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Groundfish and Shrimp Investigations

Annual Report

January 1, 1970-December 31, 1970

by
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**Fish Commission of Oregon
Research Division**

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Groundfish and Shrimp Investigations

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Introduction

The title of the investigation was changed from Otter Trawl Investigations to Groundfish and Shrimp Investigations. Jim Meehan's title was changed from Project Leader to Program Leader. Jack Robinson was designated Project Leader for management studies and Bob Demory was designated Project Leader for research. Meehan, Robinson, Demory, Lukas, and Forsberg were transferred to the new laboratory in Newport. Mike Hosie vacated the Aquatic Biologist I position on the PL 88-309 shrimp study in July.

Seasonal employees included Meyer Ueoka for the April-September season in Coos Bay and John Johnson during the June-September period in Astoria.

Oregon's trawl fleet increased to 93 vessels in 1970 (Table 1).

Reports

Reports were prepared for the PMFC annual meeting held in November at Palo Alto, California, and the International Trawl Fishery Technical Subcommittee meeting in July at San Francisco, California.

The following reports were published during 1970:

1. Demory, Robert L. Investigation of the abundance and recruitment of bottom fish off Oregon, with emphasis on Dover sole. PL 88-309 Annual Prog. Rep., August 1970 (processed).
2. _____ . Report of cruise 69-5, lingcod tagging. Fish Comm. Oreg., February 1970 (processed).

Table 1. Vessels Landing Groundfish and Shrimp in Oregon
by Port by Fishery, 1970

Boat	Port of Landing						Fishery		Boat	Port of Landing						Fishery	
	A	G	N	C	P	B	S	G		A	G	N	C	P	B	S	G
Amak	-	-	-	x	*	-	x	x	KDM1/	-	-	-	-	*	-	x	-
Aquarius1/	-	-	-	-	x	*	x	x	Kincheloe	-	-	-	-	-	*	-	x
Arney P.1/	-	-	-	*	-	-	x	-	Kodiak	-	-	x	*	-	-	x	-
Azalea1/	-	-	-	x	*	x	x	-	Lituya1/	*	-	x	-	-	-	-	x
Barbara S.1/	*	-	x	-	-	-	-	x	Madeline J.	-	x	*	-	-	-	x	-
Betty A.	-	-	-	*	-	-	-	x	Margaret A.	*	-	-	-	-	-	-	x
Bonnie C.1/	-	-	-	*	-	-	x	-	Margaret E.	*	-	-	-	-	-	-	x
Bristol	-	-	x	*	-	-	x	-	Marian F.	*	-	-	-	-	-	-	x
Carica	-	x	x	*	-	-	x	-	Martle	x	-	*	-	-	-	x	x
Christina J.	-	-	-	*	-	-	x	-	Mildred	*	-	-	-	-	-	-	x
Christy	-	-	*	-	-	-	-	x	Miss Connie	-	x	*	x	-	-	x	-
Columbia	x	-	-	*	-	-	-	x	Miss Yvonne	x	x	*	-	-	-	x	-
Coolidge II	*	-	-	-	-	-	x	x	Mitkof	*	-	-	-	-	-	x	x
Coral Sea1/	*	-	-	-	-	-	-	x	Morning Star	-	-	-	*	-	-	-	x
Corsair	-	x	*	-	-	-	x	-	Nel Ron Dic	-	-	-	*	-	-	x	-
Daphne1/	-	-	-	-	*	x	x	-	Nestucca	*	-	-	-	-	-	x	x
Dare II	-	-	x	*	-	-	x	x	New Mexico	*	-	-	-	-	-	-	x
Defender	-	-	-	*	-	-	x	-	Ocean Spray	*	-	x	-	-	-	x	x
Destiny	-	-	*	-	-	-	-	x	Oregonian	-	-	*	-	-	-	x	x
Donna	-	-	-	-	-	*	x	-	Orion1/	x	*	x	x	-	-	x	-
Donna B.	-	-	-	-	-	*	-	x	Owners Joy1/	*	-	-	-	-	-	x	-
Elaine Dell	-	-	-	*	-	-	x	-	Pacific	-	-	-	*	-	-	-	x
Empress	*	-	-	-	-	-	-	x	Pacific Cryer1/	-	-	-	-	*	-	x	-
Estep	-	-	-	*	-	-	-	x	Pacific Hustler	-	-	x	*	-	-	x	-
Fargo	x	x	*	x	-	-	x	-	Pacific Queen	-	-	*	x	-	-	-	x
Faymar	-	-	-	-	-	*	x	x	Panda	-	-	-	x	x	*	x	x
Flo-N	-	-	-	-	-	*	-	x	Paul C.1/	-	-	-	x	*	x	x	-
Francis E.1/	-	-	-	-	x	*	x	-	Pisces	-	-	-	*	-	-	x	-
Frank F.	-	-	-	*	-	-	x	-	Rainbow	x	-	*	x	-	-	x	x
Frank Lowe	-	-	-	*	-	-	x	-	Rose Ann Hess	*	-	-	-	-	-	-	x
Gallent Maid	*	-	-	-	-	-	-	x	Ruth Ellen	-	-	*	x	-	-	x	x
General Pershing	-	-	-	-	*	x	x	-	Sea Breeze II	-	-	*	-	-	-	x	-
Guide	-	-	-	*	-	-	-	x	Sea Master1/	-	-	-	*	-	-	x	-
Harmony	-	-	-	*	-	-	-	x	Seal1/	-	-	-	-	*	-	-	x
Helen Louise	-	-	-	*	-	-	x	x	Silver Queen1/	-	-	-	-	*	x	x	-
Intrepid	-	-	-	-	-	*	-	x	Stephanie1/	-	-	-	-	x	*	x	-
Irene Kay	-	-	-	x	-	*	x	x	Sunward	*	-	-	-	-	-	-	x
Ironsides	-	-	-	*	-	-	x	-	Tradewind	-	-	*	-	-	-	x	-
Jaka-B	x	x	*	x	-	-	x	-	Tralee	*	-	-	-	-	-	-	x
Jefferson	-	-	-	x	-	*	x	x	Trask	*	-	-	-	-	-	x	x
Jennie Decker	*	-	-	-	-	-	-	x	Trego	-	-	-	*	-	-	x	x
Jul-E1/	-	-	x	*	-	-	x	-	Tom & Al	*	-	x	-	-	-	-	x
Junior	-	-	-	*	-	-	-	x	Washington (Big)	*	-	-	-	-	-	x	x
Kangaroo	-	-	-	*	-	-	x	-	Washington (Little)	-	-	x	*	-	-	x	x
Karen	-	-	-	*	-	-	x	x	Western	*	-	-	-	-	-	-	x
Karen Kelly1/	-	-	-	*	x	x	x	-	Western Main	*	-	-	-	-	-	x	x
Kathy Jo	*	-	x	-	-	-	-	x									

Key 1/ Out-of-state boat
A = Astoria-Warrenton
G = Garibaldi
N = Newport
C = Coos Bay-Winchester Bay
P = Port Orford

B = Brookings
S = Shrimp fishery
G = Groundfish
x = Delivered in this port
* = Home port for Oregon boats or
main port for out-of-state boats.

3. _____ . Report of cruise 70-3, deep water Dover sole. Fish Comm. Oreg., July 1970 (processed).
4. _____ . Report of cruise 70-5, deep water Dover sole. Fish Comm. Oreg., July 1970 (processed).
5. _____ , and Brent O. Forsberg. Report of cruise 70-8, deep water Dover sole. Fish Comm. Oreg., July 1970 (processed).
6. _____ . Report of cruise 70-11, techniques for proposed charter work. Fish Comm. Oreg., December 1970 (processed).
7. Forsberg, Brent O. Report of cruise 70-6, rex sole tagging. Fish Comm. Oreg., July 1970 (processed).
8. _____ . Report of cruise 70-10, rex sole tagging. Fish Comm. Oreg., July 1970 (processed).
9. _____ . Report of cruise 70-12, pre-season albacore. Fish Comm. Oreg., July 1970 (processed).
10. Hosie, Michael. Report of cruise 69-6, shrimp. Fish Comm. Oreg., February 1970 (processed).
11. _____ . Report of cruise 70-4, shrimp. Fish Comm. Oreg., April 1970 (processed).
12. Lukas, Gerald. Report of cruise 69-4, shrimp. Fish Comm. Oreg., February 1970 (processed).
13. _____ . Report of cruise 70-1, shrimp. Fish Comm. Oreg., February 1970 (processed).
14. _____ . Report of cruise 70-2, shrimp. Fish Comm. Oreg., April 1970 (processed).
15. _____ . Investigation of the abundance and distribution of shrimp off Oregon. PL 88-309 Annual Prog. Rep., August 1970 (processed).

16. _____ . Report of cruise 70-7, shrimp. Fish Comm. Oreg., September 1970 (processed).
17. _____ . Report of cruise 70-9, shrimp. Fish Comm. Oreg., November 1970 (processed).
18. Meehan, James M. Boat charter, PL 88-309 Annual Prog. Rep., August 1970 (processed).
19. _____, *et al.* Trawl investigation progress report. January 1, 1967-December 31, 1968. Fish Comm. Oreg., Res. Div., July 1970 (processed).
20. Niska, Edwin L. The Oregon trawl fishery for mink food, 1958-65. PMFC. Bul. 7:89-101, 1969.

Regulations

The staff recommended FCO action to support the California Area A closure at a public hearing in August. The FCO closed Oregon landings of shrimp caught south of 42°00' N. latitude effective August 22, after the California quota was filled.

