FISHERIES RESEARCH BOARD OF CANADA

MANUSCRIPT REPORTS OF THE BIOLOGICAL STATIONS

No.

425

Title

Brief on the

Fishery Wealth of British Columbia

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1951

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Fishery Wealth of British Columbia

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This report was presented at the Second Resources Conference in Victoria on February 17 and 18, 1949, and was given a limited distribution in the published transactions. As the compilations have general usefulness, they are reproduced in this form for supplementary distribution.

ABSTRACT

The fisheries wealth of British Columbia does not lend itself to ready expression in a single figure apart from dollar values. In recent years values have ranged from ten million dollars to fifty-nine million dollars (in 1947). The rise in value in recent years has been produced largely by rising dollar values of the products but also as a result of greater and more diversified production. Important parts of the resource such as the salmons, halibut, dogfish are being exploited to or beyond their capacity for sustained production. Others such as blackcod and soupfin shark give indications of over-fishing. Some, such as herring, albacore and pilchards have prospects of erratic production. Still others such as the rockfishes, ratfish, seaweeds, etc., give promise of increasing production as a result of technological advances, increased familiarity of the consuming public, and increased population. Some fisheries such as the herring, some salmon, etc. are carried out largely in local waters. In others such as halibut, flatfish, pilchard, etc. the fishing is mostly in international waters and the maintenance or increase of the British Columbia fishery depends upon the success with which Canadian fishermen can compete with those of other nationalities. Sufficient wealth exists to support an increased British Columbia fishing population, but if Canada is to maintain a favourable position in export trade and at the same time maintain high living standards in the fishing population, extensive increase in the numbers supported by the fisheries resource appears inadvisable.

The proper assessment of the present and future value of a natural resource such as fish demands a knowledge of the amounts of raw materials available, their disposition, and the possibilities for their replacement. These conditions are only partly fulfilled by existing information on the fish resources of British Columbia. Biological data on the existing stocks are as yet far from adequate. Also, although very useful records relating to quantities and values of the products handled annually by the fishing industry have been maintained for many years (and are freely drawn upon for the present report), these figures in some instances represent combinations of several important species, each of which may present a separate problem of assessment. In the present account some attempt has been made to indicate the status of these various components. In such cases, particularly salmon, flatfish, rockfish, and shellfish, it should be recognized that strict accuracy is by no means claimed for the figures presented, although it is believed that the general statements and conclusions are reasonably correct. It should be noted that a system for obtaining greatly improved fisheries statistics is now being set up by the Dominion Department of Fisheries.

Dollar values are notably poor indices of the real value of resources but the variety of products of the fishing industry in British Columbia is so great that it is only on the basis of value that all can be considered together. It has accordingly been considered justifiable to include table 1 in which are the annual values of marketed fish in British Columbia. As an index of how these total values have been influenced by price, table 2 is added in which the price per pound of important species is given.

Table 1. Total Marketed Value of Fisheries of British Columbia

Year	$	Year	$	Year	$
1876	104,697	1900	4,878,820	1924	21,257,567
1877	583,433	1901	7,942,771	1925	22,414,618
1878	925,767	1902	5,284,824	1926	27,367,109
1879	631,766	1903	4,748,365	1927	22,890,913
1880	713,335	1904	5,219,107	1928	26,562,727
1881	1,454,321	1905	9,850,216	1929	23,930,692
1882	1,842,675	1906	7,003,347	1930	23,103,302
1883	1,644,646	1907	6,122,923	1931	11,108,873
1884	1,358,267	1908	6,465,038	1932	9.909,116
1885	1,078,038	1909	10,314,755	1933	12,001,471
1886	1,577,348	1910	9,163,235	1934	15,234,335
1887	1,974,887	1911	13,677,125	1935	15,169,529
1888	1,902,195	1912	14,455,488	1936	17,231,534
1889	3,348,067	1913	13,891,398	1937	16,155,439
1890	3,481,432	1914	11,515,086	1938	18,672,750
1891	3,008,755	1915	14,538,320	1939	17,698,989
1892	2,849,483	1916	14,637,346	1940	21,710,167
1893	4,443,963	1917	21,518,595	1941	31,732,037
1894	3,950,478	1918	27,282,223	1942	38,059,559
1895	4,401,354	1919	25,301,607	1943	32,478,632
1896	4,183,999	1920	22,329,161	1944	34,900,990
1897	6,138,865	1921	13,953,670	1945	44,531,858
1898	3,713,101	1922	18,849,658	1946	43,817,147
1899	5,214,074	1923	20,793,914	1947	58,764,950 *

* Includes a considerable quantity of salmon canned from cold-storage stocks of fish caught in 1946.

Table 2. Marketed Prices of Selected Species of Fish.

Year	Herring per lb.	Halibut per lb.	Pilchards per lb.	Salmon per lb.
1917	.024	.152	.087	.105
1920	.012	.172	.061	.120
1925	.012	.122	.013('26)	.080
1930	.010	.096	.011	.072
1935	.006	.092	.007	.068
1940	.013	.120	.011	.096
1945	.033	.215	.021	.149
1947	.047	.246	.043	.163('46)

Commercial salmon fishing operations in British Columbia can be traced back for about a hundred years. A few of the earlier landmarks in this relatively long history are as follows:

1835-58. Curing and export of salmon from the Fraser river by the Hudson's Bay Company.

1863. Establishment of salmon curing plant at Becher bay.

1864. Establishment of salmon curing plant on the Fraser river.

1870. First commercial cannery established on the Fraser river.

1875. First cannery established on the Skeena river.

1887. Establishment of cold storage plants on the Fraser river.

1897. First shipment of cured chum salmon to Japan.

1904. (ca.) Introduction of the purse seine.

1906. (ca.) Introduction of the iron chink.

For the purpose of assessing the present status of the fishery it would seem unnecessary to reproduce the earlier catch records in detail. Total annual catches during the last 30 years are presented in table 3, together with a breakdown of the chief products as marketed. Included under "value", but not shown as marketed products, are certain quantities of liver, oil, roe, meal, and other items which are of relatively small value or which are only recorded for certain years.

Table 3. Salmon Caught and Marketed in British Columbia 1917--1947.

