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 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 1995b). During fall (October-December) and spring (March-June), harbor porpoises are widely dispersed from North Carolina to Maine, where the 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. During winter (January to February), intermediate densities of harbor porpoises are in waters off New Jersey to North Carolina, and low densities are found in waters off New York to New Brunswick, Canada as documented by sighting surveys, strandings, and takes reported by NMFS observers in the Sea Sampling Program. There were two stranding records from Florida (Smithsonian strandings data base).

Gaskin (1984, 1992) proposed that there were four separate populations in the western North Atlantic: the Gulf of Maine/Bay of Fundy, Gulf of St. Lawrence, Newfoundland and Greenland populations. Recent analyzes involving mtDNA, organochlorine contaminants, and life history parameters support Gaskin's proposal. In particular, there is a suggestion that the Gulf of Maine/Bay of Fundy females are different than Gulf of St. Lawrence females, but males were statistically indistinguishable (Palka *et al.* 1996). Research on microsatellites, a potentially powerful genetic tool, 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

To estimate the absolute population size of harbor porpoises aggregated in the Gulf of Maine/Bay of Fundy region, three line-transect sighting surveys were conducted during the summers of 1991, 1992 and 1995 (Table 1; Figure 1).

The population sizes were 37,500 harbor porpoises in 1991 (CV = 0.29, 95% confidence interval (CI) = 26,700-86,400) (Palka 1995a), 67,500 harbor porpoises in 1992 (CV = 0.23, 95% CI = 32,900-104,600), and 74,000 harbor porpoises in 1995 (CV=0.20, 95% CI = 40,900-109,100) (Palka 1996). The inverse variance weighted-average abundance estimate (Smith *et al.* 1993) was 54,300 harbor porpoises (CV = 0.14, 95% CI = 41,300-71,400). Possible reasons for inter-annual differences in abundance and distribution include experimental error and inter-annual changes in water temperature and availability of primary prey species (Palka 1995b).

The shipboard sighting survey procedure used in all three surveys involved two independent teams on one ship that searched using the naked eye in non-closing mode. Abundance, corrected for g(0), was estimated using the direct-duplicate method (Palka 1995a) and variability was estimated using bootstrap re-sampling methods. Potential biases not explicitly

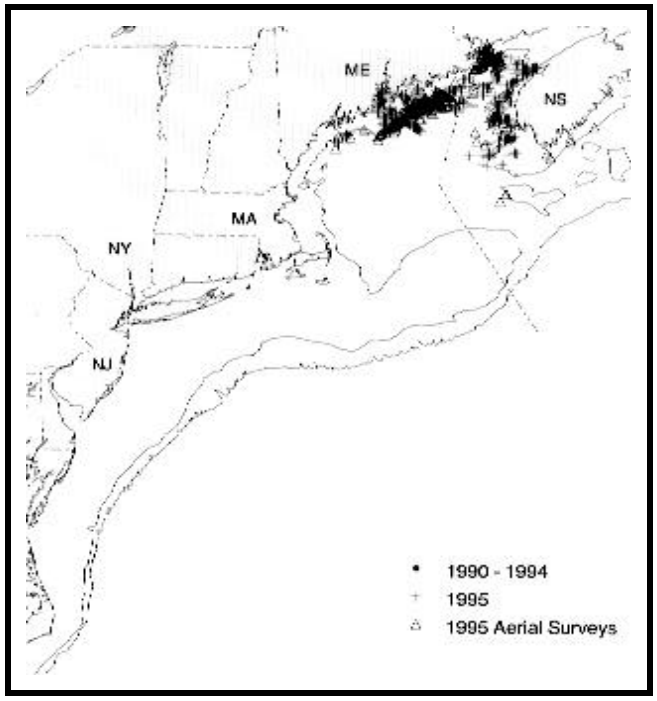

Figure 1. *Distribution of harbor porpoise sightings from NEFSC shipboard and aerial surveys during the summer in 1990-1995. Isobaths are at 100 m and 1,000 m.*

accounted for are ship avoidance and time of submergence. During 1995 a small section of the region was surveyed by airplane while the rest of the region was surveyed by ship, as in previous years. An abundance estimate including g(0) was estimated for both the plane and ship (Palka 1996). During 1995, in addition to the Gulf of Maine/Bay of Fundy area, waters from Virginia to the mouth of the Gulf of St. Lawrence were surveyed and no harbor porpoises were seen except in the vicinity of the Gulf of Maine/Bay of Fundy.

Table 1. Summary of abundance estimates for the Gulf of Maine/Bay of Fundy harbor porpoise. 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
Jul-Aug 1991	N. Gulf of Maine & lower Bay of Fundy	37,500	0.29
Jul-Sep 1992	N. Gulf of Maine & lower Bay of Fundy	67,500	0.23
Jul-Sep 1995	N. Gulf of Maine & lower Bay of Fundy	74,000	0.20
Inverse variance-weighted average of above 1991, 1992 and 1995 estimates		54,300	0.14

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 harbor porpoises is 54,300 (CV=0.14). The minimum population estimate for the Gulf of Maine/Bay of Fundy harbor porpoise is 48,289 (CV=0.14).

