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Ohio Sea Grant

OEAGLS-Oceanic Education Activities for Great Lakes Schools

THE ESTUARY: A SPECIAL PLACE

by

Rosanne Fortner, The Ohio State University
and
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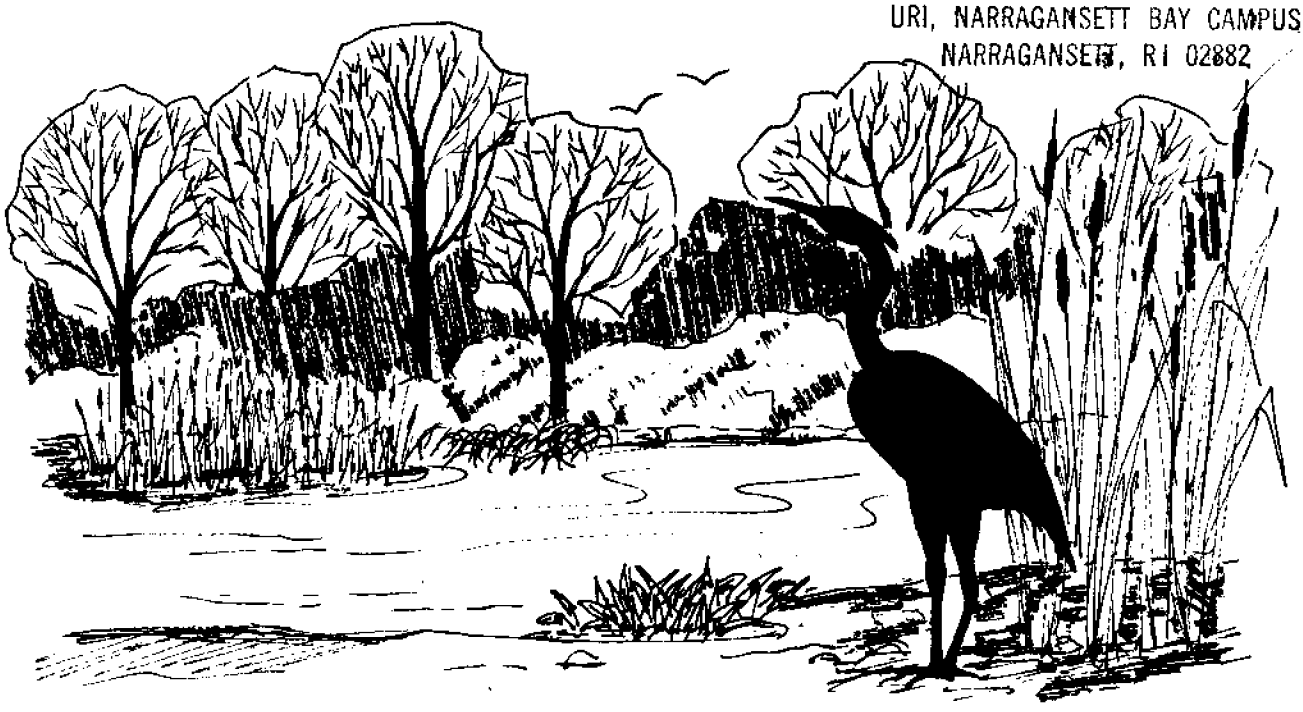

Ohio Sea Grant Program
Charles E. Herdendorf, Program Director
Victor J. Mayer, Principal Investigator

OEAGLS Investigation #20
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Published by Ohio Sea Grant
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THE ESTUARY: A SPECIAL PLACE

INTRODUCTION

To most people, an estuary (es-chew-airy) is the place where fresh water meets the sea. In its larger meaning, an estuary is that part of the mouth of a stream in which the water level is influenced by the lake or sea into which the stream flows. The Great Lakes have some estuaries. Old Woman Creek on Lake Erie has an estuary that has been set aside by the state and federal governments as a "national estuarine sanctuary."

Why should the government bother to preserve an estuary like Old Woman Creek? There are many reasons.

1. The estuaries of the world serve as the breeding grounds for many important animals that live in deeper waters.

2. An estuary has a wide variety of habitats available for wildlife to use as nesting and feeding sites.

3. The sediments and waters of an estuary are places where nutrients are recycled, where the basic things needed for life are made available to organisms.

4. Estuaries serve as a buffer zone to prevent pollutants from the land from entering the lake or ocean and to lessen the effects that flooding and water level changes would have on the land.

5. Estuaries are "endangered environments," not only because of their buffering effect, but also because their quiet waters and nearness to lakes or oceans makes them attractive as places for marinas, homesites, and tourist-type developments. Few estuaries still exist in their natural condition.

In this investigation you will examine some of the characteristics of the estuary at Old Woman Creek to learn something of the importance of estuaries worldwide.

OBJECTIVES

When you have completed this investigation, you will be able to:

1. Describe the methods used by ecologists to sample populations of plant and animal life in the water.

2. Give a general description of the plant communities that are found in different depths of water in an estuary.

3. Explain how plant communities are important to animal life in the estuary.

4. List the types of organisms that are found as plankton in an estuary.

5. Predict the effects of some human and environmental forces on conditions in an estuary.

ACTIVITY A

WHAT IS THE ROLE OF PLANTS IN AN ESTUARY?

An estuary contains some areas that are almost always under water, some areas that are almost always dry land, and some areas between those two extremes. Each of these types of environments has a set of plants that can survive best under the given conditions, and each set of plants has a special role to play in the estuary.

MATERIALS

Colored pencils, ruler

PROCEDURE

A. Figure 1 is an aerial photograph of the Old Woman Creek estuary, east of Huron, Ohio.

Figure 1.

