



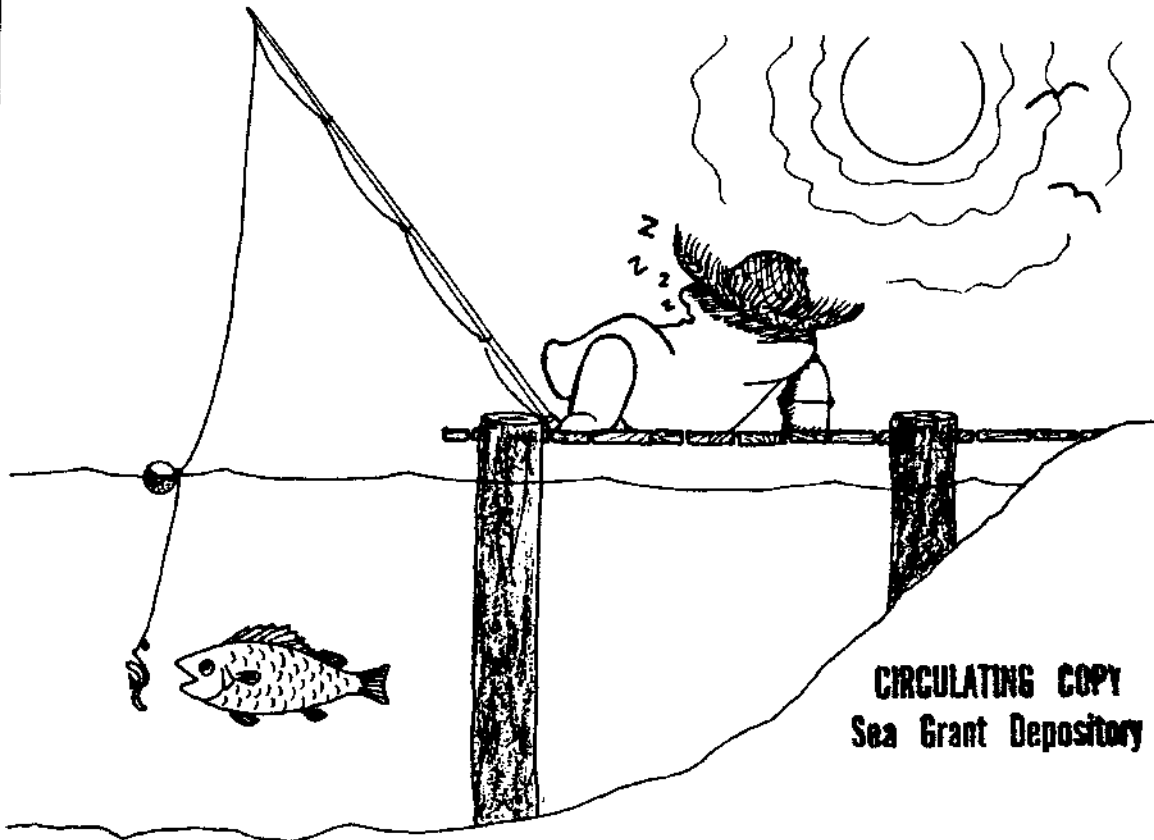
LOAN COPY ONLY

YELLOW PERCH IN LAKE ERIE

by

Rosanne Fortner and Gabriele Reil,
The Ohio State University
and

Susan Leach, Upper Arlington (Ohio) Public Schools



CIRCULATING COPY
Sea Grant Depository

TEACHER GUIDE

OEAGLS-Oceanic
Education
Activities
for
Great
Lakes
Schools

OEAGLS INVESTIGATION #9

Completed March, 1979
Reprinted 1980, 1982, 1984
Revised 1986

Instructional activity was prepared with the support of the National Oceanic and Atmospheric Administration, Ohio State University's School of Natural Resources and College of Education. However, any opinions, conclusions, or recommendations expressed herein are those of the authors, and do not necessarily reflect those of NOAA or the University.

TEACHER GUIDE



TEACHER GUIDE

YELLOW PERCH IN LAKE ERIE

by Rosanne W. Fortner, Gabriele Riel and Susan Leach
Ohio Sea Grant Education Program

OVERVIEW

This investigation consists of two games. Activity A is a board game designed to introduce the stages of the perch life cycle and the forces affecting the perch population at each stage.

Using information gained in Activity A, students participate in a role-playing situation in Activity B. Various interest groups provide input on the development of a perch management policy for Lake Erie.

PREREQUISITE STUDENT BACKGROUND

Basic mathematical skills: addition, subtraction, and division by 2.

MATERIALS: Perch Life Cycle game board, spinner, place marker tokens (one per student), and CHANCE cards, all constructed using patterns in this guide; record sheets (in Student Guide); paper clip; paper fastener; six role descriptions in this guide.

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

1. Describe the life cycle of the yellow perch.
2. Discuss the factors that can affect perch populations at each stage of the life cycle.
3. Discuss the pros and cons of some methods used to manage a Great Lakes perch population.

SUGGESTED APPROACH

Activity A is designed for groups of 2-4 players, each with a set of game materials.

For Activity B students work in groups of 6, with each student having a different role. "Extra" students should be assigned the Ohio Division of Wildlife role and placed as the 7th member of other teams.



YELLOW PERCH IN LAKE ERIE

by

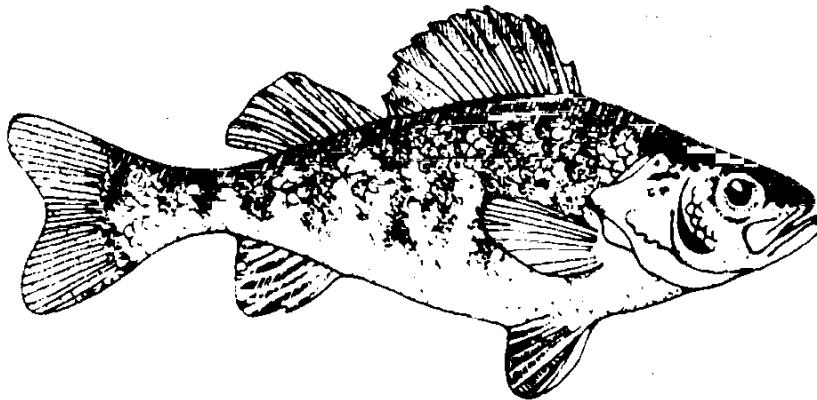
Rosanne W. Fortner, Gabriele Reil and Susan Leach

INTRODUCTION

Each spring, hundreds of thousands of yellow perch deposit their eggs over vegetation in the shallow waters of Lake Erie's shoreline. A female perch can lay jelly-like ribbons of up to 50,000 eggs at one time. At this rate will Lake Erie soon have a population explosion of yellow perch? Why are so many eggs laid by each fish? How does nature control population size? Can people also affect fish populations?

OBJECTIVES: When you have completed these activities, you should be able to:

1. Describe the life cycle of the yellow perch.
2. Discuss the factors that can affect perch populations at each stage of the life cycle.
3. Discuss the pros and cons of some methods used to manage the Lake Erie perch population.



YELLOW PERCH

Perca flavescens

length: 10-34 cm

weight: 112-568 g

coloring: bright green to olive to golden brown on back, yellow-green, yellow on sides, grey to milk-white below

common names: perch, lake perch, American perch

Figure 1: Characteristics of Yellow Perch (Fish of Lake Michigan, University of Wisconsin, 1974.)

ACTIVITY A: WHAT CAN HAPPEN TO A GROWING PERCH?

KEYWORDS: Spawning, commercial fishing, sport fishing, population.

MATERIALS: Perch Life Cycle game board, spinner, place marker tokens (one per student), CHANCE cards, record sheets.

It will be necessary for you to construct the game materials using the pages in the back of this guide. These pages can be cut out as they are, or they can be glued to cardboard sheets and then cut out.

PROCEDURE

Twenty to thirty minutes are needed to play the board game the first time. Students may want to play again, and a second round can usually be finished during the same class period.

A. **Object of the game:** The first player to have one male and one female fish survive to spawn is the winner. Another more important object is to find out the things that can happen to perch populations. Be sure you read the information in the board spaces and on the game cards. If you read them out loud all players can learn about what is happening to your perch.

TEACHER'S NOTE: The numbers used in the game reflect reality, but are obviously not exact. They were chosen to allow reasonably simple mathematics while indicating the relative impact of the various factors affecting the perch population.

B. **The game board:** The shape of the board represents the shape of a yellow perch. At the tail is an area marked START. Other shaded areas stand for important events in a perch's life: hatching, "birthdays," and maturity. Some of the areas tell you how large or how old your fish are when you have passed that point on the board.

The events of the shaded areas happen to your population even if you don't land exactly on the areas. Simply passing such a space means that the event has happened.

The game chart may need some clarifying information that you can provide. For instance, some of the factors affecting perch may be considered either natural or human-caused. An algae bloom may occur naturally with seasonal changes, or it may be induced by phosphates being added to lake water. Diseases likewise may be caused by nature or by humans' effect on the water. The stocking of pike in the lake by people has the effect of reducing perch populations by the natural process of predation.

The sample summary sheet in this manual is intended to serve as your guide only, not as a list of "correct" answers. Students may, for example, wish to list predators separately (kingfishers, pike, etc.). Discussion of possibilities will contribute to student understanding of the concepts in the activity.

C. **How to begin:** Two to four people can play. Choose a token to represent your perch population and place it on the START space of the game board. Each population begins with 50,000 eggs. Record this number on the record sheet for each player.

The person with the highest total on two spins of the spinner plays first. The one with the next highest total goes second, and so on. CHANCE on the spinner counts as zero.



D. How to play When your turn comes, spin the spinner and move your token clockwise the number of spaces indicated. If the spinner points to CHANCE or if you land on a space marked CHANCE, draw a CHANCE card from the top of the deck and follow the instructions on it. If the card does not say "KEEP THIS CARD" place it back on the bottom of the deck before the next player's turn.

NOTE: CHANCE cards refer to fish, not to eggs. If you spin a CHANCE before your eggs hatch, spin again.

As you play, record the size of your perch population on your record sheet. In most cases, males and females are added together to get the population size, but some events affect only one sex of the fish. Unless you are told to do differently, assume that half of your fish are females and half are males (see "hatching" space).

E. Losing all your perch: If the space you are on or the CHANCE cards drawn cause you to lose more fish than you have on your record sheet, your population has been wiped out. Depending on where you are on the board, this can have two different effects:

(1) If your eggs have not hatched when they are all wiped out, go back to START and begin all over again with 50,000 eggs.

(2) After the eggs hatch, your population is expected to be on its own. If you lose all your fish, you are out of the game.

F. Winning the game: The first person to land exactly on the SPAWN square with at least one male and one female is the winner. If all players but one are wiped out, the remaining player is still not the winner until his or her fish make it to spawning. If no fish make it to spawning, your team may start the game over again.

G. When the game is over: Using the game board spaces and the CHANCE cards, complete the game chart in Figure 2 and answer the following questions:

1. Why is it an advantage to the yellow perch to lay so many eggs?

T1. Laying many eggs is an adaptation for the perch's survival. There are many hazards to the developing perch, and beginning with large numbers helps to insure that at least two fish will survive to replace the parent fish.

2. In which part of the perch life cycle are the most animals lost?

T2. Largest losses occur among eggs and fry. Be flexible in accepting other student answers. Students may attempt to add up all losses at each stage rather than responding intuitively with this answer.

3. At what age does a perch become sexually mature?

T3. Sexual maturity occurs about 3 years of age (20 cm long).

4. What destroys most of the perch that become mature?

T4. Most mature perch are claimed by commercial and sport fishing.

5. In what ways could the numbers of perch be increased?

T5. Numbers of perch can be increased by stocking, protection of spawning habitat, and elimination of some obstacles to survival (pollution, fishing, etc.).

6. Could factors like those that affect perch in Lake Erie also affect fish in the ocean? Do you think that these factors have as big an effect on fish in the ocean? Explain your answer.

T6. Yes, such factors also affect ocean fish. For some factors, such as pollution, the effects in the ocean may not be as great because of dilution in a greater volume of water. Algae blooms and other seasonal factors would also be less significant in the oceans.

ACTIVITY A: WHAT CAN HAPPEN TO A GROWING PERCH?

KEYWORDS: Spawning, commercial fishing, sport fishing, population.

MATERIALS: Perch Life Cycle game board, spinner, place marker tokens (one per student), CHANCE cards, record sheets.

It will be necessary for you to construct the game materials using the pages in the back of this guide. These pages can be cut out as they are, or they can be glued to cardboard sheets and then cut out.

PROCEDURE

Twenty to thirty minutes are needed to play the board game the first time. Students may want to play again, and a second round can usually be finished during the same class period.

- A. Object of the game: The first player to have one male and one female fish survive to spawn is the winner. Another more important object is to find out the things that can happen to perch populations. Be sure you read the information in the board spaces and on the game cards. If you read them out loud all players can learn about what is happening to your perch.

