

ESTUARIES: location and human impact

Estuaries

Estuaries are semi-enclosed bodies of water that are formed when fresh water from rivers and coastal streams flows into and mixes with salt water from the ocean. Estuaries and the lands surrounding them are places of transition from land to sea, and from fresh water to salt water. Estuaries are often called bays, lagoons, harbors, inlets or sounds.

The waters of estuaries support unique communities of plants and animals, specially adapted for life at the border of the sea. These "estuarine" environments are among the most productive on earth. The productivity of estuarine habitats foster a wonderful abundance of diversity in wildlife. Shore birds, fish, marine mammals, shellfish, reptiles, sea birds and marine worms are just some of the animals that make their homes in and around Florida's estuaries.

This article takes a look at a federal program designed to protect nationally significant estuaries around the country and provides detail on each of the Florida estuaries in the program.

Importance of Estuaries

The values and functions of estuaries are considerable. Estuaries play important roles in flood and erosion control, pollution filtration, water quality protection, wildlife conservation, coastal storm protection, and recreation. Many finfish and shellfish species depend on estuarine habitats as primary habitat, or as spawning and nursery grounds. More than 70% of Florida's recreationally and commercially important fishes, crustaceans, and shellfish spend part of their lives in estuaries, usually when they are young.

To support growing human populations on the coast, estuaries are frequently overused and misused by society. Estuaries are disposal sites for human and industrial wastes, are dredged to create navigational routes for large ships, and receive various contaminants that stormwater picks up from streets, lawns and construction sites. Stresses caused by overuse of estuary resources and unchecked coastal land use practices have resulted in beach and shellfish bed closings, harmful algae blooms, unproductive fisheries, loss of habitat, fish kills, and a host of other problems.

National Estuary Program

The National Estuary Program (NEP) was established by Congress in 1987, as an amendment to the Clean Water Act, to recognize and protect "estuaries of national significance." The NEP targets a broad range of issues and engages local communities in the process of identifying problems affecting their estuary and coming up with solutions. The program focuses not just on improving water quality, but on maintaining the character of the entire ecosystem.

The NEP is administered by the U.S. Environmental Protection Agency (EPA), which provides money to local communities to study their estuary. Each NEP has a management committee that is made up of representatives from federal, state and local government agencies responsible for managing the estuary's resources, and often include

other members of the community: conservation advocates, business leaders, educators and researchers. These stakeholders work together to

- Identify the major threats facing an estuary.
- Develop a comprehensive conservation and management plan (CCMP) as part of a consensus community process that sets forth specific actions to restore and maintain the estuary.
- Encourage implementation of the CCMP.
- Monitor the progress that has been made toward the achievements of the CCMP's goals.

A monitoring review is typically completed every two years following the CCMP's adoption.

Individual estuaries are nominated to participate in the NEP by their respective Governors. The EPA Administrator approves or disapproves the nominee. Of the 28 estuaries in the NEP, four are found in Florida: Charlotte Harbor, Indian River Lagoon, Sarasota Bay and Tampa Bay.

Florida Estuaries in the NEP

Florida estuary #1: Charlotte Harbor

This estuary joined the NEP in 1995 and is near Cape Coral, Fort Myers and Port Charlotte. On the west coast of Florida, Charlotte Harbor covers 4,400 square miles and is the second largest open water estuary in the state. The Peace, Myakka and Caloosahatchee Rivers drain into the coastal waters of the estuary. The Charlotte Harbor estuary and nearby coastal waters serve as home, feeding ground and/or nursery area for more than 270 species of resident, migrant and commercial fishes of the Gulf of Mexico. Manatees, sea turtles, wood storks, and dolphins are also found in the estuary and its watershed. This estuary is host to a wide array of habitats including: mangroves, tidal pools, beaches, shellfish growing areas, and forested wetlands.