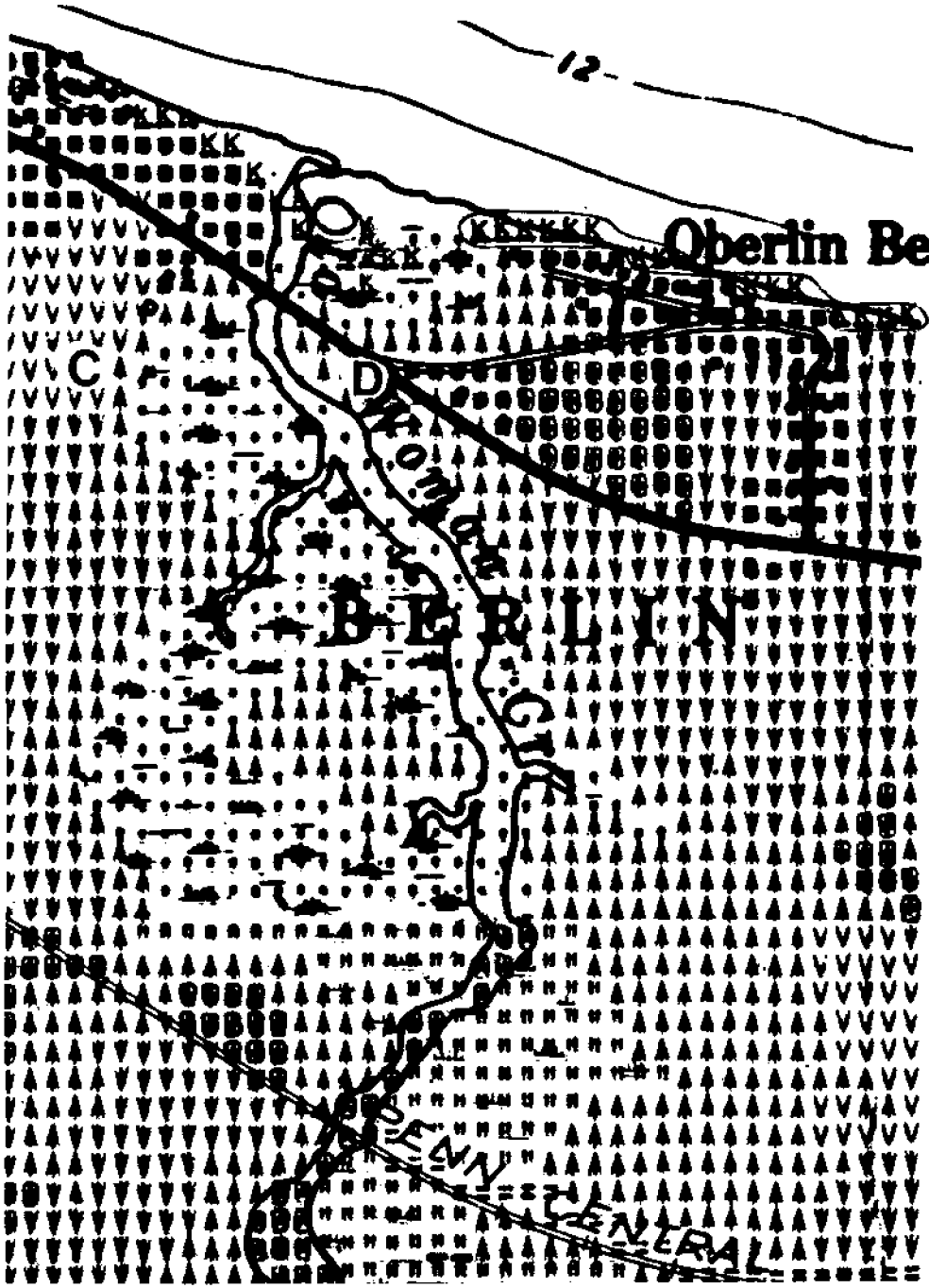


Figure 2. Computer map of Old Woman Creek

Figure 2 shows the land use and plant types (vegetation) in the same area. Each symbol drawn by the computer stands for the main characteristic of an area equal to about ¼ of an acre (about 930 square meters).

COMPUTER MAP SYMBOLS

- ▪ homes (residential area)
- ⊞ rangeland (cattle grazing, unused fields, etc.)
- ♣ deciduous forest
- ▣ stream or canal
- •• open water
- " non-forested wetlands
- ⁂ marsh or swamp
- ⁑ beach
- ⩛ row crops (corn, soybeans, etc.)
- ⩔ cover crops

With your pencil, outline the main parts of the Old Woman Creek estuary on the computer map.

1. Begin by outlining the beach areas (K). One beach that runs along the shore at Oberlin Beach has been outlined as an example. West of Oberlin Beach lies the mouth of Old Woman Creek, and another beach begins just west of that.

NOTE: The mouth of the creek (where it joins the lake) is drawn in one place near the word "Old," but there is really a sand spit there that shifts back and forth over the years. Figure 1, taken in 1976, shows another possible position of the spit.

2. The estuary itself is surrounded almost entirely by deciduous forest (▲). Look on either side of the creek and find the border of the forest. Draw a line that separates the forest from the estuary. You will also find a patch of forest just below the "B" in "BERLIN." Outline this forest with another line.

3. What three types of features (see symbols) are now shown to lie <u>within</u> the estuary itself? (Remember, the estuary is surrounded by deciduous forest, but the deciduous forest is not a part of the estuary proper.)

   a. _____

   b. _____

   c. _____

4. Use colored pencils to shade in the following features:

   green - forests on border of estuary and on the island

   blue - the open water of the lake and the main stream channel

   brown - the marshy and non-forested wetlands areas of the estuary

   yellow - the beach

   red - residential areas

B. Sampling the populations.

1. With your ruler, draw a line straight across Figure 2 between points C and D. This will be called your transect line. Ecologists (people who study about the environment) use a transect as a way to sample the populations of living things in a community. For example, by naming and counting the plants along a transect, they get an idea of what the whole plant community is like, without counting and naming every organism in the whole community.

2. Figure 3 represents your transect line and the plants that might be found along it. It is drawn as a profile, or side view, so you can tell where and how deep the water is. Figure 3 is four times as long as line C-D that you drew, so all its parts are four times bigger. Label the parts of Figure 3 to show the type of features from the computer map that your transect line crosses. Then turn to the Appendix on pages 17-18 for descriptions of the plants.

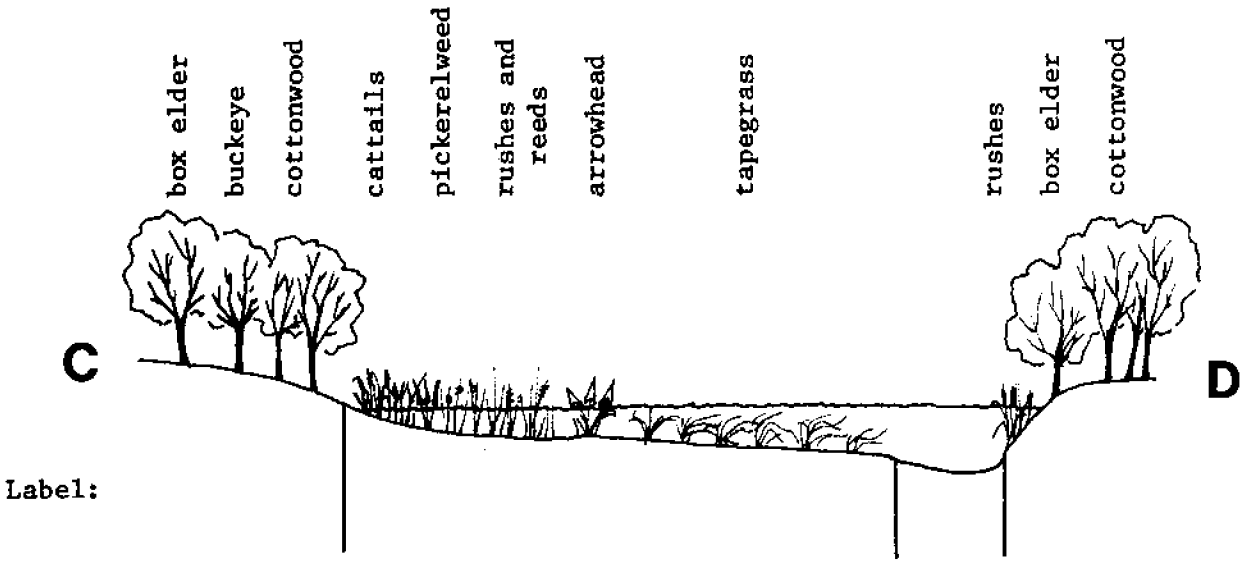


Figure 3. Transect and profile across Old Woman Creek Estuary

3. Which area of the estuary has plants rooted in fairly dry soil?

_____

What do these plants provide for the animals that live nearby?

_____

4. Which area(s) have plants with roots submerged (underwater) but leaves emergent (sticking out of the water)?

_____

Which areas have plants submerged? _____

Each of the areas crossed by the transect line is able to support a group of animals. Suppose the area is watched for one week. Figure 4 is a list of the larger animals that might be seen and their activities in each area.

Animal	Number seen in week	Area	Activity: Hunting	Eating	Reproducing	Hiding	Other
Raccoon	1	Forest edge		X			washing food
White-tail Deer	2	Forest		X		X	drinking
Fox	1	Forest	X	X			
Songbirds	21	Forest edge		X	X		nesting
Black Snake	1	Forest	X			X	
American Egret	8	Forest			X		nesting
American Egret	15	Marsh	X	X			wading
Green Heron	2	Marsh	X	X			wading
Kingfisher	4	Marsh	X	X	X		
Water Snake	1	Marsh	X	X			swimming
Seagull	4	Marsh		X	X		
Carp	8	Marsh		X	X		
Yellow Perch	60	Marsh		X	X		
Yellow Perch	12	Open water		X			swimming
Freshwater Drum	9	Marsh		X			
Gizzard Shad	~150	Marsh			X		swimming
Gizzard Shad	30	Open water		X			
Clam	17	Marsh mud		X	X		
Emerald Shiner	42	Open water		X			
Walleye	84	Marsh		X	X		

Figure 4: Animals' use of the transect area of Old Woman Creek Estuary

Remember, these plant communities and their animal visitors are only being sampled. There are many more organisms in the estuary than we have mentioned here.

5. In which part of the estuary would you find the largest number of animals?

_____

6. What are the two main activities carried on by animals in this area?

_____

7. Your answers to questions 4 and 5 should be the same. Why would an area with many aquatic (water) plants be visited by such a large number of different animals? (Hint: See the list of animal activities.)

_____

_____

8. Perhaps you have listed "eating" in some of your answers above. Which of the animals in Figure 4 might be using the marsh plants as food?

