NATIONAL OCEANOGRAPHIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL MARINE FISHERIES SERVICE
SOUTHEAST FISHERIES SCIENCE CENTER STRATEGIC PLAN FOR MARINE MAMMAL RESEARCH

FALL 2008

VISION

Healthy marine mammal populations in the ecosystems of the western North Atlantic Ocean

MISSION STATEMENT

Provide the best possible science to support effective management and conservation of marine mammal populations and restoration of healthy marine ecosystems in the southeastern United States and Caribbean.

BACKGROUND

The National Marine Fisheries Service (NMFS) Southeast Fisheries Science Center (SEFSC) Marine Mammal Program is responsible for science-based assessment and conservation of marine mammal populations in the Northwest Atlantic, Gulf of Mexico and portions of the Caribbean Sea. This broad geographic scope includes approximately 2,500 miles of coastline and 13 states, encompasses diverse tropical and sub-tropical habitats and includes three Large Marine Ecosystems (LME): the Southeast United States Continental Shelf LME, the Gulf of Mexico LME and the Caribbean Sea LME (Fig. 1). Each LME contains diverse habitats including bays, sounds and estuaries, coastal waters, continental shelf and shelf break habitats, and deep offshore waters. This diversity, in turn, supports a varied marine mammal fauna. In all, 26 species, from the rare North Atlantic right whale to the popular bottlenose dolphin, utilize these waters. Under the Marine Mammal Protection Act of 1972

***Figure 1**. The SEFSC Marine Mammal Program is responsible for marine mammal assessment in the southeastern United States and Caribbean encompassing three large marine ecosystems.*

(MMPA), the National Marine Fisheries Service manages marine mammals at the population level rather than the species level. Thus, these 26 species are broken down into more than 80 populations ("stocks") in the Southeast U.S. Atlantic and Gulf of Mexico LMEs, plus as many as 20 additional stocks in the Caribbean LME. Each of these populations requires accurate assessment of status to ensure their continued presence as functioning elements of these ecosystems. The SEFSC Marine Mammal Program's mission is to provide science to support effective management of marine mammal stocks and thereby ensure that these stocks are restored and preserved for future generations.

Significant negative impacts due to human activities have been documented for many of these populations. The major threats identified include coastal development, habitat degradation (e.g., pollution, loss of prey, harmful algal blooms, hypoxic zones), energy development, military activities, ocean noise, fishery interactions, and impacts from climate change. Research targets those populations and species that experience significant negative impacts (Table 1) so that effective management strategies can be developed to reduce or eliminate these stressors. In addition, certain populations or species are targeted as indicators of ecosystem health. For example, pantropical spotted dolphins are the primary oceanic small delphinid in the Gulf of Mexico. Research and monitoring of these populations provides information on ecosystem changes that may affect multiple animal populations and human health.

Table 1. *Priority species and stocks in estuarine, coastal and offshore waters in the Gulf of Mexico (GOM) and western North Atlantic (WNA). When there are multiple stocks within a category, the number of stocks is indicated in parentheses. The number of WNA estuarine bottlenose dolphin stocks has not yet been determined. Listed in alphabetical order.*

Species	**Stock(s)**	**Stressor(s)**	**Ecosystem Indicator**
Atlantic spotted dolphin	WNA and GOM	energy development, ocean sound, military activities	X
Bottlenose dolphin	WNA coastal stocks (n=~7)	fishery interactions, habitat degradation	X
	WNA estuarine stocks (n=?)	fishery interactions, climate change, habitat degradation	X
	GOM coastal and continental shelf stocks (n=5)	fishery interactions, habitat degradation, energy development	X
	GOM estuarine stocks (n=33)	fishery interactions, climate change, habitat degradation	X
Bryde's whale	GOM	energy development, ocean sound, military activities, habitat degradation	X
North Atlantic right whale	WNA	ship strikes, fishery interactions habitat degradation	
Sperm whale	GOM	energy development, ocean sound, military activities	X
Short-finned /Long-finned pilot whale	WNA	fishery interactions	
Pygmy sperm whale/ Dwarf sperm whale	WNA and GOM	energy development, ocean sound, military activities	
Pantropical spotted dolphin	GOM	energy development, ocean sound, military activities	X

Accurate assessments of population status require an accounting of the human-induced mortalities, accurate estimates of abundance, and a complete understanding of population structure and mixing rates among populations. The SEFSC Marine Mammal Program maintains core capabilities to address these needs and has researchers at laboratories in Beaufort, North Carolina, Miami, Florida, Pascagoula, Mississippi, and Lafayette, Louisiana. Population assessment scientists utilize the NOAA vessel *Gordon Gunter* as well as NOAA aircraft to perform surveys for abundance estimation. Shipboard surveys make use of trained visual observers and acoustic monitoring technologies to detect and count marine mammals along pre-planned transect lines. The resultant data are analyzed to estimate abundance, quantify spatial distribution, and identify habitat requirements for the species encountered.

