NMFS SEFSC Sea Turtle Program (STP) Strategic Plan (2015-2020)

Background and Purpose

The National Marine Fisheries Service's Southeast Fisheries Science Center (NMFS SEFSC), a part of the U.S. Department of Commerce National Oceanic and Atmospheric Administration (NOAA), is responsible for working cooperatively with diverse partners to manage living marine resources throughout the U. S. Gulf of Mexico, U. S. Caribbean Sea, and a large portion of the northwestern Atlantic Ocean (**Fig. 1**). This region regularly hosts populations for five of the seven sea turtle species recognized worldwide during multiple life stages, with sporadic occurrence by a sixth (**Table 1**). All sea turtle populations inhabiting waters under U.S. jurisdiction are considered to be depleted and as a result are listed as either threatened or endangered under the US Endangered Species Act (ESA) (**Table 1**).

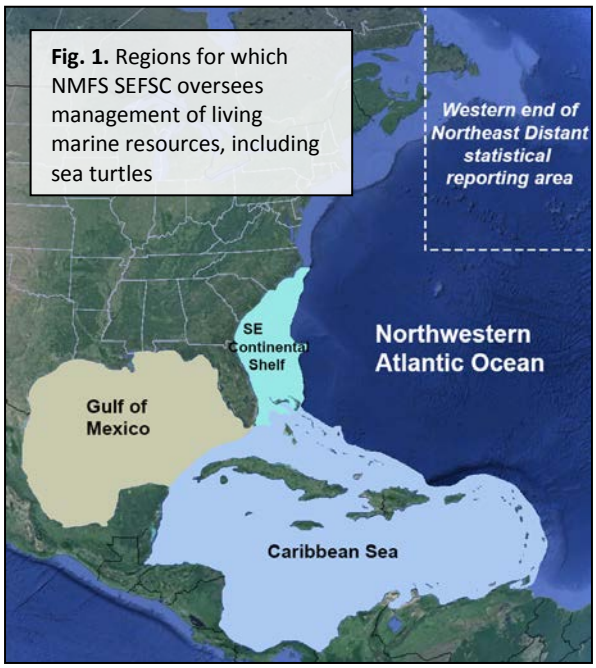

Fig. 1. Regions for which NMFS SEFSC oversees management of living marine resources, including sea turtles

Although different sea turtle species diverge in their habitat and forage requirements, they share a number of distinctive biological and behavioral characteristics. These include dependence on and fidelity to specific nesting beaches, temperature-dependent sex determination, late maturation, generally infrequent surfacing behavior, and migratory routes and developmental habitats that encompass ocean basins and cross geo-political boundaries. Throughout different life stages and habitats, sea turtle populations are negatively impacted by numerous influences of human origin, including habitat degradation and destruction, fishery interactions, military activities, and climate change. Taken together, all of these factors can present distinct challenges to sea turtle population assessment and management.

The goal of the NMFS SEFSC Sea Turtle Program (STP) is to provide the best available data and information to support science-based management decisions and to promote the recovery of sea turtles and their habitats in the Atlantic Ocean, Gulf of Mexico, and Caribbean Sea. This strategic plan outlines the framework that guides and prioritizes work conducted by the NMFS SEFSC STP (hereafter, STP) and describes focal activities carried out by STP staff to address those priorities, both current and projected for 2015-2020.

Guidance framework

A summary of the primary, overarching legal mandates, agency goals, and research themes that encompass all work conducted by the STP can be found in **Table 2,** and these include:

- Endangered Species Act (ESA)
- Magnuson-Stevens Fishery Conservation and Management Reauthorization Act (MFCMA)
- NOAA Next Generation Strategic Plan (NOAA NGSP)
- NMFS Strategic Plan
- SEFSC Strategic Plan.

