

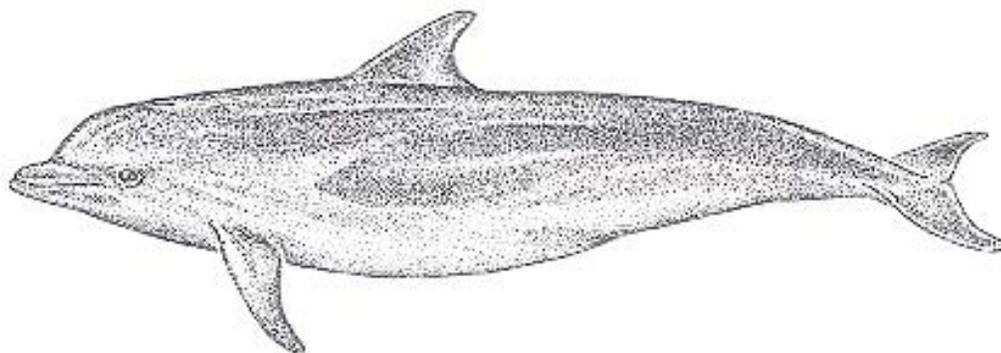


NOAA TECHNICAL MEMORANDUM NMFS-SEFSC- 473

**GULF OF MEXICO BOTTLENOSE DOLPHIN  
STOCK IDENTIFICATION WORKSHOP**

14-15 March 2000  
Sarasota, Florida

Carrie W. Hubbard  
Steven L. Swartz



U.S. Department of Commerce  
National Oceanic and Atmospheric Administration  
NOAA Fisheries  
Southeast Fisheries Science Center  
75 Virginia Beach Drive  
Miami, Florida 33149

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January 2002

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## ABSTRACT

The Protected Species and Biodiversity Branch of NOAA Fisheries' Southeast Fisheries Science Center in Sarasota, Florida convened a workshop on 14-15 March 2000. The purpose of the workshop was to review and discuss existing information on bottlenose dolphin (*Tursiops truncatus*) stock structure in the Gulf of Mexico, past and present research, and to make suggestions for creating a Gulf-wide research strategy for this species. A panel of 20 researchers from various government agencies and universities participated in the workshop. Current and prior research on Gulf of Mexico bottlenose dolphins was summarized. Methodological, spatial, and temporal gaps in that data were discussed. The panel reviewed the various risks to bottlenose dolphins in the Gulf of Mexico from fisheries, urbanization, and industry. A series of suggestions for future research that would help define bottlenose dolphin stock structure in the Gulf of Mexico were made. These included continuing on-going studies and expanding research into regions of the Gulf that have not previously been studied. It was also suggested that researchers in the Gulf of Mexico begin to collaborate their efforts and data. Assignment tests that could link stranded animals to specific regions of the Gulf would be valuable, and it was suggested that future research attempt to determine which chemical ratios may be useful. The panel suggested that the strategy for identifying bottlenose dolphin stocks in the Gulf of Mexico employ the relatively new "geographical cluster analysis" method using genetic samples as well as other data sets.

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## INTRODUCTION

Bottlenose dolphins (*Tursiops truncatus*) are distributed continuously throughout the continental shelf, coastal, and bay-sound-estuary waters of the northern Gulf of Mexico and along the U.S. mid-Atlantic coast. NOAA Fisheries is responsible for managing this species in accordance with the Marine Mammal Protection Act (MMPA). The management objective under the MMPA is to maintain bottlenose dolphins as functioning components of their ecosystem throughout their full range. Management units under the MMPA are based on stock structure coupled with specific management objectives. Thus, to effectively manage the species, the structure of the bottlenose dolphin population in terms of its component stocks must be understood.

In the aftermath of the 1987/1988 die-off of mid-Atlantic bottlenose dolphins and the subsequent listing of the coastal migratory stock as depleted, the NOAA Fisheries' Southeast Fisheries Science Center (SEFSC) developed a stock identification research strategy and began coordinating efforts with non-NOAA Fisheries' scientists in the U.S. western mid-Atlantic in 1998. This work is still continuing and data will be analyzed to discern distinct stock units and their relationship to the overall population.

In the Gulf of Mexico, numerous independent research programs have examined local bottlenose populations. In some cases, these efforts have generated significant amounts of information on distribution, abundance, movements, genetics, and behavior of bottlenose dolphins in specific locales. However, there has yet to be any integration of this data towards interpreting the stock structure of bottlenose dolphins throughout the Gulf of Mexico.

Currently, bottlenose dolphins in the U.S. Gulf of Mexico are managed as 38 different stocks: one continental shelf edge and continental slope stock, one outer continental shelf stock, three coastal stocks (western, northern, and eastern Gulf), and 33 bay, sound and estuary stocks (Waring et al. 1999). This management approach minimizes the risk to bottlenose dolphins in the absence of adequate stock structure data. A coordinated effort that pools and interprets existing data and guides future research should result in a stock structure scheme more reflective of the actual bottlenose dolphin population and thus yield better informed management decisions.

Recognizing the need to begin a collaborative bottlenose dolphin stock identification program in the Gulf of Mexico, a workshop was proposed and endorsed by the Atlantic Scientific Review Group at its November 1998 and April 1999 meetings. On 14-15 March 2000 a Bottlenose Dolphin Stock Identification Workshop was convened in Sarasota, Florida (Appendix 1). Twenty researchers and experts in population biology affiliated with various NOAA Fisheries laboratories and/or universities and with expertise in fields such as genetics, population dynamics, and photo-identification, participated in the workshop (Appendix 2). The primary goal of this workshop was to discuss and explore possible scientific avenues and activities that would guide future research towards identifying the stock structure of bottlenose dolphins in the Gulf of Mexico. Specific objectives included:

1. reviewing and assessing the available data on distribution, abundance, movements, genetics, and other relevant topics of bottlenose dolphin populations in the Gulf of Mexico;
2. identifying spatial, temporal, and methodological gaps in the current data that may need to be addressed in the future;
3. discussing the concept of stocks and stock structure within the context of bottlenose dolphin management and examining stock structure and population models that may be applicable to the Gulf of Mexico; and
4. initiating a process which will eventually lead to a collaborative Gulf-wide network of bottlenose dolphin researchers working towards elucidating stock structure in the Gulf of Mexico, improved management decisions, and an increased understanding of the species.

## **SUMMARY OF THE WORKSHOP**

### **Pre-workshop Data Request/Questionnaire**

In an effort to review the present status of bottlenose dolphin research in the Gulf of Mexico as comprehensively as possible, researchers throughout the Gulf were contacted two months prior to the workshop ([Appendices 3 & 4](#)). A questionnaire was designed to not only collect general information about the researchers, their objectives, the spatial and temporal coverage of their projects, and the methods they employed, but also to ask specific questions about stock structure. This request for data was mailed to researchers currently active or who have previously conducted research in the Gulf, and included a letter explaining the purpose for collecting this data. It was hoped that through networking, most, if not all, of the scientists collecting data relevant to bottlenose dolphin stock structure in the Gulf of Mexico would have an opportunity to respond.

