LONG-FINNED PILOT WHALE (*Globicephala melas*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

There are two species of pilot whales in the Western Atlantic — the Atlantic or long-finned pilot whale, *Globicephala melas*, and the short-finned pilot whale, *G. macrorhynchus*. These species are difficult to identify to the species level at sea; therefore, some of the descriptive material below refers to *Globicephala* spp., and is identified as such. The species boundary is considered to be in the New Jersey to Cape Hatteras area. Sightings north of this area are likely *G. melas*.

Pilot whales (*Globicephala* spp.) are distributed principally along the continental shelf edge in the winter and early spring off the northeast U.S. coast, (CeTAP 1982; Payne and Heinemann 1993). In late spring, pilot whales move onto Georges Bank and into the Gulf of Maine and more northern waters, and remain in these areas through late autumn (CeTAP 1982; Payne and Heinemann 1993). In general, pilot whales generally occupy areas of high relief or submerged banks. They are also associated with the Gulf Stream north wall and thermal fronts along the continental shelf edge.

The long-finned pilot whale is distributed from North Carolina to Iceland and possibly the Baltic Sea (Sergeant 1962; Leatherwood et al. 1979; Abend 1993). The stock structure of the North Atlantic population is currently unknown (Anon., 1993); however, several recently initiated genetic studies and proposed North Atlantic sighting surveys will likely provide information required to delineate stock boundaries.

POPULATION SIZE

The total number of long-finned pilot whales off the eastern U.S. and Canadian Atlantic coast is unknown, but several estimates from selected regions do exist. Mitchell (1974) used cumulative catch data from the 1951-61 drive fishery off Newfoundland to estimate the initial population size (ca. 50,000 animals). Mercer (1975), used population models to estimate a population in the same region of between 43,000-96,000 long-finned pilot whales, with a range of 50,000-60,000 being considered the best estimate.

Seasonal abundance estimates are available from an aerial survey program conducted in the continental shelf waters between Cape Hatteras, North Carolina, and Nova Scotia from 1978 to 1982 (CeTAP 1982). Because pilot whales are difficult to identify at sea, seasonal abundance estimates were reported at the generic level. An estimate based on variance-weighted pooling of CeTAP (1982) spring, summer, and autumn data is 11,120 long-finned pilot whales (CV = 0.29). An average for these three seasons was chosen because the greatest proportion of the population off the northeast U.S. coast appears to be in the CeTAP study area in these seasons. This estimate was not corrected for g(0), the probability of detecting an animal group on the trackline.

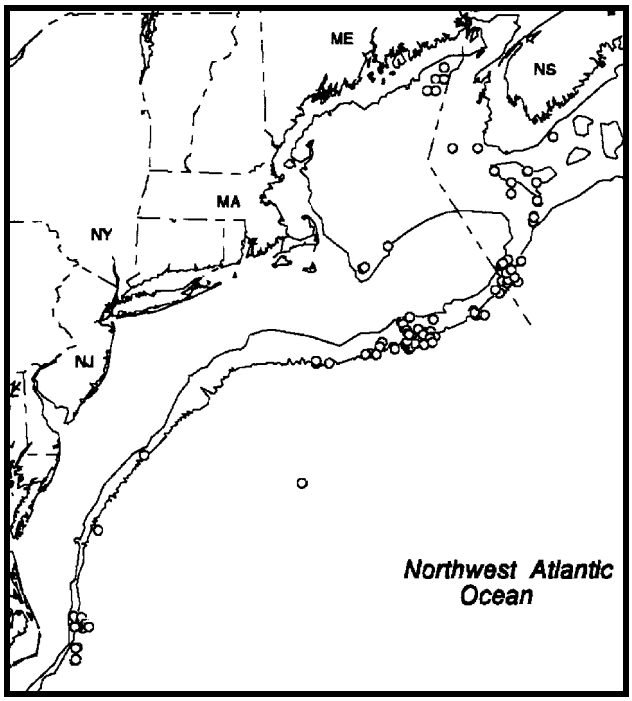

Figure 1. *Distribution of pilot whale sightings from NEFSC shipboard surveys during the summer in 1990-1994. Isobaths are at 100 m and 1,000 m.*

