A Real Fish Story

Students raise salmon and ecological awareness

Harlan Kredit

PHOTOS COURTESY OF THE AUTHOR

When I returned to teach in my home community in northwest Washington after teaching biology in Michigan for 12 years, I discovered a big salmon problem in local waters. My neighborhood stream, Fishtrap Creek, which used to contain huge numbers of salmon each fall, had virtually none left. I was determined to see if my biology students could be part of a plan to restore the salmon runs.

Fishtrap Creek is a tributary of the Nooksack River, which flows into Puget Sound. Our high school property borders the stream for approximately 305 m, so that is where we first concentrated our efforts. We began with one small salmon egg box on campus in 1976, which was constructed with considerable student help. In 1982, we built a structure to house salmon incubation trays, and in 1993, enlarged the hatchery and fully enclosed it. In this hatchery, we currently raise 100 000 coho salmon each year. A difficult water chemistry problem initially posed a major challenge: high levels of iron in our groundwater. With the help of several former students who were working as engineers, we designed a dechlorination column so we could use city water in our hatchery.

Fish fry

Students have a major responsibility in operating the hatchery. They monitor water flow, temperature, fish mortality, and other parameters daily. Each week, students weigh 50 fish so they can calculate the necessary amount of food for the salmon fry that week (1.5% of the fishes' body weight per day, see Figure 1).

Because we have a backup generator for power failures, every student must know how to start the generator quickly and fix water flow and aeration problems. I "mess up" the valves and switches and then time groups of students to see how long they take to bring the hatchery back on-line with all pumps working and proper water flow. The practice provides great competition among students and surely gets their attention!

In addition to raising salmon in our hatchery, we use 1.2 m sections of plastic drainpipe as incubation tubes for 50 000 chum salmon. Students close the pipe on the bottom, stand the pipe on end in a barrel of water, and then carefully place 1000 eggs in the tube between layers of coarse gravel. Students then cover each end with a mesh screen and place the tubes in fast-moving riffles in our stream. After the fish hatch, they wriggle through the gravel and complete their life cycle. Each student maintains two incubation tubes. After the fish have migrated, students remove the tubes and determine the survival rate by counting the dead eggs and fish fry.

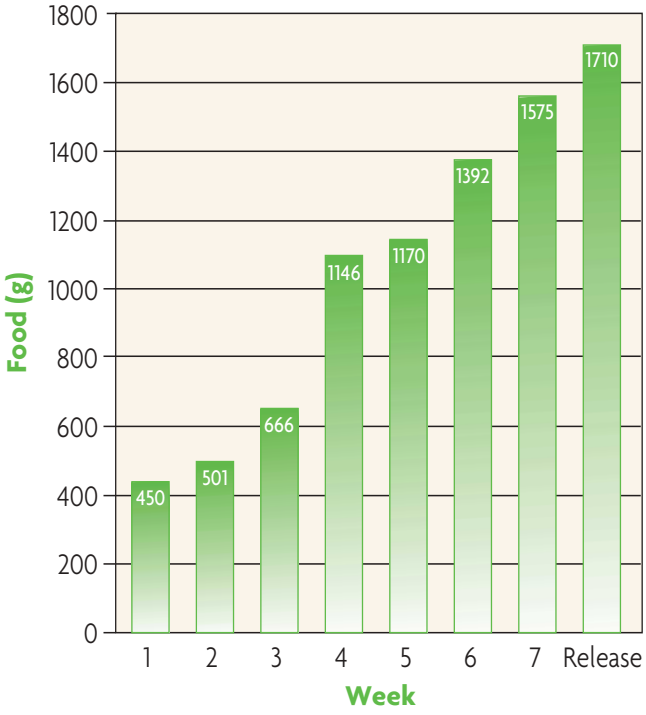
Restoration and outreach

Successfully restoring a stream involves much more than just "throwing" salmon into the stream. We have consistently stressed a holistic approach to restoration by looking at other parameters of potential problems in the watershed. To establish baseline data, we conducted a major stream survey along 16 km of the stream, measuring depth, width, water flow, substrate type, tree overhang, vegetation type on the banks, and number and location of spawning riffles and large, woody debris. The survey exceeded 200 pages and has been used by various county and state officials.

FIGURE 1

Feeding data.

Amount of food per day = 1.5% of the weight of 100 000 fish



We began a vigorous revegetation program and have planted over 12 000 trees and shrubs (native vegetation) along the banks of the stream (Figure 2). Students erected colorful signs with the message "This Stream Is in Your Hands" at all stream road crossings. They also stenciled "Dump No Waste" onto every storm drain in the city (approximately 300) (Figure 3, p. 26). We adopted 6 km of a major highway that runs through our watershed and regularly pick up roadside litter (Figure 4, p. 27).

One of our most effective projects was to produce two colorful brochures (one for students and one for adults) that highlighted the history of Fishtrap Creek, the salmon life cycle, and the reason that salmon are an important natural resource in the Pacific Northwest. This turned out to be a great opportunity for our school's art and English departments to work with our science students. The brochures were distributed door to door by the students, and the student version was distributed to elementary schools in our district.

To make sure the landowners along the stream would understand what we are doing, we recently invited them to a student-led meet-

FIGURE 2

Revegetation program.

Students plant trees and shrubs (native vegetation) along the banks of the stream.

FIGURE 3

Storm drain stenciling project.

Students stencil "Dump No Waste" onto storm drains in the city.

ing at our school. We gave a brief overview of the salmon life cycle, distributed brochures illustrating the different species of salmon, talked about the problems of noxious weeds, and asked the landowners to help count the salmon as they migrated upstream. Students baked cookies and offered rides to older citizens to make it easier for them to attend.

