



# 2019 Lagoon Days

## Volunteer Guidebook

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## Thank You!

... for being ready and willing to help during Lagoon Days 2019! Each year the 4<sup>th</sup> grade students of Indian River County look forward to coming to the Environmental Learning Center (ELC) campus on Wabasso Island for an exciting day of outdoor exploration in and around the Indian River Lagoon. Your role in this annual adventure is essential. As you can imagine, it takes a lot of energy and local talent to pull off an environmental education opportunity of this magnitude. This year, close to 1,400 fourth graders will participate! Almost 130 job slots must be filled in order to run the program. Without people like you, Lagoon Days would not happen! **Again, thank you!**

## Lagoon Days Goals

- To teach students about the natural world and local history through experiential learning, building our 3-grade program SPLASH 3.
- To demonstrate the importance of interconnections in the environment – emphasize how everything fits together and interacts like the pieces of a puzzle.
- To cultivate an appreciation for the Indian River Lagoon, one of North America's most diverse estuaries.
- To develop a sense of stewardship for natural resources and to comprehend how individual actions directly affect Planet Earth.

## Introduction

*When one tugs at a single thing in nature, he finds it attached to the rest of the world.*

John Muir

The theme for Lagoon Days is **interconnections**. During the field trips, students will explore three stations, learning about a different component of the Indian River Lagoon ecosystem at each. Activities take place outside and are designed to illustrate the interconnectedness of organisms within an ecosystem. Just like the pieces in a jigsaw puzzle! When you link the concepts taught at your station with those at the others, you help students put the pieces together and understand the role each component plays in the grand picture. Students also learn how their actions directly affect the environment.

Through your involvement in Lagoon Days, you not only teach about the interconnections between plant and animal communities, you also demonstrate that great things are accomplished through the interaction of individuals in the human community!



The **Lagoon Days 2019 Curriculum and Volunteer Guidebook** provides general information about the program and topics to be taught at each of the three stations during Lagoon Days. It is written and produced by Sara Piotter (Education Director), Sarah Christopherson (current Naturalist), Melody Ray-Culp (former Education Coordinator), Heather Stapleton (former Education Director), Rosemary Badger (former Naturalist), Sarah Rhodes-Ondi (current Naturalist), Rich Wilson (former Naturalist), Katrina Morrell (former Naturalist), and Vanessa Spero-Swingle (former Naturalist). Staff works closely with volunteers – feel free to contact us with questions or suggestions.

### Check-In

**Please be at the ELC Caterer's Kitchen at 9:15am.** This will give us time before the students arrive to make introductions, go over final program details, distribute hand-held VHF radios, and synchronize watches. If you have a name tag (either ELC or your work) please wear. Otherwise, we are doing away with the nametags – the end up in the water. As our day now ends a few hours earlier, it's up to you if you'd like to bring a lunch. If so, you're welcome to store that in the in the Caterers' Kitchen and enjoy lunch after the students depart. Staff will immediately transition into cleanup after 1:00pm BUT having lunch on campus is a great opportunity to relax and unwind with some personal nature time. ☺ Either way, please bring a reusable water bottle.

### Daily Schedule

Generally there will be three schools visiting the ELC campus from March 7<sup>th</sup> thru April 26<sup>th</sup>. Each of the county's public schools is assigned to one of these days and we may also host a few local private schools.

Each station is roughly 45 minutes long. Students have 5 minutes to travel between stations. The daily schedule is as follows:

<b>9:15</b>	<b>Volunteers meet</b>	11:00-11:45	Station 2
9:30-9:45	School buses arrive at ELC	11:50-12:30	Station 3
10:00-10:05	Welcome and Introduction	12:35-12:55	Lunch & Wrap-up
10:10-10:55	Station 1	1:00	School buses depart ELC

**We must keep careful track of time.** There is a lot to cover during each station period, and it is imperative that we finish each station on time. If buses arrive more than 20 minutes late, each group of students may have to miss one station. This will depend on how quickly students can get off the bus and organized. Be flexible and ready to make some last minute changes. Also, if changes occur, please keep a positive attitude, as students will follow your lead.

You have received an email asking for your help with our Lagoon Days program and may have already given a list of your available dates. If you have not yet signed up, please contact Director of Education & Outreach, Sara Piotter, to volunteer or to alter your availability. **Please contact Sara Piotter right away if you are no longer able to come or must leave early during any of your scheduled dates (SaraP@DiscoverELC.org, 589-5050 x 111). This allows us to try to find a replacemen**



## General Curriculum Information

All programs offered by the ELC, for children and adults alike, are designed to nurture an appreciation for nature and all living things. Each year, all of the 3<sup>rd</sup> graders come for a field trip based on their special curriculum called ***Splash 3***. Our Lagoon Days program is the next step. When they come to your station, ask how many have been to the ELC for a field trip before and let them tell you what they already know.

The detailed station summaries provided herein are your teaching tools for Lagoon Days. **The curriculum for each station includes more information than you can cover during the station period, but try to hit the general concepts and key points on the cheat sheets.**

Don't worry if you've never taught the station before – you will work with someone who can show you the ropes and familiarize you with the flow of activity and information. Bring this ***Curriculum and Guidebook*** with you when you teach, and feel free to mark it up with notes and colored highlighting. We have added **cheat sheets** outlining key points that should be covered for each station. Laminated copies of the cheat sheets will be posted at each station. Please feel free to adapt the cheat sheets to your needs and teaching style. Add any information based on your own valuable expertise!

Reading the material included for all stations, not just the one at which you will be teaching, will help prepare you for discussing how your station fits into the big picture.

**Remember to emphasize interconnections and to incorporate this theme throughout the day.**



## Logistics

Students travel from station to station with their teachers and chaperones. Usually there are no more than 25 students in each group

We request that at least two adults from the school (teachers or chaperones), and no more than four, accompany each group.

When the school buses arrive, ELC staff will work to escort school groups to the picnic area underneath the Discovery Station. This area will be sectioned off according to our 3 Lagoon Days stations. Each group will be asked to gather in this picnic area according to their assigned start station. Instructors will be waiting for them at their respective signs.

The program will begin with a short introduction and orientation to Lagoon Days. Immediately after, instructors will lead their first group of students to their assigned station. The station rotation flows as follows:

Benthic Ecology → Seining → Water Quality Lab

At the beginning of each station period, introduce yourself. You are very important! If you work in an environmental field, let the students know – you might inspire them to follow in your footsteps. And, if you aren't a professional, let them know you are someone who cares greatly about the environment, and want to help people learn about it.

At the end of each station period, tell students where they should go next and point them in the right direction. After the last station, please direct the chaperones and teachers to take their students back to the picnic area for the wrap-up.

## Teachers and Chaperones

Teachers and chaperones play a vital role during the field trip. Teachers are instructed to tell prospective chaperones exactly what their responsibilities will be before they “hire” them for the job. In brief, teachers and chaperones are expected to serve as role models, supervise students at all times, participate fully in all activities, and serve as disciplinarians. Everyone is fully aware that they will get wet and dirty during this adventure. If you are having a hard time getting the students' attention, enlist the aid of the school adults – it's their job to maintain order amongst the students, not yours!

The teacher will be the leader of each group. The leader is responsible for guiding the students from station to station. Should a child need to use the bathroom during the field trip, a teacher or chaperone must accompany the student. An adult must be in the bathroom any time there are children in there – unfortunately, our bathrooms have sometimes become sites for student mischief.

Following is a copy of the letter to prospective chaperones

*Our mission is to educate, inspire and empower all people to be active stewards of the environment and their own well-being.*



February 2019

**Dear Prospective Chaperone,**

The Lagoon Days program at the Environmental Learning Center (ELC) is a high point in the school year for those who participate. Participants will explore the fascinating Indian River Lagoon ecosystem at five different educational stations. All stations are outside, and all activities emphasize the Lagoon Days theme, **Interconnections**.

