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Relative Catching Efficiency of Salmon Drift Nets and Relative Viability of Salmon Caught

A. W. May

Fisheries Research Board of Canada
Biological Station, St. John's, Newfoundland

Introduction

During research vessel fishing for Atlantic salmon by drift nets in 1969 off southwest Newfoundland and in the Labrador Sea-West Greenland area, records were kept of the numbers of salmon caught by nets of various mesh sizes. Nets used were of twisted Ulstron (polypropylene) or monofilament nylon (polyamide), and varied in depth from 1.5 to 2.5 fathoms at southwestern Newfoundland, but were all about 1.5 fathoms in depth off West Greenland. In the former area nets of different mesh sizes were fished in a regular order with the Ulstron nets of smallest mesh size at one end of the fleet, and the largest at the other, followed by the monofilament nets. In the latter area no attempt was made to regulate the fishing order after the first few sets (during which the order as described above was maintained).

Mesh sizes used at southwest Newfoundland (Port aux Basques) were 4½, 5¼, 6 and 6½ inches (114, 133, 152 and 165 mm) and at West Greenland were 4½, 5, 5½ and 6 inches (114, 127, 140 and 152 mm). Mesh sizes measured wet after use by means of a hand-held rule approximated these nominal sizes closely. Amount of gear fished was generally 1 nautical mile at Port aux Basques and 3 miles at West Greenland. Further details of gear and fishing are given by May (MS, 1970 - this meeting).

Net comparisons

Port aux Basques

Total effort by each type of mesh, along with numbers and sizes caught, numbers and percents tagged, and percent returns of tagged fish are listed in Table 1. The data are presented separately for an early period of very poor catches, and a later period of relatively good catches, as well as combined over the whole period for each mesh type separately and for all gear combined.

Considering the most reliable data from the period of good fishing (May 22 - June 10, 1969), best catching rates were obtained with Ulstron nets of 4½ and 5¼ inches (114 and 133 mm) and monofilament nets of 6 inches (152 mm), i.e., 2.3 to 2.4 salmon caught per mile of net per hour fished. There was a gradual increase in proportions of fish suitable for tagging from the smallest to largest Ulstron meshes (83 to 95%), while 98% of fish taken by monofilament nets were tagged. Returns of tagged fish, grouped by the mesh type in which the fish were originally caught, were variable for the Ulstron meshes, though they were minimal with the smallest mesh. Greatest returns (47%) resulted from

tagged fish released from monofilament nets. This compared with an average return of 33% from the Ulstron nets. The difference is not, however, statistically significant (.10 > P > .05).

Tagged fish were rated as fair, good or excellent condition according to amount of scale loss and apparent viability. Arbitrary numerical values were assigned to each condition rating (1 = dead fish, 2 = fair condition, 3 = good and 4 = excellent) and these were averaged for each mesh size and type of twine (Table 3). On this basis there was a progressive increase in average condition with increase in mesh size; the monofilament nets producing the best average condition. Considering tagged fish only, however, condition ratings were variable for the various Ulstron mesh sizes, but remained higher for monofilament nets.

Average length of fish caught increased with mesh size for the Ulstron nets, but the average size caught in monofilament nets was smaller than that for the comparable Ulstron mesh size (Table 1).

West Greenland

Effort, catch and tagging data are listed in Table 2. The data are shown separately for each of 3 major areas; most fishing and tagging was done in Disko Bay (Sept. 22 - Oct. 2, 1969). The latter material is also presented with the exclusion of a single day's fishing during which the gear was not patrolled, to give a more meaningful comparison of the relation between numbers caught and tagged (the routine tagging procedure involved continuous patrolling of the nets while fishing).

With reference to the most abundant data series (Disko Bay, Sept. 22 - Oct. 2), the monofilament nets were by far the most efficient catching gear; the catch rate being 2.3 times that of the next best gear (3.7 versus 1.6 salmon per mile of net per hour fished). Ulstron nets of 4½ inch (114 mm) mesh size produced the lowest catch rate, confirming the results of Templeman (1968) who compared these with 5-6 inch (127-152 mm) meshes. As in the earlier experiment at Port aux Basques the proportion of fish caught in condition suitable for tagging increased with mesh size in the Ulstron nets, but was greatest (78%) for fish taken in monofilament nets (Disko Bay data excluding Sept. 30 fishing). Percent returns from each mesh type are shown, but since returns to date total only 14 fish from the Disko Bay tagging, no conclusions are drawn.

