Marine Invertebrates/Plankton Lesson - Teacher Resource Notes

Contents:

I. Safety Requirements:

a. Chaperones, 1 per 10 students.
b. Closed toe water shoes are required for wading. (old tennis shoes are great)
c. Bring water, each student should have a water bottle!
d. A floppy hat for shade may be helpful
e. Stay with partners/team (buddy system)
f. Be careful of rocks, barnacles, stingrays, jellyfish, lion fish, scorpion fish, fire sponge, sea urchins…(see reference sheet for at the following link: http://www.floridahealth.gov/diseases-and-conditions/food-and-waterborne-disease/_documents/stings.pdf)
g. Don't touch anything you haven't been told to touch.
h. Wading only, no swimming.
i. Only use the two-way radio for project related help or emergency.
j. Report any injury or concern to site staff.

II. Pre-collection - information and questions:

Background information:

This study will take samples from two sites. One site, the "Lagoon", is a tidal area north of the Jupiter Inlet with one small (several meters) to the Intracoastal Waterway allowing water exchange only by tide. No current flows through the lagoon. Maximum depth may vary from three to five feet. The lagoon shoreline is surrounded by Mangroves and has a soft muddy bottom.

The other site "ICW" (Intracoastal Waterway), is located 8/10 of a mile west of the mouth of the Jupiter Inlet and 4/10 of a mile east to the Loxahatchee River. This site is directly on the north edge of the Intracoastal waterway where it is directly influenced by both tidal change and currents in and out of the inlet. The shoreline has few mangroves and the site has hard sandy bottom.

Prior to collection or site visit:

Students are to use the above background information regarding the two study sites to make respond to the following items:

1. Make a prediction/hypothesis regarding the diversity of the invertebrates expected in each of the two study sites.
2. The plankton net captures very small organisms moving in the water column. What are your predictions regarding the number of Zooplankton vs Phytoplankton in each study site?

III. Equipment:

a. 6 – Hester Dendys (8, 3 inch square panels = .09 square meters each)
b. 8 – 2 gallon buckets (to collect Hester dendys)
c. 7 – sorting trays (6 of Hester Dendys and 1 for plankton)
d. 12 -sorting plates (1 or 2 per team as needed)
e. 6 - plastic petri dishes (one per team)
f. 20+ plastic pipettes (1 per student)
g. 20+ plastic spoons (1 per student)
h. Magnifying boxes & lenses
i. 6 microscopes
j. 2 – refractometers
k. 2 - Thermometers
l. 2 – GPS units (to record plankton sampling coordinates)
m. 2 - Plankton nets (1 for each site)
n. 2 – 1L collection bottles (1 for each plankton collecting team)
o. Identification guides for both Marine Invertebrates and Plankton

IV. Instructions for sample collection: (separate instructions follow for analysis)

20 students are recommended for this total activity*

*This activity may be adjusted to meet the needs of the group size.

12 students to collect six samplers at two sites

4 students to collect plankton at two sites

2 students to measure salinity (1 at each site)

2 students to record coordinates (1 at each site)

There are two study sites for this activity. One site is in the Intracoastal Waterway (**ICW**) on the south side of JILONA and one site is in the **Lagoon** on the north side of JILONA. Three Hester Dendy samplers (samplers) will be retrieved from each of these two sites. Salinity readings, GPS coordinates will also be collected at each of these sites. If the plankton study is being done, plankton will also need to be collected at these two sites. **All students going to each study site will wait and move to and from their respective study site together as a group, along with appropriate chaperones.**

Division of tasks: (Students should be trained on equipment use prior to the field trip)

1. Identify 12 students to be sampler collectors. In teams of 2, each team will take 1 bucket and go as a group with a chaperone to their study site to collect the samplers.
2. Identify 2 students to measure and record salinity and temperature. One student for each site along with their group and chaperone.
3. Identify 2 students to take and record the GPS coordinates for each sampler site and plankton collection site (if collecting plankton). One student for each site.
4. Identify 4 students to collect plankton, two students at each site, *if collecting plankton*.

