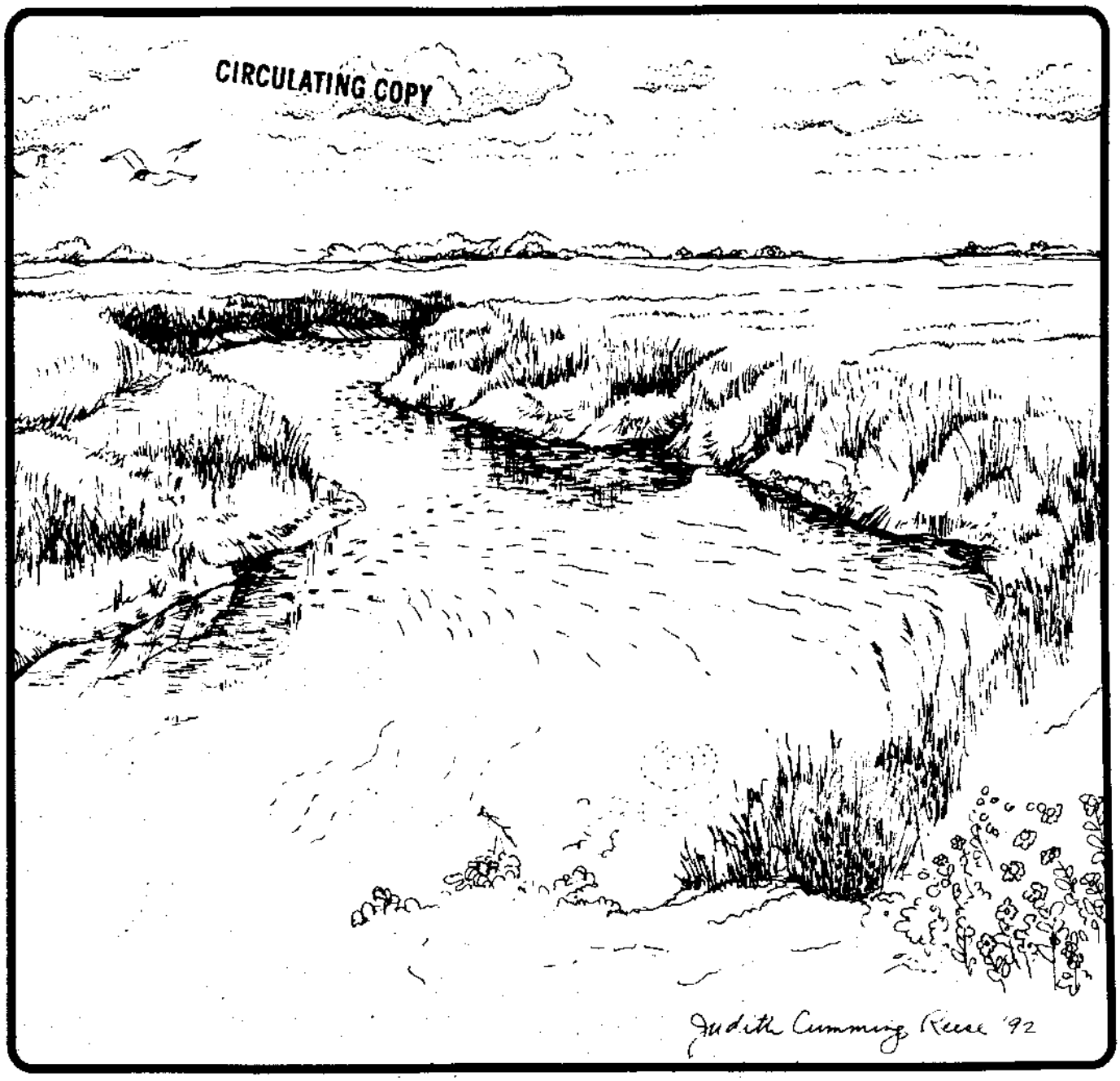
Marsh Classroom Adventure



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South Carolina Wildlife & Marine Resources Department
South Carolina Sea Grant Consortium

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Acknowledgements

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Resources

The activities included in this training guide were compiled from the following sources:

The "Marsh Habitat Study" activity was adapted from "Salt Marsh Discovery", developed by the Bellefield Nature Center and included in **Sea Sampler – Aquatic Activities for the Field and Classroom – Elementary**, S.C. Sea Grant Consortium, Charleston, SC, 1985, 118pp.

Sea Sampler can be ordered from:
SC Sea Grant Consortium
287 Meeting Street
Charleston, SC 29401
(803) 727-2078
Elementary version - $4.25
Secondary version - $4.00

"Wetland Metaphors" and "Marsh Munchers" are reprinted with permission from **Project WILD**, 1987 Western Regional Environmental Education Council.

In South Carolina write:
Don Winslow, Education Coordinator
S.C. Wildlife and Marine Resources Department
P.O. Box 167
Columbia, SC 29202

The following resources were used to provide information for the Marsh Classroom Adventure:

Ballantine, T., **Tideland Treasure, a Naturalist's Guide to the Beaches and Salt Marshes of Hilton Head Island and the Southeastern Coast**, Deerfield Publishing,Inc., SC, 1983, 210 pp.

Coulombe, D.A., **The Seaside Naturalist, a Guide to Nature Study at the Seashore**, Prentice Hall Press, NY, 1984, 246 pp.

Spitsbergen, J., **Seacoast Life: An Ecological Guide to Natural Seashore Communities in North Carolina**, University of North Carolina Press, Chapel Hill, NC, 1980, 112 pp.

The Training Session

The Marine Education Program of the Marine Resources Division would like to thank you for participating in our Marsh Classroom Adventure training session. This program is designed for teachers, like yourself, who want to know more about the marsh environment, so that you, in turn, will feel comfortable introducing your students to this unique ecosystem.

BACKGROUND

By taking part in the Marsh Classroom Adventure training program, and by utilizing this guide, you will be preparing yourself to use the marsh as an outdoor classroom with your students. As you will see, the marsh provides an excellent hands-on opportunity for students to learn a wide range of biological and ecological principles. These are concepts normally taught in the classroom, but are much more exciting and memorable when reinforced with an effective trip into the field.

We recognize that many teachers, particularly of elementary school students, have a limited science background, especially marine science, and that this can be very intimidating. Our program will provide you with a thorough, yet easily accessible, source of information about the marsh environment. You can then use your expertise to put this information into a form that is meaningful to your students.

In this time of growing environmental concern, it is imperative that today's students gain a knowledge of and concern for their natural surroundings. It is only through this process that we can expect them, as adults, to become responsible stewards of our shared resources. The Marsh Classroom Adventure training session and guidebook furthers this goal in several ways. First, the program is a learning experience for teachers. Also, by educating teachers how to effectively use the marsh as a classroom, an increasing number of students will ultimately be exposed to the wonders of the marsh environment. Finally, our program not only seeks to educate, but also to stimulate curiosity, which is the first step in developing an environmental awareness.

ONCE YOU HAVE BEEN TRAINED

It is our goal that by participating in the Marsh Classroom Adventure training session, and by availing yourself of the information contained in this guide, you will feel comfortable conducting a marsh classroom on your own with your students. At that point, you will need a marsh to use. The marsh areas at the Marine Resources Center at Fort Johnson are available by appointment to anyone who has been trained by our staff. Some teachers have expressed the difficulty and inconvenience involved in getting to Fort Johnson. If this is a problem for you, there are a few alternatives to consider.

If you know of a marsh close to your school that is public property, there is no problem in using it as long as you do not intend to alter it in any way in making it accessible. If your school is bordered by a marsh, and you want to establish a permanent set up, you must get a permit. Any kind of boardwalk or raised platform must be approved by the South Carolina Coastal Council. We are assuming that this last alternative is unlikely; however, please make sure you are aware of the process involved if you need a permanent structure in the marsh.

LOGISTICS

If you decide that you want to take advantage of the extensive marsh areas around the Marine Resources Center, reservations must be made by contacting the Marine Education Program at 762-5077 for scheduling.

To better prepare your students for the visit, we suggest borrowing the Wildlife Department's excellent 25 minute video, "The Thin Green Line". This video will introduce your students to the marsh and let them know what to expect. As you will see during your training, the video is very informative and entertaining.

It is best to schedule your marsh classroom as close to low tide as possible, so please consult a tide chart before you call. Spring and fall are the best times of the year to schedule marsh classroom experiences. The marsh in the winter time is not as diverse, since many of the plants are dormant and the animals have either moved offshore or are buried and inactive. If your students are dressed properly, exploring the marsh will be fun. If not, they will be miserable. Some marsh areas are "messier" than others, so it is always best to be prepared for the worst! An old pair of sneakers is a must. Do not let your students wear thongs or open toed shoes.

