Charleston

Oregon Fish Commission

Research Division

TRAWL INVESTIGATION

PROGRESS REPORT

January 1, 1965-December 31, 1966

November 1967

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TRAWL INVESTIGATION
PROGRESS REPORT

January 1, 1965-December 31, 1966

INTRODUCTION

This progress report covers the activities of the trawl investigation staff throughout the 1965 and 1966 calendar years.

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 trawl vessels and filleting plants; (3) collecting and analyzing shrimp samples from the commercial shrimp fishery for age and growth studies; (4) obtaining length-frequencies, sex, and age structures from Dover, English, and petrale soles and Pacific ocean perch; (5) examining animal food landings for species composition; (6) initiating a PL 88-309 research study on bottomfish with special emphasis on Dover sole; (7) initiating a PL 88-309 research study on pink shrimp; and (8) surveillance and documentation of foreign fleet activities.

Investigational work conducted in the laboratory consisted of: (1) coding the 1965 and 1966 trawl catch and effort data with regard to hours fished, area of capture, and species and poundages caught; (2) preparation of 1964 and 1965 catch and effort data for PMFC 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, interstate, and federal fisheries

meetings relative to the trawl fishery; (7) writing and editing reports and manuscripts; and (8) handling budgeting and administrative matters relative to the trawl investigation.

PERSONNEL

Several changes and promotions were made in the staff of Otter Trawl Investigations during the report period.

In February 1965, Gary Milburn joined the staff as an Aquatic Biologist 1. He filled the AEC contract position left vacant when Jay O. Hoover terminated in October 1964. In November 1965, Robert L. Demory and Halbert Bailey joined the staff on the PL 88-309 Dover sole project. Their positions were an Aquatic Biologist 2 and an Aquatic Biologist 1, respectively. Also during November, Jack G. Robinson was promoted from a Senior Aquatic Biologist 1 to an Aquatic Biologist 2. His shrimp management duties were expanded to include PL 88-309 shrimp research projects. In November 1965, Austin R. Magill transferred to the Water Resources Division. In February 1966, James M. Meehan assumed the duties of project leader. The AEC contract terminated in February 1966 and Milburn was shifted to a position on the PL 88-309 shrimp program. He was promoted to a Senior Aquatic Biologist 1 in July 1966. In October 1966, Terry Link was hired as an Experimental Biological Technician 1 to assist on PL 88-309 projects. Halbert Bailey transferred to the Fish Culture Division in December 1966. His position was still vacant December 31, 1966.

Summer employees consisted of Bill Barss during the period June-September 1965 and 1966, Terry Link during March-April 1966, and Mike Tagliavento during June-September 1966.

FLEET ACTIVITIES

The markets for trawl-caught fish and shrimp remained good throughout this 2-year period. No limits were placed on Pacific ocean perch.

The vessels landing bottomfish and shrimp in 1965 are listed in Table 1 by port of landing. Included in this list are 63 vessels that made one or more landings at Oregon ports. Those vessels that are full-time trawlers are designated by a "T." Many vessels landing at Coos Bay and Brookings are of California registry and land in Oregon ports during the shrimp season. Vessels having their home port in Oregon are designated by an "O." During 1965 the M/V Galaxy shifted its base of operations from Oregon to Alaska. Also in 1965 the M/V Mary R. sank.

During 1966 a total of 65 vessels made one or more landings in Oregon ports. These are shown in Table 2. During 1966 the M/V Golden West and M/V Hero sank. All hands were lost on the Hero.

During the summer of 1965, the Coos Bay Seafoods plant burned and was a complete loss. They have utilized temporary facilities to continue their shrimp processing. Their quick frozen fish portion production will not be resumed until a new plant is built. Construction had not started as of December 31, 1966.

Staff biologists participated in California Department of Fish and Game shrimp survey cruises off northern California in 1965 and 1966. Several sampling-at-sea trips of 1 to 3 days were made on commercial trawl vessels in 1965 and 1966.

REPORTS

Reports were prepared for the PMFC annual meetings in November 1965 and 1966; the International Trawl Technical Subcommittee meetings in June 1965 and 1966; and the Oregon Fish Commission Biennial Report, 1964-66.

Table 1. List of vessels engaged in trawling in Oregon by port during 1965.

Astoria	Newport	Coos Bay and Winchester Bay	Brookings
Advance (T,O)	Destiny (T,O)	Amak (T,O)	Azalea
Eagle (T,O)	Madeline J. (T,O)	Christina J. (O)	Bristol
Empress (T,O)	Miss Connie (T,O)	Columbia (T,O)	Ethel G.
Galaxy (T,O)	Oregonian (T,O)	Dare II (T,O)	Faymar (O)
Ivanhoe	Pacific Queen (T,O)	Frank F. (O)	General Pershing
Jennie Decker (T,O)	Ruth Ellen (T,O)	Frank Lowe (O)	Golden West (T)
Junior (T,O)	W.C.F. No. 1 (T,O)	Helen Louise (T,O)	Jefferson (O)
Kodiak (T,O)		Hero (T,O)	Joseph Alioto
Lynda Dawn (T,O)		Intrepid (O)	Kincheloe (T,O)
Margaret A. (T,O)		Karen (O)	Pisces (T)
Marian F. (T,O)		Margaret E. (T,O)	Stephanie (O)
Mary R. (T,O)		Nel-Ron-Dic (O)	Sunset
Meldon (T,O)		Pearl Harbor (T,O)	
Nestucca (O)		Trego (T,O)	
New Hope (O)		Washington (little) (T,O)	
New Mexico (T,O)			
Rodoma (T,O)			
Roseann Hess (T,O)			
Silver Queen (T)			
Sunrise (O)			
Tom & Al (T,O)			
Tralee (T,O)			
Trask (T,O)			
Valhalla II (T,O)			
Washington (big (T,O)			
Western (T,O)			
Western Flyer (T)			
Western Maid (T)			
Yaquina (T)			

1/ (T) = full-time trawler.
2/ (O) = vessel based in Oregon.

Table 2. List of vessels engaged in trawling in Oregon by port during 1966.

Astoria	Newport	Coos Bay and Winchester Bay	Port Orford	Brookings
Advance (T,O)	Barbara S.	Columbia (T,O)	Amak (T,O)	Bonnie C.
Eagle (T,O)	Destiny (T,O)	Christina J. (O)	Azalea	Faymar (O)
Empress (T,O)	Janet Ray	Dare II (T,O)	Bristol	Frances E.
Jennie Decker (T,O)	Madeline J. (T,O)	Franklin (T,O)	Daphne	Jefferson (O)
Kodiak (T,O)	Margaret E. (T,O)	Frank F. (O)	General Pershing	Kincheloe (T,O)
Lynda Dawn (T,O)	Miss Connie (O)	Frank Lowe (O)	Golden West	Stephanie (T,O)
Margaret A. (T,O)	Oregonian (T,O)	Helen Louise (T,O)	Sea	
Marian F. (T,O)	Pacific Queen (T,O)	Hero (T,O)		
Meldon (T,O)	Rainbow (T,O)	Intrepid (O)		
Mitkof (T,O)	Ruth Ellen (T,O)	Kangaroo (O)		
Nestucca (O)	Silver Queen	Karen (O)		
New Hope (O)	W.C.F. No. 1 (T,O)	Nel-Ron-Dic (O)		
New Mexico (T,O)		Pearl Harbor (T)		
Rodoma (T,O)		Pisces (T)		
Roseann Hess (T,O)		Washington (little) (T,O)		
San Vito (T)				
Sunrise (O)				
Thoreen (T)				
Tom & Al (T,O)				
Tonquin (T,O)				
Tralee (T,O)				
Trask (T,O)				
Valhalla II (T,O)				
Washington (big) (T,O)				
Western (T,O)				

1/ (T) = full-time trawler.
2/ (O) = vessel based in Oregon.

The following papers were written by the trawl staff during this 2-year period:

Robinson, Jack G. New northern record for ocean white fish. Oregon Fish Comm. Res. Briefs 11(1):52. June 1965.

Magill, Austin R. and Gary S. Milburn. Tagging studies to determine offshore-inshore exchange of groundfish off Oregon and Washington. AEC Prog. Rep. No. 4, November 1965 (processed).

Milburn, Gary S. Tagging studies to determine offshore-inshore exchange of groundfish off Oregon and Washington. AEC Final Rep. February 1966 (processed).

Demory, Robert L. Investigation of the abundance and recruitment of bottom-fish off Oregon, with emphasis on Dover sole. PL 88-309 Prog. Rep. July 1966 (processed).

Robinson, Jack G. Study on the distribution and abundance of pink shrimp, Pandalus jordani, in the Pacific Ocean off Oregon. PL 88-309 Prog. Rep. July 1966 (processed).

Grinols, Richard B. and Jay O. Hoover. A record of Diretmus argentus Johnson (Pisces: Diretmudae) from the northeastern Pacific Ocean. Fisheries Res. Papers, Wash. Dept. Fisheries 2(4):67-74. December 1966.

Robinson, Jack G. Cruise Report 66-1, Shrimp. May 1966.

Demory Robert L. Cruise Report 66-2, Shrimp Cruise, Phase B-Fish. August 1966.

Bailey, Halbert. Cruise Report 66-5, Pacific Ocean Perch Survey, October 1966.

Bailey, Halbert. Cruise Report 66-6, Pacific Ocean Perch Survey, October 1966.

SEISMIC

Responsibility for seismic problems was transferred from Otter Trawl Investigations to Pelagic Fisheries Investigation.

REGULATION CHANGES

In 1964 the Fish Commission enacted an October 31-March 1 closed season for shrimp. This season was in force during 1965 and 1966. In addition, the Commission in 1964 adopted a special closed season for shrimp caught south of 42° 00' N. Latitude, extending from October 1 to May 1. The special

season can be modified by as much as 60 days in the opening, closing, or combination of the two. The special season for shrimp captured south of 42° 00' N. Latitude was closed on August 1, 1965, and August 8, 1966.

There were no bottomfish regulation changes during this time. Discussions were begun with industry representatives at their request on small sole limits. Their feeling is that 100 undersized English, petrale, and Dover sole in the aggregate is too restrictive.

BOTTOMFISH MARKET SAMPLING

Market sampling was expanded in 1966 to include age sampling for English and petrale sole and Pacific ocean perch. Dover age sampling has been continuous since 1949, but age samples of the other species have not been taken since 1952. The expanded program was made possible by funds from the Commercial Fisheries Research and Development Act (PL 88-309).

Total sampling effort in 1965 resulted in 29 English sole samples, 28 petrale sole samples, 35 Dover sole samples, and 38 Pacific ocean perch samples. In 1966 sample size was determined by analyzing past length-age frequency samples for Dover, English, and petrale sole. The sample size was set to maintain an error of less than 10%. Sample size by month is: Dover sole, 400 scales; English sole, 150 interopercular bones; and petrale sole, 200 otoliths. Sample size for perch was arbitrarily set at 400 otoliths per month. Through December 31, 1966, numbers of fish sampled were: 2,773 Dover, 1,300 English, 1,200 petrale, and 1,500 perch. Lengths taken with age samples more than satisfied the requirements for length frequency.

Coos Bay landings were also sampled during the 1966 summer season. Sample sizes were the same as for Astoria. Numbers sampled were 978 Dover, 200 English, and 400 petrale. Perch were not sampled there.

English sole

Graphed in Figure 1 are the length frequencies of 2,900 English sole measured in 1965. The length-frequency distributions are graphed by month by sex as well as by composite annual total. The skewness to the right is partially the result of an industry size limit. Soles less than 32 cm are not considered large enough for the fillet market and are discarded at sea.

The same skewness is apparent in the 1966 samples shown in Figure 2.

Petrale sole

Petrale sole market samples for 1965 are summarized in Figure 3. As with English sole, market sampling for length frequencies was somewhat reduced in 1966 (Figure 4). This is the result of more effort being expended on the collection and preparation of aging structures.

Dover sole

Dover sole sampling has been carried on during the summer months for the past 11 years and throughout the year for the past 3 years. The mean lengths of males and females, as well as the sex ratios, for these time periods are shown in Table 3. The monthly and yearly length frequencies are plotted by sex for 1965 in Figures 5 and 6 and for 1966 in Figure 7.

Pacific ocean perch

A total of 38 samples was taken of market landings during 1965. These are depicted in Figure 8 by month and Figure 9 by year. During 1966 sampling was suspended for a short period on perch while a satisfactory sexing technique was developed. Length frequencies for perch by month and year by sex are shown in Figure 10.

