



Game of Survival: Fish Style!

Objectives: Students will play a game of survival by creating fish with dominant and recessive traits to understand how evolution through adaptations of structures and functions help with survival and continuation of genetic variations.

Subject Areas: Science

Grade Levels: 6-8, 9-12

Topics: Animals, Biology, Ecology, STEM

Great Lakes Literacy Principles:

4. Water makes Earth habitable; fresh water sustains life on land.
5. The Great Lakes support a broad diversity of life and ecosystems.

Materials:

- Game of Survival Handouts for Students
- Natural Disaster Cards (attached)
- Hat/Bucket/thing to put Natural Disaster cards in to pick randomly
- Coins (or flip a coin app on phones)
- Pencils, crayons, markers, etc.
- Extra paper (half sheets will work)
- Optional Prerequisite Lesson: Fish Form and Function Kit from Great Lakes Aquarium

Prerequisite Skills and Terms:

Students must be familiar with fish structures and functions and why structures may differ. The main structures to look at would be color, shape, fin placement, eye placement, and type of mouth. Students should be able to explain the benefits to differences in these structures and what the function of that different structure would be. Terms to know: Dorsal fin, sucker mouth, pectoral fin, pelvic fin, evolution, structure, function, dominant trait, recessive trait, barbels (whisker-like sense organs along a fish's mouth), and spines (related to fins).

A good introduction would be using the "Fish Form and Function" kit from the Great Lakes Aquarium. This lesson is somewhat based on the Future Fish 4000 activity in that kit. The other activities can help students become familiar with structure and function of fish anatomy.

Directions:

Put the students into small groups: each group represents a school of fish. Each student will have a fish. Students will receive a copy of "Game of Survival" with directions and chart. The students will follow the directions to figure out which structures their fish will have. This is done by flipping a coin for each structure (flip once to pick color, once to pick shape, etc.). Head represents the dominant trait while tails represents the recessive trait. Have students circle the structures they have flipped for on the chart. On the back of their instruction sheet, students will draw their fish using the structures that they flipped for. The reason why they flip for each structure is to show the random chance that is present in genetics and distribution of traits. This is a very simplified version where there are only two options (50/50 chance) and there is only dominant or recessive phenotypes present from the genotypes. In this activity, there is no co-dominance or blended traits.

Once students have drawn their fish:

1. Pull one of the Natural Disaster Cards from a hat or bucket. Read only the **Bold** text to the students. They must explain why their fish survives, possible answers are in *italics*. Underlined words show the trait. It's up to you if you follow only the possible answers or accept students' creative answers as well. You can also, to make it less of a debate, just tell students who survives or not but have them explain why.
2. Students must explain why their structure could help their fish survive. The cards also explain why some fish survive and some don't. But let the students be creative and decide for yourself if it's a valid argument. This is where the fun can begin with the students' creativity and thinking. It requires them to draw on what they know in order to develop a solid argument to survive to the next round.
3. After each Natural Disaster, have the survivors pair up and draw a new fish. Only the dominant traits are carried onto the next generation.
4. Take the "dead fish" and put them on the board, labeling them as Round One.
5. Repeat steps 1-4 until all the fish are "dead". The last school of fish (group) living wins! You can repeat the cards or use the "end all" option:
 - a. Eurasian Water Milfoil invades the lake and surrounding rivers. This plant overcrowds the habitat, uses nutrients that other plants need and causes those plants to die. The decomposing plants use up oxygen (decomposition requires use of oxygen) which takes oxygen from the water that fish need to survive. The result is an anoxic environment: there is no oxygen in the water so everything dies.

Have students comment on the diversity of structures (traits) from each round. The idea is that Round One should have more diversity in the traits than later rounds.