YEAR	VALUE	QUANTITY						
	(thousands of dollars)	Caught and landed (cwt.)	Salted or pickled	Fresh and frozen (cwt.)	Canned (cases)	Smoked (cwt.)	Dry-salted (cwt.)	Mild cured (cwt.)
1917	16,829	1,601,520		262,067	1,557,485	1,418	12,670	8,611
1918	17,207	1,493,502			1,626,157			
1919	17,537	1,668,353		441,779	1,393,156	7,147	8,235	5,857
1920	15,129	1,262,864	134	198,519	1,187,616	2,660	33,645	8,924
1921	8,578	842,026	595	237,712	603,548	1,293	64,205	9.801
1922	13,074	1,509,075	3,807	251,526	1,285,946	1,264	96,671	27,691
1923	11,937	1,514,765	1,732	228,087	1,341,677	373	103,116	14,624
1924	13,027	1,965,159	3,244	272,189	1,745,213	638	155,191	79,798
1925	14,974	1,873,376	450	204,319	1,719,282	655	138,454	27,770
1926	18,777	2,125,555	1,584	189,302	2,065,190	834	139,858	13,950
1927	14,254	1,490,395	384	210,096	1.360,634	432	81,170	21,918
1928	17,346	2,257,455	10,520	253,131	2,035,629	536	170,253	21,467
1929	14,266	1,514,038	233	206,314	1,398,770	438	77,362	21,913
1930	16,611	2,296,213	851	249,777	2,221,819	1,328	116,223	25,095
1931	7,195	1,287,041	136	214,033	685,104	177	386,693	9,149
1932	7,586	1,291,487	206	183,613	1,081,031	263	127,289	12,141
1933	9,184	1,410,504	279	214,138	1,265,049	439	82,875	18,262
1934	12,402	1,659,900	122	169,649	1,582,926	139	90,981	31,988
1935	12,099	1,789,431	2,027	288,347	1,529,022	85	169,480	20,368
1936	13,387	1,995,499	2,589	211,753	1,881,026	68	149,533	13,321
1937	11,908	1,691,736	23	261,363	1,508,577	81	108,983	26,238
1938	14,491	1,734,664	802	212,754	1,707,830	139	69,209	19,684
1939	12,995	1,476,372		232,978	1,539,057			24,221
1940	13,757	1,431,905		248,891	1,470,425	117		6,228
1941	20,879	1,900,349		186,550	2,295,431	301		12,331
1942	22,420	1,621,980		158,769	1,814,297	289		9,359
1943	14,740	1,214,214		197,089	1,258,221	103		7,378
1944	15,623	1,075,719		219,961	1,097,555	2,018		19,287
1945	25,425	1,709,649		357,256	1,739,308	3,388		13,942
1946	24,346	1,496,762		286,504	1,348,137	2,301		16,581
1947	35,693	1,628,100		439,440	1,527,135*	1,597		13,900

* Includes a considerable quantity canned from cold-storage stocks of fish caught in 1946.

Table 4. The number of salmon fishing licences issued in British Columbia.

Year	Gill-nets	Trolls	Purse-seines	Drag-seines	Trap-nets
1917	5,286	1,370	99	136	16
1918	5,073	1,786	122	147	24
1919	4,598	2,260	138	104	21
1920	4,761	1,855	155	45	19
1921	4,777	1,452	59	35	8
1922	4,483	1,513	147	40	4
1923	3,969	1,416	223	31	6
1924	3,696	1,553	242	32	6
1925	4,226	1,821	329	37	19
1926	4,850	2,416	445	41	6
1927	5,643	3,093	552	46	7
1928	5,179	2,987	397	22	7
1929	5,609	2,630	371	22	7
1930	6,061	3,115	343	21	7
1931	4,893	3,115	228	21	7
1932	5,359	3,033	157	30	7
1933	6,113	2,880	238	31	8
1934	6,826	3,099	296	9	8
1935	6,218	3,107	293	9	8
1936	6,620	3,511	287	9	7
1937	6,096	3,162	291	9	5
1938	7,125	3,453	300	9	5
1939	6,502	3,947	339	9	5
1940	6,392	3,222	350	9	5
1941	5,502	3,080	333	9	5
1942	5,253	3,843	312	9	5
1943	6,043	4,346	290	9	5
1944	5,426	4,483	293	10	5
1945	5,646	4,764	312	9	5
1946	7,346	5,727	346	9	5

The tables presented above show that total annual production of salmon has remained relatively constant over the past 30 years. From this fact it might be inferred that the fishery is in a stable condition and that a continuation of current measures of conservation will ensure the maintenance of production at about this level. This would be an optimistic viewpoint. "Salmon", as understood in the figures quoted, comprises six species of fish, namely, sockeye, spring, coho, pink, chum, and steelhead. In the early days of the fishery the sockeye provided by far the greater part of the catch. In later years production has only been sustained by utilizing far greater proportions of species which were formerly considered less desirable. More recently, these other species have shown weaknesses in certain years. Efficiency of gear has increased and the present mobility of the salmon fishing fleet is such that the appearance of a good run of any species in any area quickly results in an intensive fishery.

In general, it may be said that salmon stocks are being fully utilized and that no sustained increase in production is possible under existing conditions.

In addition to an intensive fishery, salmon stocks are being subjected to pressure through the impact of industrial operations on the freshwater habitats. Removal of forest cover has changed the character of the run-off in some areas and has almost certainly caused some deterioration in the conditions for natural propagation. The blocking of rivers by hydro-electric dams, the diversion of water for agricultural, industrial, and municipal requirements and the disposal of industrial effluents, are factors which, while not yet of widespread seriousness, will increasingly tend to restrict the available breeding grounds or the movements of fish towards these grounds. The maintenance of salmon stocks in the future would seem to depend to a large extent on (a) co-operation between different interests in planning the uses to which supplies of fresh water shall be put (b) the degree of success which attends efforts to increase the production of young salmon in the waters available for this purpose.

Although, as noted in the introduction to this report, precise figures cannot be presented for the annual catch of the several species included under "salmon", table 5 shows the extent to which each contributes to the canned pack.

Sockeyes. Nearly all the commercial catch of this species is canned. Over the period of the fishery, declines in stocks have occurred on the Fraser and Skeena rivers (the areas of greatest production) and also in less important districts such as the west coast of Vancouver Island. Increased runs to the Fraser river have occurred in recent years.

Springs. All or nearly all the salmon tabulated as "mild-cured" can be referred to this species. Large quantities are also marketed fresh and frozen. Spring salmon are also favoured for pickling. There is little precise information as to the status of this species in British Columbia at the present time, although the early season runs to certain rivers have declined in recent years.

Cohos. In addition to important contributions to the canned pack, large quantities of cohos are sold fresh. Considerable fluctuations in the runs are apparent, with production notably low in 1940 and 1946 but no strongly marked general trends presently apparent.