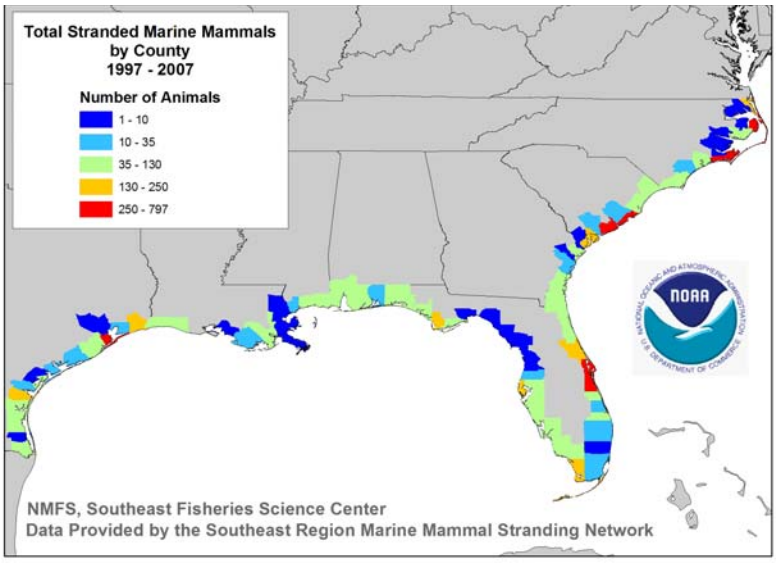
In addition to large-vessel surveys, the Marine Mammal Program conducts small-boat field research to estimate the abundance of dolphins in the many small bays, sounds, and estuaries found along the U.S. Atlantic coast and in the Gulf of Mexico. Both small- and large-vessel surveys also collect tissue samples through remote dart-biopsy techniques (Fig. 2). These skin samples provide DNA for genetic studies of population structure and health at the Lafayette facility which houses a state-of-the-art molecular genetics laboratory. In addition to genetic analyses of population structure and gene flow, the genetics lab conducts research into the evolutionary relationships among cetacean species, social structure, and genetic species identifications in support of stranding networks, NMFS fisheries observer programs, and law enforcement. Tissue samples are also used to examine the levels of pollutants in the bodies of marine mammals.

Figure 2. *A remote biopsy dart is used to collect tissue samples for genetic and other analyses.*

For some species, research on the movements of individual animals through photo analysis and telemetry are also conducted and integrated with genetic data to produce a more complete understanding of historical and present day population structure. These studies also examine habitat use and seasonal migratory movements. Expertise in mortality estimation and habitat modeling provides increased insight into the interactions between marine mammals and the ecosystems they inhabit and enhances conservation and management capabilities. Finally, the Marine Mammal Program coordinates the Southeast U.S. Marine Mammal Stranding Network in partnership with the NMFS Southeast Regional Office (SERO). More than 700 marine mammals strand on beaches of the Southeast region annually (Fig. 3), and large-scale unusual mortality events (UMEs) of cetaceans are more common in the Southeast region than anywhere else in the U.S. Coordination of and training for response to these events ensures proper treatment of live stranded animals as well as collection of scientific information and samples from dead animals for analysis of cause of death, tracking of trends in mortalities, and enhanced understanding of the health and disease of marine mammals.

In addition to the research mission, Program scientists provide advice to management and advisory bodies that develop management measures for marine mammals. The Marine Mammal Program has provided scientific support for the Harbor Porpoise Take Reduction Team, Bottlenose Dolphin Take Reduction Team, and the Pelagic Longline Take Reduction Team. For these teams, SEFSC scientists provided critical information on population structure, abundance, and mortality of marine mammals that allowed these bodies to develop plans to reduce commercial fisheries interactions. SEFSC has also provided support for conservation strategies to reduce the mortality of the highly endangered North Atlantic right whale associated with both fisheries interactions and ship strikes. Finally, SEFSC collects data and develops analytical products that are used to support environmental planning for military operations and energy resource development and exploration. The research conducted by the SEFSC Marine Mammal Program feeds directly into the development and implementation of science-based management efforts that promote the conservation of marine mammals throughout the southeastern U.S.

Figure 3. *Marine mammal stranding events by county in the southeastern United States*



MANDATES AND AUTHORITIES

The primary mandate for NOAA's marine mammal research and conservation programs is the MMPA. In particular, sections 117 and 118 of the MMPA direct the Secretary of Commerce to prepare a stock assessment report for each marine mammal stock which occurs in U.S. waters based upon the best available science. These reports must describe the geographic range of the stock, provide estimates of abundance, productivity and population trends, and quantify mortality on those stocks due to human interactions with an emphasis on characterizing those caused by commercial fishing. In cases where commercial fishery related mortality exceeds benchmark standards in the Act, Take Reduction Teams must be formed to develop recommended strategies to reduce mortality and serious injuries to marine mammals.

The MMPA also contains provisions in Title IV for the establishment of the Marine Mammal Health and Stranding Response Program. The purposes of the program include the collection and dissemination of data on the health of marine mammal populations, investigation of correlations between environmental conditions and human activities and marine mammal strandings, and the coordination of response to Unusual Mortality Events (UMEs). The primary mandates for NMFS, through the Secretary of Commerce, under this provision are to oversee and

set standards for regional Marine Mammal Stranding Networks and to facilitate the collection, management, and dissemination of data collected from stranded marine mammals.

For those species that are listed as endangered under the Endangered Species Act (ESA), section 4 of the ESA requires evaluations of the status of the species, assessment of population size and trends, identification of critical habitat, development of recovery plans with specified management actions, and quantification of threats from human activities. Section 7 of the ESA requires Federal agencies that conduct or authorize an activity to consult with NMFS to determine if the action will have a negative impact on a listed species or its critical habitat and to develop mitigation actions to minimize these effects.

The mandates of both the MMPA and ESA require extensive scientific data collection and analysis to develop effective science-based management and recovery programs. The SEFSC Marine Mammal Program strives to meet these mandates in its region of responsibility.