The goal of the excursion is to provide a positive, outdoor experience that will promote an understanding of the environment and inspire interest in learning about the world around us.

Chaperones play a vital role during Lagoon Days. As a chaperone, your main role is to promote a safe, successful learning experience. Before you accept the "job," carefully consider the responsibilities listed below. As a chaperone, you must agree to do the following:

- **Participate fully in all activities, including those that require getting into the water.** Your help is needed and expected at every station. **You will get wet and dirty.** Dress accordingly and wear closed toe, closed heel shoes with laces. Hat or visor and sunglasses are suggested.
- When students are leaving the water stations (canoeing, benthic, and seining), we ask that a teacher or a chaperone be in charge of seeing that everybody gets a fresh water rinse and uses hand sanitizer.
- Serve as a role model. Listen and observe quietly, provide guidance to children as needed. Be enthusiastic about the activities and nurture enthusiasm in the students.
- Supervise children at all times. Keep them together and make periodic head counts. Should a child need to use the bathroom, an adult must accompany the student.
- Serve as disciplinarian when necessary and help children abide by the rules.
- Help take lunches off the bus upon arrival at the ELC and carry them where directed. During lunch, keep children under the Discovery Station and help support students separate recyclables, compost, and trash.
- Do not bring children not enrolled in the 4<sup>th</sup> grade at the school you are accompanying.

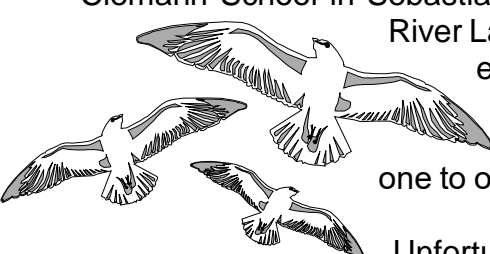
Should you decide to accept this important chaperone "job," we look forward to seeing you at the ELC ☺. Your help is greatly appreciated! And if you decide not to come to the ELC as a chaperone, you are warmly encouraged to visit any time we're open.

Sincerely,  
The ELC Education

*Our mission is to educate, inspire and empower all people to be active stewards of the environment and their own well-being.*

## A Little History

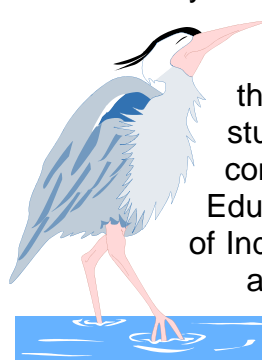
Lagoon Days has its roots in an excursion developed by Lawrence Wineland, the game warden at Pelican Island Wildlife Refuge from 1964 to 1981. He recognized the role that environmental education plays in promoting respect for the world around us. Mr. Wineland approached Principal Judd Suttle, of Clemann School in Sebastian, to propose a venture that would get children interested in the Indian River Lagoon. The program began with a boat trip to Pelican Island and continued each spring for several years. It earned the strong support of local teachers and principals. In an article from the Press Journal (September 30, 1977), Mr. Wineland said that, although the program is an expensive one to operate, “we feel it’s one of the very best ways that money could be spent.”



Unfortunately, funding problems did occur, prompting Principal Roy Howard, of Osceola Elementary School, to step in with new ideas in 1978. With help from many private citizens and several organizations including the Freshwater Fish and Game Commission, Pelican Island Audubon Society, Florida Medical Entomological Research Laboratory, Harbor Branch Oceanographic Institution, and Coast Guard Auxiliary, Mr. Howard kept the momentum going. The boat trips to Pelican Island evolved into an expanded program called River Days, which got the children into the water seining for marine life, peering through microscopes, learning how to fish and how to canoe, and observing local birds and other wildlife. Mr. Howard writes, “The community was unbelievably supportive,” and describes how 160, 5<sup>th</sup> grade students from Osceola walked over to the canal-side home of Joan and Allen Edwards, where a boat “armada” carried them to spoil islands that had been carefully selected as outdoor classrooms.

Eventually all 5<sup>th</sup> grade students in Indian River County got involved – the south county students had their adventure at Riverside Park, and north county students had theirs at the Wabasso Causeway. In 1992, the Environmental Learning Center (ELC) opened its doors, and River Days became an integral part of its environmental education efforts.

River Days became known as Lagoon Days.



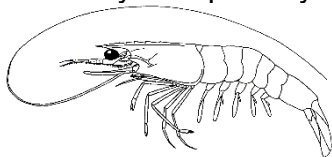
At the request of the school board, the ELC began hosting 4<sup>th</sup> grade students. During the transition year, both grades participated so that no one missed out. More than 1200 students experience Lagoon Days each year! In 1997, the Florida Department of Education conferred upon the ELC Lagoon Days program the Sharing Success in Environmental Education Award. Lagoon Days has had a powerful impact on the environmental awareness of Indian River County school children since its early roots were established nearly 50 years ago. We think Mr. Wineland would be proud to see how his idea has grown and evolved.



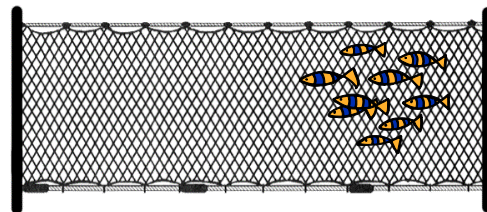
## Lagoon Days Stations Outline

All Lagoon Days activities take place outside. Student groups rotate in the following order: Benthic Ecology, Seining, and Water Quality Lab. Stations are described below in **alphabetical** order (not necessarily the order that you will be rotating through).

**Benthic Ecology** Students explore the lagoon bottom (benthos), by wading into the lagoon, collecting benthic core samples, sieving them, and using magnifying equipment to examine the organisms they uncover. Razor-sharp oyster shells are abundant at this station, and attention to safety is especially important. No one is permitted to be in water above the waist. Students must use gloves (supplied) to pick up anything they wish to examine. **TO ENSURE SAFETY, ALL TEACHERS & CHAPERONES ARE NEEDED IN THE WATER WITH THE STUDENTS.** A teacher or a chaperone is needed to see that everybody gets a fresh water rinse and uses hand sanitizer when leaving this station.

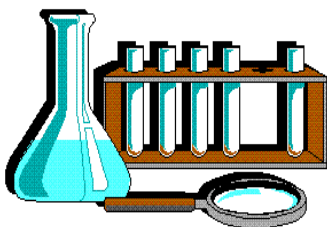


**Seining** Students learn how to use a seine net, a tool that scientists employ to collect marine specimens. They will also identify what they collect and learn about the interconnections between the organisms and seagrasses. *No swimming is permitted – no one is allowed to be in water above the waist. The wooden platform we work from can be slippery. No jumping or climbing on the structure is allowed.* **TO ENSURE SAFETY, ALL TEACHERS AND CHAPERONES ARE NEEDED IN THE WATER WITH THE STUDENTS.** A teacher or a chaperone is needed to see that everybody gets a fresh water rinse and uses hand sanitizer when leaving this station.



**Water Quality Lab (NEW!)** Students learn how to collect water samples, perform basic water quality tests, and analyze results to assess water quality of the Indian River Lagoon (IRL) and our Freshwater Pond. Students will practice skills used by real-life scientist and will leave with a better understanding of the role habitat quality has on lagoon health and biodiversity. As water quality issues have plagued our Lagoon, and water worldwide, this station is quite relevant to introduce this year as our NEW Lagoon Days station.

