

SCALLOP EXPLORATIONS OFF OREGON

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BCF's exploratory fishing vessel "John N. Cobb" conducted two surveys for the weathervane scallop (*Patinopecten caurinus*) off Oregon, one in 1963, the other in 1967. The primary fishing gear was an 8-foot, New Bedford-type, scallop dredge.

In 1963, greatest concentrations of scallops occurred between Tillamook Head and Cape Falcon, Oregon, in 53 fathoms. Catch rates reached 753 scallops (5 bushels) per $\frac{1}{2}$ -hour tow. But, when this area was fished again in 1967, catch rates reached only 10 scallops per $\frac{1}{2}$ -hour tow. The best catch in 1967 was 118 scallops per $\frac{1}{2}$ -hour haul off Sand Lake, Oregon, in 55 fathoms.

The first survey began Sept. 30, 1963, and lasted 7 weeks. It explored the grounds from Cape Arago to Heceta Head, from Alsea Bay to Yaquina Head, and from Cape Falcon to the Columbia River at depths from 28 to 65 fathoms (fig. 1).

The second survey, a 3-week cruise, started March 6, 1967. Hauls that had been made off Tillamook Head in 1963 were duplicated, and hauls were made over unsurveyed grounds between Cape Falcon and Cascade Head and just north of the Columbia River (fig. 1).

The primary aim of the explorations was to locate and delineate concentrations of scallops along the Oregon coast. Secondary aims were to (1) obtain information on the catch rates of the 8-foot, New Bedford-type, scallop dredge--and to compare its catching efficiency with that of a modified 400-mesh eastern otter trawl; (2) collect biological data on size, distribution, and abundance of scallops; and (3) collect scallops for meat-yield analysis by the Oregon State University Seafoods Laboratory at Astoria.

THE SCALLOP RESOURCE

Scallops are an important fishery resource along the Atlantic coast of the U. S. (Posgay, 1957) and Canada (Bourne, 1964). A moderate scallop fishery existed in Puget Sound, Wash., between 1935 and 1952. No sustained scallop fishery exists today along the Pacific coast of the U. S. and Canada, although recent

catches off Kodiak, Alaska, indicate a fishery may develop there in the near future. Because there has been considerable speculation on the availability of scallops, surveys

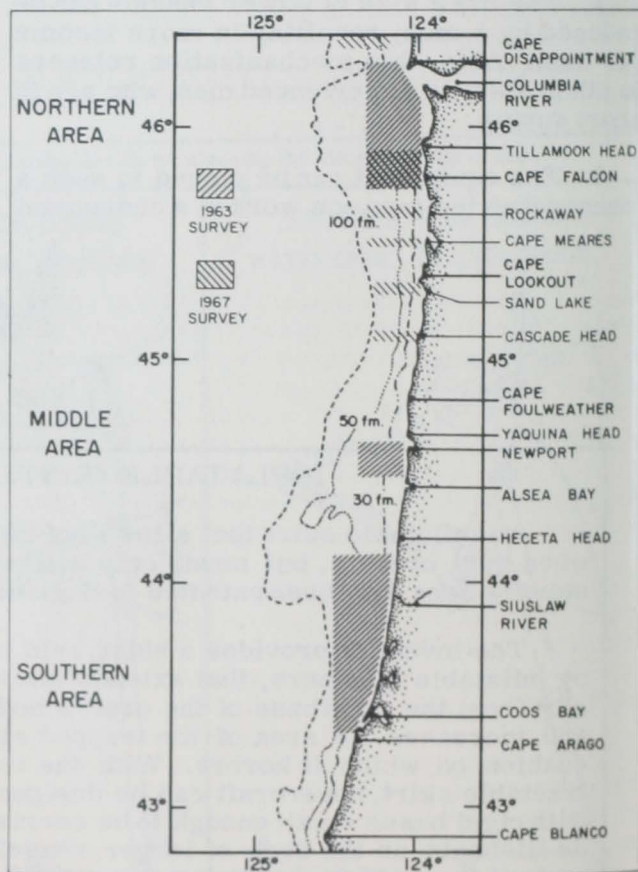


Fig. 1 - The areas surveyed for scallops off Oregon coast.

