

Activity 2: Water Quality Tests

Using the water test kits provided, test the **pH, dissolved oxygen, and salinity** of the brackish pond. When you reach the large (2nd) boardwalk, if the tide is high enough test the salt water at the end of the railing to the right. Use a bucket to retrieve water for testing. Compare readings from water quality tests for brackish and salt water.

	Brackish Water	Salt Water
pH		
Dissolved oxygen		
Salinity		

After sampling salt marsh for organisms (Activity 3), compare animals found with those found in brackish, referring to the salinity chart.

Table 1 Approximate salinity is in parts per thousand (ppt) for fresh, brackish, salt, estuary, and ocean water and possible plant and animal species present.

Freshwater 0-5 ppt - frogs, tadpoles, painted turtles, beaver, pond lilies, cattails, fish, water bugs.

Brackish water 6-11- ppt - overlapping of species from fresh and salt water, particularly from salt.

Salt marsh water 11-25 ppt - cordgrasses (spartina species), crabs (blue, marsh, fiddler), diamondback terrapin, killifish, sheephead minnows, mummichug, grass shrimp, and perch.

Delaware Estuary can range from 0-35 ppt. The ocean is 35 ppt on the average, but oceanic salinities vary with depth and latitude. The further south on the bay the saltier the water. The salinity of the bay can vary depending on drought or rain; for example, the bay will be more fresh after much rain, and saltier after a drought.

Some animals, such as muskrats, otters, ducks and geese, northern water snakes, snapping turtles, and raccoons can be found in fresh and salt marsh areas regardless of the salt content. Animals which are strictly freshwater species would not be found in salt water because their bodies cannot tolerate salt. Use the key provided to identify the animals you found today.

Activity 4:

Identifying Plants of the Tidal Salt Marsh

You may have heard it said “eight percent of the Diamond State’s area is made up of wetlands.” The greater proportion of these wetlands are salt rather than fresh marshes. These saltmarshes represent Delaware’s “Last Frontier,” and one of the sadder aspects of 21st century living is witnessing the gradual disappearance of the black duck, the otter, the muskrat, the clapper rail, the marsh hawk and their habitats. Let’s look at some of the plant species which comprise a typical salt meadow community.



Switchgrass
(Panicum virgatum)

On that indefinable area between upland and marshland, sometimes wet, sometimes dry, flooded by storm tides only, occurs the gunner’s friend, **Switchgrass** (*Panicum virgatum*), ideal for blind construction, this plant maintains good game cover along the upland marsh margins throughout the year. Height to about 5 ft.

In scattered patches throughout the marsh and along gut and pond edges occur the two tall grasses of the saltmarsh, **Big Cordgrass** (*Spartina cynosuroides*) (7 ft) and **Giant Reed** (*Phragmites communis*) (9 ft). They are easily separated by their inflorescences, or heads; open in the *Spartina cynosuroides* and feathery in the *Phragmites communis*.



Big Cordgrass
Spartina cynosuroides



Giant Reed
Phragmites communis



Just within the upland margins, on higher tidal ditchbanks, mosquito control ditchbanks, and higher marsh elevations grow the “myrtle bushes” of the Bay folk. **Marsh Elder** (*Iva frutescens*) is one of the species that makes up the upland margins.

Marsh Elder
(Iva frutescens)



Groundselbush (*Baccharis halimifolia*) is another species that makes up the upland margin. Alternate branching and leaf shape easily distinguish the groundsel from the Marsh Elder. Height averages 5-6 ft.

Groundselbush
(*Baccharis halimifolia*)

Saltmarsh cordgrass
Spartina alterniflora



Covering extensive areas and occurring on regularly inundated portions of the marsh is **Saltmarsh cordgrass** *Spartina alterniflora*. This plant attains its best growth (+5 ft.) on “deep” marshes and along the inner margins of tidal guts. Its leaves tend to in-roll even more than the other cordgrasses. The three cordgrasses shown here comprise 75% of the vegetation of Delaware’s coastal marshes.



Another dominant species, **Saltmeadow cordgrass** *Spartina patens* (to 2 ft.) occurs also on regularly flooded areas, but of slightly higher elevations than saltmarsh cordgrass.

Saltgrass
Distichlis spicata

Saltgrass *Distichlis spicata* (1 ft.), although not nearly as common, very often occurs simultaneously, the two collectively (or individually) being known also as “Salthay.” The inflorescence and “close-in” branching of saltgrass will separate these two commonly associated plants.



Saltmeadow cordgrass
Spartina patens

Activity 5: Wetlands -- The Nutrient Trap

Background Information: Where do nutrients come from? Nutrients are a natural part of plants and animals -- when they die and decompose, the nutrients are returned to the soil and water, where they can be “recycled” by other living things.

People also put nutrients on the land, in the soil, and in the water. Ask: *Who has ever walked their dog? -- gone to the bathroom? -- fertilized their lawn or garden?* Human and animal wastes contain nutrients like nitrogen and phosphorus, and they often end up in the water from these sorts of activities.

Too many nutrients make the water unhealthy. When soil washes away and ends up in the water, two forms of pollution result: muddy, cloudy water (too much sediment), and pea soup (excess algae)! *What are some ways that soil washes off of the land?* There are many answers: rain picks up loose soil (from construction, bare lawns, bare spot under downspouts, etc.); river and streams carve and carry away soil from their banks; etc.

