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COMPARISON OF SALMON CATCHES IN MONOFILAMENT AND MULTIFILAMENT GILL NETS--Part II

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ABSTRACT

The second phase of a monofilament-multifilament gill-net study was completed by the U. S. Bureau of Commercial Fisheries during the 1963 summer field season. Salmon catches in standard multifilament nets were compared with those in an all-monofilament net unit. Results of a 1962 study, in which multifilament nets were compared with alternate monofilament-multifilament nets, are also examined in an analysis of efficiency and cost of three gill-net combinations.

Sockeye catches in all-monofilament nets were greater than in all-multifilament, but chum and pink catches were the same in both gear types, as were the lengths of all species. In terms of cost and efficiency, the alternated combination appeared superior for the capture of high-seas salmon followed by all-multifilament and all-monofilament.

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INTRODUCTION

In the salmon research program in the North Pacific Ocean and Bering Sea by the U. S. Bureau of Commercial Fisheries, one facet of the work has been an investigation into more efficient sampling gear. Much of the Bureau's research, in support of the United States Section of the International North Pacific Fisheries Commission, has required relatively large numbers of salmon specimens for racial analysis and relative abundance and distribution studies.

The capture of pelagic salmon on the high seas has been accomplished with surface gill nets. To provide adequate samples of each species and age group, the length of the net string has gradually been increased to over 1½ miles. Increasing the length of the string has resulted in an increase in manpower as well as gear damage and loss from sudden changes in weather, whales, and shipping. In addition, inshore fishing stations in the Aleutian Island chain, an area of considerable interest, are difficult to sample with a long gill-net string because of its susceptibility to tangling in the severe tidal currents near the islands.

The apparent success reported by the Japanese high-seas commercial salmon fishery with monofilament gill nets stimulated Bureau scientists to investigate the relative efficiency of monofilament netting and its potential as a research-sampling tool.

In the first phase of the study, conducted during the 1962 summer field season (reported in the May 1963 Commercial Fisheries Review), the catches in standard multifilament nets were compared with those in the monofilament nets of an experimental unit of alternate mono-

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filament-multifilament nets of like mesh size and construction. The results of that phase i dicated a significantly larger catch in the monofilament nets and, in general, provided sam directly comparable to those of the multifilament nets in terms of age a length of the fish (Larkins 1963).

Fig. 1 - The Bureau of Commercial Fisheries research vessel George B. Kelez.

The results of the second phase the study, in which the standard mul filament nets were tested against an perimental unit of all-monofilament nets, are reported here. This exper ment, completed during the 1963 sur mer cruise of the Bureau's researc vessel George B. Kelez (fig. 1), was so designed to permit a three-way c parison between all-multifilament, a ternate multifilament-monofilament, all-monofilament net combinations.

METHODS AND MATERIALS

The multifilament nets, each 50 fathoms long and 4 fathoms deep, were made of type 3 nylon. The mesh sizes used were the same as in past years: $5\frac{1}{4}$, $4\frac{1}{2}$, $3\frac{1}{4}$, and $2\frac{1}{2}$ inches (stretched measure). The webbing, dyed dark green, was "hung in" 50 percent on the cork a lead lines.