Table 5. British Columbia Canned Salmon Pack. 1917--1947

Year	Total Sockeyes	Total Springs	Cohos and Bluebacks	Steelheads	Pinks	Chums
1917	339,848	76,276	157,589	11,740	496,749	475,273
1918	276,459	107,354	191,068	15,916	527,745	497,615
1919	369,445	100,551	199,993	4,493	346,639	372,035
1920	351,405	118,301	120,033	2,395	520,856	84,626
1921	163,914	49,752	124,348	1,220	192,906	71,408
1922	299,614	39,596	109,276	1,657	581,979	258,204
1923	334,647	27,142	119,141	1,760	440,932	418,055
1924	369,503	27,456	119,989	1,811	657,538	568,916
1925	392,643	73,499	199,180	1,996	445,400	607,904
1926	336,995	69,199	181,894	2,165	772,993	701,962
1927	308,032	58,977	181,968	1,746	247,617	562,109
1928	203,541	18,856	156,757	865	792,362	863,256
1929	281,306	19,377	196,444	672	477,969	424,982
1930	477,678	38,804	190,594	1,656	1,111,937	401,114
1931	291,464	27,147	102,175	1,326	206,995	55,997
1932	284,355	76,060	188,971	1,168	223,716	306,761
1933	258,107	20,266	159,052	1,459	532,558	293,630
1934	377,882	29,784	225,430	1,282	435,364	513,184
1935	350,444	21,920	231,492	596	514,966	409,604
1936	415,024	29,854	246,061	1,068	591,532	597,487
1937	325,774	16,171	133,208	844	585,576	447,602
1938	447,453	15,531	301,123	1,035	400,876	541,812
1939	269,888	16,103	245,096	797	620,602	386,584
1940	366,403	17,741	224,524	1,205	213,911	643,443
1941	455,297	50,476	391,407	3,454	427,766	920,470
1942	666,571	24,745	211,139	4,649	270,622	633,834
1943	164,889	10,658	186,042 1/2	3,095	530,188 1/2	363,348 1/2
1944	247,714	19,362	183,546 1/2	3,926 1/2	389,692	255,316 1/2
1945	329,001 1/2	12,800	218,887	2,922	825,512 1/2	350,188
1946	543,027	8,100 1/2	100,154 1/2	4,115 1/2	116,607 1/2	576,133 1/2
1947	286,285	9,955 1/2	145,029	3,234	599,212	460,999

Pinks. Nearly all the pink salmon caught commercially are canned. It has been estimated that during the last ten years about 5% of the catch has been marketed fresh or frozen. Small quantities have at times been dry-salted.

Although fluctuating considerably, pink salmon catches have tended to decline in recent years at least in the Nass and Skeena areas (W. S. Hoar).

Chums. Although, as shown in table 5, this species makes a large contribution to the canned pack, it is also used in other ways. It has been estimated that between 1935 and 1947 about 40% of the chum catch has been marketed fresh or frozen. Chums also provided about 95% of the dry-salted salmon from 1925-38. The relatively small quantities of smoked and kippered salmon are largely of this species.

Chum salmon runs have been characterized by great irregularity in size. While a significant downward trend may not be established, recent low catches in certain years and certain areas give grounds for concern.

Steelheads. This species makes only a small contribution to the annual commercial salmon catch. Most of the yield is canned.

The general conservation requirements are not well known. In certain streams the runs appear to be maintaining themselves reasonably well.

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Halibut

Although halibut were sought by the primitive Indians no serious attempts were made at developing a fishery in the Pacific until 1888. In 1889 the total coastwise catch of the species was 17,772 cwt. of which 6,050 cwt. was landed in British Columbia. Thereafter the fishery grew apace with many accompanying improvements in vessels and fishing methods until finally over-exploitation of all accessible banks was apparent. In 1924 the fishery was placed under the control of an international commission (The International Fisheries Commission) which has since then regulated the catch on the quota basis and effected substantial rehabilitation.

The fishery is for the most part in international waters and the Canadian fishery is in competition with that of the United States for as large a share of the quota as possible. In table 6 Canadian landings are shown along with United States landings in Canadian ports. Many additional United States landings were made in the home ports of the boats. British Columbia halibut production can be increased by having more and better equipped Canadian vessels.

Halibut is almost entirely disposed of on the fresh and frozen markets and most of the Canadian production is exported. Increased population in British Columbia would naturally lead to increased local consumption.

In recent years the value of halibut livers and viscera as sources of vitamin A have been recognized. They are now a recognized by-product of the fishery and the production is shown in table 6.

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Table 6. Hundredweight of Halibut Landed in British Columbia.

	Landed by Canadian vessels	Landed by U. S. vessels	Liver	Viscera
1917	113,529	134,475	--	--
1918	72,578	113,651	--	--
1919	80,770	130,007	--	--
1920	92,006	146,764	--	--
1921	130,554	195,314	--	--
1922	120,695	172,489	--	--
1923	131,001	203,666	--	--
1924	122,250	209,132	--	--
1925	93,892	224,348	--	--
1926	110,257	204,838	--	--
1927	113,888	186,644	--	--
1928	100,396	202,424	--	--
1929	98,486	205,435	--	--
1930	84,818	169,978	--	--
1931	76,272	105,733	--	--
1932	62,503	106,344	--	--
1933	83,240	87,573	--	--
1934	97,681	84,921	--	--
1935	101,927	69,216	--	--
1936	105,918	62,203	--	--
1937	117,212	70,213	--	--
1938	120,247	73,302	--	--
1939	133,967	93,221	--	--
1940	126,936	112,352	--	--
1941	129,289	100,368	--	--
1942	110,282	133,633	--	--
1943	126,869	123,165	1,750	2,556
1944	131,671	57,577	2,177	3,474
1945	149,053	--	2,330	3,237
1946	179,910	--	2,595	2,893
1947	241,193	--	3,532	4,634
1948	188,308			

Herring

The commercial herring fishery in British Columbia has been pursued since, before 1887 to the present and the landings have increased from about 1,500 cwt. in 1887 to 2,563,403 cwt. in 1947 (3,395,013 cwt. in 1940 and more than 4,100,000 cwt. in 1948). Total production has fluctuated in response to changes in marketing conditions. The loss of the dry salt market in the late 1930's has been fully compensated for by the increase in canning during the war years and more recently by the reduction of herring to oil and meal.

It seems likely that herring production can be stabilized at more than 2,000,000 cwt. When market conditions justify the exploitation of the late runs in central and northern British Columbia sustained annual production in the province may reach 2,500,000 cwt. or even 3,000,000 cwt.

Up to the present the large production has been maintained by exporting most of the products (oil, meal, canned herring, dry salt herring). A greater proportion especially of the first two may find domestic outlets with increasing population. Additional consumption in British Columbia may be hoped for with improved cannery procedures and the development of further desirable specialty products.

References

A. L. Tester. The herring fishery of British Columbia - past and present. Bulletin of the Biological Board of Canada, No. 47. 1935.

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Table 7. Hundredweight of Herring Taken in British Columbia, Omitting Landings at Canadian Ports by U. S. Vessels.

Year	Cwt.	Year	Cwt.	Year	Cwt.
1917	487,241	1928	1,533,136	1938	1,528,913
1918	636,921	1929	1,315,667	1939	2,164,812
1919	567,868	1930	1,221,962	1940	3,395,013
1920	1,001,357	1931	1,481,080	1941	1,688,515
1921	943,476	1932	1,003,204	1942	2,324,827
1922	1,002,519	1933	1,077,159	1943	1,827,943
1923	1,035,823	1934	820,362	1944	1,871,038
1924	1,153,799	1935	1,008,507	1945	2,576,536
1925	1,435,665	1936	1,620,625	1946	2,123,651
1926	1,299,749	1937	1,929,795	1947	2,563,403
1927	1,720,646				

Pilchard

The pilchard fishery in British Columbia started in 1917 continuing as small canning and experimental operations until 1925 which was the first of several years of rapid expansion following the installation of reduction plants. The catch as shown in table 8 has fluctuated widely. These fluctuations have resulted from changes in demand (economic conditions), changes in the abundance of the fish, and variations in the availablity of fish to the fishery independent of their abundance. The recent decline in production reflects an actual decline in abundance resulting from the failure of the population to reproduce itself during a period of heavy exploitation.