You should also recommend that they wear an old pair of jeans or pants that can get covered with marsh mud. During the warmer months, sunscreen and bug spray are recommended, as well as a hat or cap.

If you do intend to use the marsh at the Marine Resources Center, there are several rules that must be followed:

1. No more than 30 students may use the marsh at any one time, and adult supervision must be provided. If you will have more that 30 students with you, divide the group and plan a supervised activity for the ones not in the marsh. Refer to the enclosed activities for ideas.

2. Please keep in mind the fragile nature of the marsh and do not remove living plants or animals.

3. Buses should park across the street from the Marine Resources Research Institute, which is the second building on the left after entering the gate of the Marine Center. There are two marsh areas available at Fort Johnson. The area directly behind the Marshlands House (the first building on the left) is the easier of the two to access. However, this area tends to be fairly wet and muddy most of the time. The other area, which is behind the College of Charleston Grice Lab, is drier and exhibits more clearly defined zonation of plants and animals. Please let us know which area you would like to use so that someone here will be available to lead you to the area.

4. Please bring all of the materials that you will need to use because the Marine Resources Division does not supply materials. This includes pencils, jars, activity sheets, etc.

5. Picnic facilities are available next to the Marshlands House. If you wish to use them, please so indicate when you schedule the marsh classroom.

6. Release forms from the school must be delivered to the receptionist at the Marshlands House prior to use of the marsh classroom areas at the Marine Resources Center.

7. If you need further information regarding scheduling the marsh for your students, or if you would like more information about future Marsh Classroom Adventure training sessions for teachers, please contact the Marine Education Program at 762-5077.

Beach Classroom Adventure training sessions for teachers are also offered. Additional information regarding this program can be received by contacting the Marine Education Program.

Thank you once again for taking the time to become a better educated educator. You are assisting us in our efforts to spread the conservation message, and you are making a difference!

Salt Marsh Vocabulary

1. SALT MARSH – An intertidal area of abundant plant and animal life within an estuary. The majority of coastal animals depend on the salt marsh for their daily and long-term survival because the marsh provides both habitat and a source of food.

2. ESTUARY – A body of water that is partially enclosed by land where saltwater from the ocean mixes with freshwater from rivers and land drainage. Because of this, an estuary is a very unique habitat, and creates an area with abundant marine and salt marsh, or estuarine, life. Charleston Harbor is an example of an estuary.

3. DETRITUS – This is the base of the salt marsh food web. It is a nutrient mass composed of dead plant matter, such as salt marsh cordgrass, and associated microorganisms. Detritus feeds many of the creatures of the marsh, such as fiddler crabs, periwinkle snails, and oysters. These in turn are eaten by larger crustaceans and fish, and so on up the food chain.

4. TIDES – The rising and falling of coastal waters due to the gravitational pull of the moon and the sun on the earth. The moon's effect on the tides varies during it's phases. During the full and new moon phases, we experience what are called spring tides. This is when the highest ranging tides occur, the highest of high-tides and the lowest of low-tides. The neap tides, which occur during the quarter moon phases, are when we experience the lowest range in tides, the highest of low-tides and the lowest of high-tides.

5. SALINITY – The concentration of salt dissolved in water. This is expressed in parts per thousand (0/00). The average salinity of ocean water is about 35 parts salt to 1,000 parts water. The fresh and salt water mixing within an estuary results in salinities that can range from 0 to 35 parts per thousand.

Why Study the Salt Marsh?

The salt marsh provides an excellent example through which many important ecological principles can be taught. The marsh habitat requires a great deal of adaptation by the plants and animals that live there. Even so, it is an incredibly productive ecosystem. For this and many other reasons, it is wise for us to understand the salt marsh and its workings. Many coastal residents see the marsh every day but do not fully appreciate how they directly benefit from it.

Salt marshes occur along the intertidal shore of sounds, estuaries, creeks and rivers where the water has a high salinity, although not quite as high as the open ocean. Life in the salt marsh is completely dictated and regulated by the twice daily ebb and flow of the tides. Some marsh animals and plants are inundated at every high tide, while some prefer the drier areas of the upper marsh. Environmental conditions in the marsh change constantly with regard to salinity, temperature and available moisture. That, plus the very low oxygen content of the marsh soil contribute to a relatively low diversity of life in the marsh. However, the plants and animals that tolerate these conditions flourish, so the marsh is literally teeming with life.

The salt marsh is one of, if not the, most productive ecosystems on earth. If you consider that the productivity of a natural, undisturbed marsh occurs completely without the use of pesticides, herbicides and other chemicals which are the mainstay of agricultural lands, this fact is even more impressive. Many people believe the salt marsh to be a smelly, insect-ridden wasteland that is more useful when filled. This could not be further from the truth.

The key to all of this productivity is a simple plant called *Spartina alterniflora*, or salt marsh cordgrass. This is a remarkable plant for many reasons, not the least of which is that it can withstand the harsh environmental variables of the marsh. Cordgrass has adaptations which enable it to tolerate daily submersion by tides. *Spartina* is able to secrete excess salt through special salt glands. By far the most amazing thing about *Spartina* is that when it dies, it breaks down to form detritus, upon which all other life in the marsh depends. Detritus is the base of the food chain in the marsh. Few marsh critters fe ed directly on live Spartina but many are detritus feeders. Examples are fiddler crabs and some species of snails, which extract detritus directly from mash sediment. Several types of bivalves, such as clams, oysters and mussels, filter the nutrients from the water column. These small organisms are then fed upon by birds, larger fish and humans.

The marsh is also a nursery for larval and juvenile stages of many marine organisms, or zooplankton. The marsh offers these immature creatures sources of food and protection from predators in the marsh grasses. The combination of detritus and the availability of zooplankton makes the marsh a rich source of food for many small fish and invertebrates. Since these animals are then fed upon by larger animals, and because the tides flush marsh nutrients out into the ocean, it can be said that the marsh supports life well beyond its borders.

So how do we benefit from the marsh? The most obvious benefit is its commercial value. The marsh food chain supports 95% of all economically important marine species in South Carolina waters. If you enjoy eating clams, oysters, blue crabs, shrimp, or just about any fish you can name, then you derive a direct benefit from the marsh. The harvesting of these resources supports a very important commercial and recreational industry in this state, pumping millions of dollars a year into our state's economy. This is one reason for stringent laws that protect the salt marshes of South Carolina. Legislation serves to protect our marshes that in the past were filled and developed with little knowledge of or regard for their environmental or economic importance.

Marshes also perform functions such as flood control and pollution breakdown. Marshes are similar to sponges in that they are able to soak up and hold a large volume of water. With this ability, the marsh helps to alleviate flooding problems in coastal areas. Bacteria living in marsh sediment have the ability to break down many pollutants. Run-off from agricultural and residential areas upriver concentrates in estuaries and sounds along the coast. Marsh sediments soak up many of the pollutants, which are then detoxified by the resident bacteria. However, the marsh can only tolerate a limited amount, and problems do occur when the marsh is overloaded.

The salt marsh also has aesthetic values which are difficult to quantify. The marsh is a place of great beauty,

and the more one understands its delicate balance, the more beautiful it becomes. The distinctive odor that some people find offensive is almost pleasant to many coastal residents and visitors. The sight of a great blue heron flying low over the marsh is truly a special treat. The salt marsh is fun to explore and is a perfect environment to learn about the wonders of our natural surroundings.

Wetland Metaphors

OBJECTIVES

Students will be able to: 1) describe the characteristics of wetlands; and 2) demonstrate their understanding of the importance of wetlands to wildlife and humans.

METHOD

Students are presented with a selection of "hands-on" objects for investigation as metaphors for natural functions of wetlands.

BACKGROUND

Wetlands are many different things to many different people. Some people have never heard or thought about wetlands. Others are working actively to protect wetlands because of their importance. Wetlands include areas like freshwater and saltwater marshes, wet meadows, swamps, lagoons, bogs, and prairie potholes. All wetlands, whether coastal or inland, provide special habitats that serve areas far beyond their boundaries. Wetlands are uniquely important to plants, animals, humans, and the total environment.

Because of the abundance of food, vegetative cover (shelter), and water found there, most wetlands are rich with diverse wildlife species. Coastal and inland marshes, for example, provide breeding, resting and wintering habitats for thousands of migratory birds--including ducks, geese, swans, cranes, and shore birds. Many species of fish that are important for commercial and personal use by humans reproduce and spend part, or all, of their life cycle in fertile wetlands adjacent to larger, more open bodies of water. These fish species include bass, salmon, walleye, perch, and pickerel. A wide variety of reptiles, amphibians, insects, and crustaceans also breed and live in wetlands. Frog and toads, turtles of all kinds, salamanders, snakes, dragonflies, water striders, clams, and crayfish flourish in wetland habitats. Many mammals-from muskrats and beaver to whitetail deer and moose-also depend on wetland areas. Wetlands are often referred to as "nurseries" because they provide critical breeding and rearing habitats for countless numbers and kinds of wildlife.

