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# Pacific Cod Age Composition and Landing Statistics for Selected Fishing Grounds, and Quarter Years, in Hecate Strait, 1958-80

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November 1981

## Canadian Data Report of Fisheries and Aquatic Sciences No. 301

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PACIFIC COD AGE COMPOSITION AND LANDING  
STATISTICS FOR SELECTED FISHING GROUNDS, AND  
QUARTER YEARS, IN HECATE STRAIT, 1958-80

by

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Cat. No. Fs 97-13/301

ISSN 0706-6465

## ABSTRACT

Foucher, R. P., and K. F. Jacobs. 1981. Pacific cod age composition and landing statistics for selected fishing grounds and quarter years, in Hecate Strait, 1958-80. Can. Data Rep. Fish. Aquat. Sci. 3U1: iii + 11 p.

Use of a computer program to derive age compositions from length-frequency samples greatly reduced the time required for determining age composition of Pacific cod samples. A total of 133,588 fish were aged from 3 major grounds in Hecate Strait. The age group in greatest abundance in landings from both Horseshoe and Two Peaks-Butterworth grounds during April-June was age 3. In both cases there was a large increase of landings of age-2 fish relative to age-3 fish during July-September. In the White Rocks winter fishery age-2 fish were most abundant in the landings from October-December and the same year class was most abundant as age-3 fish from January-March.

**Key words:** Pacific cod, age composition, trawl landings, Hecate Strait.

## RÉSUMÉ

Foucher, R. P., and K. F. Jacobs. 1981. Pacific cod age composition and landing statistics for selected fishing grounds and quarter years, in Hecate Strait, 1958-80. Can. Data Rep. Fish. Aquat. Sci. 3U1: iii + 11 p.

En utilisant un programme informatique pour traiter les données de longueur et de fréquence, on a pu réduire considérablement le temps requis pour déterminer la composition par âge d'échantillons de morue du Pacifique. On a ainsi déterminé l'âge de 133 588 poissons pêchés dans trois grandes zones du détroit d'Hécate. Le groupe d'âge le plus abondant dans les débarquements des zones Horseshoe et Two Peaks-Butterworth d'avril à juin était celui de 3 ans. Dans les deux cas, on a constaté une forte hausse des débarquements de poissons de 2 ans par rapport aux poissons de 3 ans entre juillet et septembre. En hiver, dans la zone White Rocks, les poissons de 2 ans étaient les plus abondants dans les débarquements d'octobre à décembre, les poissons de 3 ans étant plus nombreux de janvier à mars.

**Mots-clés:** morue du Pacifique, composition par âge, débarquements de chalut, détroit d'Hécate.

## INTRODUCTION

Age composition of commercial landings is essential information for assessment of fish stocks. In the case of Pacific cod, a method of ageing by interpretation of annuli on scales has been developed (Kennedy 1969). However, there are problems with the criteria used to identify annuli, readability of the scales and the time required for this method.

A long time-series of length-frequency data are available for Pacific cod landings in British Columbia, and recently a method has been developed to convert length frequencies to age frequencies, using a computer program. The generalized method, developed by Schnute and Fournier (1980), was modified by Foucher and Fournier (In preparation) for application to Pacific cod.

This report contains resulting age compositions, of Pacific cod (converted to nos. landed), together with landing statistics for Pacific cod from important trawling grounds, and selected time periods, in Hecate Strait (Areas 5C and 5D) (Fig. 1).

## METHODS AND MATERIALS

Length-frequency data were obtained from Canadian commercial landings of Pacific cod from selected grounds in Hecate Strait. These samples were collected by port liaison officers and consisted of 100-300 fish each. Although samples sometimes included data by sex, the sexes were combined for consistency, and because of lack of evidence for a significant difference in length-at-age by sex, at least for those age groups making up the bulk of the samples.

Samples for ageing were grouped by month in most cases. Where there appeared to be little variation in the length frequencies over the three months of a quarter, especially during the winter when growth is likely to be slower, samples were grouped by quarter. Conversion from length frequency to age frequency was accomplished using a computer method described elsewhere (Foucher and Fournier, In Press).