Although there is very little overlap in pilchard fishing grounds between Canada and the United States the migrating habits of the fish renders a single population subject to exploitation by both Canada and the United States. The larger fish on which the Canadian fishery depends migrate between Canadian and Californian waters. The younger ones remain in the south. It is evident therefore that United States (California) policy in protecting young fish will influence the rehabilitation of the Canadian fishery to a large extent.

It seems likely that a succession of successful spawning years for pilchards will cause the restoration of a Canadian fishery at some time in the future. It is evident also that the fishery will always be an erratic one since both the abundance of the fish and the courses of migration are subject to variation.

Table 8. Hundredweight of Pilchard Taken in British Columbia

Year	Cwt.	Year	Cwt.	Year	Cwt.	Year	Cwt.
1917	1,600	1925	319,000	1933	81,000	1941	1,200,100
1918	72,800	1926	970,000	1934	860,000	1942	1,317,600
1919	65,600	1927	1,368,600	1935	906,400	1943	1,774,800
1920	88,000	1928	1,610,200	1936	889,000	1944	1,182,400
1921	19,800	1929	1,726,800	1937	961,600	1945	686,000
1922	20,400	1930	1,501,400	1938	1,035,400	1946	79,800
1923	19,400	1931	1,472,000	1939	110,400	1947	8,800
1924	27,400	1932	887,000	1940	575,400	1948	--

References

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Hart, J. L. Memorandum of the pilchard situation (unpublished).

Albacore

The fishery for albacore (tuna) is the most recently developed of the important fisheries in British Columbia as may be inferred from the table. The history of the fishery is so brief and the amount of scientific work on the species so scant that there is little basis for predicting the future of the fishery. The fluctuations in production which are shown by the landing figures have been caused more by variation in fishing intensity than by changes in the supply of fish. However, reliable indications are that the fishery relies upon two (or at most three) year broods of immature fish of varying size and radical fluctuations in landings of the same species have been experienced during the longer history of the California fishery.

The albacore fishery is carried on off shore--usually well off shore. As it is in international waters the Canadian fleet is in competition with those of other nationalities, particularly that of the United States. Improvements and increase in Canadian vessels and gear which are the natural accompaniment of increased population will increase the Canadian share of the catch but it is not possible to say whether such improvements will stabilize the fishery in the face of such causes of variation as have been experienced in the past.

The albacore pack is almost entirely canned but most of the catch is exported frozen for processing. Increase in the consuming population and decrease in price would both lead to increased local consumption.

Table 9. Hundredweight of Albacore Landed in British Columbia.

Year	Cwt.	Year	Cwt.
1939	2,838	1944	4,636
1940	45	1945	14,287
1941	760	1946	4,316
1942	--	1947	7,965
1943	288	1948	19,656

References

Brock, V. E. Contribution to the biology of the albacore (Germo alalunga) of the Oregon coast and other parts of the north Pacific. Stanford Ichthyological Bulletin, Vol. 2, No. 6, December, 1943.

Hart, J. L. and others. Accumulated data on albacore (Thunnus alalunga). Circular of the Pacific Biological Station, No. 12, May 10, 1948.

Fisheries Statistics of Canada.

Flatfish

Fishing for flatfish in British Columbia has been carried on for many years. The fishery is entirely carried on by trawlers of various types, and trawls are the only kind of gear capable of taking flatfish in commercial quantities. Production levels for the fishery were comparatively low as shown in table 10 for some time but rose sharply during the war years as a result of (1) increased demand for food, (2) improvements in the gear (3) increased knowledge of the fishery. Since 1945 production has held up to meet the demand resulting from the increasing popularity of quick frozen fillets. A large proportion of the production is exported to the United States. Canadian primary producers are in competition on the most grounds with a large well-equipped and aggressive United States fleet.

Excluding the halibut there are sixteen species of flatfish in British Columbia of which all but three enter into the commercial catch. One of the three has been used and small poundages may be included for some years in the table. The statistical record has been neither specific nor consistent in its separation of the catch into species although it is probable that the composition between 1920 and 1942 was reasonably constant with the bulk of the landings being comprised of lemon sole. Since then the total landing figures are quite inadequate to indicate the changes which have taken place in the fishery as the major effort has shifted from lemon sole to rock sole to brill. Records of substantial portions of the landings in 1947 and 1948 (November to October) show the following percentage compositions by species.

Table 10. Hundredweight of flatfish exclusive of halibut taken in British Columbia.

Year	Soles	Flounder, Brill, Plaice, etc.	Total	Year	Soles	Flounder. Brill, Plaice, etc.	Total
1917	7,806	7,826	15,632	1933	4,731	1,338	6,069
1918	12,092	15,062	27,144	1934	5,764	1,330	7,094
1919	14,262	23,878	38.140	1935	5,276	1,169	6,445
1920	2,374	11,122	13,496	1936	6,444	1,202	7,646
1921	2,967	2,005	4,972	1937	5,605	650	6,255
1922	9,253	3,614	12,867	1938	6,554	2,176	8,730
1923	3,675	754	4,429	1939	6,473	1,507	7,980
1924	4,847	509	5,356	1940	7,673	6,247	13,920
1925	4,978	3,738	8,716	1941	4,954	3,700	8,654
1926	6,518	1,152	7,670	1942	6,375	5,924	12,299
1927	12,638	3,473	16,111	1943	7,610	11,821	19,431
1928	5,673	4,132	9,805	1944	31,826	20,889	52,715
1929	8,002	5,325	13,327	1945	51,718	13,830	65,548
1930	8,485	5,013	13,498	1946	95,630	5,044	100,674
1931	4,771	1,531	6,302	1947	61,053	1,930	62,983
1932	4,305	1,235	5,540	1948		more than	100,000

	1947	1948
Lemon sole	15	18
Rock sole	43	16
Brill	23	57
Flounder	4	2
Dover sole	10	1
Rex sole	1	1
Butter sole	4	5

Flatfish production in the future cannot be estimated with any confidence. Many of the older fishing grounds are less productive than formerly. On the other hand the fishing grounds off northern British Columbia are not completely prospected and increasing knowledge on the part of fishermen of the grounds and the movements of fish on them will doubtless lead to more complete use of the resource. Finally it must be kept in mind that most of the fishing is in international waters. British Columbia landings may accordingly increase or decrease in accordance with the share of the total production landed by Canadian vessels.

References

Clemens and Wilby. Fishes of the Pacific Coast of Canada.

Bulletin of the Fisheries Research Board of Canada. No. 68, 1946.

Appendix: Annual Report of the Pacific Biological Station, 1947 and 1948. (unpublished).

Fisheries Statistics in Canada.

Dogfish (or grayfish), Sharks, and Skates

Of the sharks the dogfish is by far the most important species in British Columbia (compare tables 11 and 12). This species has had a long and erratic history in British Columbia's fisheries. At some times bounties for its destruction have been asked for and recommended. More recently concern has been felt for its conservation. The carcasses of dogfish were formerly reduced, but high production cost of an operation which could not be adapted to a continuous method led to the closing of reduction plants so that now the fishery is carried out entirely for the livers. The change in the interest of the fishery has led to lack of consistency in the records as shown in table 11. The livers are processed for their vitamin A content. In 1947, the only year for which complete data are available, dogfish landed in British Columbia were the source of 11,096,385 million units of vitamin A.