Wetlands also have the unique ability to purify the environment. They act as natural filtering systems and have been shown to be extremely effective; for example, they can trap and neutralize sewage waste, allow silt to settle, and promote the decomposition of many toxic substances.

The importance of vegetation associated with wetlands cannot be overlooked. Plants absorb nutrients and help cycle them through food webs. Plants also help keep nutrient concentrations from reaching toxic levels. Plants slow down water flow causing silt to settle out. Through photosynthesis, plants add oxygen to the system and provide food to other life forms. Of great importance to humans are the flood control characteristics of wetlands. When runoff from rains and spring thaws is high, wetland areas absorb excess water until it gradually drains away down streams and rivers and through the soil. Acting as buffers, healthy wetlands prevent flooding and erosion. In dryer periods, wetlands hold precious moisture after open bodies of water have disappeared.

The many activities that take place in wetlands make them among the most productive ecosystems in the world. As remarkable and resilient as wetlands are, these unique areas have limits. Their destruction and/or abuse can have devastating effects on wildlife, humans, and overall environmental quality. Many of the major attributes of wetlands can be explored through the use of metaphors. To use a metaphor is to apply a word or phrase to an object or concept which it does not literally denote, in order to suggest a comparison between the two. A metaphor represents a concept or idea through another concept or idea. "A tree is a home" and "Books are windows of thought" are two examples. In this activity a variety of everyday objects are used to represent the natural functions of wetlands. For example:

OBJECT	METAPHORIC FUNCTION
sponge	absorbs excess water caused by runoff; retains moisture for a time even if standing water dries up (e.g.,sponge placed in a small puddle of water absorbs water until saturated, then stays wet after standing water has evaporated)

pillow or bed	is a resting place for migratory birds
mixer or egg beater	mixes nutrients and oxygen into the water
cradle	provides a nursery that shelters, protects, and feeds young wildlife
sieve or strainer	strains silt, debris, etc., from water
filter	filters smaller impurities from water
antacid	neutralizes toxic substances
cereal	provides nutrient-rich foods
soap	helps cleanse the environment, as wetlands do

Wetland habitats are being converted to other uses (agriculture, roadways, housing developments) or otherwise being destroyed (drained for pest control or polluted) at a rate of a half million acres per year. And although many wetlands are protected by federal and state laws, there still appears to be a significant need to create a greater understanding of the importance of wetlands as ecosystems and as wildlife habitat. The major purpose of this activity is for students to develop an appreciation and understanding of wetlands through the power of metaphor, linking the characteristics and natural functions of wetlands to the familiar realm of everyday life.

MATERIALS

a large pillowcase, bag, or box; sponge; small pillow; soap; eggbeater or mixer; small doll cradle; sieve or strainer; paper (coffee) filter; antacid tablets; small box of cereal; 3 X 5 cards with pictures that could be used to show other wetland metaphors (a zoo could represent the idea of wildlife diversity in a wetland, a lush vegetable garden could represent the idea of a productive wetland in which food is abundant, a vacation resort could represent the idea of a resting or wintering place for migrating waterfowl)

Note: A metaphoric approach such as this allows a variety of objects to suggest some appropriate linkage to the basic characteristics of wetlands.

PROCEDURE

1. Prepare a "Mystery Metaphor Container" (pillowcase, bag or box). It should be possible for a student to put his or her hand into the container and pull out an object. You may want to collect as many as one metaphoric object per student, but at least have enough for one per group of four students. Put the container aside to use later.

2. Discuss the variety of wetlands found in your local area, state, country, etc. Then invite the students to sit quietly and close their eyes. Ask them to imagine and visualize a wetland. Have them examine what it looks like. Have them look carefully at the plants and animals, including insects and small creatures. What does the air feel like? How does it smell?

Optional: Play a tape recording of natural sounds from wetlands. Some are available commercially in record and nature stores.

3. Invite the students to tell what they imagined. Compile a list of their offerings. Encourage discussion and mutual sharing.

4. With their list as a point of reference, help the students identify which plants and animals are actually most likely to be found in a wetland. If possible, have them classify the plants and animals according to the kind of wetland in which they would be found. State or federal wildlife officials and representatives of private conservation or nature-related organizations can be helpful. The series of Golden nature guides from Western Publishing Company, Inc. are also useful. "Wading into Wetlands" from the National Wildlife Federation's *Naturescope* series includes a variety of useful information as well.

5. Next provide the students with background information to serve as an overview of the basic ecological activities that characterize the wetland habitat. For example, you can include the following:

- Sponge effect - absorbs runoff
- Filter effect - takes out silt, toxins, wastes, etc.
- Nutrient control - absorbs nutrients form fertilizers and other sources that may cause contamination downstream
- Natural nursery - provides protection and nourishment for newborn wildlife
- Etc.

Suggest that these activities and many more that they could probably think of are taking place in wetlands all the time.

6. Now bring out the "Mystery Metaphor Container." Tell the students that everything in the container has something to do with a wetland. Have the students divide into groups of four. Announce that when it is their turn, you want a representative of each group to draw an object from the container. Then, as a group, they must figure out how the object could represent what a wetland is or does.

7. Have the designated student reach into the container and withdraw one object, ask them to work as a team to describe the relationship between their meta-

phoric object and the wetland. Encourage the students to build on each other's ideas. You can also assist by strengthening their connections. Note: Allow the students time to discuss their ideas with each other before doing so in front of the entire class.

8. Ask each group to report their ideas to the class.

9. Following discussion and review of the functions represented by each metaphor, ask the students to summarize the major roles that wetlands perform in contributing to habitat for wildlife. List ways in which wetlands are important to humans. Why do humans convert wetlands to other uses? Ask them if their own attitudes about wetlands are different now. If yes, how? If not, why not?

10. For the final part of this activity, encourage the students' understanding of how the wetlands' condition depends upon each of us. Many kinds of wildlife depend upon wetlands. Our own well-being requires wetland ecosystems. Strengthen the students' understanding of the connectedness that humans have to wetlands. Recreation, aesthetics, utilitarian uses, environmental quality, and nature study are but a few of the connections we each have with wetlands.

EXTENSIONS

1. Personally visit a wetland to verify the appropriateness of the metaphors explored in the classroom. Identify and discuss any limitations to the appropriateness of these metaphors. Identify what seem to be the most compelling attributes of the metaphors in helping you understand the characteristics and nature of the wetland. Expand on your understanding of these metaphors. Identify new and appropriate metaphors!

2. Investigate local, county, state, and federal regulations and laws that govern uses of wetlands.

EVALUATION

For Younger Students:
What is a wetland?
Name three reasons wetlands are important. Wetlands are sometimes called nurseries because so many young animals grow up in them. Name some animals that spend part of their lives in wetlands.

For Older Students:
Why are wetlands called one of the world's most productive ecosystems?
Wetlands are important to a range of organisms in the animal kingdom, from zooplankton to humans. Select five species of animals, and describe how wetlands are important to each.

Age: Grades 1-12
Subjects: Science, Language Arts
Skills: analysis, application, classification, comparing similarities and differences, description, generalization, identification, inference, interpretation, listing, public speaking, recognition, reporting, small group work, synthesis
Duration: one or two 30-60 minute periods
Group Size: any
Setting: indoors or outdoors
Conceptual Framework Reference: III.A., III.A.1., III.B., III.B.1., III.B.2., III.B.3., III.B.4., III.C., III.C.1., III.D., III.D.1., III.D.2., III.D.3., III.D.4., II.A., II.B., II.B.1., II.B.2., II.B.3., II.C., II.D., II.E., II.F., I.A., I.A.1., I.A.2., I.A.3., I.A.4., I.C., I.B.1., I.B.2., I.B.3., I.B.4., I.C., I.C.1., I.C.2., I.C.3., I.C.4., I.D.
Key Vocabulary: wetlands, metaphor

Basic Ecology Vocabulary

1. HABITAT – The place where a plant or animal lives. An example of an estuarine habitat would be the salt marsh.

2. POPULATION – A group of individuals of a single species.

3. COMMUNITY – The assemblage of plant and animal populations that share a habitat, acting together as an interdependent group, a "unit of life". An example of an estuarine community would be all of the species living in the salt marsh, which would include the saltmarsh cordgrass, other plants common to marsh areas, fiddler crabs, periwinkle snails, oysters, mussels, shrimp, crabs, fish, egrets, and many other species as well.

4. NICHE – The role of an organism in the community.

5. ENVIRONMENT – The surroundings and conditions that affect the growth and development of an organism. The estuarine environment includes many different habitats and the external factors acting on them. Examples of these factors would be rainfall, solar radiation, the tides, freshwater inflow, and water pollution.