TEACHERS NOTE: The numbers used in the game reflect reality, but are obviously not exact. They were chosen to allow reasonably simple mathematics while indicating the relative impact of the various factors affecting the perch population.

- B. The game board: The shape of the board represents the shape of a yellow perch. At the tail is an area marked START. Other shaded areas stand for important events in a perch's life: hatching, "birthdays," and maturity. Some of the areas tell you how large or how old your fish are when you have passed that point on the board.

The events of the shaded areas happen to your population even if you don't land exactly on the areas. Simply passing such a space means that the event has happened.

The game chart may need some clarifying information that you can provide. For instance, some of the factors affecting perch may be considered either natural or human-caused. An algae bloom may occur naturally with seasonal changes, or it may be induced by phosphates being added to lake water. Diseases likewise may be caused by nature or by humans' effect on the water. The stocking of pike in the lake by people has the effect of reducing perch populations by the natural process of predation.

The sample summary sheet in this manual is intended to serve as your guide only, not as a list of "correct" answers. Students may, for example, wish to list predators separately (kingfishers, pike, etc.). Discussion of possibilities will contribute to student understanding of the concepts in the activity.

- C. How to begin: Two to four people can play. Choose a token to represent your perch population and place it on the START space of the game board. Each population begins with 50,000 eggs. Record this number on the record sheet for each player.

The person with the highest total on two spins of the spinner plays first. The one with the next highest total goes second, and so on. CHANCE on the spinner counts as zero.



D. How to play When your turn comes spin the spinner and move your token clockwise the number of spaces indicated. If the spinner points to CHANCE or if you land on a space marked CHANCE, draw a CHANCE card from the top of the deck and follow the instructions on it. If the card does not say "KEEP THIS CARD" place it back on the bottom of the deck before the next player's turn.

NOTE: CHANCE cards refer to fish, not to eggs. If you spin a CHANCE before your eggs hatch, spin again.

As you play, record the size of your perch population on your record sheet. In most cases, males and females are added together to get the population size, but some events affect only one sex of the fish. Unless you are told to do differently, assume that half of your fish are females and half are males (see "hatching" space).

E. Losing all your perch If the space you are on or the CHANCE cards drawn cause you to lose more fish than you have on your record sheet, your population has been wiped out. Depending on where you are on the board, this can have two different effects.

(1) If your eggs have not hatched when they are all wiped out, go back to START and begin all over again with 50,000 eggs.

(2) After the eggs hatch, your population is expected to be on its own. If you lose all your fish, you are out of the game.

F. Winning the game The first person to land exactly on the SPAWN square with at least one male and one female is the winner. If all players but one are wiped out, the remaining player is still not the winner until his or her fish make it to spawning. If no fish make it to spawning, your team may start the game over again.

G. When the game is over Using the game board spaces and the CHANCE cards, complete the game chart in Figure 2 and answer the following questions.

1. Why is it an advantage to the yellow perch to lay so many eggs?

T1. Laying many eggs is an adaptation for the perch's survival. There are many hazards to the developing perch, and beginning with large numbers helps to insure that at least two fish will survive to replace the parent fish.

2. In which part of the perch life cycle are the most animals lost?

T2. Largest losses occur among eggs and fry. Be flexible in accepting other student answers. Students may attempt to add up all losses at each stage rather than responding intuitively with this answer.

3. At what age does a perch become sexually mature?

T3. Sexual maturity occurs about 3 years of age (20 cm long).

4. What destroys most of the perch that become mature?

T4. Most mature perch are claimed by commercial and sport fishing.

5. In what ways could the numbers of perch be increased?

T5. Numbers of perch can be increased by stocking, protection of spawning habitat, and elimination of some obstacles to survival (pollution, fishing, etc.).

6. Could factors like those that affect perch in Lake Erie also affect fish in the ocean? Do you think that these factors have as big an effect on fish in the ocean? Explain your answer.

T6. Yes, such factors also affect ocean fish. For some factors, such as pollution, the effects in the ocean may not be as great because of dilution in a greater volume of water. Algae blooms and other seasonal factors would also be less significant in the oceans.

- 3 Within your group of representatives reach a decision about the best proposal or write a new one. Give this to the DOW person as your group's recommendation.
- 4 All DOW representatives meet and choose the best perch management policy. While they are meeting, all the interest group representatives write letters to the people they represent, telling how they have worked for the group's cause and what results have been so far.
- 5 The DOW announces what its new perch management policy will be. DOW representatives answer any questions from the interest groups. Record the DOW decision on your worksheet.
6. Was this decision fair to all parties concerned? If not, what interest groups would suffer because of the new policy? Explain on your worksheet.

- 7 Will the new policy produce the optimum sustained yield of perch in Lake Erie? Explain on your worksheet.

Four states and two nations border Lake Erie and all these governments try to manage fisheries in the best interests of their people. Regulation of fisheries in the ocean involves the same difficulties as in the Great Lakes. Such factors as territorial waters claimed by coastal nations, rights to migratory fish, protection of endangered species, and ways to enforce fishing laws must all be considered. Your class may wish to find out what happened to world fisheries when the United States declared a 200 mile territorial sea. One of the results is described in the article that follows.

COLUMBUS DISPATCH, March 1, 1979

1977 Law Has Increased Cod, Haddock And The Complaints Of U.S. Fishermen

BOSTON (AP) — The schools of cod and haddock have grown since foreign fishermen were chased from New England's rich fishing waters two years ago but so have the complaints from U.S. fishermen.

The problem, say New England fishermen, is over-regulation by the same law that made the foreign competition pull in its nets and set sail.

TWO YEARS AGO Thursday, the U.S. Fishery Conservation and Management Act ended the severe depletion of fish stocks by the commercial fleets of the Soviet Union, Japan and Poland. The law set strict limits on foreign vessels fishing within 200 miles of U.S. shores, but it also set regulatory controls on American fishermen.

"The situation is tough because we're dealing with a group that has never been under regulation," said Norm Olsen of Portland, Maine, a fisherman who serves on the New England Fishery Council.

Quotas set by the council are aimed at allowing the fish population in Georges Bank and the Gulf of Maine to recover from decades of overfishing by foreign fleets.

BUT THE FISH are plentiful now, say

the fishermen, and quotas only keep them from making more money.

"There's plenty of fish out there," says Edwin Smith, general manager of the New Bedford Seafood Cooperative. "A man should be able to go out and make a living instead of having to stay in port."

Quotas are set on several species, allowing so many to be taken each quarter. Some quotas are filled well before the three months are up, banning certain catches for weeks.

"WE HAD A closure from Nov. 19 to Jan. 1 last year," said Harry Swain, president of Boatowners United Inc. of New Bedford. "It was an economic disaster for some of the men. A boat owner has to hope he can make his payments until he can go out again."

But David Crestin of the Gloucester office of the National Marine Fisheries Service says, "It's tough to predict what the stocks are going to do, and the fishing industry doesn't believe us."

Figures from fisheries officials show fishing has gotten better — and more profitable — since the law went into effect. In 1976, New England fishermen hauled in 293.3 million pounds of fish valued at \$69.7

million. Last year, the catch was 350.3 million pounds, worth \$100.7 million.

BUT THERE ARE also more fishermen. The number of U.S. vessels trolling the waters has doubled since the foreign ships left.

"If we did nothing to control their catch, they would have taken more and certainly made more money," said Crestin. "Anytime you affect someone's pocketbook, actually or potentially, they're going to be mad at you."

Others say the controls have a roller coaster effect on prices, which rise when fishermen cannot bring in fresh catches. Smith said the price of cod went from 30 cents a pound the first six months of 1978 to 70 cents the last half when lower limits were imposed.

OLSEN AND OTHER members of the New England Fishery Council are looking for ways to improve the regulatory process and stabilize prices, but they aren't hopeful.

"There may be a way to clear this up, but I can't tell you what it is," said Olsen. "The problem is, everybody's for regulation as long as it doesn't regulate them."

ROLE #1 PAT TRAPPER

Division of Wildlife (DOW)
Ohio Department of Natural Resources

As a biologist and representative of the the Division of Wildlife, it will be your responsibility to inform the public about what is being done and what needs to be done to manage the perch fishery in Lake Erie. The term fishery refers to the industry or occupation of catching, processing and selling fish. As far back as the 1860's the perch fishery was very active, especially on Lake Erie. By the late 1950's, perch was the number one commercial fish taken from the lake.

Sport and commercial fishers alike value the perch for its delicious, flaky white flesh. As the fishery manager, your goal is to work toward an "optimum sustainable yield" of perch. **Yield** refers to the number of fish caught (harvested). **Optimum** means the most or the biggest possible, with all factors considered. An optimum yield of perch is the best number to catch each year without interfering with the normal workings of the population or with other populations in the lake. If this best number can be repeated in the harvest over the coming years, it is said to be a **sustainable yield**. The goal for Lake Erie, then, is to develop regulations that will allow the optimum number and weight of perch to be harvested each year.

Perch are harvested by two groups, the commercial fishers and the sports fishers, in both the U.S. and Canada. On Lake Erie there are about 1,000 people employed by the commercial fishing industry. Most of these operate in the most productive area, the Western Basin of the lake. In 1985 they caught 3.5 million pounds of fish and sold them for about \$730,000. About 81,000 pounds of the catch was yellow perch. This catch was only 1/25th the size of the catch of 1980, when commercial fishermen were allowed to use gill nets.

Commercial fishers sell their catch to restaurants, food stores and food processors. The perch that will be used as food are processed into filets (boneless strips of flesh from the sides of the fish) which are sold mainly in the large cities around the lake.

Sport fishing on Lake Erie is a major attraction for thousand of Ohio anglers. There are few regulations governing perch fishing for sport in the state. People can fish in any season and catch up to 50 perch a day. In 1985, Ohio sport fishers caught 1,800,000 pounds of perch in Lake Erie. This was about 95% of all the perch taken in the lake that year by Ohio fishers.

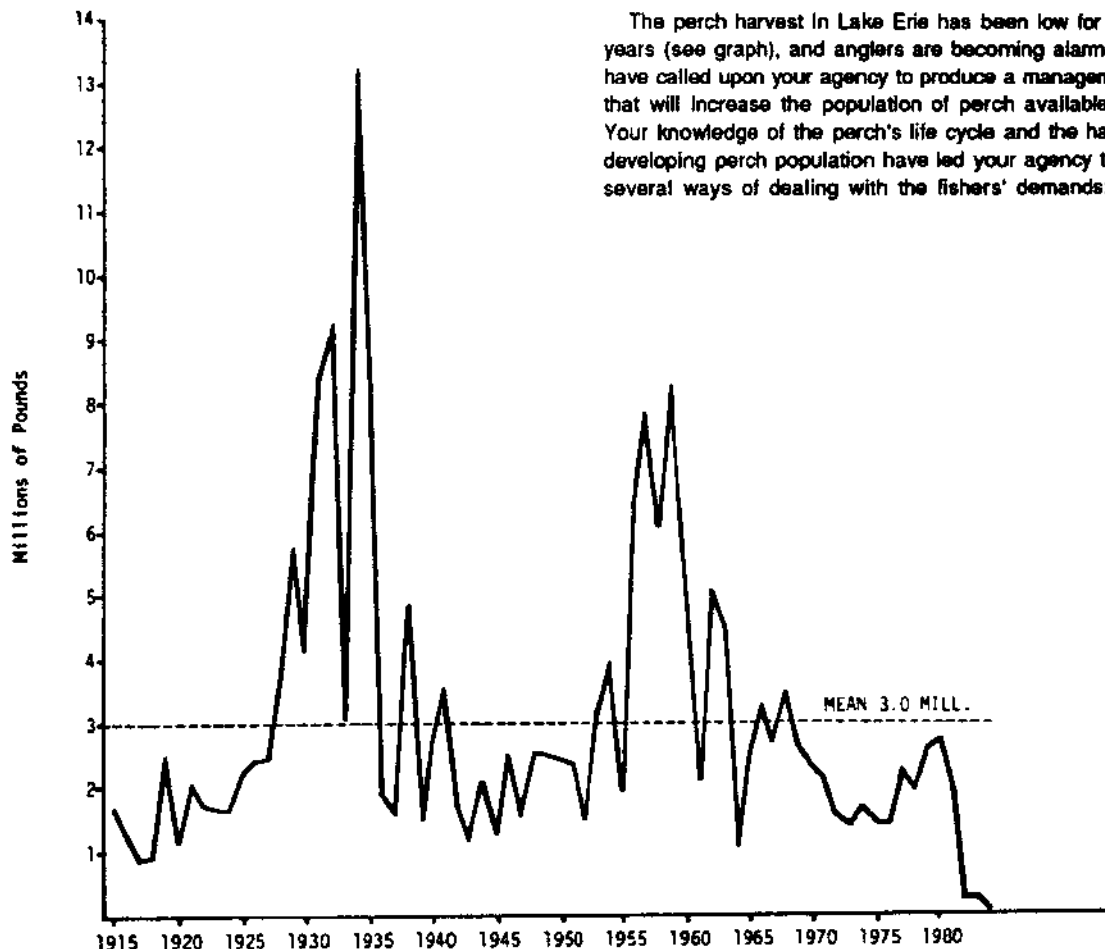


Figure 6. Ohio Lake Erie Yellow Perch Landings, 1914-1984.

