NC Sea Turtle Project

Volunteer Handbook

Revised: 2023

ABOUT THIS HANDBOOK

This Handbook was developed to aid volunteers and other collaborators in the NC Sea Turtle Project in ensuring their management practices comply with the law and are biologically sound. Note that all sea turtle species found in the US are protected by state and federal laws. As such, it is unlawful for anyone to conduct work with sea turtles in North Carolina without authorization from the NCWRC, either as a permit holder or by working as part of a permitted volunteer program. If in doubt, please contact the NCWRC for further information.

These guidelines are meant to provide appropriate protocols for dealing with sea turtles in North Carolina. If you are ever uncertain about what the appropriate action is, please make every attempt to contact the NCWRC Sea Turtle Stranding Coordinator and/or Sea Turtle Biologist BEFORE doing anything (call the Sea Turtle Hotline at **252-241-7367)**. The NCWRC is also open to suggestions and discussions concerning any topic related to sea turtle management.

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The North Carolina Wildlife Resources Commission gratefully acknowledges the contribution of volunteers and cooperators toward the protection of sea turtles in the State. The actions of a large, engaged network contribute to the recovery of these animals.

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General Permit Guidelines for Volunteers and Cooperators

The NC Wildlife Resources Commission (NCWRC) is responsible for the protection of nesting sea turtles, their eggs, and hatchlings by general statutes of North Carolina (GS 113-129, GS 113-331 & GS 113-333) and NC Administrative Code 15A NCAC 10I.0102. In addition, the NCWRC has authority granted to the state through Cooperative Agreements with the US Fish & Wildlife Service and NOAA-National Marine Fisheries Service, to conserve nesting turtles, incubating eggs, and emergent hatchlings, and respond to stranded sea turtles in North Carolina. The NCWRC Sea Turtle Project has two primary components: documenting and protecting sea turtle nests and hatchlings on coastal North Carolina beaches; and responding to sick, injured or dead sea turtles that occur along the North Carolina coast. The primary goal of the NCWRC Sea Turtle Project is to facilitate the recovery of sea turtle populations that occur in North Carolina. Towards this end, all management and protection actions for sea turtles undertaken in North Carolina will minimize impacts on the natural order of reproduction and other aspects of their life cycle.

The NCWRC provides annual Endangered Species Permits ("Letters of Authorization") to various individuals or entities engaged in conservation activities, including nest monitoring, nest protection, hatchling protection, nest inventories, stranding response, rehabilitation, and research. For permits issued to entities, the person named (generally the coordinator or director) is responsible for the actions of all individuals who work under that entity (authorized individuals). Each permit authorizes specific activities that can be undertaken by that individual or entity. The permit holder and all authorized personnel are expected to know the conditions and responsibilities associated with the permit, as described in the permit and in this Handbook.

The permit holder and authorized individuals should carry identification and either a badge or copy of the permit when conducting authorized activities. You may be asked by law enforcement officials to provide proof that you are authorized to conduct such activities, and you may be approached similarly by individuals who may be concerned that your actions are harmful or unlawful. Please respond in a calm and thoughtful manner when you are confronted with these situations, and keep in mind that you represent the larger sea turtle conservation community (refer to the Code of Conduct below).

This Handbook describes actions and protocols that are deemed acceptable for the conservation of sea turtles in North Carolina. The permit holder and authorized personnel may engage in only those activities specified in their sea turtle permit. That is, not all permit holders may be authorized to conduct all activities listed in this Handbook. It is the responsibility of the permit holder and authorized individuals to understand the actions that are allowed by their permit. If you are faced with a situation or conditions not covered by this Handbook, or are unsure in any situation, please contact the NCWRC Sea Turtle Stranding Coordinator and/or Sea Turtle Biologist BEFORE doing anything (call the Sea Turtle Hotline at **252-241-7367**).

Code of Conduct

The oceanside coastline of North Carolina is regularly used as nesting habitat by sea turtles in summer months. In addition, many people, both local and from far away, visit the beautiful beaches of North Carolina in summer and fall months. This creates a unique opportunity for sea turtle volunteers to help raise awareness and advocate for sea turtles through their interactions with beach visitors. The attitude and demeanor of all sea turtle volunteers will influence the public's perception of sea turtles and sea turtle conservation. The following guiding principles are intended to reinforce respect and trust between sea turtle volunteers and beach visitors, and engender strong support for sea turtle conservation in North Carolina:

1. Each volunteer should act in a manner that promotes trust and confidence through their actions that should exude courtesy, civility, transparency, honesty, and kindness.
2. Each volunteer should remember that s/he is a trained professional and should present a professional demeanor and decorum.
3. Use each interaction with the public as an opportunity to provide education, as well as to increase awareness and support of sea turtle conservation.
4. Beach visitors are encouraged, through example, to act courteously and respectfully of volunteers, and respond appropriately to volunteer requests/directions, to maintain the safety of the nest, hatchlings, and nesting turtles.
5. In cases where individuals are acting in a manner that could negatively affect sea turtles, remain professional and calm, and recommend actions that would minimize impacts on sea turtles.
6. Coarse, profane, or argumentative language is unacceptable when interacting with the public. Avoid shouting or being overly loud.
7. If volunteers feel unsafe, they should remove themselves from the situation as quickly as possible and contact local law enforcement to report the situation and request assistance.
8. If someone is tampering with a nest, use best judgment to decide if it is safe to approach them and ask them to stop. If the situation appears unsafe, do not confront them. Watch from a safe distance and call local law enforcement for assistance.

Social Media Policy

Volunteers and cooperators who are in the field and on the beach working with turtles and their nests are the public face of the NC Sea Turtle Project. Similarly, when posting to social media, volunteers and cooperators are acting as members of the NC Sea Turtle Project. Photos, videos, texts, etc., posted to social media should be consistent with authorized actions laid out in these guidelines. When in doubt, the best course of action is to not post to social media. In addition, be mindful when responding to comments to social media posts and avoid being baited into debates. For transparency, we require all social media posts concerning volunteer work with sea turtles in North Carolina to include a statement about official authorization for the work. For example, for sea turtle volunteers in Atlantic Beach, the following text should be included with each social media post:

> This conservation work for protected sea turtles in Atlantic Beach is authorized by the NC Wildlife Resources Commission (ES Permit XXSTYY).
> **note that XX and YY are specific to each project. Please consult your volunteer coordinator or director for the specific permit ID).*

Reporting Requirements

The documentation of all data and information collected during the activities associated with sea turtle conservation in North Carolina must be completed in a timely manner. Data on nests and nesting turtles, as well as stranded turtles, are reported through online systems. For nesting data, it is expected that information associated with new nests, nest emergences, nest inventories, predation events, etc., will be uploaded to the online database in a timely manner (within 24-48 hours of the event). Data collected on stranded turtles are also expected to be reported/uploaded within 24 hours of the event. If data are unable to be uploaded in this manner, please contact the NCWRC Sea Turtle Biologist and/or Sea Turtle Stranding Coordinator to discuss appropriate accommodations.

Additionally, when reporting data using the online databases, please take a few minutes to verify that the information uploaded is correct, and if not, adjust the information entered. The NCWRC Sea Turtle Biologist and/or Sea Turtle Stranding Coordinator may contact you later with follow-up questions or requests for more detail. Volunteer coordinators of nesting beach projects should review their online data at the end of each season and correct any errors.

Actions Prohibited Under NCWRC Permit

Engaging in any of the following activities is unlawful and could result in revocation of the permit and/or law enforcement action.

- Removing eggs from the beach and incubating eggs in artificial containers or hatcheries
- Relocating nests for reasons other than outlined in the Nest Relocation section
- Keeping eggs or hatchlings in any kind of structure (sheds, garages, homes, etc.) or for any period of time except by special permission or per instructions given by the NCWRC
- Use of a probe to locate the nest chamber
- Moving nests landward of any obstacle that would prevent an unencumbered route to the sea for the hatchlings
- Premature opening of a nest, including prior to storms or hurricanes, without prior authorization
- Detaining hatchlings from moving to the sea once they have emerged, unless per instructions given by the NCWRC
- Directly exposing hatchlings or nesting females to visible light (including red light)
- Keeping injured or cold-stunned turtles in a facility that is not a designated rehabilitation facility or coordination site without prior approval
- Widely publicizing expected hatchling emergence windows and/or nest inventory dates, unless specific arrangements are made in coordination with the NCWRC in advance

Guidelines for Patrols and Nest Management

The following section will outline best practices for volunteers interacting with sea turtles and their nests in different scenarios. Volunteers should be familiar with this information, in particular the section on prohibited acts, before making any contact with sea turtles. Always remember that all sea turtles are protected by the US Endangered Species Act, which prohibits all unauthorized "take," including general disturbance of individual turtles. Your priority is to ensure that your actions comply with approved conservation activities for sea turtles.

Typically, daily morning patrols will be conducted on all nesting beaches during the nesting season (01 May through 31 August), although some projects may start earlier and/or end later, depending on circumstances. Please keep in mind that other wildlife and protected species use open sandy beach habitat, and should be respected as much as sea turtles. Minimize impacts to shorebirds and their chicks by avoiding the wrack line where they may be foraging, respecting areas posted for shorebird nesting, and accessing the beach only through existing pathways. Be mindful of seabeach amaranth (*Amaranthus pumilus*), a threatened plant species found on Altantic coast beaches. Stranded marine mammals should be reported immediately – do not push stranded marine mammals back into the water. Note that in cooler months, seals may haul out onto the beach to bask, and should not be disturbed. For marine mammal issues, you should call the NCWRC hotline at **252-241-7367** for further instructions.

Seabeach amaranth from Cape Hatteras National Seashore (NPS photo).

Additionally, for volunteers and others who rely on motorized vehicles (trucks, ATVs, UTVs) to access oceanside beaches for nest patrols or stranding response during the nesting and hatching season (01 May through 15 November), you should abide by these **best practices of beach driving** for the benefit of sea turtles and their nests:

a. Do not drive on the beach at night to minimize disturbance of nesting females and emergent hatchlings (note: some projects have special authorization to conduct night patrols with motorized vehicles, and use filtered lights to minimize impacts);
b. As much as possible, transit the beach below the high tide line, to minimize the chance of accidentally running over unmarked sea turtle nests and eggs;
c. Maintain slow speeds, especially on beaches frequented by visitors; and
d. Remove any ruts in front of incubating sea turtle nests that are within the window of hatchling emergence, to minimize impeding the seaward movement of those hatchlings.

Nesting Females

Sea turtles in North Carolina generally nest between dusk and dawn, although occasionally some individuals, particularly Kemp's ridleys, may nest during daylight hours. Although their vision is adapted for aquatic conditions, adult female sea turtles on the beach can distinguish movement and light and can be easily frightened and discouraged from laying eggs. Care must be taken to avoid disturbing adult female turtles while nesting (or attempting to nest) by extinguishing all sources of light. No flashlights of any kind, camera flashes, phone lights, etc. should be used to illuminate adult females on the beach at

night. If you need light to help you move across the dune, etc., ensure that you have a red filter over the source of light (flashlight, headlamp), and use this light sparingly, never directly shining light on nesting turtles or hatchlings, and turning lights off when not needed. Be ready to extinguish the source of red light if you encounter an adult female or hatchlings on the beach. Note that the eyes of sea turtles are less sensitive to longer visible wavelengths of light (>625 nm, which is red), **but they are still able to detect red light**. If you see an adult female coming out of the surf, immediately turn off all lights and do not move. Wait until she has moved up the beach past you and has started digging before you move again (carefully, and with as low a profile as possible, to minimize the potential for disturbance).

While an adult female is on the beach, you may encounter beach visitors who are interested in watching the turtle during its nesting process. It is possible for people to observe the nesting process, provided that they do not disturb the turtle while she is on the beach. They should remain at least 20 feet away from the turtle at all times. Transmitting this information is done best by calmly explaining and demonstrating with your own behavior (please see Code of Conduct above). You should not interfere with the nesting process, but you may quickly check the turtle for tags while the turtle is quiescent and laying eggs (in the nesting trance) or once she has completed covering the nest and is heading back to the water. Record any tags observed. If you believe the turtle is injured, carrying scientific equipment (satellite tag or other telemetry device), or misoriented from artificial light and cannot return to the ocean under its own power, you should call the NCWRC hotline at **252-241-7367** for further instructions.

Crowd Control

Beach visitors are often excited by the prospect of being able to observe sea turtles during nesting and hatching events. The presence of large crowds can make managing nest emergences and excavations more challenging. Members of the public who are present on the beach at the same time as a sea turtle may be invited to quietly observe, but these events should not be largely publicized to avoid attracting unmanageable crowd sizes. The NCWRC Sea Turtle Project will furnish you with an official badge that will inform the public that you are duly authorized to perform sea turtle management activities. Please wear it at all times during your turtle activities and refer to the Code of Conduct for a refresher on best practices for interacting with the public.

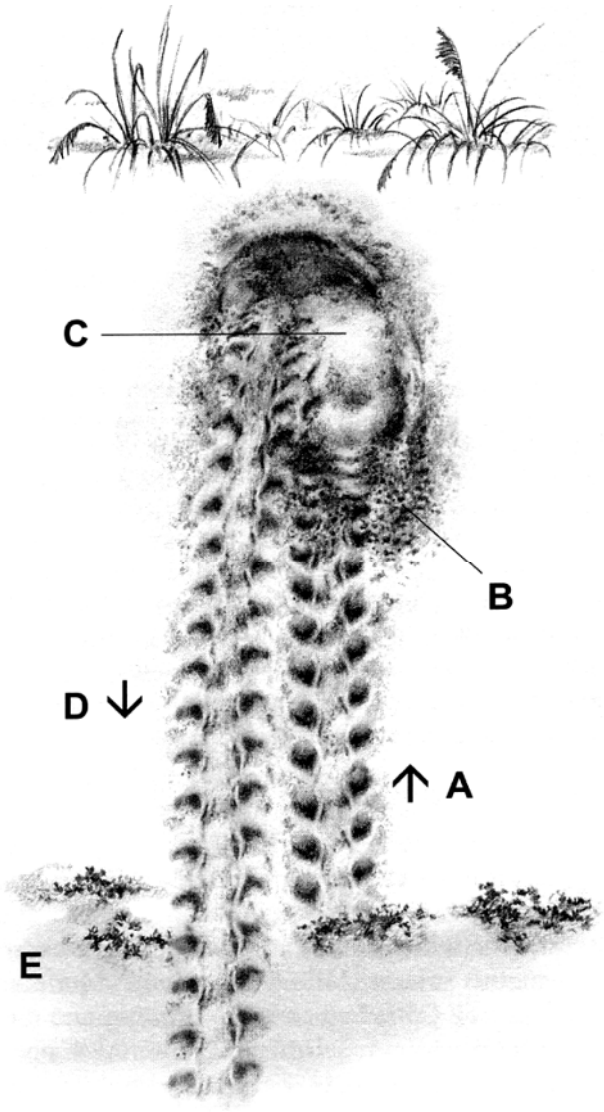
- Nesting event: Keep people at least 20 ft. from the female and make sure they remain behind the turtle at all times. Do not try to approach her when there is a large crowd of people. Inform them about what is happening and ask them not to take pictures because the flash can cause the turtle to abandon the nest, and/or become disoriented. Be a role model for appropriate behavior around a nesting turtle. Photos are allowed during daytime nesting events.

- Hatchling emergence or nest inventory event: Have one or more individuals from your group act as an interpreter and circulate through the crowd informing people of what is happening. You may involve the public by recruiting people out of the crowd to inform late arrivals. Use some sort of barrier such as string or construction tape to restrain the crowd from a fan-shaped alleyway for the hatchlings to use to get to the water. Short lawn fencing might also be used in the same manner, but do not leave it on the beach when no one is present. A low (4 inches or less) ridge of sand can be raked up to form a fan shaped alley which will keep the hatchlings moving toward the water. You can also drag your foot to make two lines leading from the nest to the water – ask people to remain outside the two lines while the hatchlings make their way to the ocean while inside the lines. Whichever method you use, ensure that the alleyway is at least 5 feet wide at the top and widens as it nears the ocean so that it is at least 20 feet in width and allows for dispersal of hatchlings as they reach the water.

Nest and Egg Cavity Identification

Daily patrols of all ocean-facing beaches are needed to identify new nests with eggs, so they can be marked and protected during incubation. In addition, data on numbers of nests laid each season are needed for assessing sea turtle population trends.

When monitoring a nesting beach, try to patrol the beach as soon as possible after sunrise. This ensures that new turtle crawls/tracks have not been effaced by pedestrian foot traffic that increases during the day. In addition, the turtle tracks are easier to visualize from the increased relief provided by the angle of the early morning sun.



Once you have found a crawl on the beach, you should ensure that it is a new crawl, rather than one that is a few days old. Sea turtle tracks may remain visible on the beach for several days under favorable conditions. Once you are sure it is a fresh crawl, you will need to identify whether the female laid eggs or if it was a *false crawl* - a crawl that did not result in eggs being laid. Some false crawls will be easily distinguished because they have the appearance of a simple U-turn on the beach, with no sign of disturbed sand associated with nest cavity construction. However, some females may begin to dig a nest cavity before giving up and returning to the water. A female may even leave a series of abandoned nest cavities before returning to the water. In some cases, it is challenging to distinguish between a true nest and a false crawl. The best method to confirm that a crawl contains a true nest is to verify the presence of eggs laid by the female.

For turtle crawls, you can distinguish between the arrival and departure crawl by looking for the direction that the sand is pushed in, while the turtle was crawling. In the above figure, **A** denotes the incoming crawl, while **D** represents the departure crawl. **E** indicates the high tide line (note earlier high tide effaced part of incoming crawl). For nests, follow the incoming crawl up to the area where the sand is disturbed. In the disturbed sand area (**B** and **C** in the figure), there may be two *body pits* or differentiated areas of digging. The primary body pit is the larger of the two (**C**) and usually the turtle makes this just before digging the nest chamber. The smaller body pit (**B**) is made after nesting when the turtle covers and camouflages the site. False crawls usually will not have a well-defined secondary body pit.

Before disturbing the site, you may want to place markers or flags along the outer edges of the smaller body pit, to keep you oriented while you try to locate the eggs. Please use caution when placing markers and avoid putting anything more than 2 inches deep into the sand, to avoid accidentally puncturing the

eggs. As a first step in finding the location of the eggs, face in the direction of the turtle's approach and begin your search for the egg chamber approximately 20-24 inches into the disturbed area that forms the primary body pit (about half-way between **B** and **C** in the figure). Expand your search outward from this point until you find the eggs or decide that it was a false crawl. Note that turtles can sometimes crawl back over the body pit area on their return to the ocean, making it more difficult to visualize where the eggs are likely to be (assuming they are there).

To uncover the eggs, gently dig by hand; the sand covering the neck of the nest cavity will "give way" as you gently push with your fingers. Stop digging as soon as you see or feel the first layer of eggs. **Never use a probe, stick, or sharp object to find a nest** – it greatly increases the likelihood of accidentally puncturing eggs, which will reduce hatching success. After verifying the presence of eggs and collecting a genetic sample (see Appendix VIII), in most cases you will quickly cover up eggs with moist sand that you removed from the cavity (do not allow dry sand from the beach surface to fall in the nest cavity). Once filled in, replace the layer of dry sand over the nest. In cases where the nest location meets the requirements for relocation, you should move the eggs up the beach to a safer incubation location (see pages 13-14 for more information). In cases where the tracks appear to be a real nest but it is not possible to locate the clutch of eggs, you should assume that it is a nest and mark off the entire area for protection during incubation. At the end of incubation, the hatchlings should emerge, and you can follow their tracks back to the precise nest location for excavation and inventory.

In some cases, you may find hatchling tracks from an unmarked nest, also known as a "wild nest". You should call the Sea Turtle Hotline (**252-241-7367**) to discuss how best to manage the nest.

Typical fresh nesting crawl with eggs made by a loggerhead sea turtle and encountered during early morning beach patrol. The incoming track is on the left, outgoing track is on the right. The egg chamber is located roughly 40 cm deep in the sand, around the area indicated by the black dashed circle.

