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OTTER TRAWL INVESTIGATIONS

Progress Report

May - November 1959

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Introduction

During this period the otter trawl fishery operated at peak production, and, as in past years, the bulk of the field work was conducted in this period. Field work consisted of: (1) commercial landings of Dover sole and shrimp were sampled; (2) a limited number of samples were taken of mink food landings; (3) 4 trips were made on otter trawlers to sample the catches at sea before they were sorted on the boats; (4) 4 trips were made on shrimp boats to sample the catches at sea; and (5) interviews with otter trawlers and shrimp fishermen were expanded to include all boats landing at ports south of Astoria. Laboratory work consisted of: (1) processing and partial analysis of the sampling data collected; (2) completing an analysis, from IBM records, of the 1958 landings of Dover, English, and petrale soles, and Pacific Ocean perch; (3) completing and submitting the May 1958-April 1959 otter trawl investigations progress report and other reports including a summary of the 1959 sampling at sea, a summary of the 1959 otter trawl and shrimp fisheries for the Pacific Marine Fisheries Commission meeting in San Francisco, and a report on the development of regulations in the otter trawl fishery.

Personnel

The only change in personnel during this period was as follows: Mr. Gerald Carlson reported for work on otter trawl studies June 5 and returned to school September 23.

Fleet Activities

The markets for bottom fish apparently were fair to good in 1959. Preliminary figures indicate that the landings of food fish were greater for most species than during the previous year in spite of a fleet tie-up in

the early part of the year. The markets for canned shrimp apparently were weak; shrimp fishing was curtailed in late summer, and finally ended for the year in November. A large surplus of canned shrimp was on hand when the boats finally quit fishing. Apparently the Oregon shrimp were competing for markets with shrimp from Alaska and the Gulf States.

At Coos Bay the small otter trawl fleet made steady deliveries of bottom fish during the season, and at Brookings a new fishery developed for pink shrimp which were landed at Brookings and trucked to the hand-picking operations in Northern California.

A list of the boats active in the Oregon otter trawl and shrimp fisheries during this period are shown in Table 1. A number of the boats alternated between trawling for bottom fish and shrimp.

Landing Records for 1958

In Figures 1-3 are shown the total landings, numbers of significant landings, and the pounds per significant landing of Dover, English, and petrale soles at Astoria for the years 1942-58. For the period 1951-58, these data have been allocated by area. The data for Pacific Ocean perch are shown in Figure 4 for the years 1951-58. In the past this information has been presented in tables, but because of the number of years now involved, the present graphs appear less cumbersome than tables.

Of the 4 species shown, only the landings of English sole do not show significant reductions in total landings in 1958 from the landings made in 1957. This can be explained partially by the fact that a number of boats were attracted to the new fishery for pink shrimp, and later in the year most of the boats left bottom fish and shrimp to fish for albacore. Also, new regulations and poor winter weather restricted the landings of petrale and Dover soles from deep water areas.

In landings from the "local" area, Willapa Bay to Cape Falcon, petrale

Table 1. Oregon Trawlers Landing Bottom Fish and/or Shrimp, by Port; 1959.

Astoria-Warrenton	Landed Bottom Fish	Landed Shrimp	Newport	Landed Bottom Fish	Landed Shrimp
Betty	X		Alten	X	
Columbia	X		Dare II	X	
Daphne	X		Destiny	X	
Eagle ✓	X	X	Harold J.	X	
Emancipator ✓	X	X	Margaret E.	X	
Frank F.	X		Oregonian	X	
Galaxy ✓	X	X	Pacific Queen	X	
Georgene	X		Ruth Ellen	X	
Gordon Lyle (Burned & sank) ✓		X	Sea Breeze II (Landed mostly in Warrenton) ✓	X	X
Jennie F. Decker	X		Winchester Bay		
Jimmy Boy ✓		X	Karen	X	
Kincheloe ✓	X	X	Hero	X	
Kiska	X		Trego	X	
Kodiak ✓		X			
Margaret A.	X		Coos Bay		
Marian F.	X		Anak (Landed mostly in Eureka)	X	
Mary R.	X		Empire II	X	
Nestucca ✓	X	X	Madeline J.	X	
New Hope ✓	X	X	Nelrondic	X	
New Mexico	X		Pearl Harbor	X	
Rodoma ✓	X	X	Washington (Little)	X	
Rose Ann Hess	X	X			
Silver Queen ✓	X	X	Brookings (Chetco River)		
Sunrise		X	Adena II		X
Tralee	X		Faymar		X
Trask	X		Intrepid (Also landed in Coos Bay)		X
Valhalla II ✓		X	Jefferson		X
Washington (Big)	X		General Pershing		X
Western	X		Martiri		X
West Wind	X		Ocean Queen		X
			Stephanie		X
Garibaldi					
Ella Mae	X				
W.C.F. #1	X				

Figure 1. Total Pounds Landed, Calculated Numbers of Landings, and Pounds Per Significant Landing of Dover Sole, Astoria, 1942 - 1958. Allocation by Area for the Period 1951 - 1958.

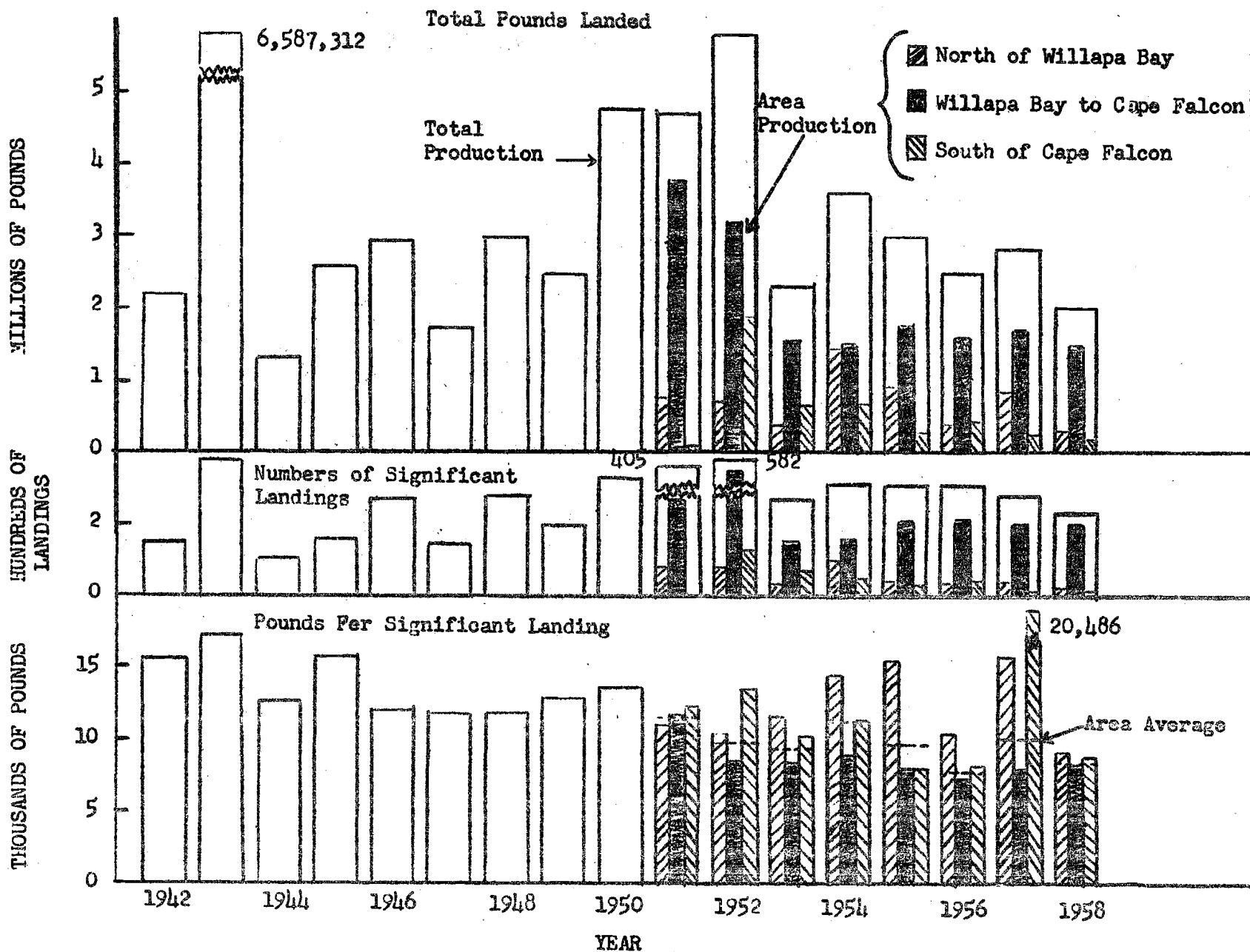


Figure 2. Total Pounds Landed, Calculated Numbers of Landings, and Pounds Per Significant Landing of English Sole, Astoria, 1942 - 1958. Allocation by Area for the Period 1951 - 1958.

