Comparison of Arctic Charr and Atlantic Salmon Catches in 114 and 127 mm Mesh Gill Nets during the 1984 Fishery at Makkovik and Bay of Islands, Labrador

by

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Abstract

Small mesh nets (114 mm) caught a significantly larger proportion of small Arctic charr at Makkovik than the large mesh (127 mm) but had the opposite effect at Bay of Islands. The small nets caught significantly smaller Atlantic salmon (< 64 cm) at Makkovik but had no effect at Bay of Islands. Both mesh sizes caught a similar length frequency distribution of larger salmon (> 64 cm). Net marks on charr caught in the two mesh sizes were similar; but were more common posteriorly on small salmon caught in the 127 mm mesh than in the 114 mm nets. Large salmon were the only fish which had net marks predominately on the head region. There was no difference between the mesh sizes in the quality of charr or salmon graded at the Makkovik fish plant. Our data could not be used to estimate quantitatively the relative efficiencies of the mesh sizes because nets could not be deployed randomly.

Résumé

A Makkovik, les filets à petites mailles (114 mm) ont permis de capturer une proportion significativement plus grande d'ombles chevaliers de petite taille que les filet à grosses mailles (127 mm); l'inverse s'est produit à Bay of Islands. Les filets à petites mailles ont permis de capturer des saumons atlantiques significativement plus petits ($<$ 64 cm) à Makkovik, mais ils n'ont eu aucun effet à Bay of Islands. Dans le cas des saumons de plus grande taille ($\geq$ 64 cm), la distribution de fréquences concernant la longueur des poissons capturés était semblable pour les deux grosseurs de maille. Les marques laissées sur les ombles par les deux types de mailles étaient semblables, mais dans le cas des saumons de petite taille, les marques laissées par les mailles de 127 mm étaient le plus souvent situées plus loin dans l'axe antéro-postérieur de l'animal que les marques des mailles de 114 mm. Les saumons de grande taille étaient les seuls poissons chez qui les marques étaient situées surtout dans la région de la tête. D'après l'évaluation faite à l'usine de traitement du poisson de Makkovik, la grosseur des mailles du filet utilisé n'a entraîné aucune différence dans la qualité des ombles ou des saumons capturés. Nos données ne pouvaient être utilisées pour évaluer quantitativement l'efficacité relative des différentes grosseurs de maille parce que les filets n'ont pu être posés d'une manière aléatoire.

Introduction

The commercial fishery for anadromous salmonids along the Labrador coast from Cape Range to Davis Inlet has a minimum size for gill nets of 127 mm stretched mesh. Fishermen in this region submitted a petition to DFO requesting that the minimum mesh size be reduced to 114 mm. Their reasons were that Arctic charr in the region are smaller than in more northern areas and that 127 mm mesh is too large to exploit effectively the resource. Also, interviews with fishermen in the Makkovik - Bay of Islands area indicated that an additional consideration was that many charr were being caught by the body in the large mesh. This resulted in poor quality of the catch and consequently lower price to the fishermen.

The Research and Resource Services Branches of the Department of Fisheries and Oceans had several concerns with the request. It was thought that the smaller mesh would increase the harvest of smaller charr and thereby impact on the availability of larger charr in future years. If correct, this would have a further, previously unstated, effect. The fish plants on the Labrador coast generally reject charr less than 900 g dressed weight (with head intact). Thus, the smaller mesh could increase the unmarketable and often wasted portion of the charr catch. The second concern over the request was an increase in the catch of non-maturing one-sea-winter (1SW) salmon. There appears to be little separation of salmon and charr berths in the area of concern, unlike more northern areas. Increased exploitation of 1SW salmon could reduce future harvest and escapement of large salmon. Present information suggests that there is no surplus of large salmon spawners and increased exploitation could adversely affect stock abundance of the large salmon resource. The potential loss of large salmon could have serious economic implications since it is the larger salmon which attracts buyers and a higher price. Also, it was expected that increased exploitation would result in an increased harvest of fish of non-Newfoundland and Labrador origin. This would be in contravention of DFO policy.

Our purpose was to compare the size of charr and salmon caught in 114 and 127 mm meshes in the Makkovik - Bay of Islands area. Also, we examined the distribution of net marks on fishes caught in the different nets and the quality of these catches when they were graded at the local fish plant.