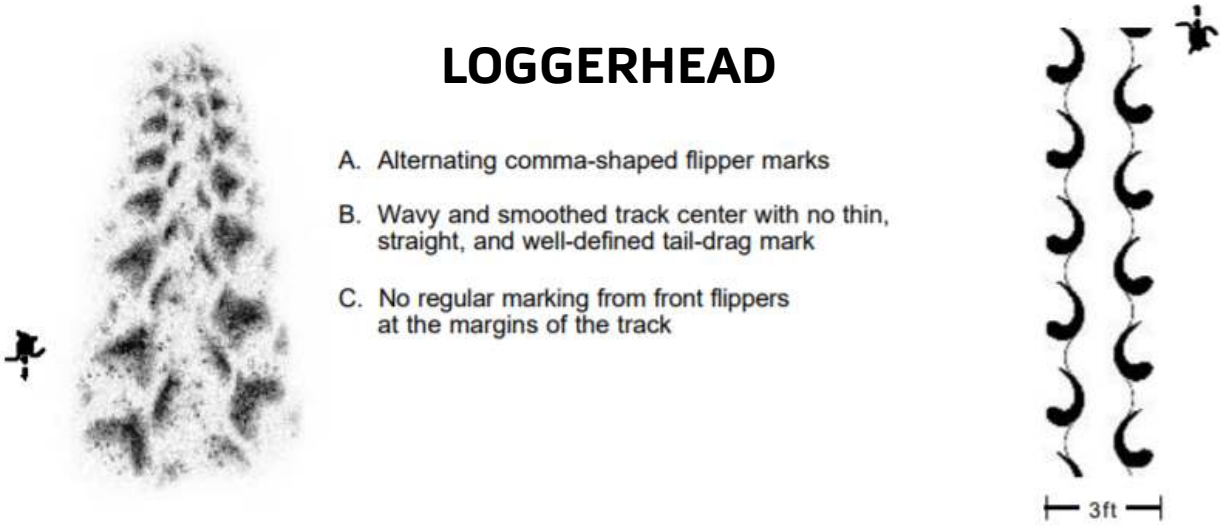
Typical fresh non-nesting crawls (false crawls) made by loggerhead sea turtles and encountered during morning beach patrol. Note lack of body pit at the apex of the crawl in left side photo. On the right, the turtle made a body pit and began to excavate an egg chamber but returned to the sea before laying eggs.

ASSIGN THE PROPER DATE!

Always use the date of the second half of the night when the new nest or emergence is found, to assign the date of the activity. Examples:
If a turtle lays eggs at 11:15 PM on 15 July, the assigned date is 16 July
If hatchlings emerge from a nest at 7:50 PM on 09 September, the assigned date is 10 September

Sea Turtle Crawl Characteristics by Species

Sea turtle nesting crawls found in North Carolina will most often belong to loggerhead sea turtles, which are the most common nesting species in the state. Almost every year, some nests are laid by green turtles, Kemp's ridleys, and leatherbacks in North Carolina. In 2015, two hawksbill nests were laid on Hatteras Island, although species identification was confirmed after incubation had been completed (see https://bit.ly/3w55oG3 for more details about this rare occurrence). While tracks may help identify which species laid an individual nest, species identification always should be confirmed by inspection of hatchlings or dead embryos during the nest inventory.

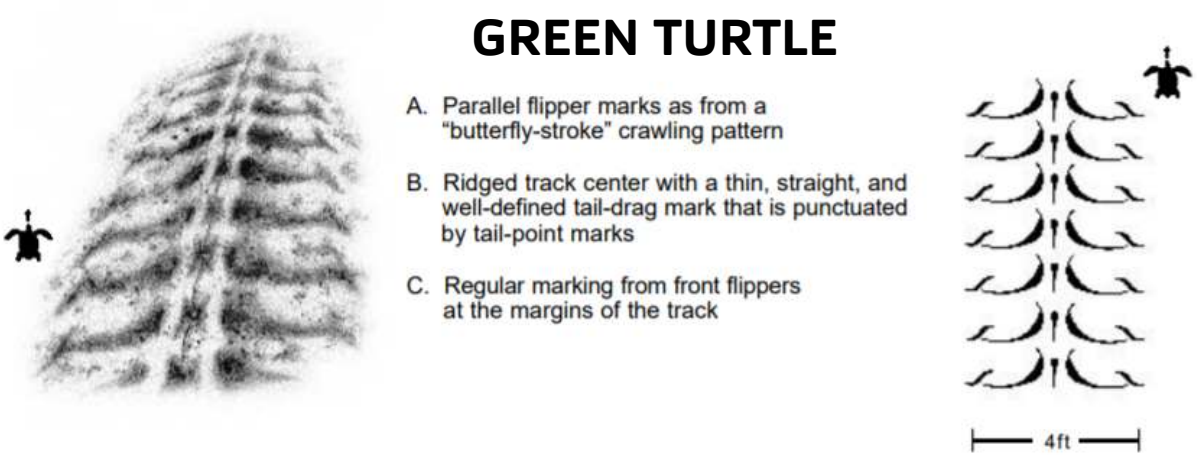


Loggerhead (*Caretta caretta*)

Track width: typically 70-90 cm. (25-35 in.)

Type of track: moderately deeply cut, with alternating (asymmetrical) diagonal marks made by the forelimbs. Typically no tail drag mark.

Preferred beach: generally extensive mainland beaches and barrier islands; moderately steep beach profile preferred.

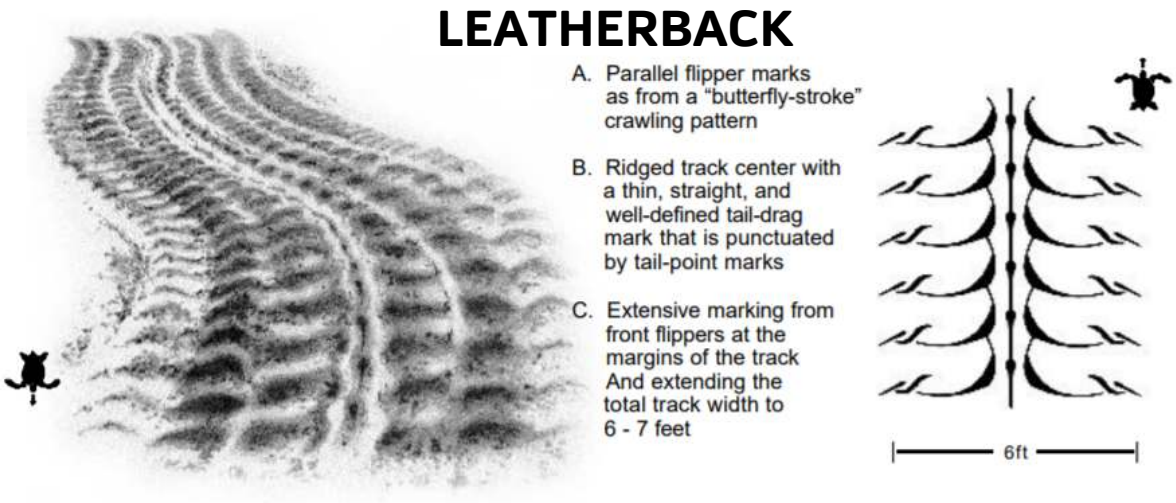


Green Turtle (*Chelonia mydas*)

Track width: typically about 100-130 cm (40-50 in.) but variable.

Type of track: deeply cut, with symmetrical diagonal markings made by the forelimbs. Straight, central tail drag marks present, either as a solid or a broken line.

Preferred beach: ranges from large, open beaches to small cove beaches; preferably with an open offshore approach.



Leatherback Sea Turtles (*Dermochelys coriacea*)

Track width: 150-230 cm (60-90 in.)

Type of track: very deep and broad, with symmetrical diagonal marks made by the forelimbs, and usually with a deep incised median groove formed by dragging the relatively long tail.

Preferred beach: wide, long, tropical beaches with steep slope, deep rock-free sand, and an unobstructed deep water or soft mud bottom approach.

Kemp's ridley Sea Turtles (*Lepidochelys kempii*)

While less common, Kemp's ridley turtles also nest on North Carolina beaches. Kemp's ridley turtles are smaller and lighter than loggerheads, although they have a similar crawl pattern. Their lighter weight means their crawls are less distinct in the sand, and are often obscured more quickly by wind and rain than loggerhead crawls. The eggs in Kemp's ridley nests are closer to the surface than loggerheads, so care should be taken when searching for the nest cavity.

Hawksbill Sea Turtles (***Eretmochelys imbricata***)

Hawksbills nests are rare in North Carolina. The size and gait of adult female hawksbills are most similar to loggerheads, although hawksbills tend to crawl farther up the beach to lay their eggs. Hawksbill eggs are similar in size to loggerheads, but may be more numerous in the nest cavity. For suspected hawksbill nests, species identification should be confirmed by inspecting live or dead hatchlings/embryos encountered during nest inventory at the end of incubation.

Nest Protection

Sea turtle eggs laid on beaches in North Carolina require protection during incubation. Sometimes, delineating a nest's location with stakes, string/tape, and a sign is enough to avoid accidental damage from human activity. There are other situations where more actions are needed to protect the incubating nest. Time of season, latitude, presence of predators, distance from high tide line, etc. are all factors that influence the levels of protection that a nest should receive. Use the following guidance to protect incubating nests on beaches in North Carolina.

- All nests should be marked so that they can be easily identified by sea turtle patrollers and beach visitors. Cordoning off space around the nest will help beach visitors from accidentally disturbing the egg cavity. Note that curious beach walkers may be drawn to a delineated nest location on the beach, so be sure that all nest signs are placed where they can be read without stepping on the egg cavity. To mark a nest:
  - Place four stakes into the sand so that they form at least a 4 foot x 4 foot square around the known nest cavity with eggs. Ensure that the stakes are buried sufficiently deep so that they will withstand wind, rain, and storms during the incubation period.
  - Encircle the poles with construction tape, caution tape, or twine with pieces of brightly colored material attached to it for increased visibility. This should form a visible barrier that will keep people from getting too close to incubating eggs.
  - When placing the stakes, mark the level of sand on all stakes with a permanent marker, and also mark 12 inches above the sand. This will help you document the accretion or erosion of sand on top of the egg cavity during incubation.
  - Affix a nest sign to one of the stakes.
  - For nests where the egg location is not known, place the stakes along on the outside perimeter of the body pit/nest area (this may require more than four stakes), to ensure that the eggs are protected from accidental disturbance. You will be able to find the nest cavity at time of hatchling emergence.

- Sea turtle eggs on some beaches may be exposed to mammalian predators such as raccoons, foxes, coyotes, and potentially armadillos. Metal wire or rigid plastic screening is an effective defense against most mammalian predators that causes minimal disturbance to the nest. Mesh size for this type of screening should be between 2 inches by 4 inches to 4 inches by 4 in. The most common deployment strategy for mesh to protect incubating eggs is to place at least 1 square yard of material on top of the nest location, anchoring the corners of the mesh with stakes or pegs and burying the edges. The 4-inch side of the wire opening should be parallel with the shoreline. If predators learn to dig into the nest from the side, bend the sides of the screen down so that a five-sided cage is formed. Another approach is to increase the total size of the piece of mesh. Covering the mesh with a thin layer of sand will hide it from passers-by and predators.

- During incubation, excess sand may blow over a nest, or accrete from storm-related overwash, making it difficult or impossible for hatchlings to successfully emerge at the end of incubation. Marks placed on the stakes on the first day of incubation will help facilitate monitoring of sand accumulation. Reduce the depth of accreted sand over the nest to its original level if it has accumulated more than 12 in. or 30.5 cm. For deeply covered nests, it may be necessary to build a ramp from the original sand surface to the accreted area of the beach, to help emergent hatchlings exit the nest area.
- In situations where eggs are incubating on beaches that also have motor vehicle traffic, the nests must be marked with adequate buffer zones to avoid incidental crushing. Each nest should be marked such that a 50-foot buffer zone is allowed on all sides of the nest during incubation. Additionally, when hatchlings are expected to emerge, a 50-foot-wide corridor from nest to the ocean must be created and kept vehicle-free until emergence has completed, and the nest has been excavated. Removal of vehicle ruts in the sand in front of nests may be required, to allow hatchlings to freely crawl from the nest to the ocean.

Nest Relocation

Turtle nests should be allowed to incubate at their original location, *in situ*, if there is ***any*** reasonable likelihood of survival. Relocation is to be used as a method of **last resort** in terms of nest management. In most cases, nests that are naturally laid in areas with heavy foot or vehicular traffic can be marked so that they are avoided by beach goers. If a nest is laid near a bright light that may misorient hatchlings, ask the party responsible for the light if the light can either be turned off or shaded, at least around the time of expected emergence. If you need assistance with lighting problems, please call the Sea Turtle Project Coordinators. Nests should be moved ***only*** when one or more of the following situations exist:

- The nest is located ***below the average high tide line*** where ***regular daily*** inundation will result in embryonic mortality. Higher than average tides in the future and/or potential storm surge should not be a factor, as these events would not lead to regular inundation and are difficult to predict. Some level of overwash is natural and in some cases, necessary for successful incubation.

- The nest is laid in an area ***known*** to be susceptible to erosion. Examples include areas near groins or rock revetments, areas near inlets, etc.

- The nest is laid under a sloughing escarpment and is subject to being buried too deeply.

If you believe a nest that does not meet these above conditions should be moved, you must call the NC Sea Turtle Hotline at **252-241-7367** for consultation BEFORE you relocate the eggs. In rare cases, a permit may be issued in advance for unusual, but lawfully conducted, human activities that pose a serious threat to nests, such as emergency dune pushing following a major storm event, or beach construction activities during summer months. When these situations arise and only after permits have been issued, the local sea turtle volunteers/participants will be notified by the NCWRC and given instructions on nest relocation protocol that are unique to the situation at hand.

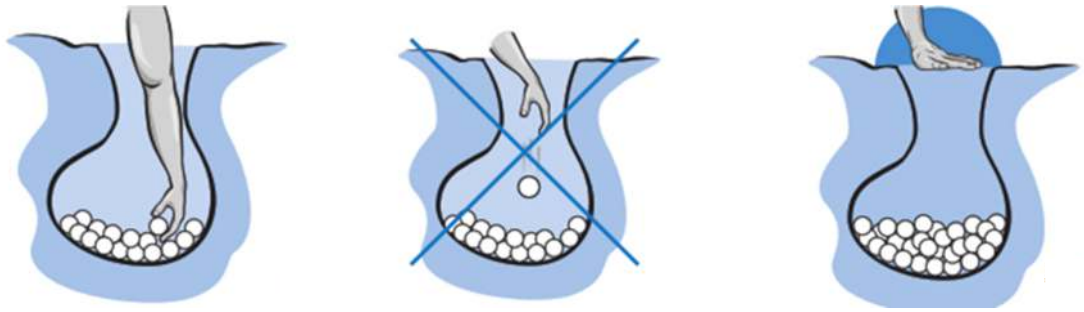
In general, the overall relocation rate for sea turtle nests laid in North Carolina is expected to be ≤30%. If a beach has relocation rates that are >30%, the Sea Turtle Project Coordinators will consult with the beach coordinator about nest relocation activities and develop plans to reduce relocation rates in future years.

Relocated nests may have a lower hatching success rate than natural nests, but careful and timely handling of eggs will reduce this risk. The shorter the amount of time between laying and relocation, the

better chances that successful incubation and hatchling emergence will occur. This is another benefit of conducting beach patrols as early in the morning as possible.

If you determine that relocation is necessary according to the criteria listed above, use the following guidelines:

- **Find the egg chamber** by using the methods described in the Nest and Egg Cavity Identification section.
- **Try to move nests within 12 hours** after they are laid and *before 9:00 AM the following morning.* Embryos have a better chance for development when relocation is accomplished within that time.
- **Minimize rotation of eggs** in any direction during handling. Maintain the original orientation throughout the relocation process. It may be helpful to place a small light pencil mark on the top to help maintain the original orientation. ***Do not use ink*** because it may contain solvents harmful to the embryo if it permeates the eggshell.
- **Excavate the eggs by hand**, not with a shovel. Move eggs one at a time to a transport container. A common container used is a rigid plastic bucket with a 2-3 inch layer of damp sand on the bottom. When all the eggs are in the container, cover them with a thin layer of damp sand or lightly moistened towel. Keep excavated eggs shaded on hot, sunny days. If you have enough of them, chicken egg cartons are also a good method for transporting sea turtle eggs to the new relocation site. If using egg cartons, do not place sand below or on top of eggs in cartons. Use care when moving the bucket or cartons, taking care to avoid bumping or spinning them.
- **Relocate as close as possible to the original nest site**, while at the same time avoiding making clusters of nests. Concentrating nests in a small area may attract predators and/or alter natural sex ratios. Additionally, nests should be relocated to areas above the high tide line that are relatively free of vegetation. Invasion of the nest by roots can prevent the hatchlings from emerging from the nest. Relocated nests do not need to be placed in dunes if there is sufficient flat beach above the average high tide line.
- **Dig to the same depth** and dimensions of the original egg chamber by hand or with a trowel. Round out the bottom so that the shape of the nest chamber is roughly similar to an inverted light bulb.
- **Place eggs one at a time** into the new egg chamber while continuing to maintain the original orientation of each egg. Try to gently wipe off any excess sand, because airspace between the eggs in the chamber is important for respiration. Be sure to record how many eggs you are relocating, as part of data collection. This information will be entered into the online database for sea turtle nests.
- **Cover the eggs with moist sand** excavated from the new nest chamber after you finish transferring. Dry sand should not be allowed to fall into the egg chamber. Once the eggs are reburied to the upper level of the surrounding moist sand, gently pat the sand surface above the eggs with your hand. Replace the dry sand over this area to the depth present before you began.
- **Mark the nest's new location** following the steps listed in the preceding section entitled Nest Protection.



Schematic representation of relocating eggs to a new chamber. Note bowl-shaped cavity at base of chamber and how eggs should be placed gently into chamber (do not drop them). After all eggs are placed, place moist sand over eggs and pat sand gently at the top.

HATCHERIES

Hatcheries are designated areas with a high concentration of relocated eggs and are **not permitted** by NCWRC. Maintaining the natural dispersion of incubating sea turtle eggs spreads out the relative threat risk of mammalian predation or excessive inundation and helps produce a mixed sex ratio.

Egg Incubation and Monitoring

The amount of time needed for successful egg development and hatchling emergence varies between 50 and 70+ days and is largely dependent on sand temperatures at nest depth. Generally, warmer sand temperatures result in faster incubation rates and cooler sand temperatures result in slower rates. During the incubation period, beach patrollers should check on the status of all marked nests to verify that they remain protected. Documentation of nest disturbances should be noted and logged in the online nesting database. Disturbances can include damage to the stakes, string and/or sign around the nest area, evidence of digging around the nest area, egg damage by predators, overwash from storms or seasonal high tides, etc. In addition, daily checks for excessive sand accumulation are needed, and accreted sand more than 12 inches should be removed; conversely, excessive erosion of sand from above the eggs should be addressed by adding extra sand to the top of the nest, up to the original height of the sand at time when the eggs were first laid.

If predators have entered a nest during incubation, determine if there are any remaining intact eggs. If viable eggs are present, immediately remove spilled egg contents from the nest chamber. Carefully clean any intact eggs with yolk on them by gently rubbing them with dry sand **(do not wash eggs in water)**. Take extreme care to avoid rotating the eggs during this procedure. Rebury all intact eggs and predator excluder mesh/screen (if using – see Nest Protection Section). Document how many eggs were disturbed (if possible) and convey the information to the person responsible for online data entry in the seaturtle.org database.

Hatchling Emergence and Protection

The timing and circumstances of hatchling emergence and dispersal are critical to their survival. Therefore, the emergence of hatchlings should be allowed to occur as naturally as possible. While not required, you may wish to “babysit” nests that are close to the expected time of incubation, to observe hatchlings entering the sea and to help ensure that the hatchling emergence process is uninterrupted by beach visitors. Please follow these guidelines for hatchling emergence events.