Not only is the Water Quality Lab a great conversation starter, it could even lead to ideas for science fair projects!







## Safety

Safety is our highest priority at the ELC. Please have everyone follow all the rules for each station and be especially alert to enforcing the ones pertaining to safety. Emergency Medical Services (EMS) is just across the IRL and can be on campus within a matter of minutes. If a medical **emergency** should arise, **dial 911** immediately and then notify ELC staff via VHF radio. Should a medical *concern* arise, notify *ELC staff by radio* and explain the situation.

To get to the Benthic Ecology and Seining stations, students must cross or walk along Live Oak Drive. The group should cross the street together, led by an adult. When walking along Live Oak Drive from Benthic Ecology to Seining, groups should walk on the grass, not on the road, and stick to the left side of traffic cones.

At each water station, the ELC will provide hand sanitizer. At the Benthic & Seining stations participants will also get a fresh water rinse. When students are leaving the water stations (benthic and seining), we ask that a teacher or a chaperone be in charge of seeing that everybody uses hand sanitizer (and a fresh water rinse if at the Benthic & Seining stations). For students who are not comfortable around water or cannot swim, we will have life jackets available at the seining station.

## Communication

There will be a VHF radio at each station. An announcement will be made five minutes before the end of each station period so you know when to start wrapping things up. Another announcement will be made when the station actually ends. It is critical that you listen for radio instructions and keep good track of time. Please pay attention to your watch as well as radio communication has its challenges.

Radios ARE waterproof up to 30 minutes! They 'should' work from the canoe dock all the way to the benthic station with clear audio. **All radios (and name tags) should be returned to the Caterer's Kitchen at the end of each day.**

## What to Wear and Bring

Wear clothing and shoes that can get wet and dirty. All children, teachers, and chaperones are told they must wear closed-toe, closed-heel shoes with laces. Flimsy water shoes, sandals, and other non-lacing shoes are not acceptable. They get sucked into the mud at the Benthic Ecology and Seining Stations and do not protect feet from razor-sharp oyster shells and other harmful objects. **Please, no crocs at any time (and, IF you are at Benthic Ecology or Seining, please refrain from open-toed Tevas as well).** We have instructed teachers that students may wear "rugged," closed toe water shoes, or dive booties. Instructors at the Benthic Ecology or Seining Stations must follow these guidelines as well. If you are teaching at the Water Quality Lab station, you may wear whatever shoes you wish to protect your feet, but **please don't wear flip-flops**. Please keep your shoes on at all times.

Dress appropriately for the weather. Although activities will be cancelled due to severe weather, we will continue if it is merely raining. Rescheduling an entire program is not possible. Shorts and t-shirts work well for all stations. Ladies – please no swimsuits or revealing shorts. Bring your lunch, hat, sunglasses, sunscreen, water proof watch (for Benthic Ecology and Seining Stations, if you have one), and, most importantly, your enthusiasm and love for nature ☺. Drinking water and cups will also be available at each station.



## Lunch

Students will be leaving promptly at 1:00pm this year, which might change our past lunch procedures. Please feel free to enjoy lunch on campus, after the students depart. You may store your lunch in the Wetland Room, the volunteer break room, or in the Caterer's Kitchen fridge.

Students will eat lunch in the picnic area located underneath the Discovery Station. Since timing has changed significantly, we'll do a brief wrap-up while classes are finishing up their lunch. Classes will depart promptly by 1:00pm.

## After Station 3

After you finish teaching the last station period, please do your best to neaten up at the station, but please **leave all equipment at that station**. We have a method for cleaning up & storing at the end of each day. Please return your VHF radio and your clip-on nametag to the Caterer's Kitchen Room.

THANK YOU!

*"The conservationist's most important task, if we are to save the earth, is to educate."* Peter Scott,  
founder chairman of the World Wildlife Federation



## Benthic Ecology Station

### Location

Along Live Oak Drive, south of the pontoon boat dock. Students will be coming from the Lagoon Food Web Station. After the Benthic Ecology Station, you will send them to the Seining Station. Watch out for cars!

### Station Flow

Discuss benthos, rules, how to use equipment (10 min). Benthic collection (20 min). Observation of collected specimens (15 min).

### Equipment

Station sign (puzzle piece)	Plastic bins (3)
Large table	Buckets (1)
Laminated rules	Hand lenses
PVC core samplers (5)	Horseshoe crab carapace
Sieves (5)	Oyster and clam shells
Gloves (in crate)	Horse conch shell/ egg case
Plastic dishes (15-20)	Drinking water jug and cups
Dip net	Trash bag
Aerators (3)	
Umbrellas	
Identification cards	

### Rules

**Taped areas designate unsafe areas where there are razor-sharp oysters or underwater obstacles. Do not go beyond the colored marking tape.**

Do the “stingray shuffle” to let stingrays know you are entering their neighborhood. Explain that stingrays are a common benthic predator that has a venomous barb on the end of its tail. But they are not out there just waiting to get you. By shuffling your feet, you are warning them of your presence, just as you’d knock on the door at your neighbor’s house to let him know you are there. Don’t make students afraid. Just explain that we’re entering the territory of the animals that live in the lagoon.

Keep shoes on at all times and make sure shoelaces are always tied. No one, including instructors, should be wearing sandals or flimsy water shoes. **Anyone not wearing suitable footwear is not allowed in the water. Please note that tennis shoes are preferred, but if the students have on water shoes, they must be “rugged,” closed toe water shoes or dive booties.** (Do not feel bad about enforcing this rule – all teachers, chaperones and students were forewarned. And, participants will be told the same thing at the seining station, so please do not allow exceptions).

Always keep head above water and do not go in above waist. Anyone with hands or knees on bottom will be asked to get out of water.



## Rules

Oyster shells are razor-sharp. Use a gloved hand, not bare hands, to pick up objects from the bottom.

No breaking off oysters from prop roots or anywhere else – only pick up free chunks.

Handle live specimens gently and respectfully.

No running or rough-housing.

Students must use the equipment by working together in groups.

## Introduction

Introduce yourself. Remind everyone to drink lots of water. What is the proper name of this body of water? Indian River Lagoon. What type of water? Brackish. What makes the water in a lagoon move? Wind.

Tell the students they are marine biologists at this station, using equipment scientists use to collect and observe benthic organisms. Begin with a discussion on the benthos. What is benthos? B is for bottom, and B is for benthos. Benthos refers to organisms that live on the bottom of a body of water, from the high water mark down. The term also refers to the actual bottom itself. Ecology is the study of habitats and the organisms that live there. So what does benthic ecology mean? **The study of the plants and animals that live on the bottom.**

When you think about what lives in the soil on land, what animals come to mind? Earthworms. What is their shape? Long and skinny. A lot of what we find living in the soil under the water is also worm-like. That is a common shape for animals that live in soil because it facilitates movement through it. The physical characteristic of the substrate largely controls the character of the benthic fauna associated with it. Substrate types in the benthic environment range from soft (such as sand and detritus) to hard and rocky. At this station, the benthic environment includes oyster beds and soft sediment. Many benthic animals feed on detritus, which is dead plant and animal material that is in the process of decaying. It often sinks down to the benthos to decompose.

The body form of an animal affects its ability to function in a given habitat. Stingrays, horseshoe crabs, and flounders are benthic animals that are flattened and streamlined. Their low profile provides a survival advantage for life on the bottom of the lagoon. Body shape is an adaptation. Water currents will not sweep them away. Also, flounders can rapidly change their color to blend into the substrate, allowing them to be undetectable to predators against the lagoon floor. Camouflage is also an adaptation.

