

Charleston Lab
Huy

Oregon Fish Commission
Research Division

TRAWL INVESTIGATIONS
PROGRESS REPORT

January 1, 1963 - December 31, 1964

TABLE OF CONTENTS

	<u>Page No.</u>
INTRODUCTION..	1
PERSONNEL.....	1
FLEET ACTIVITIES.....	2
PUBLICATIONS.....	5
SEISMIC PROBLEMS.....	6
REGULATION CHANGES.....	7
GROUND FISH MIGRATION STUDY.....	7
<u>Dover Sole</u>	8
<u>Sablefish</u>	8
OREGON MINK FOOD FISHERY.....	9
MARKET SAMPLING.....	14
<u>English Sole</u>	14
<u>Petrale Sole</u>	16
<u>Pacific Ocean Perch</u>	16
<u>Dover Sole</u>	16
LANDING RECORDS.....	22
<u>Statewide</u>	22
<u>Astoria Fishery</u>	27
TAGGING STUDIES.....	27
<u>Dover Sole, April 1955</u>	33
<u>Dover Sole, May 1961</u>	33
<u>English Sole, April 1959</u>	33
<u>Petrale Sole, April 1959</u>	35
<u>Petrale Sole, February 1960</u>	35
SHRIMP STUDIES.....	36
<u>Introduction</u>	36
<u>General</u>	36
<u>Catch Statistics</u>	37
<u>Biological Statistics</u>	42

LIST OF FIGURES

<u>Figure No.</u>		<u>Page No.</u>
1.	Length-Frequency Distribution of English Sole in Oregon Trawl Market Samples, 1963.....	15
2.	English Sole Length-Frequency Distributions in 1964 Market Samples.....	17
3.	Length-Frequency Distribution of Petrale Sole in Oregon Trawl Market Samples, 1963.....	18
4.	Petracle Sole Length-Frequency Distributions in 1964 Market Sample.....	19
5.	Length-Frequency Distribution of Pacific Ocean Perch in Oregon Trawl Market Samples, 1963.....	20
6.	Pacific Ocean Perch Length-Frequency Distribution, 1964....	21
7.	Length-Frequencies of Male and Female Dover Sole from Astoria Market Samples, 1956-1964.....	23
8.	Dover Sole Length-Frequency Distributions for 1964.....	24
9.	Chart of Pacific Coast Showing PMFC Areas.....	32
10.	Percentage Age Composition and Mean Length for Oregon Shrimp Landings in 1963, by Month and Port.....	40
11.	Percentage Age Composition and Mean Length for Oregon Shrimp Landings in 1964, by Month and Port.....	41
12.	Per Cent of Ovigerous Female Shrimp in Coos Bay Landings, 1962-1965.....	46

LIST OF TABLES

<u>Table No.</u>		<u>Page No.</u>
1.	List of Vessels Engaged in Trawling in Oregon by Port During 1963.....	3
2.	List of Vessels Engaged in Trawling in Oregon by Port During 1964.....	4
3.	Numbers of Dover Sole Recovered by Year of Tagging (AEC Project).....	8
4.	Number of Sablefish Recovered by Year of Tagging (AEC Project).....	9
5.	Total 1963 Mink Food Landings with Estimate of Species Composition as Derived by Sampling.....	10
6.	Total 1964 Mink Food Landings with Estimate of Species Composition as Derived by Sampling.....	11
7.	Comparison of English, Dover, and Petrale Sole Landed in Oregon as Fillet Fish and Mink Food During 1963 and 1964.....	13
8.	Mean Lengths and Sex Ratios of Dover Sole in Market Samples at Astoria.....	22
9.	Yearly Oregon Trawl Landings from 1956 to 1964.....	25
10.	Total Oregon Trawl Landings (by Area Fished), Calculated Hours Fished, and Catch-per-Hour by (PMFC) Areas for 1959-64.	26
11.	Total Pounds Landed, Calculated Number of Landings, and Pounds per Significant Landing for English Sole in Astoria, 1942-64. Allocation of Catch by Area for the Period 1951-64.....	28
12.	Total Pounds Landed, Calculated Number of Landings, and Pounds per Significant Landing for Petrale Sole in Astoria, 1942-64. Allocation of Catch by Area for the Period 1951-64.	29
13.	Total Pounds Landed, Calculated Number of Landings, and Pounds per Significant Landing of Dover Sole in Astoria, 1942-64. Allocation of Catch by Area for the Period 1951-64.	30
14.	Total Pounds Landed, Calculated Number of Landings, and Pounds per Significant Landing of Pacific Ocean Perch in Astoria, and Allocation of Catch by Area for the Period 1951-64.....	31
15.	Recoveries of Dover Sole by Year and PMFC Area (1955 Willapa Deep Tagging).....	33

LIST OF TABLES (Continued)

<u>Table No.</u>		<u>Page No.</u>
16.	Recoveries by Year and PMFC Area of 1961 Stonewall Bank Dover Sole Tagging.....	34
17.	Recoveries of 1959 English Sole Tagging by Year and PMFC Area.....	34
18.	Recoveries from April 1959 Petrale Sole Tagging by Gear and PMFC Area.....	35
19.	Recoveries from February-March 1960 Petrale Sole Tagging by Year and PMFC Area.....	36
20.	Total Oregon Shrimp Landings, Effort, and Catch per Effort by Year and Port.....	39
21.	Annual Oregon Shrimp Landings, by Area of Catch.....	45

INTRODUCTION

Included in this progress report are the activities of the Trawl Investigation staff throughout the calendar years of 1963 and 1964.

Major field activities during this period consisted of the following:

- (1) interviewing trawl fishermen from Astoria-Warrenton, Newport, Coos-Winchester Bays, and Brookings for catch and effort data on the bottomfish and shrimp fisheries;
- (2) recovering tagged fish from the trawl vessels and filletting plants;
- (3) collecting and analyzing shrimp samples from the commercial shrimp fishery for age and growth studies;
- (4) obtaining length-frequency samples from Dover, English, and petrale soles and Pacific ocean perch;
- (5) tagging Dover sole and sablefish for an AEC-sponsored groundfish migration study;
- and (6) keeping a general over-all observance of vessel movements and plant operations.

Investigational work conducted in the laboratory consisted of: (1) analyzing and coding the 1963 and 1964 trawl catch and effort data with regard to hours fished, area of capture, and species and poundages caught; (2) preparation of catch and effort data for FMFC annual and research staff meetings, international trawl subcommittee and committee meetings, and Fish Commission meetings; (3) processing tag recovery data; (4) processing and analyzing of pink shrimp and bottomfish market samples; (5) gathering information and presenting data relative to changes in the trawl regulations; (6) attending various state, intrastate, and federal fisheries meetings relative to trawl investigations; (7) writing and editing reports and manuscripts; and (8) handling budgeting and administrative matters relative to the Trawl Investigation.

PERSONNEL

Changes in the personnel of the Trawl Investigation reflected the Fish

Commission as a whole, as several changes occurred during these two years.

The untimely death of our project leader and Astoria laboratory administrator, Alfred Ray Morgan, was a serious loss to the project and the entire Fish Commission. Ray began his career with the Fish Commission in 1948 on the Coastal Rivers Investigation and assumed project leader status with Trawl Investigations on February 1, 1957. He was highly respected and admired by his fellow workers and acquaintances as his devotion to his chosen field of biological research was only equalled by his devotion to his family and church.

In August 1963, Austin R. Magill assumed the duties of project leader. The Biologist II position left vacant by Magill in August was filled by Edwin L. Niska in January 1964. This brought the staff up to full strength -- Magill as a Biologist III, Robinson and Niska as II's and Hoover as a Biologist I. Jay O. Hoover terminated October 23, 1964, to assume a position with the U.S. Forest Service at Mount Baker National Forest in Washington. His position was still vacant December 31, 1964.

Summer employees consisted of Tod Johnson and Ralph Domenowske during the period June-September 1963, and John Pearson during June-September 1964.

FLEET ACTIVITIES

The markets for trawl-caught fish remained good throughout this two-year period. No strikes or plant shutdowns occurred.

The vessels landing bottomfish and shrimp in 1963 are listed in Table 1 by port of landing. Included in this list are 66 vessels that made one or more landings at Oregon ports. Those vessels that are bona fide or full-time trawlers are designated by a "T". Many of the vessels landing at Coos Bay and Brookings are of California registry and emigrated to Oregon ports during the shrimp season.

During 1964, a total of 73 vessels made one or more landings at Oregon ports

Table 1. LIST OF VESSELS ENGAGED IN TRAWLING IN OREGON BY PORT DURING 1963.

Astoria	Newport	Coos Bay and Winchester Bay	Brookings
Advance (T)	Destiny (T)	Anak	Adena II
Betty (T)	Madeline J. (T)	Bonnie C.	Faymar
Eagle (T)	Miss Connie (T)	Bristol	Golden West (T)
Empress (T)	Oregonian (T)	Christina J.	Jefferson (T)
Galaxy (T)	Pacific Queen (T)	Columbia (T)	General Pershing (T)
Jennie F. Decker (T)	Ruth Ellen (T)	Dare II (T)	Kincheloe (T)
Jimmy Boy (T)		Empire II (T)	Stephanie (T)
Junior (T)		Frank F.	
Kiska (T)		Frank Lowe	
Kodiak (T)		Helen Louise	
Margaret A. (T)		Hero (T)	
Marian F. (T)		Intrepid	
Mary R. (T)		Janet Ray	
Mars		Karen (T)	
Meldon (T)		Margaret E. (T)	
Nestucca (T)		Memories	
New Hope		NelRonDic (T)	
New Mexico (T)		Pearl Harbor (T)	
Rodoma (T)		Pisces	
Rose Ann Hess (T)		Sunset	
Silver Queen (T)		Trego (T)	
Sunrise		Washington (T)	
Tralee (T)		Wauna	
Trask (T)			
Tom & Al (T)			
Valhalla II (T)			
Washington (T)			
Washington (T)			
WCF No. 1 (T)			
Western (T)			

(T) indicates bona fide Oregon trawler.

and these are shown in Table 2. This increase of seven vessels was the result of two causes. Several vessels of Washington registry landed loads of Pacific ocean perch in Astoria and several California vessels found good shrimp trawling off Coos Bay. The activity by Washington vessels was partly due to marketing difficulties experienced by the Seattle producers, so in order to sell their loads at the market price, it was necessary to unload in the Astoria-Warrenton area. There was much talk throughout 1964 about "short weighing and

Table 2. LIST OF VESSELS ENGAGED IN TRAWLING IN OREGON BY PORT DURING 1964.

Astoria	Newport	Coos Bay and Winchester Bay	Brookings
Advance (T)	Destiny (T)	Amak	Faymar (T)
Betty (T)	Madeline J. (T)	Bonnie C.	Golden West (T)
Eagle (T)	Mary Ann	Bristol	Jefferson (T)
Empress (T)	Miss Connie (T)	Christina J.	Kincheloe (T)
Dixie Maid	Oregonian (T)	Columbia (T)	Sea
Galaxy (T)	Pacific Queen (T)	Dare II (T)	Stephanie (T)
Guide	Ruth Ellen (T)	Empire II (T)	
Jennie F. Decker (T)		Ethel G.	
Junior (T)		Frank F.	
Kiska (T)		Frank Lowe	
Kodiak (T)		General Pershing	
Lynda Dawn (T) (formerly Washington)		Helen Louise (T)	
Marian F. (T)		Hero (T)	
Margaret A. (T)		Intrepid	
Meldon (T)		Janet Ray	
Mylark (T)		Karen (T)	
Nestucca (T)		Margaret E. (T)	
New Hope		Mary R. (T)	
New Mexico (T)		Memories (T)	
Patricia Joan		NelRonDic (T)Pe	
Rodoma (T)		Pearl Harbor (T)	
Rose Ann Hess (T)		Pisces	
Silver Queen (T)		Sunset	
Sunrise		Three Bees	
Tern		Trego (T)	
Tom & Al (T)		Washington (T)	
Tralee (T)		Joseph Alioto	
Trask (T)			
Valhalla II (T)			
Washington (T)			
WCF No. 1 (T)			
Western (T)			
Yaquina			

(T) indicates bona fide Oregon trawler.

scale bypassing" at the Seattle and Bellingham plants. It was even thought by some that this occurred to a small degree in the Astoria area. At the 1964 PMFC meeting, there were two resolutions introduced to curb this practice and require plants to record honest weights.

Modernization of the fishing fleet has allowed for more efficient fishing and greater safety for the vessels. In the past two years, several radar sets

have been installed as well as modern fish-finding equipment such as SIMRAD and FORUNO echo sounders. Approximately 75% of the vessels fishing bottomfish have changed from the old-style flat, weighted otter boards to the new "Luketa type" or "Chinese" trawl door, which are much more resistant to crossing, thereby permitting faster setting of the net and consequently more efficient fishing.

During the winter of 1963, the Pentec plant (Yaquina Bay Fish Company) at Newport burned and was a complete loss. It was rebuilt and resumed operations in the fall of 1964. Astoria Seafoods shut down its auxiliary fillet line that it was operating at Pacific Shrimp, Incorporated. This was evidently due to labor problems. Coos Bay Seafoods pioneered nitrogen quick freezing in Oregon with the installation of I.Q.F. facilities at their Coos Bay plant. Their speciality is rolled Dover sole in quantity controlled portions or individual servings. Apparently, there is no problem selling this type of product as the airline trade readily purchases what is available.

PUBLICATIONS

The following reports and publications were written by the trawl staff during this two-year period:

Magill, Austin R., and Michael Erho. The development and status of the pink shrimp fishery of Washington and Oregon. PMFC Bull. 6, 1963, pp 61-81.

Westrheim, Sigurd J., and Alfred R. Morgan. Results from tagging a spawning stock of Dover sole, Microstomus pacificus. PMFC Bull. 6, 1963, pp 13-23.

