

# OTTER TRAWLING INTRODUCED TO COLUMBIA RIVER SMELT FISHERY

## A Progress Report

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An otter trawl net was test fished in the Columbia River to catch eulachon. Limited commercial trawling caught about three times as many eulachons per day as gill netting did during the same period. Trawl gear costs less than gill nets and produces higher quality fish with less effort.

The fishery on the eulachon or Columbia River smelt, *Thaleichthys pacificus*, has used gill nets for many years (Pruter, 1966). The excessive handling and associated time loss using this method, plus high wastage and the product's frequently poor appearance, inspired a search for a better harvesting method. Initial results of a joint study by the Columbia River Laboratory of the Washington State Department of Fisheries and BCF's Exploratory Fishing and Gear Research Base at Seattle, Washington, indicate the potential value of using small trawl nets in the eulachon fishery (figure 1).

### THE FISHERY

Eulachon enter the Columbia River in November and are subjected to the commercial gill net fishery until they enter the tributaries, where they are taken by dip nets. While in the main river, the fish move up and down the river as well as vertically through the water column (Snyder, 1969). Eulachon form dense schools near the bottom on the ebb tide and are taken by weighted "diver" (sunken) nets. At the turn of the tide, and on the flood tide, the fish are at intermediate depths where they are caught by "bobber nets" (gill nets)

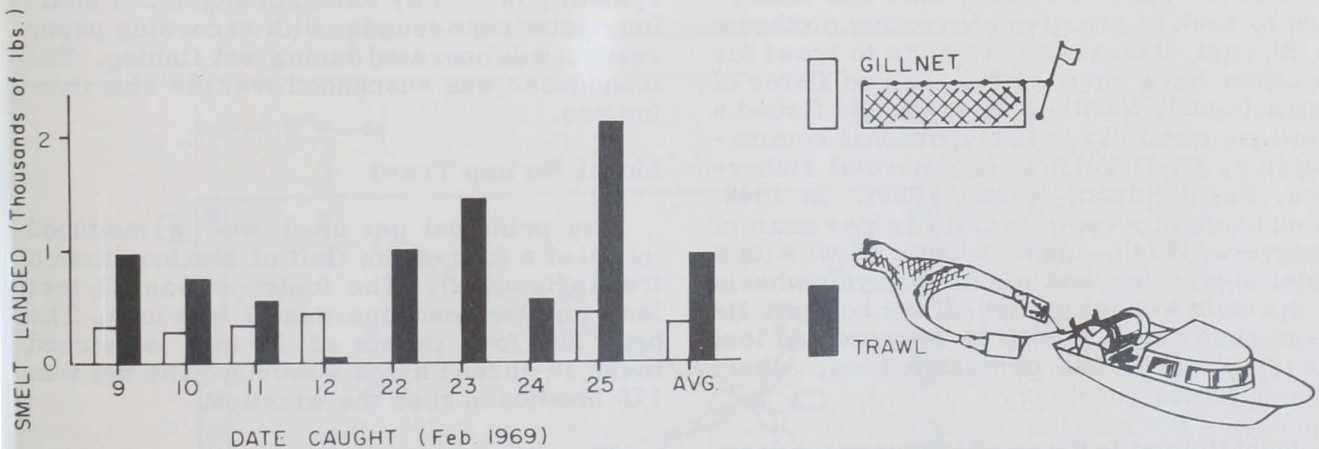


Fig. 1 - A comparison of daily catch of eulachon by an otter trawl (table 3) with the daily average catch of a sample of gill net fishermen (table 4).

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suspended below the surface by dropper lines). At high slack water, the fish are scattered near the surface and are taken with surface-floating gill nets.

Gill netting, normally a one-man operation, involves considerable handling, duplication of gear, and travel time. It is customary to fish two or more gill nets. Each net is fished by repeatedly drifting through the fishing area until the net is loaded. When all nets are loaded, the fisherman runs the boat to his shaking raft or dock. Then he removes each net from the boat, pulls it free in sections, and shakes each section vigorously to remove the smelt. When the smelt are clear of the net, he shovels them into boxes.

This process produces a poor-quality product. A net may be set and retrieved two or three times before the fish are removed (recapping); this causes some of the catch to be dragged over the boat rail several times. The fish are carried on the vessel tangled in the net with bodies distorted for some time before removal. Many fish have their heads snapped off during the shaking process, and the catch may include dirt and slivers off the floor of the shaking area when shoveled into boxes. In many cases hand sorting is required to remove badly damaged fish. These problems of the gill net fishery have led fishermen to seek alternative harvesting methods. In the past, at least two attempts to trawl for eulachon have been made. Trigve Tover of Puget Island, Washington, made and fished a trawl successfully in 1941 (personal communication, Max Holland, commercial fisherman, Puget Island, Wash., 1969). In 1942, Albert Coles, a commercial fisherman of Longview, Wash., made a beam trawl with a water pipe frame, and installed bicycle wheels at the ends to hold the net off the bottom. He made good catches until he snagged and lost his gear (personal communication, Albert Coles, 1968).

