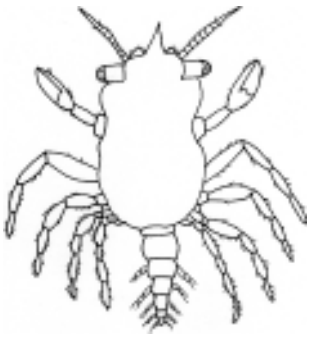
SECTION 4: Animal Communities

Lab 11: Plankton Sampling

Introduction



Megalops of a Crab Larva

Most of the ocean is a biological desert. Life is concentrated in the near-shore zones, along continental shelves and near upswellings of cold currents that carry nutrients to the surface. Why? Because of the availability of sunlight and nutrients for primary producers, such as phyto plankton, for use in the process of photosynthesis. Plankton are simply animals and plants that drift with ocean currents. Although most are small, some plankton can be large, e.g. lion's mane jellyfish, which can be eight feet across. Phytoplankton are small plant plankton that are responsible for producing most of the earth's oxygen and 90% of all photosynthetic processes. Zooplankton are animal plankton. Some are planktonic for their entire lives and are called holoplankton; some are only planktonic for the beginning of their lives and are called meroplankton. Numerically, zooplankton dominate life in the oceans. Most fish, crustaceans, mollusks, echinoderms, corals, anemones, and sponges start their lives as plankton.

Plankton have many adaptations that help them float and avoid or hide from predators: These include:

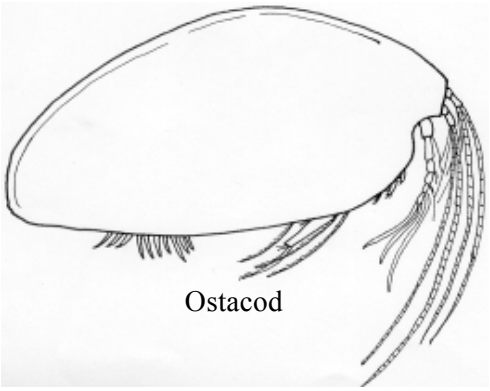
- Spines (help them float and avoid predators)
- Oil globules
- Waxy deposits
- High surface area to weight ratio
- Clear or blue color
- Zig-zag swimming motion

Objectives

- To recognize several types of plankton.
- To understand the differences between holoplankton and meroplankton.
- To identify the general adaptations of plankton to their drifting life-style.

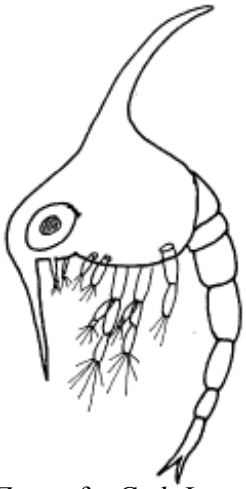
Materials Required

- Dissecting scopes
- Plankton ID sheets
- Plankton net
- Slide
- Petri dishes
- Microprojector



Ostacod

Procedure



Zoea of a Crab Larva

Design a data sheet that will record:

- Species
- Adaptations (draw and label them)
- Physical characteristics and location of sampling site

Collect sample as follows:

1) Tow the plankton net at 1,000 rpm for five minutes.
2) Take the sample back to the lab and examine one drop from the middle of the sample.
3) Identify the plankton present; draw and label some of the adaptations that you see
4) Try and quantify what is present in one drop: approximately how many of each species are there in your sample?
5) Repeat steps 2-4 at a new location and compare the results

Critical Thinking

Define a hypothesis to explain why the samples are the same or different. Try and come up with a way to test your hypothesis.

Although plankton forms the basis of the ocean's food web, what do you think would happen if there were too much activity? Why do you think that scientists have become concerned about the effects of ozone depletion and global warming on the ocean's plankton? What do you think would happen in the event of an increase in ultraviolet B radiation? How would global

warming affect or change the location of nutrient upwellings and how would this ultimately affect plankton?

Environmental Application

- Use less fertilizer on lawns and gardens.
- Support the ban on chlorofluorocarbons (CFCs) which could reduce the amount of ozone in the atmosphere.