_____

9. What is the bottom of the estuary marsh probably like: Muddy? _____ Rocky? _____ Why do you think so? _____

_____

The plants in an estuary and the shallowness of the area tend to slow down the stream's flow. When water slows down, it cannot carry as much sediment. Much of the stream's load of sediment is, therefore, deposited in the shallow areas where plants are rooted in the water. Pollutants suspended in the water may also be trapped in the estuary this way.

10. Much of the Old Woman Creek area marked "marsh" on the computer map does not appear that way in Figure 1. An estuary isn't always swampy and a swamp isn't always an estuary.

    Look back at page 1 and find the "larger meaning" of the term estuary. Write that meaning below.

_____

_____

_____

11. Based on this definition, why doesn't the Figure 1 photograph show much swampy area?

_____

ACTIVITY B HOW DOES THE ESTUARY SERVE AS A NURSERY?

The plants along your transect line are not present in large enough amounts to supply food for all the animals visiting the estuary. There are tiny plants and animals as well, that can be eaten by the larger animals. Some of these tiny organisms can only be seen through a microscope.

We have noted that a number of animals reproduce in the marsh. Their young often stay in the estuary "nursery" for long periods of time to feed on the many plants available and to grow large enough to take care of themselves in the lake. The microscope can reveal these tiny animals.

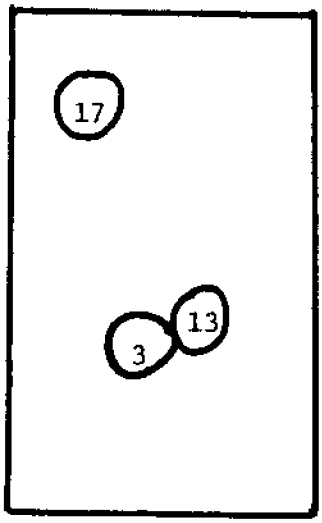
MATERIALS "Plankton samples" in Figures 6 and 7, rubber rings from canning jars (wide mouth, having an inside diameter of 7.4 cm), pencil

PROCEDURE A transect is only one method that ecologists use to sample a population. A sample can also be taken by randomly choosing an area of a certain size and counting all the organisms present. To see how this works, do the following:

1. Take a rubber jar ring and drop it anywhere on this page. Count the number of times the letter e appears in the circle.

2. Repeat this two more times. Add up your three counts and divide the total by 3. This gives you the average number of e's in an area of 43 cm^2 (the area inside the ring).

3. To estimate (make an educated guess about) the total number of e's on the page, multiply your average by 14, since the page is about 14 times as big as the area inside the circle.



$$\begin{array}{r} 17 \\ 13 \\ +\ \ 3 \\ \hline 33 \end{array}$$

$33 \div 3 = 11$ e's per circle

and

$11 \times 14 = 154$ e's per page

There are actually 168 e's on this page. If we combine the answers from your whole class, we should get something close to the actual number 168.

Now let's pretend that a jar of water has been collected from the Old Woman Creek estuary. It was collected in a special way. A plankton net (Figure 5) was towed behind a boat for about five minutes. The net had a jar at the end that caught all the tiny organisms in the water, while the water escaped through holes in the net.

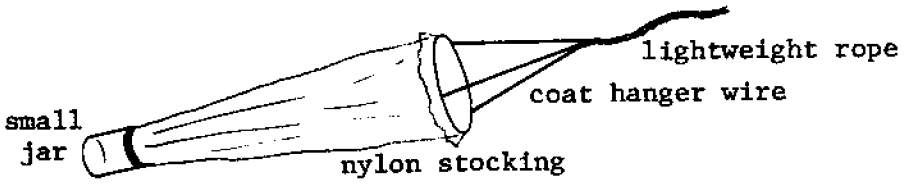


Figure 5: A student-made plankton net

The jar of water has thousands of organisms in it. You can tell they are there because they keep the water churned up in the jar, but you can't see them well enough to tell what they are. You need a microscope.

Figures 6 and 7 show some of the animals you might see through the microscope. Figure 6 is from a plankton sample collected in May, and Figure 7 is from an August sample. Look at the organisms shown and compare them to the pictures in the chart on page 10. Be sure you can tell which are algae, zooplankton and fish larvae.

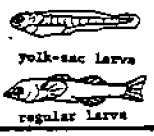
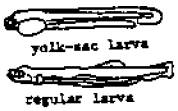
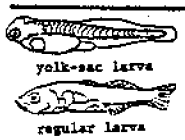
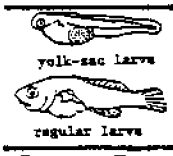
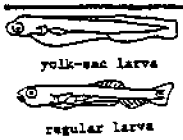
4. Repeat the sampling method you used for the letter e, but this time sample the organisms in Figures 6 and 7. It is best if you actually trace your sampling circles on Figures 6 and 7. This will make it easier for you to record on the chart and still not disturb your sample (move the ring). Also, you can come back to your samples and re-check them if the need arises. Record your results on page 10.

HINT: In the table on page 10, the first type of Algae listed is Diatoms. When recording your sample, count both kinds shown, and list them together as Diatoms. Do the same for the Green and Blue-green algae. The number you write will be a total for both species in each category. In the case of the Zooplankton, only one species of each of the different groups is shown.

If your sample circle cuts across some organisms, count those organisms anyway if there is a larger part inside the circle than out. For green and blue-green algae, each strand counts as one organism.

Figures 6 and 7 are based on actual plankton samples collected along the Lake Erie shore in 1978. Both the numbers and types of organisms are therefore fairly accurate examples of what may be found in the Old Woman Creek area.

PLANKTON SAMPLE

Organism	May Sample (Fig.6) 1	2	3	Average	Total pop. (estimate)	Aug. Sample (Fig.7) 1	2	3	Average	Total pop. (estimate)
Algae:										
Diatoms 										
Green 										
Blue-green 										
Zooplankton:										
Cladocerans 										
Copepods 										
Protozoans 										
Rotifers 										
Fish Larvae:*										
Yellow Perch 										
Gizzard Shad 										
White Bass 										
Sheepshead (freshwater drum) 										
Emerald Shiner 										

* Yolk-sac larvae have just emerged from eggs. A yolk-sac larva is younger than a regular larva. It is too young to eat. Instead it gets its nourishment from the yolk sac.

NOTE: The "Total Population" size which you have estimated here is only the population of the whole page, not the population of the whole estuary. To calculate the entire estuary plankton population would be very difficult. This activity is just meant to show what organisms might be in the estuary and how different the plankton sample is from one time to another.

Hopefully, those of you who said, "But why not just count all the e's?", on the e sampling page, can better see why scientists frequently resort to sampling techniques. (Imagine a scientist trying to count all the individual organisms in the estuary!)

