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

## STOCK DEFINITION AND GEOGRAPHIC RANGE

Studies relying on identification of individual dolphins (Scott et al. 1990; Wells 1986a) suggest that bottlenose dolphins inhabiting many of the bays, sounds, and other estuaries adjacent to the Gulf of Mexico form discrete communities. Although breeding may occur between adjacent communities, the geographic nature of these areas suggests that each community exists as a functioning unit of its ecosystem and, under the Marine Mammal Protection Act, must be maintained as such. Therefore, each of those areas forming a contiguous, enclosed or semi-enclosed body of water is considered to contain a distinct bottlenose dolphin stock and will be reported as such within this report. However, because there are insufficient data currently available with which to evaluate fisheries within each area, a separate stock assessment report will not be prepared for each local stock at this time.

Mark-recapture studies using photo-identification of individual dolphins in the vicinity of Sarasota and Tampa Bays in Florida showed that individual dolphins remained in a given area year around (Scott et al. 1990). Wells (1986a) described three distinct dolphin "communities" in the area in and around Sarasota Bay. One community was formed by dolphins residing in the Gulf of Mexico coastal waters, another consisted of the dolphins in the deep water areas of Passage Key Inlet and Tampa Bay (adjacent to Sarasota Bay), and a third community resided in the shallow waters of Sarasota Bay. Electrophoretic isozyme analysis showed significant differences between dolphins of the shallow water Sarasota community and the Tampa Bay community, and from dolphins from Charlotte Harbor, to the south; however, there was a high degree of genetic heterozygosity indicating that the Sarasota community was not genetically isolated (Duffield and Wells 1986). Wells (1986b) suggested that the Sarasota community is likely one of a number of communities which comprise a population, the limits of which are unknown. He suggested that the continuous distribution of bottlenose dolphins around the Gulf of Mexico coast theoretically allows genetic exchange between adjacent communities; however, he also noted that the females of the highly-structured Sarasota community form a stable, discrete, long-term breeding unit with strong geographical fidelity (Wells 1986b). Depletion of a bottlenose dolphin community within a restricted geographical area could have a deleterious effect on its ability to recover. Conservative management practice dictates that such a community be treated as a stock for managing interactions with fisheries.

Recent photo-identification and radio-tracking studies confirmed that some individuals remained in the same general areas within Matagorda Bay, Texas, throughout the year (Lynn 1995); thus, the situation there may be similar to that of the Florida west coast. Movement by resident bottlenose dolphins in Texas through passes linking bays with the Gulf of Mexico appears to be relatively limited (Shane 1977; Gruber 1981; McHugh 1989; Lynn 1995), but it apparently does occur and these stocks may not be reproductively isolated from the coastal stocks. Two bottlenose dolphins previously seen in the South Padre Island, Texas, coastal area were seen in Matagorda Bay, 285 km north, in May 1992 and May 1993 (Lynn 1995). Preliminary analyses of MtDNA using polymerase chain reaction procedures suggested that Matagorda Bay dolphins appear to be a localized population (NMFS unpublished data). Over 1,000 individual bottlenose dolphins have been identified in bay and coastal waters near the northeast end of Galveston Island, Texas ( Bräger et al. 1994; Bräger 1992, 1993; Henningsen 1991), but most of these were sighted only once and approximately 200 individuals were reported to use the area over the long term (Bräger et al. 1994).

Much less is known about the movements of resident bottlenose dolphins in estuaries of the northern Gulf of Mexico. There are observed seasonal differences in bottlenose dolphin abundance in Mississippi Sound that suggest seasonal migration (NMFS unpublished data); however, the spatial migration patterns are not currently known. It appears probable that some exchange occurs between the Mississippi Sound stock and the coastal stock in this area. Additional information may result in the future combining of these stocks in this area.

## POPULATION SIZE

Population size (Table I) 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 aerial surveys of the west coast of Florida in September-November 1994 (NMFS unpublished data). Standard line transect perpendicular sighting distance analytical methods were used (Buckland et al. 1993) and the

