

Recovery Plan for the Northwest Atlantic Population of the Loggerhead Sea Turtle (*Caretta caretta*) Second Revision (2008)

Assessment of Progress Toward Recovery

December 2019

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Executive Summary

In July 2019, NMFS and USFWS reconvened the NW Atlantic Loggerhead Recovery Team to review progress toward recovery for the NW Atlantic Population of the Loggerhead Sea Turtle (*Caretta caretta*), 10 years after the publication of the Recovery Plan (2008).

The Recovery Team concluded that the 2008 Recovery Plan continues to be the appropriate roadmap to recovery for the NW Atlantic Population of loggerheads.

Although progress has been made, the Recovery Team is concerned that the Recovery Units (RUs) have not met most of the critical benchmarks to achieve the Demographic Recovery Criteria, that many of the Listing Factor Recovery Criteria are not yet being addressed, and that some critical Priority 1 Recovery Actions have not yet been implemented.

I. Progress Toward Demographic Recovery Criteria

1. Number of Nests and Number of Nesting Females

- The Peninsula Florida Recovery Unit (PFRU) represents the largest nesting assemblage and based on the recovery criterion of a 1% annual increase in the number of nests, the PFRU is not recovering. The Recovery Team expressed concern that there has not been a significant increase, based on a log-linear regression model in annual numbers of nests, for this Recovery Unit over the 30 years (1989-2018; $p = 0.61$) that this population has been monitored.
- The Northern Recovery Unit (NRU) is the second largest nesting assemblage and has an annual rate of increase in number of nests of 1.3% ($p = 0.04$) based on a log-linear regression model for 37 years of nesting data (1983-2019). This annual rate of increase is below the 2% criterion for achieving recovery.
- The Northern Gulf of Mexico Recovery Unit (NGMRU) is the third largest nesting assemblage and based on the recovery criterion of 3% annual increase in the number of nests, is not recovering. The log-linear regression model for 22 years of annual nesting (1997-2018) is non-significant ($p = 0.17$).
- The data for the Dry Tortugas Recovery Unit (DTRU), the smallest Recovery Unit, are too incomplete for robust analyses due to short time series with a large data gap.
- The Recovery Team expressed concern that the DTRU and NGMRU are small, genetically distinct nesting assemblages and highly vulnerable to catastrophic events.
- Based on genetic analyses of all nests laid in the NRU, the number of annual nests since 2010 significantly correlates to the number of annual nesting females. Therefore, this Demographic Recovery Criterion for the NRU is being accomplished. However, these data are not available to assess progress toward this recovery criterion for the PFRU, DTRU, nor NGMRU. A similar genetic assessment program needs to be designed and implemented for the DTRU and NGMRU. This type of genetic analysis is not practical for the PFRU because of the size of the nesting population; other techniques need to be explored for assessing clutch frequency and remigration interval for the PFRU.

2. Trends in Abundance on Foraging Grounds

This criterion has not been accomplished; a coordinated network of index in-water sites is yet to be achieved. A workshop sponsored by NMFS was held in November 2016 to address this critical need. The outcome from the workshop was that dedicated aerial surveys designed specifically for sea turtles and covering large geographic regions are needed but are not yet implemented. While two large-scale surveys covering multiple taxa are underway (Atlantic Marine Assessment Program for Protected Species - AMAPPS and Gulf of Mexico Marine Assessment Program for Protected Species - GoMAPPS) these have not been specifically evaluated for their appropriateness to generate long-term trends in abundance for sea turtles.

3. Trends in Stranding Relative to In-Water Abundance

The Team concluded that stranding data have not been sufficiently analyzed for demographic trends. Robust analyses need to be conducted for loggerhead strandings throughout their range.

II. Progress Toward Listing Factor Recovery Criteria

The Recovery Criteria under each of the Five Listing Factors were individually assessed for progress toward recovery. Critical issues that have not yet been sufficiently addressed are:

- Beach armoring, shoreline stabilizations structures, and all other barriers to nesting continue to be a serious threat to loggerhead sea turtle recovery.
- A strategy has not been developed to assess, evaluate, and protect important marine habitats for feeding, migration, and internesting for loggerheads.
- Light management on nesting beaches is essential. Although more than 90% of loggerhead nesting in FL takes places on nesting beaches governed by lighting ordinances, not all nesting beaches in FL, AL, GA, SC, and NC have lighting ordinances or have lighting ordinances that do not adequately protect loggerheads from the adverse effects of artificial lighting. Across the southeast, implementation and enforcement of lighting ordinances are highly variable, due to funding and resource priorities.
- Consistent reporting is needed to quantify the annual percentage of total nests, nesting females and hatchlings disoriented or misoriented by artificial lighting to assess this threat and gauge progress toward reducing it across all recovery units.
- While progress has been made, bycatch of loggerheads in commercial fisheries remains a significant threat that is not yet fully addressed.
- Vessel strike mortality is a significant threat that has not yet been addressed.
- Marine debris ingestion and entanglement by loggerheads in US and international waters continues to threaten loggerheads and has not yet been addressed.
- Loggerhead sea turtle recovery is conservation dependent and no progress has been made to develop and implement specific and comprehensive Federal and State legislation to ensure long-term (including post-delisting) protection of loggerheads and their terrestrial and marine habitats, including protection from anthropogenic threats (e.g., fishery bycatch, beach nourishment, coastal armoring, dredging).

III. Status of Priority 1 Recovery Actions

Each of the 34 Priority 1 Recovery Actions in the Recovery Plan were reviewed and assessed for progress toward implementation. In summary, none have been completed, 3 are monitoring actions and are ongoing, 26 have partial progress, and 5 have no progress to date. The Recovery Team outlined those Actions that need to be continued and implemented in order for progress on recovery to be made. This assessment is presented in detail in Section III of the 2019 Loggerhead Recovery Plan Progress Assessment.

IV. Threats

The Recovery Team reviewed the threats identified in the Recovery Plan and concluded that the identification of threats and the assessment of threat severity in the Threats Analysis remain applicable (e.g., fisheries bycatch remains the major threat in the marine habitat). No new threats were identified. However, the Recovery Team concluded that several of the identified threats can be classified as “emerging issues” and are of significant concern despite our inability to directly measure the population level effects at this time. These emerging issues are: climate change, aquaculture, power generation in the marine environment, plastics (microbeads and microfibers) in the marine environment, and harmful algal blooms (HABs).

