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A DESCRIPTION OF THREE NETS SUITABLE FOR
ESTIMATING THE ABUNDANCE OF Mysis relicta

by

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ABSTRACT

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The basic net design used for vertical tows takes the form of an inverted pyramid which tapers to an apex in two stages, first as a 1mm mesh and second as a fine mesh (250 μ m) cod end. Overall net length is 1.5 m; the cross sectional area of the net mouth is 1 m². Two modifications include a collapsing version used for sampling through winter ice, and a downward sampling type which can be closed when contact is made with the lake bottom. The latter design is particularly suited to tests of net efficiency in vertical tows.

Key words: plankton; sampling (biological); quantitative estimates; vertical tow net; through ice sampler.

RESUME

Nero, R. W. 1982. A description of three nets suitable for estimating the abundance of Mysis relicta. Can. Tech. Rep. Fish. Aquat. Sci. 1046: iv + 8 p.

La forme générale du chalut servant au trait vertical est celle d'une pyramide inversée qui s'effile en deux étapes: premièrement, par un maillage de 1 mm, et deuxièmement, par un cul-de-chalut au maillage fin (250 μ m). Le chalut mesure 1,5 m de long et possède une ouverture de 1 m². Il en existe deux versions: le chalut pliant pour l'échantillonnage à travers la glace en hiver, et un chalut vertical que l'on peut fermer lorsqu'il touche le fond du lac. Ce dernier est particulièrement bien adapté aux vérifications de rendement en trait vertical.

Mots-clés: plancton; échantillonnage biologique; estimations quantitatives; chalut vertical; chalut pour l'échantillonnage à travers la glace.

INTRODUCTION

In order to study the effects of experimental, whole lake acidification on a population of *Mysis relicta* (Nero 1981), the need arose to develop a sampling net which would be simpler to use and lighter than the benthic sleds equipped with nets which are usually used to catch *Mysis* on or near the lake bottom during the daytime (Beeton 1960; Reynolds and DeGraeve 1972; Grossnickle and Morgan 1979; Malley and Reynolds 1979). Also, the net should be suitable for sampling through the ice in winter.

Mysis may be collected at night when populations are planktonic by towing a net vertically through the water column (Hakala 1978; Morgan et al. 1978; Grossnickle and Morgan 1979; Malley and Reynolds 1979). The nets described here are larger than those used in previous studies allowing better quantitative estimates at the low plankton densities encountered in the study lakes.

The nets are inexpensive and are simple to construct from easily available materials. Apart from the downward sampling version, the nets are lightweight and can be used from craft as small as a canoe.

In addition to sampling *Mysis*, the nets offer some potential as samplers for planktonic populations of other large crustaceans and larval fishes.

Evaluation of the relative catch performance of the vertical tow net and the bottom closing net was reported in Nero and Davies (1982).

VERTICAL TOW NET

The vertical tow net is used for obtaining quantitative estimates of *Mysis* density in a m^2 column of water. The large mesh size reduces the bow wave to a minimum yet allows a reasonable towing speed of $1/3 m \cdot s^{-1}$.

MATERIALS LIST

Ripstop nylon	2.1 m
6 x 26 mm aluminum bar	4.2 m
4 mm nylon cord	3 m
25 mm brass snap swivel	1 ea
1 mm mesh "Charcoal Grey Bridal Veil"®	4 m
4 mm plastic coated steel cable	As required
250 μm Mesh Nitex®	0.5 m
500 ml Nalgene® bottle	1
20 mm Tygon® tubing	10 cm
Pinch clamp	1
Lead fishnet weights	0.5 kg
The estimated cost of the net is \$100.	

