

Northwest Atlantic



Fisheries Organization

Serial No. N218

NAFO SCR Doc. 80/IX/144

ANNUAL MEETING OF SCIENTIFIC COUNCIL - SEPTEMBER 1980

Results of Small Cod Surveys in Eastern Newfoundland During 1959-64

by

W. H. Lear, A. M. Fleming¹ and R. Wells

Department of Fisheries and Oceans, Research and Resource Services
Northwest Atlantic Fisheries Center, P. O. Box 5667
St. John's, Newfoundland, Canada

Introduction

During 1959-64, regular research vessel cruises, aimed mainly toward obtaining some understanding of the distribution and abundance of pre-recruit Atlantic cod (*Gadus morhua*) along the east coast of Newfoundland and also the collection of juvenile cod for biological examination, were conducted around the coast of Newfoundland from St. Mary's Bay to Notre Dame Bay inclusive. This information was intended to complement data collected by research vessels offshore. It was apparent from casual observations around the coast that large numbers of young cod were present quite close to shore in shallow water along the east coast. The catches obtained by the beach seine during these cruises are assumed to be crude indices of abundance of juvenile cod in these inshore areas. The inshore data were analyzed and compared with indices of abundance of 3-yr-old cod in Divs. 3K and 3L as well as estimates of 4- and 5-year-old cod from cohort analyses of Divs. 3K, 3L and 2J+3K+3L combined to determine if juvenile cod surveys in eastern Newfoundland could be used as abundance indicators of year-classes which subsequently would enter the fishery.

Methods and Materials

During October 1959 and September-October 1960-64, juvenile cod surveys were conducted on board the 15 m research vessel PARR along the coast of eastern Newfoundland from Conception Bay to Notre Dame Bay during 1959 and from St. Mary's Bay to Notre Dame Bay during 1960-64 (Table 1, Fig. 1). Much of the effort during 1959 and to some degree during 1960 was directed toward searching for suitable locations for beach seining in areas where juvenile cod would be most likely to occur. On the suitable beaches, the juvenile cod were caught using a beach seine with mesh sizes of 15mm in the wings and belly, 11mm in the lengthening piece and 9mm in the codend (Fig. 2). The codend was lined with a fine meshed nylon liner. Floats were attached to the headropes and to hauling lines and an oak stick (75 cm long) was attached at the end of each wing to aid in opening the mouth of the seine (Fig. 3). The lengths of warp used on each end of the net were each about 55 m in length. The net was set in depths of 1-11 m but mainly in 4 to 6m (overall average of 1959-64 was 4.8m). The warps and nets were set out from a small boat. The end of the warp was held by a person on the beach. The warp and net were set out in a semicircle with the end of the second warp being brought back to a second person at the beach. The length of warp used generally varied with the type of beach surveyed. The net was then hauled toward the beach. With the approach of the net toward the beach, persons hauling the net moved gradually toward each other (Fig. 4), as they hauled the net onto the beach. The contents of the net were then examined and separated by species, counted and measured. The juvenile cod were measured, tagged, sampled for otoliths, scales, sex and vertebrae.

¹Present Address: 14 Amherst Heights
St. John's, Newfoundland
A1E 3J1

Results

The number of tows, average catch/tow, total catch in the 3 best tows and the highest tow for each area are shown in Tables 2-5. On the assumption that the abundance of juvenile cod in the inshore area would be reflected in the numbers of 4- and 5-yr-old cod subsequently recruited to the fishery several years later in NAFO Div. 2J, 3K and 3L, the catch rates (average catch/tow, total catch in the 3 best tows and the highest catch in a single tow for each area) of 0+ and 1-yr-old cod from each area during 1959-64 were regressed separately against the population estimates of 4-yr-old and 5-yr-old cod in the 2J+3K+3L stock 4 and 5 years later obtained from cohort analyses (Wells and Bishop, MS 1980)

For the St. Mary's Bay data, there were significant positive correlations between the numbers of cod in 2J+3K+3L of age 5 years and (1) the average numbers of 0+ cod/tow, (2) the numbers of 0+ cod in the three best tows and (3) the numbers of 0+ cod in the highest tows. All the other regressions, though not significant were positive indicating that there was some relationship between the results of the juvenile cod surveys in St. Mary's Bay and the subsequent total numbers of 5-yr-old cod in 2J+3K+3L.

For the Southern Shore area there were only two significant positive correlations. One was between the numbers of age 4 cod in 2J+3K+3L and the number of 0+ cod in the 3 best tows while the other was between the numbers of age 5 cod in 2J+3K+3L and the number of 0+ cod in the highest tow. All the other correlations were positive though not significant.

