

ACTIVITY 16

Name _____

THE GREAT ANADROMOUS FISH GAME

You have a school of herring trying to reach the spawning grounds. There are 100,000 fish in your school. There are many dangers waiting for your school. Each time you meet a hazard, deduct the number of fish that died from your school. Use this chart to keep track of how many fish you have. Round your numbers to the nearest thousand if it helps.

GOING TO THE SPAWNING GROUNDS No. of fish at start _____

Ocean	Estuary and River	Streams

The number of adult fish that reached the spawning ground is _____.
 Now how many baby (larval) fish did these adults produce? Here is how to find out:

1. Roll the die. Your number was _____.
2. Multiple this times 10 to get _____.
3. Multiple this number by the total number of adult fish to get the number of baby herring that start down stream _____.

Now the baby herring will head for the ocean. Keep track of the changes in the number of fish as they swim.

RETURNING TO THE OCEAN No. of baby herring headed for the ocean _____

Streams	Estuary and River	Ocean

The number of young herring that reached the ocean is _____.
 The average number of young herring that reached the ocean for the group I played the game with was _____. (Add all your total young together and then divide by the number of you that played.)

Are the total number of herring increasing each year or decreasing?

If you were a fisheries biologist, what actions would you take which could increase the number of herring in future years?

THE GREAT ANADROMOUS FISH GAME

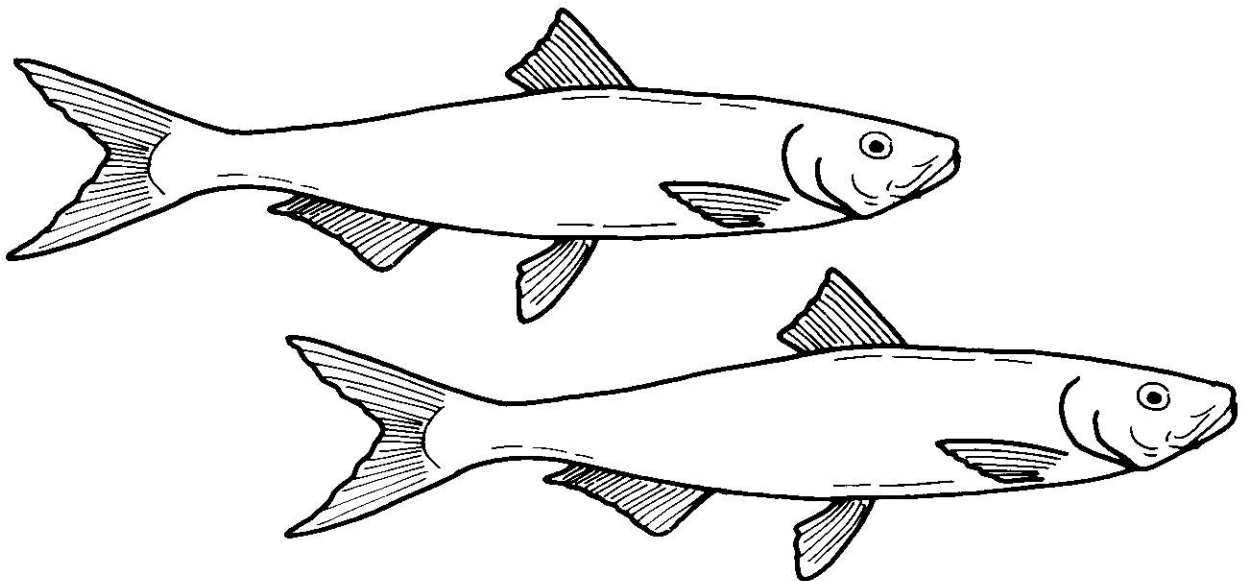
RULES:

Goal:

You are a school of herring. Your objective is to produce as many offspring as possible by successfully swimming to the spawning grounds. Once there, you will then see how many of the baby herring you can get back to the sea. The player with the most fish wins! But beware, there are many hazards lurking along the way.

