HARBOR PORPOISE (*Phocoena phocoena)*: Gulf of Maine/Bay of Fundy Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

This stock is found in U.S. and Canadian Atlantic waters. During the summer (July to September), harbor porpoises are concentrated in the northern Gulf of Maine and southern Bay of Fundy region, generally in waters less than 150 m deep (Gaskin 1977; Kraus et al. 1983; Palka 1994a). During fall (October-December) and spring (April-June), harbor porpoises are widely dispersed from North Carolina to Maine, and harbor porpoise density is much lower than during the summer. No specific migratory routes to the northern Gulf of Maine/lower Bay of Fundy region have been documented. Harbor porpoises are seen from near the coastline into the middle of the Gulf of Maine (>200 m deep) in both spring and fall. There is little information about the distribution of harbor porpoise during winter (December to March), although numerous strandings have occurred on beaches from North Carolina to New York. There are two stranding records from Florida (Smithsonian strandings data base).

Gaskin (1984, 1992) proposed that there were four separate populations in the western North Atlantic, these being the Gulf of Maine/Bay of Fundy, Gulf of St. Lawrence, Newfoundland and Greenland populations. Presently there is insufficient evidence to accept or reject this hypothesis. Results of a workshop held in February, 1994 were inconclusive with respect to population structure of harbor porpoises in the western North Atlantic, although it was agreed upon that animals found in the Gulf of Maine and Bay of Fundy are from the same stock (Palka 1994b). Research is currently being conducted to re-analyze existing genetic data and analyze new samples in order to resolve the larger scale stock structure question. This report follows Gaskin's hypothesis on harbor porpoise stock structure in the western North Atlantic; Gulf of Maine and Bay of Fundy harbor porpoises are recognized as a single management stock separate from harbor porpoise populations in the Gulf of St. Lawrence, Newfoundland, and Greenland.

POPULATION SIZE

Two line-transect sighting surveys were conducted — one in 1991, the other in 1992 — to estimate the absolute population size of the harbor porpoises aggregated in the Gulf of Maine/Bay of Fundy region during the summer. The study area was stratified by water depth and expected density of harbor porpoises. Harbor porpoise sightings are shown in Figure 1.

The shipboard sighting survey procedure to estimate abundance corrected for g(0) used two independent teams that searched using the naked eye in non-closing mode. Abundance, corrected for g(0), was estimated using the direct-duplicate method (Palka, in press) and variability was estimated using bootstrap re-sampling methods. The abundance estimates were 37,500 harbor porpoises in 1991 [coefficient of variation (CV) = 0.29, 95% confidence interval (CI) = 26,700-86,400] and 67,500 harbor porpoises in 1992 (CV = 0.23, 95% CI = 32,900-104,600). The inverse variance weighted-average estimate (Smith et al. 1993) of harbor porpoise abundance was 47,200 harbor porpoises (CV = 0.19, 95% CI = 39,500-70,600). Possible reasons for the inter-annual abundance and distribution differences include inter-annual changes in water temperature and availability of primary prey species (Palka 1994a).

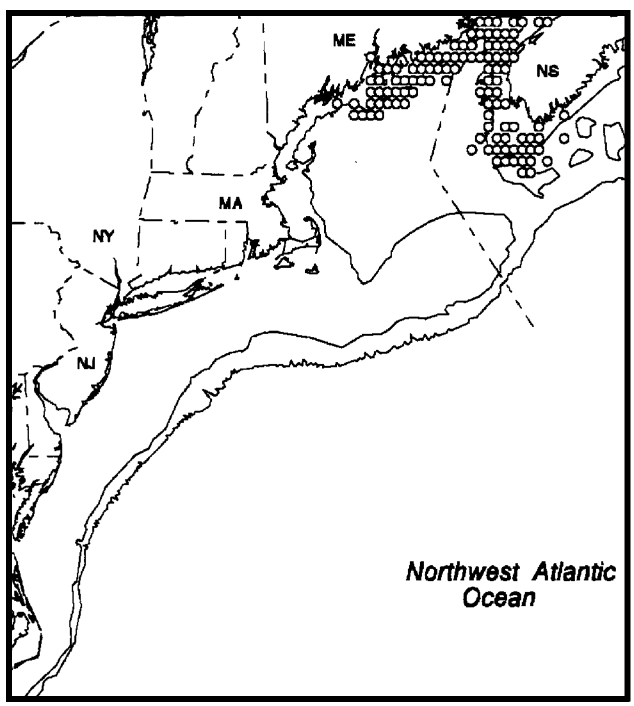

Figure 1. *Distribution of harbor porpoise sightings from NEFSC shipboard surveys during the summer in 1991-1992. Isobaths are at 100 m and 1,000 m.*

Potential biases that have not been explicitly accounted for in the present abundance estimates are ship avoidance, time of submergence, and potential recounting of animals. Preliminary analyses indicate that ship avoidance, though present to some degree, did not substantially affect the abundance estimate (NEFSC 1992).