Oyster shells provide lots of structure and shelter – oyster condos. If you were a small fish, and a predator was chasing you, would you rather be on the bare sand or in an oyster bed? Also look for eggs laid on oyster shells and for the stalked egg cases of bamboo worms on the sand flats.

## Gastropods

Gastropods or univalves are mollusks with one shell. All snails are gastropods. Gastropod means “stomach footed.” Bivalves are mollusks with two shells, such as clams, mussels and oysters.



## Echinoderms

The echinoderms are a group (phylum) of animals that include brittle stars, sea cucumbers, sea stars, sea urchins, and sand dollars. Echinoderm means “spiny skin.” All of these animals have a unique feature called a water vascular system. This system is used for locomotion and for collecting and moving food around. Simply put, it is a kind of plumbing (or hydraulic) system, made up of fluid, canals, tube feet, and suckers, among other parts. The animals move by contracting muscles and pumping fluid through the system.

Like many invertebrates, echinoderms have the ability to regenerate body parts when they break off. They can even intentionally break off one of their own arms to distract a predator – it costs them some energy, but at least they are still alive! Sea cucumbers have a very unique way to defend themselves. They can actually blow out their insides, giving the predator something to snack on while the rest of the animal gets away, and then regenerate their guts! Being able to regenerate body parts is another adaptation.

In sea stars, the wide arms merge with the central area of the animal. Brittle stars, however, have slender, serpentine arms radiating from a distinct central disc, and are much more mobile than sea stars. Brittle stars are commonly found at this station, and make great educational tools. The brittle stars the students collect are rarely completely intact. Look for the mouth and tube feet on the underside.

What kinds of plants or producers are around us? Plants present at this station include mangroves, seagrasses and algae, which are benthic and microscopic phytoplankton, which live in the water column. These are all at the base of the food web. How do they make their food? Photosynthesis. In order for marine plants to photosynthesize, they need sunlight (just like plants on land). However, sunlight must penetrate through the water. So, the water must be clear enough so that the plants can receive the sunlight. How would sea grass get sunlight if the detritus was continually stirred up by boats? Consider food webs with links to the benthos. For example: sun □ plants (producers) □ filter feeders (herbivores) □ predators (carnivores and omnivores) □ decomposers and detritivores.

Although we’ve just been talking about the bottom, there are some important **interconnections** to consider between the bottom and the water column. Many animals that live on the bottom as adults started their lives as microscopic planktonic larval forms. Clam, crab, and oyster babies, for example. Then, they undergo metamorphosis, and settle to the bottom, where they grow into the adults we love to eat.

What is metamorphosis? Lots of animals do it. Caterpillars do it when they change into butterflies, tadpoles do it when they change into frogs, and oyster babies do it when they change into adults. These changes are as significant as the change that would occur if you suddenly grew gills and lived your adult life swimming in the water, or sprouted wings and lived your adult life in the air! Metamorphosis is simply a process that some animals undergo that causes them to change their appearance and their lifestyle.



Do you go through metamorphosis? No, you just grow bigger. In general human babies are just mini versions of adults, and both stages look basically alike – one head, two eyes, ten fingers, etc.

There will be lots of interesting things on the table to look at. You may want to pass some of the shells around, or some of the critters already collected in plastic dishes. When things get too crowded and students are leaning on the table, have everyone take one step backward. Explain that you will pass things around for them to look at, but only if they can look and listen to you at the same time.

**Stress gentle handling.** Many benthic organisms have soft, fragile bodies. Put large specimens in plastic bins for observation on the table. Stress that everything collected will be returned to the collection site. Many interesting invertebrates can be collected from the submerged rocks. Anyone picking up anything from the bottom must wear a glove to protect themselves from any sharp oysters or barnacles. Challenge the students to examine each different organism they collect and to relate its form to the substrate from which it was collected. Look for animals on prop roots and on rocks.

Now let's see how to use some of the tools scientists use to study the benthos. Demonstrate how to use the PVC core samplers and the sieves. What kitchen tool does the sieve remind you of? What does a sifter do? Explain that the mesh size of the sieves determines what stays on top, and what passes through. Twist the core samplers straight into the benthos (only 3-6 inches!) and shake the plug of mud onto the sieve. Do not jab the sieve or use the core samplers as weapons. Also, look before you put the core sampler into the mud to make sure you don't stab anyone's foot.

Distribute corers, sieves, gloves, and plastic dishes for scooping up specimens. Start collecting! Supervise students closely; make sure the teachers and chaperones help. As long as they are using a glove, students may pick up oysters before heading back in. Stress respect of animals – pick up gently and return. And no pulling crabs off the oysters: this breaks their legs off.

Allow at least ten minutes at the end of for observation and wrap up. Demonstrate use of the magnifying equipment. Frequently check aerators in containers with specimens to make sure they are running. At your discretion, keep some animals for the next group.

### **Interconnections**

Many benthic critters feed on detritus. What is detritus? Do you eat detritus? Not directly, but indirectly. What do you eat that eats detritus? You are connected to the benthos through shrimp, fish. Can you think of other interconnections?

### **Clean Up**

Have students rinse mud from all the sieves and sediment corers before returning to observe their collections. At the end of the day, release all critters, except any that Ed Staff may want to keep for display in the wet lab aquaria (leave these critters in an aerated bin of water). Stack the plastic dishes, bins, and other equipment, and leave on the table for pickup. **Oddly enough, the aerators are NOT waterproof.** Please keep them out of the water or wet containers.





## Definitions

Desiccation: drying out.

Detritus: dead and decaying plant and animal material. Microscopic fungi and bacteria do the decomposing.

Infauna: animals that burrow in the substrate.

Interstitial: organisms that live in the small spaces between sediment particles.

Intertidal: the area between high and low tide.

Invertebrates: animals without a backbone.

Nekton: animals that actively swim and can move against the current.

Plankton: plants (phytoplankton) and animals (zooplankton), generally microscopic, that float or drift in the water.

Sessile: an organism that is attached to the bottom or to a surface and is not free moving.

Vertebrates: animals with a backbone.

## Topics for Discussion

How do filter feeders feed? Discuss mechanisms such as siphons, cilia (hair-like projections) and mucus (slime). Have students give examples of predators (alligators, sharks, sting rays, etc.). Explain that there are some terrestrial predators, such as raccoons and birds that come to the lagoon to feed on benthic animals as well.

Intertidal animals can be either sessile or mobile. Sessile organisms, such as barnacles and oysters, must have a way to protect themselves from desiccation during low tides. Mobile animals, such as crabs and isopods, have to keep from being swept away by waves. Infauna, such as polychaete worms and brittle stars, have pliable bodies, while bivalves and gastropods have hard shells

## Common Local Benthic Organisms

Acorn worm

Amphipods

Barnacles

Bivalves – clam, cross-barred venus, mussel, oyster, quahog, scallop, turkey wing

Brittle stars

Crabs (true) – blue, box, fiddler, mangrove, mud, stone

Gastropods – apple murex, coffee bean snail, crown conch, horse conch, mangrove snail, moon snail, mud snail, oyster drill, slipper shell, tulip snail, whelk

Hermit crabs

Horseshoe crab (more closely related to spiders than to true crabs)

Isopods

Polychaete worms – bamboo worm, bloodworm, cellophane tube worm, chimney worm, clam worm (*Nereis*), ice cream cone worm, lugworm, parchment worm)

Sea cucumbers

Sponges

Tunicates (sea squirts)

*Our mission is to educate, inspire and empower all people to be active stewards of the environment and their own well-being.*

**For More Information**

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## Benthic Ecology Station (cheat sheet)

Intro, rules, equipment use (10 min). Collecting (25 min). Observation and wrap up. (10 min).