References

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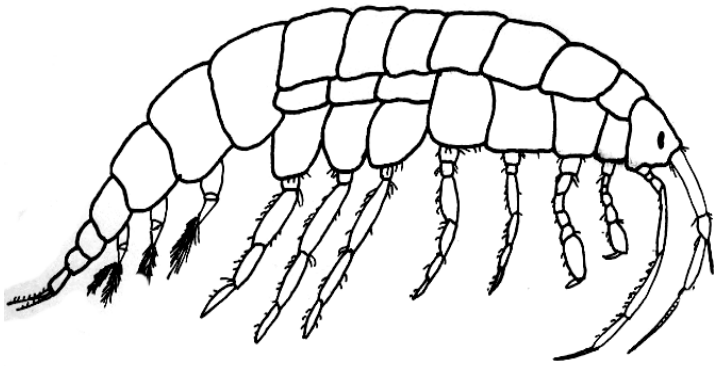
http://members.aol.com/iq3d2/plankton.htm

http://seagrant.gso.uri.edu/G_Bay/plankton.html

Sunshine State Standards

SC.D.2.4. The student understands the need for protection of the natural systems on Earth.

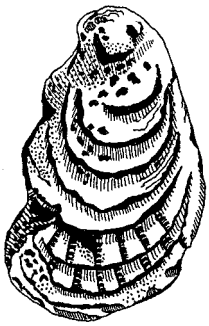
SC.H.1.4. The student uses the scientific processes and habits of mind to solve problems.



Amphipod

Lab 12: Oyster Reef Communities

Introduction



Oyster
Crassostrea virginica

The eastern oyster, *Crassostrea virginia,* is a bivalve mollusk that attaches to hard substrates below the high tide line and often forms large oyster reefs or bars. Oysters are filter feeders, consuming small particles of detritus and plankton. The oyster reef community is very important, both as a substrate for organisms to attach to and as a hiding place for many estuarine animals. It is also an important food item for predators including stone crabs, mud crabs, oyster drills, crown conchs, sea stars, and whelks. Porcelain crabs, serpulid worms, barnacles, slipper shells, mussels, flat worms, sponges, blennies, and gobies are all inhabitants of oyster reefs. The oyster reefs are often colonized by mangroves and may become overwash mangrove islands. Many of the islands in the Ten Thousand Island complex were formed in this manner. Oysters are also an important commercial fishery in many estuaries such as Chesapeake Bay and Apalachicola Bay.

Oyster beds have been destroyed or altered by dredge and fill activities; changes in salinity, which makes oysters more susceptible to disease; pollutants such as chemical pollutants and sewage. Sewage contamination can make oysters unsafe for human consumption.

Objectives

To identify the organisms associated with an oyster bar. To learn more about the physical structure of an oyster bar. To learn about the auto-ecology of oysters.

Materials Needed

- Meter tape
- Dip net
- Hammer
- Tray
- Screw driver
- Dissecting scope
- Compass
- Field guides and keys

Procedure

Oyster reefs are thought to be composed of several different habitat zones. Use the compass and transect in order to map the oyster reef. Try to identify the different zones of the reef. Take several clutches of oysters from the different zones of the reef. Record the zones where the oysters are collected. Dip fish out of the tide pools on the reef and identify these fish using the field guides and keys. Transport the oyster clutches back to the field lab. Once there, take apart the clutches and identify the inhabitants (see appendix). Design a data sheet to record the animals found in the different clutches. Record the numbers of dead and live oysters from the different sample areas of the reef. Where did the highest percentage of live oysters come from? Make a diagram of an oyster bed food web.

Critical Thinking

Draw some possible conclusions from your study of the oyster reef. Where was the highest percentage of live oysters found? Largest number of mud crabs? Compare and contrast the different areas you sampled within the reef. Develop several hypotheses explaining the possible reasons for your findings. Does your data support the conclusion that there are several distinct habitat zones within an oyster reef?

Environmental Applications

Oyster reefs are an important habitat for many estuarine organisms, and support many commercial fisheries. Oysters thrive only in brackish waters and can only be eaten if the water is relatively free from human sewage contamination. These are some of the things that you can do to help keep oysters healthy:

- Conserve water
- Ensure that septic systems are working correctly and are not leaking
- Do not over fertilize lawns and gardens
- Use pesticides carefully, and only as directed
- Support the efforts to restore sheet flow to local watersheds

References

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http://www.hydrowire.org/headlines.html

hhtp://shellfish.org/pubs/stol/jsr032.htm

Sunshine State Standards

SC.G.1.4. The student understands the competitive, interdependent, cyclic nature of living things in the environment.

SC.G.2.4. The student understands the consequences of using limited natural resources.