For the survey data from Conception, Trinity, and Bonavista bays there were no significant correlations between the indices of abundance of 0+ and 1-yr-old cod and the numbers of ages 4 and 5 in the 2J+3K+3L stock.

For the Notre Dame Bay survey data there were four significant positive correlations. These were between the numbers of age 4 in 2J+3K+3L and (1) the numbers of 1-yr-old cod in the 3 best tows and (2) the numbers of 1-yr-old cod in the highest tow. Also there were significant positive correlations between the numbers of 5-yr-old cod in 2J+3K+3L and (1) the numbers of 1-yr-old cod in the 3 best tows and (2) the number of 1-yr-old cod in the highest tow for that area. All other correlations though not significant, were positive.

The numbers of 0+ and 1-yr-old cod from the surveys in St. Mary's Bay and the Southern Shore were regressed separately against the numbers of 4- and 5-yr-old cod in Div. 3L estimated by cohort analysis (Wells, MS 1972). No significant correlations were found between the indices of abundance of 0+ and 1-yr-old cod in either St. Mary's Bay or Southern Shore and the total numbers of 4- and 5-yr-old cod in 3L.

The indices of abundance of 0+ and 1-yr-old cod from the juvenile cod surveys in each of Conception, Trinity, Bonavista and Notre Dame bays were regressed against the numbers of 4- and 5-yr-old cod in Div. 3K estimated from cohort analysis (Wells MS 1972). There were no significant correlations between the indices of 3K stock compared for either Conception, Trinity or Bonavista bays. There were two significant positive correlations for the Notre Dame Bay data. These correlations were between the numbers of 4-yr-old cod in 3K and: (1) the number of 1-yr-old cod in the 3 best tows, and (2) the numbers of 1-yr-old cod in the highest tow for that area.

For the indices of abundance of juvenile cod from each of St. Mary's Bay, Southern Shore, Conception, Trinity, Bonavista, and Notre Dame bays, a linear regression was fitted to the catches of 3-yr-old cod obtained from Soviet small fish surveys from the NAFO Div. 3K and 3L (Konstantinov and Noskov MS 1979). No significant correlations were found in any of these areas between indices of abundance of juvenile cod inshore and the offshore indices in 3K or 3L.

Discussion

The indices of abundance of juvenile cod in the inshore bays of eastern Newfoundland obtained from the survey data of 1959-64 are not reflected consistently in the estimates of stock sizes or other indices of abundance of 3-, 4-, and 5-yr-old of 2J+3K+3L cod of the same year-class as the juveniles surveyed.

This is not surprising in view of the large variances associated with the recent biomass surveys for groundfish in this area. Possibly an even greater source of variation would be that of the sweep of the beach seine since the length of warp had to be varied to suit the type of beach which was being surveyed. Thus the area swept by the seine is not standardized. The abundance estimates of juveniles inshore would be expected to be subject to an equal or possibly even greater environmental factor such as wind, tide, temperature, run off, and wave action associated with each beach surveyed. Also there is a very limited time series of 5 or 6 years of data.

Also of great importance was the opportunistic nature of the juvenile cod surveys. They were generally conducted near beaches which were free of boulders or other impediments to the seining operation. The juvenile cod may not have preferred the type of beach upon which the observers preferred to survey. Also the type of beach varied from area to area and within area, thus providing additional variance factors. The surveys were intended mainly to obtain data on the general distribution and abundance of young cod and to collect juvenile cod for biological sampling. Where the seining method was not satisfactory, the biological sampling was complemented by use of baited hooks, and spinners. The result of these other sampling gears have been omitted from this report.

If further surveys on juvenile cod abundance are contemplated the following points should be considered:

1. the bay or area surveyed should be stratified into area of similar beach types and each stratum sampled by beach type and adjusted up to the total area of beach type.
2. the beach types where juvenile cod are prevalent should be sampled on at least two different occasions per year preferably summer and autumn to correct for the biases introduced by the effect of environmental factors on distribution.
3. the survey should be continued in those bays which show the highest potential for providing the most reliable abundance indices.
4. the survey should be conducted with the use of a beach seine and a small shrimp trawl so that beach areas could be covered as well as areas just outside the influence of the beach area. The shrimp trawl could be fished in areas where there were no beaches but where there was suitable habitat for juvenile cod.