Dogfish are taken by most kinds of gear operated in British Columbia and chiefly by sunken gill nets, long lines, and trawls. Much of the catch is made in international waters.

The production of vitamin A from dogfish liver has probably reached or passed its peak and it seems likely that vitamin A production on a sustained yield basis cannot be maintained at present levels. Vitamin A appears to be most concentrated on the oldest fish in the population and as with any other fishery these are the first to show a decline in abundance with an introduction of an active fishery. There is, however, no evidence at the present time for believing that the total weight of dogfish caught cannot be maintained although this too may not be the case. This observation may prove of significance when a change in economic conditions or improved handling methods renders dogfish reduction profitable. The future of the industry is problematical at the present time as synthetic vitamin A may soon be produced to bring down prices.

The soupfin shark fishery on the Pacific Coast is a recent development. It commenced in the 1930's, grew phenomenally because of its great value, depleted the population on which it depended, and is now of very secondary importance. The British Columbia fishery followed the general course as shown by table 12. There is little hope for early or effective rehabilitation of the fishery. The fishery is carried out for the livers which are large and produce oil with a high vitamin A content. As with the dogfish most of the vitamin A is exported but substantial quantities are used domestically.

Smaller yields of low potency livers of other sharks are recorded. These fish are in considerable abundance but under present conditions cannot be caught or handled advantageously.

Skates produce rather consistently rather less than a thousand hundredweight of "wings" each year. Some increase in production would likely be possible. Skate livers are landed at times but do not command a high price.

References

Barraclough, W. E. The sunken gill net fishery, and an analysis of the availability of the dogfish (Squalus suckleyi Girard) and the soup-fin shark (Galeorhinus galeus Linnaeus) in British Columbia waters from 1943 to 1946. Unpublished thesis. University of British Columbia. 1948.

Shafer, E. G. Personal communication.

Fisheries Statistics of Canada.

Table 11. Hundredweight of Dogfish or Dogfish Liver Landed in British Columbia.

Year	Carcasses cwt.	Liver cwt.
1917	11,200	
1918	59,194	
1919	50,920	
1920	15,000	
1921	52,560	
1922	40,240	
1923	48,640	
1924	74,000	
1925	74,040	
1926	78,380	
1927	112,700	
1928	230,557	
1929	259,540	
1930	98,680	
1931	112,348	
1932	28,020	
1933	79,609	
1934	117,020	
1935	76,800	
1936	116,140	
1937	113,220	
1938	159,690	
1939	114,816	
1940	141,350	15,665
1941	142,999	34,790
1942	100,540	42,413
1943	78,924	45,685
1944	24,339	77,696
1945		58,219
1946		28,443
1947		37,593

Table 12. Hundredweight of Soupfin Shark Livers Landed in British Columbia.

Year	Cwt.
1940	26
1941	232
1942	488
1943	319
1944	61
1945	353
1946	90

Lingcod

The lingcod fishery is of long standing in British Columbia and the species was speared by native Indians who attracted it to the surface by the use of an ingenious artificial lure. However, it attained separate recognition in the fisheries statistics only in 1927. (Table 13). Since then production has been reasonably constant but this has been the result of the extension of fishing grounds and the pursuit of lingcod by new type of gear in recent years.

It seems likely that the lingcod production is close to the maximum which can be sustained. While the inshore waters of the Strait of Georgia are less productive than formerly offshore fishing grounds are still to be found and developed. It must be kept in mind, however, that many of these offshore grounds are in international waters and that Canadian landings will accordingly depend not only upon the effort put forward by Canadian fishermen but by that effort in relation to that exerted by the United States fishing fleet. Increasing Canadian population should increase Canadian demand and British Columbia's share of the catch.

Lingcod is used almost entirely in the fresh and frozen trade. Recently much of the catch is filleted. Although it is a favourite fish on local markets, a substantial part of the frozen product is exported.

Recently lingcod liver has been recognized as a very potent source of vitamin A and even the viscera are commercial sources of this vitamin. During the six years 1942-1947, inclusive, an average of 1,400 cwt. of liver and 1,200 cwt. viscera was landed annually in British Columbia ports.

The Strait of Georgia lingcod fishery is carried out almost entirely by small vessels and the fishery has a special interest and a special value as an independent outlet for the competent fisherman with limited capital.

References

Wilby, G.V. The Lingcod, Ophiodon elongatus Girard. Bulletin Biological Board of Canada, No. 54, 1937.

Fisheries Statistics of Canada.

Table 13. Hundred Weight of Lingcod Taken in British Columbia.

Year	Cwt.	Year	Cwt.
1927	49,916	1937	42,858
1928	50,772	1938	46,516
1929	48,489	1939	47,497
1930	48,591	1940	47,613
1931	50,987	1941	40,865
1932	39,960	1942	42,500
1933	40,282	1943	58,691
1934	47,806	1944	84,250
1935	62,841	1945	79,143
1936	68,932	1946	73,825
		1947	38,749

The blackcod or sable fish has long been recognized as an excellent species for smoking as it is indicated by table 14. It is taken traditionally by long liners as a supplement or by-product of the halibut fishery, and, more recently, by trawling. The restrictions placed upon the efforts of the highly efficient halibut fleet by applying catch quotas have increased the effort expended in fishing this species (as have the activities of the trawlers) to such an extent that the return for catch per unit effort has declined significantly. Evidently the species is producing to or beyond the limit of its capacity. The main fishery is carried out in deep water outside territorial limits so that the British Columbia fleet is in competition for the species with numerous well-equipped vessels of United States registry. There is little reason to expect substantial increase in British Columbia blackcod production.

Blackcod livers and viscera have recently been recognized as very valuable sources of vitamin A. From 1941 to 1947 the average annual yields of these by-products have been 470 cwt. and 590 cwt. respectively.

References

Bell, F. H. and J. T. Gharrett. The Pacific Coast Blackcod Anoplopoma fimbria. Copeia, No. 2, June, 1945.

Fisheries Statistics of Canada.

Table 14. Hundredweight of Blackcod Taken in British Columbia, Omitting Landings at Canadian Ports by U. S. Vessels.

Year	Cwt.	Year	Cwt.
1917	87,532	1933	5,647
1918	25,936	1934	6,391
1919	8,592	1935	9,698
1920	22,641	1936	7,196
1921	16,513	1937	13,410
1922	17,035	1938	8,463
1923	14,982	1939	9,067
1924	16,522	1940	13,934
1925	11,646	1941	17,472
1926	7,516	1942	12,279
1927	13,360	1943	20,959
1928	11,132	1944	22,325
1929	13,556	1945	20,987
1930	14,227	1946	23,790
1931	5,317	1947	13,087
1932	6,037		

Rockfishes

The landings of the various species of Sebastodes entering the commercial fishery have been summed to make table 15. Analysis of the table is difficult for several reasons. There are twenty-three species of rockfish in the waters of British Columbia. Of these probably eighteen are represented to some extent in the landings listed. Information about them is difficult to obtain since the individual species are rather difficult to distinguish and there is only one name which is commonly used and understood by both fishermen and scientists. The various species have different habitats and seasons of occurrence as well as broader distributional differences. Frequently because of lack of time for handling or hold space all are discarded. Under less pressing conditions or in fishing with other gear most are retained. At still other times only certain species are accepted. Line gear and trawls are rather highly selective as to species.

