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LAKE ERIE FISHERIES EXPLORATIONS, MAY-NOVEMBER 1960

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BACKGROUND

Exploratory fishing in the Great Lakes was started in the fall of 1958 by the U. S. Bureau of Commercial Fisheries. A sharp decline in availability of choice food fish and increased abundance of lower-priced, less-preferred species had forced many commercial fishermen out of business while others continued to operate at marginal or unprofitable levels. The immediate objective of the Bureau was to determine the most efficient methods for taking smelt (*Osmerus mordax*). Smelt were known to be abundant, but they could not be taken profitably with trap nets or pound nets, except during relatively short seasonal periods when excessive production caused market gluts.

In the 1958 explorations, small trap-net vessels were chartered for lampara-seine explorations. A larger trap-net boat was chartered and rigged for trawling and lampara-seine operations in 1959, and exploratory cruises were conducted from April through November (Carr and Gordon 1960). The trawl proved to be effective in taking commercial quantities of smelt in Lake Erie over extended periods and areas. The 1959 study also defined trawlable areas, seasonal depth distribution, and temperature preference of smelt, and provided valuable data on the relative availability of other species to the trawl. Limited seining was not successful.

Trawling explorations were continued in 1960 to define further the availability of smelt by season, depth, and area. The 1959 findings were substantiated and knowledge concerning the distribution and periods of availability of smelt were extended.

AREA OF OPERATION

Lake Erie, fourth largest of the five Great Lakes, has a surface area of 9,940 square miles. It is the shallowest of the lakes; the mean depth is 63.9 feet (Wright 1955). The northern part of Lake Erie lies in Canada, and the southern part lies in the United States (fig. 1).

Ontario borders the entire north shore of the lake and Michigan, Ohio, Pennsylvania, and New York share the west, south, and east shores. The lake may be divided into three distinct, broadly connected basins. The shallow western basin (maximum depth 48 feet) lies west of a line connecting Point Pelee on the north shore and Sandusky, Ohio, on the south shore. Much of that area is unsuitable for trawling because of outcroppings of bedrock, the many islands and shallow reefs, submerged net stakes, and an extensive commercial trap-net fishery. The large central basin (maximum depth 84 feet) covers almost two-thirds of the lake and was generally clear of obstacles to trawling in the areas fished. That basin is bordered on the west by a rock and sand bar that extends from the base of Long Point (north shore) to Erie, Ohio (south shore). The eastern basin is the deepest portion of the lake (maximum depth 210 feet). The bottom in most of this area is suited for trawling except for inshore depths less than about 8 fathoms ($\frac{1}{2}$ to $2\frac{1}{2}$ miles from shore).