Abundance estimates were also derived using data collected during an autumn 1991 aerial survey in the CeTAP study area (Northeast Fisheries Science Center NMFS unpublished data), which included an interplatform experiment between a Twin Otter and an AT-11), and from three fine-scale ship surveys (August 1990, June-July 1991, and June-July 1993) conducted in continental shelf edge

and deeper oceanic waters (NMFS unpublished data). Sightings were made along the continental shelf edge, in the western Gulf of Maine, and on the northwestern edge of Georges Bank during the 1991 aerial survey. Abundance estimates for *Globicephala* spp. were 5,377 (CV = 0.53) and 3,668 (CV = 0.28) for the AT-11 and NOAA Twin Otter , respectively. Data were not pooled, because the interplatform calibration analysis has not been conducted. These estimates are not fully comparable to the CeTAP estimates, because the 1991 data are from a single survey conducted during August-October, while the CeTAP estimates were based on data pooled over several years of seasonal surveys.

The three shipboard surveys covered relatively small portions of the northeastern U.S. Exclusive Economic Zone (EEZ) and pilot whale sightings during these surveys are shown in Figure 1. The abundance estimate from the August 1990 survey, conducted principally along the Gulf Stream north wall between Cape Hatteras and Georges Bank, is 1,043 long-finned pilot whales (CV = 0.78). The 1991 survey estimate, based principally on sighting effort conducted between the 200 and 2,000 meter isobaths from Cape Hatteras to Georges Bank is 896 (CV = 0.68). The estimate for the 1993 survey, conducted principally between the 200 and 2,000 meter isobaths from the southern edge of Georges Bank, across the Northeast Channel to the southwestern edge of the Scotian Shelf is 668 long-finned pilot whales (CV = 0.55).

Although the 1990-1993 surveys did not sample the same areas or encompass the entire pilot whale habitat, they did focus on segments of known or suspected high-use habitats off the northeastern U.S. coast. The collective 1990-93 data suggest that, seasonally, at least several thousand pilot whales are occupying these waters; however, survey coverage to date is not judged adequate to provide a definitive estimate of pilot whale abundance in the western North Atlantic.

Minimum Population Estimate

The minimum population estimate was based on the AT-11 aerial survey abundance estimate in 1991 of 5,377 long-finned pilot whales (CV = 0.53) (NMFS unpublished data). The AT-11 estimate was selected because that survey provided the most complete coverage of continental shelf edge and continental slope waters off the northeast U.S. coast. The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normal distributed abundance estimate, which is equivalent to the 20th percentile of the log-normal distribution as specified by NMFS (Anon. 1994) and was 3,537 long-finned pilot whales.

Current Population Trend

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

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are not known for this stock. 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).

Some of the life history parameters which have been estimated from animals taken in the Newfoundland drive fishery include: calving interval 3.3 years; lactation period about 21-22 months; gestation period 12 months; births mainly from June to November. Length at birth is 177 cm; mean length at sexual maturity, 490 cm, males; and 356 cm, females; age at sexual maturity is 12 years for males and 6 years for females, and mean adult length is 557 cm for males and 448 cm for females; and maximum age was 40 for males, and 50 for females (Sergeant 1962; Kasuya et al. 1988). Analysis of data recently collected from animals taken in the Faroe Islands drive fishery produced higher values for all parameters (Bloch et al. 1993; Desportes et al. 1993; Martin and Rothery 1993). These differences are likely related, at least in part, to larger sample sizes and newer analytical techniques.

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 0.40 because of the high variance associated with the estimate of total annual fishery-related mortality and serious injury for *Globicephala* spp. PBR for this stock is 28 long-finned pilot whales.

