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THE RELATIVE EFFICIENCIES OF NYLON AND LINEN GILL NETS FISHED IN SEVEN INLAND LAKES IN MICHIGAN

By

Kenneth L. Peterson

Abstract

Nylon thread for gill nets was first offered on the market as a longer lasting, rot-resisting twine. But commercial fishermen who first used nylon gill nets acclaimed them not so much for this quality as they did for their superiority over other nets in their ability to take fish.

Seeking experimental evidence of the relative efficiency of nylon over linen with a view to possibly using nylon nets in fisheries research and adding to evidence which so far has been scanty, an experiment was conducted in the summer of 1950 comparing nylon and linen nets in inland lakes in Michigan.

The nylon and linen nets were laid in companion sets, a nylon with a linen net, 56 of these sets being made. Each pair was fished for a comparable length of time and in the same depth of water. Lengths, depths, mesh sizes, and thread sizes of the nets were the same.

A total of 1,841 fish was collected, 995 in nylon nets and 846 in linen. The average catch of the 56 nylon nets was 17.77, of the linen nets, 15.11, or an excess of nylon over linen of 2.66 fish.

Average catches for four species were computed. For yellow perch, the linen nets caught 6.73 compared to 5.59 for the nylon, or 1.14 more fish per net. For rock bass, on the other hand, the nylon nets took 3.76, and the linen, 2.05, or an average of 1.71 more fish per nylon net.

The linen nets captured more largemouth bass with an average of 0.95 fish compared to 0.41 for the nylon, or 0.54 more fish per net. For pumpkinseed sunfish, the nylon nets took an average of 1.39, and the linen, 0.98, or 0.41 more fish per nylon net.

Statistical computations followed Snedecor, 1946, Sec. 2.13. Reliabilities for the differences obtained range from 75 percent probability for the yellow perch to 99+ percent for the rock bass. For all species combined a probability of difference of 91 percent was obtained, in the greater catch by nylon nets.

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THE RELATIVE EFFICIENCIES OF NYLON AND LINEN GILL NETS FISHED IN SEVEN INLAND LAKES IN MICHIGAN[1]

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[1] Contribution from the Michigan Institute for Fisheries Research

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By

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Nylon thread for gill nets was first offered on the market as a longer lasting, rot-resisting twine. Manufacturers were surprised when commercial fishermen, who first fished nylon gill nets extensively in Lake Erie, acclaimed them not so much for this quality as for the superiority of nylon over other nets in their ability to take fish.

If nylon is so much more effective than linen or cotton thread, then it becomes of importance not only in the commercial fisheries but also in fisheries research on inland lakes. The adequacy of age and growth studies, population studies, and sampling of fish populations in general lake survey work depends on the efficiency with which the netting gear takes fish. The difficulty of obtaining adequate samples in a relatively short time has probably been experienced by most fisheries research workers.

Having faced such problems in a state where many thousands of lakes must be surveyed, and having an interest in contributing to information that may be of value to the commercial fisheries, the Institute for Fisheries Research, Michigan Department of Conservation, conducted an experiment comparing the relative efficiencies of nylon and linen gill nets in inland lakes in the summer of 1950.

The study was made by a lake survey crew whose duties included sampling fish populations and obtaining scale samples for growth records. Seven inland lakes were netted from June 17 to September 9. Nets were laid in companion sets, a nylon net paired with a linen net, and 56 of these sets were made. Each pair was fished for a comparable length of time and in the same depth of water. The pairs of nets were set, so far as could be determined, in the same physiographical conditions.

The nets were 125 feet long by 6 feet deep. Each contained 5 sections of differing mesh sizes. The meshes for the various sections measured, stretched: 1 1/2 inches, 2 inches, 2 1/2 inches, 3 inches, and 4 inches. Thread sizes for the nylong and linen nets were roughly comparable and varied according to the size of the mesh. They ranged, from the smallest to the largest mesh, as follows: for the nylon; #46, #46, #69, #104, #104; and for the linen; 50/2, 45/3, 40/3, 35/3, and 30/3. These thread sizes are heavier, except for the smallest diameters, than those generally favored by commercial fishermen.