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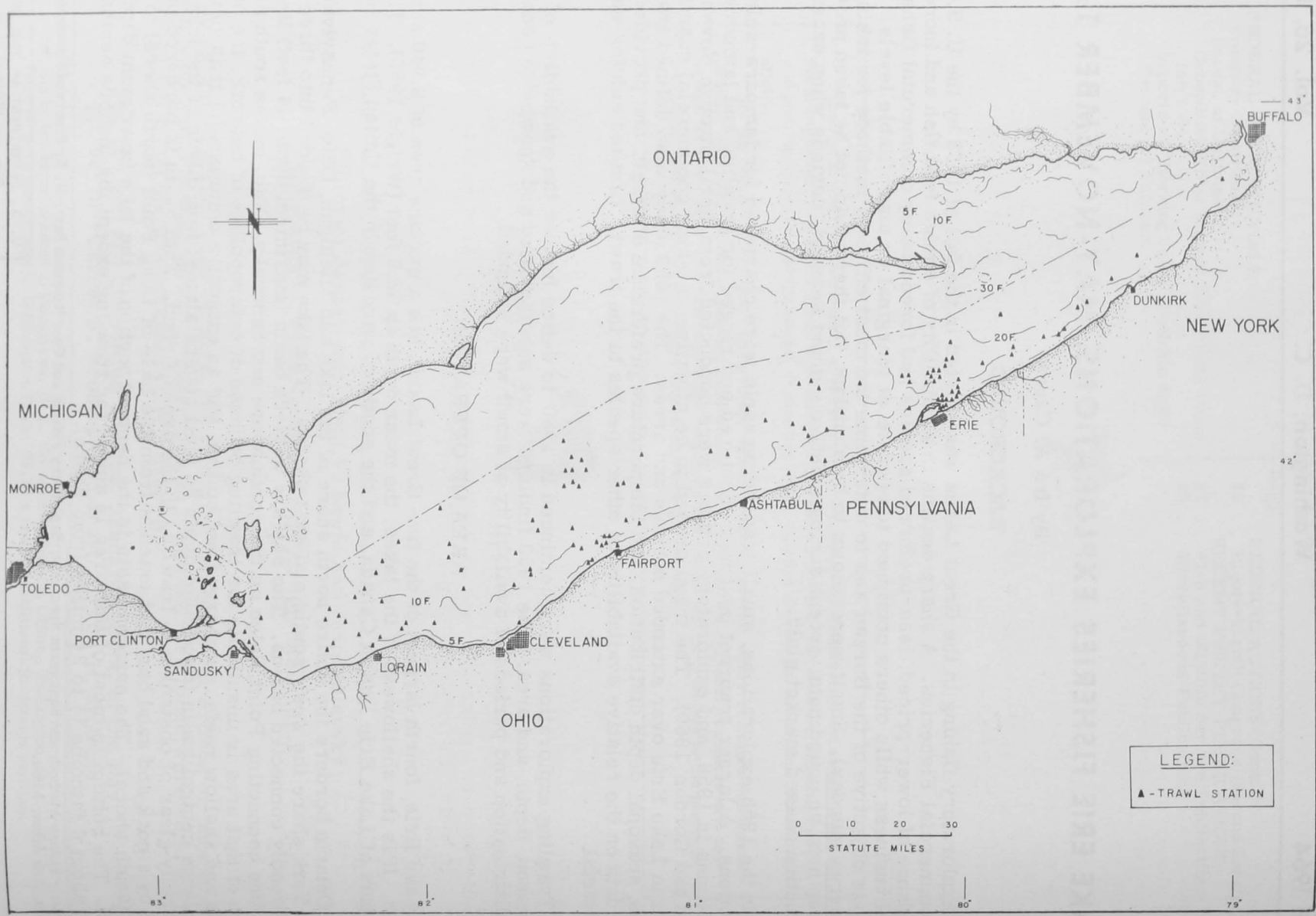


Fig. 1 - Exploratory trawling stations, Lake Erie, April-November 1960.

VESSEL, GEAR, AND METHODS

A large converted trap-net vessel, the M/V Active (fig. 2), first chartered and rigged for trawling in 1959, was purchased in 1960. This vessel was of wood construction, 50 feet long with a 14½-foot beam, and a draft of 4½ feet. After limited explorations in the spring, the vessel was repowered with a 147-hp. (continuous duty) Diesel engine with a 3:1 reduction gear, and a new deckhouse-pilothouse was added. Accessory equipment included a shallow-water echo-sounder with sufficient range and power to permit fish detection and bottom sounding at depths. Continuous recordings were made while either cruising or fishing to locate and define bottom obstacles and evaluate the density and depth distribution of fish.



Fig. 2 - Exploratory fishing vessel Active after addition of a new deckhouse-pilothouse in 1960.

A standard 50-foot (headrope length) Gulf of Mexico 2-seam semi-moon trawl was used for all but 5 drags. This trawl was made of 2½-inch, 18-thread cotton mesh in the wings and body and 1½-inch mesh in the intermediate section and cod end. The remaining 5 drags were made with a net of similar design, but with 4-inch mesh in wings and body. The bucket-type otter boards measured 2 by 5 feet and weighed 200 pounds each. All drags were made with Pacific Coast-type dandyline gear with 60-foot bridles. The gear was set off the stern and the cod end was retrieved by a lazyline before the catch was hoisted aboard. Gear damage for the season was slight; only one trawl was torn beyond repair.