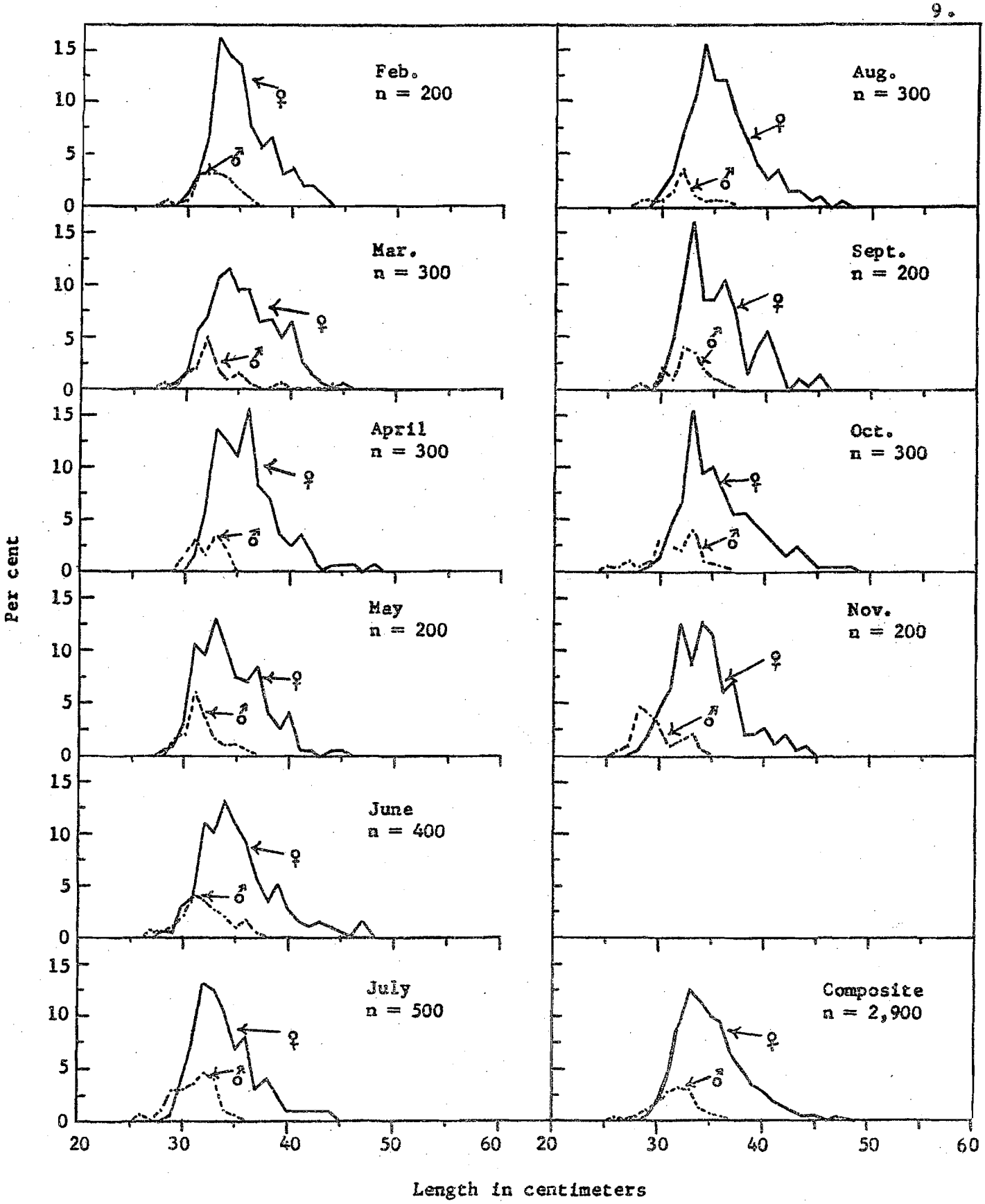

Figure 1. English sole length frequencies by sex in 1965 market samples.

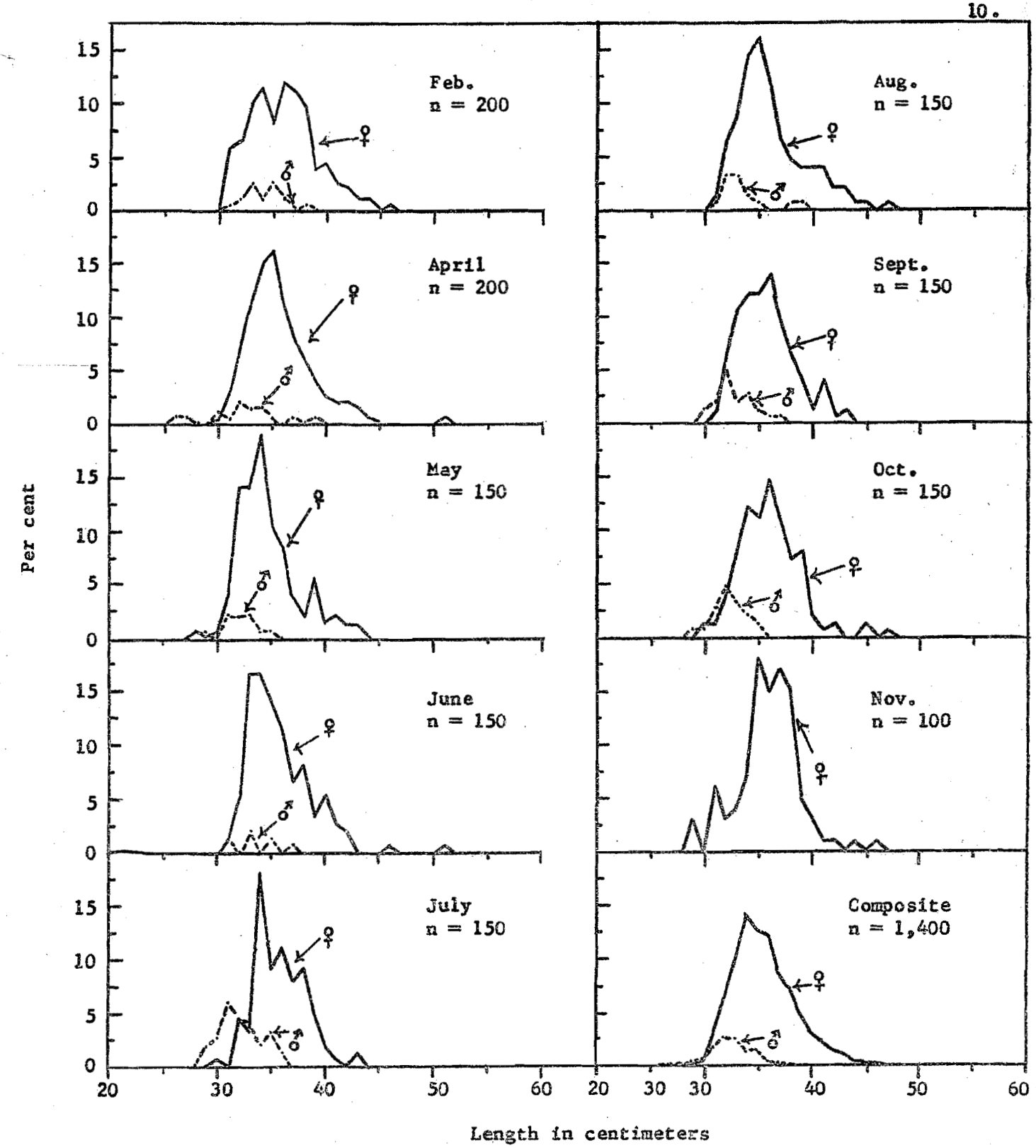

Figure 2. English sole length frequencies by sex in 1966 market samples.

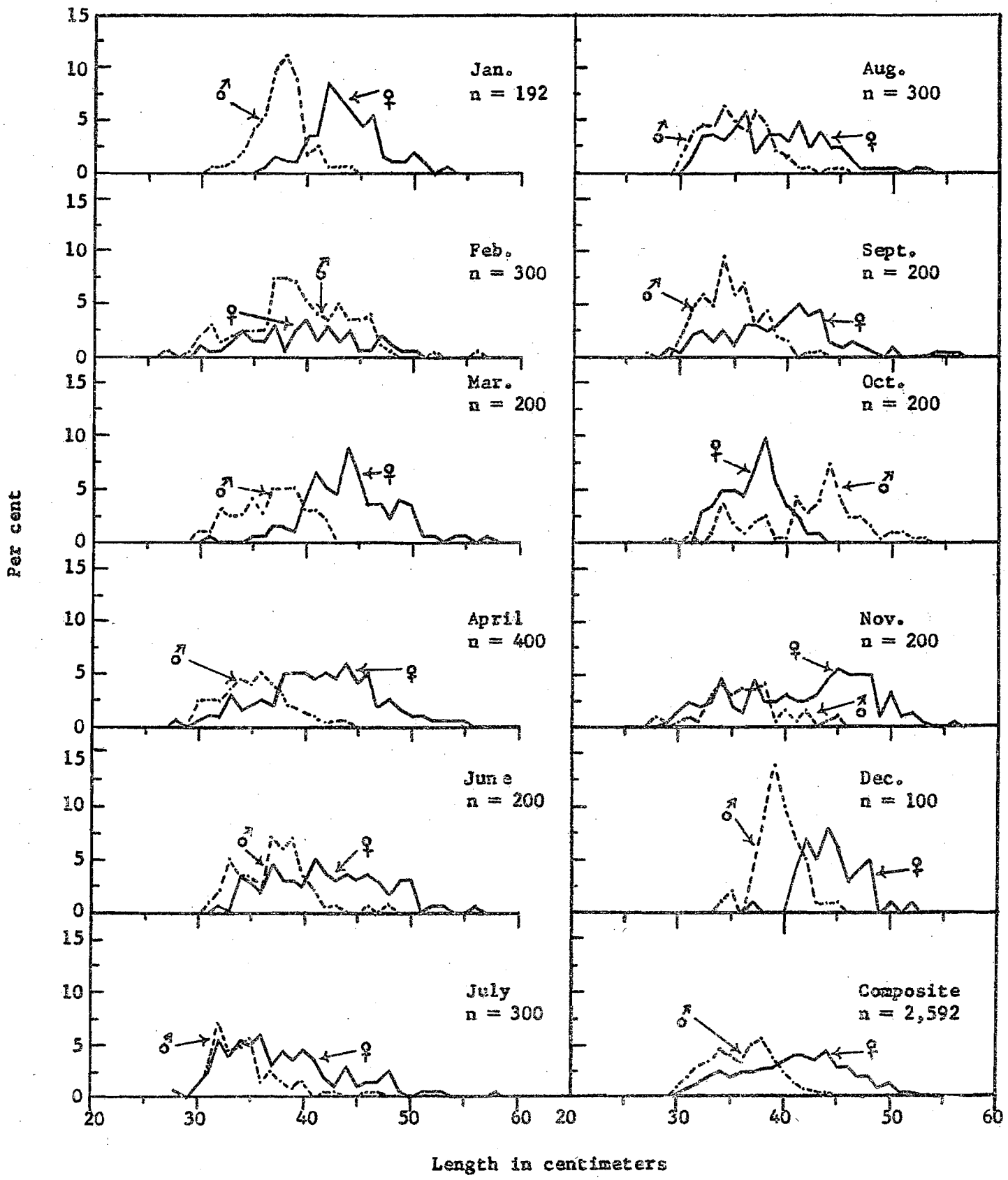

Figure 3. Petrale sole length frequencies by sex in 1965 market samples.

