

## Introduction

The Eagles Island Paddle Tour is designed for Battleship visitors to learn about native species in the Cape Fear River, the history and culture of the Gullah Geechee, local Civil War and WWII history, the effects of saltwater intrusion on native species, and the impacts of climate change on the Cape Fear ecosystem. The paddle aspect of the tour enables them to see native flora and fauna and locations with historical significance while they learn. This paddle tour will be guided by a staff member of CFRW. The length of the tour from the Battleship kayak launch and back is **3.4 miles long** and will take approximately **2 hours**. A longer tour of approximately 3 hours can be arranged.

## **Major concepts**

- 1. Understand how the Cape Fear River's role in the community has developed over time
- 2. Explain the historical significance of Eagles Island and the role that the Gullah Geechee played on the island.
- 3. Explain the effects of both freshwater and saltwater present in this ecosystem
- 4. Observe and discuss native flora and fauna
- 5. Understand why invasive species are harmful to native species and ecosystems

# **Paddle Tour**



• Tour can be done in reverse order, according to the tide.

• Stars indicate stopping points

## Stop 1: Battleship

#### **Battleship in WWII**

- The USS North Carolina (BB 55) was launched June 13, 1940, commissioned April 9, 1941, and decommissioned June 27, 1947.
- The USS NC is the most decorated battleship with only lost 10 men in its history and 67 crewmembers wounded by the end of the war.
- The battleship is 99 million pounds of steel.

### Memorializing the battleship

- In 1958 it was announced that the battleship was to be scrapped, which prompted North Carolinians to start the "Save our Ship" (SOS) campaign to bring the battleship home. It was dedicated as a state memorial to the 11,000 NC veterans who died during the war.
- USS North Carolina sees roughly 22,000 paying visitors annually, generating \$30,000 total.

### Cofferdam background

- Every 20 years, the Navy wants the ships dry-docked (taken to land for repairs and inspection). The Battleship has not been dry-docked since 1953. The Navy's request in 2009 ignited efforts for a fundraising campaign for an alternative method to repair the hull.
- Can't dry dock the ship in Norfolk, VA, because the boat is taller than the Cape Fear Memorial Bridge, and the boat is in 25 feet of mud. The Battleship will never leave Wilmington.
- Fundraising efforts made possible the construction of the cofferdam. "A cofferdam is a watertight structure built to allow the enclosed area to be pumped out, creating a dry work environment."
- Cofferdam and weir slide gates allow workers to essentially dry-dock the ship and repair any corroded spots in the hull.

#### **Construction of Cofferdam**

- Core-borings were driven down to 60 feet depth for sediment analysis.
- Results were given to an engineering firm for geo-technical analysis.
- In order to achieve a situation similar to dry-docking you must drive the piles 50+ feet down into the Castle Hayne Aquifer (limestone), which provides a near watertight seal.
- Steel piles were connected at joining points called "bents" and sealed with a watertight sealant.
- The cofferdam consists of around 280 bents to a 50+ foot depth.
- Driving down of the steel pilings began July 2016.

- The length is chosen because of funding and restrictions. The engineers are very aware the water level may go over the cofferdam and designed the system to be able to withstand a rise in water level without damaging the cofferdam or the ship itself.
- There is 20 to 25 feet of the ship below the water level that is not visible!
- Mud is very anaerobic—it can't support erosion—so mud is your friend during the repairing process.
- The repair permit does not allow for the removal of mud, so if it is moved it must be replaced or put back.
- The permitting also requires that the Weir gates are kept open to allow for a natural flow so the water does not become stagnant and stinky. The gates are only closed when it is time for repair work to be conducted.
- A 4-inch diameter hole in the bow of the ship is the main reason for the construction of the cofferdam.
- Total cost of entire project was 13 million (10 for cofferdam, 3 for the boardwalk).

## Stop 2: On river between battleship and bridge

### Discovery of the Cape Fear River & European Interactions with Native Americans

- ∉ The Cape Fear River was discovered in 1526 by Spanish explorers.
- ∉ Its name comes from its proximity to the Cape Fear headland. The Cape Fear headland was named in 1585 during an expedition in which the sailors were afraid they were going to wreck. Cape Fear is the 5<sup>th</sup> oldest surviving English place name in the US.
- ∉ At the time of European discovery, Native Americans were settled along the river and its tributaries, living in villages and farmsteads. Very little is known about them except that they hunted, gathered wild foods, and farmed. Among the tribes were the Waccamaw and another tribe that we simply call the "Cape Fear" tribe.
- ∉ By 1808 Native Americans had virtually disappeared from the area, likely due to a smallpox epidemic, and violence between Europeans and natives.