Twenty-one completed questionnaires were returned. The research represented ranges from decade-long studies to graduate student projects in their initial phases. Some of the projects overlap each other with smaller studies encompassed within a larger, more comprehensive research program. The summary of the responses illustrates the main geographical locations where bottlenose dolphin research has occurred in the Gulf of Mexico and which research methods are most commonly employed ([Appendix 5](#)). The compilation of references provided by the questionnaire respondents provides a useful bibliography for those interested in Gulf of Mexico bottlenose dolphins.

## **Workshop Panel**

The workshop panel was composed of a diverse group of researchers. The twenty participants were drawn from federal and state agencies as well as universities. Within the NOAA Fisheries SEFSC, the Beaufort, Charleston, Miami, and Pascagoula laboratories were represented at the workshop. T. Eagle represented the NOAA Fisheries' Office of Protected Resources.

All members of the panel had some position or experience that made their participation an asset and contributed to the success of the workshop. Many of the attendees have conducted research on bottlenose dolphins in the Gulf of Mexico (C. Hubard, K. Mullin, J. Reynolds, D. Weller, and R. Wells). Several scientists on the panel were selected due to their expertise in a specific field such as genetics (D. Duffield, P. Rosel), population dynamics (S. Brault, T. Eguchi, D. Goodman, P. Hammond, and B. TAYLOR), or Gulf of Mexico fisheries and habitats (D. Baltz). Others were able to add insight from their direct involvement in the planning and implementation of the bottlenose dolphin research plan in the Atlantic (A. Hohn, A. Read, and K. Urian).

## **Defining “Stock”**

Since the objectives of the workshop included discussing stock structure models and developing a plan to elucidate Gulf of Mexico bottlenose dolphin stock structure, it was imperative that the concept of a “stock” was discussed. To facilitate a discussion on the definition of stocks, panel members received background materials prior to the workshop (Taylor 1997, Taylor 1999, Taylor and Dizon 1996, Taylor and Dizon 1999).

Before bottlenose dolphin stocks in the Gulf of Mexico can be delineated, a “stock” must first be defined. The problem with defining “stock” is that in the past this word has been used to mean many different things. As discussed at the workshop, a stock is not a biological unit. Bottlenose dolphin stocks are purely management units that are utilized to meet management objectives, as designated by the MMPA. These objectives include maintaining stocks as “significant functioning element[s] in the ecosystem of which they are a part.” As amended in 1994, the management scheme of the MMPA includes calculating the number of allowable takes by humans [Potential Biological Removal (PBR)] and maintaining optimal sustainable populations (OSP). The MMPA management approach becomes more conservative as the amount of reliable data on a species decreases.

Because anthropogenic risks are not equally distributed across the range of bottlenose dolphins in the Gulf of Mexico and since some population structure has been clearly observed for bottlenose dolphins, understanding the stock structure of this species is crucial to its successful management. Basing a PBR on the estimate of bottlenose dolphins for the entire U.S. Gulf of Mexico instead of estimating PBR for each smaller stock units could risk the depletion or even extirpation of dolphins from some regions of their range within the Gulf of Mexico. Thus in order to effectively implement the MMPA, the stock structure of bottlenose dolphins in the Gulf of Mexico must be defined.

## **Bottlenose Dolphin Stock Structure in the Atlantic**

A die-off of bottlenose dolphins along the U.S. Atlantic coast from June 1987 to March 1988 was the catalyst for defining stock structure in that region (Scott *et al.* 1988). Not only did the geographical and temporal pattern of the die-off give clues to the nature of bottlenose dolphin stocks along the Atlantic coast, but the high rate of mortality caused the population to be listed as depleted under the MMPA (54 FR 41654, October 11, 1989).

In all, two stocks of bottlenose dolphins are recognized in the western Atlantic: the coastal migratory stock depleted by the die-off and an offshore stock (Waring *et al.* 1999). Although these stocks were defined, many questions remained concerning the boundaries and distinctiveness of each of these stocks. The 1994 amendments to the MMPA required that PBR's be set for these stocks, which in turn requires defining the geographical boundaries of each stock and then adequately estimating abundance for each.

Towards these goals, a workshop was held in February 1997 to develop a multi-method, multi-year research plan to examine stock structure of western Atlantic bottlenose dolphins (Hohn 1997). Among the suggestions in the resulting experimental design were the establishment of a centralized photo-identification catalog, biopsy sampling for genetic analyses, live captures, and satellite tracking.

Differences in Atlantic and Gulf of Mexico geography, oceanography, and even bottlenose dolphin population distribution support that stock identification research strategies will not be identical in these two regions. However, the research tools to study bottlenose dolphin stock structure are the same. Thus it was thought that the Gulf of Mexico research plan would benefit from discussions of the successes and problems encountered during the Atlantic research.

### **Bottlenose Dolphin Stock Structure in the Gulf of Mexico**

Whereas the stock structure of bottlenose dolphins in the Atlantic is probably over-simplified with just two defined stocks (Hohn, pers. comm.), the stock structure of bottlenose dolphins in the Gulf of Mexico represents the other end of the "lumpers versus splitters" spectrum with a total of 38 recognized stocks (Fig. 1) (Waring *et al.* 1999). Such inconsistency in the designation of stocks is due in part to the events that precipitated the stocks being defined. In the Atlantic, a sudden die-off was the impetus for examining stock structure. In the Gulf of Mexico, a variety of factors acting over a longer period of time helped determine the way Gulf bottlenose dolphins were partitioned.

In the 1970's and 1980's large numbers of bottlenose dolphins were removed from Gulf of Mexico waters for the purpose of public display or research (Scott 1990). For logistical reasons these live captures occurred in shallow bays and were often concentrated in specific locations. For example, 202 dolphins were removed from Mississippi Sound from 1973-1988 (Scott 1990). At the same time, pioneering work in Sarasota Bay showed evidence of long-term site fidelity and a structured bottlenose dolphin community (Irvine and Wells 1972, Scott *et al.* 1990, Wells and Scott 1990, Wells 1991). With the possibility that residential dolphins existed within these inshore habitats, the effect of removing large numbers of animals from small areas suddenly had the potential to be quite serious.