Groundfish Fishery

Landings

Annual Oregon landings from 1961 to 1970 by species are shown in Table 2. Table 3 presents the total catch for 1966-70 by international statistical area (Figure 1), hours fished and catch per hour. State-wide landings for 1970 are below the 10-year average. There was a substantial decline in the rockfish landings. Dover sole, rex sole, lingcod, sablefish, and animal food landings also decreased in 1970. English sole, petrale sole, starry

Table 2. Yearly Oregon Trawl Landings from 1961 to 1970
(landings in thousands of pounds)

Species	Year										Mean 1961-70
	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	
English sole	1,789	2,295	1,948	1,562	1,678	3,537	2,304	2,306	1,716	1,884	2,102
Rock sole	0	0	0	0	4	18	8	51	25	5	11
Petrable sole	1,838	2,607	2,295	1,877	1,838	1,838	1,771	1,653	1,835	2,141	1,969
Dover sole	4,054	4,454	5,345	5,529	3,631	3,492	3,565	4,325	5,554	5,538	4,549
Rex sole	988	1,333	1,033	806	985	1,498	1,219	1,075	1,215	1,074	1,123
Starry flounder	403	706	273	528	410	477	277	454	251	426	421
Other flatfish	138	216	73	143	62	205	255	215	506	646	246
Pacific cod	103	19	67	200	194	628	430	385	47	78	215
Lingcod	619	756	493	736	852	993	1,067	1,526	1,084	945	907
Sablefish	159	150	188	183	130	68	67	56	135	111	125
Pac. ocean perch	4,568	5,789	7,982	9,548	13,647	4,518	1,706	1,649	940	1,595	5,194
Other rockfish	4,832	7,125	4,681	4,147	4,121	5,069	4,061	4,253	5,101	3,515	4,691
Misc. species	117	65	6	32	23	12	8	31	4	17	32
Dogfish	0	0	0	0	1	0	0	2	Tr.	17	2
Animal food	5,790	6,176	5,540	5,990	4,152	3,357	3,999	2,815	2,599	2,052	4,249
Reduction use ^{1/}	-	-	-	-	1,498	79	18	49	45	0	169
Total	25,398	31,691	29,924	31,290	33,226	25,789	20,745	20,899	21,057	20,044	26,006
Total hours	29,929	35,254	32,412	31,312	29,254	23,676	20,183	24,456	25,692	27,587	27,976
Catch/hour	863	899	923	999	1,136	1,089	1,028	855	818	727	934

^{1/} New category introduced in 1965, previously included with miscellaneous fish.

Table 3. Total Oregon Trawl Landings (by area fished), Calculated Hours Fished, and Catch Per Hour by International Statistical Areas for 1966-70

International Statistical Area		Year					Mean 1966-70
		1966	1967	1968	1969	1970	
5-A/5-B	Pounds	701,000	98,000	2,017,000	655,000	60,000	706,000
	Hours	187	105	1,277	502	60	426
	Lbs/Hr	3,749	933	1,579	1,305	1,000	1,657
3-D	Pounds	-	-	190,000	162,000	224,000	192,000
	Hours	-	-	114	118	223	152
	Lbs/Hr	-	-	1,667	1,373	1,004	1,263
3-C	Pounds	637,000	57,000	45,000	66,000	1,080,000	377,000
	Hours	434	33	41	55	375	188
	Lbs/Hr	1,468	1,727	1,098	1,200	2,880	2,005
3-B	Pounds	258,000	1,061,000	2,203,000	565,000	1,028,000	1,023,000
	Hours	299	800	2,324	722	1,375	1,104
	Lbs/Hr	863	1,326	948	783	748	927
3-A	Pounds	13,911,000	11,981,000	9,311,000	9,925,000	8,628,000	10,751,000
	Hours	11,197	10,883	10,825	12,087	11,125	11,223
	Lbs/Hr	1,242	1,101	860	821	776	958
2-C	Pounds	5,622,000	3,530,000	2,382,000	1,719,000	1,625,000	2,976,000
	Hours	6,380	4,273	4,234	2,575	2,770	4,646
	Lbs/Hr	881	826	563	668	587	641
2-B	Pounds	3,870,000	3,599,000	3,994,000	5,868,000	6,012,000	4,669,000
	Hours	3,954	3,380	4,543	5,905	8,409	5,238
	Lbs/Hr	979	1,065	879	994	715	891
2-A	Pounds	511,000	140,000	339,000	1,762,000	1,012,000	753,000
	Hours	769	277	520	2,875	2,229	1,334
	Lbs/Hr	664	505	652	613	454	564

Table 3. (Continued)

International Statistical Area		Year					Mean 1966-70
		1966	1967	1968	1969	1970	
1-C	Pounds	279,000	280,000	418,000	335,000	375,000	337,000
	Hours	456	432	572	853	1,021	667
	Lbs/Hr	612	648	731	393	367	505
State-wide Total	Pounds	25,789,000	20,746,000	20,899,000	21,057,000	20,044,000	21,707,000
	Hours	23,676	20,183	24,456	25,692	27,587	24,317
	Lbs/Hr	1,089	1,028	855	818	727	893

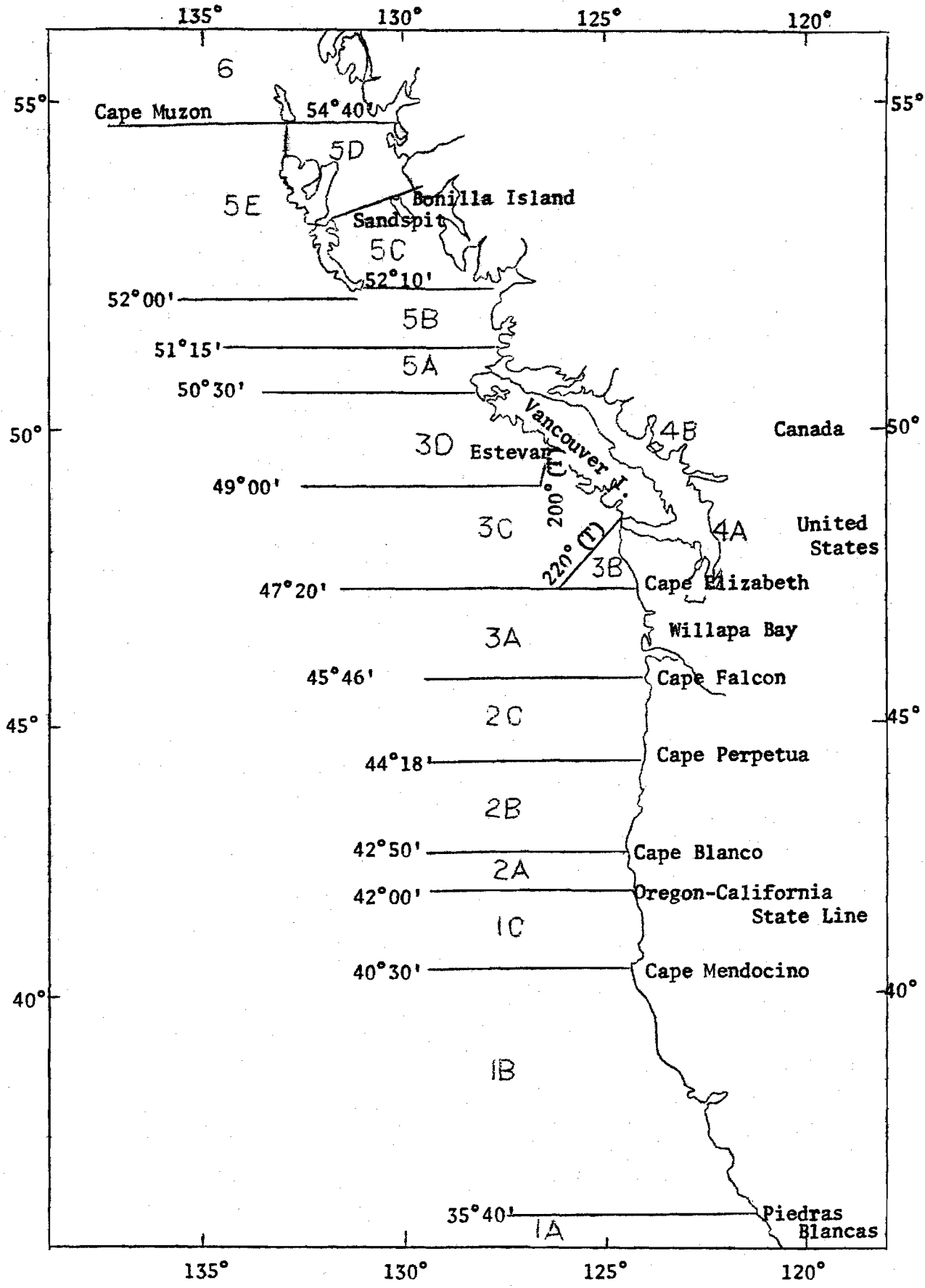


Figure 1. Chart of Pacific Coast Showing International Statistical Areas

flounder, sand sole, Pacific cod, and Pacific ocean perch landings increased. The state-wide catch rate continued its decrease due to the decline in rockfish and animal food.

The catch rates and total landings of Dover, English, and petrale sole and Pacific ocean perch for the years 1952-70 are listed in Tables 4 through 7.

Market Sampling

Sampling effort in 1970, resulted in 48 English sole samples, 57 petrale sole samples, 47 Dover sole samples, 17 Pacific ocean perch samples, and 46 rockfish composition samples.

The mean length and sample size for English, petrale, and Dover sole, and Pacific ocean perch by sex, month, and area of catch, are listed in Tables 8 through 11.

Animal Food Fishery

The purpose of this phase of the investigation is to determine the species composition of whole fishes landed annually as animal food. Animal food landings for 1970 are listed in Table 12 by species by port.

Investigation of trawl-caught fishes landed as mink food, for the year 1970, indicates a further decline in this fishery (Table 13). The 1969 landings of 2.7 million pounds dropped to 2.1 million pounds in 1970. Approximately 120 ranches in Oregon raised mink during 1969, and by the end of 1970, this total had dropped to approximately 90 ranches according to Wallace Hall of Forest Grove. There are no data on number of animals husbanded, but presumably, large herds were reduced because of the failing American market caused by influx of imported furs from Asia and Europe.