#### **General River Facts**

- ∉ The river begins over 202 miles from here in central North Carolina at the confluence of the Haw and Deep Rivers and extends all the way south of Wilmington where it widens into an estuary as it meets the Atlantic Ocean.
- ∉ The Cape Fear River was originally a true freshwater river, which was between 9 and 12 feet deep. The increase in cities and new settlements led to needing bigger ships to carry the amount of increased cargo. Labor was focused on dredging the river to make room for the bigger vessels and allow them to pass through easily.
- ∉ The existing channel in the Cape Fear River is 400 feet wide, enlarged to 500 feet in the lower reaches, and maintained to a depth of 42 feet.
- ∉ In colonial times, the river was a principal transportation route to North Carolina's interior. Today it is navigable up until Fayetteville through a series of locks and dams that were installed in the early 1800s.

∉ The Cape Fear River is a blackwater river. Blackwater rivers flow slowly through forested swamps or wetlands. Along the way, decaying vegetation leaches tannins into the water, giving it a dark, transparent appearance, like tea.

## Stop 3: Under Bridge

#### **About Eagles Island**

- ∉ Eagles Island Coalition is a partnership of local governments and groups that formed to protect Eagles Island. Their goals are to ensure water quality, promote education and awareness, conserve and restore habitat for wildlife and establish passive recreational opportunities such as canoe and kayak trails, hunting and fishing and wildlife viewing areas on the island.
- ∉ As of now, over 1000 acres of wild freshwater tidal marsh on the northern part of Eagles Island will be protected from future development.
- ∉ The conservation effort began in 2001 and continues up until today, with the group having their sights set on purchasing 22 acres of land south of the Battleship parking lot. They want to purchase that land to create a park with an interpretive center that would include a maritime museum honoring the local rice and naval store industry. The owner of the property would like to sell that land, but the coalition still needs to find further funding from private donors and local municipalities.
- ∉ The coalition has proposed building nature walkways and they have already worked on creating a self-guided paddling trail.

## Stop 4: The entrance to the small path from the large open water

#### **Invasive vs. Native Species:**

- ∉ Native species is defined as a species that normally lives and thrives in a natural ecosystem.
- ∉ Invasive species is defined as a nonnative species that significantly modifies or disrupts the natural ecosystem (also referred to as exotic, introduced, or alien species).
- ∉ Invasive species may be caused by natural migration but are usually caused by human interactions.
- ∉ Invasive species are harmful because they may
  - $\not\subset$  carry diseases that native species have no immunity to,

  - $\not\subset$  decimate native populations because native species do not recognize them as predators.
- ∉ Not all nonnative species are invasive! Some nonnative species are benign. However, all invasive species are nonnatives.
- ∉ Phragmites australis, known as the common reed, originated in Europe. It is easily spotted among wetlands due to its height and fluffy seed head. It grows thick and will not allow animals to penetrate through to forage or move to new areas, and it does not

provide food. It poses a serious threat to natural coastal habitats and out-competes native marsh plants in the Lower Cape Fear River estuary and throughout coastal North Carolina.

- ∉ When *Phragmites australis* becomes firmly rooted, it aggressively spreads, growing up to 12 feet high. Native marsh plants normally sequester carbon and protect the shoreline, but *Phragmites australis* diminishes a marsh's natural productivity by taking over its habitat. Found in thick, dense stands, *Phragmites australis* is not a suitable habitat for native birds or fish species that normally use tidal marshes as nurseries.
- ∉ Spartina alterniflora is a smooth cordgrass. It is a native grass essential to healthy salt marshes and wetland habitats. A salt marsh is "born" by the arrival of a seed or the rafting of a plant of the cord grass Spartina alterniflora. The grass spreads asexually by means of a subterranean rhizome system. The grass becomes dense and forms a baffle, which encourages the deposition of fine particulate sediment, including organic matter (salt marsh peat). This, in effect, causes a rise of the sediment surface and makes the habitat more terrestrial. As this happens, other somewhat less salt-tolerant grasses are able to invade. Eventually, this series of invasions and takeovers leads to a vertical zonation of grasses and a spread of the entire marsh system.
- ∉ Its roots provide food for geese, its seeds attract birds, and small mammals and deer forage off of foliage. Spartina is found along the Atlantic coast from Canada to South America.
- ∉ SAS = Spartina alterniflora short form
- ∉ SP = Spartina patens, the next higher grass species

## Stop 5: Throughout dugout pit

#### Miscellaneous

- ∉ This is not a natural ponded area. This large pit was dug out to provide earth to elevate the highway.
- $\notin$  Point out the wax myrtle. The wax myrtle is a native evergreen.
  - Even though it's a shrub, it can grow to be up to 40 feet tall, but it's normally no taller than 12 feet.
  - Female plants get pale blue berries in the wintertime.
- ∉ Point out yellow erosion barrier.