6. SUCCESSION – Changes which occur within a community over time due to changing environmental factors.

7. ECOLOGY – The study of the relationship between an organism and its environment.

8. ECOSYSTEM – An ecological community together with its physical environment, considered as a unit.

Marsh Habitat Study – Activity Directions

The purpose of this activity is to introduce your students to the marsh as a habitat. This is an exploratory activity and requires a trip into the marsh. If you do not have local access to a salt marsh, call the Marine Education Program and set up a visit. Please refer to the introduction section of the guide for scheduling instructions.

There are several parts to this activity. There are two pages that are titled "Marsh Habitat Study", one which is for your students to complete, and the other is an answer key. What follows are the "Marsh Habitat Study Definitions". For younger students, these detailed descriptions of the plants and animals that appear on the study sheet may need to be presented in a tailored down, creative way to be meaningful. For older students, the description sheets can be handed out with the study page. Finally, there are several pages of illustrations of the same plants and animals. These may be helpful for identification purposes.

The only materials needed besides the work sheets are pencils and possibly collecting jars.

1. Prepare your students for the activity in any way that is appropriate for the grade level. Perhaps you could discuss some of the plants and animals before your visit to the marsh, or assign each child a plant or animal to research. Discuss the difference between the high and low marsh.

2. Divide your class into groups of five and assign a group leader. Give each leader a copy of the appropriate work sheets.

3. Send your students into the marsh with their work sheets. They should be able to complete the activity in approximately twenty minutes. You may want to tell them ahead of time that they may not be able to locate all of the plants and animals on the list. If the marsh area you are using has easy access to the water's edge, you should take a dip net with you. With a dip net, you and your students can explore the shallows and perhaps locate some of the animals that live there. If not, ask your students to imagine which animals on the list would live "in the water". If you do not have a dip net, you can arrange to borrow one from the Marine Education Program.

4. After the activity, discuss what each group found and where. Ask your students to complete the following sentence about the marsh:

I wonder _____

_____

Marsh Habitat Study

Where did you find...	In The Water	Low Marsh	High Marsh
SALT MARSH CORDGRASS 			
SALT MEADOW HAY 			
PICKLE PLANT 			
NEEDLE RUSH 			
SEA OXEYE 			
MARSH ELDER 			
SEA MYRTLE 			
CHINA BLACK FIDDLER 			
SQUARE BACK CRAB 			
PERIWINKLE SNAIL 			
MUD SNAIL 			
SHRIMP 			
RIBBED MUSSEL 			
OYSTER 			
BLUE CRAB 			
SNOWY EGRET 			
BLUE HERON 			

Marsh Habitat Study

You would find...	In The Water	Low Marsh	High Marsh
SALT MARSH CORDGRASS		■	
SALT MEADOW HAY			■
PICKLE PLANT		■	■
NEEDLE RUSH			■
SEA OXEYE		■	■
MARSH ELDER			■
SEA MYRTLE			■
CHINA BLACK FIDDLER		■	
SQUARE BACK CRAB			■
PERIWINKLE SNAIL		■	
MUD SNAIL	■	■	
SHRIMP	■		
RIBBED MUSSEL	■	■	
OYSTER	■	■	
BLUE CRAB	■		
SNOWY EGRET	■	■	
BLUE HERON	■	■	

Marsh Habitat Study Definitions

PLANTS

SALT MARSH CORDGRASS (*Spartina alterniflora*) – This is the most abundant and ecologically important plant in the South Carolina salt marsh. It grows tallest near the water's edge, but is stunted in elevated areas. It is adapted in many ways to the harsh conditions of the marsh. Cordgrass provides the bulk of detritus to the community, providing the major link in the marsh ecosystem food web.

SALT MEADOW HAY (*Spartina patens*) – This grass only grows in the drier, high marsh areas, where it forms meadowlike expanses of grass. Its leaves are thinner and shorter than *S. alterniflora*, and this plant is uncommon in the intertidal zone.

PICKLE PLANT OR GLASSWORT (*Salicornia*) – An obvious succulent, this small plant grows to about 5" high in the mid and high marsh. The juicy plant tips are edible and have a very salty taste. This is a salt tolerant plant that may be found intermingled with the cordgrass. Some species exhibit red pigmentation during the fall of the year.

NEEDLE RUSH (*Juncus roemerianus*) – Grows waist high near the highest tide line. It is easy to identify this plant because of its darker color, sharp pointed stems and leaves with black tips. This plant is usually only inundated by salt water during high tide. It tends to form dense monocultures in higher elevations, but it is often found mixed in with cordgrass.

SEA OXEYE (*Borrichia frutescens*) – Generally found in the mid to upper marsh, and may grow wherever elevated spots occur. It is a succulent which, when flowering, has yellow flowers that resemble small sunflowers. Otherwise, it has prickly brown heads.

MARSH ELDER (*Iva frutescens*) – This is a shrub which colonizes the perimeter of the high marsh, where it is seldom flooded. It is well adapted to the sandy soil, extreme temperatures and salt spray of the salt marsh environment.

SEA MYRTLE (*Baccharis halimifolia*) – This shrub is common in the upper edge of most tidal marshes. The plant is most noticeable in autumn when flowers resembling tiny cotton balls cover the bush. It is highly resistant to salt spray and can withstand occasional flooding by salt water.

ANIMALS

CHINA BACK OR SAND FIDDLER (*Uca pugilator*) – These fiddler crabs, with their purplish and white markings, and their close relative, the mud fiddler, *Uca pugnax*, are very common marsh inhabitants. Fiddlers are perhaps best known for the one very large claw that all male fiddlers have, which they use to attract females. Fiddler crab burrows are easy to find, mostly in the mid to low marsh. If you look closely around the burrow, it is possible to see two sizes of mud balls - the larger being excavation material, and the smaller being food waste. Fiddler crabs are detritus eaters, and once they remove the organic material from the marsh mud, they ball up what they do not want and deposit it outside the burrow.

SQUARE BACK CRAB OR WHARF CRAB (*Sesarma cinereum*) – This small, brown crab prefers the high marsh including the fringe above the high tide line. It constructs its burrows under boards and driftwood at the marsh edge. Unlike the fiddler crabs, the square back males do not have the enlarged pincer. That characteristic, and the very squared back its name implies, help in differentiating between the two. The square back crab is opportunistic, eating dead animals, wounded live animals such as fiddler crabs, or scraping algal film off rocks and driftwood.

PERIWINKLE SNAIL (*Littorina irrorata*) – While fairly nondescriptive in appearance, it is easy to spot the periwinkle based on habitat. The cream colored periwinkle can be found attached to the salt marsh cordgrass, where it climbs up and down the stalk in response to the tides. Whether the snail is seeking to avoid immersion in the salt water or predation, or both, is not fully known. The periwinkle uses its file-like tongue, or radula, to scrape algae from the cordgrass or the marsh floor.

MUD SNAIL (*Ilyanassa obsoleta*) – A small, black-shelled snail that when present, is found in groups of thousands on the muddy marsh flats. It is a very common snail which feeds on detritus and algae. It is also a scavenger, feasting on the remains of fish, shrimp and other mollusks.

SHRIMP (*Penaeus spp.*) – A well known and common coastal inhabitant, these animals are very dependent on shallow estuarine waters. Adult shrimp spawn in the ocean, but the immature stages develop in estuaries where they feed primarily on detritus. Shrimp support a large and very important commercial industry in this state. Two species, *P. setiferus* (white shrimp) and *P. aztecus* (brown shrimp) are especially sought after.

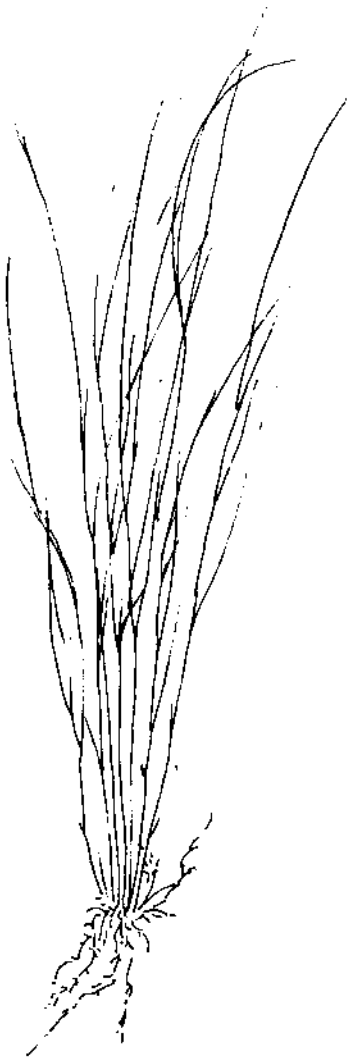
RIBBED MUSSEL (*Geukensia demissa*) – This common bivalve is usually found in clumps, embedded in the marsh mud around the stems or roots of the cordgrass, where it attaches with fibrous extensions from the hinge area known as byssal threads. The mussel is more often exposed to air than it is submerged in water, and when it is exposed, it gapes and breathes air. This helps to keep the animal cool in the hot summer marsh. The mussel is a filter feeder which strains plankton and detritus from the water when it is submerged.