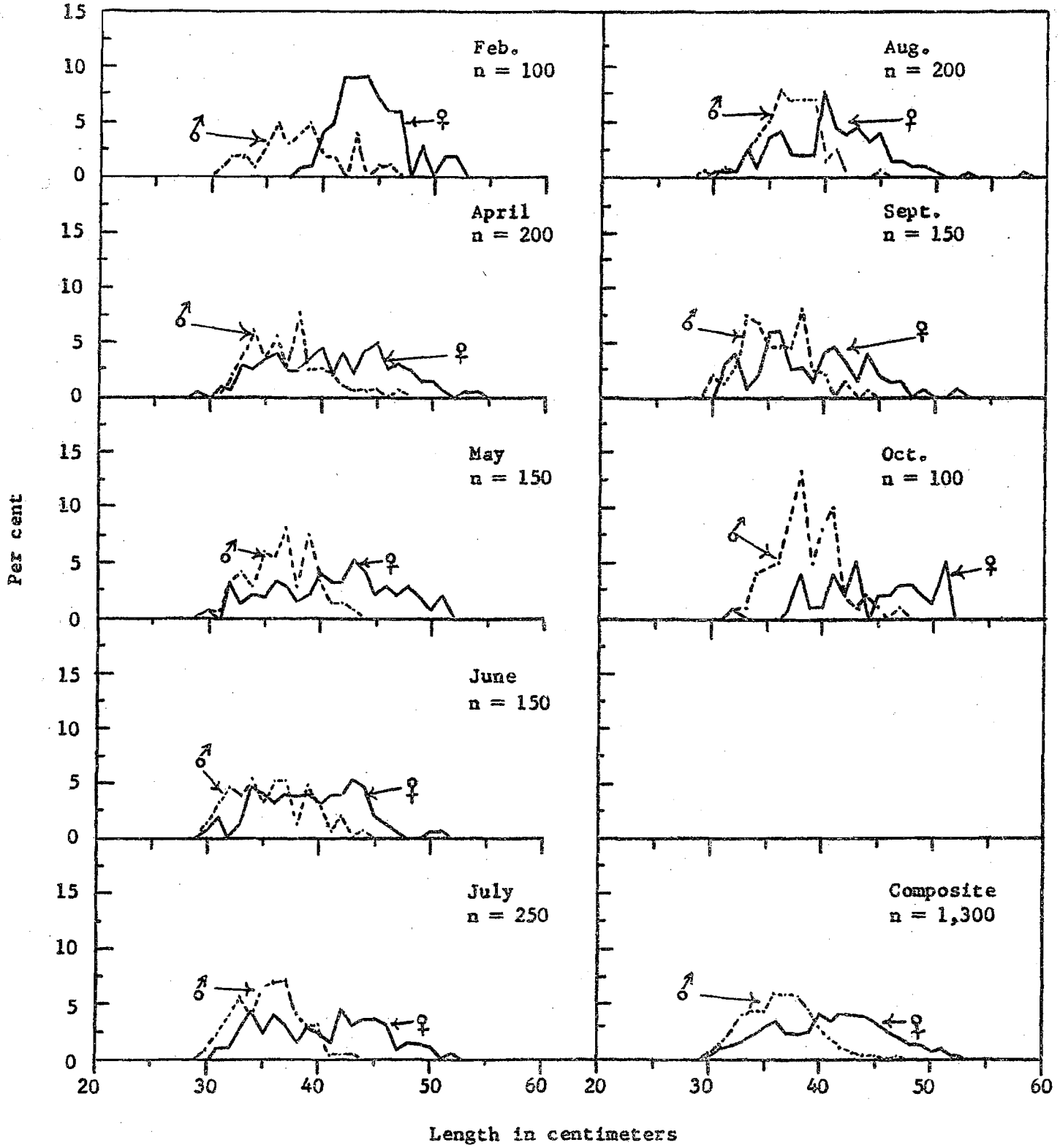

Figure 4. Petrale sole length frequencies by sex in 1966 market samples.

Table 3. Mean lengths and sex ratios of Dover sole in market samples at Astoria.

Year	Mean length in mm				% males	
	Males		Females			
	June-Sept	Jan-Dec	June-Sept	Jan-Dec	June-Sept	Jan-Dec
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	381	418	412	37.7	43.3
1965	380	380	411	414	38.8	42.1
1966	375	376	404	404	39.8	40.0

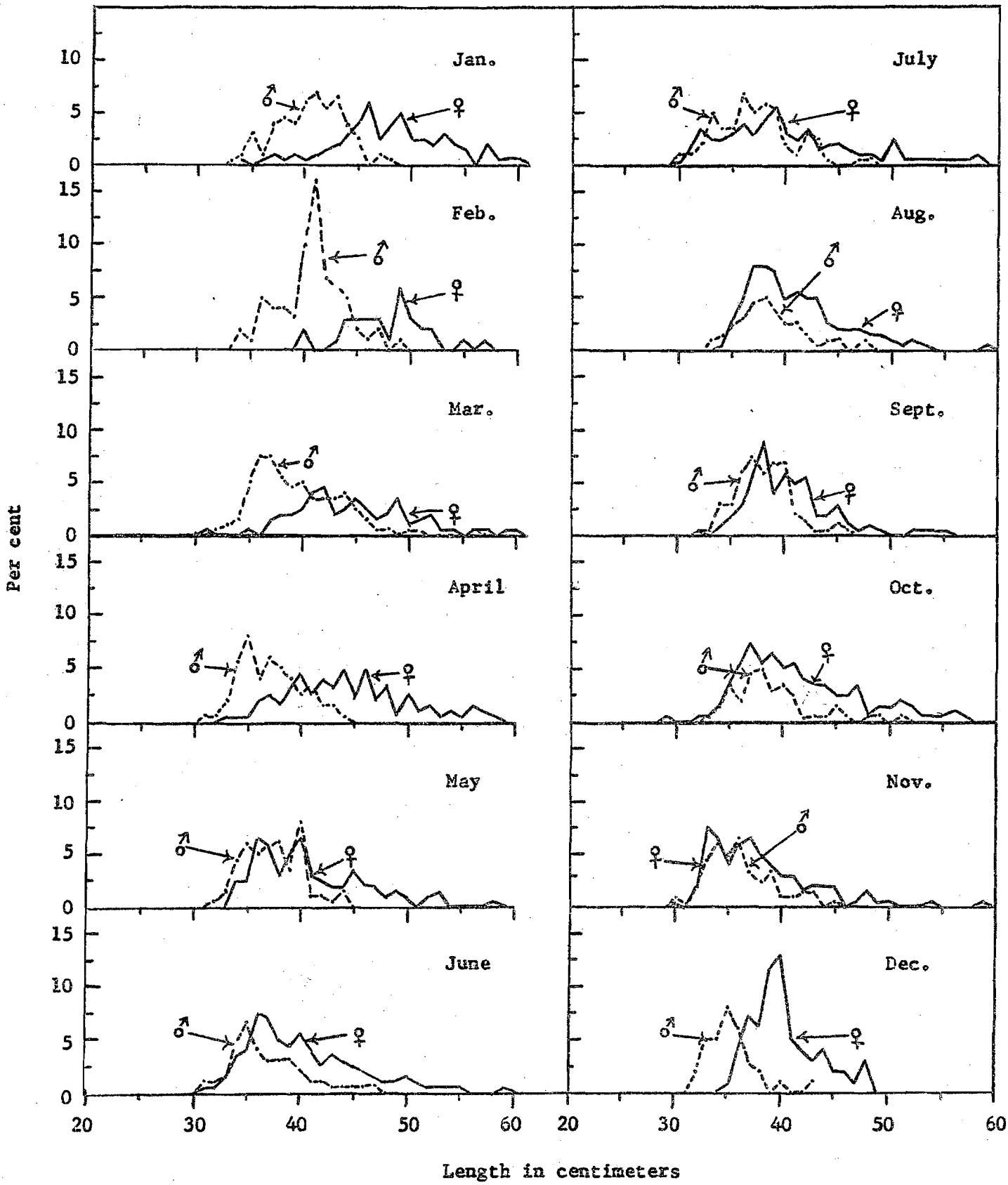

Figure 5. Dover sole length frequencies by sex in 1965 market samples.

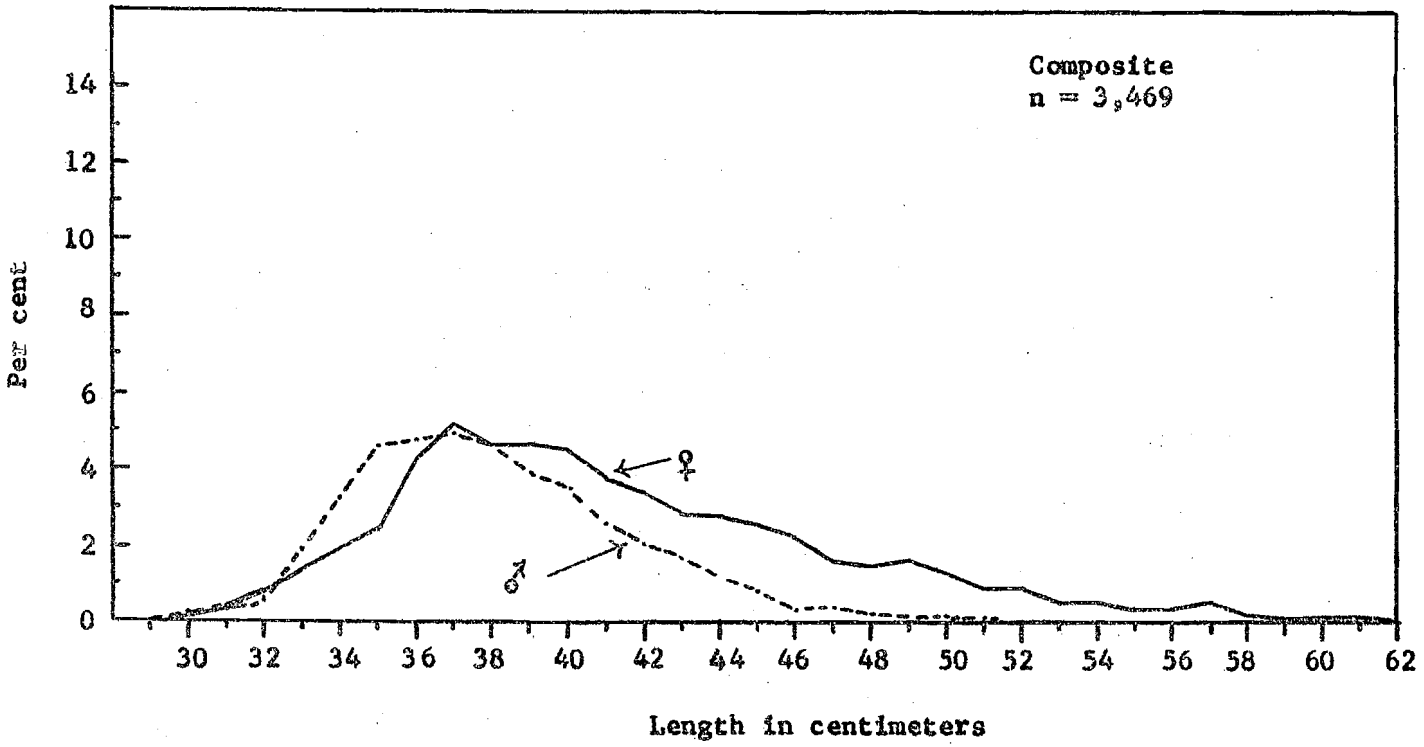

Figure 6. Dover sole length frequencies by sex in 1965 market samples.

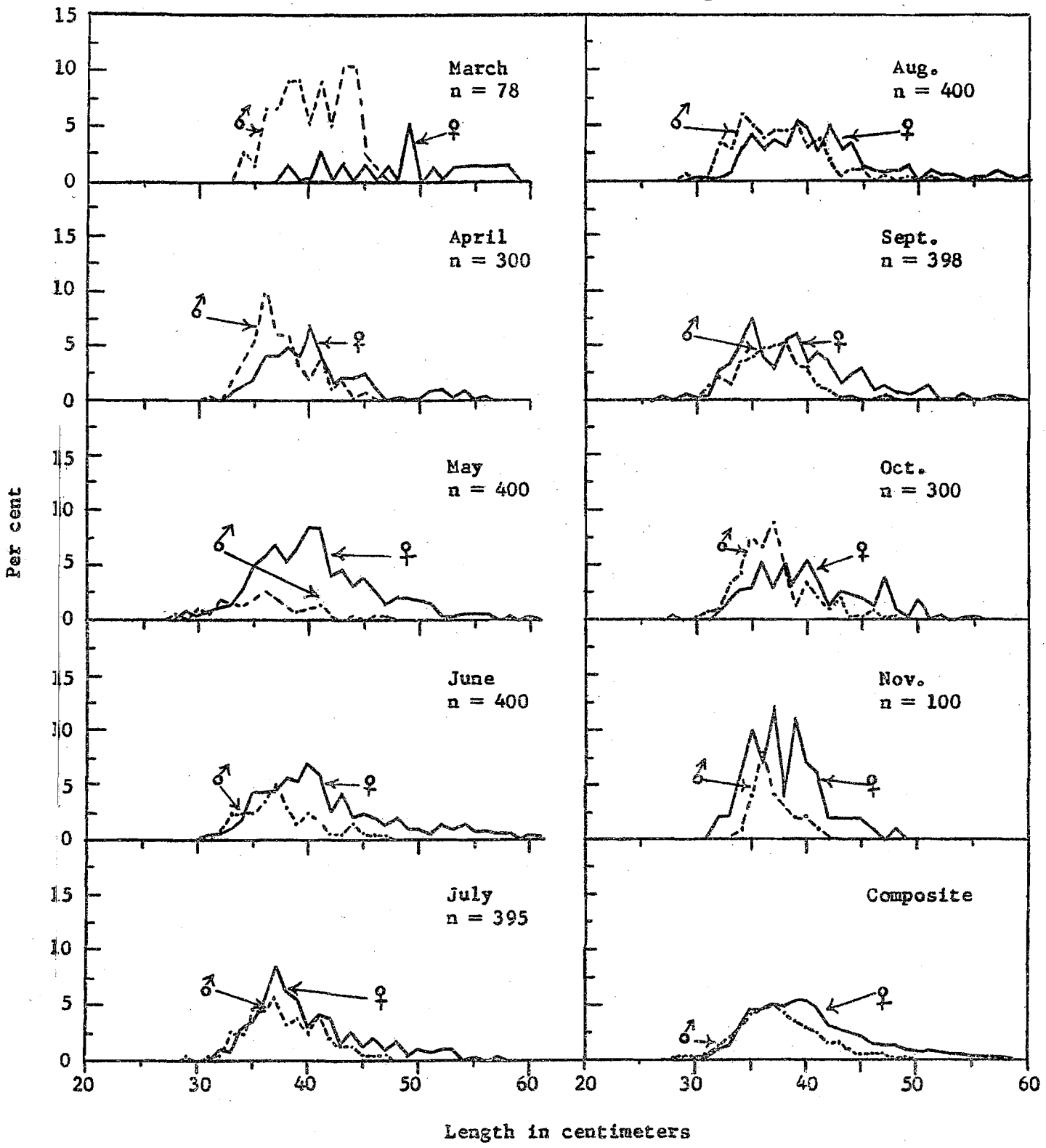

Figure 7. Dover sole length frequencies by sex in 1966 market samples.