1. Increase the survival rate at the egg stage by:

- A. Recommending a ban on construction along the lake shore within 1/2 mile of the lake, thus preserving existing spawning grounds.
- B. Recommending that industries that use water for cooling must limit the temperature increase in the water to 1°F, since spawning and hatching depend on water temperatures.
- C. Preventing dredged materials from being dumped back into the lake where they would cloud the water and possibly spread dangerous pollutants.

2. Increase the annual harvest by:

- A. Delaying the start of the commercial fishing season until June 1, when spawning will be over.
- B. Allowing commercial fishers to use gill nets from October 1 to December 1 to catch perch 20 cm or longer. Gill nets are now in use in other parts of Lake Erie. They result in a larger catch than the trap nets and seines now used in the Western Basin.
- C. Banning commercial fishing within two miles of the shoreline, so sport fishers will be able to catch more.

These two proposals are not the only possible answers to the perch decline problem, of course. They certainly will not satisfy all the people that will be affected. It will be your job to explain why both proposals are good ones. If other suggestions are presented, lead your group to consider whether they are useful or not. The group may wish to prepare a third proposal for the DOW to consider. If you favor one proposal or another, hold your opinion until others have presented theirs. As the most knowledgeable member of the group where perch are concerned, your opinion should be well thought out, for your judgment is highly respected.

When your group has agreed on a management plan, it will be your job to meet with other DOW representatives and arrive at a decision that will satisfy as many of the public's demands as possible. Report your decision in a public hearing and predict how your management plan will provide an optimum sustained yield of perch.

ROLE #2 DR. J. E. GILLMAN

STP (Save the Perch)

You are a professor of **ecology** (the study of relationships in the environment) and **ichthyology** (the study of fish) at Clearwater University. As head of your department you have watched Lake Erie go from a lake that supported trout to one that sometimes has trouble supporting the fish living in the lake now. You want to keep perch as a game fish and as an important link in the ecosystem that makes up the lake. In order to keep the perch population going in the lake, you want the Division of Wildlife to protect the 18,000 acres of marshes along Ohio's lake shore. This will serve:

1. to preserve the perch breeding grounds and
2. to provide habitat for the waterfowl and other birds that are a vital part of the area.

You want the people to understand that what affects one area of the lake will affect all areas. The areas you want to protect serve many functions, such as preservation of fish and wildlife, barriers to wind and wave erosion of the shore, natural water purifiers, natural flood control, and traps for the sediments carried into the lake by streams.

Beyond all this, you want to get the population of perch higher than it is now in order to restore the natural balance of the lake. This would require a 2-year ban on perch fishing, followed by stronger fishing regulations in later years. You also want sport fishing to be regulated by season as well as by limits, so sportsmen can only catch a certain number of perch.

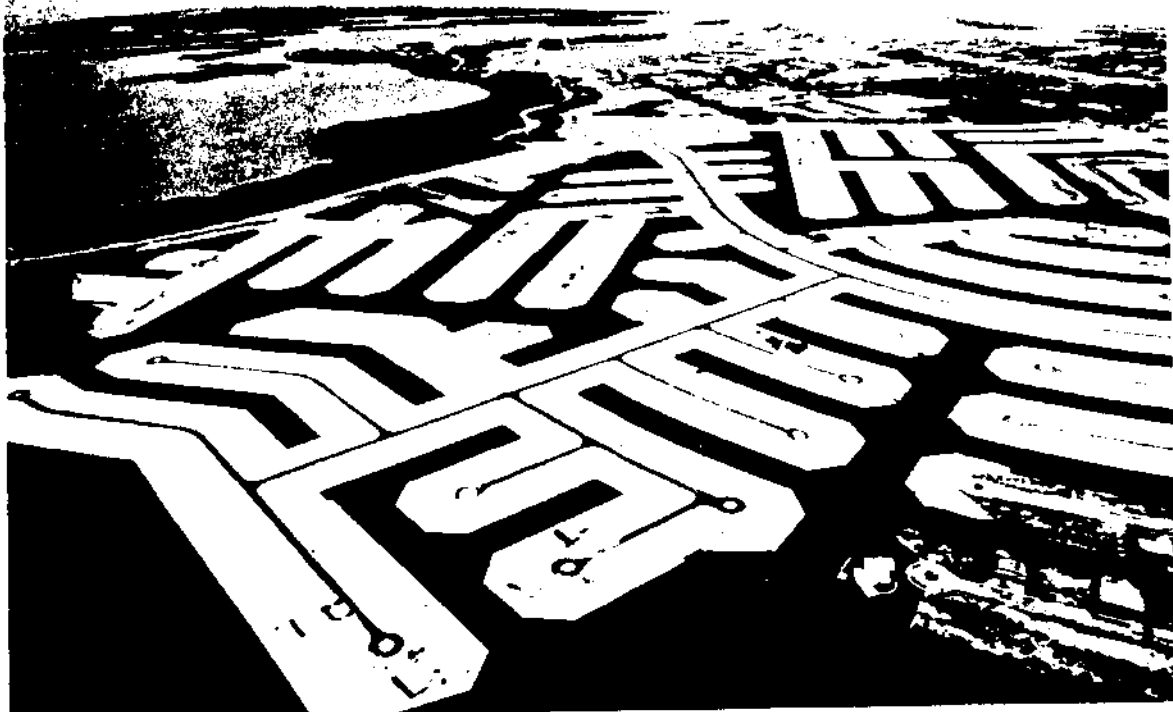
You want perch fishing to be done only with particular kinds of lures, such as spinners, and you would also like to set a size limit, such as 20 cm (8 inches) or longer, for "keeper" fish.

A power plant that has just begun operation on the lake is threatening the perch in another way. The plant pulls water from the lake to cool its machinery. Screens cover the openings of the intake pipes, but baby perch can be sucked through the screens and into the pumps where they are "entrained" and killed. A single large power plant or other industry on Lake Erie can entrain nearly 3,000,000 baby perch in one year.

In addition to protecting spawning grounds and regulating fisheries, then, some drastic measures are needed to prevent further loss of perch to industries and power plants using lake water. Think about what could be done and try to present your ideas as a compromise proposal.

Questions to consider:

1. Which of the Division of Wildlife proposals do you favor?
2. What are you willing to give up in order to have as many of your ideas as possible accepted?



The future of Ohio's wetlands?

Who's Winding the Shore? Office of Coastal Zone Management, Washington, D.C.; National Oceanic and Atmospheric Administration, 1976.

POWER PLANTS ... AND WATER USE

The Great Lakes are a huge natural reservoir containing six quintillion gallons of water. This makes them a mighty attractive site for electric power generating facilities. Thermal plants, both nuclear and fossil-fueled, use steam to drive the turbines which generate our electricity. They require the cool lake waters to remove the waste heat from the power generation equipment.

How much water do these plants use? As the largest water users in the state they use nearly three-fourths of the 17 billion gallons of Ohio's daily water consumption. A typical 290 megawatt fossil-fuel plant uses 160,000 gallons per minute. If the plant uses a once-through cooling system, as most fossil-fuel plants now do, only a very small amount of this water is lost through evaporation inside the plant. About 99% is returned to the source from which it was diverted. But this water, because it has taken heat from the steam, is about 5F° warmer than it was.



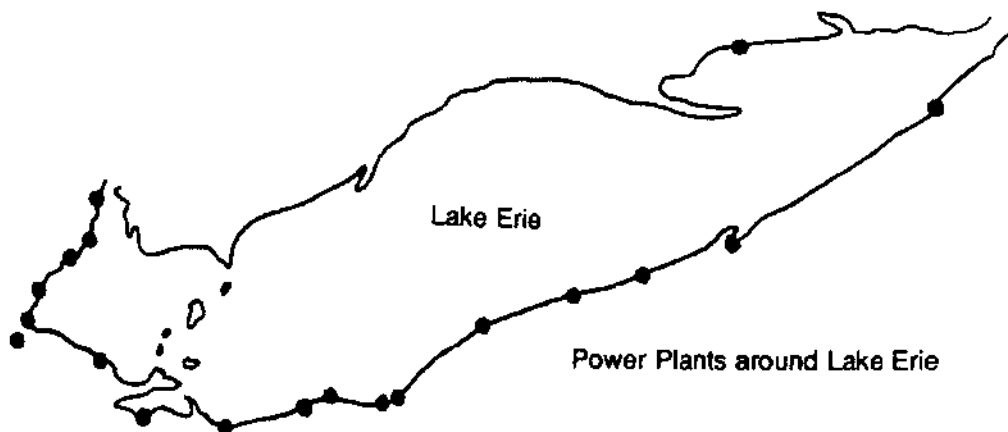
Use of cooling towers such as the one at Davis-Besse will soon be required in order to lessen this "thermal pollution." But in a cooling tower, the heat is transferred to the air through evaporation. Thus a larger amount of water is lost. A power plant with a cooling tower will pass about 15 million gallons of water in the form of steam into the atmosphere each day. A cooling tower also needs water for "blowdown" or removal of accumulated solids from the cooling water.

Ohio's streams, except for the Ohio River, cannot afford such water loss. Thus the continued use of Lake Erie (with 12.5 quadrillion gallons) and the other Great Lakes for energy facility sites is an inevitable part of our future.

The Beacon, Ohio Coastal Zone Management Newsletter,

Winter 1977.

Information sources consulted in 1968 indicate that this article is still completely accurate.



ROLE #3 "ACE" ANGLER

Sport Fisher

Ever since you were no more than a fingerling yourself, you've been fishing in Lake Erie. Your dad has told you what it was like to catch enough blue pike in an hour to last for two weeks. Your grandfather can remember catching a muskie or two. Now most sport fishers go after walleye, which is a good fighting fish. You caught a walleye once, but for a good big catch you prefer perch. Before there was a limit, you once caught 100 perch in 3 hours!

Perch fishing is exciting in its own way. A perch doesn't fight much, but there is a trick to hooking one. The perch nibbles at the bait, and it takes an experienced hand to set the hook before the bait is stolen. When you've caught a good sized perch (20 cm or longer) you have a nutritious meal. Besides its excellent flavor, perch has more protein and less fat than beef, pork, or poultry.

Since you are a business person by profession, you have little free time to devote to fishing. You appreciate the facts that you are not limited to a certain season for catching perch, and you can keep as many as 50 per day. Ice fishing around the islands is particularly enjoyable, but there are many good fishing areas all year round.

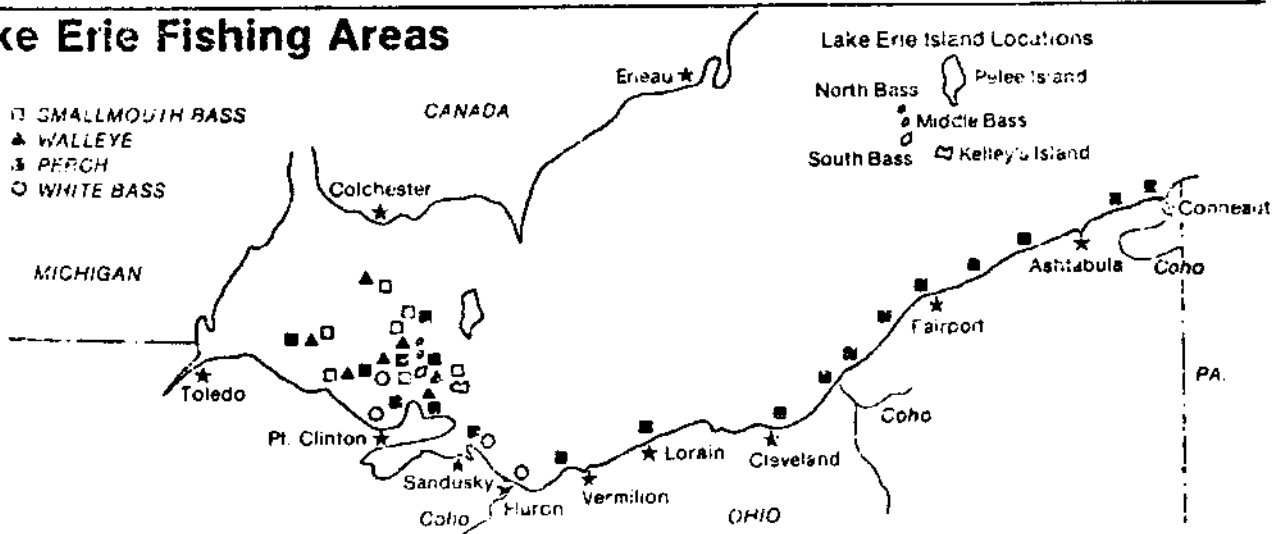
Canadian commercial fishers are now getting almost all the perch caught in Lake Erie, since gill nets have been outlawed for Ohio commercial fishers. The U.S. catch is almost totally caught by sport fishers. As a sport fisher you would like to protect this advantage. These facts may help you.