Magill, Austin R. Occurrence of the California flyingfish off northern Oregon. Oreg. Fish Comm. Res. Briefs, Vol. 9, No. 1, May 1963, pp 65-66.

Hoover, Jay O. A new northern record for the greenspotted rockfish, Oregon Fish Comm. Res. Briefs, Vol. 10, No. 1, June 1964, pp 73-74

Van Hyning, Jack M., and Austin R. Magill. Occurrence of the giant squid (Morothautilus robusta) off Oregon. Oreg. Fish Comm. Res. Briefs, Vol. 10, No. 1, June 1964, pp 67-68.

Robinson, Jack G. Range extension of the ocean whitefish (Cauliolatus principis). Awaiting publication in Research Brief No. 11.

Magill, Austin R., and Jay O. Hoover. Progress Report No. 2, tagging studies to determine the offshore-inshore exchange of groundfish off Oregon and Washington. November 1963.

Magill, Austin R., and Jay O. Hoover. Progress Report No. 3, tagging studies to determine the offshore-inshore exchange of groundfish off Oregon and Washington. December 1964.

Magill, Austin R. Notes on movements of tagged sole and halibut. Mimeographed paper, June 1964.

In addition to the papers listed, several others were edited and reviewed by members of the trawl staff. Notes covering range extensions of the Greenland halibut (Reinhardtius hippoglossoides) and rough-scale sole (Clidoderma asperrimum) are being prepared for publication.

SEISMIC PROBLEMS

During the past two years, we have had more than our share of problems trying to placate the trawl fishermen throughout the seasons of seismic explorations. Several of these fishermen have remained adamant in their views that the offshore seismic explorations by the oil companies were seriously damaging the fisheries resources.

Through the cooperation of Cliff Hall, master of the dragger Pacific Queen, Pelagic Fish Investigations and Trawl Investigations tabulated the Pacific Queen's fishing log data for the years 1959-64. This was an effort to determine if any change had taken place on the fishing grounds in regard to petrale, English, and Dover sole and rockfish density. Although the logbook data was admittedly somewhat incomplete, it pointed to declining catches of flatfish in recent years.

The fishing intensity by trawlers on various fishing areas was plotted by month and quarter to determine which areas should receive first consideration in reduction of seismic work should seismic explosions prove harmful. No areas were closed to seismic detonations; however, care was taken to restrict activities in areas of heavy fishing or in the vicinity of trawlers.

REGULATION CHANGES

During this two-year interval, only three regulation changes took place which affected the trawl fishery. One was a winter closed period on shrimp fishing, which is covered in the shrimp section. The other two pertained to petrale sole tolerance during the winter closed season and relaxation of mesh regulation sizes.

A revision of General Order XXVIII, dated January 1, 1963, allowed for the landing of 6,000 pounds of petrale sole per boat trip during the period January 1 through March 31 of each year. Prior to this, the limit had been 3,000 pounds. The relaxation of this regulation gave the fishermen greater opportunity to land substantial quantities of incidental petrale sole during the winter months.

General Order XX was also revised January 1, 1963, to allow the use of mesh down to 4 inches (stretched measure between knots) in the wings and body of a trawl net. The intermediate and cod-end remain at 4 1/2 inches as before. Chafing gear minimum size was decreased from 12 inches to 9 inches so that the knots would coincide with the knots of the cod-end. It had been the practice for the past several years for the fishermen to construct their chafing gear with 9- or 10-inch mesh. As no good reason could be found for requiring chafing gear to continue to be made of 12-inch mesh, this General Order was amended, thereby legalizing the existing gear.

GROUND FISH MIGRATION STUDY

This study is a cooperative study between the Atomic Energy Commission (AEC), The U. S. Bureau of Commercial Fisheries (BCF), and the Oregon Fish Commission (OFC) to determine the offshore-inshore movement of Dover sole (Microstomus pacificus) and sablefish (Anoplopoma fimbria) off the Columbia River. Although the initial contract began in April of 1962, several hundred fish were tagged

between May 1961 and April 1962 at OFC expense. This effected a practical starting date of May 1961. (Tagging was conducted on 13 cruises during this three-year period.) The tag release phase of this study terminated in May 1964 after a total of 9,013 Dover sole and 4,647 sablefish were tagged.

Dover sole. Of the 9,013 fish tagged, a total of 547 have been recovered through December 31, 1964. Table 3 lists these recoveries by year of tagging.

Note that quite a variation exists in the percentage return by year -- ranging from 2.5% for the 1961 tagging to 9.9% on the 1964 tagging. It is hoped that an explanation will be found for this when the analysis of the project is begun.

The movement of these Dover sole has not been great. Inshore movement of the deepwater tagged fish has been demonstrated, however, the importance of this movement may be exaggerated by the fishing pressure.

Table 3. NUMBERS OF DOVER SOLE RECOVERED BY YEAR OF TAGGING (AEC PROJECT).

Year of Tagging	Number Tagged	Recoveries by Year				Total	Per Cent of Tags Recovered
		1961	1962	1963	1964		
1961	1,585	9	9	12	9	39	2.5
1962	2,808		66	76	46	188	6.7
1963	1,902			26	24	50	2.6
1964	<u>2,718</u>				<u>270</u>	<u>270</u>	<u>9.9</u>
TOTAL	9,013	9	75	114	349	547	6.1

Sablefish. Recoveries of tagged sablefish have been very disappointing. Of the 4,647 fish tagged over a three-year period, only 15 have been recaptured. These recoveries by year of tagging are shown in Table 4.

The movements of these tagged fish have not generally been great. Of the

ten for which recovery data is known, only two moved more than 25 miles from the point of tagging; one went 120 miles north in four months and one went 275 miles south in five months.

Table 4. NUMBER OF SABLEFISH RECOVERED BY YEAR OF TAGGING (AEC PROJECT).

Year of Tagging	Number Tagged	Recoveries by Year				Total	Per Cent of Tags Recovered
		1961	1962	1963	1964		
1961	-						
1962	1,413		1	2		3	0.2
1963	2,914			9	2	11	0.4
1964	320				1	1	0.3
TOTAL	4,647		1	11	3	15	0.3

OREGON MINK FOOD FISHERY

Bottomfish species captured in trawls and delivered to Oregon plants for use as feed for mink amounted to 5.6 million pounds in 1963 and 6.0 million pounds in 1964. These landings constituted 18% and 19% of the total Oregon trawl landings, respectively. This is in contrast to mink food landings in 1956 when 14.1 million pounds were landed, which was 57% of the total Oregon trawl landings.

Approximately 2/3 of the total mink food landings were delivered to the Astoria area and the remainder at Newport, Winchester Bay, and Coos Bay (Tables 5 and 6). Newport landings were approximately 60% of the southern deliveries with combined Winchester Bay and Coos Bay landings constituting the other 40%.

Species composition of mink food landings is determined by a visual estimate of species weight in a landing at the time of delivery. Qualitative and quantitative sampling in prior years has indicated that these visual estimates give quite

Table 5. TOTAL 1963 MINK FOOD LANDINGS WITH ESTIMATE OF SPECIES COMPOSITION AS DERIVED BY SAMPLING.

Species	Astoria		Newport-Winchester-Coos		Total
	Per Cent	Pounds	Per Cent	Pounds	
English sole	7.28	243,224	7.10	158,004	401,228
Dover sole	3.20	106,911	15.57	346,497	453,408
Petrals sole	0.98	32,742	1.30	28,930	61,672
Rex sole	18.00	601,377	29.37	653,604	1,254,981
Butter sole	0.27	9,021	-	-	9,021
Sand dab	3.44	114,930	8.08	179,813	294,743
Starry flounder	1.26	42,096	0.23	5,118	47,214
Arrowtooth flounder	58.62	1,958,485	19.31	429,727	2,388,212
Miscellaneous sole	0.61	20,380	1.17	26,037	46,417
Skate	0.32	10,691	10.46	232,778	243,469
Sablefish	0.64	21,382	0.48	10,682	32,064
Lingcod	0.17	5,680	-	-	5,680
Rockfish	2.59	86,531	2.53	56,303	142,834
Pacific ocean perch	0.08	2,673	0.62	13,798	16,471
Idiot	0.35	11,693	3.21	71,436	83,129
Miscellaneous fish	<u>2.19</u>	<u>73,168</u>	<u>0.57</u>	<u>12,685</u>	<u>85,853</u>
TOTAL	100.00	3,340,984	100.00	2,225,412	5,566,396

close approximations of the actual landings. The 1963 estimates for Oregon landings are based upon 104 visual estimates, 80 in the Astoria area which constituted an 18% sample by weight of the total deliveries, and 24 samples from southern ports for a 9% sample weight. The 1964 estimates are based upon 95 observations, which was a 22% sample of the total port landings at Astoria. Inadequate estimates from southern ports precluded species estimates from Winchester Bay and Coos Bay in 1964.

Table 6. TOTAL 1964 MINK FOOD LANDINGS WITH ESTIMATE OF SPECIES COMPOSITION AS DERIVED BY SAMPLING.

Species	Astoria ^{1/}		Newport-Winchester-Coos ^{2/}		Total
	Per Cent	Pounds	Per Cent	Pounds	
English sole	5.84	232,793			
Dover sole	3.03	120,781			
Petrals sole	0.61	24,316			
Rex sole	5.26	209,673	NO SPECIES COMPOSITION		
Butter sole	0.20	7,972	ESTIMATES TAKEN		
Sand dab	2.40	95,668			
Starry flounder	2.63	104,837			
Arrowtooth flounder	58.24	2,321,551			
Miscellaneous sole	0.26	10,364			
Skate	0.53	21,127			
Sablefish	0.44	17,539			
Lingcod	0.07	2,790			
Rockfish	15.36	612,277			
Pacific ocean perch	3.38	134,733			
Idiot	0.65	25,911			
Miscellaneous fish	<u>1.10</u>	<u>43,848</u>			
TOTAL	100.00	3,986,180		1,981,170	5,967,350

^{1/} Based upon 95 dock and boat samples (903,487 pounds).

^{2/} Insufficient numbers of samples taken to warrant estimated species composition.

A comparison of the data from Astoria for the two years shows that 58% of the mink food landings are arrowtooth flounder. This species is much sought by the fur farmers for its high fat content and excellent growth factor in furred animal diets and is not presently used as a fillet fish. Rex sole has in years past been a large contributor in mink food landings. Sample estimates for this

species show that it dropped from 600,000 pounds in 1963 to 200,000 pounds in 1964.

Rockfish in the 1964 landings increased sevenfold over 1963, and became the second largest contributor to the Astoria landings. Likewise, a noticeable increase in the use of Pacific ocean perch as mink feed was noted in 1964. This is evidently caused by a lack of fillet markets for these species and consequent dumping for mink food. The total Astoria foodfish catches of rockfish and perch have not changed significantly during the two years under discussion, however, the use of these species for mink food has increased. Widow or soft brown rockfish has been occurring in increasing numbers in both foodfish and mink food landings, and this species now constitutes a large part of the rockfish landed for mink food. This species was not even listed in the composition of mink food landings during the late forties and early fifties.

English, Dover, and petrale sole warrant special discussion as General Order XXVI provides that incidental catch for animal food of the three species in aggregate shall not constitute more than 2,000 pounds or 20% by weight, whichever is the greater, of any single landing, sale, or purchase. General Order XX also provides that no more than 100 Dover, English, or petrale sole per boat trip in the aggregate may be less than 11 inches in over-all length. These regulations have been violated quite frequently by the mink food fishermen.

Table 7 is a comparison of the weights of English, Dover, and petrale sole landed in Oregon as fillet fish and mink food during 1963 and 1964. Because insufficient samples of mink food landings were taken at southern ports during 1964, the catch of whole mink food for 1964 at the southern ports was based upon the 1963 observations. Comparing total Oregon landings of English sole for fillet fish to mink-food-landed fish, 17% and 20% of the landings of this species were sold as mink food in the two years, respectively. The landings of fillet English

Table 7. COMPARISON OF ENGLISH, DOVER, AND PETRALE SOLE LANDED IN OREGON AS FILLET FISH AND MINK FOOD DURING 1963 and 1964. (All Landings in Thousands of Pounds).

Species	Pounds Fillet Fish Landed	Pounds Mink Food (Estimated)	Total Pounds (Calculated)	Per Cent Mink Food of Total Species Catch
<u>1963</u>				
Astoria:				
English	1,491	243	1,734	14
Dover	2,689	107	2,796	4
Petrals	1,520	33	1,553	2
TOTAL OREGON:				
English	1,948	401	2,349	17
Dover	5,345	453	5,798	8
Petrals	2,295	62	2,357	3
<u>1964</u>				
Astoria:				
English	993	233	1,226	19
Dover	2,457	121	2,578	5
Petrals	1,183	24	1,207	2
TOTAL OREGON: <u>1/</u>				
English	1,502	384	1,946	20
Dover	5,529	512	6,041	8
Petrals	1,877	46	1,923	2

1/ Mink food catch of sole at southern ports based upon observed 1963-1964 Astoria landings and 1963 total landings.

sole dropped 386,000 pounds from 1963 to 1964. However, the intensity of the English sole mink food fishery has not decreased proportionately as shown by the estimated 400,000 pounds landed each year. This indicates a relatively steady harvest of the young fishes and a decline in the harvest of the older stocks. The present data point to a need for stricter enforcement of regulations regarding the capture of English sole.

The annual catch of Dover sole for mink feed during these two years has been between 450,000 and 500,000 pounds. This is approximately 8% of the combined

food fish and mink food landings, and, although Dover have been fished heavily, the data do not yet show a decline.

Petrale sole in the mink feed landings is only 2% to 3% of the total trawl landings, which is not an important part of the over-all petrale landings.

