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Mangroves of the Indian River Lagoon

This educational workbook was produced through the support of the Indian River Lagoon National Estuary Program.

ONE LAGOON
ONE COMMUNITY · ONE VOICE
INDIAN RIVER LAGOON
NATIONAL ESTUARY PROGRAM

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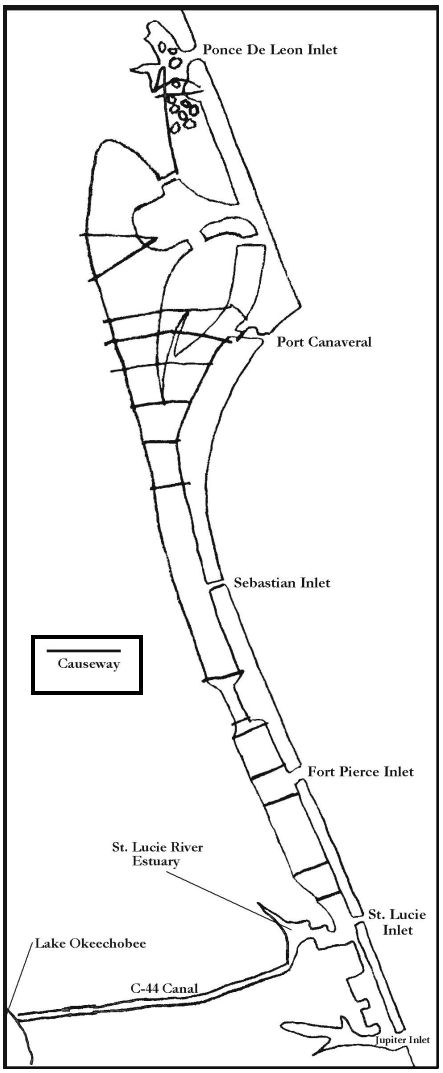
The Indian River Lagoon

We are so lucky to live near the Indian River Lagoon, the large body of water you pass over on the way to the beach. Although the word "river" is in its name, The Indian River Lagoon is not a river.

It's a very special body of water called an estuary. An estuary is a place where fresh and salt water mix. A mixture of fresh and salt water is called brackish water. While a river has headwaters (its source of freshwater) and flows downstream to a mouth, or larger body of water, The Indian River Lagoon has no headwaters and no mouth. The water in this estuary moves with the wind and tides. The Indian River Lagoon is a special type of estuary called a lagoon. Lagoons are shallow coastal water bodies, separated from the ocean by barrier islands. A lagoon typically has limited water exchange with the ocean through inlets, and receives freshwater from multiple rivers.

The Indian River Lagoon is 156 miles long, stretching from Ponce De Leon Inlet to Jupiter Inlet. While the Indian River Lagoon can be up to 5 miles across in some places, it is quite shallow, averaging only 3 feet in depth.

The estuary was originally called "Rio de Ais" by early Spanish explorers after the Ais tribe of native Americans who once lived in our region. The name was later translated to "Indian River" and eventually Indian River Lagoon.



Estuaries are very productive places. They provide an important home for many different plant and animal species. The Indian River Lagoon is one of the most diverse estuaries in North America. There are more than 2,200 different species of animals and 2,100 species of plants living in and along the Lagoon. Each year, scientists discover even more species living in this special estuary.

These plants and animals live in different types of habitats, including freshwater marshes, salt marshes, mangrove forests, seagrass beds, oyster reefs, coastal hammocks, dunes,and beaches.

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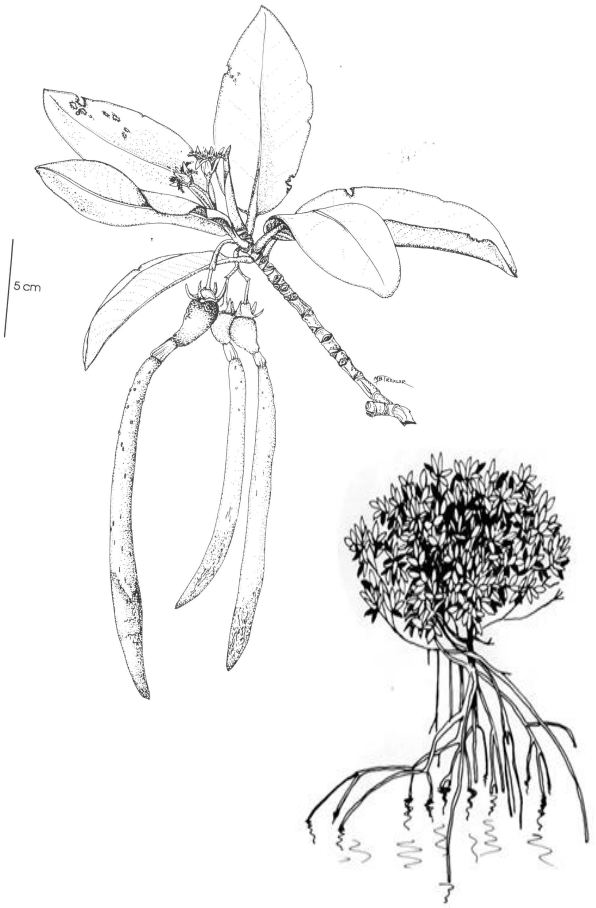
The Mangrove Forest