**Must have proper footwear. Waist deep only. No heads under water.**

What does “ology mean? Study of

Easy way to remember this: B = benthos, B = bottom,

BE = study of plants and animals that live on bottom

Adaptations: Flattened, streamline animals (sting rays, horseshoe crabs, flounder)

Garden soil animals – worms (long, skinny, maneuverable in soil). Lots of polychaete (worms) in benthos

Invertebrates – no backbone

Horseshoe crab – living fossil

Bivalve (bi = 2) vs. univalve (uni = 1) (gastropod)

Oysters – condos

Echinoderms – spiny skin, tube feet, regeneration

Lots of benthic critters have planktonic larvae

Metamorphosis – complete change in body shape and “job”

Caterpillar – butterfly; tadpole – frog

Planktonic larvae - oyster, clam, shrimp, crab, lobster, barnacle (as adult)

Do you undergo metamorphosis? How many heads, fingers, toes as a baby? You grow.

In groups of 3-4, you’ll be marine biologists using scientific equipment

Tools PVC sediment corers (not weapons, don’t stab feet)

Sieves (don’t smoosh and don’t stab into mesh)

Gloves (one glove each)

Plastic dishes

Collect, observe and discuss.

## Interconnections

Many benthic critters feed on **detritus**. What is detritus? Do you eat detritus? Not directly, but indirectly. What do you eat that eats detritus? You are connected to the benthos through shrimp, fish. What are other interconnections?



## Seining Station

### Location

Teaching platform dock along Live Oak Drive. Students will be coming from the Benthic Ecology Station. After the Seining Station, you will send them to the NEW Water Quality Laboratory at Mardie's Hut.

### Station Flow

Meet each group near the road. Watch out for cars! Discuss seagrasses, **(IF HOT and VERY SUNNY you can do your discussion on the boardwalk in the shade)**, and how to use seine nets (5-10 min). Seining (25 min). Observation of collected specimens (10 min).

### Equipment

Station sign (puzzle piece)	Seagrass ID card
Seine nets (5)	Critter ID cards
Step stool	FWS reporting sheet, with clipboard and pens
Plastic bins (3)	Floating buckets (2)
Plastic dishes (20)	Drinking water jug and cups
Aerators (3)	Trash bag
Dip nets (1 small)	

### Rules

Taped areas designate unsafe areas where there are razor-sharp oysters or underwater obstacles. Do not go beyond the colored marking tape.

Do the "stingray shuffle" to let stingrays know you are entering their neighborhood. Explain that stingrays are a common benthic predator that has a venomous barb on the end of its tail. But they are not out there just waiting to get you. By shuffling your feet, you are warning them of your presence, just as you'd knock on the door at your neighbor's house to let him know you are there. Don't make students afraid. Just explain that we're invading the territory of the animals that live in the lagoon.

Keep shoes on at all times and make sure shoelaces are always tied. No one, including instructors, should be wearing sandals or flimsy water shoes. Only closed toe shoes, dive booties, or "rugged," closed toe water shoes are acceptable. **Anyone not wearing suitable footwear is not allowed in the water.** Do not feel bad about enforcing this rule – all teachers were forewarned.

Always keep head above water and do not go in above waist. Anyone with hands or knees on bottom will be asked to get out of water.

Handle live specimens gently and respectfully. Do not poke, throw, or otherwise torment them.

Do not handle any animals unless you know they are harmless. We often find mantis shrimp, a small crustacean also known as a thumb-splitter, which lives up to its name.

No running or rough-housing.

Do not stand on nets.

Platform can be slippery and wobbly. No jumping or climbing on it. **Only one group at a time on the platform.**



Students must use the equipment by working together in groups. All equipment that goes out, must come back in.

## Introduction

Introduce yourself. Remind everyone to drink lots of water.

Students use seine nets to collect organisms associated with seagrass. Before anyone goes into the water, discuss seagrass and its importance as described below, then go over the rules. Supervise students closely and make sure the teachers and chaperones help – assign one adult to each group. Frequently check aerators in all containers with specimens to make sure they are running.

Remind students that a lagoon is a shallow body of water separated from the ocean by a barrier island. It is an estuary, a place where fresh water and salt water mix. What is the resulting water called? Brackish. What causes the water to circulate, or move around, in the lagoon? The wind, primarily. **(These details relate to test questions.)**

## Seagrass

Seagrasses are the only flowering plants that grow submerged in brackish or salt water their entire lives. They have adapted to living in a marine environment. They are not true grasses, and are not closely related to the lawn in your backyard. However, they do form dense underwater meadows that provide shelter to many plants and animals. And they do look like underwater lawns.

Approximately 52 species of seagrass occur throughout the world. Seven of those species occur in Florida, and all seven are found right here in our lagoon. That's more than any place in North America and the Caribbean! Johnson's seagrass (*Halophila johnsonii*) is the only marine plant classified as a "threatened" species by the US Fish and Wildlife Service. The three most abundant seagrasses are shoal grass (*Halodule wrightii*), manatee grass (*Syringodium filiforme*), and star grass (*Halophila engelmannii*). Also present are turtle grass (*Thalassia testudinum*), paddle grass (*Halophila decipiens*), Johnson's seagrass (*Halophila johnsonii*), and widgeon grass (*Ruppia maritima*).

Shoal grass has broad, flattened, ribbon-like blades with roots that occur deeper than the other seagrasses. Shoal grass looks like turtle grass, but its ribbon-like blades are narrower and have two or three points on the tips. Shoal grass is a good competitor because it can colonize disturbed areas before other seagrasses get a foothold, and it can live in water that is too shallow for other species. Manatee grass is easy to recognize because it is the only kind of seagrass that has cylindrical leaves instead of flattened blades.

Seagrasses only grow in shallow areas where sunlight penetrates and where sunlight levels are at least 25% of what they are at the water surface. In the Indian River Lagoon, that means seagrasses only grow in water less than 5.5 ft deep. Since the average depth of the lagoon is 3 ft, the lagoon provides ideal growing conditions. Light availability is the most important factor affecting sea grass; however, salinity, water temperature, and wave action can also limit seagrass distribution.

## Interconnections

Seagrass communities have very high biodiversity. Seagrass beds are one of the most productive ecosystems on the planet! In fact, they have been described as the marine counterpart to tropical rain forests. Their extensive root systems stabilize the substrate and provide habitat for a host of infaunal organisms. Even the blades themselves are colonized by tiny plant and animal epiphytes! Mangroves and seagrasses make important contributions to total primary productivity in the lagoon ecosystem. Like all plants, seagrasses, the algae that are associated with seagrasses, and plankton are producers that convert energy from the sun into plant tissue. This process is called photosynthesis. Because animals cannot convert energy into food themselves, they derive energy from eating plants or other animals that have eaten plants. The plants of any ecosystem are the critical foundation at the base of the energy pyramid.

Animals are consumers. Primary consumers, those that eat plant material directly, include manatees, green sea turtles, fish, and oysters. Secondary and tertiary consumers are predators. They include fish, alligators, birds, raccoons, dolphins, and humans. Point out to the students that there is often a lot of overlap in these positions in the food web. For example, a manatee eating seagrass blades covered with tiny animals is deriving energy from both plant and animal material, even though we don't usually think of manatees as predators. Scavengers such as crabs and vultures also play a critical role in the food web. What would happen if nobody cleaned up all the dead bodies?

Like mangrove leaves, dead seagrass blades also decompose and become detritus, which is a very important food source for lagoon animals. And, both mangrove and seagrass communities serve as nursery grounds. Many marine fish and invertebrate species, including those that are commercially and recreationally important, produce larvae that float around in the water column as plankton. When they settle out in seagrass meadows, the structure provides shelter from predators. **Be sure to remind students that, even if a species has no immediately obvious economic value, every species is a component in the ecosystem jigsaw puzzle. When a single one disappears, the picture is incomplete. Think interconnections!**

Why should we care about seagrasses?