Assessment of Progress Toward Recovery

Background:

NMFS and USFWS reconvened the NW Atlantic Loggerhead Recovery Team (16-18 July 2019) in Jacksonville, Florida, to determine the progress toward recovery for the Northwest Atlantic Population of the Loggerhead Sea Turtle (*Caretta caretta*) based on the criteria outlined in the Recovery Plan (2008). Prior to the in-person meeting in July, the Recovery Team had conference calls in March, April, May, and June in preparation for the July meeting.

The objectives for reconvening the Recovery Team were to

- review progress toward recovery (Demographic Recovery Criteria and Listing Factor Recovery Criteria),
- assess progress with regard to Priority 1 Recovery Actions, determine what Actions are being effectively implemented or need greater attention or if additional Actions not identified in the Plan are necessary,
- review threats to identify whether new threats have emerged that might be impeding recovery, and
- review progress toward addressing identified threats.

I. Demographic Recovery Criteria (Recovery Plan Section E.1):

As outlined in the Recovery Plan, to be considered for delisting, each recovery unit must have recovered to a viable level and each recovery unit must have increased for at least one generation. These rates of increase were dependent upon the level of vulnerability of each recovery unit. The minimum statistical level of detection (based on annual variability in nest counts over a generation time of 50 years) of 1% per year was used for the least vulnerable recovery unit (Peninsular Florida). A higher rate of increase of 3% per year was used for the most vulnerable recovery units (Dry Tortugas and Northern Gulf of Mexico). A rate of increase of 2% per year was used for the moderately vulnerable recovery unit (Northern).

Table 1 presents the annual number of nests used in the Recovery Team's 2019 assessment of progress in achieving the Demographic Recovery Criteria. The Recovery Team acknowledges the contribution of the Florida Fish and Wildlife Conservation Commission (FWC), Georgia Department of Natural Resources (GDNR), South Carolina Department of Natural Resources (SCDNR), North Carolina Wildlife Resources Commission (NCWRC), and FWS Alabama Ecological Services Field Office for these data.

1. Number of Nests and Number of Nesting Females

a. Northern Recovery Unit (NRU):

- (1) **Criterion:** There is statistical confidence (95%) that the annual rate of increase over a generation time of 50 years is 2% or greater.

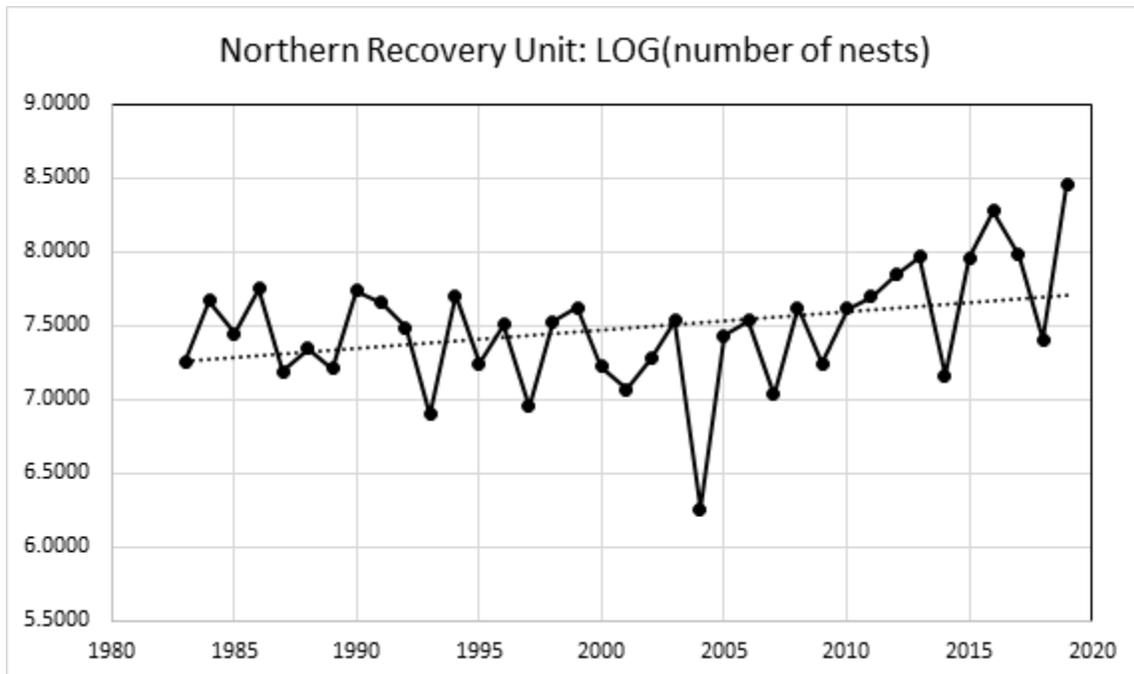


Figure 1. Log of annual loggerhead nest counts from the Northern Recovery Unit beaches, 1983-2019.

Recovery Team 2019 Progress Assessment: The rate of change in number of nests is increasing at an annual rate of 1.3% ($p = 0.04$) based on a log-linear statistical model for 37 years of nesting data (1983-2019). This rate of change is less than the 2% recovery criterion. Although there has been an observed increase in the number of nests for the past decade (total nests exceeded 14,000 for the first time in 2019), the Team cautions that looking at short term trends in nesting abundance can be misleading and needs to be considered in the context of one generation (= 50 years for loggerhead sea turtles) as specified in the Demographic Recovery Criteria.

(2) **Criterion:** This increase in the number of nests must be a result of corresponding increases in the number of nesting females (estimated from nests, clutch frequency, and remigration interval).