Table 4. Total Pounds Landed and Pounds Per Hour Per Significant Landing by International Statistical Area for Dover Sole, 1959-70 (catch in thousands of pounds)

Year of Landing	Area of Catch																		Annual Landing	Mean C/E
	1-C		2-A		2-B		2-C		3-A		3-B		3-C		3-D		5-A-B			
	Catch	C/E	Catch	C/E	Catch	C/E	Catch	C/E	Catch	C/E	Catch	C/E	Catch	C/E	Catch	C/E	Catch	C/E		
1959	0	-	0	-	2,279	528	360	275	1,853	423	51	245	0	-	0	-	0	-	4,543	445
1960	2	na	3	na	2,326	412	534	262	2,220	369	94	336	27	204	2	na	0	-	5,208	369
1961	0	-	7	307	1,944	405	259	183	1,743	349	101	242	0	-	0	-	0	-	4,054	348
1962	5	956	98	60	1,937	440	478	246	1,893	345	41	289	3	81	0	-	0	-	4,455	326
1963	1	58	34	94	2,241	430	501	250	2,472	332	90	181	6	na	0	-	0	-	5,345	344
1964	29	na	163	126	2,281	555	722	232	2,210	316	90	312	31	306	0	-	3	na	5,529	346
1965	98	305	177	337	1,242	408	598	304	1,471	384	29	310	9	153	7	na	0	-	3,631	368
1966	82	382	270	473	1,069	379	346	247	1,683	448	6	na	37	na	0	-	0	-	3,493	394
1967	87	376	56	326	1,532	572	235	260	1,563	364	89	377	2	na	0	-	1	na	3,565	418
1968	177	457	178	480	1,985	649	261	271	1,532	315	140	213	1	na	1	na	50	352	4,325	414
1969	119	333	770	458	2,968	625	115	200	1,537	334	33	333	2	na	1	na	9	na	5,554	459
1970	135	235	359	240	3,257	477	138	126	1,534	328	91	336	3	na	19	848	2	na	5,538	370

Table 5. Total Pounds Landed and Pounds Per Hour Per Significant Landing by International Statistical Area for English Sole, 1959-70 (catch in thousands of pounds)

Year of Landing	Area of Catch																		Annual Landing	Mean C/E
	1-C		2-A		2-B		2-C		3-A		3-B		3-C		3-D		5-A+B			
	Catch	C/E	Catch	C/E	Catch	C/E	Catch	C/E	Catch	C/E	Catch	C/E	Catch	C/E	Catch	C/E	Catch	C/E		
1959	0	-	0	-	107	218	41	103	1,363	363	104	300	0	-	0	-	0	-	1,615	324
1960	0	-	0	-	234	284	380	179	1,627	368	198	372	3	na	12	na	0	-	2,454	309
1961	0	-	17	359	187	213	111	160	1,286	274	188	320	0	-	0	-	0	-	1,789	259
1962	11	203	80	83	496	386	241	183	1,411	278	57	391	0	-	0	-	0	-	2,296	260
1963	6	63	37	74	255	214	307	252	1,251	259	90	401	2	na	0	-	0	-	1,948	241
1964	34	124	115	99	124	132	309	233	904	301	64	389	12	141	0	-	0	-	1,562	225
1965	32	189	93	195	150	195	397	174	960	381	34	435	12	na	0	-	0	-	1,678	265
1966	74	273	75	279	455	460	406	212	2,424	503	86	590	18	252	0	-	0	-	3,538	417
1967	91	446	34	269	342	272	310	198	1,237	354	290	538	0	-	0	-	0	-	2,304	321
1968	102	434	57	317	280	240	293	207	993	280	615	268	0	-	1	na	19	359	2,360	265
1969	42	111	202	171	156	335	247	198	948	251	119	409	1	na	0	-	1	na	1,716	233
1970	41	107	97	141	444	262	255	225	746	248	291	324	6	na	3	na	1	na	1,884	240

Table 6. Total Pounds Landed and Pounds Per Hour Per Significant Landing by International Statistical Area for Petrale Sole, 1959-70 (catch in thousands of pounds)

Year of Landing	Area of Catch																		Annual Landing	Mean C/E
	1-C		2-A		2-B		2-C		3-A		3-B		3-C		3-D		5-A-B			
	Catch	C/E	Catch	C/E	Catch	C/E	Catch	C/E	Catch	C/E	Catch	C/E	Catch	C/E	Catch	C/E	Catch	C/E		
1959	0	-	0	-	538	330	187	600	528	291	22	na	0	-	0	-	0	-	1,275	334
1960	0	-	6	na	646	396	494	302	936	297	50	na	5	na	6	na	0	-	2,143	323
1961	0	-	8	120	315	185	511	344	919	239	54	162	31	na	0	-	0	-	1,838	243
1962	4	na	37	na	623	220	594	276	1,321	297	27	271	0	-	0	-	0	-	2,606	269
1963	11	108	26	82	534	234	321	195	1,361	246	39	226	3	na	0	-	0	-	2,295	228
1964	19	60	65	209	271	169	379	298	1,091	242	39	106	13	na	Tr.	na	0	-	1,877	222
1965	27	183	53	243	369	214	644	243	684	300	9	na	52	536	0	-	0	-	1,838	257
1966	31	127	33	169	239	219	449	224	1,048	283	7	na	29	na	0	-	1	na	1,837	249
1967	25	na	18	183	213	129	365	215	1,061	300	80	na	7	na	0	1	2	na	1,771	237
1968	31	136	33	205	241	352	350	174	801	228	142	na	1	na	16	186	28	na	1,653	220
1969	37	61	283	308	319	370	234	336	930	257	28	na	1	na	0	-	3	na	1,835	269
1970	36	92	266	284	583	259	269	317	849	231	108	154	19	na	11	na	0	-	2,141	240

Table 7. Total Pounds Landed and Pounds Per Hour Per Significant Landing by International Statistical Area for Pacific Ocean Perch, 1959-70 (catch in thousands of pounds)

Year of Landing	Area of Catch																		Annual Landing	Mean C/E
	1-C		2-A		2-B		2-C		3-A		3-B		3-C		3-D		5-A-B			
	Catch	C/E	Catch	C/E	Catch	C/E	Catch	C/E	Catch	C/E	Catch	C/E	Catch	C/E	Catch	C/E	Catch	C/E		
1959	0	-	0	-	446	376	1,435	823	587	587	4	na	0	-	0	-	0	-	2,472	628
1960	0	-	0	-	141	261	1,154	623	1,053	734	130	993	141	1,067	115	na	0	-	2,734	640
1961	0	-	0	-	408	554	2,165	692	1,968	774	28	268	0	-	0	-	0	-	4,569	702
1962	0	-	1	57	449	455	2,534	608	2,772	682	33	1,413	0	-	0	-	0	-	5,789	625
1963	0	-	2	589	931	537	3,610	1,009	3,267	630	167	429	5	na	0	-	0	-	7,982	733
1964	0	-	1	na	2,505	835	3,755	1,000	2,310	574	829	744	62	392	0	-	86	1,089	9,548	787
1965	0	-	Tr.	-	1,956	909	8,847	1,544	2,681	806	30	690	133	375	13	324	0	-	13,660	1,173
1966	0	-	21	na	420	926	2,177	922	1,132	1,221	22	na	138	605	0	-	608	4,780	4,518	1,092
1967	0	-	0	-	247	402	1,032	747	324	826	16	na	6	na	0	-	81	529	1,706	663
1968	0	-	0	-	170	423	450	320	120	353	55	1,129	2	na	1	na	851	1,095	1,649	553
1969	4	na	23	214	218	278	335	477	46	323	0	-	9	na	9	na	296	740	940	430
1970	0	-	Tr.	-	127	308	416	418	73	195	2	na	901	3,481	64	996	12	196	1,595	735

Table 8. Mean Length and Sample Size of English Sole
by Area of Catch by Month and Sex for 1970

Month	Area 3A				Area 2B			
	Mean Length		Sample Size		Mean Length		Sample Size	
	♀	♂	♀	♂	♀	♂	♀	♂
January	36.2	32.3	83	16				
February	34.0	31.0	117	39				
March	35.2	31.8	111	40				
April	34.7	30.7	147	57	36.4	34.7	47	3
May	33.8	30.4	78	25	35.1	32.6	138	13
June	36.1	32.3	145	57	35.7	31.9	153	7
July	37.5	34.6	139	10	36.9	32.0	202	8
August	36.2	32.5	116	33				
September	37.6	33.0	150	55	36.5	33.4	75	28
October	35.8	32.5	128	24				
November	36.7	32.2	144	19				
December	35.7	33.4	99	5				

Table 9. Mean Length and Sample Size of Petrale Sole
by Area of Catch by Month and Sex for 1970

Month	Area 3A				Area 2B			
	Mean Length		Sample Size		Mean Length		Sample Size	
	♀	♂	♀	♂	♀	♂	♀	♂
January	43.1	36.8	76	28				
February	39.5	34.0	142	61				
March	42.0	33.9	69	33				
April	42.0	37.0	115	87	38.7	36.7	87	63
May	40.7	39.2	93	57	38.2	35.8	125	79
June	40.0	37.5	102	100	37.7	35.3	135	66
July	43.4	38.2	114	83	38.8	35.8	137	15
August	43.1	37.9	127	71	39.4	36.0	123	28
September	42.4	37.9	84	68	40.3	37.3	101	52
October	42.8	37.4	86	116				
November	43.1	37.8	77	73				
December	42.5	35.6	27	22				

Table 12. 1970 Animal Food Landings in Pounds
by Port by Species

Species	Astoria	Newport	Winchester - Coos Bay	Total
English sole	391,541	117,401	3,179	512,121
Dover sole	78,924	4,922	5,715	89,561
Petrале sole	36,808	12,278	2,816	51,902
Rex sole	241,609	10,750	4,546	256,905
Butter sole	95,423	9,364	82	104,869
Sand sole	10,005	3,338	491	13,834
Sand dab	166,702	43,226	12,750	222,678
Starry flounder	147,384	-	-	147,384
Arrowtooth flounder	351,126	44,160	29,544	424,830
Misc. sole	14,395	905	-	15,300
Skate	30,379	21,896	50,603	102,878
Sablefish	27,644	12,957	421	41,022
Lingcod	-	-	210	210
Other rockfish	11,608	764	4,897	17,269
Misc. fish	19,377	933	1,612	21,922
Unknown	28,300	-	-	28,300
Total	1,651,225	282,894	116,866	2,050,985

Table 13. Yearly Oregon Animal Food Landings from 1966 to 1970
(landings in thousands of pounds)

Species	1966	1967	1968	1969	1970	1966-70 Average
English sole	56	465	405	573	512	402
Dover sole	54	212	139	110	90	121
Petrале sole	16	147	72	56	52	69
Rex sole	183	306	155	187	257	218
Sand dab	132	179	140	235	223	182
Starry flounder	66	55	25	42	147	67
Butter sole	109	101	88	47	105	90
Arrowtooth flounder	2,204	2,208	1,089	961	425	1,377
Rockfish	292	81	307	53	17	150
Skate	163	131	366	272	103	207
Other	77	202	110	142	120	130
Total	3,352	4,087	2,896	2,678	2,051	3,013

This is emphasized further by the fact that 30 ranches pelted out completely. Clatsop County had 26 ranches in 1969, and only 16 remained by the end of 1970. The demand for animal food has been likewise substantially reduced.