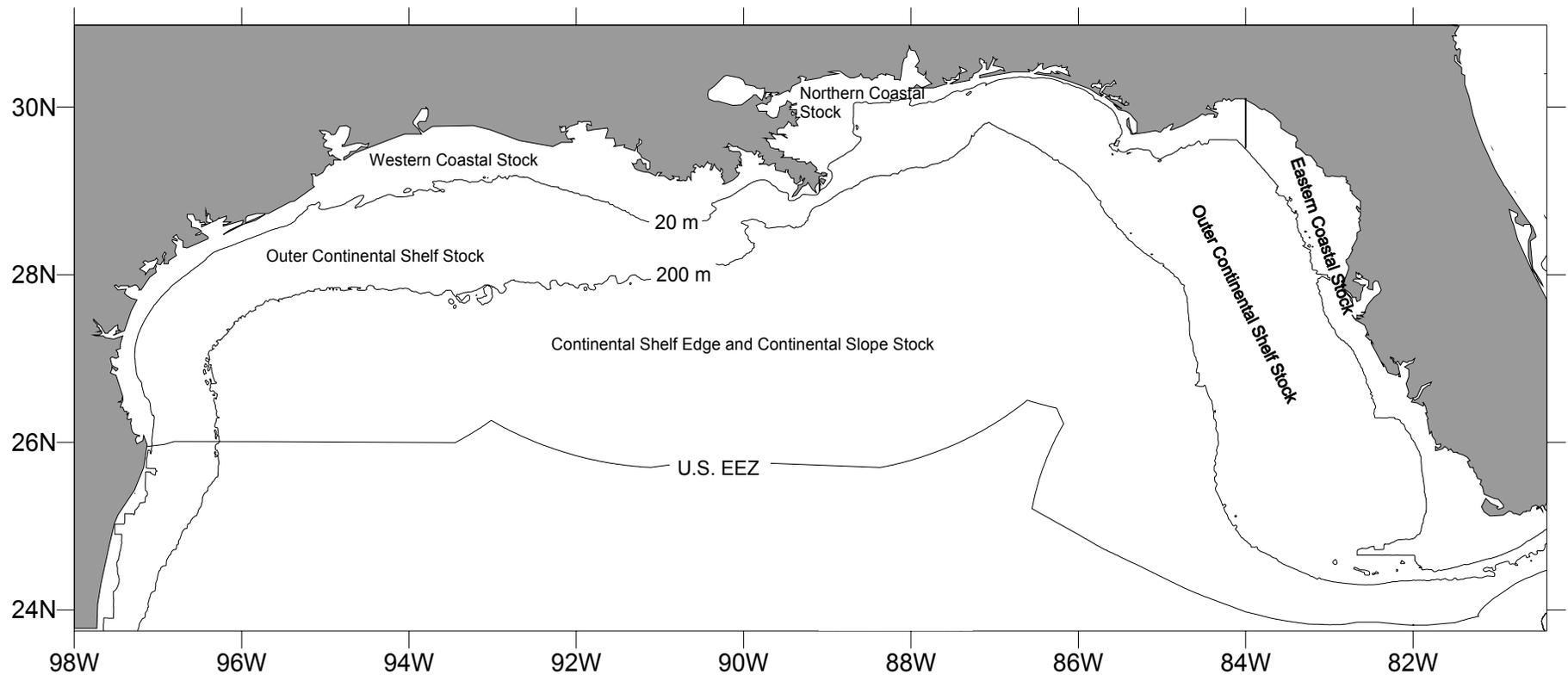
Efforts were made to estimate the abundance of bottlenose dolphins in the Gulf of Mexico. A series of aerial surveys were conducted (Blaylock and Hoggard 1994). Focus was given to the semi-enclosed and enclosed inshore waters by making each bay, sound and estuary a separate

Table 1. U.S. Gulf of Mexico bay, sound, and estuary bottlenose dolphin stocks

<p><b>Texas</b></p> <ul style="list-style-type: none"> <li>• Laguna Madre</li> <li>• Nueces Bay, Corpus Christi Bay</li> <li>• Comapano Bay, Aransas Bay, San Antonio Bay, Redfish Bay, Espiritu Santo Bay</li> <li>• Matagorda Bay, Tres Palacios Bay, Lavaca Bay</li> <li>• West Bay</li> <li>• Galveston Bay, East Bay, Trinity Bay</li> </ul> <p><b>Louisiana</b></p> <ul style="list-style-type: none"> <li>• Sabine Lake</li> <li>• Calcasieu Lake</li> <li>• Vermilion Bay, West Cote Blanche Bay, Atchafalaya Bay</li> <li>• Terrebonne Bay, Timbalier Bay</li> <li>• Barataria Bay</li> <li>• Mississippi River Delta</li> </ul> <p><b>Mississippi</b></p> <ul style="list-style-type: none"> <li>• Bay Boudreau, Mississippi Sound</li> </ul> <p><b>Alabama</b></p> <ul style="list-style-type: none"> <li>• Mobile Bay, Bonsecour Bay</li> </ul>	<p><b>Florida</b></p> <ul style="list-style-type: none"> <li>• Perdido Bay</li> <li>• Pensacola Bay, East Bay</li> <li>• Choctawhatchee Bay</li> <li>• St. Andrew Bay</li> <li>• St. Joseph Bay</li> <li>• St. Vincent Sound, Apalachicola Bay, St. Georges Sound</li> <li>• Apalachee Bay</li> <li>• Waccasassa Bay, Withlacoochee Bay, Crystal Bay</li> <li>• St. John's Sound, Clearwater Harbor</li> <li>• Tampa Bay</li> <li>• Sarasota Bay</li> <li>• Little Sarasota Bay</li> <li>• Lemon Bay</li> <li>• Pine Sound, Charlotte Harbor, Gasparilla Sound</li> <li>• Caloosahatchee River</li> <li>• Estero Bay</li> <li>• Chokoloskee Bay, Ten Thousand Islands, Gullivan Bay</li> <li>• Whitewater Bay</li> <li>• Florida Keys (Bahia Honda to Key West)</li> </ul>
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aerial survey block. These 33 blocks eventually became the 33 bay, sound, and estuary stocks (Table 1). With the exception of the Sarasota Bay estimate which is based on a direct count of known individuals (Wells 1992), the aerial survey estimates are still used for abundance and calculating PBR for the bay, sound, and estuary stocks (Leatherwood *et al.* 1978, Blaylock and Hoggard 1994, Waring *et al.* 1999). These 33 stocks cover an area of approximately 26,700 km<sup>2</sup>. The total estimate of bottlenose dolphins in these waters is 5,141, with most stocks composed of less than 300 dolphins. Because the rate of fishery mortality or injury is not known for these stocks but does exist at varying levels, and because the removal of a single dolphin would exceed PBR for most of these stocks, all 33 bay, sound and estuary stocks are considered strategic (Waring *et al.* 1999).

Survey design and oceanography also played a role in the establishment of the other five Gulf of Mexico stocks. Depth contours separate the rest of the Gulf into coastal, continental shelf, and continental shelf edge/slope habitats (Figure 1).