As at Port aux Basques, average condition rating improved with increas

in mesh size, with monofilament nets producing the highest average rating (Table 3). Average size of salmon caught (Table 2) increased with mesh size, and was slightly greater for monofilament nets than for Ulstron nets of comparable mesh size, in contrast to the result from the Port aux Basques experiment.

Conclusions

From both sets of data it appears that nets of monofilament twine are at least equal to, and may be much superior to twisted Ulstron nets in catching salmon. It is also apparent that salmon taken by monofilament drift nets remain viable for a longer period relative to those caught by Ulstron, enabling a greater proportion of the catch to be tagged. Evidence from the Port aux Basques experiment also points to a greater survival of tagged fish from monofilament nets.

Differences in catching efficiency of monofilament relative to Ulstron drift nets are probably related to lesser visibility of the former. The Ulstron nets used were dark green in colour, while the monofilament nets were of light green translucent twine. Differences between the catching efficiency of monofilament relative to Ulstron at Port aux Basques and West Greenland may be related to behavioural differences, or perhaps more likely to the different fishing techniques employed in each area. At Port aux Basques the monofilament nets were at one end of the fleet; thus fish striking the Ulstron nets and swimming along them in a direction away from the monofilament nets might pass around the end of the fleet. At West Greenland there were usually some monofilament nets at one end of the fleet and others scattered in groups throughout, providing several "windows" through which fish could have attempted to pass.

Three observations support the contention that salmon sometimes "run" along a fleet of nets in an attempt to avoid the barrier presented:

(1) Less salmon were caught when nets were tightly stretched in a straight line than when wind and current conditions caused them to assume a meandering configuration.

(2) When wind and sea conditions caused one end of the fleet to drift back toward the centre of the gear, larger numbers of salmon were caught in the loop or trap so formed than along the straight part of the fleet.

(3) Salmon lying off the nets were occasionally driven in by the small boat used for tagging.

The possibly greater survival rate and better average condition of fish caught in monofilament nets appear to be related to the lesser pressure exerted on the fish by these meshes. It was noted that fish caught by Ulstron nets were more firmly enmeshed by the thinner and more flexible twine, often resulting in noticeable constriction and net scars. Even though no external damage is visible, it is known that Ulstron nets can cause rupture of blood vessels in the muscles (Murray, White and Whitaker, 1969), and this condition was occasionally noted at West Greenland in post mortem examinations of untagged fish. Monofilament meshes on the other hand appeared to hold the fish less tightly, and they were more easily lost in attempting to retrieve them from the nets.

Average condition ratings (all fish caught) for nets of the same twine and mesh size were substantially lower at West Greenland than at Port aux Basques, indicating that salmon at West Greenland are more susceptible to injury from catching and handling (Table 3), though this was no doubt also related to the longer time necessary to patrol the greater amount of gear, resulting in more dead fish. Average condition factors for tagged fish alone were only slightly lower at West Greenland than at Port aux Basques.

Although average size of salmon caught varied with mesh size in both experiments, similar meshes took smaller fish on the average at West Greenland than at Port aux Basques. This was no doubt a reflection of differences in size composition of the salmon available to the gear in each area.

References

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Table 1. Comparison of catches, sizes, numbers tagged and numbers returned for drift nets of various mesh sizes, Port aux Basques, 1969.

All nets were of twisted Ulstron, except MF = monofilament.