Mangrove forests are important habitats along the shoreline of the Indian River Lagoon. Mangrove trees provide food and shelter for many animals – above the water and below. Their root systems create a great hiding place for fish, crabs and shrimp. Young animals especially enjoy the protection provided by mangrove roots. These roots also keep our water clean and prevent shorelines from washing away during storms. Mangrove trees cannot survive cold weather, so you'll only find them in places that stay warm during the winter. In colder areas, mangrove forests are replaced by salt marshes filled with tall, lush grasses and salt-tolerant shrubs.

There are three different types of mangrove trees in Florida; the red mangrove, the black mangrove and the white mangrove. All three of these species have something in common – they can survive in salty water. While most plants would die if you watered them with salt water, mangroves have special adaptations that help them survive in the saltiest of places. As you'll learn below, mangroves have specialized roots, leaves, and seeds, allowing them to grow where other trees cannot.

The Red Mangrove

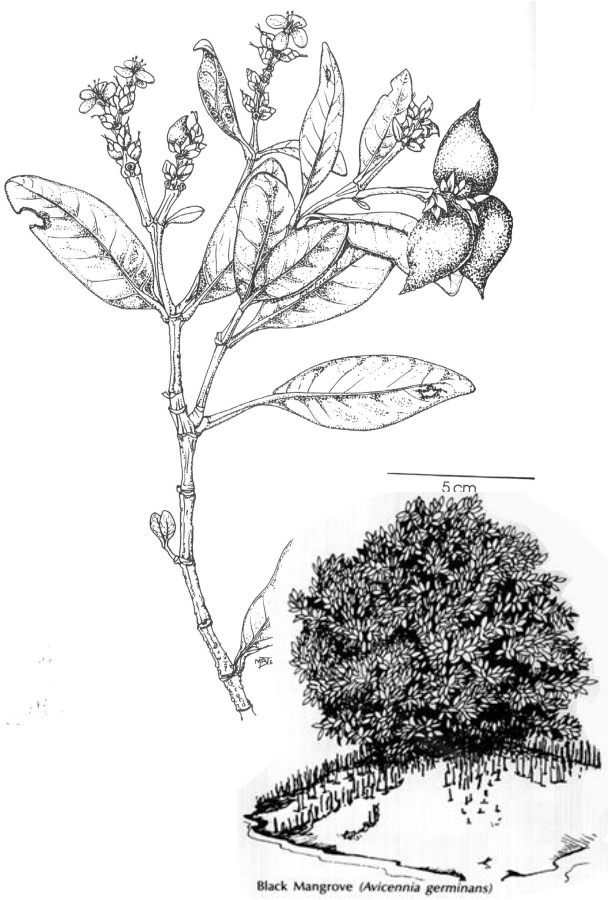
The red mangrove is the most common mangrove along the Indian River Lagoon. It is easy to identify by its specialized roots, which grow right out of its trunk and branches. These are called prop roots. They help hold the tree up in soft mud and shallow water. The red mangrove is sometimes called the walking tree, since its long, arching prop roots make the tree look like it is walking on water. These roots provide a home for many underwater plants and animals. Red mangroves remove salt from water with a special filter in their roots.



Red mangrove seeds are about as big as an acorn. Rather than falling to the ground to sprout, these seeds germinate while still attached to the tree! Out of each seed grows a long, green bean-shaped structure called a propagule. A propagule is actually a sprouted baby mangrove tree. When the propagule is fully grown, it drops from the tree and floats away. Red mangrove propagules can drift for many months before finding just the right spot to grow into a mature tree.

The Black Mangrove

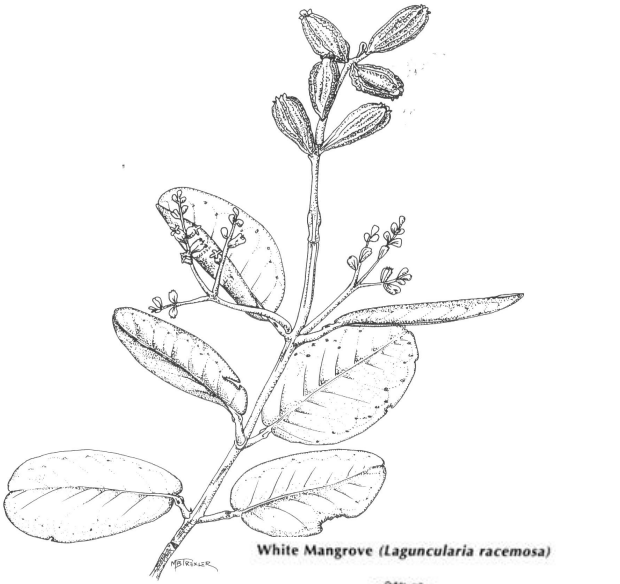
Black mangroves grow further away from the water's edge than red mangroves. Black mangroves get their name from their black bark. You can also identify black mangroves by their unique root system. Instead of prop roots, black mangroves have breathing roots. These finger-like roots stick out of the mud around the black mangrove's trunk, allowing air to get to the root system. If the roots stay under water too long, the tree drowns. Black mangrove leaves are dark green on top and silver on bottom. Black mangroves remove salt from their sap using salt glands in each leaf. You can see salt on the top of the leaves on hot days. The propagules of black mangroves look like large lima beans.



