

SEI WHALE (*Balaenoptera borealis*): Nova Scotia Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Indications are that, at least during the feeding season, a major portion of the sei whale population is centered in northerly waters, perhaps on the Scotian Shelf (Mitchell and Chapman 1977). The southern portion of the species' range during spring and summer includes the northern portions of the USA Atlantic Exclusive Economic Zone (EEZ) — the Gulf of Maine and Georges Bank. The period of greatest abundance there is in spring, with sightings concentrated along the eastern margin of Georges Bank and into the Northeast Channel area, and along the southwestern edge of Georges Bank in the area of Hydrographer Canyon (CETAP 1982). NMFS aerial surveys in 1999 and 2000 found concentrations of sei and right whales along the Northern Edge of Georges Bank in the spring. The sei whale is often found in the deeper waters characteristic of the continental shelf edge region (Hain *et al.* 1985). Mitchell (1975) similarly reported that sei whales off Nova Scotia were often distributed closer to the 2,000 m depth contour than were fin whales.

This general offshore pattern of sei whale distribution is disrupted during episodic incursions into more shallow and inshore waters. Although known to take piscine prey, sei whales (like right whales) are largely planktivorous, feeding primarily on euphausiids and copepods. In years of reduced predation on copepods by other predators, and thus greater abundance of this prey source, sei whales are reported in more inshore locations, such as the Great South Channel (in 1987 and 1989) and Stellwagen Bank (in 1986) areas (R.D. Kenney, pers. comm.; Payne *et al.* 1990). An influx of sei whales into the southern Gulf of Maine occurred in the summer of 1986 (Schilling *et al.* 1993). Such episodes, often punctuated by years or even decades of absence from an area, have been reported for sei whales from various places worldwide.

Based on analysis of records from the Blandford, Nova Scotia, whaling station, where 825 sei whales were taken between 1965 and 1972, Mitchell (1975) described two "runs" of sei whales, in June-July and in September-October. He speculated that the sei whale population migrates from south of Cape Cod and along the coast of eastern Canada in June and July, and returns on a southward migration again in September and October; however, such a migration remains unverified.

Mitchell and Chapman (1977) reviewed the sparse evidence on stock identity of northwest Atlantic sei whales, and suggested two stocks — a Nova Scotia stock and a Labrador Sea stock. The Nova Scotia stock includes the continental shelf waters of the northeastern USA, and extends northeastward to south of Newfoundland. The Scientific Committee of the IWC, while adopting these general boundaries, noted that the stock identity of sei whales (and indeed all North Atlantic whales) was a major research problem (Donovan 1991). In the absence of evidence to the contrary, the proposed IWC stock definition is provisionally adopted, and the "Nova Scotia stock" is used here as the management unit for this stock assessment. The IWC boundaries for this stock are from the USA east coast to Cape Breton, Nova Scotia, thence east to longitude 42° W.

POPULATION SIZE

The total number of sei whales in the USA Atlantic EEZ is unknown. However, two abundance estimates are available for portions of the sei whale habitat (Table 1): from Nova Scotia during the 1970's, and in the USA Atlantic EEZ during the springs of 1979-81.

Mitchell and Chapman (1977), based on tag-recapture data, estimated the Nova Scotia, Canada, stock to contain between 1,393 and 2,248 sei whales (Table 1). Based on census data, they estimated a minimum Nova Scotian population of 870 sei whales.

An abundance of 253 sei whales (CV=0.63) was estimated from an aerial survey program conducted from 1978 to 1982 on the continental shelf and shelf edge waters between Cape Hatteras, North Carolina and Nova Scotia (Table 1; CETAP 1982). The estimate is based on data collected during the spring when the greatest proportion of the population off the northeast USA coast appeared in the study area. This estimate does not include a correction for dive-time or $g(0)$, the probability of detecting an animal group on the track line. The CETAP report suggested, however, that correcting the estimated abundance for dive time would increase the estimate to approximately the same as Mitchell and Chapman's (1977) tag-recapture estimate. This estimate is almost 20 years out of date and thus

almost certainly does not reflect the current true population size; in addition, the estimate has a high degree of uncertainty (i.e., it has a large CV), and it was estimated just after cessation of extensive foreign fishing operations in the region. There are no recent abundance estimates for the sei whale.

Table 1. Summary of abundance estimates for the Nova Scotia stock of the sei whale. 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
1966 - 1972	Nova Scotia, Canada	1,393 to 2,248	None reported
spring 1978-82	Cape Hatteras, NC to Nova Scotia	253	0.63

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). A current minimum population size cannot be estimated because there are no current abundance estimates (within the last 10 years).

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 unknown for this stock. For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a “recovery” factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is unknown. The maximum productivity rate is 0.04, the default value for cetaceans. The “recovery” factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP) is assumed to be 0.10 because the sei whale is listed as endangered under the Endangered Species Act (ESA). PBR for the Nova Scotia stock of the sei whale is unknown because the minimum population size is unknown.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

There are few if any data on fishery interactions or human impacts. There was no reported fishery-related mortality or serious injury to sei whales in fisheries observed by NMFS during 1994-1998. There are no reports of mortality, entanglement, or injury in the NEFSC or NE Regional Office databases; however, there is a report of a ship strike. The New England Aquarium documented a sei whale carcass hung on the bow of a container ship as it docked in Boston on November 17, 1994.

Fishery Information

There have been no reported entanglements or other interactions between sei whales and commercial fishing activities; therefore there are no descriptions of fisheries.

STATUS OF STOCK

The status of this stock relative to OSP in the USA Atlantic EEZ is unknown, but the species is listed as endangered under the ESA. There are insufficient data to determine the population trends for sei whales. The total level of human-caused mortality and serious injury is unknown, but the rarity of mortality reports for this species suggests that this level is insignificant and approaching a zero mortality and serious injury rate. This is a strategic stock because the sei whale is listed as an endangered species under the ESA. A Recovery Plan for sei whales has been written and is awaiting legal clearance.

REFERENCES

- Barlow, J., S. L. Swartz, T. C. Eagle and P. R. Wade. 1995. U.S. Marine Mammal Stock Assessments: Guidelines for preparation, background, and a summary of the 1995 assessments. NOAA Technical Memorandum NMFS-OPR-6. U.S. Department of Commerce, Washington, DC. 73 pp.
- 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 #AA551-CT8-48 to the Bureau of Land Management, Washington, DC, 538 pp.
- Donovan, G. P. 1991. A review of IWC stock boundaries. *Rep. int. Whal. Commn.* Special Issue 13: 39-68.
- Hain, J. H. W., M. A. M. Hyman, R. D. Kenney and H. E. Winn. 1985. The role of cetaceans in the shelf-edge region of the northeastern United States. *Mar. Fish. Rev.* 47(1): 13-17.
- Mitchell, E. 1975. Preliminary report on Nova Scotia fishery for sei whales (*Balaenoptera borealis*). *Rep. int. Whal. Commn.* 25: 218-225.
- Mitchell, E. and D. G. Chapman. 1977. Preliminary assessment of stocks of northwest Atlantic sei whales (*Balaenoptera borealis*). *Rep. int. Whal. Commn.* Special Issue 1: 117-120.
- Payne, P. M., D. N. Wiley, S. B. Young, S. Pittman, P. J. Clapham and J. W. Jossi. 1990. Recent fluctuations in the abundance of baleen whales in the southern Gulf of Maine in relation to changes in selected prey. *Fish. Bull., U.S.* 88: 687-696.
- Schilling, M. R., I. Seipt, M. T. Weinrich, S. E. Frohock, A. E. Kuhlberg and P. J. Clapham. 1993. Behavior of individually identified sei whales, *Balaenoptera borealis*, during an episodic influx into the southern Gulf of Maine in 1986. *Fish. Bull., U.S.* 90(4): 749-755.
- Wade, P. R. and R. P. Angliss. 1997. Guidelines for assessing marine mammal stocks: Report of the GAMMS Workshop, April 3-5, 1996, Seattle, Washington. NOAA Technical Memorandum NMFS-OPR-12. U.S. Dept. of Commerce, Washington, DC. 93 pp.

DWARF SPERM WHALE (*Kogia simus*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The dwarf sperm whale (*Kogia simus*) appears to be distributed worldwide in temperate to tropical waters (Caldwell and Caldwell 1989). There are no stranding records for the east Canadian coast (Willis and Baird 1998). Sightings of these animals in the western North Atlantic occur primarily along the continental shelf edge and over the deeper waters off the continental shelf (Hansen *et al.* 1994; NMFS unpublished data). Dwarf sperm whales and pygmy sperm whales are difficult to distinguish and sightings of either species are often categorized as *Kogia* sp. There is no information on stock differentiation for the Atlantic population. In a recent study using hematological and stable-isotope data, Barros *et al.* (1998) speculated that dwarf sperm whales may have a more pelagic distribution than pygmy sperm whales, and/or dive deeper during feeding bouts.

POPULATION SIZE

An abundance of 115 (CV=0.61) for *Kogia* sp. was estimated from a line transect sighting survey conducted during July 6 to September 6, 1998 by a ship and plane that surveyed 15,900 km of track line in waters north of Maryland (38° N) (Figure 1; Palka *et al.* in review). Shipboard data were analyzed using the modified direct duplicate method (Palka 1995) that accounts for school size bias and $g(0)$, the probability of detecting a group on the track line. Aerial data were not corrected for $g(0)$.

An abundance of 421 (CV=0.55) for *Kogia* sp. was estimated from a shipboard line transect sighting survey conducted between 8 July and 17 August 1998 that surveyed 5,570 km of track line in waters south of Maryland (38°N) (Figure 1; Mullin in review). Abundance estimates were made using the program DISTANCE (Buckland *et al.* 1993; Laake *et al.* 1993) where school size bias and ship attraction were accounted for.

The best available abundance estimate for *Kogia* sp. is the sum of the estimates from the two 1998 USA Atlantic surveys, 536 (CV=0.45), where the estimate from the northern USA Atlantic is 115 (CV=0.61) and from the southern USA Atlantic is 421 (CV=0.55). This joint estimate is considered best because together these two surveys have the most complete coverage of the species' habitat.

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 *Kogia* sp. is 536 (CV=0.45). The minimum population estimate for *Kogia* sp. is 373.

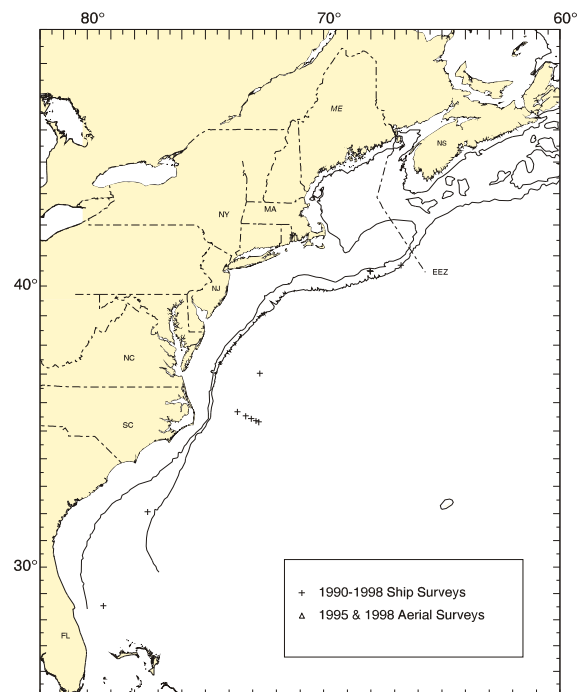


Figure 1. USA Gulf of Mexico bays and sounds. Each of the alpha-numerically designated blocks corresponds to one of the NMFS Southeast Fisheries Science Center logistical aerial survey areas listed in Table 1. The bottlenose dolphins inhabiting each bay and sound are considered to comprise a unique stock for purposes of this assessment.

Current Population Trend

The available information is insufficient to evaluate trends in population size for this species in the western North Atlantic.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. 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 373. 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 western North Atlantic Kogia sp. is 3.7.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The level of past or current, direct, human-caused mortality of dwarf sperm whales in the USA Atlantic EEZ is unknown. Available information indicates there is likely little fisheries interaction with dwarf sperm whales in the USA Atlantic EEZ. Total annual estimated average fishery-related mortality or serious injury to this stock during 1994-1998 was 0.25 dwarf sperm whales (CV=0); Table 1).

Fishery Information

Data on current incidental takes in USA 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 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.

Bycatch has been observed by NMFS Sea Samplers in the pelagic drift gillnet fishery, but no mortalities or serious injuries have been documented in other fisheries.

Pelagic Drift Gillnet

The estimated total number of hauls in the 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, 1993, 1994, 1995, 1996, and 1998 were 233, 243, 232, 197, 164, 149, and 113 respectively. In 1996 and 1997, NMFS issued management regulations which prohibited the operation of this fishery in 1997. Further, in January 1999 NMFS issued a Final Rule to prohibit the use of driftnets (*i.e.*, permanent closure) in the North Atlantic swordfish fishery (50 CFR Part 630). Fifty-nine different vessels participated in this fishery at one time or another between 1989 and 1993. Since 1994, between 10- and 13 vessels have participated in the fishery (Table 1). 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, 99% in 1995, 64% in 1996, and 99% in 1998. 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 pelagic drift gillnet fishery be stratified into two strata, a southern or winter stratum, and a northern or summer stratum. Estimates of the total bycatch, from 1989 to 1993, were obtained using the aggregated (pooled 1989-1993) catch rates, by strata (Northridge 1996). Estimates of total annual bycatch 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 self-reported fisheries information. Variances were estimated using bootstrap re-sampling techniques. There was one report of mortality or serious injury to dwarf sperm whales attributable to this fishery. Estimated annual fishery-related mortality and serious injury (CV in parentheses) was 0 dwarf sperm whales from 1991-1994, 1.0 in 1995 (CV=0), and 0 from 1996-1998;

estimated average annual mortality and serious injury related to this fishery during 1994-1998 was 0.25 dwarf sperm whales (CV=0) (Table 1).

Table 1. Summary of the incidental mortality of the dwarf sperm whale (*Kogia simus*), 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 ¹	Data Type ²	Observer Coverage	Observed Serious Injury	Observed Mortality	Estimated Mortality	Estimated CVs	Mean Annual Mortality
Pelagic ⁵ Drift Gillnet	94-98	1994=11 1995=12 1996=10 1998=13	Obs. Data Logbook	.87, .99, .64, NA, .99	0, 0, 0, 0, 0	0, 1, 0, NA, 0	0, 1.0 ⁴ , 0, NA, 0	0	0.25 (0)
TOTAL									0.25 (0)

¹ 1994, 1995, 1996 and 1998 shown, other years not available on an annual basis.

² 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. Logbook (Logbook) data are used to measure total effort, and the data are collected at the Southeast Fisheries Science Center (SEFSC).

³ The observer coverage and unit of effort for the Pelagic Drift Gillnet is a set.

⁴ One vessel was not observed and recorded 1 set in a 10 day trip in the SEFSC mandatory logbook. If you assume the vessel fished 1.4 sets per day as estimated from the 1995 SS data, the point estimate may increase by 0.08 animals. However, the SEFSC mandatory logbook data was taken at face value, and therefore it was assumed that 1 set was fished within this trip, and the point estimate would then increase by 0.01 animals.

⁵ The fishery did not operate in 1997; the average annual mortality is based on the number of years (4; 1994-1996, 1998) that the fishery operated.

Other Mortality

Historical stranding records (1883-1988) of dwarf sperm whales in the southeastern USA (Credle 1988), and strandings recorded during 1988-1997 (Barros *et al.* 1998) indicate that this species accounts for about 17% of all *Kogia* strandings in this area. During the period 1990-October 1998, three dwarf sperm whale strandings occurred in the northeastern USA (Maryland, Massachusetts, and Rhode Island), whereas 43 strandings were documented along the USA Atlantic coast between North Carolina and the Florida Keys in the same period. A pair of latex examination gloves was retrieved from the stomach of a dwarf sperm whale stranded in Miami in 1987 (Barros *et al.* 1990). In the period 1987-1994, one animal had possible propeller cuts on or near the flukes.

STATUS OF STOCK

The status of this stock relative to OSP in the USA Atlantic EEZ is unknown. This species is not listed as endangered or threatened under the Endangered Species Act. There is insufficient information with which to assess population trends. Total fishery-related mortality and serious injury for this stock is less than 10% of PBR and therefore can be considered insignificant and approaching zero mortality and serious injury rate.

REFERENCES

- Barlow, J., S. L. Swartz, T. C. Eagle and P. R. Wade. 1995. U.S. Marine Mammal Stock Assessments: Guidelines for Preparation, Background, and a Summary of the 1995 Assessments. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-OPR-6, 73 pp.
- Barros, N. B., D. A. Duffield, P. H. Ostrom, D. K. Odell and V. R. Cornish. 1998. Nearshore vs. offshore ecotype differentiation of *Kogia breviceps* and *K. simus* based on hemoglobin, morphometric and dietary analyses. Abstracts. World Marine Mammal Science Conference. Monaco. 20-24 January.
- Barros, N. B., D. K. Odell and G. W. Patton. 1990. Ingestion of plastic debris by stranded marine mammals from Florida. Page 746 in: Shomura, R.S. and M.L. Godfrey (eds). Proceedings of the Second International Conference on Marine Debris. NOAA Tech. Memo. NOAA-TM-NMFS-SWFSC-154.
- Buckland, S. T., D. R. Anderson, K. P. Burnham and J. L. Laake. 1993. Distance Sampling: estimating abundance of biological populations. Chapman & Hall, London, 446 pp.
- Caldwell, D. K. and M. C. Caldwell. 1989. Pygmy sperm whale *Kogia breviceps* (de Blainville, 1838): dwarf sperm whale *Kogia simus* Owen, 1866. Pages 235-260 in: S. H. Ridgway and R. Harrison, Handbook of marine mammals, Vol. 4: river dolphins and the larger toothed whales. *Academic Press*, San Diego.
- Credle, V. R. 1988. Magnetite and magnetoreception in dwarf and pygmy sperm whales, *Kogia simus* and *Kogia breviceps*. MSc. Thesis. University of Miami. Coral Gables, FL.
- Hansen, L. J., K. D. Mullin and C. L. Roden. 1994. Preliminary estimates of cetacean abundance in the U.S. Atlantic Exclusive Economic Zone from 1992 vessel surveys. Southeast Fisheries Science Center, Miami Laboratory, Contribution No. MIA-93/94-58.
- Laake, J. L., S. T. Buckland, D. R. Anderson and K. P. Burnham. 1993. DISTANCE user's guide, V2.0. Colorado Cooperative Fish & Wildlife Research Unit, Colorado State University, Ft. Collins, Colorado, 72 pp.
- Mullin, K. D. (in review). Abundance and distribution of cetaceans in the southern U.S. Atlantic Ocean during summer 1998. *Fish. Bull., U.S.*
- Northridge, S. 1996. Estimation of cetacean mortality in the U.S. Atlantic swordfish and tuna drift gillnet and pair trawl fisheries. Final report to the Northeast Fisheries Science Center, Contract No.40ENNF500045. 18 pp.
- Palka, D. 1995. Abundance estimate of the Gulf of Maine harbor porpoise. Rep. int Whal. Commn. Special Issue 16: 27-50.
- Palka, D., G. Waring, and D. Potter. (in review). Abundances of cetaceans and sea turtles in the northwest Atlantic during summer 1995 and 1998. *Fish. Bull., U.S.*
- Wade P. R. and R. P. 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-OPR-12, 93 pp.
- Willis, P. M., and R. W. Baird. 1998. Status of the dwarf sperm whale, *Kogia simus*, with special reference to Canada. *Can. Field Nat.*, 112:114-125.

PYGMY SPERM WHALE (*Kogia breviceps*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The pygmy sperm whale (*Kogia breviceps*) appears to be distributed worldwide in temperate to tropical waters (Caldwell and Caldwell 1989). Sightings of these animals in the Western North Atlantic occur primarily along the continental shelf edge and over the deeper waters off the continental shelf (Hansen *et al.* 1994; Southeast Fisheries Science Center unpublished data). Pygmy sperm whales and dwarf sperm whales are difficult to distinguish and sightings of either species are often categorized as *Kogia* sp. There is no information on stock differentiation for the Atlantic population. In a recent study using hematomological and stable-isotope data, Barros *et al.* (1998) speculated that dwarf sperm whales may have a more pelagic distribution than pygmy sperm whales, and/or dive deeper during feeding bouts.

POPULATION SIZE

An abundance of 115 (CV=0.61) for *Kogia* sp. was estimated from a line transect sighting survey conducted during July 6 to September 6, 1998 by a ship and plane that surveyed 15,900 km of track line in waters north of Maryland (38° N) (Figure 1; Palka *et al.* in review). Shipboard data were analyzed using the modified direct duplicate method (Palka 1995) that accounts for school size bias and $g(0)$, the probability of detecting a group on the track line. Aerial data were not corrected for $g(0)$.

An abundance of 421 (CV=0.55) for *Kogia* sp. was estimated from a shipboard line transect sighting survey conducted between 8 July and 17 August 1998 that surveyed 5,570 km of track line in waters south of Maryland (38°N) (Figure 1; Mullin in review). Abundance estimates were made using the program DISTANCE (Buckland *et al.* 1993; Laake *et al.* 1993) where school size bias and ship attraction were accounted for.

The best available abundance estimate for *Kogia* sp. is the sum of the estimates from the two 1998 USA Atlantic surveys, 536 (CV=0.45), where the estimate from the northern USA Atlantic is 115 (CV=0.61) and from the southern USA Atlantic is 421 (CV=0.55). This joint estimate is considered best because together these two surveys have the most complete coverage of the species' habitat.

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 *Kogia* sp. is 536 (CV=0.45). The minimum population estimate for *Kogia* sp. is 373.

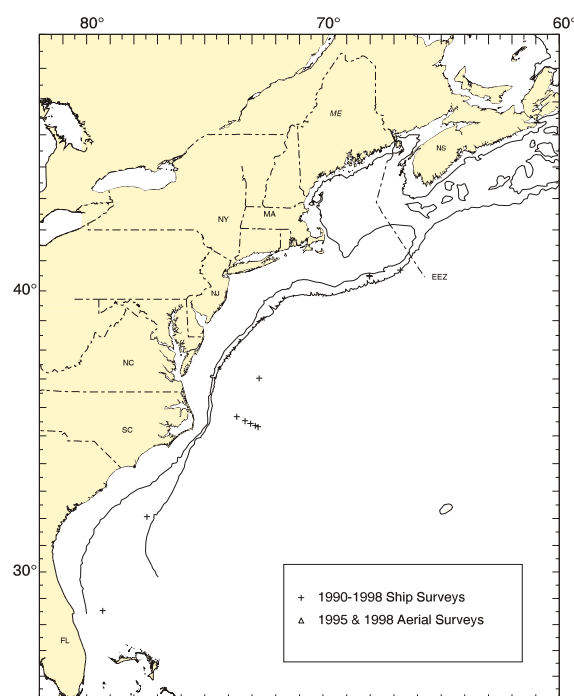


Figure 1. Distribution of *Kogia* sp. whale sightings from NEFSC and SEFSC shipboard and aerial surveys during the summer 1990-1998. Isobaths are at 100 m and 1,000 m.

Current Population Trend

The available information is insufficient to evaluate trends in population size for this species in the western North Atlantic.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. 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 373. 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 western North Atlantic Kogia sp. is 3.7.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The level of past or current, direct, human-caused mortality of pygmy sperm whales in the USA Atlantic EEZ is unknown. Available information indicates there is likely little, if any, fisheries interaction with pygmy sperm whales in the USA Atlantic EEZ.

There were no documented strandings of pygmy sperm whales along the USA Atlantic coast during 1987-present which were classified as likely caused by fishery interactions. 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.

Fishery Information

Data on current incidental takes in USA fisheries are available from several sources. In 1986, NMFS established a mandatory self-reporting fisheries information system for large pelagic fisheries. The Northeast Fisheries Science Center (NEFSC) Sea Sampling Observer Program 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. There have been no observed mortalities or serious injuries by NMFS Sea Samplers in the pelagic drift gillnet, pelagic longline, pelagic pair trawl, Northeast multispecies sink gillnet, mid-Atlantic coastal sink gillnet, nor North Atlantic bottom trawl fisheries.

Other Mortality

Historical stranding records (1883-1988) of pygmy sperm whales in the southeastern USA (Credle 1988), and strandings recorded during 1988-1997 (Barros *et al.* 1998) indicate that this species accounts for about 83% of all *Kogia* strandings in this area. During the period 1990-October 1998, 21 pygmy sperm whale strandings occurred in the northeastern USA (Delaware, New Jersey, New York and Virginia), whereas 194 strandings were documented along the USA Atlantic coast between North Carolina and the Florida Keys in the same period. Remains of plastic bags and other marine debris have been retrieved from the stomachs of 13 stranded pygmy sperm whales in the southeastern USA (Barros *et al.* 1990, 1998), and at least on one occasion the ingestion of plastic debris is believed to have been the cause of death. During the period 1987-1994 one animal had possible propeller cuts on its flukes.

STATUS OF STOCK

The status of this stock relative to OSP in the USA Atlantic EEZ is unknown. This species is not listed as endangered or threatened under the Endangered Species Act. There is insufficient information with which to assess population trends. Total fishery-related mortality and serious injury for this stock is less than 10% of PBR and therefore, can't be considered insignificant and approaching zero mortality and serious injury rate.

REFERENCES

- Barlow, J., S. L. Swartz, T. C. Eagle and P. R. Wade. 1995. U.S. Marine Mammal Stock Assessments: Guidelines for Preparation, Background, and a Summary of the 1995 Assessments. U.S. Dep. Commer., NOAA Tech.Memo. NMFS-OPR-6, 73 pp.
- Barros, N. B., D. A. Duffield, P. H. Ostrom, D.K. Odell and V. R. Cornish. 1998. Nearshore vs. offshore ecotype differentiation of *Kogia breviceps* and *K. simus* based on hemoglobin, morphometric and dietary analyses. Abstracts. World Marine Mammal Science Conference. Monaco. 20-24 January.
- Barros, N. B., D. K. Odell and G. W. Patton. 1990. Ingestion of plastic debris by stranded marine mammals from Florida. Page 746 in Shomura, R.S. and M.L. Godfrey (eds). Proceedings of the Second International Conference on Marine Debris. NOAA Tech. Memo. NOAA-TM-NMFS-SWFSC-154.
- Buckland, S. T., D. R. Anderson, K. P. Burnham and J. L. Laake. 1993. Distance Sampling: estimating abundance of biological populations. *Chapman & Hall*, London, 446 pp.
- Caldwell, D. K. and M. C. Caldwell 1989. Pygmy sperm whale *Kogia breviceps* (de Blainville 1838): dwarf sperm whale *Kogia simus* Owen, 1866. Pages 235-260 in: S. H. Ridgway and R. Harrison, Handbook of marine mammals, Vol. 4: river dolphins and the larger toothed whales. *Academic Press*, San Diego.
- Credle, V. R. 1988. Magnetite and magnetoreception in dwarf and pygmy sperm whales, *Kogia simus* and *Kogia breviceps*. MSc. Thesis. University of Miami. Coral Gables, FL.
- Hansen, L. J., K. D. Mullin and C. L. Roden. 1994. Preliminary estimates of cetacean abundance in the U.S. Atlantic Exclusive Economic Zones from 1992 vessel surveys. Southeast Fisheries Science Center, Miami Laboratory, Contribution No. MIA-93/94-58.
- Laake, J. L., S. T. Buckland, D. R. Anderson and K. P. Burnham. 1993. DISTANCE user's guide, V2.0. Colorado Cooperative Fish & Wildlife Research Unit, Colorado State University, Ft. Collins, Colorado, 72 pp.
- Mullin, K. D. (in review). Abundance and distribution of cetaceans in the southern U.S. Atlantic Ocean during summer 1998. *Fish. Bull.*
- Palka, D. 1995. Abundance estimate of the Gulf of Maine harbor porpoise. *Rep. int Whal. Commn.* Special Issue 16: 27-50
- Palka, D., G. Waring, and D. Potter. (in review). Abundances of cetaceans and sea turtles in the northwest Atlantic during summer 1995 and 1998. *Fish. Bull., U.S.*
- Wade P. R. and R. P. 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-OPR-12, 93 pp.

KILLER WHALE (*Orcinus orca*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Killer whales are characterized as uncommon or rare in waters of the U.S. Atlantic Exclusive Economic Zone (EEZ) (Katona *et al.* 1988). The 12 killer whale sightings constituted 0.1% of the 11,156 cetacean sightings in the 1978-81 CETAP surveys (CETAP 1982). The same is true for eastern Canadian waters, where the species has been described as relatively uncommon and numerically few (Mitchell and Reeves 1988). Their distribution, however, extends from the Arctic ice-edge to the West Indies. They are normally found in small groups, although 40 animals were reported from the southern Gulf of Maine in September 1979, and 29 animals in Massachusetts Bay in August 1986 (Katona *et al.* 1988). In the U.S. Atlantic EEZ, while their occurrence is unpredictable, they do occur in fishing areas, perhaps coincident with tuna, in warm seasons (Katona *et al.* 1988; NMFS unpublished data). In an extensive analysis of historical whaling records, Reeves and Mitchell (1988) plotted the distribution of killer whales in offshore and mid-ocean areas. Their results suggest that the offshore areas need to be considered in present-day distribution, movements, and stock relationships.

Stock definition is unknown. Results from other areas (e.g., the Pacific Northwest and Norway) suggest that social structure and territoriality may be important.

POPULATION SIZE

The total number of killer whales off the eastern U.S. coast is unknown.

Minimum Population Estimate

Present data are insufficient to calculate a minimum population estimate.

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 (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 unknown. 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. PBR for the western North Atlantic killer whale is unknown because the minimum population size cannot be determined.

ANNUAL HUMAN-CAUSED MORTALITY

In 1994, one killer whale was caught in the New England multispecies sink gillnet fishery but released alive. No takes were documented in a review of Canadian gillnet and trap fisheries (Read 1994).

Fishery Information

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

There have been no observed mortalities or serious injuries by NMFS Sea Samplers in the pelagic drift gillnet, pelagic longline, pelagic pair trawl, New England multispecies sink gillnet, mid-Atlantic coastal sink gillnet, and North Atlantic bottom trawl fisheries.

STATUS OF STOCK

The status of killer whales relative to OSP in U.S. Atlantic EEZ is unknown. Because there are no observed mortalities or serious injury between 1990 and 1995, the total fishery-related mortality and serious injury for this stock is considered insignificant and approaching zero mortality and serious injury rate. The species is not listed as threatened or endangered 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. There are insufficient data to determine the population trends for this species. This is not a strategic stock because, although PBR could not be calculated, there is no evidence of human-induced mortality.

REFERENCES

- Barlow, J., S.L. Swartz, T.C. Eagle, and P.R. Wade. 1995. U.S. Marine Mammal Stock Assessments: Guidelines for Preparation, Background, and a Summary of the 1995 Assessments. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-OPR-6, 73 pp.
- 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 #AA551-CT8-48 to the Bureau of Land Management, Washington, DC, 538 pp.
- Katona, S. K., J. A. Beard, P. E. Girton, and F. Wenzel. 1988. Killer whales (*Orcinus orca*) from the Bay of Fundy to the Equator, including the Gulf of Mexico. *Rit. Fiskideild.* 9: 205-224.
- Mitchell, E. and R. R. Reeves. 1988. Records of killer whales in the western North Atlantic, with emphasis on eastern Canadian waters. *Rit. Fiskideild.* 9: 161-193.
- Read, A. J. 1994. Interactions between cetaceans and gillnet and trap fisheries in the Northwest Atlantic. Rep. int. Whal. Commn. Special Issue 15: 133-147.
- Reeves, R. R. and E. Mitchell. 1988. Killer whale sightings and takes by American pelagic whalers in the North Atlantic. *Rit. Fiskideild.* 9: 7-23
- Wade P.R., and R.P. 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-OPR-12, 93 pp.

PYGMY KILLER WHALE (*Feresa attenuata*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The pygmy killer whale is distributed worldwide in tropical and subtropical waters (Ross and Leatherwood 1994). Sightings of these animals in the northern Gulf of Mexico occur primarily over the deeper waters off the continental shelf (NMF S unpublished data). There is no information on stock differentiation for the Atlantic population.

POPULATION SIZE

A single sighting of this species was made during a 1992 winter, visual sampling, line-transect vessel survey of the U.S. Atlantic Exclusive Economic Zone (EEZ) from Miami, Florida, to Cape Hatteras, North Carolina (Hansen *et al.* 1994). This sighting, of a herd of six animals, was not made during visual sampling effort; therefore, the sighting could not be used to estimate a abundance of pygmy killer whales, but it does confirm the presence of this species in the U.S. Atlantic EEZ.

Minimum Population Estimate

The minimum population estimate based on the count of animals in the single sighting, was six pygmy killer whales (Hansen *et al.* 1994).

Current Population Trend

No information was available to evaluate trends in population size.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. 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 six (6). 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 western North Atlantic pygmy killer whale is 0.1.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The level of past or current, direct, human-caused mortality of pygmy killer whales in the U.S. Atlantic EEZ is unknown; however, there has historically been some take of this species in small cetacean fisheries in the Caribbean (Caldwell and Caldwell 1971). Available information indicates there likely is little, if any, fisheries interaction with pygmy killer whales in the U.S. Atlantic EEZ. There have been no logbook reports of fishery-related mortality or serious injury and no observed fishery-related mortality or serious injury has been observed.

There have been no documented strandings of pygmy killer whales in the along the U.S. Atlantic coast during 1987-present which have been classified as likely caused by fishery interactions or other human-related causes. Stranding data probably underestimate the extent of fishery-related mortality and serious injury because not all of the dolphins which die or are seriously injured in fishery interactions 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.

Fishery Information

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

There have been no observed mortalities or serious injuries by NMFS Sea Samplers in the pelagic drift gillnet, pelagic longline, pelagic pair trawl, New England multispecies sink gillnet, mid-Atlantic coastal sink gillnet, and North Atlantic bottom trawl fisheries.

Other Mortality

This stock may be subjected to human-induced mortality caused by habitat degradation (e.g., industrial and agricultural pollution) and indirect effects of fisheries on prey. There have been, however, no studies to date which have determined the amount, if any, of indirect human-induced mortality resulting from habitat degradation or competition for prey.

STATUS OF STOCK

The status of pygmy killer whales relative to OSP in U.S. Atlantic EEZ is unknown. The species is not listed as threatened or endangered under the Endangered Species Act. There are insufficient data to determine the population trends for this species. The total known fishery-related mortality and serious injury for this stock is less than 10% of the calculated PBR and, therefore, can be considered insignificant and approaching zero mortality and serious injury rate. The western North Atlantic pygmy killer whale is considered a non-strategic stock.

REFERENCES

- Barlow, J., S.L. Swartz, T.C. Eagle, and P.R. Wade. 1995. U.S. Marine Mammal Stock Assessments: Guidelines for Preparation, Background, and a Summary of the 1995 Assessments. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-OPR-6, 73 pp.
- Caldwell, D. K. and M. C. Caldwell. 1971. The pygmy killer whale, *Feresa attenuata*, in the western Atlantic, with a summary of world records. *J. Mamm.* 52:206-209.
- Hansen, L. J., K. D. Mullin and C. L. Roden. 1994. Preliminary estimates of cetacean abundance in the northern Gulf of Mexico from vessel surveys, and of selected cetacean species in the U.S. Atlantic Exclusive Economic Zone from vessel surveys from vessel surveys. Southeast Fisheries Science Center, Miami Laboratory, Contribution No. MIA-93/94-58
- Ross, G. J. B. and S. Leatherwood. 1994. Pygmy killer whale *Feresa attenuata* (Gray 1874). Pages 387-404 in S. H. Ridgway and R. Harrison (eds), Handbook of marine mammals, Vol. 5: The first book of dolphins. *Academic Press, San Diego*, 418 pp.
- Wade P.R., and R.P. 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-OPR-12, 93 pp.

NORTHERN BOTTLENOSE WHALE (*Hyperoodon ampullatus*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Northern bottlenose whales are characterized as extremely uncommon or rare in waters of the U.S. Atlantic Exclusive Economic Zone. The two sightings of three individuals constituted less than 0.1% of the 11,156 cetacean sightings in the 1978-82 CETAP surveys. Both sightings were in the spring, along the 2,000 m isobath (CETAP 1982). In 1993 and 1996, two sightings of single animals, and in 1996, a single sighting of six animals (one juvenile), were made during summer shipboard surveys conducted along the southern edge of Georges Bank (Anon. 1993; Anon. 1996).

Northern bottlenose whales are distributed in the North Atlantic from Nova Scotia to about 70° in the Davis Strait, along the east coast of Greenland to 77° and from England to the west coast of Spitzbergen. It is largely a deep-water species and is very seldom found in waters less than 2,000 m deep (Mead 1989).

There are two main centers of bottlenose whale distribution in the western north Atlantic, one in the area called "The Gully" just north of Sable Island, Nova Scotia, and the other in Davis Strait off northern Labrador (Reeves *et al.* 1993). Studies at the entrance to the Gully from 1988-1995 identified 237 individuals and estimated the local population size at about 230 animals (95% C.I. 160-360) (Whitehead *et al.* 1997). These individuals are believed to be year-round residents and all age and sex classes are present (Gowans and Whitehead 1998). Mitchell and Kozicki (1975) documented stranding records in the Bay of Fundy and as far south as Rhode Island. Stock definition is unknown.

POPULATION SIZE

The total number of northern bottlenose whales off the eastern U.S. coast is unknown.

Minimum Population Estimate

Present data are insufficient to calculate a minimum population estimate.

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 unknown for this stock. For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a "recovery" factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is unknown. 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 western North Atlantic northern bottlenose whale is unknown because the minimum population size cannot be determined.

ANNUAL HUMAN-CAUSED MORTALITY

No mortalities have been reported in U.S. waters. A fishery for northern bottlenose whales existed in Canadian waters during both the 1800s and 1900s. Its development was due to the discovery that bottlenose whales contained spermaceti. A Norwegian fishery expanded from east to west (Labrador and Newfoundland) in several episodes. The fishery peaked in 1965. Decreasing catches led to the cessation of the fishery in the 1970s, and provided evidence that the population was depleted. A small fishery operated by Canadian whalers from Nova Scotia operated in the Gully, and took 87 animals from 1962 to 1967 (Mead 1989; Mitchell 1977).

Fishery Information

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

There have been no observed mortalities or serious injuries by NMFS Sea Samplers in the pelagic drift gillnet, pelagic longline, pelagic pair trawl, New England multispecies sink gillnet, mid-Atlantic coastal sink gillnet, and North Atlantic bottom trawl fisheries.

STATUS OF STOCK

The status of northern bottlenose whales relative to OSP in U.S. Atlantic EEZ is unknown; however, a depletion in Canadian waters in the 1970's may have impacted U.S. distribution and may be relevant to current status in U.S. waters. The species is not listed as threatened or endangered under the Endangered Species Act. There are insufficient data to determine the population trends for this species. Because there are no observed mortalities or serious injury, the total fishery-related mortality and serious injury for this stock is considered to be approaching zero mortality and serious injury rate. This is not a strategic stock because there are no recent records of fishery-related mortality or serious injury.

REFERENCES

- Anon. 1993. Cruise results, NOAA ship DELAWARE II, Cruise No. DEL 93-06, Marine Mammal Survey. NOAA NMFS NEFSC, Woods Hole Laboratory, Woods Hole, MA 5 pp.
- Anon. 1996. Cruise results, R/V ABEL-J, Cruise No. AJ-9601, Part III, Marine Mammal Survey. NOAA NMFS NEFSC, Woods Hole Laboratory, Woods Hole, MA 7 pp.
- Barlow, J., S.L. Swartz, T.C. Eagle, and P.R. Wade. 1995. U.S. Marine Mammal Stock Assessments: Guidelines for Preparation, Background, and a Summary of the 1995 Assessments. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-OPR-6, 73 pp.
- 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 #AA551-CT8-48 to the Bureau of Land Management, Washington, DC, 538 pp.
- Gowans, S. and H. Whitehead. 1998. Social organization of northern bottlenose whales. The World Marine Mammal Science Conference, Monaco, January 1998 (Abstract).
- Mead, J. G. 1989. Bottlenose whales. Pages 321-348. In: S. H. Ridgway and R. Harrison (eds), Handbook of marine mammals, Volume 4: River dolphins and the larger toothed whales. *Academic Press*, New York.
- Mitchell, E. D. 1977. Evidence that the northern bottlenose whale is depleted. *Rep. int. Whal. Commn.* 27: 195-203.
- Mitchell, E. D. and V. M. Kozicki. 1975. Autumn stranding of a northern bottlenose whale (*Hyperoodon ampullatus*) in the Bay of Fundy. *J. Fish. Res. Bd. Can.* 32: 1019-1040.
- Reeves, R.R., E. Mitchell and H. Whitehead. 1993. Status of the northern bottlenose whale, *Hyperoodon ampullatus*. *Can.Fld. Nat.* 107:490-508.
- Whitehead, H., S. Gowans, A. Faucher, and S.W. McCarrey. 1997. Population analysis of northern bottlenose whales in the Gully, Nova Scotia. *Mar. Mamm. Sci.* 13(2): 173-185.
- Wade P.R., and R.P. 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-OPR-12, 93 pp.

WHITE-BEAKED DOLPHIN (*Lagenorhynchus albirostris*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

White-beaked dolphins are the more northerly of the two species of *Lagenorhynchus* in the North West Atlantic (Leatherwood *et al.* 1976). The species is found in waters from southern New England, north to western and southern Greenland and Davis Straits (Leatherwood *et al.* 1976; CETAP 1982), in the Barents Sea and south to at least Portugal (Reeves *et al.*, in press). Differences in skull features indicate that there are at least two separate stocks, one in the eastern and one in the western North Atlantic (Mikkelsen and Lund 1994). No genetic analyzes have been conducted to distinguish the stock structure.

In waters off the northeastern U.S. coast, white-beaked dolphin sightings have been concentrated in the western Gulf of Maine and around Cape Cod (CETAP 1982). The limited distribution of this species in U.S. waters has been attributed to opportunistic feeding (CETAP 1982). Prior to the 1970's, white-sided dolphins (*L. acutus*) in U.S. waters were found primarily offshore on the continental slope, while white-beaked dolphins were found on the continental shelf. During the 1970's, there was an apparent switch in habitat use between these two species. This shift may have been a result of the increase in sand lance in the continental shelf waters (Katona *et al.* 1993; Kenny *et al.* 1996).

POPULATION SIZE

The total number of white-beaked dolphins in U.S. and Canadian waters is unknown, although one abundance estimate is available for part of the known habitat in U.S. waters, and two estimates are from Canadian waters (Table 1).

A population size of 573 white-beaked dolphins (CV=0.69) was estimated from an aerial survey program conducted from 1978 to 1982 on the continental shelf and shelf edge waters between Cape Hatteras, North Carolina and Nova Scotia (Table 1; CETAP 1982). The estimate is based on spring data because the greatest proportion of the population off the northeast U.S. coast appeared in the study area during this season. This estimate does not include a correction for dive-time or $g(0)$, the probability of detecting an animal group on the track line. This estimate may not reflect the current true population size because of its high degree of uncertainty (e.g., large CV), its old age, and it was estimated just after cessation of extensive foreign fishing operations in the region.

A population size of 5,500 white-beaked dolphins was based on an aerial survey off eastern Newfoundland and southeastern Labrador (Table 1; Alling and Whitehead 1987).

A population size of 3,486 white-beaked dolphins [95% confidence interval (CI) = 2,001-4,971] was estimated from a ship-based survey of a small segment of the Labrador Shelf in August 1982 (Table 1; Alling and Whitehead 1987). A CV was not given, but, assuming a symmetric CI, it would be 0.22.

There are no abundance estimates for this species in waters between the Gulf of Maine and the Newfoundland/Labrador region.

Table 1. Summary of abundance estimates for western North Atlantic white-beaked dolphins. Month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV). Unk=unknown.

Month/Year	Area	N_{best}	CV
spring 1978-82	Cape Hatteras, NC to Nova Scotia	573	0.69
1980's	E. Newfoundland and SE Labrador	5,500	None reported
August 1982	Labrador shelf	3,486	0.22

Minimum Population Estimate

Present data are insufficient to calculate a minimum population estimate in U.S. Exclusive Economic Zone (EEZ) waters.

Current Population Trend

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

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. 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 of white-beaked dolphins is unknown. 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 western North Atlantic white-beaked dolphin is unknown.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

White-beaked dolphins have been taken in cod traps and the Canadian groundfish gillnet fisheries off Newfoundland and Labrador and in the Gulf of St. Lawrence (Alling and Whitehead 1987; Read 1994; Hai *et al.* 1996); however, the total number of animals taken is not known.

There are no documented reports of fishery-related mortality or serious injury to this stock in the U.S. EEZ.

Fishery Information

Because of the absence of observed fishery-related mortality and serious injury to this stock in the U.S. EEZ, no U.S. fishery information is provided.

The Canadian Atlantic groundfish gillnet fishery is important and widespread. Many fishermen 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. About 3,900 licenses were issued in 1989 in the Gulf of St. Lawrence and 659 licenses were issued in the Bay of Fundy and southwestern Nova Scotia.

Other Mortality

White-beaked dolphins were hunted for food by residents in Newfoundland and Labrador (Alling and Whitehead 1987). These authors, based on interview data, estimated that 366 white-beaked dolphins were taken each year. The same authors reported that 25-50% of the killed dolphins were lost.

STATUS OF STOCK

The status of white-beaked dolphins, relative to OSP, in U.S. Atlantic coast waters is unknown. They are not listed as threatened or endangered under the Endangered Species Act. There are insufficient data to determine population trends for this species. Because there are insufficient data to calculate PBR it is not possible to determine if stock is strategic and if the total fishery-related mortality and serious injury for this stock is significant and approaching zero mortality and serious injury rate. However, because this stock has a marginal occurrence in U.S. waters and there are no documented takes in U.S. waters, this stock has been designated as not strategic.

REFERENCES

- Alling, A. K. and H. P. Whitehead. 1987. A preliminary study of the status of white-beaked dolphins, *Lagenorhynchus albirostris*, and other small cetaceans off the coast of Labrador. *Can.Fld. Nat.* 101(2): 131-135.
- Barlow, J., S. L. Swartz, T. C. Eagle, and P. R. Wade. 1995. U.S. Marine mammal stock assessments: Guidelines for preparation, background, and a summary of the 1995 assessments. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-OPR-6, 73 pp.
- 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 #AA551-CT8-48 to the Bureau of Land Management, Washington, DC, 538 pp.
- Hai, D.J., J. Lein, D. Nelson, and K. Curren. 1996. A contribution to the biology of the white-sided dolphin, *Lagenorhynchus albirostris*, in waters off Newfoundland. *Can..Fld. Nat.* 110(1).
- Katona, S. K., V. Rough, and D. T. Richardson. 1993. A field guide to whales, porpoises, and seals from Cape Cod to Newfoundland. Washington, D. C. : *Smithsonian Institution Press*. 316 pp.
- Kenney, R. D., P. M. Payne, D. W. Heineman and H. E. Winn. 1996. Shifts in Northeast shelf cetacean distributions relative to trends in Gulf of Maine/Georges Bank finfish abundance. Pp. 169-196. *In*: K. Sherman, N.A. Jaworski and T. Smada (eds.) *The northeast shelf ecosystem: assessment, sustainability, and management*. Blackwell Science, Cambridge, MA 02142, USA.
- 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.
- Mikkelsen, A.M.H. and A. Lund. 1994. Intraspecific variation in the dolphins *Lagenorhynchus albirostris* and *L. acutus* (Mammalia: Cetacea) in metrical and non-metrical skull characters, with remarks on occurrence. *J. Zool., Lond.* 234:289-299.
- Read, A. J. 1994. Interactions between cetaceans and gillnet and trap fisheries in the northwest Atlantic. *Rep. int. Whal. Commn. Special Issue 15: 133-147*.
- Reeves, R.R., R. L. Brownell Jr., C. C. Kinze, C. Smeenk and J. Lein. (in press). White-beaked dolphin (*Lagenorhynchus albirostris* (Gray 1846). *In*: S.H. Ridgway and R. Harrison (eds.) *Handbook of marine mammals, Vol 6*.
- Wade, P. R. and R. P. 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-OPR-12, 93 pp.

ATLANTIC SPOTTED DOLPHIN (*Stenella frontalis*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

There are two species of spotted dolphin in the Western Atlantic — the Atlantic spotted dolphin, *Stenella frontalis*, formerly *S. plagiodon* (Perrin *et al.* 1987), and the pantropical spotted dolphin, *S. attenuata*. These species are difficult to differentiate at sea.

Atlantic spotted dolphins are distributed in tropical and warm temperate waters of the western North Atlantic (Leatherwood *et al.* 1976). Their distribution is from southern New England, south through the Gulf of Mexico and the Caribbean to Venezuela (Leatherwood *et al.* 1976; Perrin *et al.* 1994). The large, heavily spotted form of the Atlantic spotted dolphin along the southeastern and Gulf coasts of the United States, which may warrant designation as a distinct sub-species (Rice 1998), inhabits the continental shelf, usually being found inside or near the 200 m isobath (within 250-350 km of the coast) but sometimes coming into very shallow water adjacent to the beach (Figure 1). Off the northeast USA coast, spotted dolphins are widely distributed on the continental shelf, along the continental shelf edge, and offshore over the deep ocean south of 40° N (CETAP 1982). Atlantic spotted dolphins regularly occur in the inshore waters south of Chesapeake Bay and near the continental shelf edge and continental slope waters north of this region (Payne *et al.* 1984; Mullin in review). Sightings have also been made along the north wall of the Gulf Stream and warm-core ring features (Waring *et al.* 1992). Stock structure in the western North Atlantic is unknown.

POPULATION SIZE

Total numbers of Atlantic spotted dolphins off the USA or Canadian Atlantic coast are unknown, although three estimates from selected regions of the habitat do exist for select time periods. Because *S. frontalis* and *S. attenuata* are difficult to differentiate at sea, the reported abundance estimates, prior to 1998, are for both species of spotted dolphins combined. Sightings were almost exclusively in the continental shelf edge and continental slope areas west of Georges Bank (Figure 1). An abundance of 6,107 undifferentiated spotted dolphins (CV=0.27) was estimated from an aerial survey program conducted from 1978 to 1982 on the continental, shelf and shelf edge waters between Cape Hatteras, North Carolina and Nova Scotia (CETAP 1982). As recommended in the GAMS Workshop Report (Wade and Angliss 1997), estimates older than eight years are deemed unreliable, therefore should not be used for PBR determinations. Further, due to changes in survey methodology these data should not be used to make comparisons to more current estimates.

An abundance of 4,772 (CV=1.27) undifferentiated spotted dolphins was estimated from a July to September 1995 sighting survey conducted by two ships and an airplane that covered waters from Virginia to the mouth of the Gulf of St. Lawrence (Table 1; Palka *et al.* in review). Total track line length was 32,600 km. The ships covered waters between the 50 and 1000 fathom depth contour lines, the northern edge of the Gulf Stream, and the northern Gulf of

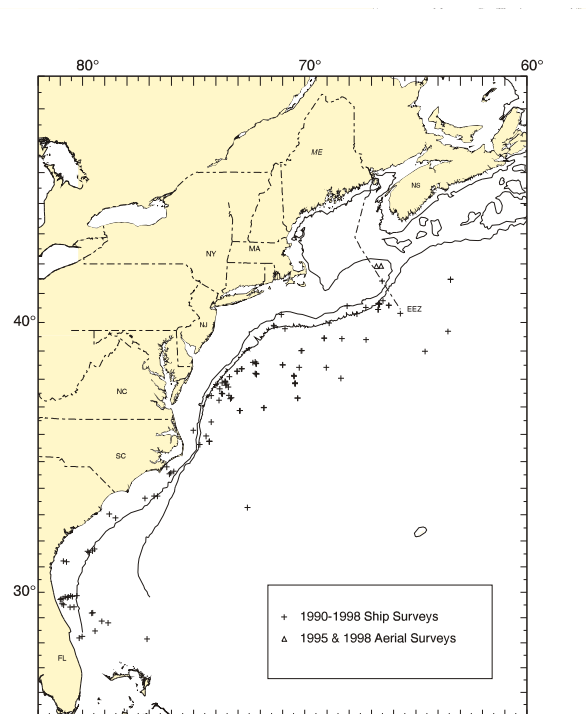


Figure 1. Distribution of spotted dolphin sightings from NEFSC and SEFSC shipboard and aerial surveys during the summer in 1990-1998. Isobaths are at 100 m and 1,000 m.

Maine/Bay of Fundy region. The airplane covered waters in the mid-Atlantic from the coastline to the 50 fathom depth contour line, the southern Gulf of Maine, and shelf waters off Nova Scotia from the coastline to the 1000 fathom depth contour line. Data collection and analysis methods used were described in Palka (1996).

An abundance of 32,043 (CV=1.39) for offshore Atlantic spotted dolphins was estimated from a line transect sighting survey conducted during July 6 to September 6, 1998 by a ship and plane that surveyed 15,900 km of track line in waters north of Maryland (38° N) (Figure 1; Palka *et al.* in review). Shipboard data were analyzed using the modified direct duplicate method (Palka 1995) that accounts for school size bias and $g(0)$, the probability of detecting a group on the track line. Aerial data were not corrected for $g(0)$.