CONSTRUCTION

The frame is made from a single piece of 6 x 26 mm aluminum bar 4.2 m in length with a 20 cm overlapping joint on one side secured with two 6 mm steel bolts. The net is constructed

from 8 pieces of material: four sides of 1 mm mesh netting for the upper net (Fig. 1B), two pieces of 250 μm -mesh net for the cod end (Fig. 1C), and two strips of ripstop nylon for the frame sleeve (Fig. 1A). The net is attached to the frame by folding the free edge of the frame sleeve over the frame and sewing it to the sleeve-netting seam. The four bridle lines are attached to holes drilled through the frame at the corners (Fig. 2C). These lines are tied with sufficient tension to keep the bridle flat, lying within the plane formed by the net frame and to force the net to lie flush with the substrate before vertical tows. The collecting funnel with attached drain tube and pinch clamp, along with four 20 g lead weights, are attached to the cod end using waterproof tape (Fig. 2H, I, J). The lead weights help keep the net from becoming tangled during descent.

OPERATION

The net is lowered, cod end first, through the water column. A speed of about $1/4 m \cdot s^{-1}$ prevents the net from tangling in the suspension bridle or from becoming fouled in the loose bottom sediments. Once the frame is in contact with the bottom, a 30-60 s pause is usually sufficient to allow mysids to redistribute over the net. An upward towing speed of about $1/3 m \cdot s^{-1}$ is recommended (Nero and Davies 1982). To ensure that all animals caught in the net are washed into the collecting funnel, the net is lifted clear of the water then lowered and raised three times without submerging the net mouth. Samples are drained into sample bottles from the collecting funnel by opening the pinch clamp.

COLLAPSING NET

A folding version of the vertical tow net can be passed through a 30 cm diameter hole in the ice, unfolds and samples in the usual manner, and then folds shut for retrieval through the ice. This net has been used through ice up to 70 cm thick.

MATERIALS LIST

Materials, in addition to those required for the vertical tow net, are as follows:

5 cm diameter steel ring	1
3 cm diameter steel ring	1
4 mm nylon cord	6 m
6 mm eye bolts	4
6 mm nuts	16
6 mm washers	8

CONSTRUCTION

Apart from changes in the bridle, frame, and frame sleeve the net design is identical to the vertical tow net previously described. A larger frame sleeve with reinforced corners and reinforced corner holes accommodates the frame and eye bolts. The frame is made from four

pieces of 6 x 26 mm aluminum bar with a 90° twist near each end so that the corners lie flat yet vertical strength is maintained along the bars length (Fig. 3). Eyebolts securing the corners of the frame function as hinges (Fig. 3H). The corners of the frame have been rounded and polished to prevent the frame sleeve from being torn.

The frame is opened by two lines from the far corners of the frame which pass through the 5 cm steel ring (Fig. 3E), join together, and attach to the 3 cm steel ring (Fig. 3C). This ring serves as an attachment point for the tow line. To limit opening of the net to a one meter square, two fixed lines (Fig. 3F) are attached to the remaining eye bolts and the 5 cm diameter ring (Fig. 3D). The closing line runs from an eyebolt on the far corner (Fig. 3H), bypasses the 5 cm ring and attaches to the 3 cm ring.

OPERATION

During cold weather sampling, the net is kept frozen in the closed position and is wrapped in a nylon tarp to form a package 2 m long and 20 cm in diameter. At the sampling site, the net is unwrapped, a sampling line attached, and the net is placed through the hole in the ice and into the water to thaw. Once the net is thawed, it can be untangled and lowered until the frame clears the bottom of the ice. By pulling on the main sampling line (Fig. 3-A) the net is forced open against the bottom of the ice. A vertical haul is then taken in an identical manner to that used for the standard net. As the net approaches the ice the closing line (Fig. 3D) is used to draw one corner of the net into the sampling hole, forcing the net to collapse. This must be done quickly to ensure that Mysis are not lost from the net. The net is drawn through the ice and re-opened to allow rinsing of the cod end. After the sample has been removed, the net should be allowed to re-freeze in the collapsed position to allow further sampling or for ease of transport.

