An Attempt at Assessing Abundance and Distribution of Pink Salmon (Oncorhynchus gorbuscha) Prior to Their Entry of Spawning Streams.

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AN ATTEMPT AT ASSESSING ABUNDANCE AND DISTRIBUTION OF PINK SALMON (*Oncorhynchus gorbuscha*) PRIOR TO THEIR ENTRY OF SPAWNING STREAMS

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ABSTRACT

Kelso, J.R.M., and R.H. Collins. 1984. An attempt at assessing abundance and distribution of pink salmon (Oncorhynchus gorbuscha) prior to their entry of spawning streams. Can. MS Rep. Fish. Aquat. Sci., 1772. i-iv + 16 pp.

Other than observations made in the spawning streams, the abundance and distribution of pink salmon (Oncorhynchus gorbuscha) in the Great Lakes is virtually unknown. In order to determine the relative abundance and habitat selection prior to spawning, we sampled the North Channel of Lake Huron using acoustic techniques, trawling and experimental gill nets. The results indicated that there was no resident population of this species in the North Channel and that their entry to the area began at the end of July when they tended to select shallow, 7 m, water and to orient to the shoreline.

RESUME

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Outre les observations effectuées dans les cours d'eau où ils frayent, on ne connaît pratiquement pas le nombre et la répartition des saumons roses (Oncorhynchus gorbuscha) dans les Grands Lacs. De façon à connaître leur nombre relatif et leur habitat avant la fraie, nous avons échantillonné le chenal nord du lac Huron grâce à des méthodes acoustiques, en pêchant au chalut et en utilisant des filets maillants expérimentaux. Les résultats ont révélé que cette espèce n'était pas représentée de façon permanente dans le chenal nord et que les saumons roses ne pénétraient dans cette zone qu'à la fin de juillet, lorsqu'ils ont tendance à choisir des eaux peu profondes (moins de sept mètres) et à se diriger vers le rivage.

INTRODUCTION

Pink salmon (Oncorhynchus gorbuscha) from the North Pacific Ocean were introduced to Lake Superior at Thunder Bay in 1956 (Emery, 1981). From an initial introduction of 21,000, they have so successfully survived the transition from the anadromous to the freshwater life-cycle that they are now a self-perpetuating population which has spread throughout the Great Lakes (Kwain and Lawrie, 1981). The normal two-year life cycle has produced major spawning runs to tributaries of the Great Lakes during odd years, although smaller even year runs are developing (Kwain and Lawrie, 1981).

The young leave the streams in the spring and move to open water where they remain until reaching maturity. Very little is known about the life history of this species beyond observations made in the spawning streams (Withler and Kwain unpublished manuscript). This study was conducted to determine the distribution of pink salmon and their migration in open water prior to entry of spawning streams. We chose the North Channel of Lake Huron for this study because of its active commercial fishery. Also, the runs into tributaries there are under study by the Ontario Ministry of Natural Resources.

METHODS

Transects were run with an acoustic census system (Kelso et al., 1974; Kelso and Minns, 1975; White, 1976) to estimate numerical abundance of fish in the water column at depth. Three principal areas of the North Channel (Fig. 1) were chosen to represent the variety of habitat including lake depths and distances from spawning streams. These three transect lines were retraced by towing a mid-water trawl at the depths where targets (fish) were observed. Two sizes of trawls were used during this survey with openings of 114 and 18 m^2.

Besides the three survey transects, numerous search patterns were used throughout the study area (using the visual record only) to find aggregations of fish. If an area showed populations of fish, it was sampled with midwater trawls to assess species composition.

Interviews with commercial fishermen aided in the direction of our search patterns as well as providing another source of data. As a result of these interviews, gangs of experimental gill nets, consisting of seven joined panels (stretched mesh sizes: 381, 508, 635, 762, 889, 1016, 1270 mm) were set overnight on the bottom in the nearshore areas (Fig. 1) at the end of August. All net sets were in shallow water of less than 7 m depth.

Pink salmon were also purchased from local commercial fishermen.

Temperature profiles were developed from an electronic bathythermograph.

RESULTS AND DISCUSSION

The study commenced on July 19th and ended August 25th, 1983. Echo analysis and search patterns found few fish in the upper water column (20 m depth) throughout the major portion of the study period (Fig. 2). Near-surface and mid-water trawls failed to produce any fish in the upper 10 m water column until the end of August (Table 1).

