

NORWEGIAN HOLDING NET TESTED IN MAINE SARDINE FISHERY

Kenneth Sherman

Sardines (juvenile Atlantic herring, *Clupea harengus harengus*) with excessive amounts of food in their stomachs are not suitable for canning. In Maine, fishermen have traditionally used weirs and stop seines for catching sardines nearshore, and have had little difficulty in holding fish until they were sufficiently clear of food for canning. Since 1962, however, a purse seine fishery for sardines has grown rapidly. Purse seine fishermen, lacking the protection found in inshore waters, have been obliged to send their catches immediately to a cannery for processing. The incidence of fish that are unacceptable for canning because of a "feedy" fish condition is thereby increased; these fish are diverted for use as fish meal. Norwegian fishermen have solved a similar problem by designing a holding net for use in the open sea.

Norwegian Holding Net

The Maine Sardine Council invited Captain Arne Gronningsaeter of Landfast, Norway, to demonstrate the use of the Norwegian holding

net to the Maine sardine industry. A sea trial of the net was made in September 1969 with a commercial purse seiner. The Bureau of Commercial Fisheries Biological Laboratory, Boothbay Harbor, Maine, cooperated in the trial by examining the changes of food content in the sardines during the holding period.

Captain Gronningsaeter instructed the captains and crews of Maine purse seiners in the handling of the holding net, which is available in a variety of sizes. The model used in the sea trial was 35 meters (115 ft.) long, 9 meters (30 ft.) wide, and 8 meters (26 ft.) deep. The netting on the sides and bottom is knotless nylon with stretched mesh of $1\frac{1}{8}$ inches. It is designed to hold up to 100,000 pounds of live sardines. In practice, the fish are transferred to the holding net immediately after they are purse seined and towed at 1 to $1\frac{1}{2}$ knots to a protected area. There, the net is anchored and the fish are left until cleared of food. The holding net in the anchored position is shown in figure 1.

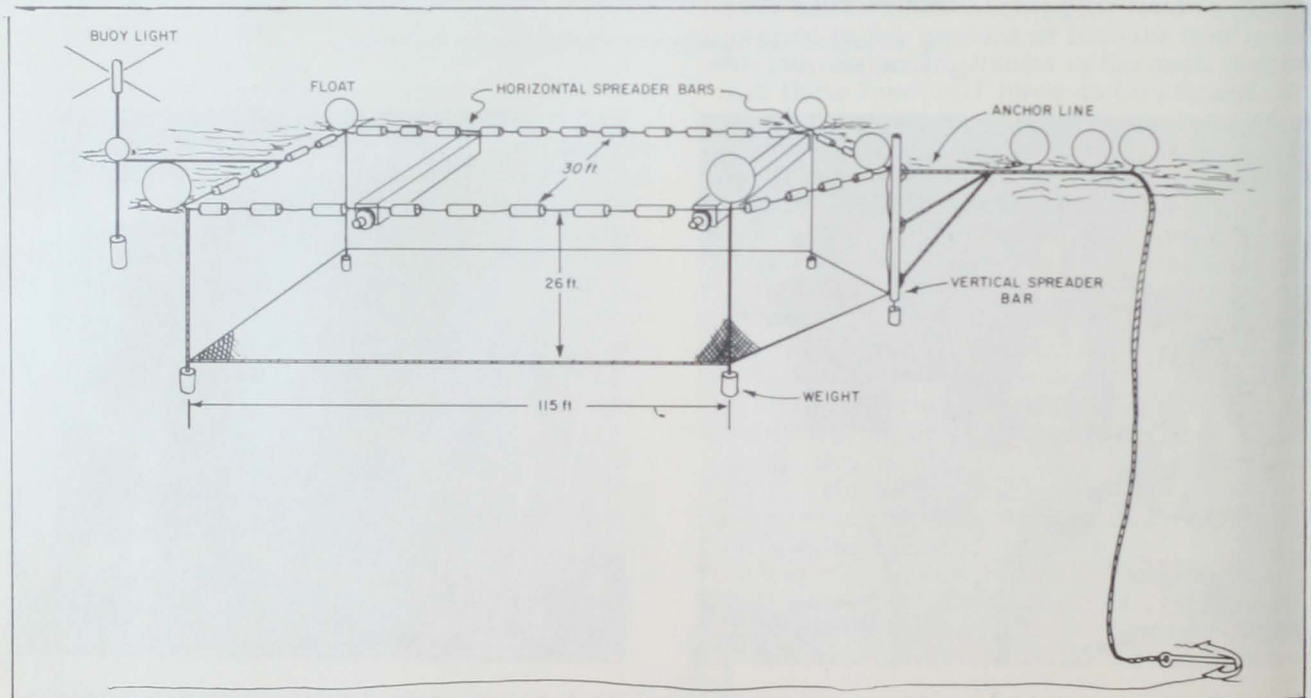


Fig. 1 - Drawing showing the holding net in the anchored position.