- A. A resident sport fishing license costs \$7.75. In 1985, the State of Ohio made about \$7,500,000 from the sale of these licenses. You are providing the state with a lot of money, and in return you have a right to get something for it (more fish).
- B. You have found that fishing near a power plant is great because the warm water has lots of food in it to attract fish.
- C. If commercial fishers get to use gill nets in the Western Basin, they will be able to catch even more perch. Commercial licenses provide only about \$33,000 a year in state revenues, and you really don't think that entitles them to as many fish as sportsmen take.
- D. You would like the U.S. to convince the Canadian government to cut the commercial perch harvest. That way, there will be more perch for U.S. sport fishers.

Questions to consider:

1. Which of the Division of Wildlife proposals do you favor?
2. What are you willing to give up in order to have as many of your ideas as possible accepted?

Lake Erie Fishing Areas



Ohio Department of Natural Resources, Division of Wildlife. Publication 137:
"Lake Erie Fishing Services and Facilities."

ROLE #4 SANDY SHORES

Urban Development League of Ohio (UDLO)

You represent an agency committed to developing the Lake Erie shoreline for the benefit of the state. Each year millions of tourists travel through the Great Lakes area. More lakeside motels, amusement parks, and scenic highways would capture more tourist dollars for the state. Private individuals are also looking for lakeshore property for vacation homes. More than one quarter of Ohio's population lives in the eight counties bordering Lake Erie, and more people would come if they had places to live. There are dozens of contracting companies just waiting for UDLO to give them the go-ahead signal so they can begin a massive construction effort and make Erie's shore a real showplace.

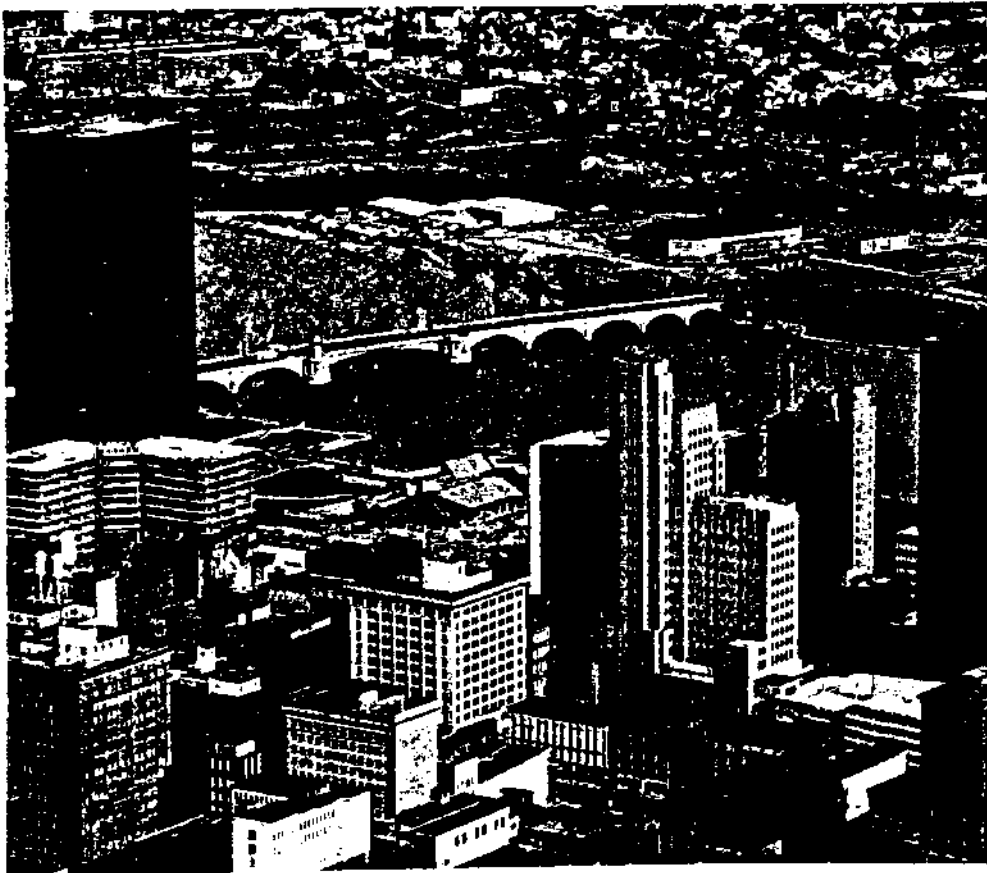
There are some problems, however. First, such development would require massive earth-moving efforts. There must be dredging for marinas, scraping for roads and parking lots, and piling for landscape purposes. Some of your contractors have not used proper erosion control methods in the past, and they have been responsible for some bad erosion problems. You must try to overcome their bad reputation by promising strict rules for erosion control. If such heavy erosion occurred on the lakeshore, the lake would be muddy, and nobody would want to visit there.

The law requires that Lake Erie ports be dredged each year to maintain a depth of 28 feet so freighters can dock. This is one of UDLO's responsibilities. Ordinarily, dredged materials are dumped in diked areas in the lake, where they eventually form new islands. Fishing is great around islands, so the sport fishers should be attracted to these areas. The DOW, however, is proposing that dredged materials be dumped inland. This would be very expensive and difficult to manage.

Finally, the DOW wants to ban construction within one - half mile of the lakeshore. This would spell disaster for UDLO's plans. People come to Lake Erie to see the lake and to play around it. If they have to hike such a distance from their motels, they probably won't even bother to come. What kind of scenic view can you get from that far away? You think it would be a terrible mistake to let this measure pass. The state would lose millions of dollars in tourist trade and property taxes without shore development.

Questions to consider:

1. What changes in the proposal will you recommend?
2. What are you willing to give up to get most of your ideas accepted?



**Downtown
Toledo**

DOWNTOWN TOLEDO HARBOR REVITALIZATION REALITY

Lake Erie's busiest port, the Port of Toledo, has long served as a vital part of that city's economy. The port developed and expanded quickly into its present 4,000 - acre complex. The Toledo - Lucas County Planning Commission has made exciting changes in downtown Toledo along the Maumee riverfront to add to the port development. The riverfront is used for commercial, residential, industrial, and recreational purposes, as well as for transportation development. The paragraphs below describe some of these developments which are now available for both Toledo residents and visitors to the city.

In the heart of the city, exciting changes have been taking place that have transformed downtown Toledo into a center of business activity. More than \$400 million has been spent during the last four years in the central business district creating thousands of square feet of first class office space in a setting studded with green space and filled with outdoor cultural events.

O-1 Anchors Seagate

Anchoring the downtown area on the beautiful Maumee riverfront is the new Owens-Illinois Inc. World Headquarters at One SeaGate. Largest of the projects, the 900,000 square foot office tower rises 32 stories above street level and has an adjoining pavilion on the north side containing a cafeteria and auditorium. The structure was built by the Fortune 500 firm at a cost of \$100 million. The new city Vistula parking facility across Summit Street is connected to the building by an underground pedestrian concourse.

Portside Festival Market

An important part of the SeaGate area will be the Portside Festival Market now under construction between the Owens-Illinois World Headquarters and the Toledo Trust Building. Modelled after Harborplace in Baltimore, the \$19 million project will contain a variety of food and retail booths expected to bring a sense of excitement to the downtown area. These plus new and existing retail establishments add up to a positive retail picture.

Also under construction as part of the SeaGate area, is the \$27 million L'Hotel Sofitel, a four-star French hotel that will have 250 rooms, three authentic French restaurants and dining facilities for 1,000 people.

Park Enhances Downtown

The entire downtown is enhanced by Promenade Park which was recently renovated by the city in an \$8 million program. The park along the riverfront is within a few blocks of most office facilities and offers a place for a few minutes of quiet relaxation. After work parties in the park and other special events help make downtown Toledo a scene of vitality and energy.

Also part of the SeaGate complex is the new headquarters of Toledo Trust which contains 85,000 square feet of office area. The \$15 million triangular structure on the Maumee River side of Summit Street features a skylight-topped atrium extending through all floors.

Across Summit Street at Four SeaGate, the ten-story twin tower Webstrand Office Building is rising. Scheduled to open in 1984, the \$27 million structure will provide 223,000 square feet of first quality office space in an innovative building incorporating the latest in energy-saving features including solar collectors. Indoor parking will be provided beneath the building.

Maritime Plaza with 30,000 square feet of office area is also an extension of the SeaGate development. Located on the riverfront on the north side of the Cherry Street Bridge, the \$11.5 million structure contains internal parking facilities.

ROLE #5 TERRY WATTS

Consolidated Ohio Power

You are the plant manager of the Water Hole Power Station on Lake Erie. Water Hole is a 20-year-old fossil fueled (coal fired) power plant capable of generating 600 megawatts of power. It has a once-through cooling system, meaning that it draws in water from the lake, uses this water to cool its steam condensers, and then discharges the water directly back to the lake. This also means that Water Hole does not have a cooling tower. It uses over 500,000 gallons of water per minute (gpm), which it discharges 15° F warmer than it was when it entered the plant.

Water Hole is in a rapidly developing area. Low cost electric power is essential to allow this development to continue. In fact, the area has developed so rapidly that Consolidated Power can no longer supply the demand with its three power plants and must now purchase power from Detroit Hydro, a neighboring company. Last spring you attempted to get a 15% rate hike to allow purchase and initial construction of a new power plant. The Public Utilities Commission allowed only a 10% increase, and this was hard to get.

You have an impingement problem at Water Hole. During the winter, large numbers of gizzard shad enter the intake canal and are trapped against screens which are placed in the canal to remove large fish and debris. These would damage the internal workings of the plant if they were allowed to go through it. Last year so many fish piled up on the screens that no water could pass and you were forced to shut down Water Hole. Damages amounting to \$100,000 resulted when the screens were smashed by the pressure of the fish and water. You would like DOW to suggest an inexpensive method to solve this problem, but they are not doing any research in this area. They have made several recommendations, most of which cost over \$1,000,000 and are not guaranteed to be successful. These costs would be passed on to consumers, and the public is already upset over energy costs.

DOW has found that you also have an entrainment problem at Water Hole. Entrainment occurs when hot water in the plant kills fish eggs and larvae (fry) which are carried along (entrained) in the intake current. DOW estimates that during a single spawning season Water Hole kills 3,000,000 fry.

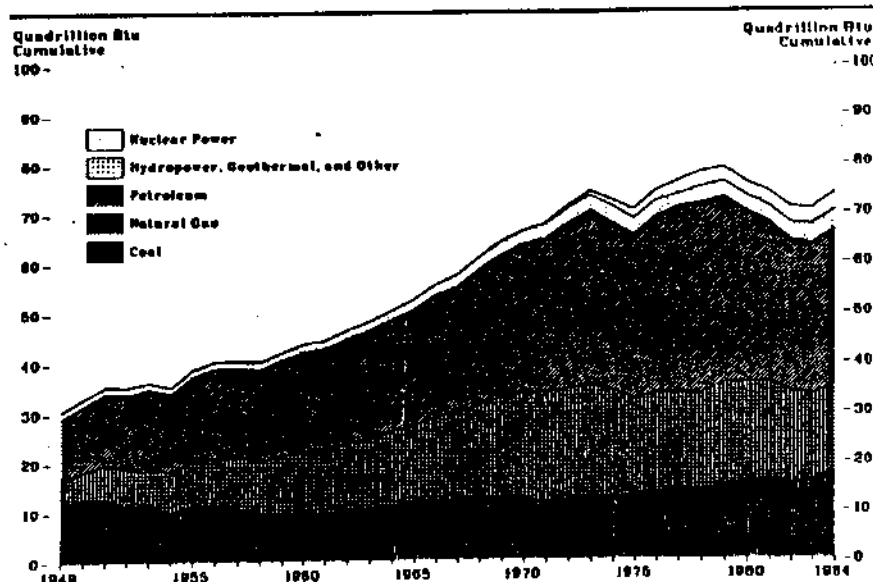
If DOW requires you to reduce the temperature of your discharge to 1° F above the intake temperature it will be necessary to install a cooling tower. This tower would reduce your entrainment and impingement problems by 95% since your intake volume would be reduced from 500,000 gpm to 20,000 gpm. However, this tower would cost between \$20 and \$35 million and would reduce your net power output from 600 megawatts to 550 megawatts. All these costs would be passed on to consumers, raising the average electric bill by 25 %. You feel this is unacceptable and unfair, especially to the many consumers in your area who are not fishermen and who do not eat perch or use Lake Erie for recreation.

The graph shows how energy use is increasing year by year. Energy use will probably never drop off, but conservation measures may level it off at the present high rate. Coal provides only a small amount of our energy, yet Ohio produces millions of tons of coal each year. You believe we should support local industry by using more Ohio coal, not by imposing restrictions that discourage its use. DOW Proposal 1 makes power production more expensive. You would favor some proposal that would cut your costs, not raise them.

Questions to be considered:

1. Which proposition do you favor?
2. What are you willing to give up (compromise) in order to get what you want?

Consumption of Energy by Source, 1949-1984



From: Annual Energy Review, National Energy Information Administration, DOE-EIA-0384(84), p.8.