How to play:

1. Open the board. Shuffle each set of hazard cards and place them in the marked locations.
2. Select your marker and place it in the Open Ocean. This is your starting point as an adult herring school. You will swim into the estuary and then upstream where you will spawn. As offspring you will swim back down to the ocean.
3. You get 100,000 herring to start, so record that number on the worksheet.
4. Roll the die. The highest number starts first. Play proceeds clockwise from that player.
5. Roll the die to determine how far you move your marker. If you land on a space that says to draw a card, do so and read it aloud. If you have a hazard card, you must record the change in number of fish in your school on your worksheet. For example, if you have 50,000 herring left and your card says that half of them were caught in nets, then you must reduce your herring to 25,000 fish. Your teacher will review fractions. You may round your results off to the nearest thousand if you wish.
6. Going to the Spawning Grounds, draw only cards that say TO Spawning Grounds.
7. Each female herring may lay 100,000 eggs, but most do not survive to hatch into baby fish (larvae). When you arrive at the Spawning Grounds, you need to figure out how many baby fish your school produced. Roll the die. Multiply the number on the die by the number of fish you have left (for example, 5 times 1,250 adult herring = 6,250) and then multiply by 10 ($6,250 \times 10 = 62,500$) to get the number of baby fish (larvae) that you will start back down the river with.
8. Return to the Ocean, drawing RETURN to Ocean cards as you go.
9. The player who gets the MOST fish back to the ocean WINS, not the player who gets there first.
10. If you find words on the cards that you do not know, look them up on the Vocabulary List.



VOCABULARY LIST

- bait:** fish or other animal used to lure a larger animal into a trap or onto a hook
- bluefish:** a species of fish larger than herring which are good predators on smaller fish; they follow prey into the estuary and are well-known for their feeding frenzies; are eaten by humans who catch them for sport as well as food
- commercial:** things that are sold; activity done to earn money or wages
- delicacies:** expensive, rare, fine
- dolphin:** a marine mammal in this game sometimes also called a porpoise; there is also a species of fish called dolphin
- gill nets:** nets which hang from floats in the water and catch fish that try to swim through the holes by tangling their gill covers
- haul seine:** large net pulled from shore by boat to circle fish school and then towed up on beach with catch; this method is not used much
- hors d'oeuvres:** French word pronounced or-dervs; bits of food served before a meal
- kippers:** herring that is salted and then smoked over a fire to preserve it
- larvae:** form different than adult which hatches from egg and will change into the adult form as it grows
- leech:** a worm that sucks blood from its prey; a parasite
- pesticide:** a chemical used to kill insects that humans regard as bad (pests)
- plankton:** tiny drifting plants and animals that live in water
- purse seine:** large circular net used from boat to catch fish; draws shut at bottom
- school:** a large number of fish that swim together
- seine:** net with floats at top and weights at bottom used to encircle fish
- snag hooks:** hooks designed to catch on a fish's body
- sport:** an activity done for fun or excitement that requires skill
- striped bass:** large predatory fish; also anadromous and are themselves reduced in numbers in recent years; enter estuaries in search of smaller fish; protected in some areas because of declining numbers
- trawl nets:** large nets towed behind a boat that scoop fish up
- tuna:** very big predatory fish that live out in the ocean
- weir traps:** traps that funnel fish through a narrow space where it is easy to net them from shore by hand

RETURN TO THE OCEAN →

**SPAWNING
GROUNDS**

**STREAM
AND CREEK
CARD**

**STREAM AND CREEK
CARDS
TO SPAWNING GROUNDS**

**STREAM AND CREEK
CARDS
RETURN TO OCEAN**

**STREAM
AND CREEK
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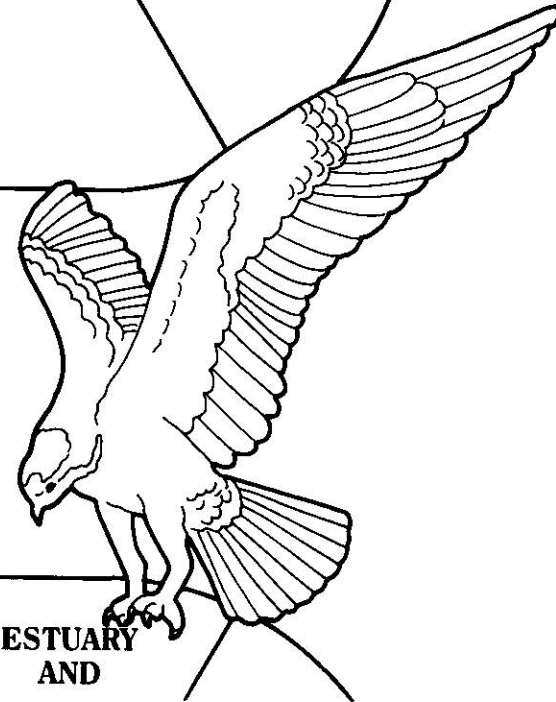
**ESTUARY
AND
RIVER
CARD**