Acoustic runs showed aggregations of fish from 50 to 75 m in the deep channels at the outlets to Lake Huron during the early part of the survey. Fish were also present at or near the bottom only of shallower areas. Deep-water trawls to 50 m (limit of cable) contained increasing numbers of fish from 35 to 50 m, the majority of which were rainbow smelt (Osmerus mordax), with incidental catches of white suckers (Catostomus commersoni), and lake whitefish (Coregonus clupeaformis). Acoustics and trawling on the shallow transect No. 3

(depth ≈15 m) at the end of July showed a large population of rainbow smelt with incidental numbers of white suckers, although few fish appeared during other periods. At the end of August, fish appeared in schools in the nearshore areas (4) at moderate depths (25 m). Targets were spread throughout the water column and trawls at mid-depth yielded large schools of alewife (Alosa pseudoharengus), small catches of smelt, and occasional white suckers and whitefish.

Incidental captures of pink salmon began to appear in the commercial catches of July 30 (Fig. 3). The initial catches were in the shallow channel leading to Lake Huron through St. Mary's River. The major catches occurred after mid-August and increased through September (MNR catch data). Catches were in the nearshore shallow areas (5 m) including reports of pink salmon becoming entangled in gill nets on the surface at the time of lifting (personal communication with commercial fishermen).

Of the experimental gill net sets (Table 2) in the nearshore area, one set yielded 88 percent of the total pink salmon collection. All mesh sizes of gill nets used (381 to 1270 mm) proved effective in the collection of pinks, since they were caught throughout the length of these nets regardless of mesh or fish size.

The surface waters (< 5 m) in August ranged from 18.5 to 21.5°C. As there was no thermocline above 10 m, pink salmon moving at the surface or nearshore remained in water temperatures greater than 18°C.

Acoustic census and fishing in the North Channel produced no evidence of a resident population of pink salmon. Availability of smelt and alewife populations for food did not appear to play a role in their distribution. Gill net catches and the commercial fishery suggest that the migrating fish remained in the shallow waters along shore in preparation for their entry to the streams. Yields from gill net sets were sporadic and nets reset in the same location did not provide reproducible catches. This fact, coupled with the trend of catches in the commercial fishery (increasing near the open lake first, followed by areas near spawning streams), suggest that travel is extensive prior to entry of the spawning stream. The population of pink salmon using spawning streams of the North Channel were therefore transients entering the North Channel from July 30 onward. These spawning pink salmon usually travelled nearshore and in waters of less than 7 m.

Fish taken in the late summer prior to entering tributaries still had firm palatable flesh and resulted in a commercial harvest of more than 12.5 tonnes in the study area (MNR catch records). In

experimental net sets, there was no apparent discrimination in the catch rate of varying mesh sizes (Fig. 4). Fish observed entering commercial nets at the surface at the time of lifting and our own catches offer a clue to their distribution during the migration, but there is no evidence for preferred habitat selection for the remainder of their life cycle.

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TABLE 1. Volume filtered and catches of mid-water trawls, North Channel, Lake Huron 1983.

Date	Water Depth (Metres)	Trawl Depth Headrope (Metres)	Trawl Duration (Mins.)	Water Volume Filtered ($m^3 \times 10^6$)	Catch by Species
July 19	45	5	30	3.65	0
	45	38	10	0.57	1 smelt
July 20	55	35	10	0.12	0
	55	35	60	1.61	8 smelt
	50	45	30	0.91	6 smelt
	60	50	30	0.91	10 smelt
	60	50	40	1.04	102 smelt, 1 whitefish
	55	50	65	1.93	156 smelt
July 22	65	50	30	4.22	10 smelt
	65	55	40	4.79	105 smelt, 1 whitefish
July 26	15	10	15	0.44	13 smelt
	15	10	10	0.22	850 smelt, 1 sculpin, 1 white sucker
	25	15	60	9.46	134 smelt, 1 whitefish, 1 white sucker
	25	15	60	8.44	75 smelt, 2 whitefish
July 27	25	20	65	2.05	174 smelt, 1 sculpin, 1 white sucker
	15	10	60	1.83	0
	45	35	105	17.90	4 smelt
	60	50	60	8.43	14 smelt
Aug. 17	27	15	60	1.61	600 smelt, 9 whitefish 6 alewife
Aug. 18	60	38	90	14.93	77 smelt, 1 alewife
Aug. 19	15	10	20	3.42	7 smelt
Aug. 22	27	20	60	9.12	78 smelt, 1 whitefish
Aug. 23	27	13	65	13.11	8 smelt, 1 whitefish, 1500 alewife
	27	13	70	13.11	4 smelt, 110 alewife, 1 white sucker

TABLE 2. Catches by species of experimental gill net sets in the North Channel, Lake Huron, 1983.