In summary any attempts to conduct juvenile cod surveys in inshore areas are going to have to deal with the problem of standardizing the area swept by the net because of the varying contours of the beach and associated impediments such as boulders and rock projections.

In addition to the above, and because of difficulties associated with beach seine surveys, it is suggested that other methods should be considered to provide ancillary data on abundance such as visual observations and estimates of school sizes using small boats in shallow water and from air surveillance from planes or helicopters using low level light cameras during night to detect schools of juvenile cod.

References

- Konstantinov, K. G., and A. S. Noskov. MS 1979. Report of USSR investigations in the ICNAF Area 1978. ICNAF Sum. Doc. 79/VI/25, Ser. No. 5465, 28 p.
- Wells, R. MS 1972. Virtual population assessment of cod in ICNAF Div. 3K and 3L. ICNAF Res. Doc. 71/16, Ser. No. 2700, 10 p.
- Wells, R. and C. Bishop. MS 1980. Some recent changes in the status of the cod stock in Div. 2J+3KL. NAFO SCR. Doc. 80/VI/101, 15p.

Table 1. Areas and dates of juvenile cod surveys with the beach seine in eastern Newfoundland during 1959-64.

Area	Year					
	1959	1960	1961	1962	1963	1964
St. Mary's Bay	-	Sept. 12-20	Sept. 8-14	Sept. 17-21	Sept. 19-25	Sept. 5-9
Southern Shore	Sept. 23-24	-	Sept. 15	Sept. 22	Sept. 26	Sept. 18
Conception Bay	Oct. 2-8	Sept. 28-29	Sept. 21-23	Sept. 26-27	Oct. 5-7	Sept. 24-25
Trinity Bay	Oct. 10-12	Oct. 3-4	Sept. 25-30	Oct. 1-14	Oct. 10-12	Sept. 29-Oct. 3
Bonavista Bay	Oct. 16	Oct. 6-10	Oct. 3-7	Oct. 11-16	Oct. 17-19	Oct. 6-8
Notre Dame Bay	Oct. 23, 26	Oct. 17-27	Oct. 9-24	Oct. 17-26	Oct. 21-31	Oct. 12-22

Table 2. Numbers of tows made with the beach seine in various areas in eastern Newfoundland during 1959-64.

Area	Number of tows					
	1959	1960	1961	1962	1963	1964
St. Mary's Bay	-	13	19	12	14	19
Southern Shore	2	-	8	6	2	7
Conception Bay	18	16	14	11	8	11
Trinity Bay	10	6	22	27	21	30
Bonavista Bay	8	11	14	20	12	14
Notre Dame Bay	3	26	49	60	65	68

Table 3. Average numbers of juvenile Atlantic cod caught per tow by beach seine in various areas in eastern Newfoundland during 1959-64.

Area	Average number/tow (age 0+)					
	1959	1960	1961	1962	1963	1964
St. Mary's Bay	-	0.15	4.58	9.92	7.79	0.42
Southern Shore	0.00	-	3.25	18.17	66.50	4.00
Conception Bay	2.72	3.94	7.64	11.27	3.25	0.20
Trinity Bay	242.30	151.00	16.00	28.52	28.29	40.47
Bonavista Bay	27.63	8.27	50.69	43.70	15.17	10.57
Notre Dame Bay	1.67	16.81	5.92	46.46	15.86	11.72

Area	Average number/tow (Age 1)					
	1959	1960	1961	1962	1963	1964
St. Mary's Bay	-	81.85	32.26	14.17	70.57	45.11
Southern Shore	3.00	-	22.88	12.17	246.50	67.43
Conception Bay	9.72	142.88	59.57	8.91	25.75	89.70
Trinity Bay	14.20	59.00	72.59	8.81	20.86	56.40
Bonavista Bay	2.25	122.09	3.29	5.70	3.92	104.21
Notre Dame Bay	1.00	45.04	4.61	7.90	14.97	25.65

Table 4. Total numbers of juvenile Atlantic cod caught in the 3 best tows by beach seine in various areas in eastern Newfoundland during 1959-64.

Area	Total of 3 best tows (age 0+)					
	1959	1960	1961	1962	1963	1964
St. Mary's Bay	-	2	68	106	84	6
Southern Shore	0*	-	19	104	200*	21
Conception Bay	49	45	102	107	19	2
Trinity Bay	2422	906	264	591	415	841
Bonavista Bay	167	81	677	551	139	127
Notre Dame Bay	5	272	162	1562	327	431

Area	Total of 3 best tows (age 1)					
	1959	1960	1961	1962	1963	1964
St. Mary's Bay	-	670	392	116	943	711
Southern Shore	9*	-	142	71	740*	429
Conception Bay	81	1600	493	67	141	776
Trinity Bay	135	337	1086	176	303	700
Bonavista Bay	18	1113	40	63	39	789
Notre Dame Bay	3	402	96	194	422	659

* adjusted up to total for 3 catches on basis of average of the 2 sets made.