Recovery Team 2019 Progress Assessment: Based on genetic analyses of nearly all clutches laid in this Recovery Unit, the number of annual nests since 2010 significantly correlates ($p = 0.004$) to the number of annual nesting females (Shamblin et al. 2017, Georgia DNR and University of Georgia, unpublished data). Therefore, this Demographic Recovery Criterion for the NRU is being achieved.

b. Peninsular Florida Recovery (PFRU)

(1) **Criterion:** There is statistical confidence (95%) that the annual rate of increase over a generation time of 50 years is 1% or greater.

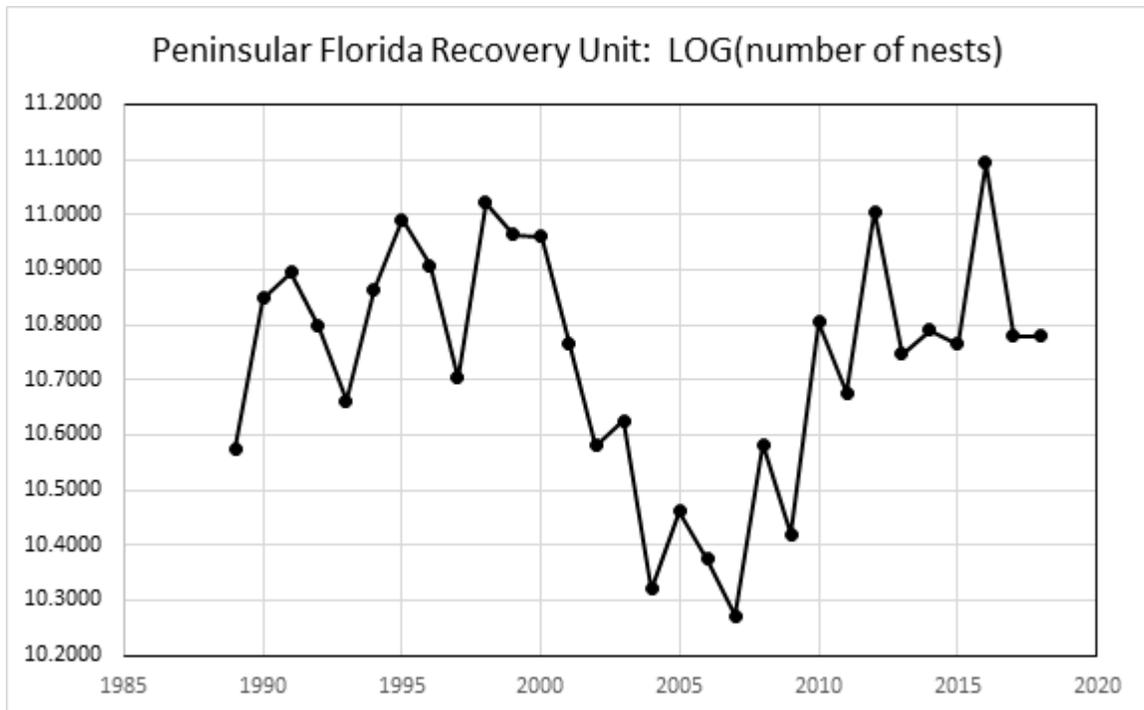


Figure 2. Log of annual loggerhead nest counts from Peninsular Florida Recovery Unit beaches, 1989-2018.

Recovery Team 2019 Progress Assessment: There is no significant change in the number of annual nests, based on a log-linear regression model for 30 years of nesting data (1989-2018; $p = 0.61$). Based on the recovery criteria of a 1% annual increase in the number of nests over a period of a generation, the PFRU is not recovering. Given that the PFRU represents the largest NW Atlantic nesting assemblage, the Recovery Team expressed concern that there has not been an increasing trend in annual numbers of nests for this Recovery Unit. Although there has been an observed increase in the number of nests for the past decade, the Team cautions that looking at short term trends in nesting abundance can be misleading and needs to be considered in the context of one generation (= 50 years for loggerhead sea turtles) as specified in the Demographic Recovery Criteria.

(2) **Criterion:** This increase in the number of nests must be a result of corresponding increases in the number of nesting females (estimated from nests, clutch frequency, and remigration interval).

Recovery Team 2019 Progress Assessment: These data are not available for the PFRU. Currently, it is not feasible to collect genetic data for the PFRU as has been done for the NRU because of the size of the nesting population. Alternate methodologies should be explored and implemented to be able to compare trends in numbers of nests with trends in number of nesting females.

c. Dry Tortugas Recovery Unit (DTRU):

- (1) **Criterion:** There is statistical confidence (95%) that the annual rate of increase over a generation time of 50 years is 3% or greater.

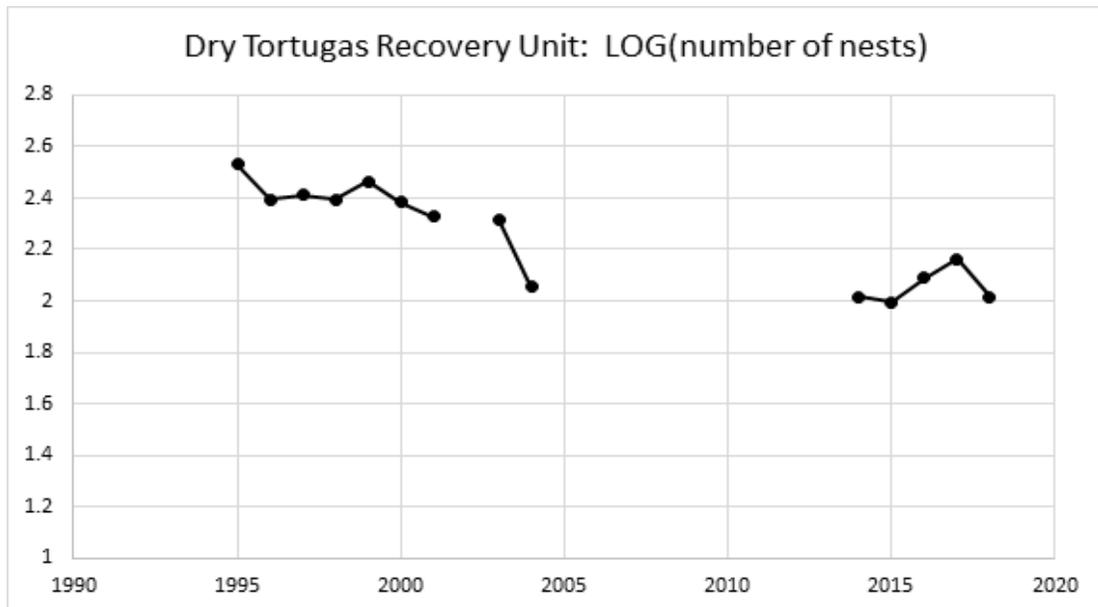


Figure 3. Log of annual loggerhead nest counts from the Dry Tortugas Recovery Unit beaches, 1995-2018, excluding 2002 and 2005-2013.

