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TRAWL COD-END MESH SIZE SELECTIVITY TOWARD YELLOW PERCH IN LAKE ERIE

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ABSTRACT

Rapid decline of the more popular food fish from the Great Lakes has prompted the introduction and use of gear designed for more efficient, economical, and year-round methods of harvest. Yellow perch, now one of the most valuable food fish of the Great Lakes, can be caught by the bottom trawl at certain times and localities.

In some Great Lakes states fishermen are allowed to harvest yellow perch with trawls. Other states do not permit trawling for yellow perch partially because of lack of knowledge concerning the biological effects of trawling on yellow perch stocks. This study sheds some light on the problem of protecting sublegal-sized perch through trawl cod-end mesh size control. An analysis of data collected by the U. S. Bureau of Commercial Fisheries research vessel *Kaho* during two cruises in Lake Erie in 1962 and 1963 indicates a cod-end mesh size of 2½ inches stretched measure is satisfactory for the efficient harvest of yellow perch. With this size mesh only 19 percent (by number) of all yellow perch caught were under 8 inches (total length) and a profitable catch rate of larger fish was maintained.

INTRODUCTION

Due to the recent decline in stocks of the more popular food fish, i.e., yellow pike or walleye, blue pike, lake trout, and whitefish, in the Great Lakes, the value and demand for yellow perch (*Perca flavescens* Mitchell) have increased. Before the choice species declined, practically all fishing was done with gill nets, trap nets, pound nets, and haul seines. When fish were plentiful those gear produced periodic market gluts and low prices.

Recent efforts to improve the competitive and economic status of the fishing industry have included improvements in catching methods, processing equipment, cold-storage techniques, and consumer education. The extension and stabilization of production seasons and reduction of production costs are of equal importance in this endeavor. During the course of routine U. S. Bureau of Commercial Fisheries exploratory fishing activities and the development of new animal food fisheries, it has become obvious that the otter trawl is effective not only in taking of alewife, chub, and smelt, but also at certain times and places is of considerable value in catching yellow perch.

To understand the benefits and disadvantages of otter trawling in the Great Lakes,

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Fig. 1 - "Trousler leg" cod end being taken aboard the R/V *Kaho* in Lake Erie.

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careful studies by species, area, and net design are desired by scientists, conservationists, and commercial fishermen. Trawl-mesh selectivity studies are an important step in this direction.

The introduction of the trawl into the Great Lakes did not occur until the late 1950's, however, and very little has been accomplished or published about the influence of various trawl characteristics in taking fresh-water fish. Numerous variables affect catch rate and success of bottom trawls. A number of noteworthy studies of these factors have been conducted in the ocean fishery (Taylor 1953; Clark 1963). One of the factors involved is species and size selectivity of different cod-end mesh sizes. Ferguson and Regier (1963) determined most desirable cod-end mesh size to obtain a high percentage of select market-size smelt in Lake Erie.

There is currently no size limit on yellow perch in the waters of the Great Lakes in Ontario, New York, or Pennsylvania. Indiana and Ohio have a size limit of 8 inches, and Michigan's legal size is $8\frac{1}{2}$ inches. In Wisconsin the size limit is 8 inches except in Green Bay where it is $7\frac{1}{2}$ inches. The legal sizes in those states correspond closely to the practical market size, and therefore identify the need to determine cod-end mesh sizes that will effectively screen out most of the individuals under those sizes (i.e., under about 8 inches).

In 1962 and 1963 strong year-classes of yellow perch were present in Lake Erie (U. S. Fish and Wildlife Service 1964). Records were kept of the size distribution of yellow perch for all catches during 2 of the 3 cruises by the Bureau of Commercial Fisheries research vessel Kaho in Lake Erie in those years.

During the second cruise (R/V Kaho Cruise 4) from September 23 to October 10, 1962, 62 trawl drags were completed and during the third cruise (R/V Kaho Cruise 11) from May 22 to June 20, 1963, 113 drags were completed. Although specific yellow perch studies were not a primary objective of those cruises, a great deal of basic information was amassed and four days were devoted entirely to special studies of mesh selectivity on yellow perch.

METHODS



Fig. 2 - "Trouser leg" cod end with catch.

During R/V Kaho Cruise 4, two days (October 6-7, 1962) were devoted to studying the influence of three cod-end mesh sizes on size selectivity of yellow perch. For this purpose, a "trouser leg" cod end was used as a means of fishing two cod ends with different mesh sizes simultaneously on one net (figs. 2 and 3).