Lab 13: Mudflat and Sandflat Communities

Introduction

Mudflats and sandflats are communities of fine sediment types that are exposed at low tide. Marine animals that are found attached to or on the surface are called epifauna. Animals that live in the sediment are called infauna. Mudflats are rich in nutrients and can support a wide variety of life. If conditions are right, they are often colonized by mangroves, salt marsh grasses, or shoal grass. They are prime feeding areas for shore birds. A wide variety of invertebrate fauna can be found on mud flats. These include annelid worms, sea cucumbers, anemones, crustaceans, snails, and bivalves. Many animals burrow into the substrate to avoid predators or find food. Other animals, such as fish, predatory snails, and crabs, come onto the mudflats at high tide At low tide, birds are often seen on the mudflats and sandflats feeding.

Objective

To become familiar with marine organisms that inhabit the mudflats of southwest Florida. To have an understanding of the importance of this habitat to a wide variety of marine organisms.

Materials required

- Shovels
- Sieves
- Quadrants
- Transect tape
- Bird field guides
- Binoculars
- Invertebrate field guide

Procedure

On the ride out in the boat to the study site, do a survey of the bird life feeding on the mudflats. Note the feeding strategies of the birds and their bill types. Record this information in a field notebook.

Do a general survey of the mudflat. Use transect tape, quadrants and shovels to sample the epifauna on the surface of the mudflats, and the infauna in the sediments. Try to key the animals out to phylum and class. Design a data sheet for recording information about the animals. Compare the epifauna with the infauna. What phyla are represented. Compare the adaptations for the two different lifestyles.

Construct a mudflat food web from the results of your study.

Critical Thinking

Use your observations of the bird feeding strategies, bill types, the mudflat sediment samples, and the quadrants to hypothesize what the different species of birds may be feeding on. Note any other predators found on the mudflats. How might the bird bill adaptations influence their feeding habits?

Environmental Applications

- Avoid disturbing mudflats that are being used by large numbers of shore birds.
- Do not run boats across shallow mud flats. This disturbs sediments and increases turbidity.

References

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http://www.css.tayloru.edu/~research/environ/mudflat.html

http://www.biodiversity.environment.gov.au/environment/wetlands/site13.htm

Sunshine State Standards

MA.E.1.4. The student understands and uses the tools of data analysis for managing information.

MA.E.3.4. The student uses statistical methods to make inferences and valid arguments about real-world situations.

SC.G.1.4. The student understands the competitive, interdependent, cyclic nature of living things in the environment.

SC.G.2.4. The student understands the consequences of using limited natural resources.

SC.H.1.4. The student uses the scientific process and habits of mind to solve problems.

Lab 14: Estimating Population Size

Introduction

A population is a group of organisms of the same species occupying a particular geographic area. Knowing population numbers of critical organisms is very important for making management decisions about coastal or marine resources. A simple method of determining population numbers is to do a total count. This may be a good method for highly visible species, such as birds, or for species with low populations, such as endangered species like manatees or Florida panthers. Another method that can be used is quadrant sampling. It involves counting or weighing organisms in plots or along transects that appear to be representative of the density of the population. You can then estimate the total population based on the density inside the quadrants. This works only if the quadrant samples are truly representative of the area as a whole.

Another method for estimating populations involves marking and recapturing the organism being studied. A single mark and recapture is known as the Peterson method. A portion of the population is captured, tagged, and then released. A second sample is then collected and the total number of marked and unmarked animals are recorded. You can then calculate the population using the formula N=MC/R, where:

- N is the estimated population,
- M is the number marked,
- C is the total number of animals captured on the second sampling and
- R is the number of recaptures.

Objective

To estimate a population using a Peterson mark/recapture census.

Materials Required

- Fingernail polish
- Collecting buckets
- Calculator

Procedure

Select a small, isolated mangrove overwash island as the study site. Count and mark 100 snails on the island. Randomly return the marked snails to the island. Return to the island a week later and collect 100 snails. Record how many are marked and estimate population for the island.

Critical Thinking

A Peterson mark/recapture works best with small, isolated populations. One assumption for this method is that animals do not leave or migrate onto the site. Isolated tree islands and ponds are usually good habitats to estimate populations with this method. How would new animals migrating into the site affect the accuracy of your estimation? What if marked animals migrated off site? How would this change the accuracy of the estimate? Design a similar study for another organism in a tidal inlet.