Most Columbia River gill net vessels seem suitable for handling small trawls. Several have gasoline engines in the 200- to 400-horsepower range, whereas trawls have been towed by vessels with engines as small as 25 horsepower (Baldwin, 1961). Also, some of the vessels have power-drive gill-net reels that could facilitate handling of the gear.

Washington State fishery regulations do not permit trawling in the Columbia River; however, the Department of Fisheries can issue

permits for trawling provided permittees obtain trawl licenses. Because the 1969 effort was experimental, the State issued a special test-fishing permit, at no cost, which allowed experimental trawling while a Department representative was aboard. All catches had to be returned to the water. The success of the initial attempts led the fishermen to purchase a trawling license and to obtain a special permit to use trawl gear on a commercial basis.

## METHODS AND MATERIALS

Several sources contributed to the program. The Washington Department of Fisheries provided background knowledge, a special fishing permit, and program monitoring. The BCF Exploratory Fishing and Gear Research Base furnished the trawling gear and technical advice on using it. Captain Arthur Peterson provided his and his mate's services and his vessel for the trawling trials in the main stem of the Columbia River near Longview, Washington.

### Vessel

The vessel used was the stern fishing, gill-net 'Sandy,' 32 feet long and with a 325-horsepower gasoline engine. The net was hauled on a gill net reel, which has a hydraulic drive system powered by the main engine. A shallow-water echo sounder with recording paper readout was operated during test fishing. The transducer was suspended over the side during use.

### Model Shrimp Trawl

The principal net used was a modified model of a four-seam Gulf of Mexico shrimp trawl (figure 2). The footrope was 22 feet long, and the headrope was 17 feet long. The body had four panels of  $1\frac{1}{4}$ -inch stretched mesh 15-thread nylon webbing. The net was 175 meshes across the wingtips.

The net was originally constructed with a horizontal separator panel and upper and lower cod ends, similar to the French "trouser trawl" (Boddeke, 1965) to test the French shrimp-sorting techniques in Pacific Northwest waters. The separator panel was removed from the net and a body liner of  $\frac{5}{8}$ -inch stretched mesh webbing was constructed and installed in the trawl. The liner was hung to the meshes along an imaginary line 50 meshes behind the center of the headrope and 20 meshes behind the center of the footrope. The