LAKE ERIE AT AN ENERGY CROSSROADS

Energy has been, for several years, one of the stickiest problems facing our country. With oil embargoes, trans-Alaskan pipelines, nuclear fusion breakthroughs, record cold winters and the creation of new Departments of Energy at the state and federal levels, it's one of the hottest news items as well. To a Lake Erie resident, problems and conflicts regarding energy often seem to peak and then fade with time. But if the issues at times seem as far away as Saudi Arabia or Prudhoe Bay, consider the following:

- Of Ohio's six nuclear units now operating or under construction, five are on Lake Erie; of the additional three units planned, two are in the lake region.

- The possibility of drilling for natural gas under Lake Erie is being considered anew by the General Assembly.

- Pittsburgh researchers are looking at the feasibility of offshore wind energy generation systems in the Great Lakes.

- Fifteen million gallons of Lake Erie's water evaporates every day from each cooling tower in use.

- A \$100 million coal gasification demonstration plant is planned for Lorain's west side, in the coastal area.

Ohio and Lake Erie are indeed at an energy crossroads both geographically and chronologically. Tough decisions will be necessary in the upcoming years.

The many uses of Lake Erie's coastal area for energy raise serious environmental, social and public health questions. Construction at major utility sites can cause greatly increased sedimentation, degrading water quality and hampering recreation and fish habitats. Land use development and traffic patterns



can be disrupted in unpredictable ways. And public fears regarding the hazards of nuclear wastes have not been allayed. On the other hand additional electrical energy must be provided if we are to reduce dependence on foreign oil.

Dealing with energy problems in the Lake region is one aspect of Ohio's Coast Zone Management Program. Seven Lake Erie communities will be studying means to alleviate impacts from energy development through the Coastal Energy Impact Program (CEIP) administered by the Ohio Department of Energy. The program will bring over \$400,000 to the county and regional planning agencies from the federal Office of Coastal Zone Management (OCZM). Projects will include analysis of the impacts of Davis-Besse and Perry nuclear power plants in Lucas and Lake counties, a study of alternate energy sources and natural gas transmission in the eastern counties, and an assessment of actions needed to bring Lorain's proposed coal gasification plant in line with air quality standards.

Ohio's CZM Program staff, as a part of its draft plan, has developed a set of policies and proposed implementation methods for improving coastal energy facility siting processes. Most of these policies involve considering additional concerns in the Ohio Power Siting Commission's (OPSC) review process. Visual impacts on the shoreline and inappropriate use of the shoreline by non-coastal dependent energy-related facilities are to be addressed. Concerns of the CZM Program will be addressed within the OPSC through representation by the Director of the Department of Natural Resources. Additional coordination will also be developed with Ohio's Department of Energy. In all, a stronger voice for coastal concerns will result throughout energy planning processes.

ROLE #6 CAPTAIN FISHER

Representative of Fishing Fleet and Buyers Co-op (Commercial Fisher)

Your father fished in the same boat you do, and you took over his business when he got older and retired. When your father left you the boat and nets, he told you to always stand behind the co-op and help other fishers as much as possible. The fishing has not been good the last few years because the Canadians have been taking all but about 10% of the perch catch with gill nets. You cannot use gill nets because they are outlawed in U.S. waters of the western basin.

You want the Division of Wildlife to permit you to use gill nets. Since you know the best selling fish are the bigger ones, you are willing to settle for a kind of gill net that will let other perch through and will only catch those over 20 cm (8 inches) long. The fishing season now lasts from March 1 to December 10. You want a longer season so you can catch more fish. Because all this will lower the number of fish in the lake, you want the Division of Wildlife to stock more perch in the lake. If all goes according to plan, the price of perch will go up. Last year you made only \$8,000 from fishing. You need this money to buy new nets and to overhaul your boat. If you do get all of these things done then you can catch perch for the new fast food Perchburger.

You need to know this information:

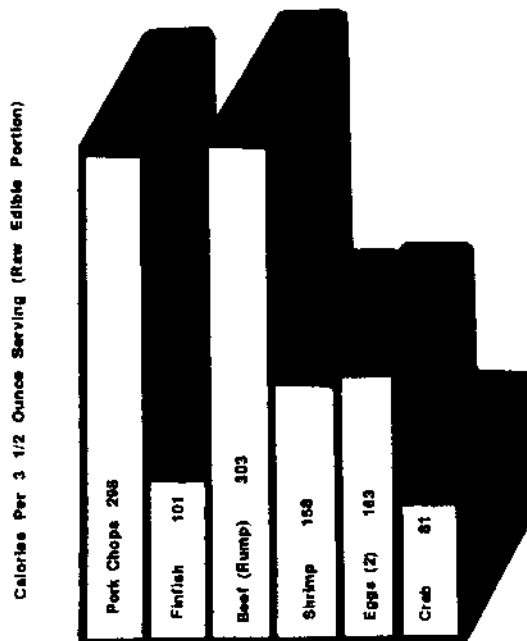
1. The fish processors in your organization are pushing for much greater use of Lake Erie fish in Ohio. To bring more fish from Maine or Florida is very expensive, and lake fish have the same flavor and nutritional value as the "imported" types. Notice how fish compares with other foods:

2. A Sea Grant researcher found that Western Basin sport fishers spend about \$31 million a year on fishing trips and support about 4,000 jobs. Perch fishing means a lot of money for local areas.
3. Canada supports its commercial fishery and therefore the Canadians are catching almost all the perch taken from the lake. The DOW should support U.S. fisheries so we can receive the same benefits.
4. Fish caught locally will cost consumers less than fish from the ocean. People would eat more fish and be healthier if fish didn't cost so much.

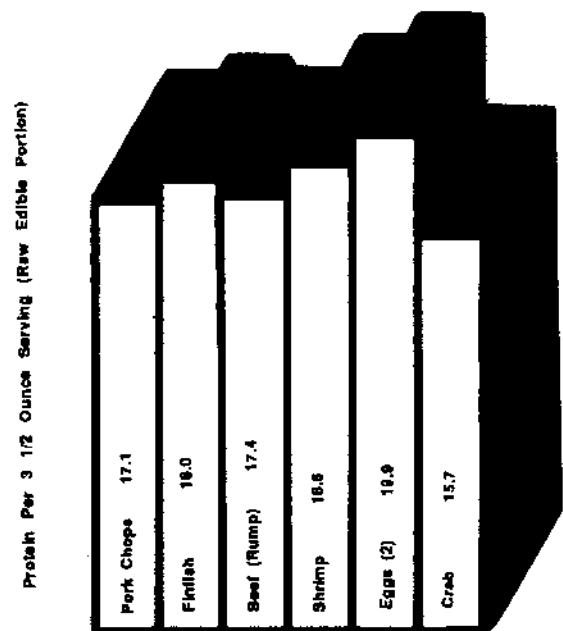
Questions to answer:

1. Which position do you favor?
2. What are you willing to use to bargain in order to get the things you want?

Calorie Comparison



Protein Comparison



"Value Your Life—Discover Seafood." National Marine Fisheries Service, Washington, D.C.; National Oceanographic and Atmospheric Administration, 1972.

EVALUATION ITEMS

1. About how many eggs does a female yellow perch lay?
 - 1) 150,000
 - *2) 50,000
 - 3) 25,000
 - 4) 5,000

2. Which of the following is probably not a reason why perch lay a large number of eggs?
 - 1) There are many other fish that eat the perch.
 - 2) Many of the eggs do not hatch.
 - *3) Lake Erie is a huge body of water and can support them all.
 - 4) The odds are against the survival of most of the perch.

3. Baby perch ("fry") survival is not affected by
 - 1) predators.
 - 2) water temperature.
 - *3) sport fishing.
 - 4) industries along the lake.

4. How could the survival rate of perch eggs be increased?
 - *1) Dump dredged materials on land instead of in the lake.
 - 2) Use more water for industrial cooling.
 - 3) Add fertilization to the water to provide more plants.
 - 4) Add herbicides to the water to get rid of some of the plants.

5. If the lake level rises, what is one way the perch population is affected?
 - 1) Population is unaffected.
 - 2) Population decreases because flood waters wash fish up on land.
 - *3) Population increases because new spawning grounds are created.

6. When and why are water plants important to perch?
 - 1) They provide food for adult perch.
 - 2) They provide food for baby perch.
 - 3) They hold eggs in place until baby perch can hatch.
 - *4) Both 2 and 3.

7. The amount of perch in Lake Erie could be increased by
 - 1) allowing unlimited use of gill nets.
 - *2) putting a limit on the fishing season.
 - 3) encouraging construction along the shoreline.
 - 4) dredging out egg laying areas.

8. Fisheries management policies are affected by
 - 1) industries.
 - 2) commercial and sport fishers.
 - 3) The state's Division of Wildlife.
 - *4) All of the above.

9. What is optimum yield?
 - 1) The best number of fingerlings to use to re-stock the lake.
 - 2) The largest number of eggs that a female perch can lay.
 - 3) The largest number of perch that a lake can support.
 - *4) The best number of perch to catch in any one year.

GAME BOARD GLOSSARY

1. **dredge** - to dig out the bottom of a waterway in order to deepen the water.
2. **fertilization** - the uniting of male and female sex cells (sperm and eggs).
3. **fillet** - to cut off the strips of fish flesh along the fish's spine and ribs.
4. **fingerling** - a young fish, about the length of a finger.
5. **gillnet** - a net made of fine threads that entangle a fish's gills. It looks like a tennis net.
6. **herbicide** - a chemical that kills plants.
7. **heron** - a large bird that eats fish.
8. **kingfisher** - a bird that eats small fish.
9. **marina** - a place where boats are docked and serviced.
10. **mature** - able to reproduce.
11. **spawning** - the depositing of eggs by fish.

REFERENCES

Annual Energy Review. National Energy Information Administration. DOE-EIA-1384 (84). P. 8.

The Beacon. Ohio Coastal Zone Newsletter. Winter 1977 and 1978.

Dewitt, John. "Ohio to Provide \$8.4 million to Carve out Inner Harbor." Cleveland Plain Dealer. P.16A. October 22, 1985.

Downtown Toledo Office Profile. Toledo Area Chamber of Commerce. Vol. 38, No. 11, 1983.

Ohio Department of Natural Resources, Division of Wildlife.

Publication 137: "Lake Erie Fishing Services and Facilities."

Publication 200: "Commercial Fish Landings, Lake Erie - 1985." Status and Trend Highlights: Ohio's Lake Erie Fish and Fisheries, March 1985.

Publication 2. Commercial Fishing Law Digest (R1184) - 1985 Fishing Regulations.

Reutter, Jeffery M. Fishery Management: Goals and Tools. Fact Sheet 17.

Reutter, J.M. and Herdendorf, C.E., "Yellow Perch in Lake Erie." Unpublished report. Columbus: Center for Lake Erie Area Research, 1978.

"Vitalize Your Life--Discover Seafood." National Marine Fisheries Service, Washington, D.C.: National Oceanographic and Atmospheric Administration, 1978.

SPINNER

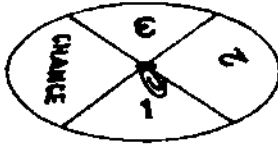
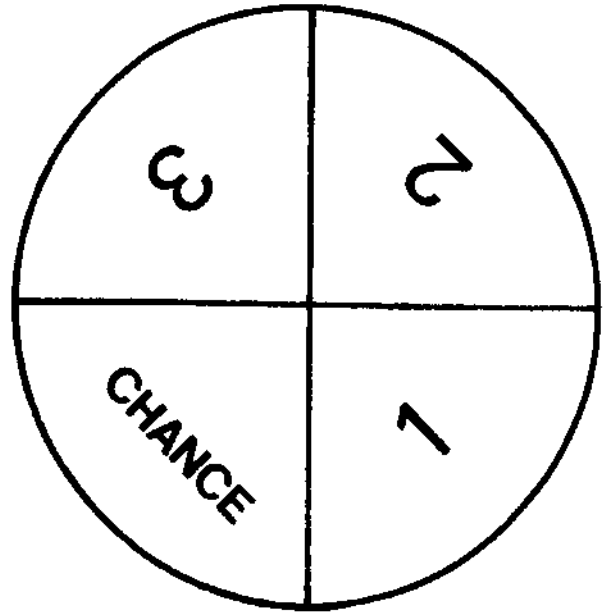
Cut out the spinner and paste it on a piece of cardboard. Punch a hole in the center and put a paper fastener through the hole so it will hold the paper clip and allow it to spin.



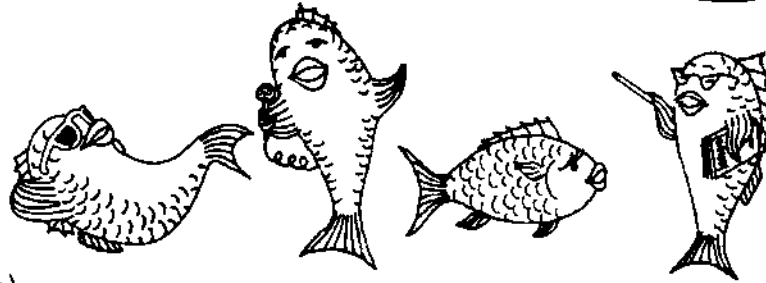
Paper clip



Paper fastener



PLACE-MARKER
TOKENS
(Cut out
and color)



CHANCE CARDS (cut apart)

Division of Wildlife stocks
20,000 new perch in the lake.
Add 5,000 of these to your
population.