The Charlotte Harbor NEP completed its CCMP in 2000. Two of the priority problems identified in the CCMP include changes to natural water flows and habitat loss. One priority problem has been identified as change in water flow. Human activities significantly alter the level of freshwater flowing into the Charlotte Harbor system. The upper Peace River's flow of freshwater is one-third less than its historic levels. In this portion of the watershed, freshwater is being diverted for farming, mining, aquifer supplies, and other projects. To address this problem, the Charlotte Harbor CCMP has established several action items, including restoring the natural hydrology for basins within the Charlotte Harbor watershed. To restore the natural hydrology, scientists will work with local governments to create minimum water flows and coordinate with locals to ensure these flows are met by decreasing water intake from several rivers.

The Charlotte Harbor NEP is also creating a freshwater flow education program to explain water resource issues to the public. It will distribute public service announcements as well as create portable exhibits to show at public events. To reduce water usage in the area, Florida state agencies will continue to regulate the installation of water conservation equipment on all new construction. The state agencies will also continue the water efficient toilet rebate program to promote the replacement of high volume toilets with more water efficient ones.

Another priority problem addressed in the Charlotte Harbor CCMP is fish and wildlife habitat loss. This problem includes the degradation and elimination of habitats caused by development, conversion of natural shorelines, cumulative impacts of docks and boats, and invasion of non-native species. To address this problem the local government is going to terminate new and existing channels in deep water to protect seagrasses, ensure compliance and enforcement of environmental regulations, and promote programs to improve the quality and quantity of fish and shellfish resources. On Don Pedro Island, Cape Haze, and Punta Gorda Isles, programs are underway to remove non-native vegetation and restore the presence of native vegetation.

Florida estuary #2: Indian River Lagoon

The Indian River Lagoon joined the NEP in 1990. The Lagoon is located along a transition zone between the warm-temperate climate to the north and a more subtropical climate to the south. The Indian River Lagoon is 156 miles long and makes up 40% of Florida's east coast, extending from Ponce De Leon Inlet at the northern end to Jupiter Inlet at the southern end. The location of the lagoon, combined with its large size and other physical characteristics, make it an estuary with extremely high biological productivity.

Manatees, alligators, sea turtles, bald eagles, snakes warblers, and other wildlife rely on the Indian River Lagoon for habitat and shelter. One-third of the U.S. manatee population uses the lagoon. Approximately 680 fish, 367 bird, 52 reptile, 16 amphibian, and 30 mammal species can be found in the Lagoon ecosystem. Of the 4,300 plant and animal species found in the Lagoon, 208 are classified as endangered, threatened, rare, or species of special concern by federal and State wildlife agencies. The diverse habitat types that can be found in the Lagoon include open water, seagrass meadows, mangrove forests, and salt marshes.

The Indian River Lagoon NEP completed its CCMP in 1996. The lagoon's CCMP contains 68 goals, objectives and priority actions ranging from improving water quality to protecting wildlife resources. In 1996, a state law was enacted to prohibit discharge of treated wastewater into the lagoon. In regions where compliance with this policy has been in effect, scientists report a significant recovery of seagrasses and red fish. Findings such as these provide strong evidence that if the water is cleaned up, the natural lagoon ecosystem can recover.

A problem that remains in the area is non-point pollution. Even though the zero wastewater discharge policy is drastically reducing point (direct source) pollution, 80% of all pollution entering the lagoon is from non-point sources. These sources include stormwater runoff from lawns, streets, and farms. In addition to nutrients and other pollutants, stormwater runoff also carries a large amount of suspended solids (sand, silt and mud) into the lagoon. This suspended material increases the turbidity of the water, decreasing seagrass photosynthesis. Suspended solids can also clog the gills of fish and clams. Devices to trap sediment on site are being installed at several locations in Brevard County and on Merritt Island, including one at the Sunrise Village Condominiums.