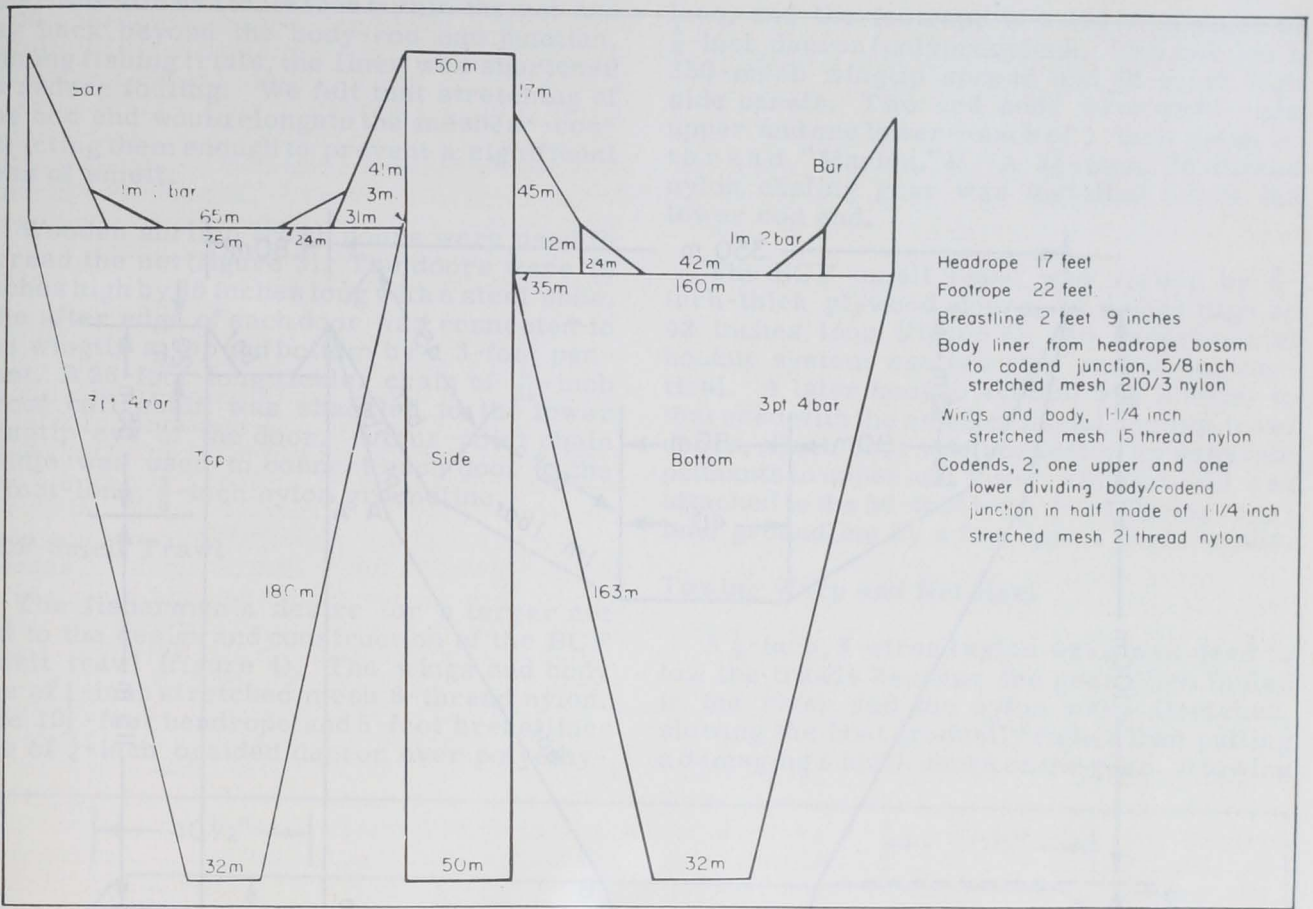


Fig. 2 - The model shrimp trawl modified for use in the smelt fishery.

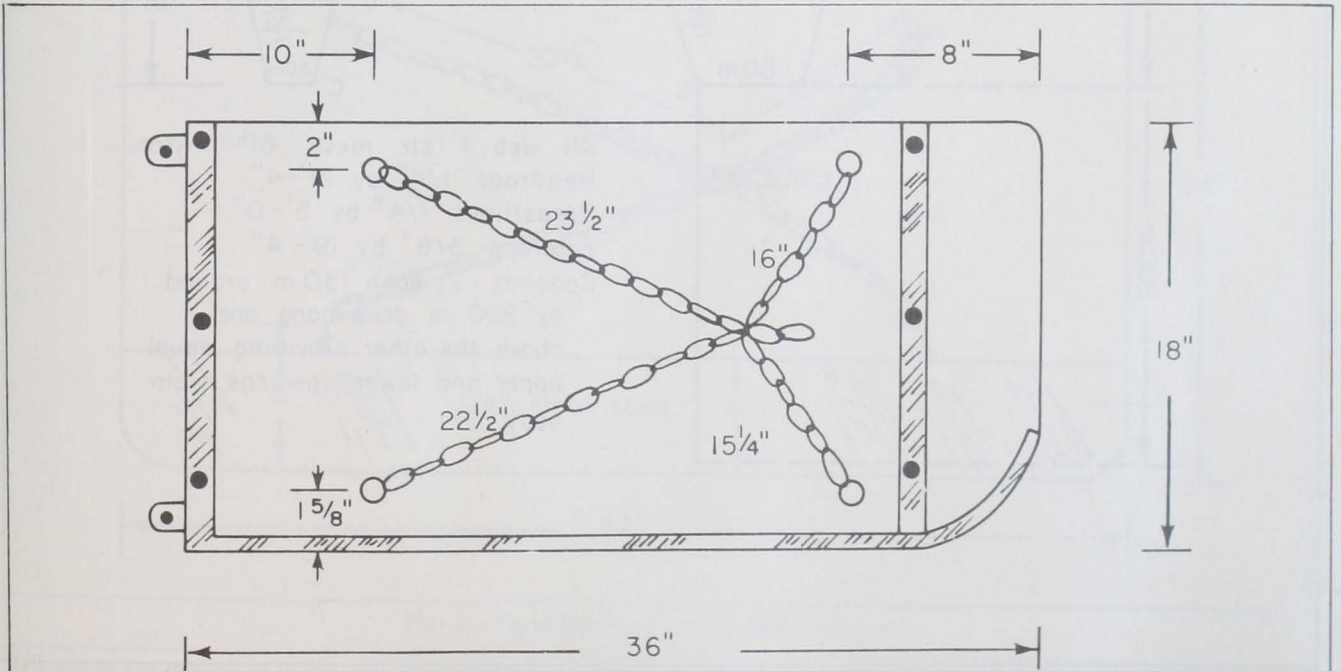


Fig. 3 - Trawl doors used with the model shrimp trawl.

