2025 Start Up Guide and Application

The Salmon in the Classroom program is administered by the Michigan Department of Natural Resources

michigan.gov/SIC

DEPARTMENT OF NATURAL RESOURCES
DNR
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TM

Acknowledgments

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School Sponsors

Organizations that fund equipment purchases for teachers change annually.
For a complete list visit www.michigan.gov/sic.

Program Partners

Michigan Sea Grant
Michigan Council of Trout Unlimited
Project F.I.S.H.
Preuss Pets
Various local sportsman groups around the state

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2025 Edition

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Application Check-list

1. Read this Start Up Guide
2. Get principal approval in letter form
3. Apply for the program using the link provided (you will be notified of acceptance/ denial in May)
4. Locate the closest faucet to where your tank will be placed (that you will use for water changes)
5. Purchase the API master test kit and API GH/KH test kit
6. Fill a cup of water from your faucet and let it sit for 24hrs.
7. Run a full set of water tests on the cup of water, including GH/KH
8. Report test results to paget3@michigan.gov
9. Find a sponsor or equipment funding
10. Purchase equipment by the end of September
11. Register for your preferred SIC Workshop
11. Follow included timeline to setup and cycle your tank

You can the full set of over 30 classroom activities on our website michigan.gov/SIC under

- Current SIC Participants

- Program Materials

Introduction

Welcome to the Michigan Department of Natural Resources (DNR), Salmon in the Classroom program.

A look around the nation shows there are quite a few state resource agencies that now sponsor salmon (or other species) in classroom programs.

Why? One reason is the tremendous interest youth have in working with live resources. Salmon in the Classroom is not just another science activity, but a very interactive, participatory program in which students raise the resource and ultimately are responsible for its survival and release.

The number one reason that the DNR supports this living resource program is to build a connection between students and the natural resources found around them. In Michigan, this program began modestly in 1997 with a handful of schools. Since that time, interest has exploded and the DNR is pleased to see this program has the potential for tremendous impact.

In our state, we face many challenges managing the Great Lakes fishery. Salmon in the Classroom can be a great educational tool for Michigan educators. Many teachers have participated for several years, but the ecology of the Great Lakes is changing at an astounding rate. Today, a new pollution, biological pollution -- defined as the disturbance of the ecological balance by the accidental or deliberate introduction of a foreign organism, animal or plant species into an environment -- may prove to be our greatest challenge.

These threats are real and we need dedicated and qualified educators to assist the DNR by providing real science, along with important messages, to students who one day will be stewards, voters and leaders of our state.

Teachers in the program receive a free, one-day professional development workshop complete with SCECHs, and this Teaching Guide. Of course, the curriculum is just one piece of our Salmon in the Classroom Teachers' Resource Kit. Posters and other resource materials are included to enhance students' learning experience.

Educators have the ability to readily measure their students' interest in each activity and the useful knowledge that it provides. As scientists, we have created the important messages we need to be understood, to reconnect our children to the great outdoors. Together, we can develop and nurture the next generation of stewards and fishers.

Salmon in the Classroom is an important tool to get young children excited about fishing. Through this program, the DNR hopes you, as educators, will share with your classes the availability of statewide fishing events. A large part of our mission is to bring outdoor opportunities to the current and future residents of Michigan. There are Free Fishing Weekends in the summer and winter annually, tackle-lending programs at state parks and easily accessible fishing piers. The DNR makes fishing accessible for everyone to enjoy. For more information, visit www.michigan.gov/freefishing.

Field trip opportunities are available to schools throughout the state at 11 DNR Visitor Centers, including two hatcheries, with expert staff. Self-guided tours are also available at the DNR state fish hatcheries without interpretive staff.

Hard work from teachers, and support from our sponsors and partners is what makes the program a success. Many Salmon in the Classroom schools have important sponsors who have helped fund the equipment needed for this project to succeed. We salute them and their important contributions to the education of the next generation.

The Salmon in the Classroom Program

One of the many reasons for joining the program is the seemingly limitless subject matter that teachers can integrate into their lesson plans through raising salmon. The program can easily cover standards in mathematics, social studies, language and arts, history and, of course, science. Salmon are a great resource for teaching across the curriculum.



Why Chinook Salmon are a Preferred Species

The story of the Great Lakes and its fisheries depends heavily on the purposeful introduction of salmon, originally native to the Pacific Northwest, in the 1960s. A myriad of stewardship and natural resource conservation lessons can easily be spawned from the introduction of Chinook salmon into the Great Lakes.

Chinook Salmon

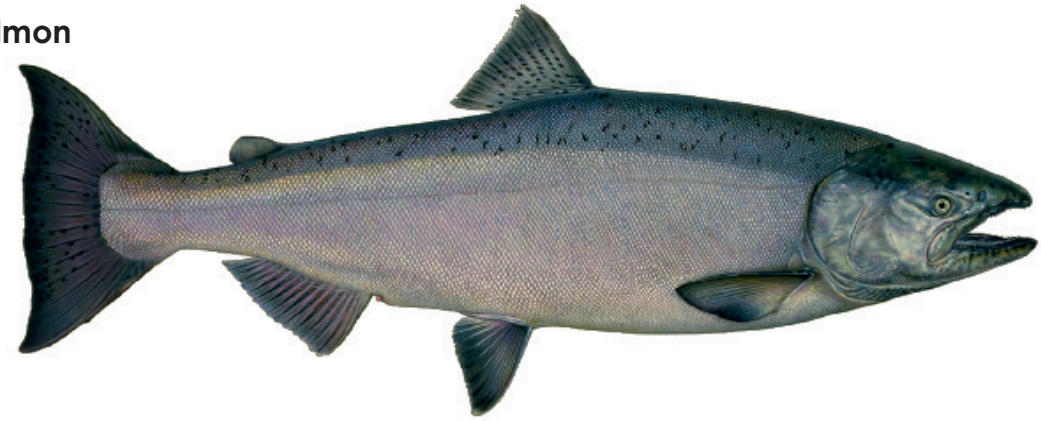
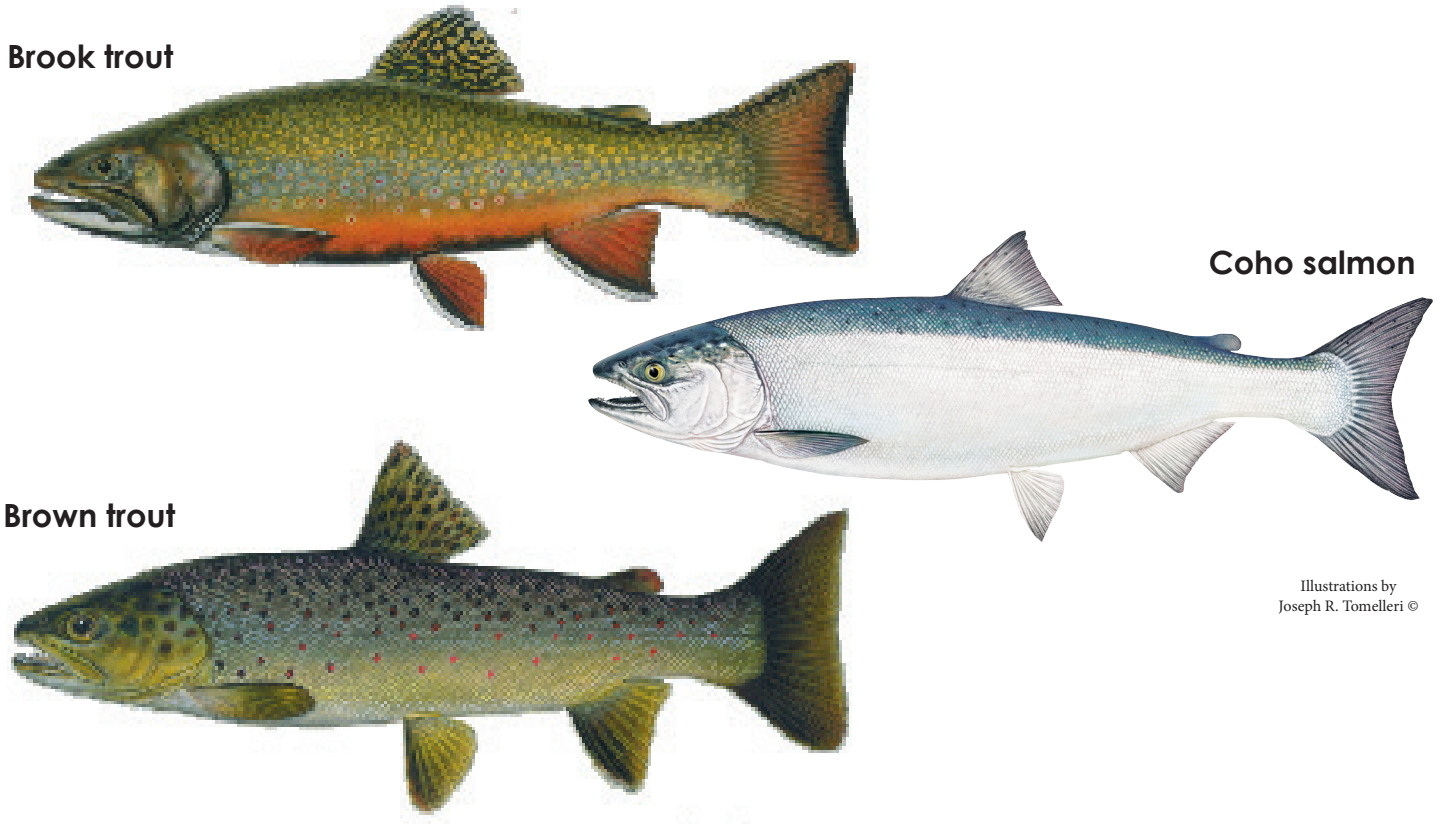


Illustration by
Joseph R. Tomelleri ©

- Spawning in fall and released in spring, the life cycle of salmon matches perfectly with the length of the school year.
- Students will mirror how the DNR raises Chinook salmon in hatcheries, allowing them to learn first-hand how fisheries managers are able to successfully rear millions of salmon each year to stock rivers across Michigan.
- Chinook salmon take food readily in an aquarium setting. Students will enjoy watching them eat. On average, Chinook salmon will be 3 – 5" when released in the spring, so students will have the opportunity to observe substantial growth of their fish during the school year.
- Students are able to visit the Little Manistee, The Boardman and/or the Platte River Weirs to watch the egg-take process. As well as the Wolf Lake State Fish Hatchery and Platte River Fish Hatchery to see first hand how Chinook are reared by the DNR.
- Although survival is limited, those released by students have just as good of a chance of surviving as those stocked by the DNR. Chinook salmon are released in the spring into the river during the smolting stage. This is the stage where they lose their juvenile markings which help camouflage them from predators. At this time, they will turn to a silver color which is a better camouflage while living in the Great Lakes.

Why Chinook Salmon are a preferred species continued



Illustrations by
Joseph R. Tomelleri ©

- Brook and Brown trout can be very fearful of people and will often times ignore food offered by hand. In a hatchery setting, fish must be either hand fed from a distance or automatic feeders must be used. If raised in an aquarium and hand fed by students, the majority of food fed will not be eaten and will sink to bottom of tank. This accumulation of food will lead to degraded water quality. Fish will also be stressed which will make them more susceptible to disease. Spring released brook/brown trout or coho salmon would be much smaller (less impact on students).

- Brook and brown trout spawn in late November, so students would have a much shorter period to observe fish development.

- When released, brook trout, brown trout and coho salmon have a much smaller chance of survival. They would be kept in hatchery raceways for an extra year and released the following spring to ensure more growth and higher survival. This is a format impossible for schools to follow.

- Brook and brown trout eggs are collected at the hatchery from broodstock and so a large part of the visible natural history would not be available.

- The main objective of Salmon in the Classroom is to provide students with an opportunity to participate in a hands-on, interactive program to learn about the natural history of the Great Lakes and their ecosystem, so they are more likely to become future stewards of natural resources and more informed citizens of conservation. It is the conclusion of the DNR that Chinook salmon provide the most excitement and best year-long experience for students to achieve this objective.