These authorizations and plans provide broad context and a foundation for NMFS, and therefore STP, efforts to manage, conserve, and recover sea turtle populations. Under the ESA, sea turtles are co-managed by NMFS and the US Fish and Wildlife Service (USFWS), which has jurisdiction over sea turtles during the terrestrial portion of their life cycle (nesting females, eggs/nests, and hatchlings) and rehabilitation. Together, NMFS and USFWS develop and refine ESA recovery plans for each sea turtle

species outlining specific goals that must be met in order for recovery and de-listing to occur, as well as lists of recommended actions for facilitating recovery (NMFS & USFWS 1991, 1992, 1993, 2008; NMFS, USFWS & SEMARNAT 2011).

Convergent guidance from three additional sources provides further direction for practical prioritization of research and management activities. In 2004, NMFS established the Protected Species Stock Assessment Improvement Plan (hereafter SAIP), in which a stock assessment was characterized as "collecting, analyzing, and reporting information related to the status of protected species and the impacts of human activities upon protected species" (NMFS 2004). Stock assessments are integral to meeting requirements of sea turtle management-related mandates, goals, and themes (**Table 2**). Under the SAIP, the following main data categories were established as the most important for improving sea turtle assessments:

- Stock/population identification
- Life history/vital rates
- Abundance (nesting and in-water)
- Anthropogenic impacts
- Assessment frequency and quality

The type and level of data available for each of these categories determined classification of a population assessment under one of three SAIP Tiers: Tier I (baseline), Tier II (elevated), or Tier III (next generation) (**Table 3**). At the highest level, Tier III, assessments would move beyond single-species approaches and instead evaluate population status within an ecological context. SAIP categories are used to evaluate the status of sea turtle populations each year as part of the Government Performance and Results Act (GPRA) Science Performance Measures. Under the SAIP framework, all sea turtle population assessments are currently characterized as Tier I.

Subsequent to SAIP development, the National Research Council report 'Assessment of Sea-Turtle Status and Trends: Integrating Demography and Abundance' (NRC 2010) and the NMFS report 'Sea Turtle Assessment Status and Research Needs' (NMFS 2013) re-emphasized the need for improved information associated with the recommended SAIP categories for advancing sea turtle assessments. In addition, the reports advised increasing dissemination of data and information related to sea turtle assessment and management. Within NMFS, the framework outlined by these three sources is applied for prioritizing support of sea turtle assessment-related research activities (NMFS 2013).

STP research and activities

The STP consists of a total of 17.25 permanent and 8.5 contract staff stationed at laboratories in Miami, FL (6); Galveston, TX (6), Pascagoula, MS (10.75); and Beaufort, NC (3) supported by both Protected Species and Fisheries Research and Management programs within NMFS. Consistent with ESA recovery plan and assessment status report recommendations, STP activities focus on the development and application of a wide array of research and management approaches and are directed at improving both the status of sea turtle assessments and the populations themselves (**Table 4**). This work is accomplished in cooperation with numerous federal and state agencies, academic institutions, and non-governmental organizations (NGOs).

- <u>Stock/population identification</u> – *A thorough understanding of population structure is necessary to define distribution boundaries, document migratory patterns, and accurately estimate abundance.*

  Sea turtle populations are typically defined through genetic characterization. Collection of tissue samples for genetic analysis is conducted and directed by STP staff through diverse efforts, including coordination and response to strandings through the southeast Sea Turtle Stranding and Salvage Network (STSSN), incidental and directed research captures, and fishery bycatch sampling by fishery observer programs. Population delineation is conducted in collaboration with the National Sea Turtle Genetics Laboratory (NMFS Southwest Fisheries Science Center), and recent efforts have yielded

multi-stock analyses of numerous foraging populations. In addition, the STP supported a Turtle Expert Working Group (TEWG) to compile, analyze, and interpret loggerhead sea turtle genetic data throughout the Atlantic Ocean.

- Life history/vital rates – *Information regarding survival rates, age structure, growth rates, stage durations, and sex ratios is integral to understanding population structure and dynamics.*

  To obtain vital rate data, the STP has estimated sea turtle survival probabilities at different life stages using diverse approaches, including satellite telemetry, capture-mark-recapture, and strandings data.