Mr. Sherman is Fishery Research Biologist, BCF Biological Laboratory, Boothbay Harbor, Maine 04575.

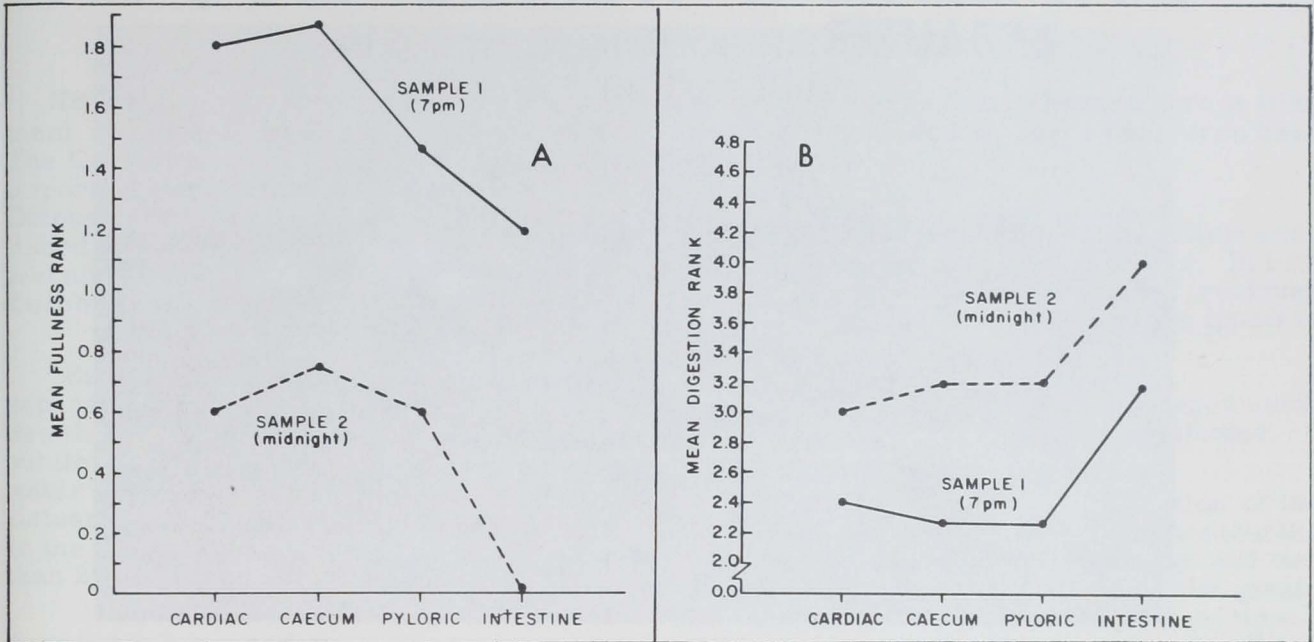


Fig. 2(A) - Comparison of the fullness rankings of the juvenile herring at the beginning of the holding experiment (sample 1 taken at 7 PM) and at the termination (sample 2, midnight). The values represent the mean rank of 10 fish selected from each sample. Rankings were made for major divisions of the digestive tract--the cardiac, pyloric, and caecal sections of the stomach and the intestine (0, devoid of recognizable food; 1, trace of food; 2, moderately full; and 3, moderately to completely full).

Fig. 2(B) - Comparison of the rankings of digestive stages of food in juvenile herring at the beginning of the holding experiment (sample 1) and at the termination (sample 2). The values represent the mean rank of 10 fish selected from each sample (1, slight digestion; 2, moderate digestion; 3, moderate to complete digestion; and 4, food liquified, with oil globules present).

Net's Effectiveness Tested

The effectiveness of the holding net for clearing "feedy" sardines was tested during a special cruise of the BCF research vessel 'Rorqual' on September 14 and 15, 1969. Determinations of the feeding activity of sardines in the net were made in cooperation with the purse seiner 'Eva Grace.' A set of about 37,000 pounds of herring was made by the seiner at 7 pm a quarter-mile east of Ragged Island, Maine (latitude 43°49.5' N., longitude 68°52' W.). The sea was calm and the quarter moon obscured by cloud cover. The fish (ranging in length from 213 mm to 247 mm) were sampled immediately after transfer to the holding net, and again at midnight just before they were pumped into the carrier.

Digestive Tracts Examined

The digestive tracts were examined in the laboratory. Contents of the stomach--including the pyloric, cardiac, and caecal sections--and intestine were examined under 25X to 600X magnification. Rankings were made of the degree of fullness and stage of digestion

(Figs. 2A and B). The amount of food in the herring after they were held for 5 hours was considerably less than when they were seined (66% less in the cardiac stomach and no food in the intestine); food in the digestive tracts was also in the late stages of digestion when the experiment ended.