LINKS TO NOAA AND NMFS MISSIONS, GOALS AND PROGRAMS

The SEFSC Marine Mammal Program makes significant contributions to NOAA's Ecosystem Mission Goal to **"Protect, restore, and manage the use of coastal and ocean resources through an ecosystem approach to management."** The desired outcomes of this goal are:

- Healthy and productive coastal and marine ecosystems that benefit society
- A well-informed public that acts as a steward of coastal and marine ecosystems

The relevant performance objectives of the Ecosystem Goal include:

- Increase the number of protected species that reach stable or increasing population levels.
- Increase the number of coastal and regional marine ecosystems with indicators of ecological health that are monitored and understood.
- Increase the number of coastal communities incorporating ecosystem and sustainable development principles in planning and management.
- Increase the portion of the population that is knowledgeable of and acting as stewards for coastal and marine ecosystems.

The Marine Mammal Program implements NOAA's Ecosystem Goal research through the Ecosystem Observations Program (EOP), Ecosystem Research Program (ERP) and Protected Species Program (PSP). The EOP "provides scientific information on the status of living coastal and marine resources and their habitat by conducting monitoring and observing activities, producing routine assessments and forecasts of the current and future states of these resources and the ecosystem as a whole, distributing this information to NOAA's clients and resource users." The EOP also includes data management and quality activities and the production of scientific papers, technical reports, and stock assessment reports. The ERP component of the NMFS and SEFSC programs focuses on the development of new approaches and models to incorporate ecosystem effects into assessments of protected species. These next generation assessments incorporate a broad range of ecological and environmental factors and are termed "Tier III" assessments under the Protected Species Stock Assessment Improvement Plan. PSP implements conservation and recovery efforts for protected species. The major program goals

and activities of the SEFSC Marine Mammal Program are aligned with the overall objectives and performance measures in both NOAA and NMFS strategic plans (Table 2).

***Table 2**. Alignment of SEFSC Marine Mammal Program Goals with performance objectives and activities under the NOAA Ecosystem goal and NMFS programs.*

NOAA Ecosystem Goal Performance Objectives	**NMFS Activities and Corresponding Program**	**SEFSC Marine Mammal Program Goals**
Increase the number of protected species that reach stable or increasing population levels.	Provide abundance and biological data for all managed stocks (EOP) Deliver comprehensive and timely stock assessments for all protected species (EOP) Increase number of stocks of protected species with adequate population assessments (PSP) Increase survey and assessment efforts for high-priority protected species such as those with known high levels of interactions with commercial fisheries or those that are endangered (EOP)	Assess the status of marine mammal stocks by • Delineating stocks • Estimating abundance • Quantifying fishery mortality
Increase number of coastal and regional marine ecosystems with indicators of ecological health that are monitored and understood. Increase number of coastal communities incorporating ecosystem and sustainable development principles into planning and management.	Improve and extend model forecasts with environmental and ecosystem data (EOP) Further develop the next generation of stock assessments for protected species ("Tier III") including development of new models to better predict spatial and temporal changes in populations and the impacts of human activities on protected species. (ERP)	Evaluate marine mammal habitat and ecosystem effects by • Quantifying species-habitat relationships • Evaluating ecosystem interactions and environmental stressors • Assessing potential impacts of climate change Evaluate causes and impacts of marine mammal mortalities by • Quantifying baseline health parameters • Evaluating patterns and causes in marine mammal strandings • Investigating causes of mass strandings and UMEs • Assessing the impacts of events on population status • Estimating bycatch in commercial fisheries
Increase portion of population that is acting as stewards for coastal and marine ecosystems.	Complete required recovery, conservation, and take reduction plans. (PSP) Reduce interactions of fisheries with protected species (PSP) Develop and implement recovery and conservation actions (PSP)	Support conservation and recovery planning by • Conducting risk assessments • Developing mitigation strategies • Quantifying effectiveness of management actions Disseminate scientific findings to promote effective management and increase public awareness Effectively archive, manage, and retrieve data

SEFSC MARINE MAMMAL PROGRAM GOALS

The marine mammal stocks in the southeastern U.S. and their ecosystems are exposed to a broad range of stressors that may have both short-term and long-term negative impacts on their viability. Scientific information is required to adequately assess the potential impacts of these stressors on each stock to support effective management and conservation. The stressors include oil and gas exploration and extraction, military operations, fisheries interactions, habitat degradation and climate change. Each of the major research goals below is directed at a particular parameter or set of parameters, but achieving each goal is ultimately required to develop a comprehensive understanding of status of each stock and effectively maintain them as functioning elements of their ecosystems.

ASSESS THE STATUS OF MARINE MAMMAL STOCKS

- Delineate stocks: *A thorough understanding of stock structure is necessary to define stock boundaries, document migratory patterns, and accurately estimate abundance.*
- Estimate abundance: *Abundance of stocks must be quantified to monitor trends, evaluate effects of management action, assess ecosystem level effects, and to determine the status of stocks.*
- Quantify fisheries mortality: *The level of fisheries mortality is quantified to assess impacts on population status and identify strategic stocks.*

EVALUATE MARINE MAMMAL HABITAT AND ECOSYSTEM INTERACTIONS

- Quantify species-habitat relationships: *Knowledge of how a species or stock uses a particular habitat can be used to mitigate fisheries interaction, assess exposure to environmental stressors and anthropogenic impacts, and improve abundance estimates.*
- Evaluate ecosystem interactions and environmental stressors: *The role of marine mammal stocks in their ecosystems must be known to estimate long-term trends in abundance and to identify the environmental stressors and their effects.*
- Assess potential impacts of environmental change: *Understanding a population's response to environmental change will result in accurate identification of causes of long-term trends in population size.*