  The STP investigates life history through observations of age, stage duration, and growth for turtles during captive-rearing, nesting, and in-water capture-mark-recapture studies. In addition, analysis of skeletal growth marks (skeletochronology) in bones of stranded sea turtles has been refined and applied to investigate size-at-age relationships, life stage durations, age at maturation, and long-term trends in growth patterns for U.S., Mexican, and Brazilian populations. Recent integration of complementary chemical analyses (stable isotope, trace element) of bone tissue with skeletal growth increments is fostering research into associations of diet and habitat use with age and growth.

  For all sea turtle species, sex is determined by nest incubation temperature, where environmental temperature fluctuations may result in varying sex ratios. However, a lack of distinguishing external characteristics for males and females during the hatchling and juvenile life stages impedes evaluation of sex ratio changes. The STP supports and conducts studies of primary (hatchling), secondary (juvenile), and operational (breeding adult) sex ratios through necropsy, laparoscopic examination of gonads, and development and application of methods to assign sex through measurement of blood testosterone levels. Cumulative results allow for evaluation of temporal trends in sex ratios and provide baseline data for assessing potential future changes resulting from effects of climate change on incubation temperatures.

- Abundance – *Population abundance must be quantified to monitor trends, evaluate impacts of management actions, assess ecosystem level effects, and determine population status.*

  Although extensive information is available regarding abundance of nesting females, both relative and absolute abundance data for in-water populations are lacking. STP efforts to characterize abundance are focused on in-water life stages and include supporting and conducting long-term fishery-dependent and –independent sampling and analyzing resultant capture-mark-recapture data.

  To increase the spatial and temporal scope of in-water abundance measurement, the STP also conducts and participates in broad-scale aerial surveys along the U.S. Atlantic and Gulf coasts. Satellite tags with dive sensors are deployed on sea turtles within these areas to determine proportion of time spent at or near the water's surface, as well as movement and seasonal distribution, to calibrate turtles' availability to be detected during aerial surveys. Use of alternative approaches for sea turtle surveys, such as Autonomous Underwater Vehicle (AUV)-borne sidescan sonar is also being evaluated. In addition, the STP relies on public input to provide qualitative information on broad-scale sea turtle distribution through its collaboration in the public sightings program iSTOR (www.seaturtle.org/istor).

- Anthropogenic impacts – *To respond to wide-ranging threats to sea turtles from human activities, comprehensive efforts must be undertaken to monitor the extent, periodicity, and underlying causes of mortality events and to determine the impacts on population status.*

  The STP coordinates and participates in the southeast STSSN by monitoring numbers of live or dead turtles that wash ashore (strand) throughout the region, allowing detection of anomalies or unusual stranding events (USEs). This information can prompt scrutiny of human activities in impacted areas to evaluate potential causes of strandings and implement management measures to mitigate further mortality.

Interactions with fisheries have been demonstrated to negatively impact sea turtle populations. To characterize the extent and nature of sea turtle/fishery interactions, STP staff compile and analyze sea turtle bycatch data collected by SEFSC observer programs for fisheries throughout the southeastern U.S. Bycatch reports provided by the STP are essential for informing regional management decisions. The STP coordinates with observer programs in order to evaluate survival probability relative to fishery interaction type, as well as to study the environmental factors underlying sea turtle distribution and how these influence bycatch probability. Furthermore, this coordination allows investigation of genetic origin of bycaught turtles to characterize which population/s may be differentially impacted by specific fisheries. Additionally, STP staff support both fishery and oil platform removal observer programs by providing training for sea turtle identification, handling, and sampling.

To reduce potential population impacts from fishery interactions, bycatch mitigation technologies must be developed, instituted, and enforced. STP research is instrumental in developing and refining modifications to fishing gear and practices that can reduce sea turtle bycatch without implementing closures. Behavioral, physiological, and morphological research involving captive-reared and wild turtles has made it possible to evaluate factors underlying interactions between turtles and fishing gear, allowing development of alternate approaches that may mitigate interactions. STP efforts are critical for continued improvement in the configuration and efficiency of Turtle Excluder Devices (TEDs) for various trawl fisheries, which is accomplished through continued gear modification and testing using captive-reared turtles. The STP informs amendments to fishery regulations, develops and tests tools and protocols for safe fishery gear removal, conducts training to ensure proper modification and use of gear by fishers, and assists with training for regulation enforcement. National and international technology transfer for gear modifications is promoted through workshops, dockside assistance, and vessel demonstrations.