The alimentary tracts cleared significantly in the holding net. When seined, the fish contained remains that were predominantly copepods, the zooplankters that were also the most

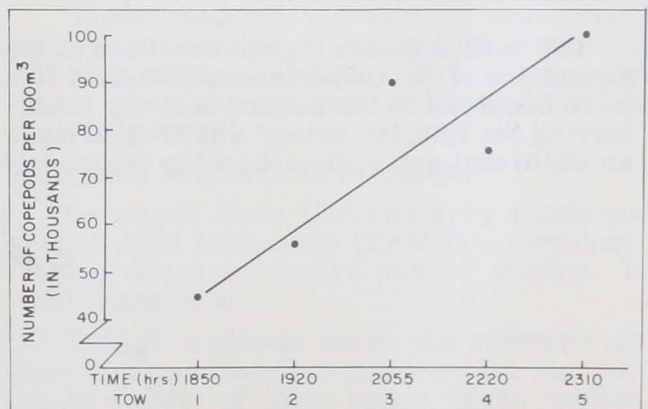


Fig. 3 - The number of copepods (per 100m³ of water strained) in the test area during the holding experiment.

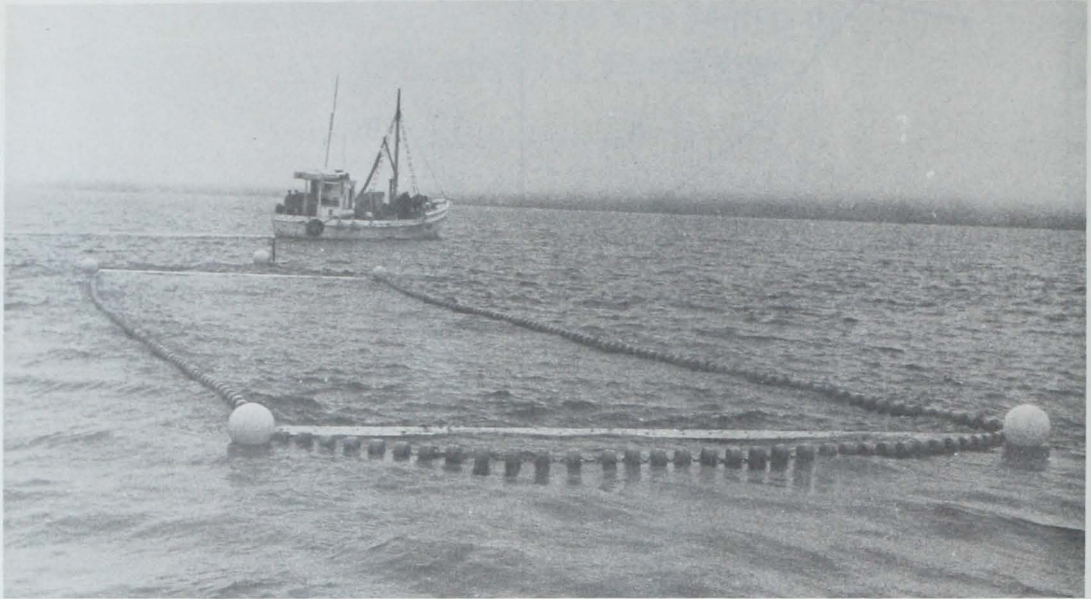


Fig. 4 - The holding net under tow. (Photo: Gareth W. Coffin)

numerous in the test area. The numbers of copepods in the area increased from 7 pm to midnight (fig. 3), while the amount of food in the restrained fish was decreasing. The increase in abundance of zooplankton reflects the vertical movement of plankton to the surface waters in the evening, and to the lower depths in daylight.

The water mass did not change significantly during the experiment. Temperatures were between 12.8°C (55°F) and 13.0°C (55.4°F) at the surface and between 10.8°C (51.4°F) and 11.7°C (53°F) at the bottom. The bathythermograph traces showed no evidence of a thermocline. Salinity was 31.9‰ at the surface and 32.4‰ on the bottom.

Sardines in Good Condition

The sardines were in good condition at the conclusion of the experiment. No dead fish were observed in the holding net. By transferring the fish, the seiner was free to make an additional set, while enhancing the quality

of the confined fish. The holding net under tow is shown in figure 4. Several sardine-plant owners have indicated that they will purchase holding nets for their purse seiners.

Whether the decrease in the feeding of sardines can be attributed to a stress condition imposed on the fish by the artificial confinement--or to the general decrease in feeding known to occur among herring during nights with weak moonlight--remains an open question requiring further study. The level of stress experienced by fish in a holding net is probably related to crowding, which will also result in a decrease in the availability of food to each fish. In addition, digestion is a function of temperature and the kind of food eaten. Clearing time during the colder months will be longer than at the higher temperatures in spring and summer regardless of stress. Within the framework of a controlled experiment, it should be possible to test effects of change in crowding, temperature, and food quality on clearing time.