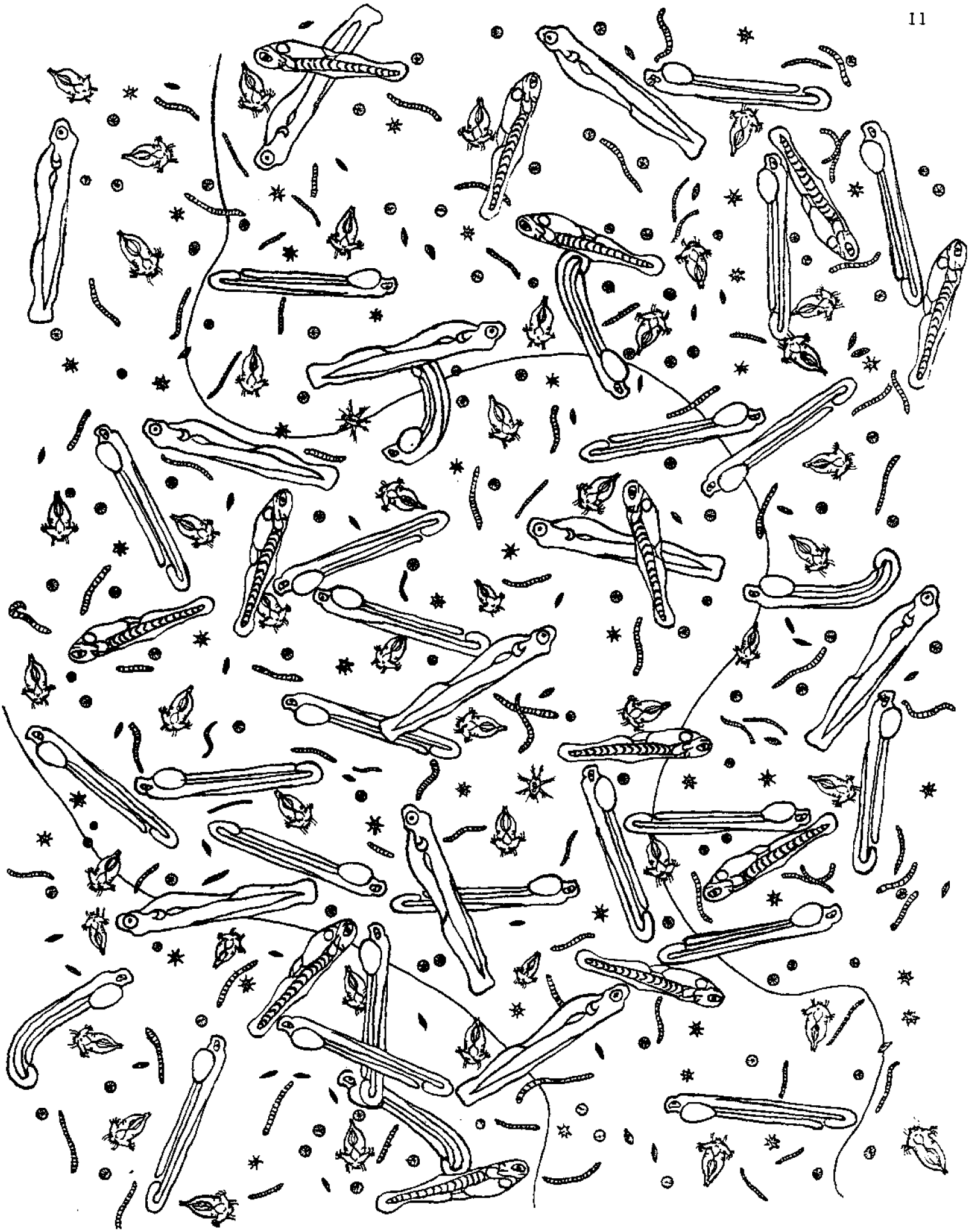


Figure 6. Estuary plankton sample, May 1978.
(Water temperature 13°C)

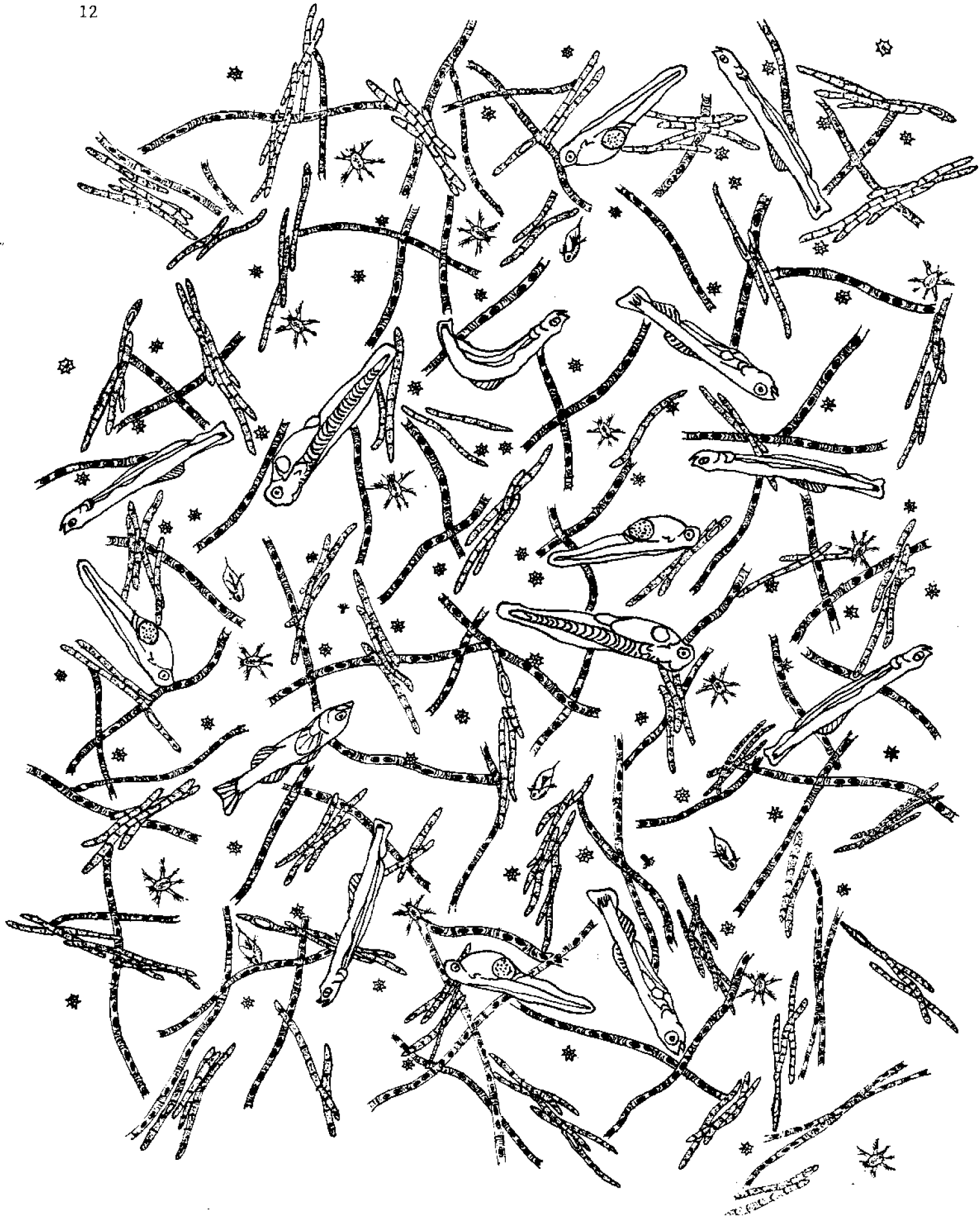


Figure 7. Estuary plankton sample, August 1978.
(Water temperature 21°C)

Answer the following questions based on the samples you "collected."

1. Put a check in the proper box to show which season had these characteristics:

	Spring (May)	Summer (August)
a. the greatest number of diatoms		
b. the greatest number of blue-green algae		
c. the greatest number of zooplankton		
d. the warmest water		
e. the most gizzard shad larvae		
f. the most yellow perch larvae		
g. the most sheepshead larvae		

2. Young perch eat a lot of algae. Which season would have the most food for baby perch? _____ In which season are the perch spawned (eggs deposited)? _____

3. Do all the types of fish in the sample spawn at the same time? _____ How can you tell? _____

_____

4. You have noted that water samples are warmer in the _____ sample.

Water temperature is an important factor in determining when fish spawn. Which species appear to require warmer water for spawning?

_____

5. What would be the advantage of having different fish spawn at different times?

_____

_____

_____

_____

_____

_____

6. Fish may enter an estuary to spawn. From your transect information, why else might fish come into the estuary?

_____

_____

7. You now have information about the microscopic and the macroscopic (visible to the unaided eye) organisms in an estuary. Using what you have learned, predict the effect of the following events on the plants and animals of the estuary:

   a. Heavy spring rains raise the level of the creek one foot higher than it is now. The water also flows very fast.

      Effect on rooted plants_____

      " " plankton_____

      " " adult fish _____

      " " fish larvae and eggs _____

      " " shore birds _____

   b. Hot water is dumped into the estuary by a utility company.

      Effect on rooted plants_____

      " " plankton_____

      " " adult fish_____

      " " fish larvae and eggs_____

      " " shore birds_____

c. The estuary is dredged out so that boats can go up the creek. The mouth of the estuary is deepened and probably protected by a sea wall. A portion to be used as a marina is deepened as well to a depth of 4 to 8 feet.

Effect on rooted plants_____

" " plankton_____

" " adult fish_____

" " fish larvae and eggs_____

" " shore birds_____

d. The estuary is filled in on the sides so that new homes can be built near the water.