OYSTER (*Crassostrea virginica*) – The most sedentary of our common mollusk species, the young oyster attaches itself to a hard surface, usually other oysters, and remains there permanently. The oyster is a very important commercial species, and is considered by many to be a delicacy. It is a filter feeder that opens its shells only when submerged to filter plankton from the water. The shells are tightly closed at low tide.

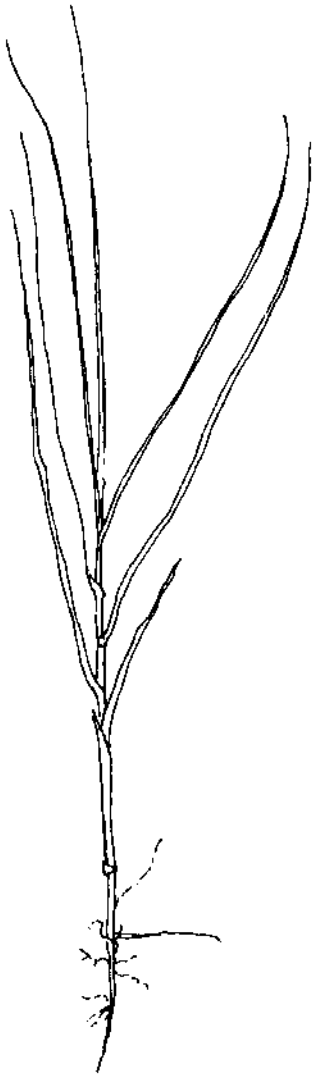
BLUE CRAB (*Callinectes sapidus*) – Another common coastal resident which occurs in both the ocean and the estuary during its life cycle. The adults spawn in the ocean, and the larvae are swept into estuaries, the nursery grounds for the developing young. Blue crabs constitute an important commercial fishery in South Carolina, and are collected recreationally as well. The blue crab is an opportunistic feeder, consuming both live and dead animals.

SNOWY EGRET (*Leucophoyx thula*) – A relatively small heron with a white body and black legs and bill. The feet of this bird are bright yellow, and it is said that the snowy wiggles its yellow toes to attract the fish it enjoys eating. The snowy also feeds on shrimp, crabs and insects. The snowy egret has a distinctive tuft of feathers on the back of its head which almost condemned this species to extinction. Hats were made at the turn of the century using egret feathers, and it wasn't until a strong conservation effort ceased this practice that the snowy began to make a comeback.

GREAT BLUE HERON (*Ardea herodias*) – The tallest of all common waders, the great blue heron can grow to four feet. The body is a distinctive bluish gray and the crown is white, bordered by black feathers. The great blue heron feeds on small fish, snakes, mice and other small creatures of the marsh. It is a common and beautiful sight in South Carolina marshes and mud flats.

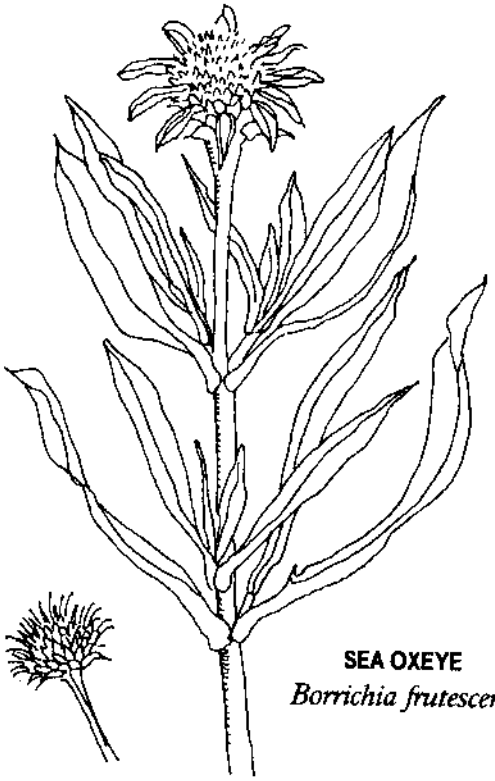


SALT MEADOW HAY
Spartina patens

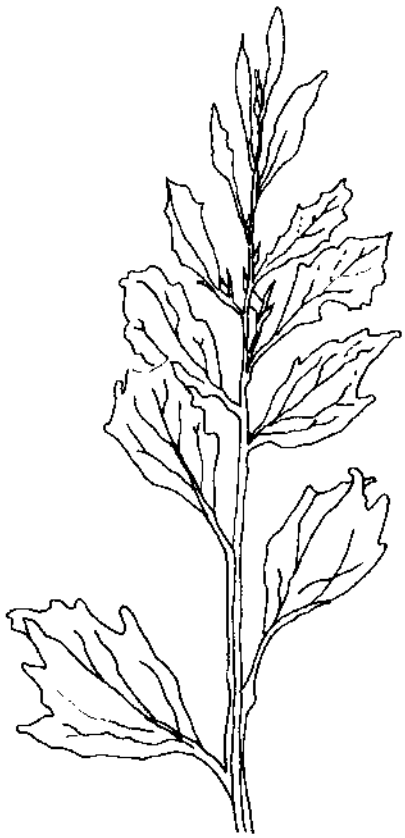


SALT MARSH CORDGRASS
Spartina alterniflora

NEEDLE RUSH
Juncus roemerianus

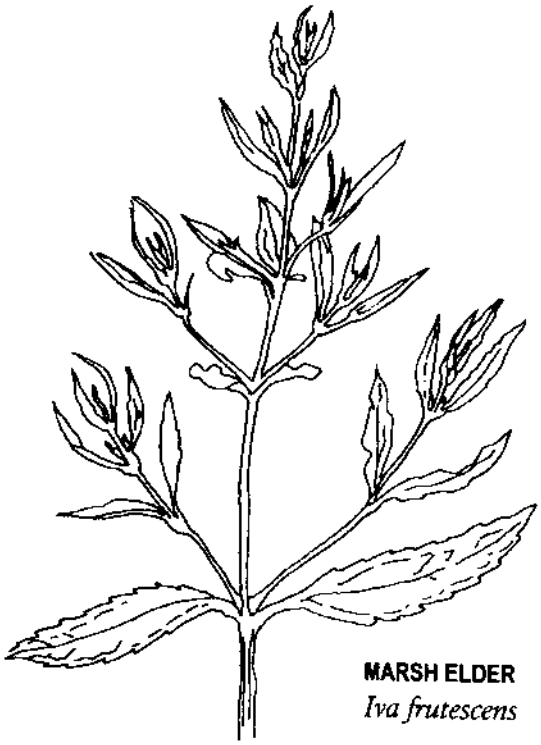


SEA OXEYE
Borrichia frutescens



SEA MYRTLE
Baccharis hamilifolia

PICKLE PLANT/GLASSWORT
Salicornia spp.