An abundance of 4,396 (CV=0.62) for offshore, and 15,840 (CV=0.60) for coastal Atlantic spotted dolphins was estimated from a shipboard line transect sighting survey conducted between 8 July and 17 August 1998 that surveyed 5,570 km of track line in waters south of Maryland (38° N) (Figure 1; Mullin in review). Abundance estimates were made using the program DISTANCE (Buckland *et al.* 1993; Laake *et al.* 1993) where school size bias and ship attraction were accounted for.

The best available abundance estimate for the Atlantic spotted dolphins is the sum of the estimates from the two 1998 USA Atlantic surveys, 52,279 (CV=0.87), where the estimate from the northern USA Atlantic is 32,043 (CV=1.39) and estimates from the southern USA Atlantic are 4,396 (CV=0.62) and 15,840 (CV=0.60). At their November 1999 meeting, the Atlantic SRG recommended that, without a genetic determination of stock structure, the abundance estimates for the coastal and offshore forms should be combined. This joint estimate is considered best because together these two surveys have the most complete coverage of the species' habitat.

Table 1. Summary of abundance estimates for both undifferentiated spotted dolphins (1995), and differentiated Atlantic spotted dolphins (1998). 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-Sep 1995	Virginia to Gulf of St. Lawrence	4,772 ¹	1.27
Jul-Sep 1998	Maryland to Gulf of St. Lawrence	32,043 ²	1.39
Jul-Aug 1998	Florida to Maryland	4,396 ²	0.62
Jul-Sep 1998	Gulf of St. Lawrence to Florida (COMBINED)	36,439 ³	1.22
Jul-Aug 1998	Florida to Maryland	15,840 ⁴	0.60

¹ Because of uncertain species identification in the 1995 survey, all spotted dolphins were lumped together.

² This represents the first estimate for the offshore Atlantic spotted dolphin.

³ This is the combined estimate for the two survey regions

⁴ This represents the first estimate for the coastal Atlantic spotted dolphin

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). Until more definitive stock identification (*i.e.*, genetic analysis) work is completed, the Atlantic Scientific Review Group recommends that the best estimate of abundance for Atlantic spotted dolphins is the combined estimates for the offshore 15,840 (CV=0.60) and coastal 36,439 (CV=1.22) forms of Atlantic spotted dolphins. This estimate is 52,279 (CV=0.87). The minimum population estimates based on the combined offshore and coastal abundance estimates is 27,785 (CV=0.87).

Current Population Trend

There are insufficient data to determine the population trends for this species, given that surveys prior to 1998 did not differentiate between species of spotted dolphins.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a “recovery” factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size for the combined offshore and coastal ‘forms’ of Atlantic spotted dolphins is 52,279 (CV=0.87). 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 set to 0.5 because this stock is of unknown status. PBR for the combined offshore and coastal forms of Atlantic spotted dolphins is 278 (CV=0.87).

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Total annual estimated average fishery-related mortality or serious injury to this stock during 1994-1998 was 7.8 undifferentiated spotted dolphins (*Stenella* spp.) CV=0.01; Table 2).

Fishery Information

No spotted dolphin mortalities were observed in 1977-1991 foreign fishing activities. Data on current incidental takes in USA 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. Total fishery-related mortality and serious injury cannot be estimated separately for the two species of spotted dolphins in the USA Atlantic Exclusive Economic Zone (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.

Bycatch has been observed by NMFS Sea Samplers in the pelagic drift gillnet and pelagic longline fisheries, but no mortalities or serious injuries have been documented in the pelagic pair trawl, Northeast multispecies sink gillnet, mid-Atlantic coastal gillnet, and North Atlantic bottom trawl fisheries; and no takes have been documented in a review of Canadian gillnet and trap fisheries (Read 1994).

Pelagic Drift Gillnet

The estimated total number of hauls in the 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, 1993, 1994, 1995, 1996, and 1998 were 233, 243, 232, 197, 164, 149, and 113 respectively. In 1996 and 1997, NMFS issued management regulations which prohibited the operation of this fishery in 1997. Further, in January 1999 NMFS issued a Final Rule to prohibit the use of driftnets (*i.e.*, permanent closure) in the North Atlantic swordfish fishery (50 CFR Part 630). Fifty-nine different vessels participated in this fishery at one time or another between 1989 and 1993. Since 1994, between 10- and 13 vessels have participated in the fishery (Table 2). 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, 99% in 1995, 64% in 1996, and 99% in 1998. 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 pelagic drift gillnet fishery be stratified into two strata, a southern or winter stratum, and a northern or summer stratum. Estimates of the total bycatch, from 1989 to 1993, were obtained using the aggregated (pooled 1989-1993) catch rates, by strata (Northridge 1996). Estimates of total annual bycatch 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 self-reported fisheries information. Variances were estimated using bootstrap re-sampling techniques. Forty-nine undifferentiated spotted dolphins mortalities were observed in the drift gillnet fishery between 1989 and 1998 and occurred northeast of Cape Hatteras within the 183 m isobath in February-April, and near Lydonia Canyon in October. Six whole animal carcasses that were sent to the Smithsonian were identified as Pantropical spotted dolphins (*S. attenuata*). The remaining animals were not identified to species. Estimated annual mortality and serious injury attributable to this fishery (CV in parentheses) was 25 in 1989 (.65), 51 in 1990 (.49), 11 in 1991 (.41), 20 in 1992 (0.18), 8.4 in 1993 (0.40), 29 in 1994 (0.01), 0 in 1995, 2 in 1996 (0.06), NA in 1997, and 0 in 1998; average annual mortality and serious injury during 1994-1998 was 7.8 (0.01) (Table 2). **Pelagic Longline**

The pelagic longline fishery operates in the USA Atlantic (including Caribbean) and Gulf of Mexico EEZ (SEFSC unpublished data). Interactions between the pelagic longline fishery and spotted dolphins 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 effort, excluding the Gulf of Mexico, for the pelagic longline fishery, based on mandatory self-reported fisheries information, was 11,279 sets in 1991, 9,869 sets in 1992, 9,862 sets in 1993, 9,481 sets in 1994, 10,129 sets in 1995, 9,885 sets in 1996, 8,023 sets in 1997, and 6,675 sets in 1998 (Cramer 1994; Scott and Brown 1997; Johnson *et al.* 1999; Yeung 1999b). Since 1992, this fishery has been monitored with about 5% observer coverage, in terms of trips observed, within every statistical reporting area within the EEZ and beyond. Off the USA Atlantic coast, 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. The 1994-1998, estimated take was based on a revised analysis of the observed incidental take and self-reported incidental take and effort data, and replace previous estimates for the 1992-1993 and 1994-1995 periods (Cramer 1994; Scott and Brown 1997; Johnson *et al.* 1999; Yeung 1999a). Further, Yeung (1999b), revised the 1992-1997 fishery mortality estimates in Johnson *et al.* (1999) to include seriously injured animals. The 1998 bycatch estimates were from Yeung (1999a). Most of the estimated marine mammal bycatch was from EEZ waters between South Carolina and Cape Cod (Johnson *et al.* 1999). Excluding the Gulf of Mexico where one animal was hooked and released alive (Appendix 1), no Atlantic spotted dolphin bycatches were observed for 1992-1998.

Table 2. Summary of the incidental mortality of undifferentiated spotted dolphins (*Stenella* sp.) 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	Observed Serious Injury	Observer Coverage ²	Observed Mortality	Estimated Mortality ⁵	Estimated CVs	Mean Annual Mortality
Pelagic Drift Gillnet ⁶	94-98	1994=11 ³ 1995=12 1996=10 1998=13	Obs. Data Logbook	0, 0, 0, 0, 0	.87, .99, .64, NA, .99	29, 0, 2, NA, 0	29, 0, 2 ⁴ , NA, 0	.01, 0, 0, NA, 0	7.75 (0.01)
TOTAL									7.8 (0.01)

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. 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 pelagic drift gillnet and pair trawl fishery is measured in terms of sets, and the longline fishery is in trips.

³ 1994, 1995, 1996, and 1998 shown, other years not available on an annual basis.

⁴ Estimates were based on two seasons. The two observed takes were during the winter season when observer coverage was 100%.

⁵ Annual mortality estimates include animals seriously injured and released alive.

⁶ The fishery did not operate in 1997; the average annual mortality is based on the number of years (4; 1994-1998) that the fishery operated.

Other Mortality

From 1995-1998, thirteen Atlantic spotted dolphins were stranded between North Carolina and Florida (NMFS unpublished data).

STATUS OF STOCK

The status of Atlantic spotted dolphins, relative to OSP in the USA Atlantic EEZ is unknown. The species is not listed as threatened or endangered under the Endangered Species Act. There are insufficient data to determine the population trends for this species. Total fishery-related mortality and serious injury for this stock is less than 10% of the calculated PBR and, therefore, can be considered to be insignificant and approaching zero mortality and serious injury rate. Average annual fishery-related mortality and serious injury does not exceed the PBR; therefore, this is not a strategic stock.

REFERENCES

- Barlow, J., S. L. Swartz, T. C. Eagle and P. R. Wade. 1995. U.S. Marine Mammal Stock Assessments: Guidelines for Preparation, Background, and a Summary of the 1995 Assessments. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-OPR-6, 73 pp.
- Buckland, S. T., D. R. Andersen, K. P. Burnham and J. L. Laake. 1993. Distance Sampling: Estimating abundance of biological populations. *Chapman and Hall*, New York, 446 pp.
- 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.
- Cramer, J. 1994. Large pelagic logbook newsletter - 1993. NOAA Tech. Mem. NMFS-SEFSC-352, 19 pp.
- Johnson, D. R., C. A. Brown, and C. Yeung. 1999. Estimates of marine mammal and marine turtle catch by the U.S. Atlantic pelagic longline fleet in 1992-1997. SEFSC PRD-98/99-03. 68 pp.
- Laake, J. L., S. T. Buckland, D. R. Anderson and K. P. Burnham. 1993. DISTANCE user's guide, V2.0. Colorado Cooperative Fish & Wildlife Research Unit, Colorado State University, Ft. Collins, Colorado, 72 pp.
- Leatherwood, S., D. K. Caldwell and H. E. Winn. 1976. Whales, dolphins, and porpoises of the western North Atlantic. A guide to their identification. NOAA Tech. Rep. NMFS Circ. 396, U.S. Dept. Commer. Washington, DC 176 pp.
- Mullin, K. D. (in review). Abundance and distribution of cetaceans in the southern U.S. Atlantic Ocean during summer 1998. *Fish. Bull., U.S.*
- Northridge, S. 1996. Estimation of cetacean mortality in the U.S. Atlantic swordfish and tuna drift gillnet and pair trawl fisheries. Final report to the Northeast Fisheries Science Center, Contract No. 40ENNF500160.
- Palka, D. 1995. Abundance estimate of the Gulf of Maine harbor porpoise. Rep. int Whal. Commn. Special Issue 16:27-50.
- Palka, D. 1996. Update on abundance of Gulf of Maine/Bay of Fundy harbor porpoises. NOAA/NMFS/NEFSC. Ref. Doc. 96-04; 37 pp. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026.
- Palka, D., G. Waring, and D. Potter. (in review). Abundances of cetaceans and sea turtles in the northwest Atlantic during summer 1995 and 1998. *Fish. Bull., U.S.*
- Payne, P. M., L. A. Selzer and A. R. Knowlton. 1984. Distribution and density of cetaceans, marine turtles, and seabirds in the shelf waters of the northeastern United States, June 1980-December 1983, based on shipboard observations. NOAA/NMFS Contract No. NA-81-FA-C-00023.
- Perrin, W. F., E. D. Mitchell, J. G. Mead, D. K. Caldwell, M. C. Caldwell, P. J. H. van Bree, and W. H. Dawbin. 1987. Revision of the spotted dolphins, *Stenella* sp. *Mar. Mammal Sci.* 3(2):99-170.
- Perrin, W. F., D. K. Caldwell, and M. C. Caldwell. 1994. Atlantic spotted dolphin. Pages 173-190. In: S. H. Ridgway and R. Harrison (eds.). *Handbook of marine mammals, Volume 5: The first book of dolphins*. Academic Press, San Diego, 418 pp.
- Rice, D. W. 1998. *Marine mammals of the world, systematics and distribution*. Spec. Publ. No 4. Society for Marine Mammalogy, Lawrence, KS. 231 pp.
- Scott, G. P. and C. A. Brown. 1997. Estimates of marine mammal and marine turtle catch by the U.S. Atlantic pelagic longline fleet in 1994-1995. Miami Laboratory Contribution MIA-96/97-28

- Wade, P. R., and R. P. 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-OPR-12, 93 pp.
- Waring, G. T., C. P. Fairfield, C. M. Ruhsam and M. Sano. 1992. Cetaceans associated with Gulf Stream features off the northeastern USA shelf. ICES Marine Mammals Comm. CM 1992/N:12, 29 pp.
- Yeung, C. 1999a. Estimates of marine mammal and marine turtle bycatch by the U.S. Atlantic pelagic longline fleet in 1998. NOAA Technical Memorandum NMFS-SEFSC-430, 26 pp.
- Yeung, C. 1999b. Revised Mortality Estimates of Marine Mammal Bycatch in 1992-1997 based on Serious Injury Guidelines. NOAA Technical Memorandum NMFS-SEFSC-429, 23 pp.

PANTROPICAL SPOTTED DOLPHIN (*Stenella attenuata*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

There are two species of spotted dolphin in the Western Atlantic — the Atlantic spotted dolphin, *Stenella frontalis*, formerly *S. plagiodon* (Perrin *et al.* 1987), and the pantropical spotted dolphin, *S. attenuata*. These species are difficult to differentiate at sea.

The pantropical spotted dolphin is distributed worldwide in tropical and some sub-tropical oceans (Perrin *et al.* 1987; Perrin and Hohn 1994). Sightings of this species in the northern Gulf of Mexico occur over the deeper waters, and rarely over the continental shelf or continental shelf edge (Mullin *et al.* 1991; SEFSC, unpublished data). Pantropical spotted dolphins were seen in all seasons during recent seasonal aerial surveys of the northern Gulf of Mexico, and during recent winter aerial surveys offshore of the southeastern USA Atlantic coast (SEFSC unpublished data). Some of the Pacific populations have been divided into different geographic stocks based on morphological characteristics (Perrin *et al.* 1987; Perrin and Hohn 1994); however, there is no information on stock differentiation in the Atlantic population.

POPULATION SIZE

Total numbers of pantropical spotted dolphins off the USA or Canadian Atlantic coast are unknown, although three estimates from selected regions of the habitat do exist for select time periods. Because *S. frontalis* and *S. attenuata* are difficult to differentiate at sea, the reported abundance estimates, prior to 1998, are for both species of spotted dolphins combined. Sightings were almost exclusively in the continental shelf edge and continental slope areas west of Georges Bank (Figure 1). An abundance of 6,107 undifferentiated spotted dolphins (CV=0.27) was estimated from an aerial survey program conducted from 1978 to 1982 on the continental, shelf and shelf edge waters between Cape Hatteras, North Carolina and Nova Scotia (CETAP 1982). As recommended in the GAMS Workshop Report (Wade and Angliss 1997), estimates older than eight years are deemed unreliable, therefore should not be used for PBR determinations. Further, due to changes in survey methodology these data should not be used to make comparisons to more current estimates.

An abundance of 4,772 (CV=1.27) undifferentiated spotted dolphins was estimated from a July to September 1995 sighting survey conducted by two ships and an airplane that covered waters from Virginia to the mouth of the Gulf of St. Lawrence (Table 1; Palka *et al.* in review). Total track line length was 32,600 km. The ships covered waters between the 50 and 1000 fathom depth contour lines, the northern edge of the Gulf Stream, and the northern Gulf of Maine/Bay of Fundy region. The airplane covered waters in the mid-Atlantic from the coastline to the 50 fathom depth contour line, the southern Gulf of Maine,

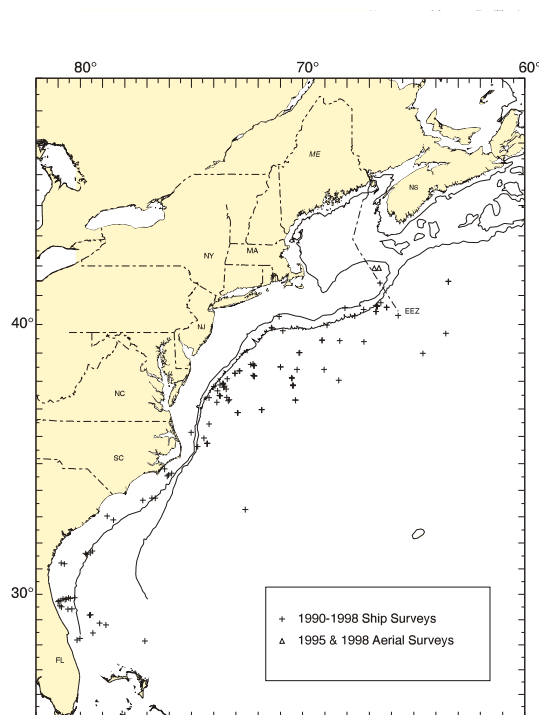


Figure 1. Distribution of spotted dolphin sightings from NEFSC and SEFSC shipboard and aerial surveys during the summer in 1990-1998. Isobaths are at 100 m and 1,000 m.

and shelf waters off Nova Scotia from the coastline to the 1000 fathom depth contour line. Data collection and analysis methods used were described in Palka (1996).

An abundance of 343 (CV=1.03) for pantropical spotted dolphins was estimated from a line transect sighting survey conducted during July 6 to September 6, 1998 by a ship and plane that surveyed 15,900 km of track line in waters north of Maryland (38° N) (Figure 1; Palka *et al.* in review). Shipboard data were analyzed using the modified direct duplicate method (Palka 1995) that accounts for school size bias and $g(0)$, the probability of detecting a group on the track line. Aerial data were not corrected for $g(0)$.

An abundance of 12,774 (CV=0.57) for pantropical spotted dolphins was estimated from a shipboard line transect sighting survey conducted between 8 July and 17 August 1998 that surveyed 5,570 km of track line in waters south of Maryland (38°N) (Figure 1; Mullin in review). Abundance estimates were made using the program DISTANCE (Buckland *et al.* 1993; Laake *et al.* 1993) where school size bias and ship attraction were accounted for.

The best available abundance estimate for pantropical spotted dolphins is the sum of the estimates from the two 1998 USA Atlantic surveys, 13,117 (CV=0.36), where the estimate from the northern USA Atlantic is 343 (CV=1.03) and from the southern USA Atlantic is 12,774 (CV=0.57). This joint estimate is considered best because together these two surveys have the most complete coverage of the species' habitat.

Table 1. Summary of abundance estimates for both undifferentiated spotted dolphins (1995), and differentiated pantropical spotted dolphins (1998). 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-Sep 1995	Virginia to Gulf of St. Lawrence	4,772 ¹	1.27
Jul-Sep 1998	Maryland to Gulf of St. Lawrence	343 ²	1.03
Jul-Aug 1998	Florida to Maryland	12,774 ²	0.57
Jul-Aug 1998	Gulf of St. Lawrence to Florida (COMBINED)	13,117 ³	0.56

¹ Because of uncertain species identification in the 1995 survey, all spotted dolphins were lumped together.

² This represents the first estimates for pantropical spotted dolphin.

³ This represents the combined estimates for both regions.

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 pantropical spotted dolphins is 13,117 (CV=0.56). The minimum population estimate for pantropical spotted dolphins is 8,450 (CV=0.56).

Current Population Trend

There are insufficient data to determine the population trends for this species, because prior to 1998 spotted dolphins (*Stenella* spp) were not differentiated during surveys.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a "recovery" factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size for the pantropical spotted dolphins is 8,450 (CV=0.56). 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 pantropical dolphins is 84.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Total annual estimated average fishery-related mortality or serious injury to this stock during 1994-1998 was 7.8 undifferentiated spotted dolphins (*Stenella* sp.) CV=0.01; Table 2).

Fisheries Information

No spotted dolphin mortalities were observed in 1977-1991 foreign fishing activities. Data on current incidental takes in USA 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. Total fishery-related mortality and serious injury cannot be estimated separately for the two species of spotted dolphins in the USA Atlantic Exclusive Economic Zone (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.

Bycatch has been observed by NMFS Sea Samplers in the pelagic drift gillnet and pelagic longline fisheries, but no mortalities or serious injuries have been documented in the pelagic pair trawl, Northeast multispecies sink gillnet, mid-Atlantic coastal gillnet, and North Atlantic bottom trawl fisheries; and no takes have been documented in a review of Canadian gillnet and trap fisheries (Read 1994).

Pelagic Drift Gillnet

The estimated total number of hauls in the 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, 1993, 1994, 1995, 1996, and 1998 were 233, 243, 232, 197, 164, 149, 113 respectively. In 1996 and 1997, NMFS issued management regulations which prohibited the operation of this fishery in 1997. Further, in January 1999 NMFS issued a Final Rule to prohibit the use of driftnets (*i.e.*, permanent closure) in the North Atlantic swordfish fishery (50 CFR Part 630). Fifty-nine different vessels participated in this fishery at one time or another between 1989 and 1993. Since 1994, between 10 and 13 vessels have participated in the fishery (Table 2). 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, 99% in 1995, 64% in 1996, and 99% 1998. 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 pelagic drift gillnet fishery be stratified into two strata, a southern or winter stratum, and a northern or summer stratum. Estimates of the total bycatch, from 1989 to 1993, were obtained using the aggregated (pooled 1989-1993) catch rates, by strata (Northridge 1996). Estimates of total annual bycatch 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 self-reported fisheries information. Variances were estimated using bootstrap re-sampling techniques. Forty-nine spotted dolphin mortalities were observed in the drift gillnet fishery between 1989 and 1998 and occurred northeast of Cape Hatteras within the 183 m isobath in February-April, and near Lydonia Canyon in October. Six whole animal carcasses that were sent to the Smithsonian were identified as Pantropical spotted dolphins (*S. attenuata*). The remaining animals were not identified to species. Estimated annual mortality and serious injury attributable to this fishery (CV in parentheses) was 25 in 1989 (.65), 51 in 1990 (.49), 11 in 1991 (.41), 20 in 1992 (0.18), 8.4 in 1993 (0.40), 29 in 1994 (0.01), 0 in 1995, 2 in 1996 (0.06), NA in 1997, and 0 in 1998; average annual mortality and serious injury during 1994-1998 was 7.8 (0.01) (Table 2).

Pelagic Longline

The pelagic longline fishery operates in the USA Atlantic (including Caribbean) and Gulf of Mexico EEZ (SEFSC unpublished data). Interactions between the pelagic longline fishery and spotted dolphins 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 effort, excluding the Gulf of Mexico, for the pelagic longline fishery, based on mandatory self-reported fisheries information, was 11,279 sets in 1991, 9,869 sets in 1992, 9,862 sets in 1993, 9,481 sets in 1994, 10,129 sets in 1995, 9,885 sets in 1996, 8,023 sets in 1997, and 6,675 sets in 1998 (Cramer 1994; Scott and Brown 1997; Johnson *et al.* 1999; Yeung, 1999a). Since 1992, this fishery has been monitored with about 5% observer coverage, in terms of trips observed, within every statistical reporting area within the EEZ and beyond. Off the USA Atlantic coast, 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. The 1994-1998, estimated take was based on a revised analysis of the observed incidental take and self-reported incidental take and effort data, and replace previous estimates for the 1992-1993 and 1994-1995 periods (Cramer 1994; Scott and Brown 1997; Johnson *et al.* 1999; Yeung 1999b). Further, Yeung (1999b), revised the 1992-1997 fishery mortality estimates in Johnson *et al.* (1999) to include seriously injured animals. The 1998 bycatch estimates were from Yeung (1999a). Most of the estimated marine mammal bycatch was from EEZ waters between South Carolina and Cape Cod (Johnson *et al.* 1999). Excluding the Gulf of Mexico where one animal was hooked and released alive (Appendix 1), no pantropical spotted dolphin bycatches were observed for 1992-1998.

Table 2. Summary of the incidental mortality of undifferentiated spotted dolphins (*Stenella* sp.) 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	Observed Serious Injury	Observer Coverage ²	Observed Mortality	Estimated Mortality ³	Estimated CVs	Mean Annual Mortality
Pelagic ⁴ Drift Gillnet	94-98	1994=11 ⁵ 1995=12 1996=10 1998=13	Obs. Data Logbook	0, 0, 0, 0, 0	.87, .99, .64, NA, .99	29, 0, 2, NA, 0	29, 0, 2 ⁴ , NA, 0	.01, 0, 0, NA, 0	7.8 (0.01)
TOTAL									7.8 (0.01)

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. 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 pelagic drift gillnet and pair trawl fishery is measured in terms of sets, and the longline fishery is in trips.

³ 1994, 1995, 1996 and 1998 shown, other years not available on an annual basis.

⁴ Estimates were based on two seasons. The two observed takes were during the winter season when observer coverage was 100%.

⁵ Annual mortality estimates include animals seriously injured and released alive.

⁶ The fishery did not operate in 1997; the average annual mortality is based on the number of years (4; 1994-1998) that the fishery operated.

Other Mortality

From 1995-1998, 15 pantropical spotted dolphins were stranded between North Carolina and Florida (NMFS unpublished data). The 15 mortalities includes the 1996 mass stranding of 11 animals in Florida (NMFS unpublished data).

STATUS OF STOCK

The status of pantropical spotted dolphins, relative to OSP in the USA Atlantic EEZ is unknown. The species is not listed as threatened or endangered under the Endangered Species Act. There are insufficient data to determine the population trends for this species. Total fishery-related mortality and serious injury for this stock is less than 10% of the calculated PBR and, therefore, can be considered to be insignificant and approaching zero mortality and serious injury rate. Average annual fishery-related mortality and serious injury does not exceed the PBR; therefore, this is not a strategic stock

REFERENCES

- Barlow, J., S. L. Swartz, T. C. Eagle, and P. R. Wade. 1995. U.S. Marine Mammal Stock Assessments: Guidelines for Preparation, Background, and a Summary of the 1995 Assessments. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-OPR-6, 73 pp.
- Buckland, S. T., D. R. Anderson, K. P. Burnham and J. L. Laake. 1993. Distance sampling: estimating abundance of biological populations. Chapman and Hall, New York, NY, 442 pp.
- 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.
- Cramer, J. 1994. Large pelagic logbook newsletter - 1993. NOAA Tech. Mem. NMFS-SEFSC-352, 19 pp.
- Johnson, D. R., C. A. Brown, and C. Yeung. 1999. Estimates of marine mammal and marine turtle catch by the U.S. Atlantic pelagic longline fleet in 1992-1997. SEFSC PRD-98/99-03. 68 pp.
- Laake, J. L., S. T. Buckland, D. R. Anderson and K. P. Burnham. 1993. DISTANCE user's guide, V2.0. Colorado Cooperative Fish & Wildlife Research Unit, Colorado State University, Ft. Collins, Colorado, 72 pp.
- Mullin, K. D. (in review). Abundance and distribution of cetaceans in the southern U.S. Atlantic Ocean during summer 1998. *Fish. Bull., U.S.*
- Mullin, K., W. Hoggard, C. Roden, R. Lohofener, C. Rogers and B. Taggart. 1991. Cetaceans on the upper continental slope in the north-central Gulf of Mexico. OCS Study/MMS 91-0027. U.S. Dept. of the Interior, Minerals Management Service, Gulf of Mexico OCS Regional Office, New Orleans, Louisiana, 108 pp.
- Northridge, S. 1996. Estimation of cetacean mortality in the U.S. Atlantic swordfish and tuna drift gillnet and pair trawl fisheries. Final report to the Northeast Fisheries Science Center, Contract No. 40ENNF5001 60.
- Palka, D. 1995. Abundance estimate of the Gulf of Maine harbor porpoise. Rep. int Whal. Commn. Special Issue 16:27-50.
- Palka, D. 1996. Update on abundance of Gulf of Maine/Bay of Fundy harbor porpoises. NOAA/NMFS/NEFSC. Ref. Doc. 96-04; 37p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026.
- Palka, D., G. Waring, and D. Potter. (in review). Abundances of cetaceans and sea turtles in the northwest Atlantic during summer 1995 and 1998. *Fish. Bull., U.S.*
- Perrin, W. F., E. D. Mitchell, J. G. Mead, D. K. Caldwell, M. C. Caldwell, P. J. H. van Bree, and W. H. Dawbin. 1987. Revision of the spotted dolphins, *Stenella* sp. *Mar. Mammal Sci.* 3(2):99-170.
- Perrin, W. F., D. K. Caldwell, and M. C. Caldwell. 1994. Atlantic spotted dolphin. Pages 173-190. In: S. H. Ridgway and R. Harrison (eds.). Handbook of marine mammals, Volume 5: The first book of dolphins. *Academic Press*, San Diego, 418 pp.
- Perrin, W. F. and A. A. Hohn. 1994. Pantropical spotted dolphin *Stenella attenuata*. Pages 71-98. In: S. H. Ridgway and R. Harrison (eds.). Handbook of marine mammals, Vol. 5: The first book of dolphins. *Academic Press*, San Diego, 418 pp.
- Scott, G. P. and C. A. Brown. 1997. Estimates of marine mammal and marine turtle catch by the U.S. Atlantic pelagic longline fleet in 1994-1995. Miami Laboratory Contribution MIA-96/97-28

- Wade, P. R., and R. P. 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-OPR-012, 93 pp.
- Yeung, C. 1999a. Estimates of marine mammal and marine turtle bycatch by the U.S. Atlantic pelagic longline fleet in 1998. NOAA Technical Memorandum NMFS-SEFSC-430, 26 pp.
- Yeung, C. 1999b. Revised Mortality Estimates of Marine Mammal Bycatch in 1992-1997 based on Serious Injury Guidelines. NOAA Technical Memorandum NMFS-SEFSC-429, 23 pp.

STRIPED DOLPHIN (*Stenella coeruleoalba*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The striped dolphin, *Stenella coeruleoalba*, is distributed worldwide in warm-temperate to tropical seas (Archer and Perrin 1997). Striped dolphins are found in the western North Atlantic from Nova Scotia south to at least Jamaica and in the Gulf of Mexico. In general, striped dolphins appear to prefer continental slope waters offshore to the Gulf Stream (Leatherwood *et al.* 1976; Perrin *et al.* 1994; Schmidly 1981). There is very little information concerning striped dolphin stock structure in the western North Atlantic (Archer and Perrin 1997).

In waters off the northeastern USA coast, striped dolphins are distributed along the continental shelf edge from Cape Hatteras to the southern margin of Georges Bank, and also occur offshore over the continental slope and rise in the mid-Atlantic region (CETAP 1982). Continental shelf edge sightings in this program were generally centered along the 1,000 m depth contour in all seasons (CETAP 1982). During 1990 and 1991 cetacean habitat-use surveys, striped dolphins were associated with the Gulf Stream north wall and warm-core ring features (Waring *et al.* 1992). Striped dolphins seen in a survey of the New England Sea Mounts (Palka 1997) were in waters that were between 20° and 27°C and deeper than 900 m.

Although striped dolphins are considered to be uncommon in Canadian Atlantic waters (Baird *et al.* 1993), recent summer sightings (2-125 individuals) in the deeper and warmer waters of the Gully (submarine canyon off eastern Nova Scotia shelf) suggest that this region may be an important part of their range (Gowans and Whitehead 1995; Baird *et al.* 1997).

POPULATION SIZE

Total numbers of striped dolphins off the USA or Canadian Atlantic coast are unknown, although four estimates from selected regions of the habitat do exist for select time periods. Sightings were almost exclusively in the continental shelf edge and continental slope areas west of Georges Bank (Figure 1). An abundance of 36,780 striped dolphins (CV=0.27) was estimated from an aerial survey program conducted from 1978 to 1982 on the continental shelf and shelf edge waters between Cape Hatteras, North Carolina and Nova Scotia (CETAP 1982). An abundance of 25,939 (CV=0.36) and 13,157 (CV=0.45) striped dolphins was estimated from line transect aerial surveys conducted from August to September 1991 using the Twin Otter and AT-11, respectively (Anon. 1991). The study area included that covered in the CETAP study plus several additional continental slope survey blocks. Due to weather and logistical constraints, several survey blocks south and east of Georges Bank were not surveyed. As recommended in the GAMS Workshop Report (Wade and Angliss 1997), estimates older than eight years are deemed unreliable, therefore should not be used for PBR determinations. Further, due to changes in survey methodology these data should not be used to make comparisons to more current estimates

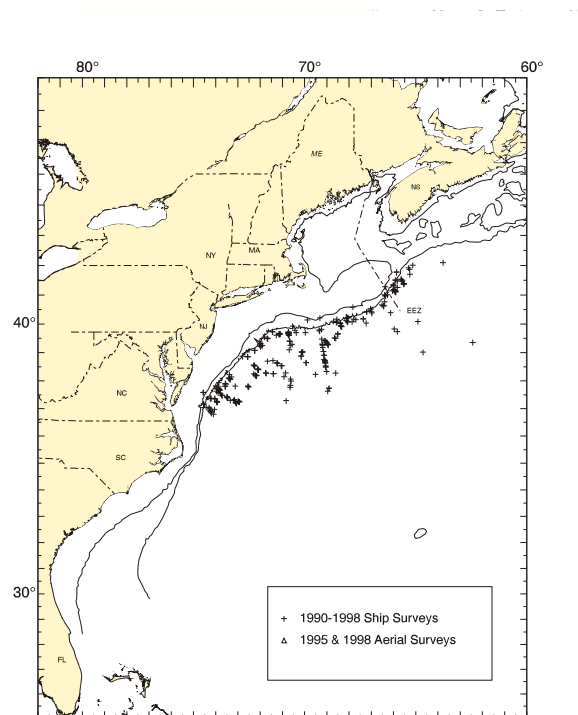


Figure 1. Distribution of striped dolphin sightings from NEFSC and SEFSC shipboard and aerial surveys during the summer in 1990-1998. Isobaths are at 100 m and 1,000 m.

An abundance of 31,669 (CV=0.73) striped dolphins was estimated from a July to September 1995 sighting survey conducted by two ships and an airplane that covered waters from Virginia to the mouth of the Gulf of St. Lawrence (Table 1; Palka *et al.* in review). Total track line length was 32,600 km. The ships covered waters between the 50 and 1000 fathom depth contour lines, the northern edge of the Gulf Stream, and the northern Gulf of Maine/Bay of Fundy region. The airplane covered waters in the mid-Atlantic from the coastline to the 50 fathom depth contour line, the southern Gulf of Maine, and shelf waters off Nova Scotia from the coastline to the 1000 fathom depth contour line. Data collection and analysis methods used were described in Palka (1996).

An abundance of 39,720 (CV=0.45) for striped dolphins was estimated from a line transect sighting survey conducted during July 6 to September 6, 1998 by a ship and plane that surveyed 15,900 km of track line in waters north of Maryland (38° N) (Figure 1; Palka *et al.* in review). Shipboard data were analyzed using the modified direct duplicate method (Palka 1995) that accounts for school size bias and $g(0)$, the probability of detecting a group on the track line. Aerial data were not corrected for $g(0)$.

An abundance of 21,826 (CV=0.78) for striped dolphins was estimated from a shipboard line transect sighting survey conducted between 8 July and 17 August 1998 that surveyed 5,570 km of track line in waters south of Maryland (38°N) (Figure 1; Mullin in review). Abundance estimates were made using the program DISTANCE (Buckland *et al.* 1993; Laake *et al.* 1993) where school size bias and ship attraction were accounted for.

The best available abundance estimate for striped dolphins is the sum of the estimates from the two 1998 USA Atlantic surveys, 61,546 (CV=0.40), where the estimate from the northern USA Atlantic is 39,720 (CV=0.45) and from the southern USA Atlantic is 21,826 (CV=0.78). This joint estimate is considered best because together these two surveys have the most complete coverage of the species' habitat.

Table 1. Summary of abundance estimates for western North Atlantic striped dolphins. 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-Sep 1995	Virginia to Gulf of St. Lawrence	31,669	0.73
Jul-Sep 1998	Maryland to Gulf of St. Lawrence	39,720	0.45
Jul-Aug 1998	Florida to Maryland	21,826	0.78
Jul-Sep 1998	Florida to Gulf of St. Lawrence (combined)	61,546	0.40

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 striped dolphins is 61,546 (CV=0.40). The minimum population estimate for the western North Atlantic striped dolphin is 44,500 (CV=0.40).

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 unknown for this stock. 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 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a "recovery" factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 44,500 (CV=0.40). 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 0.5 because this stock is of unknown status. PBR for the western North Atlantic striped dolphin is 445.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Total annual estimated average fishery-related mortality to this stock during 1994-1998 was 7.3 striped dolphins; CV=0.08) (Table 2).

Fishery Information

USA

No mortalities were observed in 1977-1991 foreign fishing activities off the northeast USA coast. Nineteen mortalities were documented between 1989 and 1993 (see below) in the pelagic drift gillnet fishery, and two mortalities were documented in 1991 in the North Atlantic bottom trawl fishery.

Data on current incidental takes in USA fisheries are available from several sources. In 1986, NMFS established a mandatory self-reported fishery 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.

Bycatch has been observed by NMFS Sea Samplers in the pelagic drift gillnet and North Atlantic bottom trawl fisheries but no mortalities or serious injuries have been documented in the pelagic longline fisheries, pelagic pair trawl, Northeast multispecies sink gillnet, and mid-Atlantic coastal sink gillnet fisheries.

Pelagic Drift Gillnet

The estimated total number of hauls in the pelagic drift net fishery increased from 714 in 1989 to 1144 in 1990; thereafter, with the introduction of quotas, effort was severely reduced. The estimated number of hauls in 1991, 1992, 1993, 1994, 1995, 1996, and 1998 were 233, 243, 232, 197, 164, 149, and 113 respectively. In 1996 and 1997, NMFS issued management regulations which prohibited the operation of this fishery in 1997. Further, in January 1999 NMFS issued a Final Rule to prohibit the use of driftnets (*i.e.*, permanent closure) in the North Atlantic swordfish fishery (50 CFR Part 630). Fifty-nine vessels participated in this fishery between 1989 and 1993. Since 1994, between 10 and 13 vessels have participated in the fishery. Observer coverage, percent of sets observed, was 8% in 1989, 6% in 1990, 20% in 1991, 40% in 1992, 42% in 1993, 87% in 1994, 99% in 1995, 64% in 1996, NA in 1997, and 99% in 1998. The greatest concentrations of effort were located 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 pelagic drift gillnet fishery be stratified into two strata, a southern or winter stratum, and a northern or summer stratum. Estimates of total bycatch, for each year from 1989 to 1993, were obtained using the aggregated (pooled 1989-1993) catch rates, by strata, assuming the 1990 injury was a mortality (Northridge 1996). Estimates of total annual bycatch 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 self-reported fishery information. Variances were estimated using bootstrap re-sampling techniques. Forty striped dolphin mortalities were observed in this fishery between 1989 and 1998 and occurred east of Cape Hatteras in January and February, and along the southern margin of Georges Bank in summer and autumn. Estimated annual mortality and serious injury (CV in parentheses) attributable to this fishery was 39 striped dolphins in 1989 (0.31), 57 in 1990 (0.33), 11 in 1991 (0.28), 7.7 in 1992 (0.31), 21 in 1993 (0.11), 13 in 1994 (0.06), 2 in 1995 (0), 7 in 1996 (CV=0.22), NA in 1997, and 4 in 1998 (CV=0). The 1994-1998 average annual mortality and serious injury to striped dolphins in the pelagic drift gillnet fishery was 7.25 (CV=0.08) (Table 2).

North Atlantic Bottom Trawl

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 vessels (full and part time) participated annually in the fishery during 1989-1995. The fishery is active in New England waters in all seasons. The only reported fishery-related mortalities (two) occurred in 1991. Total estimated mortality and serious injury attributable to this fishery in 1991 was 181 (CV=0.97); average annual mortality and serious injury during 1994-1998 was zero.

Total estimated average annual fishery-related mortality and serious injury to this stock in the Atlantic during 1994-1998 was 7.3 (CV=0.08) (Table 2).

CANADA

No mortalities were documented in review of Canadian gillnet and trap fisheries (Read 1994). However, in a recent review of striped dolphins in Atlantic Canada two records of incidental mortality have been reported (Baird *et al.* 1997) In the late 1960's and early 1970's two mortalities each, were reported in trawl and salmon net fisheries.

Between January 1993 and December 1994, 36 Spanish deep-water trawlers, covering 74 fishing trips (4,726 fishing days and 14,211 sets), were observed in NAFO Fishing Area 3 (off the Grand Bank) (Lens 1997). A total of 47 incidental catches were recorded, which included two striped dolphins. The incidental mortality rate for striped dolphins was 0.014/set.

Table 2. Summary of the incidental mortality of striped dolphins (*Stenella coeruleoalba*) 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	Number Vessel	Data Type ¹	Range of Observer Coverage ²	Observed Serious Injury	Observed Mortality	Estimated Mortality	CVs	Mean Annual Mortality
Pelagic Drift Gillnet	94-98	1994=12 1995=11 1996=10 1998=13	Obs Data Logbook	.87, .99, .64, NA, .99	0, 0, 0, 0, 0	12, 2, 7, NA, 4	13, 2.0 ³ , 10, NA, 4	.06, 0, .22, NA, 0	7.3 (0.08)
TOTAL									7.3 (0.08)

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. Mandatory logbook (Logbook) data are used to measure total effort for the pelagic drift gillnet and longline fishery, and these data are collected at the Southeast Fisheries Science Center (SEFSC).
² Observer coverage for the pelagic drift gillnet and bottom trawl fishery are in terms of sets.
³ One vessel was not observed and recorded 1 set in a 10 day trip (in the logbook). If you assume 1 set, the point estimate would increase by 0.01 animals.

Other Mortality

From 1995- 1998, seven striped dolphins were stranded between Massachusetts and Florida (NMFS unpublished data).

In eastern Canada, ten strandings were reported off eastern Canada from 1926-1971, and nineteen from 1991-1996 (Sergeant *et al.* 1970; Baird *et al.* 1997; Lucas and Hooker 1997). In both time periods, most of the strandings were on Sable Island, Nova Scotia.

STATUS OF STOCK

The status of striped dolphins, relative to OSP, in the USA Atlantic EEZ is unknown. The species is not listed as threatened or endangered under the Endangered Species Act. There are insufficient data to determine the population trends for this species. The total fishery-related mortality and serious injury for this stock is less than 10% of the calculated PBR, therefore can be considered to be insignificant and approaching zero mortality and serious injury rate. Average annual fishery-related mortality and serious injury does not exceed the PBR; therefore, this is not a strategic stock.

REFERENCES

Anon. 1991. Northeast cetacean aerial survey and interplatform study. NOAA, NMFS, NEFSC & SEFSC, 4 pp. Available from NEFSC, Woods Hole Laboratory, Woods Hole, MA.
 Archer, F. I., II and W. F. Perrin. 1997. Species account of striped dolphins (*Stenella coeruleoalba*). Paper SC/49/SM27 presented to the IWC Scientific Committee, September 1997. 27 pp.

- Baird, R.W., S. K. Hooker, H. Whitehead, and R. Etcheberry. 1997. A Review of records of striped dolphins (*Stenella coeruleoalba*) from Canadian waters. IWC Doc. SC/49/SM4, 10 pp.
- Barlow, J., S. L. Swartz, T. C. Eagle, and P. R. Wade. 1995. U.S. Marine Mammal Stock Assessments: Guidelines for Preparation, Background, and a Summary of the 1995 Assessments. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-OPR-6, 73 pp.
- Buckland, S. T., D. R. Andersen, K. P. Burnham, and J. L. Laake. 1993. Distance sampling: Estimating abundance of biological populations. *Chapman and Hall*, New York, 446 pp.
- 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.
- Cramer, J. 1994. Large pelagic logbook newsletter - 1993. NOAA Tech. Mem. NMFS-SEFSC-352, 19 pp.
- Gowans, S. and H. Whitehead. 1995. Distribution and habitat partitioning by small odontocetes in the Gully, a submarine canyon on the Scotian Shelf. *Can. J. Zool.* 73:1599-1608.
- Laake, J. L., S. T. Buckland, D. R. Anderson and K. P. Burnham. 1993. DISTANCE user's guide, V2.0. Colorado Cooperative Fish & Wildlife Research Unit, Colorado State University, Ft. Collins, Colorado, 72 pp.
- 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.
- Lens, S. 1997. Interactions between marine mammals and deep water trawlers in the NAFO regulatory area. *ICES CM* 1997/Q:8. 10 pp.
- Lucas, A. N. and S. K. Hooker. 1997. Cetacean strandings on Sable Island, Nova Scotia, 1990-1996. Paper SC/49/06 presented to the IWC Scientific Committee, September 1997. 10 pp.
- Mullin, K. D. (in review). Abundance and distribution of cetaceans in the southern U.S. Atlantic Ocean during summer 1998. *Fish. Bull., U.S.*
- Northridge, S. 1996. Estimation of cetacean mortality in the U.S. Atlantic swordfish and tuna drift gillnet and pair trawl fisheries. Final report to the Northeast Fisheries Science Center, Contract No. 40ENNF500160.
- Palka, D. 1995. Abundance estimate of the Gulf of Maine harbor porpoise. *Rep. int. Whal. Commn.* Special Issue 16:27-50.
- Palka, D. 1996. Update on abundance of Gulf of Maine/Bay of Fundy harbor porpoises. NOAA/NMFS/NEFSC. Ref. Doc. 96-04; 37p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026.
- Palka, D.L. 1997. A review of striped dolphins (*Stenella coeruleoalba*) in U.S. Atlantic waters. IWC Doc. SC/49/SM26, 13 pp.
- Palka, D., G. Waring and D. Potter. (in review). Abundances of cetaceans and sea turtles in the northwest Atlantic during summer 1995 and 1998. *Fish. Bull., U.S.*
- Perrin, W. F., C. E. Wilson and F. I. Archer II. 1994. Pages 129-159 in: S. H. Ridgway and R. Harrison (eds.), Handbook of marine mammals, Volume 5: The first book of dolphins, *Academic Press*, San Diego.
- Read, A. J. 1994. Interactions between cetaceans and gillnet and trap fisheries in the northwest Atlantic. *Rep. int. Whal. Commn.* Special Issue 15: 133-147.
- Sergeant, D.E., A.W. Mansfield and B. Beck. 1970. Inshore records of cetacea for eastern Canada, 1949-68. *J. Fish. Res. Bd. of Can.* 27: 1903-1915.
- Schmidly, D. J. 1981. Marine mammals of the southeastern United States coast and the Gulf of Mexico. Pub. No. FWS/OBS-80/41, U.S. Fish and Wildlife Service, Office of Biological Services, Washington, DC, 163 pp.
- Wade, P. R. and R. P. 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-OPR-12, 93 pp.
- Waring, G. T., C. P. Fairfield, C. M. Ruhsam and M. Sano. 1992. Cetaceans associated with Gulf Stream features off the northeastern USA shelf. *ICES Marine Mammals Comm. CM* 1992/N:12, 29 pp.
- Waring, G. T. 1998. Results of the summer 1991 R/V Chapman marine mammal sighting survey. NOAA NMFS NEFSC, Lab. Ref. Doc. No. 98-09, 21 pp. Northeast Fisheries Science Center, Woods Hole, Massachusetts.

SPINNER DOLPHIN (*Stenella longirostris*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Spinner dolphins are distributed in oceanic and coastal tropical waters (Leatherwood *et al.* 1976). This is presumably an offshore, deep-water species (Schmidly 1981; Perrin and Gilpatrick 1994), and its distribution in the Atlantic is very poorly known. In the western North Atlantic, these dolphins occur in deep water along most of the U.S. coast south to the West Indies and Venezuela, including the Gulf of Mexico. Spinner dolphin sightings have occurred exclusively in deeper (>2,000 m) oceanic waters (CETAP 1982; Waring *et al.* 1992) off the northeast U.S. coast. Stranding records exist from North Carolina, South Carolina, and Florida in the Atlantic and in Texas and Florida in the Gulf of Mexico. The North Carolina strandings represent the northernmost documented distribution of this species in the Atlantic. Stock structure in the western North Atlantic is unknown.

POPULATION SIZE

The number of spinner dolphins inhabiting the U.S. Atlantic Exclusive Economic Zone (EEZ) is unknown and seasonal abundance estimates are not available for this species since it was rarely seen in any of the surveys.

Minimum Population Estimate

Present data are insufficient to calculate a minimum population estimate.

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 unknown for this stock. For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a "recovery" factor (MMPA Sec. 3.16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is unknown. 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 western North Atlantic spinner dolphin is unknown because the minimum population size is unknown.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Total average annual estimated average fishery-related mortality and serious injury to this stock in the Atlantic during 1992-1996 was 0.38 spinner dolphin (CV = 0.35).

Fishery Information

There was no documentation of spinner dolphin mortality or serious injury in distant-water fleet (DWF) activities off the northeast U.S. coast (Waring *et al.* 1990). No takes were documented in a review of Canadian gillnet and trap fisheries (Read 1994).

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

By-catch has been observed by NMFS Sea Samplers in the pelagic drift gillnet fishery, but no mortalities or serious injuries have been documented in the pelagic longline, pelagic pair trawl, Northeast multispecies sink gillnet, mid-Atlantic coastal gillnet, and North Atlantic bottom trawl fisheries.

The estimated total number of hauls in the 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, 1993, 1994, 1995, and 1996 were 233, 243, 232, 197, 164, and 149 respectively. Fifty-nine different vessels participated in this fishery at one time or another between 1989 and 1993. Since 1994, between 10-12 vessels have participated in the fishery (Table 2). 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, 99% in 1995, and 64% in 1996. 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 pelagic 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, 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 self-reported Fishery information. Variances were estimated using bootstrap re-sampling techniques. One spinner dolphin mortality was observed between 1989 and 1993 and occurred east of Cape Hatteras in March 1993. Estimated annual fishery-related mortality and serious injury attributable to this fishery (CV in parentheses) was 0.7 in 1989 (1.00), 1.7 in 1990 (1.00), 0.7 in 1991 (1.00), 1.4 in 1992 (0.31), 0.5 in 1993 (1.00), and zero from 1994-1996. Total average annual estimated average fishery-related mortality and serious injury to this stock in the Atlantic during 1992-1996 was 0.38 spinner dolphin (CV = 0.35) (Table 1). The 1992-1996 period provides a better characterization of this fishery (i.e., fewer vessels and increased observer coverage).

Table 1. Summary of the incidental mortality of spinner dolphins (*Stenella longirostris*) 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 ¹	Data Type ²	Observer Coverage ³	Observed Mortality	Estimated Mortality ⁴	Estimated CVs ⁴	Mean Annual Mortality
Pelagic Drift Gillnet	92-96	1994=12 1995=11 1996=10	Obs. Data Logbook	.40, .42, .87, .99, .64	1, 0, 0, 0, 0	1.4, 0.5, 0, 0 ⁵ , 0	.31, 1.0, 0, 0, 0	0.31 (.35)
TOTAL								0.31 (.35)

¹ 1994 and 1995 - 1996 shown, other years not available on an annual basis.

² 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. Mandatory logbook (Logbook) data are used to measure total effort, and the data are collected at the Southeast Fisheries Science Center (SEFSC).

³ The observer coverage and unit of effort for the Pelagic Drift Gillnet is a set.

⁴ 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.

⁵ One vessel was not observed and recorded 1 set in a 10 day trip in the SEFSC mandatory logbook. If you assume the vessel fished 1.4 sets per day as estimated from the 1995 SS data, the point estimate may increase by 0.8 animals. However, the SEFSC mandatory logbook data was taken at face value, and therefore it was assumed that 1 set was fished within this trip, and the point estimate would then increase by 0.1 animals.

STATUS OF STOCK

The status of spinner dolphins relative to OSP in the U.S. Atlantic EEZ is unknown. The species is not listed as threatened or endangered under the Endangered Species Act. There are insufficient data to determine the population trends for this species. PBR cannot be calculated for this stock, but no fishery-related mortality and serious injury has been observed since 1992; therefore, total fishery-related mortality and serious injury can be considered insignificant and approaching zero mortality and serious injury rate. Population size and PBR cannot be estimated, but fishery-related mortality is very low; therefore, this stock is not a strategic stock.

REFERENCES

- Barlow, J., S.L. Swartz, T.C. Eagle, and P.R. Wade. 1995. U.S. Marine Mammal Stock Assessments: Guidelines for Preparation, Background, and a Summary of the 1995 Assessments. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-OPR-6, 73 pp.
- 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.
- 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.
- Northridge, S. 1996. Estimation of cetacean mortality in the U.S. Atlantic swordfish and tuna drift gillnet and pair trawl fisheries. Final report to the Northeast Fisheries Science Center, Contract No. 40ENNF500045, 18 pp.
- Perrin, W. F. and J. W. Gilpatrick, Jr. 1994. Spinner dolphin. Pages 99-128 in: S. H. Ridgway and R. Harrison (eds), Handbook of marine mammals, Volume 5: The first book of dolphins. *Academic Press*, San Diego, 418 pp.
- Read, A. J. 1994. Interactions between cetaceans and gillnet and trap fisheries in the northwest Atlantic. *Rep. int. Whal. Commn. Special Issue 15: 133-147*.
- Reilly, S. B. and J. Barlow. 1986. Rates of increase in dolphin population size. *Fish. Bull., U.S.* 84(3): 527-533.
- Schmidly, D. J. 1981. Marine mammals of the southeastern United States coast and the Gulf of Mexico. Pub. No. FWS/OBS-80/41, U.S. Fish and Wildlife Service, Office of Biological Services, Washington, DC, 163 pp.
- Wade, P.R., and R.P. 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-OPR-12, 93 pp.
- Waring, G. T., C. P. Fairfield, C. M. Ruhsam and M. Sano. 1992. Cetaceans associated with Gulf Stream features off the northeastern USA shelf. *ICES Marine Mammals Comm. CM 1992/N:12*, 29 pp.