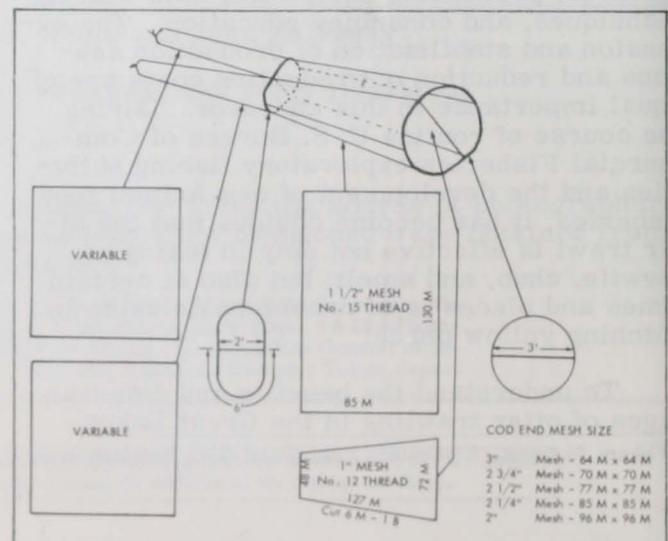


Fig. 3 - Construction of the "trouser leg" cod end, M=Mesh number.

The "trouser leg" was attached to a standard 52-foot (headrope) Gulf of Mexico-type fish trawl. Seven drags were completed; 3 comparing mesh sizes of $2\frac{1}{4}$ and $2\frac{3}{4}$ inches^{1/} (table 1). All drags were between Cleveland and Fairport, Ohio, at a depth of 13-14 fathoms.

On June 17 to 19, 1963, during R/V *Kaho* Cruise No. 11, size selectivity studies using the "trouser leg" cod end were continued off Avon Point, Ohio, at a depth of $10\frac{1}{2}$ to 11 fathoms. Four mesh sizes, 2, $2\frac{1}{4}$, $2\frac{1}{2}$, and 3 inches, were compared (table 2). On 2 drags, mesh sizes of 2 and $2\frac{1}{2}$ inches were paired; 2 drags paired mesh sizes of $2\frac{1}{4}$ and $2\frac{1}{2}$ inches; and 1 drag had mesh sizes of $2\frac{1}{2}$ and 3 inches paired. In addition, 3 drags were made in which both legs of the cod end were of $2\frac{1}{2}$ -inch mesh.

Table 1 - Summary of Yellow Perch Catches Taken in Paired Tows Using "Trouser Leg" Cod Ends during R/V *Kaho* Cruise 4

Number of Drags	Cod-End Mesh Size	30-Minute Drag	Fish		Percentage 8" or Longer
			Under 8"	Over 8"	
3	<u>Inches</u> $2\frac{1}{2}$	<u>Lbs.</u> 12	<u>No.</u> 14	<u>No.</u> 98	<u>%</u> 88
	with $2\frac{3}{4}$	5	2	45	96
4	$2\frac{1}{4}$	22	150	220	59
	with $2\frac{3}{4}$	9	15	91	86

Table 2 - Summary of Yellow Perch Catches Taken in Paired Tows Using "Trouser Leg"-Type Cod Ends during R/V *Kaho* Cruise 11

Number of Drags	Cod-End Mesh Size	30-Minute Drag	Fish		Percentage 8" or Longer
			Under 8"	Over 8"	
2	<u>Inches</u> 2	<u>Lbs.</u> 113	<u>No.</u> 69	<u>No.</u> 60	<u>%</u> 47
	with $2\frac{1}{2}$	62	28	138	83
2	$2\frac{1}{4}$	93	40	82	67
	with $2\frac{1}{2}$	55	30	84	74
3	$2\frac{1}{2}$	29	34	136	80
	with $2\frac{1}{2}$	65	37	138	79
1	$2\frac{1}{2}$	37	8	46	85
	with 3	6	-	11	100

In the 1962 studies, direction of drags was kept constant (west and WNW.). In 1963, the directions and alternate tows were reversed (north and south) with the exception of the $2\frac{1}{4}$ - and $2\frac{1}{2}$ -inch study where drags were N. and WNW. A constant engine speed of 1,100 r.p.m. produced a towing speed of about 3 m.p.h. With the exception of two drags of one-hour duration, all drags were 30 minutes long and all catch rates are equated to 30 minutes.