Recovery Team 2019 Progress Assessment: The data for the DTRU are too incomplete (i.e., too short a time series and gaps in the data) for robust analyses. A consistent monitoring program needs to continue to assess nesting trends in the DTRU and assess progress towards recovery.

- (2) **Criterion:** This increase in the number of nests must be a result of corresponding increases in the number of nesting females (estimated from nests, clutch frequency, and remigration interval).

Recovery Team 2019 Progress Assessment: These data are not available for the DTRU. Because of the size and geographic distribution of this RU, genetic analyses similar to those of the NRU are feasible and the Team recommends incorporating genetic analyses into the DTRU monitoring program.

d. Northern Gulf of Mexico Recovery Unit (NGMRU):

- (1) **Criterion:** There is statistical confidence (95%) that the annual rate of increase over a generation time of 50 years is 3% or greater.

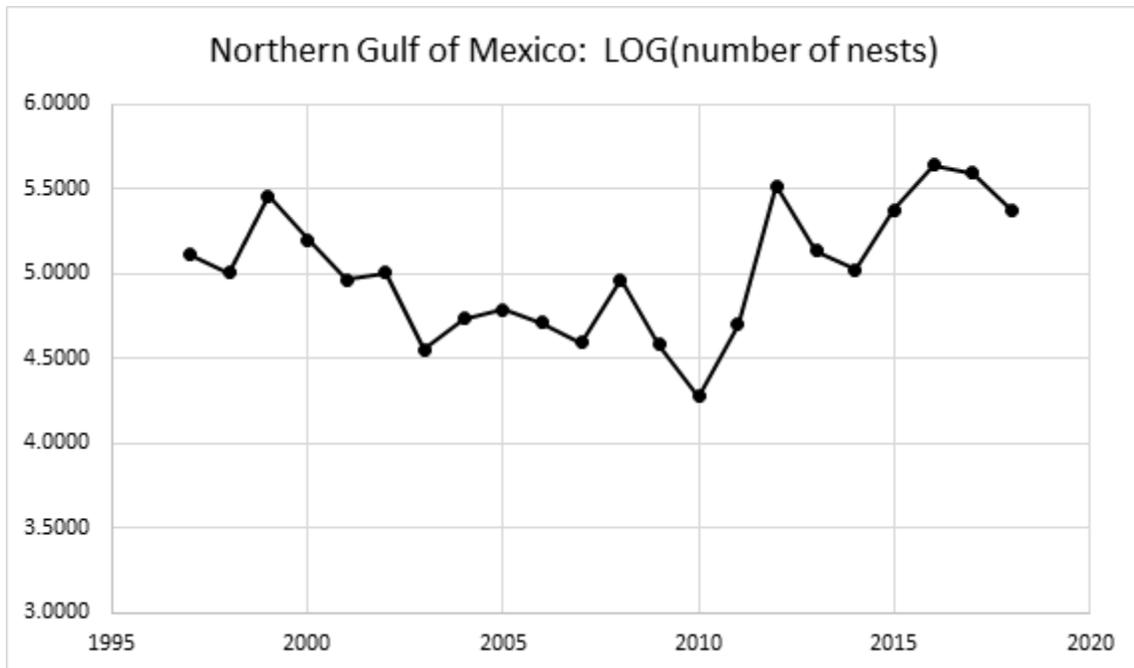


Figure 4. Log of annual loggerhead nest counts from Northern Gulf of Mexico Recovery Unit beaches, 1997-2018.

Recovery Team 2019 Progress Assessment: Based on a log-linear regression model for 22 years of annual nest numbers (1997-2018), the annual rate of change in number of nests is a non-significant increase of 1.7% ($p = 0.174$), far below the 3% indicated in the recovery criteria. Although there has been an observed increase in the number of nests in recent years, the Team cautions that looking at short term trends in nesting abundance can be misleading and needs to be considered in the context of one generation (= 50 years for loggerhead sea turtles) as specified in the Demographic Recovery Criteria.

(2) **Criterion:** This increase in the number of nests must be a result of corresponding increases in the number of nesting females (estimated from nests, clutch frequency, and remigration interval).

Recovery Team 2019 Progress Assessment: These data are not available for the NGMRU. Because of the size and geographic distribution of this RU, genetic analyses similar to those of the NRU are feasible and the Team recommends incorporating genetic analyses into the NGMRU monitoring program.

2. Trends in Abundance on Foraging Grounds

Criteria: A network of index in-water sites, both oceanic and neritic, distributed across the foraging range is established and monitoring is implemented to measure abundance. There is statistical confidence (95%) that a composite estimate of relative abundance from these sites is increasing for at least one generation.

Recovery Team 2019 Progress Assessment: This criterion has not been accomplished; a coordinated network of index in-water sites is yet to be achieved. A workshop sponsored by NMFS was held in November 2016 to develop and evaluate methods to determine abundance and trends of NW Atlantic loggerheads on foraging grounds. The outcome from the workshop was that dedicated aerial surveys appropriately designed for sea turtles, and covering large geographic regions, were the best approach to monitoring abundance. Although two large-scale surveys covering multiple taxa are underway (Atlantic Marine Assessment Program for Protected Species - AMAPPS and Gulf of Mexico Marine Assessment Program for Protected Species - GoMAPPS) these have not been specifically evaluated for their appropriateness to generate sea turtle indices of abundance, nor are they long-term efforts. The Recovery Team concluded that large-scale aerial surveys properly designed to assess trends in in-water abundance of loggerheads, in addition to a coordinated network of index in-water sites, are still needed to assess progress for this Demographic Recovery Criterion.