BOTTLENOSE DOLPHIN (*Tursiops truncatus*): Western North Atlantic Offshore Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

There are two hematologically and morphologically distinct bottlenose dolphin ecotypes (Duffield *et al.* 1983; Duffield 1986) which correspond to a shallow water ecotype and a deep water ecotype; both ecotypes have been shown to inhabit waters in the western North Atlantic Ocean (Hersh and Duffield 1990; Mead and Potter 1995; Curry and Smith 1997).

Bottlenose dolphins which had stranded alive in the western North Atlantic in areas with direct access to deep oceanic waters had hemoglobin profiles which matched that of the deep, cold water ecotype (Hersh and Duffield 1990). Hersh and Duffield (1990) also described morphological differences between the deep, cold water ecotype dolphins and dolphins with hematological profiles matching the shallow, warm water ecotype which had stranded in the Indian/Banana River in Florida. Based on the distribution of sightings during ship-based surveys (Figure 1) and survey personnel observations (NMFS unpublished data), the western North Atlantic offshore stock is believed to consist of bottlenose dolphins corresponding to the hematologically and morphologically distinct deep, cold water ecotype.

Extensive aerial surveys in 1979-1981 indicated that the stock extended along the entire continental shelf break from Georges Bank to Cape Hatteras during spring and summer (CETAP 1982; Kenney 1990). The distribution of sightings contracted towards the south in the fall and the central portion of the survey area was almost devoid of sightings in the winter, although there were still sightings as far north as the southern edge of Georges Bank. The offshore stock is concentrated along the continental shelf break in waters of depths > 25 m and extends beyond the continental shelf into continental slope waters in lower concentration (Figure 1) consistent with Kenney 1990. In Canadian waters, bottlenose dolphins have occasionally been sighted on the Scotian Shelf, particularly in the Gully (Gowans and Whitehead 1995; NMFS unpublished data). Recent information from Wells *et al.* (1999) indicates that the range of the offshore bottlenose dolphin may include waters beyond the continental slope and that offshore bottlenose dolphins may move between the Gulf of Mexico and the Atlantic. Dolphins with characteristics of the offshore type have been stranded as far south as the Florida Keys, but there are no abundance or distribution estimates available for this stock in USA Exclusive Economic Zone (EEZ) waters south of Cape Hatteras.

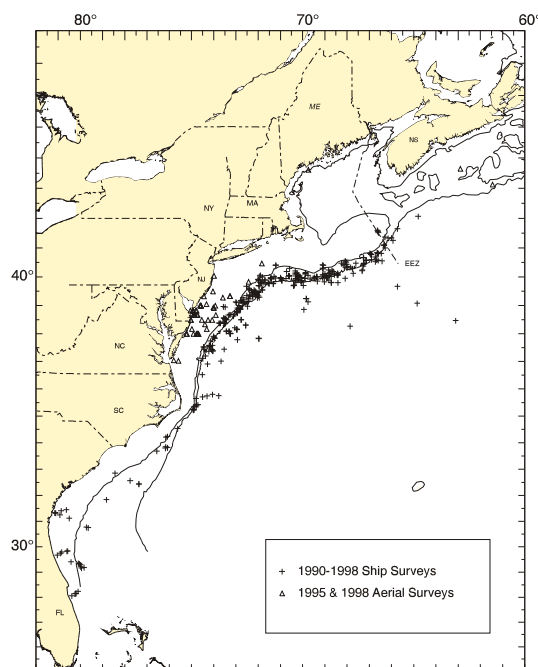


Figure 1. Distribution of bottlenose dolphin sightings from NEFSC and SEFSC shipboard and aerial surveys during the summer in 1990-1998. Isobaths are at 100 m and 1,000 m.

POPULATION SIZE

An abundance of 16,689 (CV=0.32) for bottlenose dolphins was estimated from a line transect sighting survey conducted during July 6 to September 6, 1998 by a ship and plane that surveyed 15,900 km of track line in waters north of Maryland (38° N) (Figure 1; Palka *et al.* in review). Shipboard data were analyzed using the modified direct duplicate

method (Palka 1995) that accounts for school size bias and $g(0)$, the probability of detecting a group on the track line. Aerial data were not corrected for $g(0)$.

An abundance of 13,944 (CV=0.38) for bottlenose dolphins was estimated from a shipboard line transect sighting survey conducted between 8 July and 17 August 1998 that surveyed 5,570 km of track line in waters south of Maryland (38°N) (Figure 1; Mullin in review). Abundance estimates were made using the program DISTANCE (Buckland *et al.* 1993; Laake *et al.* 1993) where school size bias and ship attraction were accounted for.

The best available abundance estimate for bottlenose dolphins is the sum of the estimates from the two 1998 USA Atlantic surveys, 30,633 (CV=0.25), where the estimate from the northern USA Atlantic is 16,689 (CV=0.32) and from the southern USA Atlantic is 13,944 (CV=0.38). This joint estimate is considered best because together these two surveys have the most complete coverage of the species' habitat.

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 offshore bottlenose dolphins is 30,633 (CV=0.25). The minimum population estimate for the western North Atlantic offshore bottlenose is 24,897.

Current Population Trend

The data are insufficient to determine population trends. Previous estimates cannot be applied to this process because previous survey coverage of the species' habitat was incomplete.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a "recovery" factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size for offshore bottlenose dolphins is 24,897. 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 western North Atlantic offshore bottlenose dolphin is 249.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Total annual estimated average fishery-related mortality or serious injury to this stock during 1994-1998 was 5.3 bottlenose dolphins (CV=0.03).

Fishery Information

There was no documentation of marine mammal mortality or serious injury in distant-water fleet (DWF) activities off the northeast coast of the USA prior to 1977. A fisheries observer program which recorded fishery data and information on incidental bycatch of marine mammals was established with implementation of the Magnuson Fisheries Conservation and Management Act (MFCMA) in 1977. DWF effort in the USA Atlantic EEZ under MFCMA was 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 from 1977 through 1982. In 1982, the first year that NMFS Northeast Regional Observer Program assumed responsibility for observer coverage of the longline vessels, there were 112 different foreign vessels, eighteen (16%) of which were Japanese tuna longline vessels operating along the USA east coast. Between 1983 and 1991, the number of foreign fishing vessels operating within the USA Atlantic EEZ each year declined from 67 to nine. Between 1983 and 1988, the numbers of DWF vessels included 3, 5, 7, 6, 8, and 8, respectively, Japanese longline vessels. Observer coverage on DWF vessels was 25-35% during 1977-82, and increased to 58%, 86%, 95%, and 98%, respectively, in 1983-86. From 1987-91, 100% observer coverage was maintained. Foreign fishing operations for squid ceased at the end of the 1986 fishing season and for mackerel at the end of the 1991 season. Observers in this program recorded nine bottlenose

dolphin mortalities in foreign-fishing activities during 1977-1988 (Waring *et al.* 1990). Seven takes occurred in the mackerel fishery, and one bottlenose dolphin each was caught in both the squid and hake trawl fisheries.

Data on current incidental takes in USA 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.

Bycatch has been observed by NMFS Sea Samplers in the pelagic drift gillnet, pelagic pair trawl, and North Atlantic bottom trawl fisheries, but no mortalities have been documented in the Northeast multispecies sink gillnet and pelagic longline fisheries.

Pelagic Longline

The pelagic longline fishery operates in the USA Atlantic (including Caribbean) and Gulf of Mexico EEZ (SEFSC unpublished data). Interactions between the pelagic longline fishery and bottlenose dolphins 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. Total effort, excluding the Gulf of Mexico, for the pelagic longline fishery, based on mandatory self-reported fisheries information, was 11,279 sets in 1991, 9,869 sets in 1992, 9,862 sets in 1993, 9,481 sets in 1994, 10,129 sets in 1995, 9,885 sets in 1996, 8,023 sets in 1997, and 6,765 in 1998 (Cramer 1994; Scott and Brown 1997; Johnson *et al.* 1999, Yeung 1999a). Since 1992, this fishery has been monitored with about 5% observer coverage, in terms of trips observed, within every statistical reporting area within the EEZ and beyond. Off the USA Atlantic coast, 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. Yeung (1999a) provides estimates of mortality for 1998, based on a treatment which includes seriously injured animals as mortalities, following guidelines proposed by the NOAA Fisheries Office of Protected Resources (Federal Register Docket No., I.D. 051398C). Yeung (1999b) provides revised estimates of mortality for 1993-1997. These estimates, which treat serious injured animals as mortalities, replace the 1993-1997 estimates which were based on a revised analysis of the observed incidental take and self-reported incidental take and effort data (Johnson *et al.* 1999), and which replaced previous estimates for the 1992-1993 (Cramer 1994) and 1994-1995 periods (Scott and Brown 1997). Most of the estimated marine mammal bycatch was from EEZ waters between South Carolina and Cape Cod (Johnson *et al.* 1999). During 1993-1998, in waters not including the Gulf of Mexico, one bottlenose dolphin was caught and released alive during 1993, and one was caught and released alive during 1998.

Pelagic Drift Gillnet

The estimated total number of hauls in the 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, 1993, 1994, 1995, 1996, and 1998 were 233, 243, 232, 197, 164, 149, and 113 respectively. In 1996 and 1997, NMFS issued management regulations which prohibited the operation of this fishery in 1997. Further, in January 1999 NMFS issued a Final Rule to prohibit the use of driftnets (*i.e.*, permanent closure) in the North Atlantic swordfish fishery (50 CFR Part 630). Fifty-nine different vessels participated in this fishery at one time or another between 1989 and 1993. Since 1994, between 10-13 vessels have participated in the fishery (Table 1). 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, 99% in 1995, 64% in 1996, 1997 (NA), and 99% in 1998. 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 pelagic drift gillnet fishery be stratified into two strata, a southern or winter stratum, and a northern or summer stratum. Estimates of the total bycatch, from 1989 to 1993, were obtained using the aggregated (pooled 1989-1993) catch rates, by strata (Northridge 1996). Estimates of total annual bycatch 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 self-reported fisheries information. Variances were estimated using bootstrap re-sampling techniques. Sixty bottlenose dolphin mortalities have been observed between 1989 and 1998. Estimated bottlenose dolphin kills (CV in parentheses) extrapolated for each year were 72 in 1989 (0.18), 115 in 1990 (0.18), 26 in 1991 (0.15), 28 in 1992 (0.10), 22 in 1993 (0.13), 14 in 1994 (0.04), 5 in 1995 (0), zero in 1996, and 3 in 1998 (0). Mean annual estimated fishery-related mortality for this fishery in 1994-1998 was 5.3 bottlenose dolphins (CV=0.03) (Table 1).

Pelagic Pair Trawl

Effort in the pelagic pair trawl fishery 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 536 hauls in 1992, 586 in 1993, 407 in 1994, and 440 in 1995, respectively. This fishery ceased operations in 1996, when NMFS rejected a petition to consider pair trawl gear as an authorized gear type in Atlantic tunas fishery. The fishery operated from August-November in 1991, from June-November in 1992, from June-October in 1993 (Northridge 1996), and from mid-summer to November in 1994 and 1995. Sea sampling began in October 1992 (Gerrior *et al.* 1994), and 48 sets (9% of the total) were sampled in that season, 102 hauls (17% of the total) were sampled in 1993. In 1994 and 1995, 52% and 55%, respectively, of the sets were observed. 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 bycatch, showed little seasonal change for the six months of operation and did not warrant any seasonal or areal stratification of this fishery (Northridge 1996). Thirty-two bottlenose dolphin mortalities were observed between 1991 and 1995. Estimated annual fishery-related mortality (CV in parentheses) was 13 dolphins in 1991 (0.52), 73 in 1992 (0.49), 85 in 1993 (0.41), 4 in 1994 (0.40) and 17 in 1995 (0.26). Since this fishery no longer exists, it has been excluded from Table 1. During the 1994 and 1995 experimental fishing seasons, fishing gear experiments were conducted to collect data on environmental parameters, gear behavior, and gear handling practices to evaluate factors affecting catch and bycatch (Goudy 1995, 1996). Results of these studies have been presented at Offshore Cetacean Take Reduction Team Meetings.

North Atlantic Bottom Trawl:

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. The fishery is active in New England waters in all seasons. One bottlenose dolphin mortality was documented in 1991 and the total estimated mortality in this fishery in 1991 was 91 (CV=0.97). Since 1992 there were no bottlenose mortalities observed in this fishery.

Squid, Mackerel and Butterfish:

The mid-Atlantic mackerel and squid trawl fisheries were combined into the Atlantic squid, mackerel and butterfish trawl fishery in 1996. These fisheries operate seasonally, principally in the USA mid-Atlantic and southern New England continental shelf region. 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. In 1996, mackerel, squid, and butterfish trawl fisheries were combined into the Atlantic squid, mackerel, and butterfish trawl fishery, and maintained a Category II classification. Although there were reports of bottlenose dolphin mortalities in the foreign fishery during 1977-1988, there were no fishery-related mortalities of bottlenose dolphins reported in the self-reported fisheries information from the mackerel trawl fishery between 1990-1992.

Table 1. Summary of the incidental mortality of bottlenose dolphins (*Tursiops truncatus*) 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 Serious Injury	Observed Mortality	Estimated Mortality ⁴	Estimated CVs	Mean Annual Mortality
Pelagic Drift Gillnet ⁵	94-98	1994=12 1995=11 1996=10 1997=N/A 1998=13	Obs. Data Logbook	.87, .99, .64, NA, .99	0, 0, 0, NA, 0	12, 5, 0, NA, 3	13, 5.0 ³ , 0, NA, 3	.05, 0, 0, NA, 0	5.3 (0.03)
TOTAL									5.3 (0.03)

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. 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 pelagic drift gillnet is measured in terms of sets. The proportion of trips sampled by the NEFSC Sea Sampling Program are reported here.

³ One vessel was not observed and recorded 1 set in a 10 day trip in the SEFSC mandatory logbook. If you assume the vessel fished 1.4 sets per day as estimated from the 1995 SS data, the point estimate may increase by 0.42 animals. However, the SEFSC mandatory logbook data was taken at face value, and therefore it was assumed that 1 set was fished within this trip, and the point estimate would then increase by 0.03 animals.

⁴ Annual mortality estimates do not include any animals injured and released alive.

⁵ The fishery did not operate in 1997; the average annual mortality is based on the number of years (4; 1994-1996, 1998) that the fishery operated.

Other Mortality

Bottlenose dolphins are one of the most frequently-stranded small cetaceans along the Atlantic coast. Many of the animals show signs of human interaction (*i.e.*, net marks, mutilation, etc.). The estimated number of animals that represent the offshore stock is presently under evaluation.

STATUS OF STOCK

The status of this stock relative to OSP in the Atlantic EEZ is unknown. The western north Atlantic offshore bottlenose dolphin is not listed as threatened or endangered under the Endangered Species Act. There are insufficient data to determine the population trends for this species. This level is less than 10% of the calculated PBR and, therefore, can be considered to be insignificant and approaching zero mortality and serious injury rate. Average 1994-1998 annual fishery-related mortality and serious injury does not exceed the PBR; therefore, this is not a strategic stock.

REFERENCES

- Barlow, J., S. L. Swartz, T. C. Eagle and P. R. Wade. 1995. U.S. Marine Mammal Stock Assessments: Guidelines for Preparation, Background, and a Summary of the 1995 Assessments. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-OPR-6, 73 pp.
- Buckland, S. T., D. R. Andersen, K. P. Burnham and J. L. Laake. 1993. Distance sampling: Estimating abundance of biological populations. *Chapman and Hall*, New York, 446 pp.
- CETAP (Cetacean and Turtle Assessment Program). 1982. A Characterization of Marine Mammals and Turtles in the Mid- and North Atlantic Areas of the U.S. Outer Continental Shelf, Final Report, Contract AA551-CT8-48, U.S. NTIS PB83-215855, Bureau of Land Management, Washington, DC, 576 pp.
- Cramer J. 1994. Large pelagic logbook newsletter - 1993. NOAA Tech. Mem. NMFS-SEFSC-352, 19 pp.

- Curry, B. E. and J. Smith. 1997. Phylogeographic structure of the bottlenose dolphin (*Tursiops truncatus*): stock identification and implications for management. Pages 327-247 in: A.E. Dizon, S.J. Chivers and W.F. Perrin (eds.), *Molecular genetics of marine mammals*. Spec. Publ. 3 Society for Marine Mammalogy.
- Duffield, D. A. 1986. Investigation of genetic variability in stocks of the bottlenose dolphin (*Tursiops truncatus*). Final report to the NMFS/SEFSC, Contract No. NA83-GA-00036, 53 pp.
- Duffield, D. A., S.H. Ridgway and L.H. Cornell. 1983. Hematology distinguishes coastal and offshore forms of dolphins (*Tursiops*). *Can. J. Zool.* 61: 930-933.
- Gerrior, P., A. S. Williams and D. J. Christensen. 1994. Observations of the 1992 U.S. pelagic pair trawl fishery in the Northwest Atlantic. *U.S. Mar. Fish. Rev.* 56(3): 24-27.
- Goudey, C.A. 1995. The 1994 experimental pair trawl fishery for tuna in the northwest Atlantic, Massachusetts Institute of Technology, Sea Grant, MITSG 95-6, Cambridge, MA. 10 pp.
- Goudey, C.A. 1996. The 1995 experimental pair trawl fishery for tuna in the northwest Atlantic, Massachusetts Institute of Technology, Sea Grant, MITSG 95-6, Cambridge, MA. 13 pp.
- Gowans S. and H. Whitehead. 1995. Distribution and habitat partitioning by small odontocetes in the Gully, a submarine canyon on the Scotian Shelf. *Can. J. Zool.* 73: 1599-1608.
- Hersh, S. L. and D. A. Duffield. 1990. Distinction between northwest Atlantic offshore and coastal bottlenose dolphins based on hemoglobin profile and morphometry. Pages 129-139 in: S. Leatherwood and R. R. Reeves (eds), *The bottlenose dolphin*, Academic Press, San Diego, 653 pp.
- Johnson, D. R., C. A. Brown and C. Yeung. 1999. Estimates of marine mammal and marine turtle catch by the U.S. Atlantic pelagic longline fleet in 1992-1997. NOAA Tech. Mem. NOAA-SEFSC-418, 70 pp.
- Kenney, R. D. 1990. Bottlenose dolphins off the northeastern United States. Pages 369-386 in: S. Leatherwood and R. R. Reeves (eds), *The bottlenose dolphin*, Academic Press, San Diego, 653 pp.
- Laake, J. L., S. T. Buckland, D. R. Anderson and K. P. Burnham. 1993. DISTANCE user's guide, V2.0. Colorado Cooperative Fish & Wildlife Research Unit, Colorado State University, Ft. Collins, Colorado, 72 pp.
- Mead, J. G. and C. W. Potter. 1995. Recognizing two populations for the bottlenose dolphin (*Tursiops truncatus*) off the Atlantic coast of North America: morphologic and ecologic considerations. *International Biological Research Institute Reports* 5:31-43.
- Mullin, K. D. (in review). Abundance and distribution of cetaceans in the southern U.S. Atlantic Ocean during summer 1998. *Fish. Bull., U.S.*
- Northridge, S. 1996. Estimation of cetacean mortality in the U.S. Atlantic swordfish and tuna drift gillnet and pair trawl fisheries. Final report to the Northeast Fisheries Science Center, Contract No. 40ENNF500045. 18 pp.
- Palka, D. 1995. Abundance estimate of the Gulf of Maine harbor porpoise. *Rep. int Whal. Commn.* Special Issue 16:27-50
- Palka, D., G. Waring and D. Potter. (in review). Abundances of cetaceans and sea turtles in the northwest Atlantic during summer 1995 and 1998. *Fish. Bull., U.S.*
- Scott, G.P. and C.A. Brown. 1997. Estimates of marine mammal and marine turtle catch by the U.S Atlantic pelagic longline fleet in 1994-1995. Miami Laboratory Contribution MIA - 96/97-28.
- Wade, P. R. and R. P. 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-OPR-12, 93 pp.
- 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.
- Wells, R.S., H.L. Rhinehart, P. Cunningham, J. Whaley, M. Baran, C. Koberna and D.P. Costa. 1999. Long distance offshore movements of bottlenose dolphins. *Marine Mammal Science*, 15(4):1098-1114.
- Yeung, C. 1999a. Estimates of marine mammal and marine turtle bycatch by the U.S. Atlantic pelagic longline fleet in 1998. NOAA Technical Memorandum NMFS-SEFSC-430, 26 pp.
- Yeung, C. 1999b. Revised Mortality Estimates of Marine Mammal Bycatch in 1992-1997 based on Serious Injury Guidelines. NOAA Technical Memorandum NMFS-SEFSC-429, 23 pp.

HOODED SEAL (*Cystophora cristata*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The hooded seal occurs throughout much of the North Atlantic and Arctic Oceans (King 1983) preferring deeper water and occurring farther offshore than harp seals (Lavigne and Kovacs 1988; Stenson *et al.* 1996). Hooded seals tend to wander far out of their range and have been seen as far south as Puerto Rico, with increased occurrences from Maine to Florida. These appearances usually occur between January and May. Although it is not known which stock these seals come from, it is known that during this time frame, the Northwest Atlantic stock of hooded seals are at their southern most point of migration in the Gulf of St. Lawrence. The world's hooded seal population is divided into three separate stocks, each identified with a specific breeding site (Lavigne and Kovacs 1988). In the northwest Atlantic, whelping occurs in the Davis Strait, off Newfoundland and in Gulf of St. Lawrence (Stenson *et al.* 1996). One stock, which whelps off the coast of eastern Canada, is divided into two breeding herds (Front and Gulf) which breed on the pack ice. The Front herd (largest) breeds off the coast of Newfoundland and Labrador and the Gulf herd breeds in the Gulf of St. Lawrence. The second stock breeds in the Davis Strait, and the third stock occurs on the West Ice off eastern Greenland.

Hooded seals are a highly migratory species. Hooded seals remain on the Newfoundland continental shelf during winter/spring (Stenson *et al.* 1996). Breeding occurs at about the same time in March for each stock. Adults from all stocks then assemble in the Denmark Strait to molt between late June and August (King 1983; Anon 1995), and following this, the seals disperse widely. Some move south and west around the southern tip of Greenland, and then north along the west coast of Greenland. Others move to the east and north between Greenland and Svalbard during late summer and early fall (Lavigne and Kovacs 1988). Little else is known about the activities of hooded seals during the rest of the year until they assemble again in February for breeding.

Hooded seals are rarely found in the U.S. Atlantic Exclusive Economic Zone. Small numbers of hooded seals at the extreme southern limit of their range occur in the winter and spring seasons. The influx of harp seals and geographic distribution in New England to mid-Atlantic waters is based on stranding data.

POPULATION SIZE

The number of hooded seals in the western North Atlantic is unknown. Seasonal abundance estimates are available based on a variety of analytical methods based on commercial catch data, and including aerial surveys. These methods often include surveying the whelping concentrations and modeling the pup production. Several estimates of pup production at the Front are available. Hooded seal pup production between 1966 and 1977 was estimated between 25,000 - 32,000 annually (Benjaminsen and Oritsland 1975; Sergeant 1976; Lett 1977; Winters and Bergflodt 1978; Stenson *et al.* 1996). Estimated pup production dropped to 26,000 hooded seal pups in 1978 (Winters and Bergflodt 1978). Pup production estimates began to increase after 1978, reaching 62,000 (95% CI. 43,700 - 89,400) by 1984 (Bowen *et al.* 1987). Bowen *et al.* (1987) also estimated pup production in the Davis Strait at 18,600 (95% C.I. 14,000 - 23,000). A 1985 survey at the Front (Hay *et al.* 1985) produced an estimate of 61,400 (95% C.I. 16,500 - 119,450). Hammill *et al.* (1992) estimated pup production to be 82,000 (SE=12,636) in 1990. No recent population estimate is available, but assuming a ratio of pups to total population of 1:5, pup production in the Gulf and Front herds would represent a total population of approximately 400,000-450,000 hooded seals (Stenson 1993). Based on the 1990 survey, Stenson *et al.* (1996) suggests that pup production may have increased at about 5% per year since 1984. However, because of exchange between the Front and the Davis Strait stocks, the possibility of a stable or slightly declining level of pup production are also likely (Stenson 1993; Stenson *et al.* 1996). It appears that the number of hooded seals is increasing.

Table 1. Summary of pup production estimates for western North Atlantic hooded seals. Year and area covered during each abundance survey, and resulting abundance estimate (N_{\min}) and coefficient of variation (CV).

Month/Year	Area	N_{\min}	CV
1978	Front herd: Newfoundland/ Labrador	26,000	None reported
1984	Front herd: Newfoundland/Labrador	62,000	None reported
1984	Davis Strait	18,600	None reported
1985	Front herd: Newfoundland/Labrador	61,400	None reported
1990	Front herd: Newfound/Labrador	82,100	None reported

Minimum population estimate

Present data are insufficient to calculate the minimum population estimate for U.S. waters. It is estimated that there are approximately 400,000 hooded seals (5:1 ratio of adults to pups) in Canadian waters (Stenson *et al.* 1993).

Current population trend

The population appears to be increasing in U.S. Atlantic EEZ, judging from stranding records, although the actual magnitude of this increase is unknown. The Canadian population appears to be increasing but, because different methods have been used over time to estimate population size, the magnitude of this increase has not been quantified.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. The most appropriate data are based on Canadian studies. Pup production in Canada may be increasing slowly (5% per annum), but due to the wide confidence intervals and lack of understanding regarding stock dynamics, it is possible that pup production is stable or declining (Stenson 1993).

For purposes of this assessment, the maximum net productivity rate was assumed to be 0.12. This value is based on theoretical modeling showing that pinniped populations may not grow at rates much greater than 12% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a "recovery" factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is unknown. The maximum productivity rate is 0.12, the default value for pinnipeds. The recover factor (F_R) for this stock is 1.0, the value for stocks with unknown population status, but know to be increasing. PBR for the western North Atlantic hooded seal in U.S. waters is unknown. Applying the fomula to abundance estimates (400,000) in Canadian waters results in a PBR = 24,000 hooded seals.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

In Atlantic Canada, hooded seals have been commercially hunted at the Front since the late 1800's. In 1974 total allowable catch (TAC) was set at 15,000, and reduced to 12,000 in 1983 and to 2,340 in 1984 (Stenson 1993; Anon 1998). From 1991- 1992 the TAC was increased to 15,000. A TAC of 8,000 was set for 1993, and held at that level through 1997. From 1974 through 1982, the average catch was 12,800 animals, mainly pups. Since 1983 catches ranged from 33 in 1986 to 6,425 in 1991, with a mean catch of 1,001 between 1983 and 1995. In 1996 catches (25,754) were more than three times the allowable quota (Anon 1998). The high catch was attributable to good ice conditions and strong market demand. Catches in 1997 were 7,058, slightly below the TAC.

Hunting in the Gulf of St. Lawrence (below 50°N) has been prohibited since 1964. No commercial hunting of hooded seals is permitted in the Davis Strait.

Total annual estimated average fishery-related mortality or serious injury to this stock in U.S. waters during 1992-1996 was 5.6 hooded seals (CV = 0.96; Table 2).

Fishery Information

USA

Data on current incidental takes in U.S. fisheries are available from several sources. In 1986, NMFS established a mandatory self-reported fishery 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 by-catch has been observed by NMFS Sea Samplers in the New England multispecies sink gillnet fisheries, but no mortalities have been documented in the Mid-Atlantic coastal gillnet, Atlantic drift gillnet, pelagic pair trawl or pelagic longline fisheries.

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%, 5%, and 4% for 1990 to 1996, respectively. The fishery has been observed in the Gulf of Maine and in Southern New England. There was one hooded seal mortality observed in the New England multispecies sink gillnet fishery between 1990 and 1996. Annual estimates of hooded seal by-catch in the New England multispecies sink gillnet fishery reflect seasonal distribution of the species and of fishing effort. Estimated annual mortalities (CV in parentheses) from this fishery during 1990-1996 was zero (1990-1994), and 28 in 1995 (0.96), and zero in 1996. The 1995 by-catch includes five animals from the estimated number of unknown seals (based on observed mortalities of seals that could not be identified to species). The unknown seals were prorated, based on spatial/temporal patterns of by-catch of harbor seals, gray seals, harp seals, and hooded seals. Average annual estimated fishery-related mortality and serious injury to this stock attributable to this fishery during 1992-1996 was 5.6 hooded seals (CV = 0.96). The stratification design used is the same as that for harbor porpoise (Bravington and Bisack 1996). The by-catch occurred only in winter (January-May) and was in waters between Cape Ann and New Hampshire.

CANADA

An unknown number of hooded seals have been taken in Newfoundland and Labrador groundfish gillnets (Read 1994).

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.

Hooded seals are being taken in Canadian lumpfish and groundfish gillnets and trawls; however, estimates of total removals have not been calculated to date.

Table 2. Summary of the incidental mortality of hooded seal (*Cystophora cristata*) 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	92-96	349	Obs. Data Weighout, Logbooks	.07, .05, .07, .05, .04	0, 0, 0, 1, 0	0, 0, 0, 28, 0	0, 0, 0, .96, 0	5.6 (.96)
TOTAL								5.6 (.96)

¹ Observer data (Obs. Data) are used to measure by-catch 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 determine the spatial distribution of some fishing effort in the New England multispecies sink gillnet fishery.

² The observer coverage for the New England multispecies sink gillnet fishery is measured in trips.

Other Mortality

In 1988-93, strandings were less than 20 per year, and from 1994-1996 they increased to about 50 per annum (Rubinstein 1994; Rubinstein, pers. comm). Carcasses were recovered from Massachusetts, Connecticut, and New York (Rubinstein 1994), North Carolina and U.S. Virgin Islands (NMFS, unpubl. data). The increased number of strandings may indicate a possible shift in distribution or range expansion southward into U.S. waters; if so, fishery interactions may increase.

STATUS OF STOCK

The status of hooded seals relative to OSP in U.S. Atlantic EEZ is unknown, but the population appears to be increasing in Canada. They are not listed as threatened or endangered under the Endangered Species Act. The total fishery-related mortality and serious injury for this stock is believed to be very low relative to the population size in Canadian waters and can be considered insignificant and approaching zero mortality and serious injury rate. This is not a strategic stock because the level of human-caused mortality and serious injury is believed to be very low relative to overall stock size.

REFERENCES

- Anon. 1995. Report of the Joint ICES/NAFO Working Group on Harp and Hooded Seals. 5-9 June 1995, Dartmouth, Nova Scotia Canada. NAFO SCS Doc. 95/16. Serial No. N2569. 40 pp.
- Anon. 1998. Report of the Joint ICES/NAFO Working Group on Harp and Hooded Seals. 28 August - 3 September 1997, Copenhagen, Denmark. *ICES CM 1998/Assess:3*. 35 pp.
- Barlow, J., S.L. Swartz, T.C. Eagle, and P.R. Wade. 1995. U.S. Marine Mammal Stock Assessments: Guidelines for Preparation, Background, and a Summary of the 1995 Assessments. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-OPR-6, 73 pp.
- Benjaminsen, T., and T. Oritsland. 1975. The survival of year-classes and estimates of production and sustainable yield of northwest Atlantic harp seals. *Int. Comm. Northwest Atl. Fish. Res. Doc.* 75/121.
- Bowen, W.D., R.A. Myers and K. Hay. 1987. Abundance estimation of a dispersed, dynamic population: Hooded seals (*Cystophora cristata*) in the Northwest Atlantic. *Can. J. Fish. Aquat. Sci.* 44: 282-295.
- Bravington, M. V. and K. D. Bisack. 1996. Estimates of harbor porpoise by-catch in the Gulf of Maine sink gillnet fishery, 1990-93. *Rep. int. Whal. Commn.* 46:567-574.

- Hammill, M. O., G. B. Stenson, and R. A. Myers. 1992. Hooded seal (*Cystophora cristata*) pup production in the Gulf of St. Lawrence. *Can. J. Fish. Aquat. Sci.* 49: 2546-2550.
- Hay, K., G. B. Stenson, D. Wakeham, and R. A. Myers. 1985. Estimation of pup production of hooded seals (*Cystophora cristata*) at Newfoundland during March 1985. *Can. Atl. Fish. Sci. Adv. Comm.* 85/96.
- King, J. E. 1983. *Seals of the World*. Cornell University Press, Ithaca, NY, 240 pp.
- Lavigne, D. M. and K. M. Kovacs. 1988. Harps and Hoods Ice Breeding Seals of the Northwest Atlantic. *University of Waterloo Press*, Waterloo, Ontario, Canada, 174 pp.
- Lett, P.F. 1977. A model to determine stock size and management options for the Newfoundland hooded seal stock. *Can. Atl. Fish. Sci. Adv. Comm. Res. Doc.* 77/25.
- Read, A. J. 1994. Interactions between cetaceans and gillnet and trap fisheries in the northwest Atlantic. *Rep. int. Whal. Commn. Special Issue 15: 133-147*.
- Rubinstein, B. 1994. An apparent shift in distribution of ice seals, *Phoca groenlandica*, *Cystophora cristata*, and *Phoca hispida*, toward the east coast of the United States. M.A. Thesis, Boston University, Boston, MA, 45 pp.
- Sergeant, D.E. 1976. Research on hooded seals *Cystophora cristata* Erxleben in 1976. International Commission for the Northwest Atlantic Fisheries Research Document 76/X/126.
- Stenson, G. B. 1993. The status of pinnipeds in the Newfoundland region. NAFO SCR Doc. 93/34.
- Stenson, G.B., R.A. Myers, I-H Ni and W.G. Warren. 1996. Pup production of hooded seals (*Cystophora cristata*) in the northwest Atlantic. NAFO Sci. Coun. Studies 26:105-114.
- Wade, P.R., and R.P. 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-OPR-12, 93 pp.
- Walden, J. 1996. The New England gillnet effort survey. NOAA, NMFS, NEFSC, Woods Hole, Massachusetts. NEFSC [Northeast Fisheries Science Center] Ref. Doc. 99-10. 38p.
- Winters, G. H. And B. Bergflodt. 1978. Mortality and productivity of the Newfoundland hooded seal stock. International Commission for the Northwest Atlantic Fisheries Res. Doc. 78/XI/91.

SPERM WHALE (*Physeter macrocephalus*): Northern Gulf of Mexico Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Sperm whales are found throughout the world's oceans in deep waters from between about 60° N and 60° S latitudes (Leatherwood and Reeves 1983; Rice 1989). There has been speculation, based on year round occurrence of strandings, opportunistic sightings, and whaling catches, that sperm whales in the Gulf of Mexico may constitute a distinct stock (Schmidly 1981), but there is no information on stock differentiation. Seasonal aerial surveys confirm that sperm whales are present in the northern Gulf of Mexico in all seasons, but sightings are more common during the summer months (Mullin et al. 1991; Davis et al., in preparation).

POPULATION SIZE

Estimates of abundance were derived through the application of distance sampling analysis (Buckland et al. 1993) and the computer program DISTANCE (Laake et al. 1993) to sighting data collected during 1991-1994 spring-summer, visual sampling, line-transect vessel surveys of the northern Gulf of Mexico (Hansen et al. 1995) (Fig. 1), which includes data collected as part of the GulfCet program (Davis et al., in preparation). These surveys were conducted throughout the area from approximately the 200 m isobath along the U.S. coast to the seaward extent of the U.S. Exclusive Economic Zone. The seasonal GulfCet aerial surveys included only a small portion of the stock range and these data were not used for abundance estimation. Estimated abundance of sperm whales by survey year [coefficient of variation (CV) in parentheses] was 143 in 1991 (0.58), 931 in 1992 (0.48), 229 in 1993 (0.52), and 771 in 1994 (0.42) (Hansen et al. 1995). Survey effort-weighted estimated average abundance of sperm whales for all surveys combined was 530 (CV = 0.31) (Hansen et al. 1995).

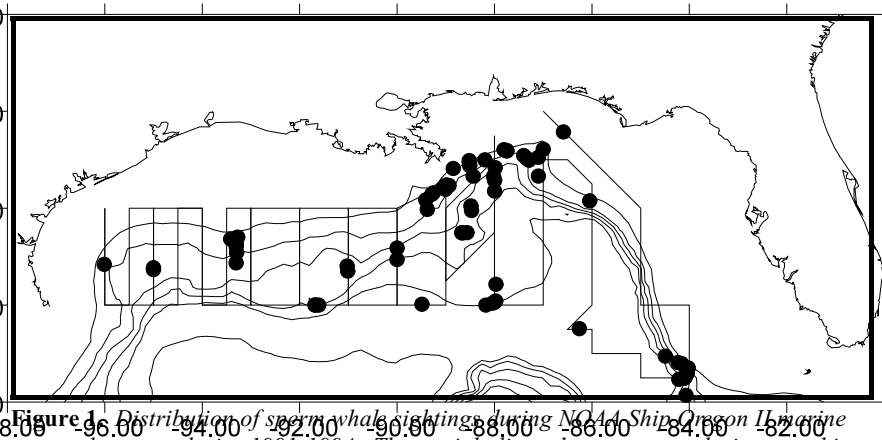


Figure 1. Distribution of sperm whale sightings during NOAA Ship Oregon Line marine mammal surveys during 1991-1994. The straight lines show transects during two ship surveys and are examples of typical ship survey transects. Isobaths are in 183 m (100 fm) intervals.

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, which is equivalent to the 20th percentile of the log-normal distributed abundance estimate as specified by NMFS (Anon. 1994). The minimum population estimate was calculated from the 1991-1994 average abundance estimate of 530 sperm whales (CV = 0.31) (Hansen et al. 1995) and is 411 sperm whales.

Current Population Trend

No trend was discernable in the average annual abundance estimates. All of the log-normal 95% confidence intervals of the annual estimates overlap, indicating that the estimates were not significantly different at that level. The variation in abundance estimates may represent inter-annual variation in distribution, rather than a change in abundance.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are not known for this stock; therefore, the default maximum net productivity rate of 0.04 (Anon. 1994) was used for purposes of this assessment.

POTENTIAL BIOLOGICAL REMOVAL

Potential biological removal level (PBR) was specified as the product of the minimum population size, one half the maximum net productivity rate, and a recovery factor for endangered, threatened, or depleted stocks, or stocks of unknown status relative to optimum sustainable population (OSP) (Anon. 1994). The recovery factor was 0.10 because sperm whales are an endangered species. The resulting PBR for this stock is 0.8 sperm whales.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

A commercial fishery for sperm whales operated in the Gulf of Mexico during the late 1700's to the early 1900's, but the exact number of whales taken is not known (Townsend 1935).

The level of current, direct, human-caused mortality and serious injury of sperm whales in the northern Gulf of Mexico is unknown, but available information indicates there likely is little, if any, fisheries interaction with sperm whales in the northern Gulf of Mexico.

There were no documented strandings of sperm whales in the northern Gulf of Mexico during 1987-1994 which were classified as likely caused by fishery interactions or other human-related causes. 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.

The total known fishery-related mortality and serious injury for this stock is less than 10% of the calculated PBR and, therefore, can be considered 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

Pelagic swordfish, tunas, and billfish are the targets of the longline fishery operating in the U.S. Gulf of Mexico. Total longline effort for the Gulf of Mexico pelagic fishery, including OCS edge, continental slope, and Mexican territorial waters, based on mandatory logbook reporting, was 4,400 sets in 1991, 4,850 sets in 1992, and 3,260 sets in 1993 (Cramer 1994). This fishery has been monitored with about 5% observer coverage, in terms of trips observed, since 1992. There were no reports of mortality or serious injury to sperm whales by this fishery.

Pair trawl fishing gear has the potential to capture marine mammals, but there have been no reports of mortality or serious injury to marine mammals in the Gulf of Mexico. This fishery has not been observed by NMFS observers, and there are no other data available as to the extent of this fishery in the Gulf of Mexico. It is assumed that it is very limited in scope and duration.

Other Mortality

A total of nine sperm whale strandings were documented in the northern Gulf of Mexico during 1987-1994. One of the whales had deep, parallel cuts posterior to the dorsal ridge that were believed to be caused by the propeller of a large vessel. This trauma was assumed to be the proximate cause of this stranding.

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.

STATUS OF STOCK

Stock size is considered to be low relative to OSP and the species is therefore listed as endangered under the Endangered Species Act (ESA). There are insufficient data to determine population trends. The total level of human-caused mortality and serious injury is unknown, but it is believed to be insignificant; however, because this species is listed as endangered and there is presently no recovery plan in place, any fishery-related mortality would be unlawful. This is a strategic stock because the sperm whale is listed as an endangered species under the ESA.

REFERENCES

- 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.
- Buckland, S. T., D. R. Anderson, K. P. Burnham and J. L. Laake. 1993. Distance Sampling: estimating abundance of biological populations. Chapman & Hall, London, 446 pp.
- Cramer, J. 1994. Large pelagic logbook newsletter - 1993. NOAA Tech. Mem. NMFS-SEFSC-352, 19 pp.
- Davis, R., G. Scott, B. Würsig, W. Evans, G. Fargion, L. Hansen, K. Mullin, N. May, T. Leming, B. Mate, J. Norris, and T. Jefferson. In preparation. Distribution and abundance of marine mammals in the north-central and western Gulf of Mexico: Final Report. OCS Study #MMS 94-0003. Texas Institute of Oceanography and the National Marine Fisheries Service. U.S. Dept. of the Interior, Minerals Mgmt. Service, Gulf of Mexico OCS Region, New Orleans, Louisiana.
- Hansen, L. J., K. D. Mullin and C. L. Roden. 1995. Estimates of cetacean abundance in the northern Gulf of Mexico from vessel surveys. Southeast Fisheries Science Center, Miami Laboratory, Contribution No. MIA-94/95-25, 9 pp. + tables and figures.
- Laake, J. L., S. T. Buckland, D. R. Anderson, and K. P. Burnham. DISTANCE user's guide, V2.0. Colorado Cooperative Fish & Wildlife Research Unit, Colorado State University, Ft. Collins, Colorado, 72 pp.
- Leatherwood, S. and R. R. Reeves. 1983. The Sierra Club handbook of whales and dolphins. Sierra Club Books, San Francisco, 302 pp.
- Mullin, K., W. Hoggard, C. Roden, R. Lohoefer, C. Rogers and B. Taggart. 1991. Cetaceans on the upper continental slope in the north-central Gulf of Mexico. OCS Study/MMS 91-0027. U.S. Dept. of the Interior, Minerals Management Service, Gulf of Mexico OCS Regional Office, New Orleans, Louisiana, 108 pp.
- Rice, D. W. 1989. Sperm whale, *Physeter macrocephalus* Linnaeus, 1758. Pages 177-233 in S. H. Ridgway and R. Harrison (editors), Handbook of marine mammals, Vol. 4: river dolphins and the larger toothed whales. Academic Press, London, 442 pp.
- Schmidly, D. J. 1981. Marine mammals of the southeastern United States and the Gulf of Mexico. U.S. Fish and Wildlife Service, Office of Biological Services, Washington, DC, FWS/OBS-80/41, 165 pp.
- Townsend, C. H. 1935. The distribution of certain whales as shown by logbook records of American whale ships. Zoologica 19: 1-50.

DWARF SPERM WHALE (*Kogia simus*): Northern Gulf of Mexico Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The dwarf sperm whale appears to be distributed worldwide in temperate to tropical waters (Caldwell and Caldwell 1989). Sightings of these animals in the northern Gulf of Mexico occur primarily along the continental shelf edge and over the deeper waters off the continental shelf (Mullin *et al.* 1991; Southeast Fisheries Science Center, SEFSC, unpublished data). Dwarf sperm whales and pygmy sperm whales (*Kogia breviceps*) are difficult to distinguish and sightings of either species are often categorized as *Kogia* sp. Sightings of this category were documented in all seasons during seasonal GulfCet aerial surveys of the northern Gulf of Mexico during 1993-1995 (Hansen *et al.* 1996). The few reliable sightings of dwarf sperm whales during those surveys were more numerous in spring, probably a result of greater survey efforts in that season (Jefferson and Shapiro 1997). Pygmy and dwarf sperm whales have been sighted in the northwestern Gulf of Mexico in waters 1000 m deep, on average (Davis *et al.* 1998). However, these authors cautioned that inferences on preferred bottom depths should await surveys for the entire Gulf of Mexico. The difficulty in sighting pygmy and dwarf sperm whales may be exacerbated by their avoidance reaction towards ships, and change in behavior towards approaching survey aircraft (Würsig *et al.* 1998). In a recent study using hematological and stable-isotope data, Barros *et al.* (1998) speculated that dwarf sperm whales may have a more pelagic distribution than pygmy sperm whales, and/or dive deeper during feeding bouts. There is no information on stock differentiation.

POPULATION SIZE

Estimates of abundance of *Kogia* sp. were derived through the application of distance sampling analysis (Buckland *et al.* 1993) and the computer program DISTANCE (Laake *et al.* 1993) to sighting data collected during 1991-1994 spring-summer, visual sampling, line-transect vessel surveys of the northern Gulf of Mexico (Fig. 1 in Hansen *et al.* 1995), which includes data collected as part of the GulfCet program (Hansen *et al.* 1996). These surveys were conducted throughout the area from approximately the 200 m isobath along the USA coast to the seaward extent of the USA Exclusive Economic Zone. The seasonal GulfCet aerial surveys included only a small portion of the species' range and therefore, these data were not used to estimate population size. Estimated abundance of *Kogia* sp. by survey year [coefficient of variation (CV) in parentheses] was 109 in 1991 (0.68), 1,010 in 1992 (0.40), 580 in 1993 (0.45), and 162 in 1994 (0.61) (Hansen *et al.* 1995). Survey effort-weighted estimated average abundance of *Kogia* sp. for all surveys combined was 547 (CV=0.28) (Hansen *et al.* 1995). Estimates of dwarf sperm whale abundance cannot be provided due to uncertainty of species identification at sea.

Minimum Population Estimate

A minimum population estimate was not calculated because of uncertainty of species identification at sea.

Current Population Trend

There is insufficient information to describe any population trend of this species in the Gulf of Mexico.

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. 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 the minimum population size, one half the maximum net productivity rate, and a "recovery" factor (Wade and Angliss 1997). The "recovery" factor, which accounts for endangered, depleted, and 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 dwarf sperm whale is unknown because the minimum population estimate cannot be estimated.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The level of past or current, direct, human-caused mortality of dwarf sperm whales in the northern Gulf of Mexico is unknown. Available information indicates there likely is little, if any, fisheries interaction with dwarf sperm whales in the northern Gulf of Mexico. There have been no logbook reports of fishery-related mortality or serious injury and no fishery-related mortality or serious injury has been observed.

There were no documented strandings of dwarf sperm whales in the northern Gulf of Mexico during 1987-October 1998 which were classified as likely caused by fishery interactions, but there have been stranding investigation reports of dwarf sperm whales which may have died as a result of other human-related causes. 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.

Fisheries Information

Pelagic swordfish, tunas, and billfish are the targets of the longline fishery operating in the USA Gulf of Mexico. Total longline effort for the Gulf of Mexico pelagic fishery, including OCS edge, continental slope, and Mexican territorial waters, based on mandatory logbook reporting, was 4,400 sets in 1991, 4,850 sets in 1992, and 3,260 sets in 1993 (Cramer 1994). This fishery has been monitored with about 5% observer coverage, in terms of trips observed, since 1992. There were no reports of mortality or serious injury of dwarf sperm whales by this fishery.

Pair trawl fishing gear has the potential to capture marine mammals, but there have been no reports of mortality or serious injury to marine mammals in the Gulf of Mexico. This fishery has not been observed by NMFS observers, and there are no other data available as to the extent of this fishery in the Gulf of Mexico. It is assumed that it is very limited in scope and duration.

Other Mortality

A total of at least 16 dwarf sperm whale strandings were documented in the northern Gulf of Mexico from 1990 through October 1998.

STATUS OF STOCK

The status of this stock relative to OSP is unknown and there are insufficient data to determine population trends. This species is not listed under the Endangered Species Act. Although the PBR cannot be calculated, there is no known fishery-related mortality or serious injury to this stock and, therefore, total fishery-related mortality and serious injury can be considered insignificant and approaching zero mortality and serious injury rate. The total level of fishery-related mortality and serious injury is unknown, but it is believed to be insignificant.

REFERENCES

- Barlow, J., S. L. Swartz, T. C. Eagle and P. R. Wade. 1995. U.S. Marine Mammal Stock Assessments: Guidelines for Preparation, Background and a Summary of the 1995 Assessments. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-OPR-6, 73 pp.
- Barros, N. B., D. A. Duffield, P. H. Ostrom, D. K. Odell and V. R. Cornish. 1998. Nearshore vs. offshore ecotype differentiation of *Kogia breviceps* and *K. simus* based on hemoglobin, morphometric and dietary analyses. Abstracts. World Marine Mammal Science Conference. Monaco. 20-24 January.
- Buckland, S. T., D. R. Anderson, K. P. Burnham and J. L. Laake. 1993. Distance Sampling: estimating abundance of biological populations. *Chapman & Hall*, London, 446 pp.
- Caldwell, D. K. and M. C. Caldwell. 1989. Pygmy sperm whale *Kogia breviceps* (de Blainville, 1838): dwarf sperm whale *Kogia simus* Owen, 1866. Pages 235-260 in: S. H. Ridgway and R. Harrison (eds), Handbook of marine mammals, Vol. 4: River dolphins and the larger toothed whales. *Academic Press*, San Diego.
- Cramer, J. 1994. Large pelagic logbook newsletter - 1993. NOAA Tech. Mem. NMFS-SEFSC-352, 19 pp.
- Davis, R. W., G. S. Fargion, N. May, T. D. Leming, M. Baumgartner, W. E. Evans, L. J. Hansen and K. Mullin. 1998. Physical habitats of cetaceans along the continental slope of the north-central and western Gulf of Mexico. *Mar. Mammal. Sci.*, 14:490-507.
- Hansen, L. J., K. D. Mullin, T. A. Jefferson and G. P. Scott. 1996. Visual surveys aboard ships and aircraft. Pages 55-132. In: R. W. Davis and G. S. Fargion (eds). Distribution and abundance of marine mammals in the north-central and

- western Gulf of Mexico: Final Report. Volume II: Technical Report. OCS Study MMS 96-0027. Prepared by the Texas Institute of Oceanography and the National Marine Fisheries Service. U.S. Dept. of the Interior, Minerals Mgmt. Service, Gulf of Mexico OCS Region, New Orleans, LA. 357 pp.
- Hansen, L. J., K. D. Mullin and C. L. Roden. 1995. Estimates of cetacean abundance in the northern Gulf of Mexico from vessel surveys. Southeast Fisheries Science Center, Miami Laboratory, Contribution No. MIA-94/95-25, 9 pp. + tables and figures.
- Jefferson, T. J. and A. Schiro. 1997. Distribution of cetaceans in the northern Gulf of Mexico. *Mammal Rev.*, 27:27-50.
- Laake, J. L., S. T. Buckland, D. R. Anderson and K. P. Burnham. 1993. DISTANCE user's guide, V2.0. Colorado Cooperative Fish & Wildlife Research Unit, Colorado State University, Ft. Collins, Colorado, 72 pp.
- Mullin, K., W. Hoggard, C. Roden, R. Lohofener, C. Rogers and B. Taggart. 1991. Cetaceans on the upper continental slope in the north-central Gulf of Mexico. OCS Study/MMS 91-0027. U.S. Dept. of the Interior, Minerals Management Service, Gulf of Mexico OCS Regional Office, New Orleans, Louisiana 108 pp.
- Wade, P.R., and R.P. Angliss. 1997. Guidelines for assessing marine mammal stocks: Report of the GAMMS Workshop April 3-5, Seattle, Washington. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-OPR-12, 93 pp.
- Würsig, B., S.K. Lynn, T.A. Jefferson, and K.D. Mullin. 1998. Behavior of cetaceans in the northern Gulf of Mexico relative to survey ships and aircraft. *Aquat. Mammals*, 24:41-50.

PYGMY SPERM WHALE (*Kogia breviceps*): Northern Gulf of Mexico Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The pygmy sperm whale appears to be distributed worldwide in temperate to tropical waters (Caldwell and Caldwell 1989). Sightings of these animals in the northern Gulf of Mexico occur primarily along the continental shelf edge and over the deeper waters off the continental shelf (Mullin *et al.* 1991; Southeast Fisheries Science Center, SEFSC, unpublished data). Pygmy sperm whales and dwarf sperm whales (*Kogia simus*) are difficult to distinguish and sightings of either species are often categorized as *Kogia* sp. Sightings of this category were documented in all seasons during seasonal GulfCet aerial surveys of the northern Gulf of Mexico during 1993-1995 (Hansen *et al.* 1996). Pygmy and dwarf sperm whales have been sighted in the northwestern Gulf of Mexico in waters 1000 m deep, on average (Davis *et al.* 1998). However, these authors cautioned that inferences on preferred bottom depths should await surveys for the entire Gulf of Mexico. The difficulty in sighting pygmy and dwarf sperm whales may be exacerbated by their avoidance reaction towards ships, and change in behavior towards approaching survey aircraft (Würsig *et al.* 1998). In a recent study using hematological and stable-isotope data, Barros *et al.* (1998) speculated that dwarf sperm whales may have a more pelagic distribution than pygmy sperm whales, and/or dive deeper during feeding bouts. There is no information on stock differentiation.