For our students to be effective salmon ambassadors, they need to thoroughly understand the science behind our restoration efforts. Each fall we take them on a high alpine hike in the Cascades so they can see the origin of the Nooksack River. In spring we travel to the Olympic Peninsula for a three-day camping trip along the ocean where an important salmon river empties into the Pacific. This gives students both a mountain and a sea experience.

Considerable classroom time is also spent on salmon biology, and whenever a hatchery problem comes up, we attempt to solve it using good science observation and research techniques. We try to tie all of our work into the science goals of our curriculum, which emphasizes inquiry and research opportunities. Meaningful assessment of projects is never easy, but the technique that we use most is to have students write reports stressing a critical analysis of the data collected. For example, they compare and contrast various stream sites and discuss why the biology of each is different.

FIGURE 4

Picking up litter.

Students pick up litter alongside a major road highway that runs through the watershed.

Funding and support

None of our funds come from our school district. The Kiwanis Club has helped support our efforts for over 25 years. However, some of the projects required additional funds, which have been readily supplied by other service clubs, private individuals, local businesses, and even money from fines levied by state agencies against polluters.

Parents and former students frequently contribute skilled labor as electricians and plumbers, working alongside students as we constantly revise and update our hatchery. All students are required to give a hatchery tour to their parents, and some students give tours to elementary school classes. We strongly emphasize student work at all times. I would rather have a board nailed unevenly by a student or a have a chemical analysis be a little off than have a professional accomplish the work.

NSTA, through the Toyota TAPESTRY program, had a huge impact on our work. Two years ago, a local fair board illegally filled in a pond in the Fishtrap Creek floodplain. After agencies had made several attempts to settle the ensuing legal dispute, we volunteered to meet with all parties and proposed a plan to resolve the issue by making the area more fish friendly. The five involved agencies and groups strongly supported our plans, so we applied for a TAPESTRY grant to help us excavate a 213 m channel in which young salmon could overwinter before traveling to the ocean in spring. The original grant (and a second TAPESTRY mini-grant) not only allowed us to excavate the channel, but enabled us to design streamside brochures, purchase approximately 2000 plants, purchase water monitoring equipment, design and build a dechlorination column for our hatchery, conduct a major baseline watershed survey, and culture water samples. This plan was encouraged by the State Department of Fish and Wildlife and the

FIGURE 5

Planting alongside the channel.

Students planted hundreds of trees, shrubs, and sedges along the edge of the channel.

State Department of Ecology because of the lack of winter habitat for young fish.

We carefully surveyed the area and then excavated the channel to a depth of 2.4 m. Students planted hundreds of trees, shrubs, and sedges along the edge of the channel (Figure 5). After researching the scientific literature on the needs of young salmon, we placed approximately 60 large, rooty stumps in the channel as a hiding area for small fish. We placed water depth gauges in the channel, which students monitored weekly. Next spring, when we release our hatchery salmon, we will plant 5,000 small fish in the channel. With guidance from state fisheries biologists, we will clip the fins of the fish and build a trap where the channel joins the stream. This will help us collect data on the use of the channel by wild fish versus hatchery fish. A team of students will be responsible for emptying the trap each day.

Positive pointers

Most schools do not have salmon streams close to their schools, but aspects of this program could be used in many school districts. After teaching for 41 years, I have learned many things (some of them the hard way). I consider the following to be some of the most useful lessons.

- Dream big and believe in your students. They will not let you down. Our next dream is to use electrophoresis to genetically track our salmon.
- Do not be afraid of sweat equity. That is how students "own" projects.
- Ask for help from local and state agencies. They are some of your most supportive allies. Be sure to have them visit the classroom to describe their roles in the government and explain how their high school science experiences led to their jobs.
- Emphasize the team concept. Divide the various components of a project among students, appoint captains, and make them accountable. Let them fail or make mistakes in order to learn.
- Getting dirty, really dirty, is perfectly okay.
- Take lots of pictures, and display them in your room. Take them to parent-teacher conferences—parents love them.
- Always notify the local paper when something big is happening; publicity is extremely important.
- Be safe all of the time. Establish clear guidelines and ask students to help you enforce them. We never permit students to enter streams or rivers unless someone is with them at all times. No "freelancing" is ever permitted: We organize work according to groups, and all groups must stay together at all times. Use safety ropes in swift-moving water.
- Write letters to the parents about your projects, field trips, and expectations.
- If you want community support, do not play the blame game, but rather find a science project to work on without choosing sides.
- Keep asking "why" and "how" questions of your students. This is scientific inquiry at its best, and they will learn important science concepts in a real-life situation.
- Don't be afraid of outdoor science when you are in the middle of other units. Students are much more flexible than we are. They can move back and forth between unrelated "book stuff" and "outdoors stuff" without missing a beat. Besides, they should learn that now; the real world requires us to do that all of the time.
- Don't be discouraged. You have the best job in the world, one that teaches by example that each of us making a small contribution (one fish or one tree, for example) can make a significant difference.

CAUTION

Our stream restoration project has become a meaningful way for thousands of students to make a connection between biological science and the community in which they live. We hope that connection will help them become more productive and discerning citizens as they take their places in society. And, yes, the salmon are beginning to return in large numbers again. This past fall, I counted over 80 coho salmon traveling upstream past one point near our hatchery in less than 5 minutes.

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NSTA Connection

For information on the Toyota TAPESTRY grant program, visit *www.nsta.org/programs/tapestry*, or call 1-800-807-9852.