#### **Brackish Water**

- ∉ Brackish water is defined as water that has a higher salinity than freshwater, but a lower salinity than saltwater.
- ∉ Brackish water is created from the mixing of freshwater rivers and the oceans.
- ∉ Salt marshes, mangrove swamps, and estuaries all have brackish water.

- ∉ Many animals can be found living in brackish water environments, such as ospreys, alligators, and bull sharks (which can also tolerate fresh and saltwater by adapting their process of osmoregulation).
- ∉ Osmoregulation is defined as "the maintenance of constant osmotic pressure in the fluids of an organism by the control of water and salt concentrations."
- ∉ Usually sharks prefer high salinity environments. Through their osmoregulation process, they drink often and have a highly concentrated urine to maintain an adequate amount of water within their bodies and remove excess salt.
- ∉ Brackish water is important for the reproduction of many species. Anadromous fish migrate from the ocean upstream to spawn in the Cape Fear River. Some species of anadromous fish that have been identified in the vicinity of Eagles Island include American shad, blueback herring, hickory shad, striped bass, threadfin shad, and white perch. A couple of catadromous fish, fish that live in the river and migrate to the ocean to spawn, have been seen here as well. Those include striped mullet and American eel.
- Anadromous fish of the Cape Fear have been facing a decline in population in the past few decades.
- ∉ This is for a couple of reasons. Anadromous fish face many obstacles during their lifetime in general and during reproduction specifically.
- ∉ They have had to deal with an increase in pollution in the river. In North Carolina, our rivers are especially afflicted with sediment from clear cutting. That sediment increases the turbidity of the river, which just means that there is sediment suspended in the water column. Turbidity can negatively impact fish health by clogging their gills and smothering their eggs. Fish also have to deal with fishing and harvesting. American shad populations, for example, declined tremendously due to over-harvesting.
- ✓ Our locks and dams, of which there are 3 on the Cape Fear, are particularly harmful to the reproductive success of anadromous fish. Their populations have declined as much as 90%, due to lock and dam structures. The fish are unable to continue their migration upstream because they cannot get past the dams. At Lock and Dam #1, Cape Fear River Watch has been involved in the construction of something called Rock Arch Rapids. The rock arch rapids function as a dam might, but they are constructed in such a way that fish are able to swim upstream. The rapids are essentially a huge spans of boulders, and fish can jump into the pools of water between the boulders and rest in those pools until they have the energy to continue onwards. In that way, they're able to get upstream.
- ∉ Due to overfishing, habitat degradation, and the Lock and Dam system construction, the Atlantic sturgeon is currently classified as a threatened species in North Carolina, and their possession has been banned since 1991.

#### **Osprey:**

- ∉ Scientific name: *Pandion halieatus*
- ∉ Alternative name: Seahawk
- ∉ Range: Osprey are found on every continent except Antarctica, primarily around lakes and other large bodies of water.
- ∉ Conservation status: least concerned. The Osprey is a conservation success story. Their populations crashed in the 1950s through the 1970s because of the use of pesticides such as DDT. DDT entered into our waterways and bio-accumulated in the tissue of the fish

that osprey prey on, causing the DDT to bio-accumulate in the Osprey themselves. The DDT caused them to lay eggs with very thin, fragile shells which they crushed when they sat on them to incubate. After the ban of DDT in the US in 1972, their populations rebounded. Now, a growing concern for them is entanglement in twine and other forms of discarded lines such as fishing lines that the adults incorporate into their nests. Those pieces of trash can become entangled around the chicks and injure them or keep them from leaving the nest.

∉ Diet: Osprey feed on live fish caught with their hook-like talons. Ospreys are the only bird of prey in North America to feed almost exclusively on fish. In North America, over 80 species of fish make up 99% of the Osprey's diet. When hunting for food, they are successful in ¼ of all dives. The average time they spend hunting before making a catch is around 12 minutes.

#### Supplemental info

- ∉ Reproduction: Osprey typically lay three eggs between April and May and then defend the nest for 60 days. Nests are usually made out of sticks (generally, the male searches for materials, bring them to the nesting site, and the female arranges the materials) and can be up to 10 feet deep and 5 feet wide due to the birds returning to their mating grounds every season and adding on to their pre-existing nest.
- ∉ Migration: Young osprey make their first migration alone. The birds return to both the same feeding grounds and wintering grounds every year. Over the course of their 15-20 year lifetime, they may fly up to 160,000 miles.