POPULATION SIZE

Estimates of abundance of *Kogia* sp. were derived through the application of distance sampling analysis (Buckland *et al.* 1993) and the computer program DISTANCE (Laake *et al.* 1993) to sighting data collected during 1991-1994 spring-summer, visual sampling, line-transect vessel surveys of the northern Gulf of Mexico (Hansen *et al.* 1995) (Fig. 1), which includes data collected as part of the GulfCet program (Hansen *et al.* 1996). These surveys were conducted throughout the area from approximately the 200 m isobath along the USA coast to the seaward extent of the USA Exclusive Economic Zone. The seasonal GulfCet aerial surveys included only a small portion of the species' range and therefore, these data were not used to estimate population size. Estimated abundance of *Kogia* sp. by survey year [coefficient of variation (CV) in parentheses] was 109 in 1991 (0.68), 1,010 in 1992 (0.40), 580 in 1993 (0.45), and 162 in 1994 (0.61) (Hansen *et al.* 1995). Survey effort-weighted estimated abundance of *Kogia* sp. for all surveys combined was 547 (CV = 0.28) (Hansen *et al.* 1995). Estimates of pygmy sperm whale abundance cannot be provided due to uncertainty of species identification at sea.

Minimum Population Estimate

A minimum population estimate could not be calculated because of uncertainty of species identification at sea.

Current Population Trend

There is insufficient information to describe any population trend for this species in the Gulf of Mexico.

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. 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 the minimum population size, one half the maximum net productivity rate, and a "recovery" factor (Wade and Angliss 1997). The "recovery" factor, which accounts for endangered, depleted, and 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 pygmy sperm whale is unknown because the minimum population estimate cannot be estimated.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The level of past or current, direct, human-caused mortality of pygmy sperm whales in the northern Gulf of Mexico is unknown. A available information indicates there likely is little, if any, fisheries interaction with pygmy sperm whales in the northern Gulf of Mexico. There have been no logbook reports of fishery-related mortality or serious injury and no fishery-related mortality or serious injury has been observed.

There have been no documented strandings of pygmy sperm whales in the northern Gulf of Mexico during 1987-October 1998 which have been classified as likely caused by fishery interactions, but there have been stranding investigation reports of pygmy sperm whales which may have died as a result of other human-related causes. 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.

Fisheries Information

Pelagic swordfish, tunas, and billfish are the targets of the longline fishery operating in the USA Gulf of Mexico. Total longline effort for the Gulf of Mexico pelagic fishery, including OCS edge, continental slope, and Mexican territorial waters, based on mandatory logbook reporting, was 4,400 sets in 1991, 4,850 sets in 1992, and 3,260 sets in 1993 (Cramer 1994). This fishery has been monitored with about 5% observer coverage, in terms of trips observed, since 1992. There were no reports of mortality or serious injury of pygmy sperm whales by this fishery.

Pair trawl fishing gear has the potential to capture marine mammals, but there have been no reports of mortality or serious injury to marine mammals in the Gulf of Mexico. This fishery has not been observed by NMFS observers, and there are no other data available as to the extent of this fishery in the Gulf of Mexico. It is assumed that it is very limited in scope and duration.

Other Mortality

At least 20 pygmy sperm whale strandings were documented in the northern Gulf of Mexico from 1990 through October 1998. Two of these animals had a plastic bag or pieces thereof in their stomachs (Tarpley and Marwitz 1993, Barros, unpublished data). Another animal stranded apparently due to injuries inflicted by impact, possibly with a vessel.

STATUS OF STOCK

The status of this stock relative to OSP is unknown and there are insufficient data to determine population trends. This species is not listed under the Endangered Species Act. Although the PBR cannot be calculated, the total known fishery-related mortality and serious injury for this stock is zero and, therefore, can be considered insignificant and approaching zero mortality and serious injury rate. The total level of fishery-related mortality and serious injury is unknown, but it is believed to be insignificant.

REFERENCES

- Barlow, J., S.L. Swartz, T.C. Eagle, and P.R. Wade. 1995. U.S. Marine Mammal Stock Assessments: Guidelines for Preparation, Background and a Summary of the 1995 Assessments. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-OPR-6, 73 pp.
- Barros, N.B., D.A. Duffield, P.H. Ostrom, D.K. Odell, and V.R. Cornish. 1998. Nearshore vs. offshore ecotype differentiation of *Kogia breviceps* and *K. simus* based on hemoglobin, morphometric and dietary analyses. Abstract. World Marine Mammal Science Conference. Monaco. 20-24 January.
- Buckland, S. T., D. R. Anderson, K. P. Burnham and J. L. Laake. 1993. Distance Sampling: estimating abundance of biological populations. *Chapman & Hall*, London, 446 pp.
- Caldwell, D. K. and M. C. Caldwell 1989. Pygmy sperm whale *Kogia breviceps* (de Blainville, 1838): dwarf sperm whale *Kogia simus* Owen, 1866. Pages 235-260 in: S. H. Ridgway and R. Harrison (eds), Handbook of marine mammals, Vol. 4: River dolphins and the larger toothed whales. *Academic Press*, San Diego.
- Cramer, J. 1994. Large pelagic logbook newsletter - 1993. NOAA Tech. Mem. NMFS-SEFSC-352, 19 pp.
- Davis, R.W., G.S. Fargion, N. May, T.D. Leming, M. Baumgartner, W.E. Evans, L.J. Hansen, and K. Mullin. 1998. Physical habitats of cetaceans along the continental slope of the north-central and western Gulf of Mexico. *Mar. Mamm. Sci.*, 14:490-507.

- Hansen, L.J., K.D. Mullin, T.A. Jefferson and G.P. Scott. 1996. Visual surveys aboard ships and aircraft. Pages 55-132. *In*: R.W. Davis and G.S. Fargion (eds). Distribution and abundance of marine mammals in the north-central and western Gulf of Mexico: Final Report. Volume II: Technical Report. OCS Study MMS 96-0027. Prepared by the Texas Institute of Oceanography and the National Marine Fisheries Service. U.S. Dept. of the Interior, Minerals Mgmt. Service, Gulf of Mexico OCS Region, New Orleans, LA. 357 pp.
- Hansen, L. J., K. D. Mullin and C. L. Roden. 1995. Estimates of cetacean abundance in the northern Gulf of Mexico from vessel surveys. Southeast Fisheries Science Center, Miami Laboratory, Contribution No. MIA-94/95-25, 9 pp. + tables and figures.
- Laake, J. L., S. T. Buckland, D. R. Anderson, and K. P. Burnham. 1993. DISTANCE user's guide, V2.0. Colorado Cooperative Fish & Wildlife Research Unit, Colorado State University, Ft. Collins, Colorado, 72 pp.
- Mullin, K., W. Hoggard, C. Roden, R. Lohoefer, C. Rogers and B. Taggart. 1991. Cetaceans on the upper continental slope in the north-central Gulf of Mexico. OCS Study/MMS 91-0027. U.S. Dept. of the Interior, Minerals Management Service, Gulf of Mexico OCS Regional Office, New Orleans, Louisiana 108 pp.
- Tarpley, R. J., and S. Marwitz. 1993. Plastic debris ingestion by cetaceans along the Texas coast: two case studies. *Aquat. Mammals*, 14:93-98.
- Wade, P. R. and R. P. Angliss. 1997. Guidelines for assessing marine mammal stocks: Report of the GAMMS Workshop April 3-5, Seattle, Washington. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-OPR-12, 93 pp.
- Würsig, B., S. K. Lynn, T. A. Jefferson and K. D. Mullin. 1998. Behavior of cetaceans in the northern Gulf of Mexico relative to survey ships and aircraft. *Aquat. Mammals*, 24:41-50.

BRYDE'S WHALE (*Balaenoptera edeni*): Northern Gulf of Mexico Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Bryde's whales are considered the tropical and sub-tropical baleen whale of the world's oceans. In the western Atlantic, Bryde's whales are reported from off the southeastern United States and the southern West Indies to Cabo Frio, Brazil (Leatherwood and Reeves 1983). It is postulated that the Bryde's whales found in the Gulf of Mexico may represent a resident stock (Schmidly 1981; Leatherwood and Reeves 1983), but there is no information on stock differentiation. Most sightings of Bryde's whales have occurred during the spring-summer months (Hansen et al. 1995; Davis et al., in preparation), but strandings have occurred throughout the year (Jefferson et al. 1992).

POPULATION SIZE

Estimates of abundance were derived through the application of distance sampling analysis (Buckland et al. 1993) and the computer program DISTANCE (Laake et al. 1993) to sighting data collected during 1991-1994 spring-summer, visual sampling, line-transect vessel surveys of the northern Gulf of Mexico (Hansen et al. 1995) (Fig. 1), which includes data collected as part of the GulfCet program (Davis et al., in preparation). These surveys were conducted throughout the area from approximately the 200 m isobath along the U.S. coast to the seaward extent of the U.S. Exclusive Economic Zone. The seasonal GulfCet aerial surveys included only a small portion of the stock range and these data were not used for abundance estimation. The estimated abundance of Bryde's whales by survey year was 218 in 1991 (coefficient of variation, CV = 1.28) and zero in 1992, 1993, and 1994 (Hansen et al. 1995). Survey effort-weighted estimated average abundance of Bryde's whales for all surveys combined was 35 (CV = 1.10) (Hansen et al. 1995) and based on only three sightings, all of which occurred in 1991.

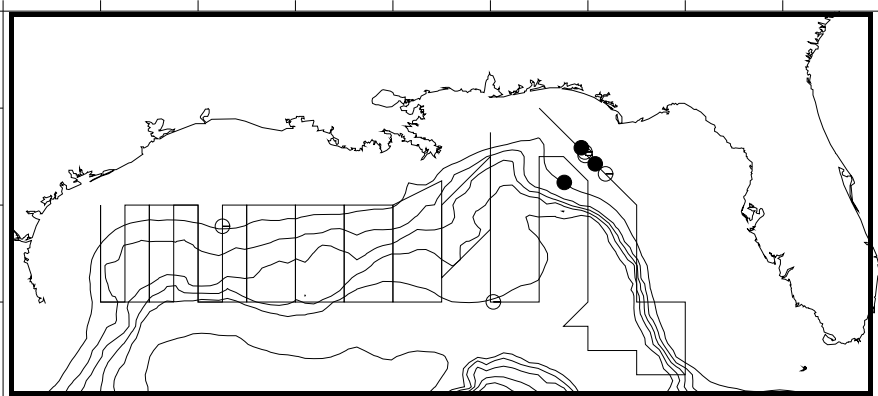


Figure 1. Distribution of Bryde's whale sightings (filled circles) and unidentified balaenopterid whales (unfilled circles) during NOAA Ship Oregon II marine mammal surveys during 1991-1994. The straight lines show transects during two ship surveys and are examples of typical ship survey transects. Isobaths are in 183 m (100 fm) intervals.

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, which is equivalent to the 20th percentile of the log-normal distributed abundance estimate as specified by NMFS (Anon. 1994). The minimum population estimate was based on the 1991-1994 average estimated abundance of Bryde's whales which was 35 (CV = 1.10) (Hansen et al. 1995) and is 17 Bryde's whales.

Current Population Trend

The abundance estimates decreased to zero for survey years 1992-1994 because Bryde's whales were not sighted during vessel surveys those years. This could be due to chance rather than to a decrease in population size and the result of a relatively small population size and low sampling intensity or it could be due to inter-annual variation in distribution.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are not known for this stock; therefore, the default maximum net productivity rate of 0.04 (Anon. 1994) was used for purposes of this assessment.

POTENTIAL BIOLOGICAL REMOVAL

Potential biological removal level (PBR) was specified as the product of the minimum population size, one half the maximum net productivity rate, and a recovery factor for endangered, threatened, or depleted stocks, or stocks of unknown status relative to optimum sustainable population (OSP) (Anon. 1994). The recovery factor was set at 0.50 because the status of the stock relative to OSP is unknown. The resulting PBR for this stock is 0.2 Bryde's whales.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The level of past or current, direct, human-caused mortality of Bryde's whales in the northern Gulf of Mexico is unknown, but available information indicates there is little fisheries interaction with Bryde's whales in the northern Gulf of Mexico. There was one report of a Bryde's whale entangled in line, but the line was removed and the animal released alive.

There were no documented strandings of Bryde's whales in the northern Gulf of Mexico during 1987-1994 which were classified as likely caused by fishery interactions or other human-related causes. 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.

The total known fishery-related mortality and serious injury for this stock is less than 10% of the calculated PBR and, therefore, can be considered 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

Pelagic swordfish, tunas, and billfish are the targets of the longline fishery operating in the U.S. Gulf of Mexico. Total longline effort for the Gulf of Mexico pelagic fishery, including OCS edge, continental slope, and Mexican territorial waters, based on mandatory logbook reporting, was 4,400 sets in 1991, 4,850 sets in 1992, and 3,260 sets in 1993 (Cramer 1994). This fishery has been monitored with about 5% observer coverage, in terms of trips observed, since 1992. There were no reports of mortality or serious injury to Bryde's whales by this fishery.

Pair trawl fishing gear has the potential to capture marine mammals, but there have been no reports of mortality or serious injury to marine mammals in the Gulf of Mexico. This fishery has not been observed by NMFS observers, and there are no other data available as to the extent of this fishery in the Gulf of Mexico. It is assumed that it is very limited in scope and duration.

Other Mortality

No human-caused mortality has been reported for this stock.

STATUS OF STOCK

The status of this stock relative to OSP is unknown and there are insufficient data to determine population trends. This species is not listed under the Endangered Species Act. The total level of human-caused mortality and serious injury is unknown, but it is believed to be insignificant; therefore, this is not a strategic stock.

REFERENCES

- 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.
- Buckland, S. T., D. R. Anderson, K. P. Burnham and J. L. Laake. 1993. Distance Sampling: estimating abundance of biological populations. Chapman & Hall, London, 446 pp.
- Cramer, J. 1994. Large pelagic logbook newsletter - 1993. NOAA Tech. Mem. NMFS-SEFSC-352, 19 pp.
- Davis, R., G. Scott, B. Würsig, W. Evans, G. Fargion, L. Hansen, K. Mullin, N. May, T. Leming, B. Mate, J. Norris and T. Jefferson. In preparation. Distribution and abundance of marine mammals in the north-central and western Gulf of Mexico: Final Report. OCS Study #MMS 94-0003. Texas Institute of Oceanography and the National Marine Fisheries Service. U.S. Dept. of the Interior, Minerals Mgmt. Service, Gulf of Mexico OCS Region, New Orleans, Louisiana.

- Hansen, L. J., K. D. Mullin and C. L. Roden. 1995. Estimates of cetacean abundance in the northern Gulf of Mexico from vessel surveys. Southeast Fisheries Science Center, Miami Laboratory, Contribution No. MIA-94/95-25, 9 pp. + tables and figures.
- Jefferson, T. A., S. Leatherwood, L. K. M. Shoda and R. L. Pitman. 1992. Marine mammals of the Gulf of Mexico: a field guide for aerial and shipboard observers. Texas A&M University Printing Center, College Station, Texas, 92 pp.
- Laake, J. L., S. T. Buckland, D. R. Anderson, and K. P. Burnham. DISTANCE user's guide, V2.0. Colorado Cooperative Fish & Wildlife Research Unit, Colorado State University, Ft. Collins, Colorado, 72 pp.
- Leatherwood, S. and R. R. Reeves. 1983. The Sierra Club handbook of whales and dolphins. Sierra Club Books, San Francisco, 302 pp.
- Schmidly, D. J. 1981. Marine mammals of the southeastern United States and the Gulf of Mexico. U.S. Fish and Wildlife Service, Office of Biological Services, Washington, DC, FWS/OBS-80/41, 165 pp.

CUVIER'S BEAKED WHALE (*Ziphius cavirostris*): Northern Gulf of Mexico Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Cuvier's beaked whales are distributed throughout the world's oceans except for the polar regions (Leatherwood and Reeves 1983; Heyning 1989). Strandings have occurred in all months along the United States east coast (Schmidly 1981) and have been documented throughout the year in the Gulf of Mexico. Strandings of Cuvier's beaked whales along the west coast of North America, based on skull characteristics, are thought to represent members of a panmictic population (Mitchell 1968), but there is no information on stock differentiation in the Gulf of Mexico and nearby waters.

Beaked whales were seen in all seasons during recent seasonal GulfCet aerial surveys of the northern Gulf of Mexico (Davis et al., in preparation). Some of the aerial survey sightings may have included Cuvier's beaked whale, but identification of beaked whale species from aerial surveys is problematic.

POPULATION SIZE

Estimates of abundance were derived through the application of distance sampling analysis (Buckland et al. 1993) and the computer program DISTANCE (Laake et al. 1993) to sighting data collected during 1991-1994 spring-summer, visual sampling, line-transect vessel surveys of the northern Gulf of Mexico (Hansen et al. 1995) (Fig. 1), which includes data collected as part of the GulfCet program (Davis et al., in preparation). These surveys were conducted throughout the area from approximately the 200 m isobath along the U.S. coast to the seaward extent of the U.S. Exclusive Economic Zone. The seasonal GulfCet aerial surveys included only a small portion of the stock range and these data were not used for abundance estimation. The estimated abundance [coefficient of variation (CV) in parentheses] by survey year was zero in 1991 and 1992, 70 in 1993 (0.63), and 38 in 1994 (0.80) (Hansen et al. 1995). Survey effort-weighted estimated average abundance of Cuvier's beaked whales was 30 (CV = 0.50) (Hansen et al. 1995). The estimated abundance of Cuvier's beaked whales is probably low because only sightings of beaked whales which could be positively identified to species were used.

Minimum Population Estimate

The minimum population estimate was based on average estimated abundance of Cuvier's beaked whales for all surveys combined which was 30 whales (CV = 0.50) (Hansen et al. 1995). 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 distributed abundance estimate as specified by NMFS (Aron 1994). The minimum population estimate is 20 Cuvier's beaked whales.

Current Population Trend

The abundance estimates were zero in 1991 and 1992, and then increased for 1993 and 1994. Cuvier's beaked whales were not sighted during the 1991 and 1992 vessel surveys. This could be due to chance given the small estimated population size and sampling intensity or inter-annual variation in distribution, rather than a change in population size.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

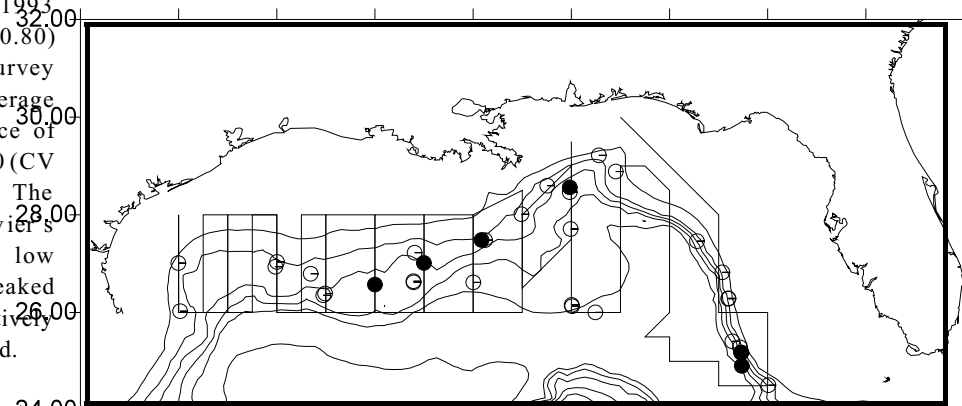


Figure 1. Distribution of Cuvier's beaked whale sightings (filled circles) and unidentified beaked whale sightings (unfilled circles) during NOAA Ship Oregon II marine mammal surveys during 1991-1994. The straight lines show transects during two surveys and are examples of typical ship survey transects. Isobaths are in 183 m (100 fm) intervals.

Current and maximum net productivity rates are not known for this stock; therefore, the default maximum net productivity rate of 0.04 (Anon. 1994) was used for purposes of this assessment.

POTENTIAL BIOLOGICAL REMOVAL

Potential biological removal level (PBR) was specified as the product of the minimum population size, one half the maximum net productivity rate, and a recovery factor for endangered, threatened, or depleted stocks, or stocks of unknown status relative to optimum sustainable population (OSP) (Anon. 1994). The recovery factor was set at 0.50 because the status of the stock relative to OSP is unknown. PBR for this stock is 0.2 Cuvier's beaked whales.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Cuvier's beaked whales were taken occasionally in a small, directed fishery for cetaceans that operated out of the Lesser Antilles (Caldwell and Caldwell 1971).

The actual level of past or current, direct, human-caused mortality of Cuvier's beaked whales in the northern Gulf of Mexico is unknown, but there have been no reports of fishery-related mortality or serious injury to beaked whales by U.S. fisheries in the Gulf of Mexico. Available information indicates there likely is little, if any, fisheries interaction with Cuvier's beaked whales in the northern Gulf of Mexico.

There were no documented strandings of Cuvier's beaked whales in the northern Gulf of Mexico during 1987-1994 which were classified as likely caused by fishery interactions or other human-related causes. 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.

Total fishery-related mortality and serious injury for this stock is less than 10% of the calculated PBR and, therefore, can be considered 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

Pelagic swordfish, tunas, and billfish are the targets of the longline fishery operating in the U.S. Gulf of Mexico. Total longline effort for the Gulf of Mexico pelagic fishery, including OCS edge, continental slope, and Mexican territorial waters, based on mandatory logbook reporting, was 4,400 sets in 1991, 4,850 sets in 1992, and 3,260 sets in 1993 (Cramer 1994). This fishery has been monitored with about 5% observer coverage, in terms of trips observed, since 1992. There were no reports of mortality or serious injury to Cuvier's or any beaked whales by this fishery.

Pair trawl fishing gear has the potential to capture marine mammals, but there have been no reports of mortality or serious injury to marine mammals in the Gulf of Mexico. This fishery has not been observed by NMFS observers, and there are no other data available as to the extent of this fishery in the Gulf of Mexico. It is assumed that it is very limited in scope and duration.

STATUS OF STOCK

The status of this stock relative to OSP is unknown and there are insufficient data to determine population trends. This species is not listed under the Endangered Species Act. The total level of human-caused mortality and serious injury is unknown, but it is believed to be insignificant; therefore, this is not a strategic stock.

REFERENCES

- 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.
- Buckland, S. T., D. R. Anderson, K. P. Burnham and J. L. Laake. 1993. Distance Sampling: estimating abundance of biological populations. Chapman & Hall, London, 446 pp.
- Caldwell, D. K. and M. C. Caldwell. 1971. Beaked whales, *Ziphius cavirostris*, in the Bahamas. Florida Academy of Science Quarterly Journal. 34: 157-160.
- Cramer, J. 1994. Large pelagic logbook newsletter - 1993. NOAA Tech. Mem. NMFS-SEFSC-352, 19 pp.
- Davis, R., G. Scott, B. Würsig, W. Evans, G. Fargion, L. Hansen, K. Mullin, N. May, T. Leming, B. Mate, J. Norris and T. Jefferson. In preparation. Distribution and abundance of marine mammals in the north-central and western

- Gulf of Mexico: Final Report. OCS Study #MMS 94-0003. Texas Institute of Oceanography and the National Marine Fisheries Service. U.S. Dept. of the Interior, Minerals Mgmt. Service, Gulf of Mexico OCS Region, New Orleans, Louisiana.
- Hansen, L. J., K. D. Mullin and C. L. Roden. 1995. Estimates of cetacean abundance in the northern Gulf of Mexico from vessel surveys. Southeast Fisheries Science Center, Miami Laboratory, Contribution No. MIA-94/95-25, 9 pp. + tables and figures.
- Heyning, J. E. 1989. Cuvier's beaked whale *Ziphius cavirostris* G. Cuvier, 1923. Pages 289-308 in S. H. Ridgway and R. Harrison (editors), Handbook of marine mammals, Vol. 4: River dolphins and the larger toothed whales, Academic Press, London, 442 pp.
- Jefferson, T. A., S. Leatherwood, L. K. M. Shoda and R. L. Pitman. 1992. Marine mammals of the Gulf of Mexico: a field guide for aerial and shipboard observers. Texas A&M University Printing Center, College Station, 92 pp.
- Laake, J. L., S. T. Buckland, D. R. Anderson, and K. P. Burnham. DISTANCE user's guide, V2.0. Colorado Cooperative Fish & Wildlife Research Unit, Colorado State University, Ft. Collins, Colorado, 72 pp.
- Leatherwood, S. and R. R. Reeves. 1983. The Sierra Club handbook of whales and dolphins. Sierra Club Books, San Francisco, 302 pp.
- Schmidly, D. J. 1981. Marine mammals of the southeastern United States and the Gulf of Mexico. U.S. Fish and Wildlife Service, Office of Biological Services, Washington, DC, FWS/OBS-80/41, 165 pp.

BLAINVILLE'S BEAKED WHALE (*Mesoplodon densirostris*): Northern Gulf of Mexico Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Only three species of *Mesoplodon* are known, from strandings and/or sightings, to occur in the Gulf of Mexico (Jefferson et al. 1992; Hansen et al. 1995). These are Blainville's beaked whale (*M. densirostris*), Gervais' beaked whale (*M. europaeus*), and Sowerby's beaked whale (*M. bidens*). The occurrence of Sowerby's beaked whale in the Gulf of Mexico is considered extralimital because there is only one known stranding of this species in the Gulf of Mexico (Bonde and O'Shea 1989) and because it normally occurs in northern temperate waters of the North Atlantic (Mead 1989).

Identification of *Mesoplodon* species at sea is problematic; therefore, nearly all sightings of these species are identified as beaked whales and may include sightings of *Ziphius cavirostris* that were not identified as such. Beaked whales were seen in all seasons during recent seasonal GulfCet aerial surveys of the northern Gulf of Mexico (Davis et al., in preparation).

Blainville's beaked whales appear to be widely but sparsely distributed in warm temperate and tropical waters of the world's oceans (Leatherwood et al. 1976; Leatherwood and Reeves 1983). Strandings have occurred along the northwestern Atlantic coast from Florida to Nova Scotia (Schmidly 1981), and there have been two documented strandings of this species in the northern Gulf of Mexico and one sighting (Jefferson et al. 1992; Hansen et al. 1995). There is no information on stock differentiation.

POPULATION SIZE

Estimates of abundance of beaked whales were derived through the application of distance sampling analysis (Buckland et al. 1993) and the computer program DISTANCE (Laake et al. 1993) to sighting data collected during 1991-1994 spring-summer, visual sampling, line-transect vessel surveys of the northern Gulf of Mexico (Hansen et al. 1995) (Fig. 1), which includes data collected as part of the GulfCet program (Davis et al., in preparation). These surveys were conducted throughout the area from approximately the 200 m isobath along the U.S. coast to the seaward extent of the U.S. Exclusive Economic Zone. The seasonal GulfCet aerial surveys included only a small portion of the stock range and these data were not used for abundance estimation. Survey effort-weighted estimated average abundance of beaked whales not identified to species for all surveys combined was 117 (coefficient of variation, CV = 0.38) (Hansen et al. 1995). Estimated beaked whale abundance (CV in parentheses) per survey year was 129 in 1991 (0.78), 18 in 1992 (1.27), 53 in 1993 (0.78), and 287 in 1994 (0.78) (Hansen et al. 1995). These estimates may also include an unknown number of Cuvier's beaked whales (*Ziphius cavirostris*) and abundance of Blainville's beaked whale cannot be estimated due to uncertainty of species identification at sea.

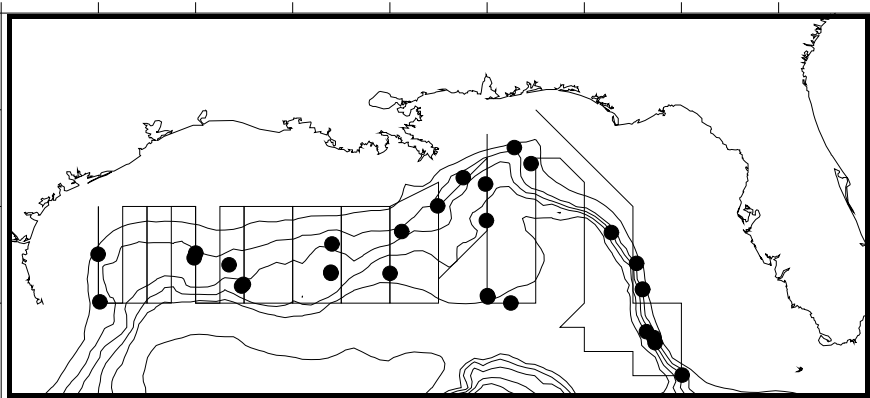


Figure 1. Distribution of beaked whale sightings during 1991-1994. The straight lines show transects during two surveys and are examples of typical survey transects. Isobaths are in 183 m (100 fm) intervals.

Minimum Population Estimate

A minimum population estimate was not calculated because of uncertainty of species identification of sightings.

Current Population Trend

The abundance estimates of beaked whales for 1991-1993 were lower than 1994, but there was considerable overlap of the log-normal 95% confidence intervals, which indicates the estimates were not significantly different at that level. Any differences in abundance estimates could be due to chance given the small estimated population size and sampling intensity or a change in distribution, rather than a change in population size.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are not known for this stock; therefore, the default maximum net productivity rate of 0.04 (Anon. 1994) was used for purposes of this assessment.

POTENTIAL BIOLOGICAL REMOVAL

Potential biological removal level (PBR) was not calculated because the minimum population size cannot be calculated.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The level of past or current, direct, human-caused mortality of beaked whales in the northern Gulf of Mexico is unknown, but there have been no documented reports of fishery-related mortality or serious injury to beaked whales by U.S. fisheries in the Gulf of Mexico. Available information indicates there likely is little, if any, fisheries interaction with beaked whales in the northern Gulf of Mexico.

There were no documented strandings of beaked whales in the northern Gulf of Mexico during 1987-1994 which were classified as likely caused by fishery interactions or other human-related causes. 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.

Although PBR cannot be calculated, the total known fishery-related mortality and serious injury for this stock is zero and, therefore, can be considered 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

Pelagic swordfish, tunas, and billfish are the targets of the longline fishery operating in the U.S. Gulf of Mexico. Total longline effort for the Gulf of Mexico pelagic fishery, including OCS edge, continental slope, and Mexican territorial waters, based on mandatory logbook reporting, was 4,400 sets in 1991, 4,850 sets in 1992, and 3,260 sets in 1993 (Cramer 1994). This fishery has been monitored with about 5% observer coverage, in terms of trips observed, since 1992.

Pair trawl fishing gear has the potential to capture marine mammals, but there have been no reports of mortality or serious injury to marine mammals in the Gulf of Mexico. This fishery has not been observed by NMFS observers, and there are no other data available as to the extent of this fishery in the Gulf of Mexico. It is assumed that it is very limited in scope and duration.

STATUS OF STOCK

The status of this stock relative to OSP is unknown and there are insufficient data to determine population trends. This species is not listed under the Endangered Species Act. The total level of human-caused mortality and serious injury is unknown, but it is believed to be insignificant; therefore, this is not a strategic stock.

REFERENCES

- 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.
- Bonde, R. K. and T. J. O'Shea. 1989. Sowerby's beaked whale (*Mesoplodon bidens*) in the Gulf of Mexico. *J. Mammal.* 70: 447-449.
- Buckland, S. T., D. R. Anderson, K. P. Burnham and J. L. Laake. 1993. *Distance Sampling: estimating abundance of biological populations.* Chapman & Hall, London, 446 pp.
- Cramer, J. 1994. Large pelagic logbook newsletter - 1993. NOAA Tech. Mem. NMFS-SEFSC-352, 19 pp.

- Davis, R., G. Scott, B. Würsig, W. Evans, G. Fargion, L. Hansen, K. Mullin, N. May, T. Leming, B. Mate, J. Norris and T. Jefferson. In preparation. Distribution and abundance of marine mammals in the north-central and western Gulf of Mexico: Final Report. OCS Study #MMS 94-0003. Texas Institute of Oceanography and the National Marine Fisheries Service. U.S. Dept. of the Interior, Minerals Mgmt. Service, Gulf of Mexico OCS Region, New Orleans, Louisiana.
- Hansen, L. J., K. D. Mullin and C. L. Roden. 1995. Estimates of cetacean abundance in the northern Gulf of Mexico from vessel surveys. Southeast Fisheries Science Center, Miami Laboratory, Contribution No. MIA-94/95-25, 9 pp. + tables and figures.
- Jefferson, T. A., S. Leatherwood, L. K. M. Shoda and R. L. Pitman. 1992. Marine mammals of the Gulf of Mexico: a field guide for aerial and shipboard observers. Texas A&M University Printing Center, College Station, TX. 92 pp.
- Laake, J. L., S. T. Buckland, D. R. Anderson, and K. P. Burnham. DISTANCE user's guide, V2.0. Colorado Cooperative Fish & Wildlife Research Unit, Colorado State University, Ft. Collins, Colorado, 72 pp.
- Leatherwood, S., D. K. Caldwell and H. E. Winn. 1976. Whales, dolphins, and porpoises of the western North Atlantic. NOAA Tech. Rep. NMFS CIRC-396, 176 pp.
- Leatherwood, S. and R. R. Reeves. 1983. The Sierra Club handbook of whales and dolphins. Sierra Club Books, San Francisco, 302 pp.
- Mead, J. G. 1989. Beaked whales of the genus *Mesoplodon*. Pages 349-430 in S. H. Ridgway and R. Harrison (editors), Handbook of marine mammals, Vol. 4: River dolphins and the larger toothed whales. Academic Press, London, 442 pp.

GERVAIS' BEAKED WHALE (*Mesoplodon europaeus*): Northern Gulf of Mexico Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Only three species of *Mesoplodon* are known, from strandings and/or sightings, to have occurred in the Gulf of Mexico (Jefferson et al. 1992; Hansen et al. 1995). These are Blainville's beaked whale (*M. densirostris*), Gervais' beaked whale (*M. europaeus*), and Sowerby's beaked whale (*M. bidens*). The occurrence of Sowerby's beaked whale in the Gulf of Mexico is considered extralimital because there is only one known stranding of this species in the Gulf of Mexico (Bonde and O'Shea 1989), and because it normally occurs in northern temperate waters of the North Atlantic (Mead 1989). Identification of *Mesoplodon* species at sea is problematic. Therefore, nearly all sightings of these species are identified as beaked whales and may include sightings of *Ziphius cavirostris* which were not identified as such. Beaked whales were seen in all seasons during recent seasonal GulfCet aerial surveys of the northern Gulf of Mexico (Davis et al., in preparation).

Strandings of Gervais' beaked whales have occurred along the northwestern Atlantic coast from Florida to New York (Mead 1989), and there have been at least ten documented strandings of this species in the Gulf of Mexico (Jefferson et al. 1992). There is no information on stock differentiation.

POPULATION SIZE

Estimates of abundance of beaked whales were derived through the application of distance sampling analysis (Buckland et al. 1993) and the computer program DISTANCE (Laake et al. 1993) to sighting data collected during 1991-1994 spring-summer, visual sampling, line-transect vessel surveys of the northern Gulf of Mexico (Hansen et al. 1995) (Fig. 1), which includes data collected as part of the GulfCet program (Davis et al., in preparation). These surveys were conducted throughout the area from approximately the 200 m isobath along the U.S. coast to the seaward extent of the U.S. Exclusive Economic Zone. The seasonal GulfCet aerial surveys included only a small portion of the stock range and these data were not used for abundance estimation. Survey effort-weighted estimated average abundance of beaked whales not identified to species for all surveys combined was 117 (coefficient of variation, CV = 0.38) (Hansen et al. 1995). Estimated beaked whale abundance (CV in parentheses) per survey year was 129 in 1991 (0.78), 18 in 1992 (1.27), 53 in 1993 (0.78), and 287 in 1994 (0.78) (Hansen et al. 1995). These estimates may also include an unknown number of Cuvier's beaked whales (*Ziphius cavirostris*) and abundance of Gervais' beaked whale cannot be estimated due to uncertainty of species identification at sea.

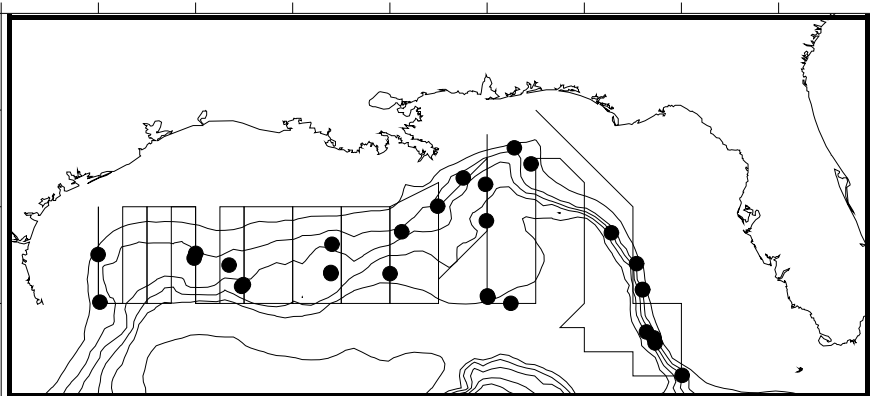


Figure 1. Distribution of beaked whale sightings during 1991-1994. The straight lines show transects during two surveys and are examples of typical survey transects. Isobaths are in 183 m (100 fm) intervals.

Minimum Population Estimate

A minimum population estimate could not be calculated because of uncertainty of species identification of sightings.

Current Population Trend

The abundance estimates of beaked whales for 1991-1993 were lower than 1994, but there was considerable overlap of the log-normal 95% confidence intervals, which indicates the estimates were not significantly different at that level. Any differences in abundance estimates could be due to chance given the small estimated population size and sampling intensity or a change in distribution, rather than a change in population size.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are not known for this stock; therefore, the default maximum net productivity rate of 0.04 (Anon. 1994) was used for purposes of this assessment.

POTENTIAL BIOLOGICAL REMOVAL

Potential biological removal level (PBR) was not calculated because the minimum population size cannot be calculated.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The level of past or current, direct, human-caused mortality of beaked whales in the northern Gulf of Mexico is unknown, but there have been no documented reports of fishery-related mortality or serious injury to beaked whales by U.S. fisheries in the Gulf of Mexico. Available information indicates there likely is little, if any, fisheries interaction with beaked whales in the northern Gulf of Mexico.

There were no documented strandings of beaked whales in the northern Gulf of Mexico during 1987-1994 which were classified as likely caused by fishery interactions or other human-related causes. 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.

Although PBR cannot be calculated, the total known fishery-related mortality and serious injury for this stock is zero and, therefore, can be considered 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

Pelagic swordfish, tunas, and billfish are the targets of the longline fishery operating in the U.S. Gulf of Mexico. Total longline effort for the Gulf of Mexico pelagic fishery, including OCS edge, continental slope, and Mexican territorial waters, based on mandatory logbook reporting, was 4,400 sets in 1991, 4,850 sets in 1992, and 3,260 sets in 1993 (Cramer 1994). This fishery has been monitored with about 5% observer coverage, in terms of trips observed, since 1992.

Pair trawl fishing gear has the potential to capture marine mammals, but there have been no reports of mortality or serious injury to marine mammals in the Gulf of Mexico. This fishery has not been observed by NMFS observers, and there are no other data available as to the extent of this fishery in the Gulf of Mexico. It is assumed that it is very limited in scope and duration.

STATUS OF STOCK

The status of this stock relative to OSP is unknown and there are insufficient data to determine population trends. This species is not listed under the Endangered Species Act. The total level of human-caused mortality and serious injury is unknown, but it is believed to be insignificant; therefore, this is not a strategic stock.

REFERENCES

- 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.
- Bonde, R. K. and T. J. O'Shea. 1989. Sowerby's beaked whale (*Mesoplodon bidens*) in the Gulf of Mexico. *J. Mammal.* 70: 447-449.
- Buckland, S. T., D. R. Anderson, K. P. Burnham and J. L. Laake. 1993. *Distance Sampling: estimating abundance of biological populations.* Chapman & Hall, London, 446 pp.
- Cramer, J. 1994. Large pelagic logbook newsletter - 1993. NOAA Tech. Mem. NMFS-SEFSC-352, 19 pp.
- Davis, R., G. Scott, B. Würsig, W. Evans, G. Fargion, L. Hansen, K. Mullin, N. May, T. Leming, B. Mate, J. Norris and T. Jefferson. In preparation. Distribution and abundance of marine mammals in the north-central and western Gulf of Mexico: Final Report. OCS Study #MMS 94-0003. Texas Institute of Oceanography and the National Marine Fisheries Service. U.S. Dept. of the Interior, Minerals Mgmt. Service, Gulf of Mexico OCS Region, New Orleans, Louisiana.

- Hansen, L. J., K. D. Mullin and C. L. Roden. 1995. Estimates of cetacean abundance in the northern Gulf of Mexico from vessel surveys. Southeast Fisheries Science Center, Miami Laboratory, Contribution No. MIA-94/95-25, 9 pp. + tables and figures.
- Jefferson, T. A., S. Leatherwood, L. K. M. Shoda and R. L. Pitman. 1992. Marine mammals of the Gulf of Mexico: a field guide for aerial and shipboard observers. Texas A&M University Printing Center, College Station, 92 pp.
- Laake, J. L., S. T. Buckland, D. R. Anderson, and K. P. Burnham. DISTANCE user's guide, V2.0. Colorado Cooperative Fish & Wildlife Research Unit, Colorado State University, Ft. Collins, Colorado, 72 pp.
- Mead, J. G. 1989. Beaked whales of the genus *Mesoplodon*. Pages 349-430 in S. H. Ridgway and R. Harrison (editors), Handbook of marine mammals, Vol. 4: River dolphins and the larger toothed whales. Academic Press, London, 442 pp.

BOTTLENOSE DOLPHIN (*Tursiops truncatus*): Gulf of Mexico Outer Continental Shelf Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The Gulf of Mexico Outer Continental Shelf (OCS) bottlenose dolphin stock is assumed to consist of the shallow, warm water bottlenose dolphin ecotype hypothesized by Hersh and Duffield (1990) inhabiting waters over the U.S. OCS in the northern Gulf of Mexico from approximately 9 km seaward of the 18 m isobath to approximately 9 km seaward of the 183 m isobath and from the U.S.-Mexican border to the Florida Keys. The stock range may extend into Mexican and Cuban territorial waters; however, there are no available estimates of either abundance or mortality from those countries. As a working hypothesis, the bottlenose dolphins inhabiting the 0-18 m depth stratum are believed to constitute coastal stocks in the western, northern, and eastern U.S. Gulf of Mexico separate from the OCS stock; however, the OCS stock may overlap with coastal stocks in some areas and may be genetically indistinguishable from those stocks. The OCS stock may be combined with some or all of the coastal stocks when additional data become available.

In addition, the aerial surveys from which the current abundance estimates were derived overlapped the outer continental shelf edge which is believed to be inhabited by the OCS edge and continental slope stock (Fig. 1). This stock is believed to consist of the deep, cold water ecotype described by Hersh and Duffield for the Atlantic (1990). It is not currently possible to differentiate the two ecotypes visually during aerial surveys.

POPULATION SIZE

Preliminary estimates of abundance were derived using distance sampling analysis (Buckland et al. 1993) and the computer program DISTANCE (Laake et al. 1993) with sighting data collected during Gulf of Mexico regional aerial line-transect surveys in September-October 1992 and 1993 (Blaylock and Hoggard 1994) and 1994 (NMFS unpublished data). Transects providing systematic coverage of the area and assumed to be randomly placed with respect to bottlenose dolphin distribution extended orthogonally from approximately 9 km past the 18 m isobath to approximately 9 km past the 183 m isobath. Approximately 3.3% of the total area was visually sampled. Preliminary analyses provided a bottlenose dolphin abundance estimate of 50,247 dolphins with coefficient of variation (CV) = 0.18. The survey area overlapped with a portion of the area occupied by the OCS edge and continental slope stock which was assumed to occur in waters over the OCS edge beyond to the seaward limits of the U.S. Exclusive Economic Zone. This would tend to inflate abundance estimate, but it is not currently possible to estimate the amount of potential bias.

Minimum Population Estimate

The minimum population estimate was based on the abundance estimate of 50,247 dolphins (CV = 0.18). 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). The minimum population estimate is 43,233 bottlenose dolphins.

Current Population Trend

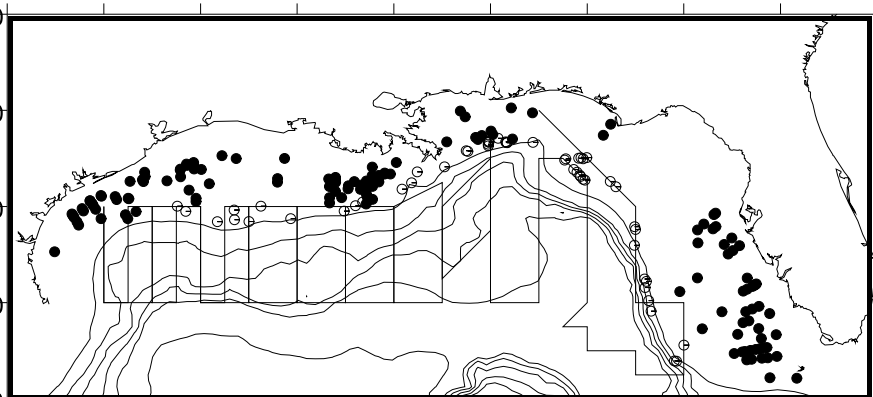


Figure 1. Sightings of U.S. Gulf of Mexico outer continental shelf (OCS) bottlenose dolphin stock during GOMEX regional aerial surveys (filled circles). Bottlenose dolphin sightings along the OCS edge and continental slope during NOAA Ship Oregon II surveys (unfilled circles), shown for comparison, are believed to be a separate stock. The straight lines show transects during two ship surveys and are examples of typical ship survey transects. Isobaths are in 183 m (100 fm) intervals.

The data are insufficient to determine population trends. Aerial surveys conducted during autumn 1983 and 1985 by the Southeast Fisheries Science Center (SEFSC) produced an abundance estimate of 31,519 bottlenose dolphins (CV = 0.08) for this stock (Scott et al. 1989). This population thus appears to have increased from earlier estimated levels; however, a valid statistical comparison of the historical and present estimated population sizes is not presently possible because of the preliminary nature of the recent population size estimate and the possible biases caused by overlap of the survey area with the OCS edge and continental slope stock.

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 (Reilly and Barlow 1986).

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 432 bottlenose dolphins.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

There are no observed cases of human-caused mortality and serious injury in this stock; however, based on an observed non-lethal take in U.S. Atlantic waters in 1993 in the pelagic longline fishery, this stock may be subject to incidental take resulting in serious injury or mortality. Fishery interactions have been reported to occur between bottlenose dolphins and the longline swordfish/tuna fishery in the Gulf of Mexico (SEFSC unpublished logbook data) and annual fishery-related mortality and serious injury to bottlenose dolphins is estimated to be 2.8 per year (CV = 0.74) during 1992-1993. This could include bottlenose dolphins from the outer continental shelf edge and continental slope stock.

Total fishery-related mortality and serious injury for this stock is less than 10% of the calculated PBR and, therefore, can 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

Annual fishing effort for the shrimp trawl fishery in the U.S. Gulf of Mexico OCS during 1988-1993 averaged approximately 2.58 million hours of tows (CV = 0.07) (NMFS unpublished data). This fishery was monitored by NMFS observers in 1992 and 1993, but less than 1% of the fishing effort was observed (NMFS unpublished data). There have been no reports of incidental mortality or injury associated with the shrimp trawl fishery in this area.

Pelagic swordfish, tunas, and billfish are the targets of the longline fishery operating in the U.S. Gulf of Mexico. Total longline effort for the Gulf of Mexico pelagic fishery, including OCS edge, continental slope, and Mexican territorial waters, based on mandatory logbook reporting, was 4,400 sets in 1991, 4,850 sets in 1992, and 3,260 sets in 1993 (Cramer 1994). This fishery has been monitored with about 5% observer coverage, in terms of trips observed, since 1992. 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. The following estimates were based on observed takes across the Atlantic longline swordfish/tuna fishery (which includes the Gulf of Mexico). All observed takes were used because the species occurs generally throughout the area of the fishery, but observed takes were infrequent in any given region of the fishery. There were no lethal takes of bottlenose dolphins observed or reported in 1992 and 1993, and only one non-lethal take was reported in 1993, which is assumed to have caused serious injury. The estimated level of fishery-related mortality and serious injury for the entire fishery, including waters outside of the Gulf of Mexico, in 1993 was 16 bottlenose dolphins (CV = 0.19). No take was observed in the Gulf of Mexico, but interactions between bottlenose dolphins and this fishery in the Gulf of Mexico have been reported under the Marine Mammal Protection Act Interim Exemption Program (NMFS 1993).

Given the fact that fishery interactions have been reported to occur between bottlenose dolphins and the longline swordfish/tuna fishery in the Gulf of Mexico, a probable level of fishery-related mortality and serious injury rate can be estimated. Under the assumption that the probability of an incidental take is proportional to fishing effort (number of sets),

the estimated level of incidental mortality and serious injury partitioned to include only the Gulf of Mexico stock would be 5.5 bottlenose dolphins in 1993 (CV = 0.19). Average annual fishery-related mortality and serious injury during 1992-1993 would be 2.8 bottlenose dolphins (CV = 0.74). This estimate could include dolphins from the OCS edge and continental slope stock.

Pair trawl fishing gear has the potential to capture marine mammals, but there have been no reports of mortality or serious injury to marine mammals in the Gulf of Mexico. This fishery has not been observed by NMFS observers, and there are no other data available as to the extent of this fishery in the Gulf of Mexico. It is assumed that it is very limited in scope and duration in the Gulf of Mexico.

A trawl fishery for butterfish was monitored by NMFS observers for a short period in the 1980's with no records of incidental take of marine mammals (Burn and Scott 1988; NMFS unpublished data), although an experimental set by NMFS resulted in the death of two bottlenose dolphins (Burn and Scott 1988). There are no other data available.

Other Human-Related Mortality or Serious Injury

The use of explosives to remove oil rigs in the portions of the OCS in the western Gulf of Mexico has the potential to cause serious injury or mortality to marine mammals. These activities have been closely monitored by NMFS observers since 1987 (Gitschlag and Hale, in press) and Gitschlag and Herczeg (in press) described the monitoring activities that occurred in 1992. There have been no reports of either serious injury or mortality to bottlenose dolphins (NMFS unpublished data).

STATUS OF STOCK

The status of this stock relative to OSP is not known and the population trend cannot be determined due to insufficient data. This species is not listed as threatened or endangered under the Endangered Species Act. This is not a strategic stock because fishery-related mortality and serious injury does not exceed PBR.

REFERENCES

- 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.
- Blaylock, R. A. and W. Hoggard. 1994. Preliminary estimates of bottlenose dolphin abundance in southern U.S. Atlantic and Gulf of Mexico continental shelf waters. NOAA Tech. Mem. NMFS-SEFSC-356, 10 pp.
- Buckland, S. T., D. R. Anderson, K. P. Burnham, and J. L. Laake. 1993. Distance sampling: Estimating abundance of biological populations. Chapman & Hall, London, 446 pp.
- Burn, D. and G. P. Scott. 1988. Synopsis of available information on marine mammal-fisheries interactions in the southeastern United States: preliminary report. NMFS/SEFC, Miami Laboratory, Coastal resources Division, Contribution ML-CRG-87/88-26, 37 pp.
- Gitschlag, G. R. and J. K. Hale. In press. Susceptibility of sea turtles to underwater explosives at offshore energy structure removals. Submitted to N. E. Gulf Science.
- Gitschlag, G. R. and B. A. Herczeg. In press. Sea turtle observations at explosive removals of energy structures. Submitted to Mar. Fish. Rev.
- Hersh, S. L. and D. A. Duffield. 1990. Distinction between northwest Atlantic offshore and coastal bottlenose dolphins based on hemoglobin profile and morphometry. Pages 129-139 in S. Leatherwood and R. R. Reeves (editors), The bottlenose dolphin, Academic Press, San Diego, 653 pp.
- Laake, J. L., S. T. Buckland, D. R. Anderson, and K. P. Burnham. DISTANCE user's guide, V2.0. Colorado Cooperative Fish & Wildlife Research Unit, Colorado State University, Ft. Collins, Colorado, 72 pp.
- Northridge, S. In review. Estimation of cetacean mortality in the U.S. Atlantic swordfish and tuna driftnet and pair trawl fisheries. Draft final report to the Northeast Fisheries Science Center, Contract No. 40ENNF500045. 18 pp.
- Reilly, S. B. and J. Barlow. 1986. Rates of increase in dolphin population size. Fish. Bull., U.S. 84(3): 527-533.

BOTTLENOSE DOLPHIN (*Tursiops truncatus*): Gulf of Mexico Continental Shelf Edge and Continental Slope Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

This bottlenose dolphin stock is defined as the stock which occupies the outer edge of the U.S. Gulf of Mexico Outer Continental Shelf (OCS) and waters over the continental slope within the U.S. Exclusive Economic Zone (EEZ), from the latitude and longitude of the U.S. EEZ off the U.S.-Mexico border to the latitude of the U.S. EEZ south of Key West, Florida. Close observation by experienced NMFS observers from shipboard surveys conducted throughout much of its range (Fig. 1) indicates that most of the dolphins sighted during ship-based surveys over the continental shelf edge and continental slope were the relatively large and robust dolphins assumed to be of the deep water ecotype hypothesized by Hersh and Duffield (1990). These dolphins were reported to be larger and darker in color than bottlenose dolphins seen over the continental shelf closer to shore (NMFS unpublished data). This stock's range may extend into Mexican and Cuban waters; however, there are no estimates available for bottlenose dolphin abundance or mortality from those countries.