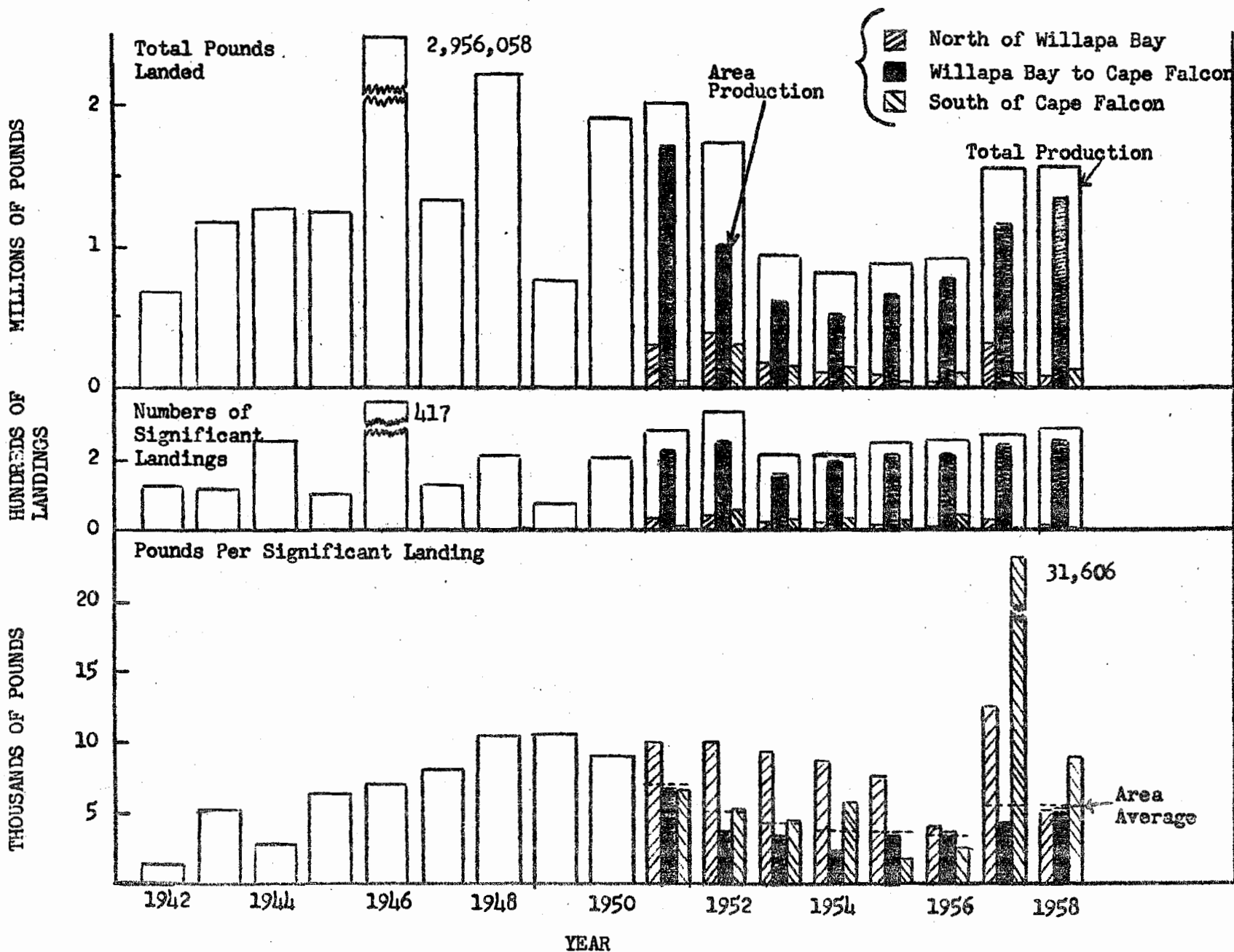


Figure 3. Total Pounds Landed, Calculated Numbers of Landings, and Pounds Per Significant Landing of Petrale Sole, Astoria, 1942 - 1958. Allocation by Area for the Period 1951 - 1958.

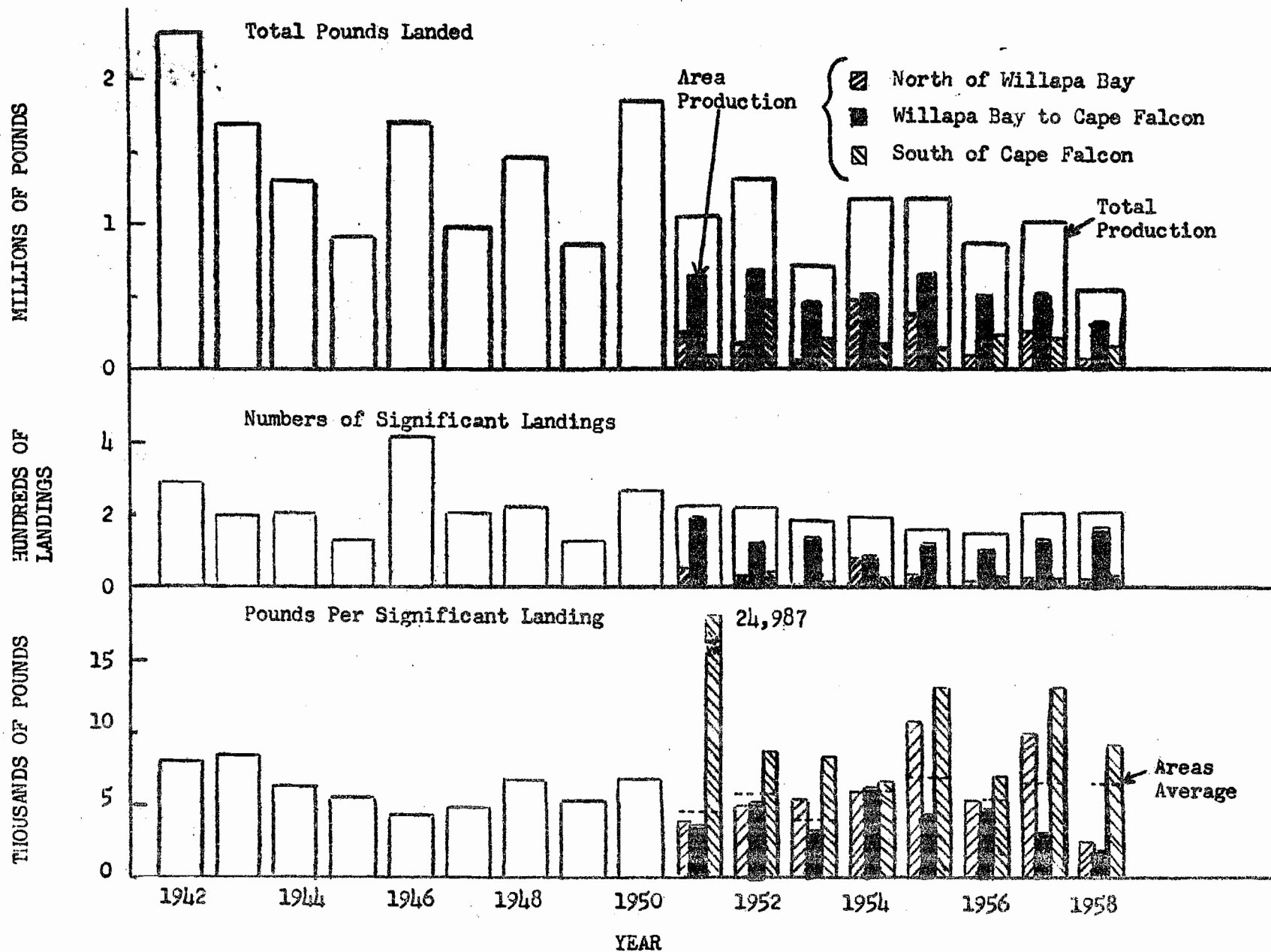
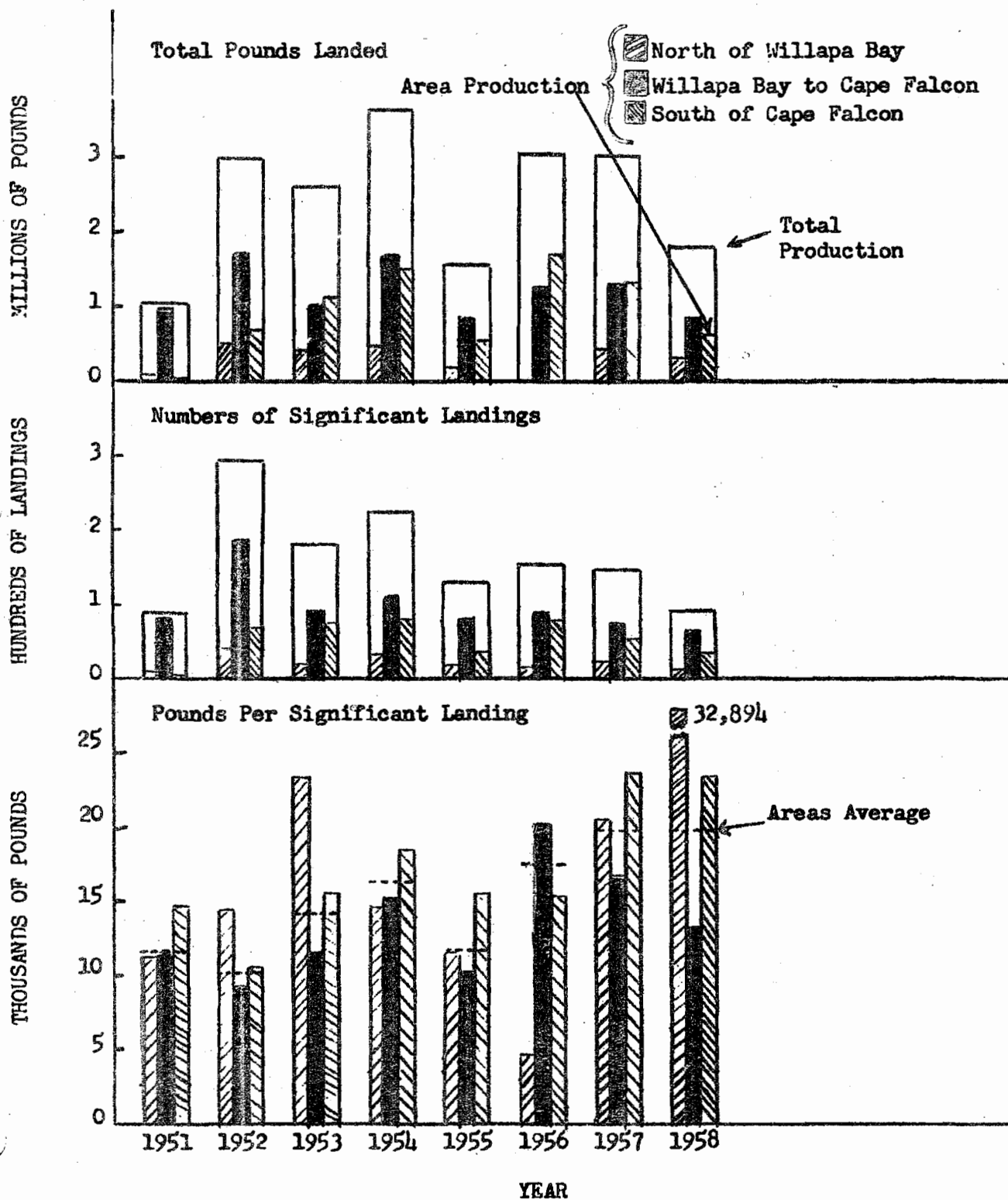


Figure 4. Total Pounds Landed, Calculated Numbers of Landings, and Pounds Per Significant Landing of Pacific Ocean Perch, Astoria, 1951 - 1958. Allocated by Area Caught.



sole and Pacific Ocean perch landings showed significant decreases. The pounds per significant landing of petrale sole decreased from 3,200 in 1957 to 1,900 in 1958 although the numbers of significant landings increased from 160 to 167. The pounds per significant landing of Pacific Ocean perch decreased from 16,800 in 1957 to 13,400 in 1958. The numbers of significant landings also decreased from 77 to 63. The pounds per significant landing of Dover sole increased slightly in 1958 to 8,300 from 8,200 in 1957, but the numbers of significant landings decreased from 210 to 180. Since 1954, English sole have either been more abundant in the "local" area or markets have been improving for this species. Both the total catch and pounds per significant landing have increased in the period 1954-58. In contrast, the pounds per significant landing of petrale sole and Pacific Ocean perch have decreased during the past 3 seasons, and the total landings also have a downward trend for that period. No definite trends are apparent in the landings of Dover sole. For all 4 species, it appears that success is better north or south of the "local" area.