Natural Disaster Cards

<p>Natural Disaster: Flood! The flood causes murky waters and fast flowing water. <i>Possible Explanations from Surviving Fish:</i> <i>Fish with <u>torpedo shape</u> or <u>sucker/vacuum mouth with barbels</u> survive. The torpedo shape helps the fish swim in fast water while the barbels help it to find food in the murky water.</i></p>	<p>Natural Disaster: Landslide of Rocky Mountain! A rocky mountain collapses and creates a dam in the stream you need to swim up in order to find a partner and breed, or spawn. You can't walk around it, so how will you swim past it? <i>Possible Explanations from Surviving Fish:</i> <i>Fish with a <u>torpedo shape</u> can swim fast enough against the flow to jump up and over the rocks.</i></p>
<p>Natural Disaster: Otter Overload! Otters have increased in numbers in the lake and are now on a feeding frenzy in the rocky habitat with scattered logs. Who will survive? <i>Possible Explanations from Surviving Fish:</i> <i>Fish with <u>flat, panfish shapes</u> survive because they could hide in the narrow spaces between rocks and logs. Fish with <u>normal mouths with teeth</u> could possibly bite the otters. Fish with <u>eyes on the sides of their heads</u> can detect otters and swim away. Fish with <u>grey coloring</u> can blend in with the grey rocks and avoid otters.</i></p>	<p>Natural Disaster: Extreme Runoff of Sediment! Sediment erodes from surrounding banks and covers all the vegetation as well as the macroinvertebrates and benthic (bottom) organisms. Who will starve? Who will be eaten by predators? <i>Possible Explanations from Surviving Fish:</i> <i>Fish with <u>normal mouths with teeth</u> can hunt and eat other fish and can survive without benthic organisms or macroinvertebrates. Fish with <u>grey coloring with spots</u> do not stand out as much as striped fish, so they blend in more with the barren landscape and won't be attacked as easily. Fish with <u>torpedo shapes</u> can swim fast to avoid being eaten.</i></p>

<p>Natural Disaster: Drought! Rain hasn't fallen for years, and the lakes and rivers are becoming shallow because of the drought. The shallow water means that aquatic plants are receiving more sunlight so they grow more. Who will starve? Who will be eaten by predators?</p> <p><i>Possible Explanations from Surviving Fish:</i> Fish that have <u>sucker/vacuum mouths with barbels</u> can eat off the bottom of the lake and survive. Fish with <u>vertical stripes</u> can blend in with all the vegetation that is present. Fish with <u>flat, panfish shapes</u> can move through the vegetation easier than torpedo shaped fish.</p>	<p>Natural Disaster: Flock of Birds! Eagles are hunting from above! In this weedy habitat, who will avoid being eaten?</p> <p><i>Possible Explanations from Surviving Fish:</i> Fish that have <u>Vertical Stripes with Dark Tops and White Bellies (called Countershading)</u> will survive because they have camouflage that helps them hide from predators. Fish with <u>eyes on the tops of their heads</u> will survive because they can see predators and swim away.</p>
<p>Natural Disaster: Zebra Mussel Invasion! Zebra mussels filter out all the nutrients that the aquatic plants need to survive. This causes plants to die off. The mussels also cause the water to become clear to the point where you can see deeper than before, making it easier for predators such as birds to spot fish. The pebbles at the bottom of the lake are light in color and aren't big enough for fish to hide in. Who survives?</p> <p><i>Possible Explanations from Surviving Fish:</i> Fish with <u>Light grey coloring with spots on the back</u> survive because, from a "birds-eye view", they blend in with the bottom of the lake. Fish with <u>eyes on the sides of the head</u> survive because they can detect predator fish around them and swim away. Fish with <u>torpedo shapes</u> can swim fast enough to catch prey, so they also survive.</p>	<p>Natural Disaster: Ice Cover! The water temperature drops and ice forms over the surface of the lake. Snow falls on top of the ice, making the entire lake dark. How will you find food in the dark?</p> <p><i>Possible Explanations from Surviving Fish:</i> Fish with <u>sucker/vacuum mouths with barbels</u> survive because they can use the barbels to sense food on the bottom of the lake.</p>

Natural Disaster: Invasion of the Ruffe!

Ruffe are small fish much like the yellow perch. They eat macroinvertebrates and benthic (bottom) organisms. They live in murky or dark areas and can sense vibrations in the water better than other fish so they can swim away quickly from predators. Who could this fish impact? Who could eat this fish?

Possible Explanations from Surviving Fish:

Fish that have sucker/vacuum mouths with barbels will not survive because they are having to compete with the Ruffe for food. But fish with teeth and a torpedo body can survive because they can eat the Ruffe only after they swim fast enough to catch it.

Natural Disaster: Overfishing!

Fishermen have found your lake to be the spot to fish and are throwing hooks and bait everywhere! It's hard to tell if food is a hook or not, so fish are biting on hooks by accident. The bottom of the lake is full of logs and sticks, so not many fishermen are fishing at the bottom of the lake. Who will survive?

Possible Explanations from Surviving Fish:

Fish that have sucker/vacuum mouths with barbels will survive because they will not be able to bite on hooks. The hooks won't even be close to them because they are swimming around the logs and sticks on the bottom of the lake where the hooks can't reach.