Perch-eating pike are stocked
in the lake. Lose all but 1,000
of your perch if they are
smaller than 23 cm.

Sport fishing banned this
year because of low popula-
tions.

Take another turn.

Excellent growing conditions
this year.

Take another turn.

Pesticides kill zooplankton and aquatic insects. Lose 1 turn while your fish move to new feeding areas.

Algae bloom results in a temporary abundance of food. (Perch eat zooplankton which eat the algae.)

Take another turn.

The legislature establishes a perch fishing season (5 months) instead of allowing year-round sport fishing. KEEP THIS CARD; it will cancel your next loss of perch.

Wastes from a chemical industry stunt the growth of your population.

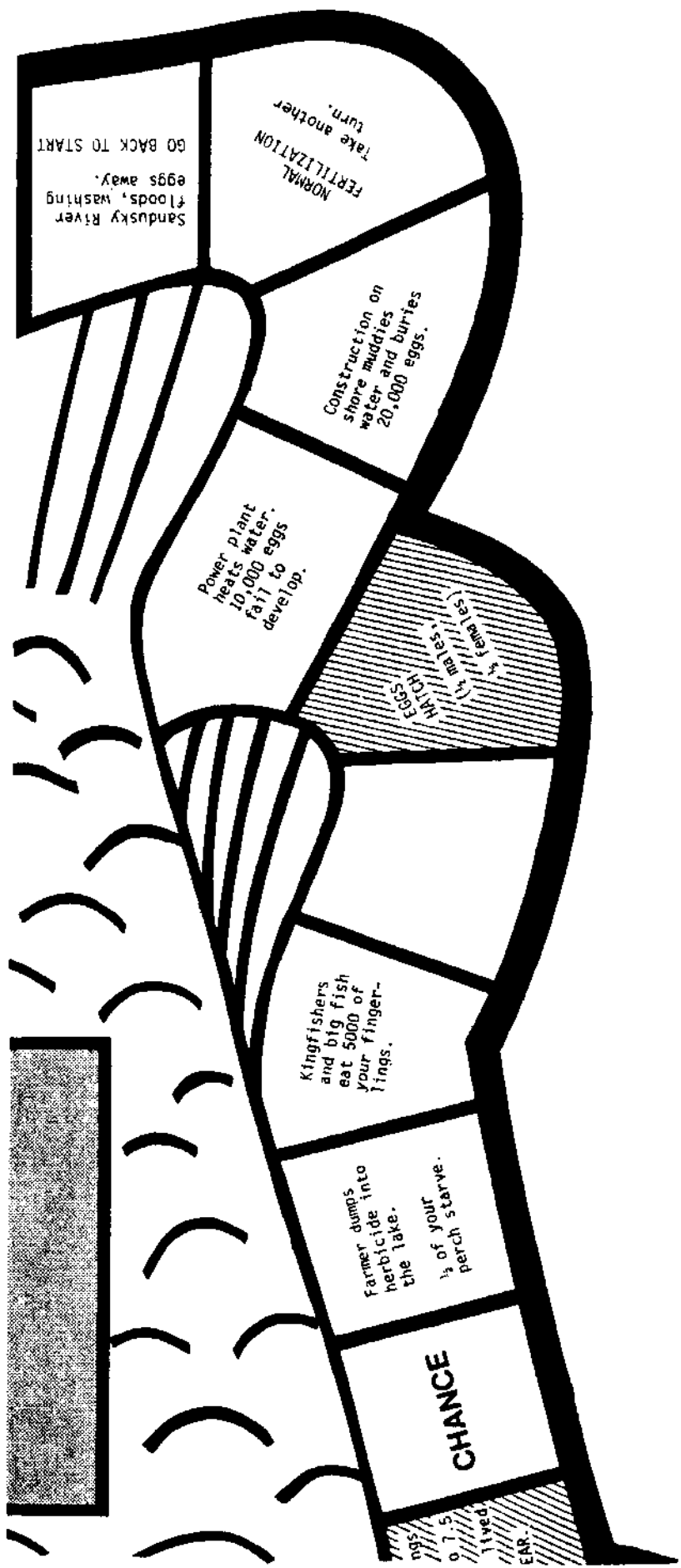
Lose 1 turn.

Heavy storms affect perch population. Wave action and habitat destruction kill 500 fish less than 15 cm. long. If your fish are larger they survive.

A rainy spring season raises the lake level, and flooded shores create new spawning grounds. Each perch population under 15 cm. gains 2,000 fish.

Sports fishermen develop a new, more effective lure. If your fish are more than 23 cm. long, 500 are caught.

Shoreline marshes filled in for new homesites. Half of your population will not find suitable spawning grounds. If your fish are under 3 years old this card has no effect.



Sandusky River floods, washing eggs away. GO BACK TO START

NORMAL FERTILIZATION Take another turn.

Construction on shore muddies water and buries 20,000 eggs.

Power plant heats water. 20,000 eggs fail to develop.

HE EGGS (1/4 males, 3/4 females)

Kingfishers and big fish eat 5000 of your fingerlings.

Farmer dumps herbicide into the lake. 1/2 of your perch starve.

CHANCE

ngs
0 7 5
lived
EAR

Construction
one mile awa
the water an
new perch 1
area. ADD
1000
PERCH!

GILL NETS
legalized in U.S.
western basin.
% of your fish
are caught.

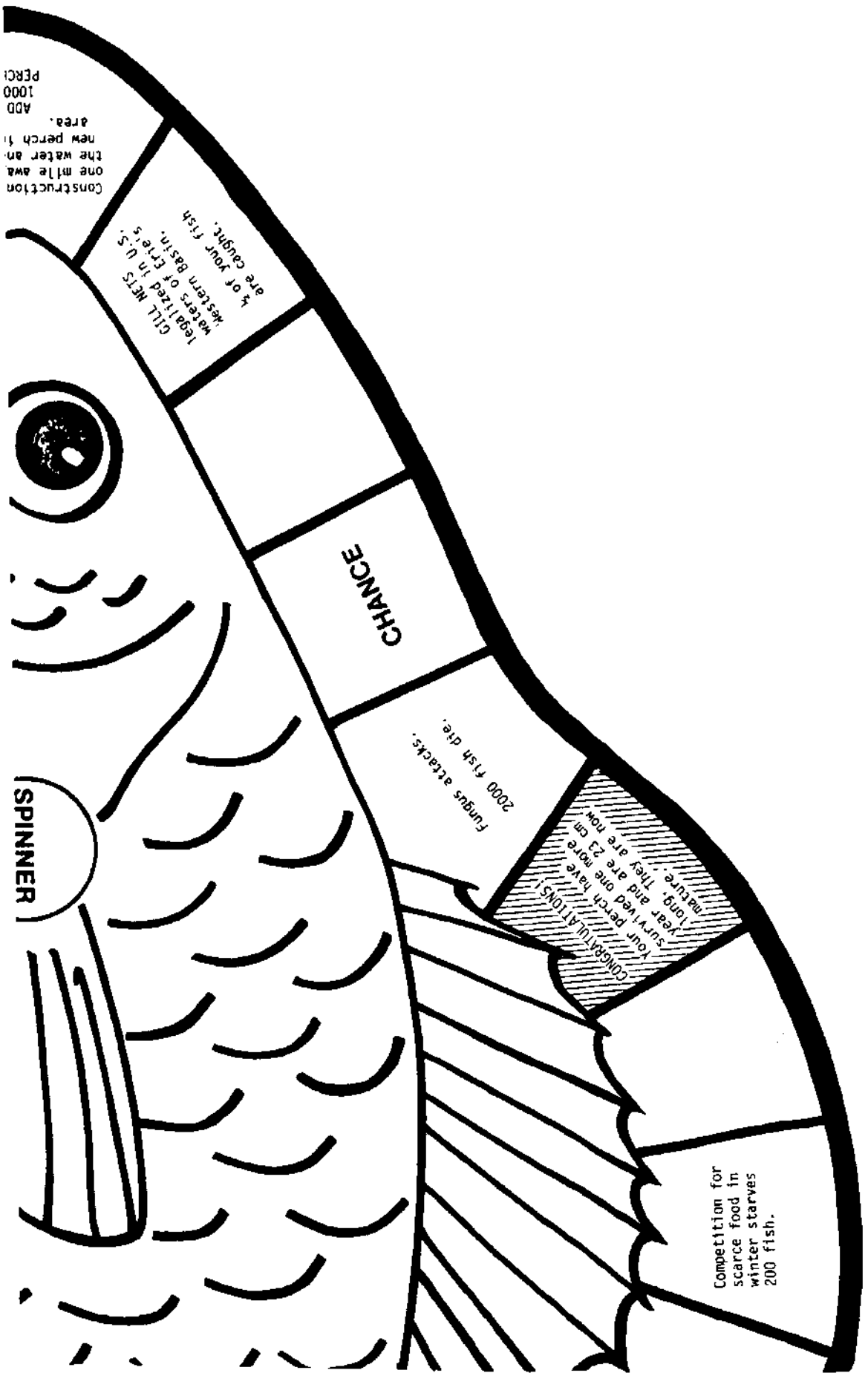
CHANGE

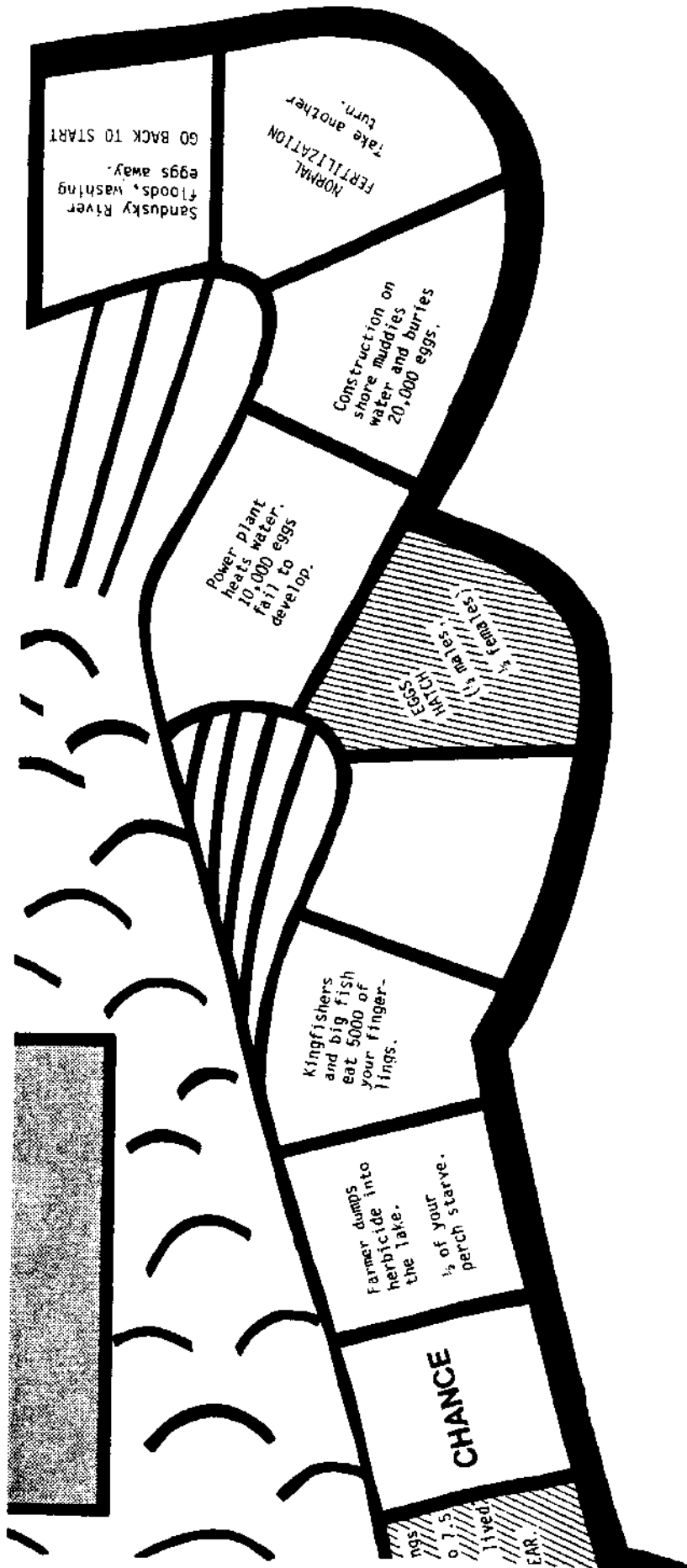
Fungus attacks.
2000 fish die.

CONGRATULATIONS!
Your perch have
survived one more
year. They are 23 cm
long. They are now
mature.