MARSH ELDER
Iva frutescens

OYSTER
Crassostrea virginica

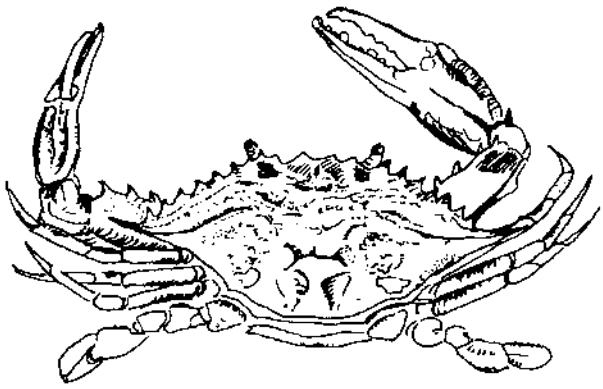
SQUARE BLACK/WHARF CRAB
Sesarma cinerea

RIBBED MUSSEL
Geukensia demissa

PERIWINKLE SNAIL
Littorina irrorata

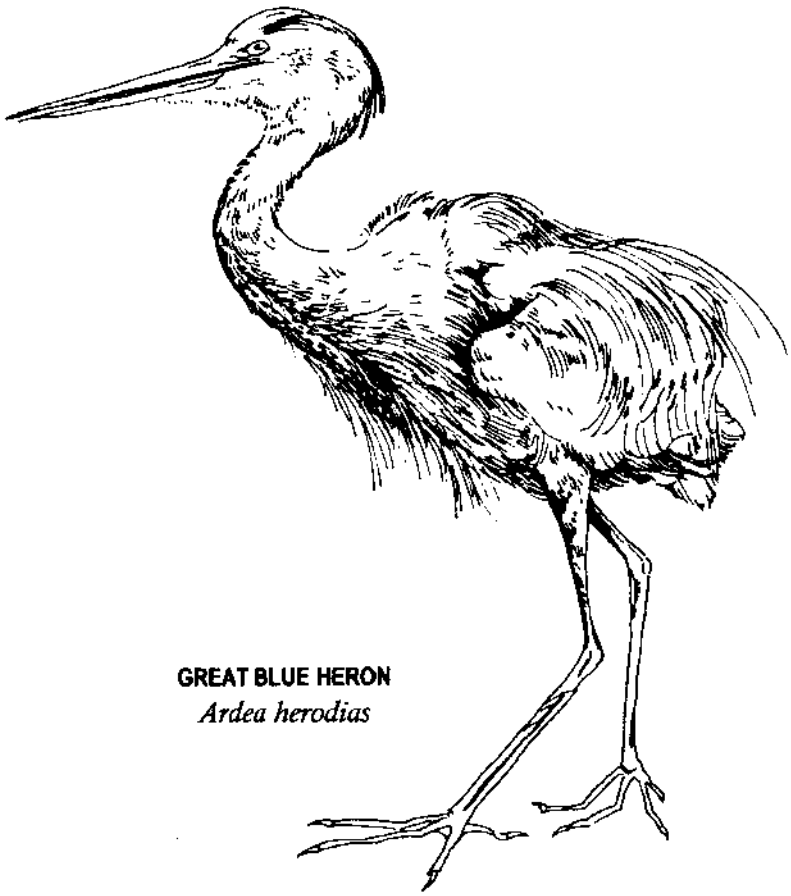
CHINA BACK/SAND FIDDLER
Uca pugilator

MUD SNAIL
Ilyanassa obsoleta

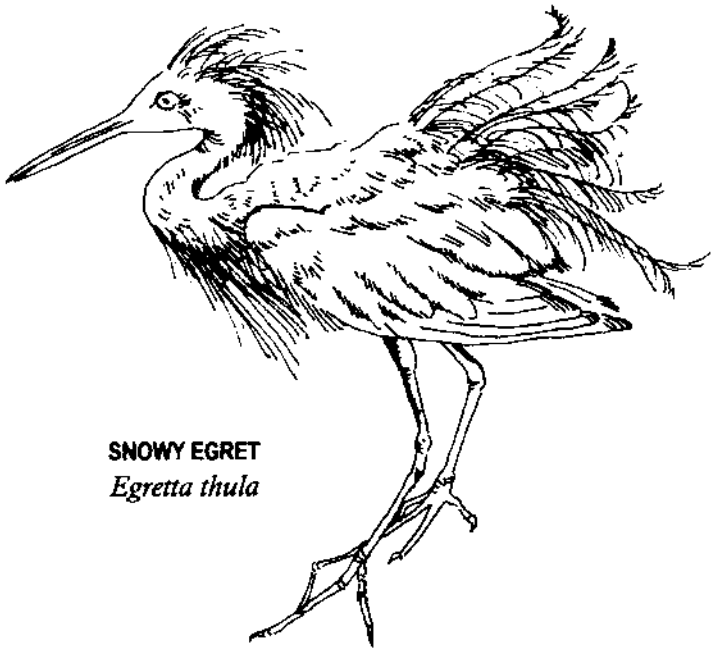


BLUE CRAB
Callinectes sapidus

SHRIMP
Penaeus spp.



GREAT BLUE HERON
Ardea herodias



SNOWY EGRET
Egretta thula

Food Relationships

1. PRODUCERS – Green plants that trap and store energy from sunlight, which is the original energy source upon which all life depends. Plants use the process of photosynthesis to sustain themselves as well as the consumers that eat them. Producers in coastal communities consist of phytoplankton, algae and rooted plants, such as *Spartina*.

2. CONSUMERS – Animals which eat plants (herbivores), animals (carnivores) or both (omnivores). There are numerous examples of consumers in coastal communities - fish, birds, humans, microscopic zooplankton, etc. Marine consumers utilize many different types of feeding habits:

Food capturers – Predators which actively chase their prey, examples – pelican and shark

Food finders – Either graze over surfaces, scraping off attached organisms, or move slowly and scavenge food, examples – periwinkle snail and blue crab

Deposit feeders – Feed on materials that have settled to the bottom, example - mud snail

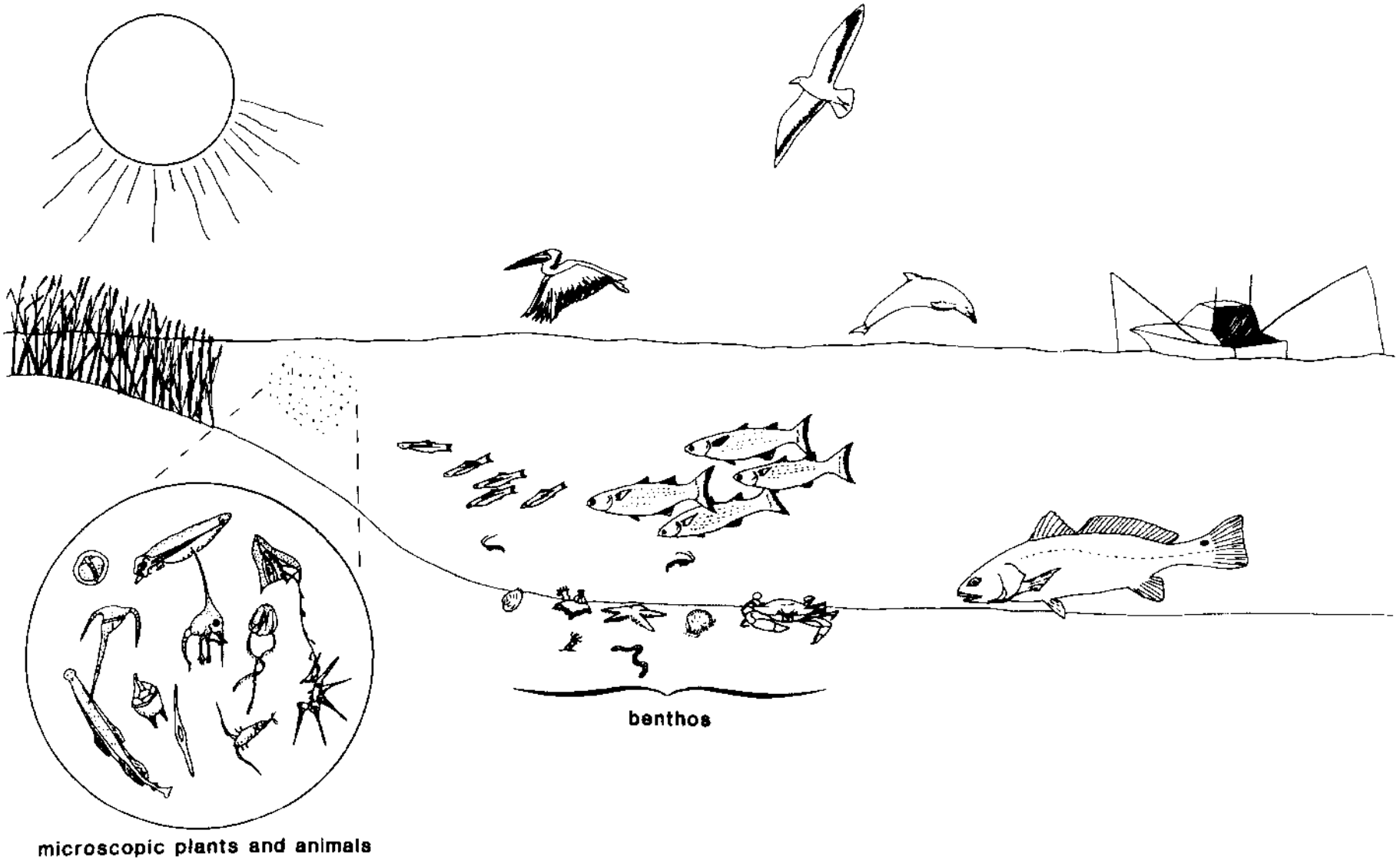
Filter feeders – Animals which eat suspended particles, usually plankton, by extracting them from the water column, examples – clam, oyster, mussel

3. DECOMPOSERS – The final link in the food web cycle, decomposers break down plant and animal organic tissue and return inorganic materials to the environment. Bacteria and fungi are common decomposers. Through a complex process that also involves scavengers, the break down is completed and inorganic materials are made available to plants for photosynthesis. In this way, the cycle of energy and nutrients through the community begins again.