ANNUAL HUMAN-CAUSED MORTALITY

Pilot whales also have a propensity to mass strand throughout their range, but the role of human activity in these events is unknown. Between two and 120 pilot whales have stranded annually either individually or in groups in the NMFS Northeast Region (Anon. 1993) since 1980.

Foreign fishery observers documented 436 pilot whale mortalities in Atlantic mackerel and squid fisheries (Waring et al. 1990; Waring,1995). Between 1989 and 1993, forty two mortalities were observed in the large pelagic drift-gillnet fishery, five in the pelagic pair trawl fishery, and one each in the pelagic longline and groundfish trawl fisheries (NMFS unpublished data; see below). Although only one mortality has been observed in the U.S. large pelagic longline fishery, 24 pilot whales were released alive, two injured, after becoming entangled or hooked in this gear. Pilot whales are frequently observed to feed on hooked fish, particularly big-eye tuna (NMFS unpublished data). One mortality was observed in New England groundfish trawl fisheries. There were no takes in the New England multispecies sink gillnet fishery. An unknown number of pilot whales have also been taken in Newfoundland and Labrador, and Bay of Fundy, groundfish gillnets, Atlantic Canada and Greenland salmon gillnets, and Atlantic Canada cod traps (Read 1994).

Total fishery-related mortality and serious injury cannot be estimated separately for the two species of pilot whales in the U.S. Atlantic EEZ because of the uncertainty in species identification by fishery observers. The Atlantic Scientific Review Group advised adopting the risk-averse strategy of assuming that either species might have been subject to the observed fishery-related mortality and serious injury. Total estimated annual fishery-related mortality of pilot whales from NMFS-observed fisheries was the sum of integer-rounded annual mortality estimates across the pelagic longline, drift gillnet, and groundfish trawl fisheries and was 109 pilot whales, *Globicephala* spp. (CV = 0.90).

Total fishery-related mortality and serious injury of pilot whales is not less than 10% of the calculated PBR for this stock 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.

Fisheries Information

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. A fishery observer program, which has collected fishery data and information on incidental by-catch of marine mammals, was established in 1977 with the implementation of the Magnuson Fisheries Conservation and Management Act (MFCMA). DWF effort in the Atlantic coast EEZ under MFCMA has been directed primarily towards Atlantic mackerel and squid. An average of 120 different foreign vessels per year (range 102-161) operated within the Atlantic coast EEZ during 1977 through 1982. In 1982, there were 112 different foreign vessels; 18 (16%) were Japanese tuna longline vessels operating along the U.S. Atlantic coast. This was the first year that the Northeast Regional Observer Program assumed responsibility for observer coverage of the longline vessels. The number of foreign vessels operating within the U.S. Atlantic EEZ each year between 1983 and 1991 averaged 33 and ranged from nine to 67. The number of Japanese longline vessels included among the DWF vessels averaged six and ranged from three to eight between 1983 and 1988. MFCMA observer coverage on DWF vessels was 25-35% during 1977-82, increased to 58%, 86%, 95%, and 98%, respectively, during 1983-86, and 100% observer coverage was maintained from 1987-91. Foreign fishing operations for squid ceased at the end of the 1986 fishing season and, for mackerel, at the end of the 1991 fishing season.

During 1977-1991, observers in this program recorded 436 pilot whale mortalities in foreign-fishing activities (Waring et al. 1990; Waring 1995). A total of 391 (90%) were taken in the mackerel fishery, and 41 (9%) occurred during *Loligo* and *Illex* squid-fishing operations. This total includes 48 documented takes by U.S. vessels involved in joint venture fishing operations in which U.S. captains transfer their catches to foreign processing vessels. Due to temporal fishing restrictions, the by-catch occurred during winter/spring (December to May) in continental shelf and continental shelf edge waters (Fairfield et al. 1993; Waring, 1995); however, the majority of the takes occurred in late spring along the 100 m isobath. Two animals were also caught in both the hake fishery and tuna longline fisheries (Waring et al. 1990).