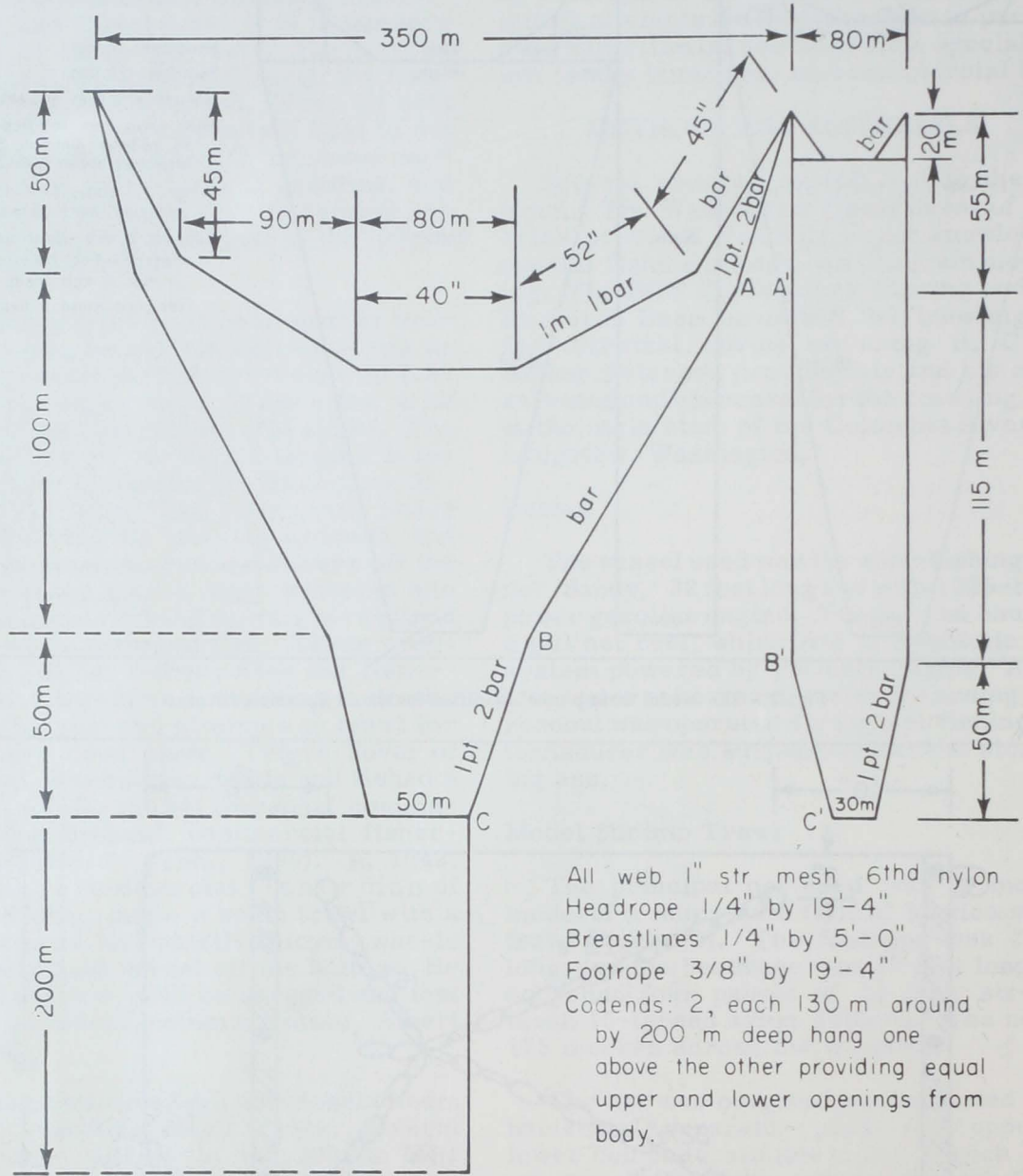


Fig. 4 - BCF Smelt Trawl

liner was allowed to lie free within the net and lay back beyond the body-cod end junction. During fishing trials, the liner was shortened to reduce fouling. We felt that stretching of the cod end would elongate the meshes--constricting them enough to prevent a significant loss of smelt.

Wooden shrimp trawl doors were used to spread the net (figure 3). The doors were 18 inches high by 36 inches long with a steel shoe. The after edge of each door was connected to the wingtip at top and bottom by a 3-foot pennant. A 26-foot-long tickler chain of  $\frac{5}{64}$ -inch proof coil chain was shackled to the lower wingtip eye of the door. A four-point chain bridle was used to connect each door to the 3-foot-long,  $\frac{3}{8}$ -inch nylon groundline.