*Figure 1.* Approximate locations of the 38 U.S. Gulf of Mexico bottlenose dolphin stocks. Each bay, sound, and estuary is considered a separate stock or is part of a geographical stock complex (see Table 1). Official definitions of the other stocks are as follows. All 3 coastal stocks are defined from shore, barrier islands or presumed bay boundaries to 9.3 km seaward of the 18.3 m (10 fm) isobath. The western coastal stock encompasses dolphins inhabiting the nearshore waters from the Texas/Mexico border to the Mississippi River mouth. The northern stock is defined from the Mississippi River mouth to approximately 84 degrees west longitude. The eastern coastal stock is defined from 84 degrees west to Key West, Florida. The Outer Continental Shelf stock is defined as dolphins inhabiting the waters from the Texas/Mexico border to Key West, Florida from approximately 9 km seaward of the 18.3 m isobath to approximately 9 km seaward of the 183 m (100 fm) isobath. The Continental Shelf Edge and Continental Slope stock includes dolphins inhabiting U.S. waters from 9 km seaward of the 183 m isobath out to the U.S. Exclusive Economic Zone (EEZ).

The coastal region encompasses approximately 86,500 km<sup>2</sup> of water. Coastal stocks are further divided into western, northern, and eastern stocks and abundance estimates vary between the three stocks (3499, 4191, and 9912, respectively) (Waring *et al.* 1999).

The outer continental shelf habitat covers about 245,800 km<sup>2</sup>. This is the largest bottlenose dolphin stock in the Gulf of Mexico with an estimate of 50,247 dolphins (Waring *et al.* 1999).

The continental shelf edge and continental slope habitat is defined as the waters from 9 km seaward of the 183 m isobath out to the U.S. Exclusive Economic Zone (EEZ). Ship surveys estimate that approximately 5618 bottlenose dolphins inhabit this region and compose this stock (Waring *et al.* 1999).

### **Bottlenose dolphins in the Gulf of Mexico**

In order to recommend future research in the Gulf of Mexico, the panel first discussed what is currently known about Gulf of Mexico bottlenose dolphins, which methods have been employed, and what gaps exist in the data. Refer to Appendix 5 for specific research methods employed by questionnaire respondents.

#### Methods

- **Shipboard and aerial surveys** have been used extensively in the Gulf of Mexico to survey large areas, especially to study bottlenose dolphins in the offshore waters of the Gulf (e.g., Leatherwood *et al.* 1978, Thompson 1982, Scott *et al.* 1989, Mullin *et al.* 1990, Blaylock and Hoggard 1994). These surveys employ line-transect techniques to estimate abundance (Buckland *et al.* 1993).
- **Photo-identification** is probably the most frequently used technique to study bottlenose dolphins in the Gulf of Mexico (e.g., Shane 1977, Gruber 1981, Irvine *et al.* 1981, Maze 1997, and Weller 1998). Photo-id can provide information on seasonal movements, site fidelity, associations, and community structure. Photo-id also provides guidance in choosing individuals for sampling with other methods such as biopsy, satellite tracking or live captures.
- **Genetic work** in the Gulf of Mexico has evolved from examining chromosomes and red blood cell enzymes to mitochondrial DNA haplotypes, DNA fingerprinting, and DNA microsatellites (e.g., Duffield and Wells 1986, Duffield and Chamberlin-Lea 1990, Duffield and Wells 1991, Urian *et al.* 1996). Although genetic work is still quite limited in the Gulf of Mexico, it began two decades ago and is becoming more frequently used as an important tool for evaluating stock structure.
- **Strandings** of bottlenose dolphins produce a wealth of data; however, the coverage of stranding networks and the thoroughness of the data collected varies across the Gulf coast states. Much of the research on prey species, morphometrics, contaminants, parasites, and genetics initially used or continues to use data gathered from stranded carcasses (e.g., Barros and Wells 1998, Fernandez and Hohn 1998).

- **Morphometrics** have contributed to the differentiation of the two ecotypes of bottlenose dolphins: a smaller inshore form and a larger offshore form (e.g., Hersh and Duffield, 1990).
- **Radio and satellite telemetry** have not been used extensively on Gulf of Mexico bottlenose dolphins, but have been used to look at movement patterns of individual dolphins (e.g., Mate *et al.* 1995).

#### Data gaps

Bottlenose dolphins are found throughout the bays, sounds, and estuaries of Texas, Louisiana, Mississippi, Alabama, and the west coast of Florida. However, studies have not been distributed uniformly. Some regions have been the focus of long term in-depth research spanning decades (e.g., Sarasota Bay and adjacent waters), whereas others (e.g., Louisiana coast, panhandle of Florida) have been mostly ignored thus far. The reasons for these spatial gaps range from lack of interest or funding to inaccessibility of the environment, such as in much of Louisiana.

Temporal gaps also exist in places where research was only conducted during portions of the year or in locations where research was begun, but subsequently lapsed.

#### Summary

In the Gulf of Mexico, as elsewhere, the biology and ecology of bottlenose dolphins is very complex. They are distributed throughout a wide assemblage of habitats, ranging from the very shallow waters of estuaries to the continental slope up to approximately 1000-m deep. Further complicating matters is the high probability that, similar to the western Atlantic, there are two ecotypes of bottlenose dolphins in the Gulf: a coastal form and a larger offshore form. Over much of the continental shelf (i.e., waters > 10 m in depth), bottlenose dolphins are sympatric with the Atlantic spotted dolphin, *Stenella frontalis*. There is some evidence that hybrids may be present as a result of interbreeding between these two species, making the task of resolving stock structure even more difficult.

The results of the locally based research projects also vary across the Gulf of Mexico. Bottlenose dolphins in the western and northern Gulf may have a community structure similar to bottlenose dolphins along the mid-Atlantic coast. Along the west coast of Florida bottlenose dolphins appear to be organized differently: in smaller, structured, communities that exhibit long term stability. Seasonal movements into and out of bays, sounds, and estuaries have been documented in many locales; however, the direction of and motive for this migration varies from site to site (Shane 1977, Gruber 1981, Irvine *et al.* 1981, Thompson 1981, Scott *et al.* 1989, Henningsen 1991, Bräger 1993, Fertl 1994, Lynn 1995, Würsig and Lynn 1996, Maze 1997, Hubard 1998, Weller 1998). Despite these differences, some evidence of long-term site fidelity has been observed in most of the studies that focus on identifying individual animals. Currently there has been little direct collaboration among researchers working in different study areas (e.g., comparison of photo-id catalogs).

For further summaries of Gulf of Mexico bottlenose dolphin research see the responses to the questionnaire (Appendix 5) and consult the most recent stock assessment report (Waring *et al.* 1999).

## **Risks to Bottlenose Dolphins in the Gulf of Mexico**

Bottlenose dolphins in the Gulf of Mexico face a variety of anthropogenic pressures. To consider the possible risks to bottlenose dolphin stocks, the workshop participants discussed factors that may negatively affect bottlenose dolphins, their sources, and their geographical distribution in the northern Gulf of Mexico.