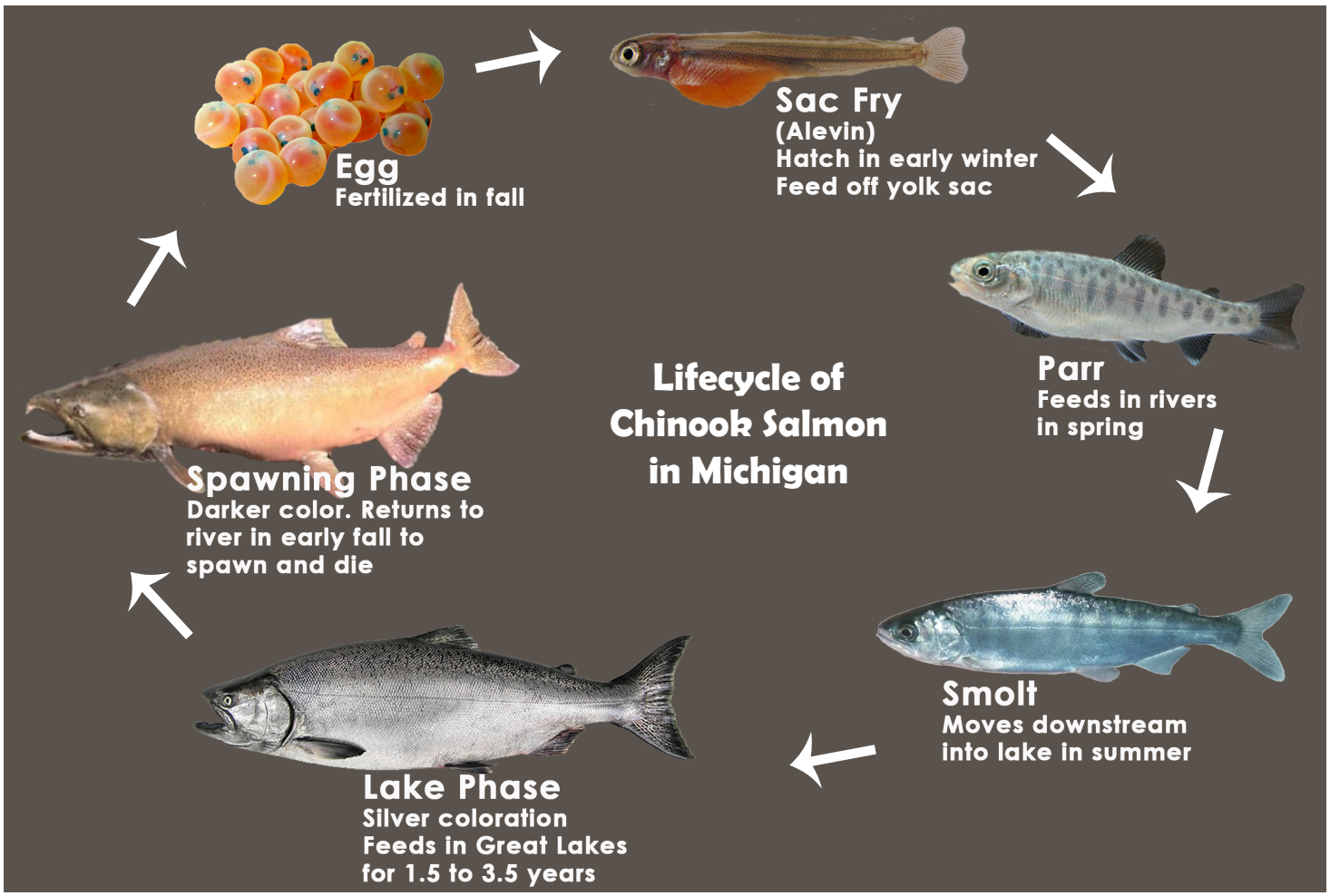
Lifecycle of Wild Chinook Salmon in Michigan

The life cycle of Chinook salmon in the Great Lakes can be described as **potamodramous**, which technically means migrations within fresh water and which describes a fish that spends the bulk of its adult life in large, freshwater lakes (like the Great Lakes), but migrates back to its **natal stream** to spawn. Chinook salmon, like other Pacific salmon, are not native to the Great Lakes. Both Chinook and coho salmon were brought to Michigan in the 1960s, Atlantic and pink salmon have also been introduced.

Chinook salmon are native to the Pacific Ocean, where their migrations are **anadromous** (migrations from salt to fresh water). In their native habitat, these fish generally spend three years living in the ocean. The Great Lakes provide an ocean-like habitat for adult Chinooks, where they spend most of their three-year average lifespan, foraging and growing in preparation for **spawning**.

From mid-to-late August, adult Chinook, which can weigh more than 30 pounds (our state record is 46+ pounds), begin staging off the mouth of their natal river (where they were either stocked or hatched.) The decreasing day length (photoperiod) and falling water temperatures prompt the mature salmon to enter the river to seek out appropriate spawning habitat. The salmon use their sense of smell to return to their natal stream, sometimes traveling hundreds of miles on their journey.

Once in the river, adult Chinook no longer need food and actually stop feeding, living off their body reserves to complete the spawning phase of their life. They still can be caught by fishers, though, as they will strike hooks and bait out of aggression. The fish seek out small, clean gravel on which to make their spawning bed called a **redd**. Once the eggs are fertilized, they are covered over, and remain in the gravel, where they will develop during the winter and early spring. After spawning, all Pacific salmon die and their bodies decompose, releasing nutrients into the water which aids **plankton** production for their offspring.



Lifecycle of Wild Chinook Salmon in Michigan

As winter passes and the water begins to warm, **sac fry** hatch from the eggs. The sac fry, also called **alevins**, remain in the gravel while they take nourishment from their **yolk sac**. Once the yolk sac has been absorbed, the young salmon begin to emerge from the gravel. Now called **swim-up fry**, they begin feeding on insects and insect larvae (called macro-invertebrates) in the stream.

After the small Chinook, now called **parr**, have spent a month or two growing in the warming waters of the stream, the increasing day length and water temperature trigger a physiological change in the fish called **smoltification**. During this process, the fish lose their "parr" marks and take on a much more silvery appearance, which is their protective coloration for the "fish-eat-fish" world they are about to enter.

They are now called **smolts**. In early June, the smolts migrate downstream out of their natal river and into the Great Lakes. This is an especially perilous time for the young Chinook since they must run through a gauntlet of fish-eating predators that include pike, walleye, smallmouth bass and brown trout, as well as kingfishers, great blue herons, double-crested cormorants, gulls, terns and mergansers. It truly is survival of the fittest!

Once in the Great Lakes, the Chinook will continue to feed on aquatic insects until they are large enough to start feeding on small fish. They now will begin growing quickly. The high protein content of their exclusively fish-based diet coupled with the Chinook's voracious appetite results in a very high growth rate. Their preferred food is invasive alewives, but, like most other fish, they are opportunists and will eat whatever is available to them. Chinook salmon are pelagic fish, which means they spend most of their time **foraging** offshore in open-water environments, usually in the middle of the water column.

They will spend two to four years (three is most common) foraging in the **pelagic** zones of the Great Lakes until they reach sexual maturity. Then, as fall approaches, these fish will begin to stage off the mouth of their natal streams and the cycle begins again. To learn more about the lifecycle of salmon in Michigan visit https://youtu.be/QYLTqvmO27A

What Does That Mean?

alevins - another name for sac fry

anadromous - migrates from salt to fresh water

forage - search for food

natal stream - the stream where they originated

parr - a juvenile fish, one preparing to leave the fresh waters of its home

pelagic fish - spend most of their time foraging offshore in open-water environments

photoperiod - the relative exposure of an organism to daylight

plankton - microscopic water borne organisms

potamodramous - migrates within fresh water

redd - spawning bed

sac fry - hatched, young salmon with large yolk sac for nourishment

smolt/smoltification - process of becoming physiologically adapted to a lake environment. This term in Pacific Salmon refers to them becoming physiologically adapted to salt water.

spawning - the act of laying eggs

swim-up fry - fry after yolk sac is gone

yolk sac - serves as the food source for the developing embryo

Why We Need Hatcheries

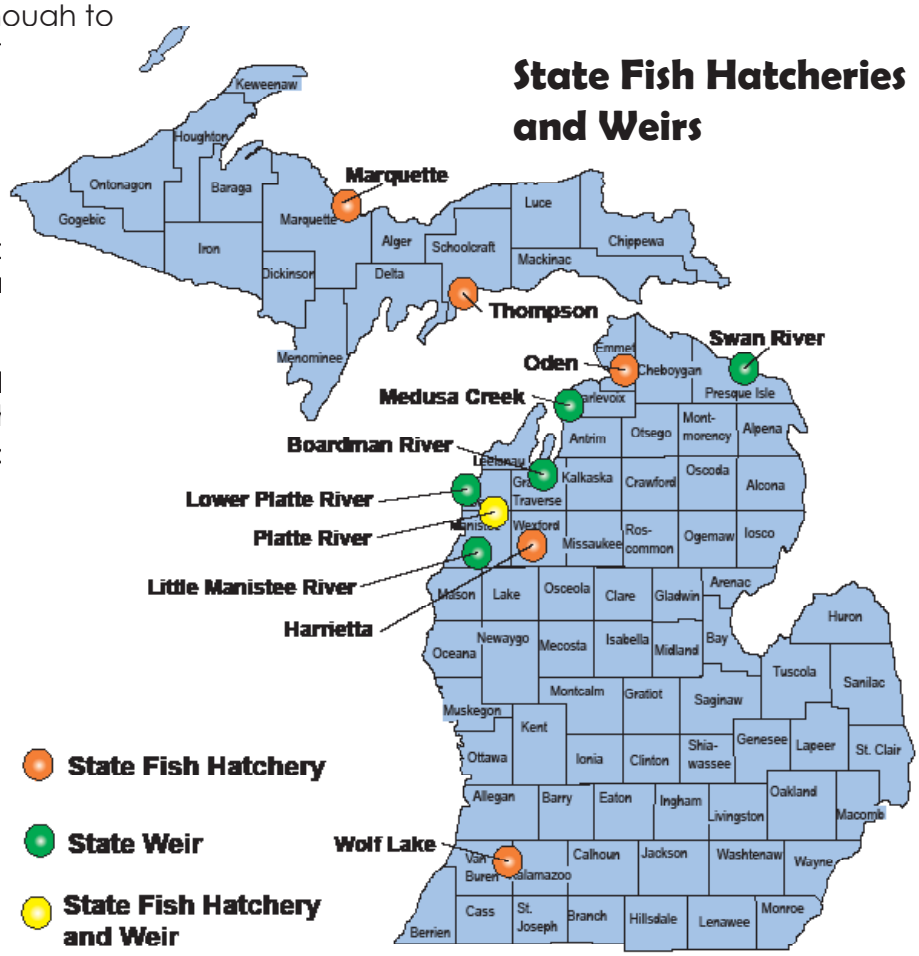
In an ideal world -- and an angler's dream -- a person could catch naturally reproduced brook, brown and rainbow trout on crystal-clear, cold water streams without another fisher in sight. They could fish from a boat on one of Michigan's 11,000 inland lakes, catching their limit of walleyes hatched within that very lake. Anglers could venture out onto a Great Lake, hooking a good-sized Chinook, Coho or steelhead that emerged from the gravel of a connected stream just two or three springs earlier.

All of these situations occur in Michigan. However, our state has nearly one million licensed anglers. The Great Lakes and our inland lakes and streams cannot provide enough naturally reproduced fish. In fact, 40% of all recreational fishing in Michigan depends on stocked fish, and the money to operate these important facilities comes from all those fisher men and women who purchase a fishing license each year.

The DNR hatches, rears and transports fish as part of its Fish Production Program. These activities benefit the state's inland and Great Lakes fisheries and increase angling opportunities. To manage Michigan's fish populations, the DNR sets limits on the size and number of fish that can be caught and kept. Some species are managed with size limits so they can grow big enough to reproduce before they are caught by anglers. Other fish species don't have size limits, but there is still a limit on the number anglers can keep. Find the Fishing Regulation Guide at Michigan.gov/FishingGuide

In some cases, even with the best management, fish are not able to reproduce fast enough to keep up with angler demand. When this happens, the DNR sometimes adds fish in lakes and streams – also called "stocking" fish. To do this, the DNR rears fish in hatcheries until they are large enough to survive on their own. Then they are transferred to waterbodies where they can grow large enough for anglers to keep.

Anyone is welcome to come and visit a state's six fish hatcheries to see how they work. Plan a trip by visiting Michigan.gov/hatcheries



Education Contacts at State Fish Hatcheries

Wolf Lake State Fish Hatchery
Shana Ramsey, 269-668-2876
ramseys2@michigan.gov

Oden State Fish Hatchery (Seasonal)
Christine Steensma, 231-347-4689
steensmac@michigan.gov

Habitat Before Conservation

Fish habitat in Michigan has undergone many changes throughout state history. Prior to the logging era, our streams teemed with native brook trout and Grayling (now extirpated in Michigan). The Great Lakes had plentiful native lake trout and whitefish. (Salmon were not introduced until the 1960s.) The extensive logging that forever changed the Michigan landscape had far-ranging and long-lasting negative effects on fish habitat.