POPULATION SIZE

Preliminary estimates of abundance were derived using distance sampling analysis (Buckland et al. 1993) and the computer program DISTANCE (Laake et al. 1993) with sighting data collected during shipboard line-transect surveys conducted during the spring of 1992-1994 (Fig. 1). These surveys were conducted throughout the area from approximately the 200 m isobath along the U.S. coast to the seaward extent of the U.S. Exclusive Economic Zone. The seasonal GulfCet aerial surveys included only a small portion of the stock range and these data were not used for abundance estimation. Average bottlenose dolphin abundance over six surveys was estimated at 5,618 dolphins with coefficient of variation (CV) = 0.26. In this analysis, it was assumed that all of the bottlenose dolphins sighted during the ship-based surveys were of this stock. The survey area overlapped in some areas with the OCS stock which was assumed to occur from approximately 9 km seaward of the 18 m isobath to approximately 9 km seaward of the 183 m isobath; however, the amount of overlap is considered insignificant and its effect on the abundance estimate is not known.

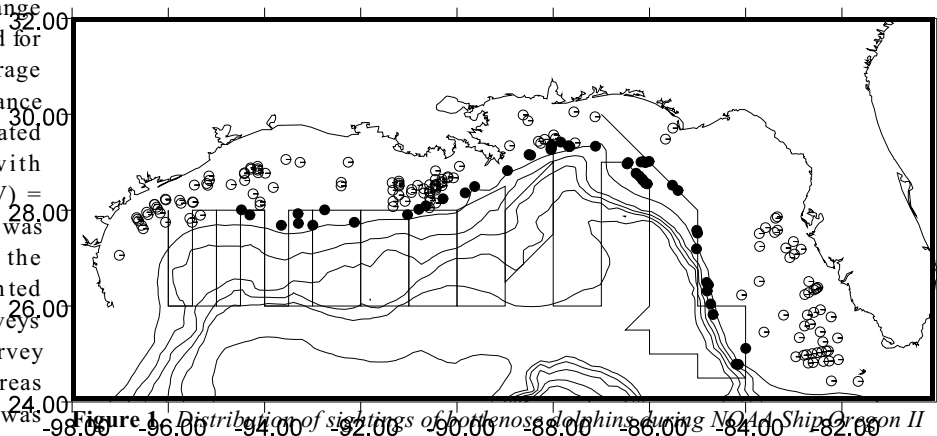


Figure 1. Distribution of sightings of bottlenose dolphins during NMFS Shipboard II marine mammal surveys in the Gulf of Mexico outer continental shelf (OCS) edge and continental slope waters (filled circles). Sightings of the OCS bottlenose dolphin stock made during GOMEX regional aerial surveys (unfilled circles) are shown for comparison. The bottlenose dolphin on the OCS are believed to be a separate stock. The straight lines show transects during two ship surveys and are examples of typical ship survey transects. Isobaths are in 183 m (100 fm) intervals.

Minimum Population Estimate

The minimum population estimate was based on the average bottlenose dolphin abundance estimate of 5,618 bottlenose dolphins (CV = 0.26). 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). The minimum population estimate is 4,530 bottlenose dolphins.

Current Population Trend

The data are insufficient to determine population trends.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates for this stock are unknown. The maximum net productivity rate for purposes of this assessment, was assumed to be 0.04. 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 (Reilly and Barlow, 1986).

POTENTIAL BIOLOGICAL REMOVAL

Potential biological removal (PBR) has been 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). The recovery factor was 0.50 because of the stock's unknown status relative to OSP. PBR for this stock is 45 bottlenose dolphins.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

There are no observed cases of human-caused mortality and serious injury in this stock; however, based on an observed non-lethal take in U.S. Atlantic waters in 1993 in the pelagic longline fishery, this stock may be subject to incidental take resulting in serious injury or mortality. Fishery interactions have been reported to occur between bottlenose dolphins and the longline swordfish/tuna fishery in the Gulf of Mexico [Southeast Fisheries Science Center (SEFSC) unpublished logbook data] and annual fishery-related mortality and serious injury to bottlenose dolphins is estimated to be 2.8 per year (CV = 0.74) during 1992-1993. This estimate could include bottlenose dolphins from the OCS stock.

The total fishery-related mortality and serious injury for this stock is less than 10% of the calculated PBR and, therefore, can 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 Interaction

Pelagic swordfish, tunas, and billfish are the targets of the longline fishery operating in the U.S. Gulf of Mexico. Total longline effort for the Gulf of Mexico pelagic fishery, including OCS edge, continental slope, and Mexican territorial waters, based on mandatory logbook reporting, was 4,400 sets in 1991, 4,850 sets in 1992, and 3,260 sets in 1993 (Cramer 1994). This fishery has been monitored with about 5% observer coverage, in terms of trips observed, since 1992. 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. The following estimates were based on observed takes across the Atlantic longline swordfish/tuna fishery (which includes the Gulf of Mexico). All observed takes were used because the species occurs generally throughout the area of the fishery, but observed takes were infrequent in any given region of the fishery. There were no lethal takes of bottlenose dolphins observed or reported in 1992 and 1993, and only one non-lethal take was reported in 1993, which is assumed to have caused serious injury. The estimated level of fishery-related mortality and serious injury for the entire fishery, including waters outside of the Gulf of Mexico, in 1993 was 16 bottlenose dolphins (CV = 0.19). No take was observed in the Gulf of Mexico, but there are logbook reports of interactions between bottlenose dolphins and this fishery (SEFSC unpublished logbook data).

Given the fact that fishery interactions have been reported to occur between bottlenose dolphins and the longline swordfish/tuna fishery in the Gulf of Mexico, a probable level of fishery-related mortality and serious injury rate can be estimated. Under the assumption that the probability of an incidental take is proportional to fishing effort (number of sets), the estimated level of incidental mortality and serious injury partitioned to include only the Gulf of Mexico stock would be 5.5 bottlenose dolphins in 1993 (CV = 0.19). Average annual fishery-related mortality and serious injury during 1992-1993 would be 2.8 bottlenose dolphins (CV = 0.74). This estimate could include dolphins from the OCS stock.

Pair trawl fishing gear has the potential to capture marine mammals, but there have been no reports of mortality or serious injury to marine mammals in the Gulf of Mexico. This fishery has not been observed by NMFS observers, and there are no other data available as to the extent of this fishery in the Gulf of Mexico. It is assumed that it is very limited in scope and duration.

A trawl fishery for butterfish was monitored by NMFS observers for a short period in the 1980's with no records of incidental take of marine mammals (Burn and Scott 1988; NMFS unpublished data), although an experimental NMFS set resulted in the death of two bottlenose dolphins (Burn and Scott 1988). There are no other data available.

Other Mortality

No direct or indirect human-caused mortality has been reported for this stock.

STATUS OF STOCK

The status of this stock relative to OSP is not known and the population trend cannot be determined due to insufficient data. This species is not listed as threatened or endangered under the Endangered Species Act. This is not a strategic stock because fishery-related mortality or serious injury does not exceed PBR.

REFERENCES

- 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.
- Buckland, S. T., D. R. Anderson, K. P. Burnham, and J. L. Laake. 1993. Distance sampling: Estimating abundance of biological populations. Chapman & Hall, London, 446 pp.
- Burn, D. and G. P. Scott. 1988. Synopsis of available information on marine mammal-fisheries interactions in the southeastern United States: preliminary report. NMFS/SEFSC, Miami Laboratory, Coastal resources Division, Contribution ML-CRG-87/88-26, 37 pp.
- Cramer, J. 1994. Large pelagic logbook newsletter - 1993. NOAA Tech. Mem. NMFS-SEFSC-352, 19 pp.
- Hersh, S. L. and D. A. Duffield. 1990. Distinction between northwest Atlantic offshore and coastal bottlenose dolphins based on hemoglobin profile and morphometry. Pages 129-139 in S. Leatherwood and R. R. Reeves (editors), The bottlenose dolphin, Academic Press, San Diego, 653 pp.
- Laake, J. L., S. T. Buckland, D. R. Anderson, and K. P. Burnham. DISTANCE user's guide, V2.0. Colorado Cooperative Fish & Wildlife Research Unit, Colorado State University, Ft. Collins, Colorado, 72 pp.
- Northridge, S. In review. Estimation of cetacean mortality in the U.S. Atlantic swordfish and tuna driftnet and pair trawl fisheries. Draft final report to the Northeast Fisheries Science Center, Contract No. 40ENNF500045. 18 pp.
- Reilly, S. B. and J. Barlow. 1986. Rates of increase in dolphin population size. Fish. Bull., U.S. 84(3): 527-533.

BOTTLENOSE DOLPHIN (*Tursiops truncatus*): Western Gulf of Mexico Coastal Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The western Gulf of Mexico coastal bottlenose dolphin stock has been defined for management purposes as the bottlenose dolphins inhabiting the nearshore coastal waters in the U.S. Gulf of Mexico from the Texas border to the Mississippi River mouth, from shore or presumed bay boundaries to 9.3 km seaward of the 18.3 m isobath (Fig. 1). As a working hypothesis, it is assumed that the dolphins occupying habitats with dissimilar climactic, coastal, and oceanographic characteristics might be restricted in their movements between habitats and, thus, constitute separate stocks. The western coastal area is characterized by an arid to temperate climate, sand beaches, and low fresh water input. The northern coastal stock area which is characterized by a temperate climate, barrier islands, sand beaches, coastal marshes and marsh islands, and has a relatively high level of fresh water input from rivers and streams. The eastern coastal stock area is temperate to subtropical in climate, is bordered by a mixture of coastal marshes, sand beaches, marsh and mangrove islands, and has an intermediate level of freshwater input.

The stock occurs trans-boundary with Mexico; however, there is no information available for abundance estimation, nor for estimating fishery-related mortality in Mexican waters. The ratio of DDE to DDT was extraordinarily high in tissues of one bottlenose dolphin stranded on the Texas coast (Varanasi et al. 1992), suggesting recent exposure to DDT which is still in use in Mexico.

The Mississippi River outflow may constitute an effective ecological barrier to stock migration at the eastern boundary. This assumption has not been tested and interbreeding may, in fact, occur between this and the northern coastal stock at this boundary; therefore, the

definition of this stock may be revised and the stock may be incorporated with the northern coastal stock when more data become available. There are data which suggest that there is considerable alongshore movement by some members of the western coastal stock (NMFS unpublished data), but the extent of this movement is unknown.

Some of this stock may co-occur with the resident bay, sound, and estuarine stocks, and breeding may occur among these stocks. For instance, two bottlenose dolphins previously seen in the South Padre Island area in Texas were seen in Matagorda Bay, 285 km north, in May 1992 and May 1993 (Lynn 1995). These sightings suggest that some bay stocks dolphins occasionally traverse the coastal stock area.

Portions of this stock may co-occur with the U.S. Gulf of Mexico outer continental shelf (OCS) stock. The seaward boundary for this stock corresponds to aerial survey strata (NMFS unpublished data) and thus, represents a management boundary rather than an ecological boundary. Anecdotal evidence suggests that both the coastal and OCS stocks consist of the shallow, warm water ecotype described by Hersh and Duffield (1990). Data are not currently available to determine genetically if the two stocks should be separated or, if so, where; and interbreeding may occur at the boundary interface.

POPULATION SIZE

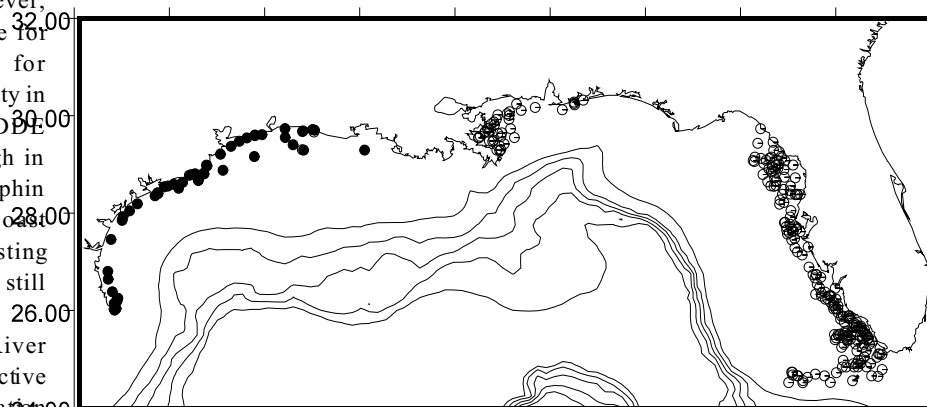


Figure 6.05. Sightings of bottlenose dolphins in the Gulf of Mexico in 1992-1994. Western Gulf of Mexico coastal bottlenose dolphin stock is shown with filled circles. Isobaths are in 183 m (100 fm) intervals.

Preliminary abundance estimates were derived using distance sampling analysis (Buckland et al. 1993) and the computer program DISTANCE (Laake et al. 1993) with sighting data collected during aerial line-transect surveys in September-October 1992 (Blaylock and Hoggard 1994). Sampling transects extended orthogonally from shore out to approximately 9 km past the 18 m isobath. The 1992 coastal survey area extended from the U.S. -Mexican border to the Mississippi River mouth. Systematic transects were placed randomly with respect to bottlenose dolphin distribution and provided approximately 5% visual coverage of the survey area. Bottlenose dolphin abundance was estimated to be 3,499 dolphins (CV = 0.21) (Blaylock and Hoggard 1994).

Minimum Population Estimate

The minimum population estimate was based on the 1992 abundance estimate of 3,499 bottlenose dolphins (CV = 0.21) (Blaylock and Hoggard 1994). The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The minimum population estimate is 2,938 bottlenose dolphins.

Current Population Trend

Aerial surveys of this area conducted by NMFS in autumn 1983 resulted in an estimated bottlenose dolphin abundance of 4,718 (CV = 0.10). The data are not sufficient to conduct a statistical trend analysis, but the current population size estimate is significantly lower than the 1983 estimate (Student's t-test, $P < 0.001$) and suggests a decline in stock abundance.

This stock was subject to higher than usual mortality levels in 1990, 1992, and 1993-94, and the incidence of bottlenose dolphin strandings along the Texas coast in those years was significantly higher than the 1984-94 mean stranding rate (Southeast U.S. Marine Mammal Stranding Network unpublished data). Some of these mortalities may have been related to accumulation of anthropogenic hydrocarbon contaminants. A recent study indicated an inverse relationship between hydrocarbon contaminant levels and certain bacterial and viral antigen titers in bottlenose dolphins from Matagorda Bay, Texas (Reif et al., in review).

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. 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 "recovery" factor, which accounts for endangered, depleted, and 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, because of an undetermined level of fishery-related mortality, and because of the recent occurrence of three anomalous mortality events. PBR for this stock is 29 dolphins.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The level of direct human-caused mortality in this stock is unknown. An annual mean of 13 (CV = 0.46) bottlenose dolphins stranded on the Texas coast during the period 1988-1993, showing signs of fishery interactions such as net entanglement, mutilation, gunshot wounds, etc. (Southeast U.S. Marine Mammal Stranding Network unpublished data). This was 10.3% of the total bottlenose dolphin strandings reported for this area. There were 283 reported bottlenose dolphin strandings in Texas (1994), of these 7 (2%) showed signs of human interaction. Three had evidence of fishery entanglement, one of which was found in a shrimp trawl, three were mutilated and one was shot. In 1995 the total number of reported bottlenose dolphins in Texas for 1995 was 110 and 3 (3%) were human interactions. One was found in a shrimp trawl. The total bottlenose dolphin strandings from January through August 31, 1996 was 175 and 1 (0.5%) had evidence of human interaction (entanglement).

There are a number of difficulties associated with the interpretation of stranding data. It is possible that some or all of the stranded dolphins may have been from a bay, sound or estuarine stock; however, the proportion of the stranded dolphins belonging to another stock cannot be determined because of the difficulty of determining from where the stranded carcass originated. Stranding data probably underestimate the extent of fishery-related mortality and serious injury because

not all of the dolphins which die or are seriously injured in fishery interactions 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.

Fisheries Information

Annual fishing effort for the shrimp trawl fishery in the western Gulf of Mexico coastal stock area during 1988-1993 averaged approximately 0.35 million hours of tows ($CV = 0.16$) (NMFS unpublished data). This fishery was monitored by NMFS observers in 1992 and 1993, but less than 1% of the fishing effort was observed (NMFS unpublished data). There have been no reports of incidental mortality or injury in the western Gulf of Mexico coastal bottlenose dolphin stock associated with the shrimp trawl fishery in this area.

The menhaden purse seine fishery targets the Gulf menhaden, *Brevoortia patronus*, in Gulf of Mexico coastal waters approximately 3-18 m in depth (NMFS 1991). Seventy-five menhaden vessels operate within 1.6 km of shore from Apalachicola, Florida to Freeport, Texas, from April-October. Lethal takes of bottlenose dolphins reported by the menhaden fishery during the period 1982-1988 ranged between 0-4 dolphins annually (NMFS unpublished data).

Gillnets are not used in Texas, and gillnets over 46 m³ in area will not be allowed in Florida past July 1995, but fixed and runaround gillnets are currently in use in Louisiana, Mississippi, and Alabama. These fisheries, for the most part, operate year around. They are state-controlled and licensed, and vary widely in intensity and target species. No marine mammal mortalities associated with gillnet fisheries have been reported in these states, but stranding data suggest that gillnet and marine mammal interaction does occur, causing mortality and serious injury.

The fishery for blue crabs operates in estuarine areas throughout the Gulf coast employing traps attached to a buoy with rope. Bottlenose dolphins have been reported stranded in Mississippi with polypropylene rope around their flukes indicating the possibility of entanglement with crab pot lines (NMFS 1991); however, this fishery has not been monitored by observers.

Two bottlenose dolphins were entangled and died in a scientific research net fishery for sea turtles in Sabine Pass in 1993 (A. Landry, Texas A&M University, report to Texas Marine Mammal Stranding Network, August 1993). The nets used in this Endangered Species Act (ESA) permitted research activity were two 4.9 m deep x 91.5 m in length stationary entanglement nets adjacent to each other. They were fished in shallow water (0.9-2.5 m depth), monitored continuously throughout the day, and removed at night.

Other Mortality

The coast adjacent to the nearshore habitat occupied by this stock varies from agricultural to industrial and, in some places, such as Galveston Island, is dense in human population. Concentrations of chlorinated hydrocarbons and metals were relatively low in most of the bottlenose dolphins examined in conjunction with an anomalous mortality event in Texas bays in 1990; however, some had concentrations at levels of possible toxicological concern (Varanasi et al. 1992). Agricultural runoff following periods of high rainfall in 1992 was implicated in a high level of bottlenose dolphin mortalities in Matagorda Bay, which is adjacent to the western coastal stock area (NMFS unpublished data). A recent study of hydrocarbon contaminant levels was conducted in conjunction with a health assessment study of 35 live-captured bottlenose dolphins in Matagorda Bay which adjoins the coastal stock area. Alpha-HCB, p,p,DDE, and PCB concentrations were inversely related to the magnitude of the serum antibody titer to *Erysipelas* spp. and *Staphylococcus* spp. bacteria (Reif et al., in review.). A similar and more pronounced trend was seen in relationship to the pseudorabies virus; however, since pseudorabies virus is not known to infect bottlenose dolphins, the significance of this finding is not clear. Concentrations of contaminants were higher in dolphins having evidence of exposure to the cetacean morbillivirus. The reason for the difference in the relationship between antibody titers to bacteria and pseudorabies and antibody titers to cetacean morbillivirus is not understood.

STATUS OF STOCK

The status of this stock relative to OSP is unknown. A population trend analysis is not available due to insufficient information. This species is not listed as threatened or endangered under the ESA. The occurrence of three anomalous mortality events among bottlenose dolphins along the Texas coast since 1990 (NMFS unpublished data) is cause for concern and the available evidence suggests that bottlenose dolphin stocks in the northern and western portion of the U.S. Gulf of Mexico may have experienced a morbillivirus epidemic in 1993 (Lipscomb 1993); however, the effects of these events on stock abundance has yet to be determined. 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 not a strategic stock because the known level of fishery-related mortality or serious injury does not exceed PBR.

REFERENCES

- Barlow, J., S.L. Swartz, T.C. Eagle, and P.R. Wade. 1995. U.S. Marine Mammal Stock Assessments: Guidelines for Preparation, Background and a Summary of the 1995 Assessments. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-OPR-6, 73 pp.
- Blaylock R. A. and W. Hoggard. 1994. Preliminary estimates of bottlenose dolphin abundance in southern U.S. Atlantic and Gulf of Mexico continental shelf waters. NOAA Tech. Mem. NMFS-SEFSC-356, 10 pp.
- Buckland, S. T., D. R. Anderson, K. P. Burnham, and J. L. Laake. 1993. Distance sampling: Estimating abundance of biological populations. Chapman & Hall, London, 446 pp.
- Hersh, S. L. and D. A. Duffield. 1990. Distinction between northwest Atlantic offshore and coastal bottlenose dolphins based on hemoglobin profile and morphometry. Pages 129-139 in S. Leatherwood and R. R. Reeves (editors), The bottlenose dolphin, Academic Press, San Diego, 653 pp.
- Laake, J. L., S. T. Buckland, D. R. Anderson, and K. P. Burnham. 1993. DISTANCE user's guide, V2.0. Colorado Cooperative Fish & Wildlife Research Unit, Colorado State University, Ft. Collins, Colorado, 72 pp.
- Lipscomb, T. P. 1993. Some answers to questions about morbillivirus. Pages 4-5 in R. A. Blaylock, B. Mase, and D. K. Odell (editors), Strandings - Newsletter of the Southeast U.S. Marine Mammal Stranding Network, Vol. 2 No. 3, Southeast Fisheries Science Center, Miami Laboratory, Miami, Florida, 8 pp.
- NMFS. 1991. Proposed regime to govern the interactions between marine mammals and commercial fishing operations after October 1, 1993. Draft Environmental Impact Statement. June 1991.
- Reif, J. S., L. J. Hansen, S. Galloway, G. Mitchum, T. L. Schmitt. In review. The relationship between chlorinated hydrocarbon contaminants and selected health parameters in bottlenose dolphins (*Tursiops truncatus*) from Matagorda Bay, Texas, 1992. Colorado State University, Fort Collins, and NMFS, Southeast Fisheries Science Center, Miami, Florida.
- Varanasi, U., K. L. Tilbury, D. W. Brown, M. M. Krahn, C. A. Wigren, R. C. Clark, and S-L. Chan. 1992. Pages 56-86 in L. J. Hansen (editor), Report on investigation of 1990 Gulf of Mexico bottlenose dolphin strandings, Southeast Fisheries Science Center Contribution MIA-92/93-21, 219 pp.
- Wade, P.R., and R.P. Angliss. 1997. Guidelines for assessing marine mammal stocks: Report of the GAMMS Workshop April 3-5, Seattle, Washington. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-OPR-12, 93 pp.

BOTTLENOSE DOLPHIN (*Tursiops truncatus*): Northern Gulf of Mexico Coastal Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The northern Gulf of Mexico coastal bottlenose dolphin stock has been defined for management purposes as those bottlenose dolphins occupying the nearshore coastal waters in the U.S. Gulf of Mexico from the Mississippi River mouth to approximately 84° W longitude, from shore, barrier islands, or presumed bay boundaries to 9.3 km seaward of the 18.3 m isobath (Fig. 1). As a working hypothesis, it is assumed that the dolphins occupying habitats with dissimilar climactic, coastal, and oceanographic characteristics might be restricted in their movements between habitats and, thus, constitute separate stocks. The northern coastal stock area is characterized by a temperate climate, barrier islands, sand beaches, coastal marshes and marsh islands, and has a relatively high level of fresh water input from rivers and streams. It is bordered on the east by an extensive area of coastal marsh and marsh islands typical of Florida's Apalachee Bay. The western coastal area is characterized by an arid to temperate climate, sand beaches, and low fresh water input. The eastern coastal stock area is temperate to subtropical in climate, is bordered by a mixture of coastal marshes, sand beaches, marsh and mangrove islands, and has an intermediate level of freshwater input.

The definition of this stock may be changed and it may be incorporated with other Gulf of Mexico stocks when more data become available. Seasonal changes in bottlenose dolphin abundance in Mississippi Sound (NMFS unpublished data) suggests that there is interchange with at least that portion of the Gulf of Mexico bay and sound stocks; however, its extent and significance is not presently known. Portions of this stock may co-occur with the U.S. Gulf of Mexico outer continental shelf (OCS) stock. The seaward boundary for this stock corresponds to aerial survey strata (NMFS unpublished data) and thus, represents a management boundary rather than an ecological boundary. Anecdotal evidence suggests that both the coastal and OCS stocks consist of the shallow, warm water ecotype described by Hersh and Duffield (1990). Data are not currently available to determine genetically if the stocks should be separated or, if so, where; and interbreeding may occur at the boundary interface.

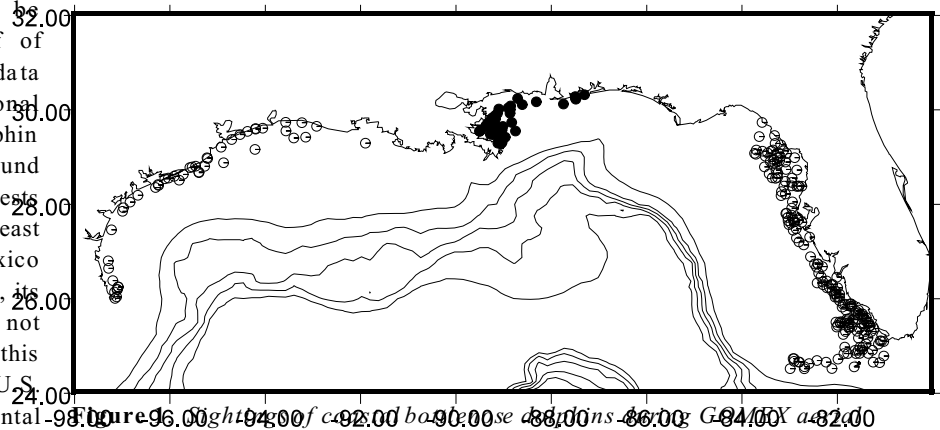


Figure 1. Sightings of coastal bottlenose dolphins in the Gulf of Mexico as a result of aerial surveys of the Gulf of Mexico in 1992-1994. Northern Gulf of Mexico coastal bottlenose dolphin stock is shown with filled circles. Isobaths are in 183 m (100 fm) intervals.

POPULATION SIZE

Preliminary estimates of abundance were derived using distance sampling analysis (Buckland et al. 1993) and the computer program DISTANCE (Laake et al. 1993) with sighting data collected during aerial line-transect surveys in September-October 1993 (Blaylock and Hoggard 1994). Systematic sampling transects, placed randomly with respect to the bottlenose dolphin distribution, extended orthogonally from shore out to approximately 9 km past the 18 m isobath. The area surveyed extended from the Mississippi River mouth to approximately 84° W Longitude, and approximately 5% of the total area was visually searched. Bottlenose dolphin abundance was estimated to be 4,191 dolphins with coefficient of variation (CV) = 0.21 (Blaylock and Hoggard 1994).

Minimum Population Estimate

The minimum population estimate was based on the 1993 abundance estimate of 4,191 dolphins (CV = 0.21) (Blaylock and Hoggard 1994). The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The minimum population estimate is 3,518 bottlenose dolphins.

Current Population Trend

Aerial surveys of this area conducted partly in autumn 1983 and partly in autumn 1985, by NMFS resulted in an estimated bottlenose dolphin abundance of 1,319 (CV = 0.10). The data are not sufficient to conduct a statistical trend analysis, but the current population size estimate is significantly higher than the 1983-85 estimate (Student's t-test, $P < 0.005$).

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. 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 "recovery" factor, which accounts for endangered, depleted, and 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, because the stock apparently sustains some unknown level of fishery-related mortality, and because of the unknown effects of the 1993 mortality event. PBR for this stock is 35 dolphins.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The level of direct human-caused mortality in this stock is unknown. An annual average of ten bottlenose dolphins (CV = 0.41) stranded on the coast of Louisiana, Mississippi, or Alabama during the period 1988-1993, showing signs of fishery interactions such as net entanglement, mutilation, gunshot wounds, etc. (Southeast U.S. Marine Mammal Stranding Network unpublished data). This was 8.2% of the total bottlenose dolphin strandings reported for this area. In 1994, the Stranding Network reported a total of 92 bottlenose dolphins in Mississippi, Louisiana and Alabama, four (4%) were reported as showing signs of human interaction. One was a boat strike, one entangled in fishing gear and 2 had gunshot wounds. There were 78 strandings reported in 1995 in the northern Gulf and 10 (12%) had evidence of human interaction; 6 were entanglements (2 were found wrapped in a square gillnet), two mutilations and 2 had gunshot wounds. A total of 120 bottlenose dolphin strandings was reported from January through August 31, 1996, and four (3%) of these were reported as human interactions (2 net entanglements, 1 boat strike and one mutilation).

There are a number of difficulties associated with the interpretation of stranding data. It is possible that some or all of the stranded dolphins may have been from a bay, sound or estuarine stock; however, the proportion of the stranded dolphins belonging to another stock cannot be determined because of the difficulty of determining from where the stranded carcass originated. Stranding data probably underestimate the extent of fishery-related mortality and serious injury because not all of the dolphins which die or are seriously injured in fishery interactions 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.

Fisheries Information

Annual fishing effort for the shrimp trawl fishery in the northern Gulf of Mexico coastal stock area during 1988-1993 averaged approximately 2.17 million hours of tows (CV = 0.13) (NMFS unpublished data). This fishery was monitored by NMFS observers in 1992 and 1993, but less than 1% of the fishing effort was observed (NMFS unpublished data). There have been no reports of incidental mortality or injury in the northern Gulf of Mexico coastal bottlenose dolphin stock associated with the shrimp trawl fishery in this area.

The menhaden purse seine fishery targets the Gulf menhaden, *Brevoortia patronus*, in Gulf of Mexico coastal waters approximately 3-18 m in depth (NMFS 1991). Seventy-five menhaden vessels operate within 1.6 km of shore from Apalachicola, Florida to Freeport, Texas, from April-October. Lethal takes of bottlenose dolphins reported by the menhaden fishery during the period 1982-1988 ranged between 0-4 dolphins annually (NMFS unpublished data).

Other clupeid purse seiners opportunistically target Spanish sardine, thread herring, ladyfish, cigarfish, and blue runners. Single boat purse seiners, fishing for sardines and herrings, operate in coastal waters between the Mississippi River delta and Pascagoula, Mississippi and in the Florida panhandle between Pensacola and Apalachicola. It is estimated that ten vessels participate in this fishery between May-October. There are no estimates of dolphin mortality associated with this fishery.

Gillnets are not used in Texas, and gillnets over 46 m³ in area will not be allowed in Florida past July 1995, but fixed and runaround gillnets are currently in use in Louisiana, Mississippi, and Alabama. These fisheries, for the most part, operate year around. They are state-controlled and licensed, and vary widely in intensity and target species. No marine mammal mortalities associated with gillnet fisheries have been reported in these states, but stranding data suggest that gillnet and marine mammal interaction does occur, causing mortality and serious injury.

The fishery for blue crabs operates in estuarine areas throughout the Gulf coast employing traps attached to a buoy with rope. Bottlenose dolphins have been reported stranded in Mississippi with polypropylene rope around their flukes indicating the possibility of entanglement with crab pot lines (NMFS 1991); however, this fishery has not been monitored by observers.

Other Mortality

The nearshore habitat occupied by this stock is adjacent to areas of high human population. Two stranded dolphins from the northern Gulf coastal area (one from Mississippi and one from Alabama) had the highest levels of DDT derivatives of any of the bottlenose dolphin liver samples analyzed in conjunction with the 1990 mortality investigation conducted by NMFS (Varanasi et al. 1992). The significance of these findings are unclear, but there is some evidence that increased exposure to anthropogenic compounds may reduce immune function in bottlenose dolphins. A recent study found the magnitude of the serum antibody titer to *Erysipelas* spp. and *Staphylococcus* spp. bacteria in bottlenose dolphins was inversely related to α -HCB, p,p-DDE, and PCB's concentrations (Reif et al., in review).

This stock was subject to a high incidence of mortality in 1993, which was suspected to have been the result of a morbillivirus epidemic. The effect of this mortality event on the stock cannot be determined, in part, because the mortality may have also affected the bay, sound and estuarine stock and the stock identity of the stranded animals could not be determined. The increase in mortalities began in the Florida panhandle area and moved westward during that period (NMFS unpublished data). Concentrations of contaminants were found to be higher in dolphins having evidence of exposure to the cetacean morbillivirus (Reif et al., in review). The reason for the relationship between cetacean morbillivirus antibody titers and high contaminant levels is not understood and the effect of the epidemic on this stock has not been determined.

STATUS OF STOCK

The status of this stock relative to OSP is not known and population trends cannot be determined due to insufficient data. This species is not listed as threatened or endangered under the Endangered Species Act. The total fishery-related mortality and serious injury for this stock is unknown, but considering the evidence from stranding data, it may not be 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 not a strategic stock because the known level of fishery-related mortality or serious injury does not exceed PBR.

REFERENCES

- Barlow, J., S.L. Swartz, T.C. Eagle, and P.R. Wade. 1995. U.S. Marine Mammal Stock Assessments: Guidelines for Preparation, Background and a Summary of the 1995 Assessments. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-OPR-6, 73 pp..
- Blaylock, R. A. and W. Hoggard. 1994. Preliminary estimates of bottlenose dolphin abundance in southern U.S. Atlantic and Gulf of Mexico continental shelf waters. NOAA Tech. Mem. NMFS-SEFSC-356, 10 pp.
- Buckland, S. T., D. R. Anderson, K. P. Burnham, and J. L. Laake. 1993. Distance sampling: Estimating abundance of biological populations. Chapman & Hall, London, 446 pp.
- Hersh, S. L. and D. A. Duffield. 1990. Distinction between northwest Atlantic offshore and coastal bottlenose dolphins based on hemoglobin profile and morphometry. Pages 129-139 in S. Leatherwood and R. R. Reeves (editors), The bottlenose dolphin, Academic Press, San Diego, 653 pp.
- Laake, J. L., S. T. Buckland, D. R. Anderson, and K. P. Burnham. 1993. DISTANCE user's guide, V2.0. Colorado Cooperative Fish & Wildlife Research Unit, Colorado State University, Ft. Collins, Colorado, 72 pp.

- Lipscomb, T. P. 1993. Some answers to questions about morbillivirus. Pages 4-5 in R. A. Blaylock, B. Mase, and D. K. Odell (editors), *Strandings* - Newsletter of the Southeast U.S. Marine Mammal Stranding Network, Vol. 2 No. 3, Southeast Fisheries Science Center, Miami Laboratory, Miami, Florida, 8 pp.
- NMFS. 1991. Proposed regime to govern the interactions between marine mammals and commercial fishing operations after October 1, 1993. Draft Environmental Impact Statement. June 1991.
- Reif, J. S., L. J. Hansen, S. Galloway, G. Mitchum, T. L. Schmitt. In review. The relationship between chlorinated hydrocarbon contaminants and selected health parameters in bottlenose dolphins (*Tursiops truncatus*) from Matagorda Bay, Texas, 1992. Colorado State University, Fort Collins, and NMFS, Southeast Fisheries Science Center, Miami, Florida.
- Wade, P.R., and R.P. Angliss. 1997. Guidelines for assessing marine mammal stocks: Report of the GAMMS Workshop April 3-5, Seattle, Washington. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-OPR-12, 93 pp.

BOTTLENOSE DOLPHIN (*Tursiops truncatus*): Eastern Gulf of Mexico Coastal Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The eastern Gulf of Mexico coastal bottlenose dolphin stock has been defined for management purposes as the bottlenose dolphins occupying the area which extends from approximately 84° W Longitude to Key West, Florida, from shore, barrier islands, or presumed bay boundaries to 9.3 km seaward of the 18.3 m isobath (Fig. 1). As a working hypothesis, it is assumed that the dolphins occupying habitats with dissimilar climactic, coastal, and oceanographic characteristics might be restricted in their movements between habitats and, thus, constitute separate stocks. The eastern coastal stock area is temperate to subtropical in climate, is bordered by a mixture of coastal marshes, sand beaches, marsh and mangrove islands, and has an intermediate level of freshwater input. It is bordered on the north by an extensive area of coastal marsh and marsh islands typical of Florida's Apalachee Bay. The western coastal area is characterized by an arid to temperate climate, sand beaches, and low fresh water input. The northern coastal stock area is characterized by a temperate climate, barrier islands, sand beaches, coastal marshes and marsh islands, and has a relatively high level of fresh water input from rivers and streams.

Portions of this stock may co-occur with the U.S. Gulf of Mexico outer continental shelf (OCS) stock. The seaward

boundary for this stock corresponds to aerial survey strata (NMFS unpublished data) and thus, represents a management boundary rather than an ecological boundary. Anecdotal evidence suggests that both the coastal and OCS stocks consist of the shallow, warm water ecotype described by Hersh and Duffield (1990). Data are not currently available to determine genetically if the two stocks should be separated or, if so, where; and interbreeding may occur at the boundary interface.

POPULATION SIZE

Preliminary estimates of abundance were derived using distance sampling analysis (Buckland et al. 1993) and the computer program DISTANCE (Laake et al. 1993) with sighting data collected during aerial line-transect surveys conducted during autumn 1994 (NMFS unpublished data). Systematic sampling transects, placed randomly with respect to the bottlenose dolphin distribution, extended orthogonally from shore out to approximately 9 km past the 18 m isobath. Approximately 5% of the total survey area was visually searched. Bottlenose dolphin abundance was estimated to be 9,912 dolphins with coefficient of variation (CV) = 0.12.

Minimum Population Estimate

The minimum population estimate was based on the 1994 abundance estimate of 9,912 (CV = 0.12) (NMFS unpublished data). The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The minimum population estimate is 8,963 bottlenose dolphins.

Current Population Trend

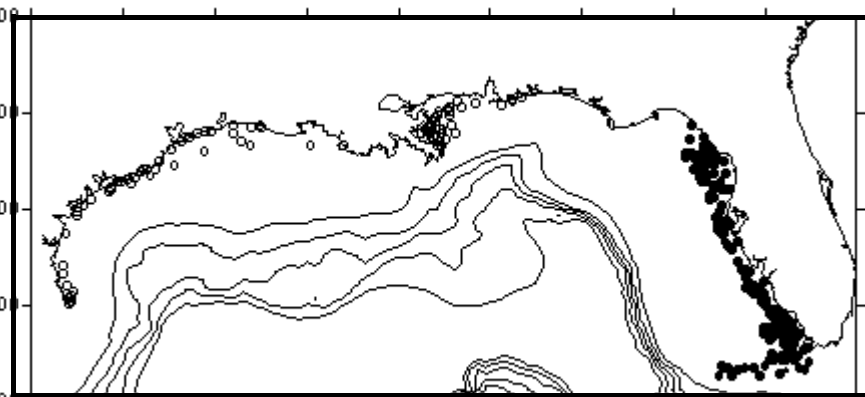


Figure 1. Sightings of coastal bottlenose dolphins during GOMEX aerial surveys of the Gulf of Mexico in 1992-1994. Eastern Gulf of Mexico coastal bottlenose dolphin stock is shown with filled circles. Isobaths are in 183 m (100 fm) intervals.

Aerial surveys of this area conducted by NMFS in autumn 1985, resulted in an estimated bottlenose dolphin abundance of 4,711 (CV = 0.05). The data are not sufficient to conduct a statistical trend analysis, but the current population size estimate is significantly higher than the 1985 estimate (Student's t-test, $P < 0.0005$).

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. 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 "recovery" factor, which accounts for endangered, depleted, and 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 this stock is 90 dolphins.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The level of direct human-caused mortality in this stock is unknown. An annual mean of eight bottlenose dolphins (CV = 0.41) stranded on the Florida Gulf coast during the period 1988-1993, showing signs of fishery interactions such as net entanglement, mutilation, gunshot wounds, etc. (Southeast U.S. Marine Mammal Stranding Network unpublished data). This was 8.9% of the total bottlenose dolphin strandings reported for this area. Morgan and Patton (1990) reported that 12.9% of 116 cetaceans examined by Mote Marine Laboratory's marine mammal stranding response program on the west coast of Florida between 1984 and 1990 exhibited evidence of human-caused mortality or serious injury. The stranding networks reported a total of 62 bottlenose dolphin strandings in 1994 with only one reported human interaction. Eighty-three strandings were reported in 1995 and 2 had evidence of human interactions. One was found entangled in a gillnet, and one was a boat strike. The network reported 111 bottlenose dolphins from January through August 31, 1996. Three showed signs of human interaction (one entanglement-gillnet, one boat strike and one mutilation).

There are a number of difficulties associated with the interpretation of stranding data. It is possible that some or all of the stranded dolphins may have been from a bay, sound or estuarine stock; however, the proportion of the stranded dolphins belonging to another stock cannot be determined because of the difficulty of determining from where the stranded carcass originated. Stranding data probably underestimate the extent of fishery-related mortality and serious injury because not all of the dolphins which die or are seriously injured in fishery interactions 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.

Fisheries Information

Annual fishing effort for the shrimp trawl fishery in the eastern Gulf of Mexico coastal stock area during 1988-1993 averaged approximately 0.102 million hours of tows (CV = 0.30) (NMFS unpublished data). This fishery was monitored by NMFS observers in 1992 and 1993, but less than 1% of the fishing effort was observed (NMFS unpublished data). There was one report in 1992 of an incidental mortality in the eastern Gulf of Mexico coastal bottlenose dolphin stock which was associated with the shrimp trawl fishery in this area.

Gillnets are not used in Texas, and gillnets over 46 m³ in area will not be allowed in Florida past July 1995, but fixed and runaround gillnets are currently in use in Louisiana, Mississippi, and Alabama. These fisheries, for the most part, operate year around. They are state-controlled and licensed, and vary widely in intensity and target species. No marine mammal mortalities associated with gillnet fisheries have been reported in these states, but stranding data suggest that gillnet and marine mammal interaction does occur, causing mortality and serious injury. A coastal gillnet fishery for menhaden was reported to have taken one bottlenose dolphin in 1991 (NMFS unpublished data). There are no effort data available for this fishery.

The menhaden purse seine fishery targets the Gulf menhaden, *Brevoortia patronus*, in Gulf of Mexico coastal waters approximately 3-18 m in depth (NMFS 1991). Seventy-five menhaden vessels operate within 1.6 km of shore from Apalachicola, Florida to Freeport, Texas, from April-October. Lethal takes of bottlenose dolphins reported by the menhaden fishery during the period 1982-1988 ranged between 0-4 dolphins annually (NMFS unpublished data).

Other clupeid purse seiners opportunistically target Spanish sardine, thread herring, ladyfish, cigarfish, and blue runners. There are no effort data available for this fishery and there are no estimates of dolphin mortality associated with this fishery.

A fishery for blue crabs operates in estuarine areas throughout the Gulf coast employing traps attached to a buoy with rope. Bottlenose dolphins have been reported stranded in other coastal locations in the Gulf of Mexico with polypropylene rope around their flukes indicating the possibility of entanglement with crab pot lines (NMFS 1991); however, this fishery has not been monitored by observers.

Other Mortality

The nearshore habitat occupied by this stock is adjacent to areas of high human population and in some areas of Florida, such as the Tampa Bay area, is highly industrialized. PCB concentrations in three stranded dolphins sampled from this stock ranged from 16-46 µg/g wet weight. Concentrations of α -HCB, p,p,DDE, and PCB's were inversely related to the magnitude of the serum antibody titer to *Erysipelas* spp. and *Staphylococcus* spp. bacteria in a study of bottlenose dolphins in Texas (Reif et al., in review). A similar and more pronounced trend was seen in relationship to the pseudorabies virus; however, since pseudorabies virus is not known to infect bottlenose dolphins, the significance of this finding is not clear. Concentrations of contaminants were higher in dolphins having evidence of exposure to the cetacean morbillivirus. The reason for the difference in the relationship between antibody titers to bacteria and pseudorabies and antibody titers to cetacean morbillivirus is not understood.

STATUS OF STOCK

The status of this stock relative to OSP is not known and population trends cannot be determined due to insufficient data. This species is not listed as threatened or endangered under the Endangered Species Act. The total known fishery-related mortality and serious injury for this stock is less than 10% of the calculated PBR and, therefore, can be considered to be insignificant and approaching zero mortality and serious injury rate. This is not a strategic stock because the known level of fishery-related mortality or serious injury does not exceed PBR.

REFERENCES

- Barlow, J., S.L. Swartz, T.C. Eagle, and P.R. Wade. 1995. U.S. Marine Mammal Stock Assessments: Guidelines for Preparation, Background and a Summary of the 1995 Assessments. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-OPR-6, 73 pp.
- Buckland, S. T., D. R. Anderson, K. P. Burnham, and J. L. Laake. 1993. Distance sampling: Estimating abundance of biological populations. Chapman & Hall, London, 446 pp.
- Laake, J. L., S. T. Buckland, D. R. Anderson, and K. P. Burnham. 1993. DISTANCE user's guide, V2.0. Colorado Cooperative Fish & Wildlife Research Unit, Colorado State University, Ft. Collins, Colorado, 72 pp.
- Morgan, M. A. and G. W. Patton. 1990. Human dolphin interactions on the west coast of Florida: Documentation from MML's marine mammal response program. MML Technical Report #191, 9 pp.
- NMFS. 1991. Proposed regime to govern the interactions between marine mammals and commercial fishing operations after October 1, 1993. Draft Environmental Impact Statement. June 1991.
- Wade, P.R., and R.P. Angliss. 1997. Guidelines for assessing marine mammal stocks: Report of the GAMMS Workshop April 3-5, Seattle, Washington. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-OPR-12, 93 pp.

BOTTLENOSE DOLPHIN (*Tursiops truncatus*): Gulf of Mexico Bay, Sound, and Estuarine Stocks

STOCK DEFINITION AND GEOGRAPHIC RANGE

Bottlenose dolphins are distributed throughout the bays, sounds, and estuaries of the Gulf of Mexico (Mullin 1988). The identification of biologically-meaningful “stocks” of bottlenose dolphins in these waters is complicated by the high degree of behavioral variability exhibited by this species (Shane *et al.* 1986; Wells and Scott 1999), and by the lack of requisite information for much of the region.

Previous stock assessment reports have provisionally identified distinct stocks in each of 33 areas of contiguous, enclosed, or semi-enclosed bodies of water adjacent to the Gulf of Mexico (Table 1, Waring *et al.* 1997), based on descriptions of relatively discrete dolphin “communities” in some of these areas. A “community” includes resident dolphins that regularly share large portions of their ranges, exhibit similar distinct genetic profiles, and interact with each other to a much greater extent than with dolphins in adjacent waters. The term, as adapted from Wells *et al.* (1987), emphasizes geographic, genetic, and social relationships of dolphins. Bottlenose dolphin communities do not constitute closed demographic populations, as individuals from adjacent communities are known to interbreed. Nevertheless, the geographic nature of these areas and long-term stability of residency patterns suggest that many of these communities exist as functioning units of their ecosystems and, under the Marine Mammal Protection Act, must be maintained as such. Also, the stable patterns of residency observed within communities suggest that long periods would be required to repopulate the home range of a community were it eradicated or severely depleted. Thus, in the absence of information supporting management on a larger scale, it is appropriate to adopt a risk-averse approach and focus management efforts at the level of the community rather than at some larger demographic scale. Support for this risk-averse approach derives from several sources. Long-term (year-round, multi-year) residency by at least some individuals has been reported from nearly every site where photographic identification or tagging studies have been conducted in the Gulf of Mexico. In Texas, some of the dolphins in the Matagorda-Espiritu Santo Bay area (Gruber 1981; Lynn 1995; Würsig and Lynn 1996), Aransas Pass (Shane 1977; Weller 1998), San Luis Pass (Maze 1997), and Galveston Bay (Bräger 1993; Bräger *et al.* 1994; Fertl 1994) have been reported as long-term residents. Hubard (1998) reported sightings of dolphins tagged 12-15 years previously in Mississippi Sound. In Florida, long-term residency has been reported from Choctawhatchee Bay (1989-1993, F. Townsend unpublished data), Tampa Bay (Wells 1986a; Wells *et al.* 1996a), Sarasota Bay (Irvine and Wells 1972; Irvine *et al.* 1981; Wells 1986a, 1991; Scott *et al.* 1990; Wells *et al.* 1987), Lemon Bay (Wells *et al.* 1996b), and Charlotte Harbor/Pine Island Sound (Shane 1990; Wells *et al.* 1996b, 1997). In many cases, residents emphasize use of the bay, sound, or estuary waters, with limited movements through passes to the Gulf of Mexico (Shane 1977, 1990; Gruber 1981; Irvine *et al.* 1981; Lynn 1995, Maze 1997). These habitat use patterns are reflected in the ecology of the dolphins in some areas; for example, residents of Sarasota Bay, Florida lacked squid in their diet, unlike non-resident dolphins stranded on nearby Gulf beaches (Barros and Wells 1998).

Genetic data also support the concept of relatively discrete bay, sound, and estuary stocks. Analyses of mitochondrial DNA haplotype distributions indicate the existence of clinal variations along the Gulf of Mexico coastline (Duffield and Wells *In press*). Differences in reproductive seasonality from site to site also suggest genetic-based distinctions between communities (Urian *et al.* 1996). Mitochondrial DNA analyses suggest finer-scale structural levels as well. For example, Matagorda Bay, Texas dolphins appear to be a localized population (NMFS unpublished data), and differences in haplotype frequencies distinguish between adjacent communities in Tampa Bay, Sarasota Bay, and Charlotte Harbor/Pine Island Sound, along the central west coast of Florida (Duffield and Wells 1991; *in press*). Examination of protein electrophoretic data resulted in similar conclusions for the Florida dolphins (Duffield and Wells 1986).

The long-term structure and stability of at least some of these communities is exemplified by the residents of Sarasota Bay, Florida. This community has been observed since 1970 (Irvine and Wells 1972; Scott *et al.* 1990; Wells 1991). The number of dolphins regularly occupying the Sarasota Bay area has remained consistently at about 100. At least four generations of identifiable residents currently inhabit the region, including half of those first identified in 1970. Maximum immigration and emigration rates of about 2-3% have been estimated (Wells and Scott 1990).

Genetic exchange occurs between resident communities; hence the application of the demographically and behaviorally-based term “community” rather than “population” (Wells 1986a). Some of the calves in Sarasota Bay

apparently have been sired by non-residents (Duffield and Wells, in press). A variety of potential exchange mechanisms occur in the Gulf. Small numbers of inshore dolphins traveling between regions have been reported, with patterns ranging from traveling through adjacent communities (Wells 1986b; Wells *et al.* 1996a,b) to movements over distances of several hundred km in Texas waters (Gruber 1981; Würsig and Lynn 1996; Würsig unpublished data). In many areas year-round residents co-occur with non-resident dolphins, providing potential opportunities for genetic exchange. About 17% of group sightings involving resident Sarasota Bay dolphins include at least one non-resident as well (Wells *et al.* 1987). Similar mixing of inshore residents and non-residents is seen off San Luis Pass, Texas (Maze 1997). Non-residents exhibit a variety of patterns, ranging from apparent nomadism recorded as transience in a given area, to apparent seasonal or non-seasonal migrations. Passes, especially the mouths of the larger estuaries, serve as mixing areas. For example, several communities mix at the mouth of Tampa Bay, Florida (Wells 1986a), and most of the dolphins identified in the mouths of Galveston Bay and Aransas Pass, Texas were considered transients (Henningsen 1991; Bräger 1993; Weller 1998).

Seasonal movements of dolphins into and out of some of the bays, sounds, and estuaries provide additional opportunities for genetic exchange with residents, and complicate the identification of stocks in coastal and inshore waters. In small bay systems such as Sarasota Bay, Florida and San Luis Pass, Texas residents move into Gulf coastal waters in fall/winter, and return inshore in spring/summer (Irvine *et al.* 1981; Maze 1997). In larger bay systems, seasonal changes in abundance suggest possible migrations, with increases in more northerly bay systems in summer, and in more southerly systems in winter. Fall/winter increases in abundance have been noted for Matagorda Bay (Gruber 1981; Lynn 1995; Würsig and Lynn 1996), Aransas Pass (Shane 1977; Weller 1998), Tampa Bay (Scott *et al.* 1989), and Charlotte Harbor/Pine Island Sound (Thompson 1981; Scott *et al.* 1989). Spring/summer increases in abundance have been reported for Galveston Bay (Henningsen 1991; Bräger 1993; Fertl 1994) and Mississippi Sound (Hubard 1998).

Much uncertainty remains regarding the structure of bottlenose dolphin stocks in many of the Gulf of Mexico bays, sounds, and estuaries. Given the apparent co-occurrence of resident and non-resident dolphins in these areas, and the demonstrated variations in abundance, it appears that consideration should be given to the existence of a complex of stocks, and to the roles of bays, sounds, and estuaries for stocks emphasizing Gulf of Mexico coastal waters. A starting point for management strategy should be the protection of the long-term resident communities, with their multi-generational geographic, genetic, demographic, and social stability. These localized units would be at greatest risk from geographically localized impacts. Complete characterization of many of these basic units would benefit from additional photo-identification, telemetry, and genetic research (Wells 1994).