3. Trends in Strandings Relative to In-water Abundance

Criteria: Stranding trends are not increasing at a rate greater than the trends in in-water relative abundance for similar age classes for at least one generation.

Recovery Team 2019 Progress Assessment: Stranding data have not been sufficiently analyzed for demographic trends and in-water trends are not yet determined. The Team recommended that geographically broad, robust analyses be conducted regarding trends in loggerhead strandings throughout their range.

II. Listing Factor Recovery Criteria (Recovery Plan Section E.2):

The five Listing Factor Recovery Criteria were individually assessed for progress toward recovery.

1. Present or Threatened Destruction, Modification, or Curtailment of a Species Habitat or Range

a. Terrestrial

(i.a) Beach armoring, shoreline stabilization structures, and all other barriers to nesting are categorized and inventoried for areas under U.S. jurisdiction.

Recovery Team 2019 Progress Assessment: The data may exist but are not compiled. Baseline levels have not been determined for any state. Florida has a representative index of all barriers (Witherington et al. 2011) and a draft inventory of beach armoring that covers armoring and shoreline stabilization structures but not all other barriers to nesting (Florida Beaches Habitat Conservation Plan (in progress), HCP).

(i.b) A peer-reviewed strategy is developed and implemented to ensure that the percentage of nesting beach free of barriers to nesting is stable or increasing relative to baseline levels.

Recovery Team 2019 Progress Assessment: Nesting beach free of permanent barriers is decreasing. A workshop was held in 2016 to evaluate the impact of permanent barriers on sea turtles. The Florida Beaches Habitat Conservation Plan (HCP) is in progress and working toward an implementation strategy to minimize the impacts of ongoing beach armoring. The Recovery Team recommends a strategy be developed for the entire loggerhead nesting range. Local ordinances in a limited number of counties have been developed to address non-permanent barriers (i.e., beach furniture) to nesting. The Recovery Team recommends that these ordinances be expanded and adopted throughout the loggerhead nesting range.

(ii) Beach sand placement projects conducted in areas under U.S. jurisdiction are in compliance with state and FWS criteria and are conducted in a manner that accommodates loggerhead needs and does not degrade or eliminate nesting habitat.

Recovery Team 2019 Progress Assessment: For the most part, sand placement projects on nesting beaches are conducted in compliance with state and FWS criteria, and the Team recommends this compliance continue. Work should continue to minimize nesting effects by further refining criteria, such as beach slope and post-placement hardening (as can result from fine calcium carbonate sediment composition). The Team expressed concern over the timing of beach nourishment projects and recommends projects be conducted in the non-nesting season to minimize effects on loggerhead reproduction.

(iii) At least 1,581 km of loggerhead nesting beaches and adjacent uplands (current amount as identified in Appendix 4 of the Recovery Plan) under U.S. jurisdiction are maintained within conservation lands in public (Federal, state, or local) or private (NGO and private conservation lands) ownership that are managed in a manner compatible with sea turtle nesting.

Recovery Team 2019 Progress Assessment: 1,581 km have been maintained and some additional lands have been acquired in AL and GA.

(iv) A peer-reviewed model is developed that describes the effects of sea level rise on loggerhead nesting beaches, and steps have been taken to mitigate such effects.

Recovery Team 2019 Progress Assessment: Multiple models exist predicting sea level rise along loggerhead nesting habitat. These models were developed for other purposes but we can infer from these models the effects on nesting habitat. A pilot study was done for SE FL specific for sea turtles to forecast the 2028 shoreline to determine the dune base position and quantify the beach width. There have essentially been no steps taken to protect loggerhead nesting habitat from impending sea level rise. Conservation easements have been proposed and are under exploration, but outcomes may be limited to

individual parcel protection and this approach may not be feasible across large geographic areas.

(v) Nesting beaches outside U.S. jurisdiction are managed for compatibility with loggerhead nesting.

Recovery Team 2019 Progress Assessment: Data are not immediately available to evaluate whether this criterion is being met.

b. Marine (estuarine, neritic, and oceanic)

A peer-reviewed, comprehensive strategy is developed and implemented to identify, prioritize, and protect marine habitats (e.g., feeding, migratory, internesting) important to loggerheads.

Recovery Team 2019 Progress Assessment: A strategy has not been developed to assess, evaluate, and protect important marine habitats for feeding, migratory, and internesting habitat for loggerheads. Critical marine habitat has been designated under the ESA for NW Atlantic loggerheads, providing additional regulatory review under Section 7. There have been a number of European initiatives, that include the mid-Atlantic ridge and Macaronesian States, to protect seamounts which are important oceanic stage loggerhead development areas (Santos et al. 2007).

2. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

- a. i. Legal harvest (both commercial and subsistence) in the Caribbean, Atlantic, and Mediterranean is identified and quantified.

Recovery Team 2019 Progress Assessment: Appendix 3 of the Recovery Plan identifies (but does not quantify) specifics of legal harvest outside the US in the loggerhead range (there is no legal harvest in the Mediterranean). Additional effort is needed to fully understand the level of legal take of sea turtles outside the US.

- a. ii. A strategy is developed and implemented to eliminate legal harvest through international agreements.

Recovery Team 2019 Progress Assessment: The Inter-American Convention (IAC) for the Protection and Conservation of Sea Turtles is an intergovernmental treaty that provides the legal framework for countries in the Americas and the Caribbean to take actions for the benefit of sea turtles. The IAC prohibits direct harvest with potential exception for traditional economic subsistence. Not all nations within the loggerhead range are party to the IAC. Since the Recovery Plan was finalized in 2008, The Bahamas has prohibited harvest of all sea turtles as of 2009. No formal strategy has been developed outside of IAC, however with the cessation of harvest in The Bahamas most countries with significant NW Atlantic Loggerhead assemblages prohibit harvest.

- b. A scientifically based nest management plan outlining strategies for protecting nests (under U.S. jurisdiction) from natural and manmade impacts is developed and implemented.