Study Area and Methods

We contacted two commercial fishermen at each of Makkovik and Bay of Islands (Fig. 1) who volunteered to use 114 and 127 mm mesh nets in their traditional fishing berths. Commercial nets were obtained at the government store in Nain which is the same supplier which would be used by fishermen in the event of a change in minimum mesh size regulations. Mesh sizes were measured on a sample of the nets of each size and averaged 112 mm (range 111 - 114, n = 18) and 126 mm (range 124 - 127, n = 28). Sampling was done at Makkovik from July 16 to August 15 and at Bay of Islands from July 20 to August 14 by LGL Limited. Floating nets were used and were hung in 46 and 92 m lengths. Nets were rotated among berths at irregular intervals determined by the need to clean the gear. Fishermen were unwilling to rotate nets on a

regular basis. Catches from each mesh size were kept separate. Fork length, weight, sex and state of maturity were recorded from each fish. Otoliths were collected from charr for ageing and scales from salmon. Three regions were distinguished on fish and the presence of net marks on these regions were recorded. The regions were from the nose to the posterior margin of the operculum (= region I), posterior of the margin of the operculum to posterior tip of the pectoral fin (= II), and posterior from the posterior tip of the pectoral fin (= III). Whenever possible, the grade of fish, as determined at the local fish plant, was recorded for the whole catch from each mesh size. This was only possible at Makkovik.

Statistical analyses follow Conover (1980). Smirnov tests on length frequency distributions are one sided. Minimum significance of all analyses were at the 95% confidence level.

Results

The mean length and age of charr caught at Makkovik in 114 mm mesh was 48.2 cm (range 19.8 - 60.0) and 8.5 y (range 6 - 14) and in 127 mm mesh it was 49.0 cm (range 25.8 - 61.4) and 8.7 y (range 4 - 11). The mean length and age of charr caught at Bay of Islands in 114 mm mesh was 42.3 cm (range 26.0 - 56.5) and 8.4 y (range 4 - 14) and in 127 mm mesh it was 38.3 cm (range 27.4 - 53.4) and 7.6 y (range 4 - 11). The mean length of salmon at Makkovik in 114 and 127 mm mesh was 60.6 cm and 62.6 cm, respectively and at Bay of Islands it was 63.1 cm and 65.7 cm, respectively. Mean lengths of salmon were calculated from frequency distributions in 2 cm intervals. Ages of salmon were not available at the time of writing. Data on sex and state of maturity of fishes were considered unreliable because of the inexperience of the personnel who collected it.

The length frequency distributions of charr caught in 114 and 127 mm mesh were significantly different at Makkovik and at Bay of Islands (Smirnov (S) = 0.2497, df = 228,55, $p < 0.005$ and S = 0.2921, df = 270,80, $p < 0.005$, respectively). However, at Makkovik the small mesh caught a larger proportion of small fish while at Bay of Islands the small mesh caught more large fish (Fig. 2). Charr caught at Bay of Islands in 114 and in 127 mm mesh were significantly smaller than those caught at Makkovik (S = 0.3899, df = 270,228, $p < 0.005$ and S = 0.6068, df = 80,55, $p < 0.005$, respectively).

The small mesh caught a greater proportion of small salmon (< 640 mm) at Makkovik (K = 0.2742, df = 199,95, $p < 0.005$) but at Bay of Islands there was no significant difference between the mesh sizes (Fig. 3; K = 0.1714, df = 95,53). Small salmon caught at Bay of Islands in 114 and 127 mm mesh were significantly smaller than those caught at Makkovik (S = 0.3749, df = 199,95, $p < 0.005$ and S = 0.2721, df = 95,53, $p < 0.01$, respectively).

There were no significant differences in the length frequency distributions of large salmon ($\geq$ 640 mm) caught between the mesh sizes within areas or between the areas for either mesh size (Fig. 3).

Charr harvested at Bay of Islands were smaller at each age than those caught at Makkovik or in more northern areas (Fig. 4). Fish from Makkovik were slightly larger at each age (> 6 years) than northern samples.