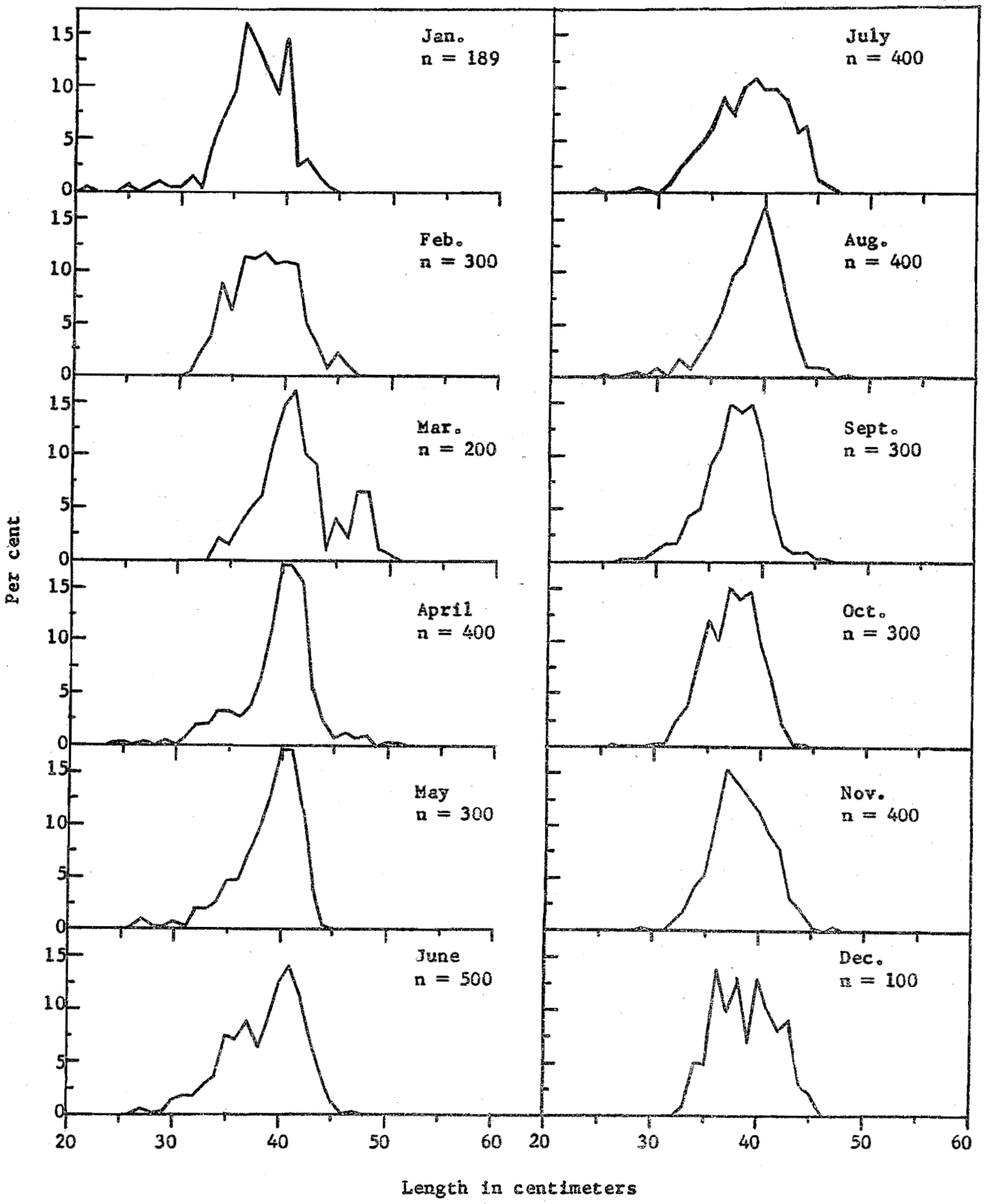

Figure 8. Pacific ocean perch length frequencies in 1965 market samples.

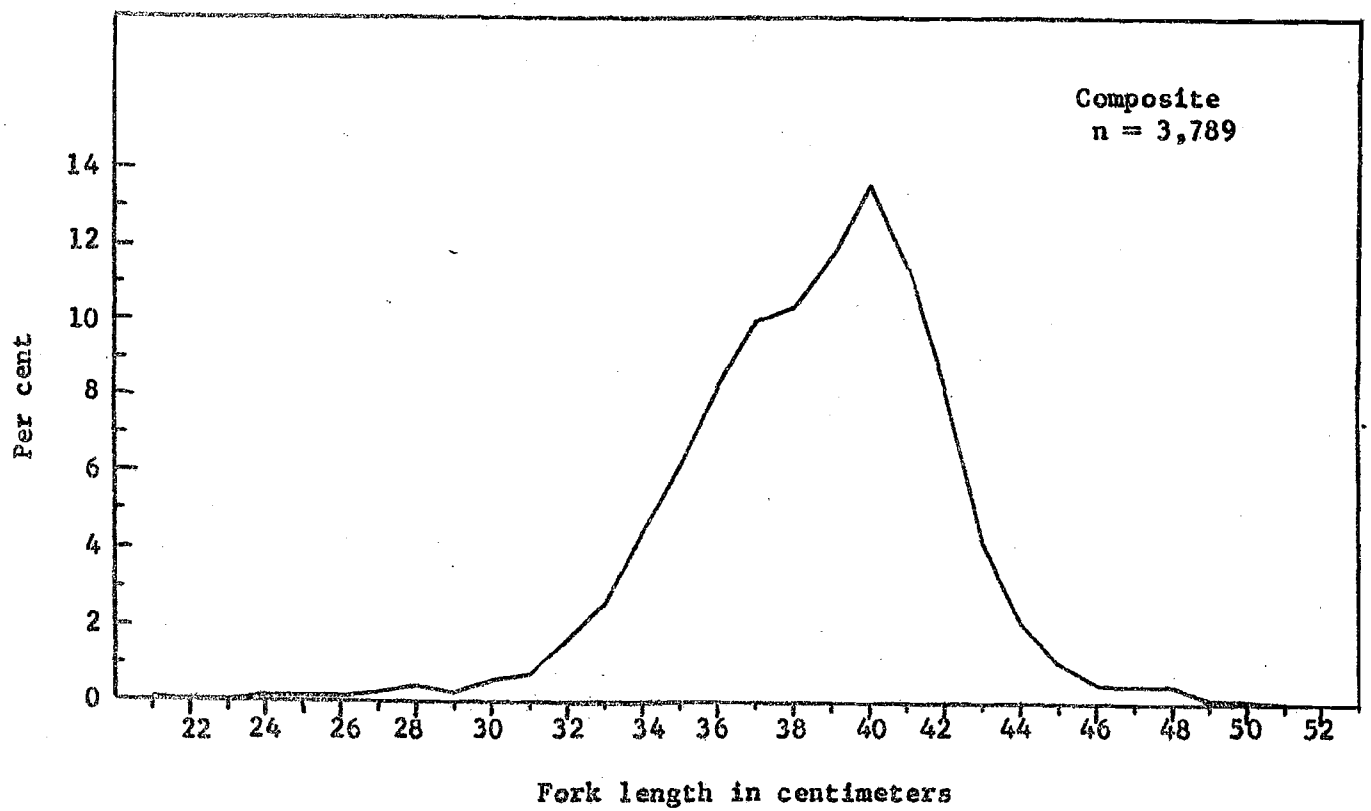

Figure 9. Pacific ocean perch length frequencies in 1965 market samples.

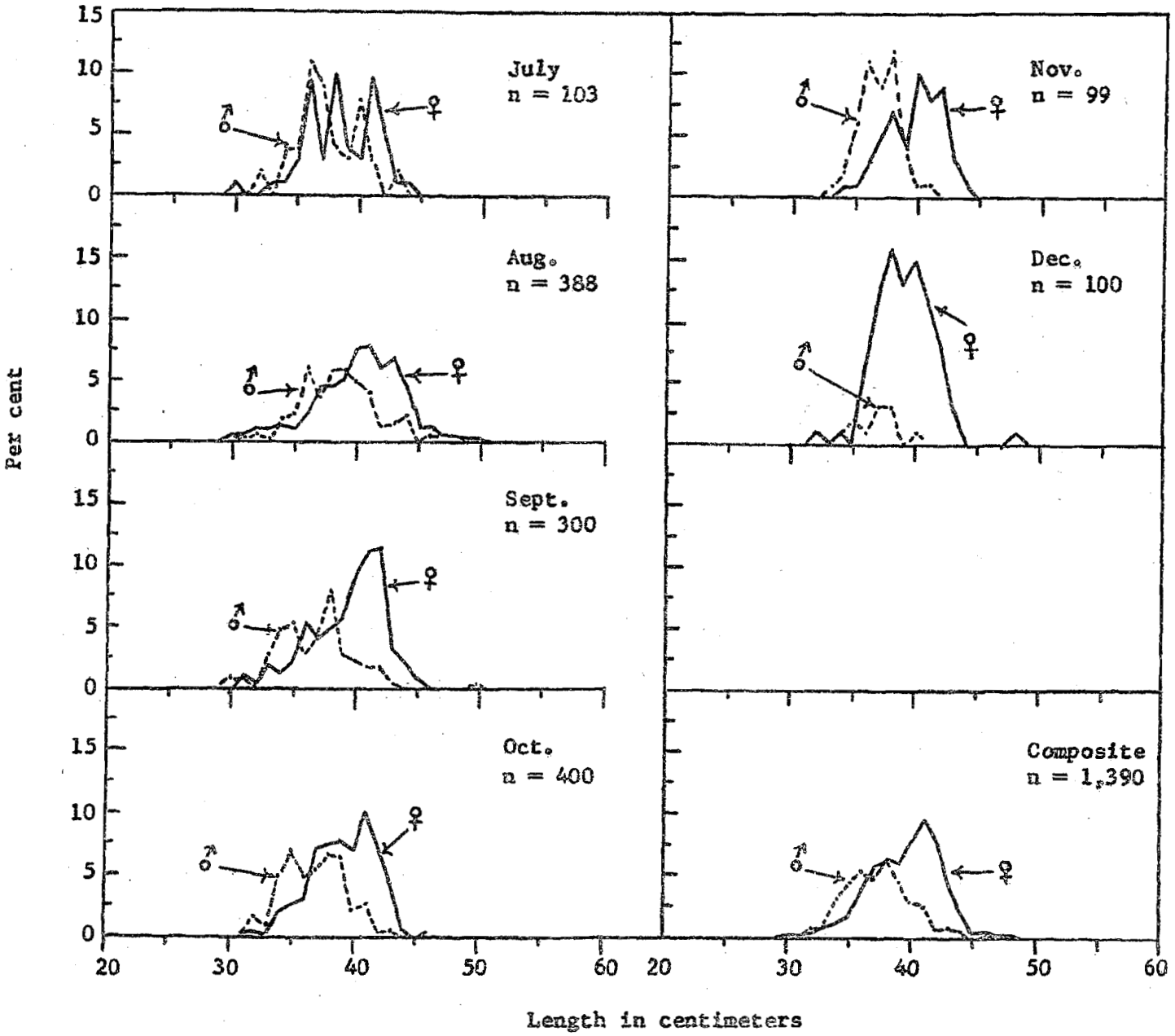

Figure 10. Pacific ocean perch length frequencies by sex in 1966 market samples.