EVALUATE CAUSES AND IMPACTS OF MARINE MAMMAL MORTALITIES

- Quantify baseline health parameters: *An adequate description of "normal" health is necessary to evaluate Unusual Mortality Events, identify stocks at risk and develop quantifiable health parameters that can be used in comprehensive models of stock status.*
- Evaluate patterns and causes in marine mammal strandings: *Seasonal and spatial variation in the types of marine mammal strandings provides information on the underlying processes causing mortalities including both human interactions and environmental effects.*
- Investigate causes of mass strandings or Unusual Mortality Events: *Knowledge of the proximate cause(s) of mass strandings and events is necessary for mitigation planning and for evaluating long-term trends in health status of stocks.*

- Assess the impacts of mortality events on the population status of affected stocks: *Recurrent mortality events can have significant long-term negative impacts, and it is important to quantify these impacts so that the stocks may be properly protected and managed.*

SUPPORT CONSERVATION AND RECOVERY PLANNING

- Conduct risk assessments: *Sources of risk (e.g., oil and gas exploration and extraction, pollutants, harmful algal blooms, etc.) must be identified and their impacts quantified by developing comprehensive risk assessment models for each stock or groups of stocks.*
- Develop mitigation strategies: *The risk assessments will identify the most critical issues, and risks will be mitigated by working with SERO, constituents, and other partners to develop effective methods to reduce the risks to acceptable levels.*
- Quantify effectiveness of management actions: *All management actions put in place must be monitored and threshold criteria evaluated to determine the effectiveness of the action.*

DISSEMINATE SCIENTIFIC FINDINGS TO PROMOTE EFFECTIVE MANAGEMENT AND CONSERVATION AND INCREASE PUBLIC AWARENESS

Significant findings must be published in the peer-reviewed literature and presented at scientific forums. Important findings must also be provided to the public in the appropriate formats.

EFFECTIVELY ARCHIVE, MANAGE, AND RETRIEVE DATA

Data and analytical products must be adequately described and archived so that current and future users can both understand and use the data appropriately.

RECENT ACCOMPLISHMENTS: 2001 to 2007

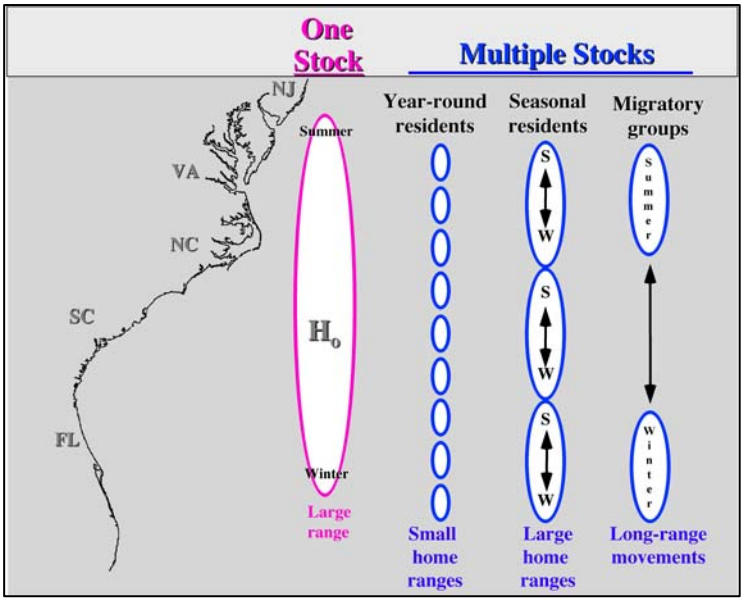
Figure 4. *The NOAA Ship Gordon Gunter is the Program's primary research platform.*

Since 2001, the SEFSC Marine Mammal Program has focused primarily on science activities to support the development and implementation of the Bottlenose Dolphin Take Reduction Plan, the Pelagic Longline Take Reduction Plan, and North Atlantic Right Whale recovery actions including the evaluation of critical habitat boundaries and ship strike mitigation. In addition, significant improvements in collection of field survey data, abundance estimation methodologies and genetic analyses have been developed and incorporated into the Program's suite of capabilities.

This period saw a significant increase in the level and frequency of marine mammal assessment surveys conducted by the Program. Prior to 2001, there had been only two dedicated large vessel surveys for marine mammal assessments along the southeastern U.S. Atlantic coast, one in 1998 and one in 1999. There were no dedicated marine mammal assessment cruises in the Gulf of Mexico; however, marine mammal abundance and distribution data were collected during multidisciplinary cruises throughout the 1990's. Similarly, aerial surveys had last been conducted on the Atlantic coast in 1995 and in the Gulf from 1992-1996. The stock assessments for nearly all species were sorely out of date. In the Atlantic, large vessel surveys were conducted during the summers of 2004-2006 and the winter of 2002, and aerial surveys were conducted during the winter and summer of 2002, summer 2004, and winter 2005. The first dedicated marine mammal assessment cruises were conducted in the Gulf during the summer of 2003 and the spring of 2004. In addition, a survey focused on biopsy collection in the Gulf was conducted in the summer of 2007. The assessment cruises focused on abundance estimation, biopsy collection, and habitat assessment. As a result, the abundance estimates for all oceanic stocks in the Gulf of Mexico and all stocks in the Atlantic were updated.