BOTTOM CLOSING NET

For testing whether animals avoid the towing bridles and whether or not Mysis close to the substrate are sampled when using the vertical tow net, a downward sampling net was designed. This net samples downwards through the water column without prior disturbance and closes a few centimeters above the substrate.

MATERIALS LIST

Materials, in addition to those required for the vertical tow net are as follows:

Lead weights	3.0 kg
5 cm diameter steel ring	1
6 x 26 mm aluminum bar	1.5 m
1 cm grommets	24
4 mm nylon cord	20 m
Second Sampling Line (4 mm cord)	As required
1 mm steel cable	5 m

CONSTRUCTION

The bottom-closing net itself is a frameless, inverted version of the vertical tow net with an enlarged nylon sleeve to accommodate a drawstring closure (Fig. 4G). An additional tension line is attached to the cod end to hold the net upright while at the surface (Fig. 4C).

During descent, the net is held open by tension on the opening lines (Fig. 4E) produced by the weighted aluminum frame (Fig. 4I). The opening lines pass through holes drilled through the frame at the corners and attach by nylon tabs to the net sleeve. One half meter above the net the opening lines are joined together by a 5 cm steel ring (Fig. 4B) which is attached to the main descent line (Fig. 4A).

The ascent line (Fig. 4D) attaches to the ends of a drawstring closure (Fig. 4F) which passes through two holes on one side of the frame and encircles the net through grommets along the nylon sleeve.

OPERATION

The downward sampling net is somewhat more cumbersome to use than the simpler vertical nets and, as such, requires calm weather for optimum performance. To begin a tow, at the surface, the drawstring is opened and the ascent line is left slack. The descent line is held taught, keeping the net open due to the weight of the frame on the opening lines. The net is lowered through the water column at about $1/4 \text{ m s}^{-1}$. After contact with the bottom, an additional 2 m of the descent line are released and the ascent line is drawn tight, closing the net and raising it to the surface. At the side of the boat the net is rinsed and the sample removed as in the operation of the standard net.

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FIGURES

Figures 1, 2, 3, and 4 on the following pages show the net designs and name various parts. All dimensions are given in centimeters.