In Table 2 are shown the 1958 Oregon landings by species by PMFC areas. These statistics have been prepared in cooperation with other member agencies of PMFC to show the areas of catch of the various species, particularly those species harvested by several states or countries.

English and Petrale Sole Tagging

Between April 15 and 25, 1959, biologists of the Trawl Investigation participated in a highly successful bottom fish tagging experiment. A total of 4,599 English sole and 550 petrale sole was tagged over the ten-day period. Much of the success of this venture is due the U. S. Fish and Wildlife Service who provided the excellent facilities of their experimental gear and exploratory vessel, the John N. Cobb, during Cruise No. 42. Tagging was done in conjunction with instrumentation studies by FWS personnel.

Table 2. Oregon Otter Trawl Landings, by Area Caught, 1958.
Rounded to Nearest 500 Pounds.

Species	Area 3D	Area 3C	Area 3B	Area 3A	Area 2D	Area 2C	Area 2B	Total All Areas
Sablefish								
Round		1,000	5,000	3,000	30,000	59,500	3,500	102,000
Dressed			1,000		12,000	8,000	500	21,500
Gray Cod		21,500	52,500	31,500	361,500	3,000	tr. ^{1/}	470,000
Ling Cod								
Round	1,000	22,500	22,000	4,000	156,500	39,500	16,500	262,000
Dressed	500		1,000	500	17,000	5,000	2,000	26,000
Ocean Perch	29,000	19,500	165,500	54,000	877,000	1,215,500	86,500	2,473,000
Other Rockfish	7,500	4,000	92,000	54,000	2,779,000	930,000	509,000	4,375,500
Petrals Sole	5,500	4,000	6,500	17,500	355,500	292,000	1,014,000	1,754,000
English Sole		tr.	8,000	41,500	1,430,500	227,500	127,000	1,834,500
Dover Sole		1,000	27,500	89,000	1,772,000	704,500	744,000	3,338,000
Rex Sole				8,000	631,000	21,500	5,500	666,000
Rock Sole								
Starry Fld.	8,000			15,000	289,500	21,000	15,500	349,500
Other Flatfish		1,000	6,500	500	6,000	500	6,000	20,500
Dogfish								
Misc. Species					tr.			tr.
Animal Food			11,000	482,000	2,485,000	3,236,500	3,393,000	9,607,500
Industrial					142,500		4,500	147,000

^{1/} tr. = < 250 Pounds.

The operation was conducted in waters adjacent to the Northern Oregon coast in an area extending from Manhattan Beach south to the Siletz River in depths ranging from 60-75 fathoms. Most of the fish were caught and released from Cape Lookout to Haystack Rock in about 70 fathoms. The numbers of English and petrale sole tagged each tow, subsequent recoveries from each tow through December 31, 1959, and Loran bearing where tagged are shown in Table 3.

One side of the top of the main hatch was used for the actual tagging. This location afforded ample space for the tagging boards and tags and working room for two taggers and a recorder. The two "checkers" immediately aft and adjacent to the main hatch were converted into live tanks by covering with a large tarpaulin and filling with sea water.

Tows were limited to about 30 minutes in order to keep the fish in as good a physical condition as possible. As the cod-end was brought aboard, it was split into one of the live tanks. Deck hands then proceeded to sort the English and petrale soles into the empty tank and count the other fish and invertebrates overboard. Both English and petrale soles are prone to gill in the net quite easily. However, most of the "gillers" seemed to revive sufficiently after sloshing around in the holding tanks for a short while.

While tagging was under way, one of the deck hands dip-netted the fish from the tank and served them up to the taggers. This was a great help in speeding up the operation. The fish were measured, tagged, sexed, in the case of the English sole, and immediately released. Both of these species, especially the English sole, lend themselves quite well to tagging. They are rigid and thin enough so that after they are measured, they can be turned on their side and inserted into one of the grooves of the measuring board. This helps to hold them while attaching the tag and does not appear to be a harmful practice. English sole can be sexed with a good degree of accuracy simply by holding them up to the light and observing the shape and position of the gonads.

Table 3. English and Petrale Sole Tagging, John N. Cobb Cruise No. 42, April 1959.

Date	Drag No.	No. English Sole Tagged	No. Recov. Through Dec. 31, 1959	No. Petrale Sole Tagged	No. Recov. Through Dec. 31, 1959	Area Tagged Loran Bearing	Double Tagged Petersen & Dart
4/15/59	1	205	14			2H4-2830-2810	5
"	2	89	8			2785-2765	4
4/16/59	3	120	12	12		2860-2835	
"	4	124	7	13		2810-2785	
"	5	276	12	18	1	2660-2645 (Cascade Hd)	
"	6	91	7	5	1	2610-2585	
4/18/59	7	152	11	18		2650-2638	
"	8	172	5	20	2	2640-2650	
"	9	164	6			2665-2675	
4/19/59	10	192	10	13		2860-2845	
"	11	158	9	17	2	2845-2870	
"	12	190	10			2860-2835	
"	13	26	1			2810-2795	
"	14	99	8			2810-2820	
"	15	117	9			2835-2860 (Cape Lookout)	
"	16	204	15			2845-2835	
4/20/59	17	150	10	39	1	2870-2885	
"	18	155	6	27		2835-2825	
"	19	93	7	54	3	2775-2760	
"	20	6	0	1		2750-2760	
"	21	215	16	58	2	2760-2785	
4/21/59	22	95	8	23	1	3005-3020	
"	23	6	0	9		3060-3080 (Manhattan Beach)	
"	24	102	13	4		3070-3080	
4/23/59	25	33	3	1		3070-3045	
"	26	18	0	2		3020-3005	
"	27	59	4	14		2910-2885	
4/24/59	28	109	5	22	2	2885-2875	
"	29	125	5	20		2850-2825	5
"	30	136	8	25	1	2785-2775	
"	31	315	8	37		2750-2775	
4/25/59	32	150	9	21	1	2760-2750	5
"	33	199	6	44	2	2715-2700	2
"	34	106	9	20		2680-2665	
"	35	74	2	8		2640-2615	
"	36	74	2	5		2600-2580	
Total		4,599	265	550	19		21

Fish that showed any ill effects before or during tagging were discarded. In general the petrale sole did not seem to be as hardy as the English sole. This may be due to the fact that the gill cover of the English appears to fit much tighter than that of the petrale. However, the petrale seemed to revive if left in the tank a little longer. Care was taken, especially with the smaller fish, to release them as close as possible to the boat. This was done to protect them from the "goony birds" (black footed albatross) which were waiting ever ready to dive on any stunned or injured fish. An occasional tagged fish was probably lost in this way.

The great majority of fish were tagged with fluorescent-red Petersen disc tags and stainless steel pins. Spaghetti tags were used on 135 of the petrale sole and a few dart tags were used in conjunction with the Petersen discs. The Petersen tags were the easiest and quickest to apply.

In Figure 5, the solid line represents the length frequency of English sole tagged on the Cobb cruise in April 1959. The broken line in the same figure represents the length frequency of the tagged fish recovered through December 31, 1959. The average size of the recoveries appears to be somewhat larger than that for the total number tagged. The length frequency for petrale sole is shown in Figure 6. Table 4 contains the total catch of fish and crabs, by species, taken during the tagging operation.

English and Petrale Sole Tag Recoveries

Recoveries by commercial otter trawlers were made from releases on the Cobb cruise before the cruise was completed. Although the normal time period of this progress report ends November 30, data on tag recoveries through December 31 have been included. The movements of English and petrale sole from the tagging area are shown in 10-mile intervals by 30-day periods in Table 5. The heavy concentration of recoveries 40-80 miles north of the tagging area was caused by the fishery at the mouth of the Columbia River.

Figure 5. Length Frequencies, in Per Cent, of Tagged and Recovered (Through December 31, 1959) English Sole from the April 1959 Tagging. On Cruise # 42 of the John N. Cobb.