The current provisional stocks follow the designations in Table 1, with a few revisions. Available information suggests that Block B35, Little Sarasota Bay, can be subsumed under Sarasota Bay, and B36, Caloosahatchee River, can be considered a part of Pine Island Sound. As more information becomes available, additional combination or division may be warranted. For example, a number of geographically and socially distinct subgroupings of dolphins in regions such as Tampa Bay, Charlotte Harbor, Pine Island Sound, Aransas Pass, and Matagorda Bay have been identified, but the importance of these distinctions to stock designations remain undetermined (Shane 1977; Gruber 1981; Wells *et al.* 1996a,b, 1997; Würsig and Lynn 1996).

Understanding the full complement of the stock complex using the bay, sound, and estuarine waters of the Gulf of Mexico will require much additional information. The development of biologically-based criteria to better define and manage stocks in this region should integrate multiple approaches, including studies of ranging patterns, genetics, morphology, social patterns, distribution, life history, stomach contents, isozyme analyses, and contaminant concentrations. Spatially-explicit population modeling could aid in evaluating the implications of community-based stock definition. As these studies provide new information on what constitutes a bottlenose dolphin "biological stock," current provisional definitions will likely need to be revised. As stocks are more clearly identified, it will be possible to conduct abundance estimates using standardized methodology across sites (thereby avoiding some of the previous problems of mixing results of aerial and boat-based surveys), identify fisheries and other human impacts relative to specific stocks, and perform individual stock assessments. As recommended by the Atlantic Scientific Review Group (November 1998, Portland, Maine), a workshop was held from March 13-15, 2000 in Sarasota, FL to review current information pertaining to bottlenose dolphin stock structure in Gulf of Mexico bays, sounds, and estuaries. As a result of this, efforts are being made to conduct simulations of alternative stock structure and, if warranted, propose a new stock structure.

Table 1. Bottlenose dolphin abundance (N_{BEST}), coefficient of variation (CV), minimum population estimate (N_{MIN}), and Potential Biological Removal (PBR) in USA Gulf of Mexico bays, sounds, and other estuaries. Blocks refer to

aerial survey blocks illustrated in Fig. 1. Blocks with an abundance of zero were surveyed but not considered stocks at this time (but see Note 1 below).

Blocks	Gulf of Mexico Estuary	N _{BEST}	CV	N _{MIN}	PBR	Year	Reference
B51	Laguna Madre	80	1.57	31	0.3	1992	A
B52	Nueces Bay, Corpus Christi Bay	58	0.61	36	0.4	1992	A
B50	Companso Bay, Aransas Bay, San Antonio Bay, Redfish Bay, Espiritu Santo Bay	55	0.82	30	0.3	1992	A
B54	Matagorda Bay, Tres Palacios Bay, Lavaca Bay	61	0.45	42	0.4	1992	A
B55	West Bay	29	1.10	14	0.1	1992	A
B56	Galveston Bay, East Bay, Trinity Bay	152	0.43	107	1.1	1992	A
B57	Sabine Lake	0 ¹	-			1992	A
B58	Calcasieu Lake	0 ¹	-			1992	A
B59	Vermillion Bay, West Cote Blanche Bay, Atchafalaya Bay	0 ¹	-			1992	A
B60	Terrebonne Bay, Timbalier Bay	100	0.53	66	0.7	1993	A
B61	Barataria Bay	219	0.55	142	1.4	1993	A
B30	Mississippi River Delta	0 ¹	-			1993	A
B02-05, 29,31	Bay Boudreau, Mississippi Sound	1,401	0.13	1,256	13	1993	A
B06	Mobile Bay, Bonsecour Bay	122	0.34	92	0.9	1993	A
B07	Perdido Bay	0 ¹	-			1993	A
B08	Pensacola Bay, East Bay	33	0.80	18	0.2	1993	A
B09	Choctawhatchee Bay	242	0.31	188	1.9	1993	A
B10	St. Andrew Bay	124	0.57	79	0.8	1993	A
B11	St. Joseph Bay	0 ¹	-			1993	A
B12-13	St. Vincent Sound, Apalachicola Bay, St. Georges Sound	387	0.34	293	2.9	1993	A
B14-15	Apalachee Bay	491	0.39	358	3.6	1993	A
B16	Waccasassa Bay, Withlacoochee Bay, Crystal Bay	100	0.85	54	0.5	1994	A
B17	St. John's Sound, Clearwater Harbor	37	1.06	18	0.2	1994	A
B32-34	Tampa Bay	559	0.24	458	4.6	1994	A
B20	Sarasota Bay	97	na ³	97	1.0	1992	B
B35	Little Sarasota Bay	2 ²	0.24	2	0.0	1985	C
B21	Lemon Bay	0 ¹	-			1994	A
B22-23	Pine Sound, Charlotte Harbor, Gasparilla Sound	209	0.38	153	1.5	1994	A
B36	Caloosahatchee River	0 ^{1,2}	-			1985	C
B24	Estero Bay	104	0.67	62	0.6	1994	A
B25	Chokoloskee Bay, Ten Thousand Islands, Gullivan Bay	208	0.46	144	1.4	1994	A
B27	Whitewater Bay	242	0.37	179	1.8	1994	A
B28	Florida Keys (Bahia Honda to Key West)	29	1.00	14	0.1	1994	A

References: A- Blaylock and Hoggard 1994; B- Wells 1992; C- Scott *et al.* 1989

Notes:

¹ During earlier surveys (Scott *et al.* 1989), the range of seasonal abundances was as follows: B57, 0-2 (CV= 0.38); B58, 0-6 (0.34); B59, 0-0; B30, 0-182(0.14); B07, 0-0; B21, 0-15(0.43); and B36, 0-0.

² Block not surveyed during surveys reported in Blaylock and Hoggard 1994.

³ No CV because N_{BEST} was a direct count of known individuals.

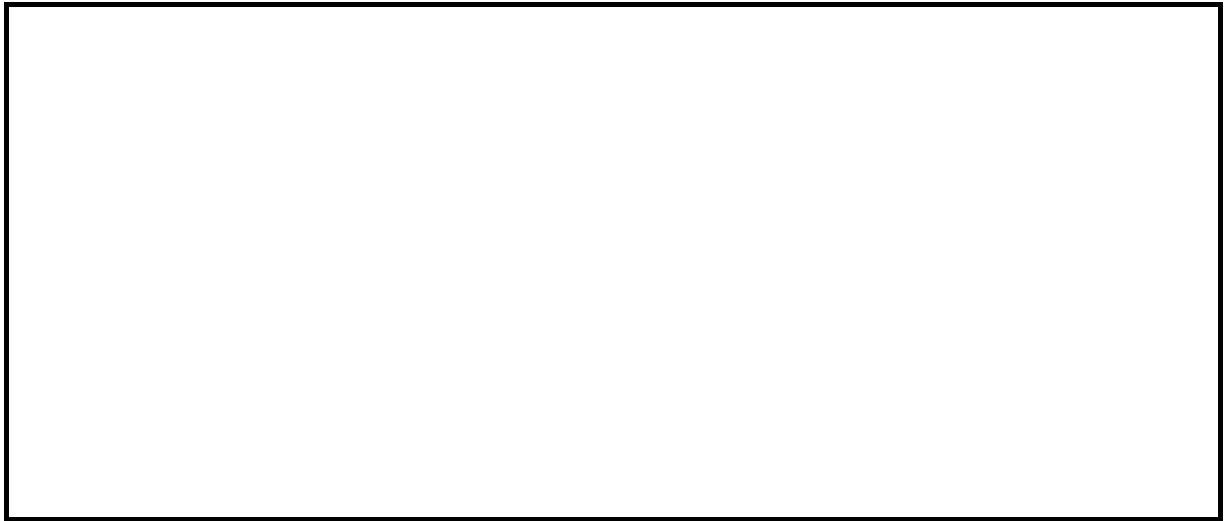


Figure 1. USA Gulf of Mexico bays and sounds. Each of the alpha-numerically designated blocks corresponds to one of the NMFS Southeast Fisheries Science Center logistical aerial survey areas listed in Table 1. The bottlenose dolphins inhabiting each bay and sound are considered to comprise a unique stock for purposes of this assessment.

POPULATION SIZE

Population size (Table 1) for all of the stocks except Sarasota Bay, Florida, was estimated from preliminary analyses of line-transect data collected during aerial surveys conducted in September-October 1992 in Texas and Louisiana; in September-October 1993 in Louisiana, Mississippi, Alabama, and the Florida panhandle (Blaylock and Hoggard 1994); and in September-November 1994 along the west coast of Florida (NMFS unpublished data). Standard line-transect perpendicular sighting distance analytical methods (Buckland *et al.* 1993) and the computer program DISTANCE (Laake *et al.* 1993) were used. Stock size in Sarasota Bay, Florida, was obtained through direct count of known individuals (Wells 1992).

Minimum Population Estimate

The minimum population estimate (Table 1) is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The minimum population estimate was calculated for each block from the estimated population size and its associated coefficient of variation. Where the population size resulted from a direct count of known individuals, the minimum population size was identical to the estimated population size.

Current Population Trend

The data are insufficient to determine population trends for all of the Gulf of Mexico bay, sound, and estuary bottlenose dolphin communities. The Sarasota Bay community, however, has been monitored since 1970 and has remained relatively constant over the last 20+ years at approximately 105 animals (Wells 1998). Three anomalous mortality events have occurred among portions of these dolphin communities between 1990 and 1994; however, it is not possible to accurately partition the mortalities between bay and coastal stocks, thus the impact of these mortality events on communities is not known.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are not known for the dolphin communities that comprise these stocks. While productivity rates may be estimated for individual females within communities, such estimates are confounded at the stock level due to the influx of dolphins from adjacent areas which balance losses, and the unexplained loss of some individuals which offset births and recruitment (Wells 1998). Continued monitoring and expanded survey coverage will be required to address and develop estimates of productivity for these dolphin

communities. 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 “recovery” factor, which accounts for endangered, depleted, and threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP), is assumed to be 0.5 because these stocks are of unknown status. PBR for each stock is given in Table 1.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

There are a number of difficulties associated with the interpretation of stranding data. It is possible that some or all of the stranded dolphins may have been from a nearby coastal stock; however, the proportion of stranded dolphins belonging to another stock cannot be determined because of the difficulty of determining from where the stranded carcass originated. Stranding data probably underestimate the extent of fishery-related mortality and serious injury because not all of the dolphins which die or are seriously injured in fishery interactions 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, and the condition of the carcass if badly decomposed can inhibit the interpretation of cause of death.

A total of 1,881 bottlenose dolphins were found stranded in the USA Southeast Gulf of Mexico from 1993 to 1997 (Table 2) (NMFS unpublished data). Of these, 57 or 3% showed evidence of human interactions as the cause of death (*e.g.*, gear entanglement, mutilation, gunshot wounds). Bottlenose dolphins are known to become entangled in recreational and commercial fishing gear (Wells *et al.* 1998; Gorzelany 1998; Wells and Scott 1994) and some are struck by recreational and commercial vessels (Wells and Scott 1997). In 1998 alone, two resident bottlenose dolphins and an associated calf were killed by vessel strikes and a resident young-of-the-year died from entanglement in a crab-pot float line (R.S. Wells, pers. comm.).

The Gulf of Mexico menhaden fishery was observed to take 9 bottlenose dolphins (three fatally) between 1992 and 1995 (NMFS unpublished data). There were 1,366 sets observed out of 26,097 total sets, which if extrapolated for all years suggests that as many as 172 bottlenose dolphins could have been taken in this fishery with up to 57 animals killed. An observer program is urgently needed to obtain statistically reliable information for this fishery on the number of sets annually, the incidental take and mortality rates, and the communities from which bottlenose dolphins are being taken.

Some of the bay, sound and estuarine communities were the focus of a live-capture fishery for bottlenose dolphins which supplied dolphins to the U.S. Navy and to oceanaria for research and public display for almost two decades (NMFS unpublished data). During the period between 1972-89, 490 bottlenose dolphins, an average of 29 dolphins annually, were removed from a few locations in the Gulf of Mexico, including the Florida Keys. Mississippi Sound sustained the highest level of removals with 202 dolphins taken from this stock during this period, representing 41% of the total and an annual average of 12 dolphins (compared to a current PBR of 13). The annual average number of removals never exceeded current PBR levels, but it may be biologically significant that 73% of the dolphins removed during 1982-88 were females. The impact of those removals on the stocks is unknown.

Fishery Information

Annual fishing effort for the shrimp trawl fishery in the USA Gulf of Mexico bays, sounds, and estuaries during 1988-1993 averaged approximately 2.20 million hours of tows (CV=0.11) (NMFS unpublished data). There have been very low numbers of incidental mortality or injury in the stocks associated with the shrimp trawl fishery.

A fishery for blue crabs operates in estuarine areas throughout the Gulf of Mexico coast employing traps attached to a buoy with rope. Bottlenose dolphins have been reported stranded with polypropylene rope around their flukes (NMFS 1991; McFee and Brooks, Jr. 1998; NMFS unpublished data), indicating the possibility of entanglement with crab pot lines. This fishery has not been monitored by observers and there are no estimates of bottlenose dolphin mortality or serious injury for this fishery.

Gillnets are not used in Texas, and gillnets over 46 m³ in area were not allowed in Florida past July 1995, but fixed and runaround gillnets are currently in use in Louisiana, Mississippi, and Alabama. These fisheries, for the most part, operate year around. They are state-controlled and licensed, and vary widely in intensity and target species. No marine

mammal mortalities associated with gillnet fisheries have been reported in these states, but stranding data suggest that gillnet and marine mammal interaction does occur, causing mortality and serious injury.

Table 2. Bottlenose dolphin strandings in the USA Gulf of Mexico (West Florida to Texas) from 1993 to 1997. Data are from the Southeast Marine Mammal Stranding Database (SESUS).

State	1993	1994	1995	1996	1997	Total
Florida						
No. Stranded	134	51	101	133	63	482
No. Human Interactions	4	2	3	2	0	11
% With Human Interactions	3%	4%	3%	2%	0%	2%
Alabama						
No. Stranded	48	16	15	17	14	110
No. Human Interactions	1	0	1	0	1	3
% With Human Interactions	2%	0%	7%	0%	7%	3%
Mississippi						
No. Stranded	64	25	32	59	42	222
No. Human Interactions	4	0	4	2	2	12
% With Human Interactions	6%	0%	12%	3%	5%	5%
Louisiana						
No. Stranded	14	74	31	92	42	253
No. Human Interactions	0	0	1	3	1	5
% With Human Interactions	0%	0%	3%	3%	2%	2%
Texas						
No. Stranded	133	227	110	208	136	814
No. Human Interactions	4	6	7	7	2	26
% With Human Interactions	0%	3%	6%	3%	0%	3%
Totals						
No. Stranded	393	393	289	509	297	1881
No. Human Interactions	13	8	16	14	6	57
% With Human Interactions	3%	2%	6%	3%	2%	3%

Other Mortality

The near shore habitat occupied by many of these stocks is adjacent to areas of high human population, and in some bays, such as Mobile Bay in Alabama and Galveston Bay in Texas, is highly industrialized. The area surrounding Galveston Bay, for example, has a coastal population of over 3 million people. More than 50% of all chemical products manufactured in the USA are produced there and 17% of the oil produced in the Gulf of Mexico is refined there (Henningsen and Würsig 1991). Many of the enclosed bays in Texas are surrounded by agricultural lands which receive periodic pesticide applications.

Concentrations of chlorinated hydrocarbons and metals were examined in conjunction with an anomalous mortality event of bottlenose dolphins in Texas bays in 1990 and found to be relatively low in most; however, some had concentrations at levels of possible toxicological concern (Varanasi *et al.* 1992). No studies to date have determined the amount, if any, of indirect human-induced mortality resulting from pollution or habitat degradation. However, a recent

health assessment of 35 bottlenose dolphins from Matagorda Bay, Texas associated high levels of chlorinated hydrocarbons with low health assessment scores (Reif *et al.* in review). Morbillivirus has also been implicated in the deaths of bottlenose dolphins in some of these communities (Duignan *et al.* 1996).

STATUS OF STOCK

The status of these stocks relative to OSP is unknown and this species is not listed as threatened or endangered under the Endangered Species Act. The occurrence of three anomalous mortality events among bottlenose dolphins along the USA Gulf of Mexico coast since 1990 (NMFS unpublished data) is cause for concern; however, the effects of the mortality events on stock abundance have not yet been determined. The available evidence suggests that bottlenose dolphin stocks in the northern and western coastal portion of the USA Gulf of Mexico may have experienced a morbillivirus epidemic in 1993 (Lipscomb 1993; Lipscomb *et al.* 1994). Seven of 35 live-captured bottlenose dolphins (20%) from Matagorda Bay, Texas, in 1992, tested positive for previous exposure to cetacean morbillivirus (Reif *et al.* in review), and it is possible that other estuarine resident stocks have been exposed to the morbillivirus (Duignan *et al.* 1996).

The relatively high number of bottlenose dolphin deaths which occurred during the mortality events in the last decade suggests that some of these stocks may be stressed. Fishery-related mortality and serious injury for each of these stocks is not known, but considering the evidence from stranding data, the total fishery-related mortality and serious injury exceeds 10% of the total PBR, and, therefore, it is not insignificant and approaching the zero mortality and serious injury rate. For these reasons, and because the PBR for most of these stocks would be exceeded with the incidental capture of a single dolphin, each of these stocks is a strategic stock.

REFERENCES

- Barlow, J., S. L. Swartz, T. C. Eagle and P. R. Wade. 1995. U.S. Marine Mammal Stock Assessments: Guidelines for Preparation, Background and a Summary of the 1995 Assessments. NOAA Technical Memorandum. NMFS-OPR-6, 73 pp.
- Barros, N. B. and R. S. Wells. 1998. Prey and feeding patterns of resident bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. *J. Mamm.* 79(3):1045-1059.
- Blaylock, R. A. and W. Hoggard. 1994. Preliminary estimates of bottlenose dolphin abundance in southern U.S. Atlantic and Gulf of Mexico continental shelf waters. NOAA Technical Memorandum. NMFS-SEFSC-356, 10 pp.
- Bräger, S. 1993. Diurnal and seasonal behavior patterns of bottlenose dolphins (*Tursiops truncatus*). *Mar. Mammal Sci.* 9: 434-440.
- Bräger, S., B. Würsig, A. Acevedo and T. Henningsen. 1994. Association patterns of bottlenose dolphins (*Tursiops truncatus*) in Galveston Bay, Texas. *J. Mamm.* 75(2): 431-437.
- Buckland, S. T., D. R. Anderson, K. P. Burnham and J. L. Laake. 1993. Distance sampling: Estimating abundance of biological populations. *Chapman & Hall*, London. 446 pp.
- Duffield, D. A. and R. S. Wells. 1986. Population structure of bottlenose dolphins: Genetic studies of bottlenose dolphins along the central west coast of Florida. Contract Report to National Marine Fisheries Service, Southeast Fisheries Center, Contract No. 45-WCNF-5-00366, 16 pp.
- Duffield, D. A. and R. S. Wells. 1991. The combined application of chromosome, protein and molecular data for the investigation of social unit structure and dynamics in *Tursiops truncatus*. Pages 155-169 in A.R. Hoelzel (ed), Genetic Ecology of Whales and Dolphins. *Rep. int. Whal. Commn.*, Special Issue 13, Cambridge, U.K.
- Duffield, D. A. and R. S. Wells. In press. The molecular profile of a resident community of bottlenose dolphins, *Tursiops truncatus*. In C.J. Pfeiffer (ed), *Cell and Molecular Biology of Marine Mammals*.
- Duignan, P. J., C. House, D. K. Odell, R. S. Wells, L. Hansen, M. T. Walsh, D. J. St. Aubin, B. K. Rima and J. R. Geraci. 1996. Morbillivirus infection in bottlenose dolphin: evidence for recurrent epizootics in the Western Atlantic and Gulf of Mexico. *Mar. Mammal Sci.* 12(4):499-515.
- Fertl, D. C. 1994. Occurrence, movements, and behavior of bottlenose dolphins (*Tursiops truncatus*) in association with the shrimp fishery in Galveston Bay, Texas. M. Sc. thesis, Texas A&M University, College Station. 117 pp.
- Gorzelany, J. F. 1998. Unusual deaths of two free-ranging Atlantic bottlenose dolphins (*Tursiops truncatus*) related to ingestion of recreational fishing gear. *Marine Mammal Sci.* 14(3):614-6167.
- Gruber, J. A. 1981. Ecology of the Atlantic bottlenose dolphin (*Tursiops truncatus*) in the Pass Cavallo area of Matagorda Bay, Texas. M. Sc. thesis, Texas A&M University, College Station. 182 pp.
- Henningsen, T. 1991. Zur Verbreitung und Ökologie des Großen Tümmlers (*Tursiops truncatus*) in Galveston, Texas. Diploma thesis, Christian-Albrechts-Universität, Kiel, Germany. 80 pp.

- Henningsen, T. and B. Würsig. 1991. Bottle-nosed dolphins in Galveston Bay, Texas: Numbers and activities. Pages 36-38 in P. G. H. Evans (ed), European research on cetaceans - 5. Proceedings of the Fifth Annual Conference of the European Cetacean Society, Sandefjord, Norway, 21-23 February, 1991. Cambridge, UK.
- Hubard, C. W. 1998. Abundance, distribution, and site fidelity of bottlenose dolphins in Mississippi Sound, Mississippi. M. Sc. thesis, University of Alabama, Tuscaloosa. 101 pp.
- Irvine, B. and R. S. Wells. 1972. Results of attempts to tag Atlantic bottlenose dolphins (*Tursiops truncatus*). *Cetology* 13:1-5.
- Irvine, A. B., M. D. Scott, R. S. Wells and J. H. Kaufmann. 1981. Movements and activities of the Atlantic bottlenose dolphin, *Tursiops truncatus*, near Sarasota, Florida. *Fish. Bull. U.S.* 79:671-688.
- Laake, J. L., S. T. Buckland, D. R. Anderson and K. P. Burnham. 1993. DISTANCE user's guide, V2.0. Colorado Cooperative Fish & Wildlife Research Unit, Colorado State University, Ft. Collins. 72 pp.
- Lipscomb, T. P. 1993. Some answers to questions about morbillivirus. Pages 4-5 in R. A. Blaylock, B. Mase, and D. K. Odell (eds), Strandings, Vol. 2, No. 3, SEFSC Miami Laboratory, Miami, Florida, 7 pp.
- Lipscomb, T. P. 1994. Morbilliviral disease in an Atlantic bottlenose dolphin (*Tursiops truncatus*) from the Gulf of Mexico. *Journal of Wildlife Diseases* 30(4): 572-576.
- Lynn, S. K. 1995. Movements, site fidelity, and surfacing patterns of bottlenose dolphins on the central Texas coast. M. Sc. thesis, Texas A&M University, College Station. 92 pp.
- Maze, K. S. 1997. Bottlenose dolphins of San Luis Pass, Texas: Occurrence patterns, site fidelity, and habitat use. M. Sc. thesis, Texas A&M University, College Station. 79 pp.
- McFee, W. E. and W. Brooks Jr. 1998. Fact finding meeting of marine mammal entanglement in the crab pot fishery: A summary. U.S. Fish and Wildlife Service unpublished report.
- Mullin, K. D. 1988. Comparative seasonal abundance and ecology of bottlenose dolphins (*Tursiops truncatus*) in three habitats of the north-central Gulf of Mexico. Ph. D. dissertation, Mississippi State University, Starkville. 135 pp.
- NMFS. 1991. Proposed regime to govern the interactions between marine mammals and commercial fishing operations after October 1, 1993. Draft Environmental Impact Statement, June 1991.
- Reif, J. S., L. J. Hansen, S. Galloway, G. Mitchum and T. L. Schmitt. (in review). The relationship between chlorinated hydrocarbon contaminants and selected health parameters in bottlenose dolphins (*Tursiops truncatus*) from Matagorda Bay, Texas, 1992. Colorado State University, Fort Collins, and NMFS, Southeast Fisheries Science Center, Miami, Florida.
- Scott, G. P., D. M. Burn, L. J. Hansen and R. E. Owen. 1989. Estimates of bottlenose dolphin abundance in the Gulf of Mexico from regional aerial surveys. *CRD* 88/89-07.
- Scott, G. P. 1990. Management-oriented research on bottlenose dolphins by the Southeast Fisheries Center. Pages 623-639 in S. Leatherwood and R. R. Reeves (eds), The bottlenose dolphin. *Academic Press*, San Diego. 653 pp.
- Scott, M. D., R. S. Wells and A. B. Irvine. 1990. A long-term study of bottlenose dolphins on the west coast of Florida. Pages 235-244 in: S. Leatherwood and R. R. Reeves (eds), The bottlenose dolphin. *Academic Press*, San Diego. 653 pp.
- Shane, S. H. 1977. The population biology of the Atlantic bottlenose dolphin, *Tursiops truncatus*, in the Aransas Pass area of Texas. M. Sc. thesis, Texas A&M University, College Station. 238 pp.
- Shane, S. H. 1990. Behavior and ecology of the bottlenose dolphin at Sanibel Island, Florida. Pages 245-265 in S. Leatherwood and R. R. Reeves (eds), The bottlenose dolphin. *Academic Press*, San Diego. 653 pp.
- Shane, S. H., R. S. Wells and B. Würsig. 1986. Ecology, behavior, and social organization of the bottlenose dolphin: A review. *Mar. Mammal Sci.* 2(1):34-63.
- Thompson, N.B. 1981. Estimates of abundance of *Tursiops truncatus* in Charlotte Harbor, Florida. NOAA/NMFS/SEFSC/Miami Laboratory, Fishery Data Analysis Technical Report.
- Urian, K.W., D.A. Duffield, A.J. Read, R.S. Wells and D.D. Shell. 1996. Seasonality of reproduction in bottlenose dolphins, *Tursiops truncatus*. *J. Mamm.* 77:394-403.
- Varanasi, U., K. L. Tilbury, D. W. Brown, M. M. Krahn, C. A. Wigren, R. C. Clark and S. L. Chan. 1992. Pages 56-86 in: L. J. Hansen (ed), Report on Investigation of 1990 Gulf of Mexico Bottlenose Dolphin Strandings, Southeast Fisheries Science Center Contribution MIA-92/93-21, 219 pp.
- Wade, P. R. and R. P. Angliss. 1997. Guidelines for assessing marine mammal stocks: Report of the GAMMS Workshop April 3-5, Seattle, Washington. NOAA Technical Memorandum. NMFS-OPR-12, 93 pp.

- Waring, G. T., D. L. Palka, K. D. Mullin, J. H. W. Hain, L. J. Hansen and K. D. Bisack. 1997. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments -- 1996. NOAA Technical Memorandum. NMFS-NE-114.
- Weller, D. W. 1998. Global and regional variation in the biology and behavior of bottlenose dolphins. Ph. D. dissertation, Texas A&M University, College Station. 142 pp.
- Wells, R. S. 1986a. Population structure of bottlenose dolphins: behavioral studies along the central west coast of Florida. Contract report to NMFS, SEFSC. Contract No. 45-WCNF-5-00366, 58 pp.
- Wells, R. S. 1986b. Structural aspects of dolphin societies. Ph. D. dissertation, University of California, Santa Cruz. 234 pp.
- Wells, R. S. 1991. The role of long-term study in understanding the social structure of a bottlenose dolphin community. Pages 199-225 in: K. Pryor and K.S. Norris (eds), *Dolphin Societies: Discoveries and Puzzles*. University of California Press, Berkeley. 397 pp.
- Wells, R. S. 1992. The marine mammals of Sarasota Bay. Pages 9.1-9.23 in: *Sarasota Bay: Framework for action*. Sarasota Bay National Estuary Program, Sarasota, Florida.
- Wells, R. S. 1994. Determination of bottlenose dolphin stock discreteness: Application of a combined behavioral and genetic approach. Pages 16-20 in: K. R. Wang, P. M. Payne, and V. G. Thayer (compilers), *Coastal Stock(s) of Atlantic Bottlenose Dolphin: Status Review and Management*. Proceedings and Recommendations from a Workshop held in Beaufort, NC, 13-14 September 1993. NOAA Technical Memorandum. NMFS-OPR-4. 120 pp.
- Wells, R. S. 1998. Progress report: Sarasota long-term bottlenose dolphin research. Unpublished contract report to the U.S. Department of Commerce, NOAA Fisheries, Southeast Fisheries Science Center, Miami. 5 pp.
- Wells, R. S. and M. D. Scott. 1990. Estimating bottlenose dolphin population parameters from individual identification and capture-release techniques. Pages 407-415 in: P. S. Hammond, S. A. Mizroch and G. P. Donovan (eds), *Individual Recognition of Cetaceans: Use of Photo-Identification and Other Techniques to Estimate Population Parameters*. *Rep. int. Whal. Commn.*, Special Issue 12, Cambridge, U.K. 440 pp.
- Wells, R. S. and M.D. Scott. 1999. Bottlenose dolphins. Pages 137-182 in S.H. Ridgway and R. Harrison (eds), *Handbook of Marine Mammals, Vol. 6, the Second Book of Dolphins and Porpoises*. Academic Press, San Diego.
- Wells, R. S., M. D. Scott and A. B. Irvine. 1987. The social structure of free-ranging bottlenose dolphins. Pages 247-305 in: Genoways, H. (ed), *Current Mammalogy, Vol. 1*. New York, Plenum Press.
- Wells, R. S., K. W. Urian, A. J. Read, M. K. Bassos, W. J. Carr and M. D. Scott. 1996a. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Tampa Bay, Florida: 1988-1993. NOAA Technical Memorandum. NMFS-SEFSC-385, 25 pp. + 6 Tables, 8 Figures, and 4 Appendices.
- Wells, R. S., M. K. Bassos, K. W. Urian, W. J. Carr and M. D. Scott. 1996b. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Charlotte Harbor, Florida: 1990-1994. NOAA Technical Memorandum. NMFS-SEFSC-384, 36 pp. + 8 Tables, 10 Figures, and 5 Appendices.
- Wells, R. S., M. K. Bassos, K. W. Urian, S. H. Shane, E. C. G. Owen, C. F. Weiss, W. J. Carr and M. D. Scott. 1997. Low-level monitoring of bottlenose dolphins, *Tursiops truncatus*, in Pine Island Sound, Florida: 1996. Contract report to National Marine Fisheries Service, Southeast Fisheries Center. Contribution No. 40-WCNF601958
- Würsig, B. and S. K. Lynn. 1996. Movements, site fidelity, and respiration patterns of bottlenose dolphins on the central Texas coast. NOAA Technical Memorandum. NMFS-SEFSC-383, 43 pp. + 10 Tables, 15 Figures, and 6 Appendices.

ATLANTIC SPOTTED DOLPHIN (*Stenella frontalis*): Northern Gulf of Mexico Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The Atlantic spotted dolphin is endemic to the Atlantic Ocean in warm temperate to tropical waters (Perrin et al. 1987, 1994). Sightings of this species are concentrated along the continental shelf edge and also occur over the continental shelf in the northern Gulf of Mexico [Fritts et al. 1983; Mullin et al. 1991; Southeast Fisheries Science Center (SEFSC) unpublished data], but they have been reported as occurring around oceanic islands and far offshore in other areas (Perrin et al. 1994). The island and offshore animals may be a different stock than those occurring on the continental shelf (Perrin et al. 1994). Atlantic spotted dolphins were seen in all seasons during seasonal recent GulfCet aerial surveys of the northern Gulf of Mexico during 1993-1995 (Davis et al., in preparation). Atlantic spotted dolphins were seen in 1992 during regional aerial surveys conducted in the autumn of 1992-1994 over the U.S. continental shelf [see Blaylock and Hoggard (1994) for a description of the areas surveyed in 1992-1993]. These surveys were designed to estimate abundance of bottlenose dolphins and spotted dolphin abundance was not estimated. It has been suggested that there may be a seasonal movement of this species onto the continental shelf in the spring, but data supporting this hypothesis are limited (Caldwell and Caldwell 1966; Fritts et al. 1983).

POPULATION SIZE

Estimates of abundance were derived through the application of distance sampling analysis (Buckland et al. 1993) and the computer program DISTANCE (Laake et al. 1993) to sighting data collected during 1991-1994 spring-summer, visual sampling, line-transect vessel surveys of the northern Gulf of Mexico (Hansen et al. 1995) (Fig. 1), which includes data collected as part of the GulfCet program (Davis et al., in preparation). These surveys were conducted throughout the area from approximately the 200 m isobath along the U.S. coast to the seaward extent of the U.S. Exclusive Economic Zone. The seasonal GulfCet aerial surveys included only a small portion of the stock range and these data were not used for abundance estimation. Estimated

abundance of Atlantic spotted dolphins [coefficient of variation (CV) in parentheses] by survey year was zero in 1991, 4,527 in 1992 (0.65), 4,618 in 1993 (0.62), and 2,186 in 1994 (0.85) (Hansen et al. 1995). Survey effort-weighted estimated average abundance of Atlantic spotted dolphins for all surveys combined was 3,213 (CV = 0.44) (Hansen et al. 1995). This is probably an underestimate and should be considered a partial stock estimate because the continental shelf areas were not generally covered by either the vessel or GulfCet aerial surveys.

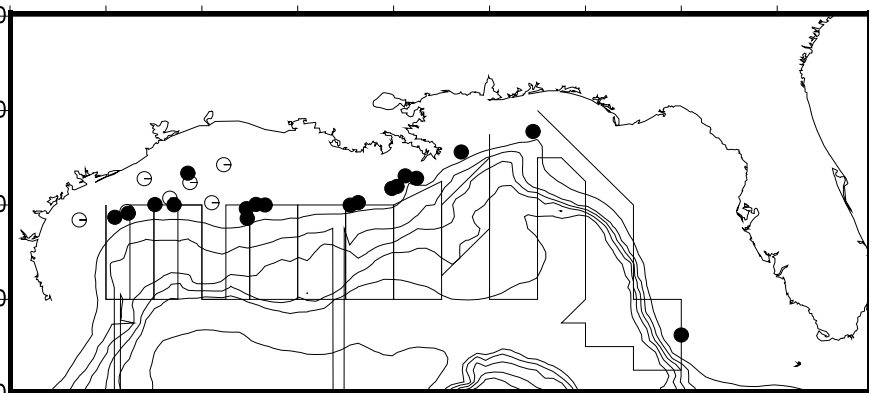


Figure 96. Distribution of Atlantic spotted dolphin sightings during II marine mammal surveys during 1991-1994 (filled circles) and during GOMEX regional aerial surveys during 1992-1994 (unfilled circles). The straight lines show transects during two ship surveys and are examples of typical ship survey transects. Isobaths are in 183 m (100 fm) intervals.

Minimum Population Estimate

The minimum population size was estimated using the average abundance estimate of Atlantic spotted dolphins for all surveys combined which was 3,213 (CV = 0.44) (Hansen et al. 1995). 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 distributed abundance estimate as specified by NMFS (Anon. 1994). The minimum population estimate is 2,255 Atlantic spotted dolphins.

Current Population Trend

No trend was identified in the annual abundance estimates. There were no sightings of this stock during 1991. The lack of sightings during 1991 may have been due to less sampling that year along the continental shelf edge where sightings of this species were concentrated. The difference in abundance estimates during 1992-1994 were not significant using the criteria of no overlap of log-normal 95 % confidence intervals.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are not known for this stock; therefore, the default maximum net productivity rate of 0.04 (Anon. 1994) was used for purposes of this assessment.

POTENTIAL BIOLOGICAL REMOVAL

Potential biological removal level (PBR) was specified as the product of the minimum population size, one half the maximum net productivity rate, and a recovery factor for endangered, threatened, or depleted stocks, or stocks of unknown status relative to optimum sustainable population (OSP) (Anon. 1994). The recovery factor was set at 0.50 because the status of the stock relative to OSP is unknown. The resulting PBR, based on the partial estimate, for this stock is 23 dolphins.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The level of past or current, direct, human-caused mortality of Atlantic spotted dolphins in the northern Gulf of Mexico is unknown; however, interactions between spotted dolphins and fisheries have been observed in the northern Gulf of Mexico.

There were two documented strandings of Atlantic spotted dolphins in the northern Gulf of Mexico during 1987-1994 which were classified as likely caused by fishery interactions. Stranding data probably underestimate the extent of fishery-related mortality and serious injury because not all of the dolphins which die or are seriously injured in fishery interactions 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.

Total estimated average annual fishing-related mortality and serious injury of spotted dolphins (both species) is 1.5 spotted dolphins annually (CV = 0.33). Observed fishery-related mortality and serious injury for spotted dolphins is less than 10% of PBR and can be considered insignificant and approaching zero mortality and serious injury rate for this stock. 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

Pelagic swordfish, tunas, and billfish are the targets of the longline fishery operating in the U.S. Gulf of Mexico. Total longline effort for the Gulf of Mexico pelagic fishery, including OCS edge, continental slope, and Mexican territorial waters, based on mandatory logbook reporting, was 4,400 sets in 1991, 4,850 sets in 1992, and 3,260 sets in 1993 (Cramer 1994). This fishery has been monitored with about 5% observer coverage, in terms of trips observed, since 1992. There were two observed incidental takes and releases of spotted dolphins in the Gulf of Mexico during 1994, but no observed lethal takes of Atlantic spotted dolphins by this fishery in the Gulf of Mexico.

Estimates of fishery-related mortality and serious injury were based on a generalized linear model (Poisson error assumption) fit to the available observed incidental take for the entire Atlantic longline swordfish/tuna fishery (which includes the Gulf of Mexico) (SEFSC, unpublished data). Takes observed throughout the range of this fishery were used because the species occurs generally throughout the area of the fishery, but observed takes were infrequent in any given region. Either spotted dolphin species may have been involved in the observed fishery-related mortality and serious injury incidents, but because of the difficulty of species identification by fishery observers, they cannot currently be separated. Estimated mortality and serious injury to spotted dolphins attributable to the longline fishery for the entire fishery (including waters outside of the Gulf of Mexico) for 1993 was 16 (CV = 0.19). Estimated fishery-related mortality and serious injury for the Gulf of Mexico, based on proportionality of fishing effort (number of sets) in 1993 was 4.4 spotted dolphins. Estimated average annual fishing-related mortality and serious injury of spotted dolphins attributable to this fishery during 1991-1993 was 1.5 annually (CV = 0.33).

Pair trawl fishing gear has the potential to capture marine mammals, but there have been no reports of mortality or serious injury to marine mammals in the Gulf of Mexico. This fishery has not been observed by NMFS observers, and

there are no other data available as to the extent of this fishery in the Gulf of Mexico. It is assumed that it is very limited in scope and duration.

STATUS OF STOCK

The status of this stock relative to OSP is unknown and there are insufficient data to determine population trends. This species is not listed under the Endangered Species Act. The total level of human-caused mortality and serious injury is unknown, but it is believed to be low relative to PBR; therefore, this is not a strategic stock.

REFERENCES

- 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.
- Blaylock, R. A. and W. Hoggard. 1994. Preliminary estimates of bottlenose dolphin abundance in southern U.S. Atlantic and Gulf of Mexico continental shelf waters. NOAA Tech. Mem. NMFS-SEFSC-356, 10 pp.
- Buckland, S. T., D. R. Anderson, K. P. Burnham and J. L. Laake. 1993. Distance Sampling: estimating abundance of biological populations. Chapman & Hall, London, 446 pp.
- Caldwell, D. K. and M. C. Caldwell. 1966. Observations on the distribution, coloration, behavior and audible sound production of the spotted dolphin, *Stenella plagiodon* (Cope). Los Angeles County Museum Contribution to Science, 104:1-28.
- Cramer, J. 1994. Large pelagic logbook newsletter - 1993. NOAA Tech. Mem. NMFS-SEFSC-352, 19 pp.
- Davis, R., G. Scott, B. Würsig, W. Evans, G. Fargion, L. Hansen, K. Mullin, N. May, T. Leming, B. Mate, J. Norris and T. Jefferson. In preparation. Distribution and abundance of marine mammals in the north-central and western Gulf of Mexico: Final Report. OCS Study #MMS 94-0003. Texas Institute of Oceanography and the National Marine Fisheries Service. U.S. Dept. of the Interior, Minerals Mgmt. Service, Gulf of Mexico OCS Region, New Orleans, Louisiana.
- Fritts, T. H., A. B. Irvine, R. D. Jennings, L. A. Collum, W. Hoffman and M. A. McGehee. 1983. Turtles, birds, and mammals in the northern Gulf of Mexico and nearby Atlantic waters. U.S. Fish and Wildlife Service, Division of Biological Services, Washington, D. C., FWS/OBS-82/65, 455 pp.
- Hansen, L. J., K. D. Mullin and C. L. Roden. 1995. Estimates of cetacean abundance in the northern Gulf of Mexico from vessel surveys. Southeast Fisheries Science Center, Miami Laboratory, Contribution No. MIA-94/95-25, 9 pp. + tables and figures.
- Laake, J. L., S. T. Buckland, D. R. Anderson, and K. P. Burnham. DISTANCE user's guide, V2.0. Colorado Cooperative Fish & Wildlife Research Unit, Colorado State University, Ft. Collins, Colorado, 72 pp.
- Mullin, K., W. Hoggard, C. Roden, R. Lohofener, C. Rogers and B. Taggart. 1991. Cetaceans on the upper continental slope in the north-central Gulf of Mexico. OCS Study/MMS 91-0027. U.S. Dept. of the Interior, Minerals Management Service, Gulf of Mexico OCS Regional Office, New Orleans, 108 pp.
- Perrin, W. F., E. D. Mitchell, J. G. Mead, D. K. Caldwell, M. C. Caldwell, P. J. H. van Bree and W. H. Dawbin. 1987. Revision of the spotted dolphins, *Stenella* spp. Mar. Mam. Sci. 3(2):99-170.
- Perrin, W. F., D. K. Caldwell and M. C. Caldwell. 1994. Atlantic spotted dolphin *Stenella frontalis* (G. Cuvier, 1829). Pages 173-190 in S. H. Ridgway and R. Harrison (editors), Handbook of marine mammals, Vol. 5: The first book of dolphins. Academic Press, London, 416 pp.

PANTROPICAL SPOTTED DOLPHIN (*Stenella attenuata*): Northern Gulf of Mexico Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The pantropical spotted dolphin is distributed worldwide in tropical and some sub-tropical oceans (Perrin et al. 1987; Perrin and Hohn 1994). Sightings of this species occurred over the deeper waters of the northern Gulf of Mexico, and rarely over the continental shelf or continental shelf edge [Mullin et al. 1991; Southeast Fisheries Science Center (SEFSC) unpublished data]. Pantropical spotted dolphins were seen in all seasons during recent seasonal GulfCet aerial surveys of the northern Gulf of Mexico during 1993-1995 (Davis et al., in preparation). Some of the Pacific populations have been divided into different geographic stocks based on morphological characteristics (Perrin et al. 1987; Perrin and Hohn 1994); however, there is no information on stock differentiation for the Atlantic population.

POPULATION SIZE

Estimates of abundance were derived through the application of distance sampling analysis (Buckland et al. 1993) and the computer program DISTANCE (Laake et al. 1993) to sighting data collected during 1991-1994 spring-summer, visual sampling, line-transect vessel surveys of the northern Gulf of Mexico (Hansen et al. 1995) (Fig. 1), which includes data collected as part of the GulfCet program (Davis et al., in preparation). These surveys were conducted throughout the area from approximately the 200 m isobath along the U.S. coast to the seaward extent of the U.S. Exclusive Economic Zone. The seasonal GulfCet aerial surveys included only a small portion of the stock range and these data were not used for abundance estimation. Estimated abundance of pantropical spotted dolphins by survey year [coefficient of variation (CV) in parentheses] was 19,767 in 1991 (0.45), 15,280 in 1992 (0.36), 29,414 in 1993 (0.29), and 71,847 in 1994 (0.31) (Hansen et al. 1995). Survey effort-weighted estimated average abundance of pantropical spotted dolphins for all surveys combined was 31,320 (CV = 0.20) (Hansen et al. 1995).

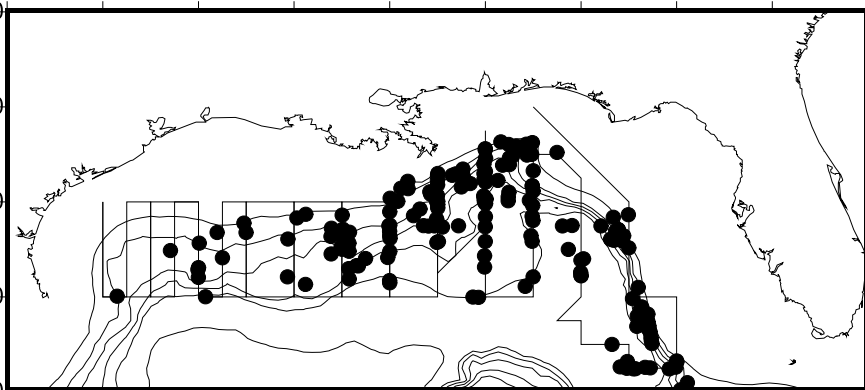


Figure 1. Distribution of pantropical spotted dolphins during Oregon II marine mammal surveys during 1991-1994. The straight lines show transects during two surveys and are examples of typical survey transects. Isobaths are in 183 m (100 fm) intervals.

Minimum Population Estimate

The minimum population size was estimated from the average estimated abundance of pantropical spotted dolphins which was 31,320 (CV = 0.20) (Hansen et al. 1995). 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 distributed abundance estimate as specified by NMFS (Anon. 1994). The minimum population estimate is 26,510 pantropical spotted dolphins.

Current Population Trend

The 1994 abundance estimate was larger than the estimates for 1991-1993. The 1992 and 1994 estimates were significantly different using the criteria of no overlap of log-normal 95% confidence intervals, but differences within 1991-1993 estimates and differences between 1991, 1993, and 1994 were not significant. The observed differences in abundance estimates may have been caused by inter-annual variation in distribution patterns and spatial sampling, rather than changes in population size.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are not known for this stock; therefore, the default maximum net productivity rate of 0.04 (Anon. 1994) was used for purposes of this assessment.

POTENTIAL BIOLOGICAL REMOVAL

Potential biological removal level (PBR) was specified as the product of the minimum population size, one half the maximum net productivity rate, and a recovery factor for endangered, threatened, or depleted stocks, or stocks of unknown status relative to optimum sustainable population (OSP) (Anon. 1994). The recovery factor was set at 0.50 because the status of the stock relative to OSP is unknown. The resulting PBR for this stock is 265 animals.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The level of past or current, direct, human-caused mortality of pantropical spotted dolphins in the northern Gulf of Mexico is unknown; however, interactions between spotted dolphins and fisheries have been observed in the northern Gulf of Mexico.

There was one documented stranding of a pantropical spotted dolphin in the northern Gulf of Mexico during 1987-1994 which was classified as likely caused by fishery interactions. Stranding data probably underestimate the extent of fishery-related mortality and serious injury because not all of the dolphins which die or are seriously injured in fishery interactions 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.

Total estimated average annual fishing-related mortality and serious injury of spotted dolphins (both species) is 1.5 spotted dolphins annually (CV = 0.33). Observed fishery-related mortality and serious injury for spotted dolphins is less than 10% of PBR and can be considered insignificant and approaching zero mortality and serious injury rate for this stock. 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

Pelagic swordfish, tunas, and billfish are the targets of the longline fishery operating in the U.S. Gulf of Mexico. Total longline effort for the Gulf of Mexico pelagic fishery, including OCS edge, continental slope, and Mexican territorial waters, based on mandatory logbook reporting, was 4,400 sets in 1991, 4,850 sets in 1992, and 3,260 sets in 1993 (Cramer 1994). This fishery has been monitored with about 5% observer coverage, in terms of trips observed, since 1992. There were two observed incidental takes and releases of spotted dolphins in the Gulf of Mexico during 1994, but no observed lethal takes of Atlantic spotted dolphins by this fishery in the Gulf of Mexico.

Estimates of fishery-related mortality and serious injury were based on a generalized linear model (Poisson error assumption) fit to the available observed incidental take for the entire Atlantic longline swordfish/tuna fishery (which includes the Gulf of Mexico) (SEFSC, unpublished data). Takes observed throughout the range of this fishery were used because the species occurs generally throughout the area of the fishery, but observed takes were infrequent in any given region. Either spotted dolphin species may have been involved in the observed fishery-related mortality and serious injury incidents, but because of the difficulty of species identification by fishery observers, they cannot currently be separated. Estimated mortality and serious injury to spotted dolphins attributable to the longline fishery for the entire fishery (including waters outside of the Gulf of Mexico) for 1993 was 16 (CV = 0.19). Estimated fishery-related mortality and serious injury for the Gulf of Mexico, based on proportionality of fishing effort (number of sets) in 1993 was 4.4 spotted dolphins. Estimated average annual fishing-related mortality and serious injury of spotted dolphins attributable to this fishery during 1991-1993 was 1.5 annually (CV = 0.33).

Pair trawl fishing gear has the potential to capture marine mammals, but there have been no reports of mortality or serious injury to marine mammals in the Gulf of Mexico. This fishery has not been observed by NMFS observers, and there are no other data available as to the extent of this fishery in the Gulf of Mexico. It is assumed that it is very limited in scope and duration.

STATUS OF STOCK

The status of this stock relative to OSP is unknown and there are insufficient data to determine population trends. This species is not listed under the Endangered Species Act. The total level of human-caused mortality and serious injury is unknown, but it is believed to be insignificant relative to PBR; therefore, this is not a strategic stock.

REFERENCES

- 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.
- Buckland, S. T., D. R. Anderson, K. P. Burnham and J. L. Laake. 1993. Distance Sampling: estimating abundance of biological populations. Chapman & Hall, London, 446 pp.
- Cramer, J. 1994. Large pelagic logbook newsletter - 1993. NOAA Tech. Mem. NMFS-SEFSC-352, 19 pp.
- Davis, R., G. Scott, B. Würsig, W. Evans, G. Fargion, L. Hansen, K. Mullin, N. May, T. Leming, B. Mate, J. Norris and T. Jefferson. In preparation. Distribution and abundance of marine mammals in the north-central and western Gulf of Mexico: Final Report. OCS Study #MMS 94-0003. Texas Institute of Oceanography and the National Marine Fisheries Service. U.S. Dept. of the Interior, Minerals Mgmt. Service, Gulf of Mexico OCS Region, New Orleans, Louisiana.
- Hansen, L. J., K. D. Mullin and C. L. Roden. 1995. Estimates of cetacean abundance in the northern Gulf of Mexico from vessel surveys. Southeast Fisheries Science Center, Miami Laboratory, Contribution No. MIA-94/95-25, 9 pp. + tables and figures.
- Laake, J. L., S. T. Buckland, D. R. Anderson, and K. P. Burnham. DISTANCE user's guide, V2.0. Colorado Cooperative Fish & Wildlife Research Unit, Colorado State University, Ft. Collins, Colorado, 72 pp.
- Mullin, K., W. Hoggard, C. Roden, R. Lohoefer, C. Rogers and B. Taggart. 1991. Cetaceans on the upper continental slope in the north-central Gulf of Mexico. OCS Study/MMS 91-0027. U.S. Dept. of the Interior, Minerals Management Service, Gulf of Mexico OCS Regional Office, New Orleans, 108 pp.
- Perrin, W. F., E. D. Mitchell, J. G. Mead, D. K. Caldwell, M. C. Caldwell, P. J. H. van Bree, and W. H. Dawbin. 1987. Revision of the spotted dolphins, *Stenella* spp. Mar. Mam. Sci. 3(2): 99-170.
- Perrin, W. F. and A. A. Hohn. 1994. Pantropical spotted dolphin *Stenella attenuata*. Pages 71-98 in S. H. Ridgway and R. Harrison (editors), Handbook of marine mammals, Vol. 5: The first book of dolphins. Academic Press, London, 416 pp.

STRIPED DOLPHIN (*Stenella coeruleoalba*): Northern Gulf of Mexico Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The striped dolphin is distributed worldwide in tropical to warm temperate oceanic waters (Leatherwood and Reeves 1983; Perrin et al. 1994). Sightings of these animals in the northern Gulf of Mexico occur primarily over the deeper waters off the continental shelf [Mullin et al. 1991; Southeast Fisheries Science Center (SEFSC) unpublished data]. Striped dolphins were seen in fall, winter, and spring during recent seasonal GulfCet aerial surveys of the northern Gulf of Mexico during 1993-1995 (Davis et al., in preparation). There is no information on stock differentiation for the Atlantic population.

POPULATION SIZE

Estimates of abundance were derived through the application of distance sampling analysis (Buckland et al. 1993) and the computer program DISTANCE (Laake et al. 1993) to sighting data collected during 1991-1994 spring-summer, visual sampling, line-transect vessel surveys of the northern Gulf of Mexico (Hansen et al. 1995) (Fig. 1), which includes data collected as part of the GulfCet program (Davis et al., in preparation). These surveys were conducted throughout the area from approximately the 200 m isobath along the U.S. coast to the seaward extent of the U.S. Exclusive Economic Zone. The seasonal GulfCet aerial surveys included only a small portion of the stock range and these data were not used for abundance estimation. Estimated abundance of striped dolphins by survey year [coefficient of variation (CV) in parentheses] was 3,483 in 1991 (0.76), 2,574 in 1992 (0.52), 4,160 in 1993 (0.63), and 8,147 in 1994 (0.60) (Hansen et al. 1995). Survey effort-weighted estimated average abundance of striped dolphins for all surveys combined was 4,858 (CV = 0.44) (Hansen et al. 1995).