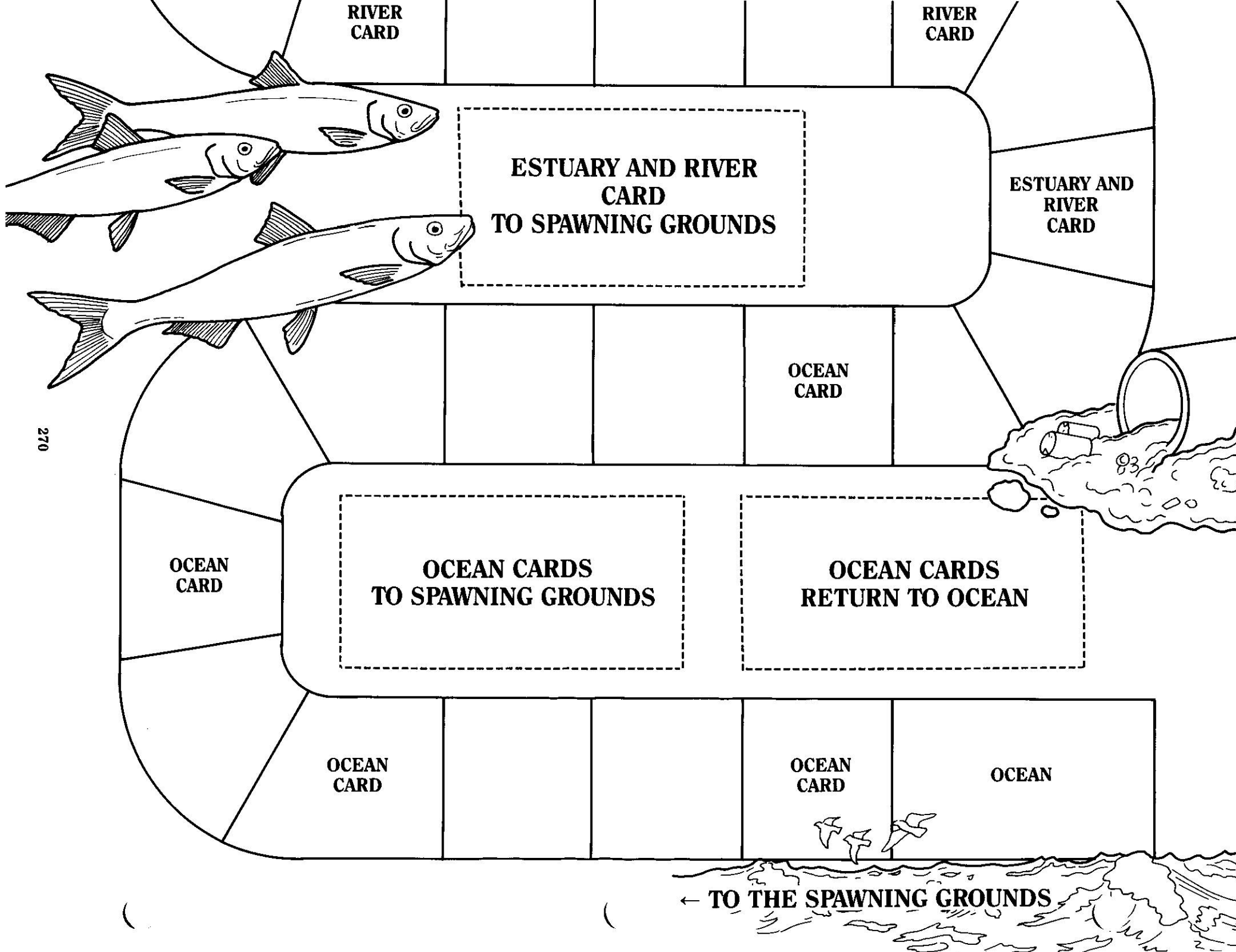
**STREAM
AND CREEK
CARD**

**ESTUARY AND
RIVER CARD
RETURN TO OCEAN**

**ESTUARY
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**ESTUARY
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<p>Ocean to Spawning Grounds 1/2 of your school is caught by commercial fishermen using gill nets. They will be used to make plant fertilizer.</p>	<p>Ocean to Spawning Grounds 1/2 of your school is eaten by a school of hungry dolphins which herd the fish while eating them.</p>
<p>Ocean to Spawning Grounds 1/4 of your school is caught by commercial fishermen using trawl nets. They will be processed into fish meal for chicken feed.</p>	<p>Ocean to Spawning Grounds 1/2 of your school is caught by commercial fishermen using gill nets. They will be made into kipers and canned.</p>
<p>Ocean to Spawning Grounds 1/4 of your school is caught by commercial fishermen using a haul seine. They will be sold for bait for crab and lobster traps and for fish bait.</p>	<p>Ocean to Spawning Grounds 1/2 of your school is caught by commercial fishermen using gill nets. The roe (eggs) from these will be processed and sold as delicacies in Japan.</p>
<p>Ocean to Spawning Grounds None of your school dies; it has found enough food, has not been caught by predators, and has encountered normal weather.</p>	<p>Ocean to Spawning Grounds 1/2 of your school is caught by commercial fisherman using a purse seine. They will be processed into fish oil for use in paint, medicines and cosmetics.</p>
<p>Ocean to Spawning Grounds None of your school dies as the weather has been perfect for spawning. Advance one space.</p>	<p>Ocean to Spawning Grounds 1/4 of your school is eaten by a school of striped bass.</p>

OCEAN CARDS
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<p>Ocean to Spawning Grounds 1/4 of your school is eaten by a school of hungry bluefish.</p>	<p>Estuary to Spawning Grounds 1/2 of your school is caught by commercial fishermen using haul seines. They will be made into smoked herring.</p>
<p>Estuary to Spawning Grounds 1/4 of your school is eaten by a large flock of seagulls that caught the school in shallow water.</p>	<p>Estuary to Spawning Grounds 1/2 of your school is caught by commercial fishermen who sell them to an aquarium or zoo for seal food.</p>
<p>Estuary to Spawning Grounds 1/4 of your school dies as it gets pulled into the cooling water intake of a huge electric power plant that does not yet have a screen.</p>	<p>Estuary to Spawning Grounds 1/2 of your school dies as part of the school takes a fork in the river that leads to a dam with no way around.</p>
<p>Estuary to Spawning Grounds 1/4 of your school is eaten by a school of hungry striped bass.</p>	<p>Estuary to Spawning Grounds 1/4 of your school dies in an early spring storm that blows them ashore when they were in shallow water.</p>