Environmental Application

Remnant populations of isolated animals can easily be lost by a single natural or human-induced disaster. Hunting and habitat destruction reduced heath hens in the northeastern United States to only one population on an island off of the coast of Massachusetts. Despite the efforts of wildlife biologists, the heath hen went extinct after natural disasters such as fire and disease decimated the one remaining population. Even small, isolated habitats, such as temporary wetlands, sloughs, and scrubs, can serve as important refuges for endangered or threatened species. When it comes to protecting endangered species, it is not a good idea to have "all your eggs in one basket."

References

Everhart, W.H., A.W. Eipper and W.D. Young. *Principles of Fishery Science.* Cornell University Press. Ithaca, NY.

Norse, E.A. (1993). Global Marine Biological Diversity.*Island Press, Washington. D.C.*

Smith, G.B.(1996). Marine Science Lab. Activities. *Edison Community College, Fort Myers. Fl.*

Sunshine State Standards

MA.E.1.4. The student understands and uses the tools of data analysis for managing information.

MA.A.4.4. The student uses estimation in problem solving and computation.

Lab 15: Animal Movements

Introduction

Blue Crabs

Learning the movements of marine organisms is critical to managing nearshore habitats. Many animals have specific habitat needs during critical life stages such as reproduction and molting. By tagging individuals, researchers can learn about what habitats are critical for the organism's protection. Recently, researchers have been tagging sharks, juvenile Kemp's Ridley sea turtles and goliath grouper within the Ten Thousand Islands and Rookery Bay. The goliath grouper is protected and the Kemps Ridley is Endangered. In addition, the Florida Marine Research Institute has been following radio-collared manatees in the same region. Simple tag and release studies tell scientists a lot about an animal's range. In a simple tag-and-release study an animal is caught, tagged, and released at one location and then, hopefully, recaptured at another. These studies do not explain, however, how the animal traveled from one point to the other. Radio telemetry studies provide this information but are expensive and require a great deal of labor. Sometimes simpler and more inexpensive methods can provide the same information.

Blue crabs are important predators and commercial commodities in estuaries. They are easily caught in crab traps baited with fish heads and carcasses. Blue crabs are very quick and can deliver a painful pinch. Use care when handling. A wet cloth over their eyes will make them easier to handle. Also, cooling the crabs by placing them on ice will slow them down.

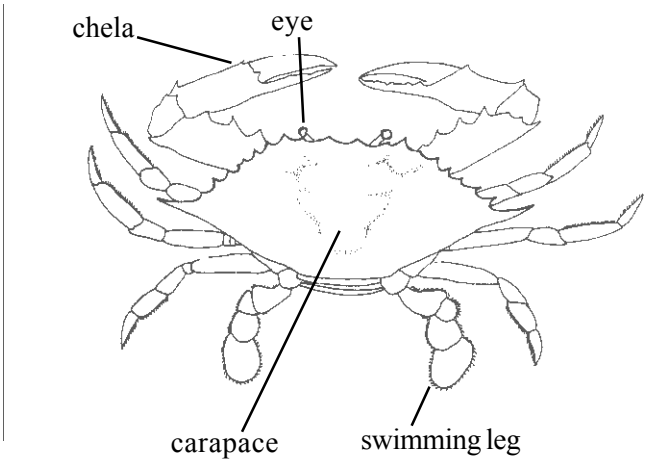
Objective

- To follow the movements of blue crabs in Rookery Bay.
- To learn the external anatomy of the blue crab.

Materials required

- Crab trap
- Monofilament line
- Steel leaders
- Ping pong ball
- Steel wire

Blue Crab



Procedure

Using the diagram, identify the important external body parts and then sex your crab (see following illustrations for sex traits). Place the crab on ice to make it easier to handle. Watch out for the claws when it starts to warm

Cover the crab's eyes with a cool damp cloth. Tie a wire across from one point to the other point on the crab's carapace. Use the above equipment to attach a ping pong ball to the crab with a steel leader and monofilament line. The crab can cut the line, so use the leader to prevent this from occurring. Make sure there is enough line so the crab can reach the bottom. Make sure the crab is fully alert before placing it back in the water.

Place the crab back in the bay and follow the crab's movement for the next 30 minutes. Draw a map of its movement. You can try releasing the crab at different locations to see if it has a preference for certain habitats (mangroves, seagrass beds, mudflats, and inlets).

