The Great Swim

Authors: Michigan Water Stewardship Program, Eaton Conservation District, borrowed from the Michigan Department of Natural Resources (Aquatic Invasive Species Education Project, adapted from The Great Migration Challenge by Flying WILD)

Lesson Overview: Your students can reenact the life of a non-native salmon in Michigan and live through the happy days and perils of a little salmon's journey.

Objectives: Students will be able to:

1. Study the lifecycle of Chinook Salmon using a charting system.
2. Identify 2 aquatic invasive species.
3. Identify 3 challenges salmon have to deal with while trying to survive.

This lesson meets the following Michigan Department of Education standards:

Next Generation Science Standards (NGSS):

- ✓ 3-LS4-4 - Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.
- ✓ 3-LS1-1 - Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.
- ✓ MS-LS2-4 - Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
- ✓ MS-LS2-2 - Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
- ✓ MS-LS2-5 - Evaluate competing design solutions for maintaining biodiversity and ecosystem services.
- ✓ HS-LS2-1 - Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.
- ✓ HS-LS2-2 - Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.
- ✓ HS-LS2-6 - Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.

Recommended Grade(s): Third through Twelfth Grades

Recommended Subject(s): Science **Duration:** Prep time: 10 min., Activity: 30 min

Materials Required: Great Swim half sheet game cards, masking tape, 5 dice, 5 plastic jars (optional), several circle stickers, several 6-inch pieces of string, several plastic eggs, white board or large paper

Suggested Vocabulary for Students: alewife, buttoned up, Eurasian Watermilfoil, fisheries biologist, fry, hatchery, lamprey, natal stream, phragmites, plankton, predacious, quagga mussels, rusty crayfish, salmon, spawn, tagged, zebra mussels

Background Information for Educator:

Native stocks of lake trout once comprised a great resource in Lake Michigan. However, predation by the parasitic sea lamprey, coupled with intense commercial fishing in the 1940s and 1950s nearly eliminated the lake trout. Sea lampreys, native to the Atlantic Ocean, entered the Great Lakes system in the 1800s through manmade locks and shipping canals. The first observation of the lamprey occurred in Lake Ontario in the 1830's. Through the Welland Canal, a navigational canal connecting the Great Lakes while bypassing Niagara Falls, sea lampreys moved into Lake Erie. After spreading throughout Erie, sea lampreys moved to the other Great Lakes, appearing in Lake Michigan in 1936. By the late 1940's, populations of sea lampreys exploded in all of the upper Great Lakes resulting in the drastic population decline of lake trout. With the Great Lakes top predator in decline, came the next invader, the alewife. Alewives, unintentionally introduced into Lake Michigan in 1949 from the Atlantic Ocean, depleted food sources for themselves and other native fishes. Their high numbers and ability to out-compete fish with similar diets led to depletions and local extinctions of native species. These disruptions in the native fish community and food web, coupled with habitat alterations and degradation, contributed to the decline of important commercial and sport fisheries. Rehabilitation of the Lake Michigan fish community began in 1960 with the extension of the sea lamprey control program to Lake Michigan, plantings of lake trout and the introduction of Coho salmon, Chinook salmon, brown trout and steelhead trout. Lake trout planting began in 1965 and Coho salmon and Chinook salmon were introduced from the Pacific Northwest in 1966 and 1967. Rainbow trout, or steelhead, and brown trout were also extensively planted. Of the five major salmonids stocked, only lake trout was released with the main objective being rehabilitation (i.e. to re-establish reproducing populations). The others were stocked to provide angling opportunities and to utilize the overabundance of nonnative alewives, which became a nuisance when vast numbers died and washed up on local beaches.

Lesson Procedure:

Set Up:

- ~ Print out Station cards and cut in half.
- ~ Using the masking tape, mount them around the room or schoolyard. (At least 5 ft apart)
- ~ Station 3: place two dice in a jar with a lid. (The jar is so the dice don't go flying everywhere.)
- ~ Stations 11, 13, and 15: place 1 die each in a jar with lid.
- ~ Stations 6 and 9: place circle stickers at the stations.
- ~ Station 15: place strings.
- ~ Station 19 and 20: place plastic eggs.
- ~ Create a chart on your whiteboard or paper that looks like the example above.

Caught	Died	Tagged	Spawned

Introduction:

- ~ Review the lifecycle of Chinook salmon with your students. How did non-native Chinook get to Michigan? Why are they not considered invasive?
- ~ How does the Michigan Department of Natural Resources support the Chinook salmon population? What ecological niche do they take on?
- ~ Review the vocabulary list with students.