Table 5. Total numbers of juvenile Atlantic cod caught in the highest tow by beach seine in various areas in eastern Newfoundland during 1959-64.

Area	Number in highest tow (Age 0+)					
	1959	1960	1961	1962	1963	1964
St. Mary's Bay	-	1	35	91	41	3
Southern Shore	0	-	9	67	117	8
Conception Bay	32	25	71	53	10	1
Trinity Bay	1434	594	111	258	224	424
Bonavista Bay	98	54	390	312	93	89
Notre Dame Bay	3	152	106	890	152	247

Area	Number in highest tow (Age 1)					
	1959	1960	1961	1962	1963	1964
St. Mary's Bay	-	288	239	63	673	571
Southern Shore	3	-	63	66	275	332
Conception Bay	28	645	317	34	55	756
Trinity Bay	90	174	454	85	147	339
Bonavista Bay	18	554	24	24	18	344
Notre Dame Bay	2	143	40	93	191	339

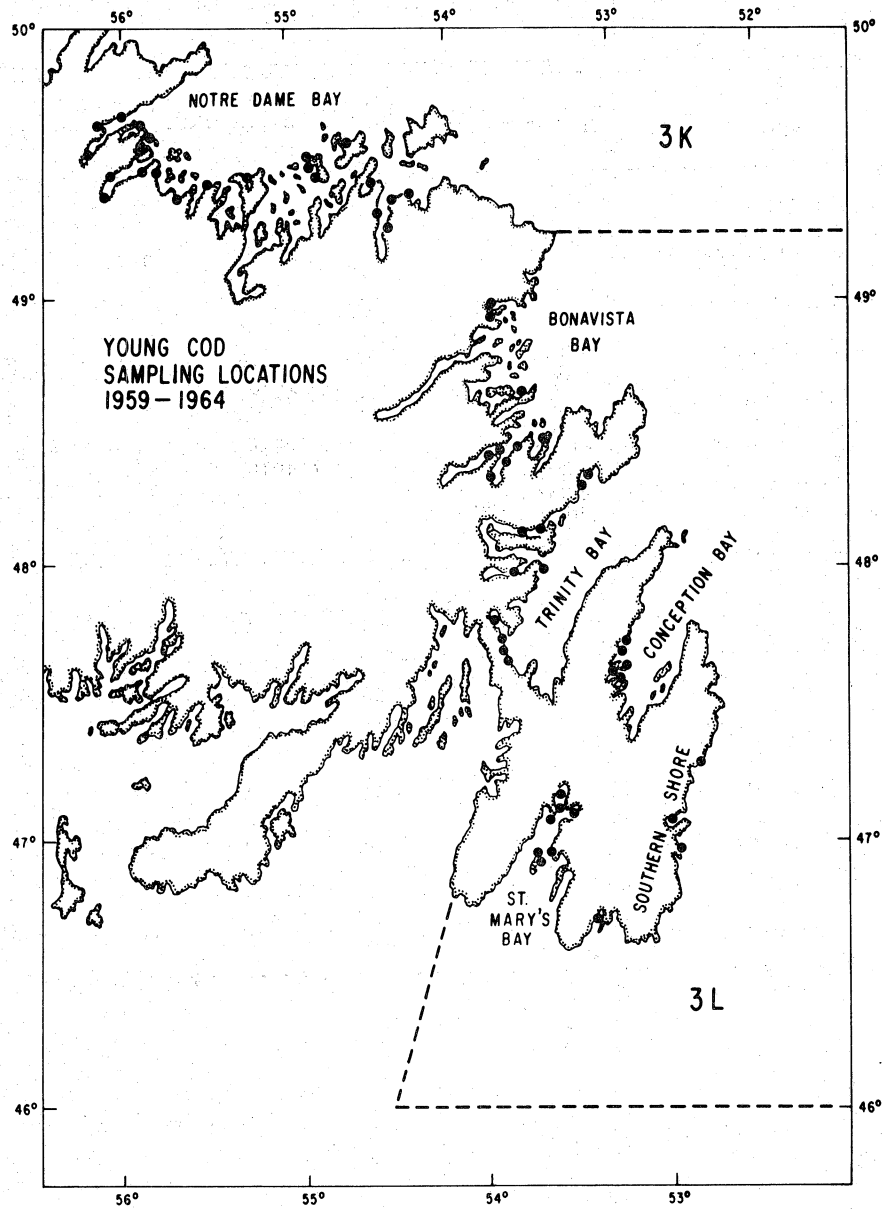


Fig. 1. Area map of eastern Newfoundland showing the areas in which young cod were surveyed and sampled during 1959-64.