Competition for
scarce food in
winter starves
200 fish.

SPINNER





Sandusky River
floods, washing
eggs away.
GO BACK TO START

NORMAL
FERTILIZATION
Take another
turn.

Construction on
shore muddies
water and buries
20,000 eggs.

Power plant
heats water.
10,000 eggs
fail to
develop.

EGGS
HATCH
(1 male,
3 females)

Kingfishers
and big fish
eat 5000 of
your finger-
lings.

Farmer dumps
herbicide into
the lake.
1/2 of your
perch starve.

CHANCE

EGGS
0 1 5
Lived
EAR

Construction
one mile away,
the water and
new perch in
area.
ADD
1000
PERCH

GILL NETS
legalized in U.S.
western basin.
1/3 of your fish
are caught.

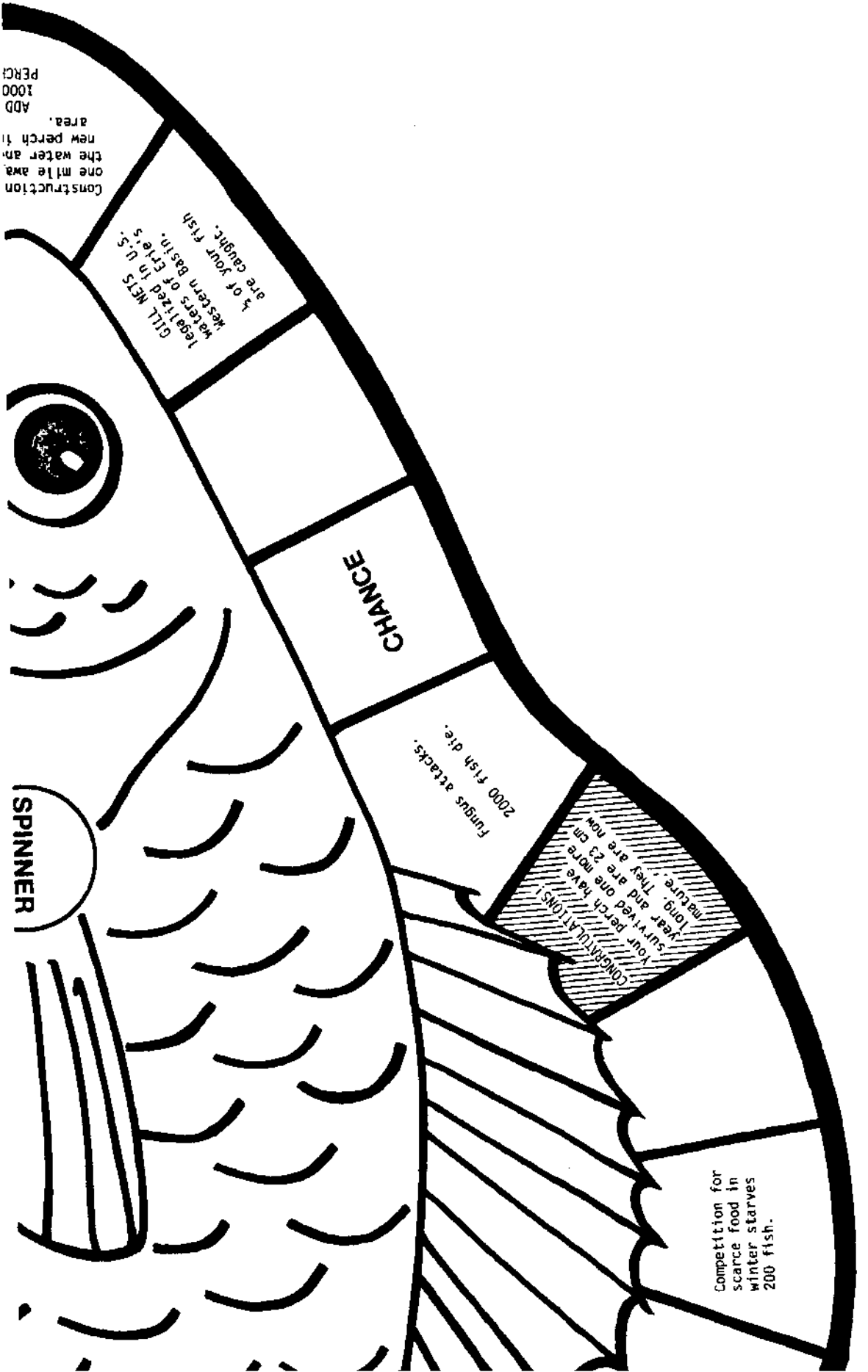
CHANGE

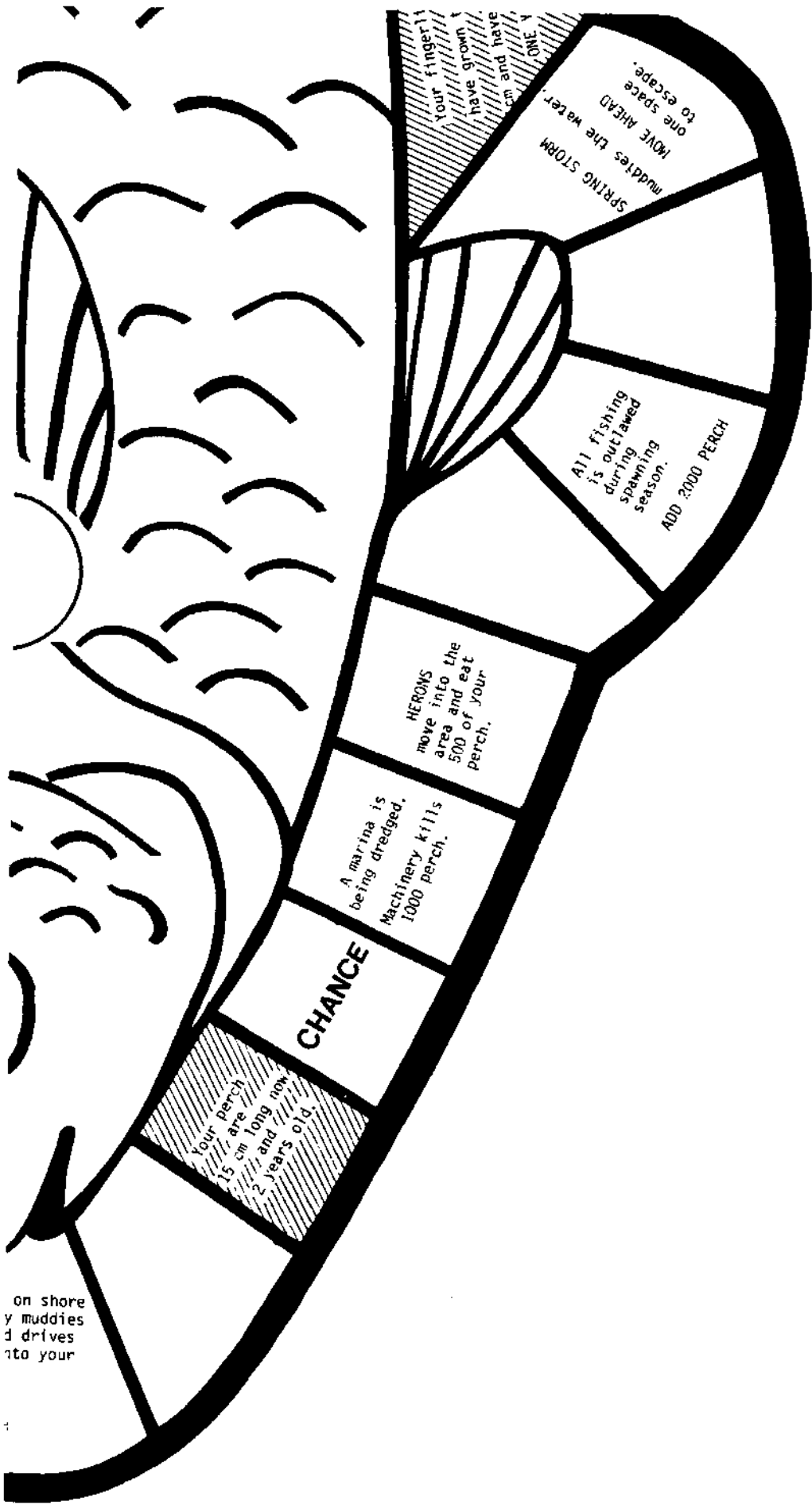
Fungus attacks.
2000 fish die.

CONSPIRACIONS!
Your perch have
survived one more
year and are now
mature. They are 23
cm long.

Competition for
scarce food in
winter starves
200 fish.

SPINNER







Ohio Sea Grant Program

Charles E. Herdendorf, Program Director
Rosanne W. Fortner, Assistant Director for Education
Victor J. Mayer, Project Director

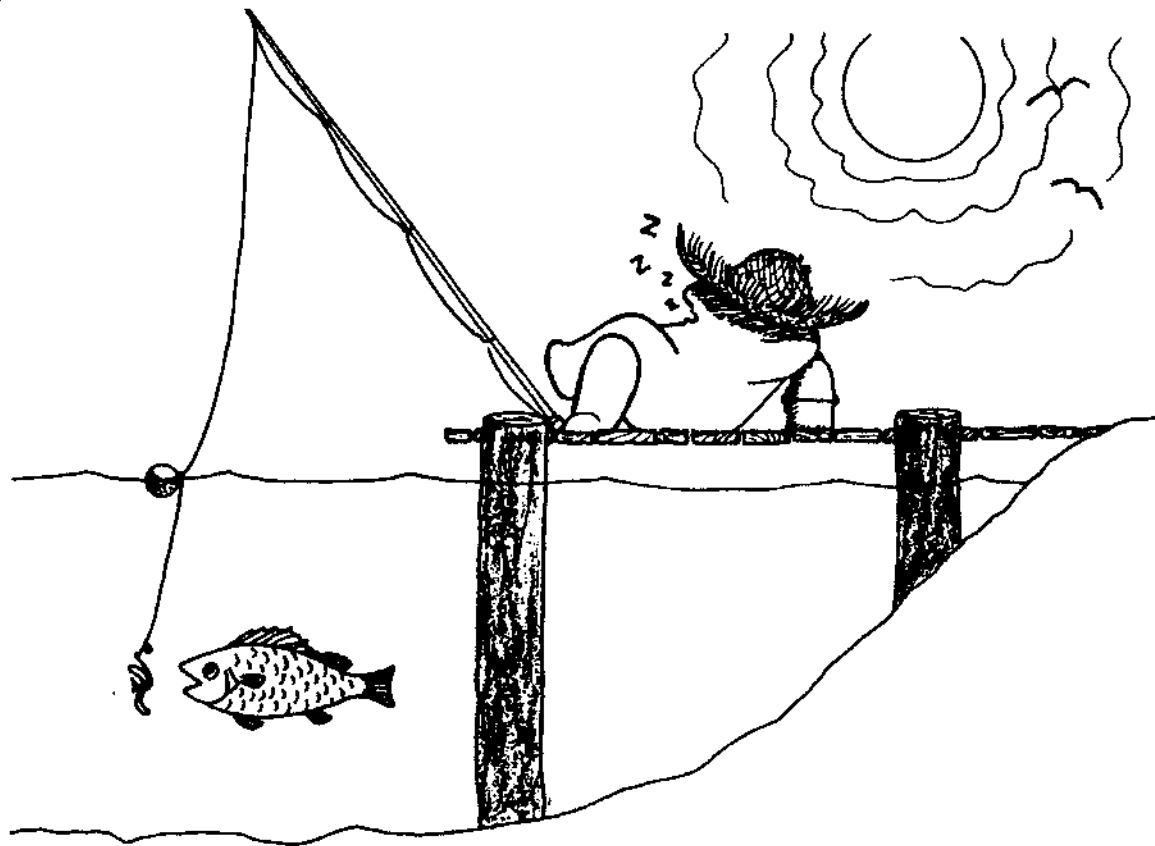


YELLOW PERCH IN LAKE ERIE

by

Rosanne Fortner and Gabriele Reil,
The Ohio State University
and

Susan Leach, Upper Arlington (Ohio) Public Schools



OEAGLS-Oceanic
Education
Activities
for
Great
Lakes
Schools

OEAGLS INVESTIGATION #9

Completed May, 1979

Revised July, 1980
and June 1985

This instructional activity was prepared with the support of the National Oceanic and Atmospheric Administration and The Ohio State University's College of Education and School of Natural Resources.

Any opinions, findings, conclusions, or recommendations expressed herein are those of the authors, and do not necessarily reflect the views of NOAA or the University.

Copyright ©

The Ohio State University Research Foundation, 1979, 1985.

Permission is hereby granted to schools to reproduce all or part of this material for instructional purposes, provided credit is given to the Ohio Sea Grant Education Program.