Age frequencies, in numbers landed by age ( $N_i$ ), were computed as:  
 $N_i = (W/w) n \times p_i$  where  $W$  = Canada-U.S. landings ( $t$ );  $w$  = sample weight ( $t$ );  
 $n$  = numbers sampled; and  $p_i$  = proportion of fish at age  $i$ . Where samples were grouped by month these monthly  $N_i$ 's were summed by quarter-year.

Canada-U.S. landings of Pacific cod and corresponding calculated Canada-U.S. trawling effort are included in the tables. The method for calculating Canada-U.S. effort is described elsewhere (Westrheim et al., In Preparation).

## RESULTS

Age frequencies were calculated for three trawling grounds in Hecate Strait--Horseshoe (April-June and July-September), Two Peaks-Butterworth (April-June and July-September), and White Rocks (January-March and October-December) for the period 1957-80 (Table 1). A total of 133,588 fish lengths were involved, and ranged from 12,655 (Horseshoe/July-September) to 29,961 (White Rocks/January-March) among area-time cells.

Calculated age compositions for Canada-U.S. landings of Pacific cod from the selected area-time cells in Hecate Strait are contained in Tables 2-7, together with corresponding landings and calculated effort.

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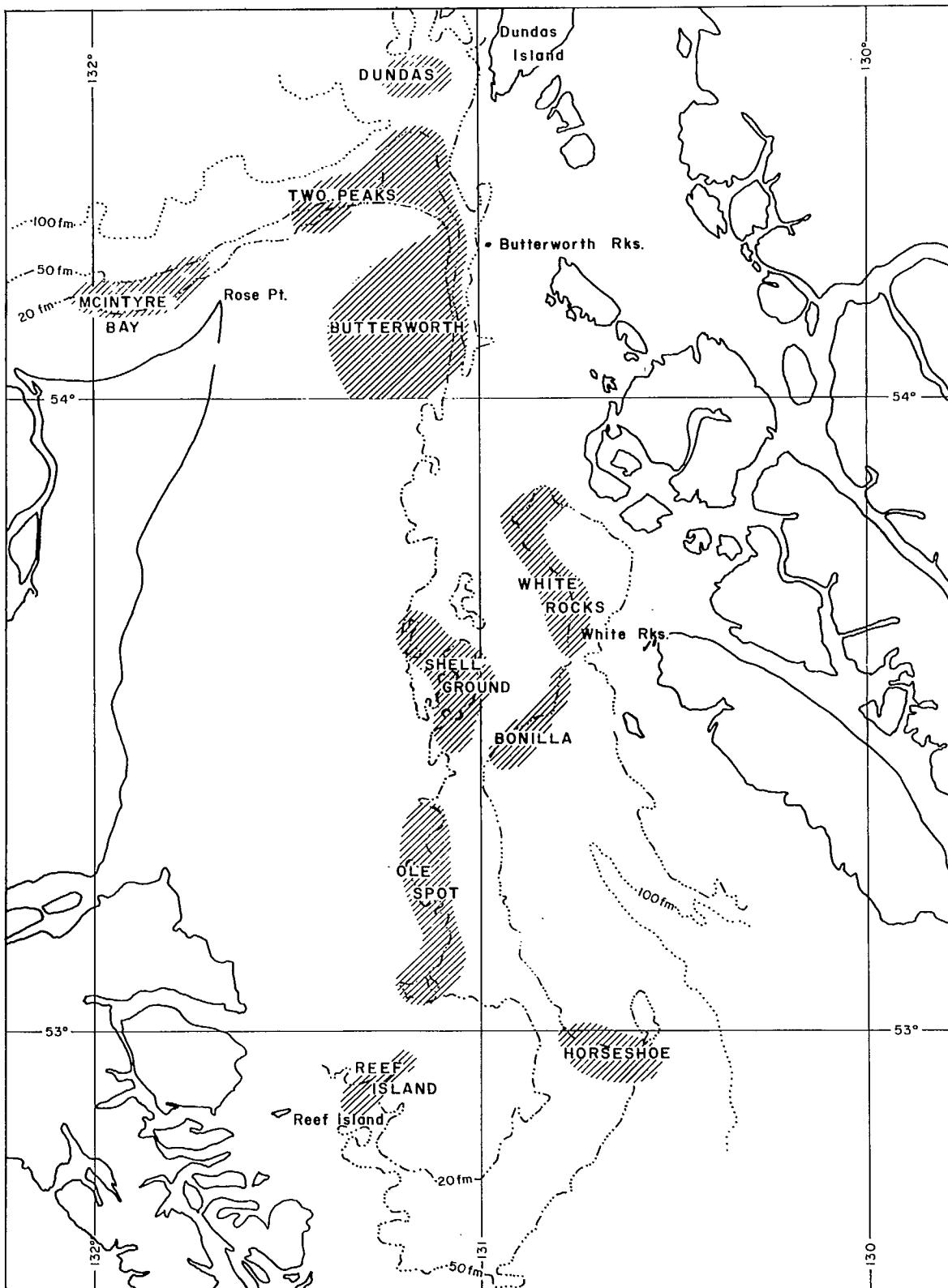