Recovery Team 2019 Progress Assessment: Most states with significant loggerhead nesting have developed management plans to guide nest protection. Efforts should focus on ensuring consistency across states and to ensure that the least manipulative nest protection strategies are employed.

3. Disease or Predation

- a. Ecologically sound predator control programs are implemented to ensure that the annual rate of mammalian predation on nests (under U.S. jurisdiction) is 10% or below within each recovery unit based on standardized surveys.

Recovery Team 2019 Progress Assessment: Programs are in place throughout the US loggerhead nesting range that control predation at or below 10% within each recovery unit.

- b. A peer-reviewed strategy is developed to recognize, respond to, and investigate mass/unusual mortality or disease events.

Recovery Team 2019 Progress Assessment: NMFS created and funded a new veterinary pathologist position to serve a national role to lead investigations of unusual, mass mortality, or disease events, working in conjunction with the states. Strategies have been developed and implemented to respond to cold stunning events throughout the US loggerhead range.

4. Inadequacy of Existing Regulatory Mechanisms

- a. i. Light management plans, which meet minimum standards identified in the Florida Model Lighting Ordinance (Florida Administrative Code Rule 62B-55), are developed, fully implemented, and effectively enforced on nesting beaches under U.S. jurisdiction.

Recovery Team 2019 Progress Assessment: Florida Administrative Code (FAC) has been updated to reflect new information and new technologies. More than 90% of loggerhead nesting in FL takes places on nesting beaches subjected to lighting ordinances that meet the FAC criteria. In GA, all nesting beaches with human development and artificial lighting are subject to lighting ordinances. In SC, NC, and AL, very few nesting beaches have local lighting ordinances. The existing ones do not conform to current effective minimization measures as outlined in the FAC criteria (considered to be best practice). Implementation and enforcement are highly variable, due to different government entities involved, availability of funding and staff, and varying levels of prioritizing light management on nesting beaches.

- a. ii. Annual percentage of total nests with hatchlings disoriented or misoriented by artificial lighting does not exceed 10% based on standardized surveys.

Recovery Team 2019 Progress Assessment: This cannot be currently quantified. Efforts are underway in NC, SC, GA, FL, and AL to develop program(s)/methodologies to enable quantification. Significant efforts are needed to move toward implementation that can result in quantification.

- b. Specific and comprehensive Federal legislation is developed, promulgated, implemented, and enforced to ensure long-term (including post-delisting) protection of loggerheads and their terrestrial and marine habitats, including protection from fishery interactions.

Recovery Team 2019 Progress Assessment: Progress has not been made on this critical issue. Loggerhead sea turtles are a conservation-dependent species and comprehensive Federal legislation is needed to ensure long-term (including post-delisting) protection of loggerheads and their terrestrial and marine habitats.

- c. State and local legislation is developed and/or maintained, promulgated, implemented, and enforced to ensure long-term (including post-delisting) protection of loggerheads and their terrestrial and marine habitats, including protection from fishery interactions.

Recovery Team 2019 Progress Assessment: State and local laws vary in their scope, strength, and level of enforcement. These laws are not comprehensive and are generally focused on nesting turtles, hatchlings, and nest protection. With a few exceptions, fishery bycatch reduction requirements are rooted in Federal legislation, efforts should be undertaken at the state level to ensure that state managed fisheries are assessed for sea turtle bycatch and actions are taken to minimize sea turtle bycatch.

- d. Foreign nations with significant loggerhead foraging or migratory habitat have implemented national legislation and have acceded to international and multilateral agreements to ensure long-term protection of loggerheads and their habitats. Nations that have important foraging or migratory habitat include Canada, Mexico, Cuba, The Bahamas, Turks and Caicos Islands, Nicaragua, Panama, Colombia, Spain, Portugal, Morocco, and Cape Verde Islands.

Recovery Team 2019 Progress Assessment: The Recovery Team recommends that NMFS, FWS, and DOS increase efforts to encourage Canada and The Bahamas to accede to the IAC. Canada listed the loggerhead turtle as Endangered under the Species at Risk Act in 2017. Increased focus on identification of Marine Protected Areas is likely to have positive effects on the protection of some loggerhead habitats particularly for oceanic waters. Protection of the Sargasso Sea is critical to long-term loggerhead habitat protection. Efforts should be supported and encouraged to protect this habitat. An updated inventory of national legislation in non-US range states is needed.

- e. Nations that conduct activities affecting loggerheads in foraging or migratory habitats in the North Atlantic Basin and the western Mediterranean have implemented national legislation and have acceded to international and multilateral agreements to ensure long-term protection of loggerheads and their habitats throughout the high seas and in foreign EEZs.

Recovery Team 2019 Progress Assessment: There is limited progress on this criterion. There have been some efforts by EU nations to protect seamounts which are important developmental and foraging areas for oceanic loggerheads (Santos et al. 2007). The International Convention for the Prevention of Pollution from Ships (MARPOL) came into force in 1973; this agreement should help to reduce plastics and other debris in the marine environments inhabited by NW Atlantic loggerheads, but this remains an increasing threat.

5. Other Natural or Manmade Factors Affecting Its Continued Existence

- a. A peer-reviewed strategy is developed and fully implemented to minimize fishery interactions and mortality for each domestic commercial fishing gear type that has loggerhead bycatch.

Recovery Team 2019 Progress Assessment: While a peer-reviewed strategy has not been developed, progress has been made to reduce loggerhead bycatch to various degrees in some fisheries, including otter trawl for shrimp, longline, and some gillnet and pound net fisheries; however, some of these fisheries continue to capture and kill loggerheads and additional measures should be taken to further reduce bycatch. Other fisheries that have loggerhead bycatch have not yet been addressed (e.g., lobster and crab pot/trap/vertical line fisheries). Additionally, efforts should be enhanced to evaluate outcomes of regulatory measures designed to reduce NW Atlantic loggerhead bycatch to ensure their effectiveness to guide adaptive management. In September 2019, NMFS convened a Sea Turtle Bycatch Reduction Prioritization Workshop to prioritize NMFS bycatch reduction efforts for all sea turtle species.

- b. A peer-reviewed strategy is developed and fully implemented in cooperation with relevant nations to minimize fishery interactions and mortality of loggerheads in foreign EEZs and on the high seas.