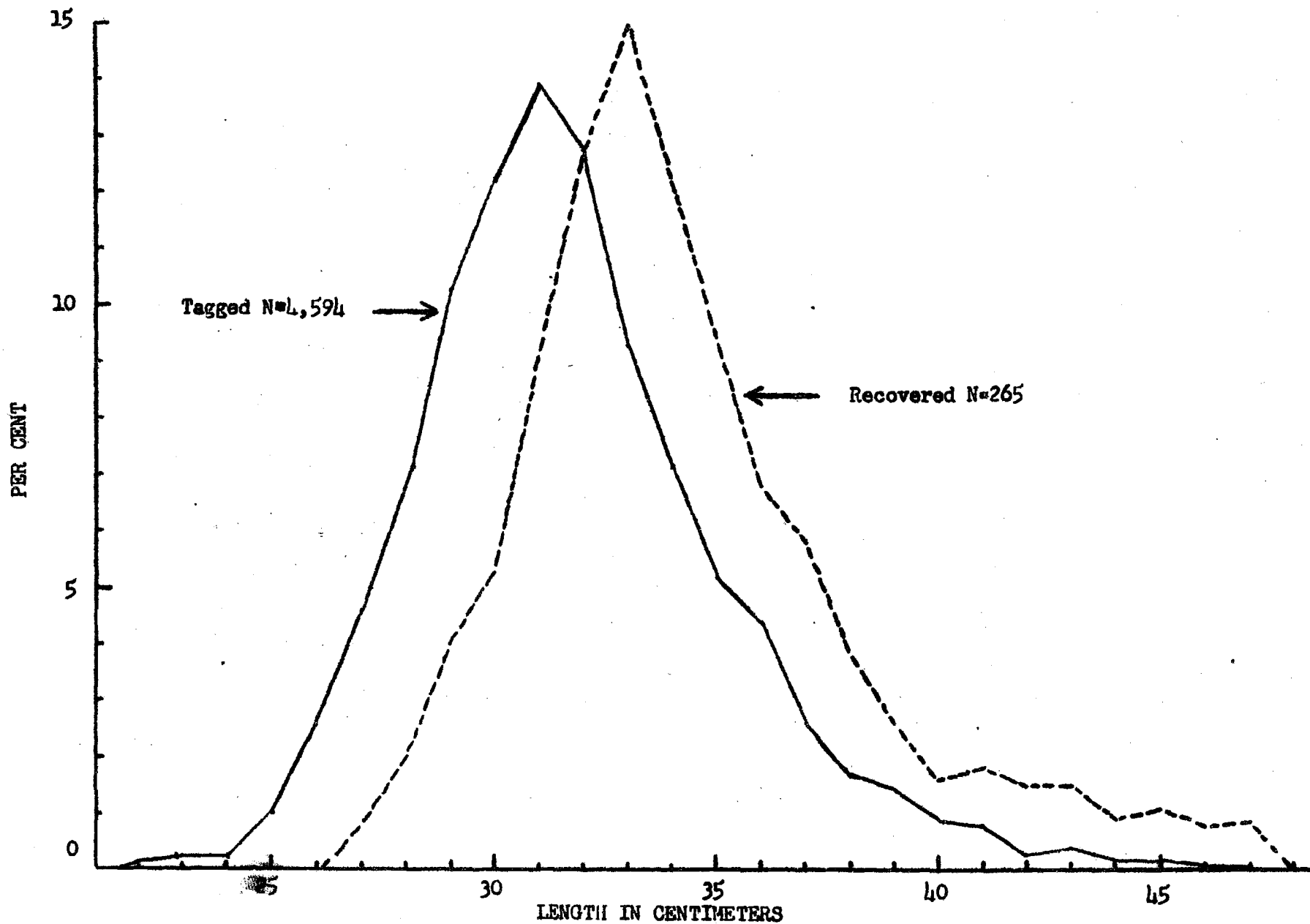


Figure 6. Length Frequencies, in Per Cent, of Petrale Sole Tagged on Cruise # 42 of the John N. Cobb, April 1959.

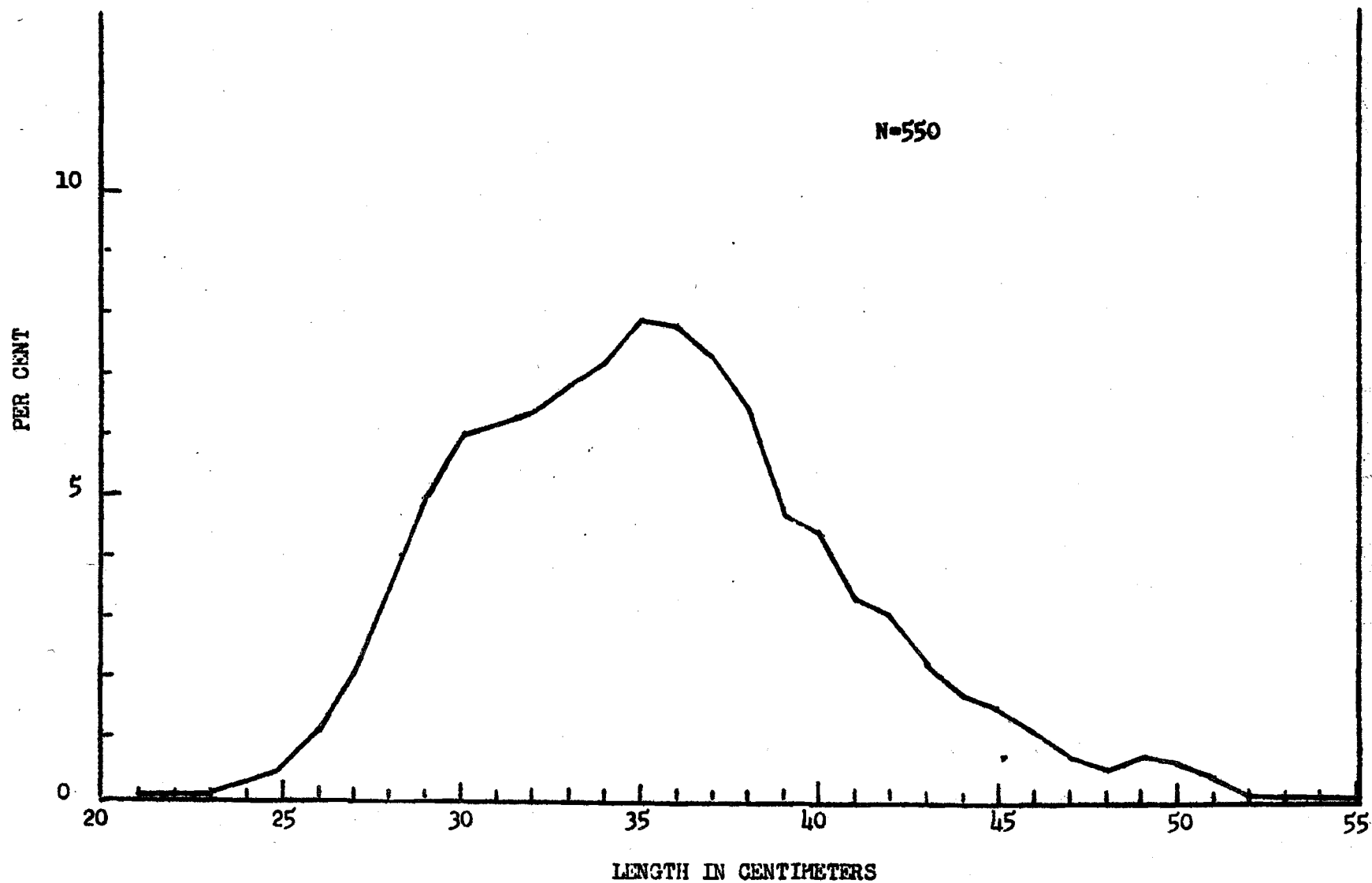


Table 4. The Catch by Species During the English and Petrale Sole Tagging on the John N. Cobb Cruise No. 42, April 1959.

<u>Species</u>	<u>Number</u>
Dover Sole	520
English Sole	4,641
Petrале Sole	630
Rex Sole	521
Arrowtooth Sole	148
Sand Dabs	38
Bellingham Sole	
Slender Sole	22
Ling Cod	28
Sablefish	19
True Cod	2
Halibut	18
Rockfish	
Bocaccio	
<u>S. paucispinis</u>	138
Yellow-Tailed Rockfish	
<u>S. flavidus</u>	16
Orange Rockfish	
<u>S. pinniger</u>	41
Green-Striped Rockfish	
<u>S. elongatus</u>	109
Dogfish	77
Skates	188
Shad	12
Ratfish	333
Hake	<u>4</u>
Total	7,505
Crabs (Dungeness) Female	110
Male	11
Octopus	Not Counted

Table 5. Recoveries of Tagged English and Petrale Soles Showing Movement in Miles From Tagging Areas by 30-Day Periods.

Miles Migrated	Days Out							
	0-30	31-60	61-90	91-120	121-150	151-180	181-210	211-240
201-210						1		
191-200							(1) 1/2	
181-190							1	
171-180				2				2
161-170								(1) 2
151-160				1				2
141-150			6	5	3		6	2
131-140			1 (1)	2	1		1	1
121-130			1		3			
111-120								
101-110			1					
91-100			3					
81-90	2		1		1			
71-80		1	8	5	2	3	7	1
61-70	2	8	9	11	10	4	(2) 12	4
51-60		7	11	19	7	5	11	1
41-50		1	1	2	1	2	5	1
31-40	1	2	3	2	2	1	2	
21-30	1						1	
11-20		1	1		1		(1)	
1-10	1					(2)	1	
0	(1) 3							
1-10			1			(1)		
11-20				1			(1)	
21-30	1		(1)	2				
31-40				(2) 1	1			
41-50					1			
51-60				1				
61-70								
71-80							1	
81-90				1				
91-100			(1)				1	
101-110							(1)	
111-120							1	
121-130								
131-140								
141-150								
151-160								
161-170								
171-180							(1)	
181-190								
191-200								1
201-210								
211-220								
221-230						2	1	
231-240								
241-250						1		

1/ Petrale Sole in Parentheses.

By 90 days the English sole had ranged north 150 miles. Some petrale sole had moved south 100 miles. This picture may be distorted by the lack of a summer fishery for English sole south of the tagging area. By 180 days the English sole had ranged 200 miles north and more than 240 miles south of the tagging area. The most complete picture can be seen in the 181-210 day period. In this period both English and petrale sole were recovered in nearly all fishing areas north and south of the tagging area within the maximum limits of movement reported from this tagging study.

Dover Sole Tag Recoveries

Recoveries have continued to be made from the Dover sole tagged in the Willapa Deep in April 1955. A summary of recoveries by Loran blocks and depths, in 30-fathom intervals, for recoveries where this information was available is shown in Table 6 for the period April 1955 - December 1959. Only 2 recoveries have been made south of the Columbia River and only 1 north of Umatilla. Of the 239 recoveries where the area and depth of catch were known, 71 per cent were from the tagging area in deep water.