Black Mangrove *(Avicennia germinans)*

The White Mangrove

White mangroves grow the farthest from the water's edge. They cannot live in the water, unlike red and black mangroves. They do not have a specialized root system. You can identify the white mangrove by its leaves. The leaves are bright green ovals. You'll see two rows of black dots if you hold a leaf up to the sun. Also, there are two little bumps at the bottom of each leaf. Scientists think these bumps might make sweet nectar. Like the black mangrove, white mangroves use salt glands in their leaves to pump out the salt taken in by the roots. Propagules of the white mangrove are small and tear drop shaped with wrinkles.


White Mangrove *(Laguncularia racemosa)*


Artwork courtesy of U.S. Fish & Wildlife Service

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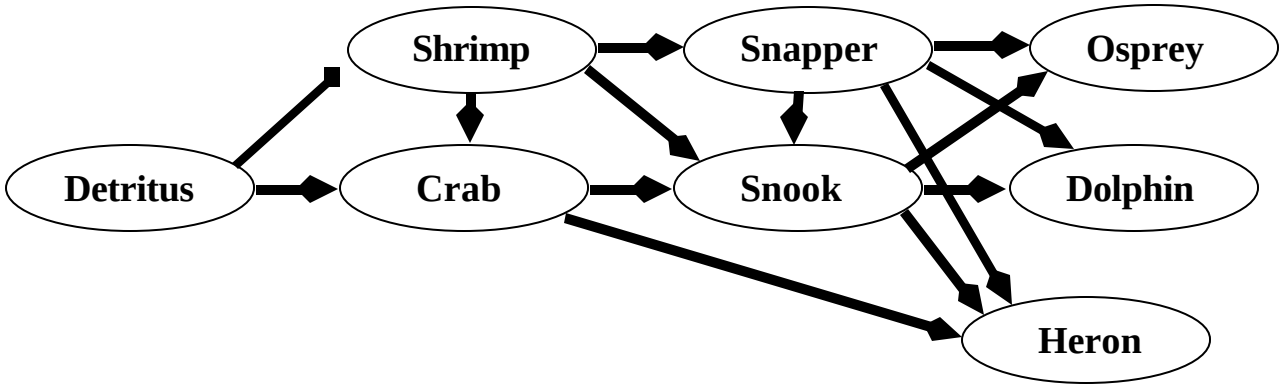
Mangroves in the Food Chain

Few animals eat mangrove leaves while they are still attached to the tree. They don't taste very good! Dead mangrove leaves fall into the water, where they decompose, or break down. This creates a dark, smelly muck called detritus. Mangrove **detritus** is at the base of the Indian River Lagoon's **food web**. These broken down bits of dead mangrove leaves provide food for tiny animals, which in turn become food for larger animals. Without mangroves, the Indian River Lagoon would not have as many fish, shrimp, crabs, lobsters, and birds.

How does a food web work? First, plants take in sunlight to grow. Sunlight gives the plant energy to make leaves, roots, and branches. Plant-eating animals, called **herbivores**, eat the plants. Small meat-eating animals, called **carnivores**, eat the herbivores. Larger carnivores eat the smaller carnivores. Plants and algae are at the bottom of the food web, and large carnivores are at the top. Many other animals are in the middle.

A simplified version of a food web is called a **food chain**. Let's look at one example of a food chain in a mangrove forest. Mangrove leaves fall into the water and decompose, forming detritus. A crab eats the detritus. A young snapper then eats the crab. A hungry snook gobbles up the snapper. A dolphin eats the tasty snook.

This is just one example of how food energy can flow through a mangrove forest. There are actually many different food chains occurring at the same time. Animals do not eat just one type of food. Animals are not eaten by only one type of predator. When you connect all of the different food chains together, you end up with a food web.



Food webs are complicated. The food web connects all plants and animals in the mangrove forest. What happens if you remove certain animals from the food web? What would happen if there were no plants in the food web?

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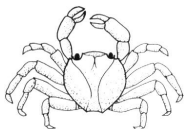
Food Chain Mix Up

These food chains are out of order. Number these organisms to show the flow of energy through the food chain.