### Coastal development

As the human population along the Gulf coast increases, shoreline development, wetland loss, and increased dredging and channelization impact coastal dwelling bottlenose dolphins. Increases in the number of people near the coast usually means more watercraft, while industrial expansion can translate to increased exposure to harmful chemicals (see below).

### Watercraft

Boats and personal watercraft pose a collision hazard and their presence may disturb bottlenose dolphins, disrupting feeding, resting, or socializing behaviors.

### “Swim with” programs

Several businesses along the Gulf coast have promoted swimming with and/or feeding wild bottlenose dolphins. These activities endanger dolphins in several ways: making them more likely to approach boats thereby increasing their chance of being injured, creating a dependence on humans for food, and often subjecting them to unhealthy or unnatural diets. Feeding wild dolphins is illegal and specifically prohibited by the MMPA. Swimming with wild dolphins can disturb the dolphins’ behavior which can constitute harassment as defined and prohibited by the MMPA. The habituation of wild dolphins to the presence of humans also poses a threat to people, who are sometimes bitten or otherwise harmed by aggressive dolphins.

### Fisheries

A variety of commercial and recreational fisheries exist in the Gulf of Mexico, including purse seining, crab traps, gill nets, and shrimp trawling. These fisheries use lines, nets, or monofilament, all of which pose an entanglement threat to Gulf bottlenose dolphins. Some fisheries, such as trawling for shrimp, may also have a more indirect affect on dolphins such as a habituated dependence on the fishery for food or a reduction in available prey items due to bycatch mortality.

### Chemical pollutants

Bottlenose dolphins in the Gulf of Mexico are exposed to a variety of chemical pollutants depending on which region of the Gulf they inhabit. Agricultural runoff may contain chemicals such as pesticides and fertilizers that accumulate in a dolphin’s body. Fertilizers may have the added effect of causing eutrophication that leads to harmful algal blooms like red tide that have been shown to kill or sicken fish, seabirds, and dolphins. Industrial areas expose bottlenose dolphins to heavy metals, anti-fouling chemicals, and various petrochemical-processing agents.

### Oil and gas industry

Oil and gas industry activities may affect bottlenose dolphins in ways that include: habitat alteration in the form of rigs, increased boat traffic, and the chance of a spill from a well,

pipeline, or tanker. Noise pollution is another factor that may affect bottlenose dolphins. Air and ship traffic, noise from platforms, and seismic surveying have altered the acoustic environment of the Gulf of Mexico.

The panel noted that many of these risks are difficult to quantify and their long term effects on the biology, ecology, and social structure of bottlenose dolphin stocks in the Gulf of Mexico may be extremely difficult to assess, but nevertheless these issues cannot be ignored.

### **Geographic Cluster Analysis**

The workshop included a discussion on ways of modeling populations and new methods of examining stock structure. Barbara Taylor gave a presentation on a new approach that has been used to elucidate the stock structure of Alaskan harbor seals. When a species' range is continuous over a large area, it is difficult to know where to draw the boundaries between stocks. Often these stock delineations are drawn based on geographical features for sampling and logistical reasons. Gulf of Mexico bottlenose dolphins are prime examples of these problems.

Instead of the traditional method of dividing the range into stocks and then analyzing data, this approach uses genetic data to help draw the stock boundaries. Genetic similarity between individuals is examined; however, geographical constraints determine which individuals can be directly compared. Individuals with genetic similarity are clustered and these clusters are ranked to show all plausible stock boundaries. Boundaries can then be selected that fulfill management objectives. Other types of data such as photo-id or telemetry can help ground-truth the stock boundaries, especially by providing information on dispersal.

## **STRATEGY FOR FUTURE RESEARCH**

Considering the available data on Gulf of Mexico bottlenose dolphins and taking into account geographical and methodological gaps in that data, the potential risks to bottlenose dolphins, and the overall theory of stock structure, the panel made a series of suggestions that would improve our understanding of bottlenose dolphin stock structure and status in the Gulf of Mexico. It is hoped that these suggestions should serve as a framework to guide future bottlenose dolphin research in the Gulf of Mexico, outlining higher priority research and aiding in the allocation of any future resources.

1. In the absence of conclusive evidence suggesting otherwise and with data showing some degree of site fidelity throughout the Gulf, it was suggested that the division of bottlenose dolphin stocks in the Gulf of Mexico remain at the current risk-adverse strategy of 38 different stocks.
2. To further understand the differences between inshore and offshore bottlenose dolphins, it was suggested that large-scale ship surveys be conducted along the continental shelf and slope. Line transect theory can be employed to estimate abundance of bottlenose dolphins and biopsies can be obtained to genetically distinguish between the two ecotypes and identify the distribution

of each. These efforts may also help examine the unclear relationship between bottlenose dolphins and Atlantic spotted dolphins in regions where their distributions overlap and interbreeding may occur.

3. Recognizing that there are already samples in-hand that have not yet been analyzed, it was suggested that efforts be made to process and analyze available bottlenose dolphin samples from the Gulf of Mexico. These may include teeth and other tissues collected from live captures and strandings.

4. It was suggested that bottlenose dolphin researchers in the Gulf of Mexico begin or improve collaboration amongst themselves. The major joining force for Atlantic researchers is the Mid-Atlantic Bottlenose Dolphin Photo-Identification Catalog. Creating a centralized or at least regional photo-id catalog(s) of bottlenose dolphins in the Gulf of Mexico would require and encourage cooperation among researchers and could lead to important discoveries regarding home ranges, movement patterns, and genetic dispersal. It is also suggested that, similar to the manatee library, a Gulf of Mexico bottlenose dolphin library be established or at least a CD-ROM be created with relevant bottlenose dolphin references.

5. The panel suggested that the stranding networks be included as part of the collaborative research effort and better utilized as they can provide a wealth of information on life history, feeding habits, and morphometrics as well as fishery interactions. However, the primary problem with strandings is the inability to determine with any certainty where the animal lived when it was healthy.

6. To aid in the assignment of a bottlenose dolphin carcass to one particular stock or region of the Gulf of Mexico, the panel discussed the use of chemical markers. It was suggested that a literature search be conducted to identify chemical pollutants occurring in different areas of the Gulf of Mexico. Furthermore, it was suggested that specific chemicals or ratios of chemicals present in bottlenose dolphin tissue be identified to serve as assignment tests. This research would probably involve the sampling of individuals (e.g., from photo-id catalogs) with a known home range throughout the Gulf. Contaminant studies can also help assess the health of animals in a population.