Sampling of species composition of the animal food landings shows a drastic decline in the prime mink food fish, the arrowtooth flounder. Landings of this species declined from 961 thousand pounds in 1969, to 425 thousand pounds in 1970. No obvious reason for this decline is apparent. Fishermen who normally deliver this fish remark that it has become increasingly harder to locate. Some believe the Russian trawlers are, in part, responsible for the decline. Arrowtooth flounder is taken at a depth range from 40 to 200+ fathoms, well within the range fished by USSR and Japanese trawlers. The eight year annual average of turbot landings for the period 1958-65 was 2.4 million pounds.

Tagging Studies

A total of 2,537 rex sole was tagged off the Columbia River during April-June 1970. A total of 175 yellowtail rockfish was tagged off Coos Bay during March 1970. Returned fish will provide information on stock movement.

A total of 661 Dover sole was tagged in deep water (out to 350 fathoms) off Coos Bay in January, March, and December 1970. Returns from this tagging will aid in determining the interchange between deep-water and shallow-water stocks of Dover sole.

Recoveries made from several prior tagging studies are treated individually below. International statistical areas referred to are shown in Figure 1.

Dover Sole, May 1964

During this period, 2,697 Dover sde were tagged and released from 47 to 200 fathoms southwest of the Columbia River. A total of 652 tags had been recovered through December 31, 1970 (Table 14).

Dover Sole, November 1967 and April 1968

A total of 1,494 Dover sole was tagged off the mouth of the Columbia River in depths of 40-215 fathoms. Table 15 lists the recoveries by year of recovery and international statistical area.

Lingcod, September-November 1969

A total of 58 lingcod was tagged off the Columbia River in depths of 32-55 fathoms. A total of 5 tags had been recovered through December 31, 1970 (Table 16).

Shrimp Fishery

Management

A record 59 vessels delivered 13,733,806 pounds into Oregon ports during 1970 (Table 17). This was 25% more than the previous record landing (1968) of 10,976,300 pounds, 31% more than the 1969 landings (10,504,823 pounds). Continued abundance of shrimp, especially the 1968 year class (age group II), and record market demand early in the season contributed to the record 1970 fishery. Fishermen received 14¢ per pound in 1970, compared to 12¢ per pound in 1969, even though a severe market slump in May continued through July in south and south-central Oregon ports. Ex-vessel value of the 1970 catch was approximately 1.8 million dollars.

About 90,000 pounds of shrimp were captured off Oregon in February 1970, during the Oregon closed season (November 1-February 28). This was

Table 14. Recoveries of Dover Sole, by Year by International Statistical Area (AEC Study)

International Statistical Area	Recoveries by Year							Total
	1964	1965	1966	1967	1968	1969	1970	
3A	268	172	82	61	33	13	18	647
2C				1	2			3
Unknown	2							2
TOTAL	270	172	82	62	35	13	18	652

Table 15. Recoveries of Dover Sole by Year by International Statistical Area

International Statistical Area	Recoveries by Year			Total
	1968	1969	1970	
3A	21	11	6	38
TOTAL	21	11	6	38

Table 16. Recoveries of Lingcod by Year by International Statistical Area

International Statistical Area	Recoveries by Year		Total
	1969	1970	
3A	3	2	5
TOTAL	3	2	5

Table 17. Annual Oregon Shrimp Landings by Port (1957-70)
in Thousands of Pounds

Year	Astoria Warrenton	Garibaldi	Newport	Coos Bay - Winchester Bay	Port Orford	Brookings	Total
1957	117	0	0	287	0	0	404
1958	1,522	0	0	400 lbs.	0	0	1,522
1959	2,368	0	0	6	0	390	2,764
1960	590	0	0	84	0	459	1,133
1961	768	0	0	431	0	257	1,456
1962	395	0	0	886	19	1,451	2,751
1963	1,072	0	0	1,570	0	473	3,115
1964	233	0	31	4,414	405	394	5,477
1965	73	0	21	925	180	552	1,751
1966	102	0	622	2,800	665	562	4,751
1967	1,722	1,290	3,092	2,653	784	832	10,373
1968	2,340	559	2,048	4,122	1,271	637	10,977
1969	2,726	2,358	1,505	3,696	74	146	10,505
1970	2,633	1,401	2,996	4,923	1,231	550	13,734
Mean 1957-70	1,190	1,402	1,474	1,914	514	559	5,051
5-Year Mean (1966-70)	1,905	-	2,053	3,639	805	545	10,068

delivered into Washington by Oregon vessels and transshipped to Oregon for processing. Following a request by the FCO, the Washington Department of Fisheries issued an emergency order to restrict shrimp caught south of 45°15' N. latitude (Oregon-Washington boundary) from being landed in Washington prior to March 1, 1971. The order was similar in nature and function to those issued by the FCO for several years (including 1970) with regard to the northern California fishery (area 18). It was the first time Washington has done such an act in Oregon's behalf.

Catch Statistics

Landings were above average at every port except Garibaldi and Brookings, where landings were about average. A record landing was made at Coos Bay-

Winchester Bay - 4,923,000 pounds (Table 17). Much of this catch was made in March and April before market problems severely cut back production. The slump also affected Brookings' processors and effected a late start there. Improving market conditions showed in increased production at Coos Bay and south during August (Table 18). The market problems did not affect northern Oregon processors significantly, and monthly landings at Newport, Garibaldi, and Columbia River ports were largest during May-July. Much of the increase in mid-season catches there were due to improved fishing and weather conditions over pre-May conditions.

The most important fishing development in 1970 came at Port Orford where after a record 1968 fishery, shrimp could scarcely be found in 1969 or much of 1970.

Table 19 summarizes monthly catch, effort, and catch/effort in each state area of catch (Figure 2). In August 1970, shrimp became available in Area 20 (Port Orford), and between August 20-October 9, 1,550,400 pounds were taken by 17 vessels at a catch rate exceeding 1,200 pounds per hour tow. The 1968 year class dominated landings, but the 1969 year class contributed significantly also. The 1970 year class (0-age group) appeared strongly in October catches (personal communication, numerous fishermen) and should show strongly in 1971.

Other areas off Oregon also were good producers in 1970, with the exception of area 28 (Tillamook Head), where catch and catch/effort were substantially below 1969 levels (Table 20), but close to the long-term mean in both catch and catch/effort (601,300 pounds; 497 pounds/hour in 1970 vs. 616,700 pounds; 506 pounds/hour mean for 1957-70). The 1970 catch was, however, much below the 1966-70 mean of 1,050,800 pounds (619 pounds/hour).

Table 18. Monthly Landings and Fleet Size by Port in 1970

	Astoria	Garibaldi	Newport	Coos Bay	Port Orford	Brookings	Total
March C	197,627	240,087	100,759	761,746	0	0	1,100,219
V	7	3	9	28	0	0	38
April C	278,127	119,255	293,034	1,392,519	6,900	0	2,089,835
V	7	4	12	32	1	0	45
May C	400,578	491,787	289,359	330,227	0	36,795	1,548,746
V	7	8	8	21	0	4	44
June C	752,418	211,962	501,272	356,418	0	0	1,822,070
V	9	6	13	13	0	0	33
July C	441,150	163,105	680,694	222,243	0	118,024	1,625,216
V	7	6	15	12	0	3	32
Aug. C	318,358	203,516	598,833	635,851	313,000	215,975	2,285,533
V	4	3	11	17	10	9	41
Sept. C	161,132	169,460	321,007	837,624	770,400	157,000	2,416,623
V	4	3	6	19	13	11	42
Oct. C	83,508	1,740	210,799	386,767	140,600	22,150	845,564
V	3	1	5	13	9	5	31
Total C	2,632,898	1,400,912	2,995,757	4,923,395	1,230,900	549,944	13,733,806
V	12	8	22	35	13	14	59

Table 19. Oregon 1970 Catch (C), Catch for Which Effort is Known (C_e), Effort, and Catch/Effort by Area

OFC Statistical Area		March	April	May	June	July	August	September	October	Totals
32	C	0	0	0	361,051	114,193	0	0	0	475,244
	C _e	0	0	0	334,747	114,193	0	0	0	448,940
	e	0	0	0	(7) 451	(5) 129	0	0	0	(7) 580
	C/e	-	-	-	742	885	-	-	-	775
30	C	4,458	1,820	0	277,612	299,246	128,518	60,985	6,014	778,653
	C _e	4,458	1,820	0	271,745	299,246	128,518	38,985	6,014	750,786
	e	(2) 13	(1) 10	0	(7) 565	(7) 486	(3) 225	(3) 85	(1) 9	(7) 1,393
	C/e	343	182	-	481	616	571	459	668	539
29	C	0	260	0	2,450	161	5,500	0	0	8,371
	C _e	0	260	0	2,450	161	5,500	0	0	8,371
	e	0	(1) 2	0	(2) 9	(1) 1	(1) 9	0	4	(2) 25
	C/e	-	130	-	272	161	611	-	0	335
28	C	130,763	113,788	4,900	54,063	6,062	168,032	79,638	44,051	601,297
	C _e	130,763	113,788	4,900	54,063	6,062	168,032	79,638	38,003	595,249
	e	(11) 297	(7) 214	(3) 13	(6) 125	(4) 24	(4) 272	(4) 142	(3) 110	1,197
	C/e	440	532	377	432	252	618	561	345	497
26	C	125,649	500,113	1,113,374	359,604	187,270	245,546	287,402	96,804	2,915,762
	C _e	125,649	493,775	1,074,606	338,952	176,390	245,546	287,402	96,804	2,839,124
	e	(11) 322	(17) 672	(21) 2,034	(16) 643	(11) 343	(10) 435	(8) 452	(7) 173	5,074
	C/e	390	735	528	527	514	564	636	560	560
24	C	65,750	44,479	63,450	410,580	677,467	573,111	223,574	149,178	2,207,589
	C _e	65,750	33,839	63,450	389,363	671,103	573,111	223,574	124,098	2,144,288
	e	(8) 153	(7) 41	(4) 106	(12) 522	(15) 1,006	(12) 833	(6) 315	(5) 201	3,177
	C/e	430	825	598	746	668	688	710	617	675