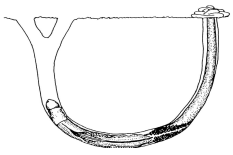
Grunt

Heron

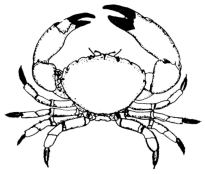


Marsh Crab

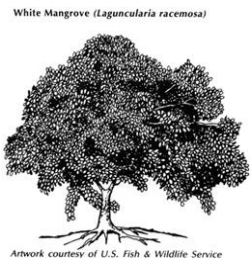
Red Mangrove



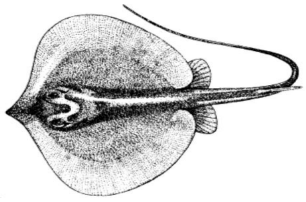
Acorn worm



Stone Crab

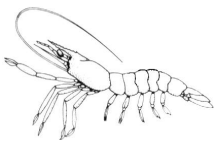


White Mangrove

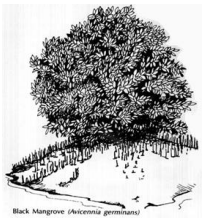


Sting Ray

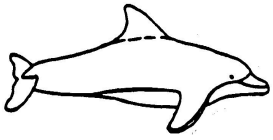
Adult Snook



Grass Shrimp



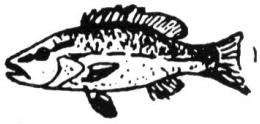
Black Mangrove



Dolphin

Seahorse

Sun



Young Mangrove Snapper

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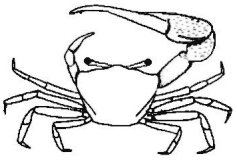
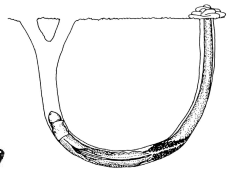
Mangrove Forest as Habitat

What is a **habitat**? A habitat is a place out in the environment where a plant or animal lives. Habitats must provide certain basic needs, including food, water, and shelter. There are many places for animals to live in a mangrove forest. Some animals live in the mud. Other animals live in the water that flows through the forest. Some animals attach themselves to the underwater roots of the mangrove, while others live high up in the tree's branches.

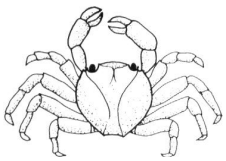
In the mud you will find the detritus eaters. These animals eat broken down bits of mangrove leaves, moving energy from the mangrove tree into the food web. Clams, marsh crabs, fiddler crabs, and worms all eat detritus.



Fiddler Crab

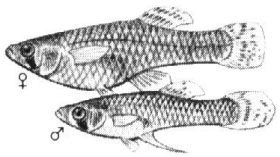


Acorn Worm



Marsh Crab

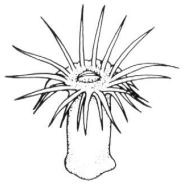
A common and important animal living in the water of the mangrove forest is the mosquitofish. This relative of the guppy is named for its appetite for mosquitoes. A mosquitofish can eat up to 200 mosquito larvae (tiny, developing mosquito's) a day. The mosquitofish is an important food source for juvenile fish and wading birds. Young fish use the mangrove forest as a nursery habitat, or first home. They can safely swim through the dense roots of the mangroves, while their predators, like other larger fish, are too big to follow. Plus, there's lots of food in and around the mangrove roots for the young fish to feed on.



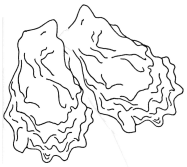
Mosquitofish

Young fish use the mangrove forest as a nursery habitat, or first home. They can safely swim through the dense roots of the mangroves, while their predators, like other larger fish, are too big to follow. Plus, there's lots of food in and around the mangrove roots for the young fish to feed on.

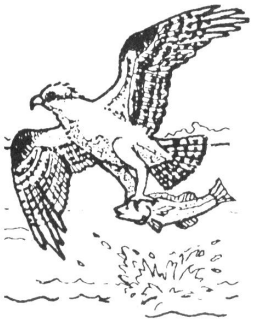
Many invertebrates (animals without back bones) make their homes right on the mangrove roots. Under the water, oysters, mussels, sea anemones, and barnacles attach to the roots and wait for the tide to bring them food. Above the water, spiders set webs to catch flying insects, and mangrove tree crabs scurry about.



Sea Anemone



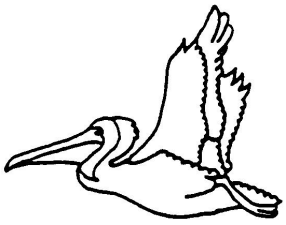
Oyster



Osprey

Mangrove forests are also an important habitat for birds. Osprey, pelicans, egrets, and herons all use the mangrove forest. They nest in the branches. They hunt in the marsh. During storms these birds move deep into the marsh for protection from the wind.