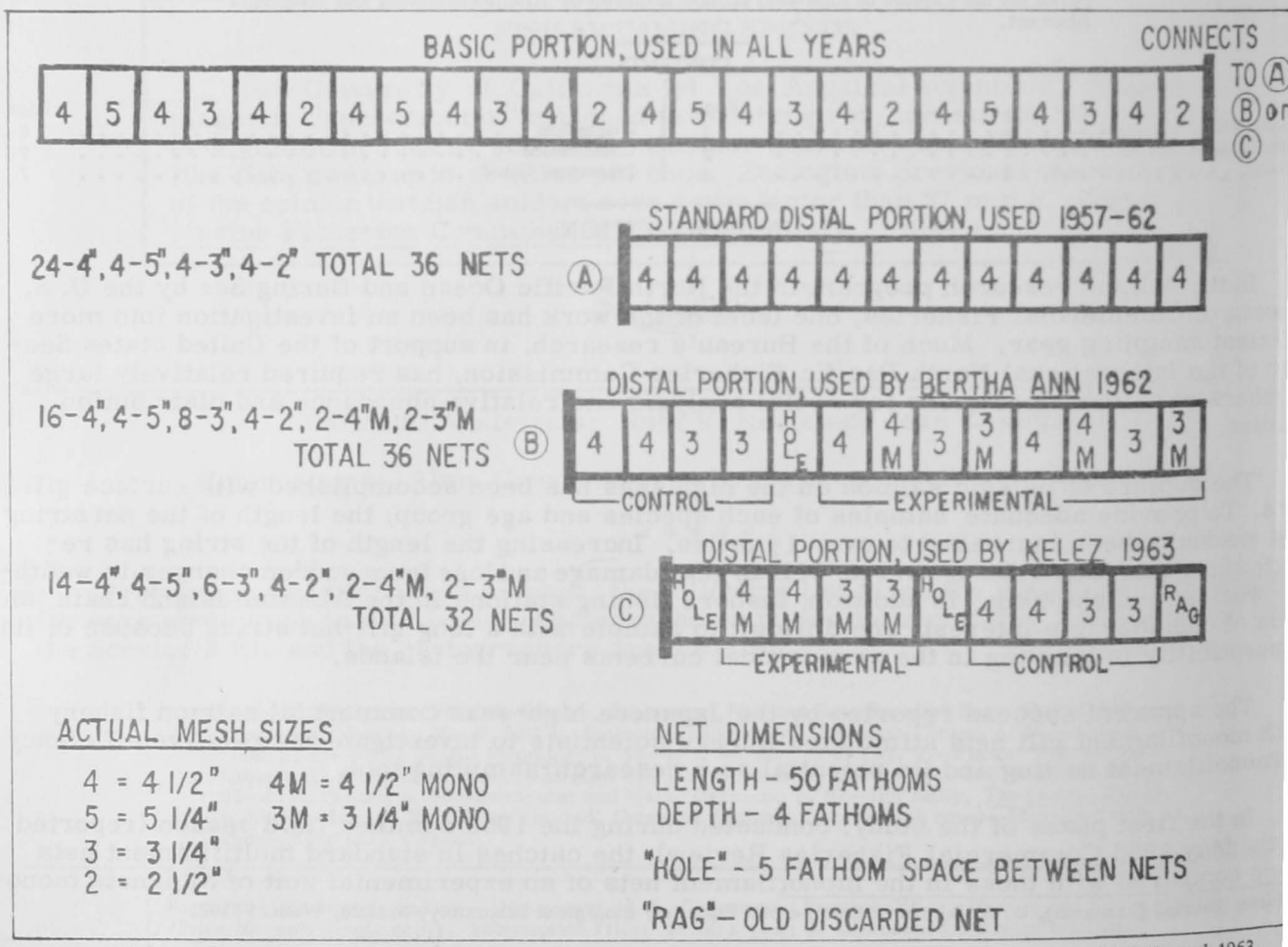


Fig. 2 - Composition of high-seas salmon gill nets used by the Bureau of Commercial Fisheries from 1957 through 1963.

Table 1 - Comparison of Gross Catches in Monofilament and Multifilament Gill Nets, 1963