Table 19. Continued

OFC										
Statistical Area		March	April	May	June	July	August	September	October	Totals
22	C	773,569	1,428,435	324,077	317,454	188,519	616,201	673,579	365,013	4,686,847
	C _e	770,976	1,385,158	308,110	312,685	188,519	616,201	562,100	333,100	4,476,849
	e	(28) 1,048	(33) 1,623	(21) 625	(13) 942	(12) 600	(17) 1,228	(20) 1,228	(13) 639	7,933
	C/e	736	856	493	332	314	502	458	520	565
21	C	30	940	6,150	39,256	33,724	4,850	106,767	7,965	199,682
	C _e	30	940	6,150	39,256	33,724	4,850	106,767	7,965	199,682
	e	(1) 3	(2) 8	(2) 14	(7) 74	(5) 92	(4) 22	168	23	404
	C/e	10	118	439	530	366	220	635	345	494
20	C	0	0	0	0	0	418,850	955,478	176,089	1,550,417
	C _e	0	0	0	0	0	349,000	883,578	166,289	1,398,867
	e	0	4	0	0	0	(14) 203	(17) 713	(10) 219	(17) 1,139
	C/e	-	(1) 0	-	-	-	1,720	1,240	760	1,228
19	C	0	0	17,445	0	550	94,275	29,200	450	141,920
	C _e	0	0	5,950	0	550	84,875	29,200	0	120,575
	e	0	0	(3) 21	0	(1) 5	(8) 191	55	-	272
	C/e	-	-	280	-	110	444	531	-	443
18	C	0	0	19,350	0	118,024	30,650	0	0	168,024
	C _e	0	0	6,600	0	118,024	21,350	0	0	145,974
	e	0	0	(3) 14	0	(3) 157	(3) 26	0	0	197
	C/e	-	-	470	-	752	821	-	-	740
TOTALS	C	1,100,219	2,089,835	1,548,746	1,822,070	1,625,216	2,285,533	2,416,623	845,564	13,733,806
	C _e	1,097,626	2,029,580	1,469,766	1,743,261	1,607,972	2,196,983	2,211,244	766,130	13,122,662
	e	1,836	2,574	2,827	3,331	2,843	3,444	3,158	1,362	21,375
	C/e	598	790	520	523	565	638	700	564	614
V	38	45	44	33	32	41	42	31	59	

e - (n)N = number vessels in parentheses; hours towed.
V - number vessels.

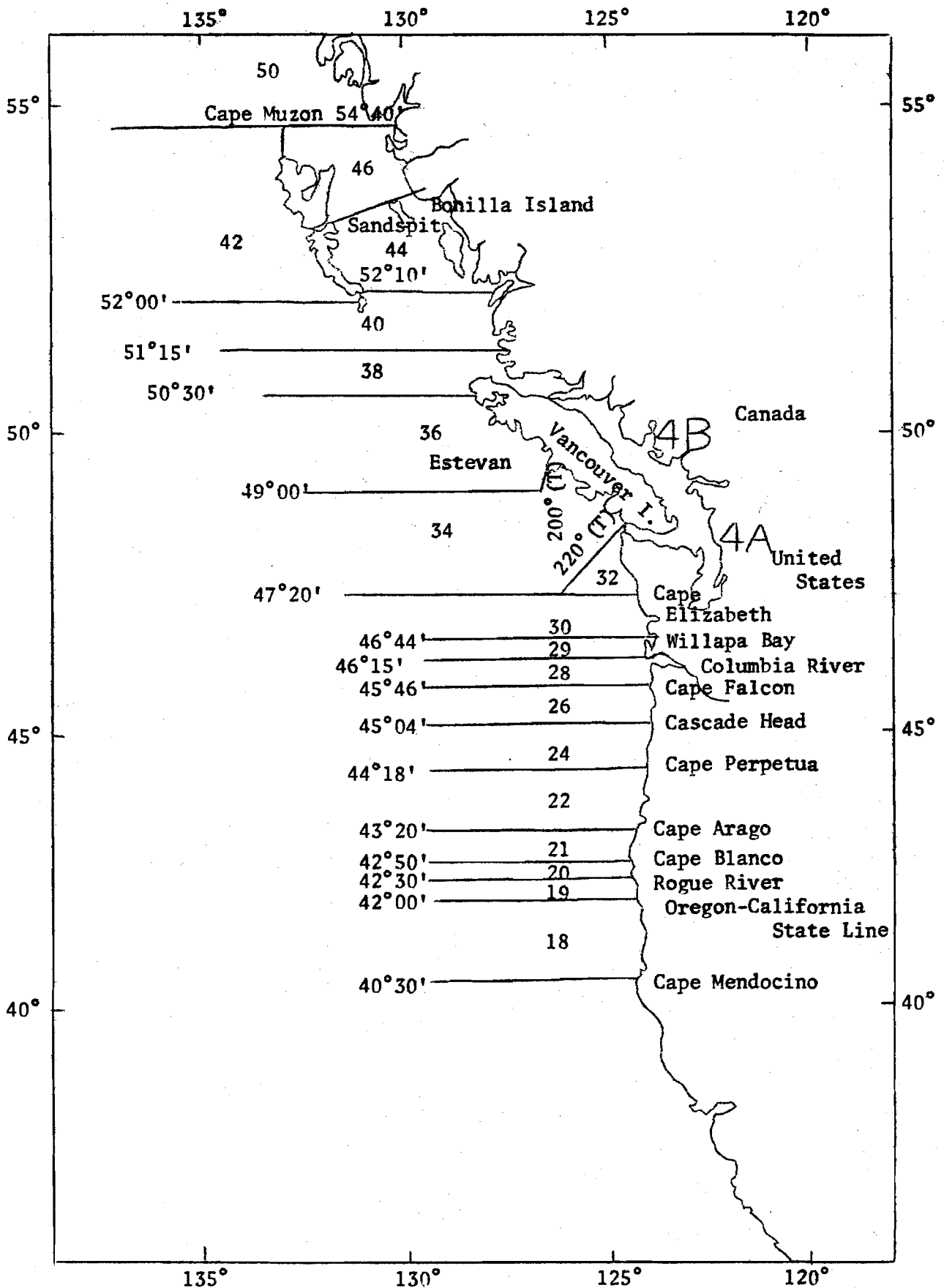


Figure 2. Chart of Pacific Coast Showing State Statistical Areas

Table 20. Annual Oregon Shrimp Catch and Catch/Effort by Area of Catch (thousands of pounds)

Year		Area of Catch									
		32	30 1/	28	26	24	22	21	20	19	18
1957	C	0	0	116.8	0	0	286.8	0	0	0	0
	C/E	-	-	n.a.	-	-	n.a.	-	-	-	-
1958	C	0	81.8	1,017.8	423.3	0	0	0	0	0	0
	C/E	-	386	569	569	-	-	-	-	-	-
1959	C	2.0	191.7	980.0	1,149.9	0	50.1	0	0	16.1	374.2
	C/E	120	505	526	523	-	501	-	-	240	510
1960	C	0	2.0	339.8	249.1	0	82.3	0	0	136.7	322.5
	C/E	-	250	300	345	-	445	-	-	318	644
1961	C	0	367.4	214.9	185.2	0	431.1	0	0	74.9	182.4
	C/E	-	356	311	354	-	562	-	-	550	839
1962	C	0	101.7	183.0	110.3	0	681.5	223.0	6.4	151.4	1,293.0
	C/E	-	394	325	380	-	336	640	n.a.	470	574
1963	C	0	14.9	441.2	588.8	0	1,205.3	421.1	3.6	113.0	326.9
	C/E	-	340	615	511	-	540	820	360	286	495
1964	C	0	11.3	77.7	145.5	2.0	2,639.9	1,894.2	496.1	0	210.8
	C/E	-	342	600	582	183	549	837	771	-	518
1965	C	0	3.8	8.8	83.4	0	739.9	181.6	212.6	446.0	74.4
	C/E	-	172	231	268	-	309	367	450	315	386
1966	C	0	0	24.4	226.3	473.2	1,928.8	837.8	862.2	350.8	47.7
	C/E	-	-	469	680	553	502	562	729	368	401
1967	C	0	102.9	1,636.5	2,705.7	1,656.5	1,678.2	1,028.2	733.6	744.6	87.8
	C/E	-	672	677	625	580	321	512	655	482	794

Table 20. (Continued)

Year		Area of Catch									
		32	30 ^{1/}	28	26	24	22	21	20	19	18
1968	C	0	25.2	1,771.6	2,660.8	325.9	4,062.8	238.9	1,302.7	307.2	281.2
	C/E	-	494	792	635	556	580	636	1,087	554	895
1969	C	166.4	1,067.4	1,220.0	3,852.1	251.1	3,666.9	159.4	2.1	15.0	140.4
	C/E	692	690	662	567	430	431	398	58	157	551
1970	C	475.2	787.1	601.3	2,915.8	2,207.6	4,686.9	199.7	1,550.4	141.9	168.0
	C/E	775	539	497	560	675	565	494	1,228	443	740
Mean	C ^{2/}	53.6	152.5	616.7	1,176.6	702.3	1,581.5	576.0	574.4	208.1	292.4
	C/E	529	428	506	508	496	470	585	667	380	612
1966-70	C	128.3 ^{3/}	396.5	1,050.8	2,472.1	982.9	3,204.7	492.8	890.2	311.9	145.0
	C/E	734	599	619	613	559	480	520	751	401	676

^{1/} Areas 30 and 29 combined.