The Atlantic Canadian and Greenland salmon gillnet fishery is seasonal, with the peak from June to September, depending on location. In southern and eastern Newfoundland, and Labrador during 1989, 2,196 nets 91 m long were used. There are no effort data available for the Greenland fishery; however, the fishery was terminated in 1993 under an agreement between Canada and North Atlantic Salmon Fund (Read 1994).

The groundfish gillnet fishery is widespread and important. Many fisherman hold groundfish gillnet licenses but the number of active fishermen is 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.

There were 3,121 cod traps operating in Newfoundland and Labrador during 1979, and about 7,500 in 1980 (Read 1994). This fishery was closed at the end of 1993 due to collapse of Canadian groundfish resources.

The distribution of long-finned pilot whale, a northern species, overlaps with that of the short-finned pilot whale, a predominantly southern species, between 35°30'N to 38°00'N (Leatherwood et al. 1976). Although long-finned pilot whales are most likely taken in the waters north of Delaware Bay, many of the pilot whale takes are not identified to species and by-catch does occur in the overlap area. In this summary, therefore, long-finned pilot whales (*Globicephala melas*) and unidentified pilot whales (*Globicephala* spp.) are considered together.

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

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. The estimated number of hauls in 1991, 1992, and 1993 were 233, 243, and 232 respectively. Fifty-nine different vessels participated in this fishery at one time or another between 1989 and 1993. 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). Forty-two pilot whale (*Globicephala* spp.) mortalities were observed between 1989 and 1993. Six animals were released alive but one was injured. The annual fishery-related mortality (CV in parentheses) was 77 in 1989 (1.1), 132 in 1990 (0.59), 30 in 1991 (0.76), 33 in 1992 (0.29), and 31 in 1993 (0.34); average annual mortality between 1989-1993 was 61 pilot whales (0.87). Because animals released alive may have subsequently died due to injuries received during entanglement, pilot whales that were released were included in the mortality estimates. Pilot whales were taken along the continental shelf edge, northeast of Cape Hatteras in January and February. Takes were recorded at the continental shelf edge east of Cape Charles, Virginia, in June. Pilot whales were taken from Hydrographer Canyon along the Great South Channel to Georges Bank from July-November. Takes occurred at the Oceanographer Canyon continental shelf break and along the continental shelf northeast of Cape Hatteras in October-November.

Effort in the Atlantic swordfish/tuna/shark pair trawl fishery has increased during the period 1989 to 1993, from zero hauls in 1989 and 1990, to an estimated 171 hauls in 1991, and then to an estimated 989 and 1087 hauls in 1992 and 1993, respectively. The fishery operated from August-November in 1991, from June-November in 1992, and from June-October in 1993. Sea sampling began in October 1992, and 101 sets (10% of the total) were sampled in that season, 201 hauls (18% of the total) were sampled in 1993. Nineteen vessels have operated in this fishery. The fishery extends from 35°N to 41°N, and from 69°W to 72°W. Approximately 50% of the total effort was within a one degree square at 39°N, 72°W, around Hudson Canyon. Examination of the locations and species composition of the by-catch, showed little seasonal change for the six months of operation and did not warrant any seasonal or areal stratification of this fishery (Northridge, in review). Five pilot whale (*Globicephala* spp.) mortalities were reported from logbook entries in 1993, but no fishery-related mortality or serious injury was reported by observers.