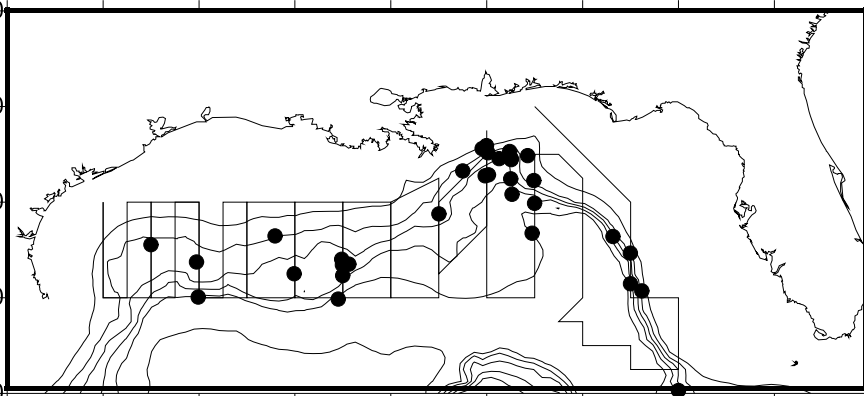


Figure 1. Distribution of striped dolphin sightings during NOAA Southeast Fisheries Science Center marine mammal surveys during 1991-1994. The straight lines show transects during two surveys and are examples of typical survey transects. Isobaths are in 183 m (100 fm) intervals.

Minimum Population Estimate

The minimum population size was estimated from the average estimate abundance which was 4,858 striped dolphins (CV = 0.44) (Hansen et al. 1995). 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 distributed abundance estimate as specified by NMFS (Anon. 1994). The minimum population estimate is 3,409 striped dolphins.

Current Population Trend

The abundance estimates for 1991-1993 were less than the 1994 estimate. The abundance estimates were not significantly different using the criteria of no overlap of log-normal 95% confidence intervals. The apparent differences in abundance estimates may have been caused by small sample sizes; only 29 observations of herds of striped dolphins were used in the distance sampling analysis. The differences in the estimates may also have been caused by inter-annual variation in distribution patterns and spatial sampling, rather than changes in population size.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are not known for this stock; therefore, the default maximum net productivity rate of 0.04 (Anon. 1994) was used for purposes of this assessment.

POTENTIAL BIOLOGICAL REMOVAL

Potential biological removal level (PBR) was specified as the product of the minimum population size, one half the maximum net productivity rate, and a recovery factor for endangered, threatened, or depleted stocks, or stocks of unknown status relative to optimum sustainable population (OSP) (Anon. 1994). The recovery factor was set at 0.50 because the status of the stock relative to OSP is unknown. PBR for this stock is 34 striped dolphins.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The level of past or current, direct, human-caused mortality of striped dolphins in the northern Gulf of Mexico is unknown. Available information indicates there likely is little, if any, fisheries interaction with striped dolphins in the northern Gulf of Mexico. There have been no logbook reports of fishery-related mortality or serious injury and no fishery-related mortality or serious injury has been observed.

There were no documented strandings of striped dolphins in the northern Gulf of Mexico during 1987-1994 which were classified as likely caused by fishery interactions or other human-related causes. Stranding data probably underestimate the extent of fishery-related mortality and serious injury because not all of the dolphins which die or are seriously injured in fishery interactions 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.

Total known fishery-related mortality and serious injury for this stock is less than 10% of the calculated PBR and, therefore, can be considered 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

Pelagic swordfish, tunas, and billfish are the targets of the longline fishery operating in the U.S. Gulf of Mexico. Total longline effort for the Gulf of Mexico pelagic fishery, including OCS edge, continental slope, and Mexican territorial waters, based on mandatory logbook reporting, was 4,400 sets in 1991, 4,850 sets in 1992, and 3,260 sets in 1993 (Cramer 1994). This fishery has been monitored with about 5% observer coverage, in terms of trips observed, since 1992. There were no reports of mortality or serious injury to striped dolphins by this fishery.

Pair trawl fishing gear has the potential to capture marine mammals, but there have been no reports of mortality or serious injury to marine mammals in the Gulf of Mexico. This fishery has not been observed by NMFS observers, and there are no other data available as to the extent of this fishery in the Gulf of Mexico. It is assumed that it is very limited in scope and duration.

STATUS OF STOCK

The status of this stock relative to OSP is unknown and there are insufficient data to determine population trends. This species is not listed under the Endangered Species Act. The total level of human-caused mortality and serious injury is unknown, but it is believed to be insignificant relative to PBR; therefore, this is not a strategic stock.

REFERENCES

- 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.
- Buckland, S. T., D. R. Anderson, K. P. Burnham and J. L. Laake. 1993. Distance Sampling: estimating abundance of biological populations. Chapman & Hall, London, 446 pp.
- Cramer, J. 1994. Large pelagic logbook newsletter - 1993. NOAA Tech. Mem. NMFS-SEFSC-352, 19 pp.
- Davis, R., G. Scott, B. Würsig, W. Evans, G. Fargion, L. Hansen, K. Mullin, N. May, T. Leming, B. Mate, J. Norris and T. Jefferson. In preparation. Distribution and abundance of marine mammals in the north-central and western Gulf of Mexico: Final Report. OCS Study #MMS 94-0003. Texas Institute of Oceanography and the National Marine Fisheries Service. U.S. Dept. of the Interior, Minerals Mgmt. Service, Gulf of Mexico OCS Region, New Orleans, Louisiana.
- Hansen, L. J., K. D. Mullin and C. L. Roden. 1995. Estimates of cetacean abundance in the northern Gulf of Mexico from vessel surveys. Southeast Fisheries Science Center, Miami Laboratory, Contribution No. MIA-94/95-25, 9 pp. + tables and figures.

- Laake, J. L., S. T. Buckland, D. R. Anderson, and K. P. Burnham. DISTANCE user's guide, V2.0. Colorado Cooperative Fish & Wildlife Research Unit, Colorado State University, Ft. Collins, Colorado, 72 pp.
- Leatherwood, S. and R. R. Reeves. 1983. The Sierra Club handbook of whales and dolphins. Sierra Club Books, San Francisco, 302 pp.
- Mullin, K., W. Hoggard, C. Roden, R. Lohoefer, C. Rogers and B. Taggart. 1991. Cetaceans on the upper continental slope in the north-central Gulf of Mexico. OCS Study/MMS 91-0027. U.S. Dept. of the Interior, Minerals Management Service, Gulf of Mexico OCS Regional Office, New Orleans, 108 pp.
- Perrin, W. F., C. E. Wilson and F. I. Archer II. 1994. Striped dolphin *Stenella coeruleoalba* (Meyen, 1833). Pages 129-159 in S. H. Ridgway and R. Harrison (editors), Handbook of marine mammals, Vol. 5: The first book of dolphins. Academic Press, London, 416 pp.

SPINNER DOLPHIN (*Stenella longirostris*): Northern Gulf of Mexico Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The spinner dolphin is distributed worldwide in tropical to warm temperate waters in the world's oceans (Leatherwood and Reeves 1983; Perrin and Gilpatrick 1994). Sightings of these animals in the northern Gulf of Mexico occur primarily over the deeper waters off the continental shelf [Southeast Fisheries Science Center (SEFSC) unpublished data]. Spinner dolphins were seen in winter, spring and summer during recent seasonal GulfCet aerial surveys of the northern Gulf of Mexico during 1993-1995 (Davis et al., in preparation). Different geographic stocks have been identified in the Pacific based on morphological characteristics (Perrin and Gilpatrick 1994); however, there is no information on stock differentiation for the Atlantic population.

POPULATION SIZE

Estimates of abundance were derived through the application of distance sampling analysis (Buckland et al. 1993) and the computer program DISTANCE (Laake et al. 1993) to sighting data collected during 1991-1994 spring-summer, visual sampling, line-transect vessel surveys of the northern Gulf of Mexico (Hansen et al. 1995) (Fig. 1), which includes data collected as part of the GulfCet program (Davis et al., in preparation). These surveys were conducted throughout the area from approximately the 200 m isobath along the U.S. coast to the seaward extent of the U.S. Exclusive Economic Zone. The seasonal GulfCet aerial surveys included only a small portion of the stock range and these data were not used for abundance estimation. Estimated abundance of spinner dolphins by survey year [coefficient of variation (CV) in parentheses] was zero in 1991, 2,593 in 1992 (0.63), 2,336 in 1993 (0.62), and 15,995 in 1994 (0.67) (Hansen et al. 1995). Survey effort-weighted estimated average abundance of spinner dolphins for all surveys combined was 6,316 (CV = 0.43) (Hansen et al. 1995).

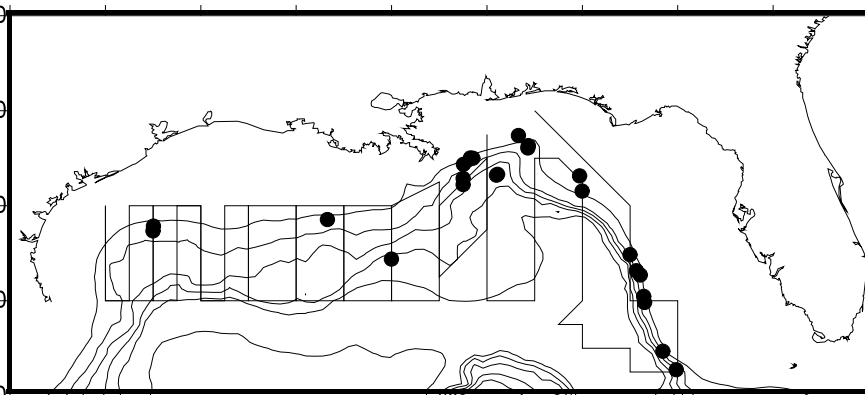


Figure 1. Distribution of spinner dolphin sightings during NOAA-SEFSC marine mammal surveys during 1991-1994. The straight lines show transects during two surveys and are examples of typical survey transects. Isobaths are in 183 m (100 fm) intervals.

Minimum Population Estimate

The minimum population size was estimated from the average estimate abundance which was 6,316 spinner dolphins (CV = 0.43) (Hansen et al. 1995). 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 distributed abundance estimate as specified by NMFS (Anon. 1994). The minimum population estimate is 4,465 spinner dolphins.

Current Population Trend

The abundance estimates for 1992 and 1993 were approximately the same and the 1994 estimate was considerably larger; however, the estimates were not significantly different using the criteria of no overlap of log-normal 95% confidence intervals. The apparent differences in abundance estimates may have been caused by less sampling effort during 1991 (Hansen et al. 1995), or by inter-annual variation in distribution patterns or spatial sampling patterns, rather than changes in population size.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates for this stock are not known; therefore, the default maximum net productivity rate of 0.04 (Anon. 1994) was used for purposes of this assessment.

POTENTIAL BIOLOGICAL REMOVAL

Potential biological removal level (PBR) was specified as the product of the minimum population size, one half the maximum net productivity rate, and a recovery factor for endangered, threatened, or depleted stocks, or stocks of unknown status relative to optimum sustainable population (OSP) (Anon. 1994). The recovery factor was set at 0.50 because the status of the stock relative to OSP is unknown. PBR for this stock is 45 spinner dolphins.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The level of past or current, direct, human-caused mortality of spinner dolphins in the northern Gulf of Mexico is unknown. Available information indicates there likely is little, if any, fisheries interaction with spinner dolphins in the northern Gulf of Mexico. There have been no logbook reports of fishery-related mortality or serious injury and no fishery-related mortality or serious injury has been observed.

There were no documented strandings of spinner dolphins in the northern Gulf of Mexico during 1987-1994 which were classified as likely caused by fishery interactions or other human-related causes. Stranding data probably underestimate the extent of fishery-related mortality and serious injury because not all of the dolphins which die or are seriously injured in fishery interactions 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.

The total known fishery-related mortality and serious injury for this stock is less than 10% of the calculated PBR and, therefore, can be considered 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

Pelagic swordfish, tunas, and billfish are the targets of the longline fishery operating in the U.S. Gulf of Mexico. Total longline effort for the Gulf of Mexico pelagic fishery, including OCS edge, continental slope, and Mexican territorial waters, based on mandatory logbook reporting, was 4,400 sets in 1991, 4,850 sets in 1992, and 3,260 sets in 1993 (Cramer 1994). This fishery has been monitored with about 5% observer coverage, in terms of trips observed, since 1992. There were no reports of mortality or serious injury of spinner dolphins by this fishery.

Pair trawl fishing gear has the potential to capture marine mammals, but there have been no reports of mortality or serious injury to marine mammals in the Gulf of Mexico. This fishery has not been observed by NMFS observers, and there are no other data available as to the extent of this fishery in the Gulf of Mexico. It is assumed that it is very limited in scope and duration.

STATUS OF STOCK

The status of this stock relative to OSP is unknown and there are insufficient data to determine population trends. This species is not listed under the Endangered Species Act. The total level of human-caused mortality and serious injury is unknown, but it is believed to be insignificant relative to PBR; therefore, this is not a strategic stock.

REFERENCES

- 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.
- Buckland, S. T., D. R. Anderson, K. P. Burnham and J. L. Laake. 1993. Distance Sampling: estimating abundance of biological populations. Chapman & Hall, London, 446 pp.
- Cramer, J. 1994. Large pelagic logbook newsletter - 1993. NOAA Tech. Mem. NMFS-SEFSC-352, 19 pp.
- Davis, R., G. Scott, B. Würsig, W. Evans, G. Fargion, L. Hansen, K. Mullin, N. May, T. Leming, B. Mate, J. Norris and T. Jefferson. In preparation. Distribution and abundance of marine mammals in the north-central and western Gulf of Mexico: Final Report, OCS Study #MMS 94-0003. Texas Institute of Oceanography and the National Marine Fisheries Service. U.S. Dept. of the Interior, Minerals Mgmt. Service, Gulf of Mexico OCS Region, New Orleans, Louisiana.

- Hansen, L. J., K. D. Mullin and C. L. Roden. 1995. Estimates of cetacean abundance in the northern Gulf of Mexico from vessel surveys. Southeast Fisheries Science Center, Miami Laboratory, Contribution No. MIA-94/95-25, 9 pp + tables and figures.
- Laake, J. L., S. T. Buckland, D. R. Anderson, and K. P. Burnham. DISTANCE user's guide, V2.0. Colorado Cooperative Fish & Wildlife Research Unit, Colorado State University, Ft. Collins, Colorado, 72 pp.
- Leatherwood, S. and R. R. Reeves. 1983. The Sierra Club handbook of whales and dolphins. Sierra Club Books, San Francisco, 302 pp.
- Perrin, W. F. and J. W. Gilpatrick, Jr. 1994. Spinner dolphin *Stenella longirostris* (Gray, 1828). Pages 99-128 in S. H. Ridgway and R. Harrison (editors), Handbook of marine mammals, Vol. 5: The first book of dolphins. Academic Press, London, 416 pp.

ROUGH-TOOTHED DOLPHIN (*Steno bredanensis*): Northern Gulf of Mexico Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The rough-toothed dolphin is distributed worldwide in tropical to warm temperate waters (Leatherwood and Reeves 1983; Miyazaki and Perrin 1994). Sightings of these animals in the northern Gulf of Mexico occur primarily over the deeper waters off the continental shelf [Southeast Fisheries Science Center (SEFSC) unpublished data]. Rough-toothed dolphins were seen in all seasons during recent seasonal GulfCet aerial surveys of the northern Gulf of Mexico during 1993-1995 (Davis et al., in preparation). There is no information on stock differentiation for the Atlantic population.

POPULATION SIZE

Estimates of abundance were derived through the application of distance sampling analysis (Buckland et al. 1993) and the computer program DISTANCE (Laake et al. 1993) to sighting data collected during 1991-1994 spring-summer, visual sampling, line-transect vessel surveys of the northern Gulf of Mexico (Hansen et al. 1995), which includes data collected as part of the GulfCet program (Davis et al., in preparation). These surveys were conducted throughout the area from approximately the 200 m isobath along the U.S. coast to the seaward extent of the U.S. Exclusive Economic Zone. The seasonal GulfCet aerial surveys included only a small portion of the stock range and these data were not used for abundance estimation. Estimated abundance of rough-toothed dolphins by survey year [coefficient of variation (CV) in parentheses] was 545 in 1991 (1.15), 758 in 1992 (0.58), 1,192 in 1993 (0.48), and 527 in 1994 (0.86) (Hansen et al. 1995). Survey effort weighted estimated average abundance of rough-toothed dolphins for all surveys combined was 852 (CV = 0.31) (Hansen et al. 1995).

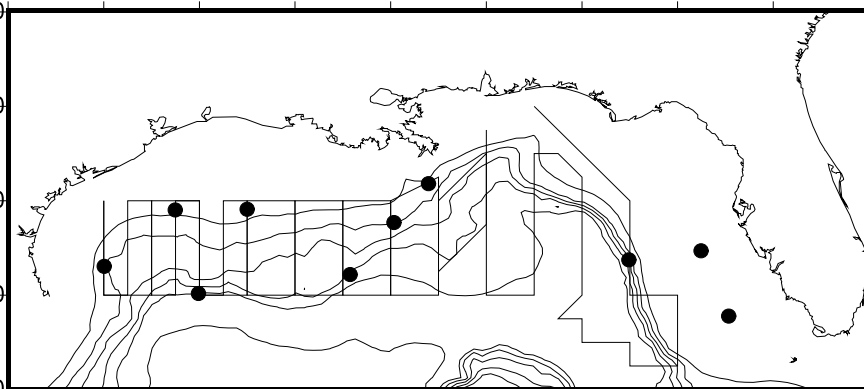


Figure 96. Distribution of rough-toothed dolphin sightings along Ship II marine mammal surveys during 1991-1994. The straight lines show transects during two surveys and are examples of typical survey transects. Isobaths are in 183 m (100 fm) intervals.

Minimum Population Estimate

The minimum population size was estimated from the average estimate abundance which was 852 rough-toothed dolphins (CV = 0.31) (Hansen et al. 1995). 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 distributed abundance estimate as specified by NMFS (Anon. 1994). The minimum population estimate is 660 rough-toothed dolphins.

Current Population Trend

The 1993 abundance estimate was greater than the 1991, 1993, and 1994 estimates; however, the abundance estimates were not significantly different using the criteria of no overlap of log-normal 95% confidence intervals. The apparent differences in abundance estimates may have been caused by small sample sizes (Hansen et al. 1995) or by inter-annual variation in distribution patterns or spatial sampling patterns, rather than changes in population size.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are not known for this stock; therefore, the default maximum net productivity rate of 0.04 (Anon. 1994) was used for purposes of this assessment.

POTENTIAL BIOLOGICAL REMOVAL

Potential biological removal level (PBR) was specified as the product of the minimum population size, one half the maximum net productivity rate, and a recovery factor for endangered, threatened, or depleted stocks, or stocks of unknown status relative to optimum sustainable population (OSP) (Anon. 1994). The recovery factor was set at 0.50 because the status of the stock relative to OSP is unknown. The resulting PBR for this stock is 6.6 rough-toothed dolphins.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The level of past or current, direct, human-caused mortality of rough-toothed dolphins in the northern Gulf of Mexico is unknown. Available information indicates there likely is little, if any, fisheries interaction with rough-toothed dolphins in the northern Gulf of Mexico. There have been no logbook reports of fishery-related mortality or serious injury and no fishery-related mortality or serious injury has been observed.

There were no documented strandings of rough-toothed dolphins in the northern Gulf of Mexico during 1987-1994 which were classified as likely caused by fishery interactions or other human-related causes. 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.

Total fishery-related mortality and serious injury for this stock is less than 10% of the calculated PBR and, therefore, can be considered 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

Pelagic swordfish, tunas, and billfish are the targets of the longline fishery operating in the U.S. Gulf of Mexico. Total longline effort for the Gulf of Mexico pelagic fishery, including OCS edge, continental slope, and Mexican territorial waters, based on mandatory logbook reporting, was 4,400 sets in 1991, 4,850 sets in 1992, and 3,260 sets in 1993 (Cramer 1994). This fishery has been monitored with about 5% observer coverage, in terms of trips observed, since 1992. There were no reports of mortality or serious injury of rough-toothed dolphins by this fishery.

Pair trawl fishing gear has the potential to capture marine mammals, but there have been no reports of mortality or serious injury to marine mammals in the Gulf of Mexico. This fishery has not been observed by NMFS observers, and there are no other data available as to the extent of this fishery in the Gulf of Mexico. It is assumed that it is very limited in scope and duration.

STATUS OF STOCK

The status of this stock relative to OSP is unknown and there are insufficient data to determine population trends. This species is not listed under the Endangered Species Act. The total level of human-caused mortality and serious injury is unknown, but it is believed to be insignificant relative to PBR; therefore, this is not a strategic stock.

REFERENCES

- 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.
- Buckland, S. T., D. R. Anderson, K. P. Burnham and J. L. Laake. 1993. Distance Sampling: estimating abundance of biological populations. Chapman & Hall, London, 446 pp.
- Cramer, J. 1994. Large pelagic logbook newsletter - 1993. NOAA Tech. Mem. NMFS-SEFSC-352, 19 pp.
- Davis, R., G. Scott, B. Würsig, W. Evans, G. Fargion, L. Hansen, K. Mullin, N. May, T. Leming, B. Mate, J. Norris and T. Jefferson. In preparation. Distribution and abundance of marine mammals in the north-central and western Gulf of Mexico: Final Report. OCS Study #MMS 94-0003. Texas Institute of Oceanography and the National Marine Fisheries Service. U.S. Dept. of the Interior, Minerals Mgmt. Service, Gulf of Mexico OCS Region, New Orleans, Louisiana.

- Hansen, L. J., K. D. Mullin and C. L. Roden. 1995. Estimates of cetacean abundance in the northern Gulf of Mexico from vessel surveys. Southeast Fisheries Science Center, Miami Laboratory, Contribution No. MIA-94/95-25, 9 pp. + tables and figures.
- Laake, J. L., S. T. Buckland, D. R. Anderson, and K. P. Burnham. DISTANCE user's guide, V2.0. Colorado Cooperative Fish & Wildlife Research Unit, Colorado State University, Ft. Collins, Colorado, 72 pp.
- Leatherwood, S. and R. R. Reeves. 1983. The Sierra Club handbook of whales and dolphins. Sierra Club Books, San Francisco, 302 pp.
- Miyazaki, N. and W. F. Perrin. 1994. Rough-toothed dolphin *Steno bredanensis* (Lesson, 1828). Pages 1-21 in S. H. Ridgway and R. Harrison (editors), Handbook of marine mammals, Vol. 5: The first book of dolphins. Academic Press, London, 416 pp.

CLYMENE DOLPHIN (*Stenella clymene*): Northern Gulf of Mexico Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The Clymene dolphin is endemic to tropical and sub-tropical waters of the Atlantic (Leatherwood and Reeves 1983; Perrin and Mead 1994). Sightings of these animals in the northern Gulf of Mexico occur primarily over the deeper waters off the continental shelf (Mullin et al. 1994). Clymene dolphins were seen in the winter, spring and summer during recent seasonal GulfCet aerial surveys of the northern Gulf of Mexico during 1993-1995 (Davis et al., in preparation). There is no information on stock differentiation for the Atlantic population.

POPULATION SIZE

Estimates of abundance were derived through the application of distance sampling analysis (Buckland et al. 1993) and the computer program DISTANCE (Laake et al. 1993) to sighting data collected during 1991-1994 spring-summer, visual sampling, line-transect vessel surveys of the northern Gulf of Mexico (Hansen et al. 1995) (Fig. 1), which includes data collected as part of the GulfCet program (Davis et al., in preparation). These surveys were conducted throughout the area from approximately the 200 m isobath along the U.S. coast to the seaward extent of the U.S. Exclusive Economic Zone. The seasonal GulfCet aerial surveys included only a small portion of the stock range and these data were not used for abundance estimation. Estimated abundance of Clymene dolphins by survey year [coefficient of variation (CV) in parentheses] was 1,936 in 1991 (0.69), 3,390 in 1992 (0.48), 6,486 in 1993 (0.46), and 12,255 in 1994 (0.62) (Hansen et al. 1995). Survey effort-weighted estimated average abundance of Clymene dolphins for all surveys combined was 5,571 (CV = 0.37) (Hansen et al. 1995).

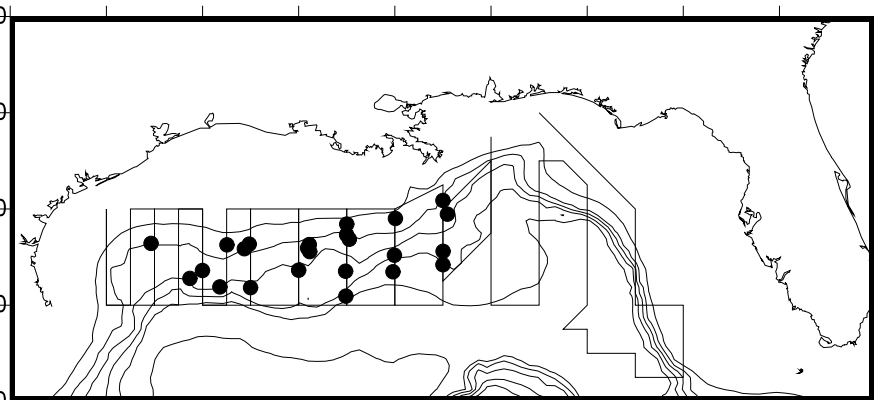


Figure 1. Distribution of sighting data during marine mammal surveys during 1991-1994. The straight lines show transects during two surveys and are examples of typical survey transects. Isobaths are in 183 m (100 fm) intervals.

Minimum Population Estimate

The minimum population size was estimated from the average estimate abundance which was 5,571 Clymene dolphins (CV = 0.37) (Hansen et al. 1995). 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 distributed abundance estimate as specified by NMFS (Anon. 1994). The minimum population estimate is 4,120 Clymene dolphins.

Current Population Trend

The abundance estimates showed an increasing trend during 1991-1994; however, the estimates were not significantly different using the criteria of no overlap of log-normal 95% confidence intervals. The apparent differences in abundance estimates may have been caused by small sample sizes (Hansen et al. 1995) or by inter-annual variation in distribution patterns or spatial sampling patterns, rather than changes in population size.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are not known for this stock; therefore, the default maximum net productivity rate of 0.04 (Anon. 1994) was used for purposes of this assessment.

POTENTIAL BIOLOGICAL REMOVAL

Potential biological removal level (PBR) was specified as the product of the minimum population size, one half the maximum net productivity rate, and a recovery factor for endangered, threatened, or depleted stocks, or stocks of unknown status relative to optimum sustainable population (OSP) (Anon. 1994). The recovery factor was set at 0.50 because the status of the stock relative to OSP is unknown. PBR for this stock is 41 Clymene dolphins.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The level of past or current, direct, human-caused mortality of Clymene dolphins in the northern Gulf of Mexico is unknown. Available information indicates there likely is little, if any, fisheries interaction with Clymene dolphins in the northern Gulf of Mexico. There have been no logbook reports of fishery-related mortality or serious injury and no fishery-related mortality or serious injury has been observed.

There were no documented strandings of Clymene dolphins in the northern Gulf of Mexico during 1987-1994 which were classified as likely caused by fishery interactions or other human-related causes. 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.

The total known fishery-related mortality and serious injury for this stock is less than 10% of the calculated PBR and, therefore, can be considered 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

Pelagic swordfish, tunas, and billfish are the targets of the longline fishery operating in the U.S. Gulf of Mexico. Total longline effort for the Gulf of Mexico pelagic fishery, including OCS edge, continental slope, and Mexican territorial waters, based on mandatory logbook reporting, was 4,400 sets in 1991, 4,850 sets in 1992, and 3,260 sets in 1993 (Cramer 1994). This fishery has been monitored with about 5% observer coverage, in terms of trips observed, since 1992. There were no reports of mortality or serious injury to Clymene dolphins by this fishery.

Pair trawl fishing gear has the potential to capture marine mammals, but there have been no reports of mortality or serious injury to marine mammals in the Gulf of Mexico. This fishery has not been observed by NMFS observers, and there are no other data available as to the extent of this fishery in the Gulf of Mexico.

STATUS OF STOCK

The status of this stock relative to OSP is unknown and there are insufficient data to determine population trends. This species is not listed under the Endangered Species Act. The total level of human-caused mortality and serious injury is unknown, but it is believed to be insignificant relative to PBR; therefore, this is not a strategic stock.

REFERENCES

- 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.
- Buckland, S. T., D. R. Anderson, K. P. Burnham and J. L. Laake. 1993. Distance Sampling: estimating abundance of biological populations. Chapman & Hall, London, 446 pp.
- Cramer, J. 1994. Large pelagic logbook newsletter - 1993. NOAA Tech. Mem. NMFS-SEFSC-352, 19 pp.
- Davis, R., G. Scott, B. Würsig, W. Evans, G. Fargion, L. Hansen, K. Mullin, N. May, T. Leming, B. Mate, J. Norris and T. Jefferson. In preparation. Distribution and abundance of marine mammals in the north-central and western Gulf of Mexico: Final Report. OCS Study #MMS 94-0003. Texas Institute of Oceanography and the National Marine Fisheries Service. U.S. Dept. of the Interior, Minerals Mgmt. Service, Gulf of Mexico OCS Region, New Orleans, Louisiana.
- Hansen, L. J., K. D. Mullin and C. L. Roden. 1995. Estimates of cetacean abundance in the northern Gulf of Mexico from vessel surveys. Southeast Fisheries Science Center, Miami Laboratory, Contribution No. MIA-94/95-25, 9 pp. + tables and figures.
- Laake, J. L., S. T. Buckland, D. R. Anderson, and K. P. Burnham. DISTANCE user's guide, V2.0. Colorado Cooperative Fish & Wildlife Research Unit, Colorado State University, Ft. Collins, Colorado, 72 pp.

- Leatherwood, S. and R. R. Reeves. 1983. The Sierra Club handbook of whales and dolphins. Sierra Club Books, San Francisco, 302 pp.
- Mullin, K. D., L.V. Higgins, T.A. Jefferson, and L. J. Hansen. 1994. Sightings of the Clymene dolphin (*Stenella clymene*) in the Gulf of Mexico. Mar. Mam. Sci. 10(4): 464-470.
- Perrin, W. F. and J. G. Mead. 1994. Clymene dolphin *Stenella clymene* (Gray, 1846). Pages 161-171 in S. H. Ridgway and R. Harrison (editors), Handbook of marine mammals, Vol. 5: The first book of dolphins. Academic Press, London, 416 pp.

FRASER'S DOLPHIN (*Lagenodelphis hosei*): Northern Gulf of Mexico Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Fraser's dolphin is distributed worldwide in tropical waters (Perrin et al. 1994). Sightings of these animals in the northern Gulf of Mexico occur primarily over the deeper waters off the continental shelf (Leatherwood et al. 1993). Fraser's dolphins have been observed recently in the northern Gulf of Mexico during the spring, summer, and fall (Leatherwood et al. 1993), and also were seen in the winter during recent seasonal GulfCet aerial surveys of the northern Gulf of Mexico during 1993-1995 (Davis et al., in preparation). There is no information on stock differentiation for the Atlantic population.

POPULATION SIZE

Estimates of abundance were derived through the application of distance sampling analysis (Buckland et al. 1993) and the computer program DISTANCE (Laake et al. 1993) to sighting data collected during 1991-1994 spring-summer, visual sampling, line-transect vessel surveys of the northern Gulf of Mexico (Hansen et al. 1995) (Fig. 1), which includes data collected as part of the GulfCet program (Davis et al., in preparation). These surveys were conducted throughout the area from approximately the 200 m isobath along the U.S. coast to the seaward extent of the U.S. Exclusive Economic Zone. The seasonal GulfCet aerial surveys included only a small portion of the stock range and these data were not used for abundance estimation. Estimated abundance of Fraser's dolphins by survey year [coefficient of variation (CV) in parentheses] was zero in 1991, 443 in 1992 (0.92), and zero in 1993 and 1994 (Hansen et al. 1995). Survey effort-weighted estimated average abundance of Fraser's dolphins for all vessel surveys combined was 127 (CV = 0.90) (Hansen et al. 1995).

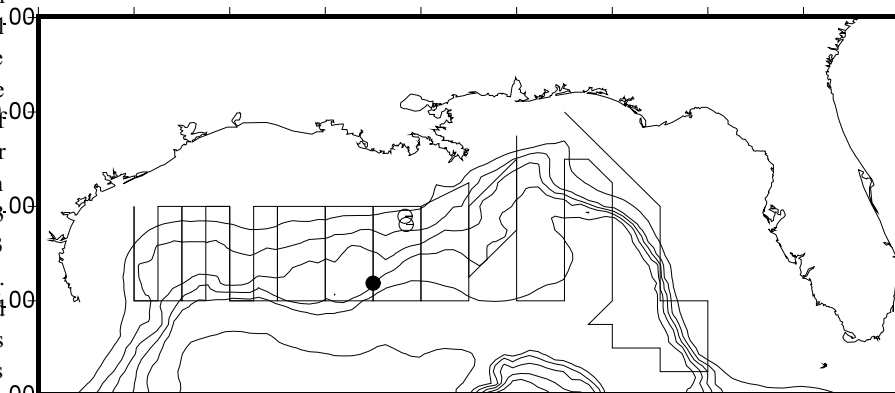


Figure 1. Distribution of Fraser's dolphin sightings during 1991-1994 vessel surveys (filled circle) and during GulfCet seasonal aerial surveys (unfilled circles). The straight lines show transects during two ship surveys and are examples of typical survey transects. Isobaths are in 183 m (100 fm) intervals.

Minimum Population Estimate

The minimum population size was estimated from the average estimate abundance which was 127 Fraser's dolphins (CV = 0.90) (Hansen et al. 1995). 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 distributed abundance estimate as specified by NMFS (Anon. 1994). The minimum population estimate is 66 Fraser's dolphins.

Current Population Trend

No trend was identified in the annual abundance estimates. There were no observations of Fraser's dolphins during 1991 and 1993 vessel surveys, and the 1992 estimate is based on only one observation (Hansen et al. 1995); however, five other sightings of Fraser's dolphins were documented in the northern Gulf of Mexico during other surveys in 1992, 1993 and 1994 (Leatherwood et al. 1993, SEFSC unpublished data). The apparent differences in abundance estimates may have been caused by low sampling intensity relative to population size (Hansen et al. 1995) or by inter-annual variation in distribution patterns or spatial sampling patterns, rather than changes in population size.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are not known; therefore, the default maximum net productivity rate of 0.04 (Anon. 1994) was used for purposes of this assessment.

POTENTIAL BIOLOGICAL REMOVAL

Potential biological removal level (PBR) was specified as the product of the minimum population size, one half the maximum net productivity rate, and a recovery factor for endangered, threatened, or depleted stocks, or stocks of unknown status relative to optimum sustainable population (OSP) (Anon. 1994). The recovery factor was set at 0.50 because the status of the stock relative to OSP is unknown. PBR for this stock is 0.7 Fraser's dolphins.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The level of past or current, direct, human-caused mortality of Fraser's dolphins in the northern Gulf of Mexico is unknown. Available information indicates there likely is little, if any, fisheries interaction with Fraser's dolphins in the northern Gulf of Mexico. There have been no logbook reports of fishery-related mortality or serious injury and no fishery-related mortality or serious injury has been observed.

There were no documented strandings of Fraser's dolphins in the northern Gulf of Mexico during 1987-1994 which were classified as likely caused by fishery interactions or other human-related causes. 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.

Available information indicates there likely is little, if any, fisheries interaction with Fraser's dolphins in the northern Gulf of Mexico. The total known fishery-related mortality and serious injury for this stock is less than 10% of the calculated PBR and, therefore, can be considered 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

Pelagic swordfish, tunas, and billfish are the targets of the longline fishery operating in the U.S. Gulf of Mexico. Total longline effort for the Gulf of Mexico pelagic fishery, including OCS edge, continental slope, and Mexican territorial waters, based on mandatory logbook reporting, was 4,400 sets in 1991, 4,850 sets in 1992, and 3,260 sets in 1993 (Cramer 1994). This fishery has been monitored with about 5% observer coverage, in terms of trips observed, since 1992. There were no reports of mortality or serious injury of Fraser's dolphins by this fishery.

Pair trawl fishing gear has the potential to capture marine mammals, but there have been no reports of mortality or serious injury to marine mammals in the Gulf of Mexico. This fishery has not been observed by NMFS observers, and there are no other data available as to the extent of this fishery in the Gulf of Mexico.

STATUS OF STOCK

The status of this stock relative to OSP is unknown and there are insufficient data to determine population trends. This species is not listed under the Endangered Species Act. The total level of human-caused mortality and serious injury is unknown, but it is believed to be insignificant relative to PBR; therefore this is not a strategic stock.

REFERENCES

- 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.
- Buckland, S. T., D. R. Anderson, K. P. Burnham and J. L. Laake. 1993. Distance Sampling: estimating abundance of biological populations. Chapman & Hall, London, 446 pp.
- Cramer, J. 1994. Large pelagic logbook newsletter - 1993. NOAA Tech. Mem. NMFS-SEFSC-352, 19 pp.
- Davis, R., G. Scott, B. Würsig, W. Evans, G. Fargion, L. Hansen, K. Mullin, N. May, T. Leming, B. Mate, J. Norris and T. Jefferson. In preparation. Distribution and abundance of marine mammals in the north-central and western Gulf of Mexico: Final Report. OCS Study #MMS 94-0003. Texas Institute of Oceanography and the National Marine Fisheries Service. U.S. Dept. of the Interior, Minerals Mgmt. Service, Gulf of Mexico OCS Region, New Orleans, Louisiana.
- Hansen, L. J., K. D. Mullin and C. L. Roden. 1995. Estimates of cetacean abundance in the northern Gulf of Mexico from vessel surveys. Southeast Fisheries Science Center, Miami Laboratory, Contribution No. MIA-94/95-25, 9 pp. + tables and figures.
- Laake, J. L., S. T. Buckland, D. R. Anderson, and K. P. Burnham. DISTANCE user's guide, V2.0. Colorado Cooperative Fish & Wildlife Research Unit, Colorado State University, Ft. Collins, Colorado, 72 pp.
- Leatherwood, S., T. A. Jefferson, J. C. Norris, W. E. Stevens, L. J. Hansen, and K. D. Mullin. 1993. Occurrence and sounds of Fraser's dolphin in the Gulf of Mexico. The Texas Journal of Science, 45(4):349-354.
- Perrin, W. F., S. Leatherwood and A. Collet. 1994. Fraser's dolphin *Lagenodelphis hosei* (Fraser 1956). Pages 225-240 in S. H. Ridgway and R. Harrison (editors), Handbook of marine mammals, Vol. 5: The first book of dolphins. Academic Press, London, 416 pp.

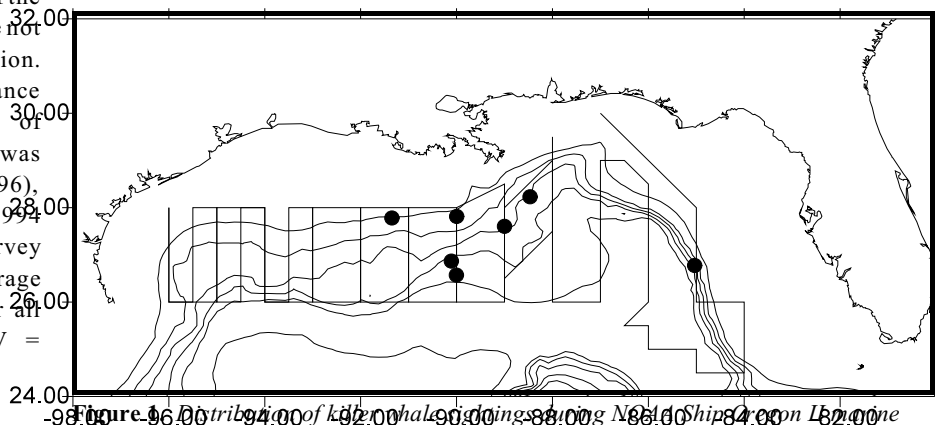
KILLER WHALE (*Orcinus orca*): Northern Gulf of Mexico Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The killer whale is distributed worldwide from tropical to polar regions (Leatherwood and Reeves 1983). Sightings of these animals in the northern Gulf of Mexico occur primarily over the deeper waters off the continental shelf [Southeast Fisheries Science Center (SEFSC) unpublished data]. Killer whales were seen only in the summer during recent seasonal GulfCet aerial surveys of the northern Gulf of Mexico during 1993-1995 (Davis et al., in preparation) and in the late spring during vessel surveys (SEFSC unpublished data). Different stocks have been identified in the northeastern Pacific based on morphological, behavioral, and genetic characteristics (Bigg et al. 1990; Hoelzel 1991). There is no information on stock differentiation for the Atlantic population, although an analysis of vocalizations of killer whales from Iceland and Norway indicated that stocks from these areas may represent different stocks (Moore et al. 1988).

POPULATION SIZE

Estimates of abundance were derived through the application of distance sampling analysis (Buckland et al. 1993) and the computer program DISTANCE (Laake et al. 1993) to sighting data collected during 1991-1994 spring-summer, visual sampling, line-transect vessel surveys of the northern Gulf of Mexico (Hansen et al. 1995), which includes data collected as part of the GulfCet program (Davis et al., in preparation). These surveys were conducted throughout the area from approximately the 200 m isobath along the U.S. coast to the seaward extent of the U.S. Exclusive Economic Zone. The seasonal GulfCet aerial surveys included only a small portion of the stock range and these data were not used for abundance estimation. Estimated killer whale abundance by survey year [coefficient of variation (CV) in parentheses] was zero in 1991, 138 in 1992 (0.96), 641 in 1993 (0.50), and 193 in 1994 (1.12) (Hansen et al. 1995). Survey effort-weighted estimated average abundance of killer whales for all surveys combined was 277 (CV = 0.42) (Hansen et al. 1995).



Minimum Population Estimate

The minimum population size was estimated from the average estimate abundance which was 277 killer whales (CV = 0.42) (Hansen et al. 1995). 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 distributed abundance estimate as specified by NMFS (Anon. 1994). The minimum population estimate is 197 killer whales.

Current Population Trend

The abundance estimates were highest during 1993; however, there were no observations of this species during 1991, and the 1992-1994 estimates were not significantly different using the criteria of no overlap of log-normal 95% confidence intervals. The apparent differences in abundance estimates may have been caused by lower sampling effort during 1991, and by low sampling intensity relative to population size (Hansen et al. 1995) or by inter-annual variation in distribution patterns or spatial sampling patterns, rather than changes in population size. Preliminary analysis of existing photo-identification data shows that some individual whales have been seen during more than one survey (SEFSC unpublished data).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates for this stock are not known; therefore, the default maximum net productivity rate of 0.04 (Anon. 1994) was used for purposes of this assessment.

POTENTIAL BIOLOGICAL REMOVAL

Potential biological removal level (PBR) was specified as the product of the minimum population size, one half the maximum net productivity rate, and a recovery factor for endangered, threatened, or depleted stocks, or stocks of unknown status relative to optimum sustainable population (OSP) (Anon. 1994). The recovery factor was set at 0.50 because the status of the stock relative to OSP is unknown. PBR for this stock is 2.0 killer whales.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The level of past or current, direct, human-caused mortality of killer whales in the northern Gulf of Mexico is unknown. Available information indicates there likely is little, if any, fisheries interaction with killer whales in the northern Gulf of Mexico. There have been no logbook reports of fishery-related mortality or serious injury and no fishery-related mortality or serious injury has been observed.

There were no documented strandings of killer whales in the northern Gulf of Mexico during 1987-1994 which were classified as likely caused by fishery interactions or other human-related causes. 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.

The total known fishery-related mortality and serious injury for this stock is less than 10% of the calculated PBR and, therefore, can be considered 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

Pelagic swordfish, tunas, and billfish are the targets of the longline fishery operating in the U.S. Gulf of Mexico. Total longline effort for the Gulf of Mexico pelagic fishery, including OCS edge, continental slope, and Mexican territorial waters, based on mandatory logbook reporting, was 4,400 sets in 1991, 4,850 sets in 1992, and 3,260 sets in 1993 (Cramer 1994). This fishery has been monitored with about 5% observer coverage, in terms of trips observed, since 1992. There were no reports of mortality or serious injury of killer whales by this fishery.

Pair trawl fishing gear has the potential to capture marine mammals, but there have been no reports of mortality or serious injury to marine mammals in the Gulf of Mexico. This fishery has not been observed by NMFS observers, and there are no other data available as to the extent of this fishery in the Gulf of Mexico. It is assumed that it is very limited in scope and duration.

STATUS OF STOCK

The status of this stock relative to OSP is unknown and there are insufficient data to determine population trends. This species is not listed under the Endangered Species Act. The total level of human-caused mortality and serious injury is unknown, but it is believed to be insignificant relative to PBR; therefore, this is not a strategic stock.

REFERENCES

- 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.
- Bigg, M. A., P. F. Olesiuk, G. M. Ellis, J. K. B. Ford and K. C. Balcomb. 1990. Social organization and genealogy of resident killer whales (*Orcinus orca*) in the coastal waters of British Columbia and Washington State. Pages 383-405 in P. S. Hammond, S. A. Mizroch and G. P. Donovan (editors), Individual recognition of cetaceans: Use of photoidentification and other techniques to estimate population parameters, Rep. Int. Whal. Comm., Special Issue 12, Cambridge, 440 pp.
- Buckland, S. T., D. R. Anderson, K. P. Burnham and J. L. Laake. 1993. Distance Sampling: estimating abundance of biological populations. Chapman & Hall, London, 446 pp.
- Cramer, J. 1994. Large pelagic logbook newsletter - 1993. NOAA Tech. Mem. NMFS-SEFSC-352, 19 pp.

- Davis, R., G. Scott, B. Würsig, W. Evans, G. Fargion, L. Hansen, K. Mullin, N. May, T. Leming, B. Mate, J. Norris and T. Jefferson. In preparation. Distribution and abundance of marine mammals in the north-central and western Gulf of Mexico: Final Report. OCS Study #MMS 94-0003. Texas Institute of Oceanography and the National Marine Fisheries Service. U.S. Dept. of the Interior, Minerals Mgmt. Service, Gulf of Mexico OCS Region, New Orleans, Louisiana.
- Hansen, L. J., K. D. Mullin and C. L. Roden. 1995. Estimates of cetacean abundance in the northern Gulf of Mexico from vessel surveys. Southeast Fisheries Science Center, Miami Laboratory, Contribution No. MIA-94/95-25, 9 pp. + tables and figures.
- Hoelzel, A. R. 1991. Analysis of regional mitochondrial DNA variation in the killer whale; implications for conservation. Pages 225-233 in A. R. Hoelzel (editor), Genetic ecology of whales and dolphins, Rep. Int. Whal. Commn. Special Issue 13, Cambridge, 311 pp.
- Laake, J. L., S. T. Buckland, D. R. Anderson, and K. P. Burnham. DISTANCE user's guide, V2.0. Colorado Cooperative Fish & Wildlife Research Unit, Colorado State University, Ft. Collins, Colorado, 72 pp.
- Leatherwood, S. and R. R. Reeves. 1983. The Sierra Club handbook of whales and dolphins. Sierra Club Books, San Francisco, 302 pp.
- Moore, S. E., J. K. Francine, A. E. Bowles and K. B. Ford. 1988. Analysis of calls of killer whales, *Orcinus orca*, from Iceland and Norway. Rit. Fiskideild. 11:225-250.

FALSE KILLER WHALE (*Pseudorca crassidens*): Northern Gulf of Mexico Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The false killer whale is distributed worldwide throughout warm temperate and tropical oceans (Leatherwood and Reeves 1983). Sightings of this species in the northern Gulf of Mexico occur primarily over the deeper waters off the continental shelf [Southeast Fisheries Science Center (SEFSC) unpublished data]. False killer whales were seen only in the summer during recent seasonal GulfCet aerial surveys of the northern Gulf of Mexico during 1993-1995 (Davis et al., in preparation) and in the late spring during vessel surveys (NMFS unpublished data). There is no information on stock differentiation for the Atlantic population.

POPULATION SIZE

Estimates of abundance were derived through the application of distance sampling analysis (Buckland et al. 1993) and the computer program DISTANCE (Laake et al. 1993) to sighting data collected during 1991-1994 spring-summer, visual sampling, line-transect vessel surveys of the northern Gulf of Mexico (Hansen et al. 1995) (Fig. 1), which includes data collected as part of the GulfCet program (Davis et al., in preparation). These surveys were conducted throughout the area from approximately the 200 m isobath along the U.S. coast to the seaward extent of the U.S. Exclusive Economic Zone. The seasonal GulfCet aerial surveys included only a small portion of the stock range and these data were not used for abundance estimation. Estimated abundance of false killer whales by survey year [coefficient of variation (CV) in parentheses] was 661 in 1991 (0.88), 196 in 1992 (1.00), 77 in 1993 (1.08), and 744 in 1994 (1.14) (Hansen et al. 1995). Survey effort weighted estimated average abundance of false killer whales for all surveys combined was 381 (CV = 0.62) (Hansen et al. 1995).

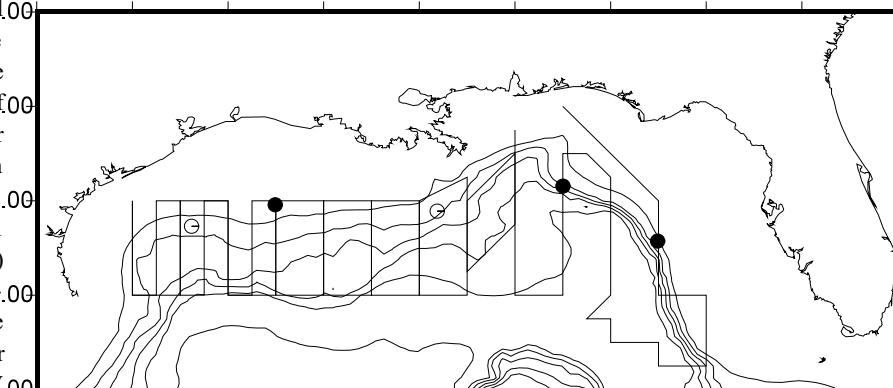


Figure 1. Distribution of false killer whale sightings during 1991-1994 marine mammal surveys (filled circles) and during GulfCet seasonal aerial surveys (filled circles). The straight lines show transects during two surveys and are examples of typical survey transects. Isobaths are in 183 m (100 fm) intervals.

Minimum Population Estimate

The minimum population size was estimated from the average estimate abundance which was 381 false killer whales (CV = 0.62) (Hansen et al. 1995). 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 distributed abundance estimate as specified by NMFS (Anon. 1994). The minimum population estimate is 236 false killer whales.

Current Population Trend

No trend was identified in the annual abundance estimates, and the differences in the abundance estimates were not significant using the criteria of no overlap of log-normal 95% confidence intervals. The apparent differences in abundance estimates may have been caused by lower sampling effort during 1991, by low sampling intensity relative to population size (Hansen et al. 1995), or by inter-annual variation in distribution patterns or spatial sampling patterns, rather than changes in population size.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are not known; therefore, the default maximum net productivity rate of 0.04 (Anon. 1994) was used for purposes of this assessment.

POTENTIAL BIOLOGICAL REMOVAL

Potential biological removal level (PBR) was specified as the product of the minimum population size, one half the maximum net productivity rate, and a recovery factor for endangered, threatened, or depleted stocks, or stocks of unknown status relative to optimum sustainable population (OSP) (Anon. 1994). The recovery factor was set at 0.50 because the status of the stock relative to OSP is unknown. PBR for this stock is 2.4 false killer whales.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The level of past or current, direct, human-caused mortality of false killer whales in the northern Gulf of Mexico is unknown. Available information indicates there likely is little, if any, fisheries interaction with false killer whales in the northern Gulf of Mexico. There have been no logbook reports of fishery-related mortality or serious injury and no fishery-related mortality or serious injury has been observed.

There were no documented strandings of false killer whales in the northern Gulf of Mexico during 1987-1994 which were classified as likely caused by fishery interactions or other human-related causes. 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.

The total known fishery-related mortality and serious injury for this stock is less than 10% of the calculated PBR and, therefore, can be considered 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

Pelagic swordfish, tunas, and billfish are the targets of the longline fishery operating in the U.S. Gulf of Mexico. Total longline effort for the Gulf of Mexico pelagic fishery, including OCS edge, continental slope, and Mexican territorial waters, based on mandatory logbook reporting, was 4,400 sets in 1991, 4,850 sets in 1992, and 3,260 sets in 1993 (Cramer 1994). This fishery has been monitored with about 5% observer coverage, in terms of trips observed, since 1992. There were no reports of mortality or serious injury of false killer whales by this fishery.

Pair trawl fishing gear has the potential to capture marine mammals, but there have been no reports of mortality or serious injury to marine mammals in the Gulf of Mexico. This fishery has not been observed by NMFS observers, and there are no other data available as to the extent of this fishery in the Gulf of Mexico. It is assumed that it is very limited in scope and duration.

STATUS OF STOCK

The status of this stock relative to OSP is unknown and there are insufficient data to determine population trends. This species is not listed under the Endangered Species Act. The total level of human-caused mortality and serious injury is unknown, but it is believed to be insignificant relative to PBR; therefore, this is not a strategic stock.