Most drags were 30 minutes long and held as closely as possible to a constant depth. Towing speed averaged approximately 2½ miles per hour. Observations including the catch, weather, sea conditions, bottom conditions, and water temperature were recorded at each station. Surface temperatures were recorded with an electric temperature meter and surface-to-bottom temperature profiles with a bathythermograph. Fish were separated and weighed by species, and numbers of smelt per pound were determined.

FISHING RESULTS

Lake Erie's three basins provide different environments which greatly influence not only the composition of fish stocks, but also their seasonal distribution. Although fishing was scattered and limited in some areas (no fishing in some months), the results were sufficient to provide general information on local differences and seasonal changes in distribution, abundance, and availability of smelt to bottom trawls.

Catches during the 1959-60 explorations (see Sand and Gordon 1960 for 1959 data) show that smelt prefer cool water. Those in the western end of the lake move eastward into the upper central and eastern basins as summer advances. The results also give strong evidence that smelt, although not heavily concentrated at any particular depth during May and June in the central basin, are present in sufficient quantity for commercial production. As the water warms, smelt prefer depths greater than 55 feet in the central basin and occasionally become heavily concentrated within a very narrow depth range. In late October, they again scatter, but by November were still available to trawls in commercial quantities but were not concentrated at any particular depth.

The seasonal bathymetric distribution of smelt in the eastern basin is essentially the same as that described for the central basin except that a deeper habitat is available and the smelt continue to move into deeper water during late summer and early fall. The extent of interchange of smelt between the central and eastern basins is not known. An easterly movement would be suspected during periods of oxygen depletion in the central basin,^{1/} but this point cannot be substantiated. It is apparent that water temperature is the principal factor in the distribution of smelt, but other factors such as food, oxygen, and spawning behavior influence distribution, especially when the temperature is not critical. The effects of currents and seiches may also be important.

The results of the 1960 work are discussed by basin. Tables 2-5, which summarize the fishing results by month, species, depth and basin, follow the discussion. Two drags in a total of 129 were not used in the computations because of gear damage which undoubtedly affected the catches. Common names of fish are used throughout; the scientific names are listed in table 1.

WESTERN BASIN: Exploratory trawling totaled 19 drags in the western basin in May, June, August, and October. The smelt were scattered in May-June, but available in moderate quantities at nearly all depths (15-47 feet) fished (table 2). Smelt made up 86.4 percent of the catches which averaged 207 pounds an hour, and yellow perch accounted for the remaining 13.6 percent. Limited trawling in that basin in August and October caught few or no smelt and produced light catches of yellow perch, sheepshead, carp, and emerald shiners (tables 3 and 4). White bass, goldfish, gizzard shad, spottail shiners, channel catfish, alewives, trout perch, and stonecats were each taken in amounts of less than 5 pounds per drag.

Table 1 - Common and Scientific Names of Fish Taken in the 1960 Lake Erie Explorations

Common Name	Scientific Name
Alewife	<i>Alosa pseudoharengus</i>
American smelt	<i>Osmerus mordax</i>
Blue pike	<i>Stizostedion vitreum glaucum</i>
Burbot	<i>Lota lota</i>
Carp	<i>Cyprinus carpio</i>
Channel catfish	<i>Ictalurus lacustris</i>
Emerald shiner	<i>Notropis atherinoides</i>
Gizzard shad	<i>Dorosoma cepedianum</i>
Goldfish	<i>Carassius auratus</i>
Lake herring	<i>Coregonus artedii</i>
Sheepshead (fresh-water drum)	<i>Aplodinotus grunniens</i>
Spottail shiner	<i>Notropis hudsonius</i>
Stonecat	<i>Noturus flavus</i>
Trout-perch	<i>Percopsis omiscomaycus</i>
Yellow pike (walleye)	<i>Stizostedion v. vitreum</i>
White bass	<i>Roccus chrysois</i>
White crappie	<i>Pomoxis annularis</i>
White sucker	<i>Catostomus commersoni</i>
Whitefish	<i>Coregonus clupeaformis</i>
Yellow perch	<i>Perca flavescens</i>

Table 2 - Summary of 1960 Lake Erie Exploratory Trawl Catches During May 18-June 15