7. To examine Gulf of Mexico bottlenose dolphin stock structure it was suggested that a framework be developed using multiple data sets similar to the geographically constrained hierarchical clustering method used to elucidate stocks of Alaskan harbor seals. Genetic sampling would be the primary tool in the hierarchical cluster approach. The first step could be a coordinated sweep across the Gulf collecting 40-50 genetic samples of known individuals approximately every 100 km. Other possible sources of data to contribute to the stock structure framework include: photo-id, telemetry, toxicants, fatty acid signatures, and stable isotope ratios from teeth.

8. The panel discussed the importance of photo-id studies. Photo-id serves two main roles in the context of the multiple data set framework: 1) photo-id is a means of ground-truthing models and dispersal rates generated from genetic sampling and 2) photo-id is the primary tool for selecting individual animals to be sampled (e.g., via biopsy or radio/satellite tagging). Acknowledging the

usefulness of photo-id data and recognizing that photo-id data become more meaningful over time, the panel suggested that photo-id research continue at currently established sites. Since there are large geographical gaps in photo-id studies along the Gulf coast, a criteria for selecting new sites was suggested. It was suggested that new photo-id research be conducted in locations: 1) where some data already exists from past studies, 2) with high (e.g., Galveston Bay) or unknown (e.g., Louisiana) levels of risk, 3) that are logistically easy to sample, 4) where known mortality events have occurred, and 5) where there is a reason to suspect a natural break in the population, such as where a sudden change in habitat occurs.

## **ACKNOWLEDGMENTS**

The workshop was held at the Mote Marine Laboratory in Sarasota, Florida. We would like to thank Randall Wells for arranging our scenic venue as well as the Director and staff at Mote. Many thanks to John Reynolds for chairing the workshop. Caterina D'Agrosa was a great help serving as rapporteur, assisting with on-site arrangements, and helping to summarize the workshop. Many of the workshop participants kindly agreed to present their data and expertise to the panel. We are grateful to all the researchers that took the time to complete the questionnaire and share their knowledge of Gulf of Mexico bottlenose dolphins. This workshop was funded by the NOAA Fisheries SEFSC's Protected Species and Biodiversity Branch .

## LITERATURE CITED

- Barros, N.B. and R.S. Wells. 1998. Prey and feeding patterns of resident bottlenose dolphins (*Tursiops truncatus*) in Sarasota Bay, Florida. *Journal of Mammalogy* 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*). *Marine Mammal Science* 9: 434-440.
- Buckland, S.T., D.R. Anderson, K.P. Burnham, and J.L. Laake. 1993. Distance sampling: estimating abundance of biological populations. Chapman and Hall, London. 446 pp.
- Duffield, D.A. and J. Chamberlin-Lea. 1990. Use of chromosome heteromorphisms and hemoglobins in studies of bottlenose dolphin populations and paternities. Pages 609-622 in S. Leatherwood and R.R. Reeves, eds. *The bottlenose dolphin*. Academic Press, San Diego, California.
- 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 Rept. to National Marine Fisheries Service, Southeast Fisheries Center. Contract No. 45-WCNF-5-00366. 10 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*. Report of the International Whaling Commission, Special Issue 13, Cambridge, U.K.
- Fernandez, S. and A.A. Hohn. 1998. Age, growth, and calving season of bottlenose dolphins, *Tursiops truncatus*, off coastal Texas. *Fishery Bulletin* 96:357-365.
- 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.
- 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. On the distribution and ecology of the dolphin (*Tursiops truncatus*) in Galveston Bay, Texas. Diplom thesis. Christian-Albrechts-Universität, Kiel, Germany. 80 pp.
- Hersh, S.L. and D.A. Duffield. 1990. Distinction of Northwestern Atlantic offshore and coastal bottlenose dolphins based on hemoglobin profile and morphometry. Pages 129-142 in S. Leatherwood and R.R. Reeves, eds. *The Bottlenose Dolphin*. Academic Press, San Diego, California.
- Hohn, A.A. 1997. Design for a multiple-method approach to determine stock structure of bottlenose dolphins in the mid-Atlantic. NOAA Technical Memorandum NMFS-SEFSC-401, 22 pp.
- 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. *Fishery Bulletin U.S.* 79:671-688.
- Leatherwood, S., J.W. Gilbert, and D.G. Chapman. 1978. An evaluation of some techniques for aerial censuses of bottlenosed dolphins. *Journal of Wildlife Management* 42:239-250.
- Lynn, S.K. 1995. Movements, site fidelity, and surfacing patterns of bottlenose dolphins on the central Texas coast. M.S. thesis, Texas A&M University, College Station, TX. 92 pp.
- Mate, B.R., K.A. Rossbach, S.L. Neukirk, R.S. Wells, A.B. Irvine, M.D. Scott and A.J. Read. 1995. Satellite-monitored movements and dive behavior of a bottlenose dolphin (*Tursiops truncatus*) in Tampa Bay, Florida. *Marine Mammal Science* 11(4):452-463.
- 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, TX. 79 pp.
- Mullin, K.D., R.R. Lohofener, W. Hoggard, C.L. Roden, and C.M. Rogers. 1990. Abundance of bottlenose dolphins, *Tursiops truncatus*, in the coastal Gulf of Mexico. *Northeast Gulf Science* 11:113-122.
- Scott, G.P. 1990. Management-oriented research on bottlenose dolphins in the Southeast Fisheries Center. Pages 623-639 in S. Leatherwood and R.R. Reeves, eds. *The bottlenose dolphin*. Academic Press, San Diego, CA.
- Scott, G.P., D.M. Burn, and L.J. Hansen. 1988. The dolphin die-off: long term effects and recovery of the population. *Proceedings of the Oceans '88 Conference*: 819-823.
- 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. CRD88/89-07.
- 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, TX 239 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, CA
- Taylor, B.L. 1997. Defining "population" to meet management objectives for marine mammals. Pages 49-65 in A.E. Dizon, S.J. Chivers, W.F. Perrin, eds. *Molecular genetics of marine mammals*. Special Publication Number 3, The Society of Marine Mammals, Lawrence, KS.
- Taylor, B.L. 1999 Refining the definition of stocks: a discussion paper. IWC/51/RMP23
- Taylor, B.L. and A.E. Dizon. 1996. The need to estimate power to link genetics and demography for conservation. *Conservation Biology* 10(2): 661-664.
- Taylor, B.L. and A.E. Dizon. 1999. First policy then science: why a management unit based solely on genetic criteria cannot work. *Molecular Ecology* 8:S11-S16.
- Thompson, N.B. 1981. Estimate of abundance of *Tursiops truncatus* in Charlotte Harbor, Florida. NOAA/NMFS/SEFSC/Miami Laboratory, Fishery Data Analysis Technical Report.
- Thompson, N.B. 1982. Estimates of abundance of *Tursiops truncatus*, in: St. Joseph-Apalachicola Bays, Florida, Mississippi Sound, Mississippi, and the Aransas-Copano-San Antonio Bay complex, Texas. Report to National Marine Fisheries Service, SEFC, Miami, Fl 26 pp.