REFERENCES

- 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.
- Buckland, S. T., D. R. Anderson, K. P. Burnham and J. L. Laake. 1993. Distance Sampling: estimating abundance of biological populations. Chapman & Hall, London, 446 pp.
- Cramer, J. 1994. Large pelagic logbook newsletter - 1993. NOAA Tech. Mem. NMFS-SEFSC-352, 19 pp.
- Davis, R., G. Scott, B. Würsig, W. Evans, G. Fargion, L. Hansen, K. Mullin, N. May, T. Leming, B. Mate, J. Norris and T. Jefferson. In preparation. Distribution and abundance of marine mammals in the north-central and western Gulf of Mexico: Final Report. OCS Study #MMS 94-0003. Texas Institute of Oceanography and the National Marine Fisheries Service. U.S. Dept. of the Interior, Minerals Mgmt. Service, Gulf of Mexico OCS Region, New Orleans, Louisiana.

- Hansen, L. J., K. D. Mullin and C. L. Roden. 1995. Estimates of cetacean abundance in the northern Gulf of Mexico from vessel surveys. Southeast Fisheries Science Center, Miami Laboratory, Contribution No. MIA-94/95-25, 9 pp. + tables and figures.
- Laake, J. L., S. T. Buckland, D. R. Anderson, and K. P. Burnham. DISTANCE user's guide, V2.0. Colorado Cooperative Fish & Wildlife Research Unit, Colorado State University, Ft. Collins, Colorado, 72 pp.
- Leatherwood, S. and R. R. Reeves. 1983. The Sierra Club handbook of whales and dolphins. Sierra Club Books, San Francisco, 302 pp.

PYGMY KILLER WHALE (*Feresa attenuata*): Northern Gulf of Mexico Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The pygmy killer whale is distributed worldwide in tropical and subtropical waters (Ross and Leatherwood 1994). Sightings of these animals in the northern Gulf of Mexico occur primarily over the deeper waters off the continental shelf [Southeast Fisheries Science Center (SEFSC) unpublished data]. Pygmy killer whales and melon-headed whales (*Peponocephala electra*) are difficult to distinguish and sightings of either species are often categorized as pygmy killer/melon-headed whales. Sightings of this category were documented in all seasons during recent seasonal GulfCet aerial surveys of the northern Gulf of Mexico during 1993-1995 (Davis et al., in preparation). There is no information on stock differentiation for the Atlantic population.

POPULATION SIZE

Estimates of abundance were derived through the application of distance sampling analysis (Buckland et al. 1993) and the computer program DISTANCE (Laake et al. 1993) to sighting data collected during 1991-1994 spring-summer, visual sampling, line-transect vessel surveys of the northern Gulf of Mexico (Hansen et al. 1995) (Fig. 1), which includes data collected as part of the GulfCet program (Davis et al., in preparation). These surveys were conducted throughout the area from approximately the 200 m isobath along the U.S. coast to the seaward extent of the U.S. Exclusive Economic Zone. The seasonal GulfCet aerial surveys included only a small portion of the stock range and these data were not used for abundance estimation. Estimated abundance of pygmy killer whales by survey year [coefficient of variation (CV) in parentheses] was 2,347 in (0.81), 356 in 1992 (0.73), 153 in 1993 (1.13), and zero in 1994 (Hansen et al. 1995). Survey effort-weighted estimated average abundance of pygmy killer whales for all surveys combined was 518 (CV = 0.81) (Hansen et al. 1995).

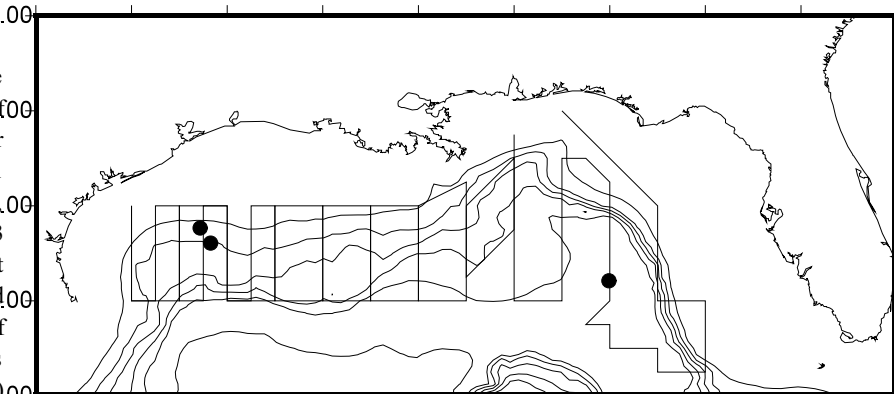


Figure 1. Distribution of pygmy killer whale sightings during 1991-1994 marine mammal surveys. The straight lines show transects during two surveys and are examples of typical survey transects. Isobaths are in 183 m (100 fm) intervals.

Minimum Population Estimate

The minimum population size was estimated from the average estimated abundance which was 518 pygmy killer whales (CV = 0.81) (Hansen et al. 1995). 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 distributed abundance estimate as specified by NMFS (Anon. 1994). The minimum population estimate is 285 pygmy killer whales.

Current Population Trend

A declining trend was identified in the annual abundance estimates; however, the 1991-1993 abundance estimates were not significantly different using the criteria of no overlap of log-normal 95% confidence intervals. There were no observations of this species during the 1994 survey. The apparent differences in abundance estimates may have been caused by lower sampling effort during 1991, by low sampling intensity relative to population size (Hansen et al. 1995), or by inter-annual variation in distribution patterns or spatial sampling patterns, rather than changes in population size.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are not known; therefore, the default maximum net productivity rate of 0.04 (Anon. 1994) was used for purposes of this assessment.

POTENTIAL BIOLOGICAL REMOVAL

Potential biological removal level (PBR) was specified as the product of the minimum population size, one half the maximum net productivity rate, and a recovery factor for endangered, threatened, or depleted stocks, or stocks of unknown status relative to optimum sustainable population (OSP) (Anon. 1994). The recovery factor was set at 0.50 because the status of the stock relative to OSP is unknown. PBR for this stock is 2.8 pygmy killer whales.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

There has historically been some take of this species in small cetacean fisheries in the Caribbean (Caldwell and Caldwell 1971); however, the level of past or current, direct, human-caused mortality of pygmy killer whales in the northern Gulf of Mexico is unknown. Available information indicates there likely is little, if any, fisheries interaction with pygmy killer whales in the northern Gulf of Mexico. There have been no logbook reports of fishery-related mortality or serious injury and no fishery-related mortality or serious injury has been observed.

There were no documented strandings of pygmy killer whales in the northern Gulf of Mexico during 1987-1994 which were classified as likely caused by fishery interactions or other human-related causes. 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.

The total known fishery-related mortality and serious injury for this stock is less than 10% of the calculated PBR and, therefore, can be considered 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

Pelagic swordfish, tunas, and billfish are the targets of the longline fishery operating in the U.S. Gulf of Mexico. Total longline effort for the Gulf of Mexico pelagic fishery, including OCS edge, continental slope, and Mexican territorial waters, based on mandatory logbook reporting, was 4,400 sets in 1991, 4,850 sets in 1992, and 3,260 sets in 1993 (Cramer 1994). This fishery has been monitored with about 5% observer coverage, in terms of trips observed, since 1992. There were no reports of mortality or serious injury of pygmy killer whales by this fishery.

Pair trawl fishing gear has the potential to capture marine mammals, but there have been no reports of mortality or serious injury to marine mammals in the Gulf of Mexico. This fishery has not been observed by NMFS observers, and there are no other data available as to the extent of this fishery in the Gulf of Mexico. It is assumed that it is very limited in scope and duration.

STATUS OF STOCK

The status of this stock relative to OSP is unknown and there are insufficient data to determine population trends. This species is not listed under the Endangered Species Act. The total level of human-caused mortality and serious injury is unknown, but it is believed to be insignificant relative to PBR; therefore, this is not a strategic stock.

REFERENCES

- 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.
- Buckland, S. T., D. R. Anderson, K. P. Burnham and J. L. Laake. 1993. Distance Sampling: estimating abundance of biological populations. Chapman & Hall, London, 446 pp.
- Caldwell, D. K. and M. C. Caldwell. 1971. The pygmy killer whale, *Feresa attenuata*, in the western Atlantic, with a summary of world records. J. Mamm. 52:206-209.
- Cramer, J. 1994. Large pelagic logbook newsletter - 1993. NOAA Tech. Mem. NMFS-SEFSC-352, 19 pp.
- Davis, R., G. Scott, B. Würsig, W. Evans, G. Fargion, L. Hansen, K. Mullin, N. May, T. Leming, B. Mate, J. Norris and T. Jefferson. In preparation. Distribution and abundance of marine mammals in the north-central and western Gulf of Mexico: Final Report. OCS Study #MMS 94-0003. Texas Institute of Oceanography and the National

- Marine Fisheries Service. U.S. Dept. of the Interior, Minerals Mgmt. Service, Gulf of Mexico OCS Region, New Orleans, Louisiana.
- Hansen, L. J., K. D. Mullin and C. L. Roden. 1995. Estimates of cetacean abundance in the northern Gulf of Mexico from vessel surveys. Southeast Fisheries Science Center, Miami Laboratory, Contribution No. MIA-94/95-25, 9 pp. + tables and figures.
- Laake, J. L., S. T. Buckland, D. R. Anderson, and K. P. Burnham. DISTANCE user's guide, V2.0. Colorado Cooperative Fish & Wildlife Research Unit, Colorado State University, Ft. Collins, Colorado, 72 pp.
- Ross, G. J. B. and S. Leatherwood. 1994. Pygmy killer whale *Feresa attenuata* (Gray, 1874). Pages 387-404 in S. H. Ridgway and R. Harrison (editors), Hand book of marine mammals, Vol. 5: The first book of dolphins. Academic Press, London, 416 pp.

DWARF SPERM WHALE (*Kogia simus*): Northern Gulf of Mexico Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The dwarf sperm whale appears to be distributed worldwide in temperate to tropical waters (Caldwell and Caldwell 1989). Sightings of these animals in the northern Gulf of Mexico occur primarily along the continental shelf edge and over the deeper waters off the continental shelf (Mullin *et al.* 1991; Southeast Fisheries Science Center, SEFSC, unpublished data). Dwarf sperm whales and pygmy sperm whales (*Kogia breviceps*) are difficult to distinguish and sightings of either species are often categorized as *Kogia* sp. Sightings of this category were documented in all seasons during seasonal GulfCet aerial surveys of the northern Gulf of Mexico during 1993-1995 (Hansen *et al.* 1996). The few reliable sightings of dwarf sperm whales during those surveys were more numerous in spring, probably a result of greater survey efforts in that season (Jefferson and Shapiro 1997). Pygmy and dwarf sperm whales have been sighted in the northwestern Gulf of Mexico in waters 1000 m deep, on average (Davis *et al.* 1998). However, these authors cautioned that inferences on preferred bottom depths should await surveys for the entire Gulf of Mexico. The difficulty in sighting pygmy and dwarf sperm whales may be exacerbated by their avoidance reaction towards ships, and change in behavior towards approaching survey aircraft (Würsig *et al.* 1998). In a recent study using hematological and stable-isotope data, Barros *et al.* (1998) speculated that dwarf sperm whales may have a more pelagic distribution than pygmy sperm whales, and/or dive deeper during feeding bouts. There is no information on stock differentiation.

POPULATION SIZE

Estimates of abundance of *Kogia* sp. were derived through the application of distance sampling analysis (Buckland *et al.* 1993) and the computer program DISTANCE (Laake *et al.* 1993) to sighting data collected during 1991-1994 spring-summer, visual sampling, line-transect vessel surveys of the northern Gulf of Mexico (Fig. 1 in Hansen *et al.* 1995), which includes data collected as part of the GulfCet program (Hansen *et al.* 1996). These surveys were conducted throughout the area from approximately the 200 m isobath along the USA coast to the seaward extent of the USA Exclusive Economic Zone. The seasonal GulfCet aerial surveys included only a small portion of the species' range and therefore, these data were not used to estimate population size. Estimated abundance of *Kogia* sp. by survey year [coefficient of variation (CV) in parentheses] was 109 in 1991 (0.68), 1,010 in 1992 (0.40), 580 in 1993 (0.45), and 162 in 1994 (0.61) (Hansen *et al.* 1995). Survey effort-weighted estimated average abundance of *Kogia* sp. for all surveys combined was 547 (CV=0.28) (Hansen *et al.* 1995). Estimates of dwarf sperm whale abundance cannot be provided due to uncertainty of species identification at sea.

Minimum Population Estimate

A minimum population estimate was not calculated because of uncertainty of species identification at sea.

Current Population Trend

There is insufficient information to describe any population trend of this species in the Gulf of Mexico.

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. 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 the minimum population size, one half the maximum net productivity rate, and a "recovery" factor (Wade and Angliss 1997). The "recovery" factor, which accounts for endangered, depleted, and 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 dwarf sperm whale is unknown because the minimum population estimate cannot be estimated.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The level of past or current, direct, human-caused mortality of dwarf sperm whales in the northern Gulf of Mexico is unknown. Available information indicates there likely is little, if any, fisheries interaction with dwarf sperm whales in the northern Gulf of Mexico. There have been no logbook reports of fishery-related mortality or serious injury and no fishery-related mortality or serious injury has been observed.

There were no documented strandings of dwarf sperm whales in the northern Gulf of Mexico during 1987-October 1998 which were classified as likely caused by fishery interactions, but there have been stranding investigation reports of dwarf sperm whales which may have died as a result of other human-related causes. 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.

Fisheries Information

Pelagic swordfish, tunas, and billfish are the targets of the longline fishery operating in the USA Gulf of Mexico. Total longline effort for the Gulf of Mexico pelagic fishery, including OCS edge, continental slope, and Mexican territorial waters, based on mandatory logbook reporting, was 4,400 sets in 1991, 4,850 sets in 1992, and 3,260 sets in 1993 (Cramer 1994). This fishery has been monitored with about 5% observer coverage, in terms of trips observed, since 1992. There were no reports of mortality or serious injury of dwarf sperm whales by this fishery.

Pair trawl fishing gear has the potential to capture marine mammals, but there have been no reports of mortality or serious injury to marine mammals in the Gulf of Mexico. This fishery has not been observed by NMFS observers, and there are no other data available as to the extent of this fishery in the Gulf of Mexico. It is assumed that it is very limited in scope and duration.

Other Mortality

A total of at least 16 dwarf sperm whale strandings were documented in the northern Gulf of Mexico from 1990 through October 1998.

STATUS OF STOCK

The status of this stock relative to OSP is unknown and there are insufficient data to determine population trends. This species is not listed under the Endangered Species Act. Although the PBR cannot be calculated, there is no known fishery-related mortality or serious injury to this stock and, therefore, total fishery-related mortality and serious injury can be considered insignificant and approaching zero mortality and serious injury rate. The total level of fishery-related mortality and serious injury is unknown, but it is believed to be insignificant.

REFERENCES

- Barlow, J., S. L. Swartz, T. C. Eagle and P. R. Wade. 1995. U.S. Marine Mammal Stock Assessments: Guidelines for Preparation, Background and a Summary of the 1995 Assessments. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-OPR-6, 73 pp.
- Barros, N. B., D. A. Duffield, P. H. Ostrom, D. K. Odell and V. R. Cornish. 1998. Nearshore vs. offshore ecotype differentiation of *Kogia breviceps* and *K. simus* based on hemoglobin, morphometric and dietary analyses. Abstracts. World Marine Mammal Science Conference. Monaco. 20-24 January.
- Buckland, S. T., D. R. Anderson, K. P. Burnham and J. L. Laake. 1993. Distance Sampling: estimating abundance of biological populations. *Chapman & Hall*, London, 446 pp.
- Caldwell, D. K. and M. C. Caldwell. 1989. Pygmy sperm whale *Kogia breviceps* (de Blainville, 1838): dwarf sperm whale *Kogia simus* Owen, 1866. Pages 235-260 in: S. H. Ridgway and R. Harrison (eds), Handbook of marine mammals, Vol. 4: River dolphins and the larger toothed whales. *Academic Press*, San Diego.
- Cramer, J. 1994. Large pelagic logbook newsletter - 1993. NOAA Tech. Mem. NMFS-SEFSC-352, 19 pp.
- Davis, R. W., G. S. Fargion, N. May, T. D. Leming, M. Baumgartner, W. E. Evans, L. J. Hansen and K. Mullin. 1998. Physical habitats of cetaceans along the continental slope of the north-central and western Gulf of Mexico. *Mar. Mammal. Sci.*, 14:490-507.
- Hansen, L. J., K. D. Mullin, T. A. Jefferson and G. P. Scott. 1996. Visual surveys aboard ships and aircraft. Pages 55-132. In: R. W. Davis and G. S. Fargion (eds). Distribution and abundance of marine mammals in the north-central and

- western Gulf of Mexico: Final Report. Volume II: Technical Report. OCS Study MMS 96-0027. Prepared by the Texas Institute of Oceanography and the National Marine Fisheries Service. U.S. Dept. of the Interior, Minerals Mgmt. Service, Gulf of Mexico OCS Region, New Orleans, LA. 357 pp.
- Hansen, L. J., K. D. Mullin and C. L. Roden. 1995. Estimates of cetacean abundance in the northern Gulf of Mexico from vessel surveys. Southeast Fisheries Science Center, Miami Laboratory, Contribution No. MIA-94/95-25, 9 pp. + tables and figures.
- Jefferson, T. J. and A. Schiro. 1997. Distribution of cetaceans in the northern Gulf of Mexico. *Mammal Rev.*, 27:27-50.
- Laake, J. L., S. T. Buckland, D. R. Anderson and K. P. Burnham. 1993. DISTANCE user's guide, V2.0. Colorado Cooperative Fish & Wildlife Research Unit, Colorado State University, Ft. Collins, Colorado, 72 pp.
- Mullin, K., W. Hoggard, C. Roden, R. Lohofener, C. Rogers and B. Taggart. 1991. Cetaceans on the upper continental slope in the north-central Gulf of Mexico. OCS Study/MMS 91-0027. U.S. Dept. of the Interior, Minerals Management Service, Gulf of Mexico OCS Regional Office, New Orleans, Louisiana 108 pp.
- Wade, P.R., and R.P. Angliss. 1997. Guidelines for assessing marine mammal stocks: Report of the GAMMS Workshop April 3-5, Seattle, Washington. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-OPR-12, 93 pp.
- Würsig, B., S.K. Lynn, T.A. Jefferson, and K.D. Mullin. 1998. Behavior of cetaceans in the northern Gulf of Mexico relative to survey ships and aircraft. *Aquat. Mammals*, 24:41-50.

PYGMY SPERM WHALE (*Kogia breviceps*): Northern Gulf of Mexico Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The pygmy sperm whale appears to be distributed worldwide in temperate to tropical waters (Caldwell and Caldwell 1989). Sightings of these animals in the northern Gulf of Mexico occur primarily along the continental shelf edge and over the deeper waters off the continental shelf (Mullin *et al.* 1991; Southeast Fisheries Science Center, SEFSC, unpublished data). Pygmy sperm whales and dwarf sperm whales (*Kogia simus*) are difficult to distinguish and sightings of either species are often categorized as *Kogia* sp. Sightings of this category were documented in all seasons during seasonal GulfCet aerial surveys of the northern Gulf of Mexico during 1993-1995 (Hansen *et al.* 1996). Pygmy and dwarf sperm whales have been sighted in the northwestern Gulf of Mexico in waters 1000 m deep, on average (Davis *et al.* 1998). However, these authors cautioned that inferences on preferred bottom depths should await surveys for the entire Gulf of Mexico. The difficulty in sighting pygmy and dwarf sperm whales may be exacerbated by their avoidance reaction towards ships, and change in behavior towards approaching survey aircraft (Würsig *et al.* 1998). In a recent study using hematological and stable-isotope data, Barros *et al.* (1998) speculated that dwarf sperm whales may have a more pelagic distribution than pygmy sperm whales, and/or dive deeper during feeding bouts. There is no information on stock differentiation.

POPULATION SIZE

Estimates of abundance of *Kogia* sp. were derived through the application of distance sampling analysis (Buckland *et al.* 1993) and the computer program DISTANCE (Laake *et al.* 1993) to sighting data collected during 1991-1994 spring-summer, visual sampling, line-transect vessel surveys of the northern Gulf of Mexico (Hansen *et al.* 1995) (Fig. 1), which includes data collected as part of the GulfCet program (Hansen *et al.* 1996). These surveys were conducted throughout the area from approximately the 200 m isobath along the USA coast to the seaward extent of the USA Exclusive Economic Zone. The seasonal GulfCet aerial surveys included only a small portion of the species' range and therefore, these data were not used to estimate population size. Estimated abundance of *Kogia* sp. by survey year [coefficient of variation (CV) in parentheses] was 109 in 1991 (0.68), 1,010 in 1992 (0.40), 580 in 1993 (0.45), and 162 in 1994 (0.61) (Hansen *et al.* 1995). Survey effort-weighted estimated abundance of *Kogia* sp. for all surveys combined was 547 (CV = 0.28) (Hansen *et al.* 1995). Estimates of pygmy sperm whale abundance cannot be provided due to uncertainty of species identification at sea.

Minimum Population Estimate

A minimum population estimate could not be calculated because of uncertainty of species identification at sea.

Current Population Trend

There is insufficient information to describe any population trend for this species in the Gulf of Mexico.

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. 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 the minimum population size, one half the maximum net productivity rate, and a "recovery" factor (Wade and Angliss 1997). The "recovery" factor, which accounts for endangered, depleted, and 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 pygmy sperm whale is unknown because the minimum population estimate cannot be estimated.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The level of past or current, direct, human-caused mortality of pygmy sperm whales in the northern Gulf of Mexico is unknown. Available information indicates there likely is little, if any, fisheries interaction with pygmy sperm whales in the northern Gulf of Mexico. There have been no logbook reports of fishery-related mortality or serious injury and no fishery-related mortality or serious injury has been observed.

There have been no documented strandings of pygmy sperm whales in the northern Gulf of Mexico during 1987-October 1998 which have been classified as likely caused by fishery interactions, but there have been stranding investigation reports of pygmy sperm whales which may have died as a result of other human-related causes. 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.

Fisheries Information

Pelagic swordfish, tunas, and billfish are the targets of the longline fishery operating in the USA Gulf of Mexico. Total longline effort for the Gulf of Mexico pelagic fishery, including OCS edge, continental slope, and Mexican territorial waters, based on mandatory logbook reporting, was 4,400 sets in 1991, 4,850 sets in 1992, and 3,260 sets in 1993 (Cramer 1994). This fishery has been monitored with about 5% observer coverage, in terms of trips observed, since 1992. There were no reports of mortality or serious injury of pygmy sperm whales by this fishery.

Pair trawl fishing gear has the potential to capture marine mammals, but there have been no reports of mortality or serious injury to marine mammals in the Gulf of Mexico. This fishery has not been observed by NMFS observers, and there are no other data available as to the extent of this fishery in the Gulf of Mexico. It is assumed that it is very limited in scope and duration.

Other Mortality

At least 20 pygmy sperm whale strandings were documented in the northern Gulf of Mexico from 1990 through October 1998. Two of these animals had a plastic bag or pieces thereof in their stomachs (Tarpley and Marwitz 1993, Barros, unpublished data). Another animal stranded apparently due to injuries inflicted by impact, possibly with a vessel.

STATUS OF STOCK

The status of this stock relative to OSP is unknown and there are insufficient data to determine population trends. This species is not listed under the Endangered Species Act. Although the PBR cannot be calculated, the total known fishery-related mortality and serious injury for this stock is zero and, therefore, can be considered insignificant and approaching zero mortality and serious injury rate. The total level of fishery-related mortality and serious injury is unknown, but it is believed to be insignificant.

REFERENCES

- Barlow, J., S.L. Swartz, T.C. Eagle, and P.R. Wade. 1995. U.S. Marine Mammal Stock Assessments: Guidelines for Preparation, Background and a Summary of the 1995 Assessments. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-OPR-6, 73 pp.
- Barros, N.B., D.A. Duffield, P.H. Ostrom, D.K. Odell, and V.R. Cornish. 1998. Nearshore vs. offshore ecotype differentiation of *Kogia breviceps* and *K. simus* based on hemoglobin, morphometric and dietary analyses. Abstract. World Marine Mammal Science Conference. Monaco. 20-24 January.
- Buckland, S. T., D. R. Anderson, K. P. Burnham and J. L. Laake. 1993. Distance Sampling: estimating abundance of biological populations. *Chapman & Hall*, London, 446 pp.
- Caldwell, D. K. and M. C. Caldwell 1989. Pygmysperm whale *Kogia breviceps* (de Blainville, 1838): dwarf sperm whale *Kogia simus* Owen, 1866. Pages 235-260 in: S. H. Ridgway and R. Harrison (eds), Handbook of marine mammals, Vol. 4: River dolphins and the larger toothed whales. *Academic Press*, San Diego.
- Cramer, J. 1994. Large pelagic logbook newsletter - 1993. NOAA Tech. Mem. NMFS-SEFSC-352, 19 pp.
- Davis, R.W., G.S. Fargion, N. May, T.D. Leming, M. Baumgartner, W.E. Evans, L.J. Hansen, and K. Mullin. 1998. Physical habitats of cetaceans along the continental slope of the north-central and western Gulf of Mexico. *Mar. Mamm. Sci.*, 14:490-507.
- Hansen, L.J., K.D. Mullin, T.A. Jefferson and G.P. Scott. 1996. Visual surveys aboard ships and aircraft. Pages 55-132. In: R.W. Davis and G.S. Fargion (eds). Distribution and abundance of marine mammals in the north-central and

- western Gulf of Mexico: Final Report. Volume II: Technical Report. OCS Study MMS 96-0027. Prepared by the Texas Institute of Oceanography and the National Marine Fisheries Service. U.S. Dept. of the Interior, Minerals Mgmt. Service, Gulf of Mexico OCS Region, New Orleans, LA. 357 pp.
- Hansen, L. J., K. D. Mullin and C. L. Roden. 1995. Estimates of cetacean abundance in the northern Gulf of Mexico from vessel surveys. Southeast Fisheries Science Center, Miami Laboratory, Contribution No. MIA-94/95-25, 9 pp. + tables and figures.
- Laake, J. L., S. T. Buckland, D. R. Anderson, and K. P. Burnham. 1993. DISTANCE user's guide, V2.0. Colorado Cooperative Fish & Wildlife Research Unit, Colorado State University, Ft. Collins, Colorado, 72 pp.
- Mullin, K., W. Hoggard, C. Roden, R. Lohofener, C. Rogers and B. Taggart. 1991. Cetaceans on the upper continental slope in the north-central Gulf of Mexico. OCS Study/MMS 91-0027. U.S. Dept. of the Interior, Minerals Management Service, Gulf of Mexico OCS Regional Office, New Orleans, Louisiana 108 pp.
- Tarpley, R. J., and S. Marwitz. 1993. Plastic debris ingestion by cetaceans along the Texas coast: two case studies. *Aquat. Mammals*, 14:93-98.
- Wade, P. R. and R. P. Angliss. 1997. Guidelines for assessing marine mammal stocks: Report of the GAMMS Workshop April 3-5, Seattle, Washington. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-OPR-12, 93 pp.
- Würsig, B., S. K. Lynn, T. A. Jefferson and K. D. Mullin. 1998. Behavior of cetaceans in the northern Gulf of Mexico relative to survey ships and aircraft. *Aquat. Mammals*, 24:41-50.

MELON-HEADED WHALE (*Peponocephala electra*): Northern Gulf of Mexico Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The melon-headed whale appears to be distributed worldwide in tropical to sub-tropical waters (Perryman et al. 1994). Sightings of these animals in the northern Gulf of Mexico occur primarily over the deeper waters off the continental shelf (Mullin et al. 1994). Melon-headed whales and pygmy killer whales (*Feresa attenuata*) are difficult to distinguish and sightings of either species are often categorized as pygmy killer/melon-headed whales. Sightings of this category were documented in all seasons during recent seasonal GulfCet aerial surveys of the northern Gulf of Mexico during 1993-1995 (Davis et al., in preparation). There is no information on stock differentiation for the Atlantic population.

POPULATION SIZE

Seasonal aerial survey data were insufficient for estimating abundance. Estimates of abundance were derived through the application of distance sampling analysis (Buckland et al. 1993) and the computer program DISTANCE (Laake et al. 1993) to sighting data collected during 1991-1994 spring-summer, visual sampling, line-transect vessel surveys of the northern Gulf of Mexico (Hansen et al. 1995) (Fig. 1), which includes data collected as part of the GulfCet program (Davis et al., in preparation). These surveys were conducted throughout the area from approximately the 200 m iso bath along the U.S. coast to the seaward extent of the U.S. Exclusive Economic Zone. The seasonal GulfCet aerial surveys included only a small portion of the stock range and these data were used for abundance estimation. Estimated abundance of melon-headed whales by survey year [coefficient of variation (CV) in parentheses] was zero in 1991, 3,174 in 1992 (0.54), 827 in 1993 (0.70) and 10,586 in 1994 (0.48) (Hansen et al. 1995). The survey effort-weighted estimated average abundance of melon-headed whales for all surveys combined was 3,965 (CV = 0.39) (Hansen et al. 1995).

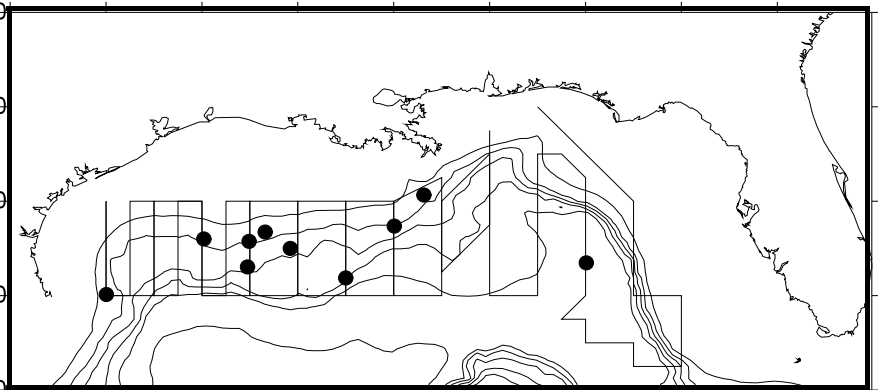


Figure 1. Distribution of melon-headed whale sightings on the northern Gulf of Mexico during 1991-1994. The straight lines show transects during two surveys and are examples of typical survey transects. Isobaths are in 183 m (100 fm) depth intervals.

Minimum Population Estimate

The minimum population size was estimated from the average abundance estimate which was 3,965 (CV = 0.39) (Hansen et al. 1995). 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 distributed abundance estimate as specified by NMFS (Anon. 1994). The minimum population estimate is 2,888 melon-headed whales.

Current Population Trend

No trend was identified in the annual abundance estimates; however, the 1994 estimate was more than ten times larger than the 1993 estimate and the difference was significant using the criteria of no overlap of log-normal 95% confidence intervals. No melon-headed whales were sighted during 1991, and the differences between the 1992 and 1993 estimates and between the 1993 and 1994 estimates were not significant. The apparent differences in abundance estimates may have been caused by lower sampling effort during 1991, and by low sampling intensity relative to population size (Hansen et al. 1995), or by inter-annual variation in distribution patterns or spatial sampling patterns, rather than changes in population size.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are not known; therefore, the default maximum net productivity rate of 0.04 (Anon. 1994) was used for purposes of this assessment.

POTENTIAL BIOLOGICAL REMOVAL

Potential biological removal level (PBR) was specified as the product of the minimum population size, one half the maximum net productivity rate, and a recovery factor for endangered, threatened, or depleted stocks, or stocks of unknown status relative to optimum sustainable population (OSP) (Anon. 1994). The recovery factor was set at 0.50 because the status of the stock relative to OSP is unknown. PBR for this stock is 29 melon-headed whales.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

There has historically been some take of this species in small cetacean fisheries in the Caribbean (Caldwell et al. 1976); however, the level of past or current, direct, human-caused mortality of melon-headed whales in the northern Gulf of Mexico is unknown. Available information indicates there likely is little, if any, fisheries interaction with melon-headed whales in the northern Gulf of Mexico. There have been no logbook reports of fishery-related mortality or serious injury and no fishery-related mortality or serious injury has been observed.

There were no documented strandings of melon-headed whales in the northern Gulf of Mexico during 1987-1994 which were classified as likely caused by fishery interactions or other human-related causes. 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.

The total known fishery-related mortality and serious injury for this stock is less than 10% of the calculated PBR and, therefore, can be considered 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

Pelagic swordfish, tunas, and billfish are the targets of the longline fishery operating in the U.S. Gulf of Mexico. Total longline effort for the Gulf of Mexico pelagic fishery, including OCS edge, continental slope, and Mexican territorial waters, based on mandatory logbook reporting, was 4,400 sets in 1991, 4,850 sets in 1992, and 3,260 sets in 1993 (Cramer 1994). This fishery has been monitored with about 5% observer coverage, in terms of trips observed, since 1992. There were no reports of mortality or serious injury to melon-headed whales by this fishery.

Pair trawl fishing gear has the potential to capture marine mammals, but there have been no reports of mortality or serious injury to marine mammals in the Gulf of Mexico. This fishery has not been observed by NMFS observers, and there are no other data available as to the extent of this fishery in the Gulf of Mexico. It is assumed that it is very limited in scope and duration.

STATUS OF STOCK

The status of this stock relative to OSP is unknown. This species is not listed under the Endangered Species Act. There are insufficient data to determine population trends. The total level of fishery-related mortality and serious injury is unknown, but it is believed to be insignificant relative to PBR; therefore, this is not a strategic stock.

REFERENCES

- 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.
- Buckland, S. T., D. R. Anderson, K. P. Burnham and J. L. Laake. 1993. Distance Sampling: estimating abundance of biological populations. Chapman & Hall, London, 446 pp.
- Caldwell, D. K., M. C. Caldwell and R. V. Walker. 1976. First records for Fraser's dolphin (*Lagenodelphis hosei*) in the Atlantic and the melon-headed whale (*Peponocephala electra*) in the western Atlantic. *Cetology* 25: 1-4.
- Cramer, J. 1994. Large pelagic logbook newsletter - 1993. NOAA Tech. Mem. NMFS-SEFSC-352, 19 pp.
- Davis, R., G. Scott, B. Würsig, W. Evans, G. Fargion, L. Hansen, K. Mullin, N. May, T. Leming, B. Mate, J. Norris and T. Jefferson. In preparation. Distribution and abundance of marine mammals in the north-central and western

- Gulf of Mexico: Final Report. OCS Study #MMS 94-0003. Texas Institute of Oceanography and the National Marine Fisheries Service. U.S. Dept. of the Interior, Minerals Mgmt. Service, Gulf of Mexico OCS Region, New Orleans, Louisiana.
- Hansen, L. J., K. D. Mullin and C. L. Roden. 1995. Estimates of cetacean abundance in the northern Gulf of Mexico from vessel surveys. Southeast Fisheries Science Center, Miami Laboratory, Contribution No. MIA-94/95-25, 9 pp. + tables and figures.
- Laake, J. L., S. T. Buckland, D. R. Anderson, and K. P. Burnham. DISTANCE user's guide, V2.0. Colorado Cooperative Fish & Wildlife Research Unit, Colorado State University, Ft. Collins, Colorado, 72 pp.
- Mullin, K. D., T. A. Jefferson, L. J. Hansen and W. Hoggard. 1994. First sightings of melon-headed whales (*Peponocephala electra*) in the Gulf of Mexico. Mar. Mam. Sci. 10(3): 342-348.

RISSO'S DOLPHIN (*Grampus griseus*): Northern Gulf of Mexico Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Risso's dolphin is distributed worldwide in tropical to warm temperate waters (Leatherwood and Reeves 1983). Sightings of these animals in the northern Gulf of Mexico occur primarily along the continental shelf and continental slope (Mullin et al. 1991; Southeast Fisheries Science Center, SEFSC, unpublished data). Risso's dolphin were seen in all seasons during recent seasonal GulfCet aerial surveys of the northern Gulf of Mexico during 1993-1995 (Davis et al., in preparation) and in the late spring during vessel surveys (SEFSC, unpublished data). There is no information on stock differentiation for the Atlantic population.

POPULATION SIZE

Seasonal aerial survey data were insufficient for abundance estimation. Estimates of abundance were derived through the application of distance sampling analysis (Buckland et al. 1993) and the computer program DISTANCE (Laake et al. 1993) to sighting data collected during 1991-1994 spring-summer, visual sampling, line-transect vessel surveys of the northern Gulf of Mexico (Hansen et al. 1995) (Fig.1), which includes data collected as part of the GulfCet program (Davis et al., in preparation). These surveys were conducted throughout the area from approximately the 200 m iso bath along the U.S. coast to the seaward extent of the U.S. Exclusive Economic Zone. The seasonal GulfCet aerial surveys included only a small portion of the stock range and these data were not used for abundance estimation. Estimated abundance of Risso's dolphins by survey year [coefficient of variation (CV) in parentheses] was 667 in 1991 (0.95), 2,325 in 1992 (0.34), 1,408 in 1993 (0.41), and 6,332 in 1994 (0.45) (Hansen et al. 1995). Survey effort-weighted average abundance of Risso's dolphins estimated for all surveys combined was 2,749 (CV = 0.27) (Hansen et al. 1995).

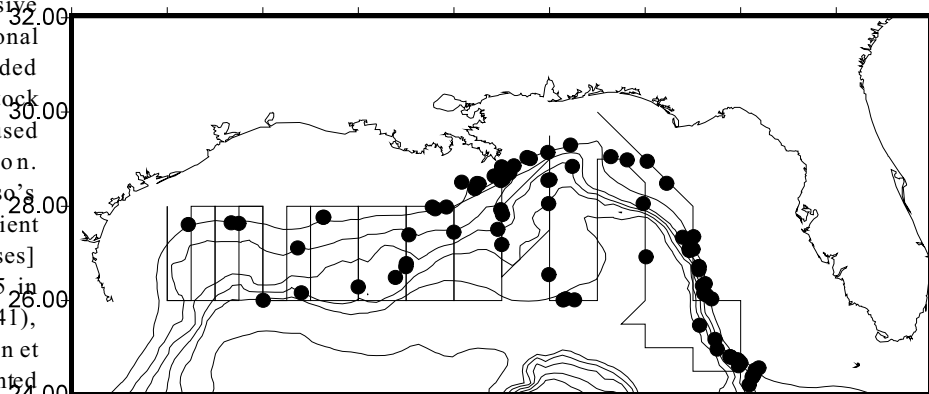


Figure 1. Distribution of Risso's dolphin sightings during 1991-1994 marine mammal surveys during 1991-1994. The straight lines show transects during two surveys and are examples of typical survey transects. Isobaths are in 183 m (100 fm) intervals.

Minimum Population Estimate

The minimum population size was estimated from the average abundance estimate which was 2,749 Risso's dolphins (CV = 0.27) (Hansen et al. 1995). 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 distributed abundance estimate as specified by NMFS (Anon. 1994). The minimum population estimate is 2,199 Risso's dolphins.

Current Population Trend

No trend was identified in the annual abundance estimates. The 1994 abundance estimate was greater than the other annual estimates, but no annual estimates differed significantly using the criteria of no overlap of log-normal 95% confidence intervals. The apparent differences in abundance estimates may have been caused by lower sampling effort during 1991 (Hansen et al. 1995) or by inter-annual variation in distribution patterns or spatial sampling patterns, rather than changes in population size.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates for this stock are not known; therefore, the default maximum net productivity rate of 0.04 (Anon. 1994) was used for purposes of this assessment.

POTENTIAL BIOLOGICAL REMOVAL

Potential biological removal level (PBR) was specified as the product of the minimum population size, one half the maximum net productivity rate, and a recovery factor for endangered, threatened, or depleted stocks, or stocks of unknown status relative to optimum sustainable population (OSP) (Anon. 1994). The recovery factor was set at 0.50 because the status of the stock relative to OSP is unknown. PBR for this stock is 22 Risso's dolphins.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The level of past or current, direct, human-caused mortality of Risso's dolphins in the northern Gulf of Mexico is unknown. This species has been taken in the U.S. longline swordfish/tuna fishery in the northern Gulf of Mexico and in the U.S. Atlantic (Lee et al. 1994). Estimated average annual fishery-related mortality and serious injury attributable to the longline swordfish/tuna fishery in the Gulf of Mexico during 1992-1993 was 19 Risso's dolphins annually (CV = 0.20).

There were no documented strandings of Risso's dolphins in the northern Gulf of Mexico during 1987-1994 which were classified as likely caused by fishery interactions or other human-related causes. 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.

The total estimated fishery-related mortality and serious injury for this stock is not less than 10% of the calculated PBR and, therefore, cannot be considered 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

Interactions between the U.S. longline swordfish/tuna fishery and Risso's dolphins have been documented in the northern Gulf of Mexico (Lee et al. 1994). Pelagic swordfish, tunas, and billfish are the targets of the longline fishery operating in the U.S. Gulf of Mexico. Total longline effort for the Gulf of Mexico pelagic fishery, including OCS edge, continental slope, and Mexican territorial waters, based on mandatory logbook reporting, was 4,400 sets in 1991, 4,850 sets in 1992, and 3,260 sets in 1993 (Cramer 1994). This fishery has been monitored with about 5% observer coverage, in terms of trips observed, since 1992. One Risso's dolphin was observed taken and released alive during 1992; the extent of injury to the animal was unknown (SEFSC, unpublished data). One lethal take of a Risso's dolphin by the fishery was observed in the Gulf of Mexico during 1993 (SEFSC, unpublished data). Annual fishery-related mortality and incidental injury was estimated using a generalized linear model (Poisson error assumption) fit to the available observed incidental take data for the entire fishery and partitioned on the fishery effort (number of sets) in the Gulf of Mexico. Estimated total mortality and serious injury to Risso's dolphins (CV in parentheses) in the Gulf of Mexico in 1992 was 24 (0.19), and in 1993 it was 13 (0.20). Estimated average annual fishery-related mortality and serious injury attributable to the longline swordfish/tuna fishery in the Gulf of Mexico during 1992-1993 was 19 Risso's dolphins annually (CV = 0.20). ~~P~~ trawl fishing gear has the potential to capture marine mammals, but there have been no reports of mortality or serious injury to marine mammals in the Gulf of Mexico. This fishery has not been observed by NMFS observers, and there are no other data available as to the extent of this fishery in the Gulf of Mexico. It is assumed that it is very limited in scope and duration.

STATUS OF STOCK

The status of this stock relative to OSP is unknown. This species is not listed under the Endangered Species Act and there are insufficient data to determine population trends. This is not a strategic stock because fishery-related mortality and serious injury does not exceed PBR; however, fishery-related mortality and serious injury is very close to PBR and requires close monitoring.

REFERENCES

- 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.
- Buckland, S. T., D. R. Anderson, K. P. Burnham and J. L. Laake. 1993. Distance Sampling: estimating abundance of biological populations. Chapman & Hall, London, 446 pp.
- Cramer, J. 1994. Large pelagic logbook newsletter - 1993. NOAA Tech. Mem. NMFS-SEFSC-352, 19 pp.
- Davis, R., G. Scott, B. Würsig, W. Evans, G. Fargion, L. Hansen, K. Mullin, N. May, T. Leming, B. Mate, J. Norris and T. Jefferson. In preparation. Distribution and abundance of marine mammals in the north-central and western Gulf of Mexico: Final Report. OCS Study #MMS 94-0003. Texas Institute of Oceanography and the National Marine Fisheries Service. U.S. Dept. of the Interior, Minerals Mgmt. Service, Gulf of Mexico OCS Region, New Orleans, Louisiana.
- Hansen, L. J., K. D. Mullin and C. L. Roden. 1995. Estimates of cetacean abundance in the northern Gulf of Mexico from vessel surveys. Southeast Fisheries Science Center, Miami Laboratory, Contribution No. MIA-94/95-25, 9 pp. + tables and figures.
- Laake, J. L., S. T. Buckland, D. R. Anderson, and K. P. Burnham. DISTANCE user's guide, V2.0. Colorado Cooperative Fish & Wildlife Research Unit, Colorado State University, Ft. Collins, Colorado, 72 pp.
- Leatherwood, S. and R. R. Reeves. 1983. The Sierra Club handbook of whales and dolphins. Sierra Club Books, San Francisco, 302 pp.
- Mullin, K., W. Hoggard, C. Roden, R. Lohofener, C. Rogers and B. Taggart. 1991. Cetaceans on the upper continental slope in the north-central Gulf of Mexico. OCS Study/MMS 91-0027. U.S. Dept. of the Interior, Minerals Management Service, Gulf of Mexico OCS Regional Office, New Orleans, Louisiana, 108 pp.

SHORT-FINNED PILOT WHALE (*Globicephala macrorhynchus*): Northern Gulf of Mexico Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The short-finned pilot whale is distributed worldwide in tropical to warm temperate waters (Leatherwood and Reeves 1983). Sightings of these animals in the northern Gulf of Mexico occur primarily along the continental shelf and continental slope [Mullin et al. 1991; Southeast Fisheries Science Center (SEFSC) unpublished data]. Short-finned pilot whales were seen in all seasons during recent seasonal GulfCet aerial surveys of the northern Gulf of Mexico during 1993-1995 (Davis et al., in preparation). There is no information on stock differentiation for the Atlantic population.

POPULATION SIZE

Abundance was estimated using distance sampling analysis (Buckland et al. 1993) and the computer program DISTANCE (Laake et al. 1993) with sighting data collected during 1991-1994 spring-summer, visual sampling, line-transect vessel surveys of the northern Gulf of Mexico (Hansen et al. 1995) (Fig. 1), which includes data collected as part of the GulfCet program (Davis et al., in preparation). These surveys were conducted throughout the area from approximately the 200 m isobath along the U.S. coast to the seaward extent of the U.S. Exclusive Economic Zone. The seasonal GulfCet aerial surveys included only a small portion of the stock range, so those data were not used for abundance estimation. Estimated abundance of short-finned pilot whales by survey year [coefficient of variation (CV) in parentheses] was zero in 1991, 909 in 1992 (0.62), 103 in 1993 (1.20), and 240 in 1994 (1.03) (Hansen et al. 1995). Survey effort-weighted estimated average abundance of short-finned pilot whales for all surveys combined was 353 (CV = 0.89) (Hansen et al. 1995).

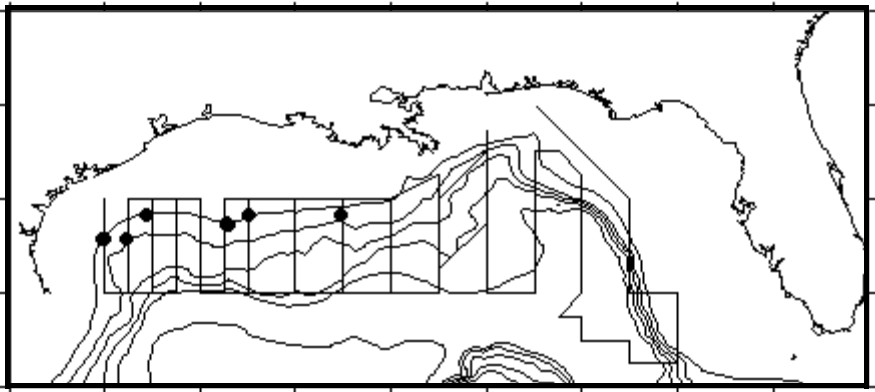


Figure 1. Distribution of short-finned pilot whale sightings during NOAA Ship Oregon II surveys during 1991-1994. The straight lines show transects during two surveys and are examples of typical survey transects. Isobaths are in 183 m (100 fm) intervals.

Minimum Population Estimate

The minimum population size was estimated from the average abundance estimate which was 353 pilot whales (CV = 0.89) (Hansen et al. 1995). The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normal distributed average abundance estimate, which is equivalent to the 20th percentile of the log-normal distributed abundance estimate as specified by NMFS (Anon. 1994). The minimum population estimate is 186 pilot whales.

Current Population Trend

The annual abundance estimates were not significantly different using the criteria of no overlap of log-normal 95% confidence intervals. The variation in abundance estimates that was observed may have been caused by lower sampling effort during 1991, by low sampling intensity relative to population size (Hansen et al. 1995), or by inter-annual variation in distribution patterns or spatial sampling patterns, rather than changes in population size.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are not known for this stock; therefore, the default maximum net productivity rate of 0.04 (Anon. 1994) was used for purposes of this assessment.

POTENTIAL BIOLOGICAL REMOVAL

Potential biological removal level (PBR) was specified as the product of the minimum population size, one half the maximum net productivity rate, and a recovery factor for endangered, threatened, or depleted stocks, or stocks of unknown status relative to optimum sustainable population (OSP) (Anon. 1994). The recovery factor was set at 0.50 because the status of the stock relative to OSP is unknown. PBR for this stock is 1.9 short-finned pilot whales.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The level of past or current, direct, human-caused mortality of short-finned pilot whales in the northern Gulf of Mexico is unknown. This species has been taken in the U.S. longline swordfish/tuna fishery in U.S. Atlantic waters (Lee et al. 1994) and there is a logbook report of a fishery-related mortality or serious injury in the northern Gulf of Mexico (NMFS unpublished data); however, fishery-related mortality or serious injury has not been observed. Total known fishery-related mortality or serious injury is estimated to be 0.3 short-finned pilot whales per year based upon the logbook report.

There were no documented strandings of short-finned pilot whales in the northern Gulf of Mexico during 1987-1994 which were classified as likely caused by fishery interactions or other human-related causes. 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.

The total known fishery-related mortality and serious injury for this stock is greater than 10% of the calculated PBR and, therefore, cannot be considered 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

Pelagic swordfish, tunas, and billfish are the targets of the longline fishery operating in the U.S. Gulf of Mexico. Interactions between the U.S. longline swordfish/tuna fishery and short-finned pilot whales have been reported in the northern Gulf of Mexico (SEFSC, unpublished logbook data), but have not been observed by NMFS fishery observers. Total longline effort for the Gulf of Mexico pelagic fishery, including OCS edge, continental slope, and Mexican territorial waters, based on mandatory logbook reporting, was 4,400 sets in 1991, 4,850 sets in 1992, and 3,260 sets in 1993 (Cramer 1994). This fishery was been monitored with about 5% observer coverage in both the Atlantic Ocean and the Gulf of Mexico, in terms of trips observed, in 1992-1993. There was one logbook report of a fishery-related injury of a pilot whale in the northern Gulf of Mexico in 1991, but no fishery interactions were observed during 1992-1993. Total known fishery-related mortality or serious injury is estimated to be 0.3 short-finned pilot whales per year based upon the logbook report.

Pair trawl fishing gear has the potential to capture marine mammals, but there have been no reports of mortality or serious injury to marine mammals in the Gulf of Mexico. This fishery has not been observed by NMFS observers, and there are no other data available as to the extent of this fishery in the Gulf of Mexico. It is assumed that it is very limited in scope and duration.

STATUS OF STOCK

The status of this stock relative to OSP is unknown and there are insufficient data to determine population trends. This species is not listed under the Endangered Species Act. The total level of estimated fishery-related mortality and serious injury is unknown, but because there is a record of a fishery-related mortality or serious injury and because of the extremely low estimated stock size, this is a strategic stock.

REFERENCES

- 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.
- Buckland, S. T., D. R. Anderson, K. P. Burnham and J. L. Laake. 1993. Distance Sampling: estimating abundance of biological populations. Chapman & Hall, London, 446 pp.
- Cramer, J. 1994. Large pelagic logbook newsletter - 1993. NOAA Tech. Mem. NMFS-SEFSC-352, 19 pp.
- Davis, R., G. Scott, B. Würsig, W. Evans, G. Fargion, L. Hansen, K. Mullin, N. May, T. Leming, B. Mate, J. Norris and T. Jefferson. In preparation. Distribution and abundance of marine mammals in the north-central and western Gulf of Mexico: Final Report. OCS Study #MMS 94-0003. Texas Institute of Oceanography and the National

- Marine Fisheries Service. U.S. Dept. of the Interior, Minerals Mgmt. Service, Gulf of Mexico OCS Region, New Orleans, Louisiana.
- Hansen, L. J., K. D. Mullin and C. L. Roden. 1995. Estimates of cetacean abundance in the northern Gulf of Mexico from vessel surveys. Southeast Fisheries Science Center, Miami Laboratory, Contribution No. MIA-94/95-25, 9 pp. + tables and figures.
- Laake, J. L., S. T. Buckland, D. R. Anderson, and K. P. Burnham. DISTANCE user's guide, V2.0. Colorado Cooperative Fish & Wildlife Research Unit, Colorado State University, Ft. Collins, Colorado, 72 pp.
- Leatherwood, S. and R. R. Reeves. 1983. The Sierra Club handbook of whales and dolphins. Sierra Club Books, San Francisco, 302 pp.
- Lee, D. W., C. J. Brown, A. J. Catalano, J. R. Grubich, T. W. Greig, R. J. Miller and M. T. Judge. 1994. SEFSC pelagic longline observer program data summary for 1992-1993. NOAA Tech. Mem. NMFS-SEFSC-347, 19 pp.
- Mullin, K., W. Hoggard, C. Roden, R. Lohoefer, C. Rogers and B. Taggart. 1991. Cetaceans on the upper continental slope in the north-central Gulf of Mexico. OCS Study/MMS 91-0027. U.S. Dept. of the Interior, Minerals Management Service, Gulf of Mexico OCS Regional Office, New Orleans, Louisiana, 108 pp.