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have been made in Alaska (Rathjen and Rivers, 1964) and along the Pacific coast of Canada (Quayle, 1961 and 1963).^{1/}

The presence of scallops off the Oregon and Washington coasts has been known for many years. Commercial fishermen report numerous scallops taken frequently by otter trawls and halibut longline gear. The quantity usually is not large enough to market, but at times enough are caught to be used as food on board fishing vessels.

Interviews with otter trawl fishermen, industry representatives, and personnel of Washington and Oregon fishery agencies indicated that few attempts had been made to harvest this resource commercially. Several years ago, a small vessel fished commercially out of Tillamook Bay, Oregon, using an otter trawl modified to dig into the bottom. Several fishermen have reported sporadic catches up to 500 pounds per drag. These interviews indicated that scallops were generally located along the entire Oregon and Washington coast at 40 to 60 fathoms and that a potential resource might exist.

GEAR AND METHODS

An 8-foot, New Bedford-type, scallop dredge was the primary gear used in the survey. The frame and bail of the dredge were made of steel, the bag of manila rope and welded steel rings connected by dredge links, and the club of oak and steel (fig. 2). Rathjen and Rivers (1964) used a similar dredge in the 1963 Gulf of Alaska explorations. Posgay (1957) and Bourne (1964) give detailed descriptions of this type of dredge and the method of operation.

A commercial 400-mesh eastern otter trawl (Greenwood, 1958), modified by the addition of 60 feet of $\frac{5}{8}$ -inch chain to the foot-rope to keep it near the bottom, was also used during the 1963 survey.

Prior to the explorations, information on the geographic and bathymetric distribution of scallops and the possible locations of commercial concentrations was obtained by interviews. This information was then used in establishing the sampling design.

The sampling procedure followed a predetermined grid pattern in which $\frac{1}{2}$ -hour drags

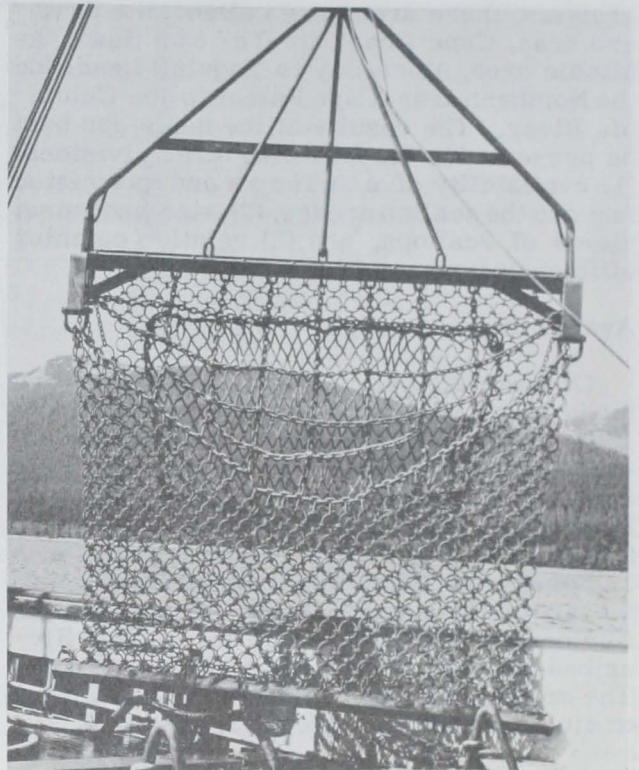


Fig. 2 - An 8-foot, New Bedford-type, scallop dredge (photo courtesy of Exploratory Fishing and Gear Research Base, Juneau, Alaska).

were made parallel to the coast at 5-fathom increments from 30 to 70 fathoms at 5 to 10 nautical mile intervals. Between each series of parallel stations, a drag (generally 1-hour long) was usually made perpendicular to the coast from about 30 to 60 fathoms to reduce the likelihood of missing significant concentrations. The interval between stations was reduced to 2.5 nautical miles when availability was greater than 1 bushel per one-half hour, or when fishing an area where a concentration of scallops had been reported.

The data collected included: (1) pounds and numbers of scallops taken, (2) height frequency of catches, and (3) total pounds of the associated catch. Scallops were counted and placed into a bushel basket that was then weighed on a spring scale. Scallop height (the distance from posterior margin of hinge to leading edge of shell in a line perpendicular to hinge) was measured with vernier calipers.