In addition to these special studies, the yellow perch taken with the standard assessment trawl (which used a one-inch mesh liner in the cod end) were

separated and placed into two size categories: (1) small--less than 8 inches, and (2) large--8 inches and over (figs. 4 and 5). Only data for drags which contained 10 pounds or more of



Fig. 4 - A sorted trawl catch taken in Lake Erie using a one-inch-mesh cod end. Legal-size (8-inch) yellow perch are in the tub in the left foreground and sublegal perch are in the tub on the right. In the box in the background is a bucket of smelt, a mixed lot of trout-perch and spottail shiners (center), two suckers, and young-of-the-year yellow perch (right).



Fig. 5 - Measuring yellow perch taken in selectivity studies.

^{1/}All cod ends were cotton material and premanufactured to the specific sizes. All measurements used in this report are stretched measure of the dry material.

yellow perch were considered for analysis. A total of 85 drags was made. Drags were made at depths ranging from 4 to 19 fathoms in the eastern, central, and western basins. All the 1962 drags used a standard 52-foot (headrope) trawl; while in the 1963 studies, 50-, 52-, and 61-foot trawls were used. All tows were of 30 minutes duration and vessel speed was about 3 m.p.h.

RESULTS

The results of the two-year study with a one-inch-mesh liner in the cod end are summarized in table 3. Although the proportionate distribution of drags in various basins were

Basin	Drags		Total Quantity		Per Drag		Fish 8" or Longer		Percentage 8" or Longer	
	No.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	%	%	
Cruise 4 - (September 23 to October 10, 1962)										
Western . . .	6	1,785	298	1,103	19.8	61.8				
Central . . .	14	3,921	280	387	7.9	9.9				
Eastern . . .	1	10	10	1	10.0	10.0				
Subtotal . .	21	5,716	272	1,491	26.1	26.1				
Cruise 11 - (May 22 to June 20, 1963)										
Western . . .	17	1,950	115	205	10.5	10.5				
Central . . .	42	5,984	142	1,927	32.4	32.4				
Eastern . . .	5	185	37	11	6.0	6.0				
Subtotal . .	64	8,083	126	2,143	26.5	26.5				
Total . . .	85	13,769	162	3,634	26.4	26.4				

similar for both years, over twice as many pounds of yellow perch per drag were obtained in 1962 than 1963. This decline agrees with the expectations shown by Lake Erie year-class strength data obtained by the Bureau's Biological Station at Sandusky, Ohio. Percentage of yellow perch longer than 8 inches was nearly identical in both years (26.1 percent in 1962 and 26.5 percent in 1963). The composite for both years was 162 pounds of yellow perch per drag of which 26.4 percent or 42 pounds were large fish

In the "trouser leg" cod-end studies the pounds of yellow perch per drag decreased from 113 to 6 in the range of

mesh sizes from 2 to 3 inches, and the catch of yellow perch over 8 inches increased from 47 percent to 100 percent over the same range (table 4). For comparisons of the "trouser leg"

and the one-inch mesh data, it should be remembered that the catch was divided in half in the "trouser leg" trawl, and thus catches should be doubled for making comparisons. The catch per unit of effort in the "trouser leg" studies may also have been influenced by distortion of the cod-end entrance caused by the heavier catch accumulated in the small-mesh leg of the cod end.

Mesh Size	Drags Used	Per 30-Minute Drag	Fish		Percentage 8" or Longer
			Under 8"	Over 8"	
Inches	No.	Lbs. (No.)		%
2	2	113	69	60	47
2 $\frac{1}{4}$	8	57	190	302	61
2 $\frac{1}{2}$	16	44	151	640	81
2 $\frac{3}{4}$	7	7	17	136	89
3	1	6	-	11	100

DISCUSSION

Trawl catch variables were controlled as much as possible and these studies demonstrated a direct relationship between mesh size and size of yellow perch caught. This difference can be clearly shown by the trend to catch larger yellow perch as mesh size increases (fig. 6). All yellow perch taken in the three-inch mesh were longer than 8 $\frac{1}{2}$ inches long; but in the two-inch mesh, only 36 percent were over 8 $\frac{1}{2}$ inches and 35 percent were less than 7 inches long. The selectivity is also reflected in the smaller total catch per unit of effort as the mesh size increased (fig. 7). Selectivity was identical for both years and seasons (spring and fall) in all mesh sizes for which comparative data was available.