The formation of the Bottlenose Dolphin Take Reduction Team prompted research efforts in abundance estimation, stock delineation, and mortality estimation of bottlenose dolphins along the Atlantic coast. Prior to this time, the stock was considered to be a single migratory stock ranging from Florida to New Jersey. A research effort to evaluate this model was initiated in 1998 and continues through the present time (Fig. 5). The abundance of bottlenose dolphins along the Atlantic coast was estimated with aerial surveys conducted in the summer and winter of 2002, summer 2004 and winter 2005. Extensive efforts were conducted during 2002-2007 including both winter and summer to collect biopsies for genetic analysis of stock structure from coastal and estuarine habitats ranging from southern Florida to New Jersey. The samples were analyzed to identify stocks along the latitudinal gradient, examine the relationships between estuarine and coastal stocks, and identify the habitats and ranges of the coastal and offshore morphotypes of bottlenose dolphins. Tag telemetry studies were conducted to identify seasonal migratory movements. These research programs verified residency patterns in North Carolina estuaries, identified seasonal migrations between New Jersey and North Carolina, and identified a potential stock ranging between North Carolina in the summer and as far south as Florida in the winter. Studies were also conducted that examined the relationships between strandings and commercial fishery activities off the coast of North Carolina. In collaboration with the SERO, a new observer program was implemented to improve data

Figure 5. *Original one stock hypothesis (left) and alternative stock structure hypotheses for bottlenose dolphins along the Atlantic coast.*



collection from gillnet vessels that are too small to take an observer. All of these studies combine to significantly improve the understanding of bottlenose dolphin population structure and status along the U.S. east coast and were essential to the development and implementation of a Take Reduction Plan for coastal bottlenose dolphins.

The Pelagic Longline Take Reduction Team (PLTRT) was initiated in 2005 and focused on interactions between the U.S. east coast pelagic longline fishery and short-finned and long-finned pilot whales. SEFSC Marine Mammal Program staff have been responsible for estimation of protected species (mammal and turtle) mortality in this fishery since 2001 and production of annual bycatch reports. The formation of the PLTRT also prompted the funding and completion of a new assessment survey of the Atlantic coast in the summer of 2004. This survey updated the 1998 abundance estimates and resulted in a significantly increased estimate of pilot whale population size due both to improved survey effort along the continental shelf break and the correction of known biases in abundance estimates. Biopsy samples from pilot whales were also collected during this survey and a dedicated survey in the summer of 2005, and an effort was initiated to analyze these samples, along with samples collected by the Northeast Fisheries Science Center (NEFSC), to delineate the habitats of the two pilot whale species. Extensive analyses of data from the longline observer program were conducted by Program staff and supported the development of a draft Take Reduction Plan that is currently in rule-making.

The SEFSC Marine Mammal Program's involvement in right whale conservation efforts also increased significantly since 2001. The Program initiated efforts to improve understanding of right whale use of habitats between North Carolina and Georgia during winter months. These areas are outside of the historically described calving areas. Aerial survey efforts initiated in 2001 and continued annually from 2003-2006 demonstrated that calving females occupy these waters throughout the winter. In addition, the Program initiated the use of passive acoustic tools to monitor right whale occurrence in the mid-Atlantic during 2002 including both continuously monitoring bottom mounted buoys and, recently, auto-detection buoys that provide near real-time notification of right whale occurrence. Marine Mammal Program staff also contributed to both evaluation of critical habitat and the development of the NOAA Ship Strike Reduction strategy by conducting habitat modeling studies and risk assessments. The increased monitoring efforts and analytical projects have directly contributed to management and conservation actions for right whales in their calving habitats.

In addition, SEFSC and SERO have worked collaboratively to improve data collection within the Southeast U.S. Marine Mammal Stranding Network and to validate historical data. This has taken the form of conducting training workshops and implementing policy changes in addition to deploying staff in two primary regions with high incidence of marine mammal strandings: the Florida Panhandle and North Carolina. In North Carolina, there is a high incidence of strandings of a diverse suite of marine mammals in addition to a high incidence of fishery mortality. Extensive efforts were made to improve data collection from these carcasses by improving response to strandings, improving data collection, and conducting complete necropsies and associated analyses. In the Florida Panhandle, there is a critical gap in the capabilities of the stranding network along with a high incidence of unusual mortality events (UMEs) associated with harmful algal blooms. The SEFSC Marine Mammal Program augmented network capabilities in this area beginning in 2005 to improve data collection. Since 2001, the Program played critical roles in data collection, coordination and analysis of four bottlenose dolphin UMEs along the Florida Gulf coast, two along the Florida Atlantic coast, two in Texas, and two multispecies UMEs in North Carolina.

SEFSC Marine Mammal Program research has directly contributed to improved management and understanding of marine mammal stocks. The MMPA mandated Stock Assessment Reports have been updated annually with new information on abundance, stock delineation, mortality, and strandings. Staff members have presented findings to take reduction teams and other management bodies in addition to national and international scientific meetings. Since 2001, the program has produced 74 peer-reviewed publications and book chapters in addition to 20 technical reports supporting management efforts (Appendix I). The last seven years have seen significant improvements in capabilities and tremendous strides in improving the understanding and management of marine mammals throughout the southeastern U.S.