BOTTOMFISH LANDINGS

State-wide

Annual Oregon landings from 1957 to 1966 by species are shown in Table 4. Table 5 presents the total catch by international statistical area, hours fished, and catch per hour. State-wide landings for 1965 are above the 10-year average. Petrale sole, Dover sole, and rockfish landings decreased in 1965, while English sole and rex sole reversed their previous trend and increased. The Pacific ocean perch catch continued its spectacular increase in 1965 to a new record. The lifting of limits on perch landings in 1965 and improved markets aided in this increase. Oregon landings dropped below the 10-year average in 1966. Petrale sole and Dover sole landings continued their decrease. English sole, rex sole, and rockfish landings increased. The Pacific ocean perch catch took a substantial drop in 1966 due to competition from a large Russian fleet. The state-wide catch per hour continued its increase in 1965. This can be attributed partially to the large loads of Pacific ocean perch. The slight increase in the catch-per-hour rate in 1966 can be attributed to a reduction in total effort and an improved English sole fishery late in the season.

Astoria

The catch rates and total landings of Dover sole, English sole, and petrale sole have been determined for the past 24 years for the Astoria area. Similar records have been kept for Pacific ocean perch for the past 15 years. Tables 6 through 9 show the total pounds landed, calculated number of landings, and pounds per significant landing for the years 1942-66.

Table 4. Yearly Oregon trawl landings from 1957 to 1966
(Landings in thousands of pounds).

Species	Year										Mean
	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1957-66
English sole	1,654	1,834	1,451	2,454	1,789	2,295	1,948	1,562	1,678	3,538	2,020
Rock sole								9	4	17	3
Petrale sole	2,096	1,754	1,275	2,143	1,838	2,607	2,295	1,877	1,838	1,837	1,956
Dover sole	3,560	3,338	4,543	5,208	4,054	4,454	5,345	5,529	3,631	3,493	4,316
Rex sole	565	666	864	1,280	988	1,333	1,033	806	985	1,498	1,002
Starry flounder	320	350	288	234	403	706	273	528	410	477	399
Other flatfish	4	20	78	204	138	216	73	143	62	205	114
Pac. true cod	516	470	344	224	103	19	67	200	194	628	277
Lingcod	562	298	327	664	619	756	493	736	852	993	630
Sablefish	226	131	75	172	159	150	188	183	130	68	148
Pac. ocean perch	2,994	2,473	2,471	2,734	4,568	5,789	7,982	9,548	13,647	4,518	5,672
Other rockfish	3,312	4,378	3,696	5,392	4,832	7,125	4,681	4,147	4,121	5,068	4,675
Misc. species		127	249	413	117	65	6	32	23	12	104
Dogfish			67	45					1		11
Animal food	10,055	9,608	7,134	4,435	5,790	6,176	5,540	5,990	4,152	3,357	6,224
Reduction use[1/]									1,498	79	158
Total	25,864	25,447	22,862	25,602	25,398	31,691	29,924	31,290	33,226	25,788	27,709
Total hours			22,769	30,005	29,429	35,254	32,412	31,312	29,254	23,676	29,264[2/]
Catch/hour			1,004	853	863	899	923	999	1,085	1,089	964[2/]

1/ New category introduced in 1965. Previously included with misc. fish.
2/ Eight-year average.

Table 5. Total Oregon trawl landings (by area fished), calculated hours fished, and catch-per-hour by Int. Stat. Areas for 1962-66.

Int. Stat. Area		Year				
		1962	1963	1964	1965	1966
5-A/5-B	Pounds			127000		700000
	Hours			78		187
	Lbs/hr			1628		3743
3-D	Pounds	19500			25000	
	Hours	55			40	
	Lbs/hr	355			625	
3-C	Pounds		21000	265000	373000	638000
	Hours		40	313	295	434
	Lbs/hr		525	847	1264	1470
3-B	Pounds	273500	652000	1451000	249000	257000
	Hours	351	923	1432	272	299
	Lbs/hr	779	706	1013	915	860
3-A	Pounds	17915500	15806000	14885000	10719000	13913000
	Hours	17484	15807	14884	10122	11197
	Lbs/hr	1025	1000	1000	1059	1243
2-C	Pounds	7093000	7047000	7348000	14011000	5622000
	Hours	9246	7558	6931	10151	6380
	Lbs/hr	767	932	1060	1380	881
2-B	Pounds	6015500	6208000	6669000	5540000	3869000
	Hours	7692	7820	6492	6628	3954
	Lbs/hr	782	794	1027	836	979
2-A	Pounds	346000	157000	445000	523000	511000
	Hours	362	204	950	1354	769
	Lbs/hr	956	770	468	386	664
1-C	Pounds	28000	33000	100000	288000	278000
	Hours	64	60	272	392	456
	Lbs/hr	445	550	368	735	
State-wide Total	Pounds	31691000	29924000	31290000	31728000	25788000
	Hours	35254	32412	31312	29254	23676
	Lbs/hr	899	923	999	1085	1089

Table 6. Total pounds landed, calculated number of landings, and pounds per significant landing for English sole in Astoria, 1942-66. Allocation of catch by area for the period 1951-66. 1/

Year	Total Pounds Landed	Pounds by Area			Calculated Number of Landings				Pounds Per Significant Landing			
		N	L	S	Total	N	L	S	Total	N	L	S
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
1965	1,097,801	101,918	902,179	93,704	193	14	165	9	5,692	7,075	5,475	9,913
1966	2,536,503	248,629	2,272,874	15,027	314	15	298	4	8,089	16,798	7,636	3,816

1/ Area definitions:
N: all areas north of Willapa Bay (including Willapa Deep).
L: Cape Falcon to Willapa Deep.
S: all areas south of Cape Falcon.

Table 7. Total pounds landed, calculated number of landings, and pounds per significant landing for petrale sole in Astoria, 1942-66. Allocation of catch by area for the period 1951-66. 1/

Year	Total Pounds Landed	Pounds by Area			Calculated Number of Landings				Pounds Per Significant Landing			
		N	L	S	Total	N	L	S	Total	N	L	S
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
1965	898,667	104,304	640,813	153,550	184	10	147	14	4,889	10,192	4,359	10,717
1966	1,058,717	105,621	938,046	15,050	198	16	177	2	5,339	6,443	5,298	6,100

1/ Area definitions:
N: all areas north of Willapa Bay (including Willapa Deep).
L: Cape Falcon to Willapa Deep.
S: all areas south of Cape Falcon.

Table 8. Total pounds landed, calculated number of landings, and pounds per significant landing of Dover sole in Astoria, 1942-66. Allocation of catch by area for the period 1951-66.[1/]

Year	Total pounds landed	Pounds by area			Calculated number of landings				Pounds per significant landing			
		N	L	S	Total	N	L	S	Total	N	L	S
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
1965	1,788,597	122,050	1,389,386	277,161	276	25	218	28	6,469	4,874	6,362	9,841
1966	1,734,325	78,296	1,638,054	17,975	228	7	218	2	7,594	10,557	7,522	7,818

1/ Area definitions:
N: all areas north of Willapa Bay (including Willapa Deep).
L: Cape Falcon to Willapa Deep.
S: all areas south of Cape Falcon.

Table 9. 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 1951-66.[1/]

Year	Total pounds landed	Pounds by area			Calculated number of landings				Pounds per significant landing			
		N	L	S	Total	N	L	S	Total	N	L	S
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	815,560	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
1965	9,906,679	721,271	2,474,964	6,710,444					27,882	22,040	17,223	35,111
1966	2,850,943	962,122	939,686	949,135	98	22	44	33	28,947	44,728	21,317	28,398

1/ Area definitions:
N: all areas north of Willapa Bay (including Willapa Deep).
L: Cape Falcon to Willapa Deep.
S: all areas south of Cape Falcon.

OREGON MINK FOOD FISHERY

A report on the Oregon trawl fishery for mink food for the years 1958-65 was prepared for Pacific Marine Fisheries Commission publication.

The total volume of whole bottomfish landed in Oregon for use as feed for mink during 1965 and 1966 was 4.15 and 3.35 million pounds, respectively. The catch in 1965 was 12% of the total trawl landings and in 1966 was 13%. These landings indicate a progressive decline in the harvest of whole fish for mink food from the previous 2 years when 5.6 million and 6.0 million pounds were taken. Oregon mink ranchers have continued to increase their herds and now rank sixth in national production. In 1965, 159 Oregon ranches produced 389,520 pelts or 4.74% of the total production of 15 major states raising mink. This means that a calculated 528.6 thousand animals were fed a calculated 18.7 million pounds of fish (assuming that 40% of the ration was fish). Fillet carcasses or scrap in the amount of 19.0 million pounds were available also during this year. Hence, total fish for mink food in 1965 amounted to 23.2 million pounds. The 1966 production figures for numbers of mink husbanded during the year are not yet available, but assuming no change or at best a slight increase, the fish requirements for Oregon ranches would not be available from Oregon trawl production alone because only a calculated 16.8 million pounds of fish for mink was produced. The shortage was probably made up from freezer stocks and possibly imports or a cut back on amount of fish fed.

The species of fish for the 1965 and 1966 landings in the mink food fishery by port are indicated in Tables 10 and 11. Species composition is generally determined by a visual estimate of species weight in a landing

Table 10. Total 1965 mink food landings in pounds by port with estimate of species composition derived by sampling.

Species	Astoria	Newport	Winchester Bay-Coos Bay	Total
English sole	293,812	242,779	28,426	565,017
Dover sole	54,433	17,987	5,103	77,523
Petrale sole	13,912	69,646	947	84,505
Rex sole	152,524	58,744	37,583	248,851
Butter sole	4,913	91,585	-	96,498
Sand dab	74,402	119,756	7,300	201,458
Starry flounder	68,783	741	-	69,524
Arrowtooth flounder	1,465,266	458,701	382,843	2,306,810
Miscellaneous sole	28,676	2,975	7,300	38,951
Skate	5,424	4,772	89,344	99,540
Sablefish	8,002	6,220	-	14,222
Lingcod	3,916	483	-	4,399
True cod	2,238	-	-	2,238
Rockfish	154,349	30,775	16,392	201,516
Pacific ocean perch	77,199	13,990	10,914	102,103
Idiot	12,039	326	7,645	20,010
Miscellaneous fish	12,331	3,302	1,632	17,265
Total	2,432,219	1,122,782	595,429	4,150,430
% total landings	58.6	27.1	14.3	100.0
% sampled	24.9	9.2	4.9	18.2

Table 11. Total 1966 mink food landings in pounds by port with estimate of species composition derived by sampling.

Species	Astoria	Newport	Winchester Bay-Coos Bay	Total
English sole	40,080	10,992	5,282	56,354
Dover sole	18,970	26,822	8,446	54,238
Petrale sole	7,540	8,408	103	16,051
Rex sole	114,970	23,504	44,308	182,782
Butter sole	13,635	45,035	50,000	108,670
Sand dab	95,190	6,367	30,163	131,720
Starry flounder	64,450	-	1,822	66,272
Arrowtooth flounder	1,221,414	724,284	251,881	2,203,579
Miscellaneous sole	12,273		12,980	25,253
Skate	12,210	28,840	122,193	163,243
Sablefish	3,972	27,487	1,216	32,675
Lingcod	2,108	-	2,370	4,478
True cod	1,200	-	-	1,200
Rockfish	3,046	174,881	58,435	236,362
Pacific ocean perch	-	-	5,870	5,870
Idiot	1,443	29,960	18,159	49,562
Miscellaneous fish	8,852	2,651	1,822	13,325
Total	1,621,353	1,109,231	621,050	3,351,634
% total landing	48.4	33.1	18.5	100.0
% sampled	13.3	4.4	16.2	10.9

at time of delivery and/or by sample counting with weight being based upon average weight of the species involved in the sample or delivery. Landings of mink food in Astoria for the '2 years cited dropped significantly while landings at Newport and southern ports remained fairly constant.

Comparison of landings by species for the 2 years indicates several interesting facts. The take of English sole during 1966 was markedly reduced. This sole had been contributing to the mink food landings in the magnitude of 400,000 pounds annually. The 1966 sampling data indicate that only 1/10 of the previous year's landings of English sole were marketed as mink food. As a corollary, the trawl fishery for market or fillet sole during 1966 experienced a record English sole catch. The total landing was 3,538,000 or double the average for the past 10 years. Good catches of large marketable English sole prevailed throughout the season. Law enforcement of statutes pertaining to numbers of undersized English, Dover, and petrale sole allowed in mink food landings was also instrumental in conserving juveniles. The total landings of Dover sole exhibit a similar pattern as shown for the English sole. In 1966, reduction to 14% of the 1965 landing of Dover sole in mink food is shown.