## Stop 6: Yellow Trail Sign

#### **American Alligators:**

- ∉ Scientific name: *Alligator mississippiensis*
- ∉ Range: Alligators can be found from North Carolina to the Rio Grande in Texas. They are usually found in freshwater rivers but can also be found in marshes, swamps, and lakes. They will not survive in saltwater for extended periods because they lack of salt glands.
- ∉ Does anyone know how to tell an alligator apart from a crocodile?
  - For me, the easiest way to tell them apart is by looking at their closed mouths. The 4th tooth on the lower jaw of crocodiles doesn't fit into their upper jaw, so it's visible on the outside of the mouth when it's closed (so you can see a tooth pointing upwards near the tip of their snout). Also, alligators have a broader, shorter snout; the snouts of crocodiles are more pointed.
  - Fun fact, alligators always have between 74 80 teeth in their mouth at any given point in time. As their teeth wear down, they're replaced. Over the course of their lifetime they can go through 3,000 teeth.
- ∉ Conservation status: least concerned. By the first half of the 1900s the alligator was almost hunted to extinction because of a demand for its hide. In 1967 it received federal protection as an endangered species and its populations rebounded. Now it is a species of least concern, but it's listed as threatened for the sake of the crocodile, which is

threatened. Because the two species look so similar, neither are allowed to be hunted just in case the two are confused. Hunting them is allowed in some states but is strictly controlled.

- ∉ We don't have crocodiles here. In the US, crocodiles are normally only found in southern Florida. They also live in Cuba, Jamaica, Mexico, Ecuador, and Venezuela. (American crocodile, *Crocodylus acutus*)
- ∉ Diet: carnivorous (eat small mammals, birds, fishes, snails, and other invertebrates).

#### Supplemental info

- ∉ Reproduction: Male and female alligators reach sexual maturity once they become about 6 feet long, usually at about 10-12 years old. Males are called bulls, and they roar to attract females. Courtship starts in April and mating occurs in early May. Once mating occurs, the female builds a nest out of vegetation which can be up to 10 feet in diameter and about 2 to 3 feet high. In late June and early July she lays around 35 to 50 eggs in the nest and covers the eggs with vegetation. In late August the young alligators begin to make high pitched noises from the inside of the eggs and the mother removes the vegetation covering the eggs. After a 65-day incubation period the eggs hatch, and 6-8 inch-long gators emerge. Interestingly, the sex of the young is determined by the temperature of the nest during incubation. Colder nests (below 87 degrees) produces females; average temperature nests (around 89 degrees) produces 75% males, and warmer nests (above 90 degrees) produces mostly females.
- ∉ Alligators are notable amongst the reptiles, because they are one of the only reptile species who care for their young after birth. The juvenile alligators hang around their mom for the first 2-3 years of their life, and she aggressively defends them. Around 80% of young alligators fall prey to predators such as birds, snakes, and larger alligators.
- ∉ Although alligators do not hibernate in the winter, they go into a state of dormancy where they burrow into mud and form "gator holes" to protect themselves from extreme temperatures. This state of dormancy is called brumation.
- ∉ Live approximately 50 years in the wild due to the fact they become too large for predators, aside from humans.

## Stop 7: Entrance to rice canal

#### History of the Gullah Geechee on Eagles Island

- ∉ The canals of Eagle's Island that we're about to paddle through were not only hand-dug but also designed by the Gullah Geechee people who were brought here as slaves from Africa. Because many of them came from the rice-growing region of West Africa (modern day Senegal, The Gambia, and The Ivory Coast), they had an intimate knowledge of rice production, and here in America they were enslaved on rice, indigo, and cotton plantations of the lower Atlantic coast.
- ∉ The city of Wilmington is notable, as it was the only port in North Carolina that operated at full capacity during slavery times. The barrier islands of the coast of North Carolina made operating ports in other cities difficult at times, so Wilmington became the only port where enslaved Africans and Gullah were brought into North Carolina.

#### **Background on Gullah Geechee**

- ∉ The Gullah Geechee people have traditionally resided in the coastal areas and sea islands of North Carolina, South Carolina, Georgia, and Florida.
- ∉ Because the Gullah Geechee were fairly isolated on islands and coastal plantations, they created a unique culture that is clearly influenced by their African ancestry.
- ∉ Gullah Geechee is a unique, creole language spoken in the coastal areas of North Carolina, South Carolina, Georgia, and Florida. It began as a simplified form of communication between European slave traders, slave owners, and diverse African ethnic groups. It is notable because it is the only distinctly African creole language in the US, and it has influenced traditional southern vocabulary and speech patterns.