- 1) They are highly productive. Healthy seagrass = more fish. More fish = more to eat, more money for fisherman, etc.
- 2) They provide food directly to herbivores like manatees, and contribute significantly to the production of detritus, on which the lagoon food web depends.
- 3) They provide habitat (food and shelter) for many animals that live in the lagoon.
- 4) They provide important nursery habitat.
- 5) Their roots and rhizomes stabilize the bottom.
- 6) Their blades trap sediments by slowing water flow, helping to maintain water clarity.
- 7) They play an important role in nutrient cycles.
- 8) Scientists estimate that each acre of seagrass is worth \$12,000 every year, in terms of commercial and recreational fisheries.





## **What Kills Seagrasses?**

When lagoon water is turbid and loaded with sediment, sunlight cannot penetrate deep enough to reach the seagrass. Additionally, when an abundance of phosphates and/or nitrates (from leakage and runoff) are present, algal blooms occur; algae can prevent sunlight from reaching the seagrass. When such conditions do not clear, the seagrass dies. Unhealthy turbidity is caused by septic tank leeching, agricultural run off, and storm water runoff from the lagoon watershed (which is the land area around the lagoon that drains into it). As land development has become more intense in the Indian River Lagoon region, storm water run off has become the leading culprit in carrying large amounts of seagrass-killing nutrients and sediments into the lagoon. Water quality is largely determined by what happens on land. Population increase and coastal development have strong negative impacts on seagrasses.

Prop scars through a seagrass bed, caused by boats, can take 20 years to heal!

## **Use of Seine Nets**

Demonstrate use of seine net on teaching platform. Which part of the net goes on the top, the floats or the lead weights? Tell the pole people to put the top of the pole on their shoulder and the pole tip on the bottom then push the poles in front, like a blind man using a cane. Don't poke the pole into the substrate. Spread the net out. Move rather quickly, and don't stop until ready to draw the net up with the collection of specimens. Divide students into groups of 5 or 6 students with 2 "pole people" and 3-4 "creature catchers." Have an adult from the school accompany each group.

Give each catcher a small plastic dish. Tell catchers to follow behind the net (walking in front scares animals away from the net!), ready to scoop up specimens as soon as the net is drawn up. Fill the plastic bins with water and put them on the end of the dock so the catchers can put their catch in them then go back for more, but explain that there is no need to collect more than a few of each species. Also remind students that everything collected will be returned to the lagoon. Silversides (anchovies) are not very hardy and should be released upon capture.

Explain that the sticky stuff covering fish is mucus that serves a very important purpose. It protects the fish from disease and infection. When this layer is removed, which happens when we touch them, the fish loses its layer of protection and becomes vulnerable. That's why we use the containers to scoop them up. Also explain how fish must be kept in water in order to prevent desiccation (drying out) and so they can breathe. Even though fish have gills instead of lungs, they still breathe oxygen. Oxygen is produced by seagrasses and dissolved in the water. What produces our oxygen on land? Plants! Without seagrass, not as much oxygen would be in the water of the lagoon.

Explain that there are a lot of tiny animals living in the plant material that will be collected that we cannot see.

**Supervise students closely and make sure ALL of the teachers and chaperones help.**



### **Observing the Catch**

Have students stand around the railing. Pass around dishes with individual specimens and discuss what was collected.

Are most of the things we found large or small? Small, illustrating the nursery role of the lagoon's seagrass meadows – animal day-care!

What color are most of the animals? Bright pink? No, they are camouflaged to blend in with their surroundings, and so they are not obvious to predators. Camouflage is an adaptation.

Discuss the difference between vertebrates (animals with backbones) and invertebrates (animals without backbones). Discuss epiphytes, which are plants and animals that grow on other plants and animals. Many epiphytes grow on seagrass blades.

At your discretion, keep some more interesting or rare animals for the next group. Change water as needed and put containers in shade during lunch. (There is a little shade under the table.)

### **Interconnections**

- Sun gives energy to seagrass, which provides habitat for all of the animals we studied today; people eat some of these animals.
- We can keep the water quality good that the seagrasses depend on by not using nutrients, pesticides, and herbicides on lawns.

### **Clean Up**

Ask students to rinse their seine nets, clean off any leftover debris, and roll up the nets at the end of each period. (Best way to roll nets to avoid tangles: ask each student with a pole to walk towards one another. Put poles together and then roll the net around both poles.)

If possible, bring water cooler, seine nets, collection report and aerators to end of boardwalk and leave it near the roadside for pickup. Other items will be stored at platform, but please allow ELC staff to do this.

### **For More Information**






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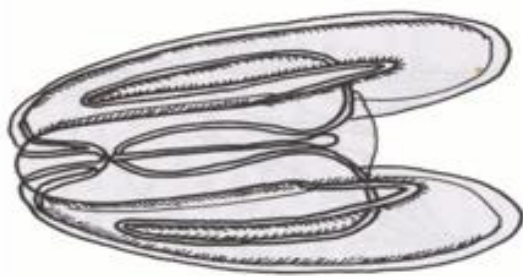

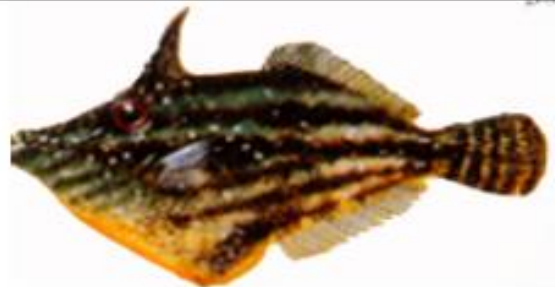

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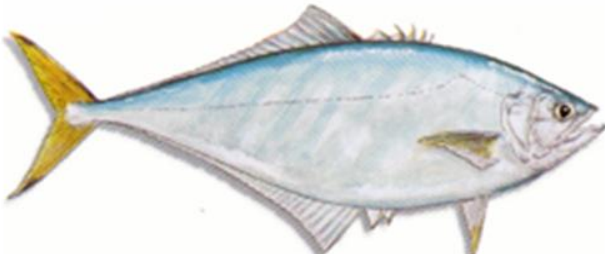

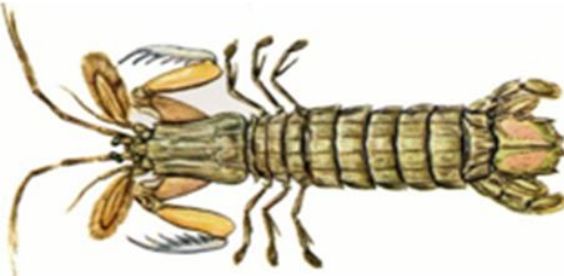

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## Common Organisms in the Indian River Lagoon






Organism		Comments & Factoids
Algae		Strangest and hardest organisms to identify. Algae are plants, but they don't have flowers or seeds, but they do photosynthesize. Algae can actually eat through shells! Kelp is largest algae.
Anchovies		Travel in densely packed schools. Lateral line helps them keep the school together. Similar to sardines – don't survive long if caught. Bay anchovies are the most abundant fish in the IRL.
Blennies		Notorious for poking through sand and stirring up clouds as they look for food. When they are not eating, blennies scoot backward into holes, leaving only their heads sticking out as they wait for more prey. Several different species of blennies.
Burrfish		Can inflate with air or water for defense. Do not have scales; instead, they have elastic skin. Have a solid plate (like one big tooth) across their top jaw and one across their bottom. Uses pectoral fins to swim, and caudal fins as a rudder.
Checkered puffer		Found primarily in protected coastal waters, especially in seagrass beds. When puffed up, floats at surface. Inflated belly wards off many predators. Delicacy in Japan, but viscera (guts) are toxic and chefs must have special license to prepare.