All students and chaperones move to and from their study site as a group.

V. Methodology for specimen & data collection:

(Students may be in waste deep water)

1. Collecting samplers:

   Each team of 2 students will go (along with their group and chaperone) to collect the samplers. Each pair of students will collect one sampler each and return to the pavilion. Each team should put about 6 inches of clean water from the study site in their bucket (enough water to cover the sampler. Samplers are to be **carefully** unclipped from the location, **gently** placed in the bucket with clean water and brought back to the pavilion with the group.

2. Measuring Salinity & Temperature:

   Each student measuring salinity will take a refractometer, plastic pipette, paper towel, thermometer and data sheet to the site (with the group). Upon entering the study area, the student will hang the thermometer in the water at about the

mid-level between the surface and the bottom while they are taking the salinity reading. Taking the salinity reading; gently wipe the refractometer prism under the daylight plate with the paper towel so it will be clean when taking the salinity reading. Collect one drop of water from the study site with the plastic pipette. Lift the daylight plate, place one drop of water on the prism and gently lower the daylight plate while preventing air bubbles from forming under the daylight plate. Keeping the refractometer positioned level and the daylight plate facing upward, raise the refractometer to your eye and read the scale. **Record your reading.** *Additional readings may be taken if desired*. Remove the thermometer from the water, **read and record the temperature**.

3. Taking GPS coordinates:

   Students taking GPS coordinates will take four coordinate readings at their study site (ICW or Lagoon). The GPS unit may be turned on while walking to the study site to allow the unit to lock on to satellite signals. The "map" page of the GPS will show location coordinates. When at the site, the student will physically move to each location of the sampler and **read and record** the longitude (West) and latitude (North) of **each sampler location**. Coordinates should include degrees, minutes and seconds (example:26° 57' 18.03" N). This student will need to move to each of the three locations as the samplers are being collected by other students so the sampler collectors will need to help the GPS recorder find the locations. If Plankton is being collected, coordinates of that location should also be taken and recorded. ("Waypoints" for each location may also be taken on the GPS).

4. Plankton collection:

   Students collecting plankton may get wetter than other students. Students will need 1 2.5-gallon bucket, 1 plankton net and 1 one liter specimen bottle. Students will select a location in the study site where they can toss the net toward deeper water. Step one, the student will make five (5) throws of the net and pull it back into themselves. After the five throws, the students will "shakedown" the plankton toward the collection bottle at the end of the net then remove the bottle and pour it into the 1 liter specimen bottle. Step two, one student will hold the plankton net with the hoop opening facing upward while the second student fills the bucket and pours the 2.5 gallons of water from the bucket down through the plankton net. This will be done with five buckets of water. After the five buckets of water are poured through the plankton net, students will remove the collection bottle from the net and add that sample to the 1 liter collection bottle for return to the pavilion.

VI. Instructions for sample analysis:

All students and chaperones are to return <u>together</u> to the pavilion for analysis of the samples.

The group of students will need to be separated into six groups for examining the collected samples. Each student should have a plastic pipette and plastic spoon to be used for separating organisms from the sampler.

First, students will examine the Hester Dendy samples to identify all the organisms on the sampler and complete the Invertebrate Data Sheet. Each sampler will be placed in a sorting tray along with the water from the bucket. Each of the six groups will be given a sorting tray containing the Hester Dendy sampler.

Secondly, each of the six groups will examine small samples from the plankton net from each study site under the microscope and complete the plankton data sheet.

VII. Methodology for Analysis of samples:

1. <u>Clearing the Hester Dendy:</u> Students will gently rinse the sampler in the bucket that they retrieved the sampler in. As not to destroy the organisms attached to the sampler, visual observations will be made to identify those organisms. Students will examine the water samples from their bucket by placing water in a petri dish and examining the sample both with magnifying lenses and under the microscope to identify and record as many kinds of organisms as possible. Plastic pipettes and spoons are to be used to separate organisms fond in the sampler sample. When students complete their observations of the samples, all water and samplers are to be placed back into the collection bucket for later return to the sampling site. Each pair/team of students will examine their own sample and share information with the other five groups to complete their "Marine Invertebrate" data sheet.