The frequency of net marks on charr increased posteriorly (Table 1) and the distribution of marks on fish were not significantly different between 114 and 127 mm mesh at Makkovik or Bay of Islands ($x^2 = 2.2$, df = 3 and $x^2 = 2.1$, df = 3, respectively). However, between areas the distribution was different. This may reflect differences between the personnel who collected the data in each area. The distribution of net marks on small salmon was significantly different between mesh sizes (Makkovik $x^2 = 13.7$, df = 3, $p < 0.005$ and Bay of Islands $x^2 = 10.5$, df = 3, $p < 0.05$) with the posterior most region being most common in the larger mesh (Table 1). In contrast to other fishes, net marks were most common around the head region of large salmon (Table 1) and were different between mesh sizes (Makkovik $x^2 = 13.5$, df = 2, $p < 0.005$ and Bay of Islands $x^2 = 10.4$, df = 2, $p < 0.01$, fish without marks were ignored).

Fishes were graded into two categories at the Makkovik fish plant. There was no significant difference in the proportions of charr graded into each category between the 114 and 127 mm mesh (Table 2; $x^2 = 2.5$). Similarly, there was no difference in the qualilty of salmon caught between the mesh sizes (Table 2; $x^2 = 1.9$). Salmon were not separated into small and large individuals by the graders at the fish plant. Similar data were not obtainable at Bay of Islands.

The 114 mm mesh nets caught more charr than the 127 mm nets for each of the four fishermen (Table 3). The smaller nets caught more small salmon and more large salmon for three of the fishermen.

Discussion

No predictions can be drawn from our study on the effect of the proposed mesh size reduction on the length frequency distribution of charr harvested by the fishery. Our results are contradictory with 114 mm mesh having caught smaller charr than the 127 mm mesh at Makkovik, but larger fish at Bay of Islands. The effect of a reduction in mesh size on the length frequency of small salmon harvested is also unclear. The smaller mesh caught smaller salmon at Makkovik, but had no significant effect at Bay of Islands. The girth of larger salmon is too great to slip through the mesh sizes used in this study. Thus the similarity in length frequencies of these fish was expected.

The similarities in distribution of net marks on charr and graded quality of all fishes between the mesh sizes suggests that a reduction in mesh size would not improve the quality of the catch.

It would not be justified to use our data to estimate quantitatively the relative efficiency of the mesh sizes. Our nets were not deployed randomly but were moved at the discretion of the volunteer fishermen. However, our results do suggest that qualitatively the small mesh nets provided much greater catches, especially of charr.

Acknowledgments

Robert and Reg Anderson, Makkovik and Brian and Rupert McNeil, Bay of Islands were the fishermen who volunteered their efforts to the study. Steve Dawson assisted with data compilation.

References

Conover, W. J. 1980. Practical nonparametric statistics. John Wiley & Sons, Inc., New York, NY. 493 p.

Table 1. Percentage of fishes with net marks on each region of the body in each mesh size in the study areas. To facilitate analysis, fishes with marks in more than one region were considered to have marks in the most posterior region only. Some fishes were not examined for net marks.

Area	Fish type	Mesh size	Sample size	Region I	Region II	Region III	No marks
Makkovik	charr	114	219	5	13	76	6
Makkovik	charr	127	55	7	18	71	4
Makkovik	grilse	114	195	6	39	53	2
Makkovik	grilse	127	93	3	19	76	2
Makkovik	salmon	114	62	78	19	3	0
Makkovik	salmon	127	42	40	36	24	0
Bay of Islands	charr	114	268	10	13	50	27
Bay of Islands	charr	127	80	11	13	41	35
Bay of Islands	grilse	114	95	12	35	49	4
Bay of Islands	grilse	127	53	4	22	74	0
Bay of Islands	salmon	114	49	72	22	2	4
Bay of Islands	salmon	127	39	48	26	23	3

Region I - Region from the tip of the nose to the posterior margin of the operculum.

Region II - Posterior of the margin of the operculum to the posterior tip of the pectoral fin.

Region III- Posterior from the posterior tip of the pectoral fin.

Table 2. Quality of fishes caught in each mesh size which were graded at the Makkovik fish plant. Not all fishes which were caught were graded.

Species	Mesh size	Grade	
		A	B
charr	114	42	115
charr	127	12	17
salmon	114	77	117
salmon	127	36	77

Table 3. Number of fishes caught by each fisheman in each mesh size adjusted for the length of time each gear type was used. Only catches in the large mesh size were adjusted.