Basin	Depth (Feet)	Number of Drags	Catch Rate (Pounds Per Hour)		Species Composition	
			Range	Average	Species	Percentage of Catch
Western	15-20	1	-	200	Smelt Other species	100.0 1/Tr.
	25-47	8	30-340	207	Yellow perch (over 8") Yellow perch (4" to 8") Smelt Other species	9.8 5.4 84.7 Tr.
Central	18-24	1	-	1,480	Yellow perch (over 8") Yellow perch (4" to 8") Smelt Other species	5.4 67.6 27.0 Tr.
	25-49	5	24-520	172	Yellow perch (over 8") Yellow perch (4" to 8") Smelt Other species	20.8 16.2 64.0 Tr.
	50-64	7	36-760	331	Yellow perch (over 8") Yellow perch (4" to 8") Smelt Other species	19.6 11.5 68.9 Tr.
Eastern	55	1	-	116	Smelt Other species	100.0 Tr.
	75	1	-	2/	Smelt	100.0

1/Tr., less than 0.05 percent.
2/Less than 5 pounds an hour.

^{1/}State of Ohio and Bureau biologists reported vast areas of oxygen depletion near the bottom in the western and central basins during September of 1960 (Carr 1962).

CENTRAL BASIN: Exploratory trawling included a total of 64 drags during May, June, August, September, October, and November. Commercial quantities of smelt were available at various depths in that area during much of the period (tables 2-5). Exceptions were in early September and late November. In early September, extensive sounding transects and limited fishing revealed a lack of fish throughout the area. In 1959, however, excellent catches (up to 4,800 pounds an hour) were taken off Conneaut, Ohio, at 60-79 feet in September and

Table 3 - Summary of 1960 Lake Erie Exploratory Trawl Catches During August 3-September 15

Basin	Depth (Feet)	Number of Drags	Catch Rate (Pounds Per Hour)		Species Composition		
			Range	Average	Species	Percentage of Catch	
Western	25-44	2	90-106	98	Yellow perch (4" to 8")	43.9	
					Yellow perch (under 4")	5.1	
					Sheepshead	28.6	
					Other species	22.4	
Central	50-74	11	90-504	255	Yellow perch (over 8")	2.4	
						Yellow perch (4" to 8")	11.7
					Smelt	85.0	
					Other species	0.9	
Central	75-76	5	172-848	555	Yellow perch (over 8")	2.1	
						Yellow perch (4" to 8")	6.1
					Smelt	90.1	
					Other species	1.7	
Eastern	15-24	1	2/	2/	Smelt	100.0	
						Yellow perch (over 8")	8.3
						Yellow perch (4" to 8")	13.9
	50-74	11	0-160	42	Smelt	65.6	
					Burbot	12.2	
					Other species	1/Tr.	
Eastern	76-80	4	80-2,450	1,310	Yellow perch (over 8")	0.5	
						Smelt	98.5
						Burbot	1.0
					Other species	Tr.	

Tr., less than 0.05 percent.
 Lower limit of range was less than 5 pounds an hour.

Table 4 - Summary of 1960 Lake Erie Exploratory Trawl Catches During October 4-16

Basin	Depth (Feet)	Number of Drags	Catch Rate (Pounds Per Hour)		Species Composition		
			Range	Average	Species	Percentage of Catch	
Western	15-24	2	2/1-62	31	Carp	100.0	
						Other species	1/Tr.
Western	25-49	6	2/1-64	20	Emerald shiners	95.0	
						Carp	5.0
					Other species	Tr.	
Central	44-49	1	-	122	Carp	100.0	
						Other species	Tr.
Central	50-75	14	2/1-1,350	364	Yellow perch (4" to 8")	0.6	
						Smelt	97.8
					Other species	1.6	
Eastern	43-49	1	-	3/	Yellow perch (over 8")	50.0	
						White bass	50.0
		50-74	4	2/1-8	2	Burbot	100.0
					Other species	Tr.	
Eastern	75-99	8	82-940	474	Yellow perch	0.2	
						Smelt	99.6
					White suckers	0.2	
					Other species	Tr.	
	127	1	-	380	Smelt	100.0	