Of the many species which are taken the following are taken on hook and line gear: Red Snapper, Sebastodes ruberrimus; Orange-spotted rockfish, Sebastodes maliger; uncertain species resembling Sebastodes ribrivinctus; banded rockfish, Sebastodes nigrocinctus; the copper rockfish, Sebastodes caurinus; and the black rockfish, Sebastodes melanops are taken in relatively shallow water by all gears: and the main trawl catches are composed of the orange rockfish, Sebastodes penniger; yellow-tailed rockfish, Sebastodes flavidus; the bocaccio, Sebastodes paucispinis; and the short spined rockfish (?) Sebastodes brevispinis.

Rockfish of several species seem to be very abundant and it appears that British Columbia landings could be increased beyond the maximum on a sustained yield basis if all the fish caught were landed. Although such a demand on the stock of fish appears heavy it seems probable that it could be sustained because the drain on some of the species at least has been going on for years without the product being landed. Most species of rockfish are destroyed by being brought to the surface due to the release of pressure and, accordingly, even although the fish were discarded the effect on the stock has been the same as though a heavy fishing was in progress.

Most of the catch of rockfish is filleted and much of the product is exported. Additional outlets for the catch will probably be necessary before production can be greatly increased. Promising experiments with canning have already been carried out.

References

Clemens, W. A. and G. V. Wilby. Fishes of the Pacific Coast of Canada. Bulletin of the Fisheries Research Board of Canada, No. 68, 1946.

Fisheries Statistics of Canada.

Table 15. Hundredweight of Rockfishes (Sebastodes) taken in British Columbia.

Year	Cwt.	Year	Cwt.	Year	Cwt.
1917	1,086	1928	4,220	1938	6,906
1918	6,238	1929	5,210	1939	2,271
1919	6,502	1930	4,248	1940	2,575
1920	4,037	1931	2,735	1941	2,782
1921	2,652	1932	2,736	1942	5,272
1922	3,683	1933	1,382	1943	22,273
1923	3,058	1934	1.643	1944	32,563
1924	3,460	1935	2,590	1945	35,496
1925	2,961	1936	3,280	1946	27,125
1926	3,916	1937	1,819	1947	8,021
1927	4,436				

Cod

Catches of the cod, true cod, or gray cod in British Columbia have been separated in the statistics only since 1927 as suggested by table 16. It is taken on many fishing grounds throughout the province and for the most part the catch has been limited by market demand rather than upon the supply of fish. However, temporary shortages occur and for a few years it looked as though certain runs in the strait of Georgia were being depleted.

Most of the fish are filleted for local or export markets. Increase in production will depend upon (1) increase in the popularity of the species on the market, (2) increased consuming populations, (3) surmounting technical difficulties in handling, etc., especially those connected with the occurrence of worms in the flesh.

Most gray cod landings come from International waters.

The Pacific cod does not have as high a vitamin assay as the Atlantic cod or several other Pacific fishes but some livers are taken and marketed. The average annual liver landing from 1942 to 1947 inclusive was about 300 cwt.

Reference

Fisheries Statistics of Canada.

Table 16. Hundredweight of Gray Cod Taken in British Columbia.

Year	Cwt.	Year	Cwt.
1927	165	1938	18,635
1928	256	1939	16,322
1929	608	1940	16,635
1930	955	1941	9,612
1931	1,628	1942	6,726
1932	2,748	1943	15,799
1933	5,170	1944	9,414
1934	12,811	1945	18,585
1935	16,691	1946	35,341
1936	8,099	1947	14,350
1937	14,306		

Eulachon

The eulachon has long been eagerly sought by the Indians of British Columbia and because of the ease with which "grease" (oil) could be obtained by primitive reduction methods the species attained an importance in primitive coastwise economy far out of proportion to its actual bulk. Most of the important runs are now preserved as an Indian prerogative, but a substantial commercial fishery exists on the Fraser River. This run shows considerable fluctuations in yield and at one time it was feared the supply of fish was being depleted. Present indications are that the fluctuations are not the result of human interference and that the fresh fish market may expect a sustained supply of between 500 and 2,000 cwt. The production figures given in table 17 are not consistent in their inclusion of certain parts of the Indian catch.

References

Hart, J. L. and J. L. McHugh. The Smelts (Osmeridae) of British Columbia. Bulletin of the Fisheries Research Board of Canada. No. 64, 1944.

Fisheries Statistics of Canada.

Table 17. Hundredweight of Eulachon Taken in British Columbia.

Year	Cwt.	Year	Cwt.
1917	1,231	1933	153
1918	1,102	1934	446
1919	181	1935	407
1920	2,115	1936	222
1921	188	1937	120
1922	179	1938	209
1923	438	1939	514
1924	1,271	1940	801
1925	361	1941	382
1926	405	1942	3,164
1927	486	1943	2,698
1928	413	1944	1,741
1929	370	1945	3,046
1930	899	1946	1,584
1931	198	1947	5,309
1932	184	1948	2,625

Anchovy

Although anchovy have been known to occur in British Columbia waters for many years it is only recently that they have become the object of a fishery. The catch shown in table 18 shows that the catch has never been particularly large, and that it has fluctuated radically. These fluctuations have to a large extent reflected changes in the availability of the fish to the producers and it seems probable that the local supply of anchovy will always be erratic. Greater utilization of the resource could be attained by reducing anchovies (now disallowed) on the west coast of Vancouver Island where the supply, although by no means stable, is better than near the specialty cannery plants on the strait of Georgia. However, because of low oil yields, reduction is likely to prove a marginal operation. A stabilized fishery cannot be anticipated and greatly increased use of the resource does not appear likely in the near future.

Reference

Fisheries Statistics of Canada.

Table 18. Hundredweight of Anchovies Landed in British Columbia.

Year	Cwt.
1939	19,320
1940	74,435
1941	136,727
1942	79,900
1943	1,407
1944	12,200
1945	15,000
1946	25,400
1947	28,580
1948	3,157

Miscellaneous Fishes

In addition to the species of most importance in the economy of British Columbia are a number of less important forms which non the less make some contribution to the income of the province. Landing figures for some species which have produced more consistently are listed in table 19.

Perch. These fish have a long-established specialized local market. They have not been the subject of study but can probably be expected to continue their present productivity.

Smelts. The silver smelt fishing has declined, partly because of depletion of local runs and partly because of necessary regulations which restrict the drain on the remaining populations. The catch may be expected to remain close to its present level.

Sturgeon. Sturgeon catches have been maintained in recent years. The factors affecting the supply of fish are not known but it is clear that an increased catch could not be sustained.