The nets were lifted each morning, and no set fished the same place twice. Since it was necessary, for purposes of the lake survey,

to obtain a general sample of fish life in each lake, the pairs of nets were set in various depths of water. They were usually set from shore out into the lake, but often were set parallel to the shore or in deep water with no particular orientation to the shore.

A total of 1,841 fish was collected, 995 caught in nylon nets and 846 in linen nets. The data on number of fish per set for all species, and for the number of fish per set for four of the more numerous species, were analyzed statistically (Table 1) by individual comparisons, i.e., between the nylon and the linen net in each pair (Snedecor, 1946, Sec. 2.13).

This is a more precise method of comparing the relative efficiencies of the two types of net because it takes into account the individual situations under which each pair fished. It rules out such biases, introduced if all catches were combined, as would occur when the catch of a net in one depth of water was compared to the catch of a net fished in a different depth. It was demonstrated during the summer, for instance, that below 30 feet perch were most likely to be the only species taken. It would be inappropriate, then, to allow the catch of such a net to be weighed against that of a net set in 10 feet of water.

The average catch for all species, of the 56 nylon nets, was 17.77 ± 1.63; of the linen nets 15.11 ± 1.51; and the difference was 2.66 ± 1.53. In this comparison t equals 1.74, and the probability that the difference is significant is 91 percent.

Perch and rock bass were the most numerous of the species taken. With fairly large catches for each of these fishes, it seemed advisable to compare the relative efficiency of the nets in taking these species. The linen nets caught more perch than the nylons, with an

Table 1.--Comparison of catch between nets for four species and all species combined.[1]

Species	Net	Average fish per net	Standard error of mean	Mean difference nylon over linen	Standard error of mean difference	t	Probability of real difference
Yellow perch	Nylon	5.59	0.77	-1.14	0.96	1.19	75%
	Linen	6.73	0.98				
Rock bass	Nylon	3.76	0.44	+1.71	0.46	3.71	99+%
	Linen	2.05	0.31				
Largemouth bass	Nylon	0.41	0.10	-0.54	0.39	1.38	82%
	Linen	0.95	0.39				
Pumpkinseed	Nylon	1.39	0.27	+0.41	0.29	1.41	83%
	Linen	0.98	0.22				
All species	Nylon	17.77	1.63	+2.66	1.53	1.74	91%
	Linen	15.11	1.51				

[1] Note that standard errors of the mean differences and values of t, were determined through comparison of individual nets in each pair (Snedecor, 1946, Sec. 2.13) rather than by lumping the catches of each type of net.

average catch of 6.73 ± 0.98 compared to 5.59 ± 0.77 for the nylon nets, or 1.14 ± 0.96 more fish per net. In this case t equals 1.19, and the probability of difference is 75 percent.

The nylon nets, on the other hand, caught more rock bass than did the linen, averaging 3.76 ± 0.44 fish compared to 2.05 ± 0.31 for the linen nets, or 1.71 ± 0.46 more fish per net. The value of t equals 3.71, and the probability of difference exceeds 99 percent.

The next most numerous species taken were largemouth bass and pumpkinseed sunfish. An average of 0.95 ± 0.39 largemouth was taken per linen net, and 0.41 ± 0.10 per nylon net, the catch for the linen nets exceeding that for the nylon nets by 0.54 ± 0.39. Here the value of t equals 1.38, and the probability of difference is 82 percent.

For the pumpkinseed, the nylon nets averaged 1.39 ± 0.27, and the linen nets averaged 0.98 ± 0.22, or 0.41 ± 0.29 more fish per nylon net. In this case the value of t equals 1.41, and the probability of difference is 83 percent.

Presented graphically, the data for all species (Figure 1) indicate the variances in catches between the nets in each paired set and also between the various sets. In 38 sets the nylon net outcaught its linen companion; in 16 sets the linen captured more fish than the nylon net; and in two cases the catches were equal. The unimpressive comparative showing made by the nylon nets is indicated by the fact that in 30 sets the difference between the catches of the two nets was five or less fish. In 18 other sets the difference between the catches did not exceed fifteen fish. In a few instances the catch made by the linen net greatly exceeded that of the nylon, and the reverse is true.