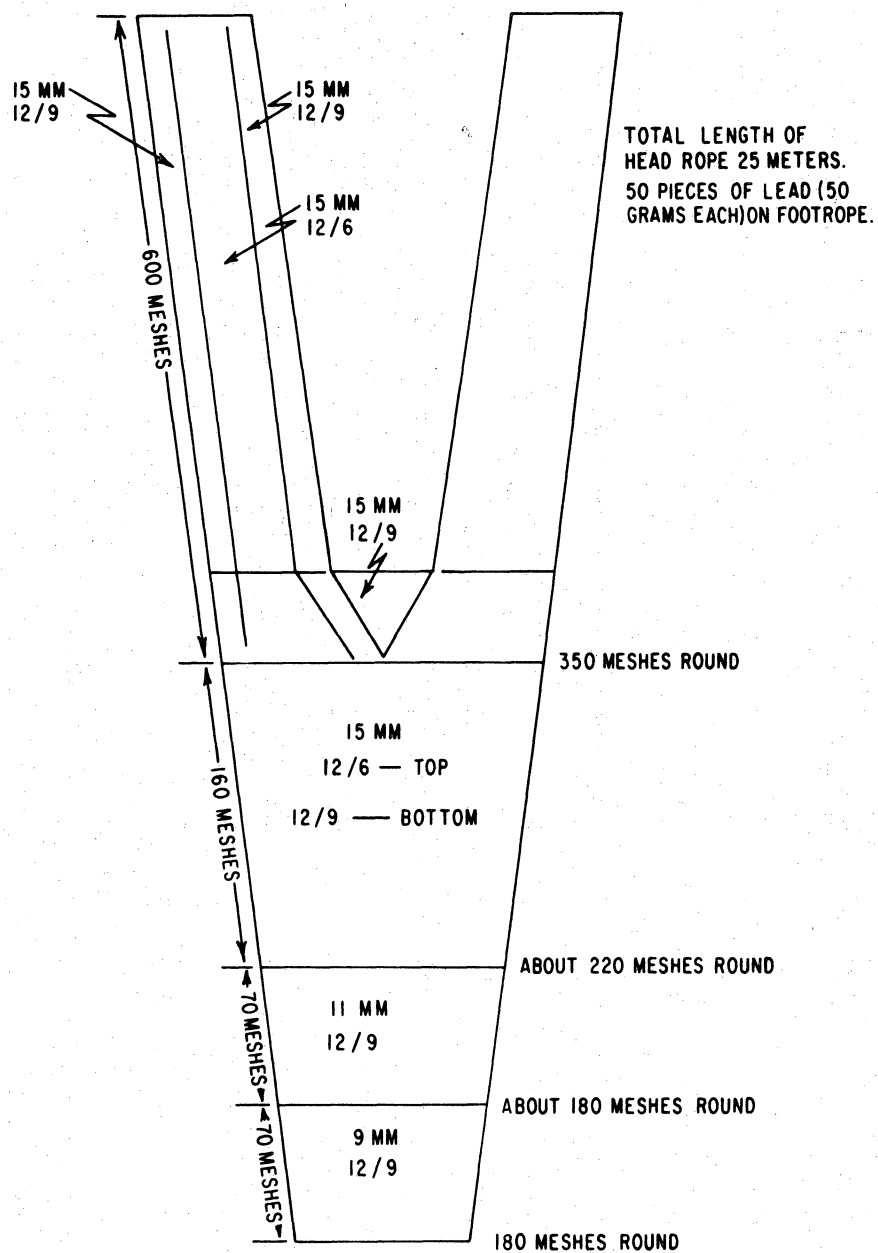


Fig. 2. Dimensions of the beach seine used for the juvenile cod surveys and sampling cruises during 1959-64 showing numbers and sizes of meshes used in the various section of the net.