Fig. 1. Trawling grounds in Hecate Strait.

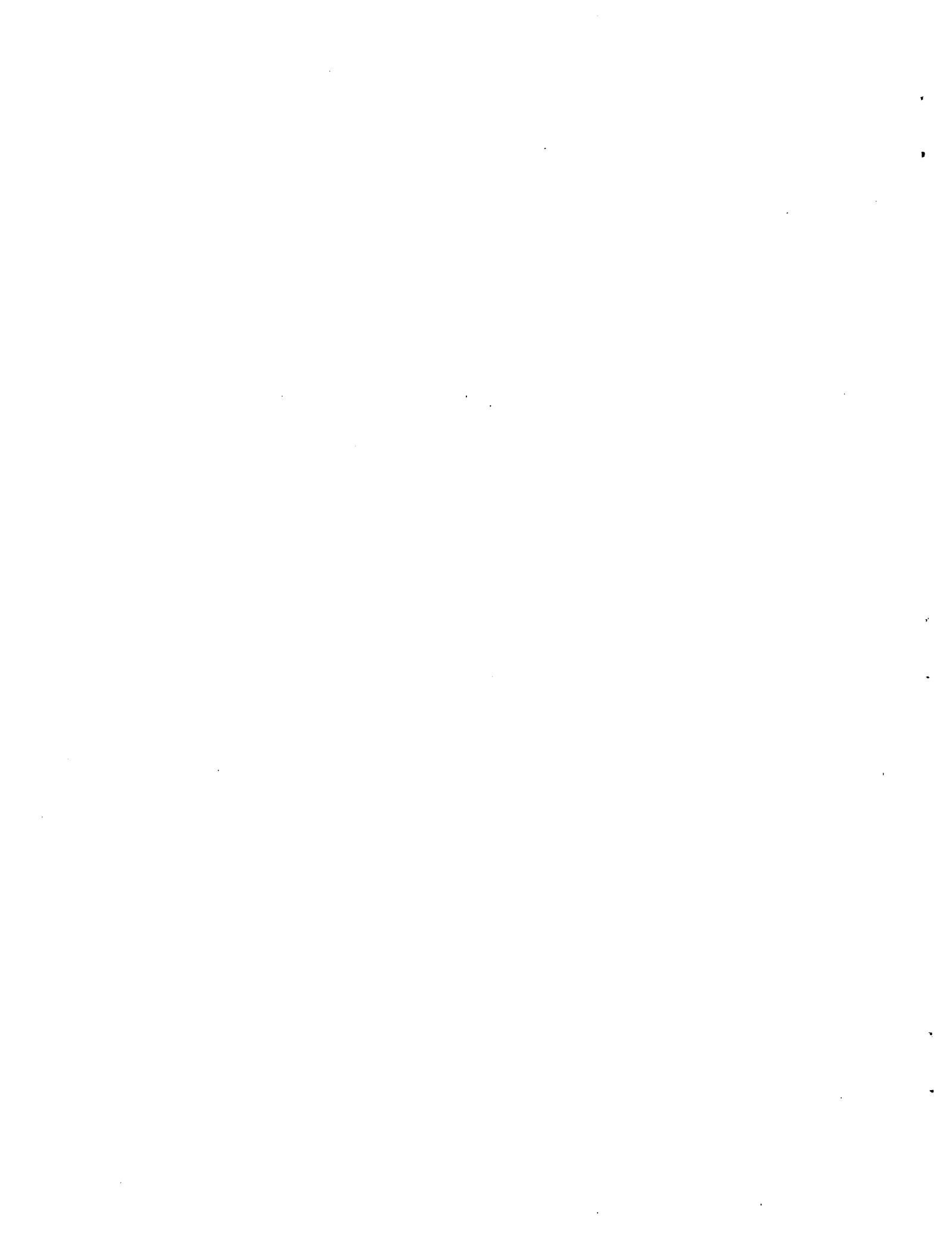


Table 1. Summary of length-frequency data used to determine age composition for samples grouped by month.

Ground	Quarter	Years	No. fish sampled
Horseshoe	Apr.-June	1958-80	25,740
	July-Sept.	1958-80	12,655
Two Peaks- Butterworth	Apr.-June	1959-80	18,886
	July-Sept.	1959-80	23,658
White Rocks	Jan.-Mar.	1960-80	29,961
	Oct.-Dec. <sup>a</sup>	1957-80	22,688
Total			133,588

<sup>a</sup>Samples grouped by quarter rather than by month.

Table 2. Pacific cod age frequency (nos. landed--in hundreds) for Horseshoe Ground,  
April-June, 1959-80

Year	Can.-U.S. landings (t)	Can.-U.S. effort (h)	Age								
			1	2	3	4	5	6	7	8	9
1958	705	569	-	30	3,034	143	116	13	-	-	-
1959	360	473	-	520	1,210	836	166	17	-	-	-
1960	172	848	-	144	444	166	15	12	1	-	-
1961	28	255	-	-	23	52	34	7	6	1	1
1962	10	116	No length-frequency sample available to age								