Gill Net Set	Duration / Net Length	Pink Salmon	White Sucker	Small Mouth Bass	Walleye	Red Horse Sucker	Rock Bass	Yellow Perch	Cisco	North Pike	Whitefish	Rainbow Smelt	Brown Bullhead
Aug. 23													
1	18.5 hrs / 128 m	2	34	3	1	1	5	8	1				
2	20.25 / 64		11				4	2		2			
3	16.5 / 64	3	69								7	3	
4	22.25 / 94	54	341		1		16	5	4	1	2	1	
Aug. 24													
5	22.5 / 27	2	31			1	2				1		
6	23.75 / 128		126			1					19	1	
Aug. 25													
7	22.0 / 64		26				11	4			2	3	
8	22.75 / 64		27		1	1	4	7		1			2
TOTAL		61	665	3	3	4	42	26	5	4	31	8	2
% of Total Catch		7.1	77.9	0.4	0.4	0.5	4.9	3.0	0.6	0.5	3.6	0.9	0.2

LIST OF FIGURES

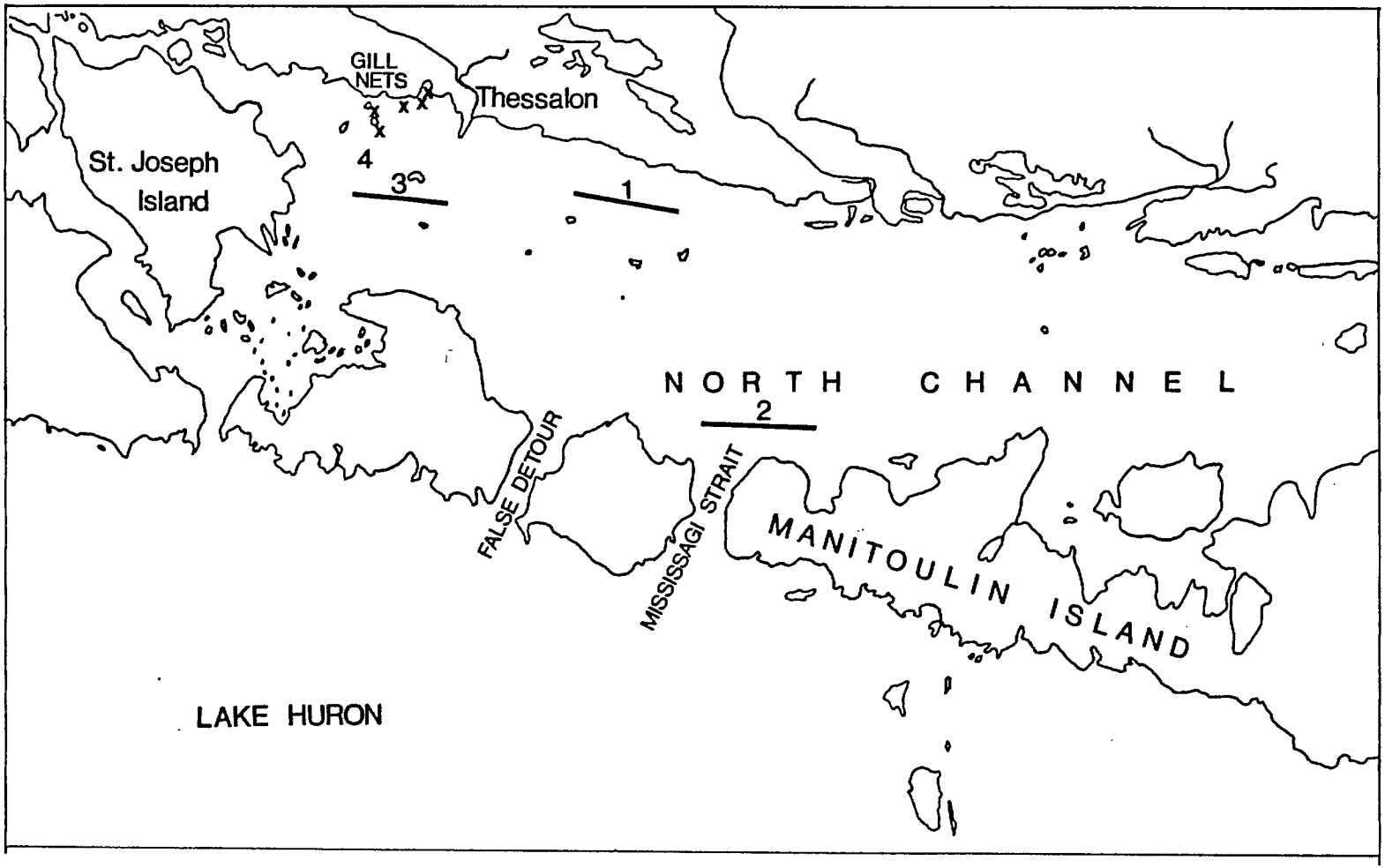

FIGURE 1: The North Channel of Lake Huron showing transects for regular acoustic monitoring (bars with numbers 1 to 3) an auxiliary transect (4) and locations of gill net sets (x).