Set Number	Date	3¼-Inch Multifilament									3¼-Inch Monofilament								
		No. of Sockeye	No. of Chum	No. of Pink	Total No.	No. of Nets	Catch Per Net (Number) Sockeye	Chum	Pink	Total Catch Per Net (No.)	No. of Sockeye	No. of Chum	No. of Pink	Total No.	No. of Nets	Catch Per Net (Number) Sockeye	Chum	Pink	Total Catch Per Net (No.)
1	7/3	5	2	1	8	6	0.8	0.3	0.2	1.3	1	1	0	2	2	0.5	0.5	0	1.0
2	7/4	5	4	0	9	6	0.8	0.7	0	1.5	2	5	0	7	2	1.0	2.5	0	3.5
3	7/5	0	0	0	0	6	0	0	0	0	0	0	0	0	2	0	0	0	0
4	7/7	6	10	0	16	6	1.0	1.7	0	2.7	15	0	0	15	2	7.5	0	0	7.5
5	7/8	8	5	0	13	6	1.3	0.8	0	2.2	2	2	0	4	2	1.0	1.0	0	2.0
6	7/9	11	19	0	30	6	1.8	3.2	0	5.0	4	10	1	15	2	2.0	5.0	0.5	7.5
7	7/10	5	5	0	10	6	0.8	0.8	0	1.7	0	0	0	0	2	0	0	0	0
8	7/11	14	0	1	15	6	2.3	0	0.2	2.5	1	0	0	1	2	0.5	0	0	0.5
9	7/15	6	5	0	11	6	1.0	0.8	0	1.8	1	1	0	2	2	0.5	0.5	0	1.0
10	7/17	45	7	0	52	6	7.5	1.2	0	8.7	16	2	0	18	2	8.0	1.0	0	9.0
11	7/18	80	5	0	85	6	13.3	0.8	0	14.2	36	1	0	37	2	18.0	0.5	0	18.5
12	7/19	21	1	0	22	6	3.5	0.2	0	3.7	8	0	0	8	2	4.0	0	0	4.0
13	7/20	94	9	0	103	6	15.7	1.5	0	17.2	41	1	0	42	2	20.5	0.5	0	21.0
14	7/23	109	3	1	113	6	18.2	0.5	0.2	18.8	65	0	0	65	2	32.5	0	0	32.5
15	7/26	426	6	0	432	6	71.0	1.0	0	72.0	235	2	0	237	2	117.5	1.0	0	118.5
16	7/29	No monofilament																	
17	7/30	48	2	0	50	6	8.0	0.3	0	8.3	27	3	1	31	2	13.5	1.5	0.5	15.5
18	7/31	41	5	0	46	6	6.8	0.8	0	7.7	34	1	0	35	2	17.0	0.5	0	17.5
19	8/2	4	5	0	9	6	0.7	0.8	0	1.5	0	3	0	3	2	0	1.5	0	1.5
20	8/3	89	4	0	93	6	14.8	0.7	0	15.5	37	3	0	40	2	18.5	1.5	0	20.0
21	8/4	85	2	0	87	6	14.2	0.3	0	14.5	100	3	0	103	2	50.0	1.5	0	51.5
22	8/5	No monofilament																	
23	8/11	No monofilament																	
24	8/12	39	4	0	43	6	6.5	0.7	0	7.2	12	6	0	18	2	6.0	3.0	0	9.0
25	8/13	35	10	0	45	6	5.8	1.7	0	7.5	11	3	0	14	2	5.5	1.5	0	7.0
26	8/14	11	3	0	14	6	1.8	0.5	0	2.3	2	4	0	6	2	1.0	2.0	0	3.0
27	8/15	Net string rolled																	
28	8/18	No monofilament																	
29	8/19	No monofilament																	
30	8/20	No monofilament																	
31	8/22	No monofilament																	
32	8/23	No monofilament																	
33	8/24	No monofilament																	
34	8/27	22	10	0	32	6	3.7	1.7	0	5.3	8	4	0	12	2	4.0	2.0	0	6.0
35	8/28	41	22	0	63	6	6.8	3.7	0	10.5	10	4	0	14	2	5.0	2.0	0	7.0
36	8/29	26	81	1	108	6	4.3	13.5	0.2	18.0	18	17	0	35	2	9.0	8.5	0	17.5
37	8/30	19	17	0	36	6	3.2	2.8	0	6.0	10	6	0	16	2	5.0	3.0	0	8.0
38	8/31	23	9	0	32	6	3.8	1.5	0	5.3	11	1	0	12	2	5.5	0.5	0	6.0
39	9/1	Net string rolled																	
40	9/2	19	1	0	20	6	3.2	0.2	0	3.3	9	2	0	11	2	4.5	1.0	0	5.5
41	9/4	16	0	0	16	6	2.7	0	0	2.7	16	0	0	16	2	8.0	0	0	8.0
42	9/9	No monofilament																	
43	9/11	No monofilament																	