Arrowtooth flounder continues to be the major species landed in the mink food fishery. Rex sole is second, followed by rockfishes. Pacific ocean perch is no longer significant in the mink food landings.

TAGGING STUDIES

No tagging work 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 international statistical areas referred to are shown in Figure 11.

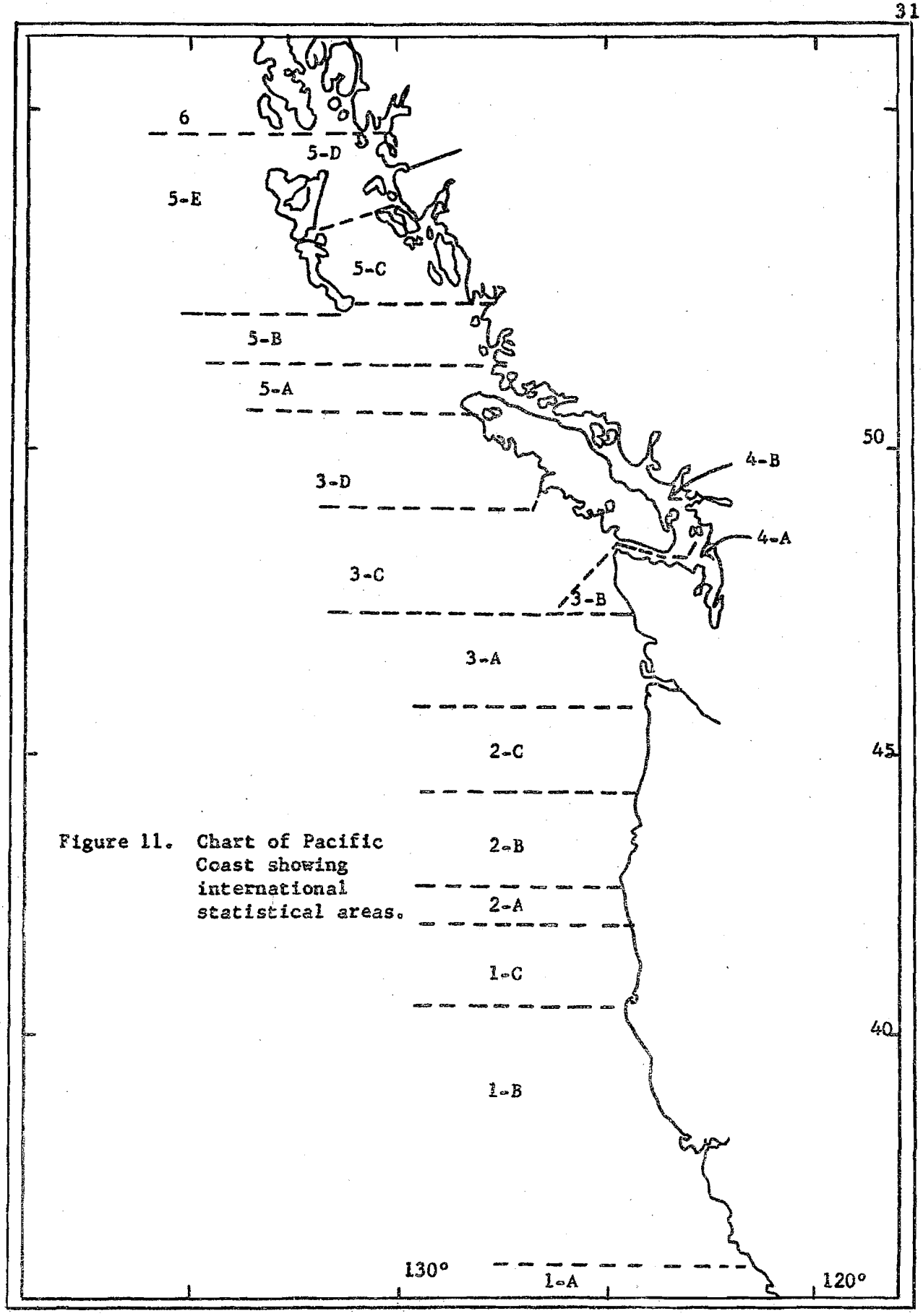

Figure 11. Chart of Pacific Coast showing international statistical areas.

Dover sole, April 1955

Recoveries continue to come in from this deep-water tagging in Willapa Deep. Recoveries by year by area are shown in Table 12.

Dover sole, May 1961

A total of 4,321 fish were released from the John N. Cobb in international statistical Area 2-C (Stonewall Bank) in May 1961. The recoveries from these fish are shown in Table 13.

Petrale sole, February 1960

A total of 5,026 petrale sole was tagged in 170-200 fathoms at Heceta Bank during February and March 1960. A total of 350 tags had been recovered by the end of 1966. Dispersion from the point of tagging ranged from Vancouver Island to Eureka, California. The recaptures by year and international statistical area are shown in Table 14.

AEC GROUNDFISH MIGRATION STUDY

A cooperative study was initiated in May 1961 by the Atomic Energy Commission, Bureau of Commercial Fisheries, and Oregon Fish Commission to determine the offshore-inshore movements of Dover sole and sablefish.

During the period from May 1961 to May 1964, 9,013 Dover sole and 4,647 sablefish were tagged and released at approximately 25-fathom intervals from 50 to 450 fathoms in a 35-mile long area southwest of the Columbia River. Tagged fish were brought in as part of the catch of commercial trawlers.

Of the 9,013 Dover sole tagged, a total of 870 have been recovered through December 31, 1966. Table 15 lists these recoveries by year of tagging. Returns of tagged Dover sole show a northeasterly and inshore

Table 12. Recoveries of Dover sole by year by international statistical area (1955 Willapa Deep tagging).

International stat. area	Recoveries by year											
	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966
3-C	1									1		
3-B	1	4	1									
3-A*	30	61	79	41	19	9	3	10	13	4	8	1
2-C												
2-B												
2-A												
1-C				1								
Unknown	2	4	1	1					1			1
Total	34	69	81	43	19	9	3	10	14	5	8	2

*Area of tagging.

Table 13. Recoveries of Dover sole by year by international statistical area (1961 Stonewall Bank tagging).

International stat. area	Recoveries by year					
	1961	1962	1963	1964	1965	1966
3-A		2	5	5	1	
2-C*	12	76	67	48	24	1
2-B		3	3	8	3	
2-A			1			
1-C						1
Unknown		2	1		1	1
Total	12	83	77	61	29	3

*Area of tagging.

Table 14. Recoveries of petrale sole by year by international statistical area (February-March 1960, Heceta Bank tagging).

International stat. area	Recoveries by year						
	1960	1961	1962	1963	1964	1965	1966
3-C	5	1					
3-B	5	11	3				
3-A	8	9	3				
2-C	27	21	18	7		1	1
2-B*	104	30	46	14	4	1	2
2-A	1	2					
1-C	1	4	9	3			
Unknown	4		1	2		2	
Total	155	78	80	26	4	4	3

*Area of tagging.

Table 15. Number of Dover sole recovered by year of tagging and recovery (AEC study).

Year of tagging	Number tagged	Recoveries by year						
		1961	1962	1963	1964	1965	1966	Total
1961	1,585	9	14	9	10		4	46
1962	2,808		66	78	46	30	7	227
1963	1,902			26	23	13	5	67
1964	2,718				270	176	84	530
Total	9,013	9	80	113	349	219	100	870

movement during the late spring and early summer. An opposite movement to offshore areas is shown during the late fall and early winter.

A higher recovery rate was found for Dover sole tagged in shallow water than for those tagged in deeper areas. Two factors appear to explain this differential recovery rate: (1) the fishery is most intense in the shallow areas during the summer; and (2) most of the deep-water tagged fish were males and males do not move as far inshore as do the females. No difference in availability of deep-water tagged fish and those tagged in shallow water could be attributed to size.

Of the 4,647 sablefish tagged, only 21 were returned (Table 16). The recovery rate is inadequate to draw any general conclusions regarding movements. The low number of recoveries can probably be attributed to several factors, but the major reason appears to be the lack of fishing effort in the deeper waters where most of the marketable sablefish are found.

One full-time biologist and one quarter-time biologist were used on this study. This study was terminated in February 1966 and the results have been reported by Milburn (1966).

SHRIMP MARKET SAMPLING

Activities were expanded in 1966 by a Pacific Marine Fisheries Commission financed port sampler at Brookings and Port Orford, Oregon, and Crescent City, California.

Results of market sampling in 1965 and 1966 are summarized in Figures 12 and 13. Figure 12 shows age composition of shrimp at three major ports in 1965 while Figure 13 shows the same parameters for 1966. A striking feature of these data was the dominant 1964 year class which first appeared in commercial catch samples in September 1964 (see Figure 11, OFC Trawl

Table 16. Number of sablefish recovered by year of tagging and recovery (AEC study).

Year of tagging	Number tagged	Recoveries by year					Total
		1962	1963	1964	1965	1966	
1962	1,413	1	2			1	4
1963	2,914		9	2	4	1	16
1964	320			1			1
total	4,647	1	11	3	4	2	21

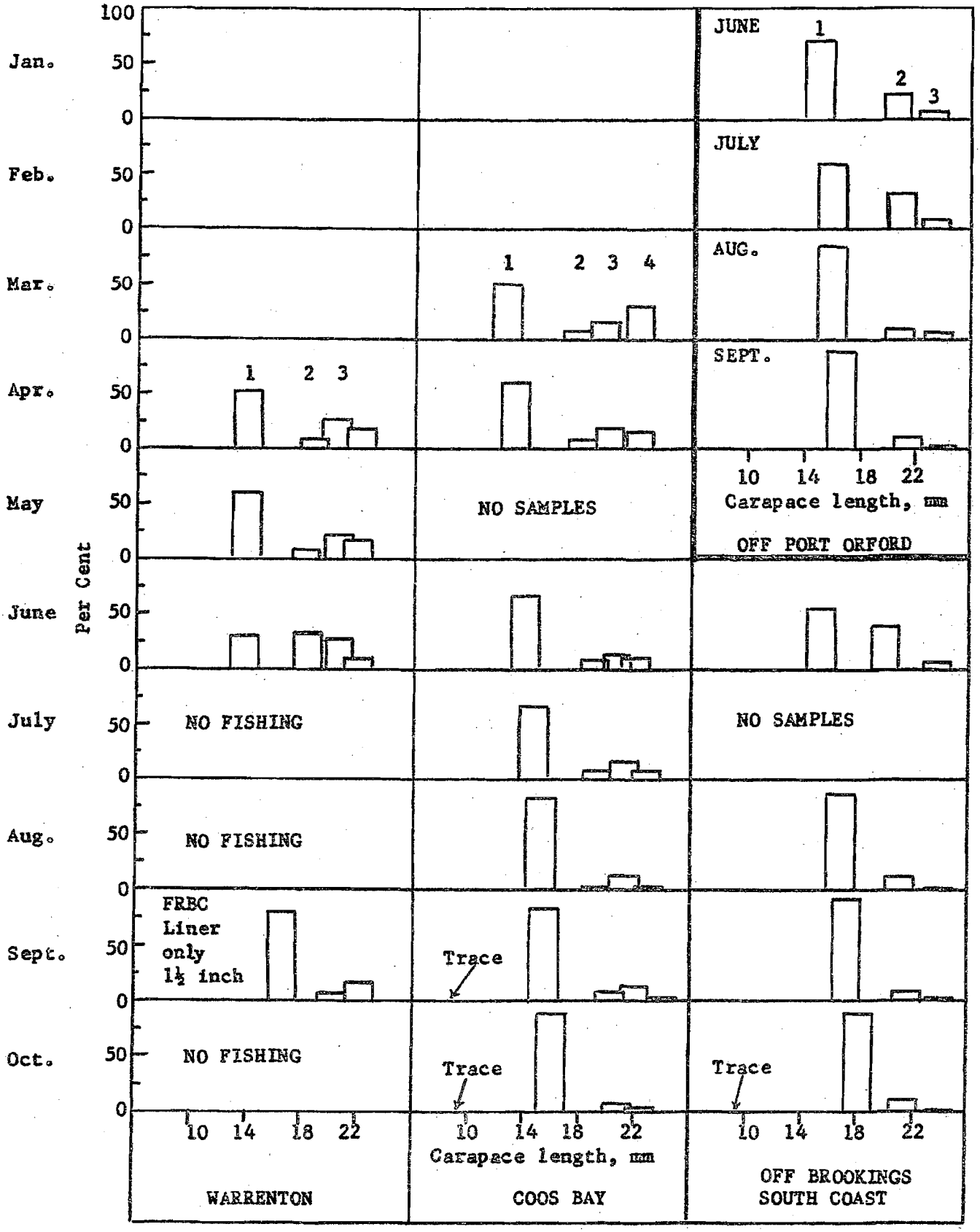

Figure 12. Percentage age composition and mean length for Oregon shrimp landings in 1965, by port and month.