Direct habitat loss due to human development is listed as a priority problem. To address this problem, large areas of the lagoon which have been altered are now being restored. There has been concentrated efforts to reconnect salt marshes and mangroves swamps that were impounded to curtail mosquitos. Reconnection of these impoundments



with culverts that can be opened and closed represents a compromise between the need for effective mosquito control and a healthy lagoon ecosystem. The NEP and affiliated agencies plan to reconnect all publicly owned mosquito impoundments by the end of the decade.

Florida estuary #3: Sarasota Bay

The Sarasota Bay joined the NEP in 1988. It is located along Florida's southwestern coast and is near the cities of Sarasota, Bradenton and Long Boat Key. The estuary is an elongated lagoon extending for 56 miles. Distinctive habitats of the Bay area include salt marshes, mangroves, freshwater wetlands, barrier islands, seagrass beds, oyster reefs, and soft bottoms. Approximately 1,400 plant and animal species inhabit Sarasota Bay and its bordering lands. The Bay has a great diversity of bird species, including herons, egrets, ibis, bald eagles, white and brown pelicans, and various shorebirds. Sea turtles, manatees, and dolphins are some of the most celebrated wildlife inhabitants of the Bay. Sea turtles, including the federally-protected threatened loggerheads, nest on the beaches of the area.

The Sarasota Bay NEP completed its CCMP in 1995. One priority problem in the estuary is excess nitrogen pollution. Too much nitrogen in Bay water causes the growth of small plants called algae that can be detrimental to marine life. Algae inhibits light penetration to submerged plants, causing seagrasses to die. At night, algae consume oxygen, creating low-oxygen or no-oxygen conditions in the Bay that results in fish kills. Principal sources of nitrogen to the Bay are treated wastewater, stormwater pollution, and atmospheric deposition.

Atmospheric deposition occurs when pollution in the air falls to the ground in the form of dust, raindrops or just by gravity, eventually ending up in streams, lakes or the ocean. The Sarasota Bay Program has been working with the community to cost-effectively limit and control the amount of nitrogen entering the Bay. Since 1990, nitrogen loading has been reduced by 47 percent baywide and nitrogen pollution from wastewater treatment plants has been reduced by 80 percent. This reduction in nitrogen has been mainly due to improvements at the City of Sarasota and Manatee County wastewater treatment operations, and several areas have improved stormwater management. Future plans to reduce nitrogen include installing a central sewer system in North Sarasota County.

Florida estuary #4: Tampa Bay

Tampa Bay joined the NEP in 1991 and is located near the cities of Clearwater, Tampa, and St. Petersburg. Tampa Bay, Florida's largest open-water estuary, stretches 398 square miles at high tide. About 200 species of fish are found in Tampa Bay, including the popular snook, redfish and spotted sea trout. Islands covered with mangrove trees in Tampa Bay support the most diverse colonial waterbird nesting colonies in North America, annually hosting 40,000 pairs of 25 different species of birds, from the white ibis, great blue heron to the reddish egret, the rarest heron in the nation. The Tampa Bay NEP completed its CCMP in 1996. The Tampa Bay CCMP identified habitat loss and nitrogen pollution as priority problems. Nutrients such as nitrogen and phosphorus are introduced into the estuary by urban stormwater, leachate from septic tanks, sewage treatment plants, and atmospheric deposition from power plants and cars.

Atmospheric deposition occurs when pollution in the air falls to the ground in the form of dust, raindrops or just by gravity, eventually ending up in streams, lakes or the ocean. Excessive levels of these nutrients cause algae blooms, declines of seagrass beds, low-oxygen levels and fish kills.

Decreasing stormwater runoff is one way the community will attempt to reduce nitrogen loading. Actions to reduce stormwater runoff include: providing incentives to residents and developers to reduce fertilizer and pesticide usage, and requiring older properties to meet existing stormwater treatment standards. Habitat loss and degradation is another priority problem in Tampa Bay. According to the Tampa Bay Regional Planning Council, the Tampa Bay region is the third fastest growing urban area in the nation. In an attempt to accommodate the growing population, development activities have escalated dramatically, causing significant habitat losses in the Bay area. Shoreline, salt marsh, and seagrass habitats are the most severely affected by the development.