Total	....	1,353	256	4	1,613	180	7.5	1.4	-	8.96	732	85	2	819	60	12.2	1.4	-	13.65
		4½-Inch Multifilament									4½-Inch Monofilament								
1	7/3	4	1	5	10	14	0.3	0.1	0.4	0.7	2	2	4	8	2	1.0	1.0	2.0	4.0
2	7/4	18	8	4	30	14	1.3	0.6	0.3	2.1	2	2	1	5	2	1.0	1.0	0.5	2.5
3	7/5	0	0	0	0	14	0	0	0	0	0	0	0	0	2	0	0	0	0
4	7/7	10	1	2	13	14	0.7	0.1	0.1	0.9	5	0	0	5	2	2.5	0	0	2.5
5	7/8	26	4	9	39	14	1.9	0.3	0.6	2.8	9	3	3	15	2	4.5	1.5	1.5	7.5
6	7/9	24	15	86	125	14	1.7	1.1	6.1	8.9	7	4	21	32	2	3.5	2.0	10.5	16.0
7	7/10	3	8	7	18	14	0.2	0.6	0.5	1.3	0	1	1	2	2	0	0.5	0.5	1.0
8	7/11	20	2	6	28	14	1.4	0.1	0.4	2.0	4	1	3	8	2	2.0	0.5	1.5	4.0
9	7/15	1	8	1	10	14	0.1	0.6	0.1	0.7	1	3	1	5	2	0.5	1.5	0.5	2.5
10	7/17	69	19	7	95	14	4.9	1.4	0.5	6.8	17	2	2	21	2	8.5	1.0	1.0	10.5
11	7/18	163	22	5	190	14	11.6	1.6	0.4	13.6	41	4	0	45	2	20.5	2.0	0	22.5
12	7/19	8	14	0	22	14	0.6	1.0	0	1.6	3	3	0	6	2	1.5	1.5	0	3.0
13	7/20	64	16	1	81	14	4.6	1.1	0.1	5.8	9	2	0	11	2	4.5	1.0	0	5.5
14	7/23	42	2	1	45	14	3.0	0.1	0.1	3.2	20	3	0	23	2	10.0	1.5	0	11.5
15	7/26	213	27	4	244	14	15.2	1.9	0.6	17.4	37	3	2	42	2	18.5	1.5	1.0	21.0
16	7/29	No monofilament																	
17	7/30	94	33	6	133	14	6.7	2.4	0.4	9.5	9	2	0	11	2	4.5	1.0	0	5.5
18	7/31	89	40	2	131	14	6.4	2.9	0.1	9.4	16	5	0	21	2	8.0	2.5	0	10.5
19	8/2	17	84	0	101	14	1.2	6.0	0	7.2	2	5	0	7	2	1.0	2.5	0	3.5
20	8/3	95	20	0	115	14	6.8	1.4	0	8.2	20	5	0	25	2	10.0	2.5	0	12.5
21	8/4	81	67	0	147	14	5.8	4.8	0	10.5	40	4	0	44	2	20.0	2.0	0	22.0
22	8/5	No monofilament																	
23	8/11	No monofilament																	
24	8/12	48	23	0	71	14	3.4	1.6	0	5.1	6	3	0	9	2	3.0	1.5	0	4.5
25	8/13	48	40	0	88	14	3.4	2.9	0	6.3	6	3	0	9	2	3.0	1.5	0	4.5
26	8/14	11	52	0	63	14	0.8	3.7	0	4.5	5	8	0	13	2	2.5	4.0	0	6.5
27	8/15	Net string rolled																	
28	8/18	No monofilament																	
29	8/19	No monofilament																	
30	8/20	No monofilament																	
31	8/22	No monofilament																	
32	8/23	No monofilament																	
33	8/24	No monofilament																	
34	8/27	11	38	0	49	14	0.8	2.7	0	3.5	0	4	0	4	2	0	2.0	0	2.0
35	8/28	31	72	2	105	14	2.2	5.1	0.1	7.5	6	7	0	13	2	3.0	3.5	0	6.5
36	8/29	15	64	0	79	14	1.1	4.6	0	5.6	2	3	0	5	2	1.0	1.5	0	2.5
37	8/30	4	54	0	58	14	0.3	3.9	0	4.1	0	8	0	8	2	0	4.0	0	4.0
38	8/31	31	42	0	73	14	2.2	3.0	0	5.2	1	7	0	8	2	0.5	3.5	0	4.0
39	9/1	Net string rolled																	
40	9/2	16	17	0	33	14	1.1	1.2	0	2.4	1	2	0	3	2	0.5	1.0	0	1.5
41	9/4	77	6	0	83	14	5.5	0.4	0	5.9	6	3	0	9	2	3.0	1.5	0	4.5
42	9/9	No monofilament																	
43	9/11	No monofilament																	
Total	....	1,333	799	148	2,280	420	3.17	1.90	0.35	5.43	277	102	38	417	60	4.62	1.70	0.63	6.95