YELLOW PERCH IN LAKE ERIE

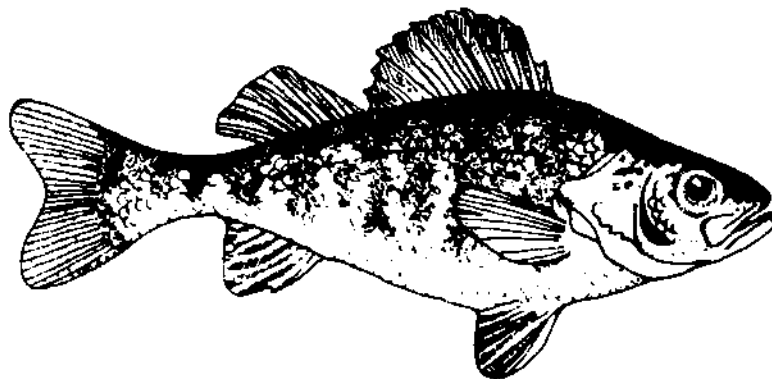
by
Rosanne W. Fortner, Gabriele Reil and Susan Leach

INTRODUCTION

Each spring, hundreds of thousands of yellow perch deposit their eggs over vegetation in the shallow waters of Lake Erie's shoreline. A female perch can lay jelly-like ribbons of up to 50,000 eggs at one time. At this rate will Lake Erie soon have a population explosion of yellow perch? Why are so many eggs laid by each fish? How does nature control population size? Can people also affect fish populations?

OBJECTIVES: When you have completed these activities, you should be able to:

1. Describe the life cycle of the yellow perch.
2. Discuss the factors that can affect perch populations at each stage of the life cycle.
3. Discuss the pros and cons of some methods used to manage the Lake Erie perch population.



YELLOW PERCH

Perca flavescens

length: 10-34 cm

weight: 112-568 g.

coloring: bright green to olive to golden brown on back; yellow-green, yellow on sides; grey to milk-white below

common names: perch, lake perch, American perch

Figure 1: Characteristics of Yellow Perch (Fish of Lake Michigan, University of Wisconsin, 1974.)

ACTIVITY A: WHAT CAN HAPPEN TO A GROWING PERCH?

MATERIALS: Perch Life Cycle game board, spinner, place marker tokens (one per student), CHANCE cards, record sheets.

PROCEDURE

- A. Object of the game: The first player to have one male and one female fish survive to spawn is the winner. Another more important object is to find out the things that can happen to perch populations. Be sure you read the information in the board spaces and on the game cards. If you read them out loud all players can learn about what is happening to your perch.
- B. The game board: The shape of the board represents the shape of a yellow perch. At the tail is an area marked START. Other shaded areas stand for important events in a perch's life: hatching, "birthdays," and maturity. Some of the areas tell you how large or how old your fish are when you have passed that point on the board.

The events of the shaded areas happen to your population even if you don't land exactly on the areas. Simply passing such a space means that the event has happened.

- C. How to begin: Two to four people can play. Choose a token to represent your perch population and place it on the START space of the game board. Each population begins with 50,000 eggs. Record this number on the record sheet for each player.

The person with the highest total on two spins of the spinner plays first. The one with the next highest total goes second, and so on. CHANCE on the spinner counts as zero.

- D. How to play: When your turn comes, spin the spinner and move your token clockwise the number of spaces indicated. If the spinner points to CHANCE or if you land on a space marked CHANCE, draw a CHANCE card from the top of the deck and follow the instructions on it. If the card does not say "KEEP THIS CARD" place it back on the bottom of the deck before the next player's turn.

NOTE: CHANCE cards refer to fish, not to eggs. If you spin a CHANCE before your eggs hatch, spin again.

As you play, record the size of your perch population on your record sheet. In most cases, males and females are added together to get the population size, but some events affect only one sex of the fish. Unless you are told to do differently, assume that half of your fish are females and half are males (see "hatching" space).

- E. Losing all your perch: If the space you are on or the CHANCE cards drawn cause you to lose more fish than you have on your record sheet, your population has been wiped out. Depending on where you are on the board, this can have two different effects:

- (1) If your eggs have not hatched when they are all wiped out, go back to START and begin all over again with 50,000 eggs.
- (2) After the eggs hatch, your population is expected to be on its own. If you lose all your fish, you are out of the game.



F. Winning the game: The first person to land exactly on the SPAWN square with at least one male and one female is the winner. If all players but one are wiped out, the remaining player is still not the winner until his or her fish make it to spawning. If no fish make it to spawning, your team may start the game over again.

G. When the game is over: Using the game board spaces and the CHANCE cards, complete the game chart in Figure 2 and answer the following questions.

1. Why is it an advantage to the yellow perch to lay so many eggs?

2. In which part of the perch life cycle are the most animals lost?

3. At what age does a perch become sexually mature?

4. What destroys most of the perch that become mature?

5. In what ways could the numbers of perch be increased?

6. Could factors like those that affect perch in Lake Erie also affect fish in the ocean? Do you think that these factors have as big an effect on fish in the ocean? Explain your answer.

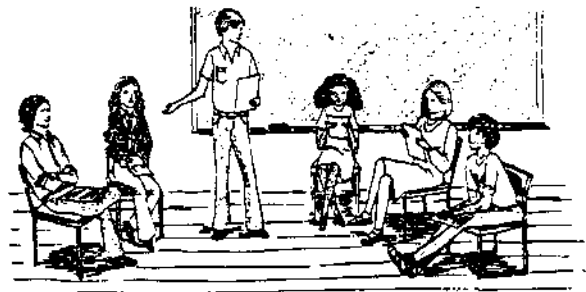
ACTIVITY B: HOW CAN THE FISHERY BE MANAGED?

Now that you have learned of the many things that can happen to a population of perch, you know why it is sometimes necessary to make rules to protect them. The organization responsible for making and enforcing those rules in Ohio is the Division of Wildlife, a part of the Ohio Department of Natural Resources.

PROCEDURE

Many people and organizations are affected by a fishery management policy. The interested groups all want the policy to benefit them. Your teacher will assign you to represent one of these interest groups:

Ohio Division of Wildlife (DOW)
Commercial Fishers Co-Op
Sport Fishers
Urban Development League of Ohio
Save the Perch
Consolidated Ohio Power Company



The Ohio Division of Wildlife (DOW) is considering the following proposals for managing the perch in the Western Basin of Lake Erie:

1. Increase the survival rate at the egg stage by:

- A. Recommending a ban on construction along the lake shore within 1/2 mile of the lake, thus preserving existing spawning grounds.

- B. Recommending that industries that use water for cooling must limit the temperature increase in that water to 1 degree F, since spawning and hatching depend on water temperature.

- C. Preventing dredged materials from being dumped back into the lake where they would cloud the water and possibly spread dangerous pollutants.

2. Increase the annual harvest by:

- A. Delaying the start of the commercial fishing season until June 1, when spawning will be over.

- B. Allowing commercial fishers to use gill nets from October 1 to December 10 to catch perch 20 cm or longer. Gill nets are now in use in other parts of Lake Erie. They result in a larger catch than the trap nets and seines now used in the Western Basin.

- C. Banning commercial fishing within two miles of the shoreline, so sport fishers will be able to catch more.

Study your role description and be prepared to try to convince others that what your group wants would really be the best for everybody. Your activity schedule will be:

1. Meet with representatives of the other interest groups. The DOW representative will be able to explain what the agency proposes to do to manage the perch populations.
2. Explain why your interest group is for or against the proposals and present a policy that you wish the DOW to enforce.
3. Within your group of representatives, reach a decision about the best proposal, or write a new one. Give this to the DOW person as your group's recommendation.
4. All DOW representatives meet and choose the best perch management policy. While they are meeting, all the interest group representatives write letters to the people they represent, telling how they have worked for the group's cause and what results have been so far.

5. The DOW announces what its new perch management policy will be. DOW representatives answer any questions from the interest groups. Record the DOW decision on your worksheet

6. Was this decision fair to all parties concerned? If not, what interest groups would suffer because of the new policy? Explain on your worksheet.

7. Will the new policy produce the optimum sustained yield of perch in Lake Erie? Explain on your worksheet.

Four states and two nations border Lake Erie, and all these governments try to manage fisheries in the best interests of their people. Regulation of fisheries in the ocean involves the same difficulties as in the Great Lakes. Such factors as territorial waters claimed by coastal nations, rights to migratory fish, protection of endangered species, and ways to enforce fishing laws must all be considered. Your class may wish to find out what happened to world fisheries when the United States declared a 200 mile territorial sea. One of the results is described in the article that follows.

COLUMBUS DISPATCH, March 1, 1979

1977 Law Has Increased Cod, Haddock And The Complaints Of U.S. Fishermen

BOSTON (AP) — The schools of cod and haddock have grown since foreign fishermen were chased from New England's rich fishing waters two years ago but so have the complaints from U.S. fishermen.

The problem, say New England fishermen, is over-regulation by the same law that made the foreign competition pull in its nets and set sail.

TWO YEARS AGO Thursday, the U.S. Fishery Conservation and Management Act ended the severe depletion of fish stocks by the commercial fleets of the Soviet Union, Japan and Poland. The law set strict limits on foreign vessels fishing within 200 miles of U.S. shores, but it also set regulatory controls on American fishermen.

"The situation is tough because we're dealing with a group that has never been under regulation," said Norm Olsen of Portland, Maine, a fisherman who serves on the New England Fishery Council.

Quotas set by the council are aimed at allowing the fish population in Georges Bank and the Gulf of Maine to recover from decades of overfishing by foreign fleets.

BUT THE FISH are plentiful now, say

the fishermen, and quotas only keep them from making more money.

"There's plenty of fish out there," says Edwin Smith, general manager of the New Bedford Seafood Cooperative. "A man should be able to go out and make a living instead of having to stay in port."

Quotas are set on several species, allowing so many to be taken each quarter. Some quotas are filled well before the three months are up, banning certain catches for weeks.

"WE HAD A closure from Nov. 19 to Jan. 1 last year," said Harry Swain, president of Boatowners United Inc. of New Bedford. "It was an economic disaster for some of the men. A boat owner has to hope he can make his payments until he can go out again."

But David Crestin of the Gloucester office of the National Marine Fisheries Service says, "It's tough to predict what the stocks are going to do, and the fishing industry doesn't believe us."

Figures from fisheries officials show fishing has gotten better — and more profitable — since the law went into effect. In 1976, New England fishermen hauled in 293.3 million pounds of fish valued at \$69.7

million. Last year, the catch was 350.3 million pounds, worth \$100.7 million.

BUT THERE ARE also more fishermen: The number of U.S. vessels trolling the waters has doubled since the foreign ships left.

"If we did nothing to control their catch, they would have taken more and certainly made more money," said Crestin. "Anytime you affect someone's pocketbook, actually or potentially, they're going to be mad at you."





Others say the controls have a roller coaster effect on prices, which rise when fishermen cannot bring in fresh catches. Smith said the price of cod went from 30 cents a pound the first six months of 1978 to 70 cents the last half when lower limits were imposed.

OLSEN AND OTHER members of the New England Fishery Council are looking for ways to improve the regulatory process and stabilize prices, but they aren't hopeful.

"There may be a way to clear this up, but I can't tell you what it is," said Olsen. "The problem is, everybody's for regulation as long as it doesn't regulate them."

PERCH POPULATION RECORD

Player's Name:

Token				
Size of Population				

Calculating Space

FACTORS AFFECTING PERCH

Stage of Life Cycle	Natural Factors	Effect of Factors: + for increased pop. - for decreased pop	Human Factors	Effect of Factors: + for increased pop. - for decreased pop.
Eggs (use no CHANCE cards)				
Young Perch (hatching to 2 years)				
2-3 Year Old Perch				
Mature Perch				

Figure 2: Game Chart

Name _____

**WORKSHEET
YELLOW PERCH IN LAKE ERIE**

ACTIVITY A: WHAT HAPPENS TO A GROWING PERCH?

1. Why is it an advantage to the yellow perch to lay so many eggs?

2. In which part of the perch life cycle are the most animals lost?

3. At what age does a perch become sexually mature? _____

4. What destroys most of the perch that become mature? _____

5. In what ways could the numbers of perch be increased?

6. Could factors like those that affect perch in Lake Erie also affect fish in the ocean?

Do you think that these factors have as big an effect on fish in the ocean? _____

Explain your answer. _____

ACTIVITY B: HOW CAN THE PERCH FISHERY BE MANAGED?

2. My interest group (is in favor of, is against) the DOW proposals that recommend

The reasons for this are

My interest group would prefer

3. The representatives I met with decided that the best proposal would be to

4. (On your own paper, write a letter to the interest group you represent telling them how you worked for the group's cause and what has happened so far.)

5. The DOW decision was

6. Was this decision fair to all parties concerned?_____If not, what interest groups would suffer because of the new policy?_____

Explain.

7. Will the new policy produce the optimum sustained yield of perch in Lake Erie?_____Explain.

NATIONAL SEA GRANT DEPOSITORY

Pell Library Building - GSO

University of Rhode Island

Narragansett, RI 02882-1197 USA



Ohio Sea Grant Program

Charles E. Hendershot, Program Director

Rosanne W. Fortner, Assistant Director for Education

Victor J. Meyer, Project Director