Pelagic swordfish, tunas, and billfish are the targets of the U.S. longline fishery in the U.S. Atlantic and Gulf of Mexico EEZ (SEFSC unpublished logbook data). Interactions between the longline swordfish/tuna fishery and pilot whales have been reported; however, a vessel may fish in more than one statistical reporting area and it is not possible to separate estimates of fishing effort other than to subtract Gulf of Mexico effort from Atlantic fishing effort, which includes the Caribbean Sea. This fishery has been monitored with about 5% observer coverage, in terms of trips observed, since 1992. Total longline effort for the Atlantic pelagic fishery (including the Caribbean), based on

mandatory logbook reporting, was 11,279 sets in 1991, 10,605 sets in 1992, and 11,538 in 1993 (Cramer 1994). The fishery has been observed from January to March off Cape Hatteras, in May and June in the entire Mid-Atlantic, and in July through December in the Mid-Atlantic Bight and off Nova Scotia. Twenty four animals were released alive, but two were injured. One mortality was observed between 1990 and 1993. January-March by-catch was concentrated on the continental shelf edge northeast of Cape Hatteras. By-catch was recorded in this area during April-June, and takes also occurred north of Hydrographer Canyon off the continental shelf in water over 1,000 fathoms during April-June. During the July-September period, takes occurred on the continental shelf edge east of Cape Charles, Virginia, and on Block Canyon slope in over 1,000 fathoms of water. October-December by-catch occurred along the 20 to 50 fathom contour lines between Barnegatt Bay and Cape Hatteras. Estimated take was based on a generalized linear model (Poisson error assumption) fit to the available observed incidental take and self-reported incidental take and effort data for the fishery (SEFSC unpublished data). The estimated fishery-related mortality to pilot whales in the U.S. Atlantic attributable to this fishery occurred in 1992 and was 22 (CV = 0.23); average annual mortality between 1992-1993 was eleven pilot whales (0.33).

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. The fishery is active in New England in all seasons. One mortality was documented between 1989 and 1993. Also, one animal was released alive. The estimated fishery-related mortality in 1990 was 184 (CV = 0.99); average annual fishery-related mortality during 1989-1993 was 37 pilot whales (2.21).

The mid-Atlantic mackerel and squid trawl fisheries were combined into the Atlantic mid-water trawl fishery in the revised proposed list of fisheries in 1995. The fishery occurs along the U.S. mid-Atlantic continental shelf region between New Brunswick, Canada, and Cape Hatteras year around. The mackerel trawl fishery was classified as a Category II fishery since 1990 and the squid fishery was originally classified as a Category II fishery in 1990, but was reclassified as a Category III fishery in 1992. The combined fishery has been proposed for classification as a Category II fishery. Three fishery-related mortality of pilot whales were reported in logbook reports from the mackerel trawl fishery between 1990-1992.

Other Mortality

A potential human-caused source of mortality is from polychlorinated biphenyls (PCBs) and DDT, moderate levels of which have been found in pilot whale blubber (Taruski 1975; Muir et al. 1988). The effect of the observed levels of such contaminants is unknown.

STATUS OF STOCK

The status of long-finned pilot whales relative to OSP in U.S. Atlantic coast waters is unknown, but stock abundance may have been affected by reduction in foreign fishing, curtailment of the Newfoundland drive fishery for pilot whales in 1971, and increased abundance of herring, mackerel, and squid stocks. There are insufficient data to determine the population trends for this species. The species is not listed under the Endangered Species Act. In Canada, the Cetacean Protection Regulations of 1982, promulgated under the Standing Fisheries Act, prohibit the catching or harassment of all cetacean species. The total level of human-caused mortality and serious injury is believed to be significant based on current data. This is a strategic stock because the 1989-93 estimated average annual fishery-related mortality to pilot whales, *Globicephala* spp., exceeds PBR.

REFERENCES

Abend, A. 1993. Long-finned pilot whale distribution and diet as determined from stable carbon and nitrogen ratio isotope tracers. M.S. Thesis, University of Massachusetts, Amherst.

Anon. 1994. Report of the PBR (Potential Biological Removal) workshop. June 27-29, 1994. NOAA, NMFS Southwest Fisheries Science Center, La Jolla, California, 13 pp. + Appendices.