Heron



Pelican

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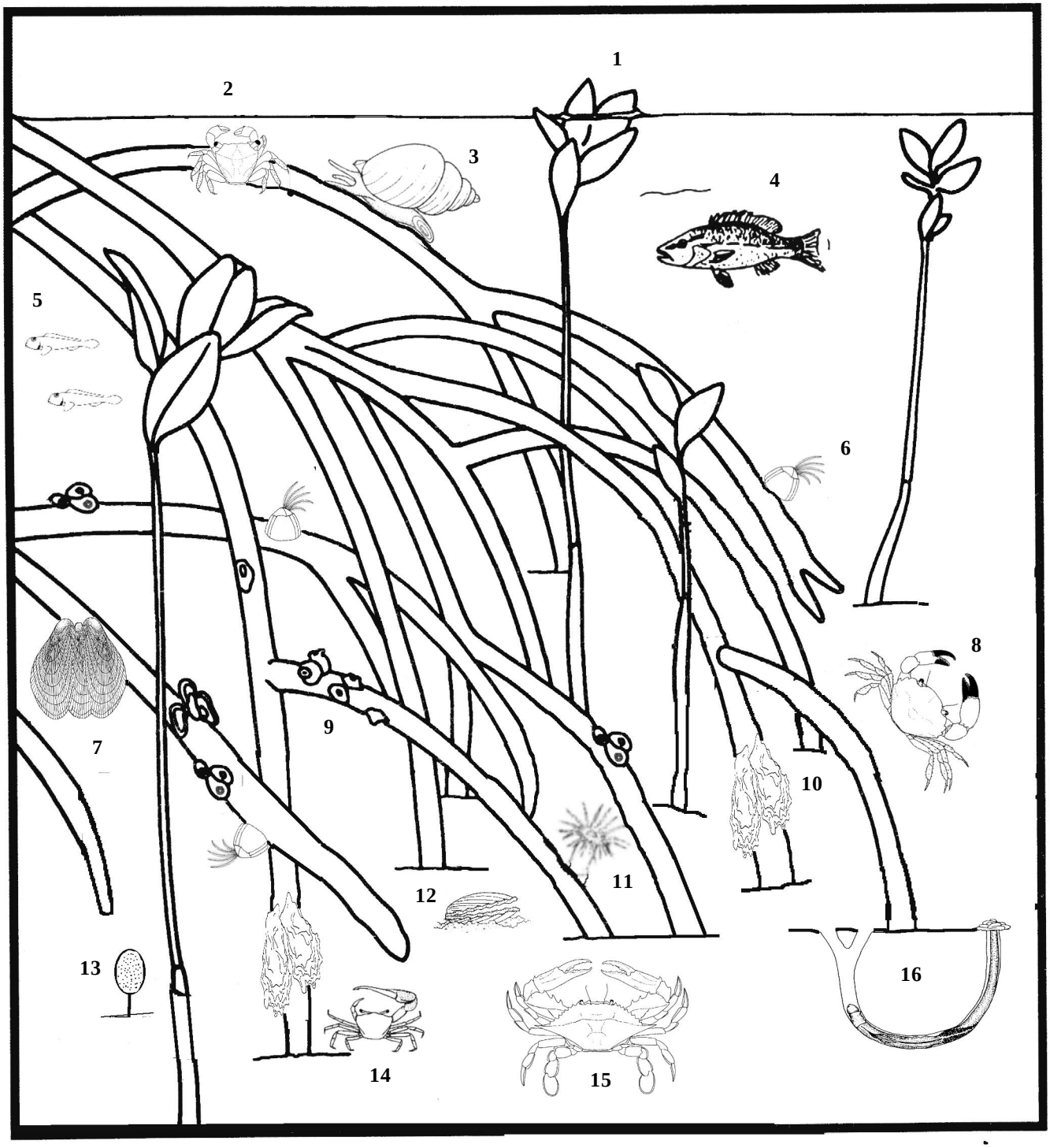
Mangrove Habitat
Roots, Water & Mud



1 Red mangrove seedling
2 marsh crab
3 mangrove snail
4 mangrove snapper
5 blenny
6 barnacle
7 mussels
8 mud crab
9 sea squirt
10 oyster
11 anemone
12 clam
13 bamboo worm egg sac
14 fiddler crab
15 blue crab
16 acorn worm

