

Fisheries Management Background

One of the ways that fisheries biologists learn about fish communities is by conducting surveys where fish are caught and measured. From the data collected, biologists can make inferences about the fish community as a whole.

Methods

Collection methods include: angling (hook and line), many types of nets, electricity, and sometimes chemicals.

Angling

Sometimes biologists use rod and reel methods to capture fish for study. This collection method is time-consuming, however it is good to use for fish less susceptible to other methodologies. In many cases, angling is used to supplement other fishery surveys. For example, the New York State Department of Environmental Conservation (NYSDEC) conducts Angler Diary programs throughout New York State where anglers complete diaries of their fishing experiences. Data from these programs are used to enhance fisheries data collected by other techniques.

Nets

Biologists use different nets depending on which fish species and habitat type they are trying to survey. Nets fall into two general categories: passive gear and active gear.

Passive gear is set in a specific location and catches fish without having to be moved. Passive gear either entangles fish by ensnaring them in the mesh, like a gill net, or entraps fish by leading them into an enclosed space from which they cannot find the way out, like a hoop net.ⁱ

Active gear requires the net to be pulled in a manner that surrounds the fish so they can be captured. Some examples of active gear include: beach seines which are pulled around fish near a beach and then pulled up onto the shore; purse seines which encircle the fish in open water and close like a purse with the fish inside; and trawls which are pulled through the water in a straight line and catch anything in their path that cannot swim faster than the pulled net.

Electrofishing

Biologists can capture fish by stunning them with an electrical field. This can be done by a boat that has a mounted generator for fishing in ponds and lakes or with a battery mounted on a backpack for fishing in shallow streams. When an electrical field is applied to the water, the electricity acts on the muscles of the fish and causes them to swim toward the positive electrode. This behavior is called *galvanotaxis*.ⁱⁱ Stronger electrical fields immobilize the fish. Biologists on the boat or in the stream then net the immobilized fish and place them in a holding tank for processing. Electrofishing generally does not harm fish, so they can be released after processing. Electrofishing only works in shallow water because the operators must be able to see the fish in order to capture them. Also, electrofishing does not work in saltwater.

Chemicals

Sometimes biologists use a technique borrowed from the South American Indians to collect fish. South American Indians discovered that the ground up root of a specific plant killed

fish, but did not affect their edibility.ⁱⁱⁱ The active ingredient in this plant root is rotenone, a very effective fish poison (it is also used as an organic insecticide). However, because rotenone kills the fish outright, it tells the biologist everything that *was* there, but not what *is* there. Thus, the primary use of rotenone in fisheries management is to eliminate fish from a water body when an undesirable species has invaded the water body and the only way to get rid of it is to remove all of the fish and start over.

Considerations

When collecting fish, biologists cannot measure ALL of the fish in a community. Thus, an inference is made about the fish community based upon a piece of the community. Gear choice is important here. For example, gear can be biased; meaning that it may only collect small fish or only big fish or one species more than another. Biologists must select the best gear possible to obtain the most accurate picture of the fish community being studied.

Observations

When fish are caught, biologists make several observations and take different measurements. First, the fish must be correctly identified. While this is relatively easy for common species, there are hundreds of species of freshwater fish in New York State (NYS)! If a biologist is not certain of the fish species, then a specimen is preserved for identification in the lab or transferred to the NYS Museum for identification. The NYS Museum maintains a collection of fishes from all over NYS and acts as a reference library for fishes.^{iv} Once the fish is identified, it is measured from the tip of the nose, with its mouth closed, to the tip of the furthest extension of the tail. This is called the *total length*. The fish is also weighed to the nearest gram. For fish smaller than 100mm, weight is not precise, so it is not taken. A scale sample is also taken from the fish and examined in the lab to determine the age of the fish. Fish leave marks, *annuli*, on their scales every year as they grow. All measurements and observations can be taken without harming the fish to ensure a safe return to the water.

Additional Needs

Sometimes biologists need more information about the fish and water body than just species, length, and weight. Two examples are contaminant levels and fish disease. Fish can take in contaminants such as PCB's or pesticides and may not be safe to eat. Also, a fish may have a disease that could affect other fishes in the community. When this kind of information is needed, biologists store select samples of fish for later analysis. Biologists strive to not kill any more fish than necessary to collect the needed information.

Data Analysis

The data collected allows biologists to make conclusions about the fish populations. Two examples of such conclusions are *catch per unit effort (CPUE)* and *length frequency distribution*. Scientists can determine the CPUE from the number of fish caught and the amount of effort expended. It is usually expressed as number per hour, number per day, or number per net. The CPUE gives an index of abundance or a fish population number that can be compared with catch rates from other years or other waters. The measured lengths of the fish allows biologists to determine the length-frequency distribution, or proportion of the population in set size categories. The length frequency distribution will show whether the fish are small, large, or a range of sizes.

Conclusion

Once scientists reach a conclusion about a fish population, they can take management actions if needed. Actions are taken to improve the status of the population. Actions may include a change in the fishing regulations, specifically the size limit, bag limit, or open season. For example, if after a survey is conducted it is found that the largemouth bass population is low in number and size of fish, then the size limit might be increased or the bag limit might be decreased. When making management decisions, scientists view and cross check all aspects of the data with other data. In many cases, fisheries management involves the management of human behavior in order to achieve a specific goal for a fish population or community.

Vocabulary:

- Active Gear: nets that require someone or something to move the net to catch the fish; e.g. seines, electro-fishing gear
- Annuli: the annual mark laid down on a fish scale or other hard structure as a fish grows
- Catch per Unit Effort (CPUE): number of fish caught per unit of effort (effort can be measured in hours, days, or net sets depending upon the type of gear used).
- Conserve: non-wasteful use of resources
- Fisheries Management: activities or tools used to find out the health of a body of freshwater.; information used to help to create or change laws
- Galvanotaxis: movement toward the positive electrode when a fish is exposed to an electrical field.
- Gear Bias: difference between what a type of fishing gear catches and what is really there
- Length Frequency Distribution: number of fish collected in each number of discrete or set size classes (classes often divided into centimeters)
- Mesh Size: size of the openings in the net
- Passive Gear: the net just sits there without moving and catches fish; e.g. gill nets, trap nets
- Preserve: complete protection of resource; restriction on use
- Total Length: measurement from tip of fish's nose, with its mouth closed, to the tip of the furthest extension of its tail

Additional Resources:

NYSDEC Region One-Freshwater Fisheries Office, 631-444-0280

NYSDEC Region One-Angler Diary Program, 631-444-0282

ⁱ Nielson, L.A. and D. L. Johnson (eds.). *Fisheries Techniques*. Bethesda, MD: American Fisheries Society, 1983.

ⁱⁱ *Fisheries Techniques*.

ⁱⁱⁱ Rotenone in Sportfish Management. Alaska Sportfish Division of Fish and Game. 09 January 12.
<<http://www.sf.adfg.state.ak.us/statewide/invasivespecies/index.cfm/FA/rotenone.about>>

^{iv} Ichthyology Collection. New York State Museum Fish Collection. 09 January 12.
<<http://collections.nysm.nysed.gov/fish/index.html>>