MARKET SAMPLING

The intensity of market sampling was increased during 1963 and 1964. Prior to 1963, the only regular sampling was of Dover sole during the summer months when a weekly sample of 400 Dover sole was collected--50 of these for age analysis and all 400 for length and sex. Samples of English sole, petrale sole, and Pacific ocean perch were taken occasionally for length-frequency analysis but with no degree of regularity. During 1963, the Dover sole summer samples were cut down to 100 fish -- 50 for age and the total 100 for length and sex. More emphasis was placed on getting length and sex samples from the other species. During 1964, additional emphasis was placed on monitoring age, sex, and lengths of trawl-caught fish by weekly sampling of Dover sole, English sole, petrale sole, and Pacific ocean perch. Weather and landings precluded getting 52 weekly samples of each species; however, fairly complete coverage was acquired.

Total sampling effort in 1963 resulted in 6 English sole samples, 5 petrale sole samples, 9 Pacific ocean perch samples, and 11 Dover sole samples. The 1964 samples were more numerous and spread out throughout the year and consisted of measuring a total of 10,670 fish, broken down as 30 samples of English sole, 21 samples of petrale sole, 35 samples of Pacific ocean perch, and 18 samples of Dover sole.

English Sole

Graphed in Figure 1 are the length frequencies from the 600 English sole measured in 1963. The mean is at 36 cm while the mode is at 33 cm. The reason for this 3-cm difference is partially explainable by the fact that the English

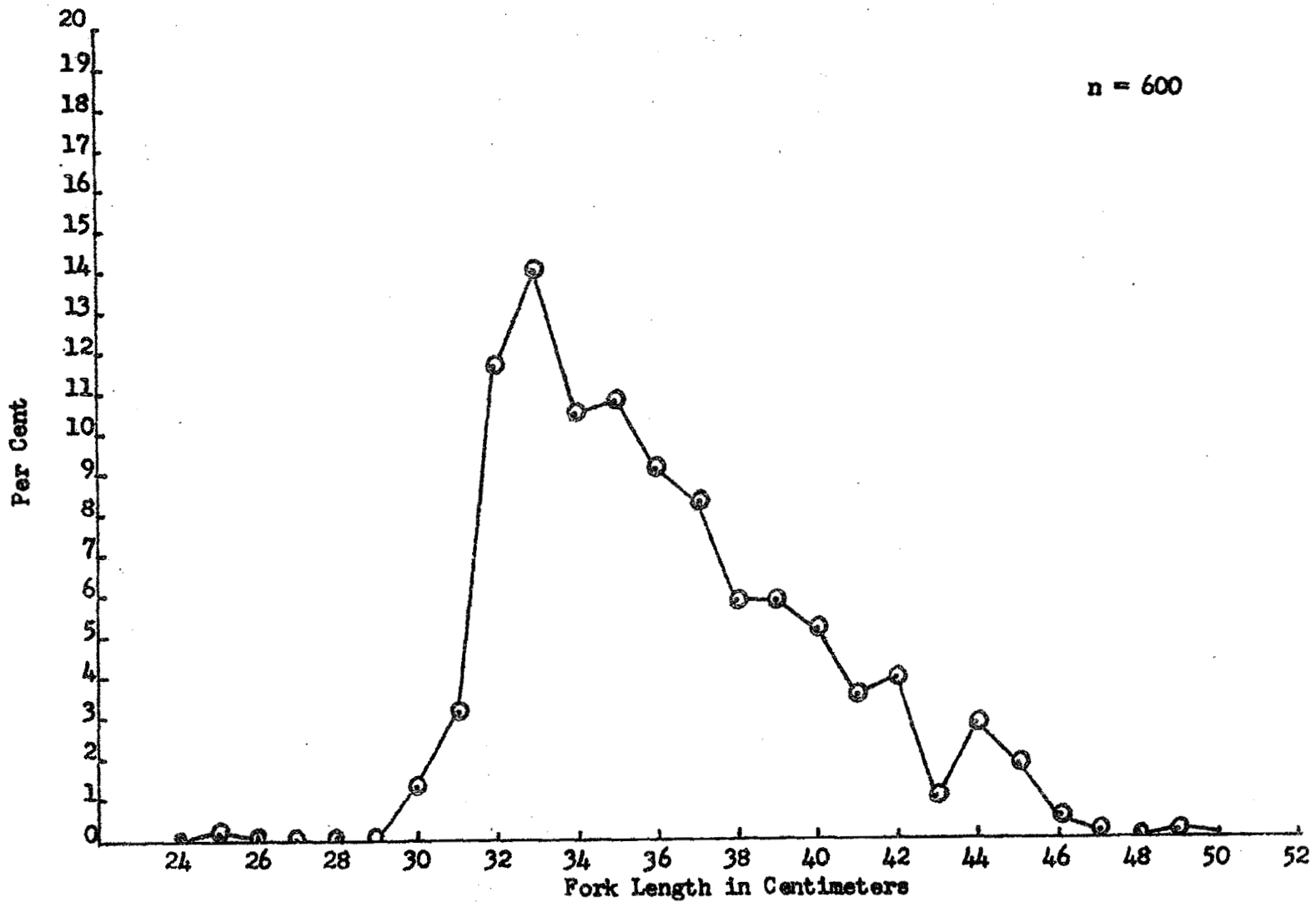


Figure 1. Length-Frequency Distribution of English Sole in Oregon Trawl Market Samples, 1963.

sole under about 32-33 cm are too small for the fillet market and are, therefore, discarded from the catch, which causes the distribution of the landed fish to be skewed to the right.

The same skewness to the right is apparent in the 1964 samples which are shown in Figure 2. Due to the more numerous samples, the length-frequency distributions are grouped by month of sampling as well as a yearly total or composite grouping.

Petrals Sole

The petrale sole market sole samples taken in Oregon (all Astoria) in 1963 are summarized and presented in Figure 3. A very small percentage of fish landed were smaller than 13 inches or 32.5 cm which is the approximate minimum size acceptable to the fillet markets. The market sampling program for 1964 was greatly expanded from 1963 as is evident by the length-frequency distributions shown in Figure 4. Samples of the petrale sole as landed were taken in all months except January, March, and May. The separation in modal size between males and females is quite evident, especially in the composite grouping.

Pacific Ocean Perch

A total of nine samples was taken of market landings during 1963 and these are depicted as length frequencies in Figure 5. Two modes are evident, one at 35 cm and the other at 40 cm, while the mean is 38.8 cm. A somewhat different picture is shown in Figure 6, which is a composite length-frequency diagram of the 1964 Pacific ocean perch samples. The 1964 mode is at 40 cm and the mean slightly less than 1963 at 38.4 cm.

Dover Sole

The Dover sole sampling has been more intensive than other species and has been carried on during the summer months for the past nine years. The length

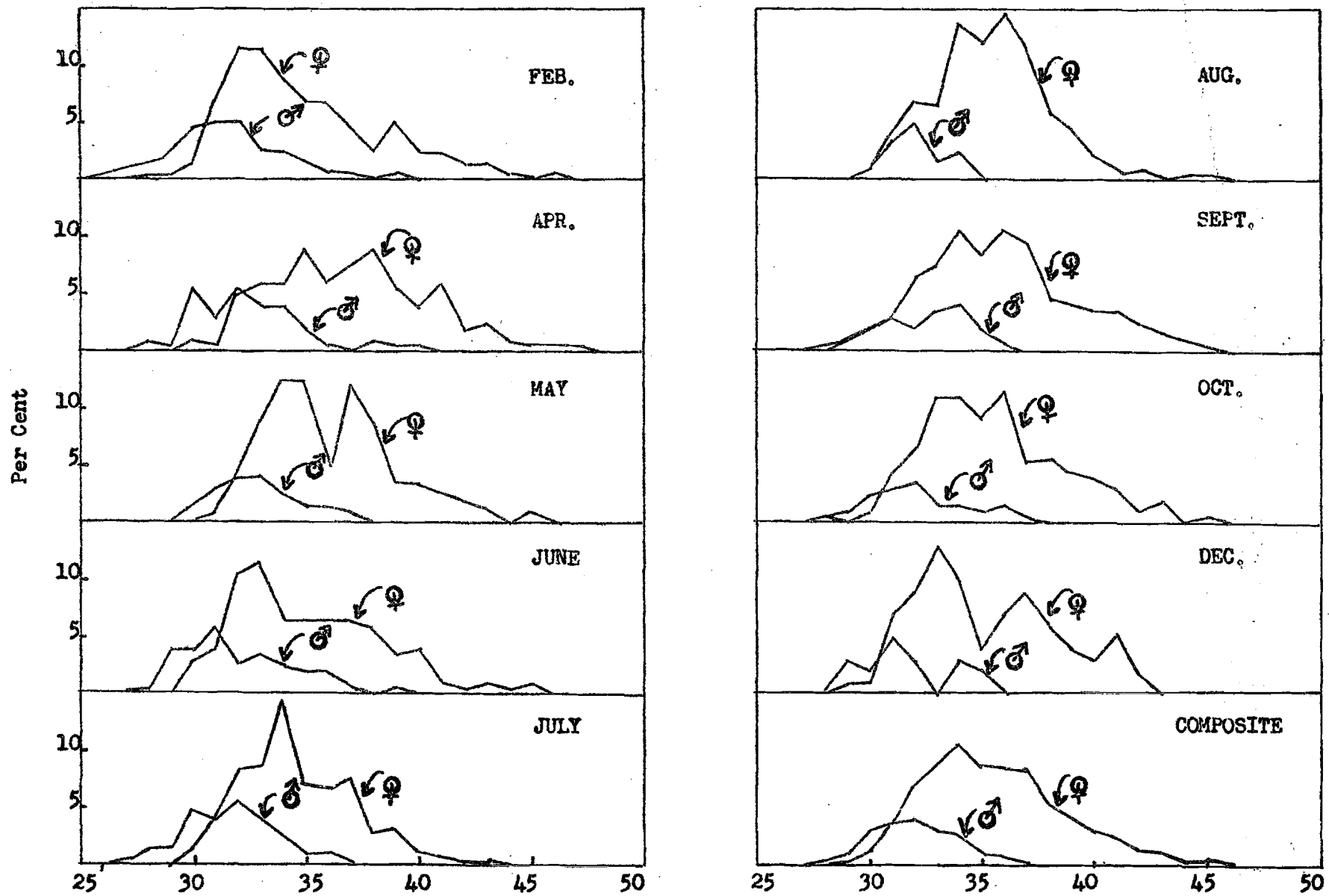


Figure 2. English Sole Length-Frequency Distributions in 1964 Market Samples.

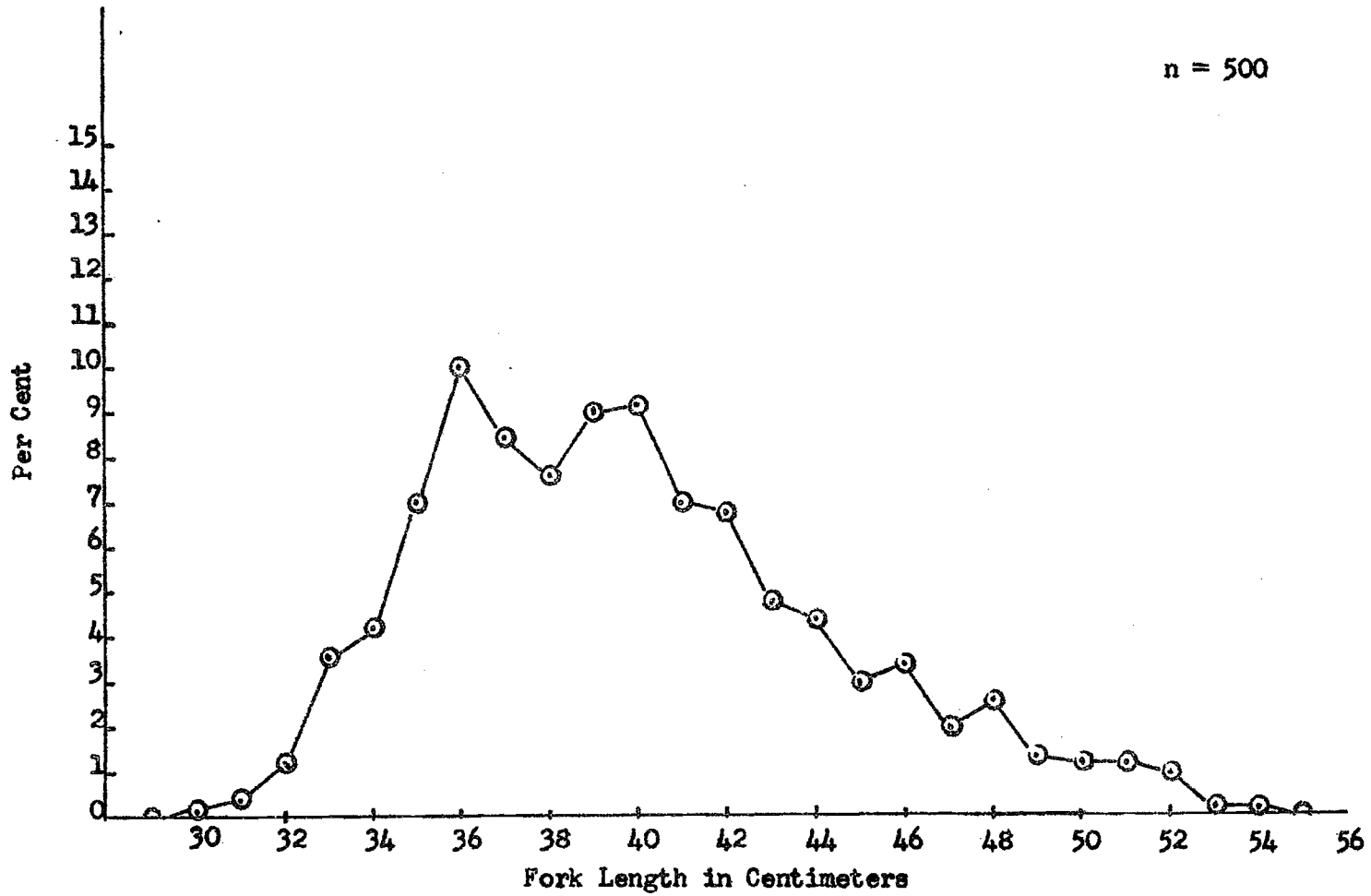


Figure 3. Length-Frequency Distribution of Petrale Sole in Oregon Trawl Market Samples, 1963.