The most significant impact was seen in the streams and rivers that were used to float huge rafts of logs to mills near the Great Lakes shorelines. The log rafts scoured out the river bottoms, upsetting gravel beds and destroying countless trout spawning redds. Some rivers had many natural meanders to them which created various pools, eddies and riffles that provided cover and feeding areas for trout. These same meanders were viewed as a hindrance in the effort to move logs quickly to the mill. In these areas, straight channels were dug and the rivers were diverted away from their natural paths. The fast-growing country's hunger for more lumber led the lumberjacks to harvest almost all Michigan's white pine forests.

At this time, there was never any thought given to the idea of leaving a buffer strip of uncut timber along stream banks, which is a best practice today. The timber-harvesting practices of long ago caused tremendous erosion problems. Given the prevalence of sand in most northern Michigan soils, this erosion translated to tons and tons of sand being transported into the once-pristine trout streams. Sand is a form of pollution that settles to the bottom of the stream bed and covers up the gravel that is needed as spawning substrate and as habitat for the macro-invertebrates trout feed on.

As Michigan grew and became more industrialized, this growth led to more roads being built which, in turn, caused more erosion at points where roads cross streams. Poorly designed road crossings remain one of the most significant problems threatening trout and salmon nesting habitat today. The increased industrialization also led to significant pollution problems both inland and in the Great Lakes. Pollutants such as PCBs and mercury impaired the ability of fish to successfully reproduce or, in some instances, to even survive.

What Does That Mean?

aquatic invasives - a non-native plant or animal deliberately or accidentally introduced into a new habitat that causes harm

buffer strip - vegetated area streamside, provides erosion control, habitat and nutrients

buttoned up - yolk sac absorbed

ecosystems - a natural unit consisting of all plants, animals and micro-organisms (biotic factors) in an area functioning together with all of the non-living physical (abiotic) factors of the environment

eddies - water current moving contrary to main current

erosion - natural processes including rain, weathering, dissolution, abrasion, corrosion and transportation, by which material is removed from the earth's surface

extirpated - a species is no longer naturally occurring in a region, but survives in other locations

habitat - environment in which an organism normally lives

mercury - a silvery white poisonous metallic element, liquid at room temperature

PCBs - polychlorinated biphenyls (PCBs) are a class of organic compounds. Used as coolants and insulating fluids for transformers and other electronics

phosphate - a salt or ester of phosphoric acid

phosphorus - a highly reactive, poisonous, non-metalic element occurring naturally in phosphates used in fertilizers

pools - area of river where the water is deeper and slower

rehabilitation - the process of restoring the land and natural environment

riffles - rocky shoal or sandbar lying just below a waterway

substrate - pebbles, sand an sediment on the stream bottom

Change on the Horizon

However, times are still changing, and, from a fish-habitat perspective, they have changed for the better over the past decade or two. Although pollution still occurs, it is much reduced from levels seen in the 1950s through the 1970s. As a society, we now are much more aware of how our actions affect the environment. This is also reflected in how we manage our landscape. Buffer strips are demanded in timber harvest operations. People are encouraged to use low phosphorus fertilizers. Phosphate containing detergents, which harm fish, are no longer available. Many habitat improvement projects have been completed, making miles and miles of streams suitable for trout reproduction again. There's still a long way to go in improving habitat, however. Only a fraction of the degradation caused by human activities over the past century and a half has been repaired.

Another significant threat to the current and future balance and health of our aquatic ecosystems are invasive species. Aquatic invasive species are biological pollutants including fish, diseases and plants that previously were not found in Michigan waters and can take over and harm ecosystems or economy.
As aquatic invasives and new diseases enter our waterways, the role hatcheries play will change over time. All of these issues, coupled with the incredible amount of fishing activities in Michigan, make it a certainty that fish hatcheries will continue to play an important role in fisheries management.

Aquatic Invasive Species Classroom Activities

The Michigan Department of Natural Resources, the Michigan Department of Environment, Great Lakes and Energy, and the Michigan Department of Agriculture and Rural Development have produced a set of Aquatic Invasive Species Enrichment Activities that would be useful classroom tools. Activities span grades 2-12, and can be done in your classroom to supplement your SIC program, or as a release day activity.

Find the activities under the "Current Teacher" tab on the michigan.gov/sic website.

The Invasion of the Great Lakes

The Great Lakes' food web has changed significantly in the last 200 years - incoming invasive species had an enormous impact.

The Great Lakes invasion by two non-native species, the sea lamprey and the alewife, completely changed the ecosystem and fishery. By the 1950s, sea lamprey had decimated the native Lake trout population. Then, to make matters worse, another non-native species, the alewife, was no longer kept in check by Lake trout predation. The alewife population exploded and then crashed, causing massive, stinking die-offs along beaches.

Great Lakes fisheries managers were on the lookout for a new predator to help keep alewife populations in check. During the 1960s, they started stocking the lakes with Chinook and coho salmon. Anglers were lined up in record numbers to take advantage of the salmon's success. Salmon preyed on the invasive alewife, and took some sea lamprey predation pressure off of the native Lake trout. Not only did the salmon help re-balance the ecosystem in the Great Lakes, but it also created a multi-billion dollar sport fishery. But, the story does not end there. A new threat came into the Great Lakes, and during the late 1980s, invasive Zebra and Quagga mussels arrived in the ballast water discharge from ocean-going lake freighters called "salties". The mussels consume plankton in large numbers, filtering food out of the ecosystem, leaving less for native consumers in the food web. Now, prey species are declining and so, too, are the salmon that eat them.

Should we keep stocking salmon at high levels and risk a collapse of the alewives in Lake Michigan, or should we reduce salmon numbers? What is best for the economy? What is best for the fishery? And what is best for the ecosystem? Since the 1970s, Chinook salmon populations have risen and plummeted, while native Lake trout have rebounded.

As the density of Quagga mussels has increased in Lake Michigan, the density of the plankton has declined. With less food to eat, the biomass of prey species preferred by salmon is at a historic low in Lake Michigan. The goals of fisheries managers are to preserve fishing opportunities without allowing the prey species to collapse. The tale of invasive species in the Great Lakes is not over.

Salmon in the Classroom Timeline

September

- ☐ Complete Scientific Collector's Permit App
- ☐ ***Returning teachers seeking "Green Eggs"***
  - ☐ Register for pickup (link in fall newsletter) Set up tank and equipment by Sept. 20
  - ☐ Maintain tank temperature of 52° F

  **Green egg pickup can change daily. Teacher is responsible for registering ahead, and checking status of egg take

  **Green eggs are potentially more difficult to rear. Mortality of green eggs requires completion of Fish Loss Report, and travel to the hatchery for replacement eggs.

October

- ☐ Check email for Scientific Collector's Permit, must be in your possession to pick up eggs.
- ☐ Check email for "Salmon Sense Newsletter." If not received, email paget3@michigan.gov
- ☐ For those teachers seeking
  - ☐ Set up tank and equipment by October 15
  - ☐ Use precycling protocol to cycle tank.
  - ☐ Let tank grow good bacteria at room temp.
  - ☐ Attend mandatory "Tank Setup" Zoom

November

- ☐ Week of egg pickup, slowly drop temp. to 52
- ☐ When picking up eggs you must have:
  - ☐ Scientific Collector's Permit
  - ☐ Lunch box sized cooler with ice
  - ☐ Small tupperware container
- ☐ Eggs must be taken back to your classroom, acclimated and placed in tank immediately after pick-up
- ☐ Dead white eggs should be removed daily
- ☐ Eggs may begin hatching
- ☐ Monitor water quality and record data

December

- Check email for "Salmon Sense Newsletter"
- Eggs should all hatch by winter break. If you have substantial die-off or unhatched eggs contact paget3@michigan.gov
- Dead white eggs/debris should be removed
- Begin training/feeding when all have absorbed yolk sac, and 80% are swimming up
- Over winter break - feed and check water every other day. Siphon when needed.

If you are experiencing mortality, email paget3@michigan.gov to help discuss options, and adjustments

January

- Check on fry during break, feed and siphon as needed. (Auto-feeders are ok)
- All fry should have "buttoned up" (Absorbed their yolk sack) and should be "swimming up"
- Follow the feeding schedule in this manual
- Maintain water temperature at 52° F
- Test water quality twice weekly (using this guide). Rinse sponge filter in tank water
- Follow trouble shooting guide if levels are off. If ammonia spikes, hold off feeding.
- Siphon debris and change 25% water weekly.
- Look for abnormal behavior, email if seen

February and March

- Record water quality data and siphon tank twice weekly (25% water change)
- Observe salmon & watch behavior. Email paget3@michigan.gov with concerns
- Continue feeding as indicated in Feeding Schedule
- To help maintain stable water quality, add an additional sponge filter to handle increasing bioload
- Check email for "Salmon Sense Newsletter" to help with your release day event
- Rinse sponge in old tank water, replace HOB filter pads

April and May

- Test water quality and siphon debris and change 25% of water twice a week
- Observe salmon for stress or sickness - contact paget3@michigan.gov with concerns
- Continue feeding per the schedule
- Retrieve Stocking Permit **Fish release: April 15-May 15 Lower Peninsula**
  April 15-May 30 for Upper Peninsula
- Submit completed Stocking Report within 14 days after release
  - Indicate continuation (or not) for next year
  - ***Any reports not submitted by June 1 are dropped from the program***

Policies and Procedures

Designated "Permittee" on Scientific Collector's Permit is legally obligated to follow all guidelines and submit all reports by their deadlines.
1 permit = 1 tank = 1 set of eggs.

Co-teachers are not legal permit holders, but can attend a workshop and co-teach the curriculum.

Current Scientific Collector's Permit must be in your possession (paper, or on phone as PDF) when transporting eggs or fish, and displayed in the classroom during the year. You must apply for this permit each year by September 1, using the electronic form.

New Permittees must attend a workshop, where they will receive their stocking permit and eggs.

Tank setup must be done at least two weeks in advance of egg pickup, preferably one month.

Precycling Protocol following the precycling protocol in October will ensure your tank is cycled before fish arrive.

Egg Pick-up and Workshop reservations must be done through the interactive form. Link will be in the Salmon Sense Newsletter. You will get your eggs at the end of your workshop. You must have:

- Scientific Collector's Permit in hand
- lunch box sized cooler
- small tupperware container
- ice

Eggs must be taken back to your tank and acclimated immediately following their pick-up.

Water Quality Data Sheets must be completed by an adult, at least once a week. This data is mandatory.

Fish mortality or odd behavior should be reported to the coordinator, so suggestions can be given to increase fish health.

SIC and related curriculum must be used with your 3rd - 12th grade students for at least 1 unit of study.

Students should actively be involved in the care of your salmon.

The **Facebook "Michigan Salmon in the Classroom" group** is an excellent source of peer advice and resources.

The SIC Coordinator is available for questions and advice at paget3@michigan.gov or 517.284.6033

Fish feeding should be done following the schedule included in this guide, using only the food provided.

Automatic feeders are ok. Look for a high quality feeder, and test it off the tank to ensure it is not overfeeding the fish. Utilize for school breaks only. Daily feeding should be done by the teacher or student.