Dover Sole Market Sampling

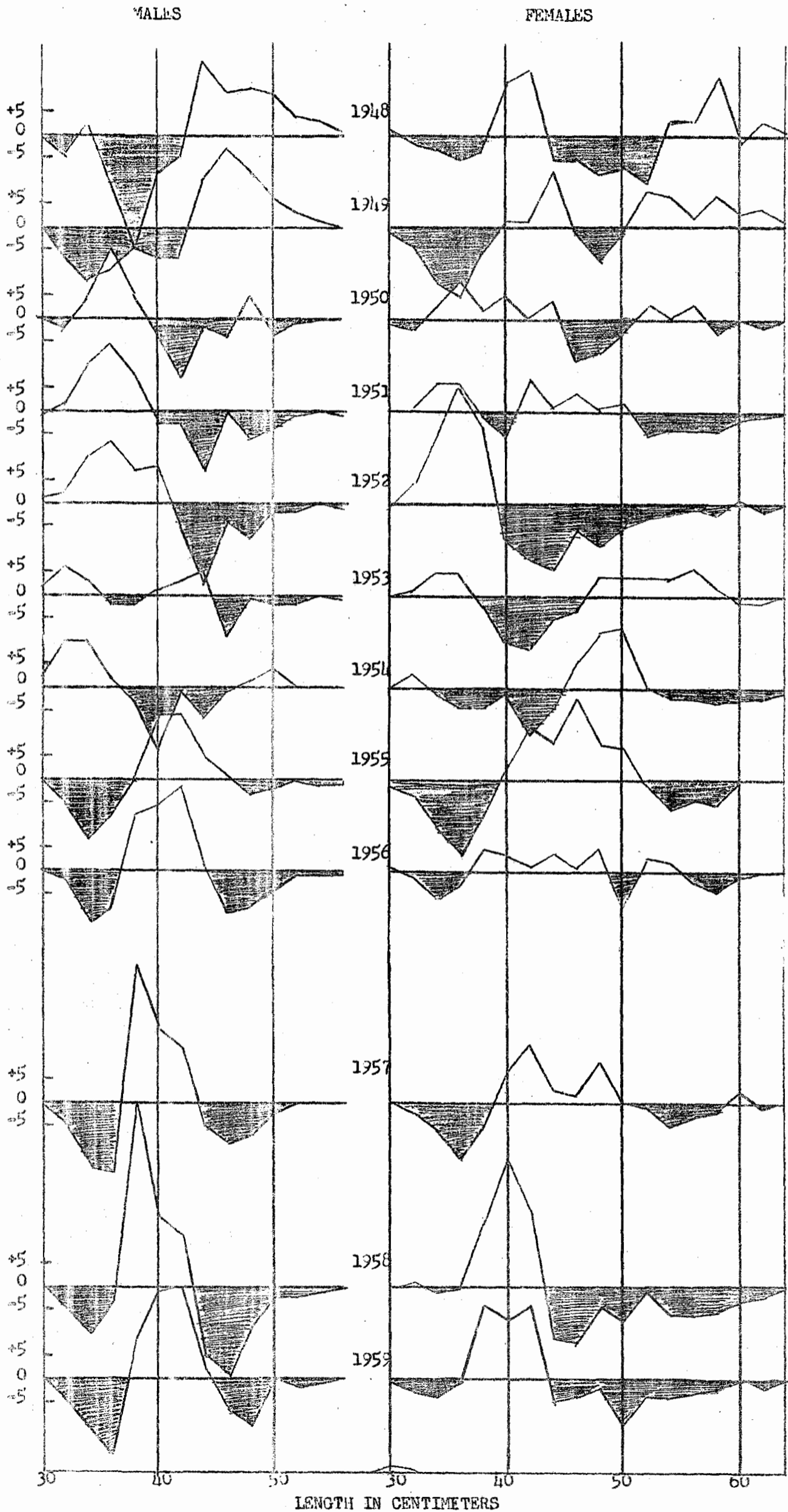
As in past seasons, Dover sole landed for human consumption were sampled for size, sex, and age composition. During the June-September period, 9 samples containing 3,600 Dover sole were taken. The mean length of the females was 436 mm. in 1959 compared to 429 mm. in 1958. However, these mean lengths are both smaller than for most years since 1948. The mean length of male Dover sole in 1959 was found to be 403 mm. compared to 392 mm. in 1958. This mean length for males is the largest since 1949. In Figure 7 the deviations at 2 cm. intervals from a 12-year average length frequency are shown. As the mean lengths indicated, in recent seasons there has been a decline in numbers of large female Dover sole. At the other end of the scale, represented mainly by males, there have been few small fish landed since 1954. This is probably coincident with the mesh regulations

Table 6. Dover Sole Tag Recoveries, by Loran Blocks
and Depth, April 1955 - December 1959.

Loran Bearing	Depths in Fathoms									
	0-30	31-60	61-90	91-120	121-150	151-180	181-210	211-240	241-270	271-300
2H5-2300										
2400 (Carmanah Pt. 120 mi.)					1					
2500										
2600										
2700										
2800 (Umatilla 95 mi.)			2							
2900		1								
3000										
3100			1							
2H5-3200				1					1	
2H1-4200	1									
4100		5								
4000	1	13								
3900		12								
3800		9	1		5	5	21	25	40	30
3700				2		2	7	24	9	8
3600		7	2							
3500 (Columbia R.)		2								
3400										
3300 (Tillamook Rk. 65 mi.)			1							
2H1-3200										
2H3-2500 (Humboldt Bay 335 mi.)										1
Total	2	49	7	3	6	7	28	49	49	39

239 Total Recoveries
169 (71%) in Deep Water Tagging Area

Figure 7. Dover Sole Length Frequencies, by Sex, From Commercial Landings at Astoria showing the Deviations From a 12-year Average, 1948 - 1959.



which were effective in April 1955. It is probable that the samples were taken from boats that did not use the small-mesh Pacific Ocean perch nets while fishing for Dover sole, or this change in length frequencies after 1954 would have been obscured. Males in the samples of fillet fish formed only 34 per cent of the fish landed. This is slightly lower than in 1957 and is the lowest percentage since 1954.

Progress is slowly being made on the analysis of the data collected in the Dover sole age and growth study. All of the scales and otoliths have been read at least twice. This includes the material from the 1953 market samples for the age composition of the Dover sole landed as fillet fish.

Observations of Mink Food

The sampling of mink food for species composition was confined to 4 samples at Astoria in conjunction with a sampling-at-sea program and 2 samples at ports south of Astoria. However, a number of estimates were made of landings observed during routine visits to water fronts. These estimates are shown in Table 7. These data show the estimated percentage of each species. If a species was not observed in the landing, it was placed in the column labeled "0". In 19 landings no Dover sole were observed; in 6 landings, Dover sole were estimated to contribute a trace to 5 per cent; and in 1 landing, Dover sole were estimated to make up 66-75 per cent of the total landing. While these data are observations only, they do give indications of the presence or absence of certain species in the landings. An increased use of arrowtooth sole (turbot), Bellingham sole, and skates is indicated. The large number of trips which contained little or no Dover, English, or petrale soles is also significant because it indicates that the fishermen were either avoiding these fish or were discarding the sub-fillet-sized fish at sea. At least some of both occurred and, in part, was undoubtedly because of the 11-inch minimum size regulation on Dover, English, and petrale soles.

Table 7. Estimates of Percentage Species Composition
of 32 Oregon Mink Food Landings, 1959.

Species	<u>Estimated Per Cent</u>										
	0	Tr-5	6-15	16-25	26-35	36-45	46-55	56-65	66-75	76-85	86-95
	<u>Frequency</u>										
Dover Sole	19	6	1	4	1	-	-	-	1	-	-
English Sole	18	5	3	2	3	1	-	-	-	-	-
Petrals Sole	25	6	1	-	-	-	-	-	-	-	-
Arrowtooth Sole	5	1	2	2	5	4	3	4	2	3	1
Rex Sole	5	8	6	5	4	1	1	-	-	-	-
Bellingham Sole	17	9	2	1	1	1	-	-	-	-	1
and Dabs	14	18	-	-	-	-	-	-	-	-	-
Starry Flounder	16	13	-	-	1	-	2	-	-	-	-
Pacific Ocean Perch	26	2	-	2	1	-	-	-	-	1	-
Other Rockfish	10	10	6	2	1	1	-	2	-	-	-
Skates	6	19	4	3	-	-	-	-	-	-	-

As in some other years, weak fillet fish markets at ports south of Astoria allowed a quantity of fillet-sized fish to go into mink food. However, at all ports, including Astoria, there were fewer numbers of small Dover, English, and petrale soles landed for mink food than in recent seasons.

The species composition of 6 samples of mink food landings taken in 1959 are shown in Table 8. The Astoria landings from which these samples were taken are not thought to be typical of the 1959 mink food landings. A limited amount of sampling at sea was undertaken in 1959, and the fishermen were requested to land all of the fish caught so that additional samples could be taken. It is probable that much less of the mink food would have been landed if the biologists had not been on board the fishing boats. It is also probable that less fishing would have been done in the limited area where most of the small English sole were taken on 3 of the trips. In addition, the 2 samples from ports south of Astoria probably contained lower percentages of rockfish than was true of the total landings at those ports in 1959.

Sampling at Sea

Before and after the 11-inch minimum size was established on Dover, English, and petrale soles in 1958, members of the fishing industry insisted that no tolerance or a low tolerance for incomplete sorting of small fish was impractical in the fishing operations. In 1959, in order to examine the tolerance of 100 fish less than 11 inches more closely, a limited sampling-at-sea program was undertaken. The details of this study have been summarized and submitted in a separate report. The data from the 4 trips indicated that nets of $4\frac{1}{2}$ -inch or larger mesh, whether double or single bags, would catch more than 100 English sole less than 11 inches if the small fish were abundant. Less difficulty was indicated with Dover sole less than 11 inches. Petrale sole were obtained in very small numbers during the 4 trips, and few were less than 11 inches. However, it can

Table 8. Species Composition of Trawl Fish
Counted in Mink Food Samples, 1959.

Species	Astoria			Newport			Winchester Bay		
	Numbers of Fish	Pounds	% by Weight	Numbers of Fish	Pounds	% by Weight	Numbers of Fish	Pounds	% by Weight
Dover Sole	66	59.9	1.4	169	163.8	26.0	278	328.4	41.9
English Sole	2,285	1,362.3	31.2	318	238.3	37.9	29	29.7	3.8
Petrals Sole	116	79.2	1.8	36	24.5	3.9	12	16.7	2.1
Arrowtooth Sole	228	684.0	15.6	13	39	6.2	16	48.0	6.1
Bellingham Sole	1,418	680.6	15.6						
Rex Sole	1,366	683.0	15.6	138	69	11.0	466	233	29.7
Misc. Soles	279	418.2	9.6	23	6.2	1.0	61	12.2	1.6
Rockfishes	7	5.2	.1	8	21.6	3.4	36	106	13.5
Misc. Fishes	234	399.5	9.1	47	66.9	10.6	6	10.1	1.3
Total	5,999	4,371.9		752	629.3		904	784.1	

probably be assumed that if small petrale sole were abundant in a fishing area, they would also be taken in quantities greater than the 100 fish tolerance.

Pink Shrimp Studies, May-November 1959

Introduction

In May the first landings of shrimp were brought into the Southern Oregon port of Brookings. The magnitude of this new operation and the problems arising from it are discussed at some length in a report entitled "The Oregon Fishery for the Pink Shrimp, Pandalus jordani" which was prepared for the November 1959 meeting of the PMFC. This report covers the entire Oregon fishery through September 1959, including essentially the information that would normally appear in this progress report. However, a brief summary and more up-to-date tables and graphs are contained herein. No additional information is available on the Brookings fishery except that operations ended for the season in the latter part of September.