The experimental monofilament nets, dyed light grey, were constructed identically with the multifilament nets; only the $4\frac{1}{2}$- and $3\frac{1}{4}$-inch mesh sizes were used. The webbing, of Japanese manufacture, was very similar to the German Perlon used in 1962.

The vessel's net string (fig. 2) was composed of a standard 24 net portion of all-multifilament webbing with varying mesh sizes, an experimental portion consisting of two $3\frac{1}{4}$- and two $4\frac{1}{2}$-inch monofilament nets, and a control portion of two $3\frac{1}{4}$- and two $4\frac{1}{2}$-inch multifilament nets. All nets within each portion were laced together to form a continuous unit and a five-fathom opening was left between each portion so fish could not lead from one unit to another. An old, discarded net "rag" was attached to the end of the string to prevent bunching of the last net.

The 32 net string, equipped with two lighted flag poles and radio buoys, was set shortly after dark, allowed to drift freely through the night, and hauled after dawn. Setting took about 45 minutes, the nets fished for an average of 12 hours, and hauling time varied from $1\frac{1}{2}$ to 3 hours.

The nets were repaired daily and replaced when necessary. Through the season, as the nets became worn, their efficiency was probably somewhat reduced, but the state of repair of the two types of webbing is believed to have been equal at any one time.

Both the basic and control portions of the net strings in 1962 and 1963 were identical, except for the position of the control portion, and from the basis for comparison between the alternated monofilament-multifilament unit in 1962 and the all-monofilament unit in 1963.

RESULTS

The 1963 salmon catches by net type for the $3\frac{1}{4}$- and $4\frac{1}{2}$-inch nets are shown in table 1. Preliminary tests between the total salmon catch per net of the multifilament nets in the basic and control portions of the string over the entire season show no significant differences[1/]. Therefore, all of the $3\frac{1}{4}$- and $4\frac{1}{2}$-inch multifilament nets have been used in the comparison with monofilament catches.

In 73 percent of the $3\frac{1}{4}$-inch and 57 percent of the $4\frac{1}{2}$-inch comparisons, the total catch per unit of effort of the monofilament exceeded that of the multifilament nets; over the season, the $3\frac{1}{4}$-inch monofilament caught 1.5 and the $4\frac{1}{2}$-inch monofilament 1.3 times as many salmon per net as the multifilament.

In the comparison of individual species taken in the two net types, a very interesting difference is apparent. While the relative efficiency of the monofilament nets (table 2) for sockeye and pink salmon was considerably higher than that of the multifilament, the catch per net of chum salmon in the two net types was almost identical. Statistically, only the difference in catch of sockeye salmon between the two net types was significant[2/]. This difference in relative efficiency of monofilament netting for three species indicates that the species composition of catches in the monofilament and multifilament nets was also different.

Table 2 - Catch Per Unit of Effort for All $3\frac{1}{2}$- and $4\frac{1}{2}$-Inch Nets and Relative Efficiency of Monofilament, 1963

Mesh Size	Catch Per Net (Number)								Relative Efficiency of Monofilament (Number)			
	Multifilament				Monofilament							
	Sockeye	Chum	Pink	Total	Sockeye	Chum	Pink	Total	Sockeye	Chum	Pink	Total
Inches												
$3\frac{1}{4}$	7.5	1.4	-	8.96	12.2	1.4	-	13.65	1.6	1.0	-	1.52
$4\frac{1}{2}$	3.2	1.9	0.4	5.43	4.6	1.7	0.6	6.95	1.4	0.9	1.8	1.28

1/Paired "t" tests: $3\frac{1}{4}$-inch mesh nets: $t = 1.04$ with 29 d.f.

$4\frac{1}{2}$-inch mesh nets: $t = 0.48$ with 29 d.f.

2/Paired "t" tests: $3\frac{1}{4}$-inch mesh nets: sockeye, $t = -2.3$ with 29 d.f.; chum, $t = -0.02$ with 29 d.f.