Effect on rooted plants_____

" " plankton_____

" " adult fish_____

" " fish larvae and eggs_____

" " shore birds_____

REVIEW QUESTIONS

1. Define estuary. Where are estuaries found?

_____

_____

2. Explain what is meant by population sampling.

_____

_____

3. Describe a method by which scientists can sample a macroscopic community. Describe a sampling method for a microscopic community.

_____

_____

_____

_____

_____

_____

4. Give a general description of the types of plants found in different depths of water in an estuary.

5. List three ways in which plants are useful to animals in the estuary.

6. What types of organisms might be found in an estuary plankton sample?

7. Why are estuaries considered to be "endangered environments?"

APPENDIX

Macroscopic Plants of the Estuary
(Old Woman Creek)

1. Trees (Rooted on land. Excess water around root system may destroy some trees.)

Box elder

Cottonwood

Buckeye

2. Emergent plants (Roots are in water, but leaves and seeds emerge into the air.)

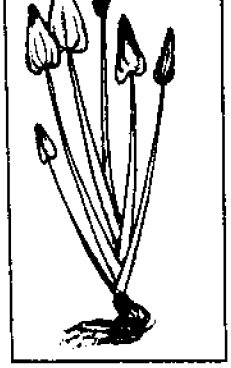
Rushes

Cattails

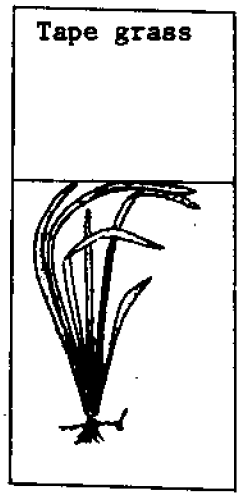
Arrowhead

Reeds

Pickerelweed



3. Submerged plants (Roots and leaves underwater.)



EP-16

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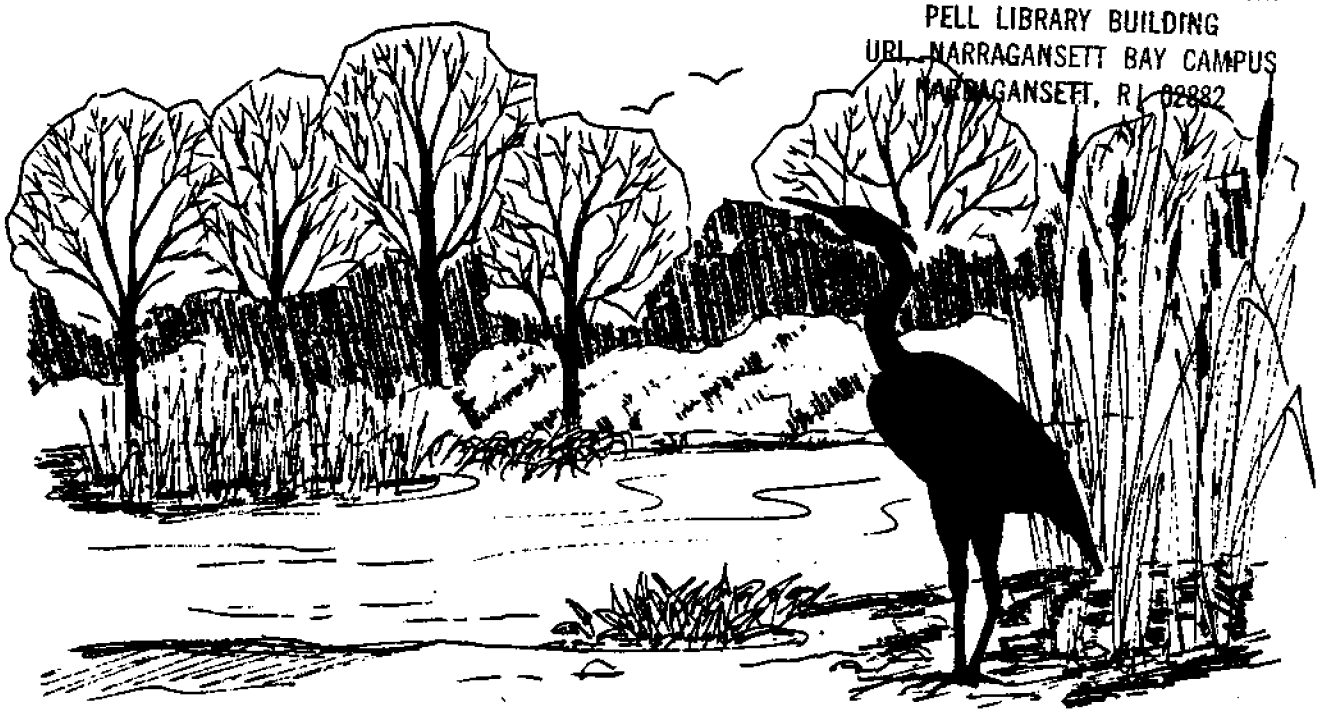

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TEACHER GUIDE

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INVESTIGATION

THE ESTUARY: A SPECIAL PLACE

OVERVIEW

The Old Woman Creek estuary on Lake Erie is examined to illustrate the characteristics and importance of estuaries in general. Activities also demonstrate the population sampling methods used by ecologists.

In Activity A, students study the general characteristics of the estuary by means of a computer map. A hypothetical transect line is constructed and the larger plants and animals along the line are considered for their role in the life of the estuary. Activity B involves analysis of a plankton sample (illustrated) to show how the waters of the estuary serve as a nursery for lake fish. Finally, students are led to consider the impact on the estuary from such factors as high water levels, heated water, dredging and filling in.

PREREQUISITE STUDENT BACKGROUND

Students should be able to accurately perform mathematical exercises involving addition, multiplication and division by two digits.

MATERIALS

Colored pencils, ruler, rubber canning rings (wide mouth size)

OBJECTIVES

When students have completed this investigation, they should be able to:

1. Describe the methods used by ecologists to sample populations of plant and animal life in the water.
2. Give a general description of the plant communities that are found in different depths of water in an estuary.
3. Explain how plant communities are important to animal life in the estuary.
4. List the types of organisms that are found as plankton in an estuary.
5. Predict the effects of some human and environmental forces on conditions in an estuary.

SUGGESTED APPROACH

Older students (grade 7 and above) can work individually through this investigation. Younger students will probably gain more by working in pairs and discussing the work as they proceed. In either case, the teacher should follow the investigation with a class discussion of results and a consideration of the special characteristics of Old Woman Creek. The articles on pages 8 and 9 provide this information. A map on page 7 shows the location of all the National Estuarine Sanctuaries in 1980.

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Authors: Ron Mischler, McCormick Junior High
Rosanne W. Fortner, Ohio State University