Anon. 1993. Status of fishery resources off the northeastern United States for 1993. NOAA Tech. Mem. NMFS-F/NEC-101, 140 pp.

Bloch, D., M. Zachariassen and P. Zachariassen. 1993. Some external characters of the long-finned pilot whale off Faroe Island and a comparison with the short-finned pilot whale. Rep. Int. Whal. Commn. Special Issue 14:117-135.

CeTAP. 1982. A characterization of marine mammals and turtles in the mid- and north Atlantic areas of the U.S. outer continental shelf. Cetacean and Turtle Assessment Program, University of Rhode Island. Final Report, Contract AA51-C78-48, Bureau of Land Management, Washington, DC. 538 pp.

Desportes, G., M. Saboureau and A. Lacroix. 1993. Reproductive maturity and seasonality of male pilot long-finned whales off the Faroe Islands. Rep. Int. Whal. Commn. Special Issue 14: 233-262.

Fairfield, C. P., G. T. Waring and M. H. Sano. 1993. Pilot whales incidentally taken during the distant water fleet Atlantic mackerel fishery in the mid-Atlantic Bight, 1984-88. Rep. Int. Whal. Commn. Special Issue 14: 107-116.

Kasuya, T., D. E. Sergeant and K. Tanaka. 1988. Re-examination of life history parameters of long-finned pilot whales in the Newfoundland waters. Sci. Rep. Whales Res. Inst. No. 39: 103-119.

Leatherwood, S., D. K. Caldwell and H. E. Winn. 1976. Whales, dolphins, and porpoises of the western North Atlantic. A guide to their identification. U.S. Dept. of Commerce, NOAA Tech. Rep. NMFS Circ. 396, 176 pp.

Martin, A. R. and P. Rothery. 1993. Reproductive parameters of female long-finned pilot whales (*Globicephala melas*) around the Faroe Islands. Rep. Int. Whal. Commn. Special Issue 14: 263-304.

Mercer, M. C. 1975. Modified Leslie-DeLury population models of the long-finned pilot whale (*Globicephala melaena*) and annual production of the short-finned squid (*Illex illecebrosus*) based upon their interactions at Newfoundland. J. Fish. Res. Bd. Can. 32(7): 1145-54.

Mitchell, E. 1975. Present status of northwest Atlantic fin and other whale stocks. Pages 108-169 *in* W. E. Schevill (editor), The whale problem: A status report. Harvard University Press, Cambridge, Massachusetts, 419 pp.

Muir, D. C. G., R. Wagermann, N. P. Grift, R. J. Norstrom, M. Simon, and J. Lien. 1988. Organochlorine chemical and heavy metal contaminants in white-beaked dolphins (*Lagenorhynchus albirostris*) and pilot whales (*Globicephala melaena*) from the coast of Newfoundland. Canada. Arch. Environ. Contam. Toxicol. 17: 613-29.

Payne, P. M. and D. W. Heinemann. 1993. The distribution of pilot whales (*Globicephala* spp.) in shelf/shelf edge and slope waters of the northeastern United States, 1978-1988. Rep. Int. Whal. Commn. Special Issue 14: 51-68.

Sergeant D. E. 1962. The biology of the pilot or pothead whale (*Globicephala melaena* (Traill) in Newfoundland waters. Bull. Fish. Res. Bd. Can. 132: 1-84.

Taruski, A. G., C. E. Olney, and H. E. Winn. 1975. Chlorinated hydrocarbons in cetaceans. J. Fish. Res. Bd. Can. 32(11): 2205-9.

Waring, G. T., P. Gerrior, P. M. Payne, B. L. Parry and J. R. Nicolas. 1990. Incidental take of marine mammals in foreign fishery activities off the northeast United States, 1977-1988. Fish. Bull., U.S. 88(2): 347-360.

Waring, G. T. 1995. Fishery and ecological interactions for selected cetaceans off the northeast USA. Ph.D. dissertation, University of Massachusetts, Amherst, 260 pp.