Catch Statistics

Complete landing records for the 1959 season in Northern Oregon show that 14 boats made 223 landings for a total of 2,377,065 pounds. This amount is about 850,000 pounds above the total for last year. Total landings at Astoria by month are shown in Figure 8. Although there were considerably fewer large landings this season than in 1958, the average landing was only slightly lower, 10,400 pounds in 1959 compared to 11,000 in 1958. The 1959 catch in pounds per hour for all areas combined was a little higher than in 1958, however, some areas did show small decreases. This information is presented in Table 9 with total landings and numbers of landings by PMFC area.

Fishing Effort

Fishing effort according to hours fished by depth and Loran block for 1959 is shown in Figure 9. The length of the bar in each Loran block indicates the hours fished in that block in per cent of the total hours

Figure 8. Total Landings of Pink Shrimp at Astoria, by Month, 1957 - 1959.

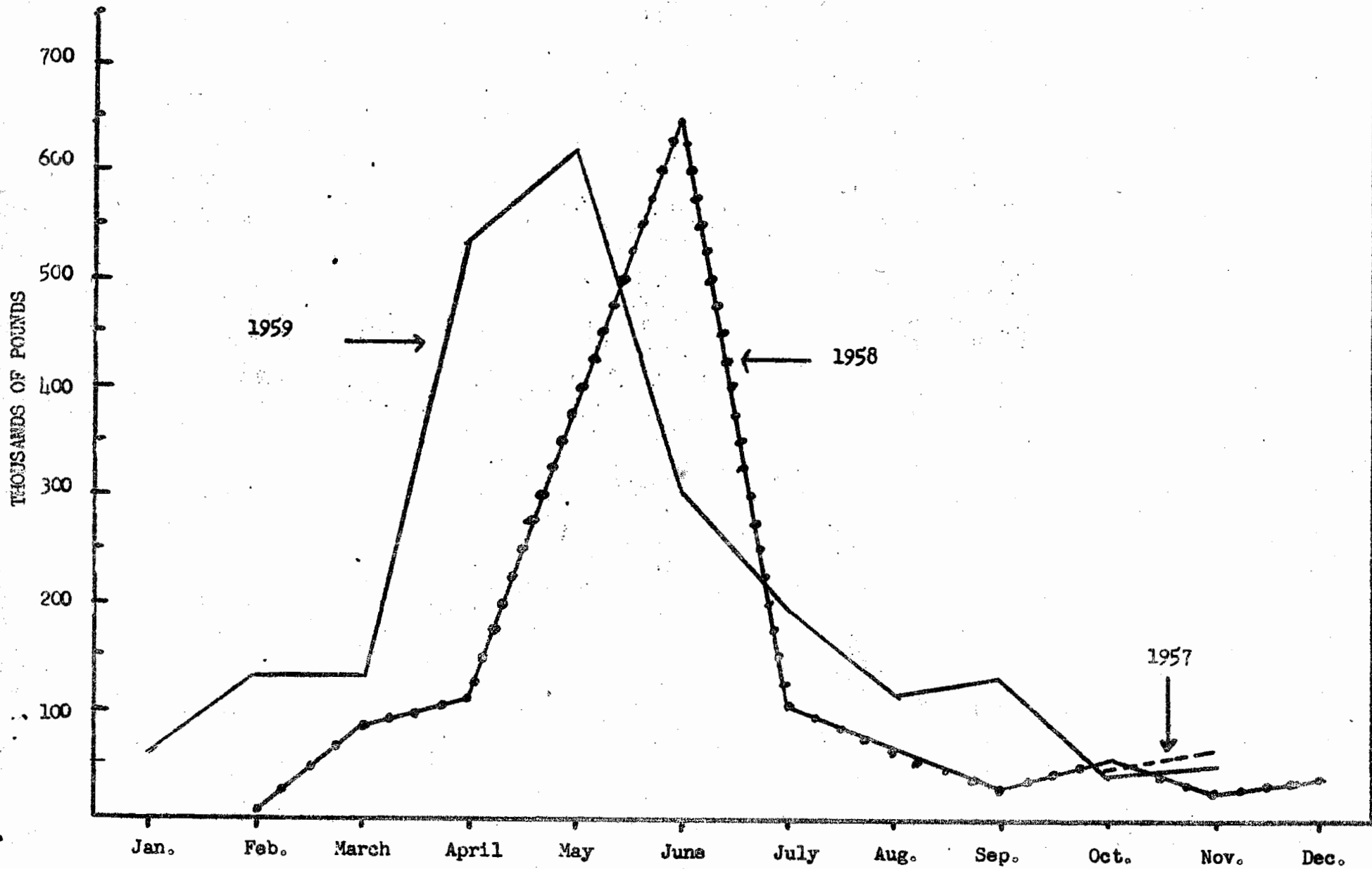
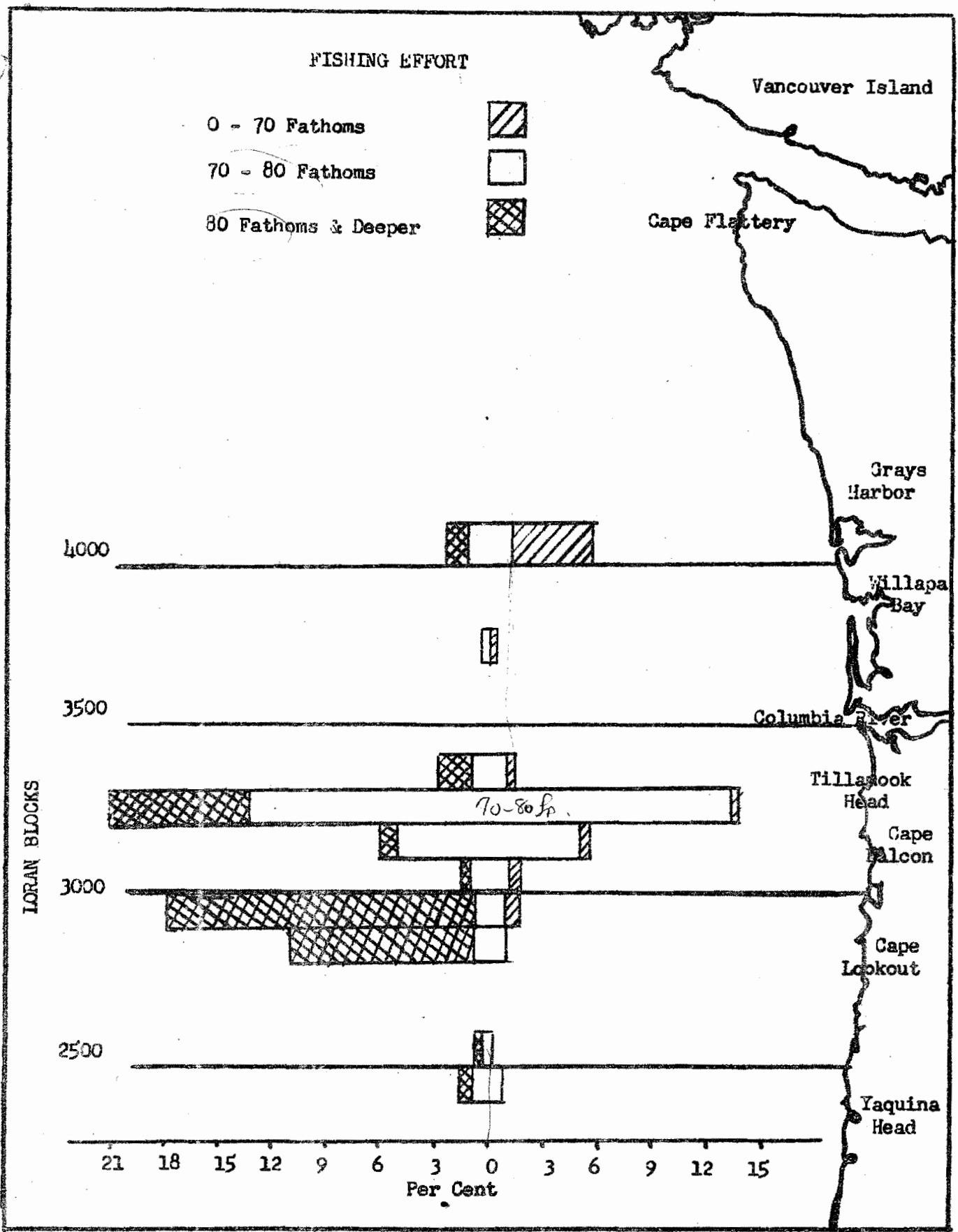


Table 9. Pounds Landed, Numbers of Landings, and Pounds Per Hour of Pink Shrimp in Oregon, by PMFC Area, 1958 - 1959.

Area	Pounds Landed		Numbers of Landings		Pounds Per Hour		1960
	1958	1959	1958	1959	1958	1959	
Cape Flattery to Cape Elizabeth	None	2,034	None	None	1	None	120
Cape Elizabeth to Willapa Bay	81,100	165,205	2000	8	11 8	386	542 250
Willapa Bay to Cape Falcon	1,018,300	1,006,551	539517	99	106 1136	499	526 299
Cape Falcon to Cape Perpetua	423,300	1,149,911	249134	31	102 122	592	523 345
Cape Perpetua to Cape Blanco	None	53,364	82345	None	5 287	None	414 287
Soj Cape Blanco	—	390311	460,000		764 935		510 492
Oregon Total	1,522,700	2,377,065		138	228	492	522
Washington Total Caught off Oregon	1,145,070	286,580	1/				1
Total Pounds of Pink Shrimp Caught off Oregon	2,667,770	2,663,645					

1/ Preliminary estimate

Figure 9. Fishing Effort of Northern Oregon Shrimp Fleet By Loran Block, Expressed in Per Cent of Total Time Fished, 1959.



fished in all areas during the season. The bars are centered on the clear portion which represents the 70-80 fathom interval. The effort above 80 fathoms is shown by cross-hatching and that below 70 fathoms by diagonal lines. As an illustration, about 35 per cent of the total effort was expended in the 3200 block. Broken down by depth, under 70 fathoms was less than 1 per cent, 70-80 was about 27 per cent, and over 80 was almost 8 per cent. As would be expected after looking at the data in Table 7, most of the effort was concentrated in the Tillamook Rock and Cape Lookout areas. It is interesting to note that most of the fishing in the Tillamook Rock area was done in 70-80 fathoms, while that done in the Cape Lookout area was in depths deeper than 80 fathoms.