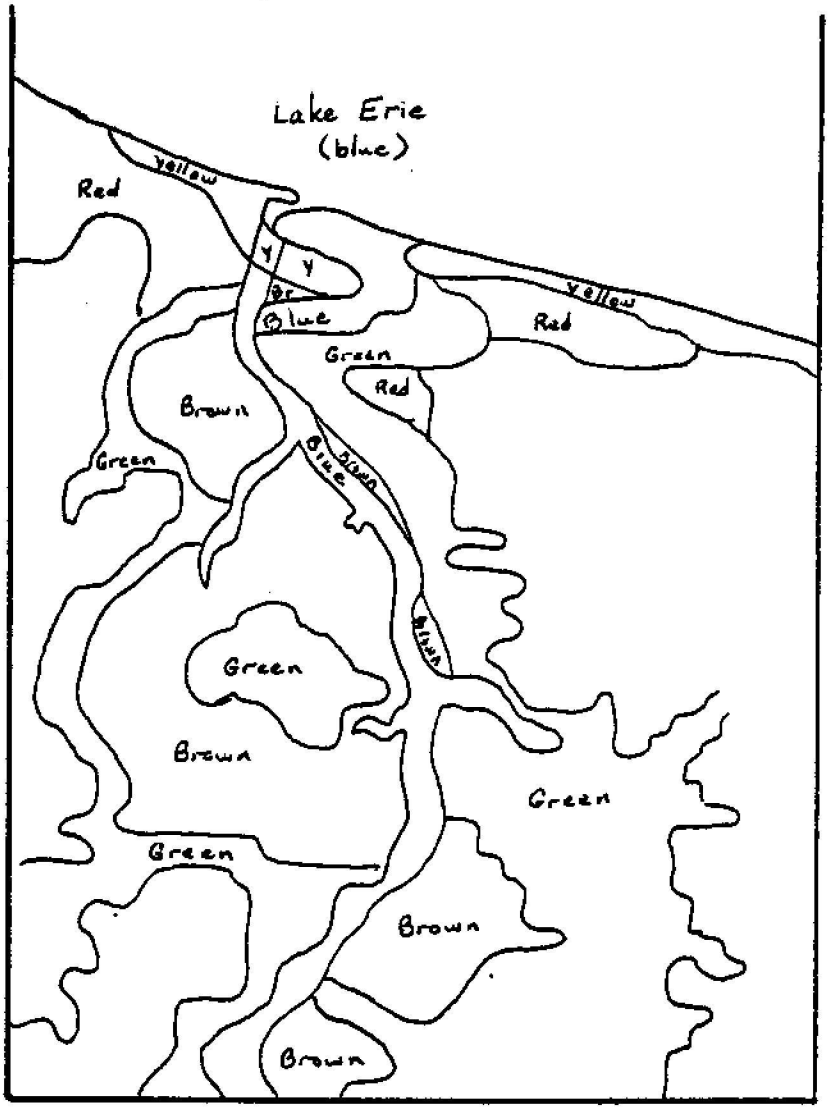
Several excellent films are available on the subject of estuaries. We recommend one from NOAA entitled "Estuarine Heritage." It is 28 minutes long, and it shows the importance of the estuary for food production, animal habitat and recreational resources. It also depicts some of the major threats to estuaries from human activities. Even though the estuaries discussed are all on ocean coastlines, the characteristics and problems are much the same. Order this film (free loan) from: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Rockville, MD 20852.

ACTIVITY A

WHAT IS THE ROLE OF PLANTS IN AN ESTUARY?

PROCEDURE A

1-4. The students' maps should look something like this:

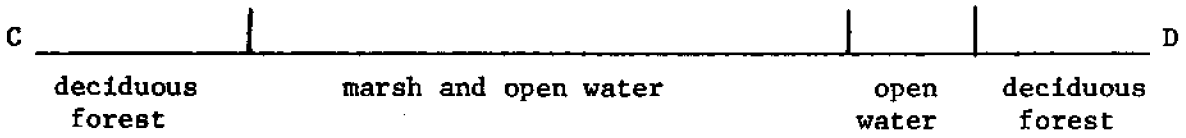


3. Marsh, open water and deciduous forest.

PROCEDURE B

Keywords: submerged, emergent, transect, sample

2. Labels under Figure 3 should be as follows:



3. Forest plants are rooted in dry soil. These plants could provide nest sites, protection (places to hide), and food for the animals.

4. Marsh areas have emergent plants. Some submerged plants are in the open water areas and the marsh.

5. The marsh has the greatest number of animals.

6. Most of the animals are eating or reproducing there.

7. The plants provide food, nest sites and protection.

8. Most of the fish listed are plant eaters when they are young. Carp eat plants as adults too. Songbirds may eat the seeds of the plants.

9. The bottom of the estuary is muddy. This provides the plants with something to hold their roots in place.

10. An estuary is that part of the mouth of a stream in which the water level is influenced by the lake or sea into which the stream flows.

11. The water level must have been (actually was) higher when the picture was taken than when the computer map was made.

ACTIVITY B

HOW DOES THE ESTUARY SERVE AS A NURSERY?

Keywords: plankton, algae, zooplankton, larvae

Have the students practice the technique and calculations for the e "population" on one or two printed pages before going on to the plankton pages.

If for some reason you wish to use the regular mouth jar rubbers, having and i.d. of 5.7 cm, use 25.5 cm^2 for the area in Step 2, and use 24 for the multiplication factor in Step 3. In this case, the sample calculation becomes 16 x 24 = 384.

In sampling from Figures 6 and 7, students will often have organisms that are only partly visible in the ring. Follow the general rule that if ½ of the organism or more is visible, the students should count that as one whole organism. For algae clumps, it is probably most accurate to count every strand of algae as a different organism, rather than counting clumps or clusters.

1. For most of the following, results would probably be more accurate if the entire class would pool its information.

	Spring	Summer
a. most diatoms	✓	
b. most blue-green algae		✓
c. most zooplankton	✓	
d. warmest water		✓
e. most gizzard shad	✓	
f. most perch	✓	
g. most sheepshead		✓

2. Perch spawn in spring (March-May). There is more food for them in summer, however. Note that they have yolk sacs in the May plankton sample. The larvae use the yolk as food, then begin to feed on algae.

3. No. There are no bass or sheepshead in the May sample. They appear as yolk-sac larvae in the August sample.

4. Summer water is warmer. Sheepshead and white bass appear to require warmer water for spawning.

5. Spawning times could be related to the availability of food for the larvae. There may also be temperature tolerances of the fish to be considered, and some fish are sensitive to overcrowding. Discuss all possibilities that students suggest.

6. Fish might also enter the estuary to eat or to find shelter among the water plants (Figure 4).

7. a. --Rooted plants may be washed out or completely submerged. (Submersion would kill plants that are ordinarily emergent.) The mud of the bottom could be washed out, preventing plants from becoming re-established.

--Plankton would be swept out into the open water of the lake.

--Adult fish might find more spawning sites in the submerged plants, but there is a greater chance of eggs washing away. Muddy water would reduce the ability of sight-feeding fish to find food.

--Fish eggs and larvae could wash away into the lake where they could be killed by temperature changes or eaten by other fish. If larvae remained, their food supply would probably be reduced because of plankton loss.

--Shore birds would probably have more trouble catching small fish, and the nest sites for the birds could be destroyed.

b. --Plants could be killed.

--Plant Plankton would probably increase in number up to a certain water temperature. Zooplankton would probably be killed.

--Fish that depend on warmer water temperatures to determine their spawning time might spawn earlier than usual. If the temperature got too high, some fish would not enter the estuary at all.

--Fish larvae might have more algae to eat, but excess heat could kill both eggs and larvae.

--The food supply would be affected.

c. --Removal of bottom sediments would cause destruction of the water plants rooted there.

--Fish, shore birds and other animals that depended on the plants for breeding areas, food or shelter would no longer enter the estuary.

--Plankton would be washed out into the lake. (No water plants to hold them back.)

d. --Nobody wants a marsh as a back yard. We can assume that the water edges are bordered by seawalls or sand beaches in front of the homes. The character of the estuary would be completely changed. Students will probably have interesting ideas on what changes would be involved. All possibilities should be discussed.

--Few rooted plants could survive.

--Not many plankton.

--Adult fish would move further inland to spawn, or spawning may be prevented.

--No spawning, no eggs.

--Food supply decrease, so they find other feeding grounds. Few plants, so no nest sites.

REVIEW QUESTIONS

1. An estuary is the part of the mouth of a stream in which the water level is influenced by the body of water into which the stream flows. Estuaries are found where streams flow into a lake or sea.

2. Population sampling is the method which ecologists use to find out how many and what kinds of organisms are in a community. A portion of the organisms in a given area are identified and counted, then an estimate of the total population is made.

3. A macroscopic community can be sampled using a transect, a line that runs through the community. All the organisms along the line are identified and counted to get a sample of the total population that is present.