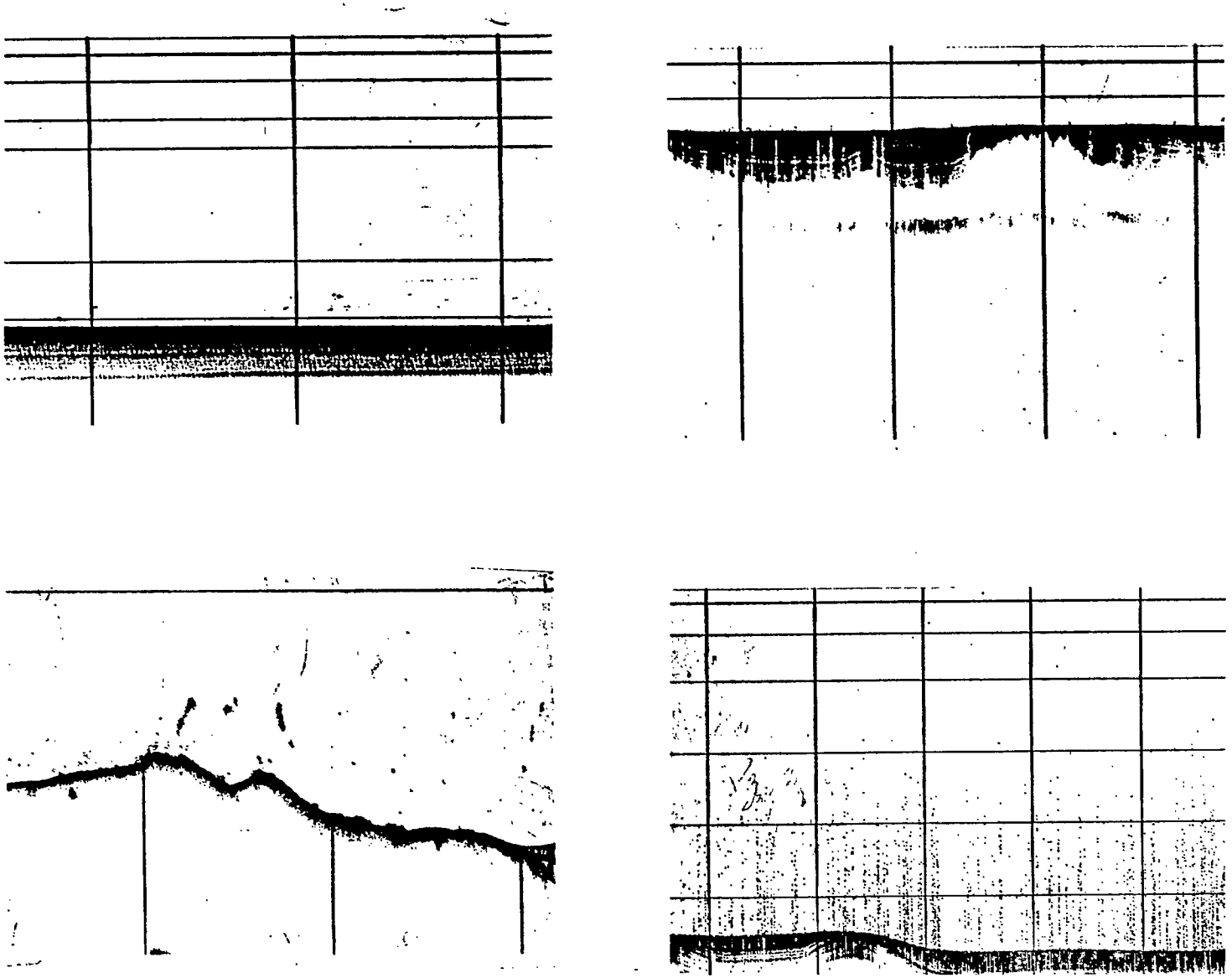

FIGURE 2: Echograms from transect locations 4 (2 echograms at left), 1 (upper right), and 2 (lower right). Horizontal lines are depth marks beginning at 3, 5, 10, 20, 30, and 40 m.