1963	500	438	-	525	1,398	322	40	54	3	-	-
1964	1,061	761	-	80	4,094	810	419	76	36	22	-
1965	1,418	1,256	-	384	3,818	1,581	579	182	69	1	-
1966	1,947	1,357	-	532	3,329	2,553	953	416	53	-	-
1967	581	759	-	108	1,159	778	184	101	14	10	-
1968	461	1,332	-	53	1,396	309	53	14	6	2	3
1969	278	1,125	-	-	17	669	182	50	13	0	2
1970	7	325	No length-frequency sample available to age								
1971	131	495	-	-	106	159	188	24	6	-	-
1972	295	495	-	1,012	602	174	53	-	-	-	-
1973	775	661	-	746	2,479	378	37	41	9	9	-
1974	610	596	-	1,674	1,040	133	378	26	35	5	8
1975	504	876	-	94	1,500	504	124	109	0	8	-
1976	338	600	-	258	495	648	117	13	48	-	-
1977	148	331	-	284	356	104	7	3	5	6	-
1978	356	639	-	52	862	374	130	39	9	17	1
1979	878	996	-	2,199	1,102	1,216	221	39	11	-	-
1980	762	1,030	58	576	1,755	1,070	304	96	0	5	-

Table 3. Pacific cod age frequency (nos. landed--in hundreds) for Horseshoe Ground,  
July-September, 1958-80