- Allow sea turtle nests to complete the incubation and emergence processes undisturbed. **Never dig into a nest to see if hatchlings are ready to emerge.** The premature opening of a nest could attract predators or alter the physical environment of the nest resulting in the death of hatchlings. If you suspect there is a physical barrier blocking the emergence of the hatchlings, call the Sea Turtle Hotline (**252-241-7367**) for consultation on what steps to take.

- As hatchlings emerge from the nest, allow them to crawl down the beach and into the water unassisted. Hatchlings should not be manipulated or touched during their emergence and crawl to the ocean. For hatchlings that accidentally flip onto their backs, they should be allowed to right themselves (they are able to successfully complete this). Some hatchlings may initially go in the

wrong direction, or possibly turn in a circle, but this behavior is normal and temporary; they should eventually head toward the ocean. **Do not use lights to attract hatchlings in the proper direction. Never shine any visible light directly on the hatchlings (including red light)**. If hatchlings continue to orient in the wrong direction, they may be misoriented or disoriented due to artificial light.

- Hatchlings that are misoriented by lights and unable to successfully crawl to the water should be taken to a darker portion of the beach for immediate release. Collect them in an open bucket or box and carry them to a darker area of the beach. Release them on the dry sand well above the high tide line, to allow them to crawl a moderate distance to the water. **Do not use lights to attract hatchlings in the proper direction. Never shine any visible light directly on the hatchlings (including red light)**. Be sure to document misorientation events and ask the person responsible for online data entry to include these data in the seaturtle.org database.

- Hatchlings that emerge from the nest when nearshore water temperatures are below 50 °F or 11 °C are likely to cold stun upon entering the water. When faced with this situation, immediately call the Sea Turtle Hotline at **252-241-7367**. If instructed, collect the hatchlings as they emerge and place them in a rigid container lined with several inches of moist sand. **To avoid suffocation, do not cover the container completely.** Arrangements will be made to ensure the hatchlings will be released in an appropriate manner.

- **Inventories of nest contents, to quantify hatching success, will be conducted at least 72 hours after the first emergence of hatchlings or 90 days after laying, whichever comes first** (see below for important qualifications). If the nest exhibits a trickle hatch (a few hatchlings emerge each night over 3-day period) then wait **a minimum of 120 hours (5 days)** after first hatchling emergence.

- If predators have entered a nest after first emergence, determine if there are any remaining live hatchlings and allow them to make their way to the ocean. Contact the Sea Turtle Hotline (**252-241-7367**) to discuss how to proceed.

- If an unmarked nest (also called “wild nest”) produces hatchlings, you should follow the hatchling tracks back to the emergence location, to locate the nest cavity. Once you have found the location, contact the Sea Turtle Hotline (**252-241-7367**) to discuss how to proceed.

Post-Emergence Excavation

Nests will be excavated only after a minimum of 72 hours have passed since the first emergence or 90 days after deposition, whichever comes first, except for nests that have been laid before 31 July. Nests before 31 July generally emerge before 75 days. If a nest laid before 31 July has not emerged within 75 days of incubation, or if a nest laid after 31 July has not emerged within 90 days of incubation, contact the Sea Turtle Hotline (**252-241-7367**) to discuss how to proceed. In some cases, eggs incubating for more than 90 days can still produce hatchlings.

The goal of nest excavation is to determine the overall success of the eggs in the nest; basically, how many eggs in a clutch produced hatchlings. There are two basic measures: hatching success and emergence success. Hatching success measures the proportion of eggs that hatched in each nest, while the emergence success measures the proportion of live hatchlings that emerged naturally from the nest. Most projects in the SE USA report emergence success, although some report only hatching success. Both values are related, and both values are automatically calculated in the online nesting database used by all sea turtle nest monitoring projects in North Carolina.

Inventory Protocol

Because chances are high that live hatchlings remain in the nest cavity at inventory, post-emergence excavations should be scheduled as close as logistically possible to sunrise or sunset, but still during daylight hours so nest contents can be visualized and categorized. Beach visitors may come over to inquire about actions related to the nest inventory and they may be invited to observe, and possibly watch live straggler hatchlings as they scurry to the water.

To help ensure that any live hatchlings are allowed to crawl freely down the beach, and to avoid accidental stepping on live hatchlings, a buffer zone should be demarcated between where hatchlings will crawl to the ocean and where on-lookers can congregate. In some cases, it is enough to drag a stick in the sand to form a line that people should stay behind. In other cases, such as when there are many people, stakes and string/tape may be erected to identify where people should remain. In addition, hatchlings entering the water may be dispersed by the wave action in the swash zone. Remind people at or in the water to remain in place until all hatchlings have been released.

When inventorying or excavating a nest, gloves should always be worn to protect possible turtles and volunteers from being cross contaminated by various microbes. Gently begin digging into the depression left by the hatched nest. When the sand "gives way," the nest chamber has been breached. Hatchlings that are entangled in roots or perhaps constrained by compacted sand may be close to the surface or at the top of the nest cavity. Do not pull on the hatchlings but try to work them free by breaking the roots or loosening the sand. All live hatchlings found during excavation should be allowed to crawl to the ocean and released immediately. ***Be sure to verify species when hatchlings are found in the nest*** (see Appendix IV and Appendix V)**.**

All contents of the nest should be removed carefully and placed the sand nearby for collating and counting. Verify that no extra eggshells or eggs remain on the sides of the “bowl” of the nest cavity. If many (>25) live hatchlings are found before reaching any eggs or eggshells, quickly cover the egg chamber with moist sand and return the site to its original condition. Wait at least 48 hours before excavating again. If fewer than 25 hatchlings are encountered during the initial excavation, follow hatchling release procedures above.

Once all the material from the excavated nest has been collected, separate nest contents into the following groups, and record how many are in each group:

- **Live hatchlings (LH)**
  This includes all live hatchlings free of eggshell plus any live pipped hatchlings (not fully emerged from the eggshell) that are subsequently released (see below)
- **Dead hatchlings (DH)**
  This includes all dead hatchlings that are free from their eggshells
- **Unhatched eggs (UE)**
  These are either whole unhatched eggs or have a pipped hatchling that died before escaping from the eggshell. Note that some unhatched eggs might be broken, either during the excavation process or by hatchlings or predators such as ghost crabs, etc. If in doubt, inspect the inside of the eggshell for signs of remaining yolk.
- **Whole empty eggshells (ES)** (>50% of the whole shell)
  Normally, the shells from individual eggs remain intact and are easily recognizable as individual eggshells. Each of these large shells should be counted as one hatched egg. Include any eggshells from live pipped hatchlings.
- **Small eggshell pieces** (< 50% of the whole shell).
  Sometimes, during hatchling emergence or inventory, the eggshells are shredded into small pieces. <u>These fragments should not be counted</u>. Note: if you encounter nest contents consisting of only small shredded eggshell pieces, call the Sea Turtle Hotline (**252-241-7367**) for instructions on how to enumerate the contents.

Contents of a sea turtle nest enumerated during inventory 72 hours after emergence. Empty eggshells are grouped in piles of 10, while unhatched eggs and dead hatchlings are kept separate.

Once values for each category listed above have been recorded, place unhatched eggs, dead hatchlings, and eggshells back in the nest cavity and cover them up. The debris left in an emerged sea turtle nest is an important source of nutrients for the resource-poor dune system.

Pipped eggs are those in which some part of the hatchling has broken through the eggshell but is not yet completely free. Pipped eggs range from those with just a small hole to those with large tears. All pipped live hatchlings that survive to be released are counted as LH. Any that subsequently die are counted as PE (and grouped with UE). Don't forget to add the eggshell of live pipped hatchlings to the ES category.

If the nest contained live pipped eggs, perform these steps:

- For any hatchling that is not fully out of the eggshell but otherwise normal and has no visible yolk-sac on its plastron, it can be freed of the eggshell and released with other live hatchlings. These should be counted as part of the Live Hatchling category.
- For hatchlings that are not fully out of the shell and are not fully straightened out and/or have visible yolk sacs, these should be returned to the nest chamber, near the top (bury the other contents of the nest at the bottom of the egg chamber first, covered by a few inches of moist sand), covered by 3-4 inches of clean moist sand. This will allow these hatchlings time to internalize the yolk sacs and be able to crawl out of the sand and down the beach on their own.
    - Smooth out the sand in front of the nest and keep the nest location marked.
    - Wait 2-3 days for the hatchlings to complete their emergence from the sand. After 72 hours, you can open the nest to enumerate how many survived. Finalize the nest inventory data based on the information collected by the inventory of the upper portion of the nest.
- If you encounter the scenario when nearshore water temperatures are below 50 °F or 11 °C, call the Sea Turtle Hotline at **252-241-7367** for further instructions on what to do with the pipped turtles. In all cases of pipped eggs with hatchlings, please note all actions taken and ask the person responsible for online data entry to include details of the final results in the comments section of the inventory in seaturtle.org.

Nest Analyses

The NC Sea Turtle Project collates all nesting information using the online Sea Turtle Nest Monitoring System of seaturtle.org (http://www.seaturtle.org/nestdb/?view=1). This system automatically tabulates various metrics of hatching and emergence success, but the following information is provided for understanding the foundation of calculating success rates of nests.

Total Clutch Size (TCS) is the sum of unhatched eggs including pipped eggs with dead hatchlings (UE) plus whole eggshells (ES), using the following formula:

$$TCS = (UE + ES)$$

TCS for relocated nests is also documented during egg relocation. Estimating total clutch size during nest inventory is an imperfect metric, and errors can be introduced by unknown eggs being removed by underground predators such as ghost crabs, the challenges of accurately counting hatched shells, etc. Comparing clutch size values for relocated nests at beginning and end of incubation provides important information on the range of error associated with estimating clutch size at the end of incubation. Do not be concerned if clutch size at time of laying does not exactly match clutch size calculated at time of nest inventory for relocated nests.

Hatching Success (HSucc) is the percentage of eggs that produced hatchlings, including those that remain in the nest chamber (both live pipped and those completely emerged from eggshells). It is based on the following formula:

$$HSucc = \frac{ES}{TCS} * 100$$

Emergence Success (ESucc) is the percentage of eggs that produced hatchlings that reached the surface of the sand.

$$ESucc = \frac{ES - (LH + DH)}{TCS} * 100$$

Hatchling Rescue and Release

The optimal outcome for all sea turtle hatchlings is to emerge safely from a nest at night, scramble across the sand to the water, and swim out past the breakers into the wider ocean. However, not all live hatchlings achieve their optimal outcome immediately. Some remain in the nest cavity until inventory, some become lost on the beach due to visible artificial lights at night, some may be picked up by birds and dropped on the beach, some may be found washed back in after initially making it to the water, and some may be weak and unable to make it to the water quickly. Use the following guidelines for ensuring that all live hatchlings are given the best opportunity to fulfill their ecological role of entering the water and swimming out into the ocean:

Live hatchlings found in the nest cavity during inventory:
Allow them to crawl down the beach and into the water. For hatchlings that appear weak, slow, or deformed, allow them time to equilibrate after being liberated from the nest cavity. In many cases, they will “perk up” eventually and start their march to the water. For those that remain weak, bring them closer to the water’s edge to help them enter the sea. In rare cases, you may have to wade out into the water to help release them on an outgoing wave; these turtles may be dehydrated and exposure to seawater will allow them to ingest

water and recover their strength. If you have trouble releasing a hatchling after taking these steps, please call the Sea Turtle Hotline (**252-241-7367**) for further instructions.

Hatchlings found on the beach (lost, stuck, or washed in):
If they are active, release them on the wet sand and allow them to crawl to the water and enter the ocean. If conditions are not amenable to allowing them to crawl, you may bring them to the swash zone on the beach and allow them to crawl into the water. In rare cases, you may have to wade out into the water to help release them on an outgoing wave; these turtles may be dehydrated and exposure to seawater will allow them to ingest water and recover their strength. If the hatchling appears to be inactive or unwilling to swim, please call the Sea Turtle Hotline (**252-241-7367**) for further instructions.

In cases where members of the public find live hatchlings and transport them directly to a sea turtle rehabilitation center (KBSTRRC or STAR) or one of the other NC Aquariums, NCWRC will work directly with the facilities to release these turtles in the most appropriate way. Whenever possible, hatchlings will be released as soon as possible on a nearby beach, so they can crawl into the water and swim away. Note that a quick return to the water is critical for the best outcome for these hatchlings; if hatchlings do not enter the water soon after emergence from a nest, they may deplete their dedicated energy reserves (excess yolk in body cavity) and be unable to swim successfully past the breakers and coastal zone. For other situations not covered above, please call immediately the Sea Turtle Hotline (**252-241-7367**) for further instructions.

Sea Turtle Stranding Response

You may receive reports of stranded sea turtles on the beach or injured turtles floating in the water. When responding to a stranded turtle, a critical first determination is whether the turtle is alive or dead. Live turtles found on the beach (other than nesting females or emergent hatchlings) should be considered sick or injured, and thus rapid response may help increase the chances for recovery from disease or injuries. Response measures will vary depending on the situation, but in every scenario, responders must:

- contact the NC Sea Turtle Emergency Hotline at **252-241-7367**
- evaluate the condition of the turtle; and
- take photos, fill out a stranding form, and submit online at seaturtle.org/strand.

North Carolina has two full-time sea turtle rehabilitation centers, as well as support from the NC Aquariums and the NCSU College of Veterinary Medicine. In cooperation with the NCWRC Sea Turtle Stranding Coordinator and Sea Turtle Biologist, the people associated with the institutions above are the most suited to administering care and first aid. If you are responding to a sick or injured sea turtle, your job is to keep the animal as safe and calm as possible, including during transport to a rehabilitation or other care facility if you are approved to do so.

Remember, **your first response should be to call the emergency number** (**252-241-7367**) and stay in constant contact with NCWRC Sea Turtle Stranding Coordinator or Sea Turtle Biologist – they will instruct you on what to do. They may ask you to provide first aid or assist in transporting the turtle. As each case is individual, it is critical that you **follow the instructions specific for that animal given by the NCWRC Sea Turtle Stranding Coordinator or Sea Turtle Biologist or rehabilitation staff**.

Also note that all strandings (including live strandings) require a complete stranding report. You can do this electronically at www.seaturtle.org/strand. The most important information to be filled out is the

date and location of the stranding, plus any other specific information related to the disease or injury of the turtle. Additional information about filling out a stranding report is found in Appendix VI. ***Gloves (nitrile, latex, etc.) should be used when handling injured or sick turtles, for the benefit of both the turtles and the volunteers.***

Live Stranded Turtles

Approach

Observe the turtle's behavior before making the approach. Advance slowly, calmly, and cautiously, avoiding loud noises, abrupt movements, or bright lights. Debilitated sea turtles are not likely to be aggressive, but people have been bitten, scratched, or slapped hard with a flipper. Also, be aware of the possibility that you may be responding to a nesting female on the beach that was mistaken for a live stranded animal.

Assessment

Conduct an external visual examination of the turtle for signs of injuries or disease, looking at the head, flippers and carapace. Note any anomalies such as any bleeding, missing flippers, cracks in the carapace, sunken eyes, excessive barnacle coverage, or entanglement in gear, and be prepared to relay this information to the NC Sea Turtle Emergency Hotline at **252-241-7367**. **Do not move or flip the turtle unless instructed to do so.**

First Aid

If instructed to by the NCWRC Sea Turtle Stranding Coordinator or Sea Turtle Biologist, you may give simple supportive care by relieving distress and making the animal as comfortable as possible. This may be as simple as providing shade or moving the turtle out of the swash zone. In many cases, such efforts can improve the animal's chances of recovery significantly. If instructed, place the turtle in a transport bin or other rigid box. If there are no carapace injuries and the air temperature is above 75 ˚F, a moistened towel may be placed on the carapace.


Assessing a stranded lethargic loggerhead turtle (left) or responding to cold stunned green turtles (right)

Transport

You may be asked to assist in transporting the turtle to a rehabilitation or care facility. During transport, it is important to maintain a quiet environment and ensure the turtle is secured. Smaller turtles can be transported in plastic transport bins or rigid boxes. Larger turtles can be transported in an SUV or a truck bed with a cover. Ensure there are no objects that could fall on or otherwise injure the turtle during transport. If transporting a cold stunned turtle (see below), it is important to not attempt to warm the turtle during transport, but rather maintain a cool environment.

Cold Stuns

Because sea turtles are ectothermic and rely on their environment to regulate their temperatures, they are vulnerable to becoming stunned by colder temperatures. This can result in large numbers of stranded, dazed turtles. If you are responding to a cold stun with multiple turtles, be sure to inform the NCWRC Sea Turtle Stranding Coordinator and/or Sea Turtle Biologist. They will provide follow-up instruction. Do not attempt to warm the turtle(s) as rapid warming may further injure the animal(s). Controlled slow warming will be done at the appropriate rehabilitation facility.

Cold stunned turtles collected during a single patrol at Cape Lookout National Seashore

Dead Stranded Turtles

Information about the numbers of deaths and causes of injuries to sea turtles directly helps identify threats to sea turtles, which inform conservation actions. It is extremely important that all dead and injured sea turtles be reported as soon as possible and that an attempt be made to ascertain cause of death. You can submit a report electronically at www.seaturtle.org/strand. Please see Appendix VI of this handbook to review the different data fields that are needed for each stranded turtle. The report should be filled out as accurately and completely as possible. Please take photos of each turtle, including an overhead photo of the whole turtle, plus extra photos of any wounds or other anomalies. Please check for metal flipper tags and internal PIT tags (if you have a scanner). Please take a photo of the tags and/or PIT tag scanner screen with ID.

When you are notified about a stranded turtle, please respond as rapidly as possible to avoid losing the animal on the next high tide. If you are unable to respond right away, contact the Sea Turtle Project

Hotline immediately so that an alternate responder can be arranged. Once you have collected the necessary data for submitting a stranding report and collected photographs, you may be asked to collect samples or additional information, depending on species or age class of the turtle. This is another reason why you should contact the Sea Turtle Hotline (**252-241-7367**) every time you respond to a stranded turtle. Once all data, photos and possibly samples have been collected, the disposition of the carcass should be finalized. There are several options, and most involve applying paint to the carcass to avoid duplicate reports:

- Salvage/collect the carcass (if directed to by the Sea Turtle Hotline)
- Mark the carapace with a few lines of spray-paint and bury it in the sand, above the high tide line
- Mark the carapace with a few lines of spray-paint and contact the city maintenance department to dispose of the carcass (usually burial by bulldozer)
- If no other option is available, mark the carapace with several lines of spray-paint leave it in place. If the carcass is in the water or near the water line, pull it further up the beach if possible before painting.

If you are unsure what to do, call the Sea Turtle Hotline at **252-241-7367**. Additionally**, all turtles with tags, no matter what condition, should not be buried until all requested samples are collected**. Contact the Sea Turtle Hotline for instructions on what samples are needed or if you should salvage the whole carcass.

Incidental Captures

You may also receive calls about turtles that have become entangled, hooked, or otherwise captured incidentally to other activities. Please record these interactions in the same manner as a traditional stranding by filling out the stranding form. Be sure to note capture gear type and take photos of any attached gear. If the turtle is alive, follow the protocols listed above for live stranded turtles. If a live turtle is caught by hook and line, make every effort to bring the turtle to land for hook removal. If the hook is in the turtle's mouth, at least 2 feet of line should be left attached to the hook before transporting it to a rehabilitation or care facility. The excess line can be coiled and secured with tape to the turtle's carapace. In addition to the stranding form, a Sea Turtle Hook and Line Incidental Capture Intake Form should be filled out when possible, see Appendix VII.

A juvenile Kemp's ridley that was captured by hook and line

Sea turtles that are observed entangled in commercial fishing gear (pound nets, gill nets, pot buoys, etc.) should be reported immediately to the Sea Turtle Hotline (**252-241-7367**), so the NCWRC Sea Turtle Stranding Coordinator and/or Sea Turtle Biologist can coordinate with NC Division of Marine Fisheries to address the situation as quickly as possible. Usually, NC Marine Patrol officers will respond immediately and work to release the turtle or retrieve it if it needs veterinary attention. Unless instructed otherwise by NCWRC or NC Division of Marine Fisheries, do not free a live turtle from commercial fishing gear that is not your own.