Period	Mesh (inches)	Effort (mile-hr)	No. caught	No./ mile-hr	No. tagged	No./ mile-hr	% Tagged	% Returned	*Av. size caught (cm)
May 2-19	4½	8.465	0	0	0	0	-	-	-
	5¼	8.465	9	1.06	8	0.95	88.9	37.5	-
	6	8.465	2	0.24	2	0.24	100	50.0	-
	6½	8.465	2	0.24	2	0.24	100	0	-
	6 MF	8.465	0	0	0	0	-	-	-
May 22-June 10	4½	22.197	54	2.43	45	2.03	83.3	24.4	67.2
	5¼	24.340	57	2.34	51	2.10	89.5	35.3	72.0
	6	24.340	49	2.01	45	1.85	91.8	40.0	73.1
	6½	24.340	41	1.68	39	1.60	95.1	33.3	75.5
	6 MF	23.835	56	2.35	55	2.31	98.2	47.3	71.3
May 2-June 10 Combined	4½	30.662	54	1.76	45	1.47	83.3	24.4	67.2
	5¼	32.805	66	2.01	59	1.80	89.4	35.6	71.9
	6	32.805	51	1.55	47	1.43	92.2	40.4	73.4
	6½	32.805	43	1.31	41	1.25	95.3	31.7	76.2
	6 MF	32.300	56	1.73	55	1.70	98.2	47.3	71.3
May 2-19	All	42.325	13	0.31	12	0.28	92.3	25.0	75.4
May 22-June 10	All	119.052	257	2.16	235	1.97	91.4	36.6	71.6
May 2-June 10	All	161.377	270	1.67	247	1.53	91.5	36.4	71.8

* Fork Length

Table 2. Comparison of catches, sizes, numbers tagged and numbers returned for drift nets of various mesh sizes, Labrador Sea-West Greenland, 1969. All nets were of twisted Ulstron, except MF = monofilament.

Area & Date	Mesh (inches)	Effort (mile-hr)	No. caught	No./ mile-hr	No. tagged	No./ mile-hr	% Tagged	% Returned	*Av. size caught (cm)
Labrador Sea (Sept. 6)	5	1.980	4	2.02	1	0.51	25.0	0	64.3
	5½	6.600	18	2.73	4	0.61	22.2	0	67.1
South Greenland (Sept. 10-19)	4½	29.190	10	0.34	4	0.14	40.0	0	62.0
	5	54.170	28	0.52	15	0.28	53.6	0	65.3
	5½	62.475	17	0.27	6	0.10	35.3	0	67.1
	NK	-	1	-	0	-	-	-	-
Disko Bay (Sept. 22-Oct. 2)	4½	43.993	44	1.00	24	0.55	54.5	12.5	64.1
	5	92.135	147	1.60	88	0.96	59.9	2.3	66.7
	5½	102.865	151	1.47	95	0.92	62.9	3.2	67.0
	6	36.408	43	1.18	29	0.80	67.4	0	67.8
	6 MF	44.038	164	3.72	119	2.70	72.6	5.0	68.4
Disko Bay (excluding Sept. 30 - nets not tended)	4½	41.103	43	1.05	24	0.58	55.8	-	-
	5	85.675	143	1.67	87	1.02	60.8	-	-
	5½	97.085	146	1.50	95	0.98	65.1	-	-
	6	34.538	39	1.13	29	0.84	74.4	-	-
	6 MF	40.808	152	3.72	118	2.89	77.6	-	-
All Areas (Sept. 6-Oct. 2)	4½	73.183	54	0.74	28	0.38	51.9	-	63.7
	5	148.285	179	1.21	104	0.70	58.1	-	66.4
	5½	171.940	186	1.08	105	0.61	56.5	-	67.0
	6	36.408	43	1.18	29	0.80	67.4	-	67.8
	6 MF	44.038	164	3.72	119	2.70	72.6	-	68.4
Labrador Sea	All	8.580	22	2.56	5	0.58	22.7	-	66.6
South Greenland	All	145.835	56	0.38	25	0.17	44.6	-	65.3
Disko Bay	All	319.439	549	1.72	355	1.11	64.7	3.9	67.2
Disko Bay excl. Sept. 30	All	299.209	523	1.75	353	1.18	67.5	-	-
All Areas	All	473.454	627	1.32	385	0.81	61.4	3.6	67.0

* Fork Length

Table 3. Average condition rating for each mesh size and type of twine. MF = monofilament. Data for 2 fishing days when nets were not patrolled are excluded from the West Greenland averages under the column for all fish.

Mesh	All Fish		Tagged Fish Only	
(inches)	Port aux Basques	West Greenland	Port aux Basques	West Greenland
4½	2.87	2.11	3.24	3.11
5	-	2.30	-	3.18
5½	2.92	-	3.15	-
5½	-	2.36	-	3.20
6	3.10	2.69	3.28	3.28
6½	3.14	-	3.24	-
6 MF	3.34	2.78	3.38	3.30