2. <u>Examining plankton samples</u>: After students examine the Hester Dendy sampler samples, each pair/team should collect, in a clean petri dish, a small amount of water from each study site collection site bottle. Student are to examine their same under the microscope and complete their "Marine Plankton" data sheet. When students complete their plankton observations and data sheet, all plankton samples are to be returned to a specified container for return to the study site.

VIII. Vocabulary:

Benthic - the flora and fauna found on the bottom, or in the bottom sediments, of a sea, lake, or other body of water.

Benthos - used to describe the bottom most layer of aquatic zones, and includes the sand, silt, and organisms found there.

Biodiversity - The number and variety of species found within a specified geographic region and the variability within and between species and ecosystems.
Consumer - an organism, usually an animal, that feeds on plants or other animals.
Endobenthic – in the sediment.
Epibenthos – on top of the sediment.
Hester Dendy – multi-plate invertebrate sampler consisting of 8, 9 or 14 three-inch square or round Masonite plates stacked, spaced at varying distances.
Hyperbenthos - just above the sediment.
Larvae - The newly hatched, earliest form of any of various animals that undergo metamorphosis, differing markedly in appearance from the adult.
Macro Invertebrate - A macroscopic invertebrate, especially an aquatic organism such as a crustacean, a mollusk, or an aquatic insect.
Pelagic - Relating to or occurring or living in or frequenting the open ocean; oceanic islands like Bermuda; oceanic currents; oceanic birds; pelagic organisms.
Phytoplankton - Photosynthetic constituent of plankton, mainly comprised of unicellular algae.
Plankton - small, often microscopic plants and animals floating, drifting or weakly swimming in bodies of fresh or salt water. The aggregate of small plant and animal organisms that float or drift in great numbers in fresh or salt water.
Plankton net – a very fine net used to collect plankton or other microscopic organisms.
Producer - An autotrophic organism capable of producing complex organic compounds from simple inorganic molecules through the process of photosynthesis or through chemosynthesis. Producers are in the first trophic level in a food chain. It serves as a food source for consumers or for higher trophic levels.
Zooplankton - Animal or animal-like constituent of plankton, comprised mainly of freely floating protozoa, small crustaceans, fish eggs and larvae.

IX. Follow-up questions:

1. Comparing the numbers and diversity of the organisms found on the three samplers taken from the same study site, identify and explain any differences found between the sampler in the same study site.

2. Comparing the numbers and diversity of the organisms found on the sampler at the two study sites, identify and explain those differences between the two study sites.

3. Explain how your observed results did or did not support your pre-collection predictions regarding invertebrate diversity at the two sites.

4. After examining plankton from the two study sites, describe and explain the differences found in the organisms found in the two sites regarding the following:

    a. Zooplankton vs. Phytoplankton
    b. Diversity at each site
    c. Most abundant plankton at each site.
    d. Environmental conditions at each site

5. Explain how your observed results did or did not support your pre-collection predictions regarding zooplankton and phytoplankton at the two sites.

X. Benchmark correlation Science:

SC.912.N.1.1 Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following:
1. Pose questions about the natural world, (Articulate the purpose of the investigation and identify the relevant scientific concepts).
2. Conduct systematic observations, (Write procedures that are clear and replicable. Identify observables and examine relationships between test (independent) variable and outcome (dependent) variable. Employ appropriate methods for accurate and consistent observations; conduct and record measurements at appropriate levels of precision. Follow safety guidelines).
3. Examine books and other sources of information to see what is already known,
4. Review what is known in light of empirical evidence, (Examine whether available empirical evidence can be interpreted in terms of existing knowledge and models, and if not, modify or develop new models).
5. Plan investigations, (Design and evaluate a scientific investigation).
6. Use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs), (Collect data or evidence in an organized way. Properly use instruments, equipment, and materials (e.g., scales, probeware, meter sticks, microscopes, computers) including set-up, calibration, technique, maintenance, and storage).
7. Pose answers, explanations, or descriptions of events,
8. Generate explanations that explicate or describe natural phenomena (inferences),
9. Use appropriate evidence and reasoning to justify these explanations to others,
10. Communicate results of scientific investigations, and
11. Evaluate the merits of the explanations produced by others.

