*REVISED 3.31.11. **For Intermediates and Seniors only.** The following information will be used to develop 5-8 multiple choice questions and added to Section 5 of the MEE. To help them learn this material, youth can prepare short answer questions based on the information given in the lesson and place them on "flash cards" and then used to "quiz" other 4-H members. This information comes from the 4-H Marine and Aquatic Ecosystem Leader's Guide.*

LESSON 4 - COASTAL ECOSYSTEMS:
Beach, Estuary, Marsh, and Swamp

BACKGROUND BASICS.

Coastal areas exist at the interface of land areas and large bodies of water. Florida has many miles of coastal areas due to the fact that it is a peninsula bordered by the Atlantic Ocean on the east, the Gulf of Mexico on the west and Florida Bay to the south. In addition to these areas, Florida also has an abundance of bays and **estuaries** associated with the state's river systems that add many miles to the coastline. These coastal and **estuarine** ecosystems are extremely productive areas for sea life. These areas are also one of the main features that attract millions of people to Florida. *(Beach photo by E. Curtis)*

Of all Florida's natural areas, the coastal ecosystems that consist of beach/dune/**barrier islands**, salt marshes, estuaries and mangrove swamps are the most threatened. Why? For one thing, nearly 80% of the state's human population live in coastal areas. The development resulting from this ever increasing population pressure has consumed large portions of these coastal ecosystems. Human activities around the remaining coastal natural areas can impact water quality, promote beach development, affect sedimentation rates, and decrease biodiversity, thus further threaten these fragile ecosystems. *(Marsh photo by E. Leach.)*

In some areas even the **salinity** of the water can be altered by human activities. (Salinity is a term used to describe the relative amount of salts in water or in soil). Storm water runoff, sewage discharges, bridges and other structures can alter water flow and either increase or decrease salinity levels. Salinity is important because some

organisms can only live within a specific range of salinity. If the range of salinity goes beyond the tolerance limits of a particular organism, it may not be able to survive unless it is able to move and find a more suitable environment. Since saltwater and freshwater from the land are often combined in coastal areas, the varying levels of salinity may determine the types of ecosystems that can exist.

Beach/Dune/Barrier Island Ecosystems

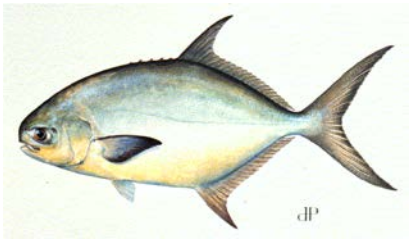
The beach/dune/barrier island ecosystem is probably the most dynamic habitat found in Florida. These areas change constantly with the action of winds, tides and currents. The most dramatic changes occur during storms as strong winds send waves crashing into dune areas or when hurricanes push storm surges far inland. These natural actions have occurred for millennia shaping and changing the coastal ecosystems. *(Beach photo by S. Russell)*

Recent human habitation has, in many areas, altered the cycles of sand movement, **dune development** and succession. **Beach erosion** has increased dramatically in some areas to a point where the replenishment of sand is done by dredging offshore areas or trucking sand from inland sandpits. In many instances, various physical structures are installed to prevent the erosion. **Sea walls, jetties, groins and riprap** are used to "stop" the natural forces at work, yet may cause other problems such as depositing and building up sand in the wrong places.

To understand part of the dynamics of the beach/dune/barrier island complex, one should understand the differences between **high wave energy** and **low wave energy areas**. This can be interpreted simply by the size and the frequency of waves. Differences in wave energy will determine the amount of change in the physical environment, and will greatly influence the types of plant and animal species that can live in a coastal area.

Very few plants or animals live directly on high energy ocean beaches, but many species depend on them for survival. Arthropods, molluscs, and insects escape the pounding surf below the sand. Gulls, sandpipers and other shorebirds are common predators that probe the sand for food. *(Bird photo by A. Timbrook.)*

One of Florida's most highly valued food fish, the pompano, also lives in this environment, feeding on sand fleas and mole shrimp that have burrowed into the sand at the shore line. Huge schools of baitfish including menhaden, cigar minnows, and Spanish sardines attract predators such as cobia, crevalle jack, Spanish mackerel and other prized gamefish. *(Pompano graphic courtesy of FWCC and D. Peebles).*



Florida's east coast is considered a high wave energy system. Prevailing wind action on the Atlantic Ocean has many hundreds of miles to build swells. These **swells** increase as they approach shallow inshore areas and finally break, forming waves of significant height (3-12 ft.) depending on the power of the offshore wind.

The force of high energy waves can move tremendous amounts of sand and bottom material from the beach to offshore sites. When sufficient materials are deposited in these areas **barrier islands** can develop. Sometimes the opposite occurs and sand is deposited at the beach front, where wind can move it inland to form sand dunes. In either case the beach is the all important **buffer zone**, absorbing the energy of waves that might otherwise erode dunes and other coastal formations. Thus, the shape of a beach is constantly changing and influenced by seasonal changes in wind patterns.

The west coast of Florida is much different. The height and frequency of waves along most of this coast are much smaller when compared to the Atlantic side. The smaller surface area of the Gulf of Mexico, combined with varying winds and bottom features produces less energy for wave formation. Fewer and much smaller beach areas exist in the Big Bend area of the Gulf coast due to the lower wave energy. Those that do exist are often part of a barrier island that also helps protect inshore marshes and land areas.