Sampling of Commercial Landings

The percentage of gravid female pink shrimp is shown in Figure 10. The 1959 egg-bearing season appears to parallel the 1957 season. Figure 11 shows the sex ratio by month for 1957-59. As in 1958, the transitional phases were not present after September 20. A comparison between the 1958 and 1959 carapace length frequencies taken from commercial samples indicates that there was a smaller percentage of large females in 1959. Figures 12 and 13 illustrate this point. In Figures 14 and 15 the increase in size, by month, of male shrimp is shown from samples of Commercial landings in 1958 and 1959.

Otter Trawl Investigations
Oregon Fish Commission
A. R. Morgan
~~S. N. Wilkes~~
Gerald Carlson
Aquatic Biologists
March 24, 1960

Figure 10. Percentage of Gravid Female Pink Shrimp in Samples of Commercial Landings at Astoria, 1957 - 1959.

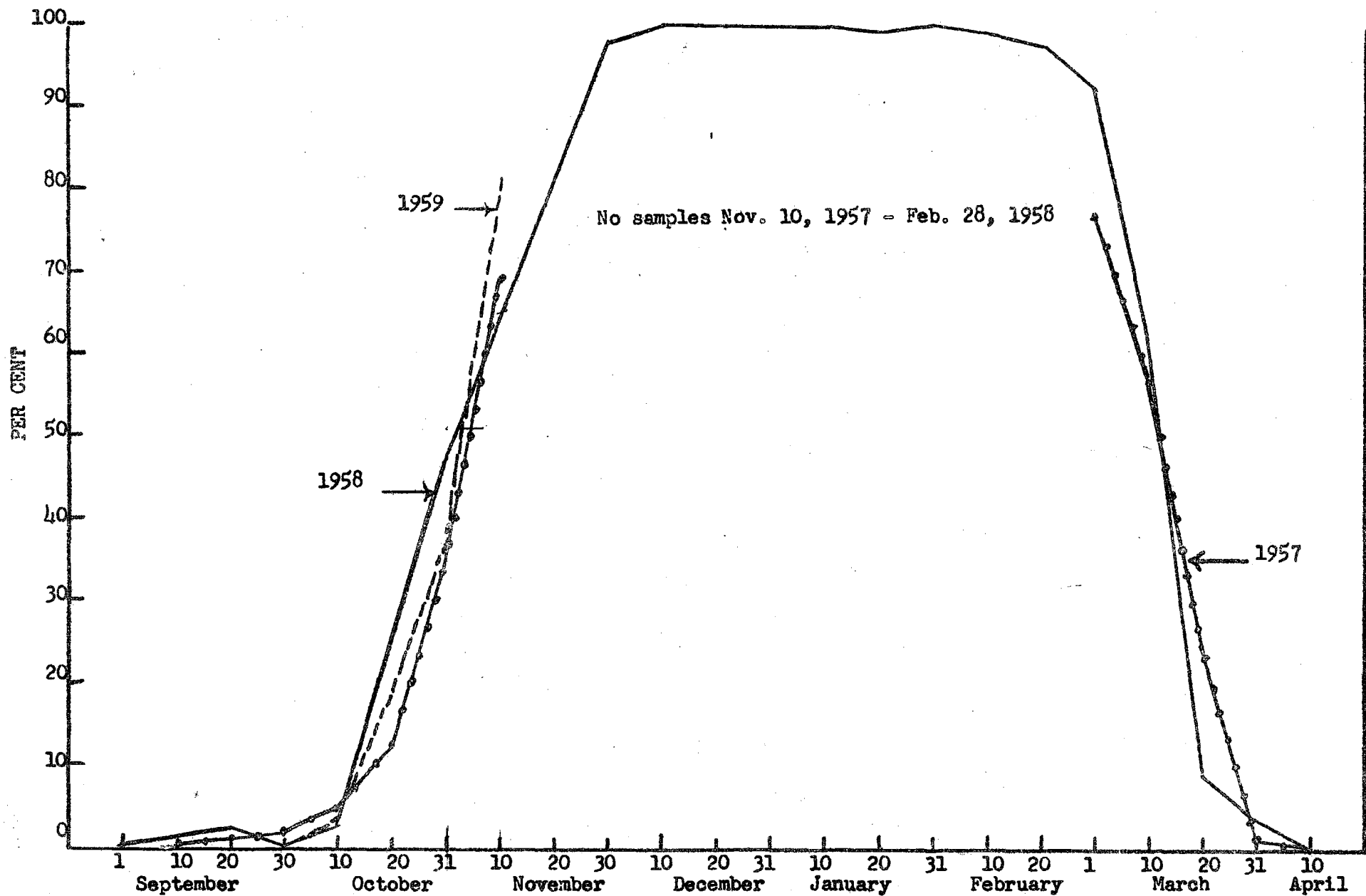


Figure 11. Monthly Sex Ratios of Pink Shrimp Taken From Commercial Samples at Astoria, September 1957 - November 1959.

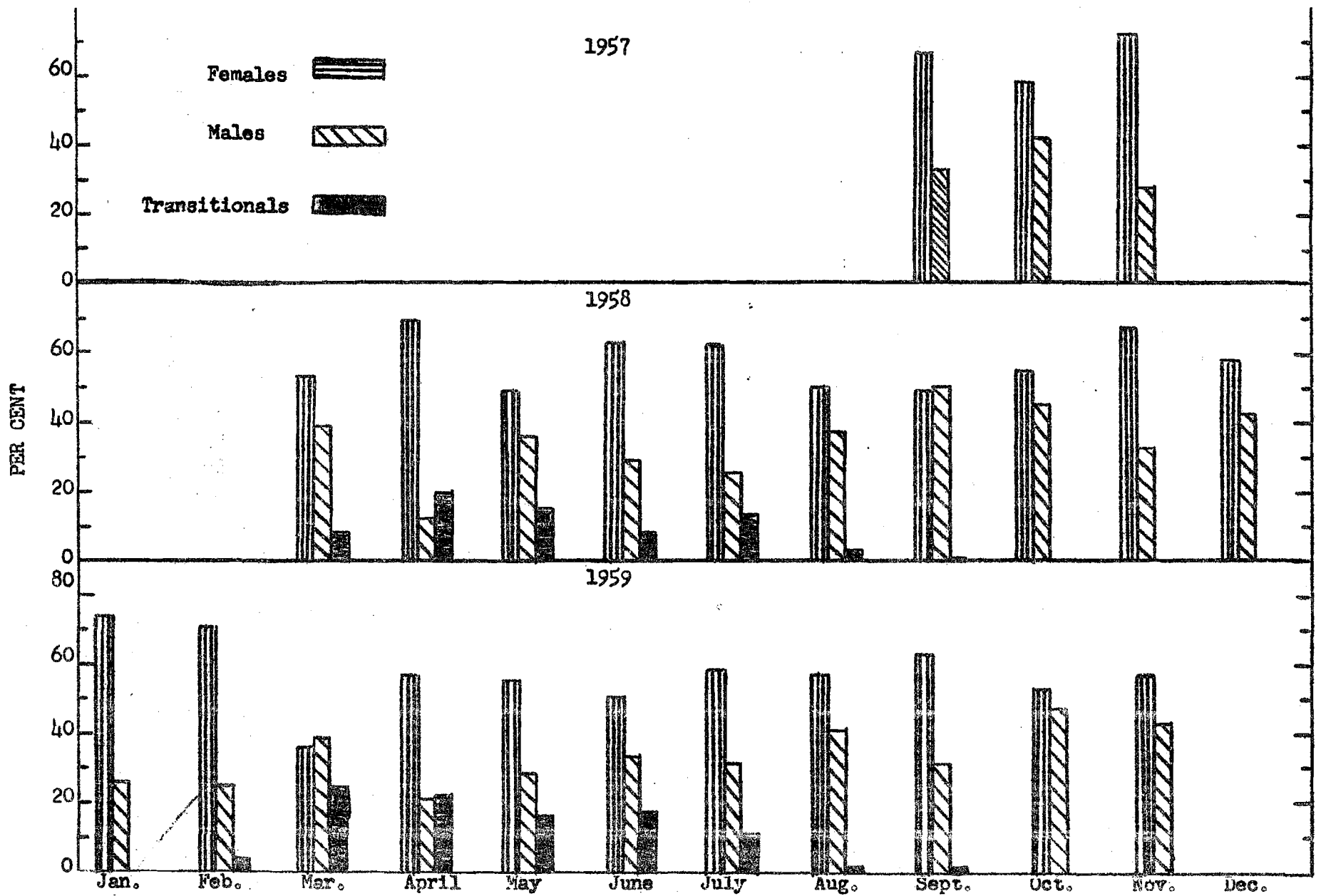


Figure 12. Female Pink Shrimp Carapace Length Frequencies for 1958, Expressed in Per Cent of the Total Monthly Sample.