APPENDIX I - IMPORTANT TELEPHONE NUMBERS

Wildlife Resources Commission Personnel:

NC Sea Turtle Hotline……...252-241-7367

Sea Turtle Rescue and Rehabilitation:

For live stranded turtles, call the NC Sea Turtle Hotline first (see above).
If unable to make contact, call the appropriate rehabilitation partner:

Karen Beasley Sea Turtle Rescue and Rehabilitation Center 910-329-0222
(Cape Lookout to SC Border)

Network for Endangered Sea Turtles Hotline……...252-441-8622
(Ocracoke to VA border)

Other Relevant Phone Numbers

NC Aquariums:

Fort Fisher Aquarium……...910-772-0500
Pine Knoll Shores Aquarium……252-247-4003
Roanoke Island Aquarium……252-475-2300
Jenette's Pier (Nags Head) ……252-255-1501

Law Enforcement Hotlines:

NC Division of Marine Fisheries Dispatch……800-682-2632
NC Wildlife Resources Commission Helpline……..……866-318-2401

APPENDIX II - FAQS

Frequently Asked Questions experienced on the beach by volunteers, with recommended answers:

Concerning nest excavation:

Q. Why do some eggs not hatch from the nest?

A. Based on published studies, >99% of eggs laid in a sea turtle nest are fertilized when laid. However, during the approximately 60 days of incubation, there are many environmental factors that can arrest development of the eggs. These include temperature extremes (especially for those eggs closest to the surface of the sand), bacterial or fungal attack, predation by crabs or insects, excessive tidal inundation, accidental trampling of the nest, plant roots, etc. During excavation, unhatched eggs can be opened to observe the developmental stage of the embryo. If development stops soon after fertilization, the embryo may have deteriorated during incubation, so unhatched eggs with no visible embryo should not be assumed to be unfertilized.

Q. What is the average clutch size?

A. The average number of eggs per nest for loggerheads is about 110 eggs, although as many as 198 eggs in one nest were seen in North Carolina. For green turtles, it is about 120 eggs. For Kemp's Ridley's, each nest contains around 105 eggs. For leatherbacks, the average number of eggs is about 80, not including the 20 or so small, yolkless spacer eggs common to this species.

Q. How long does it take for the eggs to hatch?

A. Development is usually complete within two months, but the exact time depends on the temperature of the sand: warmer sand means faster incubation. Late season nests that are exposed to cooler temperatures may take much longer to incubate, sometimes even longer than 75 days.

Q. How many of the hatchlings will survive?

A. Good question! This is one of the mysteries of sea turtles, although some people assume it is somewhere around 1 out of every 1000 hatchlings will make it to adulthood. The rate of survivorship is related to the size of the turtle, so that adult loggerheads have the highest rate of survivorship while hatchlings and small juveniles have much lower rates of survivorship.

Q. How can you tell what the sex is?

A. Only adult sea turtles are clearly sexually dimorphic: adult males will have tails that extend well beyond the edge of the carapace. For hatchlings and juveniles, male and females look the same. Also, sea turtles do not have sexually dimorphic sex chromosomes, so you cannot classify their sex by looking at their genes. The sex of sea turtles is determined by incubation temperature during the middle of embryonic development: warmer temperatures produce more females, cooler temperatures produce more males. In North Carolina, the "pivotal temperature" (the temperature that produces 50% of each sex) is about 29.2 °C (or 84.6 °F) for loggerheads.

Q. Where do the hatchlings go once in the ocean?

A. It isn't entirely known, because there are limited observations of sea turtles between the stages of hatchling and "dinner-plate" size juveniles. Some tracking studies of small loggerheads from Florida reported that they swim and float along the major North Atlantic currents, near the Sargasso Sea.

Eventually, small juvenile loggerheads will reach the waters around Macaronesia (Cape Verde, Canaries, Azores, and Madeira islands). When they reach larger sizes, they return to coastal waters along the SE USA. Green turtles are thought to spend less time the oceanic environment and return to coastal waters after 5-6 years. Little is known about Kemp's ridley hatchlings from nests laid on US Atlantic coast beaches, and one of the biggest mysteries in sea turtle biology is where hatchling leatherbacks go during their juvenile stages.

Q. Why don't you excavate the nest early, such as before the arrival of a tropical storm or hurricane?
A. An overall goal of the NC Sea Turtle Project is to minimize impacts on the natural order of reproduction and other aspects of the life cycle of sea turtles. This includes allowing egg incubation to proceed with minimal disturbance or alteration. Opening a nest before the hatchlings naturally emerge can have detrimental effects on the turtles. Many researchers have described changes to hatchling behavior after the incubation conditions have been manipulated. These changes include changes in size, crawling speed, swimming speed, etc. and are thought to affect survivorship and/or likelihood of reproductive success (fitness). Thus, opening a nest early, in anticipation of a predicted storm or hurricane, may appear to have "saved" the hatchlings, while in fact it is more likely that the hatchlings are less likely to survive because of the intervention. In addition, some late stage incubating nests survive washover associated with storms and still end with the natural emergence of hatchlings. It is not possible to predict which nests will weather a storm or hurricane, but opening a nest early likely will reduce the fitness of the hatchlings, decreasing their change of survival.

Concerning nesting females:

Q. How old is the nesting turtle?
A. Nobody knows for sure because they were not marked when they left the beach as hatchlings. Research on growth suggests it takes at least 30 years for North Atlantic loggerheads to reach the age of maturity, although any nesting female may be older than that. For green turtles in the North Atlantic, minimum age of maturity in the wild is estimated to be 30-40 years. For leatherbacks, there is still debate about the age of maturity, and estimates vary between one and several decades. Keep in mind that the age of maturity of individual sea turtles will vary, with some maturing earlier and some maturing later.

Q. Why do nesting turtles cry?
A. Their "tears" are how sea turtles get rid of excess salt that accumulates from drinking seawater. Sea turtles have large salt glands behind their eyes, and they exude excess salt ("cry") all the time, including in the water, but it is just more difficult to see the tears underwater.

Q. Does she come back to guard the eggs?
A. No. Once the female is finished covering over the nesting cavity, she will leave the eggs to their fate on the beach. Under normal conditions, the eggs should successfully produce hatchlings, although predators or weather conditions can reduce hatching success.

Q. How often do the females lay eggs?
A. Normally, loggerheads and green turtles can lay several nests in one season, but they do not usually reproduce in consecutive years. In North Carolina, the most nests laid by a single loggerhead in a season is eight. Leatherbacks can lay up to 12 nests in one season, but they also do not nest in consecutive years. Kemp's ridleys usually nest a few times, often in consecutive years.

Q. Where do they go between this nest and the next one they lay?

A. They will lay eggs every two weeks or so during the nesting season, and between nesting events they usually pick a spot offshore and remain there, mostly inactive, until it is time to nest again. Some females may swim dozens or hundreds of miles to another location to lay subsequent nests. Between nesting seasons, they can migrate long distances to feeding grounds. Several dozen loggerhead females from NC have been tracked after their last nest of the season, and most went north to the Chesapeake Bay or Delaware Bay for several weeks before moving south (or east near the warm Gulf Stream) during the winter. Most adult female loggerheads appear to remain close to the Atlantic seaboard of the US, although some may make forays into the wider North Atlantic.

Concerning stranded turtles:

Q. Can you tell what caused the death of a turtle?

A. Usually, it is easier to rule out possible causes of death than identify the precise mortality factor. Turtle deaths in NC waters can be the result of various factors, including accidental capture by fishing nets or lines, boat strikes, accidental capture by dredging boats, ingestion of marine debris, pollution, or cold-stunning. Some sea turtles that are sick or injured also end up beached on land, and these turtles can undergo treatment at the Karen Beasley Sea Turtle Rescue and Rehabilitation Center (KBSTRRC) in Surf City, or the STAR Rehabilitation Center on Roanoke Island.

Q. Can I take home a piece of shell or a part of the skeleton?

A. All sea turtles in the US are protected by federal and state law, and it is illegal to possess any live turtles or their parts, unless you have a permit that specifically says that you can hold on to parts of sea turtles.

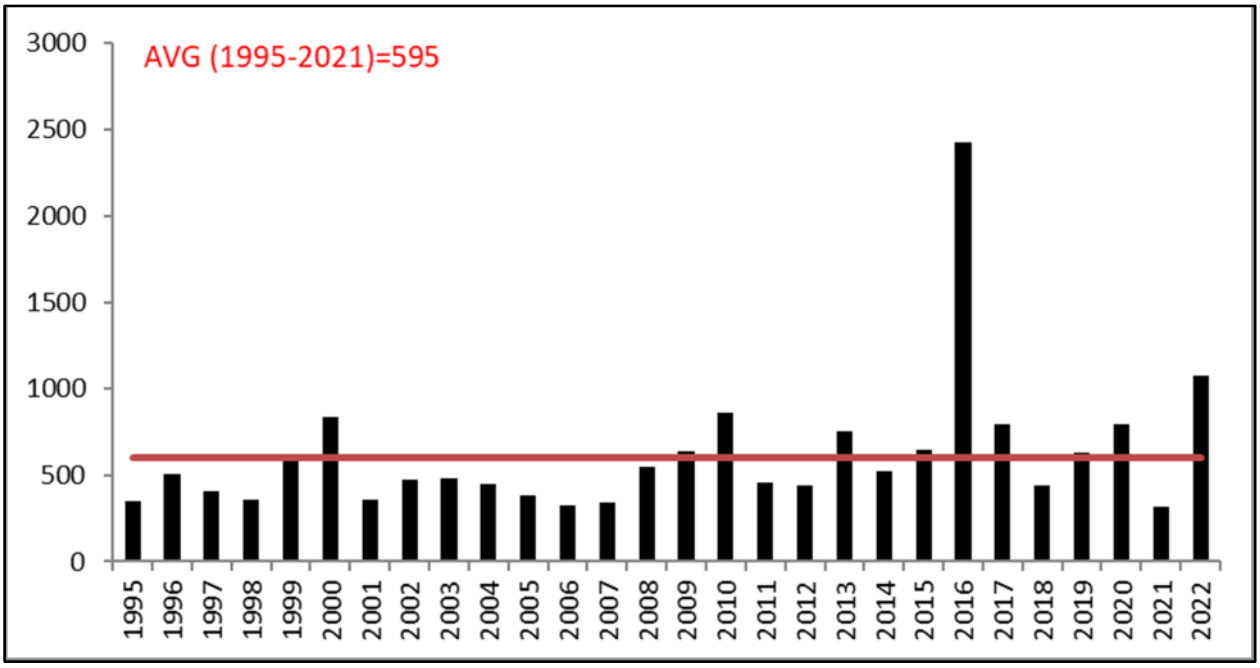
Q. If I see a dead or injured sea turtle on my beach, what should I do?

A. Please call the NC Sea Turtle Hotline**: 252-241-7367**. If you see any dead or injured marine mammals (dolphins, whales, seals) or other wildlife, please contact your local police department or call the NC Sea Turtle Hotline for assistance (**252-241-7367).**

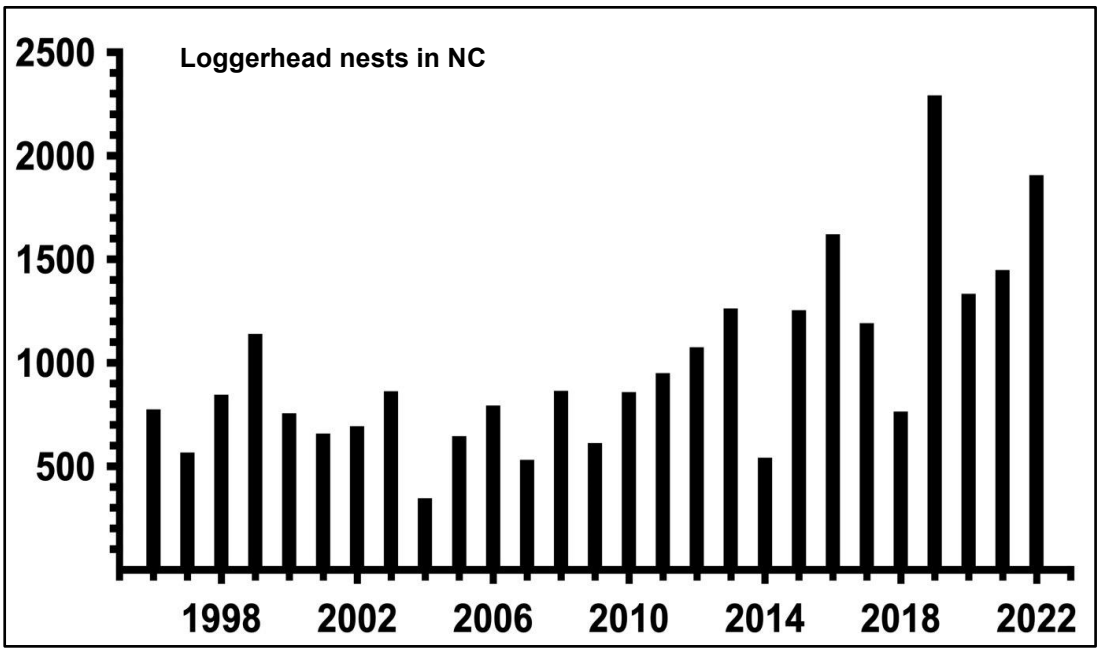
Stranded hawksbill sea turtles are rare in North Carolina

APPENDIX III - GRAPHS

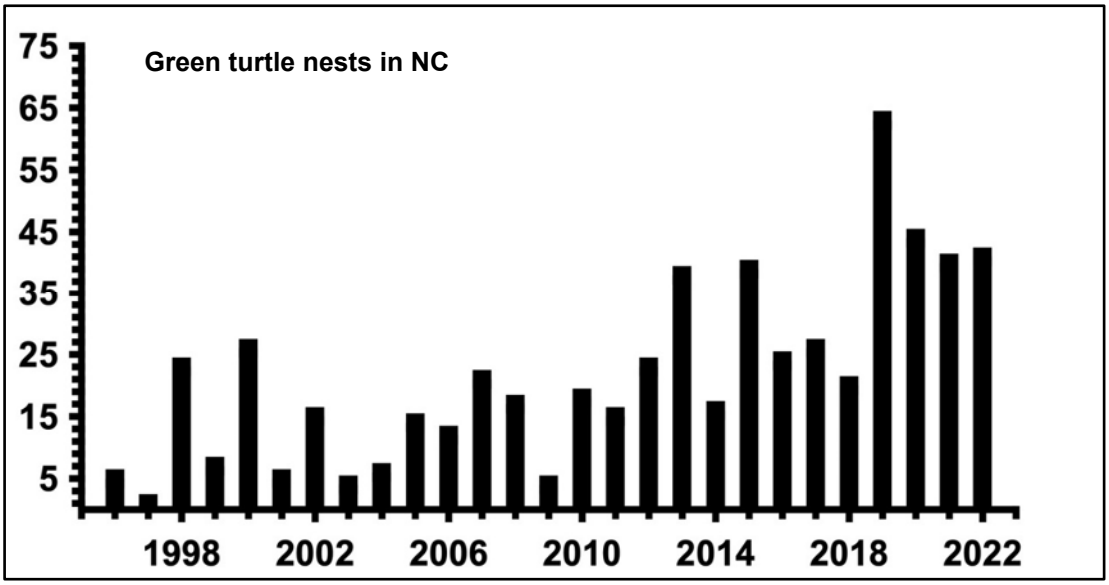
Stranding and nesting summaries for North Carolina



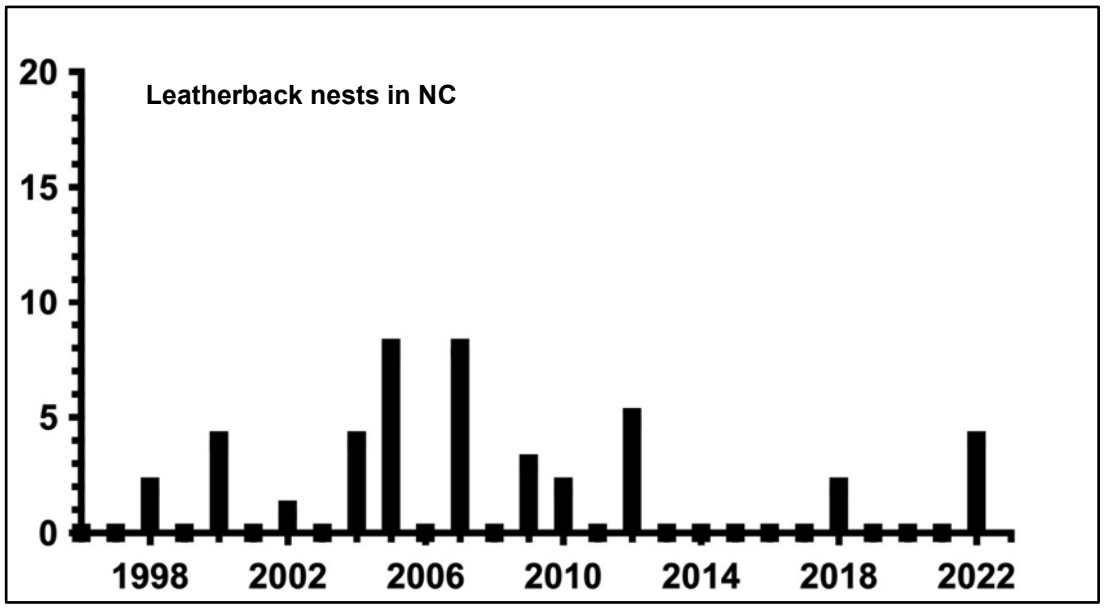
Annual observed stranded sea turtles in North Carolina (inshore and oceanic waters)



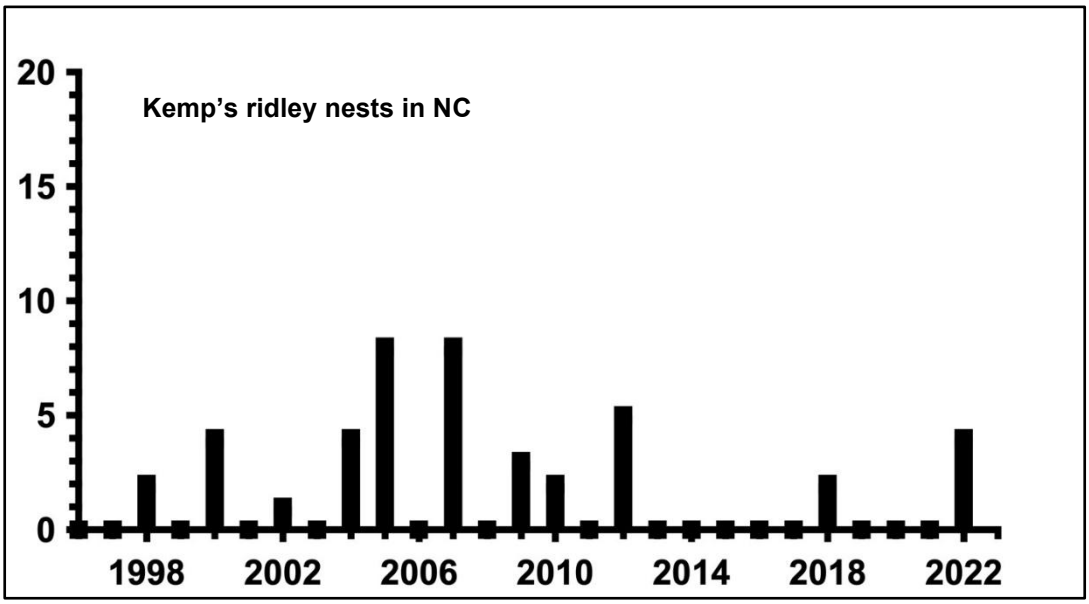
Annual loggerhead sea turtle nest totals observed in North Carolina (note that statewide standardized nest monitoring was achieved after 1995).