Fisherman		Species	114	127
Makkovik	#1	charr	149	29
		grilse	108	57
		salmon	40	33
Makkovik	#2	charr	79	46
		grilse	91	56
		salmon	29	20
Bay of Islands	#1	charr	127	85
		grilse	68	25
		salmon	42	23
Bay of Islands	#2	charr	143	20
		grilse	27	28
		salmon	11	21

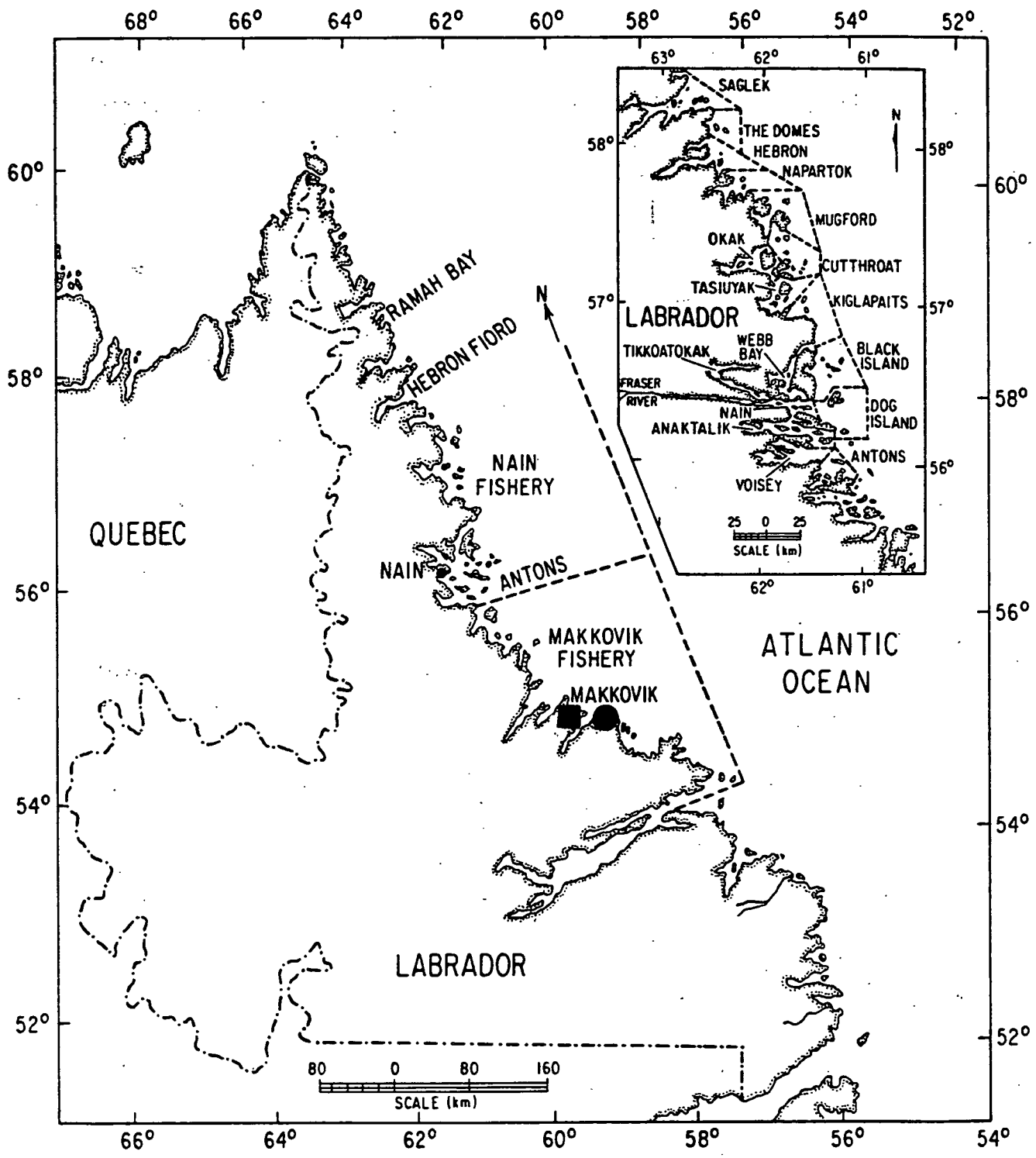

Fig. 1. Map of Labrador showing locations of Makkovik (●) and Bay of Islands (■).