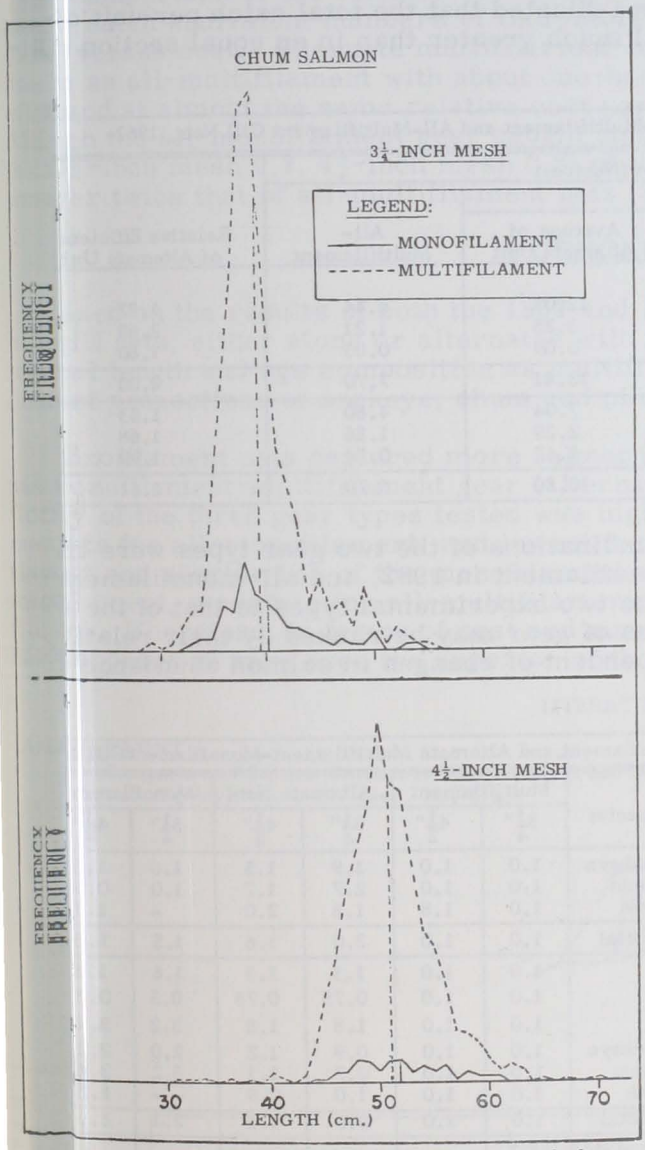
$4\frac{1}{4}$-inch mesh nets: sockeye, $t = -2.1$ with 28 d.f.; chum, $t = 0.8$ with 28 d.f.; pink, $t = -1.6$ with 14 d.f.

The relationship between the individual sockeye catches in the two net types was linear[3], and best over the range of abundance encountered in 1963.

Length frequency curves of sockeye and chum salmon taken in the two net types are similar (fig. 3) and their mean lengths (table 3) are not significantly different[4] indicating that the monofilament and multifilament gill nets had the same intraspecies selection properties. These results also infer that, length being a function of ocean-age (Larkins 1963), both net types captured similar proportions of the available ocean-age groups.

Table 3 - Mean Lengths of Salmon Captured in Monofilament and Multifilament Gill Nets, 1963

Species	Mesh Size	Monofilament	Multifilament
	Inches	. . . . . (Centimeters)	
Sockeye	$3\frac{1}{4}$	38.26	37.59
	N=	733	2,155
	$4\frac{1}{2}$	50.30	49.40
	N=	269	1,531
Chum	$3\frac{1}{4}$	40.09	39.43
	N=	86	591
	$4\frac{1}{2}$	51.85	50.90
	N=	101	1,275