Tr., less than 0.05 percent.
 Lower limit of range was less than 5 pounds an hour.
 Less than 5 pounds an hour.

ly October during commercial-type fishing. In early October 1960, smelt were heavily concentrated within a narrow depth range (72-75 feet). The average catch rate for 6 drags at these depths was 890 pounds an hour. Few or no smelt were taken at lesser depths. In late November, smelt apparently were scattered and catches were smaller (up to 330 pounds per hour). Best catches of smelt by month in 1960 from that basin were as follows: May 375-400 pounds an hour at 52-53 feet; June 400 pounds an hour at 18-22 feet and 180-240 pounds an

hour at 58-64 feet; August 400-848 pounds an hour at 65-76 feet; October 244-840 pounds an hour at 72-73 feet and 1,260-1,320 pounds an hour at 74-75 feet; November 214-330 pounds an hour at 40-45 feet.

Good catches of yellow perch were taken occasionally in the central basin. The proportion of salable-size perch (over 8 inches) varied from 8 to 80 percent. This percentage could be raised considerably by the use of larger cod-end mesh. Best average catches by month were at the following depths: May 250-360 pounds an hour at 52-53 feet; June 1,080 pounds an hour at 18-22 feet; August 140 pounds an hour at 50 feet; September 180 pounds an hour at 60 feet.

The following species were each taken from that basin in amounts of 5 pounds or less per drag: white bass, burbot, emerald shiners, spottail shiners, lake herring, whitefish, trout-perch, sheepshead, alewives, gizzard shad, and white crappie.

EASTERN BASIN:
Forty-four drags were completed in that basin--only 2 before August. Catches in August were small at all depths fished (15-64 feet). In early September, however, the largest smelt catch (2,450 pounds per hour) of the 1960 fishing was taken at 78 feet off Erie, Pa. This concentration of smelt was narrowly distributed and could not be located when the area was revisited several days later. Catches were light, up to 180 pounds per hour, at lesser depths in September. Good smelt catches (up to 900 pounds a hour) were made at 60-75 feet, and catches of up to 1,500 pounds an hour were taken at greater depths (82-85 feet) in September of 1959 (Sand and Gordon 1960).



Fig. 3 - A good catch of smelt taken off Erie, Pa., in September 1960 by the M/V *Active*

Catches of smelt were again good in October 1960 at depths greater than 72 feet: 364 pounds an hour at 73-78 feet; 340-360 pounds an hour at 82-90 feet; 640-940 pounds an hour at 90-98 feet; 380 pounds an hour at 127 feet. Fair coverage of depths from 25 to 98 feet in November produced smelt catches ranging from only a few pounds to 136 pounds per hour. No time during 1960 did fishing in the eastern basin yield commercial quantities of smelt at depths shallower than 60 feet. Yellow perch were not taken in commercial quantities in the eastern basin.

Table 5 - Summary of 1960 Lake Erie Exploratory Trawl Catches During November 7-22

Basin	Depth (Feet)	Number of Drags	Catch Rate (Pounds Per Hour)		Species Composition	
			Range	Average	Species	Percentage of Catch
Central	6-24	3	54-138	108	Smelt Burbot Other species	92.9 5.5 1.6
	25-49	7	6-330	140	Smelt Burbot Gizzard shad Other species	96.1 1.2 2.0 0.7
	50-74	10	2/1-210	62	Smelt Carp Alewife Other species	81.6 10.7 6.1 1.6
Eastern	25-49	6	2/1-136	23	Smelt Other species	100.0 1/Tr.
	50-74	4	12-122	64	Smelt Other species	100.0 Tr.
	75-98	2	2/1-20	10	Smelt Other species	100.0 Tr.

Tr., less than 0.05 percent.

Lower limit if range was less than 5 pounds an hour.

Other species that collectively amounted to only 1.2 percent of the total catch were alewives, blue pike, stonecat, gizzard shad, trout-perch, white bass, emerald shiners, burbot, lake herring, yellow pike, and white suckers.