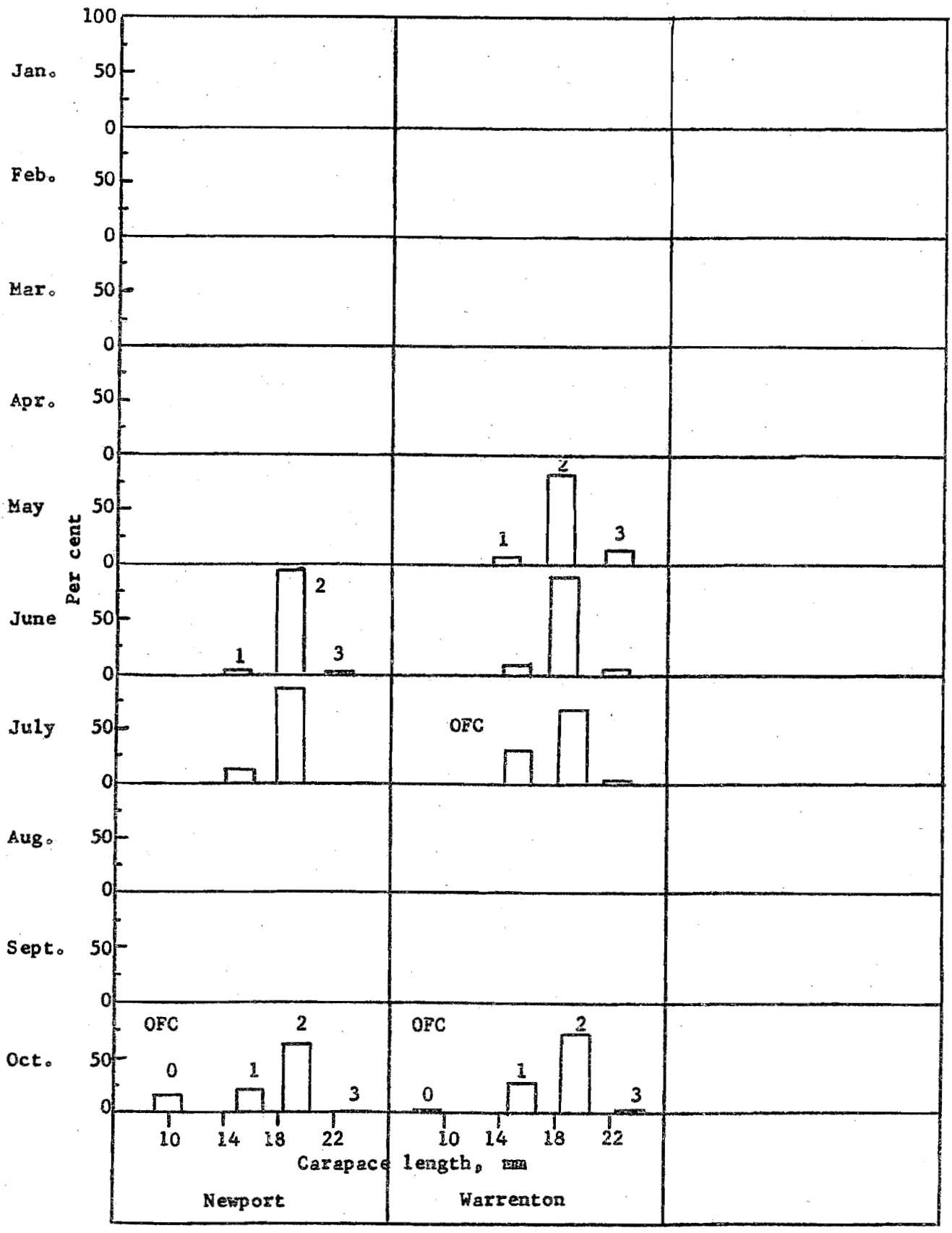

Figure 13. Percentage age composition and mean length for Oregon shrimp landed in 1966, by port and month.

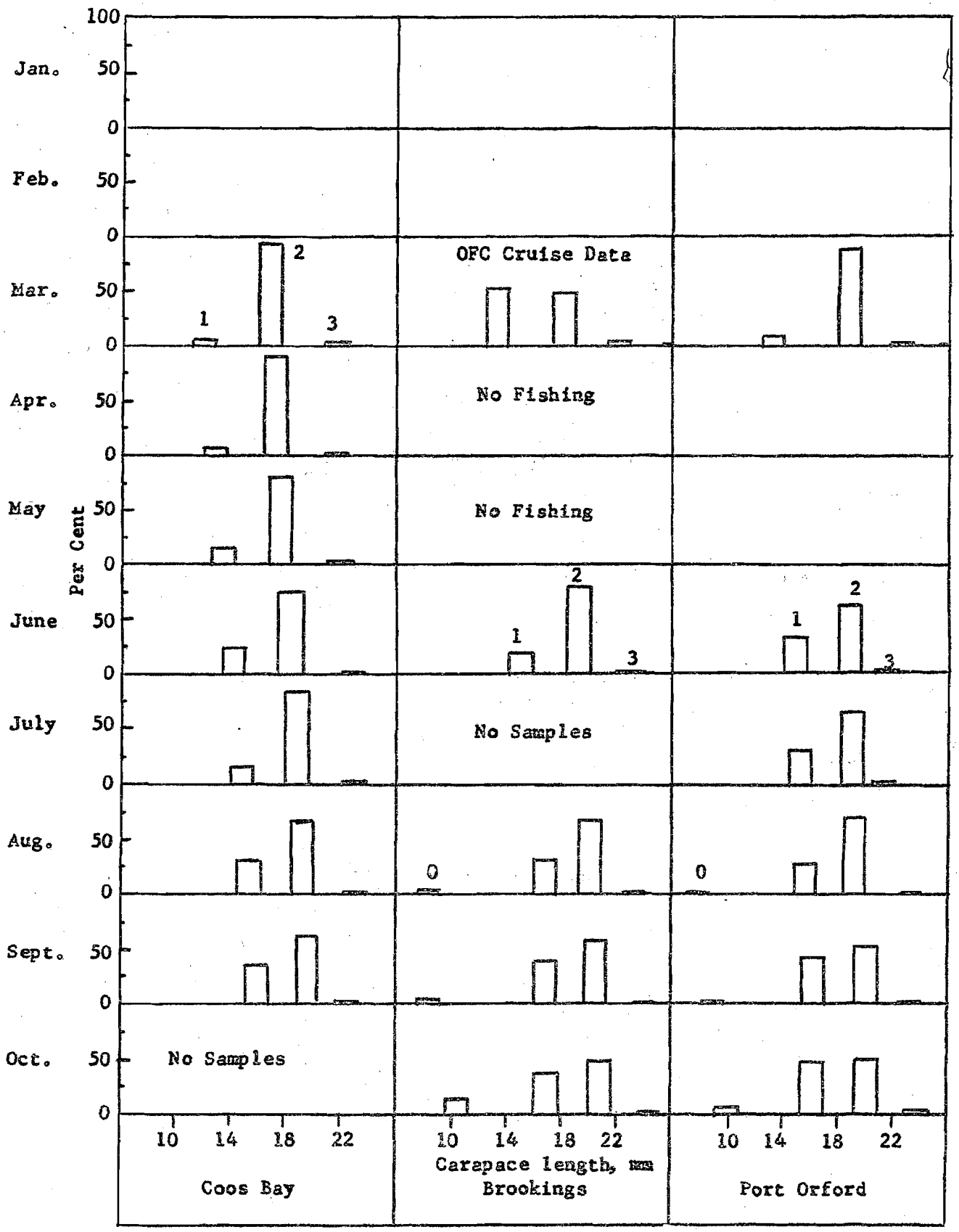

Figure 13. (cont'd)

Investigations 1963-64 Progress Report). It is rare that a year class shows so strongly during its first year of life, since its small size normally renders it unavailable to commercial nets. This very abundant year class showed up in 1965 unusually strong and continued to dominate the catch throughout 1966 in all areas off Oregon. The 1963 year class, however, appeared to be very weak throughout its life. Reasons for the weak showing of this year class are unknown. No extensive commercial fishery existed during the period this year class was brooded and born. A very strong 1961 year class, however, probably spawned the strong 1964 year class.

SHRIMP LANDINGS

After a record 5,477,427 pound Oregon landing in 1964, dominated by the 1961 year class, the catch fell off sharply to 1,747,984 pounds in 1965. The 1965 catch was dominated by the 1964 year class which due to its very small size was largely responsible for processor difficulties. Growth of this age group, however, brought it to marketable size late in 1965. Improved landings and catch per effort stimulated the fishery too late to be of much benefit that year. Table 17 shows catch and catch per effort by port by year. Tables 18 and 19 show the same parameters for area of catch by month for 1965 and 1966, respectively. The much-increased catch and catch per effort after July 1966 reflects the growth of the 1965 year class to marketable size. This growth and improved fishing north of Cape Blanco was preceded by a similar pattern in the faster growing southern Oregon shrimp landed at Port Orford and Brookings. As expected, continued growth of the very strong 1964 year class spurred a very healthy 1966 fishery. Landings of 4,751,300 pounds were the second

Table 17. Oregon shrimp landings and catch/effort by port and year, 1957-66, in pounds.

Year		Warrenton	Newport	Winchester Bay	Coos Bay	Port Orford	Brookings	Total
1957	c	116,747	0	68,325	218,551			403,623
	c/e	-	-	-	-			-
1958	c	1,521,755	-	0	400	0	0	1,522,155
	c/e	569	-	-	-	-	-	569
1959	c	2,368,140	0	0	5,676	0	390,311	2,764,127
	c/e	530	-	-	-	-	487	524
1960	c	589,778	0	0	83,550	0	459,178	1,132,506
	c/e	313	-	-	500	-	492	380
1961	c	767,523	0	0	431,126	0	257,263	1,455,912
	c/e	342	-	-	462	-	806	417
1962	c	395,056	0	0	885,627	18,935	1,450,822	2,750,440
	c/e	342	-	-	340	728	562	434
1963	c	1,072,030	0	2,016	1,581,158	0	461,583	3,114,771
	c/e	564	-	-	584	-	432	548
1964	c	233,425	31,096	113,883	4,299,738	405,020	394,265	5,477,427
	c/e	578	362	649	649	749	580	644
1965	c	73,422	18,523	7,767	916,304	180,130	551,838	1,747,984
	c/e	358	149	274	307	467	330	324
1966	c	102,208	621,669	128,254	2,671,669	665,275	562,225	4,751,300
	c/e	587	583	436	526	702	444	538

Table 18. Oregon shrimp landings by area of catch by month, 1965, in pounds.

Area		Month								
		March	April	May	June	July	August	Sept.	October	Total
Cape Elizabeth	c	0	0	0	3,784	0	0	0	0	3,784
to Willapa Bay	c/e	-	-	-	172	-	-	-	-	172
Willapa Bay to	c	0	0	0	0	0	0	0	0	0
Columbia River	c/e	-	-	-	-	-	-	-	-	-
Columbia River	c	0	1,100	6,300	1,365	0	0	0	0	8,765
to Cape Falcon	c/e	-	157	274	171	-	-	-	-	231
Cape Falcon to	c	0	28,994	52,142	1,054	1,200	0	0	0	83,390
Cascade Head	c/e	-	426	240	176	60	-	-	-	268
Cascade Head to	c	0	0	0	0	0	0	0	0	0
Cape Perpetua	c/e	-	0	-	-	-	-	-	-	0
Cape Perpetua	c	0	0	0	0	0	0	0	0	0
to Umpqua River	c/e	-	-	-	-	-	-	-	-	-
Umpqua River	c	39,326	56,560	41,226	57,282	29,784	106,142	215,887	193,730	739,937
to Cape Arago	c/e	286	258	207	180	147	286	408	463	309
Cape Arago to	c	77,825	5,862	400	10,997	23,535	7,500	54,968	550	181,637
Cape Blanco	c/e	367	202	67	244	327	326	539	110	367
Cape Blanco to	c	0	0	4,700	17,350	64,055	90,700	34,820	1,000	212,625
Rogue River	c/e	-	0	522	519	461	393	610	250	450
Rogue River to	c	0	0	0	4,175	0	235,132	135,320	71,425	446,052
N. Lat. 42°	c/e	-	-	-	209	-	325	296	334	315
N. Lat. 42°	c	0	0	0	0	24,400	17,250	4,900	27,900	74,450
and south	c/e	-	-	-	-	321	314	204	734	386
Total	c	117,151	92,516	104,768	96,007	142,974	456,724	445,895	294,605	1,750,640
	c/e	336	270	231	212	281	326	382	433	327

Table 19. Oregon shrimp landings by area of catch by month, 1966, in pounds.