| Blocks | Gulf of Mexico Estuary | $N_{BEST}$ | CV | $N_{MIN}$ | PBR | Year | Reference |
|---|---|---|---|---|---|---|---|
| B51 | Laguna Madre | 80 | 1.57 | 31 | 0.3 | 1992 | Blaylock and Hoggard 1994 |
| B52 | Nueces Bay, Corpus Christi Bay | 58 | 0.61 | 36 | 0.4 | " | " |
| B50 | Compano Bay, Aransas Bay, San Antonio Bay, Redfish Bay, Espirito Santo Bay | 55 | 0.82 | 30 | 0.3 | " | " |
| B54 | Matagorda Bay, Tres Palacios Bay, Lavaca Bay | 61 | 0.45 | 42 | 0.4 | " | " |
| B55 | West Bay | 29 | 1.10 | 14 | 0.1 | " | " |
| B56 | Galveston Bay, East Bay, Trinity Bay | 152 | 0.43 | 107 | 1.1 | " | " |
| B57 | Sabine Lake | 0 | — | 0 | 0.0 | " | " |
| B58 | Calcasieu Lake | 0 | — | 0 | 0.0 | " | " |
| B59 | Vermillion Bay, West Cote Blanche Bay, Atchafalaya Bay | 0 [1] | — | 0 | 0.0 | " | " |
| B60 | TerreBonne Bay, Timbalier Bay | 100 | 0.53 | 66 | 0.7 | 1993 | " |
| B61 | Barataria Bay | 219 | 0.55 | 142 | 1.4 | " | " |
| B30 | Mississippi River Delta | 0 [1] | — | 0 | 0.0 | " | " |
| B02-05,29,31 | Bay Boudreau, Mississippi Sound | 1,401 | 0.13 | 1,256 | 13 | " | " |
| B06 | Mobile Bay, Bonsecour Bay | 122 | 0.34 | 92 | 0.9 | " | " |
| B07 | Perdido Bay | 0 [1] | — | 0 | 0.0 | " | " |
| B08 | Pensacola Bay, East Bay | 33 | 0.80 | 18 | 0.2 | " | " |
| B09 | Choctawhatchee Bay | 242 | 0.31 | 188 | 1.9 | " | " |
| B10 | St. Andrew Bay | 124 | 0.57 | 79 | 0.8 | " | " |
| B11 | St. Joseph Bay | 0 | — | 0 | 0.0 | " | " |
| B12-13 | St. Vincent Sound, Apalachicola Bay, St. Georges Sound | 387 | 0.34 | 293 | 2.9 | " | " |
| B14-15 | Apalachee Bay | 491 | 0.39 | 358 | 3.6 | " | " |
| B16 | Waccasassa Bay, Withlacoochee Bay, Crystal Bay | 100 | 0.85 | 54 | 0.5 | 1994 | " |
| B17 | St. John's Sound, Clearwater Harbor | 37 | 1.06 | 18 | 0.2 | " | " |
| B32-34 | Tampa Bay | 559 | 0.24 | 458 | 4.6 | " | " |
| B20 | Sarasota Bay | 97 | na [3] | 97 | 1.0 | 1992 | Wells 1992 |
| B35 | Little Sarasota Bay | 2 [2] | 0.24 | 2 | 0.0 | 1985 | Scott et al. 1989 |
| B21 | Lemon Bay | 0 [1] | — | 0 | 0.0 | 1994 | Blaylock and Hoggard 1994 |
| B22-23 | Pine Sound, Charlotte Harbor, Gasparilla Sound | 209 | 0.38 | 153 | 1.5 | " | " |
| B36 | Caloosahatchee River | 0 [1,2] | — | 0 | 0.0 | 1985 | Scott et al. 1989 |
| B24 | Estero Bay | 104 | 0.67 | 62 | 0.6 | 1994 | Blaylock and Hoggard 1994 |
| B25 | Chokoloskee Bay, Ten Thousand Islands, Gullivan Bay | 208 | 0.46 | 144 | 1.4 | " | " |
| B27 | Whitewater Bay | 242 | 0.37 | 179 | 1.8 | " | " |
| B28 | Florida Keys (Bahia Honda Key to Key West) | 29 | 1.00 | 14 | 0.1 | " | " |

**Table I**. *Bottlenose dolphin abundance ($N_{BEST}$), coefficient of variation (CV), minimum population estimate ($N_{MIN}$), and Potential Biological Removal (PBR) in U.S. Gulf of Mexico bays, sounds, and other estuaries. Blocks refer to aerial survey blocks illustrated in Fig. 1.*

*Notes: [1]Bottlenose dolphins not sighted during earlier surveys (Scott et al. 1989). [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.*

computer program CIRCLE/MCDS (Laake et al. 1993). Stock size $N_{BEST}$ Sarasota Bay, Florida, was obtained through direct count of known individuals (Wells 1992).

**Minimum Population Estimate**

The minimum population estimate (Table I) 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. Three anomalous mortality events have occurred among portions of this stock between 1990 and 1994; however, it is not possible to accurately partition the mortalities between the bay and coastal stocks, thus the impact of these mortality events on these stocks is not known.