4. FOOD CHAIN – The exchange of food energy between organisms. This transfer begins with producers such as plants who use the sun's energy to make their own food, and is passed on in turn to the consumers. These consumer organisms cannot make their own food and must therefore eat producers to receive their food energy. Each step in a food chain is called a trophic level. At each trophic level, numbers of organisms usually decrease and individual size increases.

5. FOOD WEB – The complex cycle of interactions that makes up the flow of energy and food through a natural community of organisms. Energy is passed through the community by means of feeding relationships, and each species plays a role that fits into the cycle. The three basic types of organisms comprising a community are producers, consumers, and decomposers.

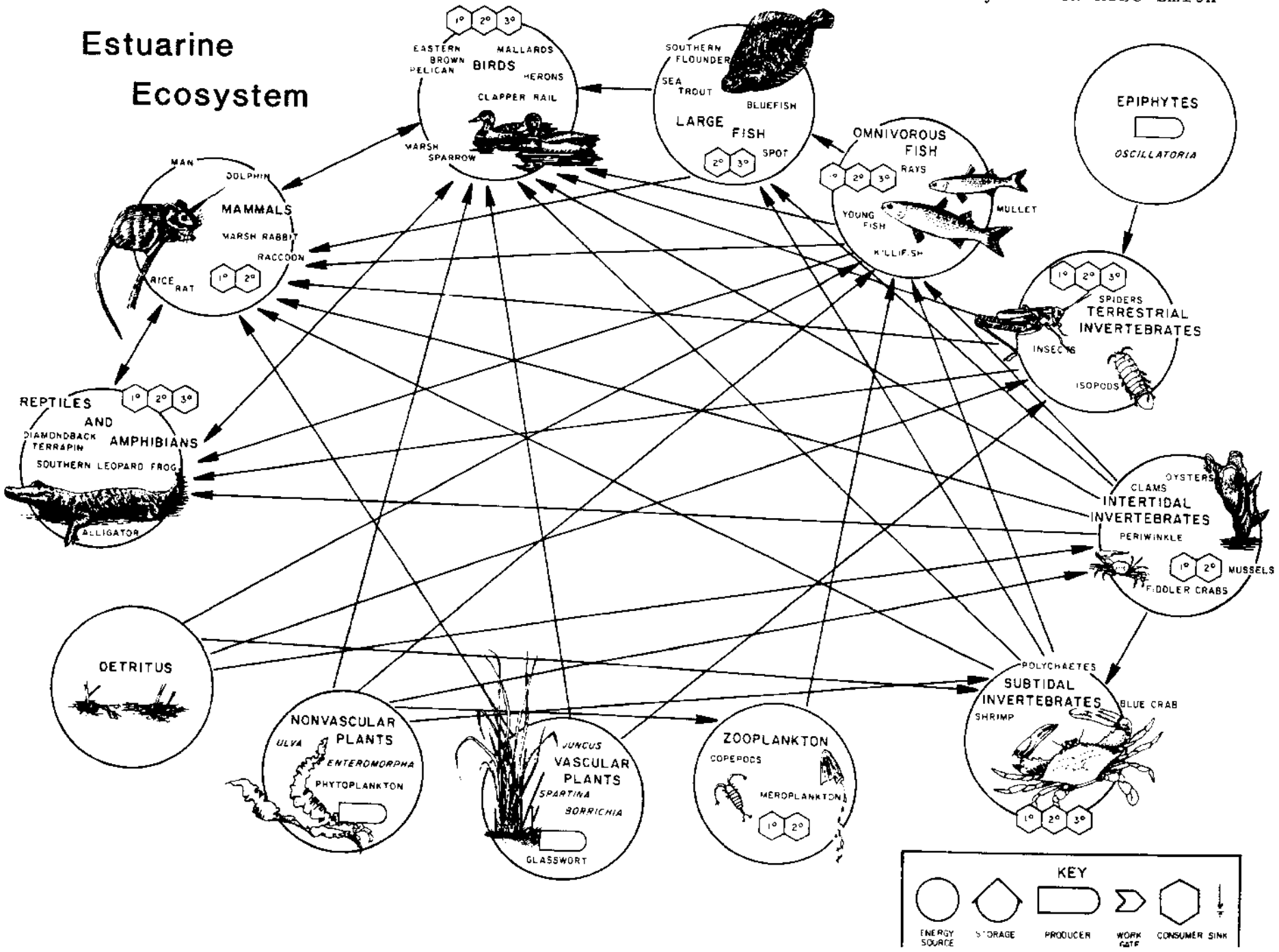
ESTUARINE FOOD WEB DIAGRAM



Graphics by Karen R. Swanson

Estuarine Ecosystem

Illustrated by Amelia Rose Smith



Marsh Munchers

OBJECTIVE

Students will be able to identify a food web in a salt marsh.

METHOD

Students will use body movement and pantomime to simulate the feeding motions of marsh animals and identify their interconnectedness in a food web.

BACKGROUND

A salt marsh is an important environment between the land and the sea. It is a place where fresh water and salt water come together to form a unique habitat for wildlife. Life forms in salt marshes are often more complex and diverse than in other habitats because of the mixture of both fresh and salt water. However the organisms found in salt marshes are often abundant. In warmer climates, mangrove trees are the dominant plants. But with the presence of trees the areas are commonly called swamps. Grasses dominate marshes. Salt marshes can be huge, with acres of grass resembling a flat pasture. Salt marshes occur in temperate regions and are one of the most productive ecosystems on earth, producing up to two times as much plant food as the most fertile agricultural lands. Salt marshes can be compared with coral reefs in terms of productivity.

The main producer for this important ecosystem is salt marsh grass which grows and actually thrives in the nutrient-rich waters of estuaries where salt water from the ocean mixes with freshwater from land drainage. A salt marsh is always producing new grass as old grass dies. Bacteria promote the decay of the marsh grass which in turn produces detritus (di-try-tus). Detritus is dead and decaying plant or animal matter. Fiddler crabs, snails, small shrimps, and some fishes like minnows feed on decomposed marsh grasses. Oysters and clams filter detritus and tiny living plants from the water. These detritus eaters serve as food for crabs, birds, and a variety of fishes including flounder, red drum, and striped bass. In fact, it is estimated that more than 70% of the fish that are caught commercially spend at least part of their lifetimes in the marsh system. Its flat expanses of wet grasslands hide the remarkable dynamics of a profuse habitat! It is truly a nursery for dozens of life forms.

Countless numbers of birds are also dependent on salt marshes for food and nesting areas. Fish hawks, sandpipers, and members of the heron family can be seen feeding along the marsh creeks during the spring and summer while ducks and marsh hawks are common sights in the winter months. Some birds - including clapper rails, terns, and red-winged blackbirds - build nests and raise their young in salt marshes. Raccoons are common predators which feed on nearly everything present.

The salt marsh environment is threatened by coastal development and pollution. The salt marshes, like other wetlands, seem likely areas for landfill and drainage as well as for other uses - and yet they are important ecological systems.

The major purpose of this activity is for students to learn about marshes, also reinforcing their understanding of the concept of a food web.

Note: Since this is a simulation, some of the animals' roles are simplified. In actual salt marshes, some animals have several roles. For the purposes of this activity, we have identified one dominant role for each animal to portray.

MATERIALS

timer; construction paper for tokens in five colors: white, green, yellow, blue, red; predator feeding behavior cards and detritus eater cards (master provided); one envelope per student

Note: This activity is written for an estimated 25 students with 1/5 of the class designated as predators and 4/5 detritus eaters.

PROCEDURE

1. Cut the appropriate colored construction paper into food tokens, according to the table below. Reproduce the feeding behavior cards (5 predator cards, 20 detritus eater cards). Put appropriate feeding behavior cards and food tokens into envelopes.

TABLE OF MATERIALS TO BE PREPARED AND PLACED IN ENVELOPES
(1 envelope per student representing 1 predator or detritus eater)

Predators	Feeding Behavior Cards	Colored Food Tokens
1 raccoon	1 each	
1 blue crab	1 each	
1 red drum fish	1 each	
1 egret	1 each	
1 person	1 each	
Detritus Eaters		
4 fiddler crabs	1 each	5 RED tokens each (20 total)
4 snails	1 each	5 BLUE tokens each (20 total)
4 oysters	1 each	5 YELLOW tokens each (20 total)
4 juvenile fish	1 each	5 GREEN tokens each (20 total)
4 shrimp	1 each	5 WHITE tokens each (20 total)

2. Describe the salt marsh habitat in terms of the plants and animals that live there. Also discuss the importance of salt marshes with emphasis on their high productivity as a place for animals and plants to live. Describe the role of detritus in the marsh food web. Mention decomposers and their importance. If appropriate for your students, introduce the terms "predator" and "prey" and "producers" and "consumers". Look at the plants and animals in the salt marsh, and emphasize the unusual relationship between fresh water and tidal salt water as found in this habitat.