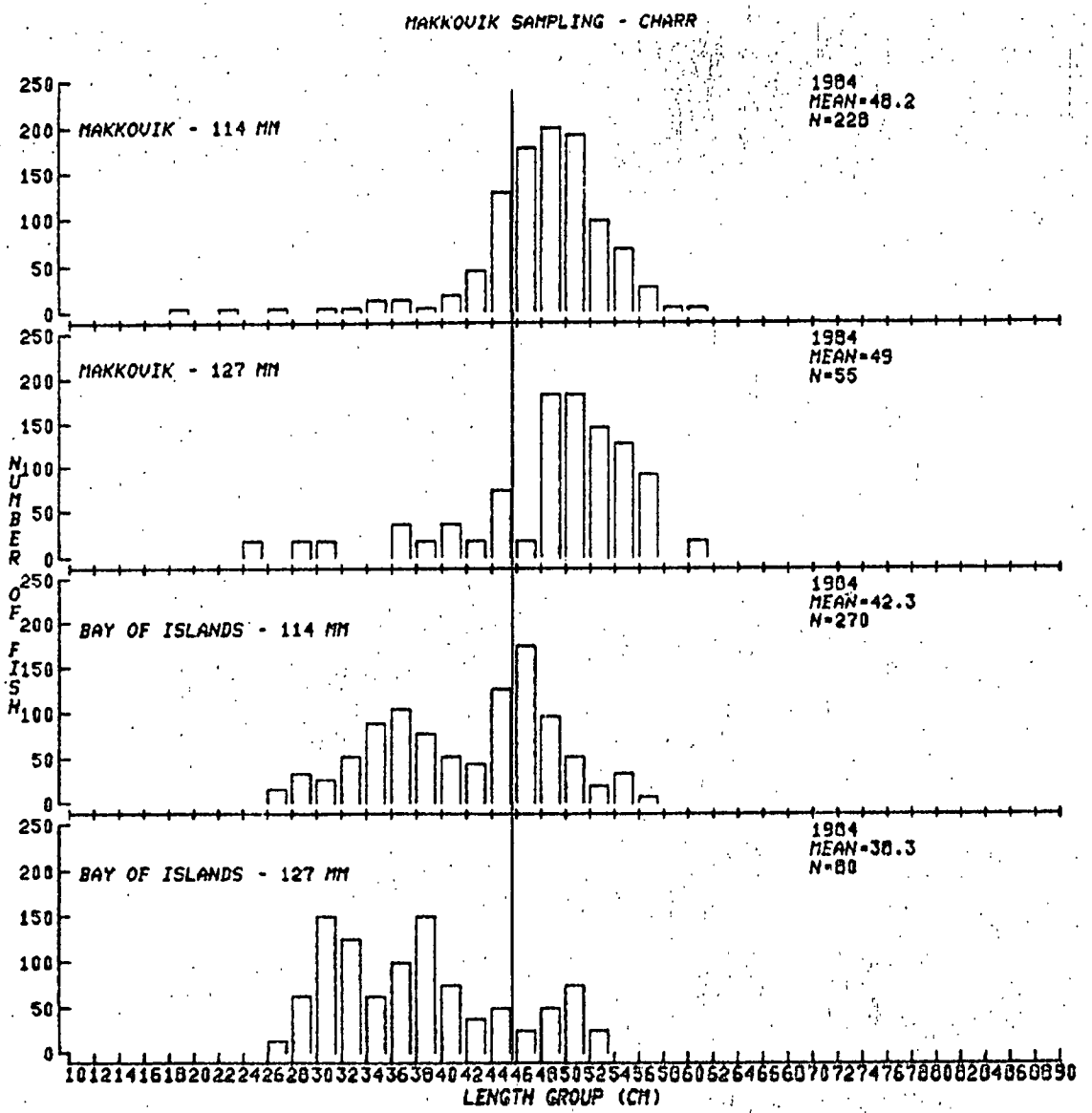

Fig. 2. Length frequency distributions of Arctic charr caught at Makkovik and Bay of Islands in each mesh size. Calculated per 1000 fish. Fish less than 46 cm (about 900 g dressed weight) are generally rejected at fish plants.