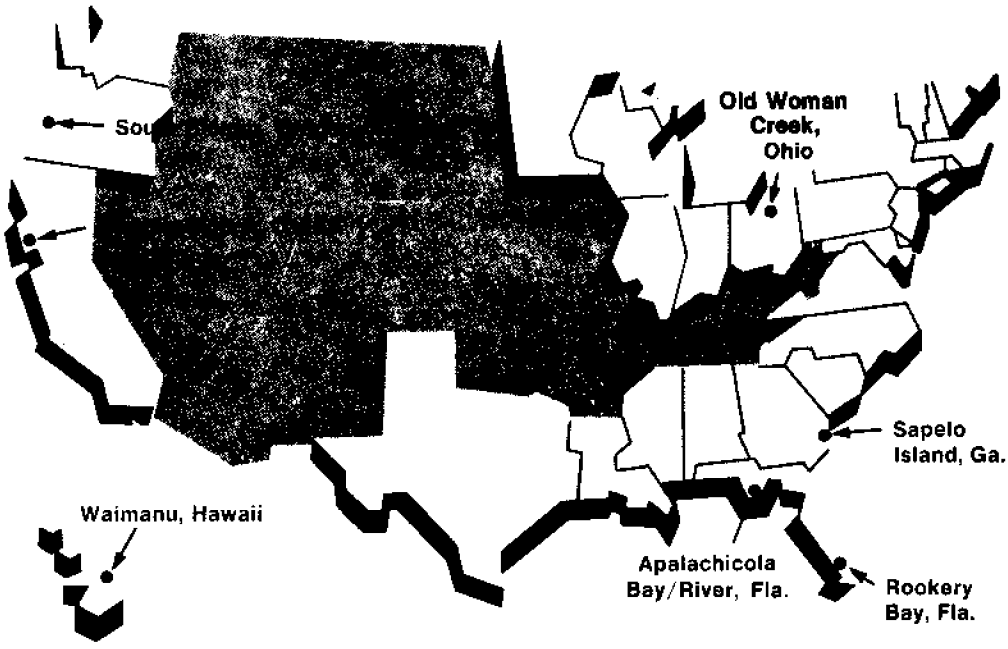
   A microscopic community in water can be sampled using a plankton net. The organisms caught in the net are examined under the microscope. All organisms in one microscope field (like one of the jar rings in the activity) are identified and counted. Averaging several such counts gives an estimate of the total community composition.

4. Plants on the shoreline are rooted in fairly dry soil and stand above the water. Along the water's edge are plants whose roots are in very wet soil or in bottom sediment but whose vegetative parts are emergent (stick out of the water). Farther out in the water are plants whose roots, stems and leaves are all underwater (submerged).

5. Plants provide food, shelter and nesting sites for the animals in and around the estuary.

6. An estuary plankton sample is likely to contain larval fish, algae and zooplankton.

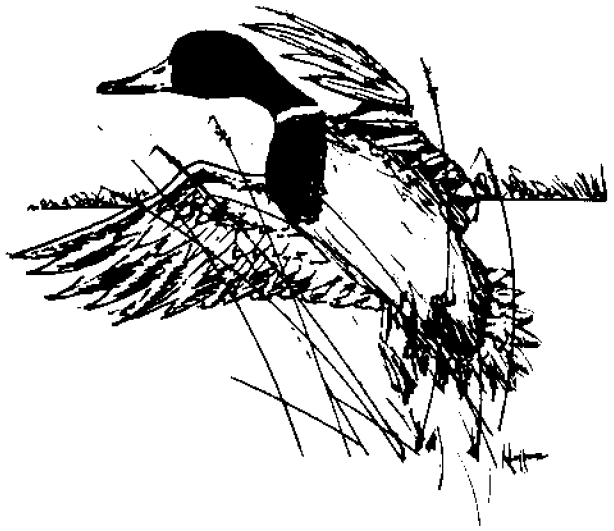
7. Estuaries are considered to be endangered environments because they trap pollutants that wash off from the land through the stream. They are also located in the heavily populated coastal zones of the world, and they are sometimes eyed as being more valuable for development of homesites, marinas and such, rather than for their contributions to the ecology of the lake or sea into which the streams flow.



Location of National Estuarine Sanctuaries

Old Woman Creek

National Estuarine Sanctuary and State Nature Preserve



Introduction

Lake Erie and its coastal zone are among Ohio's most valuable natural resources. As the state's once expansive coastal wetlands continue to disappear in the face of encroaching development, the preservation of these natural features becomes more critical. Although much of Lake Erie's shoreline is highly developed, several wetlands with significant natural attributes remain. One of these is a relatively undisturbed example of Great Lakes freshwater estuaries located at the mouth of Old Woman Creek near Huron.

Old Woman Creek is protected as a National Estuarine Sanctuary and State Nature Preserve because it is one of Ohio's best remaining examples of an estuary. The sanctuary serves as a field laboratory where scientists can study this naturally functioning system and as a place where students can learn about estuarine ecology in a natural setting.

The Ohio Department of Natural Resources and the National Estuarine Sanctuary Program will continue their work towards protection of Ohio's coastal wetlands environment, but the future of Lake Erie and its coastal zone lies with our young people. As tomorrow's decision makers, they will need a basic understanding of the importance of wetlands and possible outcomes that could result from loss of these fragile habitats.

Although this activity focuses upon Old Woman Creek Estuary, we hope the concepts and principles learned by participants will result in a broader understanding and appreciation of other coastal wetlands as well. This knowledge could provide a vital step towards intelligent decisions in the future concerning man's use/misuse of estuaries and other wetlands.

What Is An Estuary?

An estuary is traditionally defined as that place where the land's fresh waters meet and mix with the salt water of the seas and where water levels are affected by tides.

Lake Erie is actually a freshwater inland sea. Although salt concentration or salinity is not a factor here, the waters of Lake Erie and of Old Woman Creek combine in this estuary to form a third type of water chemically different from that of either creek or lake. Furthermore, even though the tidal effect on Lake Erie is extremely small, lake levels are affected by weather-induced seiches which do in turn influence the water levels of the estuary.

Importance to Man

Old Woman Creek is a diverse place where land and water join together to form a complex community that performs many natural functions:

- ... filtering out sediments and pollutants from the stream before they enter Lake Erie.
- ... affording protection from flooding. Its basin can retain large volumes of flood waters after heavy storms.
- ... providing habitat for fish. Nearly 40 kinds of fish are known to use the estuary waters at sometime during their life cycle.
- ... serving as a way station for tired and hungry birds. Approximately 200 species have been recorded in and around the estuary.
- ... furnishing a home for numerous plants, mammals, reptiles and amphibians, some of which are endangered or threatened species in Ohio.

Historical Perspective

Lake Erie's south shore was the domain of the Erie Indians in the 17th Century until their entire nation was destroyed by the Iroquois. Huron Indians migrated into the region in the late 1600's and became the dominant tribe for a brief period. The Hurons remained here until circa 1700 when the New York Iroquois once again invaded Ohio and defeated them. The Huron survivors, later called Wyandottes, journeyed to the Sandusky Bay region, and remnants of their tribe probably greeted the first Euro-American settlers who arrived at Old Woman Creek.

Old Woman Creek flows through lands claimed by the state of Connecticut as a result of a charter granted by the King of England. Following the American Revolution, the state turned over their colonial holdings to the newly formed government, except for one western tract known as the "Connecticut Western Reserve". About 1805 Almon Ruggles came to the Old Woman Creek area to survey the western portion of this land. Boundaries of "The Firelands" as this area was called, were determined to be those of present day Erie County.

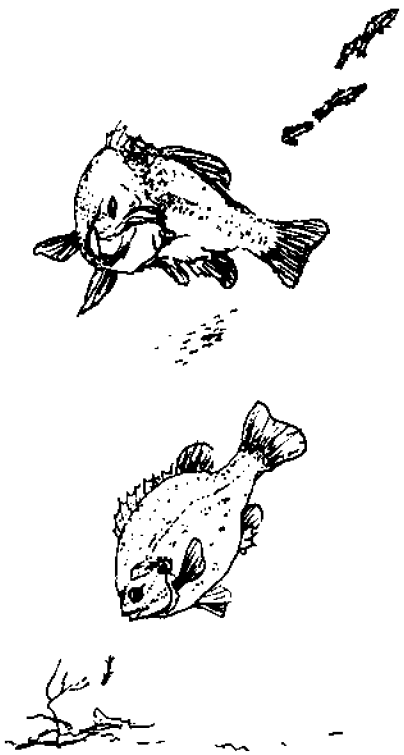
When wagon trains arrived in the Firelands area around Old Woman Creek, settlers found the land covered with dense forests. Much of the heavy timber was white oak that proved to be useful to shipbuilders in nearby Huron during the mid-1800's. Early Firelands pioneers found the rich, sandy soils of the Old Woman creek watershed well suited for agricultural purposes. During the 18th Century historical records indicate that sawmills, sandstone quarries, grist mills and a salt well were situated within the watershed.

Land adjacent to the estuary has remained relatively undisturbed through the years.