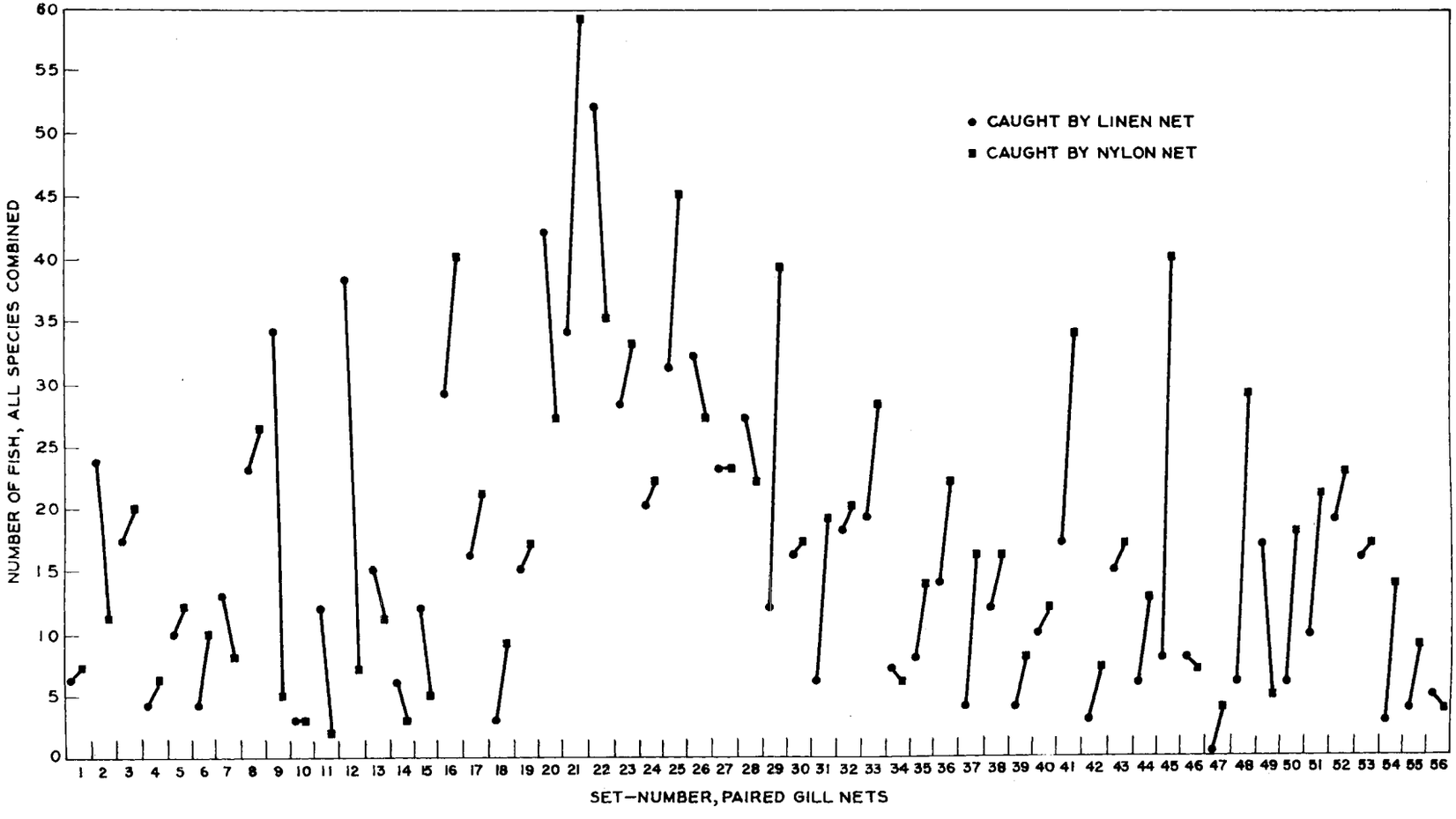

Figure 1.--One-day catches of fish for each set of paired gill nets (nylon and linen) fished in seven inland lakes in Michigan.