RESEARCH PRIORITIES FOR FY 2009–2014

SEFSC Marine Mammal Program research priorities integrate into NOAA's Ecosystem Mission Goal, are designed to meet Ecosystem Goal Performance Objectives and are guided by applicable NOAA Performance Measures and SEFSC Annual Operating Plan (AOP) measures. Operationally, the scientific data and information needed to annually update the Western North Atlantic and Gulf of Mexico Stock Assessment Reports (SARs) and the Stock Assessment Improvement Plan guide the research priorities for the SEFSC Marine Mammal Program.

Stock delineation and abundance are critical to the SARs. Abundance estimates need to be updated for each stock at least every 5 years in order to properly assess the status of each stock, estimate Potential Biological Removal, and monitor trends in abundance. This requires that the Marine Mammal Program conduct annual surveys in a broad range of geographic areas (Gulf of Mexico, Atlantic, and Caribbean Sea) and in a diverse range of habitats (bays, sounds, and estuaries; coastal waters; and the open ocean). A variety of research and analytical techniques (line-transect, mark-recapture, biopsy sampling, photo-identification, satellite tagging, acoustics) and platforms (large ships, small boats, aircraft) are needed in these diverse habitats.

In addition, the SARs require that estimates of fisheries-related mortality for each stock be updated in a timely manner, and that, wherever possible, data on other causes of anthropogenic mortality and stressors to each stock be compiled, reported and evaluated. For bottlenose dolphins in particular, stranded animals provide data that are not available for most other species, and these data provide insight into human-related impacts on coastal and inshore stocks. To improve the collection and utility of these data, the Program coordinates the Southeast Region Marine Mammal Stranding Network and supports administration and training of the network in collaboration with SERO. We will support training workshops, develop and implement data collection protocols and research plans, and manage and analyze collected data.

The SEFSC Marine Mammal Program research is prioritized to improve stock assessments to a level where they are considered "adequate" (i.e., Tier II under Stock Assessment Improvement Plan) and begin Tier III-related research. A Tier III stock assessment is ecosystem-based and will ultimately provide information needed to make more precise estimates of abundance, understand some of the mechanisms that influence stock structure, help pinpoint the reasons for changes, if any, in the status of stocks, and identify how specific human activities and/or climate change affects marine mammal stocks.

A number of research priorities for 2009-2014 complete or continue work that started prior to 2009. These include studies of the stock structures of coastal and estuarine bottlenose

dolphins, Atlantic spotted dolphins, and dwarf and pygmy sperm whales; studies to delineate the ranges and seasonal habitats of the two western North Atlantic pilot whale species; and research to more accurately estimate the abundance of sperm whales. While Gulf of Mexico bottlenose dolphin stock structure research was recently initiated, a major goal of the Marine Mammal Program over the next 5 years is to conduct studies that will make our knowledge of bottlenose dolphin stock structure in the Gulf of Mexico commensurate with that in the Atlantic. Continuation of habitat-related studies of oceanic cetacean communities in both the Atlantic and Gulf of Mexico will also be a high research priority and will provide data for habitat modeling and ultimately Tier III assessments of oceanic cetacean stocks.

Research priorities and goals for 2009-2014 include:

ASSESS THE STATUS OF MARINE MAMMAL STOCKS

- Delineate stocks
  - Conduct additional telemetry and biopsy collections and genetic analyses to refine/confirm western North Atlantic coastal bottlenose dolphin stock structure.
  - Conduct initial delineation of western North Atlantic estuarine bottlenose dolphin stocks, collect additional samples, and refine stock structure.
  - Conduct additional biopsy collection and genetic analysis of Atlantic spotted dolphins in the western North Atlantic
  - Collect and analyze biopsy samples from pilot whales along the mid-Atlantic coast during September - November to define species ranges
  - Initiate Gulf of Mexico coastal and estuarine bottlenose dolphin stock delineation studies
  - Complete Gulf of Mexico oceanic and continental shelf bottlenose dolphin stock delineation studies
  - Conduct analysis of *Kogia* spp. stock structure based upon samples from stranded animals
  - Describe available information on marine mammal stocks for U.S. Caribbean waters and develop initial stock assessment reports
- Estimate abundance
  - Conduct visual line transect surveys in the northern Gulf of Mexico and estimate abundance of coastal, continental shelf, and oceanic species (2009-2010)
  - Conduct visual line transect surveys along the Atlantic coast of the southeastern U.S. and estimate abundance of coastal, continental shelf, and

oceanic species (2011-2013)

- Conduct photo-identification mark-recapture studies to estimate abundance of selected estuarine Gulf of Mexico bottlenose dolphin stocks

- Work with partners throughout the Gulf of Mexico to develop a comprehensive photo-identification database and catalog for bottlenose dolphins

- Conduct line transect surveys in Puerto Rico and the U.S. Virgin Islands to estimate marine mammal abundance

- Quantify fisheries mortality
  - Improve estimates of annual mortality and serious injury of marine mammals in the U.S. east coast pelagic longline fishery

  - Quantify mortality of bottlenose dolphins in the U.S. shrimp fishery

  - Review available information on fisheries in U.S. Caribbean waters

EVALUATE MARINE MAMMAL HABITAT AND ECOSYSTEM INTERACTIONS

- Develop spatially-explicit habitat models
  - Develop habitat models for oceanic Gulf of Mexico and Atlantic waters based upon large vessel surveys

  - Conduct line transect aerial surveys during spring and fall over the eastern Gulf of Mexico continental shelf and develop habitat models

  - Integrate physical oceanographic models into predictive models of marine mammal spatial distribution

  - Conduct habitat assessment cruises in the Gulf of Mexico and Atlantic incorporating intensive physical and biological sampling into line transect surveys