Natural Setting

Old Woman Creek is located on the south central shore of Lake Erie approximately 3 miles east of Huron, Ohio. The creek is 10 miles long and drains a 30.4 square mile watershed within Huron and Erie Counties. Near Berlin Heights, its waters have cut through the Berea Sandstone escarpment forming a narrow, steep-walled valley 60 to 80 feet deep. From there the creek flows northwards towards Lake Erie through relatively flat farm lands and by the time it reaches Old Woman Creek estuary, it has become a slow-moving stream. The estuarine area, defined by the upstream extent of Lake Erie water, consists of marshes, a swamp forest, the stream channel, and a small island. A barrier beach at the mouth of Old Woman Creek separates the estuary from Lake Erie.

Former agricultural fields undergoing various stages of succession, oak-hickory woodlands, and a small relict prairie area comprise the uplands portion of the sanctuary.



HABITAT OVERVIEW

Barrier Beach and Lakeshore

Lakeshore and barrier beach separate the estuary from Lake Erie. Swift, dramatic changes in physical conditions characterize this coastal habitat. Wind, waves, current, and precipitation levels cause the creek mouth to shift back and forth along the coastline and occasionally become blocked by sand. Severe storms may uproot vegetation and carry debris onto the beach, significantly altering the topography of the shoreline.

Sea rocket, Russian thistle and clotburs are among the few plants which have adapted to this harsh environment. The most visible forms of animal life here are the gulls and other shorebirds that search for food in the water or along the beach. Dead fish provide food for such beach scavengers as insects, birds and some mammals.

Waters of the Estuary

The shallow, sheltered waters of the estuary support an abundant population of tiny plants and animals called plankton, which are basic to the estuarine food chain. Many tiny organisms cling to the underwater stems of water lotus, cattails, sedges and other aquatic vegetation. Estuarine waters provide excellent spawning and rearing habitat for many kinds of fish that find protection from predators and an abundant supply of food in the estuary. The fish of the estuary include such species as largemouth bass, sunfish, perch, shiners and gizzard shad.

Many species of birds also utilize the waters of the estuary. Eagles, ospreys, diving ducks and belted kingfishers are attracted by a plentiful supply of fish and other aquatic organisms. Adult mosquitoes and midges emerging from the water in swarms are eaten by swallows and terns.

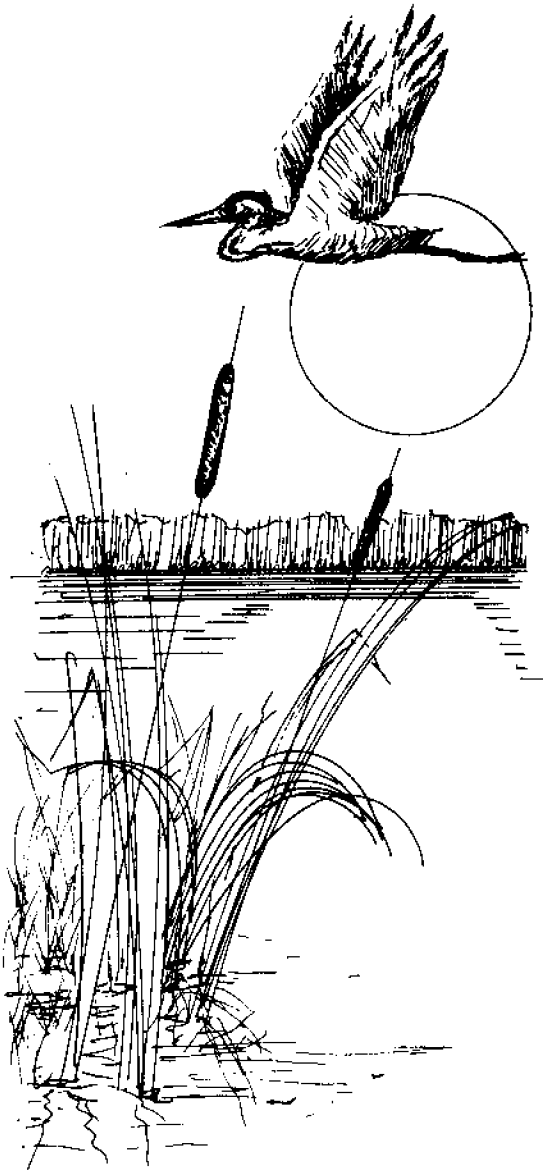
The Water's Edge

The interface between water's edge and surrounding uplands is a dynamic front that shifts back and forth from season to season. It is continually affected by changes in water depth and wind action. Cattail, arrowhead, smartweeds and other emergent aquatic plants have adapted to life in this ever-changing zone where they provide food, shelter and nesting materials. Every nook and cranny of this habitat is occupied - it teems with life. Surface and bottom waters are crowded with microscopic plants and animals. Attracted by the water supply and the abundance of food, many creatures are drawn here. Numerous invertebrates inhabit the sand and mud where they feed on algae and detritus. Egrets, herons, and shorebirds find a rich and varied diet of aquatic vegetation, animals and insects in the shallows. Deer, raccoon, and muskrats also come to exploit the shoreline's resources.

Uplands

The uplands surrounding Old Woman Creek estuary are a diverse terrestrial habitat which further enhances the value of the sanctuary to wildlife and to man. Oak-hickory forest, old fields, prairie and scrub areas each provide places for different kinds of plants and animals to live. The complex web of interactions within these communities and between them is an integral part of the larger estuarine ecosystem.

Goldenrod, asters, sumac and various grasses predominate in old crop fields. These and other weed species are valued sources of food and cover for wildlife. Grasshoppers, beetles, and spiders feed in open fields.



Attracted by the insects, seeds and fruits, birds come from nearby woodlands and scrub areas to feed. Meadowlarks, song sparrows and goldfinches are commonly seen. Red-tailed hawks and foxes hunt for small rodents that inhabit this community.

Oak-hickory forests covering the steep banks surrounding the estuary provide valuable habitat for untold numbers of wildflowers, woodland birds, and other creatures. These wooded slopes also perform several important natural functions. By retaining soil and water, woodlands prevent erosion along the estuary shoreline. Within the woodlands, essential nutrients are released from decaying plants and animal life. As these nutrients are washed down to the shoreline, estuarine waters are further enriched.

The Creek

Old Woman Creek arises from springs and meanders northward 10 miles through agricultural lands before emptying into Lake Erie. Its waters remain turbid through most of the year due to silt runoff from the surrounding crop fields.

The creek is one of the most variable of aquatic habitats. During dry periods it may be no more than a series of connected pools, but a heavy rain may quickly and unexpectedly transform this habitat into a muddy torrent, washing away many stream creatures. Plants and animals inhabiting the creek have developed a variety of adaptations for coping with the problems of survival in flowing waters. Although few rooted plants occur in the creek, algae may be found attached to the bottom; and diatoms, bacteria, and microscopic animals cling to rocks and logs forming a slick brown film.

Some aquatic animals avoid the force of the current by hiding beneath rocks or burrowing in the bottom. Others, such as caddisfly larvae and water penny beetles, depend on claws, hooks or gluelike secretions to keep from being swept downstream. Rainbow darters, blacknose dace and other stream fish have adapted their feeding, spawning and swimming habits to live in the swift water habitat.

Glossary

Estuary: A semi-enclosed coastal body of water where the land's fresh waters meet and mix with the salt water of the seas and where water levels are affected by tides.
Limnology: The study of inland waters; ponds, lakes, streams.
Aquatic: Growing or living in or upon water.
Terrestrial: Growing or living on land.
Plankton: Small microscopic plants and animals that drift suspended in water.
Food chain: The transfer of energy from one organism to another.
Food web: Several interrelated food chains.
Succession: Gradual replacement of one plant community by another until a stable or climax is reached.
Pollutant: Any gas, chemical or organic waste that contaminates air, soil or water.
Sediments: Particles of soil, sand and minerals which are carried in flowing water and settle out when the water is still.
Detritus: Tiny particles of decaying plant and animal matter.
Larvae: The free-living immature form of an animal that changes structurally when it becomes an adult (caterpillar-butterfly).
Habitat: The place where an organism lives.
Community: All the plants and animals that live in a particular habitat.
Ecosystem: The community plus the habitat that supports it.
Watershed: The area of land that drains into a particular body of water.

Resources

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NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NOAA
U.S. DEPARTMENT OF COMMERCE

ODNR
OHIO DEPARTMENT OF NATURAL RESOURCES

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