Replacement fish may be possible. Requirements are:

- Loss of 75% of eggs or fish
- Submission of:
  - Fish Loss Report
  - Water quality data sheets
  - Picture of tank and filter setup
- Make changes to maintenance or care based on the coordinators suggestions
- Replacements are prorated and at the discretion of the coordinator and hatchery biologist
- If granted, replacement eggs/fish must be picked up within 2 weeks or by March 31
- When submitting your Stocking Report you must add both the original and replacement fish

Fish Release:

- April 15 - May 15 for the Lower Peninsula
- April 15 - May 30 for the Upper Peninsula

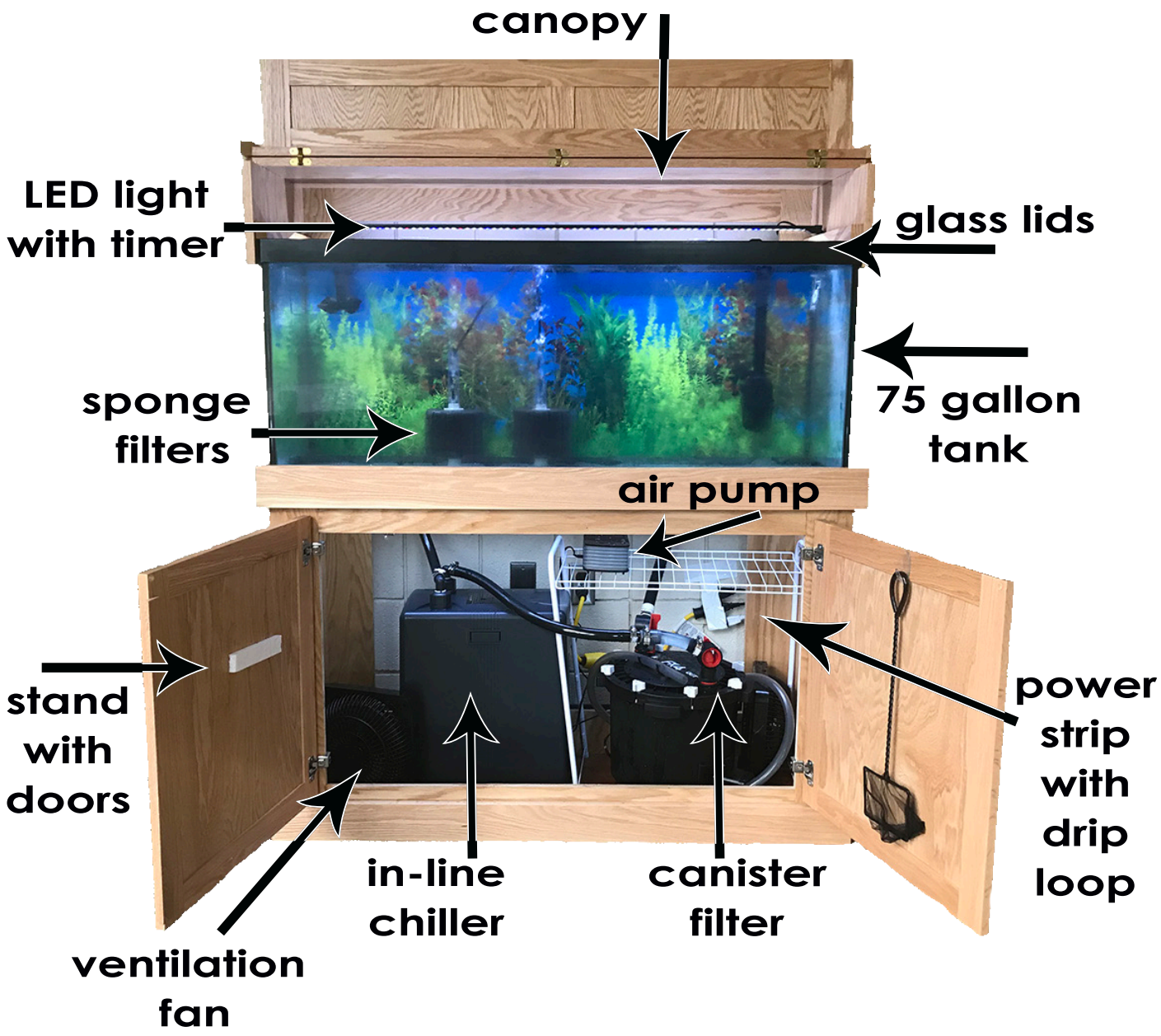
Stocking Permit must be downloaded from the website and in your possession during fish release.

A **Stocking Report** must be filed within 14 days after stocking, or before June 1 (even if stocking zero fish). You must indicate your intention to remain or drop from the program.

Replacement Permittees must file an SIC application and attend a workshop in the event that the original teacher is no longer participating.

Returning Permittees must re-attend a workshop if they have been out of the program for more than one year.

The Optimal Tank Setup



Teachers in the SIC program have a wide variety of tank setups. The picture above is the ideal setup to make maintenance easier and your water quality more stable. But, simpler setups can work as well.

Using oversized filters, multiple sponge filters, an oversized air pump, and a 75 gallon tank will help your water parameters will be more stable, and your equipment easier to maintain. We recommend you plan to filter for 150, 3" fish or 500 gallons.

Using a cabinet style stand, you can utilize magnetic baby locks on the doors to keep equipment secure. Locking lids are also recommended. Metal stands hold up better against condensation.

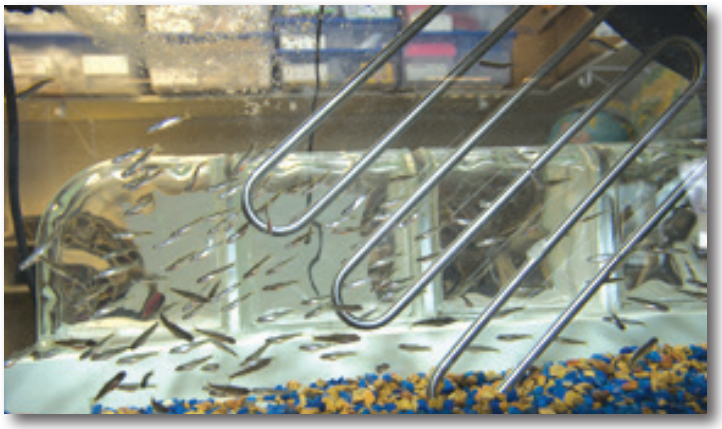
Outlet/plug protection boxes, as well as power strip protector boxes are recommended to aid in reducing accidental unplugging of your fishes' life support systems. Use signs to show that these plugs and equipment are for "fish life support".

The Equipment

Having quality equipment that is properly maintained is one of the most important components of a successful program. **The DNR does not provide this equipment.** You are required to purchase it on your own. The following information will help you research and plan equipment purchases. Remember, you can contact a teacher near you who has participated before to get advice about the equipment.

It is important to set up the equipment at least two weeks before picking up your salmon eggs to ensure everything is working properly. The health of your fish will be compromised if you wait until the last minute to set up your tank. See the "Nitrogen Cycle" for more information.

Coil Chiller in tank



Tank

The salmon need a 75 gallon or larger tank for best results. Bigger is better as it buffers water quality changes. If a used tank is available, wash it thoroughly with a 10% bleach and water solution. Then rinse with water 5 times to remove all bleach residue. Tanks and filters should be up and running for at least 1 month prior to egg pick-up. When purchasing, plan for filtration for 500 gallons for 150 fish, 3" long by the end of the year.

Chiller Units

Salmon are a coldwater fish and therefore must have the water chilled in order to survive. Tank chillers are necessary for this function. There are two main types of chillers:

- Power coolers (also known as "inline" chillers); these are external chillers. These are the quieter choice, at 68 decibels. If using an inline chiller, you will also need to purchase a canister filter. In this system, the water is pumped out of the tank, run through the chiller and filter, and pumped back into the tank. If installed in a cabinet, drill vent holes to prevent overheating. This will also extend the life of the chiller. Vacuum dust off screens and check fuses if there are issues.
- Coil coolers (also known as "drop-in" chillers); these are internal chillers. These run a bit more loudly than power coolers at 80 decibels. The water is chilled as it encounters copper tubing that rests on the back of the tank. Vacuum dust off the intake screen.

Be sure to discuss your tank setup with tank store personnel to find a filter and chiller that suits the needs of your specific tank. Chiller discounts may be available through distributors.
Email paget3@michigan.gov for more information.

Chiller Troubleshooting

If your chiller is not holding the temperature, or stops working there are a few steps you need to take:

- Float ice in ziplock bags in your tank to help maintain the temperature
- Call the manufacturer of your chiller unit and troubleshoot the problem
- Vacuum intake screens, check for blown fuses, and backflush if needed.
- If maintenance is needed - contact a local air conditioning specialist
- Add an additional air stone to increase oxygen exchange (warmer water holds less oxygen)
- Contact Tracy Page at paget3@michigan.gov for advice and help

Filter Systems

In selecting a filter, it is always better to purchase a larger filter for your tank. Plan for filtering for 150, 3" fish. For example, if you have a 75-gallon tank, it is recommended that you purchase filtration that totals 500 gallons. So a canister filter and two 100-gal sponge filters, or a double hang on the back filter and two sponge filters.

- Canister Filter- all necessary setup equipment typically accompanies the purchase of a canister filter. These filters save money in the long run as you can use "permanent media" that will only need rinsing, not replacement.
- Hanging (HOB) Filter - all necessary setup equipment typically accompanies the purchase of a hanging filter. Replacement filter cartridges will be necessary over the life of the filter. You will need to purchase filter replacements every couple of weeks.
- Sponge Filters - Additionally, it is recommended that you run at least one sponge filter on your airline. Multiple sponge filters are a great way to help buffer your water quality at the end of the school year when the fish are large. These are a cost effective addition.
- **Undergravel system - this system is not recommended because it tends to trap debris, uneaten food, and waste contributing to problems with ammonia, bacteria and fungus.

Gravel (not recommended)

In a natural coldwater stream, salmon eggs are protected by large pieces of gravel that hide them from predators and allow cool water to pass through the pore spaces providing oxygen to the incubating eggs. In a tank, gravel is purely aesthetic. The gravel is not necessary for the survival of the salmon. In fact, the buildup of waste in the gravel can contribute to water quality issues and requires a substantial amount of effort and time to maintain. If using gravel or rock, place just enough to cover the bottom of the tank.

Purchasing Supplies

Teachers and/or their sponsors are responsible for obtaining all equipment and supplies. Preuss Pets in Lansing, a SIC Partner, specializes setups for SIC teachers. If you are not near Lansing, check with your locally owned fish store to create a partnership. These stores also will often offer free water testing and have experts on staff to answer questions. Take the supply list in the following pages.

Supplies for Salmon in the Classroom can also be found at most tank supply stores, such as PetSmart, Petco, Pet Supplies Plus or online. It is recommended that you contact the store well in advance to ensure items (especially chillers) are in stock. Websites such as www.marinedepot.com and www.glaciercorp.com are also helpful.

Choosing Your Equipment

Step 1: Choose a tank and stand

Tank = Glass 75 gallons or larger. Length > height

Larger aquariums help keep water parameters more stable, and reduce maintenance.

AND

Stand = Metal or wooden aquarium stand that adequately supports edges. Must hold 700lbs.

Metal stands hold up well to condensation that may occur. However, cabinet style stands work well for locking up equipment. Drip trays are good additions.

Step 2: Choose a chiller type

Inline Chiller

Inline chillers hook to a canister filter or pump. Maintenance includes flushing at end of school year. Cabinet stands must have good ventilation. You will also need a plumbing adapter kit

OR

Coil Chiller (in tank)

Coil chillers drop into the tank and do not require an extra pump. Coil chillers are slightly louder than inline.

Step 3: Choose main filter type

Canister Filter

Canister filters go in the stand, and hook to the tank with hoses. A turn-over rate of 300 gallons per hour is the minimum. Canister filters will also hook directly to inline chillers. Very little cost associated with changing media.

OR

Hang On the Back Filter (HOB)

HOB filters hang on the tank and pour water over biowheels. Filter pads must be replaced alternating weeks, adding to maintenance costs. A turnover rate of 300 gallons per hour is the minimum.

Step 4: Add an air pump and 2 sponger filters

Air pump

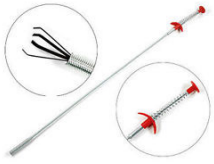
An air pump rated for 90 gallon tanks or higher is recommended. Also needed is 20ft of airline tubing, two backflow valves and an airline splitter.

AND

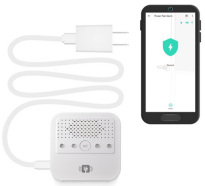
Sponge Filters

100 gal. sponge filters provide ample surface area for beneficial bacteria and increase water parameter stability. Airline tubing attaches to the sponge through the hard tube. This also provides air bubbles. You can put air stones inside them to increase flow.

Step 5: Other Required Equipment

Siphon Python brand hooks to sink  Regular style siphons into bucket 	Pythons hook to the sink, cleans tank, and then flips to fill tank from the tap. Regular siphons drain into a bucket and you can haul dirty water away, and clean water to your tank.	**Plug Protectors** 	Protect your cords from accidental unplugs! Baby-proofing outlet boxes and power strip covers are a great solution. Also post signs saying "Do not unplug - fish life support!"
API Test Kit 	You are required to test your water parameters at least weekly and record results in the tank maintenance chart. The API test kit makes this easy.	**GH/KH Test Kit** 	This test kit provides two more tests than the API test kit. It measures general hardness and alkalinity which can hamper fish growth and water parameters.
Prime 	Prime is an additive that stabilizes new water for your tank and treats chlorine. Add the recommended dose with each water change.	**Tank Lid** 	Chinook are jumpers! Your tank must have a lid, and glass lids are recommended since they are heavier.
Net 	You should have a dedicated net for this tank. Cross-contamination can occur in you use equipment from other tanks.	**Precycling Chemicals** 	Follow the precycling protocol in October to ensure your tank is fully cycled before you get eggs in November.
Filter Socks 	All filter and pump intakes should be covered tightly with a nylon or filter sock to prevent eggs, debris o fry from being sucked into the filter or pump.	**Tool Grabber** OR 	This tool helps you remove debris from the bottom of the tank without getting your arms wet. These can be purchased at auto supply stores.
Thermometer 	A reliable thermometer is a must. Use the values here to ensure your chiller is running properly.	**Battery Air Pumps** 	In case of power outage, you should have two battery back-up air pump hooked to your tank at all times. These will also be used to transport fish for release day.