Salt Marshes

The gentle incline of the Gulf Coast reduces wave force and allows marsh grasses to establish themselves in shallow water areas. Salt marshes are communities of nonwoody, salt tolerant plants, most of which are the marsh grasses. The largest amount of salt marsh in Florida occurs from Tampa to Pensacola, with the greatest development in the Big Bend area. A smaller area of salt marsh occurs along the

Indian River Lagoon and in the vicinity north of Jacksonville, Florida. Salt marshes are composed of a variety of different species, depending on location, including; grasses, sedges, and rushes. This vegetation plays a critical role in shoreline stabilization, trapping sediments and eventually "building" land in the process. (Note: Since these plants are tolerant of and grow in salty environments they are also called **halophytes**.)

Marshes provide critical wildlife habitat and are breeding and/or nursery grounds for numerous fish and invertebrates. The plants in a marsh are producer organisms in food chains and food webs that include insects (e.g., marsh fly, sand gnats, mosquitoes), birds (e.g., king fisher, great blue heron, hooded merganser), shellfish (e.g., fiddler crab, pink shrimp, clams), fish (croaker, Gulf menhaden, redfish, sea trout) and mammals (raccoon and otter). *(Salt marsh and bird photos by K. Blyler)*

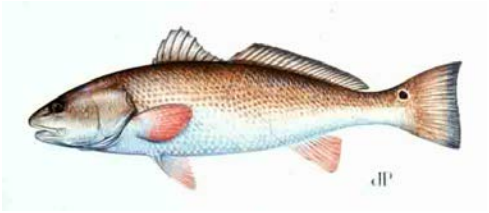
Estuaries

Those water areas where saltwater and freshwater meet are known as **estuaries.** Estuaries such as the Indian River Lagoon, Tampa Bay and Charlotte Harbor form enormous areas along both coasts of Florida. The west coast of Florida alone has approximately 2.5 million acres of estuarine habitat that include open water, salt marshes and mangrove swamps.

Estuaries are intricately interwoven with surrounding ecosystems through geological, biological, chemical, and ecological processes. The inflow of freshwater from springs and rivers, nutrients from upland areas, organic matter from salt marshes, tidal influences, and sediment loads from the land and offshore sources can all contribute to the health or demise of the fragile estuarine ecosystem.

Estuarine ecosystems hold a great diversity of habitats and are **highly productive** natural systems**. Food webs** are complex, involving many predator-prey relationships. Estuarine habitats include sandy bottom, sea grass beds, oyster bars, and mud flats and provide living areas for over two thirds of Florida's commercially important fish and shellfish.

The high **nutrient levels** in estuarine waters provide a rich "soup" that nourish plants and animals making estuaries one of the most productive ecosystems on earth. Many fish, including redfish and mullet, spawn in offshore locations where the eggs develop into larvae that are carried into estuaries by tides and currents. Huge numbers of microscopic algae, diatoms and other types of phytoplankton are estuarine producers that juvenile fish depend on for food. Larger plants such as turtle grass, manatee grass, and shoal grass provide food and cover for other consumers (e.g., crabs, scallops, shrimp, and small fish). Second order and third order consumers (e.g., great blue heron, seatrout, redfish, and coastal shark species) also roam these fertile areas in search of smaller prey.



(Redfish graphic courtesy of FWCC and D. Peebles)

Although estuaries are not sites of human development in the same ways as the beach/dune/barrier islands are, they still receive a great deal of human use. This use takes on many forms including: recreational boating, shrimping, docking and loading areas, as a place for municipal discharge, and sites for **mariculture**. These uses impact the estuaries both ecologically and in relationship to human values. Humans are influenced economically, aesthetically and culturally by this resource. With proper management and effective planning Florida's estuaries can remain a viable and important part of our future.

Mangrove Forests

The mangrove forest ecosystem exists in the southern part of Florida. On the Atlantic side mangrove forests may grow as far north as Cape Canaveral. On the west coast, they may be found as far north as Tampa Bay. The distribution of mangroves is a result of their sensitivity to freezing winter temperatures. Although, mangroves have been reported sporadically north to the Mississippi Delta, only in relatively frost free areas do the true mangrove forests develop.

Mangroves can attain heights of 80 feet, hence the name mangrove forests. In many areas hurricanes will destroy mangroves before the plants have an opportunity to reach these heights. In the process though, mangroves buffer the storm and provide protection to inland areas from high winds and water.

These bands of coastal mangroves also function as critical **nursery areas** for many species of fish and shellfish. The prop roots of the red mangrove give protection to shrimp, blue crab, and snook. Mangroves also provide areas for oysters to grow. The roots themselves form a surface upon which many marine organisms can grow.

Mangrove leaves that fall into the water form a **detritus** dependent food web that nourishes the many species dependent on this ecosystem. Mangroves also help trap sediments from upland areas, filter estuarine waters of nutrients and can even remove some pollutants from the water column. *(Mangrove photos by K. Blyler)*

CONCLUSION

The total area that Florida's coastal ecosystems cover is quite small when compared to the entire land mass of Florida. By some estimates, approximately 3% of Florida's land area consists of barrier islands, mangrove swamps and salt marshes. This should give you an idea of the limited area coastal ecosystems occupy, and the fragile nature of these areas. It's also easy to see that with 80% of the human population on or near these important coastal ecosystems the potential impact upon them is tremendous.

It is important that all of us gain a better understanding of these important ecosystems. A greater awareness will hopefully lead individuals to act in appropriate ways to help protect and preserve these critical ecosystems along the coast of Florida.

Key words *(be able to define/describe the meaning)*

1. Estuaries
2. Barrier islands
3. Salinity
4. Dune development
5. Beach erosion
6. Sea walls
7. Jetties
8. Groins
9. Rip rap
10. High wave energy
11. Low wave energy
12. Swells
13. Buffer zone
14. Halophytes
15. Highly productive
16. Food webs
17. Nutrient levels
18. Mariculture
19. Nursery areas
20. Detritus

21. Why is each ecosystem important to Florida's health and to us?
22. What are the threats facing each ecosystem? (natural and human caused)