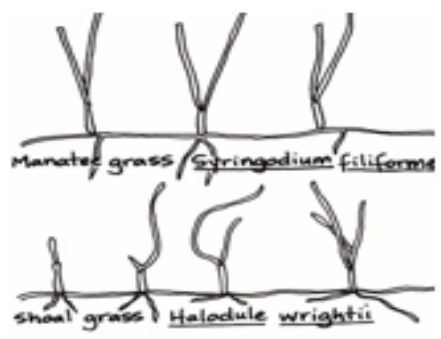



Crabs		True: blue, box, decorator (spider), fiddler, ghost, mangrove tree, mud, stone. Other: hermit, horseshoe (related to spiders and lobster). Shape on abdominal flap reveals sex. Washington monument = male; capitol building = female; triangle = immature female. Blue crabs are highly adaptive.
Comb jellies		Not jelly fish. Carnivorous. Usually don't sting (only 1 species, not found on east coast, can sting). Have 8 rows of ciliated plates, called comb rows. The comb rows all beat together for swimming and feeding. Drifters. Most are colorless, but bioluminescent (bio = life, luminescent = light).
Eels		Travel to the Sargasso Sea to spawn. Before they begin their travels, they develop an extra layer of fat which they will use in place of food. They do not eat at all while migrating! A delicacy in Europe.
File fish		Usually shades of brown or green with a long dorsal (top) spine and sandpapery skin and use camouflage. Can grow as large as 8." Inhabit grass beds and seawalls. Eat mostly plants and algae, but will prey on small shrimp and krill.
Flounder		Eyes in the young fish are on each side of its head, later one migrates to other side. For camouflage, flounder lies in the sand or mud most of the time, but is a fast swimmer. Halibut is the largest; it can weigh in excess of 700 <u>lbs!!!</u> Flat shape = adaptation.






Killifish		Do not have a lateral line. Very tolerant of changing oxygen levels, salinity, and temperature. During mating season the color of the males intensifies. Abundant in mangrove swamps and salt marshes.
Leatherjack		Schooling fishes usually found along sandy beaches, inlets, and bays. They have sharp anal and dorsal spines capable of inflicting injury if improperly handled. Small schools of leatherjacks will hang out with large fish, such as barracuda, for protection and food scraps.
Mangrove snapper		Also known as the gray snapper. Prefers a shallow water habitat. Extremely cunning! Good to eat, but very hard to catch. They eat shrimp, smaller fish, and crabs. They have very sharp teeth – they will bite!
Mantis Shrimp		A <u>stomatopod</u> , not a true shrimp. Have the fastest reflex in the animal kingdom, and can seize prey in six milliseconds. Very strong and aggressive. Can actually break aquarium glass! It's nickname is the <u>thumbsplitter</u> . Watch out!
Mojarra		Prefer sandy bottoms and shallow areas. They can dig in the sand with their protruding mouths in search of their prey. They are adept at changing color depending on the bottom: silver over sand, and striped green-brown over weedy areas. Two endemic species in the IRL.



Mullet		Most mullets are tropical. Is a "saltwater" species, but is commonly found in brackish and fresh water. Primary consumer that eats detritus (detritivore). Their scientific name, <i>Mugil cephalus</i> translates to "sucking helmet-head" because they suck up their food and then grind it in their gizzard.
Needlefish		Voracious predators living at the surface, usually blue or green on back, and silver white on sides and belly. This is called counter shading. It is a great camouflage technique. Has a thin fragile beak-like jaw. Often jumps out of the water (resembling a javelin!).
Pig fish		Also known as Sailor's choice or grunt. Grunts by grinding together special teeth in their throat. Preferred bait of <i>snook</i> fishermen. Unlike most Grunts, the Pigfish doesn't mind murky water or soft bottom.
Pin fish		One of the most abundant inshore fishes. Very tolerant of changes in their environment. Inhabit seagrass meadows in brackish water, but can also tolerate freshwater. Aggressive and territorial.
Pipe fish		Blends in perfectly with seagrass and can almost disappear. Sit-and-wait predators that hang vertically amongst the seagrass blades, swaying with the current, ready to capture their prey. Males carry eggs until they hatch. Closely related to seahorses.



Red drum		Also known as redfish because rather than a silvery appearance, it is coppery or bronze. It has a black spot at the base of its caudal fin, called an ocellus. Can grow more than 50lbs!
Seagrass		Johnson's (listed as threatened), manatee, shoal, turtle, star, paddle, and widgeon. Form underwater meadows which are critical habitat for many animals. They stabilize bottom sediments and produce oxygen in the water. Grow in depths of 5ft or less. Increasing overall acreage in recent years!
Seahorse		After the female seahorse lays eggs, the male carries them in special pouch until they hatch. They are not strong swimmers and spend much of their time with their tail wrapped around seagrass. When prey goes by, the sea horse sucks them into their mouths, like using a straw.
Sea robin		Bottom dwellers that can swim rapidly only in short bursts. They can "walk" along bottom with their modified pectoral fins and can stir up food. Sea robins can bury themselves into the sand.
Sheepshead		Occurs over a wide range of temperature and salinity. During mating season, males are bright and colorful. Aggressive. Has specialized teeth used to break open clams, oysters, barnacles, and crabs.

Snook		Very sensitive to cold. Can live up to 25 years. Age is determined by growth rings in ear bone. High-energy fish, swimming like torpedoes after prey. Legally protected while spawning in summer. 4 species inhabit the IRL. Sebastian Inlet is one of the best <u>snook</u> fishing locations in FL.
Spotted sea trout		Intimately connected with sea grass for food and shelter. Their larvae and juveniles prefer to use turtle grass as their nursery.
Tarpon		Tolerate a wide range of salinities, and can be found in completely freshwater, but prefer brackish water. A single large female can carry 12 million eggs! They have rudimentary lungs that let them gulp air as they come out of the water. Typically reach 5ft in length and can weigh <u>150 lbs</u> or more!
Toad fish		Hardy fish that can survive out of water for quite a while. Will eat almost anything. Rarely can any creature escape the Toadfish's huge mouth and powerful grasp. The male toadfish watches and cleans the nest—even at low tide! Some of its fins are venomous.
Shrimp		Very thin exoskeleton. Can swim, but more often found crawling on benthos. Some are carnivorous, others eat plankton or detritus. Critical link between producers and secondary consumers. Look out for spikes on head and tail!



## Seining Station (cheat sheet)

Discuss seagrasses (10 min). Seine nets, and rules (5min). Seining (25min).  
Observation of collected specimens (10 min).

**Must have proper footwear. Waist deep only. No heads under water.**

**IRL** shallow body of water separated from the ocean by barrier islands  
Brackish (mix of fresh and salty)  
Wind (causes circulation)

**Seagrass:** only flowering plant growing submerged in brackish/salt water  
52 species worldwide  
7 in FL, all found in IRL  
most abundant = shoal, manatee, turtle  
threatened = Johnson's  
grow in water less than 5ft (avg depth of IRL = 3ft)  
need sunlight and clear water  
very high biodiversity  
**primary producer** – foundation

## Why should we care about seagrass? Estimated \$12,000/yr/acre

<b>Productive Shelter</b>	Healthy seagrass = more fish Seagrasses and mangroves Lagoon relatively protected
<b>Food</b>	Direct = fish, crabs Indirect = nutrient rich detritus
<b>Stability</b>	Root system (roots and rhizomes) "hold on to" bottom
<b>Water clarity</b>	Trap suspended sediment by slowing water flow
<b>Nutrient cycles</b>	Oxygen, nitrogen, carbon dioxide
<b>Damage</b>	<b>turbidity:</b> dredging, storm water run-off <b>pollution:</b> lawn fertilizer, engine oil, litter <b>prop scars:</b> can take 20 yrs to heal

**Collection** (no need to collect more than a few of each species)

**Observations** Are most things that we found large or small? Small. IRL = Nursery.  
Vertebrates vs. invertebrates; Camouflage, Adaptations; Epiphytes

## Interconnections

- Sun gives energy to seagrass, which provides habitat for all of the animals we studied today; people eat some of these animals.
- We can keep the water quality good that the seagrasses depend on by not using nutrients, pesticides, and herbicides on lawns.