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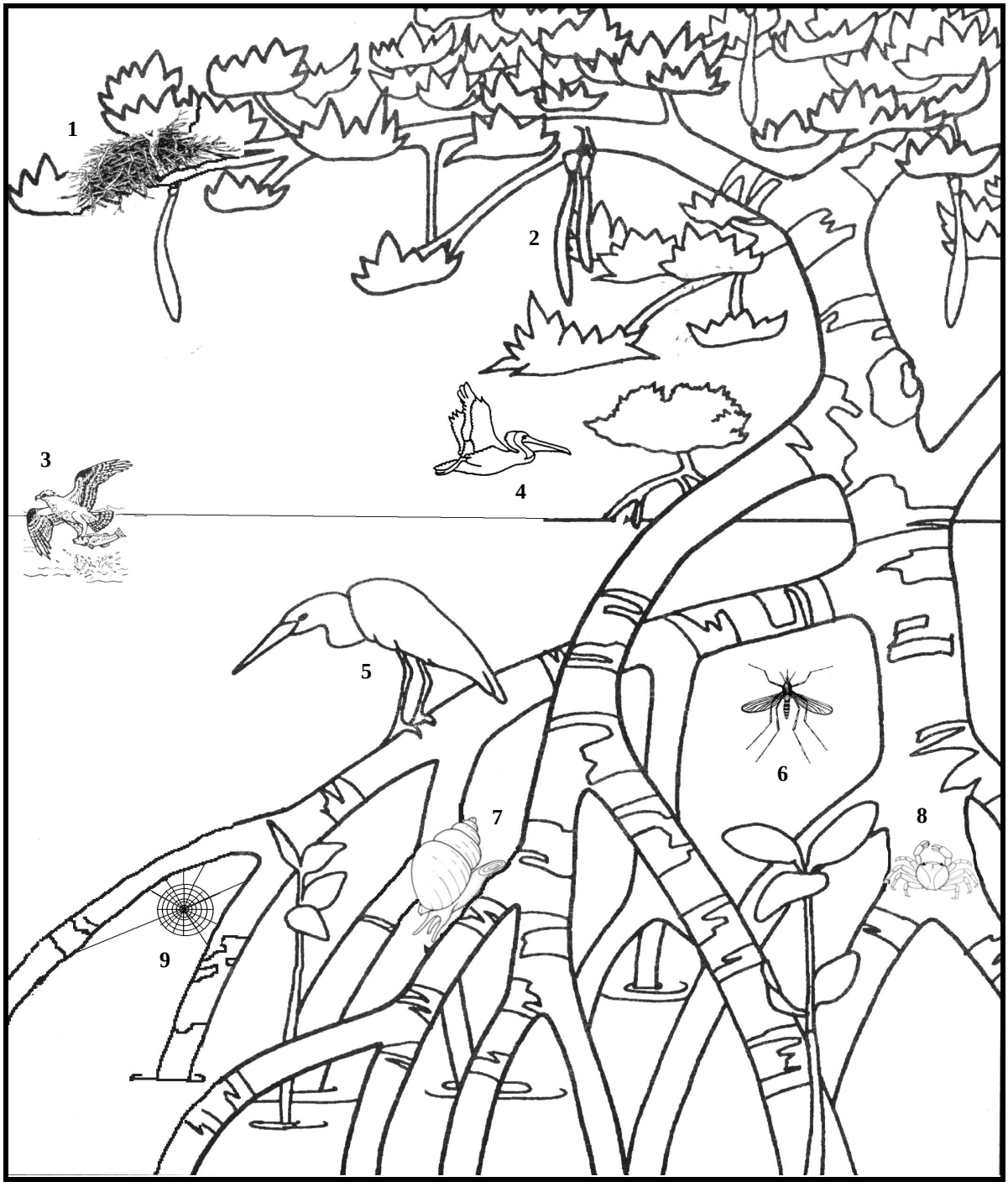
Mangrove Habitat
Trunk & Branches



1 Pelican Nest
2 Red Mangrove Propagule
3 Osprey
4 Pelican
5 Egret
6 Salt Marsh Mosquito
7 Mangrove Snail
8 Mangrove Tree Crab
9 Spider Web

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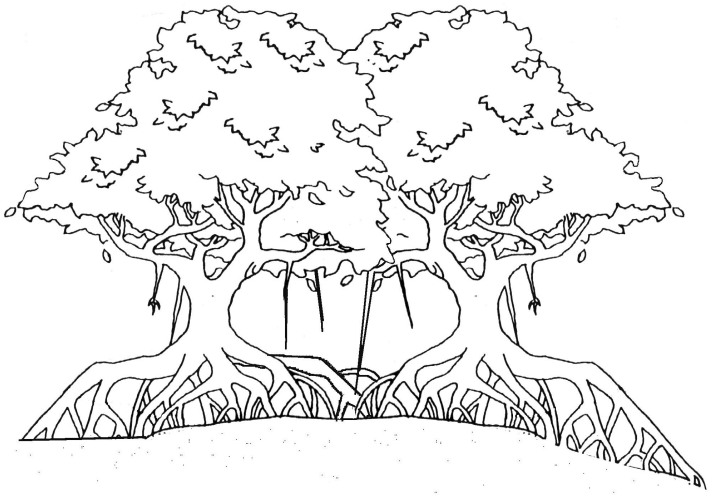
Filter the Water

Mangrove forests help keep our estuaries clean. Water moves slowly through the roots in the mangrove forest. This allows the sediment in the water time to drop to the bottom. Nutrients from sewage and fertilizer are washing into the Indian River Lagoon. These nutrients can cause harmful algae blooms. Mangrove trees are able absorb extra nutrients from the water – almost like a filter on an aquarium. When the water leaves the forest, it is cleaner than when it entered.