Recovery Team 2019 Progress Assessment: There is limited progress. There are no binding requirements in place to reduce bycatch of NW Atlantic loggerheads in foreign EEZs or the high seas. The US has made numerous attempts to advance bycatch reduction measures in longline fisheries for loggerhead turtles in ICCAT, with limited success.

- c. A peer-reviewed strategy is developed and fully implemented to quantify, monitor, and minimize effects of trophic changes on loggerheads (e.g., diet, growth rate, fecundity) from fishery harvest and habitat alterations.

Recovery Team 2019 Progress Assessment: No progress has been made on this criterion. The Team recommends that efforts be undertaken to understand the effects of loggerhead prey harvest and habitat alterations on the NW Atlantic loggerhead population.

- d. A peer-reviewed strategy is developed and fully implemented to quantify, monitor, and minimize the effects of marine debris ingestion and entanglement in U.S. territorial waters, the U.S. EEZ, foreign EEZs, and the high seas.

Recovery Team 2019 Progress Assessment: No progress has been made on this criterion.

- e. A peer-reviewed strategy is developed and fully implemented to minimize vessel strike mortality in U.S. territorial waters and the U.S. EEZ.

Recovery Team 2019 Progress Assessment: Efforts have been conducted to understand how vessels interact with sea turtles and what strategies might be used to reduce vessel strikes. Stranding data have been analyzed to identify hotspots for vessel interactions in FL and GA. A workshop was conducted to identify strategies for reducing vessel strikes. A pilot project is underway in FL that incorporates education and voluntary speed reduction in an identified vessel strike hotspot.

III. Assessment of Priority 1 Recovery Actions (Recovery Plan Section F):

Each of the 34 Priority 1 Recovery Actions in the Recovery Plan were reviewed and assessed for status and progress of implementation. The Recovery Team used the following assessment categories:

No Progress	no planning, design, or implementation work has been done
Partial Progress	planning, design, or implementation is underway but further work is needed to bring the action to completion
Ongoing	full action is ongoing (includes actions that are continuous and needed into the future)
Completed	action has been successfully completed, no work remains to be done

In summary, no recovery actions have been completed, 3 are ongoing, 26 have partial progress, and 5 have no progress to date. To facilitate summarizing these Critical Actions needed to ensure recovery, the Recovery Team divided the Actions into 3 categories: (1) Monitoring Actions, (2) Terrestrial Actions, and (3) Marine Actions. The Recovery Team reached consensus that the following Actions and Action Groups should be given highest priority for implementation and/or continuation to ensure progress towards recovery.

(1) Monitoring Actions:

These monitoring actions are required to collect the demographic data needed to assess progress toward recovery based on the Demographic Recovery Criteria. These actions are ongoing and need to be continued.

[Action 122]: Continue to monitor trends in nesting and non-nesting emergences on index/standardized beaches. Nesting surveys need to be continued to assess trends in annual numbers of nests and evaluate progress toward achieving the Demographic Recovery Criteria. Because the recovery criteria require that any increase in the number of nests must be a result of corresponding increases in the number of nesting females, genetic research to determine annual nesting female population size for the NRU should be continued and similar programs should be developed and implemented for the DTRU and NGMRU. Estimates of the number of nesting

females using PFRU beaches should be estimated through research to determine clutch frequency and remigration intervals.

[Action 134]: Implement large-scale in-water surveys to estimate indices of abundance and determine trends. This is a critical Recovery Action that is not yet accomplished that needs to be fully implemented to be able to assess progress towards recovery. A workshop sponsored by NMFS was held in November 2016 to address this critical need. The outcome from the workshop was that dedicated aerial surveys appropriately designed for sea turtles, and covering large geographic regions, were the best approach to monitoring abundance. Of While two large-scale surveys covering multiple taxa are underway (Atlantic Marine Assessment Program for Protected Species - AMAPPS and Gulf of Mexico Marine Assessment Program for Protected Species - GoMAPPS) these have not been specifically evaluated for their appropriateness to generate robust indices of abundance for loggerheads. The Recovery Team concluded that the design and implementation of broad-scale aerial surveys for loggerheads need to be accomplished to be able to assess progress for the Demographic Recovery Criterion: Trends in Abundance on Foraging Grounds.

[Action 171]: Maintain the Sea Turtle Stranding and Salvage Network. The STSSN has provided critically important information regarding loggerhead mortality and mortality factors. The network should be continued and enhanced where appropriate. However, stranding data have not yet been sufficiently analyzed for demographic trends and fully assessed for causes of mortality. The Team recommends that geographically broad, robust analyses be conducted to evaluate trends in loggerhead strandings throughout their range.

(2) Terrestrial Actions:

[Action 2223, complementary Actions: 2221, 2222, and 2228]: Ensure regulations governing placement and design of new coastal buildings and infrastructure eliminate any future need for coastal armoring. The Recovery Team recommends the following:

- Minimize proliferation of coastal armoring and ensure that the percentage of nesting beach free of any barriers to nesting is stable or increasing relative to baseline levels determined in Recovery Action 221.
- Establish programs so that following storms or other coastal events, homeowners have immediate options other than armoring, and funds are readily available to purchase coastal lands for protected status (Action 231).
- Acquire land for protected status. This is particularly critical for Hutchinson Island (Action 2322), and parcels within the Archie Carr National Wildlife Refuge (Action 2321).
- Encourage more effort toward conservation easements to ensure sea turtle nesting habitat remains available for the long term.

(3) Marine Actions:

[Action 6227, complementary Actions 6224 and 6229]: Monitor and reduce effort in the domestic commercial shrimp trawl fishery to minimize loggerhead bycatch. During the 2019 Assessment, the Team recognized that the TED program has been successful, must continue, and compliance needs to be maintained at a very high level. TEDs need to be mandated for trawl nets and skimmer trawls. TEDs also need to be considered for all non-shrimp trawl fisheries where loggerhead bycatch has been identified.