Overlap between military activities and sea turtle habitats can also have potential, deleterious effects and must be assessed. The STP employs aerial surveys and telemetry (satellite and acoustic) to evaluate sea turtle distribution, relative abundance, and habitat use associated with military operations areas to facilitate planning to minimize negative impacts from military activity.

Baseline health data are needed to evaluate changes resulting from pollution and habitat modification that may produce individually sub-lethal, but potentially cumulative, effects on population health and status. STP in-water and captive-rearing studies have provided data to characterize baseline health parameters, which serve not only as a reference against which to measure changes in wild populations, but also inform treatment and release criteria for facilities that rehabilitate injured and sick sea turtles. Samples collected during in-water studies and from stranded turtles have allowed investigation of spatial and temporal trends in contaminant loads resulting from pollution and potential health effects. Furthermore, samples collected from turtles captive-reared for TED testing have allowed development of novel cell culture and analytical techniques, facilitating characterization of toxicant exposure and effects.

- <u>Assessment frequency and quality</u> – *Modeling efforts must be conducted periodically to assess population status and incorporate updated population abundance, life history, vital rate, and demographic data. Refined modeling approaches can prioritize data collection, increase data utilization, and quantify effectiveness of management actions.*

  The STP has led and been integral to numerous assessments conducted by Turtle Expert Working Groups and Biological and Status Review Teams, collaborating with domestic and international federal and state agencies, academic institutions, and non-governmental organizations (NGOs) to assess population status for different species and identify data needs. Recently, as part of the NMFS Protected Species Assessment Tool Development and Application effort, STP staff collaborated to build a spatially-explicit matrix model to simulate loggerhead sea turtle population dynamics, allowing evaluation of anthropogenic impacts and different management scenarios. STP staff also participate in

updating recovery plans under the ESA for all sea turtle species to incorporate recent data and evaluate population status.

- Ecology – *Knowledge of ecological function is needed to understand and mitigate effects of environmental stressors and anthropogenic influences on population health, viability and abundance, and to allow population assessment in an ecosystem context.*

  Remote collection of sea turtle location data through telemetry (satellite, radio, and acoustic) enables the STP to gather information regarding movements and habitat use. Incorporation of these data into models integrating spatially-explicit environmental information will provide insight into the factors influencing sea turtle distribution and movements.

  Indirect inference of habitat use through chemical signatures over time (stable isotopes, trace elements) in various sea turtle tissues allows the STP to study the timing and factors underlying habitat shifts at different life stages. This approach makes it possible to characterize long-term diet trends for individuals and populations, which in turn enables evaluation of interactions between forage availability, diet preferences, and growth patterns.

- Data and information dissemination – *Significant findings relevant to sea turtle assessment and management must be disseminated through appropriate scientific and public fora. Data and analytical products must be adequately described and archived so that current and future users can both understand and use the data appropriately.*

  STP staff present analyses and results at domestic and international scientific meetings and publish peer-reviewed scientific journal articles, technical memoranda and reports. A list of publications supported by the STP can be found at: http://www.sefsc.noaa.gov/seaturtlepublications.jsp
  Recent development of a central data repository (InPort) has allowed compilation of STP project descriptions, metadata, and data. General information is provided to the public through outreach activities and both SEFSC-wide and laboratory-specific sea turtle websites where program summaries, staff directories, publications, training materials, and resources for the fishing community and general public are posted:

  http://www.sefsc.noaa.gov/seaturtlesprogram.jsp
  http://www.galvestonlab.sefsc.noaa.gov/seaturtles/index.html
  http://www.sefsc.noaa.gov/labs/beaufort/protected/turtles/
  http://www.sefsc.noaa.gov/labs/mississippi/harvesting_systems.htm

  The STP also disseminates data and information through conservation activities, such as serving as members in ESA Biological and Status Review and Recovery Teams and as delegates in international meetings (e.g., ICCAT, Mexus-Gulf, and the Canada-U.S.-Mexico Trilateral). In addition, STP staff provide scientific assistance to the Southeast (SERO) and Northeast (NERO) Regional Offices, NMFS Headquarters, and Canada's Department of Fisheries and Oceans (DFO).