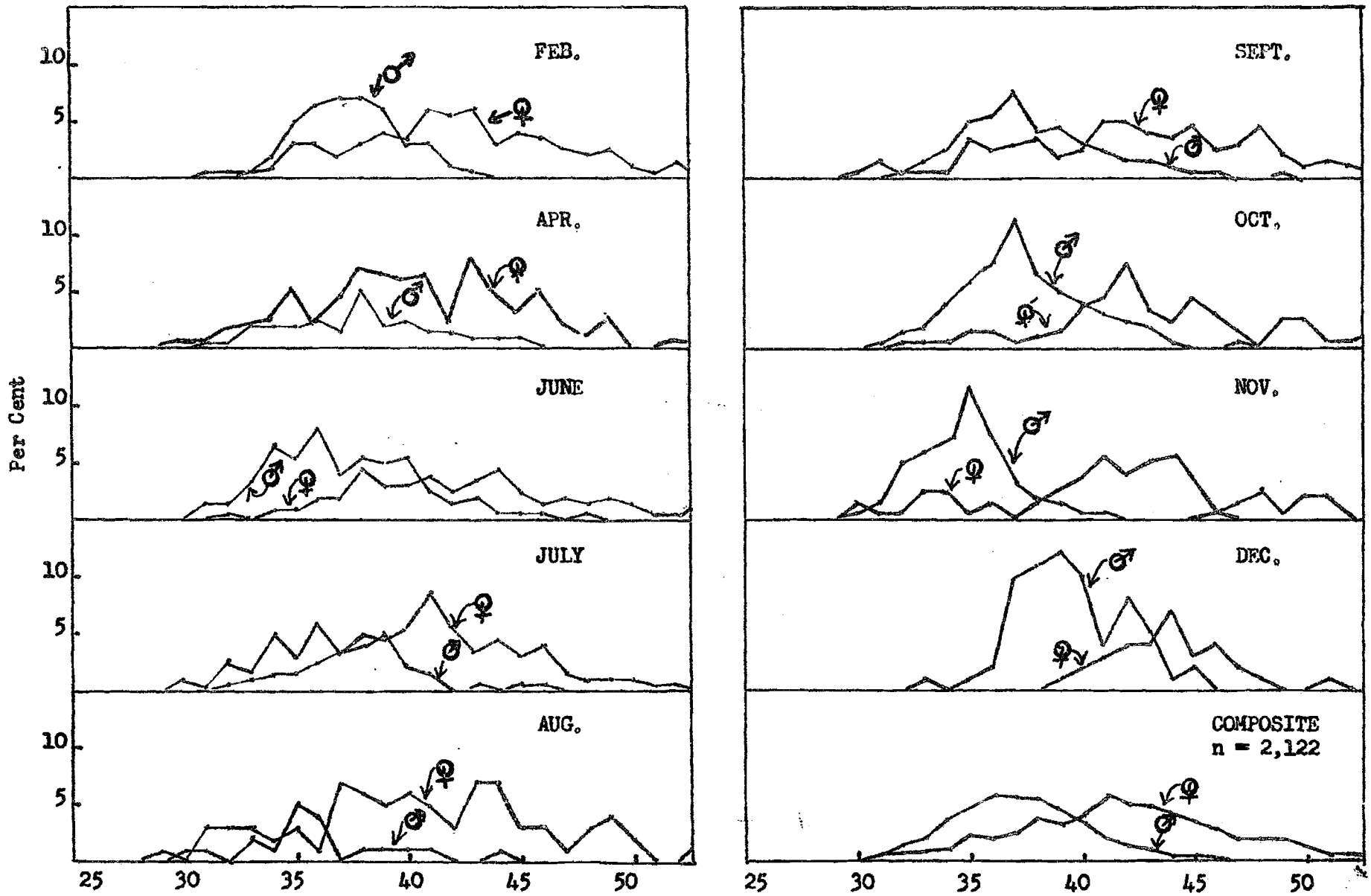


Figure 4. Petrale Sole Length-Frequency Distributions in 1964 Market Sample.

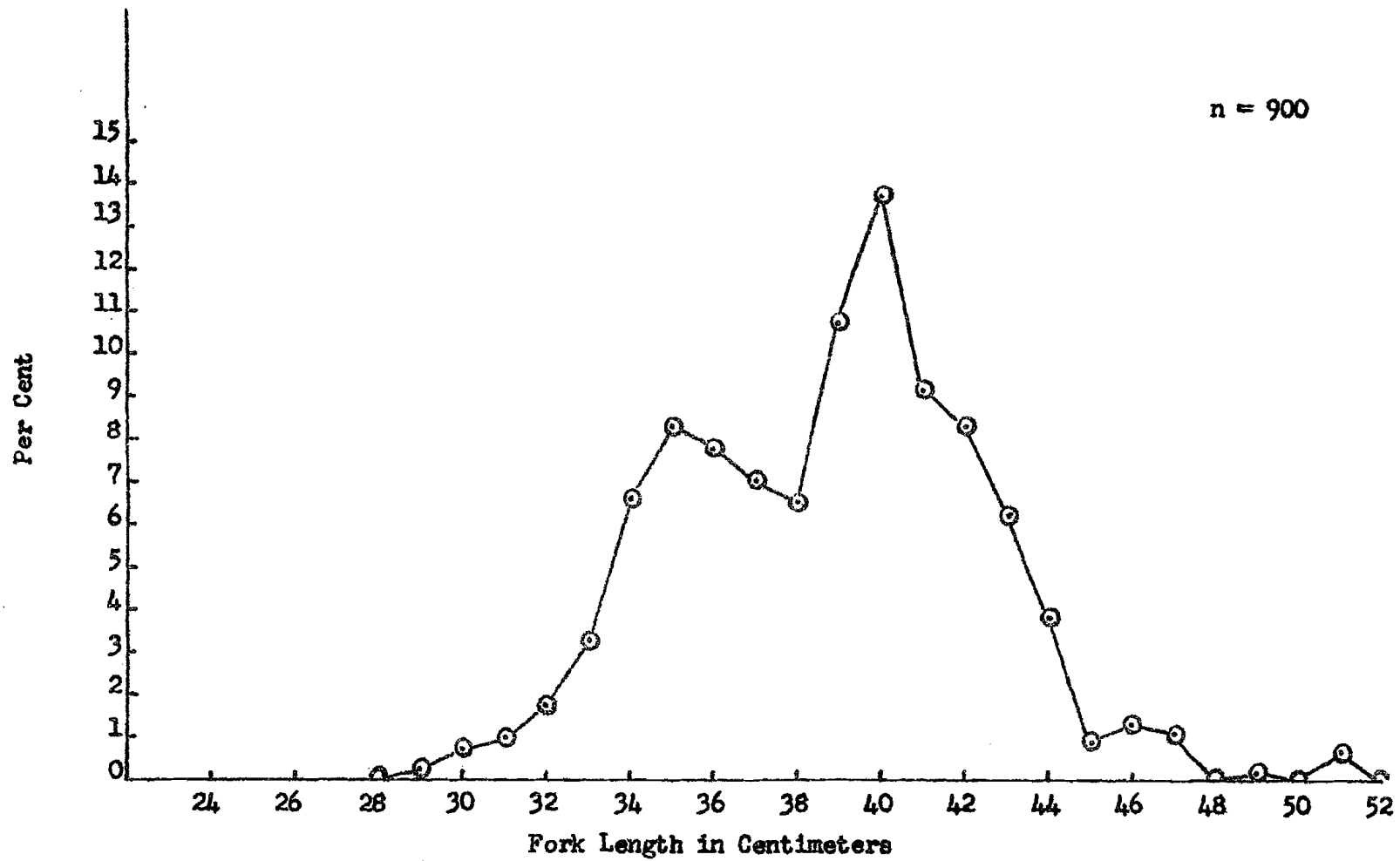


Figure 5. Length-Frequency Distribution of Pacific Ocean Perch in Oregon Trawl Market Samples, 1963.

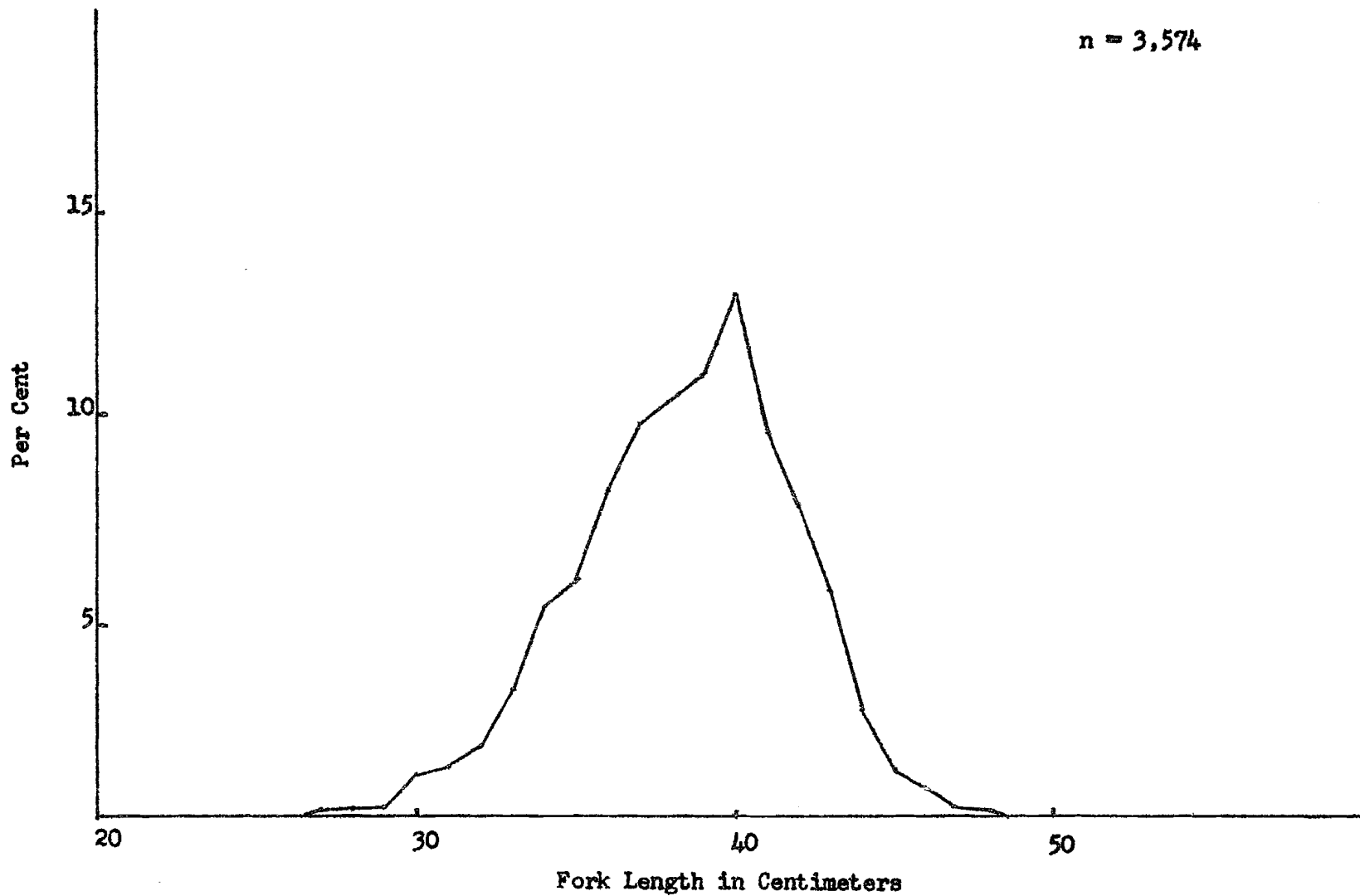


Figure 6. Pacific Ocean Perch Length-Frequency Distribution, 1964.

frequencies of this summer sampling are shown by sex in Figure 7. The mean lengths of males and females as well as sex ratios are shown in Table 8.

Table 8. MEAN LENGTHS AND SEX RATIOS OF DOVER SOLE IN MARKET SAMPLES AT ASTORIA.

Year	Mean Length		% Males
	Males	Females	
1948	412	433	48.1
1949	411	453	41.1
1950	400	441	44.8
1951	397	437	44.6
1952	396	436	43.5
1953	398	445	44.1
1954	400	444	32.5
1955	386	447	37.0
1956	402	443	46.3
1957	398	441	39.6
1958	392	429	34.8
1959	403	436	34.3
1960	397	445	33.6
1961	393	429	37.6
1962	391	426	27.8
1963	391	428	28.6
1964	375	418	37.7

A general decline in average lengths of both males and females is evident in the later years as well as a decline in the per cent of males. This is probably attributable to the increasing fishing pressure which more fully utilizes the available stocks. Starting in 1964, additional length frequencies were taken on Dover sole throughout the rest of the year. These are shown by month of sampling along with a yearly composite in Figure 8.