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normal distributed abundance estimate of 47,200 harbor porpoises (CV = 0.19) (Palka, in press). This is equivalent to the 20th percentile of the log-normal distribution as specified by NMFS (Anon. 1994). The minimum population estimate is 40,297 harbor porpoises.

Current Population Trend

There are insufficient data to determine the population trends for this species. Previous abundance estimates for harbor porpoises in the Gulf of Maine/Bay of Fundy are available from earlier studies, (e. g. 4,000 animals, Gaskin 1977, and 15,800 animals, Kraus et al. 1983). These estimates cannot be used in a trends analysis because they were for selected small regions within the entire known summer range and, in some cases, did not incorporate any estimate of g(0) (NEFSC 1992).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Although current population growth rates of western North Atlantic harbor porpoises have not been estimated due to lack of data, several attempts have been made to estimate potential population growth rates. Barlow and Boveng (1991), who used a re-scaled human life table, estimated the upper bound of the annual potential growth rate to be 9.4%. Woodley and Read (1991) used a re-scaled Himalayan tahr life table to estimate the likely annual growth rate to be 4%. In an attempt to estimate the potential population growth rate which incorporated many of the uncertainties in survivorship and reproduction, Caswell et al. (1994) used a Monte Carlo method to calculate a distribution of growth rates, which indicated that the potential growth rate is unlikely to be greater than 10% per year. The median of this distribution is approximately 4%, but, it is not known whether this is the best estimate (Palka 1994b). Therefore, the maximum net productivity rate was assumed to be 0.04 for purposes of this assessment. This value is based on theoretical calculations showing that cetacean populations may not generally grow at rates much greater than 4% given the constraints of their reproductive life history (Anon. 1994).

POTENTIAL BIOLOGICAL REMOVAL

Potential biological removal (PBR) was specified as the product of minimum population size, one-half the maximum productivity rate, and a "recovery" factor for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP) (Anon. 1994). The recovery factor was set at 0.50 because of the stock's status relative to its OSP level is unknown. PBR for this stock is 403 harbor porpoises.

ANNUAL HUMAN-CAUSED MORTALITY

Total annual estimated average fishery-related mortality and serious injury to this stock in the Atlantic during 1989-1993 was 1,876 harbor porpoises (CV = 0.32). This is probably an underestimate because it does not include fishery-related mortality and serious injury in Canadian fisheries, nor does it include mortality associated with the U.S. Atlantic coastal gillnet fishery. Average annual fishery-related mortality and serious injury may actually be more on the order of 2,100-2,350 harbor porpoises per year. Total annual 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 determination cannot be made for specific fisheries until the implementing regulations for Section 118 of the MMPA have been reviewed by the public and finalized.

Fishery Information

The Canadian gillnet fishery occurs mostly in the western portion of the Bay of Fundy during the summer and early autumn months, when the density of harbor porpoises is highest there. This fishery has been well-documented, with 19 gillnetters active in 1986, 28 active in 1987, and 21 in 1988 (Polacheck 1989). Canadian total harbor porpoise by-catch in this fishery was thought to be low, based on casual observations and discussions with fishermen. The 1986 estimated harbor porpoise by-catch was 94-116 and estimated by-catch was 130 harbor porpoises in 1989 (O'Boyle and Zwanenburg 1994).

An observer program implemented in the Canadian Bay of Fundy sink gillnet fishery during the summer of 1993 provided total by-catch estimates of between 222-424 harbor porpoises (O'Boyle and Zwanenburg 1994). No measure of variability was estimated. This program was expanded in 1994 and the 1994 by-catch was estimated to be between 80-120 harbor porpoises (DFO 1995).

Some harbor porpoises are caught in Canadian and U.S. weirs in a fishery which occurs from May to September each year. Weirs are found along the southwestern shore of the Bay of Fundy, and scattered along the western Nova Scotia and northern Maine coasts. There were 180 active weirs in the western Bay of Fundy and 56 active weirs in Maine in 1990 (Read 1994). Smith et al. (1983) estimated that approximately 70 harbor porpoises become trapped annually and, on average, 27 harbor porpoises die annually in Bay of Fundy weirs; the rest are released alive. At least 43 harbor porpoises were trapped in Bay of Fundy weirs in 1990, but the number killed is unknown. In 1993, after a cooperative program between fishermen and Canadian biologists began, over 100 harbor porpoises were released alive and an unknown number died (Read 1994).