Table 6 - Summarization of 1959-60 Lake Erie Smelt Trawling Explorations by Cruise for M/V Active

Date	Basin	Fishing Depth (Fathoms)	Number of Drags	Average Time Per Drag (Minutes)	Catch Rate (Pounds Per Hour)	
					Range	Average
1959						
April 21-May 13	Western	2-6	14	25	0-50	15
May 2-24	Central	2-13	45	30	0-600	195
May 6-23	Central	6-13	66	45	0-500	137
August 3-17	Central	5-25	31	34	0-500	97
Sept. 27-Sept. 6	Central	5-25	29	34	0-1,200	250
	Eastern					
Sept. 22-Oct. 8	Central	9-13	39	60	0-4,800	1/1,462
October 20-27	Central	5-13	14	29	0-60	15
November 9-23	Western	2-12	16	33	0-20	6
1960						
May 18-28	Western Central	2-10	16	28	0-400	202
June 6-16	Western Central Eastern	3-13	10	27	0-400	145
August 3-19	Western Central Eastern	2.5-12.5	21	31	0-790	244
Aug. 30-Sept. 23	Central Eastern	8-13	14	23	0-2,450	401
October 4-19	Western Central Eastern	2.5-16.5	37	28	0-1,320	247
November 7-22	Central	1-17	32	32	0-260	70

This high average resulted from high-volume commercial-type fishing on heavily concentrated smelt. All other average catches are the result of random exploratory fishing assessments and are not a true indication of potential commercial production rates.

CONCLUSION

The 1960 explorations substantiated the 1959 findings that smelt can be taken on a commercial scale with trawls in the central and eastern basins of Lake Erie throughout most of the fishing season (table 6), and extended knowledge concerning seasonal distribution and availability to trawls of smelt and other species. Temperature plays an important role in the seasonal distribution of smelt. At times, smelt were concentrated within a very narrow depth range; consequently, it is recommended that commercial vessels be equipped with good electronic fish-finders for this method of fishing. Data indicate that when smelt are concentrated in commercial quantities, other species are scarce; thus sorting offers no problem.

APPENDIX

A detailed fishing log, showing geographic position, depth, date, catch, and related data for each drag is available as an appendix to the reprint of this article. Write for Separate No. 702, which includes "Table 7 - Fishing Log, Trawl Stations, 1960, M/V Active, Lake Erie."

LITERATURE CITED

- | | |
|--|---|
| <p>CARR, JOHN F.
1962. Dissolved Oxygen in Lake Erie, Past and Present. <u>Proceedings of the Fifth Conference on Great Lakes Research</u>, Great Lakes Research Division, University of Michigan, Publication no. 9, pp. 1-14.</p> <p>GORDON, WILLIAM G., and KEITH D. BROUILLARD
1961. Great Lakes Trawler Conversion. U. S. Fish and Wildlife Service, Fishery Leaflet 510, 15 pp.</p> <p>HATCHER, HARLAN
1945. Lake Erie. Bobbs-Merrill Co., New York, New York, 416 pp.</p> | <p>SAND, REIDAR F., and WILLIAM G. GORDON:
1960. Exploratory Fishing in Lake Erie, September 1958-November 1959. <u>Commercial Fisheries Review</u>, vol. 22, no. 6 (June), pp. 1-12. (Also Separate No. 590.)</p> <p>WRIGHT, STILLMAN
1955. Limnological Survey of Western Lake Erie. U. S. Fish and Wildlife Service, Special Scientific Report: Fisheries No. 139, 341 pp.</p> |
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COD CROSSES THE ATLANTIC

Scientists at the Lowestoft Fisheries Laboratory have reported a remarkable migration by a cod. The fish was tagged in the North Sea in June 1957 and was recaptured by a Polish factory trawler on the northeastern slope of the Grand Bank, Newfoundland, in December 1961. During its $4\frac{1}{2}$ years of freedom it had grown from $22\frac{1}{2}$ to $29\frac{1}{2}$ inches.

Although it is generally accepted that cod are capable of crossing deep-water barriers between fishing banks, this is probably the first record of a complete crossing of the North Atlantic by this species. (Scottish Fisheries Bulletin No. 20, December 1963.)