Year	Can.-U.S. landings (t)	Can.-U.S. effort (h)	Age								
			1	2	3	4	5	6	7	8	9
1958	130	66	-	64	363	97	6	7	1	-	-
1959	265	187	-	-	775	271	77	18	-	-	-
1960	220	392	-	292	443	253	0	24	5	-	-
1961	5	15	-	-	4	10	6	1	1	-	-
1962	89	173	5	175	56	140	32	15	0	2	-
1963	128	92	-	368	160	84	24	7	-	-	-
1964	171	171	-	1	272	237	117	28	11	3	-
1965	796	736	-	130	874	1,199	548	141	36	11	-
1966	1,043	755	-	137	722	1,440	755	247	37	-	-
1967	504	598	-	-	589	763	359	111	30	7	-
1968	134	410	-	20	254	143	39	22	3	3	-
1969	79	299	-	39	192	82	48	8	5	-	-
1970	21	64	No length-frequency sample available to age								
1971	7	33	-	-	6	8	10	1	-	-	-
1972	282	263	-	1,431	377	84	9	0	5	-	-
1973	522	280	-	760	709	779	88	38	10	-	-
1974	674	411	-	1,482	548	538	220	76	10	2	-
1975	267	448	-	123	868	90	71	30	0	0	3
1976	542	629	-	864	1,226	222	195	66	6	-	-
1977	125	308	-	161	83	235	41	14	5	-	-
1978	102	179	-	18	197	168	37	3	6	1	-
1979	382	614	6	1,267	118	368	240	7	7	8	-
1980	215	703	-	52	417	390	60	19	5	2	-

Table 4. Pacific cod age frequency (nos. landed--in hundreds) for Two Peaks-Butterworth Ground, April-June, 1959-80

Year	Can.-U.S. landings (t)	Can.-U.S. effort (h)	Age					
			2	3	4	5	6	7
1959	346	1,108	413	445	304	237	11	18
1960	144	635	30	546	65	28	4	8
1961	327	980	85	810	303	36	9	12
1962	129	702	74	199	126	22	22	4
1963	298	771	122	552	410	116	55	19
1964	469	592	1,451	613	284	108	15	-
1965	270	654	34	895	228	4	5	-
1966	1,796	1,449	673	2,096	2,518	639	53	44
1967	307	232	146	350	244	186	56	25
1968	572	2,187	144	1,310	260	183	119	41
1969	302	1,201	558	161	321	97	20	24
1970	195	1,745	177	438	137	25	31	17
1971	158	1,749	623	116	56	40	3	2
1972	314	1,067	No length-frequency sample available to age					
1973	288	735	1,428	566	145	0	22	-
1974	110	257	278	111	64	31	15	-
1975	469	778	1,035	769	394	186	31	11
1976	358	1,148	227	703	397	64	40	0
1977	303	1,672	171	549	333	40	82	21
1978	250	1,320	64	269	405	150	13	20
1979	667	1,614	3,048	244	451	172	49	6
1980	407	1,428	435	174	312	87	12	27

Table 5. Pacific cod age frequency (nos. landed--in hundreds) for Two Peaks-Butterworth Ground, July-September, 1959-80

Year	Can.-U.S. landings (t)	Can.-U.S. effort (h)	Age								
			1	2	3	4	5	6	7	8	9
1959	858	493	3	1,196	735	761	299	62	18	1	-
1960	599	751	-	435	706	578	121	191	2	52	11
1961	215	361	-	148	360	223	27	11	1	5	1
1962	401	296	-	52	404	331	327	99	22	0	12
1963	456	799	38	801	392	472	126	51	6	22	2
1964	1,304	658	-	2,170	1,616	782	533	153	45	20	-
1965	2,098	804	-	552	3,665	2,399	419	98	7	12	-
1966	757	806	28	306	157	178	116	49	8	-	-
1967	557	462	-	2,139	512	154	32	0	9	3	-
1968	336	730	5	373	294	278	119	25	16	5	1
1969	338	537	-	200	137	297	201	66	21	0	6
1970	239	678	-	279	287	209	78	23	5	1	7
1971	326	1,124	39	456	217	102	143	33	30	22	-
1972	875	1,030	-	3,097	783	423	122	0	36	0	36
1973	983	787	2	1,178	1,019	1,073	207	167	10	7	23
1974	1,450	989	20	3,321	1,088	1,462	399	103	25	25	-
1975	1,204	1,190	-	623	1,180	695	644	0	260	89	25
1976	876	1,535	57	1,797	1,276	85	347	61	6	82	7
1977	1,558	2,321	591	4,869	1,777	450	47	9	38	-	-
1978	354	796	140	155	290	422	168	36	6	5	-
1979	1,416	2,815	63	3,504	821	980	457	65	56	10	-
1980	1,059	2,317	377	3,068	1,156	366	129	67	-	-	-

