# Vertical Gill Nets for Studying Depth Distribution of Small Fish


## Robert T. Lackey*

*Current Address:

*Department of Fisheries and Wildlife*
*Oregon State University*
*Corvallis, Oregon 97331*



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**Email:** Robert.Lackey@oregonstate.edu
**Phone:** (541) 737-0569
**Web:** http://fw.oregonstate.edu/content/robert-lackey

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Studies of predator-prey interrelationships among fishes in lakes usually require, among other things, knowledge of the spatial distribu-

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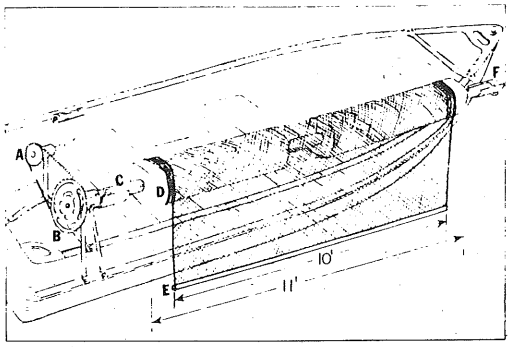


FIGURE 1.—Vertical gill net, outrigger supports, crank, and modified boat used in determining vertical depth distribution of fish. A, small sprocket; B, large sprocket; C, styrofoam float axle; D, styrofoam; E, spreader-weight; F, outrigger support.

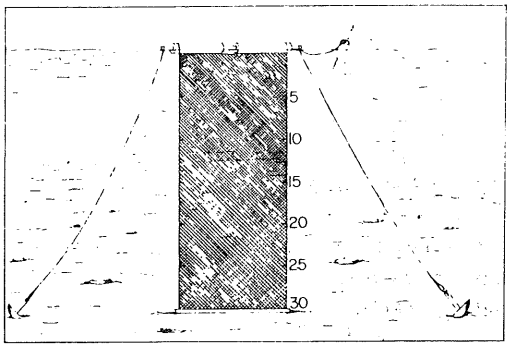


FIGURE 2.—Diagram of single 30 ft vertical gill net in sampling position. Marks on side of net indicate depth.

tions of the various species throughout their life histories. One particularly useful tool for obtaining such knowledge is the gill net set vertically in such a way that the depth at which each fish is caught can be determined. This paper describes small-meshed gill nets developed, in Maine, to determine the depth distribution of landlocked alewives (*Alosa pseudoharengus*), American smelts (*Osmerus mordax*), yellow perch (*Perca flavescens*), golden shiners (*Notemigonus crysoleucas*), and pumpkinseeds (*Lepomis gibbosus*).

Tibbles (1956) described rolling gill nets used to determine the vertical depth distribution of yellow perch in Lake Mendota, Wisconsin. Hartman (1962) used a larger gill net roller to determine diel vertical migrations of peamouth chub (*Mylocheilus caurinus*) and Kokanee (*Oncorhynchus nerka*) in a British Columbia lake. Gill nets hung vertically in gangs and used for studies of the vertical distribution of four fish species in Horsetooth Reservoir, Colorado, were described by Horak and Tanner (1964). Miller and Perrin (1967) described a gill net similar to Hartman's, but incorporating a work platform to facilitate handling the nets.

## DESCRIPTION OF NETS

The experimental vertical gill nets were made of 02 and 03 filament nylon with ¼- and ½-inch bar mesh, respectively. All nets were 10 ft wide and 10, 20, 30, 40, 50, or 60 ft long. The upper end of each net was attached to a styrofoam float and the lower end was attached to a 10 ft length of ¾-inch, thin-walled, steel conduit (Figure 1). The conduit served both as a weight and spreader, and was attached with nylon twine and plastic tape.

The float for each net consisted of two 4½-ft styrofoam rollers cemented securely to an axle consisting of a 12 ft length of 1¼-inch, thick-walled, steel conduit. Each roller was 6 inches in diameter, and was positioned on the axle in such a way that the axle projected 6 inches beyond the ends of the rollers (Figure 1). Epoxy resin was used to cement the styrofoam to the steel conduit, and ½-inch holes were drilled in the ends of the conduit to permit attachment of anchor ropes (Figure 2). In addition, when fishing the net, a ¼-inch brass bolt was placed into one end of each float axle to form a drive pin for winding up the net. This mechanism is described below, and the details of the float assembly are shown in Figure 1.

In addition to the spreader-weight attached to the lower end of each net, the nets 50 and 60 ft long also had spreaders attached midway between top and bottom to aid in keeping the nets open when suspended. The auxiliary spreaders consisted of 10-foot lengths of ½-inch, thin-walled conduit, and were held in place with plastic tape. Plastic tape of various colors was used to mark each net at 5-foot intervals, with white used at the 5-ft depth, red at 10 ft, brown at 15 ft, and so on.

To raise and lower the vertical gill nets,

outrigger supports were designed and constructed on a 14-ft aluminum boat (Figure 1). The front support was provided by a 4-ft length of 2-inch conduit bolted across the bow. A 4-inch length of similar conduit was split length wise and welded to the outer, upper side of the front cross piece to support one end of the styrofoam float axle.

The crank for raising and lowering the nets was modified from bicycle pedals, chain, and sprockets. Both pedals and pedal shafts were removed. The large sprocket was mounted aft on the outside of the boat, while the small sprocket was mounted inboard. A wooden handle was attached to the small sprocket and a bicycle chain connected the two sprockets. The bolt fastened in one end of each styrofoam float axle was designed to mesh with a forked rod welded to the axle of the large sprocket. This drive pin arrangement provided a solid connection for raising and lowering nets.

## SAMPLING PROCEDURE

Operating the vertical gill nets involves placing two anchors some distance apart and attaching ropes from each anchor to an end of the styrofoam float axle (Figure 2). Ropes twice the experimental net length were an effective distance to separate the two anchors.

The styrofoam float is placed on the outrigger supports, and the net then lowered to the lake bottom. Any net remaining on the styrofoam float is tied in place with rope to prevent further unwinding.

If sampling is to be confined to a limited area, nets of appropriate length could be constructed for each station. This eliminates tying extra net to the styrofoam floats.

Although most experimental sampling was accomplished with only one or two nets at each station, it is a simple matter to set a gang of several vertical nets. This is especially useful when several mesh sizes are being used. Styrofoam float axles can be attached end to end. This is similar to the method described by Horak and Tanner (1964). To check a gang of vertical gill nets, each net is detached from the others, raised, lowered, and reattached in the gang. The next net in the set is checked in the same manner.

## DISCUSSION

The small-meshed vertical gill nets have proved useful in studying vertical distributions of landlocked alewives, American smelts, yellow perch, golden shiners, and pumpkinseeds. Individuals of the above species are generally less than 5 inches in total length in the lakes studied.

These nets could easily be operated by one worker on reasonably calm days. On windy days two men were required to set out, check, or remove nets. Twenty nets could be raised, cleared of fish, and lowered in 2 to 4 hours under good conditions. Seven nets could easily be carried in the boat.

A distinct improvement in the nets would be the use of 2-inch steel conduit rather than 1¼-inch for the styrofoam float axle. This would provide added strength as well as a larger gluing surface to bond the styrofoam and conduit. A modification in the nets which would prove useful if deeper sets were required, would be to attach vertical gill nets end to end. Some nets could be removed from the styrofoam floats and attached to the bottom of 60 ft nets. A net of any reasonable length could be constructed and operated in the same manner as the shorter nets.

## ACKNOWLEDGMENTS

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ROBERT T. LACKEY

*Department of Zoology*
*University of Maine*
*Orono, Maine*