands in July-August 2001-2003 (Zerbini et al. 2006). Over 9,053 km of tracklines were surveyed in coastal waters (as far as 85 km offshore) between the Kenai Peninsula (150°W) and Amchitka Pass (178°W). Fin whale sightings (n = 276) were observed from east of Kodiak Island to Samalga Pass, with high aggregations recorded near the Semidi Islands. Zerbini et al. (2006) estimated that 1,652 (95% CI: 1,142-2,389) whales occurred in the area.

Minimum Population Estimate

Information on abundance of fin whales in Alaskan waters has improved considerably in the past few years. Although the full range of the northeast Pacific stock of fin whales in Alaskan waters has not been surveyed, a rough estimate

of the size of the population west of the Kenai Peninsula could include the sums of the estimates from Moore et al. (2002) and Zerbini et al. (2006). Using this approach, the provisional estimate of the fin whale population west of the Kenai Peninsula would be 5,700. This is a minimum estimate for the entire stock because it was estimated from surveys which covered only a small portion of the range of this stock.

Current Population Trend

Zerbini et al. (2006) estimated rates of increase of fin whales in coastal waters south of the Alaska Peninsula (Kodiak and Shumagin Islands). An annual increase of 4.8% (95% CI: 4.1-5.4%) was estimated for the period 1987-2003. This estimate is the first available for North Pacific fin whales and is consistent with other estimates of population growth rates of large whales. It should be used with caution, however, due to uncertainties in the initial population estimate for the first trend year (1987) and due to uncertainties about the population structure of the fin whales in the area. Also, the study represented only a small fraction of the range of the northeast Pacific stock.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

A reliable estimate of the maximum net productivity rate is currently unavailable for the Northeast Pacific fin whale stock. Hence, until additional data become available, it is recommended that the cetacean maximum net productivity rate (R_{MAX}) of 4% be employed for this stock (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 reauthorized Marine Mammal Protection Act (MMPA), the potential biological removal (PBR) is defined as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor: $PBR = N_{MIN}\ 0.5R_{MAX} \times F_R$. The recovery factor ($F_R$) for this stock is 0.1, the recommended value for cetacean stocks which are listed as endangered (Wade and Angliss 1997). Thus, the PBR level for this stock is 11.4 ($5{,}700 \times 0.02 \times 0.1$).

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Between 2007 and 2009, there were no observed incidental mortalities of fin whales in the any Alaska commercial fishery (Table 39).

Table 39. Summary of incidental serious injury and mortality of fin whales due to commercial fisheries and calculation of the mean annual mortality rate. Mean annual takes are based on 2007-2009 data. Details of how percent observer coverage is measured is included in Appendix 6.

Fishery name	Years	Data type	Percent observer coverage	Observed mortality	Estimated mortality	Mean annual takes (CV in parentheses)
BSAI pollock trawl	2007	obs data	85	0	0	0
	2008		85	0	0	
	2009		86	0	0	
Estimated total annual takes						0

Subsistence/Native Harvest Information

Subsistence hunters in Alaska and Russia have not been reported to take fin whales from this stock.

Other Mortality

Between 1925 and 1975, 47,645 fin whales were reported killed throughout the North Pacific (International Whaling Commission, BIWS catch data, February 2003 version, unpublished), although newly revealed information about illegal Soviet catches indicates that the Soviets over-reported catches of about 1,200 fin whales, presumably to hide catches of other protected species (Doroshenko 2000). Two ship strikes of fin whales occurred in Alaska waters

between 2005-2009 and have been reported in the Alaska Region stranding database (NMFS Alaska Regional Office, unpublished data).

STATUS OF STOCK

The fin whale is listed as "endangered" under the Endangered Species Act of 1973, and therefore designated as "depleted" under the MMPA. As a result, the Northeast Pacific stock is classified as a strategic stock. While reliable estimates of the minimum population size, population trends, and PBR are available for a portion of this stock, much of the North Pacific range has not been surveyed. Therefore the status of the stock relative to its Optimum Sustainable Population size is currently not available. The total estimated annual rate of mortality and serious injury for this stock is 0.4 based on takes incidental to U. S. commercial fisheries (0) and ship strikes (0.4) and does not exceed the PBR level for the stock (11.4). Thus, fishery-related mortality levels can be determined to have met a zero mortality and serious injury rate.

HABITAT CONCERNS

There are no known habitat issues that are of particular concern for this stock.

CITATIONS

Barlow, J. 1995. The abundance of cetaceans in California waters. Part 1: Ship surveys in summer and fall of 1991. Fish. Bull., U.S. 93:1-14.

Dizon, A. E., C. Lockyer, W. F. Perrin, D. P. DeMaster, and J. Sisson. 1992. Rethinking the stock concept: a phylogeographic approach. Conserv. Biol. 6:24-36.