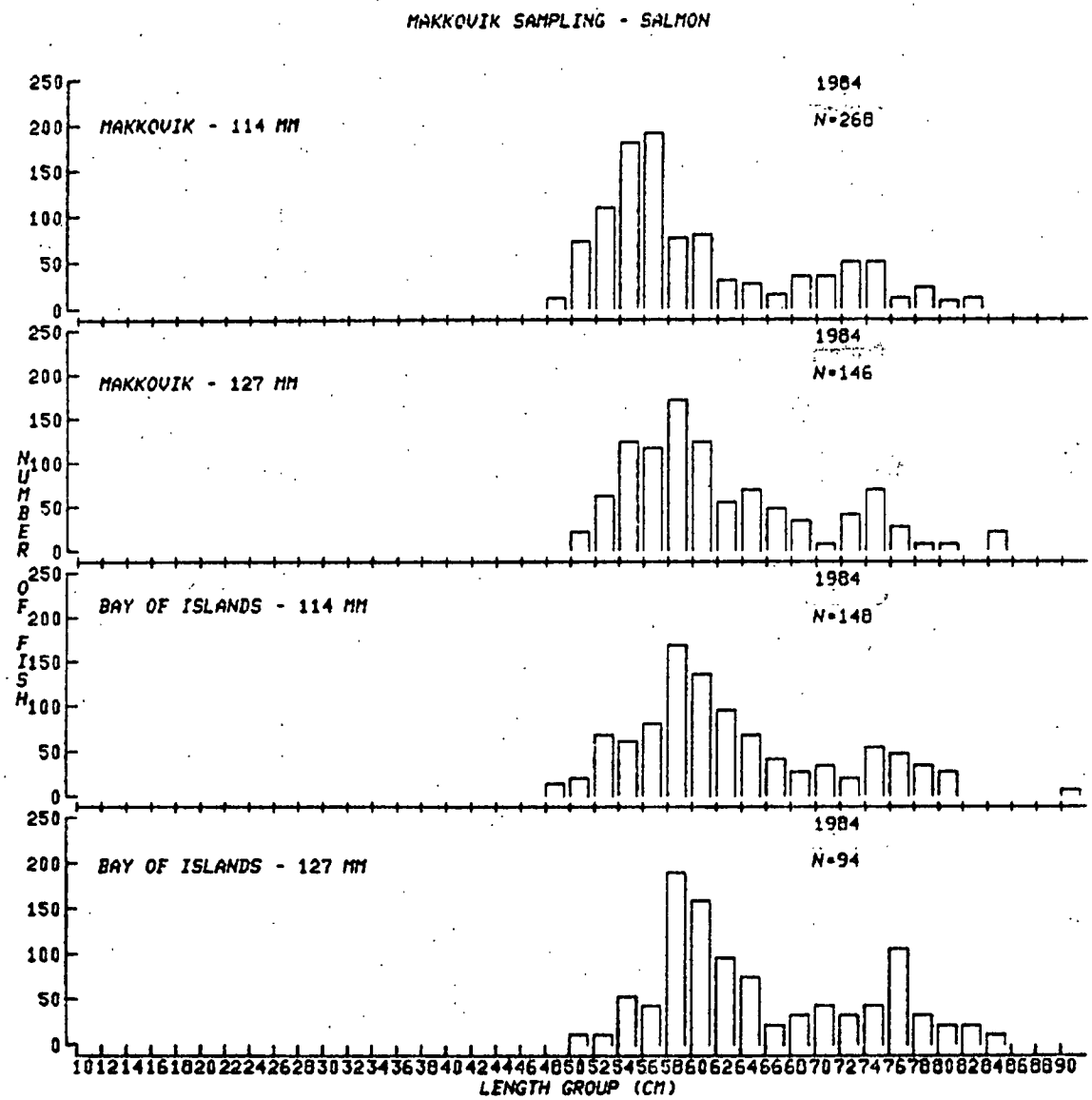

Fig. 3. Length frequency distributions of Atlantic salmon caught at Makkovik and Bay of Islands in each mesh size. Calculated per 1000 fish.