Annual nest totals of green sea turtles observed in North Carolina



Annual nest totals of leatherback sea turtles observed in North Carolina



Annual nest totals of Kemp's ridley sea turtles observed in North Carolina

First documented Kemp's ridley sea turtle nesting in North Carolina, observed on Oak Island in 1992

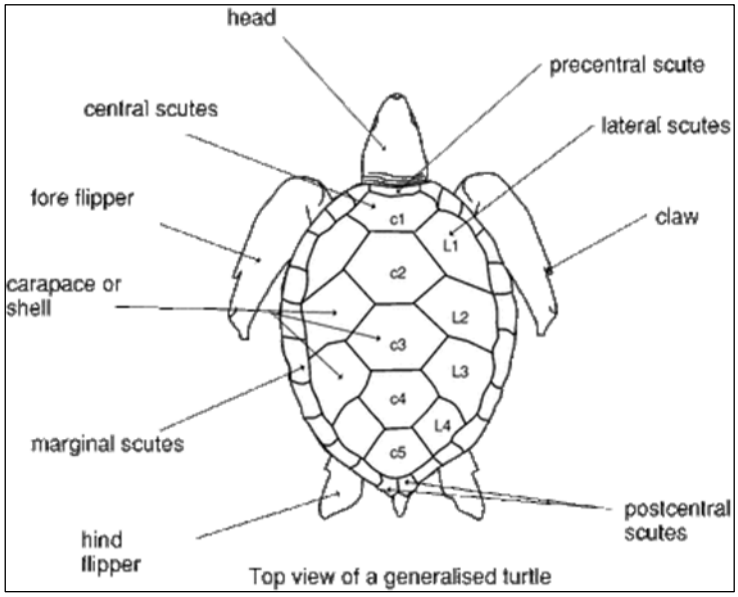
APPENDIX IV- INTRO TO SEA TURTLES

Sea turtles are some of the most iconic species that occur on North Carolina beaches. Five of the world's seven species of sea turtles occur in North Carolina, either as developing juveniles, reproductive adults, or as transient migrants on their way to other areas. The sea turtles that occur in North Carolina often migrate to other areas, especially in winter months when coastal waters are too cold for them.

North Carolina's sea turtles vary greatly in size, shape, and coloration. They can range from under 10 pounds to over 800, and can have colorful shells or leathery skin. As volunteers with the NC Wildlife Resource Commission, you should have a basic understanding of sea turtle biology, species identification, and essential knowledge of acceptable management actions when dealing with nesting sea turtles, their incubating eggs, emergent hatchlings, and stranded sea turtles.

Anatomy

The seven species of sea turtle are made up of two Families: Dermochelyidae, comprised solely by the Leatherback species, and Cheloniidae, which contains the six other species (also referred to as hard-shelled sea turtles), including loggerheads, green turtles, Kemp's ridley turtles, hawksbill turtles, olive ridley turtles, and flatback sea turtles. Note that the last two species have never been documented in North Carolina.



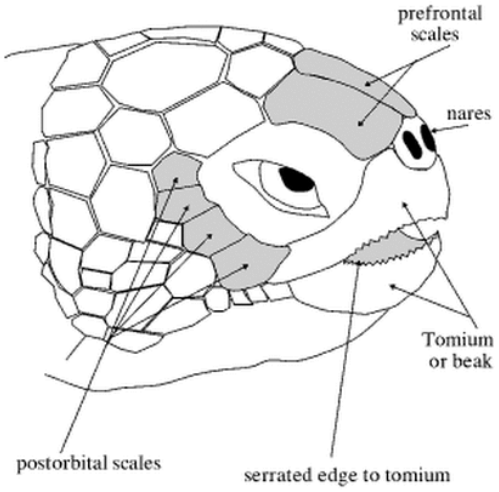
Top view of a generalised turtle

Sea turtles have many highly specialized features to allow them to survive at sea. These reptiles have paddle-shaped limbs containing elongated finger bones. They also have highly efficient salt glands that remove excess salt from their blood that comes from constantly ingesting sea water. The salt glands are located behind their eyes and the excess salt is constantly excreted through tears, which are twice as salty as ocean water.

One of the defining characteristics of all turtles, including sea turtles, is the presence of a shell. The top of the shell is called the *carapace* and the bottom is the *plastron*. Sea turtle shells are far less domed than terrestrial species of turtles, which helps facilitate hydrodynamic movements through the water. Although descended from terrestrial turtles, sea turtles lost the ability to retract their limbs or head into their shells like some other turtles. Instead, their speed and agility in the water enable them to outswim or outmaneuver many predators.

The carapace of hard-shelled sea turtles is composed of fused rib bones covered by a keratinous layer of slightly overlapping plates called *scutes*. The pattern of scutes on the carapace (including central, lateral, and marginal scutes) can help identify the species. Leatherback sea turtles, by contrast, have a leathery skin that covers their carapace.

Hard-shelled sea turtles have thick scales on the top of their heads for protection, while leatherback skulls are covered in thin leathery skin. Sea turtles have no teeth, and their jaws are adapted to the specific diet of each species. Green turtles have a serrated lower beak for eating seagrass or algae while loggerheads have strong bony mandibles for crushing crabs and whelks. Leatherbacks have sharp edges with cusps on their jaws, for eating jellyfish. Sea turtles hear through eardrums covered by a layer of skin. Sea turtles hear sounds while in the water and while on the land and have an excellent sense of smell. Sea turtles have good visual acuity in the water. When on land, their vision is attenuated but they can see various shapes and light.



Life Cycle

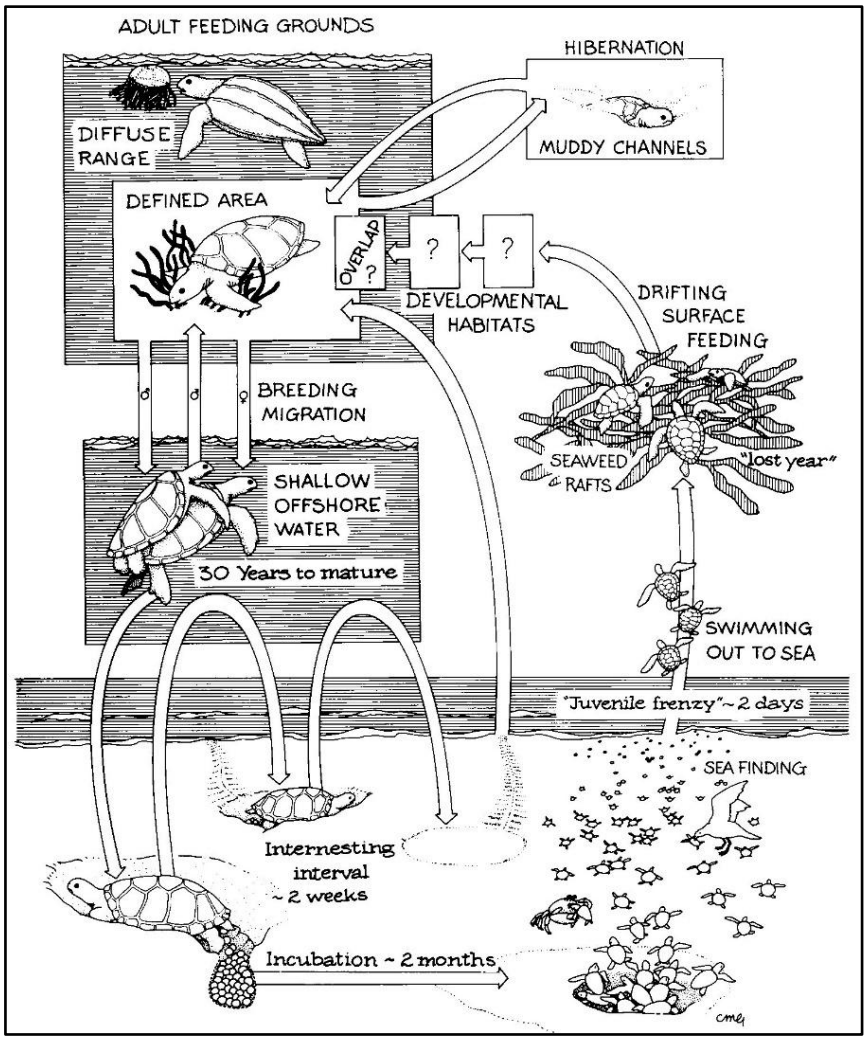
Adult sea turtles return to breed every few years in the region where they were produced as hatchlings. They often travel long distances (sometimes thousands of miles) from their feeding sites to nesting sites. A few weeks after the onset of breeding in the nearby waters, females will crawl onto the beach at night and use their rear flippers to dig a nest cavity. They will lay 100 to 125 eggs in each nest, which is called a *clutch*. The female covers the eggs up with sand, camouflages the area, and returns to the ocean. This process is repeated several times each nesting season (May through August in North Carolina), with each nesting event separated by roughly 14 days. During the nesting season, adult females will emerge from the ocean at night onto the beach but return to the water without laying eggs. These non-nesting events, also called “false crawls,” occur on a ~1:1 ratio with nesting events for loggerhead sea turtles. While some females may abandon their nesting activity when disturbed by people, beach furniture, or other wildlife, the underlying causes for many false crawls remain a mystery.

For sea turtle eggs, the length of incubation can vary from <50 days to >90 days, depending on various environmental factors, including temperature, humidity, and oxygen levels. Sex of the hatchlings is determined by the egg temperature experienced during a roughly two week period near the middle of incubation. Cooler temperatures produce more males, warmer temperatures produce more females, and temperatures around 29 ºC (84 ºF) can produce a mix of both sexes.

At the end of the incubation period, hatchlings use their caruncle, a temporary “egg tooth” on the tip of their beaks, to slice through their eggshells. The initial opening of the shell by the turtle is called “pipping,” followed by hatching, when the turtle exits from the eggshell. At hatching, the turtle is still slightly folded at its midsection, and has residual yolk in an external sac attached to its stomach. The yolk provides nutrition and energy to the hatchling for the first several days of its life. As each turtle straightens over the next few days in the nest cavity, and yolk is utilized, the sac decreases in size and becomes internalized in the body cavity, allowing the umbilical area to close and harden. The hatchlings in the nest cavity work simultaneously to slowly ascend through the sand to the top of the nest, which takes 2-6 days. When they reach the surface layer of the sand, hatchlings wait until darkness before they emerge onto the beach. A drop in temperature at the surface of the sand, which normally occurs after sundown, is associated with hatchling emergence from the nest, although rainfall or clouds occasionally can cue daytime emergence of hatchlings. Nighttime emergence helps hatchlings avoid terrestrial predators and

prevent heat stress from hot daytime sand. Many nest emergences occur before midnight, although they can also occur anytime between sunset and sunrise.

Once the hatchlings are fully out of the nest at night, they scramble to the water. They rely on visual cues to find their way to the ocean, heading to the brightest spot on the horizon. On natural beaches that are backed by vegetated dunes, the horizon over the ocean is brighter than the silhouetted dunes, and hatchlings can find their way easily to the water. On developed beaches, visible artificial lights at night can attract hatchlings, causing them to go the wrong way (also called misorientation). If they are visible on the beach, streetlamps, house lights, headlights, etc. can all cause hatchling misorientation. Hatchlings that crawl the wrong way have greater exposure to terrestrial predators, and possibly could become dehydrated if still on the beach at sunrise. Misoriented hatchlings also expend excess energy crawling on the beach instead of swimming in the water.



Model sea turtle life cycle, from Mrosovsky 1983. Note that "hibernation" or brumation is not well understood and may be rare for some species/populations. Age to maturity also varies by species and population.

For hatchlings that successfully reach the water, they swim directly against the waves to move away from shore as quickly as possible. Once beyond the shallow coastal zone and its abundant predators, they rely on magnetic cues to orient themselves while swimming further out to sea. The residual yolk in their body cavity allows them to swim constantly for up to 72 hours (sometimes called the "frenzy" period), before they can reach deeper waters beyond coastal areas. Predation is thought to be high during the first months or years after hatching.

For small loggerhead turtles that reach deeper waters after leaving the beach, they begin an oceanic phase in which they semi-passively drift in major oceanic currents, such as the Gulf Stream in the NW Atlantic. During this time, they are thought to be associated with drifting sargassum, which provides sources of food and cover from predators. Loggerheads produced from beaches in the SE USA end up in their early developmental habitat in and around Macaronesia (the island groups of the Azores, Madeira, the Canary Islands, and Cape Verde). They remain there for a few decades until ~50 cm carapace length, after which they follow the North Atlantic Gyre current back to the coast of SE USA, where they continue to develop until they reach maturity at 30-35 yrs. old. Large juvenile and adult turtles will migrate north

along the east coast of the USA and even Canada in summer months when water temperatures are warm enough for them to forage for their preferred prey. As water temperatures drop in the fall/winter, these turtles will either migrate south again along the coast, or sometimes move east into deeper warmer waters associated with the Gulf Stream and beyond. When adults are ready to reproduce, they will migrate to coastal waters in the same region they were produced to begin mating in the spring, and the females will begin to lay eggs on nearby beaches starting in May, thereby starting the cycle over again.

Threats

Modern sea turtle species descended from a single group of sea turtles that dates to 110 million years ago. The sea turtle species that exist today have survived many global extinction events, such as the impact of a comet or asteroid 66 million years ago that caused the extinction of nearly 75% of all species. Their resiliency has been challenged by the rise of anthropogenic threats and many populations around the world are considered depleted, relative to pre-industrial times. All sea turtle species have been placed on the IUCN Red List of Threatened Species, and all species/populations that occur in the US are listed as Threatened or Endangered by the federal Endangered Species Act.

***Artificial Nighttime Lighting*:** Both nesting females and emergent hatchlings use visual cues to find the ocean. At turtle eye level on the beach strand, the ocean is often not visible. Instead, the turtles move towards the brightest horizon to return to the ocean, because on natural beaches, the sky over the open ocean is brighter than over vegetated sand dunes. On developed beaches, artificial lighting from homes, streets, businesses, parking lots, etc. that are visible on the beach will attract hatchlings and nesting females inland, away from the ocean. This can result in injury or death of the turtles that are drawn onto roads or highways and increase their exposure to land-based predators.

***Beach Armoring*:** The placement of sea walls, rocks, jetties, and sandbags on beaches to protect structures can reduce suitable nesting habitat, and can also accelerate erosion, leading to even more habitat loss. Loss of habitat may displace turtles to less optimal nesting beaches.

***Beach Erosion*:** Loss of sand due to “coastal squeeze” (when a static development line doesn’t allow natural migration of the high tide line) is characteristic on many developed beaches. In response to erosion, local or state governments turn to beach construction to mitigate erosion. In North Carolina, many developed beaches undergo regular nourishment events, when sand is placed on the beach after being dredged from the ocean or from up-river sources. If not “beach compatible” (for example, too dark, too rocky, too silty), this material impedes the successful construction of sea turtle nest cavities and/or inhibits successful egg development.

Human Activity: Human activity on beaches, particularly at night, can prevent females from nesting. For instance, driving on beaches at night can disturb females before they successfully lay their eggs. Driving can also cause increased compaction of sand or even damage incubating eggs, if the turtle nests are not marked off with stakes and signs. Beach gear and furniture left overnight can entangle or deter nesting females, and deep holes created by beach visitors may entrap adults and/or hatchlings if not filled in.

Incidental capture in fishing gear: Sea turtles have suffered mortality on a massive scale as unintended catch (or bycatch) in global fisheries. Different studies have estimated that several tens of thousands of sea turtles annually were incidentally killed in activities such as shrimp trawling, longlining, and gill netting. Bycatch by recreational fisheries, including hook and line, is an understudied threat to sea turtles. In recent decades, there have been extensive efforts to reduce sea turtle mortality from bycatch. This has been achieved through gear innovation, such as the creation of turtle excluder devices (TEDs) that allow captured turtles to escape shrimp nets, use of LED lights to help turtles avoid nets, and circle longline

hooks that are less likely to incidentally capture sea turtles. Time/area closures are another tool that can reduce sea turtle bycatch, by separating fishing activity from areas or seasons when sea turtles occur in higher density. Incidental bycatch continues to threaten some populations in different parts of the world.

Consumption and Illegal Trade: In the past, the consumption of sea turtles and their eggs posed a significant threat to some populations. For instance, hawksbill sea turtles were widely hunted for their shells that were fashioned into jewelry or other items. Some studies estimate the global hawksbill population is currently <25% of what it was only a few centuries ago. International agreements established in the latter half of the 20th Century have curtailed legal international trade in hawksbill shell. Currently, some sea turtle populations are still hunted for food and shell.

Climate Change: Anthropogenic climate change poses a variety of threats and impacts to sea turtles. For example, hurricanes and tropical storms of increasing frequency and severity will likely lead to further beach erosion and increased loss of incubating eggs. This will be compounded by sea level rise, resulting in less available nesting habitat. Because hatchling sex is determined by sand temperature, even small increases in temperature could lead to fewer male hatchlings, which could ultimately impact fertility rates. Climate change may also alter ocean currents that are key to sea turtle migration. Changing currents could cause range shifts or impede turtles from returning to historic nesting or foraging grounds.

Plastic and Marine Debris: Globally, over 6 million tons of trash ends up in the ocean each year, posing a danger to marine animals. Sea turtles can become entangled in it and suffocate, or they can ingest these plastics (mistaking them for prey). Leatherbacks particularly are at high risk of ingesting plastic because they appear to be unable to distinguish floating plastic bags from jellyfish (their preferred prey). Small pieces of plastic in sea turtle stomachs are commonly reported from various places around the world, and there is concern that debris ingestion may disrupt the normal nutritional cycle in sea turtles, negatively affecting health. A related concern is microplastics and their universal presence in the digestive tracts of all sea turtles studied to date. Another type of plastic marine debris is discarded fishing gear, which may entangle sea turtles, leading to injury or death.

Pollution: Solid waste and chemicals from human activity can be toxic to sea turtles. These types of pollution come from a wide range of sources, including waste from cruise ships, agricultural fertilizer run-off, and oil spills. As pollutants are ingested by sea turtles and accumulate inside of their bodies, turtles may suffer tissue damage, immune system suppression, brain damage, or reproductive harm. Evidence suggests that exposure to pollutants and/or runoff can increase physiological stress, which may make turtles more susceptible to diseases such as fibropapillomatosis. Oil spills are also harmful because sea turtles that are exposed to oil and/or the chemical dispersants used to combat the oil spill can suffer tissue damage, physiological stress, and even death.

Vessel Strikes: As air-breathing reptiles, sea turtles must surface regularly to breathe. In addition, sea turtles may spend more time at the surface for foraging, resting and even basking. This puts them at risk of being hit by boats, especially in areas frequented by vessels such as shipping lanes or inlets. Watercraft interactions can cause crushing injuries from impacts with boat hulls, cuts and amputations from propellers, and sometimes brain injuries that may be less visible immediately but can cause death.

Sources:
Eckert, K., Bjorndal, K., Abreu-Grobois, A., & Donnelly, M. (Eds.). (1999). *Research and Management Techniques for the Conservation of Sea Turtles* (Vol. 4). IUCN-SSC Marine Turtle Specialist Group.
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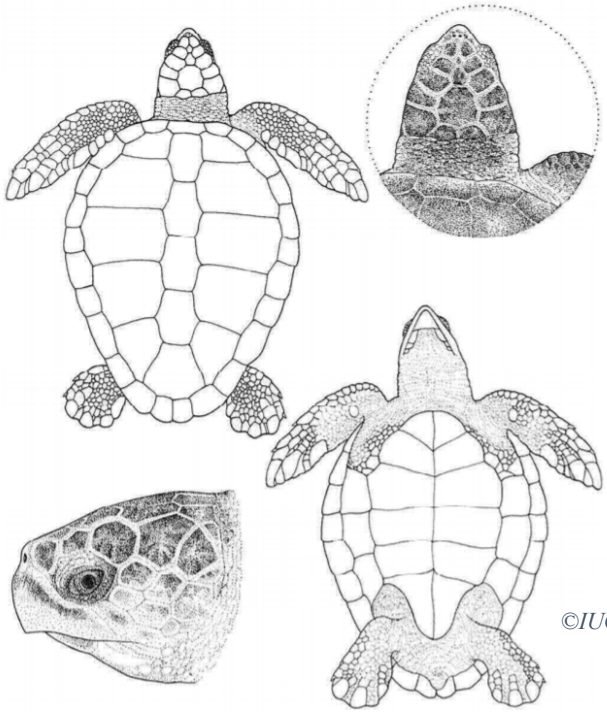
https://www.seeturtles.org/sea-turtles-threats
https://europe.oceana.org/en/threats-sea-turtles

Sea Turtle Species of North Carolina

North Carolina is frequented by five species of sea turtle. In the following section, you will find a brief overview of each species with its appearance, range, diet, nesting habits, and current threats. For a dichotomous key to identify which species you are observing, see Appendix V.