Doroshenko, N. V. 2000. Soviet whaling for blue, gray, bowhead and right whales in the North Pacific Ocean, 1961-1979. *In* Soviet whaling data (1949-1979). Eds: Yablokov, A. V. and Zemsky, V. A. Center for Russian Environmental Policy, Marine Mammal Council, Moscow, 96-103.

Forney, K. A., and R. L. Brownell. 1996. Preliminary report of the 1994 Aleutian Island marine mammal survey. Unpubl. doc. submitted to Int. Whal. Comm. (SC/48/O 11). 15 pp.

Forney, K. A., J. Barlow, and J. V. Carretta. 1995. The abundance of cetaceans in California waters. Part II: Aerial surveys in winter and spring of 1991 and 1992. Fish. Bull., U.S. 93:15-26.

Fujino, K. 1960. Monogenetic and marking approaches to identifying sub-populations of the North Pacific whales. Sci. Rep. Whales Res. Inst., Tokyo 15:84-142.

Mizroch, S. A., D. W. Rice, and J. M. Breiwick. 1984. The fin whale, *Balaenoptera physalus*. Mar. Fish. Rev. 46(4):20-24.

Mizroch, S. A., D. Rice, D. Zwiefelhofer, J. Waite, and W. Perryman. 2009. Distribution and movements of fin whales in the North Pacific Ocean. Mammal Rev. 39(3):193-227.

McDonald, M. A., and C. G. Fox. 1999. Passive acoustic methods applied to fin whale population density estimation. J. Acoust. Soc. Am. 105(5):2643-2651.

Mobley, Jr., J. R., M. Smultea, T. Norris, and D. Weller. 1996. Fin whale sighting north of Kaua'i, Hawai'i. Paci. Sci. 50(2):230-233.

Moore, S. E., K. M. Stafford, M. E. Dahlheim, C. G. Fox, H. W. Braham, J. J. Polovina, and D. E. Bain. 1998. Seasonal variation in reception of fin whale calls at five geographic areas in the North Pacific. Mar. Mamm. Sci. 14(3):617-627.

Moore, S. E., K. M. Stafford, D. K. Mellinger, C. G. Hildebrand. 2006. Listening for large whales in the offshore waters of Alaska. BioScience 56(1):49-55.

Moore, S. E., J. M. Waite, L. L. Mazzuca, and R. C. Hobbs. 2000. Provisional estimates of mysticete whale abundance on the central Bering Sea shelf. J. Cetacean Res. Manage. 2(3):227-234.

Moore, S. E., J. M. Waite, N. A. Friday and T. Honkalehto. 2002. Distribution and comparative estimates of cetacean abundance on the central and south-eastern Bering Sea shelf with observations on bathymetric and prey associations. Progr. Oceanogr. 55(1-2):249-262.

Rice, D. W. 1974. Whales and whale research in the eastern North Pacific. Pp. 170-195 *In* W. E. Schevill (ed.), The whale problem: A status report. Harvard Press, Cambridge, MA.

Shallenberger, E. W. (1981) The status of Hawaiian cetaceans. Final report for MMC contract MM7AC028. Available from: National Technical Information Service, Springfield, Virginia. PB82-109398.

Stafford, K. M., D. K. Mellinger, S. E. Moore, C. G. Fox. 2007. Seasonal variability and detection range modeling of baleen whale calls in the Gulf of Alaska, 1999–2002. J. Acoust. Soc. Amer. 122(6): 3378-3390.

Stafford, K. M., S. E. Moore, P. J. Stabeno, D. V. Holliday, J. M. Napp, and D. K. Mellinger. 2010. Biophysical ocean observation in the southeastern Bering Sea. Geophysical Research Letters, Vol. 37, L02606, doi:10.1029/2009GL040724, 2010.

Thompson, P. O. and W. A. Friedl. 1982. A long term study of low frequency sound from several species of whales off Oahu, Hawaii. Cetology 45:1-19.

Wade, P. R., and R. Angliss. 1997. Guidelines for assessing marine mammal stocks: report of the GAMMS workshop April 3-5, 1996, Seattle, Washington. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-OPR12, 93 pp.

Watkins, W. A., M. A. Daher, G. M. Reppucci, J. E. George, D. L. Martin, N. A. DiMarzio, and D. P. Gannon. 2000. Seasonality and distribution of whale calls in the North Pacific. Oceanography 13(1):62-67.

Zerbini, A. N., J. M. Waite, J. L. Laake and P. R. Wade. 2006. Abundance, trends and distribution of baleen whales off western Alaska and the central Aleutian Islands. Deep-Sea Res. Part I:1772-1790.