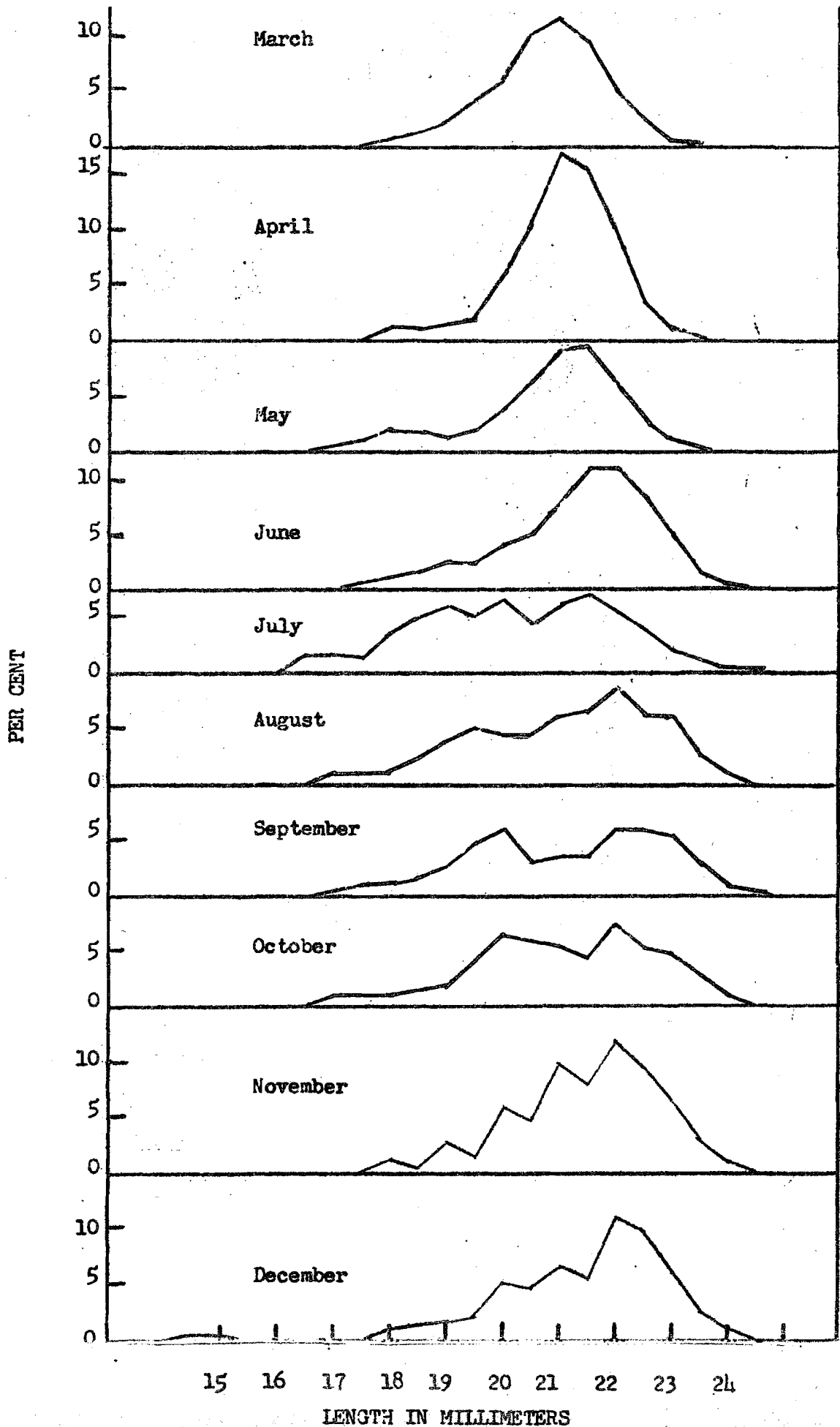


Figure 13. Female Pink Shrimp Carapace Length Frequencies for 1959, Expressed in Per Cent of the Monthly Sample.

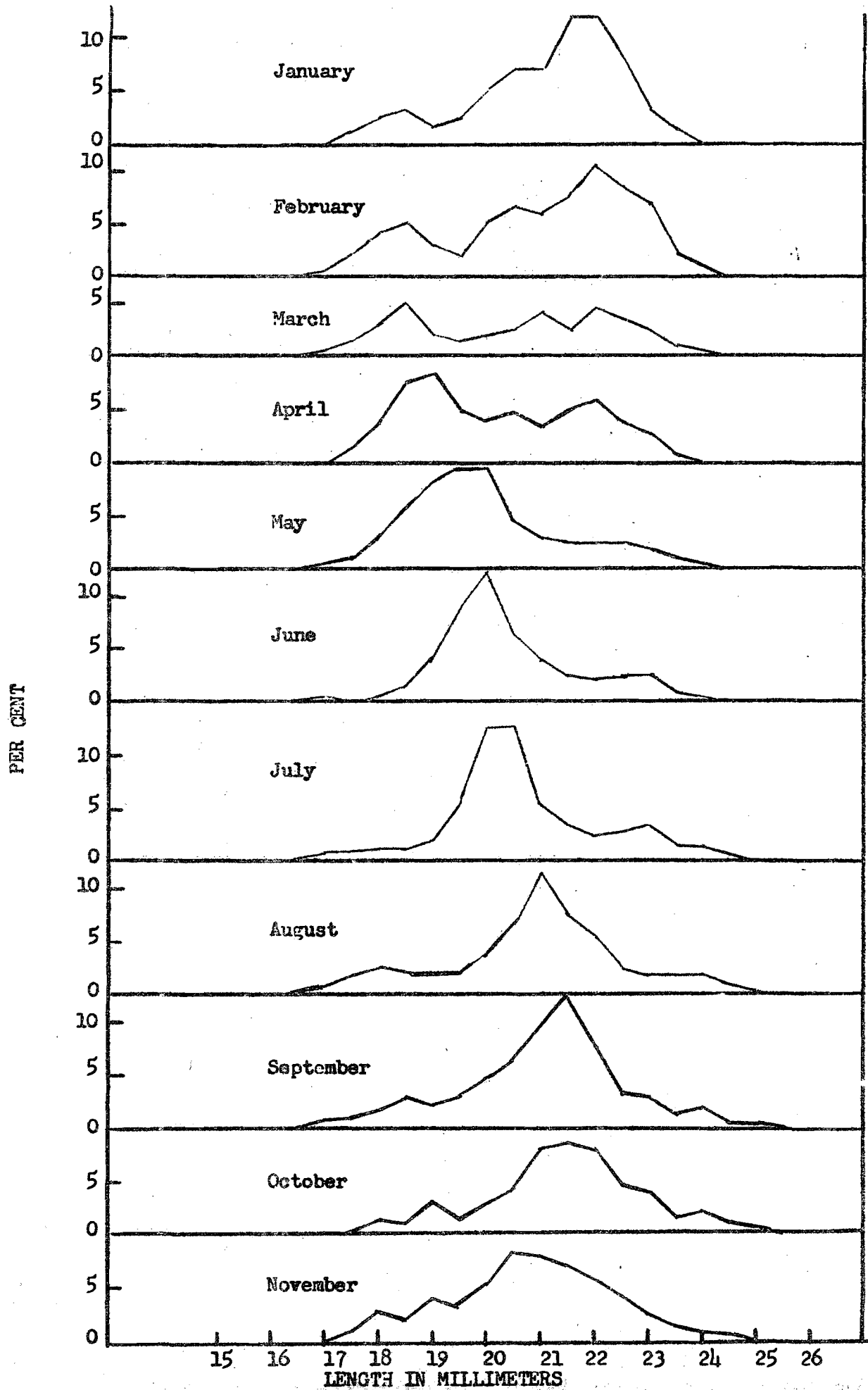


Figure 14. Male Pink Shrimp Carapace Length Frequencies for 1958,
Expressed in Per Cent of the Total Monthly Sample.

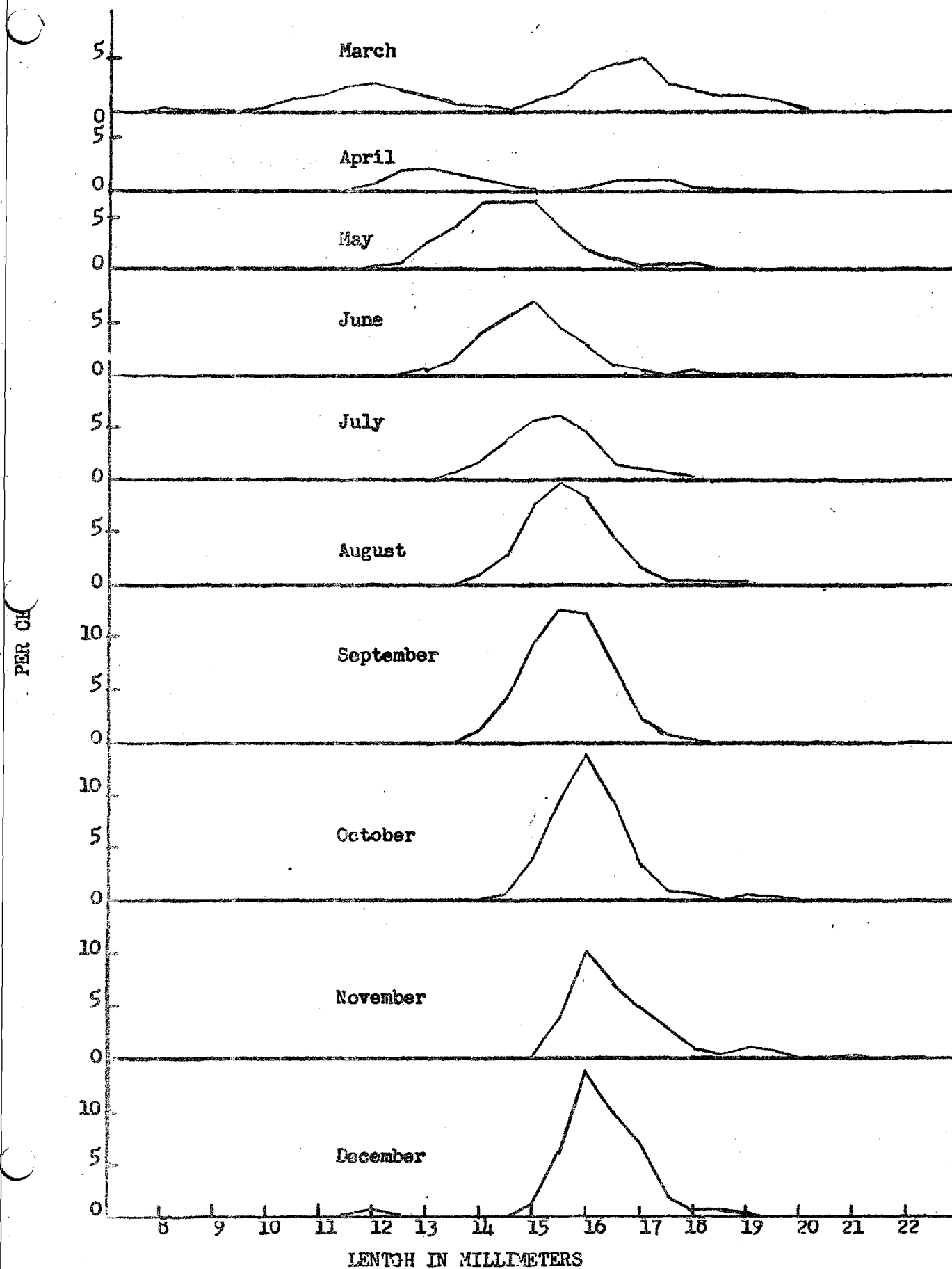


Figure 15. Male Pink Shrimp Carapace Length Frequencies for 1959, Expressed in Per Cent of the Total Monthly Sample.