LANDING RECORDS

Statewide

The total yearly statewide landings from 1956 through 1964 by species are shown in Table 9, while Table 10 presents the total catch by PMFC area, hours fished, and catch per hour. Statewide landings for both 1963 and 1964 are above

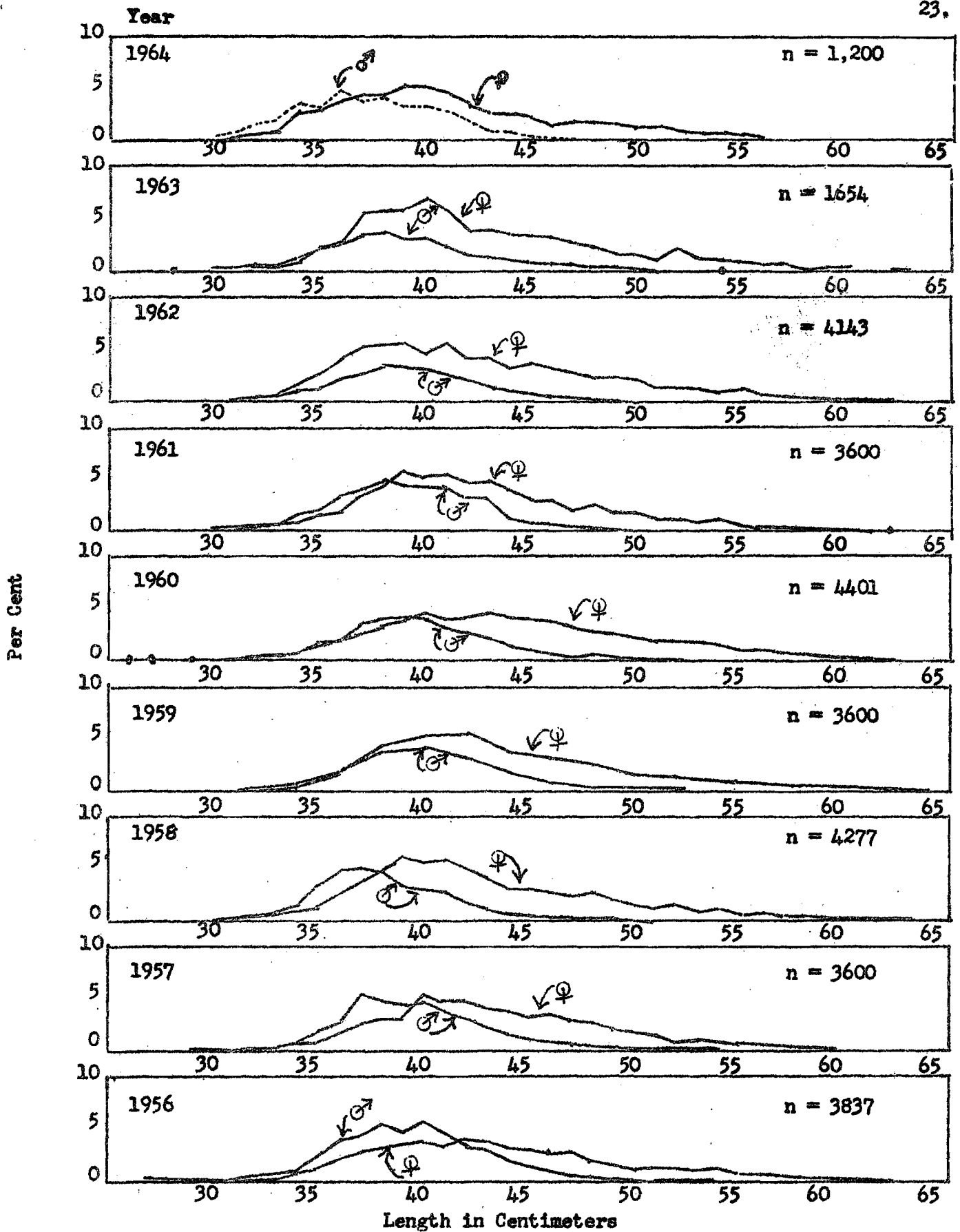


Figure 7. Length Frequencies of Male and Female Dover Sole from Astoria Market Samples, 1956-1964.

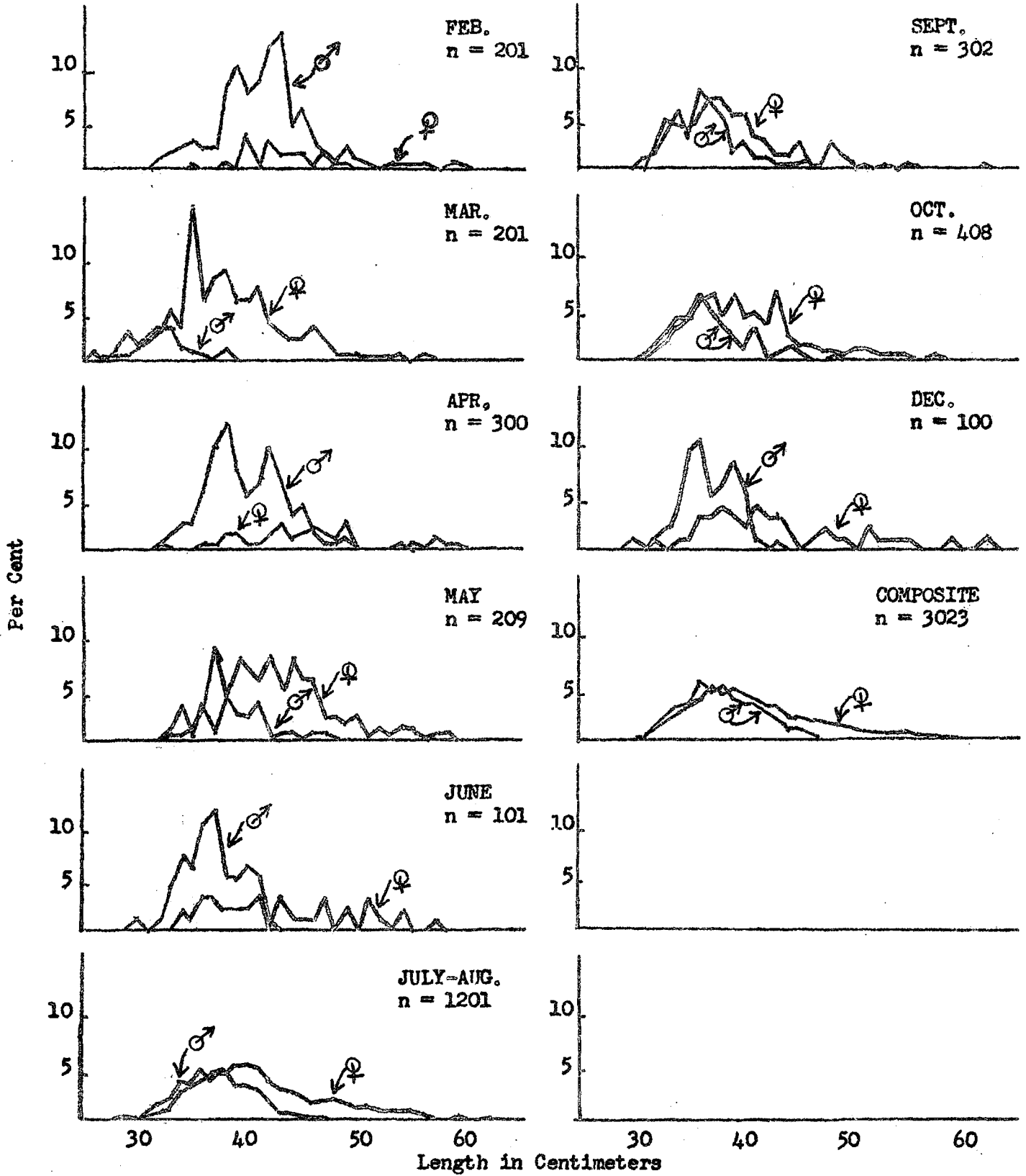


Figure 8. Dover Sole Length-Frequency Distributions for 1964.

Table 9. YEARLY OREGON TRAWL LANDINGS FROM 1956 to 1964
(LANDINGS IN THOUSANDS OF POUNDS).

Species	1956	1957	1958	1959	1960	1961	1962	1963	1964	9-Year Average
English Sole	961	1,654	1,834	1,451	2,454	1,789	2,295	1,948	1,562	1,772
Rock Sole									9	1
Petrale Sole	1,022	2,096	1,754	1,275	2,143	1,838	2,607	2,295	1,877	1,879
Dover Sole	2,595	3,560	3,338	4,543	5,208	4,054	4,454	5,345	5,529	4,292
Rex Sole	418	565	666	864	1,280	988	1,333	1,033	806	884
Starry Flounder	115	320	350	288	234	403	706	273	528	357
Other Flatfish	37	4	20	78	204	138	216	73	143	101
Pac. True Cod	180	516	470	344	224	103	19	67	200	236
Lingcod	130	562	298	327	664	619	756	493	736	509
Sablefish	185	226	131	75	172	159	150	188	183	163
Pac. Ocean Perch	2,880	2,994	2,473	2,471	2,734	4,568	5,789	7,982	9,548	4,604
Other Rockfish	2,188	3,312	4,378	3,696	5,392	4,832	7,125	4,681	4,147	4,417
Misc. Species	2		127	249	413	117	65	6	32	112
Dogfish	48			67	45					18
Animal Food	14,065	10,055	9,608	7,134	4,435	5,790	6,176	5,540	5,990	7,644
TOTAL	24,826	25,864	25,447	22,862	25,602	25,398	31,691	29,924	31,290	26,993
TOTAL HOURS				22,769	30,005	29,429	35,254	32,412	31,312	3,019
CATCH/HOUR				1,004	853	863	899	923	999	920*

* Six-year average

Table 10. TOTAL OREGON TRAWL LANDINGS (BY AREA FISHED), CALCULATED HOURS FISHED, AND CATCH-PER-HOUR BY (FMFC) AREAS FOR 1959-64.

FMFC Area		1959	1960	1961	1962	1963	1964
5-A	Pounds						127,000
	Hours						78
	Lbs/Hr						163
3-D	Pounds		155,000		19,500		
	Hours		108		55		
	Lbs/Hr		1,435		355		
3-C	Pounds		224,000			21,000	265,000
	Hours		213			40	313
	Lbs/Hr		1,052			525	847
3-B	Pounds	942,500	920,000	687,500	273,500	652,000	1,451,000
	Hours	827	651	835	351	923	1,432
	Lbs/Hr	1,140	1,413	823	779	706	1,013
3-A	Pounds	746,000	1,224,000	734,500	890,500	1,081,000	560,000
	Hours	461	1,203	912	953	1,359	798
	Lbs/Hr	1,618	1,017	805	934	795	702
2-D	Pounds	9,500,500	10,903,500	11,689,500	17,025,000	14,725,000	14,325,000
	Hours	9,317	12,733	13,944	16,531	14,448	14,086
	Lbs/Hr	1,020	856	838	1,030	1,019	1,017
2-C	Pounds	3,886,500	5,354,000	6,251,000	7,093,000	7,047,000	7,348,000
	Hours	3,948	5,825	6,178	9,246	7,558	6,931
	Lbs/Hr	984	919	1,012	767	932	1,060
2-B	Pounds	7,786,500	6,789,500	5,998,000	6,015,500	6,208,000	6,669,000
	Hours	8,216	9,212	7,508	7,692	7,820	6,492
	Lbs/Hr	948	737	799	782	794	1,027
2-A	Pounds		18,000	37,500	346,000	157,000	445,000
	Hours		40	52	362	204	950
	Lbs/Hr		450	721	956	770	468
1-C	Pounds		14,000		28,000	33,000	100,000
	Hours		20		64	60	272
	Lbs/Hr		700		445	550	368
State-wide Total	Pounds	22,862,000	25,602,000	25,398,000	31,691,000	29,924,000	31,290,000
	Hours	22,769	30,005	29,429	35,254	32,412	31,312
	Lbs/Hr	1,004	853	863	899	923	999

the nine-year average. English sole, petrale sole, rex sole, and rockfish landings decreased in 1963 and 1964, while those of Dover sole and Pacific ocean perch continued to increase. The statewide catch per hour has been increasing steadily for the past five years and was above the six-year average for both 1963 and 1964. This can be attributed partially to the large loads of Pacific ocean perch which is a volume fishery.

Astoria Fishery

For the past 22 years on petrale, English, and Dover sole and 13 years on Pacific ocean perch, the method used to determine catch-per-unit effort has been the pounds caught per significant landing. This method is not as accurate as pounds per hour fishing, but due to the difficulty experienced in assigning fishing effort by species, the pounds per significant landing system is continued as an indicator of abundance. Tables 11 through 14 show the total pounds landed, calculated number of landings, and pounds per significant landing of English sole, petrale sole, Dover sole, and Pacific ocean perch at the port of Astoria. These figures only show activity through 1963 as the 1964 data were not available at the time of writing. The three sole species appear to be leveling out at a level lower than when the fishery began. However, the total catch per significant landing for Pacific ocean perch (Table 14) is a new high for the 13 years of catch data.

TAGGING STUDIES

No tagging work, other than that of the AEC-sponsored offshore-inshore migration study was undertaken during this period. Although no tags were released, recoveries were made from several prior tagging ventures. These tagging studies are treated individually below. The PMFC areas referred to below are shown in Figure 9, which is a chart of the Pacific West Coast.