- 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*. *Journal of Mammalogy*. 77:394-403.
- Waring, G.T., D.L. Palka, P.J. Clapham, S. Swartz, M.C. Rossman, T.V.N. Cole, L.J. Hansen, K.D. Bisack, K.D. Mullin, R.S. Wells, D.K. Odell, and N.B. Barros. 1999. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments-1999. NOAA Technical Memorandum.
- 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, TX. 142 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*. Univ. 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, FL.
- 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*. Report of the International Whaling Commission, Special Issue 12, Cambridge, U.K. 440 pp.
- 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.

## **APPENDICES**

## APPENDIX 1. WORKSHOP AGENDA

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### Tuesday March 14, 2000

0900	Introductions	John Reynolds
0915	Background Information/Objectives of the workshop/ Review of current Gulf of Mexico bottlenose dolphin stock structure	Steven Swartz
0945	Introductory paper- Stock structure and management objectives	Barbara Taylor
1020	Break	
	Review of existing research:	
1040	Western Gulf of Mexico	David Weller
1120	Central Gulf of Mexico	Carrie Hubard
1200	Lunch	
1345	Eastern Gulf of Mexico	Randall Wells
1505	Review of research on chromosomes, RBC enzymes, mtDNA haplotypes, DNA fingerprinting and DNA microsatellites	Debbie Duffield
1550	Break	
1605	Review of Atlantic bottlenose dolphin research strategy and implementation	Aleta Hohn
1615	Review of Mid-Atlantic bottlenose dolphin photo-id catalog	Kim Urian
	Review of genetic research in the Atlantic and Gulf	Patricia Rosel
	Review of MMS/NMFS ship and aerial surveys in the Gulf	Keith Mullin
1650	Summary/review of what has been presented, including discussion of spatial, temporal, and methodological gaps in the Gulf	Reynolds/all
1800	Adjourn	

## APPENDIX 1. WORKSHOP AGENDA

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### Wednesday March 15, 2000

0830	Explanation of a geographically constrained hierarchical clustering approach to designate stocks using harbor seals as an example	Barbara Taylor
0945	Review and discussion of potential risks to bottlenose dolphins in the Gulf of Mexico: Texas, Louisiana, Central coast, Florida	Reynolds/all
1045	Defining bottlenose dolphin habitat	Don Baltz
1120	Development of a research strategy, including a Gulf-wide research network, and a prioritized list of suggestions for future work	Reynolds/all
1140	Lunch	
1230	Continue developing research strategy	Reynolds/all
1430	Adjourn workshop	

## APPENDIX 2. WORKSHOP PARTICIPANTS

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DATA CALL - REQUEST FOR INFORMATION

Gulf of Mexico Bottlenose Dolphin Stock Identification Program

Dear Colleague:

The National Marine Fisheries Service, Southeast Fisheries Science Center (SEFSC) is planning to convene a workshop in the spring of 2000 to assess the current status of information on bottlenose dolphin populations in the Gulf of Mexico region, and to develop a research plan to address the question of bottlenose dolphin stock structure in the Gulf of Mexico and the biological basis for management units under the Marine Mammal Protection Act (MMPA).

As a first step, we want to contact individual researchers that are currently studying bottlenose dolphin populations in the Gulf of Mexico, and/or that hold information from previous research that would be relevant to the question of stock identification. Once compiled, this inventory will be used to assess the status of current information on bottlenose dolphins in the Gulf of Mexico, and as the basis for developing a comprehensive research strategy to fill data gaps and gather the appropriate information to develop stock models for the Gulf populations.

If you are interested in cooperating in a Gulf-wide collaborative effort to investigate bottlenose dolphin stock structure and/or would like to continue to be kept informed on the progress of this project, please complete the attached questionnaire and return it by February 4, 2000.

BACKGROUND

Bottlenose dolphins (*Tursiops truncatus*) are distributed continuously throughout the continental shelf, coastal, and bay-sound-estuary waters of the northern Gulf of Mexico and along the western U.S. mid-Atlantic coast. Over the years, numerous independent research programs have examined local bottlenose dolphin populations in the Gulf. These efforts have generated significant amounts of information on bottlenose dolphins in some locales, including data on distribution, abundance, movements, genetics and behavior. What is needed is an integration of these data, including identification of data gaps and areas of additional research, to develop an acceptable interpretation of stock structure that will adequately serve as the basis of "management units" for the conservation and assessment of status of this species in the Gulf of Mexico.

Bottlenose dolphins are in competition with humans for habitat, and are known to be taken in some fisheries including the Gulf of Mexico menhaden fishery, crab pot fisheries, and occasionally in shrimping operations. In some parts of the Gulf of Mexico they are also subject

### APPENDIX 3. LETTER TO PARTICIPANTS

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to “swim with” programs, are illegally fed artificial diets by tourists, are hit by recreational and other vessels, and suffer from unusual mortality events or “die offs” from microbial infections and other causes.

The objective of management under the MMPA is to maintain bottlenose dolphins as functioning components of their ecosystem throughout their full range. Management units under the MMPA are based on stock structure coupled with specific management objectives. Thus, to effectively manage the species, the structure of the bottlenose dolphin population in terms of its component “biological stocks” must be understood. Towards this goal, stock identification research was initiated in the U.S. western mid-Atlantic in 1998 and will continue through 2000. The findings of these studies will be analyzed in the context of population genetics, rates of exchange, unique morphology, seasonal movements, etc. to discern distinct “stock” units and their relationship to the overall population.

The SEFSC recognizes the need for a coordinated collaborative Gulf-wide research program similar to that in place in the Mid-Atlantic to generate information to evaluate stock structure and status of bottlenose dolphins in the Gulf of Mexico. Information on abundance, trends, genetic distinctness, morphology, ranging patterns, and rates of interbreeding, etc. will serve as the biological basis for defining management units for this species in the Gulf of Mexico. This same information can be used to define “distinct population segments” for Population Viability Analyses (PVA) in the context of the Endangered Species Act (ESA), should such apply to bottlenose dolphins in the future. Such a research program will need to build on existing information from the Gulf of Mexico, identify data and research gaps, and guide future research to assure that sufficient relevant information are available to define individual “stocks” for management purposes.

To initiate the development of a bottlenose dolphin research plan for the Gulf of Mexico, the SEFSC will convene a workshop from 14-15 March 2000 to review the current state of knowledge of bottlenose dolphin stock structure in the Gulf of Mexico, discuss relevant stock structure models, and develop a research plan that will build on existing information and guide additional new research to address questions of stock structure. The workshop was endorsed and suggested by the Atlantic Scientific Review Group at its November 1998 and April 1999 meetings as a necessary step for developing a coordinated collaborative bottlenose dolphin stock identification program in the Gulf of Mexico.