RESULTS OF 1963 SURVEY

Two otter trawl hauls and 124 scallop dredge hauls were made during this survey in three distinct areas (fig. 1). To facilitate

^{1/}Unpublished reports, Fisheries Research Board of Canada, Biological Station, Nanaimo, B.C.

analysis, these areas are called: the Southern area, Cape Arago to Heceta Head; the Middle area, Alsea Bay to Yaquina Head; and the Northern area, Cape Falcon to the Columbia River. The results of the hauls can best be presented in the following three divisions: (1) availability of scallops and associated fauna to the scallop dredge, (2) size and meat yields of scallops, and (3) relative catching efficiency tests.

Availability to Dredge

Of the 124 scallop dredge hauls, 72 were made in the Southern area; 8 in the Middle area; and 44 in the Northern area. With the exception of three hauls on the Siuslaw River bed, all dredge hauls in the Southern and Middle areas were made at a scope ratio (length of towing cable to water depth) of 4 to 1. Speed over the bottom ranged from 1.4 to 4.0 knots and averaged 2.9. All hauls in the Northern area, and three on the Siuslaw River bed, were made at a scope ratio of 3 to 1. The speed over the bottom ranged from 1.8 to 4.6 knots and averaged 3.5.

Southern Area

Of the 72 hauls (fig. 3) between 30 and 60 fathoms, 39 took scallops. The largest catch rates occurred along the 40- and 55-fathom depth contours, where the average catch was 14 and 57 scallops per one-half hour, respectively (table 1). The average catch along the 55-fathom contour for the entire area is probably overestimated because 10 of the 16 hauls were replicate hauls made off the Siuslaw River. There, the greatest availability occurred on a well-defined bed (fig. 3). Most scallops were taken on this bed--up to 175 per 1/2-hour haul.

Table 1 - Number of 1/2-Hour Hauls and Average Catch Rates of Fish and Shellfish Taken in Southern Area

Midpoint of Depth Intervals	1/2-Hour Hauls	Average Per 1/2-Hour Haul				
		Scallops	Crab	Starfish	Sea Pens	Fish
Fathoms	No. 1/2 (Number) (Pounds) ..				
30	7	0.1	25.1	6.4	-	2.0
35	7	2.2	38.8	3.0	-	2.7
40	11	13.7	9.3	3.9	-	5.2
45	7	9.8	2.3	3.4	-	1.6
50	9	6.8	0.5	0.2	-	0.1
2/55	16	56.7	2.2	1.1	0.7	0.9
60	9	9.0	0.1	0.4	8.4	1.6

1/Six perpendicular hauls, Nos. 9, 17, 25, 33, 41, and 42 (fig. 3), made across the depth contours were excluded from this table.

2/Data for this interval include 10 replicate dredge hauls made off Siuslaw River on highly productive beds.

In the 72 hauls, 1,325 pounds of fish and shellfish were captured. Of this weight, scallops were 37 percent, Dungeness crab (*Cancer magister*) 25 percent, fish 12 percent, starfish 13 percent, sea pens 7 percent, egg cases of big skate (*Raja binoculata*) 5 percent, and miscellaneous invertebrates 1 percent. Dungeness crabs were found primarily in the shallower depths (30 and 35 fathoms, table 1) from Coos Bay to Siuslaw River. Starfish and fish catches were common but small at all depth intervals. The seapens occurred only in the deep-water intervals. Skate egg cases were found primarily in three hauls, Nos. 49, 50, and 51, made just off the Siuslaw River mouth--and the numbers taken were 61, 19, and 38, respectively.

Middle Area

The catches of eight hauls consisted primarily of starfish and miscellaneous fish in amounts of less than 25 pounds per 1/2-hour haul. No scallops or crabs were taken.

Northern Area

Scallops were found in 34 of the 44 hauls and were distributed primarily between 40 and 65 fathoms (fig. 4). Catches were larger here than in the other two areas surveyed. The catch rates were best at the 50- and 55-fathom depth contours, where they averaged 289 and 316 scallops per 1/2-hour haul (table 2). The largest catches occurred in three hauls between Tillamook Head and Cape Falcon near the 50-fathom depth contour. The haul numbers were 107, 112, and 116, and their respective catches were 635, 619, and 753 scallops per 1/2-hour haul.