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 a likely annual growth rate of 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 1994).

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 48,289 (CV=0.14). 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 0.5 because this stock is of unknown status. PBR for the Gulf of Maine/Bay of Fundy harbor porpoise is 483.

ANNUAL HUMAN-CAUSED MORTALITY

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 1980's, small kills by native hunters (Passamaquoddy Indians) were reported. However, in recent years it is believed to have nearly stopped (Polacheck 1989).

Harbor porpoises have been taken in U.S. and Canadian fishing weirs. No harbor porpoise takes have been documented in U.S. fishing weirs. In the Bay of Fundy weirs are presently operating, where Smith *et al.* (1983) estimated approximately 70 harbor porpoises become trapped annually and, on average, 27 died annually , and the rest were 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).

Recently, Gulf of Maine/Bay of Fundy harbor porpoises takes have been documented in the U.S. New England multispecies sink gillnet, Mid-Atlantic coastal gillnet, and Atlantic pelagic drift gillnet fisheries, and in the Canadian Bay of Fundy sink gillnet fishery.

Most of the harbor porpoise takes from U.S. fisheries are from the New England multispecies sink gillnet fishery, where the average annual 1990-1995 estimate of mortality is 1,833 (CV=0.12). Bycatch from the Mid-Atlantic coastal gillnet fishery is presently being estimated. One harbor porpoise was observed taken from the 1991-1995 Atlantic pelagic drift gillnet fishery, resulting in an average annual fishery-related mortality of 0.5 (CV=0.60).

Canadian total harbor porpoise by-catch in the Bay of Fundy sink gillnet fishery was thought to be low, based on casual observations and discussions with fishermen. The estimated harbor porpoise by-catch in 1986 was 94-116 and in 1989 it was 130 (Trippel *et al.* 1996). After an observer program was implemented in 1993, it was estimated 424 harbor porpoises were taken in 1993, between 80 and 120 were taken in 1994, and 87 in 1995 (Trippel *et al.* 1996).

Total annual estimated average U.S. fishery-related mortality and serious injury to this stock during 1990-1995 was 1,833 harbor porpoises (CV = 0.12). This is probably an underestimate because it does not include fishery-related mortality and serious injury associated with the U.S. Atlantic coastal gillnet fishery.

Fishery Information

Recent data on 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.

Recent bycatch has been observed by NMFS Sea Samplers in the U.S. New England multispecies sink gillnet, Mid-Atlantic coastal gillnet, Atlantic drift gillnet, and North Atlantic bottom trawl fisheries, and the Canadian Bay of Fundy sink gillnet fishery.

In 1984 the New England multispecies sink gillnet fishery was investigated by a sampling program that collected information concerning marine mammal by-catch. 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).

In 1993, there were approximately 349 full and part-time vessels in the New England multispecies sink gillnet fishery, which covered the Gulf of Maine and southern New England (Table 2). 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 1996) and their fishing effort was not used in estimating mortality. Observer coverage in terms of trips has been 1%, 6%, 7%, 5%, 7% and 5% for years 1990 to 1995, respectively. There were 310 harbor porpoise mortalities related to this fishery observed between 1990 and 1995 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 1990-1995

was 2,900 in 1990 (0.32), 2,000 in 1991 (0.35), 1,200 in 1992 (0.21), 1,400 in 1993 (0.18) (Bravington and Bisack 1996; CUD 1994) 2100 in 1994 (0.18), and 1400 in 1995 (0.27) (Bisack, in press). Average estimated harbor porpoise mortality and serious injury in the New England multispecies sink gillnet fishery during 1990-1995 was 1,833 (0.12). 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 (1994), CUD (1994) and Bravington and Bisack (1996). These revised by-catch estimates replace those published earlier (Smith *et al.* 1993). These estimates are still negatively biased because they do not include harbor 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 1995).

Two preliminary experiments, using acoustic alarms (pingers) attached to gillnets, that were conducted in the Gulf of Maine during 1992 and 1993 took 10 and 33 harbor porpoises, respectively. During fall 1994 a controlled scientific experiment was conducted in the southern Gulf of Maine, where all nets with and without active pingers were observed. In this experiment 25 harbor porpoises were taken in 423 strings with non-active pingers (controls) and two harbor porpoises were taken in 421 strings with active pingers. In addition, 17 other harbor porpoises were taken in nets with pingers that were not in the experiment (Table 2). During 1995 to 1996, experimental fisheries were conducted where all nets in a designated area used pingers and only a sample of the nets were observed. During November-December 1995, the experimental fishery was conducted in the southern Gulf of Maine (Jeffreys Ledge) region, where no harbor porpoises were observed taken in 225 pingered nets. During April 1996, three other experimental fisheries occurred. In the Jeffreys Ledge area, in 88 observed hauls using pingered nets nine harbor porpoises were taken. In the Massachusetts Bay region, in 171 observed hauls using pingered nets two harbor porpoises were taken. And, in a region just south of Cape Cod, in 53 observed hauls using pingered nets no harbor porpoises were taken. All takes from pingered nets were added directly to the estimated total bycatch for the rest of that year in the rest of the fishery.