Stop Erosion

Wind, waves, and boat wakes can wash away the soil and sand on a shoreline. This is called erosion. Mangrove forests do a great job of protecting shorelines from erosion. The thick roots of a mangrove tree slow waves down so they cause less damage to shorelines. These roots hold soil in place, preventing sediments from getting stirred up into the water. This results in cleaner, clearer water. In fact, during calm weather, mangrove roots can actually trap sediment, creating new land.

Mangrove Loss

The Indian River Lagoon has lost **80%** of its mangrove forests to development!

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Which One Am I?

Figure out which mangrove; red, black or white is described by each sentence.

1. I remove salt through the face of my leaves. _____
2. I am the most common mangrove. _____
3. I have long pencil shaped propagules. _____
4. Each of my leaves has two salt glands on the base of the stem. _____
5. My seeds look like large lima beans. _____
6. My roots drop out of my branches to help hold me up in the soft mud. _____
7. I have no special roots. _____
8. I have finger shaped roots sticking out of the mud. _____
9. I filter salt out of the water with my roots. _____
10. My propagules are tear drop shaped. _____

Mangrove Word Search

F	A	P	D	I	V	E	R	S	I	T	Y
P	I	L	E	C	A	D	R	E	N	I	V
N	O	L	R	E	H	E	E	D	R	B	H
U	I	V	T	O	R	T	E	I	P	R	A
T	E	D	I	R	T	R	O	M	R	E	B
R	M	A	B	F	A	I	R	E	E	R	I
I	S	T	A	U	R	T	L	N	Y	O	T
E	P	R	O	P	R	U	I	T	A	S	A
N	S	E	A	U	V	S	F	O	O	I	T
T	F	O	O	D	C	H	A	I	N	O	H
S	W	E	B	S	R	E	T	M	T	N	I
T	H	A	B	T	R	U	N	O	F	F	M

Find these words related to mangroves hidden in the puzzle. The words may be across, down or diagonal.

1 Detritus
2 Diversity
3 Erosion
4 Filtration
4 Food Chain
5 Habitat
6 Nutrients
7 Prop
8 Runoff
9 Sediment

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Help Protect Mangrove Forest

Scientists understand the importance of mangroves. Developers are not allowed to cut down or fill in mangrove forests any longer. However, mangroves forests still need your help. What are some things you can do to protect mangroves?

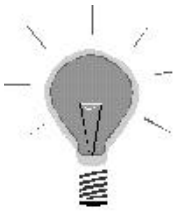
1) Learn. The more you know about mangroves the more you can do to help. What can you do to learn more about mangroves?

2) Tell people. Spread the word. Many people do not know about mangroves. People only care about things they understand. How can you spread the word about mangroves?

3) Clean up. Along the mangroves, garbage is a danger to the animals. Pick up garbage, especially fishing line, when you are out in the lagoon. How else can you help clean up?

4) Pitch in. Go to an environmental center and help collect and plant mangrove seedlings.

There are many ways you can help mangroves. The best ways are already inside your head. Brainstorm with your friends and family on ways that YOU can protect and support our wonderful mangrove forests. With your help, we will have healthy mangrove forests for generations to come.



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Mangrove Vocabulary

brack·ish (bràk¹îsh) *adjective* A mixture of fresh and salt water.

car·ni·vore (kär¹ne-vôr´) *noun* An animal which eats the meat of other animals.

coast·al (kost¹el) *adjective* Near the ocean.

de·com·pose (dê´kem-poz¹) *verb* To break down into small parts, decay.

de·tri·tus (dî-trì¹tes) *noun* Particles of dead and decaying plants and animals.

di·verse (dî-vûrs¹) *adjective* Having many different kinds.

e·ro·sion (î-ro¹zhen) *noun* The wearing away of soil or rock by water, wind, or other forces of nature.

es·tu·ar·y (ès¹ch ¡ -èr´ê) *noun* Where fresh and salt water mix in coastal areas.

food chain (f ¡ d chân) *noun* The flow of energy through animals involving prey being eaten by predators.

food web (f ¡ d wèb) *noun* A connected group of food chains.

hab·i·tat (hàb¹î-tàt´) *noun* An area where an organism is supplied with the food, water, shelter and space needed for life.

her·bi·vore (hûr¹be-vôr´) *noun* An animal that feeds on plants.

la·goon (le-g ¡ n¹) *noun* A shallow body of water protected from the ocean by barrier islands.

nu·tri·ent (n ¡ ¹trê-ent) *noun* Element necessary for life and growth.

or·gan·ism (ôr¹ge-nîz´em) *noun* A living human, plant or animal.

pred·a·tor (prèd¹e-ter) *noun* An organism that lives by hunting and eating other organisms.

prey (prâ) *noun* Animals that are hunted, killed and eaten by other animals.

prop root (pròp r ¢ t) *noun* Roots dropping out of a mangrove that help hold the tree up in soft sediment.

riv·er (rîv¹er) *noun* A large natural stream of freshwater emptying into another body of water.

run·off (rùn¹ôf´) *noun* Water that drains off the surface of the land.

sed·i·ment (sèd¹e-ment) *noun* Fine particles such as sand, silt or clay.