Table 2 - Number of 1/2-Hour Hauls and Average Catch Rates of Fish and Shellfish Taken in Northern Area

Midpoint of Depth Intervals	1/2-Hour Hauls	Average Per 1/2-Hour Haul				
		Scallops	Crabs	Starfish	Sea Pens	Fish
Fathoms	 (Number) (Pounds) ..				
30	1	-	44.0	3.0	-	-
35	6	0.2	16.7	6.5	-	1.8
40	7	16.4	24.1	2.1	-	0.4
45	8	98.1	124.5	2.6	-	0.4
50	8	289.0	14.6	3.6	-	0.8
55	7	316.3	0.6	8.0	-	2.8
60	5	38.6	0.2	3.4	1.2	0.3
65	2	5.5	-	-	1.0	1.0

In the 44 hauls, 3,692 pounds of fish and shellfish was taken. Of this weight, scallops made up 50 percent; Dungeness crab, 41 percent; fish, 1 percent; starfish, 6 percent; and egg cases of big skate, 2 percent. Dungeness

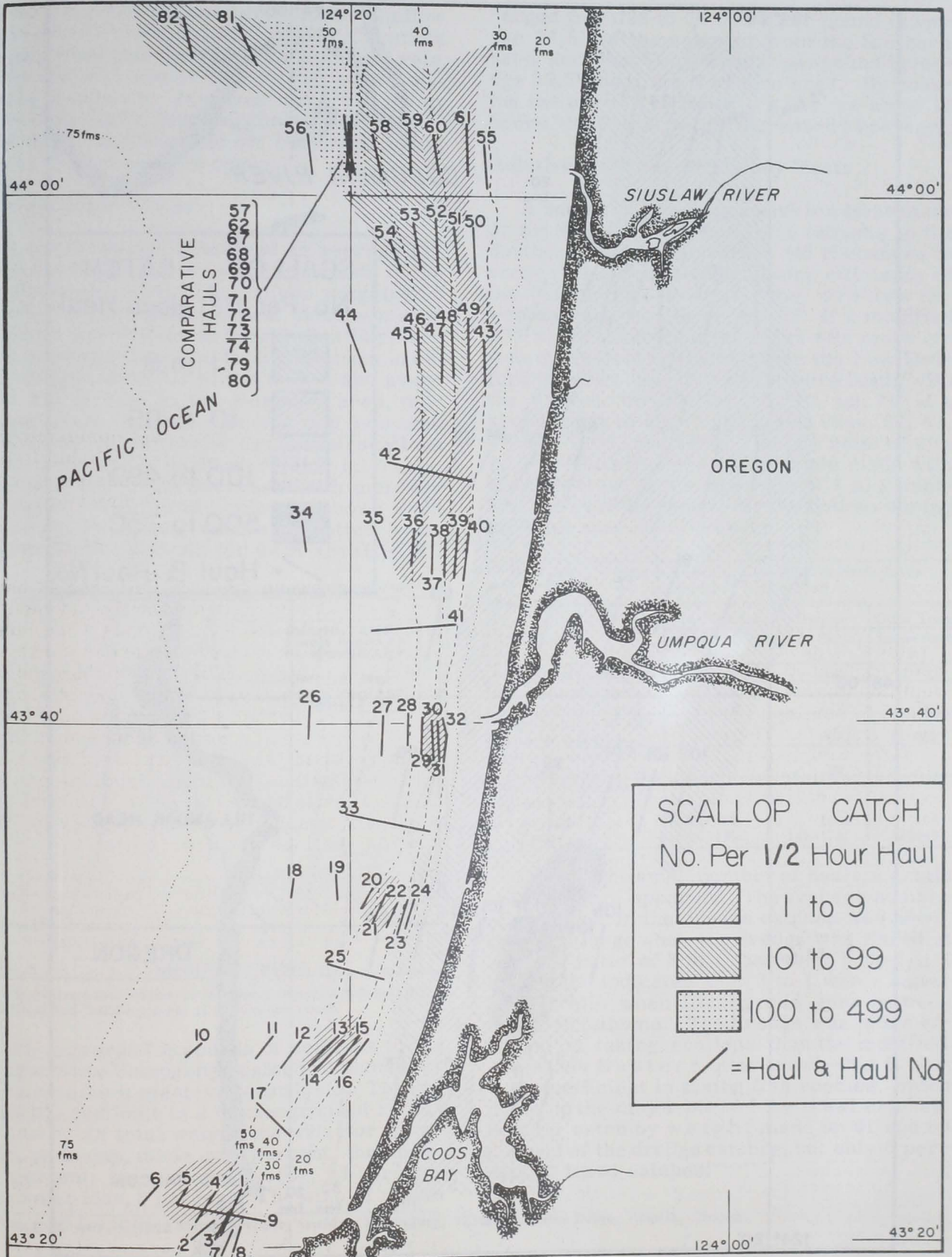


Fig. 3 - Distribution and relative abundance of scallop and location of scallop dredge stations in Southern area.

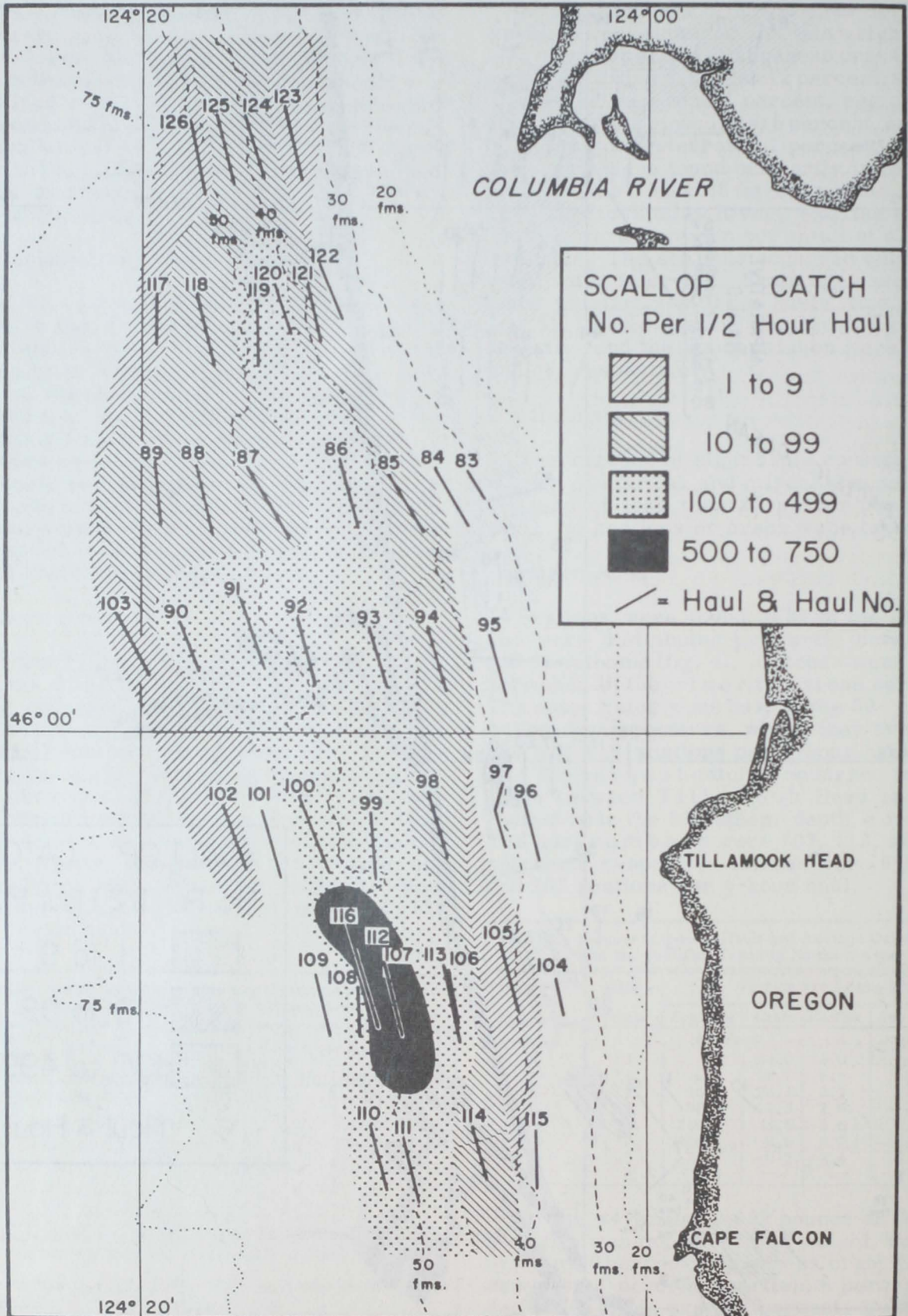


Fig. 4 - Distribution and relative abundance of scallop and location of scallop dredge stations in Northern area.