Priorities for 2015-2020

The diversity of sea turtle species, life stages, habitats, and threats to survival encompassed by SEFSC jurisdiction, along with distinctive biological and behavioral characteristics that impede study and diminishing budget allocations, constrain the status of sea turtle assessments to Tier I under the SAIP framework. For the period 2015-2020, the STP plans to conduct the following activities to improve the status of sea turtle assessments and meet ESA recovery plan goals.

Stock/population identification

- Collect tissue for genetic analysis through stranding response, directed capture, and observer programs to refine population delineation

- Support compilation, analysis, and interpretation of existing and new genetic information for population identification

Life history/vital rates

- Support development of improved method for measuring blood testosterone levels and apply to archived and new samples to characterize sex ratio trends
- Integrate skeletal growth mark, stable isotope, and trace element analyses to increase understanding of age, growth, and life stage durations, as well as factors underlying variability in growth patterns and size-at-age relationships
- Deploy satellite tags to estimate stage-and size-specific survival rates

Abundance

- Conduct long-term monitoring of in-water trends in abundance
- Conduct turtle captures at established and new in-water population assessment sites, estimate detectability, and analyze resulting capture-mark-recapture data
- Conduct and participate in aerial surveys in the Atlantic and Gulf of Mexico
- Use satellite telemetry to collect movement and dive behavior data to determine availability for detection during surveys.
- Evaluate feasibility of using acoustic technologies (e.g., AUV-borne sidescan sonar, Didson, Aris) for detecting sea turtles and measuring abundance

Anthropogenic impacts

- Coordinate and participate in the southeast Sea Turtle Stranding and Salvage Network to document strandings and identify unusual stranding events (USE) and underlying causes
- Provide fishery observer program support to document bycatch, inform serious injury determination, and to investigate survival, mortality, and genetic origin of incidentally captured turtles
- Develop and improve analytic methods for bycatch estimation and sampling design to optimally allocate observer coverage
- Conduct gear research and technology transfer to reduce interactions and mortalities in both domestic and foreign fisheries
- Provide support to law enforcement to improve compliance with fishery regulations promulgated to reduce sea turtle interactions and mortality
- Conduct stable isotope analysis to assess possible influences of anthropogenic activities on diet
- Monitor and model sea turtle carcass drift to infer origin and potential causes of mortality

Assessment frequency and quality

- Refine and improve modeling efforts to help support management decisions and assess the impacts of management actions

- Incorporate updated population structure, vital rate, life history, demographic, and bycatch information into existing population models to improve assessments

Ecology

- Conduct stable isotope analysis for different tissue types (new and archived) and potential prey/forage items to investigate foraging ecology
- Integrate skeletal growth increment, stable isotope, and trace element analysis to investigate habitat shifts and foraging trends
- Conduct state space modeling to characterize focal habitats and associated environmental variables

Data and information dissemination

- Contribute to the understanding of sea turtle biology and ecology through publishing (peer-reviewed journal articles, technical memoranda, reports) and disseminating data and information through appropriate scientific and public venues.
- Maintain, coordinate, and fulfill reporting requirements for state and federal permits required to conduct sea turtle research.
- Enhance existing and initiate new collaborative efforts to capitalize on existing data, focus data collection efforts, and facilitate attainment of recovery criteria.

Future directions

Although this strategic plan offers a static snapshot and reference framework for sea turtle population and STP activity status, both are innately dynamic and changes are likely over the 2015-2020 time frame. For instance, while some sea turtle nesting populations are showing encouraging signs of increase, for others trends are stable, declining, or even unknown, requiring continued monitoring to gain understanding of long-term trends and underlying causes. As climate changes, rising sea level has the potential to influence both availability and quality of sea turtle nesting habitat. The prospect that changes in incubation temperatures might influence population sex ratios and ultimately breeding success must be evaluated. Increases in coastal development and population densities, as well as established and emergent human activities in coastal and oceanic waters, often overlap with sea turtle populations at different life stages, making it necessary to characterize potential interactions and impacts.