SC.912.N.1.6 Describe how scientific inferences are drawn from scientific observations and provide examples from the content being studied.

Remarks/Examples:

Collect data/evidence and use tables/graphs to draw conclusions and make inferences based on patterns or trends in the data.
Florida Standards Connections: MAFS.K12.MP.1: Make sense of problems and persevere in solving them.
Cognitive Complexity: Level 2: Basic Application of Skills & Concepts

SC.912.L.17.2 Explain the general distribution of life in aquatic systems as a function of chemistry, geography, light, depth, salinity, and temperature.
Remarks/Examples:
Annually assessed on Biology EOC. Also assesses SC.912.L.17.11, SC.912.L.17.13, SC.912.N.1.3.

SC.912.L.17.3 Discuss how various oceanic and freshwater processes, such as currents, tides, and waves, affect the abundance of aquatic organisms.
Cognitive Complexity: Level 2: Basic Application of Skills & Concepts
Annually assessed on Biology EOC. Also assesses SC.912.L.17.2; SC.912.L.17.4; SC.912.L.17.8; SC.912.N.1.4.

Florida Standards Connections for 6-12 Literacy in Science

For Students in Grades 9-10
LAFS.910.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
LAFS.910.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the text.
LAFS.910.RST.3.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
LAFS.910.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
LAFS.910.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.

For Students in Grades 11-12
LAFS.1112.RST.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.
LAFS.1112.RST.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
LAFS.1112.RST.3.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.
LAFS.1112.WHST.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
LAFS.1112.WHST.3.9 Draw evidence from informational texts to support analysis, reflection, and research.
Florida Standards Connections for Mathematical Practices
MAFS.K12.MP.1: Make sense of problems and persevere in solving them**.**
MAFS.K12.MP.2: Reason abstractly and quantitatively.
MAFS.K12.MP.3: Construct viable arguments and critique the reasoning of others. [Viable arguments include evidence.]
MAFS.K12.MP.4: Model with mathematics.
MAFS.K12.MP.5: Use appropriate tools strategically.
MAFS.K12.MP.6: Attend to precision.
MAFS.K12.MP.7: Look for and make use of structure.
MAFS.K12.MP.8: Look for and express regularity in repeated reasoning.
Cognitive Complexity: Level 3: Strategic Thinking & Complex Reasoning