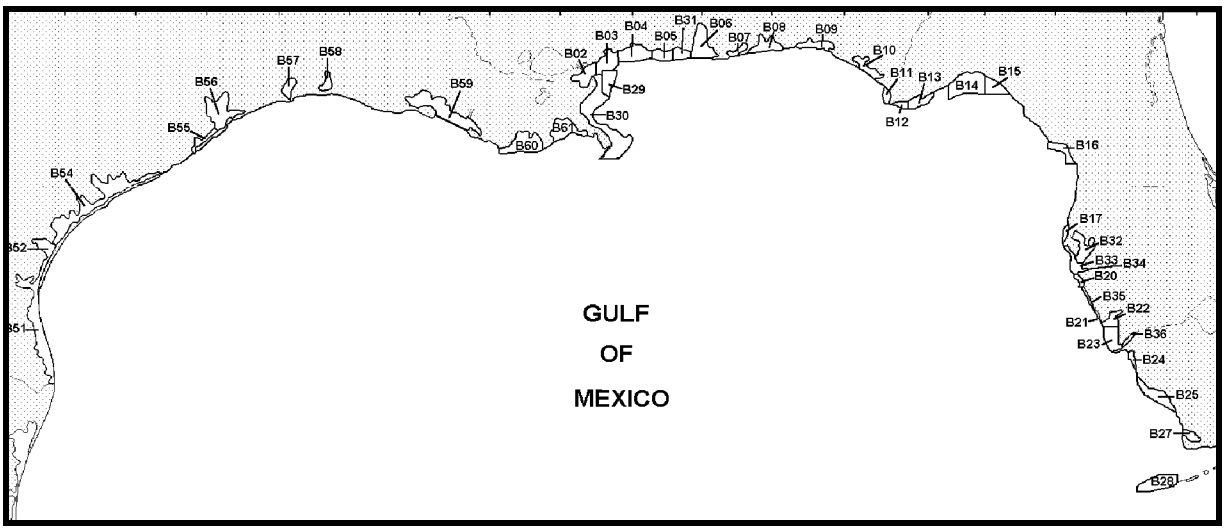


**Figure 1.** *U.S. Gulf of Mexico bays and sounds. Each of the alpha-numerically designated blocks corresponds to one of the NMFS Southeast Fisheries Science Center logistical aerial surveys areas listed in Table I. The bottlenose dolphins inhabiting each bay and sound are considered to comprise a unique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

**CURRENT AND MAXIMUM NET PRODUCTIVITY RATES**

Current and maximum net productivity rates are not known for these stocks. 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 I.

**ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY**

An annual mean of 30 bottlenose dolphins with coefficient of variation (CV) = 0.21 stranded on the coast in the U.S. Gulf of Mexico 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 represented 9.6% of the total bottlenose dolphin strandings reported for the entire U.S. Gulf of Mexico. Morgan and Patton (1990) reported that 12.9% of 116 cetacean carcasses 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.

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 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.

Some of these stocks 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 for 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 and 202 dolphins were removed 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 the 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 U.S. 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 no reports of incidental mortality or injury in any of these 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; NMFS unpublished data) indicating the possibility of entanglement with crab pot lines; however, entanglement has not been reported by fishermen. 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 $m^3$ 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.

**Other Mortality**

The nearshore 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 U.S. 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 were 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. A recent assessment of the health of 35 bottlenose dolphins from Matagorda Bay, Texas, however, associated high levels of chlorinated hydrocarbons with low health assessment scores (Reif et al., in review).

**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 U.S. 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 U.S. Gulf of Mexico may have experienced 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.

Low-level monitoring surveys in Mississippi Sound indicated a significantly lower average summer bottlenose dolphin abundance between 1985 and 1993 (NMFS unpublished data). The apparent decline in summer abundance of bottlenose dolphins in Mississippi Sound is evidence of a possible downward trend in abundance; however, there are insufficient data available with which to conduct a trend analysis. The relatively high number of bottlenose dolphin deaths which occurred during the recent mortality events 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, is not insignificant and approaching 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. 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.

Bräger, S. 1992. Untersuchungen zur Ortstreue und zum Vergesellschaftungmuster des Großen Tümmlers, *Tursiops truncatus* (Montagu, 1821). Diploma thesis, Christian-Albrechts-Universität, Kiel, Germany, 97 pp.

Bräger, S. 1993. Diurnal and seasonal behavior patterns of bottlenose dolphins (*Tursiops truncatus*). Mar. Mam. Sci. 9: 434-440.

Bräger, S., B. Würsig, Alejandro 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.

Gruber, J. A. 1981. Ecology of the Atlantic bottlenosed 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 (editor), European research on cetaceans - 5. Proceedings of the Fifth Annual Conference of the European Cetacean Society, Sandefjord, Norway, 21-23 February, 1991. Cambridge, UK.

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, 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.

McHugh, M. B. 1989. Population numbers and feeding behavior of the bottlenose dolphin (*Tursiops truncatus*) near Aransas Pass, Texas. M. A. thesis. University of Texas, Austin, 97 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.

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.

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 (editors), 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 (editors), 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.

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.

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 at Santa Cruz, Santa Cruz, 234 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.