crabs were found primarily in the shallow depth intervals (table 2) off the Columbia River. Fish and starfish catches were relatively small and occurred at all depths. Trace amounts of sea pens were taken in some deep hauls. Skate egg cases were dominant in one haul (No. 96) off Tillamook Head; there, 150 cases were taken.

Size and Meat Yields

A bushel basket contained an average 117 scallops weighing an average 45 pounds in the Southern area--and 150 scallops weighing 50 pounds in the Northern area. Southern area scallops were taller in height than Northern area scallops (fig. 5). In the Southern area, they ranged from 3.3 to 6.3 inches and averaged 4.6 inches; in the Northern area, they ranged from 3.1 to 5.1 inches and averaged 4.2 inches. In both areas, the largest scallops were taken in the shallower depth intervals, and the average size decreased with increasing depth. This trend is clearly shown when the height-frequency data are plotted by 5-fathom depth intervals for each area (fig. 6).

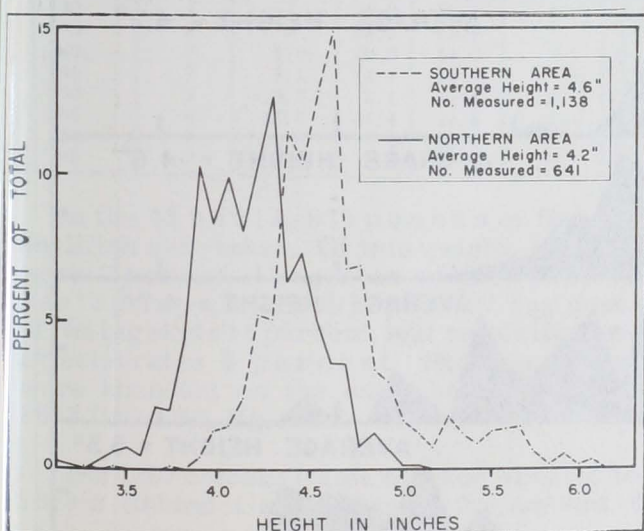


Fig. 5 - Comparison of height frequency of scallops taken in Northern and Southern areas of the Oregon coast.

We delivered 798 pounds of scallops to the Oregon State University Seafoods Laboratory in Astoria for a meat-yield analysis. The results are available in a mimeographed report by Law^{2/}. Of total weight, the adductor muscles, or meats, made up 7 percent; the shell, 57 percent; the remaining body, 33 percent; and water loss, 3 percent. The size of meats

ranged from 28 to 34 count per pound (average 31.3) in the samples from the Southern area, and from 51 to 58 count per pound (average 53.5) from the Northern area. By soaking the meats in fresh water for about 12 hours, their total weight increased 14 percent.

Relative Catching Efficiency Tests

A series of 12 comparative tows was made on the Siuslaw River bed in 55 fathoms in the Southern area to determine: (1) if changes in scope ratio affected the catching efficiency of the 8-foot, New Bedford-type, dredge for weathervane scallops; and (2) if a modified 400-mesh Eastern otter trawl was more efficient at catching scallops than the New Bedford-type dredge. Ten hauls were made with the dredge, three (Nos. 69, 70, and 71) at a scope ratio of 3 to 1 and seven (Nos. 57, 62, 67, 68, 72, 73, and 74) at a scope ratio of 4 to 1. Two hauls (Nos. 79 and 80) were made with the otter trawl at a scope ratio of 3 to 1 (table 3). The average speed over the bottom during all hauls was about 3 knots.