Step 6: Optional Supplies (to make your life easier)

Ammonia Alert 	This visual indicator sticks to the glass in your tank. It provides a warning if total ammonia levels are too high.	**Aquarium Salt** 	Aquarium salt should be kept on hand to treat a variety of water quality issues and ailments.
Stability & Paraguard 	Stability provides a kick start to your beneficial bacteria colony. Paraguard is good to have on hand for treating disease outbreaks.	**Power Outage Alarm** 	Be automatically alerted in case of a power outage. Recommended item https://a.co/d/6fVllch
Light & Timer 	A light is optional, but can be used to help students see the fish. If you use a light, use a timer as well. Keep the light on the minimum amount possible to reduce algae growth.	**Auto Feeder** 	Auto feeders are helpful during breaks. Be sure to test it over a dish for a day prior to putting it on the tank. Underfeeding with the auto feeder is recommended.
Vitamin Tray & Measuring Spoons 	A multi-day vitamin tray can be helpful in setting aside food rations. Measuring spoons dedicated to your fish food make rationing allotments easier.	**Algae Scraper** 	Occasionally algae will grow on your tank walls. This sponge scraper tool will help you remove it effectively. There are also magnetic cleaners that you drag on glass.
Background 	Tank backgrounds are not necessary, but can make the tank look more natural and hide cords and tubes.	**Gloves & Goggles** 	Long-sleeved gloves help to protect your arms from the cold water in your tank. Safety goggles are recommended when using the water test kit chemicals.

Step 7: Consumables to budget for

- Precycling additives (1 set per year)
- Filter media (pads for HOB)
- Prime (about 2 bottles per year)
- Stability (about 2 bottles per year)
- API Test Kit & GH/KH (expires in 3 years)
- Aquarium salt (1 box per year)

SIC Shopping List

Item	Description	Average Cost
Glass aquarium	75 gallon or larger. Longer than it is tall.	$200
Stand	Metal frame, or wooden cabinet stand	$160-$400
Chiller (choose 1 below)		--
a. Inline Chiller	1/4 hp. Typical brands include Arctica or Glacier	$965
b. Coil Chiller	1/6 hp. Glacier brand. (teacher discount)	$850
Main Filter (choose 1 below)		--
a. Canister filter	Fluval FX4 is recommended	$350
b. Hang on the back	Aquaclear 110 is recommended (filter pads extra)	$80
Air pump	Rated for 90 gallons. 2 outputs	$50
Air line	20 ft. Silicone holds up better.	$8
Backflow valves (qty 2)	Prevent water from siphoning down airline	$2.50 ea
Airline splitter	Split airline between two sponge filters	$10
Sponge filters (qty 2)	90 gal rated. Boost good bacteria colonies	$10 ea
Air stones (qty 2)	Insert into sponge filters to boost flow	$2
Python Siphon	Hooks to sink, to drain and refill tank.	$50-$80
API Test Kit	Tests your water parameters	$40
gH/kH test kit	Measures hardness and alkalinity	$12
Seachem Prime (qty 2)	Additive to treat chlorine and temporary spikes in levels	$15-$25
Fish net	To remove fish if needed	$5
Removal tool	Turkey baster or tool grabber to remove dead eggs, etc	$5
Thermometer	LCD style recommended	$8
Battery Air Pump	Emergency back up for outages, and fish transport	$20x2
Glass Tank Lids	Contain jumping fish and reduce water loss to evap.	$60
Algae scrubber	Long handled scrubber to clean tank walls	$10
Aquarium Salt	On hand in case of emergency to treat tank ailments	$3
Outlet box protector	Covers your cords plugged into outlets	$12
Power strip plug cover	Covers cords plugged into your power strip	$10
Precycle additives	Fishless fuel and Stability to precycle tank in October.	$20
Power outage alarm	Alerts phone, sends text and email in case of outage.	$24
Optional		
Ammonia Alert	Visual indicator of toxic ammonia levels	$13
Seachem Stability (qty 2)	A bacteria kick-start additive	$10
Long sleeved gloves	Waterproof gloves for reaching in your tank	$20
LED tank light & timer	LED lights used sparingly to highlight fish. Timer is a must.	$50-100
Auto Feeder	Eheim autofeeder is recommended	$40
Vitamin tray	To set aside food allotments	$5
Measuring spoons	To measure food allotments	$5
Tank background	To give your tank a more natural look	$20
Safety goggles	For testing water parameters	$5
ADDITIONAL:	Be sure to budget for filter media that needs replacing	
Many stores offer educator discounts	*Prices are variable.* **Approximate Average Total**	**$2800-$3000**

Setting Up Your Tank

Setting up your tank will help familiarize you with the equipment required to properly maintain it. To ensure all equipment is working properly, it is important to set up all equipment at least two weeks in advance of receiving your salmon eggs.

1. Choose a suitable location for your tank. Your tank should be in a location that is:
    - easily accessible from all sides
    - not near an uncovered window
    - within close proximity to an electrical outlet
    - near a water source (if possible)
    - in an area where the tank is readily visible to students and visitors.
2. Set up tank in chosen location and fill. Be sure that the area or cabinet is properly ventilated so the chiller does not overheat. Tank must be level or you risk leaks. If you have a wooden stand, use a drip tray also.
3. Test gH/kH and other water parameters and send your baseline numbers to paget3@michigan.gov
4. Add chiller to tank. Test it. Then turn down to room temperature. Follow manufacturer instructions.
5. Add filters. Follow manufacturer instructions. Cover intakes with a nylon to prevent sucking up eggs, debris or fish.
6. Add two sponge filters via an airline to your air pump, using the check-air valve and splitter if needed.
7. Fill tank with water. If using municipal water, dechlorinate according to manufacturer instructions for dechlorination additive.
8. Initial Water Quality: use an API test kit and gH/kH test kit upon completion of tank set up. It is important to obtain baseline levels for nitrate, nitrite, ammonia, etc. when you set up your tank to help you recognize when levels change throughout the year.
9. A Tank Maintenance Sheet follows to help you keep track. Keeping water parameter data at least once a week is mandatory. In the case of troubleshooting or replacement fish you will be asked to provide those sheets.
10. Use the precycling protocol to force a cycle in your tank before Nov.
11. A week before egg pickup, start dropping the temperature down to 52 degrees F, and monitor water quality for a period of at least two weeks prior to receiving salmon eggs.

**For hard scale and lime build up you can soak plastic/glass parts in 1 part vinegar & 1 part water for a day and scrub. Rinse 3 times with fresh water and let dry before using with fish.

Temperature

Once cycled and just prior to fish, tank temperature should be maintained between 50 and 57 degrees with 52 degrees as the optimal temperature. Colder water dissolves more oxygen than warmer water. Salmon require more oxygen than cool or warm water fish species and therefore require cooler water and its oxygen carrying ability.

Forced Pre-cycling Protocol (Recommended)

Cycle your tank before you receive eggs.

Naturally letting your tank cycle can take a long time at our low temperatures. To speed up this process and ensure you have stable and safe water parameters by the time you introduce eggs, you can do a "forced cycle" using a couple of additives. Follow the instructions below. Adjust the dates as needed to align with the school week each year.

Forced Cycling Supplies

You need just a few supplies to get your cycle going.

- 10ml syringe
- Seachem Stability 3.4 oz. or larger
- Fritz Zyme Fishless Fuel 2 oz.
- 2 oz. container of fish food (any kind)
- KH between 120-180ppm, pH between 6.8 - 8.0. Use Seachem Alkaline Buffer to raise KH/pH, or use reverse osmosis water to lower KH/pH.
- Optional: tank heater

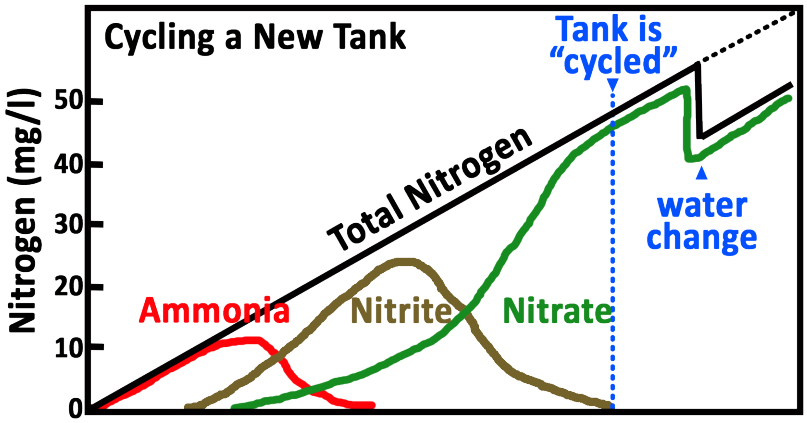
* Stability and Fishless Fuel are available as a combo here.

General Dosing Guidelines

Before starting the protocol, your KH levels must be between 120 - 180 ppm and your pH between 6.8 - 8.0. Use Seachem Alkalinity Buffer to raise those levels. Or use reverse osmosis water to lower them. These will be used for all water changes for the year.

You will see different additives suggested in the cycling protocol table.
Below is the suggested dosing for each additive.

Tank Size	Stability	Fishless Fuel	Seachem Alkaline Buffer
50 gallon	5 capfuls	10 ml (2 tsp)	2.5 tsp will raise KH ~ 2.8 degrees
75 gallon	7.5 capfuls	15 ml (3 tsp)	3.75 tsp will raise KH ~ 2.8 degrees
90 gallon	9 capfuls	20 ml (4 tsp)	4.5 tsp will raise KH ~ 2.8 degrees



The chart above illustrates the typical progression of tank cycling. Cycled = no ammonia, no nitrite and nitrate that you keep below 40 ppm with weekly water changes.

Cycling Process

Remember that this is the process we are forcing to happen in a short time frame. For the first two weeks we want ammonia levels to hover around 3ppm without going over 5ppm.

Once you are reading nitrate levels, you can discontinue adding the Fishless Fuel. Once cycled, be sure to add a tiny pinch of fish food to the filter intake at least twice a week. This "feeds" your good bacteria to keep them alive and your tank cycled until you begin feeding your fish.

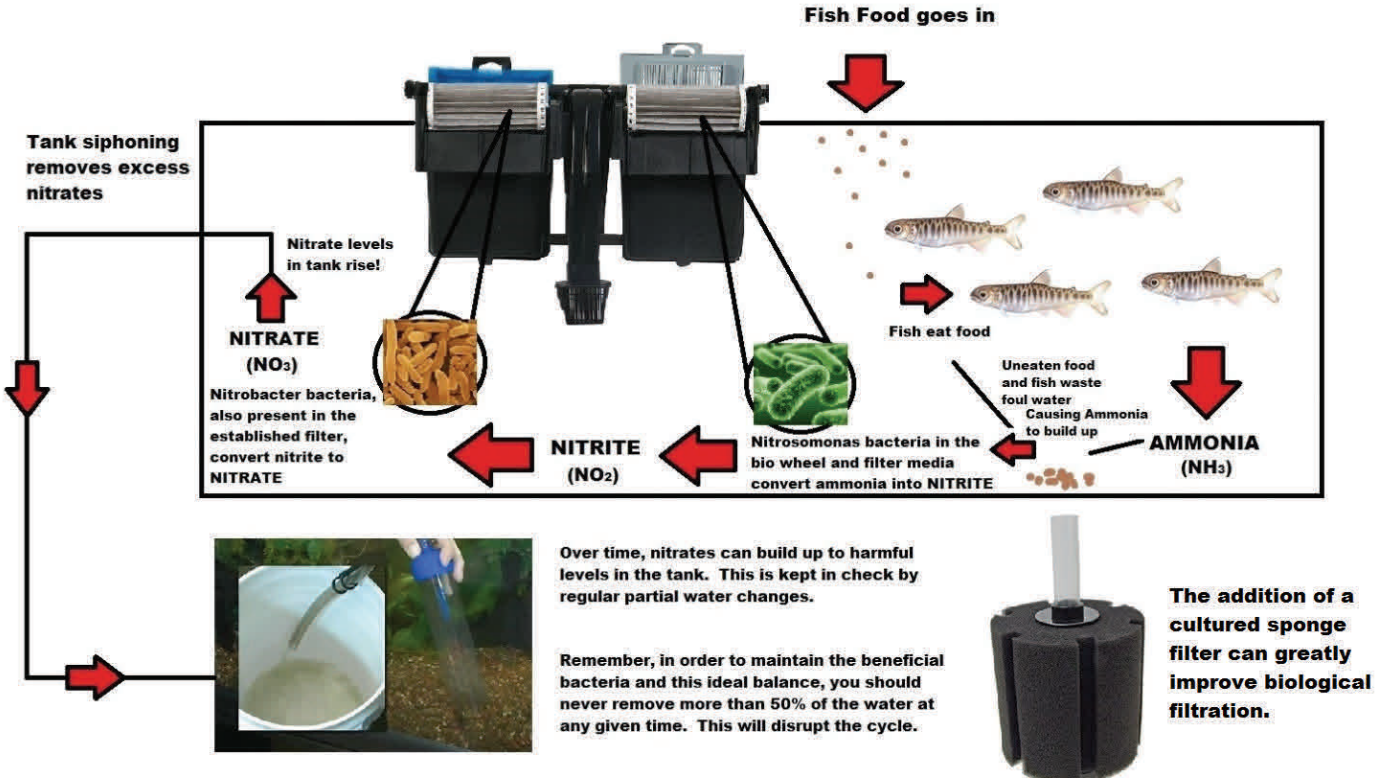
Cycling Protocol (Start this process on or near October 15 each year)