Wetlands trap soil and nutrients and help to keep them out of the water. Runoff is filtered as it passes through wetlands on its way to waterbodies. Water in streams and rivers is cleaned as it flows through wetlands. The following game will demonstrate this function.

Let's Play the Nutrient Game!

Take the class outside or to a large play area. Divide the class into two teams: **Team 1** will be “plants growing in a wetland,” and **Team 2** will be “soil particles with nutrients attached” -- this team will wear a nutrient tag (a colored tag with N or P printed on it). Explain the rules and play a few rounds.

Repeat the game several times, using student suggestions for modifying the plant spacing to change the results. Keep count of the number of rounds required to complete each game with the modified spacing. Give each student a chance to play both roles.

After the game, discuss the roles played and relate the results of the rounds to what actually happens when it rains or when water flows through a wetland.

Rules of the Game:

- The plants form an irregular line at one end of the field, spaced so their outstretched arms do not touch.
- The area behind the plants is designated as the waterway.
- The soil particles line up facing the plants and, on signal, must make their way to the waterway without being touched by a plant. The soil particles must drag one foot as they run or hop on one foot (so they don't move too quickly).
- The plants may bend, stretch, and stoop, but may not move their feet (“roots”) in order to tag the soil particles. Soil particles may not go around the end of the plant line.

- When a soil particle is tagged, he or she becomes a plant at the exact spot, and must remove the nutrient tag and give it to another plant (plants use up nutrients).

- Any particles that escaped to the waterway will then go back to the starting line and, on signal, will try to “safely” pass through the wetland again. The game continues until all of the particles have been caught.

Discussion:

Were the plants able to trap more particles in areas where they grew closer together?

What happened when there were gaps or bare spots in the line of plants? Would it have helped if you had more plants?

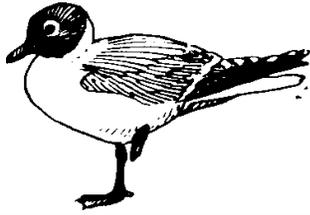
Why are shoreline or wetland plants important to the water that they border?

Why is it important to plant and maintain plants anywhere, even on lawns and areas near pavement? -- Plants hold soil in place and keep it from washing away. They also help to use up nutrients and filter pollutants, just as wetland plants do. Any place that has plants growing on it, instead of being paved, will help to reduce the amount of runoff that flows off the the land.

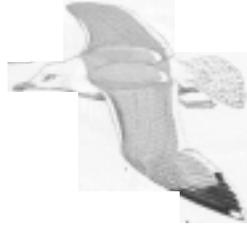
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Salt Marsh and Bay Identification Key

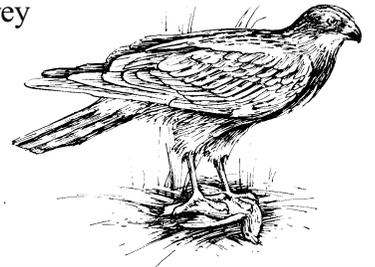
Laughing gull



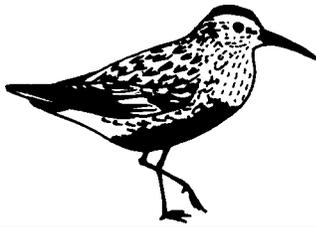
Herring gull



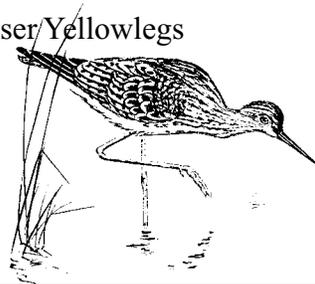
Osprey



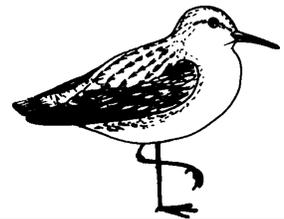
Dunlin



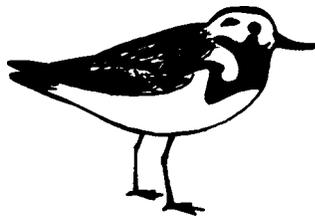
Lesser/Yellowlegs



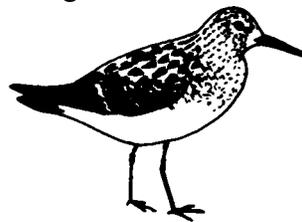
Red knot



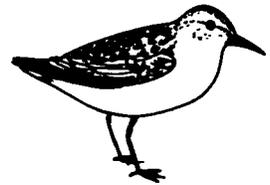
Ruddy Turnstone



Sanderling



Semipalmated sandpiper



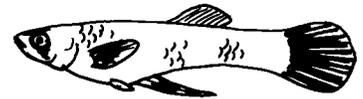
Great blue heron



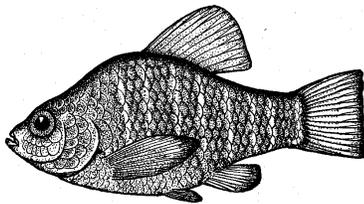
Silverside



Mummichug



Sheephead minnow



Killifish



Moon Jellyfish



Terrapin turtle