Table 11. TOTAL POUNDS LANDED, CALCULATED NUMBER OF LANDINGS, AND POUNDS PER SIGNIFICANT LANDING FOR ENGLISH SOLE IN ASTORIA, 1942-64. ALLOCATION OF CATCH BY AREA FOR THE PERIOD 1951-64. 1/

Year	Total Pounds Landed	Founds by Area			Calculated Number of Landings				Pounds Per Significant Landing			
		North	Local	South	Total	North	Local	South	Total	North	Local	South
1942	181,126	-	-	-	138	-	-	-	1,311	-	-	-
1943	665,331	-	-	-	126	-	-	-	5,280	-	-	-
1944	766,236	-	-	-	264	-	-	-	2,897	-	-	-
1945	726,314	-	-	-	114	-	-	-	6,380	-	-	-
1946	2,956,058	-	-	-	417	-	-	-	7,091	-	-	-
1947	1,338,543	-	-	-	166	-	-	-	8,071	-	-	-
1948	2,214,577	-	-	-	212	-	-	-	10,426	-	-	-
1949	765,958	-	-	-	72	-	-	-	10,602	-	-	-
1950	1,903,658	-	-	-	208	-	-	-	9,158	-	-	-
1951	2,086,088	302,053	1,720,846	63,189	293	30	251	9	7,115	10,171	6,863	6,706
1952	1,736,007	396,670	1,016,460	322,877	334	39	264	60	5,201	10,090	3,851	5,349
1953	937,568	171,882	610,627	154,959	220	18	173	35	4,252	9,359	3,524	4,372
1954	817,882	130,166	528,697	159,019	213	15	205	27	3,848	8,821	2,578	5,857
1955	882,976	94,523	757,159	31,294	251	12	229	16	3,517	7,680	3,306	1,910
1956	907,999	27,051	780,505	100,442	256	6	216	42	3,540	4,134	3,600	2,404
1957	1,557,590	306,610	1,151,623	99,357	286	24	257	3	5,438	12,638	4,482	31,606
1958	1,548,021	71,895	1,350,956	125,170	280	14	252	14	5,534	5,260	5,370	8,972
1959	1,333,516	149,734	1,150,837	34,945	286	20	255	21	4,655	7,292	4,520	1,693
1960	1,956,455	320,556	1,506,221	129,678	347	31	299	20	5,640	10,323	5,032	6,638
1961	1,515,647	257,032	1,203,277	55,338	363	32	321	13	4,172	8,050	3,753	-
1962	1,542,712	159,213	1,289,193	94,306	329	14	294	21	4,689	11,217	4,380	4,453
1963	1,374,542	224,439	1,058,705	91,398	357	32	299	26	3,890	7,026	3,540	3,454
1964	1,027,824	144,773	806,342	76,709	231	20	195	16	4,449	7,398	4,138	4,634

1/ Area definitions:

North: all areas north of Willapa Bay (including Willapa Deep).

Local: Cape Falcon to Willapa Deep.

South: all areas south of Cape Falcon.

Table 12. TOTAL POUNDS LANDED, CALCULATED NUMBER OF LANDINGS, AND POUNDS PER SIGNIFICANT LANDING FOR PETRALE SOLE IN ASTORIA, 1942-64. ALLOCATION OF CATCH BY AREA FOR THE PERIOD 1951-64. 1/

Year	Total Pounds Landed	Pounds by Area			Calculated Number of Landings				Pounds Per Significant Landing			
		North	Local	South	Total	North	Local	South	Total	North	Local	South
1942	2,319,758	-	-	-	290	-	-	-	8,010	-	-	-
1943	1,693,983	-	-	-	201	-	-	-	8,408	-	-	-
1944	1,278,244	-	-	-	203	-	-	-	6,298	-	-	-
1945	905,428	-	-	-	163	-	-	-	5,546	-	-	-
1946	1,694,604	-	-	-	420	-	-	-	4,037	-	-	-
1947	957,082	-	-	-	201	-	-	-	4,755	-	-	-
1948	1,447,155	-	-	-	218	-	-	-	6,639	-	-	-
1949	864,113	-	-	-	164	-	-	-	5,256	-	-	-
1950	1,859,142	-	-	-	271	-	-	-	6,849	-	-	-
1951	1,054,676	240,426	735,293	78,957	232	61	186	3	4,539	3,963	3,955	24,987
1952	1,305,997	159,772	679,070	467,155	222	32	136	54	5,874	4,993	5,004	8,728
1953	705,608	43,435	453,756	208,417	174	8	141	25	4,049	5,429	3,216	8,285
1954	1,173,993	481,109	501,620	191,264	189	79	81	29	6,196	6,072	6,223	6,497
1955	1,179,624	382,433	657,828	139,363	168	35	149	11	7,029	10,785	4,421	13,009
1956	828,697	93,064	500,978	234,655	158	18	107	33	5,256	5,255	4,667	7,026
1957	1,000,591	263,825	517,779	218,897	203	26	160	17	6,535	9,964	3,236	13,007
1958	533,093	68,267	316,486	148,340	109	28	167	16	4,908	2,455	1,895	9,011
1959	685,479	75,621	474,852	135,006	144	6	172	15	4,741	12,626	2,769	8,688
1960	1,204,097	188,918	766,155	249,024	176	29	108	31	6,832	8,573	7,061	6,055
1961	1,115,695	139,250	856,265	120,180	263	25	231	16	4,246	5,685	3,713	7,217
1962	1,462,534	200,952	1,104,645	156,937	283	19	248	16	5,168	10,432	4,463	9,576
1963	1,482,615	375,733	975,114	131,768	364	58	256	50	4,674	6,485	3,805	2,611
1964	1,208,114	261,114	831,859	115,142	270	59	191	20	4,474	4,422	4,344	5,659

1/ Area definitions:

North: all areas north of Willapa Bay (including Willapa Deep).

Local: Cape Falcon to Willapa Deep.

South: all areas south of Cape Falcon.

Table 13. TOTAL POUNDS LANDED, CALCULATED NUMBER OF LANDINGS, AND POUNDS PER SIGNIFICANT LANDING OF DOVER SOLE IN ASTORIA, 1942-64. ALLOCATION OF CATCH BY AREA FOR THE PERIOD 1951-64. 1/

Year	Total Pounds Landed	Pounds by Area			Calculated Number of Landings				Pounds Per Significant Landing			
		North	Local	South	Total	North	Local	South	Total	North	Local	South
1942	2,189,287	-	-	-	140	-	-	-	15,604	-	-	-
1943	6,587,312	-	-	-	379	-	-	-	17,395	-	-	-
1944	1,318,179	-	-	-	103	-	-	-	12,759	-	-	-
1945	2,570,845	-	-	-	164	-	-	-	15,722	-	-	-
1946	2,979,687	-	-	-	245	-	-	-	12,157	-	-	-
1947	1,737,933	-	-	-	145	-	-	-	11,990	-	-	-
1948	2,943,453	-	-	-	247	-	-	-	11,913	-	-	-
1949	2,456,719	-	-	-	191	-	-	-	12,848	-	-	-
1950	4,763,173	-	-	-	346	-	-	-	13,767	-	-	-
1951	4,688,405	784,416	3,804,559	99,430	405	71	326	8	11,578	11,075	11,674	12,368
1952	5,801,715	727,697	3,204,437	1,869,581	582	71	376	137	9,977	10,316	8,514	13,647
1953	2,282,292	387,889	1,254,706	639,697	242	34	146	62	9,436	11,563	8,566	10,309
1954	3,608,088	1,467,445	1,470,777	669,866	316	101	164	59	11,405	14,476	8,953	11,439
1955	2,946,239	900,338	1,776,741	269,160	302	58	217	33	9,744	15,438	8,179	8,128
1956	2,472,221	409,700	1,642,557	419,964	314	39	224	52	7,880	10,517	7,339	8,055
1957	2,823,197	858,277	1,732,147	232,773	279	54	210	11	10,107	15,878	8,242	20,486
1958	2,001,846	290,921	1,499,732	211,193	236	31	180	24	8,485	9,258	8,337	8,767
1959	2,425,789	111,766	1,604,546	709,405	281	15	227	42	8,638	7,530	7,066	17,009
1960	2,696,116	369,339	1,980,910	356,167	372	42	284	46	7,223	8,800	6,964	7,686
1961	2,047,398	330,585	1,478,714	208,099	254	34	196	18	5,862	6,963	5,805	4,399
1962	2,024,922	216,301	1,554,527	254,094	300	31	233	36	6,750	7,042	6,682	7,123
1963	2,681,149	533,299	1,868,689	279,161	417	60	319	38	6,330	8,866	5,863	7,395
1964	2,516,275	496,044	1,663,140	357,091	378	56	265	57	6,657	8,931	6,279	6,231

1/ Area definitions:

North: all areas north of Willapa Bay (including Willapa Deep).

Local: Cape Falcon to Willapa Deep.

South: all areas south of Cape Falcon.

Table 14. TOTAL POUNDS LANDED, CALCULATED NUMBER OF LANDINGS, AND POUNDS PER SIGNIFICANT LANDING OF PACIFIC OCEAN PERCH IN ASTORIA, AND ALLOCATION OF CATCH BY AREA FOR THE PERIOD 1951-64. 1/

Year	Total Pounds Landed	Founds by Area			Calculated Number of Landings				Pounds Per Significant Landing			
		North	Local	South	Total	North	Local	South	Total	North	Local	South
1951	1,023,390	39,889	953,232	30,369	87	4	82	2	11,711	11,155	11,638	14,888
1952	2,994,262	566,784	1,737,820	689,658	294	39	190	66	10,180	14,386	9,123	10,500
1953	2,609,142	429,866	1,063,590	1,115,686	182	19	92	72	14,304	23,145	11,548	15,601
1954	3,647,625	470,581	1,722,464	1,454,580	222	32	113	79	16,401	14,909	15,287	18,512
1955	1,554,132	190,301	820,484	543,347	131	17	80	35	11,860	11,365	10,242	15,514
1956	3,053,745	29,450	1,255,689	1,768,606	156	7	87	80	17,655	4,067	20,212	15,677
1957	3,047,100	426,209	1,297,952	1,324,939	154	21	77	56	19,821	20,538	16,818	23,736
1958	1,806,644	296,397	844,632	665,615	91	9	63	28	19,947	32,894	13,386	23,484
1959	1,329,220	3,680	508,560	815,980	82	0	50	34	16,125	0	10,254	23,833
1960	1,652,620	560,773	873,541	218,306	107	22	65	20	15,436	25,062	13,390	10,926
1961	2,592,038	350,039	433,400	1,808,599	158	19	45	98	16,391	18,096	9,545	18,513
1962	3,608,420	624,673	505,400	2,479,347	210	34	43	133	17,183	18,644	11,684	18,617
1963	5,118,169	1,165,584	953,343	2,999,242	243	63	55	125	21,249	18,565	17,200	24,075
1964	5,720,612	1,871,492	515,472	3,333,648	235	87	57	91	24,343	21,509	9,013	36,527

1/ Area definitions:

North: all areas north of Willapa Bay (including Willapa Deep).

Local: Cape Falcon to Willapa Deep.

South: all areas south of Cape Falcon.

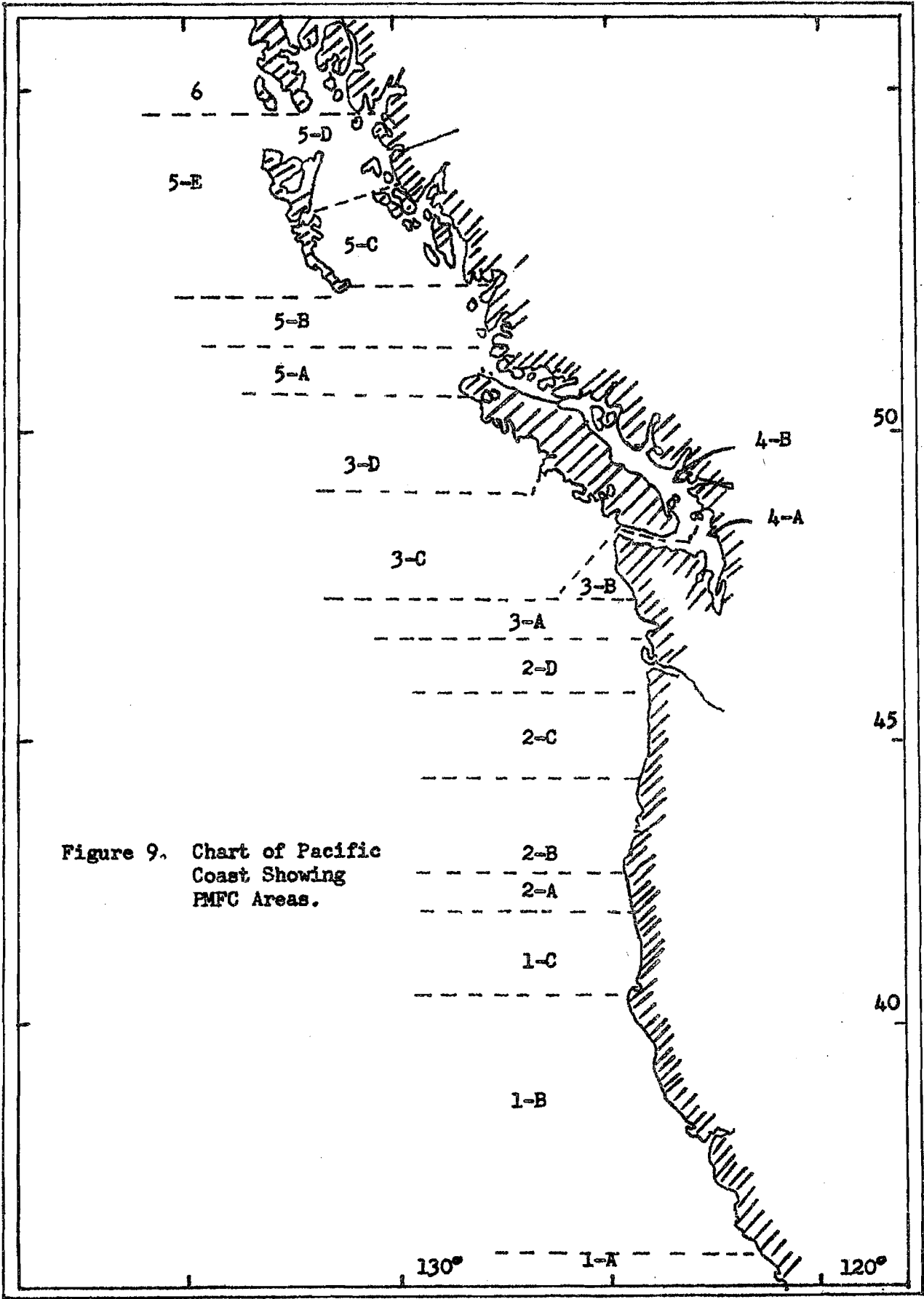


Figure 9. Chart of Pacific Coast Showing PMFC Areas.