#### BCF Smelt Trawl

The fishermen's desire for a larger net led to the design and construction of the BCF smelt trawl (figure 4). The wings and body are of  $1\frac{1}{2}$ -inch stretched mesh 6-thread nylon. The  $19\frac{1}{3}$ -foot headrope and 5-foot breastlines are of  $\frac{1}{4}$ -inch braided dacron over polyethy-

lene, and the footrope is a  $19\frac{1}{3}$ -foot piece of  $\frac{3}{8}$ -inch dacron/polypropylene. The net has a 350-mesh wingtip spread and 80-mesh high side panels. Two cod ends were used--one upper and one lower--each of 1-inch mesh 9-thread "Marlon."<sup>1/</sup> A  $2\frac{1}{2}$ -inch, 36-thread nylon chafing gear was installed below the lower cod end.

The BCF smelt trawl was spread by  $\frac{3}{4}$ -inch-thick plywood doors, 24 inches high by 42 inches long (figure 5). An experimental hookup system was tried but proved impractical. A later hookup system was similar to that used with the smaller model shrimp trawl doors. Each door was connected by separate pennants to upper and lower wingtips and was attached to the 50-foot long,  $\frac{3}{8}$ -inch polypropylene groundline by a four-point chain bridle.

#### Towing Warp and Net Reel

A  $\frac{1}{2}$ -inch, 3-strand nylon warp was used to tow the trawls because the gear often fouled in the river and the nylon warp stretched, slowing the boat gradually rather than putting a damaging sudden shock on the gear. A towing

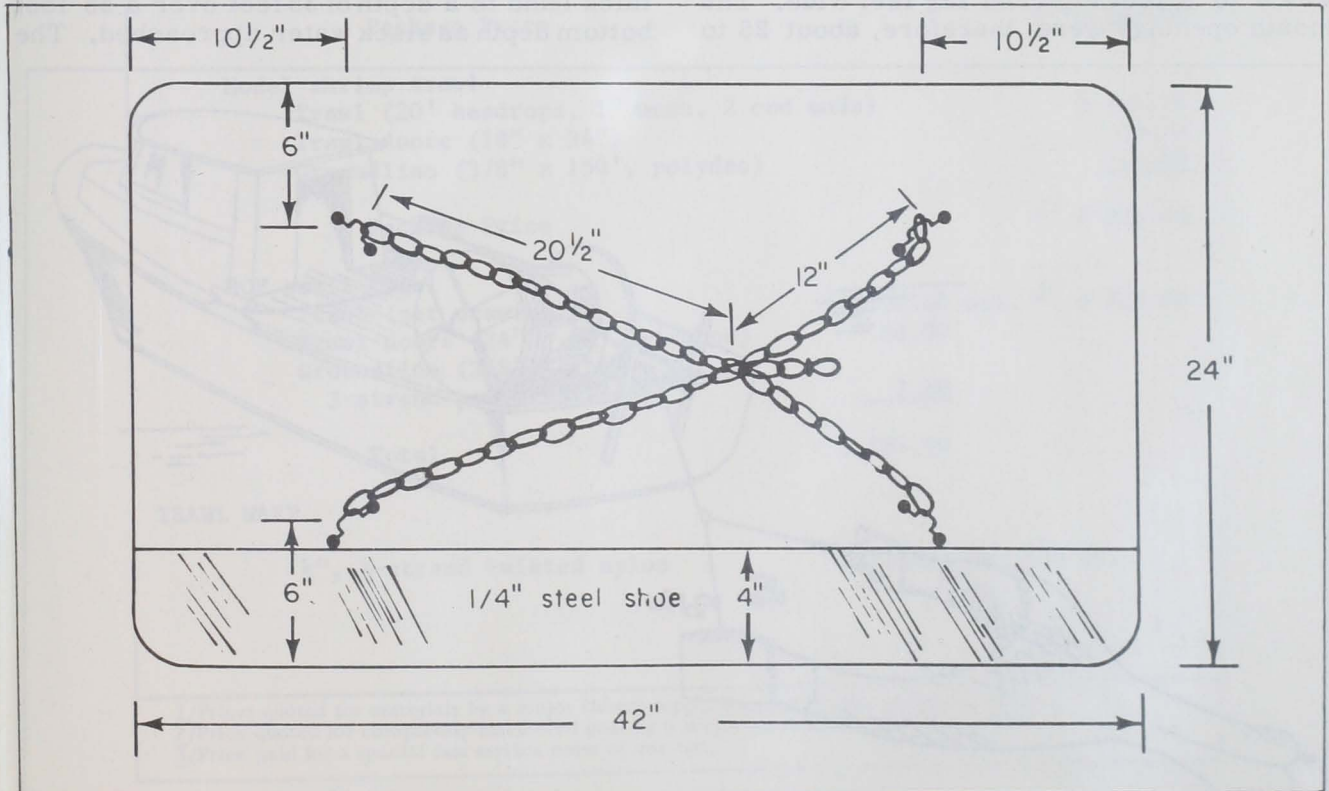


Fig. 5 - Trawl doors used with the BCF smelt trawl.