Table 3 - Catches Taken in Comparative Hauls Made on Siuslaw River Scallop Bed

Item	8-Foot Scallop Dredge		Otter Trawl
	Scope Ratio, 4:1	Scope Ratio, 3:1	Scope Ratio, 3:1
Number of hauls	7	3	2
Average speed over the bottom (knots)	2.8	2.9	3.0
Average catch of all species (pounds)	21	36	397
Average occurrence of scallops in catch (%)	91	89	5
Number of scallops per 1-hour haul:			
Average	60	163	33
Range	5-135	145-175	23-43

Despite the small number of hauls, certain relations are apparent. The average number of scallops in the dredge catches was about twice as large when the dredge was fished at a scope ratio of 3 to 1 than when fished at 4 to 1; this indicates that 3 to 1 was a better scope ratio when fishing this gear between 30 and 60 fathoms. The dredge was more efficient at taking scallops than the modified 400-mesh Eastern otter trawl--but it was very inefficient in taking fish species, which made up the major part of the trawl catches. Scallop catch by weight made up 91 and 89 percent of the dredge catches, but only 5 percent of trawl catches.

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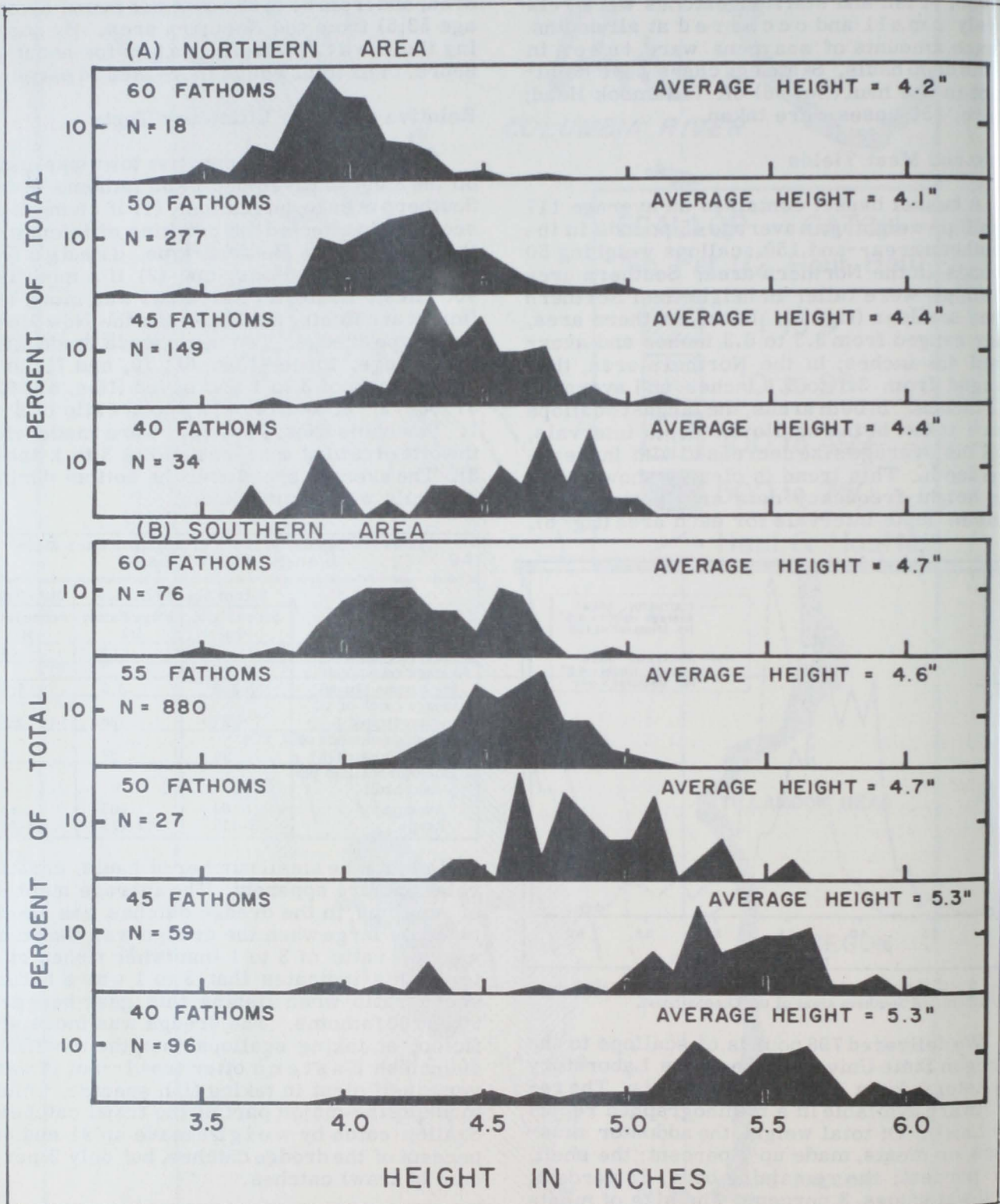


Fig. 6 - Comparison of height frequency by depth for scallops taken in (A) Northern area and (B) Southern area.