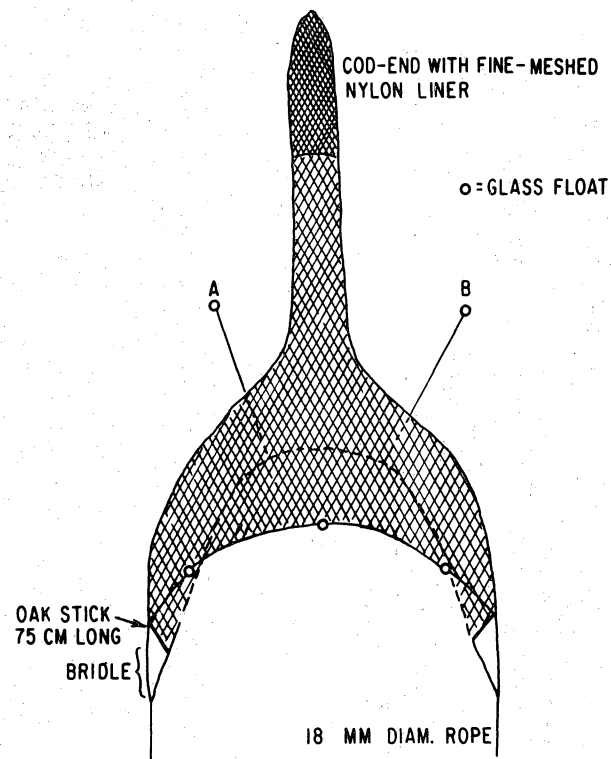
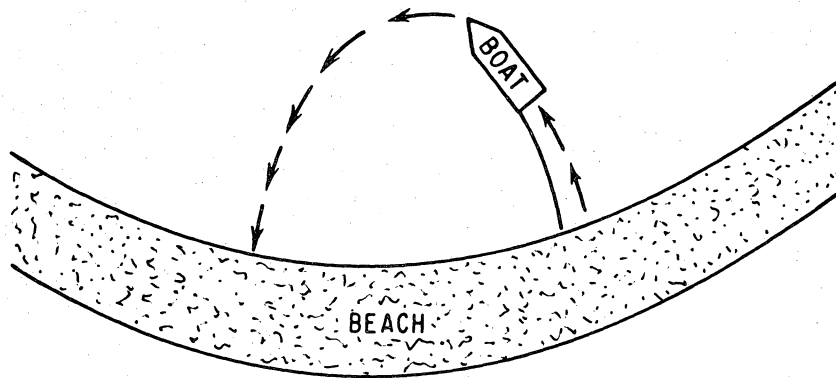
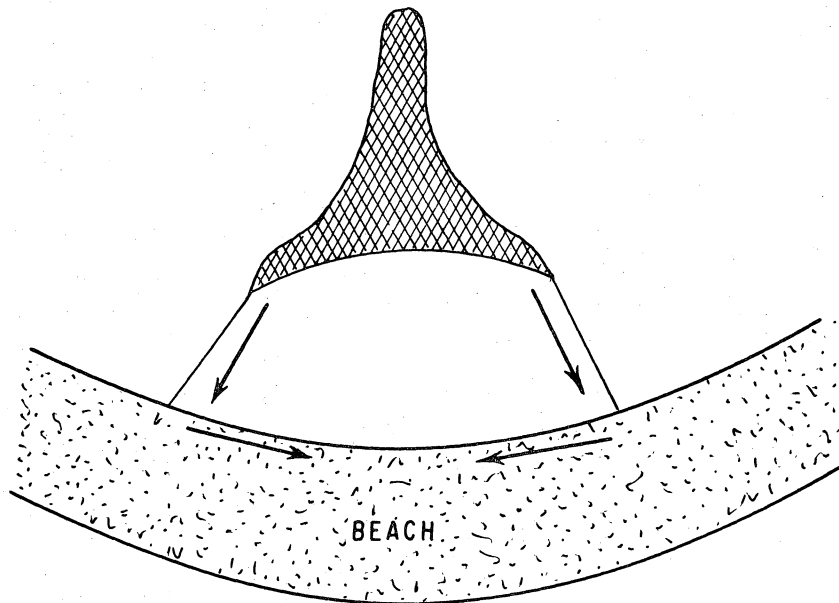


Fig. 3. Schematic diagram of the beach seine used for the juvenile cod survey and sampling cruises during 1959-64 showing the placement of floats, location of fine mesh liner and the oak sticks for opening the mouth of the net.



A. Setting the net.



B. Hauling the net.

Fig. 4. Schematic diagram showing (a) the method of setting the net from the boat, and (b) hauling the net toward the beach.