LOGGERHEAD SEA TURTLE (*Caretta caretta*)

Overview:
Named for their large heads, the loggerhead turtle is the most common species of sea turtle that nests on the SE coast of the United States. These turtles reach maturity after 30-35 years and return to nest on beaches in the same region where they were produced.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Range:
Found worldwide, with major nesting populations in Cape Verde, Florida, Brazil, Oman and Australia. In the North Atlantic, they range from the equator to near 50º N latitude (when waters are sufficiently warm), including the Mediterranean and Caribbean.

Appearance:
Loggerhead turtles have large heads with powerful, pointed jaws. In adults, the top of their shell (carapace) is slightly heart-shaped and usually reddish-brown while the bottom (plastron) is usually pale yellow. In the NW Atlantic, barnacles and other epibiota are frequently found on juvenile and adult loggerhead carapaces. Adult female loggerheads in the SE USA have an average carapace length of 98.6 cm (38.6 in.) and a weight of 113 kg (250 lb.). The most common size-class found in North Carolina is the large juvenile stage, when the carapace measures 51 - 76 cm (20 - 30 in.).

Hatchlings
Hatchlings are dark brown above and light brown or tan beneath. Hatchling shell length is approximately 4.1 - 4.8 cm (1.6 - 1.9 in.).

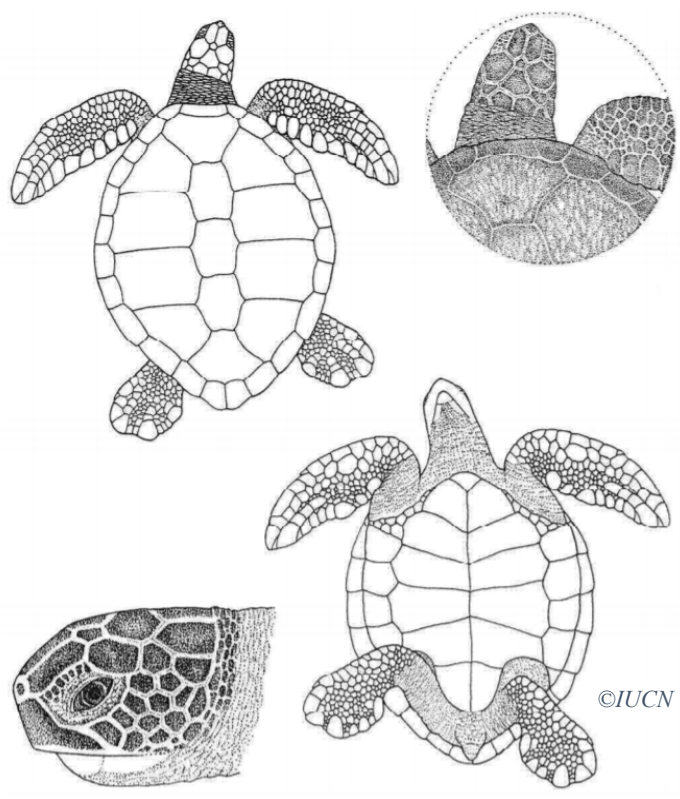
Diet:
Loggerheads are primarily carnivorous, but occasionally consume plant material. Their diet mostly consists of bottom dwelling invertebrates such as whelks, other mollusks, horseshoe crabs, and other crabs. Their powerful jaws are designed to crush their prey.

Nesting:
Primary nesting sites in the North Atlantic include beaches in the western Mediterranean, Cape Verde, Yucatán Peninsula in Mexico, and the SE USA. In this region, loggerheads mate in late March to early June and females lay eggs between late April and early September. They are solitary, night-time nesters, and they prefer high energy, relatively narrow, steeply sloped, coarse-grained beaches for nesting. Adult females lay three to five nests, sometimes more, two weeks apart during a single nesting season. Each nest contains about 120 eggs, from which hatchlings emerge after about 2 months. Loggerhead sea turtles are the most common nesting sea turtle in North Carolina.

Threats:
Loggerheads face various threats throughout their life cycle, including degradation or loss of nesting habitat, incidental capture in fishing gear, vessel strikes, ocean pollution, and climate change.

Sources:
Eckert, K., Bjorndal, K., Abreu-Grobois, A., & Donnelly, M. (Eds.). (1999). *Research and Management Techniques for the Conservation of Sea Turtles* (Vol. 4). IUCNSSC Marine Turtle Specialist Group.
https://www.marinebio.org/species/loggerhead-sea-turtles/caretta-caretta/

GREEN TURTLE (*Chelonia mydas*)



Overview:
The green sea turtle is the largest hard-shelled sea turtle. They are also the only species of sea turtle that is primarily herbivorous. While the turtles themselves are mostly brown, their diet causes their fat to be tinged green; thus, the moniker of “green turtle.”

Range:
Found worldwide, they range in tropical, subtropical and temperate regions, with major nesting populations in Costa Rica, Ascension Island, Guinea Bissau, and Australia. In the North Atlantic, they range from the equator to near 50º N latitude (when waters are sufficiently warm), including the Mediterranean.

Appearance:
They have a comparatively small head with a rounded beak and serrated lower jaw. In adults, the carapace is dark brown, grey, or olive colored and with streaks or blotches while the plastron is yellow/white. Adult female green turtles in the SE USA have an average shell length of 108 cm (42 in.) and a weight of 135 kg (300 lb.). Small juveniles with a shell length between 23 - 45 cm (9 - 18 in.) are common in North Carolina waters.

Hatchlings
Hatchling green turtles have dark brown to black carapaces, that will lighten in their first year. Their underside is white or yellow and their flippers are black with white edges. Hatchling shell lengths is approximately 5 cm (2 in.).

Diet:
As hatchlings, green turtles are omnivorous. Once they reach a few years of age, green turtles become primarily herbivorous, mainly consuming algae and seagrasses. Their diet is supplemented by sponges, invertebrates (particularly jellyfish), and discarded fish.

Nesting:
In the North Atlantic, major nesting occurs on beaches in Suriname, Guinea-Bissau, Costa Rica, the Yucatán Peninsula in Mexico, and in the SE USA. During their reproductive season, females return to nest on beaches in the same region where they were produced every 2 to 5 years. Like most sea turtles, nesting occurs at night. Some green turtles nest in North Carolina each summer. Each nest contains about 120 eggs, which produce hatchlings after about two months of incubation.

Threats:
Like other species, green turtles are threatened by habitat degradation and loss, vessel strikes, ocean pollution, and climate change, in addition to accidental bycatch in fishing gear. Green turtles are

susceptible to fibropapillomatosis, a disease that causes large tumors grown on external and internal soft tissues.

Sources:

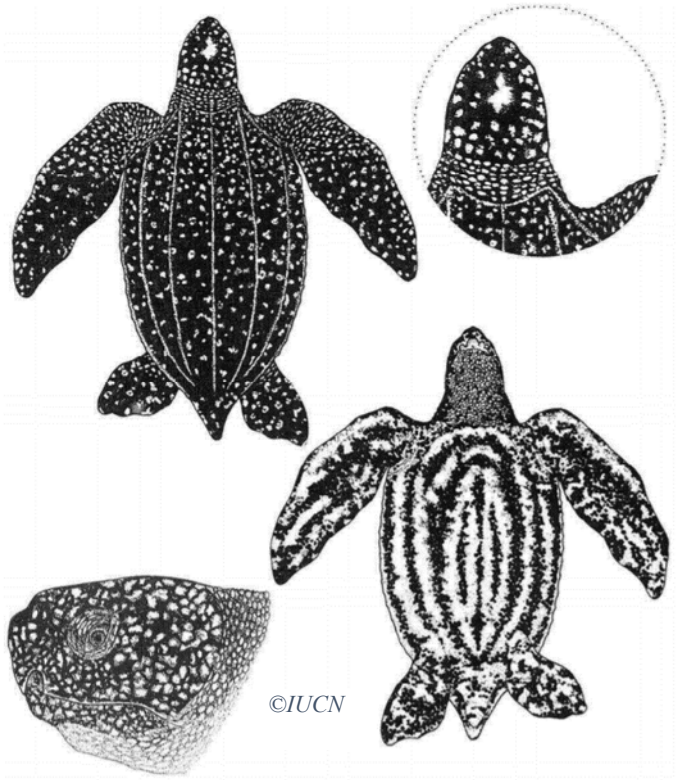
Eckert, K., Bjorndal, K., Abreu-Grobois, A., & Donnelly, M. (Eds.). (1999). *Research and Management Techniques for the Conservation of Sea Turtles* (Vol. 4). IUCNSSC Marine Turtle Specialist Group.

Green Turtle (2021, May 11). NOAA. https://www.fisheries.noaa.gov/species/green-turtle

LEATHERBACK (*Dermochelys coriacea*)

Overview:

The leatherback is the largest turtle in the world and the only species of sea turtle that lacks scales and a hard shell. Named for the tough rubbery skin that covers the carapace, they have remained unchanged for more than 100 million years and can dive nearly 4,000 feet.



Range:

Found in the Atlantic, Pacific, and Indian oceans, leatherbacks primarily live in the open sea but approach shore to nest and follow migratory prey. Leatherback physiology allows them to retain heat in colder waters, and hence they can range to extreme latitudes of the oceans, near the poles.

Appearance:

They have pointed tooth-like cusps and sharp jaws, with backwards-pointing spines in their mouths and throats. Their black, rubbery shells feature seven ridges on top, often with irregular white or pink patches. Adult leatherbacks have a pink spot atop their heads that can used for unique photo ID. Front flippers are long and back flippers are paddle-shaped. Adult Leatherbacks have a shell length between 124-165 cm (49-65 in.) and weigh over 400 kg (900 lb).

Hatchlings

Hatchling leatherbacks are black with white along the outer edges of the flippers and the ridges along their shells. Their body is covered in small scales and their shells measure 6.4 - 7.6 cm (2.5 - 3 in.).

Diet:

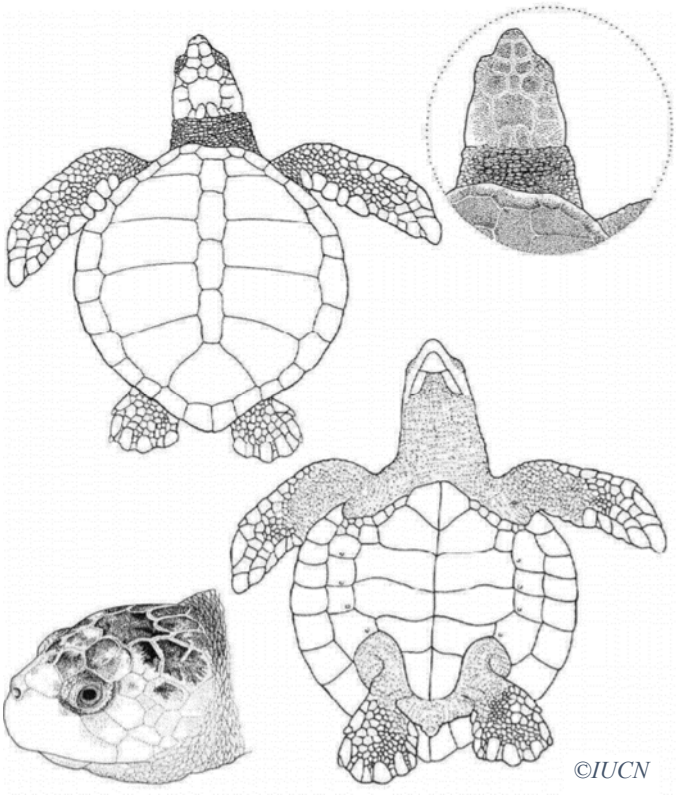
Leatherbacks' primary prey is jellyfish, salps and other soft invertebrates. They migrate long distances following different species of jellyfish and have specially evolved mouths to retain gelatinous prey.

Nesting:
In the North Atlantic, major nesting sites occur in French Guiana, Suriname, Trinidad, Grenada, Colombia, and Panama. In the SE USA, nesting is concentrated along the Atlantic coast of Florida, from March to June, and leatherbacks occasionally nest in North Carolina. Each nest contains about 100 yolked eggs and 30 “yolkless” eggs. Hatchling emergence occurs about 60 days after laying.

Threats:
Like other species, leatherback turtles are threatened by habitat degradation and loss, vessel strikes, ocean pollution, and climate change, in addition to accidental bycatch in fishing gear. Because of the similarity of appearance between jellyfish and floating plastic bags, leatherbacks are particularly susceptible to ingesting plastic marine debris.

Sources:
Eckert, K., Bjorndal, K., Abreu-Grobois, A., & Donnelly, M. (Eds.). (1999). *Research and Management Techniques for the Conservation of Sea Turtles* (Vol. 4). IUCNSSC Marine Turtle Specialist Group.
https://www.fisheries.noaa.gov/species/leatherback-turtle

KEMP’S RIDLEY (*Lepidochelys kempii*)



Overview: The Kemp’s ridley is one of the smallest sea turtle species. In the 1940s, it was estimated that more than 40,000 adult females nested per year in the Gulf of Mexico. However, their population dropped in the 1980s to less than 250 nesting females/yr. Intensive conservation action has led to signs of recovery of the main nesting colony in Tamaulipas, Mexico.

Range:
Primarily found in the Gulf of Mexico and the NW Atlantic, Kemp’s are also occasionally observed in the NE Atlantic and rarely in the Mediterranean.

Appearance:
Kemp’s ridleys have a triangular head with a slightly hooked beak. In adults, the top of their shell (carapace) is grayish-green while the bottom (plastron) is pale yellow. Their shell’s shape is more round than oblong. Front flippers have one claw while their rear flippers have one or two. Adult Kemp’s ridleys have an average shell length of 65 cm

(27 in.) and weigh between 36 - 45 kg (80 - 100 lb.). The most common size class found in North Carolina are small juveniles with a shell length between 25 - 40 cm (10 - 16 in.).

Hatchlings
Hatchling Kemp's ridleys are dark gray on both bottom and top with a short streak of light gray along the back edge of their front flippers. Their shells have ridges running from top to bottom and measure 3.8 - 4.4 cm (1.5 - 1.75 in).

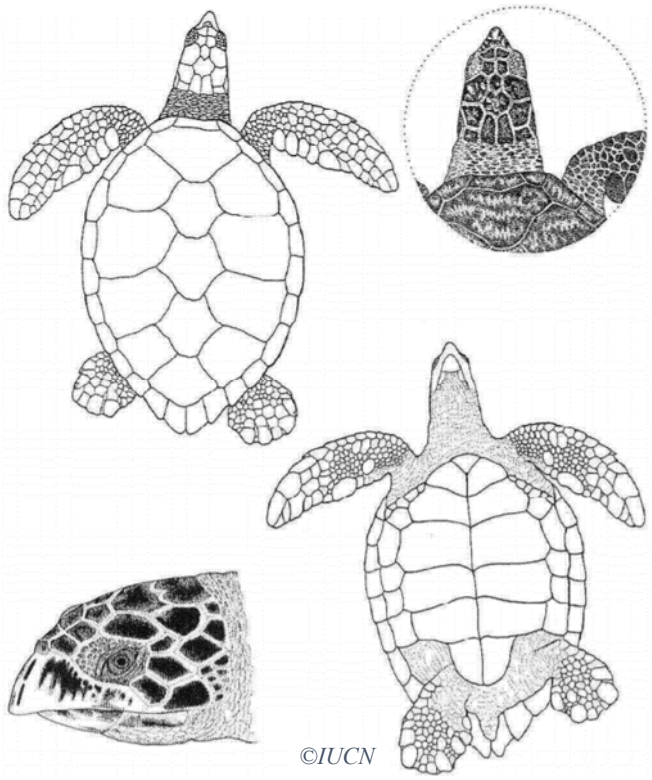
Diet:
The preferred prey of Kemp's ridleys is crab and shrimp, although they will also consume fishing discards and bait. Young turtles often live in floating rafts of Sargassum algae where they feed on small animals and plants.

Nesting:
Kemp's ridleys can display "arribada" nesting behavior, meaning that large groups of females gather offshore before emerging as a group to nest simultaneously. Individual turtles can also nest as solitary animals. This species can nest both during the day and at night. The single primary nesting site occurs in the state of Tamaulipas, Mexico, in the Gulf of Mexico. Regular nesting in smaller numbers also occurs in Texas. This species nests occasionally in North Carolina. Each nest contains about 100 eggs, which finish incubation after 50-60 days.

Threats:
Like other species, green turtles are threatened by habitat degradation and loss, vessel strikes, ocean pollution, and climate change, in addition to accidental bycatch in fishing gear.

Sources:
Eckert, K., Bjorndal, K., Abreu-Grobois, A., & Donnelly, M. (Eds.). (1999). *Research and Management Techniques for the Conservation of Sea Turtles* (Vol. 4). IUCNSSC Marine Turtle Specialist Group.
https://www.fisheries.noaa.gov/species/kemps-ridley-turtle

HAWKSBILL (*Eretmochelys imbricata*)



Overview:
Hawksbills, named for their bird-like beaks, forage mainly on sponges. By eating sponges, hawksbills help create new space for other invertebrate species in reefs and maintain coral biodiversity.

Range:
Found throughout the world, hawksbills prefer habitats in tropical or sub-tropical waters with healthy coral reef habitats. In the North Atlantic, they normally remain south of 26º N latitude.

Appearance:
Hawksbills have tapered heads with a V-shaped jaw and beak, giving them a hawk-like appearance. They have mottled shells with irregular combinations of amber, orange, red, yellow, black, or brown. The edge of their shells is serrated with overlapping scales. Adult hawksbills have a shell length between 76-112 cm (30-44 in) and weigh between 43-74 kg (95-165 lb.). The majority of hawksbills observed in North Carolina are small juveniles, < 35 cm (14 in) carapace length.

Hatchlings
Hatchling hawksbills are a rich brown with large, clearly delineated scutes (shell scales) outlined in black. Their head and flippers match their shell's coloration, and the length of their shell is approximately 2 to 3 inches long. Hatchling hawksbills are easily confused with loggerhead hatchlings.

Diet:
Hawksbills are omnivorous, but their preferred food is sea sponges. They also consume algae, coral, mollusks, and other small sea life. Their specialized beaks help them reach prey between coral and rocks.

Nesting:
In the North Atlantic, major nesting sites include São Tomé and Príncipe, Barbados, Antigua, US Virgin Islands, Puerto Rico, and the Yucatán Peninsula in Mexico. Two nests laid by hawksbills were documented in North Carolina in 2016. Some females make nests under or in vegetation, with each nest containing 130-160 eggs and completing incubation after roughly 2 months.