#### **Rice Production**

∉ Because of a rice crop's special demands, Cape Fear planters generally considered it unrealistic to grow rice unless they were wealthy enough to employ at least 50 enslaved laborers. Plantation owners lived in Wilmington while their slaves lived on Eagles Island to tend to the rice fields. They relied on those African and African American workers to tend their fields and to build and manage the extensive systems of ditches, levees and water gates that were necessary in order to harness the river's tidal flow for rice cultivation.

#### **Post-slavery**

- ∉ The canals that we're about to paddle through were eventually abandoned due to the end of slavery and therefore a massive reduction of the plantations' labor force.
- ∉ Most Gullah people left the Wilmington area after the coup of 1898. Racial tensions in the city were at a peak, and this began an era of more severe segregation and disenfranchisement of African-Americans. Many Gullah Geechee people began moving out of Wilmington and moving to surrounding counties like Durham and further away to places like Philadelphia and New Jersey. Most African Americans living in Wilmington today are likely second wave Wilmingtonians.

## **Stop 8: Dead Trees**

#### Saltwater intrusion

- ∉ Saltwater intrusion is caused by an influx of saltwater into a historical aquifer which can contaminate drinking water and adversely affect the plants and animals in the region.
- ∉ Saltwater is denser than normal freshwater, allowing it to travel below freshwater and giving it easy access to diffuse into aquifers.
- $\notin$  Depending on the severity of the intrusion, wells may be closed.
- ∉ The death of certain plants could be caused by long-term exposure or significant fluctuations in salinity in a short period of time.
- ∉ The saltwater intrusion that we experience here in the Lower Cape Fear River is largely due to Snow's Cut, which was engineered by the Army Corps of Engineers.
- ∉ Snow's cut is the name of a portion of the Intracoastal Waterway that was dredged out under the leadership of Major Snow in 1929. The cut is 1.75 miles long, 100 feet wide, 12 feet deep, and connects the Myrtle Grove Sound to the Cape Fear River. Not only did

the cut mean that saltwater intruded up the river, but also the Cape Fear's waters polluted the formerly clean saltwater of Myrtle Grove Sound, harming oyster beds and other marine life.

∉ Eventually we'll be dealing with more saltwater intrusion and its associated problems as sea levels rise.

## Stop 9: Harry Adams Boat

#### Shipwrecks:

- ∉ There are 37 shipwrecks around Eagle's Island and historic downtown Wilmington.
- There are 34 located around Eagles Island and 3 more are off the wharves and docks of the Wilmington side of the Cape Fear.
- Harry W. Adams: Schooner built in Nova Scotia in 1937. Transferred from Norfolk, VA. in 1974 and left to rot in the Cape Fear.
- ∉ The shipwrecks helps mitigate shipping lane erosion and development issues by keeping the shoreline more intact.
- ∉ Boats of all makes and eras are at the bottom of the Cape Fear. (Civil War barges, steamers, civilian luxury ships, etc.)

## Stop 10: Re-entering Cape Fear River

#### **Impact of Climate Change**

- Climate change could result in many changes to our region, some of which may already be occurring, such as:
  - more intense hurricanes, higher water temperatures, coastal erosion, ocean carbon chemistry and its acid/alkali balance, as well as sea level rise.
- Our barrier islands and coastline are especially vulnerable to an eventual rise in sea level. Potential impacts from sea-level rise include the following:
  - coastal erosion, storm-surge flooding, coastal inundation, saltwater infiltration, loss of coastal properties and habitats, declines in soil and freshwater quality, loss of transportation routes, and the potential loss of life.
- We know already that Wilmington's infrastructure will face challenges with infrastructure due to rising seas levels. Our systems are not designed to operate properly when flooded. Water, especially saltwater, can cause those systems and facilities to degrade faster than they would normally.
- Certain areas of the Port of Wilmington and Wilmington International Airport are both vulnerable to sea level rise because they are located adjacent to the Cape Fear River, which is connected to the ocean.
- Even under VERY conservative sea level rise scenarios (40 cm, or 1.3 ft by 2100), many roads and stormwater systems in New Hanover County are at serious risk of becoming permanently flooded. There are also certain Superfund sites that are at risk of flooding,

including a site near downtown which would be completely inundated by sea level rise of only 40cm. That means that hazardous contaminants contained at that and other sites could make there way back into the area's waters.

- Experts say, though, that we should expect a sea level rise of at least 2-3 feet by 2100, not 1.3 ft.
- This isn't to mention what might happen if another 100 year storm hits. Wrightsville Beach, which is a barrier island and is only about 3ft above sea level, could be completely inundated with a 100 year storm.