To enhance shoreline habitats, Tampa Bay is working to protect existing mangrove trees and encourage mangrove establishment along areas where they have been removed. To improve bay habitats and reduce boat propeller scarring of seagrasses, Tampa Bay will increase environmental awareness among boaters by putting up signs and restricting or closing boat entries in sensitive areas. Tampa Bay will also increase the number of on the water police patrols in sensitive areas.

Glossary

Estuary: Partially closed, coastal water body where fresh water empties into and mixes with saltwater.

Non-native Species: Organisms that have been introduced into a new marine ecosystem, and thrive within their new environment. The invaders often thrive in their new ecosystem, where controls may not exist to keep populations in check. (example: Brazilian Pepper)

Hydrological Alterations: Adverse changes to amounts, locations, and timing of freshwater flows, the hydrological function of flood-plain systems and natural river flows.

Mangrove Forest: Salt-tolerant trees that grow in the intertidal area in tropical and subtropical coasts.

Photosynthesis: The process in green plants and certain other organisms by which carbohydrates are synthesized from carbon dioxide and water using light as an energy source. Most forms of photosynthesis release oxygen as a byproduct.

Turbidity: Cloudy water caused by suspended silt or organic matter.

Watershed: Geographic area in which water, sediments and dissolved materials drain to a common outlet - to a point on a stream, lake, underlying aquifer, estuary or ocean.

Wetland: Critical ecosystems, identified by the amount of water usually on the land and the plant life that lives in these areas - commonly called marshes, bogs and swamps. They preserve environmental quality by controlling floods, filtering contaminants, and providing habitat.

Questions for ESTUARIES: location and human impact

Remember, questions marked with *** are "thought questions" with answers not directly in the reading.

Estuaries

- 1) In an estuary, where is the fresh water coming from?
- 2) In an estuary, where is the salt water coming from?
- 3) List four other terms for estuaries.
- 4) What is brackish water? What does that have to do with this article? ***

Importance of Estuaries

- 5) How do you think estuary misuse would affect Florida's economy?
- 6) What are five results of estuary misuse by humans?

National Estuary Program

- 7) Why was the NEP established?
- 8) Define *ecosystem* in your own words. ***
- 9) What is the EPA?
- 10) Why do you think it is beneficial to have different types of people on the NEP management committees? ***
- 11) Summarize the function of NEP management committees.
- 12) What is CCMP?

Florida Estuaries in the NEP Florida Estuary #1

- 13) Name the estuary listed as Florida estuary #1.
- 14) Where is this estuary located?
- 15) How large is it?
- 16) List the three rivers that drain into this estuary.
- 17) Explain what is meant by "degradation and elimination of habitats." ***

Florida Estuary #2

- 18) Name the estuary listed as Florida estuary #2.
- 19) Where is this estuary located?
- 20) How large is it?
- 21) How many endangered species live there?
- 22) What is non-point pollution? ***
- 23) What are some sources for non-point pollution?
- 24) What are three examples of sediment (suspended solids)?
- 25) Define *turbidity* in your own words (see glossary).

Florida Estuary #3

- 26) Name the estuary listed as Florida estuary #3.
- 27) Where is this estuary located?
- 28) How large is it?
- 29) What is the biggest problem facing this estuary?
- 30) How can too much algae harm marine life?
- 31) Define atmospheric deposition.

Florida Estuary #4

- 32) Name the estuary listed as Florida estuary #4.
- 33) Where is this estuary located?
- 34) How large is it?
- 35) Approximately how many species of fish live there?
- 36) Give evidence that our area supports "the most diverse colonial waterbird nesting colonies in North America"?
- 37) What are four sources of nitrogen & phosphorus pollution?
- 38) What are two ways to decrease stormwater runoff?
- 39) Based on the context, what do you think is meant by "nitrogen loading"? ***
- 40) From this article, what have you learned about estuaries?