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. During 1994, and 1995 221 and 382 trips were observed, respectively. 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 low. No harbor porpoises were taken in observed trips during 1993 and 1994. During 1995 six harbor porpoises were observed taken (Table 2). Polacheck *et al.* (1995) 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 North Atlantic bottom 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 1995. 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 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. In 1994 and 1995 there were 11 and 12 vessels, respectively, in the fishery (Table 2). The estimated number of hauls in 1991, 1992, 1993, 1994 and 1995 were 233, 243, 232, 197 and 164 respectively. 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. 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 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 the number of unobserved hauls as recorded in logbooks. Variances were estimated using bootstrap re-sampling techniques (Bisack, in prep.). One harbor porpoise mortality was observed between 1989 and 1995. 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 (1.00), 0.4 in 1992 (1.00), 1.5 in 1993 (0.34), 0 in 1994 and 0 in 1995. Average estimated harbor porpoise mortality and serious injury in the Atlantic pelagic drift gillnet fishery during 1991-1995 was 0.5 (0.37) (Table 2).

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. Polacheck (1989) reported there were 19 gillnetters active in 1986, 28 active in 1987, and 21 in 1988. An observer program implemented in the summer of 1993 provided a total by-catch estimates of 424 harbor porpoises. No measure of variability was estimated. The observer program was expanded in 1994 and the by-catch was estimated to be between 80-120 harbor porpoises where the fishing fleet consisted of 28 vessels (Trippel *et al.* 1996). In 1995, 89% of the fishing trips were observed, all in the Swallowtail region. The estimated by-catch was 87 harbor porpoises (Trippel *et al.* 1996). No confidence interval was able to be computed due to lack of coverage in the Wolves fishing grounds. During 1995, due to groundfish quotas being exceeded, the gillnet fishery was closed during July 21 to August 31, 1995. Approximately 30% of the observed trips used pingered nets. During 1996, the Canadian gillnet fishery was closed from August 20 to September 30, 1996 (E. Trippel, pers. comm.).

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).

Table 2. Summary of the incidental mortality of harbor porpoise (*Phocoena phocoena*) 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 CVs) 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	17, 47, 51[3], 53[3], 99[3], 43[3]	2900, 2000, 1200[3], 1400[3], 2100[3], 1400[3]	.32, .35, .21, .18, .18, .27	1833 (.12)
Pelagic Drift Gillnet	91-95	1994=11[4] 1995=12	Obs. Data Logbook	.20, .40, .42, .87, .99	0, 0, 1, 0, 0	0.7[5], 0.4, 1.5, 0, 0	1.00,1.00, 0.34, 0, 0	0.5 (.37)
Mid-Atlantic Coastal Sink Gillnet	93-95		Obs. Data Weighout	20, 221, 382	0, 0, 6[6]			
TOTAL								1834 (.12)

[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 measured in trips, and for the pelagic drift gillnet fishery the unit of effort is a set. Assessments for the mid-Atlantic coastal gillnet fishery have not been completed. The number of trips sampled by the NEFSC Sea Sampling Program are reported here.

[3] Harbor porpoise taken on observed pinger trips were added directly to the estimated total bycatch for that year. There were 10, 33, 44, and 0 observed harbor porpoise takes on pinger trips from 1992 to 1995, respectively. In addition, there were nine observed harbor porpoise takes in 1995 on trips dedicated to fish sampling versus marine mammals (Bisack, in press).

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

[5] 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).

[6] Harbor porpoise bycatch estimates for the mid-Atlantic coastal sink gillnet fishery have not been finalized. They are expected in the marine mammal stock assessment report next year.

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, 45 harbor porpoises were found stranded along the beaches from North Carolina to New York (Smithsonian stranding database 1996).

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). Concentrations of organochlorine contaminants from 110 Gulf of Maine/Bay of Fundy harbor porpoises were recently measured (Westgate 1995). PCB levels, the most prominent contaminant, and DDT levels were both higher in Gulf of Maine/Bay of Fundy harbor porpoises than in Gulf of St. Lawrence and Newfoundland harbor porpoises. The recent levels in Gulf of Maine/Bay of Fundy harbor porpoises are much lower than that found in animals ten years ago, as reported in Gaskin *et al.* (1983). Trace metal contaminants were also measured and it was found that mean concentrations of copper, zinc and mercury were similar to values previously reported for harbor porpoises in other regions of the world (Johnston 1995). 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 status of harbor porpoises, relative to OSP, in the U.S. Atlantic EEZ is unknown. 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. There are insufficient data to determine 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 a strategic stock because average annual fishery-related mortality and serious injury exceeds PBR.

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