3. Explain to the students that they are going to participate in an activity that will help them understand the salt marsh better.

4. Pass out one envelope to each student. Explain that their identity is a secret - they are not to tell others. Each envelope contains the identity of one animal that lives in a salt marsh. The only way others will know what they are is by the way they feed. When they receive their envelopes, explain that some students will be detritus eaters, and others will be predators who prey on the detritus eaters.

5. Have the students open their envelopes and see what animal they are and what feeding behavior they use. Remind them not to tell what they are. They have to indicate what they are by their feeding behavior. Emphasize that they are people pretending to be animals and humans will not be able to move exactly like animals.

Optional: If you feel it would be helpful, model each behavior first and identify it so the students will know what animal does what. However, it may be more productive to allow the students to improvise.

6. Explain the rules:
- Each student represents a detritus eater or a predator.
- Each detritus eater has 5 food tokens, representing 5 individual marsh animals of the same species.
- The detritus eater must give a food token to a predator when tagged.
- Each predator must get 10 food tokens to stay alive during a tidal cycle.
- A tidal cycle is one playing period of the game.
- Each predator can only get one token from each detritus eater at any one time in a tidal cycle, but needs to get as many prey as possible during the tidal cycle.
- Detritus eaters keep eating even after prey eat them. They represent the remaining animals of that species, until they run out of food tokens. When they run out of food tokens, they sit quietly in place – "decomposing" in the marsh.
- Detritus eaters and predators must display their feeding styles during the activity.
- Detritus eaters will show their feeding styles from stationary squat positions while predators will walk and display their behaviors.

7. Establish a play area (inside classroom or outside) and have all detritus eaters take their envelopes with them, spread out on the playing field, and start pantomiming their feeding behaviors.

8. Tell predators to begin to pantomime their respective feeding behaviors, capture their prey, and secure a food token from them, placing it in their envelope.

9. Call time when appropriate (after most predators have gotten 10 food tokens).

10. Tell students to hold onto their food envelopes so that they can participate in the discussions.

11. Discuss the results. Did every predator fill up by getting 10 food tokens during the tidal cycle? If not, why not? (Some animals are more selective in their feeding preferences, and therefore may have a more difficult

time finding food.) Talk about the different ways the animals are connected to each other and the detritus. Mention that decomposers break down plants and animals to produce the detritus. Be sure the supporting role of the producers, the plants that become the detritus, does not get overlooked by the high activity of the consumers.

12. Draw a food web based on what feeding interactions took place during the game. Add the plants which are broken down by decomposers to produce detritus.

13. Collect the envelopes, and put the color-coded tokens back in their original envelopes.

14. Optional: Shuffle the envelopes and redistribute them to the students. Replay the simulation and draw a second food web. Compare and contrast the food webs.

15. Summarize by emphasizing the importance of salt marshes. Salt marshes provide habitat for a variety of different kinds of animals. They are unusually productive habitats, growing large amounts of vegetation - especially marsh grass.

EXTENSIONS

1. Draw or paint a food web of a salt marsh as a mural. Be responsible for drawing an accurate portrait of each animal. Place each drawing in the appropriate place in the cycle. With yarn, connect each animal with what it eats.

2. If possible, visit a salt marsh.

3. Modify this activity to illustrate a freshwater marsh.

EVALUATION

Give examples of two predators and two prey species that live in salt marshes.

Use some of the organisms listed below, and others of your choice, to construct a food web that might be found in a salt marsh: people, raccoons, marsh grass, bacteria, snails, oysters, detritus, young fish, egret.

Age: Grades 3-6
Subjects: Science
Skills: analysis, classification, description, discussion, drawing (limited), generalization, identification, interpretation, kinesthetic concept development, listening, observation, psychomotor development, reading (limited), synthesis, using time and space, visualization, writing (limited)
Duration: 20-60 minutes
Group Size: designed for 25 students: can be adapted for smaller or larger groups
Setting: outdoors or large indoor playing area
Conceptual Framework Reference: III.A., III.A.1., III.A.2., III.A.3., III.B., III.B.1., III.B.2., III.B.3., III.B.4., III.C., III.C.1., III.C.2., III.C.3., III.C.4., III.D., III.E., III.E.1., III.E.2.
Key Vocabulary: salt marsh, food web, decomposer, detritus. optional: predator, prey, producer, consumer

Person Fishing Student walks forward casting line, and tags prey by grasping on the shoulder.

Blue Crab Student walks sideways, waving arms like claws and grasps prey.

Raccoon Student walks forward washing hands and grasps prey.

Red Drum Fish Student walks with hands held forward like a mouth, and grasps prey.

Egret Student struts with hands on hips, so elbows are like wings. Nearing prey, arms become a beak to grasp prey.

MASTER FOR MARSH MUNCHERS

Juvenile Fish Gulps down detritus particles in the water or on bottom. (Student puckers lips and makes sucking noises while feeding.)

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Shrimp Stirs up mud and detritus with walking legs which lifts particles to mouth. (Student makes stirring motions with both arms.)

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Snail Licks up detritus with specialized tongue called radula. (Student displays licking motion, using one hand as the radula.)

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Oyster Filters detritus from water using gills. (Student waves arms back and forth in air.)

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Fiddler Crab Picks detritus from sand with one or two claws. (Students pick objects from floor with thumb and fingers of hands acting as claws.)

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SCIENCE CORRELATIONS
Activity Cross Reference

	ACTIVITY		
	Wetland Metaphors	Marsh Habitat Study	Marsh Munchers
CN CONCEPTS			
CN1 Life Science			
CN1-A Characteristics			
CN1-A1 Living things			
CN1-A2 Animals			
CN1-A3 Plants			
CN1-B Interdependence			
CN1-B1 Basic needs	★	★	★
CN1-B2 Interactions		★	★
CN1-B3 Food relationships	★	★	★
CN1-B4 Adaptations		★	
CN1-C Change			
CN1-C1 Growth and development			
CN1-C2 Populations/communities		★	
CN2 Earth-Space Science			
CN2-A Properties			
CN2-A1 Air			
CN2-A2 Water	★		
CN2-A3 Land	★		
CN2-A4 Earth's crust	★		
CN2-A5 Earth's interior			
CN2-A6 Earth's history			
CN2-A7 Solar system			
CN2-A8 Universe			
CN2-B Interactions			
CN2-B1 Air			
CN2-B2 Water			
CN2-B3 Surface processes			
CN2-B4 Interior processes			
CN2-B5 Weather			
CN2-B6 Earth, moon, sun			
CN3 Physical Science			
CN3-A Properties of matter, forces and energy			
CN3-A1 Properties of matter			
CN3-A2 Forms of matter			
CN3-A3 Properties of forces			
CN3-A4 Properties of energy			
CN3-B Interactions of matter, energy and forces			
CN3-B1 Forces involving matter and energy			
CN3-B2 Physical and chemical changes			
CN3-B3 Energy changes			
PR PROCESS SKILLS			
PR1 Basic			
PR1-A Observing	★	★	
PR1-B Classifying	★	★	★
PR1-C Inferring	★	★	
PR1-D Predicting		★	★
PR1-E Communicating	★	★	★
PR2 Integrated			
PR2-A Generating questions			
PR2-B Identifying necessary information			
PR2-C Identifying variables			
PR2-D Formulating hypotheses			
PR2-E Defining variables operationally			
PR2-F Strategies to test a hypothesis			
PR2-G Interpreting data/drawing conclusions			
ST SCIENCE AND TECHNOLOGY			
ST1 Basic Concepts and Relationships			
ST1-A Concepts about technology			
ST1-A1 Characteristics			
ST1-A2 Development			
ST1-B Relationships b/w science and technology			
ST1-B1 Science to technology			
ST1-B2 Technology to science			
ST2 Relationships B/W Science/Technology and Self, Society and Environment			
ST2-A Relationship of science/technology to self, society and environment			
ST2-A1 Science/technology to self and society	★		
ST2-A2 Science/technology to environment	★		
ST2-B Relationship of self and society to science/technology			
ST2-B1 Self to science/technology	★		
ST2-B2 Society to science/technology	★		
NS NATURE OF SCIENCE			
NS1 Basic Concepts			
NS1-A Characteristics of science knowledge			
NS1-A1 Based on observations and data	★	★	★
NS1-A2 Tentative			
NS1-A3 Represented by models	★		★
NS1-B Development of science knowledge			
NS1-B1 Begins with discoveries	★	★	★
NS1-B2 Systematic approaches			
NS1-B3 Repeating investigations			
NS1-B4 Uses previous results			
NS1-B5 Benefits from review and discussion			