Dover Sole, April 1955

Recoveries continued to come in from this deep water tagging in Willapa Deep. Recoveries by year and PMFC area are shown in Table 15.

Table 15. RECOVERIES OF DOVER SOLE BY YEAR AND PMFC AREA (1955 WILLAPA DEEP TAGGING).

PMFC Area	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964
3-D										1
3-C	1									
3-B	1	4	1							
3-A	17	10	6	3	1	1		1	1	
2-D*	13	51	73	38	18	8	3	9	12	4
2-C										
2-B										
2-A										
1-C				1						
Unknown	2	4	1	1					1	
YEARLY TOTAL	34	69	81	43	19	9	3	10	14	5

* Area of tagging.

Growth on the Dover sole that had been at liberty from six to nine years was not great, ranging from 20 to 50 millimeters.

Dover Sole, May 1961

A total of 4,321 fish were released from the John N. Cobb in PMFC Area 2-C (Stonewall Bank) in May 1961, just prior to the beginning of the AEC tagging work. The recoveries from these fish are shown in Table 16.

English Sole, April 1959

A total of 4,511 English sole were released in the area between the

Siletz River and Manhattan Beach in April 1959. Recoveries from this tagging are shown by year and area in Table 17.

Table 16. RECOVERIES BY YEAR AND PMFC AREA OF 1961 STONEWALL BANK DOVER SOLE TAGGING.

PMFC Area	1961	1962	1963	1964
3-A				
2-D		2	5	5
2-C*	12	76	67	48
2-B		3	3	8
2-A			1	
1-C				
Unknown		2	1	
YEARLY TOTAL	12	83	77	61

* Area of tagging.

Table 17. RECOVERIES OF 1959 ENGLISH SOLE TAGGING BY YEAR AND PMFC AREA.

PMFC Area	1959	1960	1961	1962	1963	1964
3-C						
3-B	35	138	56	4	2	
3-A	6	3				
2-D	189	132	41	17	4	
2-C*	22	23	9	1	1	
2-B	10	13	2	4	1	
2-A						
1-C	2	6	4			
Unknown	4	20	2	1		
TOTAL	268	335	114	27	8	0

* Area of tagging.

Petrale Sole, April 1959

A total of 550 petrale sole were tagged between Manhattan Beach and the Siletz River in 60-75 fathoms. Over 21% of these tags had been recovered by the end of 1964 and had ranged from Vancouver Island to Eureka, California. The recoveries by FMFC area and year are shown in Table 18.

Table 18. RECOVERIES FROM APRIL 1959 PETRALE SOLE TAGGING BY GEAR AND FMFC AREA.

FMFC Area	1959	1960	1961	1962	1963	1964
3-D						
3-C	3	1				
3-B	1	2	2	1		
3-A		2	1	1	1	
2-D	5	14	11	7	3	
2-C*	7	18	14	4	3	
2-B		3	3	3		
2-A	2	1				
1-C	1		2			
Unknown					1	
TOTAL	19	41	33	16	8	0

* Area of tagging.

Petrale Sole, February 1960

A total of 5,026 petrale sole were tagged in 170-200 fathoms at Heceta Bank during February and March 1960. The recovery percentage of 7% is only about 1/3 of the April 1959 tagging. The reason for this could possibly be the difference in tagging depth. However, dispersion from the point of tagging was similar in that these fish ranged from Vancouver Island to Eureka, California.

The recaptures by year and PMFC area are shown in Table 19.

Table 19. RECOVERIES FROM FEBRUARY-MARCH 1960 PETRALE SOLE TAGGING BY YEAR AND PMFC AREA.

PMFC Area	1960	1961	1962	1963	1964
3-D					
3-C	5	1			
3-B	5	11	3		
3-A					
2-D	8	9	3		
2-C	27	21	18	7	
2-B	104	30	46	14	2
2-A	1	2			
1-C	1	4	9	3	
Unknown	4		1	2	
TOTAL	155	78	80	26	2

SHRIMP STUDIES

Introduction

Shrimp investigations in 1963 and 1964 were concerned with collecting data on the biology of the shrimp resource and on catch and effort statistics. These data concerned size, age and sex composition of the resource as sampled, spawning period, and length-to-weight distribution. Catch by port of landing, area of capture, and the corresponding effort and catch-per-unit effort were monitored.

General

Meetings attended included Fish Commission regulation hearings, Pacific

Marine Fisheries Commission meetings in the fall and spring of 1963 and 1964, and meetings with California Department of Fish and Game personnel on common shrimp resource problems.

At the October 1964 Fish Commission hearing, a closed season on shrimp landings was decreed between October 31 and March 1 of each year. Also, at that meeting, a regulation was passed restricting Oregon landings of shrimp caught south of 42° North Latitude (California-Oregon border) to the period May 1 to October 1 each year. The Fish Commission may shorten or extend this season up to 60 days, however, upon written notice. Reasons for the Oregon closures were to prevent the capture of gravid female shrimp during the peak of their spawning season and to more effectively manage the shrimp resource of common interest to California and Oregon.

A proposal to study the larval morphology of pink shrimp, proposed by Mr. Carl Forss, a doctoral candidate at Oregon State University, was approved and presented to the Pacific Marine Fisheries Commission at its November 1964 meeting. This proposal and financing for it were approved by the PMFC and will be carried out by the California Department of Fish and Game as Mr. Forss was unable to do the study as originally planned.

Catch Statistics

Monitoring of the commercial fishery continued in 1963 and 1964. The 1964 shrimp catch was the largest ever in Oregon, totaling 5,480,000 pounds. This was a 77% increase of the prior record catch of 3,100,000 pounds in 1963. The landings at Coos Bay, largely responsible for the 1963 and 1964 expansions of the fishery, amounted to 1.6 million pounds in 1963 and 4.3 million pounds in 1964, as compared to the 1962 total of 885,000 pounds. The 1964 and 1963 totals represent annual increases in landings of 175% and 76%, respectively, at Coos Bay. The 1964 total is a 386% increase over that of 1962. Landings for Coos

Bay from 1957 to 1964 are shown in Table 20. Catch per effort at Coos Bay was also up from 1962 in both 1963 and 1964. In view of the great increase in catch and effort at Coos Bay, the increase in catch-per-unit effort indicates that this fishery was being underutilized or that the stocks supporting the fishery have become more abundant. A very strong age group, the 1961 year class, was responsible for the increased abundance. Factors causing this year class to be so strong are unknown, but Figure 10 (1963 age composition by port) and Figure 11 (1964 age composition by port) support the hypothesis of an exceptionally abundant 1961 year class. In both figures, the 1961 year class is dominant, especially in 1964 when it was over three years old -- an age when shrimp year classes usually begin to disappear from the catch due probably to senility and accumulated fishing and natural mortality. The high total 1964 catch at Coos Bay was also due to the influx of a number of California vessels, which doubled the size of the fleet there. This influx was due to very stringent measures taken by California to reduce the catch in northern California, which forced the California fleet to move into Oregon; however, some were enticed by the very large and abundant shrimp available off Coos Bay. A good market in 1964 also helped the expansion. To compound the matter further, poor crab landings early in 1964 and 1963 led to an early shrimp fishery beginning in January 1963 and in February 1964, which gave the fleet three and two months, respectively, more fishing time. Generally, April had been the first month in which shrimp fishing began prior to 1963.

The situation at Warrenton was similar to Coos Bay in that fishing was much improved as measured by catch-per-effort in 1963 and 1964 than in previous years. An improved market in 1963 led to a renaissance of this fishery in that year, when slightly over one million pounds were landed. Market difficulties in 1964, however, led to a very depressed total catch. Only 233,000 pounds were

Table 20. TOTAL OREGON SHRIMP LANDINGS, EFFORT, AND CATCH PER EFFORT BY YEAR AND PORT.

Port	Year	Pounds	Hours	Lb/Hr
Warrenton	1957	116,747	-	-
	1958	1,521,755	2,674	569
	1959	2,368,140	4,464	530
	1960	589,778	1,884	313
	1961	767,523	2,242	342
	1962	395,056	1,118	342
	1963	1,072,030	1,900	564
	1964	233,425	404	578
Newport	1964	31,096	86	362
Coos Bay	1957	218,551	-	-
	1958	400	-	-
	1959	5,676	-	-
	1960	83,550	167	500
	1961	431,126	934	462
	1962	885,627	2,612	340
	1963	1,581,158	2,685	584
	1964	4,299,738	6,629	649
Brookings	1957	0	-	-
	1958	0	-	-
	1959	390,311	801	487
	1960	459,178	933	492
	1961	257,263	319	806
	1962	1,450,822	2,582	562
	1963	461,583	1,075	432
	1964	394,265	680	580
Winchester Bay	1957	68,325	-	-
	1964	113,883	-	-
Port Orford	1962	18,935	26	728
	1964	405,020	541	749
Total Per Year	1957	403,623	-	-
	1958	1,522,155	2,674	569
	1959	2,764,127	5,275	524
	1960	1,132,506	2,984	380
	1961	1,455,912	3,495	417
	1962	2,750,440	6,338	434
	1963	3,114,771	5,660	548
	1964	5,477,427	8,544	641

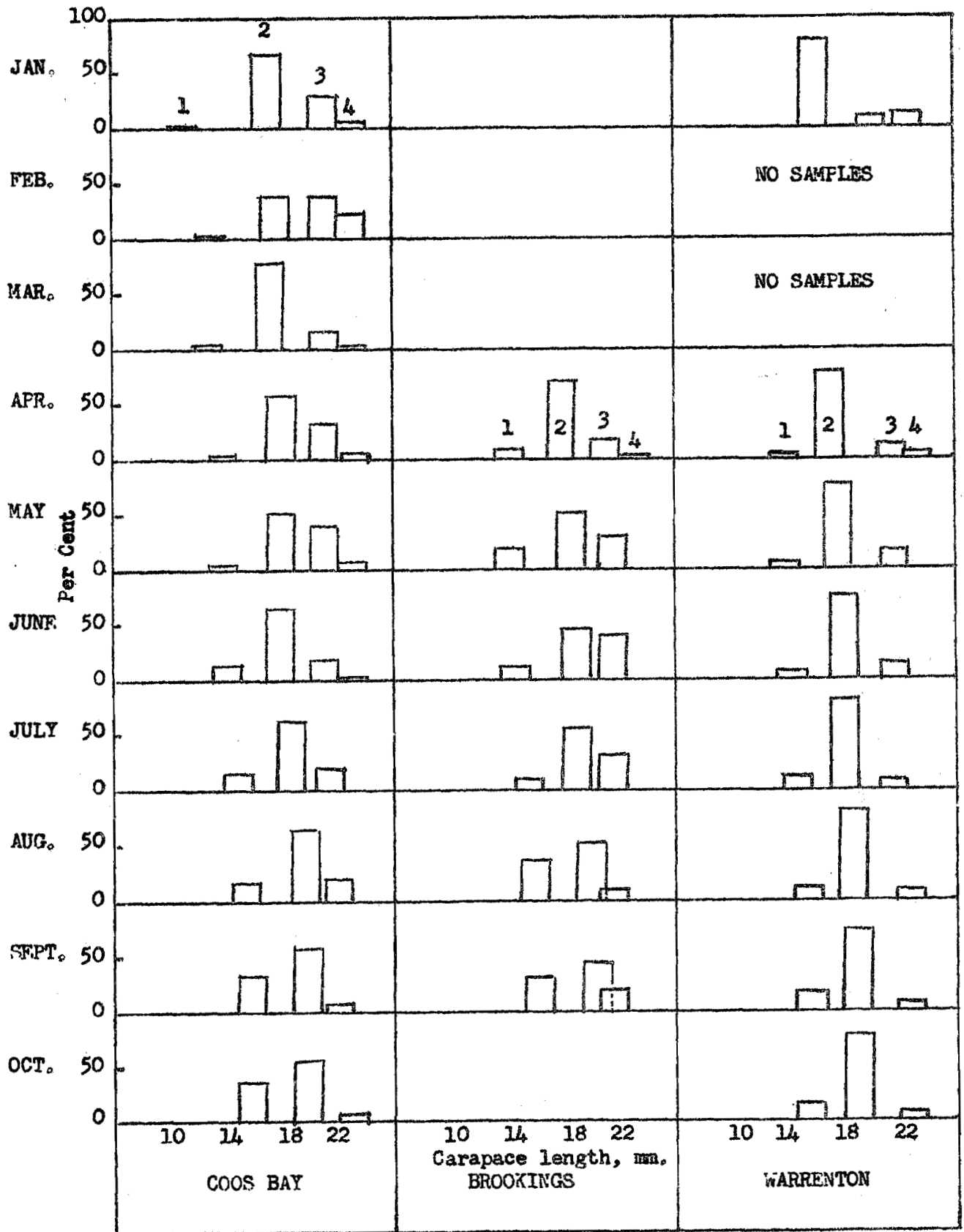


Figure 10. Percentage Age Composition and Mean Length for Oregon Shrimp Landings in 1963, by Month and Port.