Area		Month								Total
		March	April	May	June	July	August	Sept.	October	
Columbia River	c	0	0	2,000	22,382	0	0	0	0	24,382
to Cape Falcon	c/e	-	-	250	509	-	-	-	-	469
Cape Falcon to	c	0	0	71,293	23,429	0	53,355	78,240	0	226,317
Cascade Head	c/e	-	-	713	442	-	773	705	-	680
Cascade Head to	c	0	0	0	164,622	149,056	104,293	55,207	0	473,178
Cape Perpetua	c/e	-	-	-	762	642	442	323	-	553
Cape Perpetua	c	0	0	0	0	0	0	0	0	0
to Umpqua River	c/e	-	-	-	-	-	-	-	-	-
Umpqua River	c	339,675	573,349	72,809	93,050	383,183	111,555	310,587	44,592	1,928,800
to Cape Arago	c/e	729	818	253	270	485	265	471	262	502
Cape Arago to	c	0	0	231,029	406,695	35,521	91,287	27,559	45,735	837,826
Cape Blanco	c/e	-	-	755	595	404	425	530	315	562
Cape Blanco to	c	0	0	26,100	164,580	105,840	231,192	266,295	68,220	862,227
Rogue River	c/e	-	-	790	940	666	608	961	431	729
Rogue River to	c	0	0	0	20,550	43,600	87,595	129,230	69,875	350,850
N. Lat. 42°	c/e	-	-	-	260	614	374	325	411	368
N. Lat. 42°	c	0	0	2,900	23,100	20,770	950	0	0	47,720
and south	c/e	-	-	511	412	399	190	-	-	401
Total	c	339,675	573,349	406,131	918,408	737,970	680,227	867,118	228,422	4,751,300
	c/e	729	818	548	556	530	436	520	355	538

largest in history. A fair-good 1965 year class was apparently present off Oregon in 1966. Despite the healthy resource available off Oregon in 1966, northern Oregon fisheries based at Warrenton continued at a low level. One of the two machine processing plants there did not process shrimp in 1965 and left the shrimp processing industry in 1966. Only 73,422 pounds were processed at Warrenton in 1965 and 102,208 pounds in 1966 despite apparently good market demand.

This reduction in plant capacity at Warrenton was compensated for (in northern Oregon) by addition of two plants at Newport. One processor began hand peeling shrimp in 1964 and another producer installed a peeler machine there in 1966. This peeler machine was the first installed on the Pacific Coast south of Warrenton. Newport total landings were 621,669 pounds in 1966. Only 18,523 pounds were landed at Newport in 1965. At Winchester Bay, production was hampered by the small shrimp as elsewhere in 1965 and was cut short by the loss at sea of the MV Hero with all hands in September 1966. Coos Bay area landings were much smaller in 1965 than 1964, also due to small 1964 year class shrimp. A further reduction in catch was effected when the Coos Bay Seafood Company plant burned in the summer of 1965. It continued to process shrimp at a Charleston plant the rest of 1965 and after necessary plant improvements processed shrimp at a somewhat accelerated rate in 1966. Peterson Seafoods Company built a modern plant at Charleston and processed shrimp for the first time in 1966. Cape Fisheries, Inc. of Port Orford processed shrimp in 1965 and 1966. No shrimp had been processed there prior to 1965, although they had been landed and transshipped to other ports for processing.

Brookings Fisheries, Inc. continued to process shrimp at Brookings in 1965 and 1966. Several California processors bought shrimp at Brookings, Port Orford, and Charleston; these were trucked south for processing. Some shrimp were trucked from Charleston to Newport and Winchester Bay. Except for Warrenton, where very sharp demand for trawl vessels exists, the prospects are bright for continued growth of the Oregon shrimp fishery. Problems at Warrenton are currently caused by a limited number of vessels engaged in the bottomfish fishery resulting in competition for vessels by the various processors there. Also no real tradition of shrimp fishing exists there, and many vessel skippers defer to their own and crewmen's preference for groundfish fishing to avoid the sorting problems associated with shrimp fishing. Survival of the fishery at Warrenton apparently depends largely on ability of processors to pay premium prices to fishermen for their catches.

PUBLIC LAW 88-309 STUDIES

Shrimp study

On October 29, 1965, a study submitted by the Oregon Fish Commission to determine the distribution and abundance of pink shrimp off Oregon was approved. This study was designed to determine where shrimp are found off Oregon and to close some gaps in our knowledge of shrimp distribution in areas other than commercially fished areas. We also hoped to estimate the standing crop of shrimp actually present off Oregon. Commercial fishery monitoring has given us knowledge of comparative abundance from year to year, area to area, and period to period, but has not given us data on absolute abundance. It has been impossible to determine what proportion of the resource has been harvested. Also, catch/effort data used for abundance

indexes have been at times more a measure of availability than of abundance. A third major objective of this study was to measure the presence or abundance of shrimp age groups too small to be retained in the commercial nets. These nets are by law no smaller than 1-1/4-inch mesh; in practice most are of 1-1/2-inch mesh. We know that most shrimp less than 12-months old, and many between 12- and 18-months old are not retained in these nets. Therefore, research gear was designed with mesh small enough to capture all available year classes. By this means we can get an estimate of the abundance of various younger age groups and the impact of the fishery upon them. We hope to measure total mortality of these younger age groups also.

An additional benefit of this study was the data report currently in press. It includes all length-frequency and sex ratio data collected by the Fish Commission since 1951 by area and month. Two cruises have been completed, one done in March 1966 with two chartered trawl vessels; the other between September 30 and November 9, 1966, with one chartered vessel. The spring cruise surveyed the entire coast of Oregon between 50 and 125 fathoms. The fall cruise, due to bad weather, surveyed about 42% of the area surveyed in March 1966. Cruise reports have been published and results have been published in quarterly and an annual report for the Bureau of Commercial Fisheries.

Shrimp were found in March 1966 nearly the length of Oregon. They were particularly abundant between the Rogue River and Cape Blanco; Cape Blanco and the Umpqua River; off Newport; and from Cape Lookout to the Columbia River. In the last area, however, only a few large tows showed shrimp. The total population was estimated at 23.8 million pounds. Year class composition by weight was 13, 82, and 4 for the 1965, 1964, and 1963 year classes, respectively. By number the composition was 24, 74,

and 2% for the 1965, 1964, and 1963 year classes. The age composition varied from area to area, as did average size as shown in Table 20.

The fall cruise showed shrimp to be abundant in all areas surveyed. Major changes in distribution and abundance were evident south of the Rogue River and north of Cape Lookout, where shrimp were especially abundant and widespread. Total estimated crop, including the 1966 year class, was 42.2 million pounds. Assuming the unsurveyed areas to contain equal populations as those in March, the total fall 1966 Oregon shrimp population was 58.0 million pounds. The spring-fall differences in population may be due to the following reasons: (1) an underestimate in northern Oregon in March 1966; (2) movement of shrimp into the area south of Cape Blanco after the spring cruise, possibly from off California; and (3) growth of the 1964 year class.

Length frequencies showed some striking differences between actual age composition and that derived from commercial sampling (Table 21). The major difference was in the 1+ age group (1965 year class); this age group is almost unavailable to the fishery in March, but had become nearly 100% available to the fishery by September.

A trip to Kasitsna Bay, Alaska, was made in August 1966. Procedures and techniques by Bureau of Commercial Fisheries researchers were observed and results discussed. The BCF vertical distribution study there on pandalid shrimp was the reason for this trip. We hope to incorporate techniques and findings into research on pink shrimp off Oregon.

Bottomfish study

On November 4, 1965, a project was approved to study recruitment, abundance, and year class strength of Dover, English, and petrale soles and Pacific ocean perch. Emphasis is on Dover sole since there is a continuous

Table 20. Estimates of shrimp population off Oregon in 1966 with age and sex composition by area.

Area	Cruise	Population estimate (lbs)	Age composition				Sex composition			Size
			1966	1965	1964	1963	Male	Trans.	Fem.	Shrimp/lb
1	Spring	1,105,050	0	15.2	82.6	2.2	48.6	7.6	43.8	126
	Fall	7,779,500	77.6	13.1	9.3	0.0	89.6	0.9	9.5	337
2	Spring	14,851,370	0	25.5	72.0	2.5	58.9	6.4	34.7	160
	Fall	-								
3	Spring	954,960	0	57.8	39.8	2.4	69.0	3.1	27.9	192
	Fall	-								
4	Spring	2,825,172	0	2.2	95.0	2.0	56.9	13.6	29.5	137
	Fall	2,730,285	15.3	20.9	63.5	0.2	58.7	0.0	41.3	121
5	Spring	4,092,412	0	26.2	73.0	0.8	59.8	12.6	27.6	109
	Fall	31,718,050	2.5	26.8	70.4	0.4	49.6	0.0	50.4	109

Table 21. Age and sex composition of the March 1966 shrimp cruise samples and the March and September 1966 commercial catch samples (Area 2).

Sample type	Month	Age composition			Sex composition			Size
		1+	2+	3+	Male	Trans.	Fem.	shrimp/lb
Research	March	25.5	72.0	2.5	58.9	6.4	34.7	160
Commercial	March	4.4	93.1	2.5	35.9	1.2	62.9	129
Commercial	September	35.8	62.5	1.7	43.8	8.7	47.5	104

data series since 1949. Juvenile work has been limited to Dover, English, and petrale, again with emphasis on Dover.

A major problem encountered at the start was to develop a technique of aging Dover sole by the scale method. Although scales had been in use since 1957, interpretation of scales was erroneous. This project was near completion on December 31, 1966.

A data report of length frequencies and age-length frequencies of Dover, English, and petrale sole and Pacific ocean perch market samples was compiled and is in press.

Several cruises were completed. Bottomfish personnel participated in two shrimp cruises, one Dover sole cruise, and six cruises on Pacific ocean perch. Dover sole were collected on all cruises except those for Pacific ocean perch. As a result, depth distribution of juveniles has been established. Juvenile Dover sole occupy a rather narrow depth range. One-year-old fish in July were found from 12 to 70 fathoms with greatest abundance at 30-39 fathoms (Table 22). In November, 1-year-old fish were found from 40 to 90 fathoms with greatest abundance at 50-59 fathoms.

The perch cruises were additional to our normal duties. Catch rates obtained were given to the American delegation prior to the fishery talks in Moscow. These data were compared with catch rates prior to Russian fishing on the same grounds.

FOREIGN FISHING

During the last few days of March 1966, a fleet of Russian fishing and support vessels appeared off the Pacific northwest coast. In April and May, the Russian fleet moved into the area off Newport, Oregon, and started fishing on rockfish. Pacific ocean perch was the primary species in their catch. In order to assess the impact of the foreign fleet upon the domestic industry,

Table 22. Percent of juvenile Dover sole (<15 cm) by depth strata. Dash (-) indicates no fishing.

Depth strata (fathoms)	Month of catch	
	July 1966	October 1966
10-19	6.8	-
20-29	24.9	0.4
30-39	43.4	-
40-49	19.5	17.4
50-59	5.0	53.5
60-69	0.5	16.0
70-79	0.0	0.0
80-89	0.0	5.7
90-99	-	7.4
100-109	-	0.0
110-119	-	0.0
120-129	-	0.0
No. tows	43	96

the Fish Commission of Oregon together with sister agencies immediately set in motion a three-point program: (1) surveillance of the foreign fleet; (2) coordination and exchange of information with industry; and (3) initiation of bilateral talks with the USSR. Otter Trawl Investigation participated in the first two points of the program.

Between May and November, eight patrol flights from Port Angeles, Washington, and one patrol flight from Astoria were made with the U. S. Coast Guard. In addition, two OFC charter flights were made from Astoria. Three sea patrols from Westport, Washington, and one sea patrol from Astoria were made aboard chartered vessels. One sea patrol was made with the U. S. Coast Guard aboard the USCGC Yacona. Observations were also made during six rockfish survey cruises, one Dover sole cruise, one shrimp survey, and one AEC cruise conducted by the Bureau of Commercial Fisheries.

From June to December, 13 interagency and agency-industry meetings were attended. Seven of these meetings were sponsored by the Bureau of Commercial Fisheries, three by the Fish Commission of Oregon, and three by National Fishermen and Wives.

Several man-months of effort were spent in conducting and analyzing rockfish surveys and in assembling catch and effort information for Pacific ocean perch during 1964-66. This information was given to American participants at the USSR-USA fisheries meetings.

James M. Meehan
Jack G. Robinson
Robert L. Demory
Edwin L. Niska
Gary Milburn
Austin R. Magill