^{2/} Mean C, C/E calculated starting with first year in which landings were recorded per area.

^{3/} Area 32 1969-70 mean only.

Area 24 (Cape Foulweather) produced record catch and catch per effort in 1970, reflecting a possible general southward shift of shrimp within the northern Oregon beds (24-26-28). A total of 2,207,600 pounds was taken from area 24, at a catch rate of 675 pounds per hour tow.

Area 26 (Cape Lookout) produced 2,915,800 pounds (560 pounds/hour) down from 1969 (3,852,100 pounds), but well above average.

Fishing was more or less continuous throughout the northern Oregon areas; probably populations within areas 24, 26, and 28 are a single population. For that reason, length-frequency graphs were pooled for these areas.

Area 22 produced a record 4,686,900 pounds (plus an additional 200,000 pounds in area 21). Areas 22 and 21 probably include a single population. Little or no difference in age and sex composition is apparent between them.

Catches off Washington totaled 475,200 and 787,100 pounds in areas 32 and 30, respectively. Catch off California (area 18) totaled 168,000 pounds. The catch off California, plus that in area 19 (southern Oregon) totaled 309,900 pounds (141,900 in area 19) which when added to California deliveries of shrimp from these areas, added up to 3,996,900 pounds.

The California quota (3.4 million pounds) was thus considerably exceeded in 1970 from these areas. Oregon closed the season for area 18 catches in August after the California quota was filled and their season closed. Some fishing in area 19 continued into September; most Brookings (and some California) vessels shifted their effort to area 20 after the joint closures in area 18.

Biological Work

Most biological work was restricted to market sampling of commercial catches at Astoria, Newport, and Charleston. Length-frequency distributions

by sex are summarized in Figures 3, 4, and 5 (areas 22; 24-26-28; 18-20-30, respectively).

Area 22 catches (Figure 3, Table 21) showed dominance of the 1968 year class throughout the year, with a strong showing of the 1969 year class from August on. A few 1970 year class shrimp appeared in catches by September, indicating this year class will probably be strong in 1971. Early March catches were not only dominated by the 1968 year class, but by 1968 year class females. Approximately 75% of these catches were 1968 year class females. Apparently sex segregation occurred between September 1969 and March 1970. By April, sex ratio of the year class was more normal in catches. About 82% of early March-caught females were gravid; by April only 8% were gravid. Age II shrimp made up 91% (April) - 51% (October) of catches in area 22.

Area 28-26-24 shrimp catches (Figure 4, Table 22) were also dominated by the 1968 (age II) year class, but 1967 (age III) shrimp (probably including a substantial proportion of 1966 year class (age IV) shrimp) was much stronger in catches than in area 22 during March and April. By July, however, the III+ group had diminished to a relatively insignificant portion of catches. The 1969 year class (age I) appeared strongly in catches by June. Many females were gravid during March; by April 1, gravid females were rare in catches. Up to 20% of the 1968 year class apparently had spawned during the winter of 1969-70 as primary females. As in area 22, few of the 1969 year class changed sex; some of the 1968 year class also failed to change sex by October. This means that the 1968 year class will contribute some first-time spawning females at age 3-1/2 during 1971.

In areas 18, 20, and 30, limited length-frequency data (Figure 5, Table 23) showed dominance of the 1968 year class (areas 18, 20) with a very