There is evidence that harbor porpoises were harvested by natives in Maine and Canada before the 1960's, and the meat was used for human consumption, oil, and fish bait (NEFSC 1992). The extent of these past harvests is unknown, though it is believed to be small. Up until the early 1980s, small kills by native hunters (Passamaquoddy Indians) were reported. However, in recent years it is believed to have nearly stopped (Polacheck 1989).

A sampling program was conducted to collect information concerning marine mammal by-catch in the New England groundfish gillnet fishery in 1984. Approximately 10% of the vessels fishing in Maine, New Hampshire, and Massachusetts were sampled. Among the eleven gillnetters who received permits and logbooks, 30 harbor porpoises were reported caught. It was estimated, using rough estimates of fishing effort, that a maximum of 600 harbor porpoises were killed annually in this fishery (Gilbert and Wynne 1985, 1987).

Data on incidental takes in U.S. fisheries are available from several sources. In 1986, NMFS established a mandatory logbook system for large pelagic fisheries. 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.

By-catch has been observed by NMFS Sea Samplers in the New England multispecies gillnet, Atlantic swordfish/tuna/shark gillnet, and New England groundfish trawl fisheries; but no mortalities were documented in the Atlantic swordfish/tuna/shark longline, and Atlantic swordfish/tuna/shark pair trawl fisheries.

There were approximately 349 full and part-time vessels in the New England multispecies sink gillnet fishery, which covers the Gulf of Maine and southern New England, in 1993. An additional 187 vessels were reported to occasionally fish in the Gulf of Maine with gillnets for bait or personal use; however, these vessels were not covered by the observer program (Walden, in review) and their fishing effort was not used in estimating mortality. Observer coverage in terms of trips has been 1%, 6%, 7. 5%, and 5% for years 1990 to 1993, respectively. There were 220 harbor porpoise mortalities related to this fishery observed between 1990 and 1993 and one was released alive uninjured. Annual estimates of harbor porpoise by-catch in the New England multispecies sink gillnet fishery reflect seasonal distribution of the species and of fishing effort. Estimated annual by-catch (CV in parentheses) from this fishery during 1990-1993 was 2,900 in 1990 (0.32), 2,000 in 1991 (0.35), 1,200 in 1992 (0.21), and 1,400 in 1993 (0.18) (Bravington and Bisack, in review; CUD 1994); average estimated harbor porpoise mortality and serious injury in the New England multispecies sink gillnet fishery during 1989-1993 was 1,875 (0.32). These estimates include a correction factor for the under-recorded number of by-caught animals that occurred during unobserved hauls on trips with observers on the boat, when applicable. Need for such a correction became evident following re-analysis of data from the sea sampling program indicating that for some years by-catch rates from unobserved hauls were lower than that for observed hauls. Further analytical details are given in Palka (1994b) and CUD (1994). These revised by-catch estimates replace those published earlier (Smith et al. 1993). These estimates are still negatively biased because they do not include porpoises that fell out of the net while still underwater. This bias cannot be quantified at this time. By-catch in the northern Gulf of Maine occurs primarily from June to September; while in the southern Gulf of Maine by-catch occurs from January to May and September to December.

There is no evidence of differential mortality in U.S. or Canadian gillnet fisheries by age or sex, although there is substantial inter-annual variation in the age and sex composition of the by-catch (Read and Hohn, in review).

Pinger experiments, using acoustic alarms attached to some observed gillnets, were conducted in the Gulf of Maine in 1992, 1993, and 1994. All trips were observed for all vessels involved in these experiments, whether or not the nets had alarms attached. There were 12, 33, and 29 harbor porpoise mortalities observed during 1992, 1993, and 1994, respectively, from these trips. These mortalities were included estimating annual mortality.

Observer coverage of the U.S. Atlantic coastal gillnet fishery was initiated by the NEFSC Sea Sampling program in July, 1993; and from July to December 1993, 20 trips were observed. From January to April 1994, 71 trips were observed. This fishery, which extends from North Carolina to New York, is actually a combination of small vessel fisheries that target a variety of fish species, some of which operate right off the beach. The number of vessels in this fishery is unknown, because records which are held by both state and federal agencies have not been centralized and standardized. Percent coverage by the program is unknown, but it is believed to be very low. No harbor porpoises were taken in these observed trips. This result was not unexpected for July through December because there is little evidence that harbor porpoises are in the this area during this time frame; however, this is not the case for January to April. The absence of observed takes in early 1994 may reflect low observer coverage or its distribution since, harbor porpoise strandings seem to be very localized with respect to time and area, and localities also change from year to year. Polacheck et al. (in press) reported one incidental take in shad nets in the York River, Virginia. In general, strandings along U.S. Atlantic beaches suggest that harbor porpoises are taken in the Virginia shad fishery and other coastal gillnet fisheries (Read 1994).