The primary goal of this workshop is to develop a research strategy that will allow the identification of distinct “stocks” of bottlenose dolphins that populate the Gulf of Mexico. These “stock” units will serve as the basis for identifying and defining “management units”.

## APPENDIX 3. LETTER TO PARTICIPANTS

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The objectives of the workshop are:

1. Review and assess the available information on the distribution, abundance, trends, movements, genetics, and other relevant topics of bottlenose dolphin populations in the Gulf of Mexico.
2. Bring together population geneticists, population modelers, and biologists with expertise on bottlenose dolphins to discuss approaches to stock structure interpretation, conceptual population and stock structure models, and develop such concepts as may be applicable to bottlenose dolphin stock structure.
3. Identify spatial and methodological data gaps (i.e., where and what kind of additional information will be needed) and preferred research approaches (e.g., photographic identification, genetic sampling, radio-tagging and tracking, morphology, stable isotope analyses, etc.) required to evaluate alternative population models of stock structure for bottlenose dolphins in the Gulf of Mexico.
4. Develop a research strategy that will guide future research to address the goal of defining bottlenose dolphin “stocks” in the Gulf of Mexico.
5. Propose a cooperative/collaborative Gulf-wide research program and network for future implementation.

## APPENDIX 4. DATA REQUEST AND QUESTIONNAIRE

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### DATA REQUEST

Many individuals and organizations have undertaken studies of bottlenose dolphin in previous years, and the existing information from these studies forms the basis for developing a collaborative Gulf-wide stock identification program. We are asking that individual researchers currently studying bottlenose dolphin populations in the Gulf of Mexico, and/or that hold information from previous research that would be relevant to the question of stock identification, contact us and summarize the nature and extent of the information that they have collected. Once compiled, this inventory will be used to assess the status of current information on bottlenose dolphin in the Gulf of Mexico, and as the basis for developing a comprehensive research strategy to fill data gaps and gather the appropriate information to develop stock models for the Gulf populations.

If you are interested in cooperating in a Gulf-wide collaborative effort to investigate bottlenose dolphin stock structure and/or would like to continue to be kept informed on the progress of this project (e.g., receive a copy of the inventory of existing data), please complete the following questionnaire by **February 4, 2000** and return it to:

Ms. Carrie Hubard  
NOAA Southeast Fisheries Science Center  
Mississippi Laboratory  
3209 Frederic Street  
Pascagoula, MS 39567

If you have any questions concerning the workshop or this form, please contact Carrie Hubard at [chubard@triton.pas.nmfs.gov](mailto:chubard@triton.pas.nmfs.gov) or (228) 762-4591 ext. 208.

If you know of colleagues that have conducted relevant bottlenose dolphin research in the Gulf of Mexico and did not receive a copy of this form, please forward a copy of the questionnaire to them, or send us their name and address so that we can reach them.

Thank you for your time and interest.

APPENDIX 4. DATA REQUEST AND QUESTIONNAIRE

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REQUEST FOR INFORMATION  
Gulf of Mexico Bottlenose Dolphin Stock Identification Program

INFORMATION SUMMARY FORM

Please complete the following questionnaire by **February 4, 2000** and return it to:

Ms. Carrie Hubard  
NOAA Southeast Fisheries Science Center  
Mississippi Laboratory  
3209 Frederic Street  
Pascagoula, MS 39567  
Telephone 228-762-4591 ext. 208  
FAX No. 228-769-9200

Name: \_\_\_\_\_

Affiliation: \_\_\_\_\_

Address: \_\_\_\_\_

Phone number: \_\_\_\_\_

E-mail: \_\_\_\_\_

Please check off the following:

1. What are the major objectives of your bottlenose dolphin research:

- 1. Abundance estimation
- 2. Seasonal distribution and movements
- 3. Stock structure
- 4. Genetics
- 5. Behavior
- 6. Other \_\_\_\_\_

2. Describe your research area(s) (e.g., specific location names and approximate size):

\_\_\_\_\_

APPENDIX 4. DATA REQUEST AND QUESTIONNAIRE

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3. Check the type of habitat found in your research area:

- 1. Bay
- 2. Sound
- 3. Open Gulf of Mexico
- 4. Other - describe \_\_\_\_\_

4. List the years and/or seasons that your research been conducted and for which you have data:

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5. What types of data have you collected, and how many samples, individuals etc?

- 1. Photo-id – # of individuals in collection? \_\_\_\_\_
- 2. Distribution
- 3. Genetic- # samples? \_\_\_\_\_
- 4. Acoustic - # samples – hours of recordings ? \_\_\_\_\_
- 5. Parasites- # Samples? \_\_\_\_\_
- 6. Morphometrics # Samples? \_\_\_\_\_
- 7. Contaminants- # Samples? \_\_\_\_\_
- 8. Telemetry- # Samples? \_\_\_\_\_
- 9. Stable isotope ratios- # Samples? \_\_\_\_\_
- 10. Other: Describe \_\_\_\_\_

6. What methods have you used to collect this data?

- 1. Strandings
- 2. Live captures
- 3. Biopsies
- 4. Photo ID
- 5. Freeze brands
- 6. Other tags, describe \_\_\_\_\_
- 7. Line transect surveys
- 8. Other search surveys: describe \_\_\_\_\_
- 9. Radio and/or satellite tracking
- 10. Focal animals observations
- 11. Other: describe \_\_\_\_\_

7. Have you observed any seasonal migration or movement patterns in your research?

- No.
- Yes:

8. If yes to No. 7, have these findings been published?

- No  Yes

APPENDIX 4. DATA REQUEST AND QUESTIONNAIRE

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9. If yes to No. 8, please provide primary publication reference(s): \_\_\_\_\_

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10. Have you observed emigration (dispersal) and/or immigration within the dolphin population that you have studied?

\_\_\_\_\_ No.

\_\_\_\_\_ Yes. If yes, please provide the primary published reference(s): \_\_\_\_\_

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11. Have you observed any human-caused problems (e.g. harassment) or documented mortality resulting from human interaction of bottlenose dolphins in your study area:

\_\_\_\_\_ 1. No.

\_\_\_\_\_ 2. From personal watercraft

\_\_\_\_\_ 3. From boat traffic

\_\_\_\_\_ 4. From habitat loss or degradation

\_\_\_\_\_ 5. From fishery interactions: describe

fishery: \_\_\_\_\_

12. If you have developed theories on how bottlenose dolphin stocks are organized in your area, please describe these briefly on a single separate page and return it with this questionnaire.

13. Please briefly describe your plans for future research on bottlenose dolphin in the Gulf of Mexico:

14. On a separate sheet, please provide a complete listing of your bottlenose dolphin publications that are relevant to the topic of this workshop – stock structure of bottlenose dolphin in the Gulf of Mexico.

Thank you for your contribution.