Along with changes in sea turtle population status, ongoing progress in development of novel research methods and availability of new technologies has the capacity to expand and improve approaches for sea turtle assessments. For example, small Unmanned Aerial Systems (sUAS) have potential application for surveys of sea turtle abundance and remote acoustic receiver arrays offer the opportunity to investigate fine-scale habitat use. Advances in modeling approaches facilitate integration of both existing and new data streams and have the potential to enable analysis of associations between demographics, abundance, environmental variables, movements, and threats to survival. To respond to existing and emerging data and management needs, the STP plans to maintain its core activities, but also retain flexibility to allow changes in prioritization in response to yet unforeseen events and incorporation of advances in research approaches to facilitate assessment of sea turtle populations.

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Table 1. Summary of sea turtle species, populations, Endangered Species Act (ESA) status, and life stages for sea turtles occurring in U.S. waters overseen by NMFS SEFSC STP. Population descriptions incorporate information from formal distinct population segment (DPS) and proposed regional management unit (RMU; Wallace et al. 2010) designations. *Italics* denote sporadic occurrence in U.S. waters.

Species	Populations	ESA status	Life stages present
Loggerhead (Caretta caretta)	NW Atlantic Ocean	Threatened	Hatchling/juvenile/adult
Green sea turtle (Chelonia mydas)	NW Atlantic	Threatened / Endangered (Florida & Pacific Mexico breeding populations)	Hatchling/juvenile/adult
Kemp's ridley (Lepidochelys kempii)	NW Atlantic	Endangered	Hatchling/juvenile/adult
Leatherback (Dermochelys coriacea)	NW Atlantic	Endangered	Hatchling/juvenile/adult
Hawksbill (Eretmochelys imbricata)	W Atlantic, Caribbean	Endangered	Hatchling/juvenile/adult
Olive ridley (*Lepidochelys olivacea*)	*W Atlantic*	*Threatened*	*Juvenile/adult*

Table 2. Summary of overarching guidance encompassing NMFS SEFSC STP activities

Primary authorization	Sub-Category	Objectives relevant to sea turtle management
U.S Endangered Species Act (ESA) (U.S. Public Law 93-205)	Sections 2, 4, 6, 7, 8, 10	Provide the best scientific data available to guide species listings, critical habitat designation, recovery planning, consultation regarding actions authorized, funded, or carried out by federal agencies, and scientific research and incidental take permitting. Work cooperatively with state, tribal, and international partners to manage and conserve listed species. Species-specific recovery plans outline management actions as may be necessary to achieve the plan's goal for the conservation and survival of the species and objective, measurable criteria which, when met, would result in a determination, in accordance with the provisions of the ESA that the species be removed from the list.
Magnuson-Stevens Fishery Conservation and Management Reauthorization Act (MCFMA) (U.S. Public Law 109-479)	Section 316	Directs establishment of "a bycatch reduction program, including grants, to develop technological devices and other conservation engineering changes designed to minimize bycatch, seabird interactions, bycatch mortality, and post-release mortality in Federally managed fisheries."
National Oceanic and Atmospheric Administration (NOAA 2012) Next Generation Strategic Plan www.noaa.gov/ngsp	Healthy Oceans Goal	Improved understanding of ecosystems to inform resource management decisions; recovered and healthy marine and coastal species. Progress toward meeting objectives is measured by: - Next-generation fish and protected resource stock assessments incorporating habitat, ecosystem, and climate information - Living marine resource managers using high-quality data to inform management plans and decisions - Stabilized or increased abundance of species that are depleted, threatened, or endangered - Decreased bycatch of protected species - Increased number of protected species with improving status
National Marine Fisheries Service (NMFS) Strategic Plan www.nmfs.noaa.gov/mb/strategic	Protected Species Program (PSP) Activities	Priority focus: "…to stabilize or increase protected species populations and put ESA-listed species and depleted marine mammal populations on the road to recovery". - Developing and implementing recovery and conservation activities - Responding to stranding events and conducting a marine animal health program - Developing publications and presentations and interacting in public forums for the purpose of outreach and education - Preparing U.S. positions on issues and initiatives for international meetings - Funding international conservation actions - Transferring technology to international partners
NMFS SEFSC Strategic Research Plan (2013-2018)	Research Themes 1, 2, 3	- Monitor and assess fisheries and ecosystems, including populations of exploited and protected species, their habitats, and the associated human communities that rely on marine resources - Understand and forecast effects of climate change and other factors in marine ecosystems - Describe and assess the role of habitats in supporting healthy marine ecosystems and populations of fish, invertebrates, and protected species