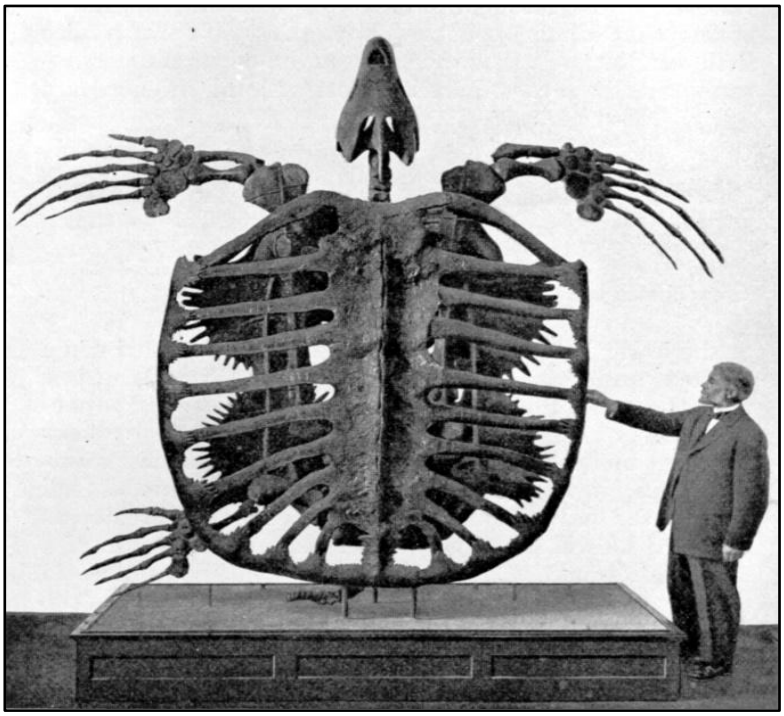
Threats:
Historically, hawksbills were pursued by hunters because of their beautiful "tortoiseshell," which has been used to create jewelry or trinkets. This practice greatly reduced their numbers globally until international trade in tortoiseshell was banned under the CITES agreement in 1977. Tortoiseshell objects can still be found for sale in some countries, although it is illegal to transport shell across international borders.

Hawksbills are also at risk to threats common to all sea turtles, including accidental bycatch in fishing gear, habitat loss, vessel strikes, ocean pollution, and climate change.

Sources:

Eckert, K., Bjorndal, K., Abreu-Grobois, A., & Donnelly, M. (Eds.). (1999). *Research and Management Techniques for the Conservation of Sea Turtles* (Vol. 4). IUCNSSC Marine Turtle Specialist Group.

Hawksbill Turtle. (2021, May 11). NOAA. https://www.fisheries.noaa.gov/species/hawksbill-turtle



Fossil of the Archelon, the largest sea turtle in the fossil records. It went extinct in the Late Cretaceous period (66-100 million years ago). Photo: Yale Peabody Museum.

APPENDIX V - INFORMATION SOURCES

INTERNET:

https://www.seaturtle.org
This is a clearinghouse for information about sea turtles from all over the world. It contains a document library, image repository, maps of turtles tracked by satellite, nesting data, stranding data, etc.

https://www.seaturtlestatus.org/online-map-data
This is an online interactive map and database of sea turtle biogeography. The database contains, "thousands of data records that have been generously contributed by SWOT Team members worldwide and sourced from published literature, including sea turtle nesting data, satellite telemetry data, species distributions, Regional Management Unit (also called subpopulations) boundaries, genetic data (mtDNA and nDNA), and more."

https://www.fisheries.noaa.gov/resources/peer-reviewed-research
The repository for NOAA publications, plans, reports, and outreach materials related to sea turtles.

https://www.fisheries.noaa.gov/national/marine-life-distress/sea-turtle-stranding-and-salvage-network
This is the national office for the US Sea Turtle Stranding and Salvage Network.

NC-CTURTLE
The NC CTURTLE list is designed to facilitate information exchange among the different participants in the NC Sea Turtle Project of the Wildlife Resources Commission. Anyone who works on or has an interest in sea turtles in North Carolina is invited to join the list.
To join or be removed from the list (or any other questions or concerns), please send a message to: matt.godfrey@ncwildlife.org

BOOKS
There are many books on sea turtles, from kids' books to coffee table books to more serious scientific books. The following is a partial list– search for more at www.amazon.com using "sea turtle."

Crawford, S.D. 2020. The Last Turtlemen of the Caribbean: Waterscapes of Labor, Conservation, and Boundary Making (Flows, Migrations, and Exchanges). University of North Carolina Press. ISBN: 978-1469660219

Davis, F.R. 2007. The Man Who Saved Sea Turtles: Archie Carr and the Origins of Conservation Biology. Oxford University Press. ISBN: 978-0195310771

Dutton, P.H., D. Squires, M. Ahmed (Eds.). 2011. Conservation of Pacific Sea Turtles. University of Hawaii Press. ISBN:978-0824834074

Hughes, G. 2015. Between the Tides: In Search of Sea Turtles. Jacana Media. ISBN: 978-1431405626

Manire, C. et al. (Eds.). 2017. Sea Turtle Health & Rehabilitation. J Ross Publishing. ISBN: 978-1604270990

Murphy, S.R. 2019. Turning of the Tide. A Memoir. Evening Post Books. ISBN: 978-1929647392

Nahill, B. (Ed.). 2020. Sea Turtle Research and Conservation: Lessons From Working In The Field. Academic Press. ISBN: 978-0128210291

Nichols, W.J., B. Nahill and M. Gaskill. 2014. A Worldwide Travel Guide to Sea Turtles. Texas A&M University Press. ASIN: B00IPXYZE6

Rieser, A. 2012. The Case of the Green Turtle: An Uncensored History of a Conservation Icon. Johns Hopkins University Press. ISBN: 978-1421405797

Seminoff, J.A., B.P. Wallace (Eds.). 2012. Sea Turtles of the Eastern Pacific: Advances in Research and Conservation. University of Arizona Press. ISBN: 978-0816511587.

Shanker, K. 2016. From Soup to Superstar: The Story of Sea Turtle Conservation along the Indian Coast. Harper Litmus Press. ISBN: 978-9351772323

Spotila, J.R. 2011. Saving Sea Turtles: Extraordinary Stories from the Battle against Extinction. John Hopkins University Press. ISBN: 978-0801899072

Spotila, J.R., P. Santidrián Tomillo (Eds.). 2015. The Leatherback Turtle: Biology and Conservation. Johns Hopkins University Press. ISBN: 978-1421417080

Witherington, B.E., D. Witherington. 2015. Our Sea Turtles: A Practical Guide for the Atlantic and Gulf, from Canada to Mexico. Pineapple Press. ISBN: 978-1561647361

Wyneken, J., K.J. Lohmann, J.A. Musick (Eds.). 2013. The Biology of Sea Turtles, Volume III. CRC Press. ISBN: 978-1439873076

SUPPLIES:
Nitrile gloves: https://www.uline.com/Grp_366/Nitrile-Gloves

Plastic mesh to be used a predator excluder over turtle nests:
https://masternetltd.com/products/industrial/industrial-commercial-mesh

PIT tag scanner: https://www.biomark.com/product/hpr-lite-handheld-pit-tag-reader/

APPENDIX VI - SPECIES IDENTIFICATION KEY

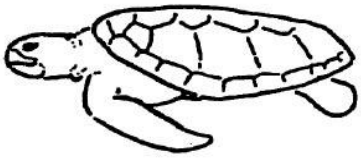
KEY FOR IDENTIFYING SEA TURTLE SPECIES IN THE WESTERN NORTH ATLANTIC

As well as the document below, http://www.seaturtle.org/documents/ID_sheet.pdf contains an infographic on identifying sea turtle species.

A. Shell black and leathery with longitudinal ridges:

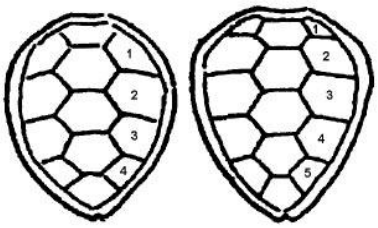
----------**LEATHERHBACK**----------

A. Shell not black and is hard----------B.



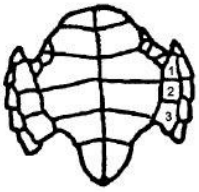
B. Costal (lateral) scute pairs usually 4----------C.

B. Costal (lateral) scute pairs 5 or more ----------D.

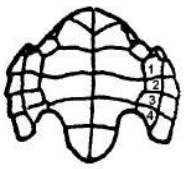


C. Two large scutes (one pair) between eyes, shell smooth, mouth normal, shell color light brown with starburst patterns, top of flippers and head light brown in color ---------**GREEN**----------

C. Four scutes (2 pairs) between eyes, scutes overlapping on carapaces, shell dark brown with light brown blotches. Top of flippers and head dark to black ----------**HAWKSBILL**----------



D. Lower shell (plastron) has 3 inframarginals, colors of upper shell (carapace), head and flippers are reddish brown ------ **LOGGERHEAD**----------



D. Lower shell (plastron) has 4 inframarginals with pores, upper shell (carapace), head, and flippers are greenish gray or dark gray----------E

E. Costal (lateral) scutes usually 5 pairs
----------**KEMP'S RIDLEY**----------

E. Costal (lateral) scutes usually 6 or more
----------OLIVE RIDLEY----------

Skulls of three species of sea turtles frequenting North Carolina waters. Left = leatherback, center = Kemp's ridley, right = loggerhead.

APPENDIX VII- NESTING FEMALE DNA SAMPLING

The Georgia Department of Natural Resources, South Carolina Department of Natural Resources, and the North Carolina Wildlife Resources Commission Sea Turtle Programs are participating in a multi-state genetics research project along with the University of Georgia to answer several basic loggerhead sea turtle nesting questions. The answers will help biologists better understand how the loggerhead population is doing. By collecting an egg from every nest, we will use DNA genetic fingerprinting to identify individual loggerhead nesting females. This information will provide a census of the actual nesting population. In addition to estimating how many females are nesting in Georgia, South Carolina, and North Carolina each year, we also have the potential to answer the following questions:

How many clutches of eggs does each nesting female lay in a year?
Is the female nesting on more than one beach?
How far apart are her nests?
How many turtles are nesting in more than one state?
Most individual females do not nest every year. How often does each turtle nest: every two years, three years, four or more years?
How precisely does a daughter return to her hatching site to lay her eggs?
For more specific information, please visit: http://www.dnr.sc.gov/seaturtle/volres/genetics.pdf

Sampling

The goal is to collect a sample from every single nest laid in North Carolina. For each nest, a sample from a single, freshly laid egg should be collected and placed in a vial containing EtOH (these will be provided). Only the eggshell is needed; please discard the contents (in the surf, buried in a hole in the sand, etc.). If the fresh nest has been predated or contains yolkless spacer eggs, these eggshells can be used in lieu of opening another egg from the nest. Ensure the eggshell is fully submerged in the liquid and that the vial is fully closed; if sand is trapped in the threads under the cap, the EtOH may leak or evaporate. Immediately label the vial with the correct code (see below) and activity number and store upright in a cool, dark place until collected by project biologists. Clear tape should be affixed over the label to prevent smearing in the event of EtOH leakage.

In some cases, it is not possible to collect an eggshell sample from freshly laid eggs. For example, if you were unable to locate the eggs when the nest was laid, or if you find a “wild” nest because of emerged hatchlings. For these cases, collect a sample from the nest during inventory. The following is a list of types of sample to be collected, in order of preference – remember to label the vial as you would for a normal sample:

A. Dead Hatchling (place whole hatchling or part of hatchling in DNA eggshell vial).
B. Dead embryo (collected from inside an unhatched egg – place in DNA eggshell vial).
C. Whole unhatched egg (place contents and eggshell from unhatched egg in DNA eggshell vial).
D. Empty eggshells from hatched eggs (place in DNA eggshell vial).

Note that the likelihood of successful DNA identification decreases as you go down the list. But it is worth the effort to try to ID the female that laid the clutch of eggs.

When labeling the vial, use a permanent marker to write and use the following labeling scheme (below). Cover the written ID with scotch tape to help protect the label

two digit year - three digit beach code (see table below) - activity number

BEACH CODES FOR NC:

Atlantic Beach	ATL
Bald Head Island	BHI
Cape Hatteras NS	HAT
Cape Lookout NS	LKT
Carolina Beach	CRL
Caswell Beach	CSW
Emerald Isle	EMD
Figure Eight	FIG
Fort Fisher	FFS

Fort Macon	FTM
Hammocks Beach	HMM
Holden Beach	HLD
Indian Beach/Salter Path	IND
Kure Beach	KUR
Lea Huttaf	LEA
Masonboro Island	MSB
Oak Island	OAK

Ocean Isle	OCN
Onslow Beach	ONS
Pea Island NWR	PEA
Pine Knoll Shores	PKS
Sunset Beach	SUN
Topsail Island	TPS
VA to Oregon Inlet (or NEST)	ORE
Wrightsville Beach	WRG

An example of a properly labeled vial for a sample taken on Masonboro Island. Be sure you are using your correct beach code and that the activity number (last 2 digits) matches what you enter in the nest database. Note spacer eggs, such as the one in the photo, can be used as the DNA sample.

APPENDIX VIII - FILLING OUT A STRANDING FORM

To Report a Stranded Turtle, fill out a stranding form and upload to www.seaturtle.org/strand. A blank stranding form and clarification of some of the fields are provided below.

OBSERVERS FULL NAME: This is the person who handled the turtle in the field. Please include your middle initial if you have one. Records are partially indexed by observers' initials.

STRANDING DATE: This is the date the stranded turtle was first observed or encountered. If you did not investigate until a later date, please make this known in the remarks section, but use the first observed date for stranding date.

ADDRESS/AFFILIATION and AREA CODE/PHONE NUMBER: Because we may need to contact you for clarification of the reported data, please provide an address and phone number.

TURTLE NUMBER BY DAY: This is used to keep track of more than one turtle reported on a single day by the same individual. Your first turtle of the day is 01, second of same day is 02, etc.

PHOTOS TAKEN?: Check YES if photos were taken of the stranded turtle. You are encouraged to take photos and submit them with the stranding form to the online system (or emailed/texted).

SPECIES VERIFIED BY STATE BIOLOGIST?: If the species was verified by state biologists, check yes; if not, leave both boxes unchecked. It is likely that a biologist will verify species by reviewing photos.

SEX: This will most often be undetermined, as immature sea turtles cannot be sexed externally. If the turtle is adult sized (>90 cm CCL for loggerheads or green turtles, and >55 cm CCL for Kemp's ridley turtles), please measure the distance the tail extends beyond the carapace's posterior tip and enter in the adjacent field (note only adult males have elongated tails; adult females have short tails).

HOW WAS SEX DETERMINED?: If sex was determined by necropsy, please check "necropsy". If you circle male or female and do not give a reason, we must code the sex as undetermined.

STATE: Enter "NC".

COUNTY: Enter the county where the turtle stranded.

LOCATION: Please describe the location in case there is no GPS location recorded. Good reference points include nearest street address, inlets, fishing piers, cape points, light houses, channel markers, watertanks, etc. Also, indicate if the stranding was inshore or on the ocean beach.

LATITUDE/LONGITUDE: Use your smartphone (or GPS unit if you have one), to establish the latitude/longitude of the stranded turtle. Please use decimal degrees, if possible. An easy way to keep track of the numbers is to take a screenshot of the phone or photo of the GPS unit. If you cannot provide accurate lat/long values, please leave these spaces blank.

CONDITION OF TURTLE: Choose the appropriate category:

1. Alive (confirmed breathing, movement, etc.)
2. Fresh dead (died within a few hours of observation. There should be no smell of decomposition or bloating, and eyes should not be cloudy)
3. Moderately decomposed (mild to moderate smell of decomposition, possible bloating of carcass, eyes may be bulging, soft tissue may be spongy, and skin/scutes might start to slough)
4. Severely decomposed (foul smell to the carcass, either greatly distended by gas or deflated, skin sloughing, limbs starting to disarticulate, and presence of maggots
5. Dried carcass (turtle is completely desiccated with only dry skin/bones and little smell)
6. Skeletal (only bones are present)

FINAL DISPOSITION OF TURTLE: Check the most appropriate box to indicate what you did with the turtle. If the carapace was painted, please indicate what color paint was used. If samples collected, please note what exactly was taken and note what was done with the remainder of the carcass.

TAG NUMBER(S): Record any metal tag numbers (if found) and the flippers they were found on. Be sure to write down the return address on the back side of the tag. If PIT tag scanner is available, carefully

scan front flippers and shoulders and record any positive ID numbers. Take a photo of the PIT tag scanner screen with detected ID to help avoid transcription errors. Living tags are rarely found on sea turtles in SE USA, but please take photos of any discolored areas of the carapace or plastron. Check “NO” for Coded Wire Tag Scan (these tags are no longer used). If you find a tagged turtle (flipper tags, PIT tags, telemetry device, etc.), alive or dead, please call the Sea Turtle Hotline immediately (252-241-7367), as there may be special requests for samples from tagged turtles.

REMARKS: This space is for your observations. The more information you include, the more useful the report to the stranding program. Use the back of the data sheet to continue your remarks if needed. Note anything unusual about the stranding; some of the more common anomalies are listed on the sheet. ***IF NO ANOMALIES WERE FOUND, WRITE THIS DOWN.*** Use the diagrams in the lower left hand corner to indicate flipper damage, wounds, tag locations or anything else you want to note about the turtle.

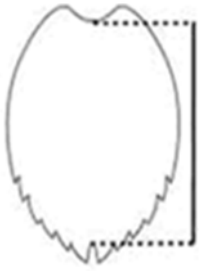
MEASUREMENT BOX: Enter the carapace measurements in the correct fields (straight and/or curved length and width). Circle the units you used as centimeters (cm) or inches (in). We strongly encourage all stranding network participants to take measurements in centimeters. Please measure according to the diagrams below. Note that only straight-line measurements taken with tree calipers will be accepted. If you don’t have tree calipers, use a flexible (not metal) tape measure for curved measurements. Lay measuring tape OVER any barnacles or other epibionts (do not go around barnacles and do not knock them off). Note below the difference between carapace length notch-tip vs notch-notch. Carapace width is measured at the widest point along the carapace. For leatherback turtles, lay a sufficiently long measuring tape from nuchal notch to the tapering end of the carapace (the “peduncle”), on either the left or right side of the central keel of the carapace. There will be only one length measurement for leatherbacks.

Carapace Length Notch to Tip

Distance from the center of the nuchal notch (near the neck) to the longest tip of the posterior marginal scute at the end of the carapace

Straight length (SCL) = measured with calipers

Curved length (CCL) = measured with flexible measuring tape



Carapace Length Notch to Notch

Distance from the center of the nuchal notch (near the neck) to the top of the notch between the tips of the posterior marginal scute at the end of the carapace

Straight length (SCL) = measured with calipers

Curved length (CCL) = measured with flexible measuring tape

OMB Control No.: 0648-0774
Expiration Date: 12/31/2024

Sea Turtle Hook & Line Incidental Capture Intake Form Instructions

Introduction: All sea turtles in United States waters are listed as threatened or endangered under the Endangered Species Act (ESA). When sea turtle distribution overlaps with commercial and recreational fishing effort, sea turtles may be accidentally captured in the fishing gear. For commercial fisheries, observers are often placed on vessels to better understand these interactions. These observations provide insight into how and why these interactions occur and the impact of the interactions on sea turtle populations. In contrast, recreational fishing often occurs from shore, piers, and private vessels making traditional observer coverage challenging. Therefore, alternative data collection methods must be considered. NOAA Fisheries will use this information to gain similar insights into recreational fishing interactions and impacts. Pier is used as a general term, and the form can be used for recreational fishing interactions on any fishing structure (e.g., jetty, pier, boat, shore).

Angler Interview: Questions 1 – 3 should be asked of the angler by the sea turtle stranding responder. If the angler is not available, please answer as many questions as possible.

1) **Where was angler fishing?** Circle location from choices given. Beach includes beaches, bulkheads and anything that is parallel to the shoreline and does NOT extend out over the water. Pier includes any structures that extend over the water such as piers, docks, etc.
2) **What was angler fishing for?** Select up to two target species. If angler names >2 species, choose: *Anything*. Species are region specific.
3) **Bait used:** Circle bait type used. If using whole or cut fish circle appropriate choice, record species if possible.

Gear Information: Questions 4 – 8 may be asked of the angler by the sea turtle stranding responder or recorded at the rehabilitation facility. <u>If possible, try and collect the fishing gear.</u> If the angler will not provide the gear, record the information on site. If the angler is not available, please answer as many questions as possible. Please use calipers to measure the hook.

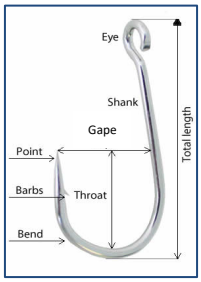
4) **Hook type used:** Identify type of hook used based on examples and descriptions below.

