

GEAR REVIEWS

3. Hoop nets, fyke nets and trap nets

- *Habitat considerations*

Trap nets can be set in water that is deeper than the height of the net, but they are usually not set in water that is shallower than the height of the net because they rely on floatation to maintain their shape. **Hoop nets and fyke nets** can be set in water that is deeper or shallower than the height of the hoops, as long as the tunnels are submerged. These nets are difficult to set where the bottom is uneven, such as among boulders, and where there is dense vegetation or an abundance of other obstructions such as logs or stumps. In shallow water it is often easier to set these nets by wading than from a boat. Kreuger et al. (1998) reported that, in deeper water, round fyke nets were easier to set than D-shaped fyke nets because they tended to roll into the proper position. It is difficult to set these nets perpendicular to strong currents. Setting perpendicular to even a moderate current is ill-advised if there is a lot of debris moving downstream that can become caught in the mesh and add to the resistance of the set, as the increased force can dislodge and/or damage the gear. **Fyke nets and trap nets** can, however, be set parallel to quite strong currents. The attachment of fyke and trap nets depends upon depth, substrate and current velocities. In deep water or over coarse substrate anchors must nearly always be used. In shallow water over soft substrates the net can often be fixed to posts driven into the substrate. In nearshore areas of lakes or rivers, one or more points of attachment can often be trees or other objects on shore.

- *Selectivity/Efficiency*

There are three aspects to the selectivity/efficiency of these nets. First, like all passive gear, their efficiency is directly related to the probability that a fish will encounter them. The second aspect is the probability that fish that encounter them will enter them, and the third is that fish that enter them will be retained. The probability of a fish encountering

these nets increases with distance traveled, so that the behavioral and seasonal factors relevant to all passive gear come into play. Hamley and Regier (1973) reported that the catchability of walleye in trap nets increased with fish size. Laarman and Ryckman (1982) found that trap net catchability increased with size, although not necessarily in a linear fashion. It is likely that the increase in catchability with size that has been commonly reported is because large fish move farther than small fish in a given period of time, and thus are more likely to encounter the net. Ricker (1975), however, suggested that the greater catchability for larger fish might be due to their tendency to seek cover, which the net could provide.

Most studies of catchability in these gears are based on mark-recapture data, and it is possible that larger fish are less affected by handling and marking. Predation upon small fish by larger fish can also occur in trap and fyke nets, which effectively biases catches.

- ***Quantification of Effort***

Effort is usually expressed in terms of catch per net per length of time set. Net dimensions are normally standardized if comparisons between catches are to be made. Gear saturation can occur when catches are high, such as during spawning migrations, because the net becomes so full that more fish have difficulty entering (C. Portt, personal observation).

The variability in trap net catches is often very high. The result is that large numbers of catches are often required to detect even large changes in abundance (Kreuger et al. 1998; Lester et al. 1996; Hamley and Howley, 1985).

- ***Fish Injury/survival***

Fish captured in hoop, trap and fyke nets are usually not injured, although this is influenced by factors such as water temperature and dissolved oxygen concentrations. It is not unusual for small numbers of fish to be wedged or tangled in the mesh of the net, like they are in gill nets, but the heavy twine used in the mesh of these nets is not very efficient in this regard. There are reports of entire catches being killed by sudden temperature changes when upwelling conditions change in large lakes, or when a seiche exposes captive fish to anoxic hypolimnetic water. Larger fish can, and do, eat small fish inside these nets, thus affecting the apparent catch of small fish and the stomach contents of the larger fish.

3. Electrofishing

- ***Description and method of use***

Electrofishing is the term generally applied to a process that establishes an electric field in the water in order to capture fish. When exposed to the field, most fish become oriented toward the anode and as the density of the electric field increases they swim toward it. In close proximity to the anode, they are immobilized. The actual sequence of responses to the electric field is more complex and varies depending upon the type of

current applied (AC, DC, pulsed DC), the initial orientation of the fish with respect to the field and field density.

There are three types of electrofishers:

- Backpack models,
- Towed barge models,
- Boat mounted models, sometimes called a **stunboat**.



Fig – 4.10

All models rely on two electrodes which deliver current into the water to stun fish. The current runs from the anode to the cathode, relating a high-voltage potential. When a fish encounters a large enough potential gradient, it becomes affected by the electricity. Usually pulsed DC current is applied, which causes galvanotaxis in the fish. Galvanotaxis is uncontrolled muscular convulsion that results in the fish swimming toward the anode. At least two people are required for an effective electrofishing crew: one to operate the anode, and the other to catch the stunned fish with a dip net.