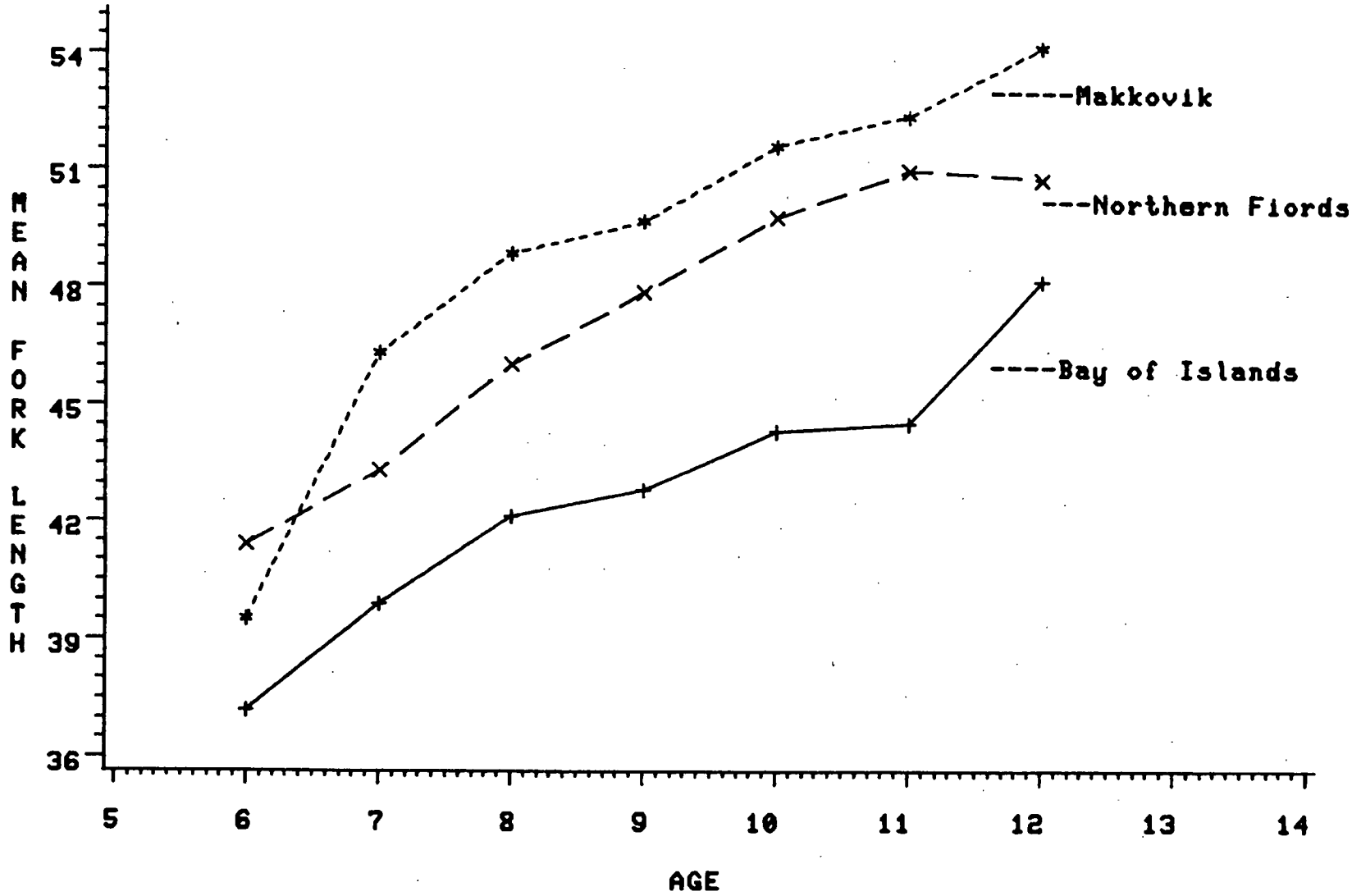

FIG. 4. MEAN FORK LENGTH (CM) AT AGE FOR BAY OF ISLANDS, MAKKOVIK, AND NORTHERN FIORD (OKAK-SAGLEK) ARCTIC CHARR SAMPLES