Circle hook

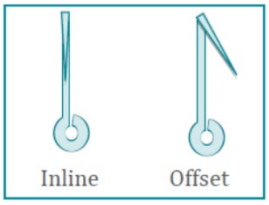
Treble hook

J-hook

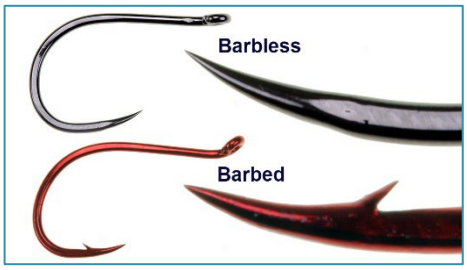
Kahle hook



- **Circle hook:** only hook with the tip curved back towards the shank at a 90° angle.
- **Treble hook:** consists of three hooks with a single eye, often used with artificial lures.
- **J-hook:** the shank is straight and resembles the letter "J" and the point and barb do not point toward the shank.
- **Kahle hook:** curved back in an oval shape with the hook point pointed toward the hook eye; distance between the point and the shank is much greater than on a circle hook.



5) **Record if the hook is Inline, Offset, Undetermined or Not Applicable (NA).** On an offset hook, the tip of the hook is not in line with the eye. The degree of offset can vary.
6) **Is the hook barbless?** Circle no or yes.
7) **What is the hook Total Length (mm):** measure the total length from the top of the eye to the bottom of the hook, as shown on page 1.
   A metric vernier caliper is recommended for recording hook measurements.
8) **What is the Gape (mm)?** Measure the Gape from the tip of the point to the inside of the shank, as shown on page 1.



Interaction Information: Questions 9 – 14 may be recorded by the sea turtle stranding responder and/or the rehabilitation facility staff depending on the type of hooking and gear location. If possible, please take photos of the gear interaction before removing the gear.

9) **Interaction type:** select the appropriate type of interaction between the sea turtle and the fishing gear.
10) **Hook/Gear Location:** select the answer that describes the location of the gear. If the hook is NOT visible inside the mouth it is considered swallowed.
11) **If turtle was released by the angler, was the hook and all line removed?** Select answer.
12) **If no, amount of line remaining on turtle (inches) _____.** Ask angler to estimate how much line was still attached to the hook when the line was cut.
13) **Hook Removal:** select the answer(s) that describe how the hook was removed. If an instrument was used, write what type in the blank. If an angler used an instrument select BOTH A) and I). If the hook was not removed, was it monitored for passage or was the animal released with the hook still in place?
14) **Were any other hooks observed (either on radiograph or visually)?** If additional hooks are observed, please answer the questions describing hook type, size and location for each additional hook in the animal.

Additional Comments: Please include any additional comments regarding the interaction that were not already recorded.

Questions 15 – 26 are only answered if additional hooks are observed.

***If possible, please take photos of the gear interaction before removing the gear. Please collect the fishing gear and contact your State Coordinator for instructions on disposition of gear. Submit this form along with your STSSN form to your State Coordinator.**

SEA TURTLE STRANDING AND SALVAGE NETWORK — STRANDING REPORT

OBSERVER'S NAME AND CONTACT INFORMATION:

First _____ M.I. _____ Last _____
Email _____
Affiliation _____
Phone number (_____) _____

STRANDING DATE: *Use two digits for date fields.*

Year 20__ __ Month__ __ Day__ __
Turtle number by day__ __ __ *Use three digits.*
State coordinators must be notified within 24 hrs; this was done by:
☐ *phone (252) 241-7367* ☐ *email sarah.finn09@ncwildlife.org*
☐ *report entered online (seaturtlestranding.com)*

STRANDING LOCATION:

State _____ County _____
Latitude _____ Longitude _____
Location description _____

SPECIES: (check one)

☐ Loggerhead (CC)
☐ Green turtle (CM)
☐ Leatherback (DC)
☐ Hawksbill (EI)
☐ Kemp's ridley (LK)
☐ Olive ridley (LO)
☐ Unidentified

Check unidentified if not positive. Do not guess.

CIRCUMSTANCES OF ENCOUNTER: (check one)

Traditional Stranding
☐ Found washed ashore or washing ashore
☐ Found floating/struggling at water surface
☐ Found underwater
☐ Trapped in jetty rocks

Incidental Capture
☐ Caught by recreational fisherman
☐ Found in the intake canal of power plant
☐ Found in dredge equipment
☐ Entangled in line of pot/trap buoy
☐ Caught in commercial hook/line fishery
☐ Caught in commercial net fishery
☐ Captured during relocation efforts
☐ Captured during research efforts
☐ Other _____

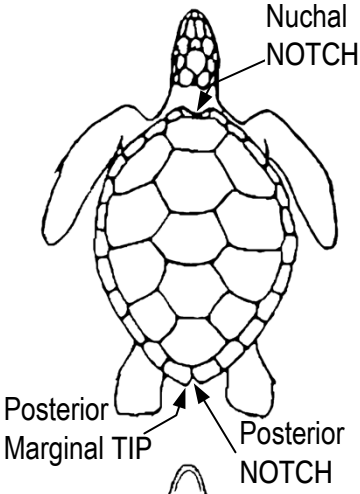
Nesting Related
☐ Caught under boardwalk/dune crossover
☐ Caught in moveable beach structure
☐ Hit by a car
☐ Wandered landward of dune (not hit by car)
☐ Trapped in man-made rock formation
☐ Trapped in a natural rock formation
☐ Fell off of/overturned by seawall
☐ Trapped by collapsed dune/scarp
☐ Post-hatchling Washback
☐ Cold-stunning

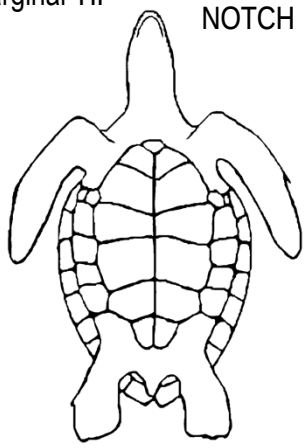
PHOTOS: (submit photos to state coordinator)

☐ YES (indicate below the completeness of photo series) ☐ NO
☐ Dorsal aspect visible ☐ Ventral aspect visible
A complete photo series includes photographs of the dorsal and ventral aspects of the turtle, and all injuries or anomalies.

CONDITION: (check one)

☐ Alive
☐ Fresh dead or mildly decomposed
☐ Moderately decomposed
☐ Severely decomposed
☐ Dried carcass
☐ Skeletal





TAGS:

Contact state coordinator before disposing of a tagged turtle!
Flipper tags found? ☐ YES ☐ NO
Check all 4 flippers. If found, record tag number & location.
1. _____
2. _____
3. _____
PIT tag scan performed? ☐ YES ☐ NO
Check all 4 flippers. If found, record tag id & location.
1. _____
2. _____
Possible tag scars? ☐ YES ☐ NO
Check all locations of possible tag scars:
☐ Front left ☐ Front right ☐ Rear left ☐ Rear right
Living tag found? ☐ YES ☐ NO
If found, photograph & record scute number & side.
_____
Tracking gear found? ☐ YES ☐ NO If present, describe.
Do not dispose of turtle or remove gear; consult STSSN coordinator.
_____

CARAPACE MEASUREMENTS:

Measurements were: ☐ Actual ☐ Estimated

Using calipers		Choose unit
Straight length (notch-tip)	_____	☐ cm ☐ in
Minimum length (notch-notch)	_____	☐ cm ☐ in
Straight width (widest point)	_____	☐ cm ☐ in
Using non-metal measuring tape		**Choose unit**
Curved length (notch-tip)	_____	☐ cm ☐ in
Minimum length (notch-notch)	_____	☐ cm ☐ in
Curved width (widest point)	_____	☐ cm ☐ in

EXAMINATION DETAILS:

Type of examination: (check one)
☐ In-person exam by STSSN participant
☐ Evaluated from photographs submitted by the public
Completeness of body: (check all that apply)
☐ Complete
☐ Missing head
☐ Missing all or most (>50%) of one or more flippers
☐ Missing 50% or more of the shell (body)
☐ Not determined
Mouth checked? ☐ YES ☐ NO ☐ UNKNOWN

WEIGHT: (do not estimate weight)

Measured weight: _____ Choose unit ☐ kg ☐ lb

TAIL MEASUREMENT:

Did the tail extend past the carapace?
At least 5cm/2in (LK or LO), 10cm/4in (CC, CM, EI), or 15cm/6in (DC)
☐ YES, directly measured: _____ Choose unit ☐ cm ☐ in
☐ NO ☐ NOT DETERMINED

FATE OR FINAL DISPOSITION:

If the stranded turtle was alive, choose one of the following:
Alive: ☐ immediately released *or* ☐ unable to recover
☐ Alive, taken to rehabilitation facility; where?
_____
☐ Died before reaching rehabilitation facility
If the turtle was found dead or died, choose one of the following:
☐ Dead and left where found; marked? ☐ YES ☐ NO
If marked, describe: _____
☐ Dead; buried, rendered, or otherwise disposed of
☐ Dead and salvaged; location of salvaged remains?
_____
Salvaged for necropsy? ☐ YES ☐ NO

ANTHROPOGENIC MATERIAL

Was there any man-made material found on the turtle (e.g., fishing gear, tar, or oil)? ☐YES ☐NO If yes, were photos taken? ☐YES ☐NO

If man-made material was present, please answer the following questions. (check all that apply)

Were any fishing hooks present on the turtle? ☐YES ☐NO
If yes, was the gear collected? ☐YES ☐NO
Where were the hooks located? ☐Mouth ☐Head ☐Neck ☐Carapace ☐Plastron ☐Front flipper ☐Rear flipper ☐Tail

Was line <0.5 cm dia. present on the turtle (fishing line)? ☐YES ☐NO
If yes, was the gear collected? ☐YES ☐NO
Where was the line located? ☐Mouth ☐Head ☐Neck ☐Carapace ☐Plastron ☐Front flipper ☐Rear flipper ☐Tail ☐Cloaca

Was the turtle entangled in line ≥0.5 cm dia. (nautical rope)? ☐YES ☐NO
If yes, was the gear collected? ☐YES ☐NO
Where was the line located? ☐Head ☐Neck ☐Carapace ☐Plastron ☐Front flipper ☐Rear flipper ☐Tail

Was the turtle entangled in fishing net? ☐YES ☐NO
If yes, was the gear collected? ☐YES ☐NO
Where was the net located? ☐Head ☐Neck ☐Carapace ☐Plastron ☐Front flipper ☐Rear flipper ☐Tail

Was there any tar or oil present? ☐YES ☐NO
If yes, were any samples collected? ☐YES ☐NO
Where was the tar or oil located? ☐Mouth ☐Head ☐Neck ☐Carapace ☐Plastron ☐Front flipper ☐Rear flipper ☐Tail

Was there any other man-made material present? ☐YES ☐NO
Please describe the material:
Where was the material located? ☐Mouth ☐Head ☐Neck ☐Carapace ☐Plastron ☐Front flipper ☐Rear flipper ☐Tail

_____

INJURIES

Were any injuries externally evident? ☐YES ☐NO If yes, were photos taken? ☐YES ☐NO

If injuries were evident, please answer the following questions. (check all that apply)

Were there any definitive vessel-strike injuries evident? ☐YES ☐NO
Where were these injuries located? ☐Head ☐Neck ☐Carapace ☐Plastron ☐Front flipper ☐Rear flipper ☐Tail

Were there any blunt force injuries evident? ☐YES ☐NO
Where were these injuries located? ☐Head ☐Carapace ☐Plastron

Were there any shark-bite injuries evident? ☐YES ☐NO
Where were these injuries located? ☐Head ☐Neck ☐Carapace ☐Plastron ☐Front flipper ☐Rear flipper ☐Tail

Were there any amputations of unknown cause evident? ☐YES ☐NO
How many amputations were present? _____
Where were these amputations located? ☐Front left flipper ☐Front right flipper ☐Rear left flipper ☐Rear right flipper

Was there an incised wound evident? ☐YES ☐NO
(e.g., clean cuts, as created by knife; typically longer than wide)
Where was the wound located? ☐Head ☐Neck ☐Carapace ☐Plastron ☐Front flipper ☐Rear flipper ☐Tail

Was there a perforating or penetrating wound evident? ☐YES ☐NO
(a wound that is typically deeper than wide)
Where was the wound located? ☐Head ☐Neck ☐Carapace ☐Plastron ☐Front flipper ☐Rear flipper ☐Tail

Was there a wound indicative of entanglement or ingestion of anthropogenic material without this material being present? ☐YES ☐NO
Where was the wounds located? ☐Head ☐Neck ☐Carapace ☐Plastron ☐Front flipper ☐Rear flipper ☐Tail

Was there a furrow on the edge of the beak? ☐YES ☐NO

Was there some other type of injury evident (not already described)? ☐YES ☐NO
Please describe: _____

DISEASES AND LEECHES

Were any diseases or leeches externally evident? ☐YES ☐NO If yes, were photos taken? ☐YES ☐NO

If diseases or leeches were evident, please answer the following questions. (check all that apply)

Were there any fibropapilloma-like tumors present? ☐YES ☐NO If yes, were photos taken? ☐YES ☐NO
Were eye tumors present? ☐YES ☐NO
Were mouth tumors present? ☐YES ☐NO
Did any of the tumors have a papillary texture? ☐YES ☐NO

Were there any non-fibropapilloma-like tumors present? ☐YES ☐NO If yes, were photos taken? ☐YES ☐NO
Please describe: _____

Were there any external skin lesions evident? ☐YES ☐NO If yes, were photos taken? ☐YES ☐NO
Which of the following best describes the lesions? ☐Superficial crusts on the skin surface ☐Deep lesions exposing underlying tissue ☐Both superficial crusts and deep lesions were present ☐Neither
Which best describes the extent of superficial crusts? ☐Found only in single area or in a few small, isolated areas ☐Found over large areas
Where were the superficial crusts found? ☐Head ☐Neck ☐Carapace ☐Plastron ☐Front flipper ☐Rear flipper ☐Tail
Which best describes the extent of the deep lesions exposing underlying tissues?
☐Found only in single area or in a few small, isolated areas ☐Found over large areas
Where were the deep lesions found? ☐Head ☐Neck ☐Carapace ☐Plastron ☐Front flipper ☐Rear flipper ☐Tail

Were there any leeches or leech eggs evident? ☐YES, small isolated egg patches or few adults ☐YES, large egg patches or many adults ☐NO If yes, were photos taken? ☐YES ☐NO

ADDITIONAL COMMENTS: _____

Sea Turtle Hook & Line Incidental Capture Intake Form

(To be filled out by the responding STSSN participant)

STSSN ID #: _____ Capture Location: _____ DATE:_____

1) Where was angler fishing? S) Shore B) Boat P) Pier U) Unknown

2) What was angler fishing for? (select up to 2, if >2 choose: A) Anything) (Regionally specific species)
A) Anything B) Catfish C) Croaker D) Drum (Red/Redfish/Black) E) Flounder
F) Ground mullet/Whiting G) Mackerel (King/Spanish) H) Trout I) Shark
O) Other:_____ U) Unknown

3) Bait used: DS) Dead shrimp LS) Live shrimp S) Squid C) Crab A) Artificial
WL) Whole live fish: _____ WD) Whole dead fish: _____
CB) Cut bait/fish:_____ O) Other: _____ U) Unknown

4) Hook Type: C) Circle T) Treble J) J K) Kahle U) Undetermined
5) Select best answer: O) Offset I) Inline U) Undetermined N) NA

6) Is the hook barbless? N) No Y) Yes

7) What is the hook Total Length (mm)? (Measure length from top of hook to bottom) _____mm

8) What is the Gape (mm)? (Measure gape from tip of the point to the inside of the shank) _____mm

9) Interaction type:
H) Hooked E) Entangled HE) Hooked & entangled U) Unknown
O) Other:_____

10) Hook/Gear Location:
a) External – E) Hooked anywhere on the body, flippers or head
External location: _____
b) Inside mouth – Hook still visible
B) Beak T) Tongue G) Glottis R) Roof of mouth O) Other mouth tissue E) Esophagus
c) Swallowed – S) Hook is NOT visible; (note internal location, if known)
Internal location: _____
d) Unknown - U) Hook location is not known

11) If turtle was released by the angler, was the hook and all line removed? YES NO NA
12) If no, estimated amount of line remaining on turtle (inches) _____

13) How was the hook removed? A) Angler removed I) Instrument_____
S) Surgery required M) Not removed, monitored for passage N) Not removed before release

14) Were any other hooks observed (either on radiograph or visually)? YES NO Unknown
If yes, answer questions on next page for each additional hook.

Additional Comments: _____
_____

***If possible, please take photos of the gear interaction before removing the gear, collect the fishing gear and contact your State Coordinator for instructions on disposition of gear. Submit this form along with your STSSN form to your State Coordinator.**

OMB Control No.: 0648-0774
Expiration Date: 12/31/2024

Sea Turtle Hook & Line Incidental Capture Intake Form
Additional Hooks

STSSN ID #: _____

Hook #: _____

15) Hook Type: C) Circle T) Treble J) J K) Kahle U) Undetermined
16) Select best answer: O) Offset I) Inline U) Undetermined N) NA

17) Is the hook barbless? N) No Y) Yes

18) What is the hook Total Length (mm)? (Measure length from top of hook to bottom) _____mm

19) What is the Gape (mm)? (Measure gape from tip of the point to the inside of the shaft) _____mm

20) Hook/Gear Location:
a) External – E) Hooked anywhere on the body, flippers or head
External location: _____
b) Inside mouth – Hook still visible
B) Beak T) Tongue G) Glottis R) Roof of mouth O) Other mouth tissue E) Esophagus
c) Swallowed – S) Hook is NOT visible; (note internal location, if known)
Internal location: _____
d) Unknown - U) Hook location is not known

Hook #: _____

21) Hook Type: C) Circle T) Treble J) J K) Kahle U) Undetermined
22) Select best answer: O) Offset I) Inline U) Undetermined N) NA

23) Is the hook barbless? N) No Y) Yes

24) What is the hook Total Length (mm)? (Measure length from top of hook to bottom) _____mm

25) What is the Gape (mm)? (Measure gape from tip of the point to the inside of the shaft) _____mm

26) Hook/Gear Location:
a) External – E) Hooked anywhere on the body, flippers or head
External location: _____
b) Inside mouth – Hook still visible
B) Beak T) Tongue G) Glottis R) Roof of mouth O) Other mouth tissue E) Esophagus
c) Swallowed – S) Hook is NOT visible; (note internal location, if known)
Internal location:_____
d) Unknown - U) Hook location is not known

Additional Comments: _____
_____
_____

PRA STATEMENT
Recreational Angler Survey of Sea Turtle Interactions
OMB Control Number: 0648-0774
Expiration Date: 12/31/2024

A. SURVEY JUSTIFICATION

Collection of these data on sea turtle interactions in the pier-based recreational fishing sector is necessary to fulfill statutory requirements of the Endangered Species Act (16 U.S.C. 1531 et. seq.) Section 7 analyses, and will provide necessary data for the conservation and recovery of endangered and threatened sea turtle populations.

B. SURVEY PURPOSE

The sea turtle interaction data that will be collected via this survey collection will be used by NOAA Fisheries protected species managers to evaluate the impacts of recreational fishing on sea turtle populations. Analysis of data collected from this survey will be used in agency documents, such as ESA Section 7 Biological Opinions and other regulatory documents. These documents are disseminated to the public, but the raw survey results will not be disseminated to the public. NOAA Fisheries will retain control over the information and safeguard it from improper access, modification, and destruction, consistent with NOAA standards for confidentiality, privacy, and electronic information.

C. PUBLIC BURDEN

Public reporting burden for this collection of information is estimated to average 5 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other suggestions for reducing this burden to Wendy Piniak, NOAA Fisheries, Office of Protected Resources, wendy.piniak@noaa.gov.

D. PUBLIC PARTICIPATION

Participation in this survey is voluntary. The information collected will be protected and kept anonymous if released. Notwithstanding any other provisions of the law, no person is required to respond to, nor shall any person be subjected to a penalty for failure to comply with, a collection of information subject to the requirements of the Paperwork Reduction Act, unless that collection of information displays a currently valid OMB Control Number.