Backpack electrofisher generators are either battery or gas powered. They employ a transformer to pulse the current before it is delivered into the water. The anode is located at the end of a long, 2 meter pole and is usually in the form of a ring. The cathode is a long, 3 meter braided steel cable that trails behind the operator. The electrofisher is operated by a deadman's switch on the anode pole. There are a number of safety features built into newer backpack models, such as audible speakers that sound when the unit is operating, tilt-switches that incapacitates the electrofisher if the backpack is tilted more than 45 degrees, and quick-release straps to enable the user to quickly remove the electrofisher in the event of some emergency.

Towed barge electrofishers operate similarly to backpack electrofishers, with the exception that the generator is located on a floating barge instead of on a backpack. Often the barge can be left stationary on the shore and longer cathodes and anodes allow the crew to sample large areas. Barge electrofishers often employ gas-powered generators since a user does not have to carry the extra weight on his or her back.

When boat electrofishing, the boat itself is the cathode, and the anode(s) are generally mounted off the bow. The stunned fish swim toward the anode, where they are caught alive using a dip net.

A relatively new fishing technique is **electrofishing** (electric fishing). Electrofishing is used primarily in freshwater by zoologists as a sampling technique. Typical uses include collecting fish for stream classification surveys such as Index of Biotic Integrity surveys, to capture brood stock for hatcheries, or to collect representative samples from fish populations for the estimation of population size and structure. Most commonly, pulses of direct current (DC) are used to induce capture-prone behavior in fish. For example, with the apparatus correctly tuned as to pulse speed, voltage gradient and current, fish will exhibit galvanotaxis; they turn into the electric field and swim toward the apparatus.

The effectiveness of electrofishing is influenced by a variety of biological, technical, logistical, and environmental factors. The catch is often selectively biased as to fish size and species composition. When using pulsed DC for fishing, the pulse rate and the intensity of the electric field strongly influence the size and nature of the catch. The conductivity of the water, which is determined by the concentration in the water of charge carriers (ions), influences the shape and extent of the electric field in the water and thus affects the field's ability to induce capture-prone behavior in the fish.

Electrofishing systems can be powered by one or more batteries or by a generator and come in various sizes, from those that are mounted to a backpack to those mounted in large boats. Systems are typically equipped with various safety devices including one or more dead man's switches and a tilt switch designed to disable the device if the unit is tipped beyond a certain limit by, for example, the operator becoming incapacitated or falling into the water. Rubber gloves and rubber boots must be worn to isolate the operator and to prevent electrocution.

- ***Quantification of Effort***

The make and model of the electrofishing unit, the electrical output settings, and the size of the dip net mesh should be provided in any description of electrofishing. Electrofishing effort can be expressed in terms of the length of stream or shoreline fished, the area fished, the length of time spent fishing, or the amount of time that a current is actually being applied to the water (electroseconds). In some situations, and with some gears, current is continuously applied, so that time spent fishing and electroseconds are the same.

The amount of time required to electrofish a reach of stream or shoreline increases as fish abundance increases because of the time required to net fish. Often the operator will leave the anode of backpack or shore units stationary with the power on, or cycling on and off, in order to 'hold' fish until they can be netted, so that electro-seconds also increase with fish abundance. Similarly, it is common to reduce boat speed if fish are abundant.

Consequently, time is not a satisfactory measure of effort for calculating CPUE using these methods. Usually, a single pass through the subject area is considered to be one unit of effort. The consistency of effort can be increased if certain conventions are adopted, including being sure to electrofish all of the available habitat, attempting to capture all fish that are observed (but not going back and re-shocking areas in order to do so), and standardizing power output to the extent possible.

- ***Fish Injury/survival***

The effects of electrofishing on fish health have been the subject of a considerable amount of research. Survival rates, injury rates, growth rates, physiological effects and gamete viability have all been examined. Much of this research has examined the relationship between electrical characteristics (type of current and wave form) and mortality and injury rates, and most has been conducted on salmonids. Mortality rates are generally low for DC electrofishing.

The most commonly reported serious injuries to fish from electrofishing are spinal dislocations and, in extreme cases, vertebral fractures that are apparently caused by strong muscular contractions. Internal hemorrhaging has also been reported and skin discolourations, referred to as branding, also occurs. A large proportion of spinal injuries evident on X-rays are not evident from external examination (Kocovsky et al. 1997). In several studies, fish have been X-rayed to determine the rate of injury. Both the rate and severity of injury increased with fish size.

Short-term physiological effects induced by pulsed DC current in the absence of injury include lactacidosis and disturbance of the inter-renal stress response (Mitton and MacDonald, 1994). Field studies examining the effect of electrofishing on growth and condition of salmonids have reported mixed results.