[Action 6246, complementary Priority Actions are 6247, 633, 638]: Promulgate regulations to implement proven measures that minimize loggerhead interactions with commercial pelagic and demersal longline fisheries. Comprehensive data are needed to estimate loggerhead bycatch throughout the NW Atlantic. The US should continue to work to advance the use of large circle hooks (18/0 or equivalent) and whole finfish bait by all ICCAT member states, throughout the ICCAT area of jurisdiction as well as require the collection of sea turtle bycatch data sufficient to robustly estimate bycatch throughout the NW Atlantic.

[Action 6245: Investigate the effectiveness of time-area closures to minimize loggerhead interactions in domestic commercial pelagic and demersal longline fisheries.] The Team recognized the need for analysis of fishing effort and loggerhead distribution data to determine whether there are times and/or areas that can be identified for targeted bycatch reduction measures.

[Action 6214: Implement measures to minimize bycatch in large mesh gillnet fisheries and Action 6215: Implement measures to minimize bycatch in other gillnet fisheries as appropriate.] The Team recognized that the collective mortality across all gillnet fisheries is likely high and needs to be more thoroughly assessed and reduced in state and federal waters.

[Action 662: Develop and implement a strategy to reduce vessel interactions with loggerheads.] Pilot efforts have very recently been initiated to attempt to reduce this threat. Analyses of STSSN data have identified hotspots for vessel strikes in FL and GA, similar analyses are needed throughout the rest of the species range. See Foley et al. (2019) for a discussion of the severity of this threat.

IV. Threats (Recovery Plan Section H):

The Recovery Team reviewed the threats identified in the Recovery Plan and concluded that the identification of threats and the assessment of threat severity in the Threats Analysis remain applicable (e.g., fisheries bycatch remains the major threat in the marine habitat). No new threats were identified. However, the Recovery Team concluded that several of the identified threats can be classified as “emerging issues” and are of significant concern despite our inability to directly measure the population level effects at this time. These emerging issues are:

Climate change: Climate change will have major effects on many aspects of loggerhead biology and will affect them in profound and varied ways, directly and indirectly (e.g., prey alterations, Gulf Stream alterations, sex ratio alterations, nesting habitat alterations).

Aquaculture: Expansion of marine aquaculture is expected in the coming years. Much of this aquaculture will overlap NW Atlantic loggerhead habitat. Significant concerns exist with regard to effects of aquaculture on sea turtles, these include, but are not limited to, entanglement and entrapment in aquaculture installations and concerns regarding disease risk and marine pollution from food and waste.

Power generation in the marine environment: Wind and wave turbines installed in the marine habitat may cause significant destruction of benthic habitats where the installations are anchored and wave turbines may entrain and kill turtles. In addition, these installations may cause significant electromagnetic fields around the cables carrying electrical energy from the turbines that can cause sensory disruption in migrating turtles.

Micro and mesoplastics in the marine environment: Plastic marine pollution may not only cause mechanical threats through ingestion and entanglement, but microplastics (microbeads and microfibers) may cause immunosuppression and can act as endocrine disrupters.

Harmful Algal Blooms (HABs): Increased frequency and duration of HABs, possibly a result of climate change, will pose an increasing threat to sea turtles.

Citations

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Table 1. Annual number of nests for each Recovery Unit: NRU = Northern Recovery Unit; PFRU = Peninsular Florida Recovery Unit; DTRU = Dry Tortugas Recovery Unit; NGMRU = Northern Gulf of Mexico Recovery Unit. LOG is the natural log for the annual number of nests in each Recovery Unit. Red numbers in the DTRU are numbers of nests carried over from the Recovery Plan (2008) and not included in the current FWC inventory due to changes in survey effort. The Recovery Team agreed that these data represent the best available data for analyses.

Year	NRU	LOG(NRU)	PFRU	LOG(PFRU)	DTRU	LOG(DTRU)	NGMRU	LOG(NGMRU)
1983	1,418	7.2570						
1984	2,144	7.6704						
1985	1,709	7.4437						
1986	2,317	7.7480						
1987	1,323	7.1877						
1988	1,553	7.3479						
1989	1,351	7.2086	39,146	10.5751				
1990	2,292	7.7372	51,412	10.8476				
1991	2,120	7.6592	53,899	10.8949				
1992	1,779	7.4838	48,873	10.7970				
1993	992	6.8997	42,691	10.6617				
1994	2,218	7.7044	52,281	10.8644				
1995	1,396	7.2414	59,381	10.9917	340	2.5315		
1996	1,827	7.5104	54,559	10.9070	249	2.3962		
1997	1,047	6.9537	44,520	10.7037	258	2.4116	166	5.1120
1998	1,855	7.5256	61,149	11.0211	249	2.3962	149	5.0039
1999	2,039	7.6202	57,766	10.9642	292	2.4654	235	5.4596
2000	1,368	7.2211	57,507	10.9597	242	2.3838	181	5.1985
2001	1,177	7.0707	47,333	10.7650	213	2.3284	143	4.9628
2002	1,449	7.2786	39,328	10.5797			149	5.0039
2003	1,874	7.5358	41,164	10.6253	208	2.3181	95	4.5539
2004	520	6.2538	30,357	10.3208	113	2.0531	114	4.7362
2005	1,694	7.4348	34,929	10.4611			120	4.7875
2006	1,871	7.5342	32,034	10.3746			111	4.7095
2007	1,133	7.0326	28,876	10.2708			99	4.5951
2008	2,041	7.6212	39,460	10.5830			143	4.9628
2009	1,403	7.2464	33,532	10.4203			98	4.5850
2010	2,030	7.6158	49,281	10.8053			72	4.2767
2011	2,205	7.6985	43,328	10.6766			110	4.7005
2012	2,547	7.8427	60,247	11.0062			250	5.5215
2013	2,881	7.9659	46,449	10.7461			170	5.1358
2014	1,289	7.1616	48,578	10.7909	104	2.0170	152	5.0239
2015	2,864	7.9600	47,339	10.7651	99	1.9956	217	5.3799
2016	3,946	8.2805	65,807	11.0945	123	2.0899	283	5.6454
2017	2,925	7.9810	48,033	10.7796	146	2.1644	269	5.5947
2018	1,643	7.4043	48,045	10.7799	104	2.0170	216	5.3753
2019	5,555	8.6225						