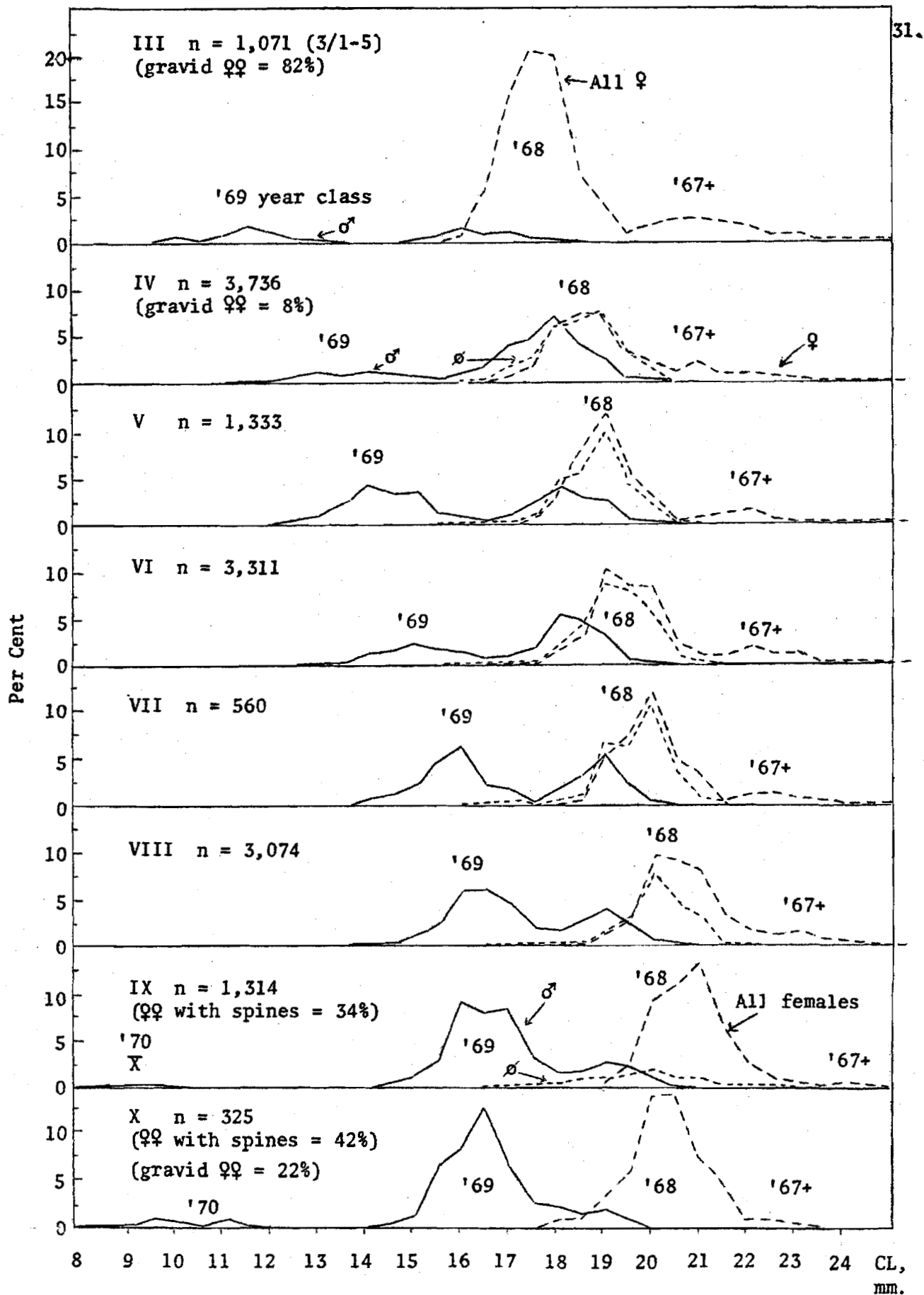


Figure 3. Area 22 Length-Frequency-Sex Composition by Month in 1970

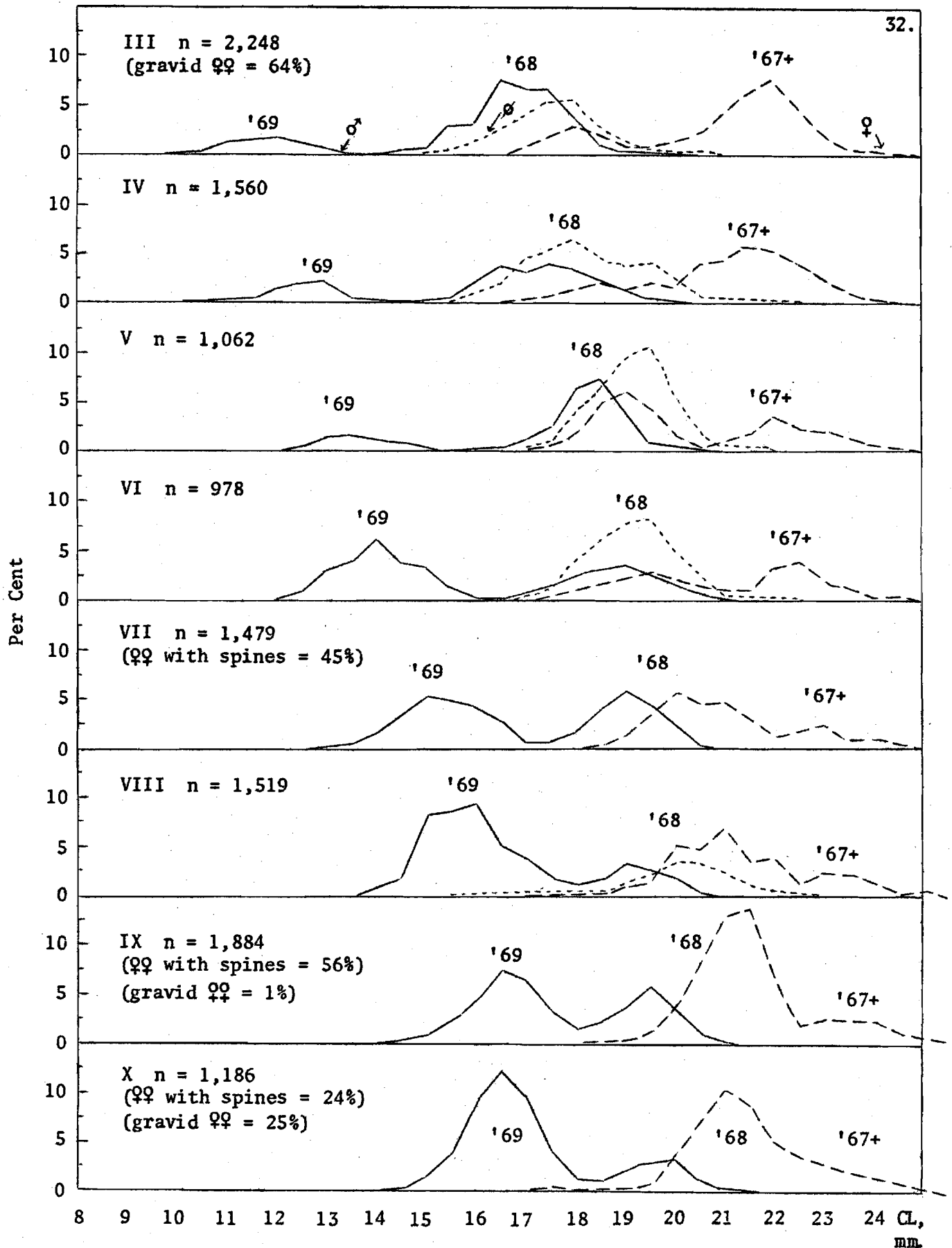


Figure 4. Area 28-26-24 Length-Frequency-Sex Composition by Month in 1970

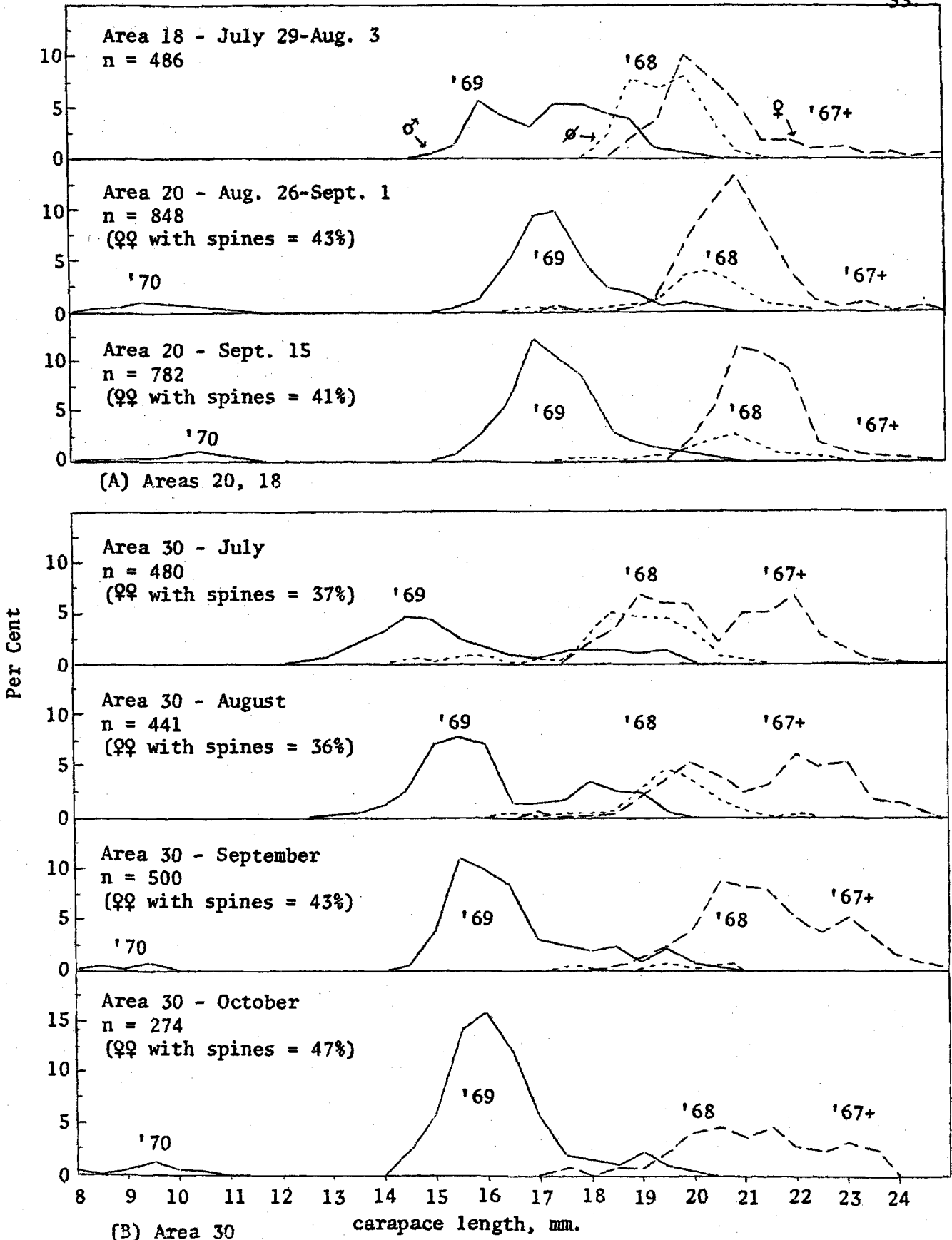


Figure 5. Areas 30, 20, and 18 Length-Frequency-Sex Composition, 1970, by Month

Table 21. Age and Sex Composition in 1970, Area 22 Samples
by Month, with Per Cent Gravid and Spineless Females

Month	Year Class ^{1/}	Per Cent			% Total	Females		Remarks
		♂	♂	♀		Gravid	No Spines ^{2/}	
March	70	0	0	0	0	-	-	
	69	5.4	0	0	5.4	-	-	
	68	3.9	1.8	74.8	80.5	74.8	-	sex segregation
	67	0	0	14.1	14.1	87.4	-	
April	70	0	0	0	0	-	-	
	69	6.3	0	0	6.3	-	-	
	68	26.0	30.8	33.9	90.7	8.2	-	sex integration
	67	0	0	3.0	3.0	5.3	-	
May	70	0	0	0	0	-	-	
	69	19.2	0.2	0	19.4	0	-	
	68	14.3	27.6	33.5	75.4	0.2	99.6	
	67	0	0	5.2	5.2	0	100.0	
June	70	0	0	0	0	-	-	
	69	9.4	0.2	0	9.6	0	-	
	68	17.3	29.9	37.1	84.3	0	99.9	
	67	0	0	6.1	6.1	0	100.0	
July	70	0	0	0	0	-	-	
	69	19.3	0.5	0	19.8	0	-	
	68	12.8	29.5	33.6	75.9	0	100.0	
	67	0	0	4.3	4.3	0	100.0	
Aug. ^{3/}	70	0	0	0	0	-	-	
	69	26.0	0.6	0	26.6	0	-	
	68	10.2	21.4	38.1	69.7	0	100.0	
	67	0	0	3.7	3.7	0	100.0	
Sept.	70	0.6	0	0	0.6	-	-	
	69	35.2	0.5	0	35.7	0	0	
	68	8.4	7.2	46.3	61.9	0	64.5	
	67	0.0	0.0	1.8	1.8	0	100.0	
Oct.	70	3.7	0	0	3.7	-	-	
	69	41.9	0	1.8	43.7	0	0	
	68	2.8	0	48.3	51.1	22.9	59.3	
	67	0	0	1.5	1.5	20.0	80.0	

^{1/} 1967 year class includes individuals of 1966 year class.

^{2/} No observations for sternal spines made prior to May, 1970.

^{3/} 8/1-9/70 - No females with spines. 8/10-30/70 - No observations made.

Table 22. Age and Sex Composition in 1970 (Areas 28-26-24) Samples by Month, with Per Cent Gravid and Spineless Females

Month	Year Class <u>1/</u>	Per Cent			% Total	Females		Remarks
		♂	♂	♀		Gravid	No Spines ^{2/}	
March	70	0	0	0	0	-	-	
	69	6.6	0	0	6.6	-	-	
	68	32.4	22.2	8.8	63.4	72.5	-	
	67+	0.4	0.6	29.0	30.0	34.2	-	
April	70	0	0	0	0	-	-	
	69	7.6	0	0	7.6	-	-	
	68	21.5	34.1	9.4	65.0	0.1	-	
	67	0	0.6	26.8	27.4	0.5	-	
May	70	0	0	0	0	-	-	} All males and transitional males possessed spines
	69	6.1	0	0	6.1	-	0	
	68	23.0	38.1	19.4	80.5	0	99.5	
	67	0	0.6	12.8	13.4	0	100.0	
June	70	0	0	0	0	-	-	
	69	24.0	0.1	0	24.0	-	0	
	68	16.5	35.4	11.7	63.6	0	93.8	
	67	0	0.5	11.9	12.4	0	100.0	
July	70	0	0	0	0	-	-	
	69	22.8	0.2	0	23.0	-	0	
	68	19.5	27.2	23.0	69.7	0	71.0	
	67	0	0	7.3	7.3	0	100.0	
Aug.	70	0	0	0	0	-	-	
	69	38.9	0.7	0.4	40.0	-	-	
	68	10.9	13.8	26.9	51.6	0	77.5	
	67	0	0.1	8.3	8.4	0	97.0	
Sept.	70	0	0	0	0	-	-	
	69	26.4	0.1	0	26.5	-	0	
	68	16.3	0.6	47.7	64.6	1.2	34.6	
	67	0	0	8.9	8.9	4.2	96.2	
Oct.	70	0	0	0	0	-	-	
	69	42.0	0	Tr.	42.0	0	0	
	68	10.7	0	39.4	50.1	24.0	71.0	} No gravid females or females in breeding dress had spines
	67	0	0	7.9	7.9	27.7	100.0	

1/ 1967 year class includes individuals of 1966 year class.

2/ No observations for sternal spines made prior to May, 1970.