## Water Quality Lab Station

### Location

Mardie's Hut, adjacent to ELC's freshwater pond. Students will be coming from the Seining Station. After the Water Quality Lab Station, you will send them to the Benthic Ecology Station.

### Station Flow

Meet each group near the seining station (if time allows) or wait for them at Mardie's Hut. Discuss the importance of water and healthy water quality. Briefly discuss the affects on plant and animal health and biodiversity if habitat quality is poor (by the end of the station, we'll lead the students to the conclusion that poor water/habitat quality can have drastic affects on plants, animals, and biodiversity). Water quality experiements (25 min) + Analysis and discussion (15 min).

### Equipment

- 5 gallon bucket (fill with lagoon water)
- 5 gallon bucket (fill with pond water)
- 5 gallon bucket (fill with hose water)
- 5 gallon bucket (for wastewater)
- Whiteboard
- Dry erase markers
- Eraser
- Floating thermometer
- Hydrometer
- Station Cheat Sheet
- Datasheets
- 3 Small bins to hold testing supplies
- Procedures for each test
- Nitrate kit
  - 4 test tubes (#106) with caps
  - Box of Nitrate TesTab (#3703A)
  - 4 Protective Sleeves (#0106-FP)
  - Nitrate Color Chart
- pH kit
  - 4 test tubes (#106) with caps
  - Box of pH TesTab (#6459A)
  - pH Color Chart
- Do Not Disturb Sign
- Timer or stopwatch
- Permanent markers

### Rules

Students must wear safety goggles.

Handle equipment responsibly.

No running or rough-housing.

Students must use the equipment by working together in groups.

Clean equipment when finished.

### Introduction

Introduce yourself. Remind everyone to drink lots of water.

Briefly chat about the IRL and water quality: water covers over 70% of Earth's surface and is required by all living things. Did you know only a teeny tiny portion of this is suitable for humans to drink? Less than 3%! So, although we have a ton of water, not all of it is safe for humans to use. The Indian River Lagoon is filled with

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brackish water. This water cannot be used for human drinking BUT, we like to use it for play, fishing, and simply for its beauty.

Outside of water for humans, plants and animals need water too. In our ecosystem, the Indian River Lagoon, the brackish water habitat is home to over 4,000 species of plants and animals! The animals and plants that live here depend on a clean Lagoon with healthy water. Check in with students regarding what they think should be in a healthy habitat and if they think the IRL is a healthy or unhealthy habitat. Ask students: So what makes water healthy or clean? Or – what makes water unhealthy or dirty?

**Answers**: physical trash (plastic, garbage), dog poop (viruses and extra nutrients), chemicals (oil, household cleaners, fertilizers, pesticides, medications)

Water health can be determined based on the concentration, or level, of a few different chemicals found in water. Certain chemicals are naturally occurring in water and include salts, dissolved nutrients (nitrates), and hydrogen. When water is unhealthy, or out of balance, the concentration of chemicals change and may lead to unsafe conditions for humans, wildlife, and plants. Today, we're going to look at water from the Indian River Lagoon and our freshwater pond to determine if the water is healthy or unhealthy for the lagoon's plants and animals.

### **Activity:**

Tell kids that we'll be working together as a team of scientist to conduct a water quality tests on water collected from the Indian River Lagoon and water from our freshwater pond. We'll split off into several groups to each test one parameter, or factor of water quality. Our tests will determine the level, or concentration of: salinity, nitrates, and pH in our sample water.

**Salinity** measures the amount of salt dissolved in a sample of water. Salt type can vary but today, we'll be measuring the concentration of the salt sodium chloride (NaCl). Salt concentration affects where certain animals and plants can live based on the amount of salt they can tolerate. In an estuary, like our IRL, the animals and plants are used to small changes in salt concentration and can still THRIVE. If salt concentrations change too drastically or too rapidly, it can be very harmful to the ecosystem. If time ask students: What might cause sudden or extreme changes to the Lagoon's salinity concentration?

**Answers**: large storms that create lots of fresh water precipitation (hurricanes) or the release of lots of freshwater from the mainland (like Lake Okeechobee discharges), seasonal changes that cause evaporation during extreme heat – summer.

**Nitrate** is a nutrient needed by all aquatic animals and plants to help them grow. When plants and animals die and when land animals create waste (scat), they release this nitrate into the water. This is a normal process but too many nutrients (from dead plants/animals or fertilizers) or too much waste (from humans and pets) allows aquatic plants, like algae, to grow like crazy! All this extra food can allow some plants to grow out of control, lowering the dissolved oxygen of the water which could lead to large-scale fish kills. Estuaries world-wide are suffering from too many nutrients which is a result of the human impact throughout their watersheds. Ask students: What happens to seagrass if algae gets a ton of extra food (nitrates) and grows so much that it covers the water surface?

**Answers**: Too much algae can block the sunlight from getting to seagrasses. This will eventually cause them to die and, not only reduce the base of the food web in the lagoon, it will release more nitrates into the water creating even more decay and unhealthy water quality conditions.



**pH** is a measurement of how acidic or basic a water sample might be. The pH scale ranges from 0 (very acidic, think sour like lemon juice) to 14 (very basic, think bitter or slippery, like household bleach) where 7 is a neutral pH. Most estuaries, like the IRL range from a pH of 7.7 to 8.2. If pH levels rise about 8.2, that could be an indicator of too much algae!

After we collect data from our tests, we'll gather as a group to analyze our data and determine if the water collected from the IRL and our pond is healthy or unhealthy. We'll also compare results and discuss the difference in habitats, and possibly, our results.

#### Testing Procedure:

1. Provide safety and equipment instructions.
2. Explain that each group will work together to test one parameter, or factor, that contributes to overall water quality of either the pond, or lagoon habitat.
3. Introduce datasheets and instructions to the group. Instruct students to record their observations on their group datasheet.
4. Divide class into 6 groups
  - 1) pH testing – pond
  - 2) pH testing – lagoon
  - 3) nitrate testing – pond
  - 4) nitrate testing – lagoon
  - 5) temperature & salinity testing – pond
  - 6) temperature & salinity testing - lagoon
5. Assign adults (school teachers, chaperones, ELC staff/volunteers) to help a few stations.
6. Inform students that each station has a procedure they must follow to ensure they're test results are the most accurate.
7. Remind students to record their test results on their station datasheet.
8. Once testing concludes, instruct students on how they should clean up their stations and dispose of their samples.
9. Discuss the results as a group, comparing the pond and the IRL as well as the results from previous classes that day.

#### Questions to ask students:

1. Which parameter do you think is most relevant to the Indian River Lagoon?
2. Do you think the results of our water quality experiments would differ if we tested the water at different times of day?
3. How can we help do our part to ensure the water quality in the Indian River Lagoon is healthy and safe for us and for the animals and plants that live there?



## Water Quality Laboratory Station (cheat sheet)