Critical Thinking

Write a short report explaining your findings. Does the blue crab have a preference for a certain habitat? Why do you think this may be so. What observations have you made to support your findings?

Environmental Application

- Protect critical habitats from being destroyed or altered.
- Support efforts to conserve wetlands.
- Support efforts to protect and restore watersheds
- Conserve water.

References

Lee, Emory., Wydoski, Richard. (1997). Marking and Tagging of Aquatic Animals. *U.S. Department of the Interior, Fish and Wildlife Service,* Washington, D.C. iii, 57p.

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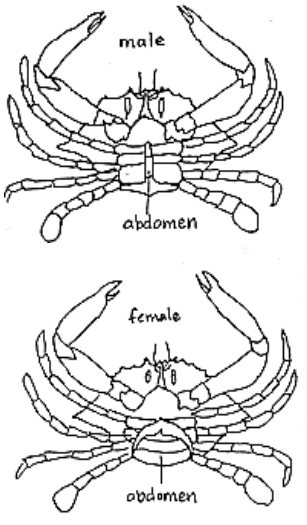
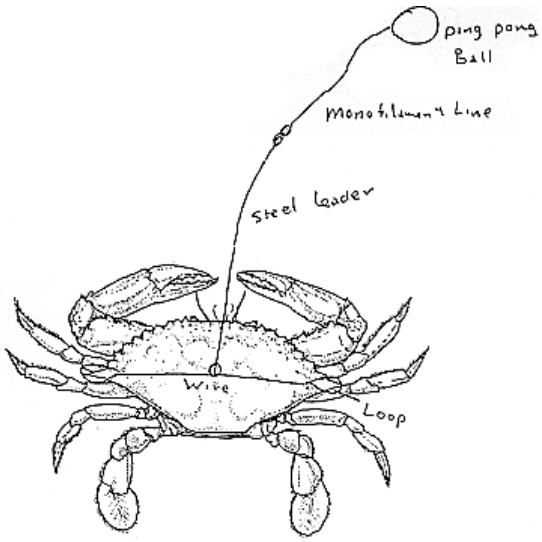
Sunshine State Standards

SC.F.1.4. The student describes patterns of structure and function in living things.

Sc.H.1.4. The student uses the scientific processes and habits of mind to solve problems.





Lab 16: Fisheries

Introduction

Fish are an important resource in southwest Florida. Ninety percent of the commercial fisheries in the Gulf of Mexico are estuarine-dependent during at least one stage of their life cycle. The annual revenue generated by saltwater fishing in Collier, Lee, and Charlotte Counties is $28 million dollars and the number of salt water anglers in this region is expected to grow to over 180,000 by the year 2010. More fishing pressure plus environmental degradation brought about by fast growth in the region has put a lot of pressure on fish populations. To successfully manage fish populations and understand how environmental changes can affect them, fisheries biologists must study the life history of the important commercial and recreational fisheries. Fish scales are often used to age fish. The rings in a fish's scale are similar to the growth rings in a tree. When the fish is growing quickly, the rings are spread apart and are light. During slow growth periods, the rings are dark and close together. Fish typically grow slower during the colder months of the year. By counting the number of times the fish has dark, close growth rings you can determine the age of the fish. Generally, this method works best in temperate climates, where there is a more pronounced difference in growth rates during the colder weather. Another structure used in aging fish are the fish's ear bones or otoliths. By dissecting the otolith, you can also count the growth rings inside the otolith.

Key Fishery Terms

Stock: A grouping of fish based on genetics, geographic distribution, and movement patterns; a managed unit of fish.

Maximum sustainable yield (MSY): The largest average catch that can be taken continuously from a stock under averagevironmental conditions.