RESULTS OF 1967 SURVEY

During the 1967 survey, 48 scallop dredge hauls were made. Between Tillamook Head and Cape Falcon, Oregon, 13 hauls were made at 1963 survey stations (fig. 1). Of the remaining hauls, 7 were off Rockaway, 6 off Cape Meares, 6 off Sand Lake, 4 off Cascade Head, and 10 just north of Columbia River. All hauls were 1/2-hour long. They were made at a scope ratio of 3 to 1, and speed over bottom ranged from 2.2 to 5.4 knots and averaged 3.9 knots.

Of the total hauls, 24 contained scallops. The largest catches occurred along the 55- and 60-fathom contour (table 4). The largest catch, 118 scallops, was taken off Sand Lake in 55 fathoms.

Table 4 - Number of 1/2-Hour Hauls and Average Catch Rates of Fish and Shellfish Taken in 1967 Survey

Midpoint of Depth Intervals	1/2-Hour Hauls	Average Per 1/2-Hour Haul				
		Scallops	Crabs	Starfish	Sea Pens	Fish
Fathoms		(Number)			(Pounds)	
25	2	-	2.0	4.0	-	5.0
30	1	-	6.0	79.0	-	1.6
35	7	-	68.7	15.6	-	4.2
40	7	1.6	10.0	14.0	-	2.9
45	7	3.1	11.1	28.1	-	2.4
50	7	6.3	2.4	11.3	.1	1.8
55	8	17.3	14.4	42.8	.1	2.8
60	7	10.4	4.4	11.4	.5	2.5
65	2	1.5	2.0	12.5	.3	2.1

In the 48 hauls, 982 pounds of fish and shellfish were taken. Of this weight, scallops were 7 percent, Dungeness crab 44 percent, fish 13 percent, starfish 17 percent, egg cases of the big skate 16 percent, and miscellaneous invertebrates 3 percent. Skate egg cases were abundant on the same bed in 1967 and 1963 (Haul 96, fig. 4).

The 1967 catches (table 4) were similar to 1963's (tables 1 and 2) except for amount of

scallops and starfish taken. The fish were found in all depth intervals, whereas sea pens were found only in deeper waters. Most crabs were found in greatest abundance in the shallower depths of less than 50 fathoms. The starfish were found at all depth intervals in both years; a higher catch rate occurred in 1967 samples. On the other hand, the scallops were found primarily between 40 and 65 fathoms; the greatest abundance occurred in about 55 fathoms.

Table 5 - Number of Scallops and Empty Scallop Half Shells Taken in Duplicated Hauls Between Tillamook Head and Cape Falcon

1963 Haul	Depth of Bottom	Number Per 1/2-Hour Haul			
		Live Scallops		Scallop Half Shells	
		1963	1967	1963	1967
Number	Fathoms				
104	35	0	0	0	0
105	40	3	10	0	0
1/113	45	122	0	30	22
107	50	635	0	40	38
112	50	619	2/	50	2/
116	53	753	0	33	142
108	55	312	0	30	36
109	60	0	0	0	44
115	40	0	0	0	0
114	45	12	7	0	6
111	50	292	3	50	76
110	55	426	0	50	76

1/Haul 113 was a repeat of haul 106, which was unsuccessful because dredge fished upsidedown.
2/In 1963, two hauls, 107 and 112, were made at same place, but only one haul was made here in 1967.

In 1963, the catch rate of scallops was high in the drags between Tillamook Head and Cape Falcon, especially in haul Nos. 107, 112, and 116 (fig. 4). All these hauls were duplicated in 1967, and the best catch was only 10 scallops (table 5). The dredge apparently was fishing in the same manner as in 1963 because empty scallop shells were taken in about the same quantity. The one exception was haul No. 116, where there was an increase of over 100 half shells.

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