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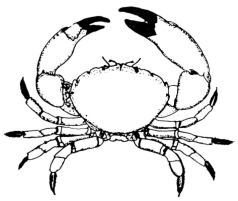
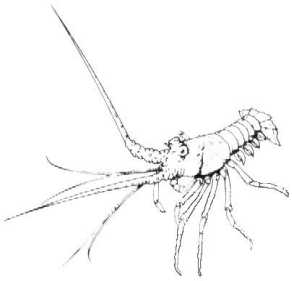
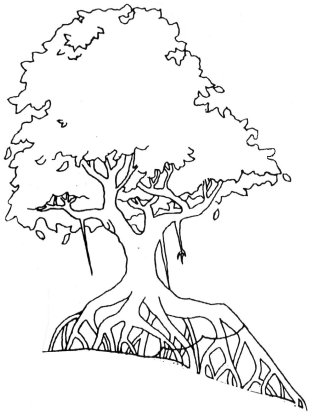
Vocabulary Crossword Puzzle







Across:

1. A shallow body of water protected from the ocean by barrier islands.

2. A large natural stream of freshwater emptying into another body of water.

3. To break down into parts.

4. A mixture of fresh and salt water.

5. An animal that feeds on plants.

6. Help hold mangrove up in soft mud.

Down:

1. Water that drains off the surface of the land.

2. An area where an organism is supplied with food, water, shelter and space.

3. Elements necessary for life and growth.

4. Particles of dead and decaying plants and animals.

5. An animal which eats other animals.

6. Where fresh and salt water mix in coastal areas.

7. Wearing away of soil or rock by water, wind or other forces of nature.

8. An animal that hunts and eats other animals.

9. Near the ocean.

10. An interlocking group of food chains.

Florida Oceanographic Coastal Center

Name: _____

Erosion Experiment

Rub two fingers together. Are they getting warm? The warmth is from friction. It is friction that steals energy from the waves. The more surface that rubs against the wave the more energy the wave loses. Rub your hands together. Did they warm up faster than your fingers? Does your hand have more surface area than your finger?

Hypothesis:

Mangroves protect the shore from erosion caused by waves. The roots take energy away from the wave.

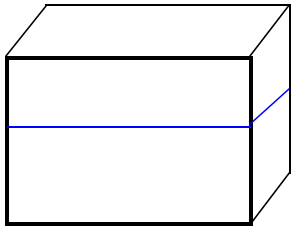
Materials you will need:

1. A five (5) gallon aquarium
2. Two and a half (2.5) gallons of water
3. A stopwatch
4. Two (2) pieces of mesh cloth
5. Ping pong paddle

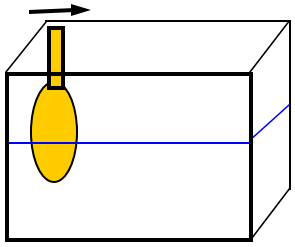
Directions:

1. Fill the aquarium half full of water. The aquarium represents the Indian River Lagoon without mangroves along the shore.
2. Pull the paddle through the water to create a wave. The paddle represents boats and wind that create waves.
3. Start the stopwatch.
4. Time how long it takes for the water to stop moving.
5. Record your answer.
6. Put a piece of mesh in the tank about an inch from the wall.
7. Create another wave.
8. Time how long it takes for the water to stop moving.
9. Record your answer.
10. Put the other piece of mesh at the other end of the tank.
11. Create another wave.
12. Time how long it takes for the water to stop moving.
13. Record your answer.

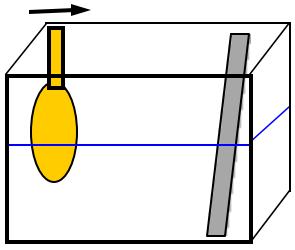
Step 1



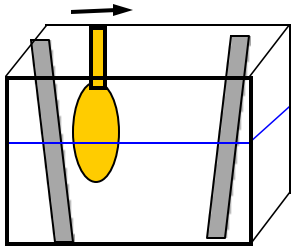
Step 2 Test 1



Step 7 Test 2



Step 11 Test 3



No Mangroves (no mesh)	Mangrove on one shore (one piece of mesh)	Mangrove on both shores (two pieces of mesh)
Time for wave to stop: _____	Time for wave to stop: _____	Time for wave to stop: _____

Discussion Questions:

1. In which test did the wave take the longest to stop? _____
2. In which test did the wave take the shortest to stop? _____
3. Which test has the most surface for the wave to rub against? _____
4. As the amount of surface in the tank increased did the time for the wave to stop increase or decrease? _____
5. Would you say mangroves are important to stop erosion? Why? _____

_____

_____

_____

6. What would happen if there were no mangroves along the Indian River Lagoon? _____

_____

_____

_____