Vessels in the New England groundfish multispecies trawl fishery, a Category III fishery under the MMPA, were observed in order to meet fishery management needs, rather than marine mammal management needs. An average of 970 (CV = 0.04) vessels (full and part time) participated annually in the fishery during 1989-1993. This fishery is active in New England waters in all seasons. One harbor porpoise mortality was observed in this fishery between 1989 and 1993. This take occurred in February, 1992 east of Barnegatt Inlet, New York at the continental shelf break. The animal was clearly dead prior to being taken by the trawl, because it was severely decomposed and the tow duration of 3.3 hours was insufficient to allow extensive decomposition; therefore, there is no estimated by-catch for this fishery. The estimated total number of hauls in the Atlantic large pelagic drift gillnet fishery increased from 714 in 1989 to 1,144 in 1990; thereafter, with the introduction of quotas, effort was severely reduced. Fifty-nine different vessels participated in this fishery at one time or another between 1989 and 1993. The estimated number of hauls in 1991, 1992, and 1993 were 233, 243, and 232, respectively. Observer coverage, expressed as percent of sets observed, ranged from 8% in 1989, 6% in 1990, 20% in 1991, to 40% in 1992, and 42% in 1993. 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. Estimates of the total by-catch, for each year, were obtained using the aggregated (pooled 1989-1993) catch rates, by strata (Northridge, in review). One harbor porpoise mortality was observed between 1989 and 1993. This by-catch was notable because it occurred in continental shelf edge waters adjacent to Cape Hatteras. Estimated annual fishery-related mortality (CV in parentheses) attributable to this fishery was 0.7 in 1989 (7. 00), 1.7 in 1990 2.65), 0.7 in 1991 (2.00), 0.4 in 1992, and 1.5 in 1993 (0.45); average estimated harbor porpoise mortality and serious injury in the Atlantic large pelagic drift gillnet fishery during 1989-1993 was 1.0 (3.06).

Other Mortality

Sixty-four harbor porpoise strandings were reported from Maine to North Carolina between January and June, 1993. Fifty of those harbor porpoises were reported stranded in the U.S. Atlantic region from New York to North Carolina between February and May. Many of the carcasses recovered in this area during this time period had cuts and body damage suggestive of net marking (Haley and Read 1993). Five out of eight carcasses and fifteen heads from the strandings that were examined showed signs of human interactions (net markings on skin and missing flippers or flukes). Decomposition of the remaining animals prevented determination of the cause of death. Earlier reports of harbor porpoise entangled in gillnets in Chesapeake Bay and along the New Jersey coast and reports of apparent mutilation of harbor porpoise carcasses, raised concern that the 1993 strandings were related to a coastal net fishery, such as the American shad coastal gillnet fishery (Haley and Read 1993). Between January and May 1994, 35 harbor porpoises were found stranded along the beaches from North Carolina to New York (A. J. Read, personal communication).

Stranding data probably underestimate the extent of fishery-related mortality and serious injury because not all of the marine mammals which die or are seriously injured may wash ashore, nor will all of those that do wash ashore necessarily show signs of entanglement or other fishery-interaction. Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of fishery interaction.

Other potential human-induced factors that may be affecting this harbor porpoise population include high levels of contaminants in their tissues and increased ship activity. Of particular concern are high levels of polychlorinated biphenyls (PCBs) and other lipophilic organochlorines in their tissues (Gaskin et al. 1983). No obvious pathology has been noted in more than 300 necropsies of harbor porpoises incidentally captured in gillnets in the Bay of Fundy (A. J. Read, unpublished data), but it is not known whether these contaminants have other effects. It has been suggested that increased shipping activity in several coastal bays has caused the disappearance of harbor porpoises in those coastal bays (NEFSC 1992).

STATUS OF STOCK

The National Marine Fisheries Service has proposed listing the Gulf of Maine harbor porpoise as threatened under the Endangered Species Act (NMFS 1993). In Canada, the Cetacean Protection Regulations of 1982, promulgated under the standing Fisheries Act, prohibit the catching or harassment of all species of cetaceans, including the harbor porpoise. There are insufficient data to determine the population trends for this species. Total annual fishery-related mortality and serious injury exceeds PBR and this is a strategic stock.

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