lengths and weights of the game fishes were recorded. Comparing average lengths as a criteria of size is of interest, for commercial fishermen have claimed that nylon nets catch larger fish because of the elasticity of the thread. The average size of yellow perch caught in nylon nets was 6.9 inches, whereas the perch caught in the linen nets averaged 6.5 inches, or four tenths of an inch less. Rock bass, on the other hand, averaged the same, 6.3 inches, for both types of net. For two other species selected at random, pumpkinseed sunfish and yellow pike-perch, the fish taken in linen nets averaged three tenths of an inch longer than those caught in nylon nets.

The results of the summer's work differ radically both from the claims made by commercial fishermen and data presented by two other limited studies. One author (Lawler, 1950) has reported upon a commercial fisherman's private experiment. Fishing in Lake Erie for whitefish, the fisherman laid out several thousand yards of net a day from August 5 to 25 in 1949. Boxes of nylon nets were alternated with linen so that the same strap or group of nets would contain both nylon and linen nets. After eleven days, however, the experiment was abandoned, as the fisherman considered it no longer worthwhile to use linen. On the average, a box of 6 nylon nets (360 yards) caught 20.5 fish, while only 6.3 fish were taken per box of linen nets. This is a ratio per box of nylon to linen of 3.2:1.

In another experiment (Molin, 1950) conducted in Lake Mälar, Sweden in November 1949, nylon and cotton nets were compared. Ten pairs of nylon and cotton nets were set. The nylon nets took 141 fish, and the cotton 67. Because the area of the nylon net used was 24.5 square meters compared to 35 square meters for the cotton, the computed catch per unit gave the nylon a three to one superiority over the cotton.

Explanations for the disparity between the results of these two experiments and the present study are not readily forthcoming. Commercial fishermen meeting with Dr. John Van Oosten at Erie, Pennsylvania in July, 1949, to discuss problems raised by the use of nylon gill nets, had some theories about the superiority of the nylon nets. They contended that the nylon nets were less visible and therefore captured more fish. They claimed that the nylon nets took larger fish than other nets because the thread stretched under water. One fisherman said that the nylon nets did not become covered with "slime" like other nets. Lake Erie fishermen were most concerned about the effectiveness with which the nylon nets took whitefish, though it was reported effective for some other species also. (Minutes of meeting supplied by Dr. John Van Oosten.)

It should be noted that the lakes netted in the present study, with one exception, were hard-water, clear lakes with sandy shoals. Nets were generally visible in less than twelve feet of water. Most nets were made in water 35 feet or less in depth. Most fish were taken in less than 20 feet of water. The nets were free from "slime" or algae throughout the summer. The thread used in the nylon nets was Brownell preshrunk nylon, and the knots seemed to hold fairly well. The linen thread was treated with copper napthenate, giving it a drab color, while the nylon thread was colorless.

The depth of water, species sought, and biological conditions in the Great Lakes may introduce elements not present in inland lakes. If the results of the study cannot be projected to Great Lakes' fishing, it might still be concluded that if nylon nets are to be used in experimental fisheries work in inland lakes, some qualities other than their ability to take fish might be considered before this more expensive gear is adopted as standard equipment.

Nylon is stronger than cotton and is almost impervious to rot. This facilitates carrying nets from lake to lake without drying when crews are pressed for time or do not have the bulky equipment necessary for drying nets. Like others, nylon nets are harmed by sunlight and should not be exposed for long periods of time. They can be handled wet better than when dry. The nets can be taken from the water as a rope and laid out again with less tangling than linen or cotton nets. They do not take color as well as linen or cotton but need not be treated as do these nets. Manufacturers are having better luck combating the knot slippage problem with the use of improved knots. But the tendency for nylon to stretch in water cannot be entirely eliminated. Attempts to take out more of this elasticity have resulted in lowering the tensile strength.

It appears that nylon may well be accepted for fisheries research work, not so much because of a relatively higher efficiency in taking fish, but on the basis of the superior strength of the thread, its immunity to rot, and the ease of handling by fisheries workers who do not generally have the equipment of commercial fishermen.

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