<p>Estuary to Spawning Grounds 1/2 of your school is caught by commercial fishermen using gill nets staked out along the shore. They will be made into salt herring.</p>	<p>Estuary to Spawning Grounds 1/4 of your school is caught by sport fishermen lining the banks of a narrow river channel using snag hooks. They will be used for food and bait.</p>

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<p>Estuary to Spawning Grounds 1/4 of your school is eaten by a school of hungry bluefish.</p>	<p>Stream to Spawning Grounds 1/2 of your school dies because your stream was channelized as a flood control project since they were born and left it. Many of the places to spawn have been destroyed.</p>
<p>Estuary to Spawning Grounds None of your school dies as it has found the conditions for the trip through the estuary and up the river to be excellent. Advance one space.</p>	<p>Stream to Spawning Grounds 1/2 of your school dies after entering a stream that has high pesticides because of runoff from a farm.</p>
<p>Estuary to Spawning Grounds 1/4 of your school is caught by commercial fishermen using weir traps and dip nets in narrow sections of the river. They are sold fresh to a seafood market.</p>	<p>Stream to Spawning Grounds 1/2 of your school dies in very low water because there has been no rain or snow this winter or early spring.</p>
<p>Stream to Spawning Grounds 1/2 of your school dies because improper farming methods have choked the stream with mud.</p>	<p>Stream to Spawning Grounds None of your school dies as the stream you enter is protected as part of a park. Dams have been removed, sediment is kept from running into the water and fishing is limited. Advance one space.</p>
<p>Stream to Spawning Grounds 1/4 of your school are caught by seagulls which have followed your schools upstream.</p>	<p>Stream to Spawning Grounds 1/2 of your school dies because the forest along the stream was cut and stumps and logs have formed dams which many cannot cross.</p>

STEAM AND CREEK
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Stream to Spawning Grounds

1/4 of your school is eaten by predators such as raccoons and river otters.

Stream Return to Ocean

1/2 of your school is eaten by small predatory fish in the stream.

Stream to Spawning Grounds

1/2 of your school is caught by local fishermen with nets and traps in the shallow, narrow creek. They are used for food.

Stream Return to Ocean

1/4 of your school is killed by pesticide runoff from a nearby farm.

Stream to Spawning Grounds

1/2 of your school dies after entering a stream next to a toxic waste dump in which the chemicals have leaked into the ground water that feeds the springs that form the creek.

Stream Return to Ocean

1/2 of your school is killed before it even hatches into larvae when mud from a new housing development smothers the eggs.

