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A new net and a new technique improve sampling of small fishes.

Variable-Mesh Beach Seine for Sampling Juvenile Salmon in Columbia River Estuary

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ABSTRACT

A 332-foot variable-mesh beach seine has been developed to sample juvenile salmon, Oncorhynchus *spp., in the Columbia River estuary. This net is designed for a two- or three-man operation and can be set with a small boat (18-20 feet) powered by an outboard engine (40 hp minimum). The net is particularly effective at capturing juvenile fall chinook salmon,* O. tshawytscha, *coho salmon,* O. kisutch, *chum salmon,* O. keta, *and cutthroat trout,* Salmo clarki; *it can also be used to sample various other species in the estuarine environment.*

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INTRODUCTION

Effective fishing gear is of primary importance to research and management workers concerned with sampling juvenile salmon, *Oncorhynchus* spp., in the estuarine environment. The National Marine Fisheries Service Biological Field Station at Hammond, Oreg., has developed a variable-mesh beach seine and seining technique that have proven particularly effective for sampling juvenile chinook salmon, *Oncorhynchus tshawytscha,* coho salmon, *O. kisutch,* chum salmon, *O. keta,* and cutthroat trout, *Salmo clarki,* in the Columbia River estuary. This paper describes this net and the technique used for its operation.

THE NET

The net is a variable mesh, single lead beach seine. Length and mesh size are dependent upon the purpose for which the net is to be used. The net we have used most effectively for sampling juvenile salmon and trout in the Columbia River estuary is 332 feet long on the cork line, fishes to a depth of 12 feet at the bunt (600 meshes deep -¼ inch mesh), and is cut to taper from 12 feet (300 meshes deep-½ inch mesh) to a fishing depth of 9 feet (230 meshes deep-½ inch mesh and 200 meshes deep-¾ inch mesh) at the wing (Figure 1). The net consists of three sections: lead wing, bunt, and anchor wing. The lead wing is further divided into two sections: a 175-foot outer or lead section of 210 d/18 × ¾ inch stretched mesh (No. 6 nylon, 3,725 ft/lb) knotted nylon seine netting and a 100-foot inner section of 210d/15 × ½ inch stretched mesh (No. 5 nylon, 4,650 ft/lb) knotted nylon. Both

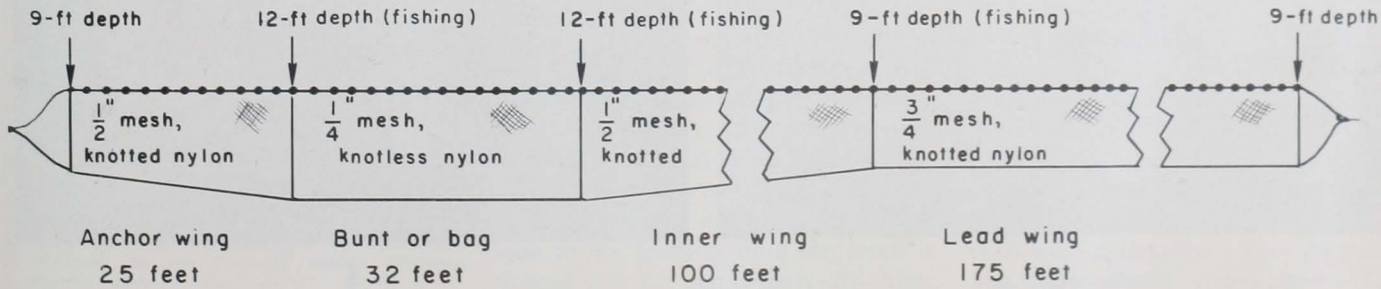


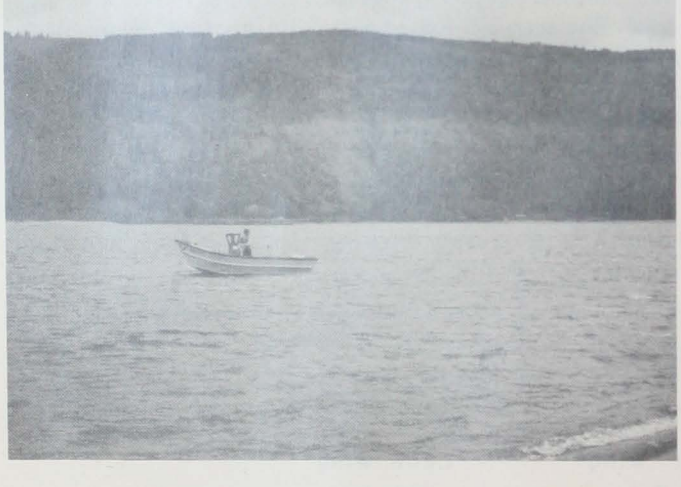
Figure 1.—A variable-mesh beach seine designed for sampling juvenile salmon in the Columbia River estuary. Depth values designate "fishing depth."