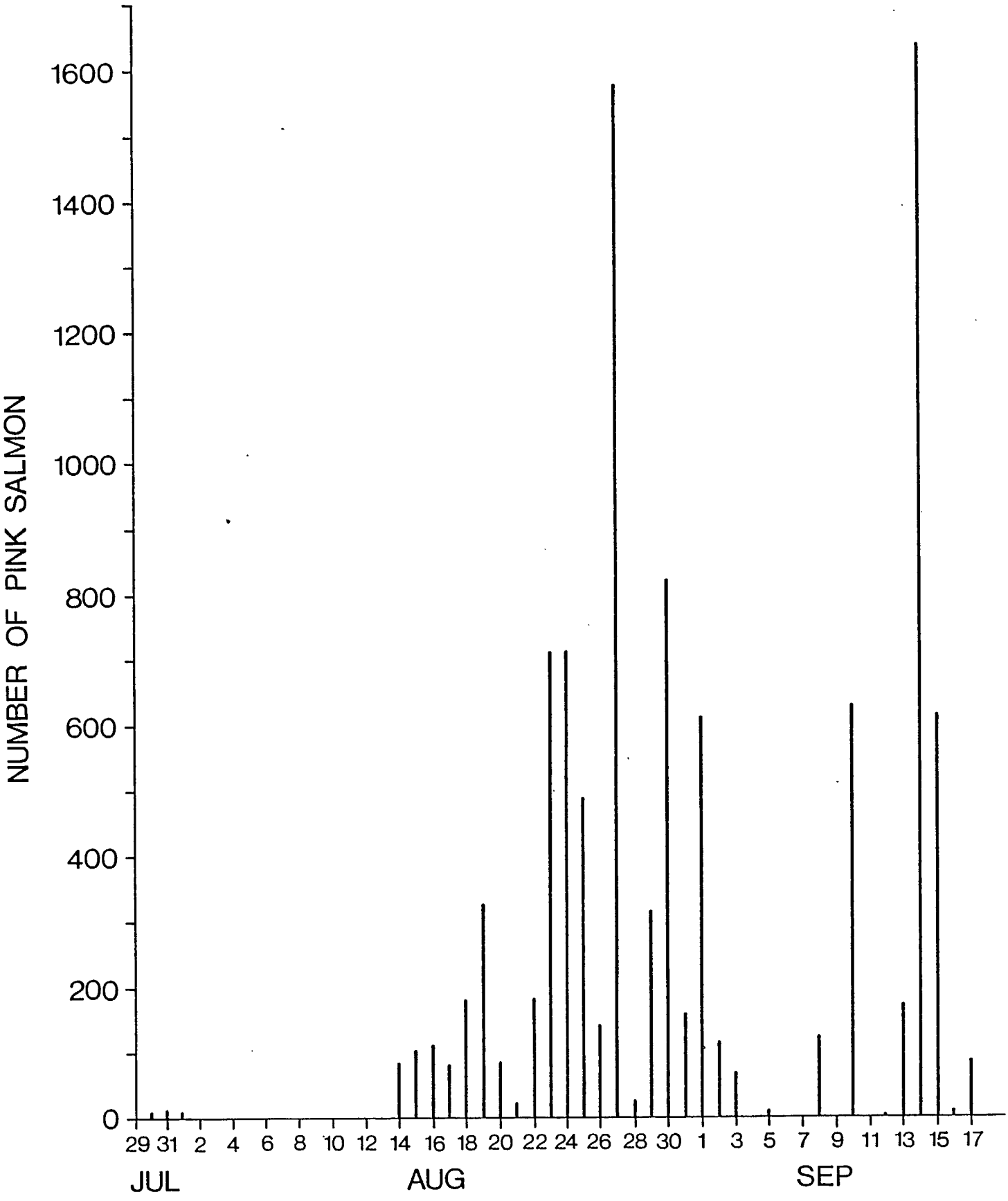

FIGURE 3: Incidence of pink salmon in the commercial gill net catches of fishermen in the North Channel and adjacent to the interconnecting straits, 1983.