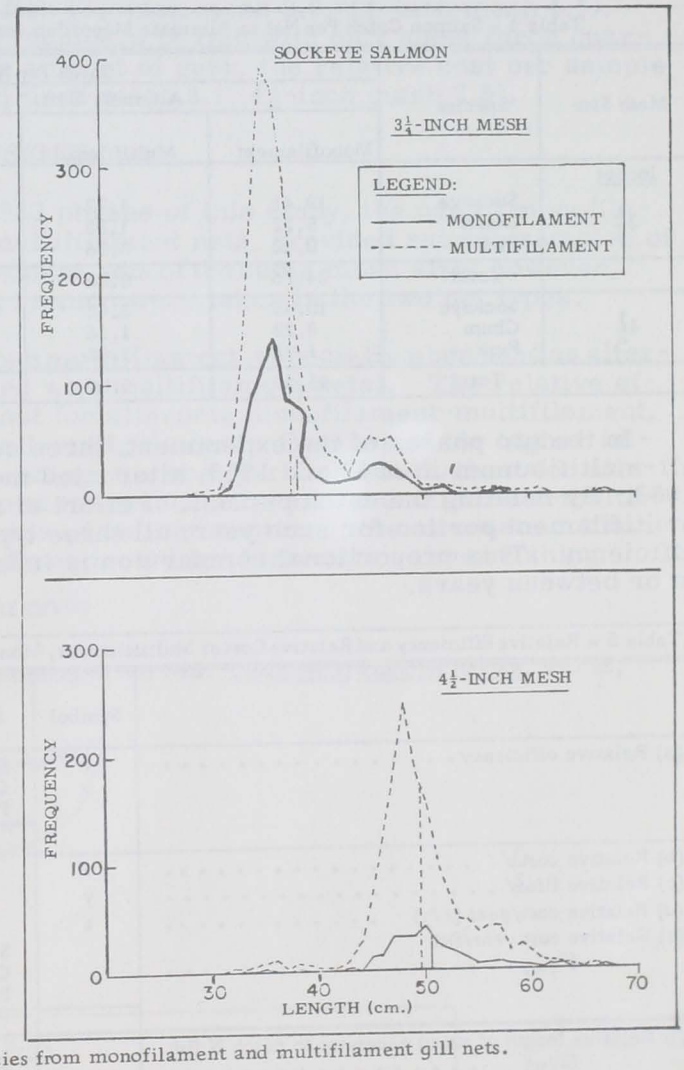


Fig. 3 - Comparison of salmon length-frequencies from monofilament and multifilament gill nets.

3/ $3\frac{1}{4}$-inch mesh nets: r = 0.97; test for b = 0, t = 19.25 with 27 d.f.
$4\frac{1}{2}$-inch mesh nets: r = 0.86; test for b = 0, t = 58.52 with 27 d.f.

4/ Sockeye: $3\frac{1}{4}$-inch mesh nets: F = < 1.0 with 1, 2,886 d.f.
$4\frac{1}{2}$-inch mesh nets: F = < 1.0 with 1, 1,798 d.f.
Chum: $3\frac{1}{4}$-inch mesh nets: F = < 1.0 with 1, 875 d.f.
$4\frac{1}{2}$-inch mesh nets: F = < 1.0 with 1, 1,374 d.f.

DISCUSSION

To summarize the preceding section, it was shown that the sockeye catches in an all-monofilament gill-net section were significantly greater than in an all-multifilament string, although the catches of chum and pink salmon were, apparently, the same in both net types. The length and age compositions of monofilament catches were the same as those of multifilament catches.

Results of the 1962 study (Larkins 1963), in which alternate monofilament-multifilament nets were used, also showed no difference in age and length comparisons between the net types; however, the catches of all three species were considerably larger in the monofilament nets than in the multifilament. It was also shown that the salmon catches in the multifilament nets adjacent to the monofilament were significantly lower than in the other multifilament nets of the net string; however, additional analysis has indicated that the total catch per unit of alternate monofilament-multifilament nets was still much greater than in an equal section of all multifilament netting (table 4).

Table 4 - Salmon Catch Per Net in Alternate Monofilament-Multifilament and All-Multifilament Gill Nets, 1962

Mesh Size	Species	Catch Per Net (Number)				Relative Efficiency of Alternate Unit
		Alternate Unit			All-Multifilament	
		Monofilament	Multifilament	Average of Alternate Unit		
Inches						
$3\frac{1}{4}$	Sockeye	19.41	4.72	12.07	6.44	1.87
	Chum	5.22	1.28	3.25	1.21	2.69
	Pink	0.12	0.06	0.09	0.05	1.80
	Total	24.76	6.06	15.41	7.70	2.00
$4\frac{1}{2}$	Sockeye	10.45	3.62	7.04	4.60	1.53
	Chum	3.22	1.36	2.29	1.36	1.68
	Pink	1.92	1.02	1.47	0.74	1.99
	Total	15.59	6.00	10.80	6.70	1.61

In the two phases of the experiment, three combinations of the two gear types were tried: all-multifilament in 1962 and 1963, alternated monofilament in 1962, and all-monofilament in 1963. By relating the catch per unit of effort of the two experimental types to that of the all-multifilament portion for each year, all three types of gear may be ranked by their relative efficiency. This proportional comparison is independent of changes in salmon abundance within or between years.