a

d

b

e



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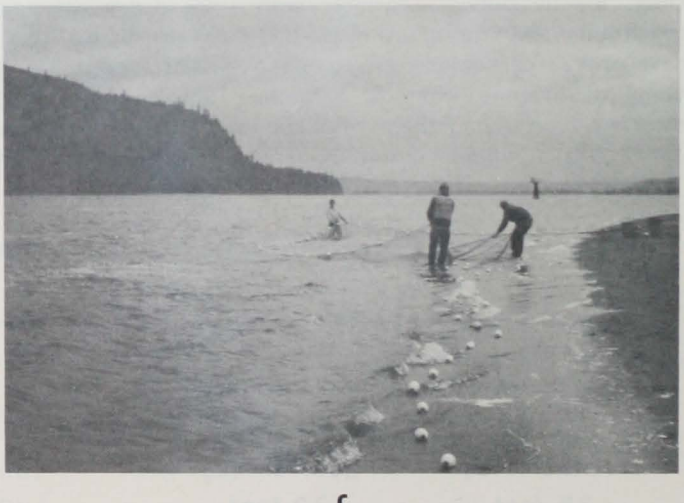

f

Figure 2.—Fishing the variable-mesh beach seine in the Columbia River estuary. (a)—picking up the net. (b)—upstream tow. (c)—downstream sweep. (d)—closing the net. (e)—hauling the net. (f)—bagging the catch.

sections are hung at 1½ feet of webbing to 1 foot of float and lead line (33 percent hang-in). Section stringers are of ⅜ inch polypropylene.

The 32-foot bunt or bag section is made of ¼ inch knotless nylon web hung at 3 feet of web to 1 foot of float and lead line (66.6 percent hang-in). The 25-foot anchor wing is made of 210 d/15 × ½ inch stretched mesh knotted nylon (No. 5 nylon, 4,650 ft/lb) and is hung the same as the lead wing.

The cork-line is $^{7}/_{16}$ inch polypropylene with webbing hung at 5-inch intervals. Floats used are B. F. Goodrich spongex k-4 grommeted plastic (14 ounce average buoyancy each) and are spaced at 24-inch centers.[1] The lead line is 120-pound/100-fathom size lead core. The gavels or breast lines are ⅜ inch polypropylene and are 9 feet long. A 100-foot tow line of $^{7}/_{16}$ inch polypropylene is attached to a 10-foot bridle made of the same material.

FISHING TECHNIQUE

The seine is best suited for beaches of sand, hard mud, or small gravel. It can be fished effectively by a two-man crew using an 18- to 20-foot boat powered by an outboard motor (40 hp minimum power). During periods of sustained operation or when large numbers of fish are being taken, the addition of a third crewman is advisable.

To set the net, the anchor wing is attached to an anchor or log on the beach and the net is laid out along the water's edge in the direction of the current. The tow line is picked up by the boat and the net is towed into the current as close to the beach as possible without grounding the motor (Figures 2a and 2b). At the end of the tow, the net is swung back with the current (Figure 2c). During the sweep, just enough power is used to keep an arc in the net. Excessive pull tends to lift the leadline and results in lowered efficiency. At the end of the sweep, the lead wing is closed (Figures 2d and 2e) and the net is worked along the beach, one man to the floatline and one to the leadline, until the catch is forced into the bag (Figure 2f). After the catch is removed from the bag, the net is in position to be reset without further handling.

[1] Reference to trade names in this publication does not imply endorsement of commercial products by the National Marine Fisheries Service, NOAA.

Table 1.—Beach seine catches at brackish water sampling stations in the Columbia River estuary, 1970.