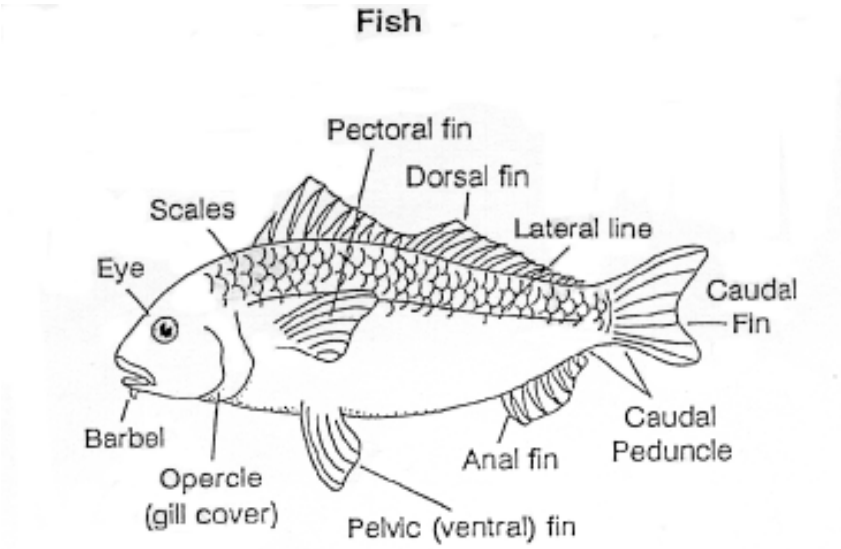
Spawning potential ratio (SPR): The number of eggs that could be produced by an average recruit in a fished stock divided by the number of eggs that could be produced by an average recruit in an unfished stock. Can be expressed as the spawning stock biomass per recruit of a fished stock divided by the spawning stock biomass per recruit before it was fished.

Year Class: The fish spawned and hatched in a given year, a "generation" of fish.

Tragedy of the Commons: Refers to what happens when a resource is not owned, but instead is open to everyone. People compete to harvest larger and larger shares of the resource until the resource is overexploited and collapses.

Objective

- To learn about the growth and life histories of fish and fisheries management.
- To learn how to collect data and identify fish using fish field guides and keys.



Materials Required

- Scope
- Dissecting tray
- Dissecting kit
- Fish diagram

Procedure

First, key out your fish using field guides and keys. Dissect and age a fish using its scales (see Appendix). Count fin rays, differentiate between spiny and soft rays, identify external structures. Determine sex and reproductive condition of fish. Locate other important internal organs. Refer to fish diagram for location of important structures. Note the presence or absence of parasites. Open the stomach and identify its contents.

Critical Thinking

From the shape and structure of the fish, its mouth and body modifications, what conclusions can you make about the life history of this fish? Why are age growth rates and age of sexual maturity so important to fishery biologists? Do some background research on your fish to see if your assumptions were correct.

Environmental Application

Here are some things that you can do to help restore fish populations.

1. Stay informed about local fisheries issues.
2. Support and volunteer your efforts to restore coastal habitats such as marshes, mangroves, and seagrass beds.
3. Support hydrological restoration efforts.
4. Write to fishery management councils, marine fisheries commissions, and elected officials to express your feelings about fishery management issues. Attend local meetings on those issues.
5. Report fisheries violations to marine law enforcement.
6. When fishing, only keep what you need. Do not be a fish hog. Practice catch and release.

References

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http://www.fws.gov/

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Sunshine State Standards

SC.H.1.4. The student uses the scientific process and habits of mind to solve problems.

Lab 17: Marine Mammals

Introduction

Because marine mammals live in aquatic habitat, making direct observations of their behavior is very difficult. While SCUBA may allow us to spend more time underwater, the resultant bubbles often scare or alter the behavior of the marine mammals being studied. Underwater cameras are useful, but expensive and often not mobile enough to keep up with the animals. Radio telemetry studies help us learn about movement patterns, but not much about behavior unless visual observations are made as well. Studies of these animals in captivity are useful, but still leave a lot to be explained about the animal's natural behavior. Visual observations from shore, boats and planes can add important information about the marine mammals' social behavior, as well as reasonably accurate estimates of population numbers. This information is vital when managing protected species such as manatees and bottlenose dolphins.

The two most common marine mammals in the nearshore waters of southwest Florida are the West Indian manatee, *Trichechus manatus,* and the bottlenose dolphin, *Tursiops truncatus*. The West Indian manatee is a member of the Sirenian family of marine mammals. Adults can weigh between 1,000 and 3,500 pounds. They are herbivores, feeding on seagrasses, algae, and freshwater aquatic plants. They eat approximately 10% of their body weight per day. Manatees are thought to be mildly sociable, forming loose, temporary social groups without any regard to sex or age. Their movement patterns vary greatly from individual to individual, but in the winter they congregate in warm water refuges around fresh water springs and power plants.

The Florida manatee has been declared an endangered species by the federal government. In 2000, the population was estimated at a little over 3,200 animals.

Dolphins and porpoises are small-toothed whales that belong to two distinct marine mammal groups. The six species of porpoises tend to be smaller, have blunt snouts, triangular teeth and are commonly found in colder waters. Dolphins have longer snouts and conical teeth.