<sup>1/</sup>Trade names referred to in this publication do not imply endorsement of commercial products.

eye was tied into the warp at each anticipated towing point, and a towing bridle, anchored to hull cleats, was used to take the strain off the reel while towing. The nylon warp and groundlines were wound on the gill net reel (figure 6). The depth of the net was altered by paying out or taking up line on the powered reel; this eliminated much physical labor. The reel had sufficient power to haul easily and unaided one catch of 600 pounds over the rail and into the vessel.

#### Gear Costs

Table 1 compared costs of the major components of trawl system and gill nets.

#### Diver Observations

The trawl gear was observed by divers in Puget Sound. The model shrimp net with 18-inch by 36-inch doors rigged as in the commercial tests was found to be  $3\frac{1}{2}$  to 4 feet high at the center of the headrope and 8 feet wide. The BCF smelt trawl with 18-inch by 36-inch doors was 4 to 8 feet high and  $12\frac{1}{2}$  feet wide. With 24-inch by 42-inch doors, the BCF net was 4 to 8 feet high and  $13\frac{1}{2}$  feet wide. The mouth openings were, therefore, about 25 to

30 square feet for the shrimp trawl, 35 to 75 square feet for the smelt trawl with small doors, and 40 to 85 square feet for the smelt trawl with large doors.

These nets were set and retrieved by hand without difficulty from BCF's 23-foot vessel 'Sea Probe.'

#### Test Fishing

The model shrimp trawl was tested in the Columbia River on February 6 and 7 under the conditions of a permit from the Washington Department of Fisheries to conduct experimental fishing. Four bottom tows were made each day during the ebb tide. Catches varied up to 350 pounds in a 14-minute tow (table 2). These catch rates were sufficiently encouraging so that the fishermen purchased a trawling license to fish commercially.

Useful information was obtained from these tests. The Washington Department of Fisheries observer, using a portable recording echo sounder, saw apparent fish signs on bottom during the ebb tide rise in a 2-foot-thick band to a depth of 35 feet over a 55-foot bottom depth as slack water approached. The