  - Develop active acoustic capabilities and collect data to quantify the relationships between marine mammal spatial distribution and prey densities

- Evaluate ecosystem interactions and environmental stressors
  - Target studies in Biscayne Bay as a model system for assessing the impact of environmental pollutants on bottlenose dolphin health and population dynamics

  - Develop approaches to assess the impacts of harmful algal blooms on Gulf

of Mexico coastal and estuarine bottlenose dolphin populations

  - Incorporate bottlenose dolphins into integrated ecosystem assessment projects in the eastern Gulf of Mexico

- Assess potential impacts of environmental change
  - Conduct a workshop to identify potential impacts of climate change on coastal and estuarine bottlenose dolphin populations

  - Incorporate climate change into risk assessments and develop approaches to integrate findings into management

EVALUATE CAUSES AND IMPACTS OF MARINE MAMMAL MORTALITIES

- Quantify baseline health parameters
  - Evaluate the spatial distribution of disease prevalence in stranded bottlenose dolphins

  - Identify information gaps, develop and implement a research plan to prioritize and address those gaps

  - Develop collaborative projects to synthesize and integrate disease prevalence data and health status data into assessments of marine mammal population status

- Evaluate patterns and causes in marine mammal strandings
  - Audit and manage Level A stranding data collected by the Southeast Region marine mammal stranding network

  - Collaborate with the NMFS Office of Protected Resources and SERO on the development and implementation of data management systems for stranding data including improving the collection of information on human interactions from stranded animals

  - Investigate spatial and temporal patterns in marine mammal strandings throughout the southeastern U.S.

  - In coordination with SERO, conduct training workshops to improve collection of data from stranded marine mammals

- Investigate causes of mass strandings or Unusual Mortality Events
  - In coordination with SERO and NMFS Office of Protected Resources, participate in investigations of UMEs and mass stranding events

- Assess the impacts of events on the population status of affected stocks
  - Integrate information collected from UMEs with stock delineation and

status to ascertain impacts

SUPPORT CONSERVATION AND RECOVERY PLANNING

- Conduct risk assessments
  - Evaluate the "depleted" status of the WNA coastal bottlenose dolphin stocks
  - Convene workshop(s) to develop a collaborative research plan for Gulf of Mexico bottlenose dolphin stocks including risk assessment
  - Support risk assessments for eastern Gulf of Mexico coastal and estuarine bottlenose dolphin stocks
- Develop mitigation strategies
  - Evaluate the effectiveness of a passive acoustic monitoring and notification system for right whales in the southeast U.S. calving grounds to improve ship strike mitigation
  - Support the implementation of the NMFS right whale ship strike reduction strategy
  - Support future take reduction teams including evaluation of bycatch mitigation strategies
  - Develop a Gulf of Mexico sperm whale research plan and provide scientific advice to support sperm whale recovery planning
- Quantify effectiveness of management actions
  - Assess the impacts of management actions implemented in the pelagic longline take reduction plan
  - Support evaluation of management actions implemented in the bottlenose dolphin take reduction plan in collaboration with SERO and the NEFSC
  - Evaluate the effectiveness of implemented measures to reduce ship strikes of North Atlantic Right whales in the Southeast and Mid-Atlantic U.S.

DISSEMINATE SCIENTIFIC FINDINGS TO PROMOTE EFFECTIVE MANAGEMENT AND CONSERVATION AND INCREASE PUBLIC AWARENESS

- Contribute to marine mammal science by publishing research findings in peer-reviewed journals
- Provide technical reports to take reduction teams and other management bodies to support implementation of sound science-based management policies

- Coordinate and produce reports on Unusual Mortality Events and mass strandings
- Disseminate scientific results at national and international meetings
- Participate in outreach programs to increase public awareness

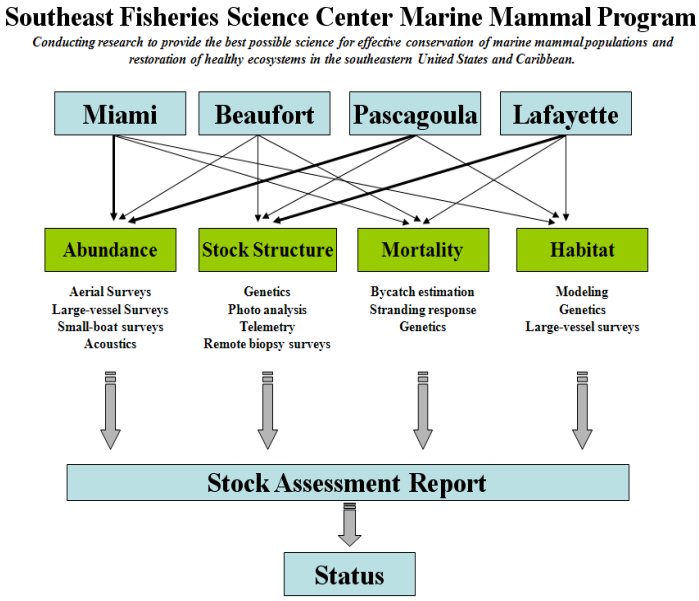
EFFECTIVELY ARCHIVE, MANAGE, AND RETRIEVE DATA

- Complete development of marine mammal data acquisition system for deployment on large vessel and aerial surveys
- Document QA/QC procedures and integrate historical survey data into an archive database
- Develop photographic data management plan and databases
- Develop database and data management systems to store environmental data including continuous *in situ* measures during cruises and remotely sensed data

REQUIREMENTS TO ACHIEVE PROGRAM GOALS

The SEFSC Marine Mammal Program takes an integrated approach to research on marine mammal populations and species (Fig. 6) combining field research, laboratory research, statistical analyses, and data management to obtain the best scientific data to support conservation of these living marine resources. In order to achieve Program goals, improve stock assessments, and meet research needs of a changing global climate, increased energy exploration, and increased military activities, resources must be sufficient to support core personnel and field and laboratory research.