Access Point for Students with Significant Cognitive Disabilities

Independent	***Supported***	***Participatory***
SC.912.N.1.In.1 Identify a problem based on a specific body of knowledge, including life science, earth and space science, or physical science, and do the following: 1. Identify a scientific question 2. Examine reliable sources of information to identify what is already known 3. Develop a possible explanation (hypothesis) 4. Plan and carry out an experiment 5. Gather data based on measurement and observations 6. Evaluate the data 7. Use the data to support reasonable explanations, inferences, and conclusions. *Date Adopted or Revised*: 02/08	SC.912.N.1.Su.1 Recognize a problem based on a specific body of knowledge, including life science, earth and space science, or physical science, and do the following: 1. Recognize a scientific question 2. Use reliable information and identify what is already known 3. Create possible explanation 4. Carry out a planned experiment 5. Record observations 6. Summarize results 7. Reach a reasonable conclusion. *Date Adopted or Revised*: 02/08	SC.912.N.1.Pa.1 Recognize a problem related to a specific body of knowledge, including life science, earth and space science, or physical science, and do the following: 1. Observe objects and activities 2. Follow planned procedures 3. Recognize a solution. *Date Adopted or Revised*: 02/08
SC.912.N.1.In.2 Describe the processes used in scientific investigations, including posing a research question, forming a hypothesis, reviewing what is known, collecting evidence, evaluating results, and reaching conclusions. *Date Adopted or Revised*: 02/08	SC.912.N.1.Su.2 Identify the basic process used in scientific investigations, including questioning, observing, recording, determining, and sharing results. *Date Adopted or Revised*: 02/08	SC.912.N.1.Pa.2 Recognize a process used in science to solve problems, such as observing, following procedures, and recognizing results. *Date Adopted or Revised*: 02/08
SC.912.N.1.In.3 Identify that scientific investigations are sometimes repeated in different locations. *Date Adopted or Revised*: 02/08	SC.912.N.1.Su.3 Recognize that scientific investigations can be repeated in different locations. *Date Adopted or Revised*: 02/08	SC.912.N.1.Pa.3 Recognize that when a variety of common activities are repeated the same way, the outcomes are the same. *Date Adopted or Revised*: 02/08
SC.912.N.1.In.4 Identify that scientists use many different methods in conducting their research. *Date Adopted or Revised*: 02/08	SC.912.N.1.Su.4 Recognize that scientists use a variety of methods to get answers to their research questions. *Date Adopted or Revised*: 02/08	SC.912.N.1.Pa.4 Recognize that people try different ways to complete a task when the first one does not work. *Date Adopted or Revised*: 02/08
SC.912.L.17.In.1 Recognize that living things in oceans and fresh water are affected by the location, availability of light, depth of the water, and temperature. Date Adopted or Revised: 02/08	SC.912.L.17.Su.1 Recognize that living things in bodies of water are affected by the location and depth of the water. Date Adopted or Revised: 02/08	SC.912.L.17.Pa.1 Recognize common living things in bodies of water. Date Adopted or Revised: 02/08 SC.912.L.17.Pa.4 Recognize actions that are harmful to living things. Date Adopted or Revised: 02/08

XI. Helpful Websites:

Garmin 64 Quick start manual: http://static.garmin.com/pumac/GPSMAP64_QSM_EN.pdf

Garmin 64 manual: http://static.garmin.com/pumac/GPSMAP64_OM_EN.pdf

Marine Invertebrate ID: http://faculty.fiu.edu/~trexlerj/lab_invert_guide.pdf

Marine Invertebrate Zoology: http://www.flmnh.ufl.edu/malacology/web_links.htm

Marine Invert ID publications: http://dep.state.fl.us/labs/cgi-bin/sbio/keys.asp

Dangerous Marine Life: http://www.floridahealth.gov/diseases-and-conditions/food-and-waterborne-disease/_documents/stings.pdf

Invertebrate Zoology: http://www.flmnh.ufl.edu/malacology/web_links.htm

Stingray basics: http://www.flmnh.ufl.edu/fish/discover/rays-skates/basics/

Marine Species ID (interactive website): http://species-identification.org/identify_species.php

Aquatic Benthic Macroinvertebrates and pollution: http://www.water.ncsu.edu/watershedss/info/macroinv.html

Marine Macro Invertebrates: https://www.marinelab.fsu.edu/education/classroom/apalachee-macroinvertebrates/

Florida DEP ID Key list: http://www.dep.state.fl.us/labs/cgi-bin/sbio/keys.asp#keys

Census for Marine zooplankton: http://www.cmarz.org/resources/zooplankton_taxonomic_references.htm

Plankton net sampling: http://sfrc.ufl.edu/planktonweb/sampling.htm

*Marine Species Identification Portal: http://species-identification.org/index.php

Plankton image based key interactive: http://cfb.unh.edu/cfbkey/html/index.html

Refractometer use: http://ucanr.edu/sites/viticulture-fresno/files/115503.pdf