	Monday	Tuesday	Wednesday	Thursday	Friday
Week 1 (~ Oct. 13)	***Set up tank*** - Chiller off - Filter running - Do initial water tests - Adjust KH to above 120 and pH below 8. - Use a heater (if available) to maintain 80 degrees.	- Record water data - Add ammonia - 2 hrs later test ammonia levels (should be about 3ppm, do not go over 5ppm. - Add ammonia if it is below 3ppm. - Add Seachem Stability	- Measure ammonia and nitrite and record. - If pH drops below 7.0 do a 25% water change. - If KH is below 150ppm add Alkaline Buffer to raise it.	- Measure ammonia and nitrite and record. You want ammonia levels staying near 3ppm. No higher than 5ppm.	- Measure ammonia and nitrite and record. - If pH is below 7.0 do a 25% water-change. - If KH is below 150ppm add Alkaline Buffer. - If ammonia and nitrite are below 3ppm, add more ammonia.
Week 2 (~ Oct. 20)	- Measure ammonia, nitrite and nitrate and record. You want ammonia levels staying near 3ppm. No higher than 5ppm.	- Measure ammonia and nitrite and record.- If pH drops below 7.0 do a 25% water-change. - If KH is below 150ppm add Alkaline Buffer. - If ammonia and nitrite are below 3ppm, add more ammonia.	- Measure ammonia, nitrite and nitrate and record. You want ammonia levels staying near 3ppm. No higher than 5ppm.	- Measure ammonia, nitrite and nitrate and record. - If your tank is cycled, BOTH ammonia and nitrite will be below 0.5 ppm and some nitrate will be measure. - If you are still reading high ammonia or nitrite, dose with Stability.	- Measure ammonia, nitrite and nitrate and record. - Check pH and KH and adjust if needed.
Week 3 (~Oct. 27)	- Measure ammonia, nitrite and nitrate and record. - If you are still reading high ammonia or nitrite, dose with Seachem Stability.	- Measure water parameters. If reading ammonia or nitrite contact paget3@michi-gan.gov for next steps.	- If cycled, 5ml fishless fuel to feed good bacteria. - Remove heater.		- Turn chiller on and set to 65. - Test water parameters to ensure ammonia and nitrite levels are dropping.
Week 4 (~Nov. 3)	- Adjust chiller slowly to 60 degrees. - Add 1 pinch fish food to filter.		-Test water and record. - Adjust chiller to 55 degrees. - Add 1 pinch fish food.	**YOU MUST HAVE ZERO AMMONIA AND ZERO NITRITE READINGS AT THIS POINT.**	- Adjust chiller to 52 degrees. - Add 1 pinch fish food to filter.
Week 5 (~Nov. 10 egg arrival)	- Add 1 small pinch of fish food to the filter.		- Test water parameters and record. - Add 1 small pinch of fish food to the filter.		- Add 1 small pinch of fish food to the filter.
Week 6 - 13 (until you start feeding your fish)	- Add 1 small pinch of fish food to the filter.		- Test water and record. - Add 1 small pinch of fish food to the filter.		- Add 1 small pinch of fish food to the filter.

The Nitrogen Cycle

In natural ecosystems, there exists a diverse community of organisms that break down waste. This biotic community contributes to a common life cycle called the NITROGEN CYCLE. *Nitrosomonas* and *Nitrobacter* bacteria are key components of the cycle and are considered a type of beneficial bacteria. The bacteria act as a natural filter. After a series of conversions, toxic waste products are rendered benign. The ideal fish tank environment will mimic this, but on a much smaller scale.

The Nitrogen Cycle in the Salmon Tank



The Salmon Tank

A newly set up tank is not instantly ready to support life. The process of tank maturation, better known as cycling, describes how organic wastes are dealt with as bacteria establish within the confines of the aquarium. An aquarium is essentially a ecosystem in a box. The tank must completely "cycle" for the salmon to begin to thrive - which can take up to a month. Cold water is slower than warm water.

Prior to hatching, the fish are not producing waste. Therefore, it won't be until you have swim-up fry and then begin feeding that your nitrogen cycle begins. As the fish begin to produce waste, harmful ammonia levels in the tank will rise until beneficial nitrifying bacteria begin to colonize and convert it to less toxic forms. Unassisted, this process can take many weeks to establish. Use of a bacterial additive such as *Seachem's Stability* or *Seed* or a cultured sponge filter, will reduce the time it takes to cycle the tank.

Beneficial bacteria establish themselves on your sterile filter material slowly over time. Porous filter material provides a home for these species of bacteria. Tank filtration consists of 3 phases: mechanical, chemical, and biological. Mechanical filtration traps waste, chemical filtration is carbon media that absorbs impurities, and biological is the beneficial bacteria that convert toxic ammonia and nitrite into less harmful nitrate.

The Importance of Cycling

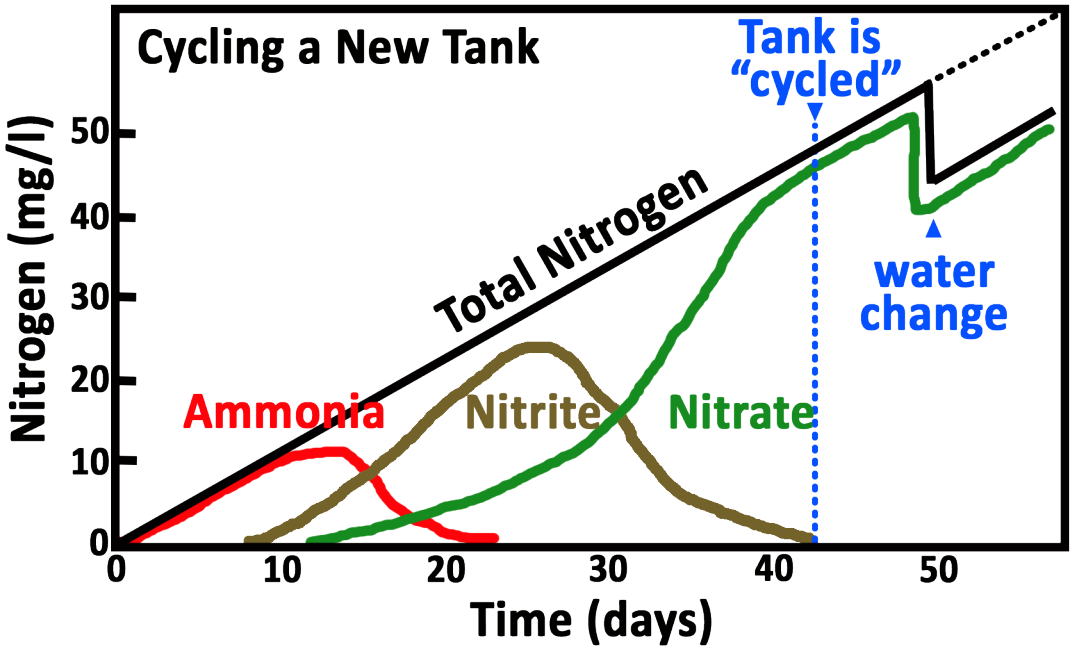
Your tank will require a large colony of beneficial bacteria to function properly. If your fish are introduced into a tank that has not cycled, the salmon can suffer what is called "new tank syndrome". This equals the loss of fish. Again, using an additive like Stability or a cultured sponge filter, you can buffer these effects as the tank cycles. In our cold water tanks, the cycling process can take longer than in a tropical fish tank you might have had at home.

A cycle consists of:

1. Spike in ammonia levels
2. Drop in ammonia as nitrite levels spike
3. Drop in nitrite as nitrate levels spike

A cycled tank = no ammonia, no nitrite and low nitrate that you remove with weekly water changes.

Until you get test results that indicate cycling is complete, do not change filter media or perform water changes except in the case of dramatic spikes. Once cycle is complete - never change the media all at one time.



The chart above illustrates the typical progression of tank cycling. Cycled = no ammonia, no nitrite and nitrate that you keep below 40 ppm with weekly water changes.

Testing Your Water - How to tell when the tank has cycled

Water parameters should be tested at least weekly. When setting up your tank, be sure to test your tap water to have a baseline value. Testing ammonia (NH4), nitrite (NO2), and nitrate (NO3) will be critical in determining the health of your tank. Be sure to read the instructions on your API test kit carefully, and shake bottles vigorously as instructed. Hold bottles vertically above the tube to get uniform drop sizes. Hold the tube against a white background to compare colors to the test chart. Students should wear safety goggles when performing water tests.

Tank Maintenance Chart

This is a mandatory copy me page

Date	# of fish lost	Temp.	pH (6.8-8)	Ammonia (0 ppm)	Nitrite (< .5 ppm)	Nitrate (< 40 ppm)	Hardness GH (75+ ppm)	Alkalinity KH (120-180 ppm)	Additives	Notes / Observations / Steps to correct issues

For a fillable PDF version of this form, visit the website michigan.gov/SIC. **To use a Sheets version of the Tank Maintenance Chart visit https://tinyurl.com/SICwaterdata**

Maintaining Water Quality

Warning: failure to adhere to the standards below will put your salmon at risk for mortality.

Completing water quality testing/data sheets is mandatory.

Weekly (minimum) or daily, as needed:

- Test water quality including ammonia, pH, nitrite, nitrate, hardness, chlorine and alkalinity. Record results on Tank Maintenance Chart. If levels are unsatisfactory, follow instructions in Troubleshooting Guidelines to remedy. Continue testing on a daily basis until safe levels are reached.
- Perform water exchange by removing approximately 25% of water in tank and replace with fresh, clean water. If using municipal water supply, dechlorinate water and test for chlorine prior to putting water in tank.
- Siphon waste from tank. Remove all visible uneaten food and waste from tank. Allowing these to remain in the tank will decrease overall water quality, stress the fish and can cause harm or mortality.
- Remove dead eggs/fry/fish immediately. They can grow bacteria and fungus, which can infect nearby healthy fish.

Filter Maintenance

Canister Filters with carbon filters

- Once a month change carbon and filter material

Canister Filters with permanent filter media

- Once every two months, rinse media in old tank water

Hanging Filters (HOB)

- Every week, replace one filter pad (alternating)
- Biowheels only need rinsing in old tank water if visibly clogged, or not spinning

Sponge Filters

- Once a month - remove from tank, and squeeze in a bucket of tank water until it mostly runs clear.
- With multiple sponge filters, space out maintenance to not be the same week.

General Guidelines

- Never change/rinse all filter media in the same week. This will disrupt or wipe out your beneficial bacteria. Always rotate media changes.
- Always use old tank water to rinse filter media. Chlorinated tap water can kill your beneficial bacteria.
- Always immediately clean any filter that looks clogged or covered in debris.
- To prevent eggs or fry getting sucked up into filters, you can cover the end of intake tubes with window screen and a rubber band.

Water Quality Timeline

Mandatory:

Daily, or at least weekly, test and record fish and tank information on the *Tank Maintenance Chart.*

Weekly:

Clean tank at least once each week per directions under *Maintaining Water Quality*.

***For hard scale and lime buildup you can soak plastic/glass parts in 1 part vinegar & 1 part water for a day and scrub. Rinse 3 times with fresh water and dry before using with fish.*

Fish Mortality

Occasionally fish may die due to disease, water quality issues, equipment failure or other issues.