Whiting. The whiting is a small soft fish taken incidentally to other species. Readier acceptance on the market would rapidly lead to increased landings.

Hake. The hake is a soft fish taken incidentally to other species. Although the flavour is good it deteriorates after being caught too rapidly for ready handling. Its greater use depends upon development of improved handling methods.

Shad. This is an exotic species introduced from the Atlantic. It has proved less successful in establishing itself in British Columbia than in more southerly Pacific rivers but may increase in importance.

Tom cod. Catches of this excellent little fish have dropped off because of changes in fishing methods. Landings could be increased but only by using small meshed trawls which would catch undesirably large quantities of young fish of other species.

Ratfish. The ratfish has long been locally recognized as having a liver whose oil was excellent for guns, etc. In addition the oil was reputed to have therapeutic merits, but these, if they exist, are not associated with vitamin content and do not lend themselves to measurement. Consequently the livers do not command a high enough price to warrant an intensive fishery for the species. An unexploited resource of considerable importance exists in this species.

Reference

Fisheries Statistics of Canada.

Table 19. Hundredweight of Perch, Smelts, Sturgeon, Whiting, and Hake taken in British Columbia.

Year	Perch cwt.	Smelts cwt.	Sturgeon cwt.	Whiting cwt.	Hake cwt.
1917	492	1,164	445	545	193
1918	1,064	2,408	103	172	451
1919	2,244	1,248	222	50	110
1920	2,021	1,371	143	36	311
1921	2,150	1,817	197	44	10
1922	1,797	400	322	156	7
1923	1,700	1,036	574	96	41
1924	1,299	1,140	306	87	10
1925	1,042	780	274	185	1
1926	923	1,281	275	101	4
1927	1,381	1,104	359	69	24
1928	1,425	782	279	18	45
1929	2,180	700	314	12	5
1930	1,678	1,455	277	40	2
1931	950	1,571	252	87	-
1932	715	1,038	202	35	-
1933	528	509	367	361	1
1934	547	1,013	212	65	-
1935	798	980	436	76	-
1936	1,168	859	140	19	24
1937	509	385	82	17	4
1938	544	737	187	20	42
1939	509	488	156	11	27
1940	500	846	151	39	22
1941	354	686	221	5	20
1942	658	159	98	1	29
1943	835	44	176	3	-
1944	1,154	246	261	54	12
1945	1,540	420	310	13	44
1946	1,359	782	182	21	87
1947	625	732	457	-	-

Whales

Whaling has been carried out intermittently in British Columbia for 38 years, the average kill during operating years being 308 whales. The annual productions are shown in the accompanying table. During operating years one, two, three or four plants were in use so that whaling effort has not been very consistent. The initial decline from the high take in 1911 resulted entirely from the decline in the kill off Vancouver Island, the Queen Charlotte Islands take showing no downward trend from 1911 to 1943 when operations ceased entirely. A definite conclusion concerning the absence of depletion or overwhaling around the Queen Charlotte Islands must be withheld in view of the defective information concerning quality and quantity of whaling effort. The whale take fell off rapidly during the first three years of operation around Vancouver Island but apparently became stable thereafter until operations ceased about 1925. The take in 1948 off Vancouver Island was 182 whales distributed among four species as follows: sperms 28; finback 39; humpback 113; and sei 2. Sperm whales and finbacks seem to have maintained their numbers under exploitation, but sulphur bottoms and seis have declined to the point where they are no longer important items in the fishery. It seems likely that an annual sustained production of two to three hundred whales is to be expected.

Table 20. Number of Whales taken in British Columbia 1911-1948.

Year	Total	Year	Total
1911	1,199	1930	320
1912	1,109	1931	---
1913	705	1932	---
1914	573	1933	209
1915	229	1934	350
1916	403	1935	202
1917	---	1936	370
1918	500	1937	317
1919	432	1938	310
1920	493	1939	---
1921	---	1940	220
1922	187	1941	271
1923	455	1942	163
1924	414	1943	91
1925	351	1944	---
1926	269	1945	---
1927	258	1946	---
1928	305	1947	---
1929	407	1948	182

The Shell-fish Industry

Shell-fish in this report are taken to include all molluscs and crustaceans and the complete list is given in table 21. These are the species that have been utilized in the past, but there are others, such as the edible mussel, which may be used in the future.

The shell-fisheries form only a small part in the fishery industry of British Columbia and it is only recently that the total marketed value of all shell-fish products has approached the million dollar mark and this is due mainly to increased prices, although there has been a significant increase in production. There is no doubt that parts of the industry are capable of expansion.

Unfortunately, the statistics and other information on the minor fisheries have been inadequately reported and on the whole, little attention has been paid to them, both from the administrative and biological points of view. It is, therefore, difficult to draw any sort of a clear picture of the history of these fisheries. In most cases there are no data on the number of persons engaged in them, or on the amount of gear in use. Therefore, any conclusions on the future trend of production or employment is largely conjecture based on certain experience with the fisheries concerned.

The products of the shell-fisheries tend to fall into the "luxury" class of food and, therefore, production is influenced markedly by economic conditions. Increased shipping facilities and a larger local population have recently created larger markets. On the other hand, most shell-fisheries are part-time and seasonal in nature, and in years of prosperity the more attractive and lucrative types of employment attract the labour.

Due to limitations of various sorts, it appears to be unlikely that British Columbia will ever have an extensive shell-fish industry; but what there is and what can be developed should be used to the full. The prospective increase in population in British Columbia will, no doubt, create a market sufficiently large to utilize the production of the industry when expanded to its maximum.

Table 22 gives the production figures for the various groups of shell-fish for the period 1924 to 1947 and the extreme degree of fluctuation may be noted.

Table 23 gives a list of the various species of shell-fish being utilized.

Table 24 gives estimates of possible production of the three main groups with the capacity per capita.

Table 21

Clams

Butter - Saxidomus giganteus
Native "little-neck" - Venerupis staminea
Japanese "little-neck" - Venerupis philippinarum
Razor - Siliqua patula

Oysters

Native or Olympia - Ostrea lurida
Pacific (Japanese) - Ostrea gigas
Eastern - Ostrea virginica

Crabs

Edible - Cancer magister

Shrimps

British Columbia - Pandalus spp.

Abalone

British Columbia - Haliotes kamtschatkana

Table 22

British Columbia Shellfish Production.