Table 3. NMFS Protected Species Stock Assessment Improvement Plan (SAIP) tier and data categories (modified from NMFS 2004, 2013)

Tier I	*Improve Stock Assessments Using Existing Data Collection Resources*. Under Tier I, no new assessment efforts were initiated, but the existing level of stock assessments is maintained and improved survey and analytic methods are developed
Tier II	*Elevate Stock Assessments to New National Standards of Excellence*. Under Tier II, ESA and MMPA mandates are met by conducting 'process-like research' to achieve level 2 for abundance, assessment, fishery mortality, and stock ID for all stocks and level 3 for these same categories for core species stocks in addition to providing information regarding life history and vital rates
Tier III	*Next Generation Assessments*. Under Tier III, high-level data would be available for all categories and habitat, behavioral, and physiological data would also be collected to provide a better understanding of ecosystem function and allow ecosystem-based approaches to assessments

Data Category/ Level	Description
Stock/Population Identification	
0	No information (qualitative or otherwise) available
1	Structure inferred from analyses undertaken for other purposes (e.g., distribution, differences in trends, differences in life history
2	Structure inferred from an analysis specifically aimed at investigating population differentiation (e.g., pollutants, stable isotopes, genetics, tagging)
3	Structure inferred from integrative analysis of at least two lines of evidence of the type listed under Level 2
4	Estimates of dispersal rate that include estimates of uncertainty
Life History/Vital Rates	
0	No information
1	Basic life history understood
2	Some age/stage parameters available
3	Age/stage parameters fully specified with uncertainty estimates
4	Seasonal and/or spatial information available
Abundance	
0	No information (qualitative or otherwise) available
1	Minimum count, abundance estimate, or index count
2	Unbiased estimate of abundance (CV≥30%)
3	Unbiased estimate of abundance (CV<30%) with seasonally OR geographically-explicit density
4	Seasonal and geographic-specific density estimates
Anthropogenic Impacts	
0	No information (qualitative or otherwise) available
1	Qualitative evidence of anthropogenic impacts
2	Minimum estimate of anthropogenic impacts
3	Unbiased estimate of anthropogenic impacts (CV≥30%)
4	Precise estimate of anthropogenic impacts (CV<30%) OR no evidence of human-induced mortality
Assessment Frequency	
0	No assessment conducted
1	Most recent assessment is ≥10 years old
2	Most recent assessment is 6-9 years old
3	Most recent assessment is 2-5 years old
4	Assessment completed in past year
Assessment Quality	
0	No assessments conducted
1	Assessment with minimum abundance or index only
2	Assessment using simple deterministic models with defaults or proxies
3	Assessment using more advanced deterministic models without defaults or proxies
4	Assessment using species-specific sophisticated models, such as stochastic models, depletion models, or projection models (e.g., population viability analysis, PVA)

Table 4. Summary of primary activities for STP staff located at NMFS SEFSC laboratories

Activity category	**NMFS SEFSC Laboratory**			
	Beaufort, NC	Miami, FL	Pascagoula, MS	Galveston, TX
Stock/population identification	x	x	x	x
Life history/ vital rates	x	x		x
Abundance	x	x		
Anthropogenic Impacts	x	x	x	x
Assessment frequency and quality	x	x		
Ecology	x	x		
Data and information dissemination	x	x	x	x