A cod-end mesh size of one inch was too small for efficient selective harvest of marketable yellow perch, since only 26 percent of all yellow perch caught with that size mesh were 8 inches or longer. The larger mesh sizes were effective in eliminating small yellow perch and smaller fish such as smelt, alewife, and gizzard shad from the catch. Total catches of all drags with a cod-end mesh size of less than 2 inches had 42 percent by weight of species

other than yellow perch; while in mesh sizes of over 2 inches, only 17 percent of other species (mostly gizzard shad) were present.

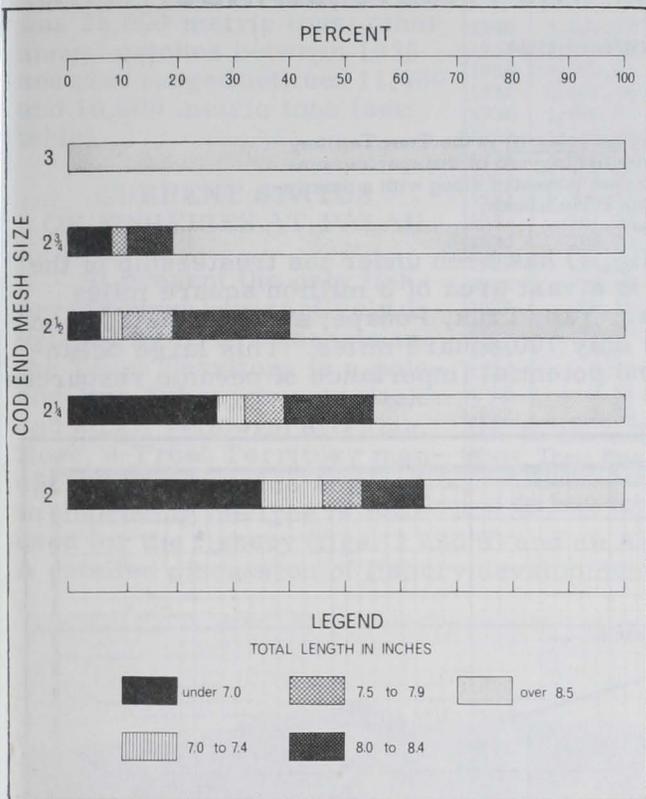


Fig. 6 - Size composition of yellow perch taken in various cod-end meshes. Percentage is based on total number of fish taken in all drags for each mesh size (stretched measure, inches).

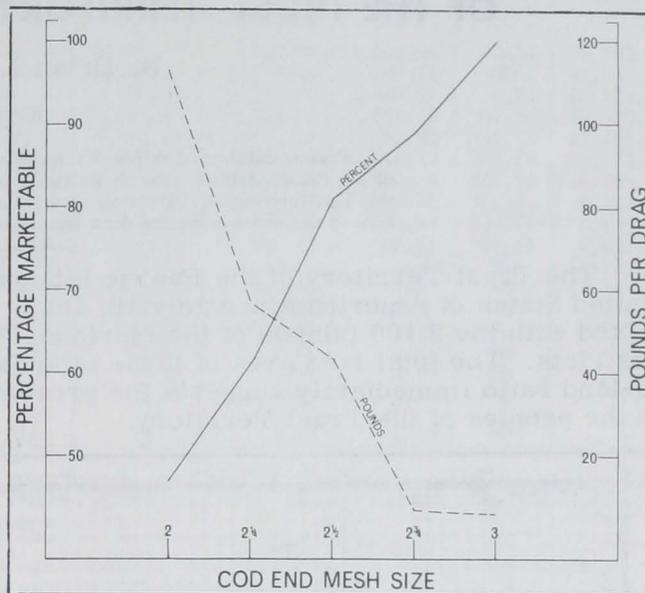


Fig. 7 - Percentage marketability (fish 8 inches and longer) and pounds of perch per thirty-minute drag for various mesh sizes. Catch-rate numbers represent only half of a divided catch in a "trouser leg" cod end.

Data from the present study indicates that the most efficient cod-end mesh size to harvest a high percentage of yellow perch 8-inches or longer, at a profitable catch rate, is 2 1/2 inches. With that size mesh, 81 percent (by number) of all yellow perch taken were over 8 inches in length and a profitable catch rate was maintained.

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