Activity:

- ~ Students can start on either Station 1, 2, 3 or 4. Students should read and follow the directions on each station until they complete the game.
- ~ As the students complete the game, they should record their results on the chart. They can, and usually will, mark an X in more than one column.
- ~ Upon completion, talk with the class about the results. Who was killed or harmed by an invasive?
- ~ Repeat the game as many times as possible to start seeing trends in the data

Wrap up:

- ~ How many salmon were negatively impacted by an invasive species?
- ~ Are the data points connected with a trend line? Or stand alone?
- ~ What percentage of fish spawn successfully?
- ~ Multiply each successful pair of spawning fish by 5,000 eggs. How many fertilized eggs were introduced to the Great Lakes system from your seasons?
- ~ Multiply each successful spawning fish by 147.7 lbs (food needed to grow to adulthood). How much food did they use utilize from the ecosystem?
- ~ Multiply the number of successfully caught fish by the average catch weight of 15 lbs. Compare the mass of fish caught, to the mass of food needed to raise those fish.

Assessment Questions:

- ~ Ask the students to retell their 'life story'. Did any two students have the *exact* same story?
- ~ Did the students get stuck or injured in some way on their journey? How do you think Salmon actually get slowed down during their life?
- ~ What can you do to help protect the Chinook Salmon population? What does the DNR Fisheries division do to help the fish? Why are fishing regulations important?

Adaptations/Extension/Enhancements:

- ~ To simulate research by fisheries biologists, have your High School students run "replicates" of the game. Each student completes the game 3 times and records their data. Using the full classroom data for all 3 replicates, have students chart trends they are seeing in the data.
- ~ Get involved with the DNR's Salmon in the Classroom project where your classroom will have the chance to hatch, raise, and release Salmon over the course of the school year.

Additional Resources:

- ~ MWSP website: www.miwaterstewardship.org
- ~ Get salmon in your classroom: https://www.michigan.gov/dnr/0,4570,7-350-79135_79220_81136---,00.html
- ~ The story of Chinook Salmon in Lake Michigan: http://www.secondwavemedia.com/custom/salmon-report/index.html
- ~ The link to this original DNR invasive species lesson plan series: https://www.michigan.gov/documents/dnr/Aquatic_Invasive_Species_Education_project_607805_7.pdf

Station 1

Watch out fry! You narrowly escape a predacious diving beetle.
Crawl ahead 5 feet. Then move to Station 7.

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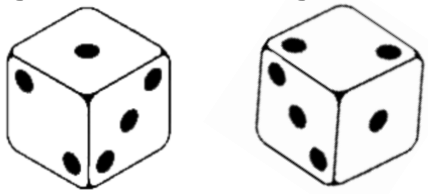
Station 2

Good news! Plankton is plentiful and your little fry self is growing well.
Make a fishy face 10 times and move ahead 6 stations.

Station 3

Good news! You are a salmon raised in a classroom by students.
Roll the dice and enjoy an easy swim ahead that many stations.



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Station 4

Lucky you! You were raised in a hatchery and have a much better shot at life.
Skip over to Station 6

Station 5

Watch out for that invasive phragmites! You get tangled in the roots and lose your way. Act confused and wander back 3 stations

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Station 6

Before you leave the hatchery you need to be tagged!
Place a sticker on your snout then move ahead 5 stations.

Station 7

Way to go! Your little fry self has buttoned up and you are learning to eat plankton. Swim over 6 Stations.

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Station 8

You made it to the big lake! But, you can't find plankton to eat because the invasive quagga and zebra mussels ate it all! Rest and count to 40, then sneak ahead 3 stations.

Station 9

Fisheries Biologists catch you for research.
They tag you with a coded wire tag and let you go.
Put a sticker on your face and swim ahead 3 stations.

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Station 10

An invasive sea lamprey latches on to your side
and makes you weak.
Crawl ahead 2 spaces.

Station 11

Bad news! An invasive rusty crayfish nipped your tail as you rested near the gravel. Roll the die and move ahead that many stations.

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Station 12

A gull snatches you up for his dinner. Die dramatically and stand with your teacher.

Station 13

You find the perfect habitat out in the big lake.
Swim around in 4 circles while you eat invasive alewives happily.
Roll the die and swim ahead that many stations.

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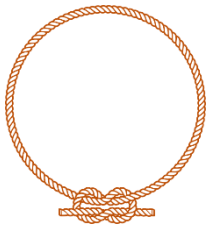
Station 14

As you swim through some quiet water at the mouth of the river where you were born, you get tangled up in a mat of invasive Eurasian Watermilfoil and get way too warm.
Die dramatically and go stand with your teacher.

Station 15

A fisher catches you and takes a selfie. He throws you back to catch another day. Tie a string on your wrist and roll the die. Move ahead that many stations.



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Station 16

You have matured and start making your way back to your natal stream to spawn. Swim ahead 2 stations.

Station 17

An eagle snags you out of the river for its dinner.
Die dramatically and go stand with your teacher.

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Station 18

Fishers are lined up in the river to catch you! Flop on the line dramatically until she puts you in her cooler.
Go stand with your teacher.

Station 19

You reach the end point of your natal stream, spawn successfully and then die naturally. Be happy that your babies will be the next generation of fish in the big lake! Take an egg to your teacher.

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Station 20

You spawn in your natal stream and then hang out for awhile since you are tired. A fisher catches you and makes you her dinner. You have completed your lifecycle with a purpose. Take an egg to your teacher.