Table 23. Age and Sex Composition in 1970 for Market Samples in Areas 18, 20, and 30, with Per Cent Gravid and Spineless Females

Month	Year Class ^{1/}	Per Cent			% Total	Females		Remarks
		♂	♀	♀		Gravid	No Spines	
July	70	0	0	0	0	-	-	} Area 18 (PMFC 92)
	69	14.6	0	0	14.6	-	-	
	68	19.7	28.8	34.5	83.0	0	100.0	
	67+	0	0	2.4	2.4	0	100.0	
Aug.	70	2.7	0	0	2.7	-	-	} Area 20 (PMFC 88)
	69	35.5	2.2	1.8	39.5	-	-	
	68	1.1	10.6	44.7	56.4	0	57.2	
	67+	0	0	1.4	1.4	0	100.0	
Sept.	70	2.5	0	0	2.5	-	-	} Area 20 (PMFC 88)
	69	43.6	0.1	0	43.7	-	-	
	68	4.2	7.9	40.2	52.3	0	59.3	
	67+	0	0	1.5	1.5	0	99.9	
July	70	0	0	0	0	-	-	} Area 30 (PMFC 74)
	69	21.0	2.5	0.6	24.1	0	0	
	68	6.5	20.4	26.5	53.4	0	39.4	
	67+	0	0.6	21.9	22.5	0	94.2	
Aug.	70	0	0	0	0	-	-	} Area 30 (PMFC 74)
	69	30.4	0.2	0.7	31.3	0	0	
	68	11.3	15.2	18.4	44.9	0	18.9	
	67+	0	0.2	23.6	23.8	0	94.3	
Sept.	70	1.6	0	0	1.6	-	-	} Area 30 (PMFC 74)
	69	37.8	0.2	0	38.0	-	-	
	68	8.6	1.2	40.2	50.0	0	29.0	
	67+	0	0	10.4	10.4	0	98.0	
Oct.	70	3.3	0	0	3.3	-	-	} Area 30 (PMFC 74)
	69	59.5	0	0.7	60.2	0	0	
	68	4.4	0	24.4	28.8	20.9	41.8	
	67+	0	0	7.7	7.7	9.5	95.2	

^{1/} 1967 year class includes individuals of 1966 year class.

strong showing of 1969 year class males (areas 20, 30). As in areas 24-26-28, area 30 catches showed a strong III+ group as late as August, probably mostly the 1966 year class. The 1970 year class showed in September in areas 20 and 30, indicating it will be strong in those areas during 1971.

Sternal Spine Observations

In May 1970, we began to record the presence (or lack) of sternal spines by sex. These paired spines appear mid-ventrally on the first three abdominal sterna of pandalid shrimps (McCrary, 1971). Males, transitional males, and immature females possess them; they are lacking on most females which have spawned. They are apparently lost at the molt (during October and later) preceding assumption of breeding dress (pleopods with setae) and spawning. They apparently are not regained by females at the post-larval release molt during which breeding dress is shed (in February-April). Results of our 1970 work suggested the above conclusions, along with McCrary's work, primarily on *Pandalus borealis* in Alaska.

The significance of the sternal spines are two-fold: (1) females which have spawned can be identified from those recently completing sex change prior to spawning in the fall. From this, an estimate of second-time spawners can be made. (2) more precise age-identification is possible. Very small age II females can be separated from large age I shrimp with the assumption that no age I shrimp could have functioned as females. Therefore, females lacking spines during summer-fall which might be assigned to the age I group actually are small age II females which spawned as 1-1/2 year-old females the previous autumn. Since most age III females have spawned at least once, (there are exceptions to this, however, noted in the foregoing text) large age II females with spines may be separated more surely from overlapping small age III females.

Results of the 1970 work are summarized in Table 24, all areas pooled. In May and June only a few females with spines were present. Some of these probably were parasitized by a bopyrid isopod. 1971 work has shown that parasitized females probably do not spawn. The rest probably are early maturing individuals completing sex change by July 1. In July, significant proportions of females with spines were present, and generally increased thereafter, reflecting the completion of sex change by transitional males. An unaccountable variation in per cent females with spines occurred between July and August - females with spines declined in August. A second decline occurred in October - this was due to many transitional males coming into breeding dress and spawning, thereby losing the spines. By November or December, with nearly 100% of females gravid, probably few individuals possessed spines. This was verified by March 1971, samples, in which only 0.5% of females (most gravid or in breeding dress) possessed sternal spines.

Table 24. The Loss of Sternal Spines in *Pandalus jordani* Females in Relation to Spawning (all areas pooled)

Month	No. Shrimp	No. Females	Per Cent of Females		
			With Spines	Without Spines	Ovigerous or in Breeding Dress
<u>1970</u>					
May	1,302	494	0.4	99.6	0
June	3,890	1,624	0.6	99.4	0
July	2,873	986	22.3	77.7	0
August	1,515	613	13.0	87.0	0
September	4,548	2,237	48.0	52.0	0.8
October	1,380	587	36.6	63.4	22.2
<u>1971</u>					
March	1,565	908	0.5	99.5	92.5

Tables 21, 22, and 23, show per cent of females without spines and per cent gravid females by month by area of catch. Most age group III+ females lacked spines throughout the year, as might be expected from the older females, most of which spawned as 2-1/2 year-old females prior to 1970. The few III+ group females possessing spines were either remnant portions which were maturing late (as 3-1/2 year-old females) or were parasitized. Most females with spines were among the 1968 year class (age II) as might be expected. If significant portions of the 1968 year class had not spawned as 1-1/2 year old primary females in the fall of 1969, much higher percentages of females with spines would have been present in late 1970.

Foreign Fishing

Groundfish and Shrimp Investigations has a four-point program involving foreign fisheries. They are (1) monitoring of the foreign fleet, (2) coordination and exchange of information with other fishery agencies, (3) preparation of materials for use by the U. S. Department of State in unilateral negotiations with the USSR, Japan, and Canada, and (4) collection and compilation of biological and statistical information for exchange with scientists of the USSR.

Table 25 lists the average number of foreign vessels observed off the Oregon and Washington coasts in 1969 and 1970.

Meetings Attended

During 1970, staff personnel attended 24 meetings concerned with fisheries on the west coast. Table 26 lists the meetings attended, location, date, and remarks.

Table 25. Average Number of Foreign Fishing Vessels Observed off the Oregon and Washington Coast by Country of Origin by Month During 1969 and 1970

State Month	1969			1970		
	USSR	Japan	Total	USSR	Japan	Total
<u>Oregon</u>						
January	0	0	0	0	1	1
February	1	0	1	0	0	0
March	1	0	1	1	0	1
April	5	0	5	12	0	12
May	35	0	35	28	0	28
June	18	0	18	20	0	20
July	2	0	2	10	1	11
August	1	0	1	13	1	14
September	9	1	10	24	2	26
October	16	1	17	24	4	28
November	5	2	7	21	0	21
December	0	1	1	1	0	1
Total Ship Months	93	5	98	154	9	163
Monthly Average	7.75	0.42	8.17	12.83	0.75	13.58
<u>Washington</u>						
January	0	1	1	0	2	2
February	1	1	2	0	2	2
March	0	1	1	0	3	3
April	0	1	1	1	0	1
May	3	0	3	2	0	2
June	29	0	29	19	1	20
July	46	1	47	22	1	23
August	36	3	39	25	1	26
September	23	1	24	17	1	18
October	5	1	6	13	1	14
November	2	2	4	1	0	1
December	0	2	2	0	1	1
Total Ship Months	145	14	159	100	13	113
Monthly Average	12.08	1.17	13.25	8.33	1.08	9.42

Table 25. (Continued)

State Month	1969			1970		
	USSR	Japan	Total	USSR	Japan	Total
<u>Oregon-Washington</u>						
January	0	1	1	0	3	3
February	2	1	3	0	2	2
March	1	1	2	1	3	4
April	5	1	6	13	0	13
May	38	0	38	30	0	30
June	47	0	47	39	1	40
July	48	1	49	32	2	34
August	37	3	40	38	2	40
September	32	2	34	41	3	44
October	21	2	23	37	5	42
November	7	4	11	22	0	22
December	<u>0</u>	<u>3</u>	<u>3</u>	<u>1</u>	<u>1</u>	<u>2</u>
Total Ship Months	238	19	257	254	22	276
Monthly Average	19.83	1.59	21.42	21.6	1.83	23.00

Table 26. Meetings Attended by Otter Trawl Personnel in 1970

Meeting	Location	Date	Remarks
American Fisheries Society	Corvallis	1/16-17	Oregon Chapter
FCO-BCF	Seattle	1/19-20	Shrimp Gear Coordination
Staff Meeting	Portland	2/16-18	Research Division
Interagency Coordination	Eureka, Calif.	2/24-26	Oregon-Calif. Shrimp Staffs
Groundfish Workshop	Eureka, Calif.	2/24-26	Aging Techniques
PMFC	Portland	3/23-24	Groundfish Committee
FCO-OSU	Astoria	3/27	Cooperative Shrimp Research
US-USSR Scientists	Seattle	4/28-29	R/V <i>Ogon</i> Staff
OTCO	Astoria	5/22	Budget Meeting
Task Force '70	Newport	7/15	Governor's Committee
Interagency Coordination	Salem	7/16	State Land Board
Technical Sub-Committee	San Francisco, Calif.	7/22-24	International Trawl Fishery Committee
FCO Meeting	Portland	8/14	Shrimp Hearing
Fisherman Hearing	Coos Bay	8/18	Rep. Dellenback
Interagency	Astoria	10/13	INPFC Discussion
Program Review	Newport	10/14	Research Division
PMFC	Portland	10/27	Advisor's Meeting
OTCO	Astoria	11/13	Annual Meeting
PMFC	Palo Alto, Calif.	11/16-20	Annual Meeting
Fishery Industry Liaison Meeting	Brookings	12/10	FCO, NMFS, OSU, USCG

Table 26. (Continued)

Meeting	Location	Date	Remarks
Fishery Industry Liaison Meeting	Coos Bay	12/11	FCO, NMFS, OSU, USCG
Fishery Industry Liaison Meeting	Newport	12/14	FCO, NMFS, OSU, USCG
Fishery Industry Liaison Meeting	Tillamook	12/15	FCO, NMFS, OSU, USCG
Fishery Industry Liaison Meeting	Astoria	12/16	FCO, NMFS, OSU, USCG

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