

#### by Carol Heiser and Dean Fowler illustrations by Spike Knuth

isheries biologists are a modest, hard-working bunch. They lumber about in clumsy, rubber waders, slog around the shorelines of streams and ponds, spend countless myopic hours at the computer analyzing data, and drive around in muddy vehicles that smell like, well, fish. Passionate about aquatic resources, they devote enormous energy to the task of assessing the health of Virginia's fish populations and the key habitats that fish depend on. Fisheries biologists use several techniques, such as electrofishing, gill-netting, and tagging, to discover clues about various fish species and the waters they live in. It is important information on which management decisions are based.

Pumpkinseed sunfish are common in warmwater Virginia streams.

#### A Snapshot Underwater

Fish populations fluctuate over time for a variety of reasons. Weather and disease are two natural factors that can influence fish abundance. For example, excessively low or high temperatures or flooding can cause sudden die-offs. Also, because fish are cold-blooded and their body temperatures fluctuate with changes in the water, temperature affects just about everything they do: breathing and feeding rates, spawning location and timing, and even migrations. Weather can also affect the abundance of organisms that fish feed on or that feed on them.

Frequently, human activities have a more significant influence on fish populations than natural factors. People catch large numbers of fish for food and sport, and land-use and development affects water quality and fish habitat. *Fisberies management*, therefore, is much more than simply stocking fish, it is the job of evaluating a resource and making sure that fish populations stay at healthy levels despite adverse factors, both natural and human, like those listed above.

The very first step a biologist takes is to find out how many fish are "out there" now and how they are doing. However, fish are elusive and hard to see underwater; frankly, it's impossible for us to swim around a pond and count them all. Since we can't count or see them all, we'll have to be satisfied with looking at a portion of the population, called a *sample*, and with collecting or *sampling* some individuals. The sample gives biologists a "snapshot" of what's going on in that body of water at that particular point in time. The technique chosen for sampling depends on the type of fish and the type of habitat they're in, whether that be a stream, lake, shoreline, open water, or shallow water.

# **Stunning Fish**

In freshwater, the most commonly used sampling technique is called *electrofishing* or electroshocking. The term might conjure up a scene of Frankenstein's lab, with a white-coated scientist wielding a plugged-in fishing pole, but that would be a flawed impression. Imagine instead a chilly, burbling mountain stream in which biologists and crew members walk cautiously over the streambed cobbles wearing rubber hip waders. One of the members carries a portable, gasoline-powered electric generator (or battery) on a backpack, or it is towed along using a tote barge. In his hands are two grounded, metal poles, one with a negative electrode on the end and the other with a positive. A device called a pulsator is used to adjust an electric current that runs between the two poles, the ends of which are placed beneath the water's surface. The water, in essence, serves as the "wire" that connects the two electrodes (see illustration).

When the current is turned on in the water, the other crew members are strategically poised a few meters downstream at various points in the streambed, with dip nets ready to scoop up any fish that are stunned by the biologist doing the "shocking." Within moments, an otherwise empty-appearing stream reveals a remarkable array of hidden treasure: redstriped candy darters, silver and saffron shiners, black-spotted and mountain redbelly dace, gold-speckled brook trout, and shimmering rainbow trout.

Fish are generally unharmed by electrofishing but can display several different responses to the electric field. Many of them escape by exhibiting a fright response when they first sense the electricity. Some exhibit a muscle response which causes them to swim toward the positive pole. Others are rendered temporarily unconscious. Those that are caught provide invaluable data about the species composition of the stream, the size and age classes within a species, and general growth and productivity rates. Once examined and measured, the fish are released live back into the stream.

Although crew members are insulated from the electricity in the water by wearing rubber waders, this

#### sampling

method involves a degree

of risk, because a crew member could fall into the electrical field or develop a leak in the waders. The power output of electrofishing generators is quite capable of stopping a human heart; so, strict safety measures are observed. Wading is generally only done in small to medium-sized shallow streams that are inaccessible by boat.

In larger streams, electrofishing by boat is preferred. The electrical field from an electrofishing boat is effective on fish to a depth of about 8 feet. Consequently, the boat is generally used for sampling fish along shorelines and in other shallow areas of lakes and streams. Because many popular game species such as largemouth bass, smallmouth bass, bluegill, shellcrackers, and trout often inhabit these types of habitats, electrofishing is the fish sampling technique most used by fisheries biologists in Virginia and nationwide.

### Netting

Most other fish sampling techniques involve the use of nets. Many are stationary and suspended from poles, like the *gill net*, which causes fish to become entangled in the net's mesh when they swim into it. Stationary nets also include *trap nets* (which are designed like conical turtle traps), *Fyke nets* (which are trap nets with wings that guide fish into the trap), *trammel nets* (which have large pockets), and *pound nets* (a series of smaller and smaller impoundments that corral fish into a concentrated area).

Other nets, referred to as active nets, require the user to move the net through the water, such as a *seine* (pronounced "sane"), which is dragged through the water to encircle fish. A frequently used active net is the *trawl*, a somewhat conical-shaped net that is dragged behind a boat. All of these nets are also used by the commercial fishing industry to harvest fish for our dinner tables.