- If you start losing fish regularly, please reach out right away to our Coordinator Tracy Page at paget3@michigan.gov for help diagnosing and solving the issue. You can also receive peer advice on the Michigan Salmon in the Classroom Facebook group.
- If you suffer a catastrophic loss of your eggs or fish (75% or more), you can complete a Fish Loss Form and submit it with your tank maintenance charts and a tank picture. We can then help solve your issues, and may grant new fish that the teacher would be responsible for driving to the hatchery to obtain. Fish must be picked up within two weeks or by March 31.

Feeding Your Salmon

Proper salmon care is essential to a successful program. The salmon will not survive without careful consideration, understanding and implementation of the following guidelines. It is your responsibility to adhere to the following guidelines when participating in the program.

Food and Feeding

Fish food will be provided when you pick up the eggs. Storing the fish food in a refrigerator is not necessary. Do not freeze fish food, or use past year's.

Your eggs should hatch in late November to early December. The sac-fry will remain on the bottom of the tank. Do not start feeding them at this point. They will feed off their yolk sac for up to one month. Once they have absorbed most of their sac they will swim up in the water column and begin searching for food. Don't be alarmed if they don't all swim up at the same time some will take longer than others.

Once approximately 80% are off the bottom and swimming, you should begin feeding. Follow feeding schedule on the data sheet.

Feeding Schedule

The feeding schedule on the next page is to be used as a general guideline. Food amounts shown are the total amount to be fed daily. Spread amount over several feedings. All food amounts are based on 150 fish. Food size and amount fed will depend on when your eggs hatch, number of mortalities and rearing water temperature. The duration on each food size may vary. If your fish are growing slower or faster than this guide adjust accordingly. Do not over feed as this will lead to water quality issues!
Past teachers have found that splitting the daily food amount into several slots of a vitamin tray makes feeding easy by students. Automatic feeders can be helpful during winter and spring breaks. Be sure to purchase a high quality auto-feeder and test it off the tank prior to use. Be sure that the auto-feeder is not overfeeding your fish while you are away. Be sure, even with an auto-feeder, that you still plan to collect water quality data and siphon the bottom and exchange 25% of the water from the tank at least once a week.

Ration Instructions

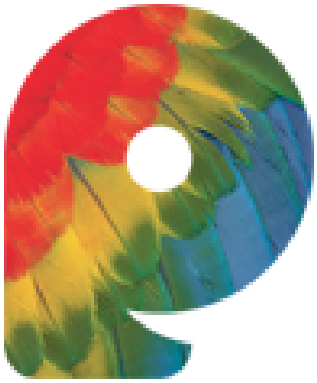
To ensure that fish receive their daily food over multiple feedings throughout the day, divide the amount to feed into the number of feedings you are able to do. This portion is called a "ration." Fish should receive either their entire ration or be fed until they are no longer actively feeding, whichever occurs first. It is not uncommon that early in rearing, fish may not eat their entire ration but should once they are feeding well. **If fish are not eating their entire ration you may need to increase the number of feedings and decrease the ration amount to accommodate what the fish need.** As the fish grow, this will change, so you will be able to increase the ration per feeding and decrease the number of feedings. Observe your fish while feeding. Their behavior will let you know what they need and if you need to make adjustments.

Feeding Schedule and Data Sheet *Mandatory Copy Me Page*

Calendar Date										
Week	1	2	3	4	5	6	7	8	9	10
Fish Length	1-1.5”	1-1.5”	1.5-2”	2-2.5”	2-2.5”	2-2.5”	2-2.5”	2.5-3”	2.5-3”	2.5-3”
Food Size	#1	#1	#2	#2	1.2mm	1.2mm	1.2mm	1.2mm	1.5mm	1.5mm
Amount per day	1/8 TSP	1/4 TSP	1/2 TSP	3/4 TSP	3/4 TSP	1 TSP	1 1/8 TSP	1 1/4 TSP	1 1/4 TSP	1 1/4 TSP
Notes										

Calendar Date										
Week	11	12	13	14	15	16	17	18	19	20
Fish Length	3-3.5”	3-3.5”	3-3.5”	3.5” +	3.5” +	3.5” +	3.5” +	3.5” +	3.5” +	3.5” +
Food Size	2.0mm	2.0mm	2.0mm	2.0mm	2.0mm	2.0mm	2.0mm	2.0mm	2.0mm	2.0mm
Amount per day	1 1/2 TSP	1 1/2 TSP	1 3/4 TSP	1 3/4 TSP	2 TSP	2 TSP	2 1/4 TSP	2 1/4 TSP	2 1/2 TSP	2 1/2 TSP
Notes										

From a Sponsor



Preuss Pets

Preuss Pets offers many services and supplies for SIC teachers:

- Expert advice on design and installation of aquariums
- Home of 75 gallon aquariums for $99.99
- Pre-seeded sponge filters
- Specialty equipment (chillers, filtration, battery back up, aquarium controllers) generally in stock year round.
- Consultation throughout the year via e-mail, phone, or store visit to troubleshoot issues - water testing, filtration maintenance etc.
- 10+ years of experience with SIC systems.

Ask us about the peace of mind and technical data that come from Neptune Systems APEX controllers and Seneye monitors.

www.preusspets.com
1127 N Cedar St, Lansing, MI 48906

Releasing Your Salmon

It is important to understand the goal of the program is to provide students with an educational opportunity to learn about the salmon life cycle and natural resource conservation. It is not intended to be part of a fish stocking or fish recovery program. Because of the small number of fish you will be releasing, survival may be low. However, taking proper care of your fish and releasing them into favorable habitat will increase their chance of survival. Having even one fish survive until release time is a success!

Releasing the salmon that you and your students have cared for over the course of an entire school year is one of the most exciting aspects of the program. It is important that you release your salmon into a suitable habitat to provide them with the best possible opportunity of surviving. It also is essential that you adhere to the regulations that have been put in place by the DNR as outlined below. Please read the information carefully. Watch this video to learn more.

Stocking Permit

A stocking permit is available on Michigan.gov/SIC and "Current Teachers" after March 15. The Permit must be in your possession when stocking your fish, and you need a new one each year.

Where You Can Stock Your Fish

Step 1: Determine which Fisheries Management Unit (FMU) your school is located in.
Step 2: Choose a stocking location in your FMU from the list of approved stocking locations.

Pre-approved Release Locations

You may stock your salmon in any of the rivers, lakes or streams on the approved list. If you are still unsure of your stocking location, contact your Salmon in the Classroom coordinator, Tracy Page.

How to Transport the Fish to Your Stocking Location

- Transfer your fish and the water from your tank into a 5-gallon bucket. Do not overcrowd the fish; use more than one 5-gallon bucket if necessary.
    - Fill a 5 gallon bucket ¾ of the way full with clean, fresh, cold water - from the tank. If fish are 3-4" in size and will be in the bucket for 30 minutes or less, place 40 – 50 fish per bucket.
    - If fish are greater than 4" in size and/or will be in the bucket for longer than 30 minutes, place only 25 – 30 fish per bucket.
- It is important to understand that no matter what size the fish are, the longer they are in the bucket, the more stressful it is on them.
- Aerate the water in each bucket with a battery operated bubbler, and pack ice in a plastic bag around or in the bucket.
- Upon arrival at the river, take the temperature of the river water and the temperature of the water in your bucket. If there is a difference of five degrees or more between the two, you will need to acclimate the fish before releasing them into the water.
- To acclimate the fish, gradually replace the water in the bucket with river water. You should replace only one-quarter of the bucket water volume every 15 minutes with river water to avoid temperature shock. See a video here.
- You can also measure the river temperature a week ahead and adjust your chiller 1 degree per day to get the temperature closer for release day.

Stocking Report

Our mandatory stocking report is an online form found at Michigan.gov/SIC and "Current Teachers". This report must be completed each spring by all permitted SIC teachers. It is due June 1, regardless of if you released fish or not. This report keeps you active in the system so you can participate the next year.

Scientific Collector's Permit

The mandatory Scientific Collector's Permit is an online form and must be manually renewed by you each fall. Complete your application for the year between August 1 and September 30 at this link Michigan.gov/SIC and "Current Teachers".

Fisheries Management Units - Find your potential release site

List of Approved Stocking Locations

Pre-approved stocking locations for the Salmon in the Classroom program listed by Fisheries Division Management Unit. Last updated 04/18. See where other teachers release on this map.

Eastern Lake Superior Management Unit

Anna River
Big Two Hearted River
Dead River (From Tourist Park to the river mouth)
Lower Tahquamenon River (including river mouth)
St. Mary's River
Sucker River

Northern Lake Huron Management Unit

Black River
Carp River
Cheboygan River
Mill Creek
Ocqueoc River
St. Mary's River
Thunder Bay River
Trout River
Van Etten Creek

Central Lake Michigan Management Unit

Bear Creek
The Bear River, Charlevoix County
Betsie River
Boardman River
Bowen Creek
Boyne River
Carp Lake Outlet
Crystal River
Little Manistee River
Manistee River below Tippy Dam
Medusa Creek
Muskegon River below Croton Dam
Pentwater River
Pere Marquette River
Platte River
Sable River, below the dam at Ludington State Park
White River

Northern Lake Michigan Management Unit

Menominee River below Hattie Street Dam
Cedar River below Veterans Park Dam @ Powers
Ford River
Escanaba River below Dam 1 @ US-2
Thompson Creek below US-2
Manistique River below Papermill Dam
Black River
Millecoquins River below Millecoquins Lake outlet
Brevoort Lake before Brevoort Lake outlet

Western Lake Superior Management Unit

Big Iron River
Black River
Black River Harbor (Lake Superior)
Carp River
Trap Rock River

Southern Lake Huron Management Unit

Any stream within the Management Unit
Lake Huron

TRIBUTARIES of the bodies of water listed through this sheet are acceptable stocking locations.

Southern Lake Michigan Management Unit

Black Creek
Black River
Blue Creek
Galien River
Grand River, prefer below Moores Park Dam Lansing
Kalamazoo River, prefer below Lake Allegan (Calkins) Dam
Macatawa River/Lake
Mill Creek, Berrien County
Paw Paw River
Pigeon River, Ottawa County
Pine Creek, Van Buren County
Red Cedar River
Rogue River, prefer below Rockford Dam
St. Joseph River, Berrien County

Lake Erie Management Unit

Belle River mainstream below town of Memphis
Black River below dam in Port Huron State Game Area
Clinton River below the City of Pontiac
Huron River, downstream of the Flatrock Dam in Flatrock. There is a city park (Huroc Park) just upstream (west) of Telegraph Road and just down stream of the dam.
Lower Rouge River
N. Branch Clinton River

**Below refers to downstream

Release Day Activities

Releasing your salmon is a fun culmination to your year. Some teachers release salmon near their school with little fanfare. Others plan elaborate field days, invite other grade levels, community partners, and make a day of it. Anything in between is fine!

To help you plan your release day, here are some ideas from past SIC teachers.

Release day rotations:

- SIC Activities
    - The Great Swim
    - Fish Finder
    - Migration Fixation
    - Water Bug Hunt
    - What's in the Water
- Fishing
- Macroinvertebrate sampling
- Gyotaku
- Water quality testing
- Turbidity
- Stream flow (orange and a timer)
- Water temperature
- Invasive species pull
- Trash cleanup
- Tree planting
- Native flower planting
- Nature hike
- Knot tying
- Stream-side sketch
- Journaling
- Sit spots
- Bird identification
- Plant identification

Guest speakers that may be in your area:

- Friends of the "river" group
- County Conservation District
- Sportsman groups (Trout Unlimited, Steelheaders, Wildlife Forever, etc)
- Nature centers
- Michigan Sea Grant
- Department of Environment, Great Lakes and Energy (EGLE)
- Department of Natural Resources (DNR)
- University professors and grad students
- Project FISH

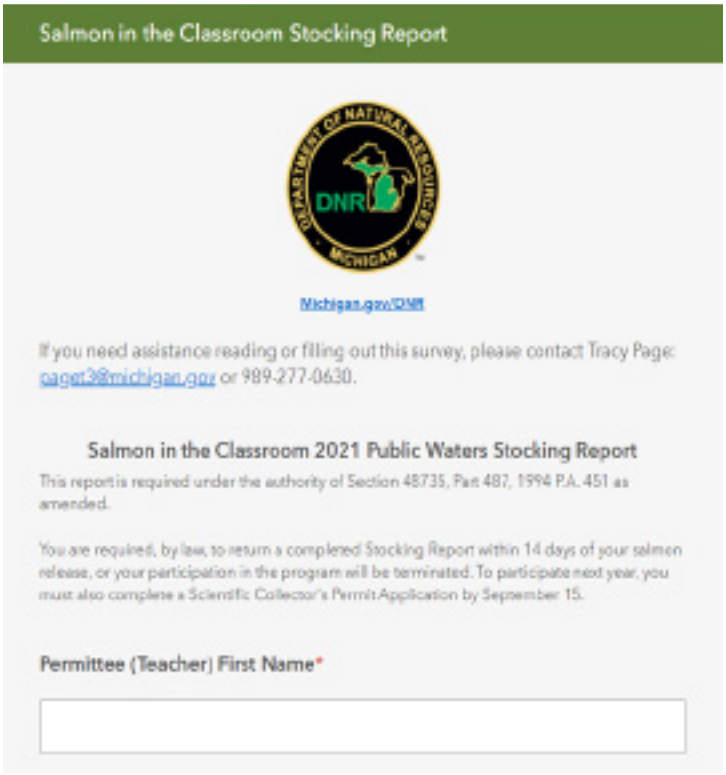
REPORTING AND PERMIT REQUIREMENTS FOR EACH YEAR

Stocking Report

Due each year within 2 weeks after release or before June 1.