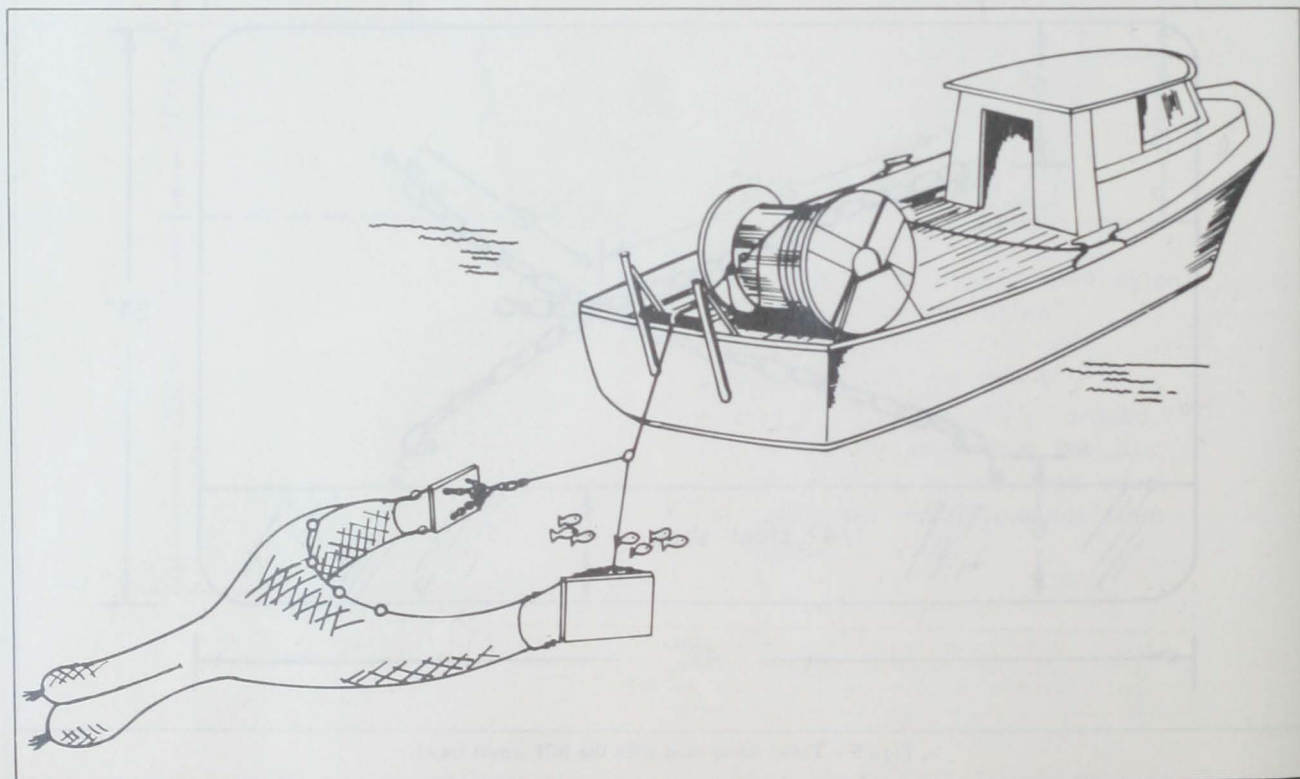


Fig. 6 - Stern picking gill net vessel with reel as rigged for smelt trawling.

Table 1 - Smelt Gear Costs		
	Materials Only	Complete
<b>GILL NETS</b>		
Diver gill net 90 fms. long x 60 meshes deep	<u>1/</u>	\$ 251.80
Floater gill net 100 fms. long x 100 meshes deep	<u>1/</u>	315.10
Bobber gill net 130 fms. long x 125 meshes deep	<u>1/</u>	479.29
<b>TRAWLS</b>		
Model shrimp trawl		
Trawl (20' headrope, 1½" mesh, 2 cod ends)		\$ 110.00
Trawl doors (18" x 36")		75.00
Groundline (3/8" x 150', polydac)		<u>25.00</u>
Package Price	<u>2/</u>	\$ 200.00
Model shrimp trawl		
Trawl (20' headrope, 1" mesh, 2 cod ends)		\$ 135.00
Trawl doors (18" x 36")		75.00
Groundline (3/8" x 150', polydac)		<u>25.00</u>
Package Price	<u>2/</u>	\$ 225.00
BCF smelt trawl		
Trawl (per drawing)	\$ 100.00 est.	<u>3/</u> \$ 431.00
Trawl doors (24" x 42", plywood)	50.00	
Groundline (3/8" x 150', 3-strand polypropylene)	<u>7.80</u>	
Total		\$ 157.80
<b>TRAWL WARP</b>		
½", 3-strand twisted nylon		\$ 13.25 per 100 ft.
<p><u>1/</u>Prices quoted for materials by a major fishery supply house in Seattle on July 1, 1969.  <u>2/</u>Price quoted for completely assembled gear by a major manufacturer on July 1, 1969.  <u>3/</u>Price paid for a special fast service order of one net.</p>		

Table 2 - Tows Made With Model Shrimp Trawl During Fishing Tests

Date	Elapsed Time	Water Depth	Warp Length	Smelt Caught
	Minutes	Feet	Feet	Pounds
February 6	15	20-25	150	3/4
" 6	15	20-54	250	76
" 6	32	50-80	350	50
" 6	33	30-55	540	22
February 7	19	50-80	300	10
" 7	14	50-80	300	98
" 7	18	50-80	350	3
" 7	14	50-65	350	350

1/Log in net.  
2/Log in the net tore the webbing.

Table 3 - Trawl Caught Smelt Landings by the Vessel Sandy

Date	Drags Made	Mean Drag Time	Total Drag Time	Eulachon Catch	Catch per Effort
	No.	Minutes	Minutes	Pounds	Lbs./Min.
1969					
2/9	5	20	100	975	9.8
2/10	6	20	120	750	6.2
2/11	6	22	132	550	4.2
2/12 <sup>1/</sup>	1	19	19	67	3.5
2/22	5	12	60	1,000	16.7
2/23	5	30	150	1,450	9.7
2/24	3	30	90	550	6.1
2/25 <sub>2/</sub>	5	30	150	2,100	14.0
Total eulachon landed (pounds) - - - - -					7,442
Days fished (number)- - - - -					8
Average catch per day (pounds)- - - - -					930.3
Average catch per drag (pounds) - - - - -					212.7
1/Smelt run entered Cowlitz River--trawl fishermen made one tow then switched to dip netting from 2/15 to 2/20.					
2/Large run entered Cowlitz River--trawl fishermen switched to dip netting.					



upper and lower cod ends were also found useful. The eulachon mainly entered the upper bag while gravel and heavy trash went into the bottom bag.