Table 5 - Relative Efficiency and Relative Cost of Multifilament, Monofilament, and Alternate Multifilament-Monofilament Gill Nets

	Symbol	Species	Multifilament		Alternate Nets		Monofilament	
			$3\frac{1}{4}$"	$4\frac{1}{2}$"	$3\frac{1}{4}$"	$4\frac{1}{2}$"	$3\frac{1}{4}$"	$4\frac{1}{2}$"
(a) Relative efficiency	w	Sockeye	1.0	1.0	1.9	1.5	1.6	1.5
		Chum	1.0	1.0	2.7	1.7	1.0	0.9
		Pink	1.0	1.8	1.8	2.0	-	1.8
		Total	1.0	1.0	2.0	1.6	1.5	1.3
(b) Relative cost[1/]	x		1.0	1.0	1.3	1.3	1.6	1.6
(c) Relative life[2/]	y		1.0	1.0	0.75	0.75	0.5	0.5
(d) Relative cost/year (x/y)	z		1.0	1.0	1.8	1.8	3.2	3.2
(e) Relative cost year/fish ($^2/_w$)		Sockeye	1.0	1.0	0.9	1.2	2.0	2.1
		Chum	1.0	1.0	0.7	1.1	3.2	3.6
		Pink	1.0	1.0	1.0	0.9	-	1.8
		Total	1.0	1.0	0.9	1.1	2.1	2.5
(f) Relative length of string necessary to catch N fish ($^1/_w$)		Sockeye	1.0	1.0	0.5	0.7	0.6	0.7
		Chum	1.0	1.0	0.4	0.6	1.0	1.1
		Pink	1.0	1.0	0.6	0.5	-	0.6
		Total	1.0	1.0	0.5	0.6	0.7	0.8

1/Based on 55 percent higher initial cost for monofilament.
2/Based on 50 percent shorter life for monofilament.

Table 5 (a) portrays the relative efficiency of the three gear units and it is apparent that, regardless of species or mesh size, the alternate monofilament-multifilament string had the highest catch per unit of effort, the all-monofilament moderate, and the all-multifilament the lowest.

Our limited experience with monofilament netting has shown that the initial cost of a finished net is about 55 percent greater than multifilament and, because of the difficulty in repairing monofilament webbing, its life is approximately 50 percent that of multifilament. By combining those factors (table 5 (b), (c)) with the relative efficiency of the three net types, an index of the cost per year per fish has been determined (table 5 (e)). The reciprocal of the relative efficiency (table 5 (f)) is a measure of the relative amount of gear necessary to capture an equivalent number of fish in the three types of gill-net strings.

A comparison of the relative cost per year per fish with the length of a net string necessary to catch equivalent numbers of fish (table 5(e), (f)), allows a final determination of efficiency versus cost. Alternate multifilament-monofilament nets provided the same number of salmon as all-multifilament with about one-half ($3\frac{1}{4}$-inch mesh 0.5, $4\frac{1}{2}$-inch mesh 0.6) of the effort and at almost the same relative cost per fish ($3\frac{1}{4}$-inch mesh 0.9, $4\frac{1}{2}$-inch mesh 1.1). Although the all-monofilament gear caught equal numbers of fish with only about three quarters ($3\frac{1}{4}$-inch mesh 0.7, $4\frac{1}{2}$-inch mesh 0.8) of the amount of gear, the relative cost per sample was never twice that of all-multifilament nets ($3\frac{1}{4}$-inch mesh 2.1, $4\frac{1}{2}$-inch mesh 2.5).

CONCLUSIONS

Based on the results of both the 1962 and 1963 phases of this study, the use of monofilament gill nets, either alone or alternated with multifilament nets, provided salmon samples of identical length and age composition as multifilament nets of the same mesh size; however, different proportions of sockeye, chum and pink salmon were taken in the two net types.

Monofilament nets captured more salmon than multifilament, especially when used as alternate monofilament-multifilament gear (alternated with multifilament nets). The relative efficiency of the three gear types tested was highest for alternate monofilament-multifilament, moderate for all-monofilament, and lowest for all-multifilament. Because of the higher initial cost and shorter life of the monofilament webbing, the cost per fish was highest for all-monofilament, moderate for all-multifilament, and lowest for alternate monofilament-multifilament. Therefore, in terms of cost and numbers of salmon captured, the alternate combination appears to have been the superior of the three tested for high-seas salmon fishing.

LITERATURE CITED

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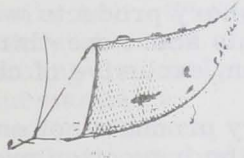

CORRECTION

In the August 1964 issue, page 7, the heading should have read: "CHANGES in Abundance of the Marine Worm, GLYCERA DIBRANCHIATA, Associated with Seawater Temperature Fluctuations."