# Raising Fish Fry

Once the sampling process is completed and the data are crunched on the computer back at the office, a biologist can then begin to outline remedies that may be needed to restore a stream or other body of fresh water to a more balanced composition, *if* necessary. The most commonly used remedies include seasons, creel limits, fish stocking, and habitat improvements. Fish stocking is also often used simply to provide anglers with a wider variety of species to fish for.

There are four warmwater and five coldwater fish hatcheries operated by the Virginia Department of Game and Inland Fisheries. In the western part of the state alone, over one million catchable trout and a quarter of a million fingerling trout are produced each year. These hatcheries are responsible for supplying the fish needed to restock a stream, river, or pond.

From egg to fry to fingerling, you can see all stages of fish development at a hatchery. Trout are reared in stacked-tray incubators and then in outdoor ponds or *race-ways* which mimic stream flow by circulating water in a con-

trolled setting. Warmwater fish, like bass, are either spawned naturally in a pond or are hatched in large jars and then stocked in ponds when they are just a few days old. When the time comes to take the fish by truck to a stream or river and stock or release them, biologists inventory the fish and record the exact location. species, and number stocked. This information is then used for comparison when the stream is sampled again at a future date.

Biologists gently remove eggs to give future fish generations a head start in the hatchery.



### Fish with Mussels

State fish hatcheries are also playing a role in another important project: the restoration of several freshwater mussel species that have declined in recent decades because of poor water quality and other environmental factors. Mussels, which are bivalves or mollusks like clams, rely on fish to carry out their life cycle, and each mussel species is associated with a particular fish species. A developing mussel larva, called a glochidium, attaches itself as a parasite to the gills of its host fish and obtains nutrients from the fish's tissues. After a few days to a few weeks, the glochidium transforms into a juvenile, drops off the fish, and begins an independent life. Unfortunately, mussel populations in the wild are low, and their associations with host fish are so specific, that the probability of the right

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mussels coming in contact with the right fish to carry out their unique life cycles is very slim.

In an attempt to give the wild populations a boost, biologists are raising mussels, like the endangered oyster mussel, with host fish, like the darter, in the Marion state fish hatchery. They collect male and female adult mussels from the Clinch River system in spring and put them in the hatchery to reproduce. Meanwhile, darters are also collected from the same area of the river and placed in holding tanks at the hatchery. When the mussels produce young, the larvae (glochidia) are removed from the females and transferred to the gills of the darter fish. The darters play host to the larvae until the mussels develop into the juvenile stage and drop off. Biologists then siphon the tanks to collect the tiny mussels, which are between the size of a dime and a quarter, and then release them back into the river where the original adults were collected. The darters are not released but are kept in the hatchery to host additional generations of mussels. In this way, over 3000 young mussels were released in 2001, about 200 of which were the oyster mussel species.

Circulating water provides oxygen to fish eggs being hatched in "egg jars" (above). The developing fry (right) are nourished until they are the proper size for release into a stream or river, like these coldwater brook trout (below). a.

b



d.

A small sampling of scales is scraped from a fish (a.) to observe rings of growth on each (b.), much like tree rings. The rings on an ear bone or otolith (c.) are more accurate. The spine of a catfish

*Frequently Asked Questions*, from the Northeast Fisheries Science Center, **www.nefsc.nmfs.gov**. From the main page click on "Fish Facts," then on the next page click on "FAQ."

*Freshwater Fish Farming in Virginia*, a 1997 publication written by Helfrich, Orth, and Neves at Virginia Tech, can be downloaded from www.ext.vt.edu/pubs/fisheries/420-010/420-010.html#L9 You can also see a listing of Hatcheries in Virginia from their Table of Contents page.

Access the *Virginia Chapter of the American Fisheries Society* through the national Web site at **www.fisheries.org** 

The *Field and Stream/Outdoor Life* magazines have numerous articles related to fish and fishing. Go to **www.fieldandstream.com** and click on "fishing" for a regional fishing guide, the 25 best fishing books, Ask the Expert, and much more.

Carol Heiser is a Wildlife Habitat Education Coordinator at the Virginia Department of Game and Inland Fisheries. Dean Fowler is a fisheries biologist with the Department who works out of the Williamsburg Regional Office.

## **Did You Know?**

A fish's body is protected by overlapping scales, and each scale contains microscopic rings that can be read like tree rings to learn the age of the fish (see illustration). Fish keep scales throughout their lives, except when lost through injury. During winter a fish grows slowly; in spring, the rate of growth increases. These changing rates of growth affect the distance between the rings on the scales. Bands of rings that are close together mark each winter season, whereas widely separated rings indicate faster growth that occurs from spring through fall. Biologists can also examine a fish's ear bones, called *otoliths*, to determine its age and learn the nutritional status and other clues about its life history.

#### Learning More...

*Careful Catcb* is one of many activities available to youth leaders and other outdoor educators through the Sportfishing and Angling Resource Education program of the Virginia Department of Game and Inland Fisheries. The activity illustrates the proper way to handle and release a fish, such as using barbless hooks, artificial lures, and landing nets when possible. For information about this or other activities from the ARE program, contact Anne Skalski, Aquatic Education Coordinator, in Richmond at (804) 367-6778.

(d.) can also be cross -sectioned (e.) for study.

> Virginia Naturally