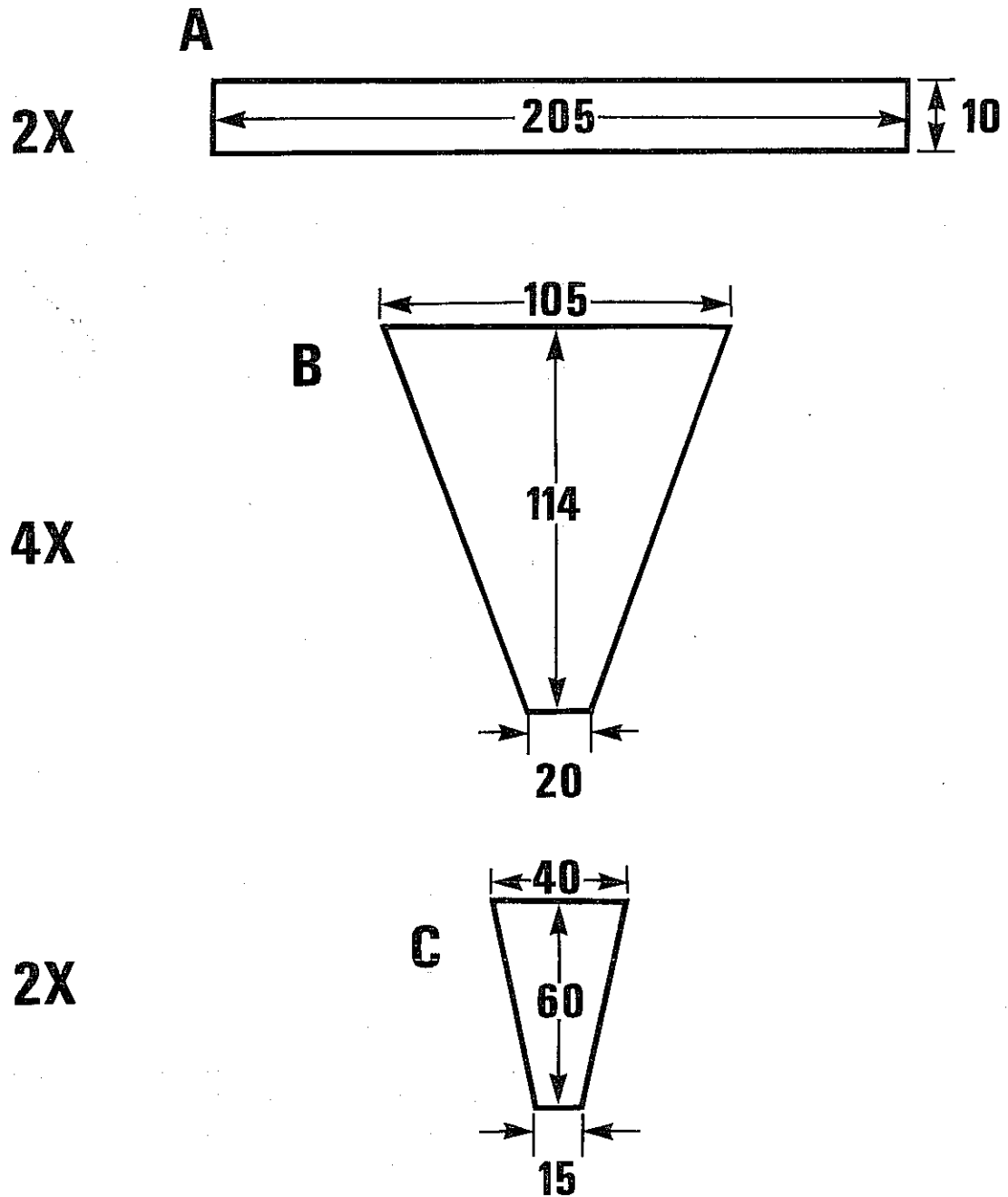


Fig. 1. Patterns for the material used in constructing the nets.

- A. Frame sleeve (ripstop nylon)
- B. Upper net (1 mm mesh)
- C. Cod end (250 μ m-mesh)

- A. Sampling line (4 mm plastic coated steel cable)
- B. Snap swivel (25 mm diameter)
- C. Bridle (4 mm nylon cord)
- D. Net frame (6 x 26 mm aluminum bar)
- E. Frame sleeve (ripstop nylon)
- F. Netting (1 mm mesh)
- G. Cod end (250 μ m-mesh)
- H. Collecting funnel
- I. Pinch clamp
- J. Drain tube