The most common marine mammal in Florida's coastal waters is the bottlenose dolphin. It grows to approximately 8 feet in length and weighs between 400 and 500 pounds.

This is strictly a coastal species that preys on fish in estuarine waters. By beaming sound waves through the water, a dolphin is able to locate its prey and swallow it whole. Bottlenose dolphins can live for approximately 40 years, and reach sexual maturity between 8 and 12 years of age. Calves often stay with their mothers for as long as five years. Studies have shown that bottlenose dolphins seem to have a complex social structure. Adult males form pairs called coalitions that work together toward a common goal, such as feeding and corralling a female. Females with calves of a similar age tend to swim together. Common behaviors observed in wild dolphins include:

- Travel, moving a long distance in the same direction, often associated with resting.
- Milling, moving in what seems to be random directions, often ` associated with feeding or mating.
- Spy-hopping and peek-a-booing, a way to get a view above the surface.

When observing dolphins, approach slowly at idle speed and keep your distance. Stay parallel to their direction of movement. Do not attempt to cut them off. If there is a very young calf in the group, be particularly careful to keep your distance. It is unlikely that the adults will allow a boat anywhere near the calf. Disturbed dolphins often show the following signs: tail slapping with a fluke or tail fin, chuffing, which is

when a dolphin repeatedly exhales explosively with each surfacing, and excessive peek-a-booing where the dolphin is frequently looking above the water surface.

Objective

To learn more about the natural behavior and identifying features of local marine mammals.

Materials Required

- Binoculars
- Bottom grab
- YSI probe
- Data sheet
- Camera

Procedure

Locate marine mammals and catalogue their behavior. Important information you may want to record might include location, number present, size, type of behavior, breathing rates, water depth, absence or presence of bottom vegetation, time of day, date, tide, water temperature, salinity, and direction of travel. Identify key characteristics that may help you identify the same mammal if you were to observe it again. Record this information into a field notebook and summarize your observations..

Critical Thinking

The Marine Mammal Protection Act was passed in 1972 to decrease dolphin kills in tuna nets. It was strengthened to prevent harassment, defined as any action that disturbs their natural behavior. Can you think of any actions that you may have seen that could disturb a manatee or dolphin? How could these interruptions disturb natural behaviors? What behaviors are most likely to be disturbed? Be careful about your assumptions regarding the animals' behavior. People often give animals human emotions and feelings with little scientific evidence to support their findings.

Environmental Application

Do not feed wild dolphins or manatees. It encourages the animal to approach boats for handouts where they can be hit by hulls and props. Feeding can also put young calves at risk for predation when the mothers are too busy looking for food. If the calf learns to expect food from humans, it will not learn to forage for himself. Feeding disrupts their normal social behavior, and teaches dolphins to eat dead fish, which may jeopardize their health.

When approaching dolphins or manatees, approach slowly at idle speed and keep your distance. Stay parallel to their direction of movement, do not attempt to cut them off. Do not swim with manatees or dolphins, remember they are wild animals. Dolphins can bite or ram people. Dolphins who have been fed by people can get very aggressive, especially when they don't get the handout that they were looking for. Marine mammals normally avoid swimmers, and swimming toward them can seriously hurt them and disrupt their normal behavior.

Your goal as a naturalist is to record natural behaviors only, and to record the information so that these animals can be better protected and managed. Manatees are listed as an endangered species as well as being protected by the Marine Mammal Protection Act. It is illegal to harass or intentionally harm them. Collision with watercraft is the major human-induced mortality factor. Manatees may also be impacted by the destruction of seagrass beds, one of their major sources of food. Feeding manatees or giving them fresh water is considered harassment. This serves to encourage them to approach docks, boats, or marinas, where they are more likely to be hit by watercraft. Swimming toward or approaching manatees too closely will disrupt their feeding and social behavior and frighten the mammal. Sometimes a manatee is frightened away from warm water refuges in the winter, which may result in death, or it can be frightened off seagrass beds into high boat traffic zones such as an inland waterway, increasing the likelihood of collisions.

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Sunshine State Standards

SC.H.2.4. The student understands that most natural events occur in comprehensible, consistent patterns.

SC.H.1.4. The student uses the scientific process and habits of mind to solve problems.

SC.G.1.4. The student understands the competitive, interdependent, cyclic nature of living things in the environment.