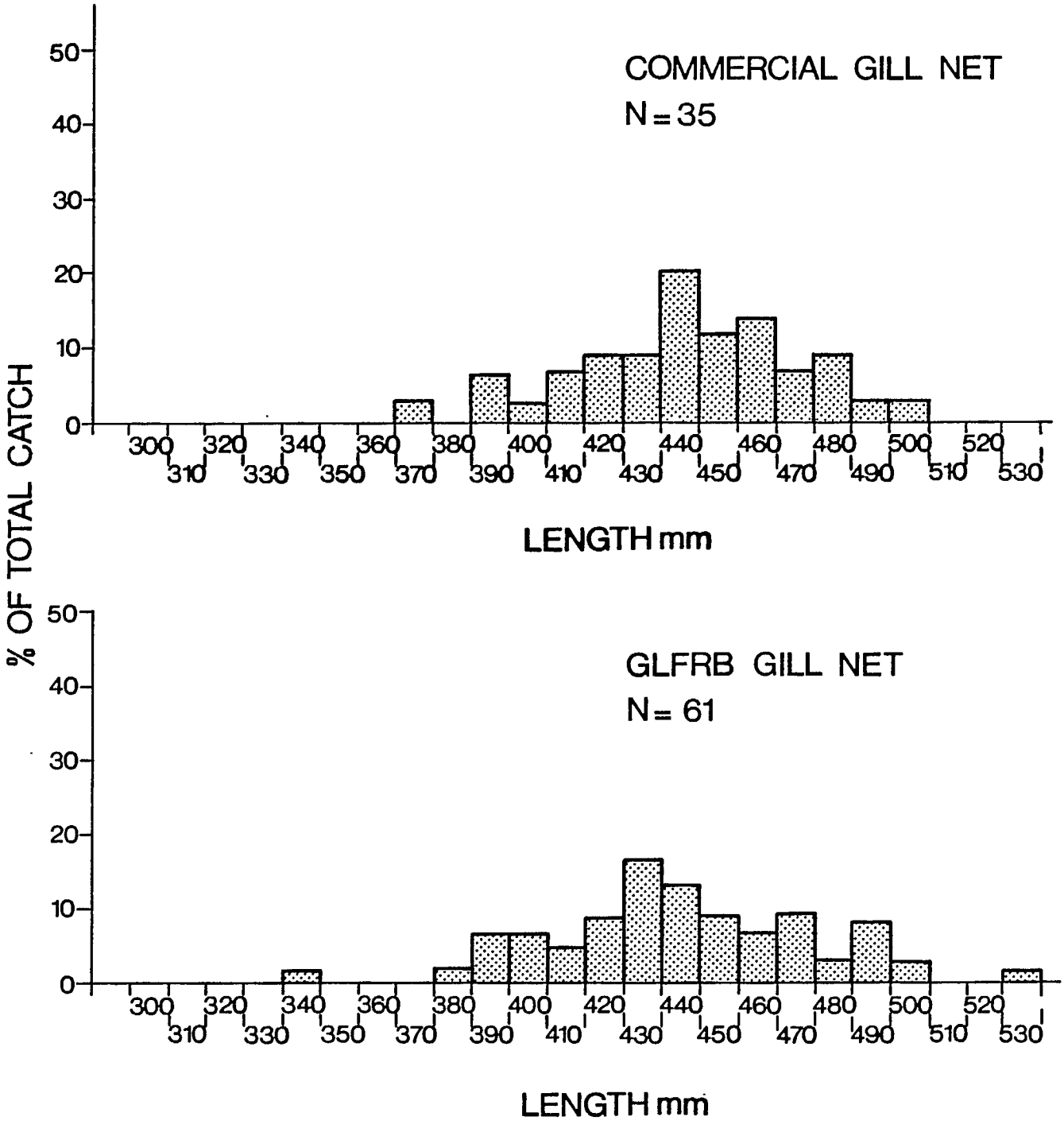

FIGURE 4: Size distribution of pink salmon caught by experimental (GLFRB) and commercial gill net set in the North Channel, Lake Huron, 1983.