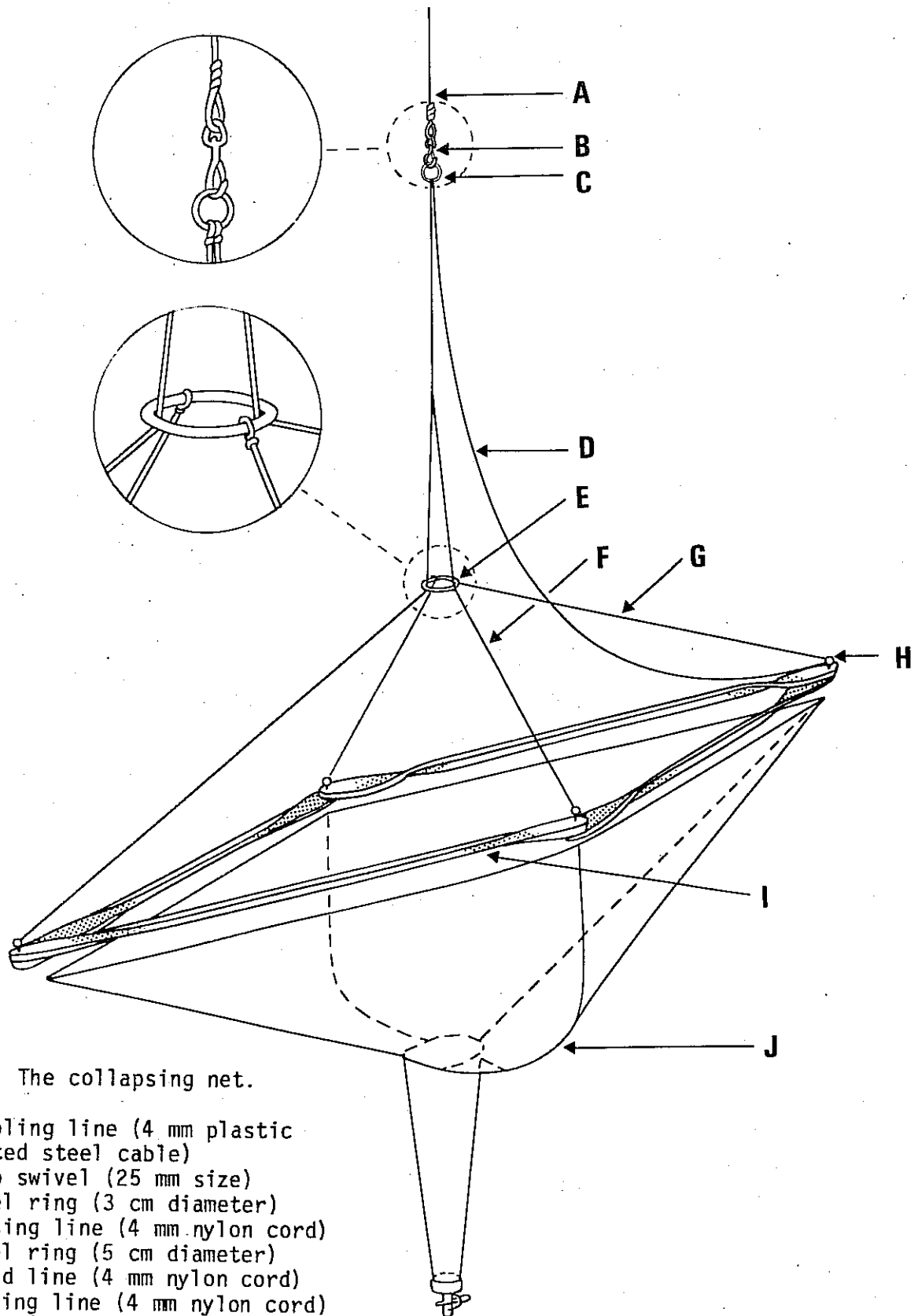


Fig. 3. The collapsing net.

- A. Sampling line (4 mm plastic coated steel cable)
- B. Snap swivel (25 mm size)
- C. Steel ring (3 cm diameter)
- D. Closing line (4 mm nylon cord)
- E. Steel ring (5 cm diameter)
- F. Fixed line (4 mm nylon cord)
- G. Opening line (4 mm nylon cord)
- H. Hinge (6 mm eyebolt)
- I. Scissor frame (6 x 26 mm aluminum bar)
- J. Standard 1 m² net (from vertical tow net)

Fig. 4. The bottom closing net.

- A. Descent line (4 mm nylon cord)
- B. Steel ring (5 cm diameter)
- C. Tension line (4 mm nylon cord)
- D. Ascent line (4 mm nylon cord)
- E. Opening line (4 mm nylon cord)
- F. Drawstring (1 mm steel cable)
- G. Sleeve with grommets (ripstop nylon, 20 cm width)
- H. Weight (20 g-lead)
- I. Frame (6 x 26 mm aluminum bar)