The BCF smelt trawl was completed after the end of the gill net season. On March 6, near Mayger, Oregon, an 8-minute tow with the trawl spread by 24-inch by 42-inch doors yielded 61 pounds of eulachon. On March 21, near Puget Island, Washington, a 20-minute tow with the trawl opened by 18-inch by 36-inch doors yielded 25 pounds, and an 18-minute tow caught 15 pounds.

#### Commercial Fishing

Commercial trawling with the model shrimp net was conducted during two periods--February 8 to 12 and February 21 to 25. The trawl fishermen shifted to dip netting for eulachon in the Cowlitz River from February 15 through 20. A total of 35 commercial drags were made. Daily landings by the commercial trawling vessel ranged from 67 pounds on February 12 to 2,100 pounds on February 25 (table 3). The average landing per day was

930 pounds or 465 pounds per man-day. These numbers do not include about 200 pounds of fish given to the BCF Biological Station at Prescott, Oregon, for studies.

No commercial trawling was done after February 25 because the trawl fishermen were engaged in the Cowlitz River dip net fishery, which finally glutted the market.

Representative landings by the gill net fishery during this period are presented in table 4 for comparison. Each landing represents one fisherman's catch for 1 day. The average landings, 339 pounds of eulachon per man-day, is about two-thirds the daily average trawl caught landing per man during this period.

#### CONCLUSIONS

Trawling for smelt in the Columbia River indicated that this method may be superior to the present method of gill netting. Trawl gear is less expensive, more durable, and may be used at different tidal stages. There is less time loss with trawl gear because net shaking

Table 4 - Representative Landings of Columbia River Smelt Taken by Commercial Gill Net Fishermen  
(Each Figure Is One Fisherman's Catch in Pounds for 1 Day)

Date	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	Daily Average
2/9	457	407	364	400	-	400	400	53	250	84	313
2/10	250	400	368	250	250	25	250	250	250	350	264
2/11	425	250	617	600	300	250	250	250	300	145	339
2/12	275	460	550	-	-	575	450	300	-	-	435
2/13 <sup>1/</sup>											
2/25	250	250	625	625	-	-	-	-	-	-	438
2/26 <sup>1/</sup>											
Total eulachon landed (pounds) - - - - -											13,205
Vessel-days fishes (number)											39
Average landing (pounds)											338.6

<sup>1/</sup>Smelt run entered Cowlitz River--gill net fishermen switched to dip netting.

is not required. The product is in much better condition. The method can be used with little or no modification to many existing vessels.

#### SUMMARY

Otter trawls were used to take smelt in the Columbia River. Two days of test fishing encouraged fishermen to engage in a commercial trawl fishery during the period open to the gill net fishery. The trawlers landed nearly three times as many fish per day as the average of a sample of gill netters. The trawl-caught fish were in excellent condition. Some held in an aquarium suffered no mortality

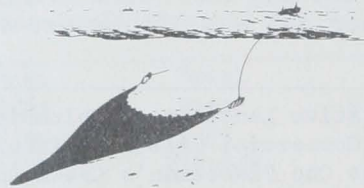
from the time of capture through the first 2 days.

#### ACKNOWLEDGEMENTS

We thank sincerely Albert Coles of Longview, Wash., whose suggestions and comments led to this program. Captain Arthur Peterson and his mate, Max Holland, of the 'Sandy' volunteered and made the field tests. Dennis Austin, Washington Department of Fisheries, monitored the test fishery. Jerry Jurkovich, BCF gear specialist, suggested changes that were incorporated in both trawl systems.

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#### WHO HIRES OCEANOGRAPHERS?

Between 2,500 and 3,000 scientists and technicians are employed in oceanography and related fields of marine science in the United States, and the number is growing. Most of these scientists are employed by colleges and universities and by university-operated oceanographic laboratories, where they are usually engaged primarily in research.

The Federal Government employs a substantial number of oceanographers. Many oceanographic positions are in activities of the Navy; the Naval Oceanographic Office in the Washington, D.C., area probably employs more than any other single activity. Government agencies with sizable oceanographic staffs are ESSA (Environmental Science Services Administration), with laboratories located in Miami and Seattle; BCF (Bureau of Commercial Fisheries) with laboratories at 14 coastal locations; and Public Health Service, with three shoreside research stations. The Bureau of Mines marine work is at Tiburon Island, California. Marine scientists employed by the U.S. Coast Guard and the CERC (Army Engineers) are usually based in Washington, D.C. A total of 22 Government agencies conduct oceanographic work of some kind. States bordering the ocean and Gulf of Mexico also employ quite a number of marine specialists.

Oceanographers are employed in limited but growing numbers by private industry (manufacturers and consulting firms), independent nonprofit laboratories, fishery laboratories, and local Governments. ("Questions About The Oceans," U.S. Naval Oceanographic Office.)