Table 6. Pacific cod frequency (nos. landed--in hundreds) for White Rocks Ground,  
January-March, 1960-80

Year	Can.-U.S. landings (t)	Can.-U.S. effort (h)	Age								
			1	2	3	4	5	6	7	8	9
1960	780	1,935	-	176	2,193	485	193	52	30	18	4
1961	720	1,884	-	35	1,832	746	183	9	10	14	-
1962	682	2,607	-	283	1,091	686	286	105	32	17	7
1963	872	2,402	-	266	1,811	992	312	39	73	21	11
1964	506	1,424	-	10	1,153	544	343	51	8	3	3
1965	1,068	1,792	-	113	2,510	1,279	384	117	9	11	1
1966	667	1,607	-	32	984	914	204	130	0	2	-
1967	492	1,018	-	210	397	554	289	140	33	14	2
1968	708	1,694	-	24	1,749	762	304	148	47	14	9
1969	268	1,287	-	44	332	445	98	0	16	-	-
1970	357	696	-	32	1,067	191	11	25	3	1	-
1971	275	1,001	-	1,074	257	129	78	17	-	-	-
1972	132	368	-	280	216	125	55	3	0	3	-
1973	180	457	-	133	415	182	58	25	8	-	-
1974	182	493	-	150	381	201	34	4	0	0	4
1975	523	829	-	108	1,215	529	205	50	49	7	14
1976	720	1,392	-	18	1,948	647	189	127	33	3	8
1977	152	869	-	255	455	41	25	3	-	-	-
1978	169	569	-	66	547	170	33	11	4	2	-
1979	362	1,161	-	322	182	701	99	15	12	2	-
1980	716	1,423	-	346	1,679	899	239	100	33	12	3

Table 7. Pacific cod age frequency (nos. landed--in hundreds) for White Rocks Ground, October-December, 1960-1980

Year	Can.-U.S. landings (t)	Can.-U.S. effort (h)	Age								
			1	2	3	4	5	6	7	8	9
1957	930	1,118	-	2,989	877	149	91	21	8	-	-
1958	466	1,157	3	113	682	700	136	0	2	-	-
1959	526	1,728	-	2,101	432	84	11	5	-	-	-
1960	105	735	-	279	115	56	11	4	2	-	-
1961	89	779	-	240	74	47	0	12	2	1	-
1962	113	471	30	424	72	25	11	3	1	-	-
1963	179	602	255	139	67	15	6	-	-	-	-
1964	547	962	-	2,034	581	82	14	3	3	-	-
1965	577	1,263	20	827	789	471	126	9	5	5	-
1966	367	1,444	20	1,064	243	186	46	17	-	-	-
1967	702	1,695	-	2,321	446	217	61	12	-	-	-
1968	83	440	26	51	100	63	14	6	3	-	-
1969	11	44	No length-frequency sample available to age-								
1970	5	82	-	8	7	3	-	-	-	-	-
1971	6	240	No length-frequency sample available to age-								
1972	296	533	15	800	217	91	21	16	6	-	-
1973	207	519	153	208	163	179	118	22	11	-	-
1974	196	405	512	200	76	13	0	2	2	-	-
1975	343	773	5	1,197	339	137	67	7	0	2	-
1976	413	1,308	-	364	488	404	108	50	19	3	3
1977	143	582	556	180	106	37	4	11	-	-	-
1978	125	480	59	72	211	113	24	7	2	-	-
1979	86	394	-	319	54	62	34	4	-	-	-
1980	122	221	16	186	248	112	14	10	-	-	-

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