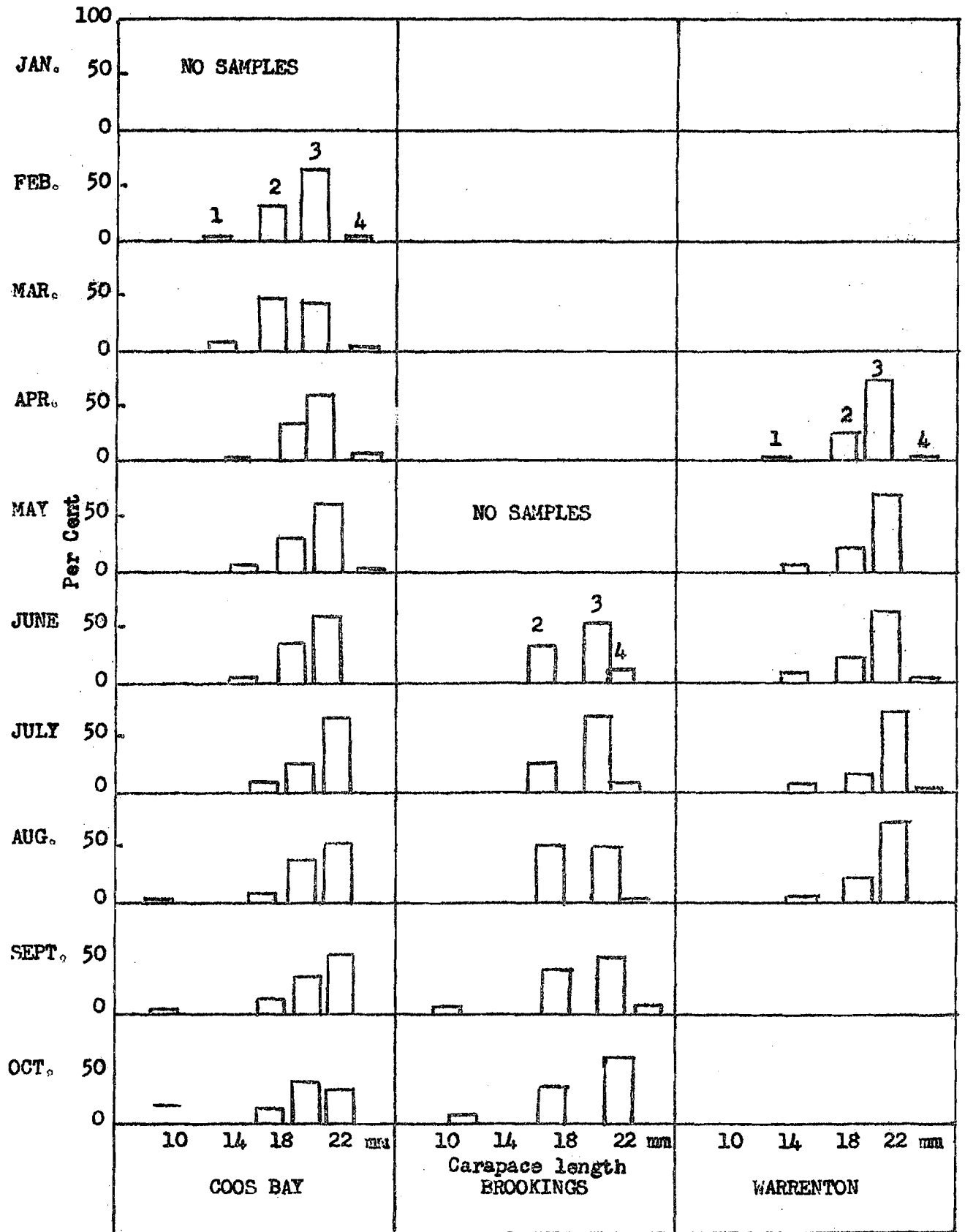


Figure 11. Percentage Age Composition and Mean Length for Oregon Shrimp Landings in 1964, by Month and Port.

landed in 1964, a 78% decrease from 1963. Table 20 shows landings at Warrenton from 1957 to 1964. As Figures 10 and 11 show, year-class composition was similar to Coos Bay, the 1961 year class being dominant at Warrenton to an even more marked degree than at Coos Bay.

The Brookings fishery, which accounted for over 50% of the total 1962 catch, decreased to pre-1962 levels in 1963 and 1964. This was largely due to the California fleet staying at home in 1963, when an increased California quota and some early Coos Bay activity by these boats induced them to forego pre- and post-closure activity off California. The 1964 Brookings landing of 394,000 pounds was down from 1963 due to a continuation of the California fleet's compliance with the quota and season and to both the California and some Brookings vessels shift of fishing to the Coos Bay and Port Orford areas.

The port of Port Orford received a record 405,000 pounds of shrimp in 1964. This was largely due to the availability of shrimp off Port Orford, just south of Cape Blanco. The area had been known to have commercial quantities of shrimp for several years, but early in 1964, a shrimp trawler experimentally fished in the area, discovered it was trawlable, and found a large amount of shrimp within it. The area had been thought untrawlable due to rough bottom.

Because of the extraordinary abundance and large size of shrimp in 1964 and the good market, shrimp were also landed in significant amounts at Newport and Winchester Bay. Thirty-one thousand pounds were landed at Newport and 114,000 pounds at Winchester Bay.

Biological Statistics

Besides monitoring the catch, considerable time was spent in sampling the catch for size, sex and age composition, as well as for certain other aspects of the biology of Pandalus jordani. Figures 10 and 11 are summaries of this activity. It has already been mentioned that both Warrenton and Coos Bay samples

showed a dominant 1961 year class. The succeeding 1962 and 1963 year classes (Figure 11), however, appear to be weak in abundance, but the predominant 1961 year class may have had a masking effect. True strength of these year classes will not be evident until 1965. The 1963 year class appears to be exceptionally weak. This age group, one year old in April 1964, is usually fairly strong in the catch in its first full year of availability to the gear. It never became more than a small part of the Coos Bay and Warrenton catch. Fishing mortality is not likely to have caused this year-class' weakness, since there was evidently only a "submaximum" fishery on the stocks from which it sprang in early spring of 1963.

In comparison to the weak 1963 year class, there apparently was a very large 1964 year class coming into the catch in the fall of 1964 at Coos Bay (Figure 11). This year class, six months old in October 1964, averaged 15% by number of the shrimp landings sampled in October 1964 and in isolated instances made up 1/3 of some landings. Because shrimp of this age are ordinarily too small to be retained in the 1½-inch mesh nets used, this high incidence suggests an extraordinarily strong year class. The very strong 1961 year class, all females in the spring of 1964 and nearly all bearing eggs, would have logically led to a "bumper crop" recruitment and apparently did. Warrenton fishing ended too soon to determine if this situation held in northern Oregon also. Brookings and northern California landings, however, showed a strong 1964 year class also. The Brookings landings, mostly caught off northern California, show this in Figure 11 where a significant incidence of 1964 year-class shrimp is shown. The effect of the strong 1964 year class and weak 1963 year class could well lead to a poor fishery in 1965 because the 1964 year class will be too small to economically process until late that year. However, the strong 1964 year class, if truly present, could lead to a very good fishery in 1966 and 1967, as the 1961 year class did in 1963 and 1964.

Table 21 shows catch and catch/effort by area of catch by year. This table largely follows landings by port, most port's landings coming from nearby areas, but makes it clear as to where the principal shrimp fisheries have been prosecuted. The main point of Table 21 is that the area immediately south of Cape Arago has become a major source of shrimp after being little utilized before 1963;

In Figure 12, the spawning season of shrimp captured off Coos Bay in 1963, 1964, and 1965 is illustrated. The spawning curves for the first two years are quite similar, showing nearly 100% of female shrimp carrying eggs in January, gradually losing eggs until March, and the eggs rapidly being hatched or lost in March. Egg loss is virtually complete by April 1 of both years, although it was slightly earlier in 1964 than in 1963. It also shows that approximately 85% of the females were egg bearing on March 1, 50% mid March, and 10% on April 1. In light of this, any closed season with intent to protect gravid female shrimp should be extended to April 1. The 1965 shrimp samples showed 96% of the females to be carrying eyed eggs on March 1, 80% on March 10, 75% on March 18, 46% on March 28, and no eggs on April 14, 1965. Apparently egg loss was about two weeks later in 1965 than in the two previous years. The fisheries at ports other than Coos Bay have begun too late in recent years to find any gravid shrimp and, therefore, to know how the egg-bearing period compares to that off Coos Bay.

Austin R. Magill
Jack G. Robinson
Edwin L. Niska

November 5, 1965

Table 21. ANNUAL OREGON SHRIMP LANDINGS, BY AREA OF CATCH.

		1957	1958	1959	1960	1961	1962	1963	1964
Cape Flattery to Cape Elizabeth	C C/E	0 -	0 -	2,034 120	0 -	0 -	0 -	0 -	0 -
Cape Elizabeth to Willapa Bay	C C/E	0 -	81,100 386	165,205 542	2,000 250	363,738 358	86,400 392	14,186 366	10,140 422
Willapa Bay to Columbia R.	C C/E	0 -	0 -	26,500 349	0 -	3,700 308	15,300 403	700 140	1,180 131
Columbia River to Cape Falcon	C C/E	116,800 -	1,017,755 569	980,051 526	339,517 300	214,863 311	182,200 325	441,223 615	77,690 600
Cape Falcon to Cascade Head	C C/E	0 -	423,300 569	1,149,911 523	249,134 345	185,222 354	110,300 380	588,690 511	145,475 582
Cascade Head to Cape Perpetua	C C/E	0 -	0 -	0 -	0 -	0 -	0 -	0 -	2,010 183
Cape Perpetua to Umpqua River	C C/E	0 -	0 -	0 -	0 -	0 -	0 -	0 -	23,001 390
Umpqua River to Cape Arago	C C/E	286,800 (Beam Trawl)	0 -	50,115 501	82,345 445	431,126 562	682,348 336	1,245,891 540	2,616,874 550
Cape Arago to Cape Blanco	C C/E	0 -	0 -	0 -	0 -	0 -	223,052 640	380,181 820	1,894,148 837
Cape Blanco to Cape Sebastian	C C/E	0 -	0 -	0 -	0 -	0 -	6,400 -	3,600 360	496,059 771
Cape Sebastian to N. Lat. 42°	C C/E	0 -	0 -	16,100 240	136,680 318	74,860 550	151,420 470	112,980 286	0 -
N. Lat. 42° and South	C C/E	0 -	0 -	374,200 510	322,500 644	182,400 839	1,293,000 574	327,320 495	210,850 518
Totals	C C/E	403,600 -	1,522,200 569	2,764,100 524	1,132,200 380	1,455,900 412	2,750,400 434	3,114,800 545	5,477,400 641

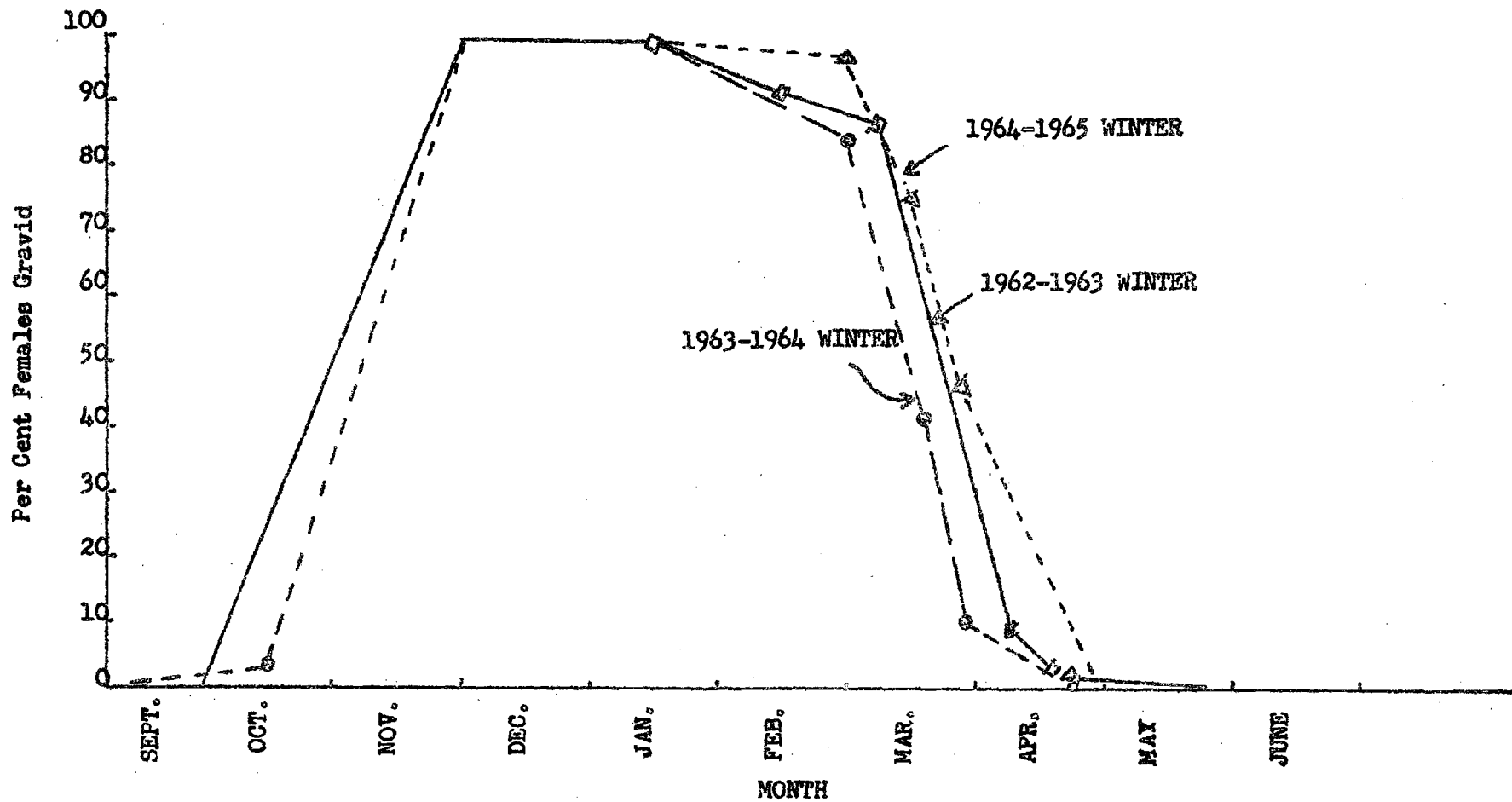


Figure 12. Per Cent of Ovigerous Female Shrimp in Coos Bay Landings, 1962-1965.