Stream to Spawning Grounds

1/4 of your school dies as your stream has been partially blocked temporarily by a highway project.

Stream Return to Ocean

1/2 of your school dies after passing through toxic chemicals leaking into the stream from an illegal waste dump.

Stream to Spawning Grounds

1/4 of your school dies after entering a stream which has an old, leaky sewer pipe running next to it. Parts of the stream are unsafe because of the leakage.

Stream Return to Ocean

1/4 of your school dies after entering a section of the stream where industrial pollutants have been dumped.

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<p>Stream Return to Ocean 1/2 of your school dies from chlorine entering the water from a small sewage treatment plant.</p>	<p>Stream Return to Ocean None of your school dies as the stream where they hatched has been cleaned up and protected by a park.</p>
<p>Stream Return to Ocean 1/2 of your school dies because the food the larvae need is not abundant.</p>	<p>Stream Return to Ocean 1/4 of your school dies after swimming into an area of very hot water where the stream is being used to cool heavy equipment.</p>
<p>Stream Return to Ocean 1/4 of your school is killed during a huge rainstorm as the tiny larvae are tumbled against rocks.</p>	<p>Estuary Return to Ocean 1/2 of your school dies after swimming through an area polluted with industrial wastes that would not have harmed the adults, but are toxic to young.</p>
<p>Stream Return to Ocean None of your larvae die as the spawning grounds are protected by laws which preserve their natural state. Advance one space.</p>	<p>Estuary Return to Ocean 1/2 of your school dies when it swims into an area where an algal bloom has died, using all the oxygen in the water as the algae decompose.</p>
<p>Stream Return to Ocean 1/4 of your school is left stranded in shallow pools by a passing flood. They cannot get back to the creek and die.</p>	<p>Estuary Return to Ocean 1/4 of your school is eaten by eels, wading birds, water snakes and other natural predators of small fish.</p>

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<p>Estuary Return to Ocean None of your school dies as it has avoided predators, has not been exposed to toxic wastes because laws have helped control wastes, and has found normal food supplies and weather.</p>	<p>Estuary Return to Ocean 1/2 of your school dies after swimming through water polluted with runoff from farms that used all the oxygen in the water as it decomposed in the summer heat.</p>
<p>Estuary Return to Ocean 1/4 of your school dies after swimming into the intake pipe of a steel mill.</p>	<p>Estuary Return to Ocean 1/2 of your school is eaten by gulls and other birds when caught in a shallow area of the river caused by unusually dry weather.</p>
<p>Estuary Return to Ocean None of your school dies as it manages a safe passage toward the sea. Advance one space.</p>	<p>Estuary Return to Ocean 1/2 of your school is eaten by a large school of hungry bluefish. The rest escape as sport fishermen scare the bluefish away while moving their boats through the school trying to catch the bluefish.</p>
<p>Estuary Return to Ocean 1/4 of your school dies after being attacked by brackish water fish leeches which are parasites that weaken the young herring.</p>	<p>Estuary Return to Ocean None of your school dies. Advance one space.</p>
<p>Estuary Return to Ocean 1/4 of your school dies from lack of food caused by salinity changes due to unusually dry summer weather.</p>	<p>Ocean Return to Ocean 1/4 of your school is eaten by a large flock of hungry gulls which caught them at the surface where the school went to escape from a bluefish school.</p>

ESTUARY AND
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<p>Ocean Return to Ocean 1/2 of your school is eaten by a hungry school of bluefish.</p>	<p>Ocean Return to Ocean 1/2 of your school dies due to lack of sufficient plankton, the food on which you depend.</p>
<p>Ocean Return to Ocean 1/2 of your school is caught by commercial fishermen to be used for bait.</p>	<p>Ocean Return to Ocean 1/4 of your school dies due to lack of food caused by an unusually dry summer.</p>
<p>Ocean Return to Ocean 1/4 of your school is eaten by striped bass.</p>	<p>Ocean Return to Ocean None of your school dies as you have escaped predators and gotten plenty of plankton to eat.</p>
<p>Ocean Return to Ocean None of your school dies as you have escaped predators and found plenty of plankton to eat.</p>	<p>Ocean Return to Ocean 1/4 of your school is eaten by a large school of tuna.</p>
<p>Ocean Return to Ocean 1/2 of your school is taken by commercial fishermen seeking immature fish to make into bite-sized hors d'oeuvres.</p>	<p>Ocean Return to Ocean None of your school dies as they have found sufficient food and escaped the notice of predators.</p>

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