Online form must be completed by all teachers that received a Scientific Collector's Permit for the year regardless of if they released fish or not.

Find the form at tinyurl.com/SICstockingreport



Scientific Collector's Permit Application

Must apply each year between August 1 and September 30.

Online form must be completed by all teachers that wish to participate for that school year. If you need to pause your participation, email grayp@michigan.gov

Find the form at tinyurl.com/SICstockingreport

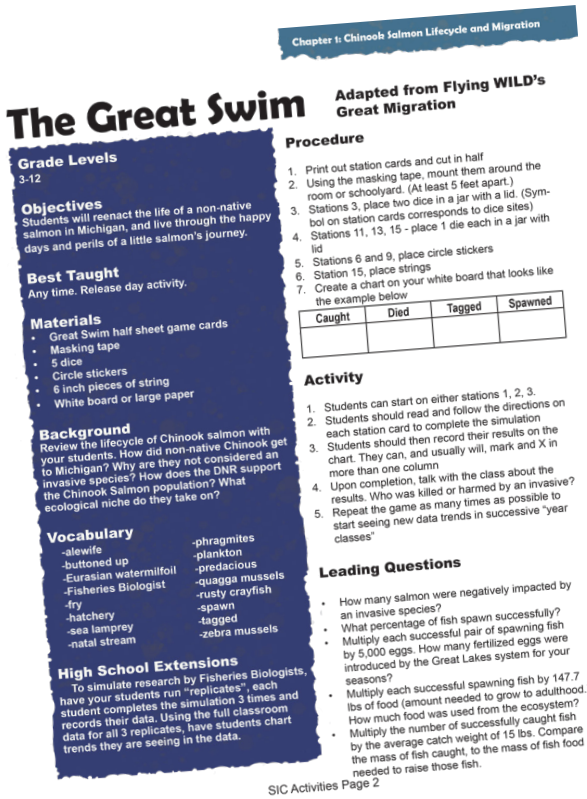
Curriculum Guide

The Salmon in the Classroom program has a separate SIC Classroom Activities guide that includes over 30 activities. All are correlated with NGSS and the guide includes appendices to connect to other resources. Be sure to download the latest version each October, we constantly add activities, resources and update science.

Find the SIC Classroom activity Guide at Michigan.gov/SIC

Under "Current Teachers",

Then scroll to the activity guide bullet.



Chapter 1: Chinook Salmon Lifecycle and Migration

The Great Swim

Adapted from Flying WILD's Great Migration

Grade Levels
3-12

Objectives
Students will reenact the life of a non-native salmon in Michigan, and live through the happy days and perils of a little salmon's journey.

Best Taught
Any time. Release day activity.

Materials
- Great Swim half sheet game cards
- Masking tape
- 5 dice
- Circle stickers
- 6 inch pieces of string
- White board or large paper

Background
Review the lifecycle of Chinook salmon with your students. How did non-native Chinook get to Michigan? Why are they not considered an invasive species? How does the DNR support the Chinook Salmon population? What ecological niche do they take on?

Vocabulary
-alewife
-buttoned up
-Eurasian watermilfoil
-Fisheries Biologist
-fry
-hatchery
-sea lamprey
-natal stream
-phragmites
-plankton
-predacious
-quagga mussels
-rusty crayfish
-spawn
-tagged
-zebra mussels

High School Extensions
To simulate research by Fisheries Biologists, have your students run "replicates", each student completes the simulation 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.

Procedure

1. Print out station cards and cut in half
2. Using the masking tape, mount them around the room or schoolyard. (At least 5 feet apart.)
3. Stations 3, place two dice in a jar with a lid. (Symbol on station cards corresponds to dice sites)
4. Stations 11, 13, 15 - place 1 die each in a jar with lid
5. Stations 6 and 9, place circle stickers
6. Station 15, place strings
7. Create a chart on your white board that looks like the example below

Caught	Died	Tagged	Spawned

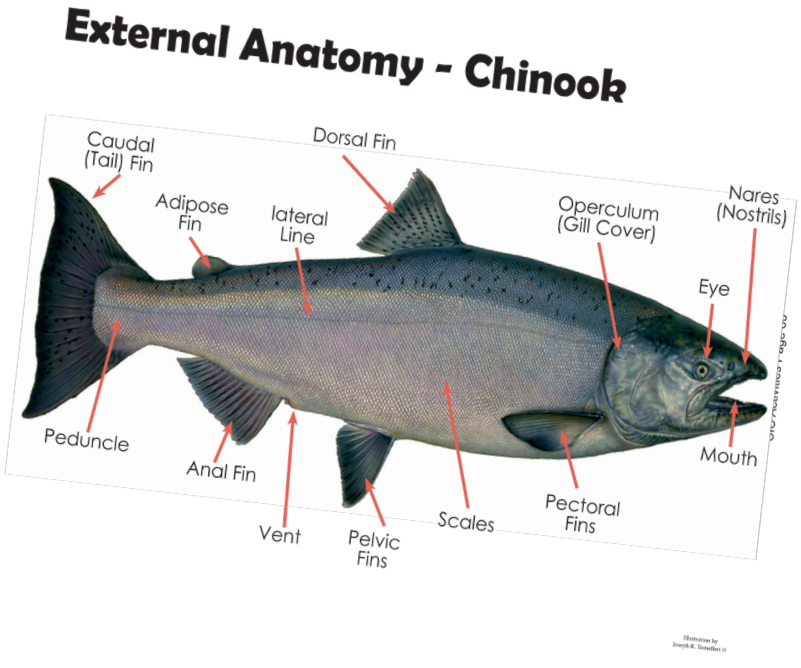
Activity

1. Students can start on either stations 1, 2, 3.
2. Students should read and follow the directions on each station card to complete the simulation
3. Students should then record their results on the chart. They can, and usually will, mark and X in more than one column
4. Upon completion, talk with the class about the results. Who was killed or harmed by an invasive?
5. Repeat the game as many times as possible to start seeing new data trends in successive "year classes"

Leading Questions

- How many salmon were negatively impacted by an invasive species?
- What percentage of fish spawn successfully?
- Multiply each successful pair of spawning fish by 5,000 eggs. How many fertilized eggs were introduced by the Great Lakes system for your seasons?
- Multiply each successful spawning fish by 147.7 lbs of food (amount needed to grow to adulthood.) How much food was used 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 fish food needed to raise those fish.

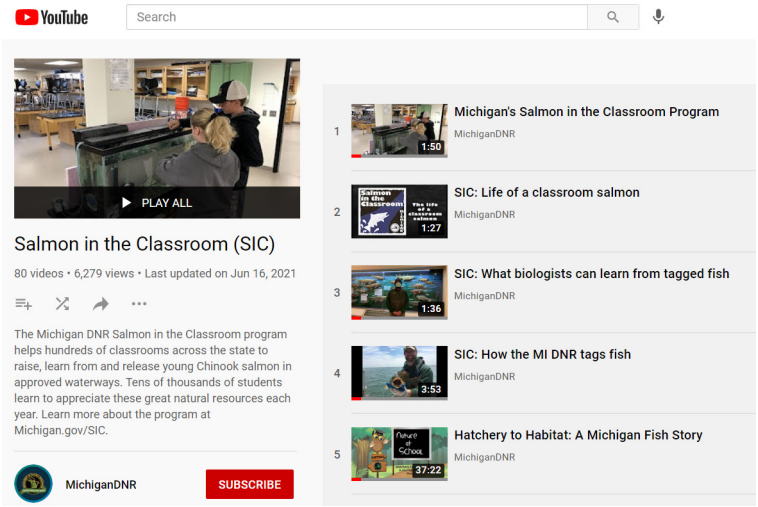
SIC Activities Page 2



Video Resources

Michigan SIC has two YouTube playlists to help you teach all about our Great Lakes resources.

Student Friendly Playlist

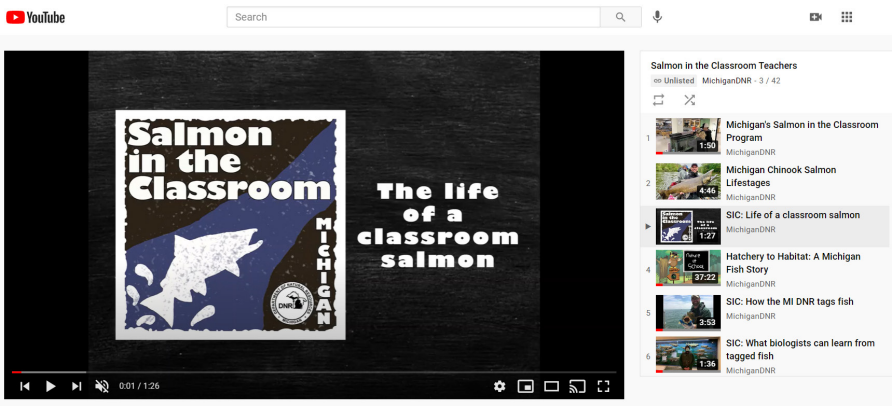


Our student friendly playlist has videos explaining hatchery processes, fisheries research techniques, fish anatomy and more. It also has videos documenting the growth and maintenance of the salmon for an entire school year.

Find it at tinyurl.com/SICstudentplaylist

Teacher Specific Playlist

Our teacher specific playlist has videos to help teachers with tank maintenance, behind the scenes information, workshop sessions for refresher, and other expert sessions.



Find it at tinyurl.com/SICteacherplaylist

Fishing How-to Videos

Do you want to teach about fishing, bait, tackle and more? The Aquatic Resources Education Association (AREA) has a great set of playlists with how-to videos on just about everything fishing related from around the country!

Find it at tinyurl.com/AREAfishingvideos

Michigan Department of Natural Resources
Michigan.gov/DNR

Salmon in the Classroom (SIC) Program

The goal of this program is to immerse 3rd through 12th grade students in a classroom based, hands-on learning opportunity, with repetitive exposure to salmon, their life cycle and their effects on the ecosystem, that will encourage a lifelong respect for natural resources - and to expose students to fishing as a fun skill!

One of the many reasons for enrolling in the program is the diversity of subject matter that teachers can integrate into their lesson plans through raising salmon. The program can easily help teachers cover STEM as well as social studies, ELA, Michigan's history and even art!

This unique learning experience allows students the opportunity to raise, care for and maintain the salmon in their classroom from fall until spring. The program culminates at the end of the school year with the release of the young fish into approved local rivers that feed one of the Great Lakes.

The Salmon in the Classroom program is not for everyone. It requires a time commitment from classrooms to raise their fish for almost the entire school year. It requires schools to obtain the necessary equipment. It requires an educator that will teach the students about our Great Lakes ecosystem, the importance of water quality to healthy fish, and fisheries management.

It is however, a rewarding program. For many students, participation in the program provides a truly motivational experience. To watch life unfold before their eyes, to guide the growth and health of developing fish, and later release those fish into a natural, quality habitat, can be a life changing experience for some.

Before completing your SIC New Teacher Application, please read through the entire SIC Start Up Guide at Michigan.gov/SIC and Interested Teachers. This is a highly competitive application process so please be thorough.

Please fill out all requested information. Incomplete forms will not be accepted. Thank you for your interest in the Salmon in the Classroom program. Applications will be reviewed, and your acceptance, or denial, will be emailed by June 15.

Tracy Page
Aquatic Education Coordinator
Michigan Department of Natural Resources
Email: paget3@michigan.gov
Telephone: 989-277-0630

SIC applications are accepted
January 1 - April 15 for "new" teachers.

Before you apply:

- Be sure you have a document drafted that outlines what standards correlate for you with SIC.
- Be sure to have a short letter of support from your principal, on letterhead, saved as a PDF.

Complete the SIC application here