Figure 6. *Schematic description of program structure and the contribution of major research areas to stock assessments.*

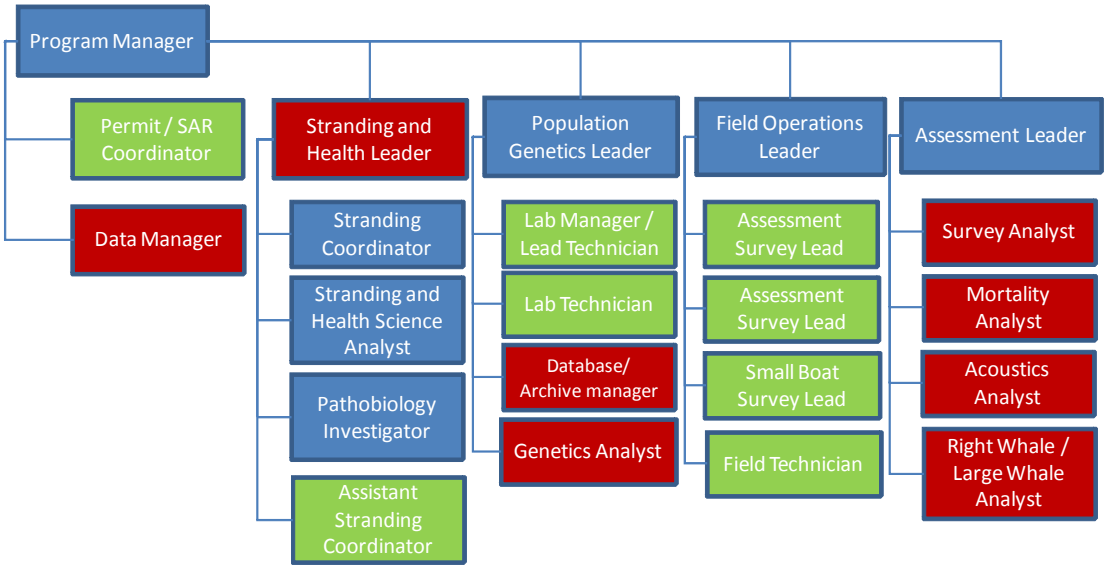


In the first half of this decade, the Program consisted of 11-12 FTE, 2-3 Term and 12-14 contract staff. At the end of FY08, the program will have 10 FTE and 7

contract staff (a 40% decrease in staff) due to severe budget cuts. The current Program budget falls $600k below the FY03 budget. In addition to staff cuts impacting stock assessment and stranding investigations, this severe reduction has resulted in the cancellation of aerial surveys, small-boat surveys, and biopsy collection, dramatically impacting the Program's ability to assess population status.

To meet the goals of this strategic plan, the Marine Mammal Program requires a permanent (i.e., non-contract) staff compliment of 23. This includes a dedicated program manager and unit leaders organized by capability including strandings and health assessment, population genetics, field operations, and assessments (Fig. 7). Currently, there are significant gaps in staffing to support mission capabilities. Many of the roles identified are unoccupied or one individual is serving multiple roles. For example, the current program manager also is tasked with developing survey design and analyzing survey data. In addition, several critical roles, particularly experienced field leads, are occupied by temporary contract employees. These positions are a long term requirement for effective operation of the program, and hence they should be permanent positions. The most critical requirement for staff development is in the assessment program. The Program currently lacks dedicated analytical staff to support efficient data analysis and dissemination.

Figure 7*. Program staffing and structure required to achieve strategic goals. Blue boxes indicate positions currently occupied by FTEs, green boxes indicate current contractors, and red boxes indicate positions that currently are not filled. Ideally, each position would be filled by a permanent FTE staff member.*



Annual field research requirements include two aerial surveys, a large-vessel cruise and two small-vessel surveys. Additional periodic surveys outside of the summer season will be needed to support effective habitat modeling and ecosystem assessments. Currently, Program resources are sufficient to support only one annual research cruise, and therefore adequate assessments of the majority of stocks cannot be completed. Additionally, the Program is unable to meet its mandates to assess the stocks in U.S. Caribbean waters and requires additional large

vessel and aircraft time to accomplish this mission. Annual operating budgets for the population genetics and stranding and health units must be restored to sufficient levels.

Finally, critical gaps in data collection from stranded marine mammals in the northern Gulf of Mexico and North Carolina limit capabilities to accomplish research goals. In North Carolina, the recent reduction in staff severely limits the Program's capability to respond to stranding events including mass strandings and unusual mortality events. In the Gulf of Mexico, frequent harmful algal blooms are often followed by large-scale dolphin die-offs. Research on the impacts of these mortality events has also been greatly diminished due to budget cuts.

A major focus of implementation of this strategic plan will include the improvement of capabilities and development of resources to accomplish the missions and mandates of the SEFSC Marine Mammal Program.

APPENDIX I. SEFSC MARINE MAMMAL PROGRAM PUBLICATIONS: 2001-2008

MMPA-mandated Marine Mammal Stock Assessment Reports

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