Species	Month and (in parentheses) no. of sets					Total catch
	April (46)	May (28)	June (33)	July (67)	August (80)	
Alosa sapidissima[1]	2	2	6	3	2	15
Ammodytes hexapterus	0	126	3	0	0	129
Catostomus macrocheilus	0	33	104	9	5	151
Clupea harengus pallasi	0	1,859	374	345	196	2,774
Cymatogaster aggregata	5	0	5,237	3,822	14,683	23,747
Cyprinus carpio	0	142	26	54	13	235
Engraulis mordax	0	0	13	1	2,042	2,056
Gasterosteus aculeatus	13	99	171	594	643	1,520
Hypomesus pretiosus[2]	728	4,342	19,900	9,049	4,073	38,092
Leptocottus armatus	1	37	139	376	450	1,003
Merluccius productus	0	0	12	1	7	19
Microgadus proximus	0	0	0	0	21	21
Mylocheilus caurinus	127	0	10	161	218	516
Oncorhynchus keta[1]	589	206	0	0	0	795
O. kisutch[1]	217	399	12	4	0	632
O. nerka[1]	0	0	0	2	0	2
O. tshawytscha[1]						
Less than 1 year old	79	2,700	3,220	8,516	1,055	15,570
Yearlings	111	1	0	0	0	112
Platichthys stellatus	54	67	229	787	654	1,789
Psettichthys melanostictus	1	2	27	0	1	31
Salmo gairdneri[1]	4	6	0	0	1	11
Syngnathus griseolineatus	0	2	1	0	0	3

[1] Juveniles only.
[2] Totals for this species include an unknown number of *Spirinchus dialatus*.

Table 2.—Beach seine catches at a freshwater sampling station in the Columbia River estuary, 1970.

Species	Month and (in parentheses) no. of sets					Total catch
	April (390)	May (545)	June (700)	July (607)	August (178)	
Acipenser transmontanus[1]	0	0	5	23	1	29
Alosa sapidissima[1]	99	1,788	11,199	1,674	739	15,499
Catostomus macrocheilus	9	24	59	27	3	122
Cottus asper	0	24	235	50	40	349
Cyprinus carpio	18	126	44	72	1	261
Gasterosteus aculeatus	21,402	23,521	12,220	45,029	27,180	129,352
Ictalurus nebulosus	0	3	1	0	0	4
Lepomis macrochirus	0	12	4	2	1	19
Micropterus salmoides	15	9	5	13	12	54
Mylocheilus caurinus	67	1,078	2,503	1,162	439	5,249
Oncorhynchus keta[1]	32	137	4	0	0	173
O. kisutch[1]	9,826	34,711	502	29	2	45,070
O. nerka[1]	33	21	19	8	0	81
O. tshawytscha[1]						
Less than 1 year old	3,506	67,783	44,701	83,334	29,156	228,480
Yearlings	3,868	3,194	361	838	980	9,241
Perca flavescens	16	441	973	667	71	2,168
Platichthys stellatus	218	408	569	474	136	1,805
Pomoxis nigromaculatus	6	77	102	13	5	203
Prosopium williamsoni[1]	5	1	29	136	62	233
Ptychocheilus oregonensis	0	2	0	1	2	5
Salmo clarki	301	360	37	7	62	767
S. gairdneri[1]	178	750	67	3	10	1,008
Thaleichthys pacificus	13	0	0	0	0	13

[1] Juveniles only.

SEINE CAPABILITIES

This beach seine has proven to be an effective tool for sampling fall chinook salmon less than 1 year old, yearling coho salmon, chum salmon fry,

and cutthroat trout fry. It has not been particularly effective at sampling yearling chinook salmon, yearling sockeye salmon, *O. nerka*, or yearling steelhead trout, *S. gairdneri*. These species are generally found in the deeper channel areas and are much more susceptible to purse seining than to beach seining (Johnsen and Sims, 1973).

Catches of more than 1,000 fall chinook and 500 coho salmon per set have not been uncommon at the better sampling sites. Generally, our catches range from about 50 to 500 fall chinook per set and from 50 to 300 coho per set during the peak of the outmigrations.

Although this net was specifically designed to sample juvenile salmon, its usefulness is not restricted to these species. Tables 1 and 2 show the catches from freshwater and brackish water sampling stations in the Columbia River estuary. These sampling sites were chosen for their abundance of juvenile salmon. Catches of any other particular species could be greatly increased by fishing in areas more favorable to their abundance. We feel that this seine would be especially adaptable to sampling juvenile American shad, *Alosa sapidissima*, Pacific herring, *Clupea harengus pallasi*, northern anchovy, *Engraulis mordax*, starry flounder, *Platichthys stellatus*, and many of the smelts.

A significant advantage of this seine as a sampling tool is that the captured fish are generally in good condition and can be released with minimal mortality.

LITERATURE CITED

Johnsen, R. C., and C. W. Sims. 1973. Purse seining for juvenile salmon and trout in the Columbia River estuary. Trans. Am. Fish. Soc. 102:341-345.

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