Amounts caught and landed, in tons. Data from the Fisheries Statistics of Canada

Date	Oysters	Clams	Abalone	Crab	Shrimp	Octopus
1924	166	2,003	--	397	43	20
1925	147	2,653	--	348	57	29
1926	236	1,281	--	419	33	19
1927	219	1,442	43	420	42	16
1928	241	1,683	58	293	60	28
1929	423	1,826	--	341	64	14
1930	320	2,399	47	242	78	18
1931	356	1,440	44	268	59	12
1932	201	1,341	--	166	72	15
1933	223	1,275	--	271	65	14
1934	330	898	24	277	70	14
1935	335	17,902	--	325	118	14
1936	620	2,572	2	316	34	10
1937	233	2,304	5	402	60	10
1938	298	3,832	--	397	75	11
1939	1,131	1,459	16	542	41	7
1940	868	1,540	29	702	57	9
1941	3,650	1,576	--	582	30	13
1942	1,498	1,776	--	386	19	3
1943	1,510	1,333	10	338	25	2
1944	1,988	1,418	--	360	19	10
1945	1,409	2,403	21	451	39	33
1946	2,658	2,466	4	731	59	20
1947	2,430	3,210	14	920	53	2

Table 23

SPECIES	Probable future annual production in tons.	Production per Capita in lbs. (1,000,000 population)	Present Employment (part time) (Basic fishery)	Future Estimated Employment
Clams	2,000	4	500	600
Oysters	20,000	40 = 2 quarts	150	500
Crabs	1,000	2	200	300

Table 24

Area	Average annual Catch (tons)	Maximum annual catch (tons)
Northern B. C.	723	1,689
Central B. C.	215	587
Queen Charlotte Strait	393	670
Gulf of Georgia	410	683
Total	1,741	3,629

The Clam Fishery.

From the earliest times clams have been an important source of food to Indians of the British Columbia coast and more recently they have become a source of income. Clams have been dug commercially for nearly 60 years with generally satisfactory returns to the diggers. The annual production has varied widely and this appears to have been due more to economic conditions than actual fluctuations in abundance.

In years of prosperity labour conditions are such that more lucrative and attractive forms of work lure the fishermen and Indians who normally dig clams, for clam-digging is only a part time occupation. In addition, there may be fluctuations in abundance due to biological factors, such as poor or infrequent seedings, and a combination of these and heavy fishing, especially on the major clam producing beaches, may result in reduced populations.

Up to the present time fluctuations in demand and the results of economic conditions have tended to hold the stocks of clams at a reasonable level. Until 1936 commercial butter clam-digging activities were confined to the Gulf of Georgia and only since that time have operations been conducted in central and northern British Columbia and on the west coast of Vancouver Island.

In the Gulf of Georgia region there has been a gradual increase in production from 1906 to 1934. In 1935 and 1936 a very rapid increase occurred when production rose markedly, undoubtedly due to the opening of an export market for raw butter clams. In 1936 the Central Area began to produce and after that time contributed most of the additional production stimulated by the development of the export market. The west coast of Vancouver Island added a substantial quantity in the peak year of 1938. In the following year production dropped 60%, probably due in part to the increase in the minimum size limit from $1\frac{1}{2}$" to $2\frac{1}{2}$" in length, as well as to other factors which cannot be determined.

During the recent war, production was maintained at about the 1,500 ton level and since that time this amount has been doubled, mainly by contributions from the northern area. To date only a small part of the total area of clam-bearing ground has been assessed. The assessment is a large undertaking because of the extreme length of coast line, the limited annual working time and the wide variation in size and distribution of beaches. So far attention has been paid mainly to the biology of the more important species. Recently, however, much valuable information on productivity of a single beach has been obtained by Mr. Neave of the Pacific Biological Station, from experiments conducted at Seal Island, near Comox. It is not an easy matter, however, to apply these findings to other areas where conditions, such as rates of growth and seeding are very different. However, the last decade has seen the exploitation of all areas of the coast with clam-producing beaches and it is reasonably certain that all of the largest and most productive beaches have been worked.

More exact information is required on the extent of initial populations, on rates of growth and annual seeding success in the various areas, and until then no accurate determination can be made as to whether the grounds are, or are not being exploited to the maximum of which they are capable. However, for the purpose of this brief an effort will be made to provide a rough estimate.

The average annual production for the various districts for the years 1939 to 1947 is given in table 24, in addition to the maximum catch obtained during these years.

The average annual production for the whole Strait of Georgia area over a 30 year period is approximately 500 tons which Neave (1945), considered to be the yield from 15% of the clam-bearing ground and represents 20% of the population in the area during periods of fairly high abundance. Also, according to Neave (1945), in controlled operations at Seal Island, an annual catch of 20% of a large initial stock had been successfully maintained for a five-year period. Using the Gulf of Georgia as a basis, it would appear that much of the other three areas in the province should be capable of yielding an equivalent amount on a long term basis, thus giving an estimated annual production of between 2,000 and 3,000 tons.

The average catch per man tide for all areas for the period 1939 to 1947 is 239.5 pounds. To produce 2,000 tons of clams approximately 16,000 man tides are required and with about 50 of the 80 low tides in the season actually used for digging, the number of persons engaged in the industry during recent years may be estimated to be between 400 and 500. It must be pointed out, however, that the labour is only part-time and is used to fill in and augment income between the seasons of more important fisheries.

The possibilities of the future development of this industry offers not a great deal of promise. There is a limited amount of clam bearing ground. The only field which may lead to expansion is the cultivation of various suitable species. This item is on the proposed program of investigation but it is doubtful if the large gap between the cost of labour and the value of the product will make cultivation economic possibility under present conditions. However, much basic information remains to be gathered for even the biology of all species is not adequately understood.

This is a brief resume of the conditions in the butter-clam fishery which is estimated to be able to yield an annual sustained yield of 2,000 tons, employing between 400 and 500 men intermittently over a five month period.

The other species, such as the razor clam and the little-neck clam are relatively minor species and are not included in this analysis, but the fishery of which may employ another 100 men.

Abalone and Octopus

Abalone and octopus are fished to a limited extent and it is believed that they are present in quantities that warrant a much larger production. However, little information is available either on quantities or on the rates of reproduction.

Oysters

Three species of oysters are grown in British Columbia. Small quantities of Eastern oysters (Ostrea virginica) have been brought from the Atlantic Coast and re-laid for a short time before marketing. Considerable time and effort have gone into attempts to establish this species with limited success. The production of the Native or Olympia oyster, the only indigenous species, has now reached a very low ebb. Not more than two or three operators are now handling this species. The fishing, rather than the culturing of the Native oyster is responsible for its decline. Much of our foreshore which is unsuitable for growing other species may be adapted for the culture of the Native variety. The imported Japanese oyster has been the

mainstay of the British Columbia oyster industry since about 1930. From 1939 to 1947 no seed was obtained from Japan and the industry has had to rely on the last (1939) imported Japanese seed, along with a small amount from Washington State and some from the results of seeding in Ladysmith Harbour and Baynes Sound.

The years 1949 and 1950 will see the results of 1947 Japanese seed come onto the market and good production figures should result for, at the present time, there is an unlimited market. The necessity of obtaining seed from foreign countries is unsatisfactory, both from an economic and practical point of view. Every effort should be made to produce seed in British Columbia in sufficient quantity to supply the needs of the industry.

At the present time in British Columbia 2,000 acres of foreshore are under lease for oyster growing purposes. In 1947 the industry produced 2,400 tons, which is a return of 1.2 tons per acre. It is estimated that, under normal conditions, one acre of oyster ground should yield approximately 10 tons annually. Assuming that of the 2,000 acres under lease only 50% or 1,000 acres are actually suitable for oyster culture, then the yield should be 10,000 tons. In 1947, however, only 50% of the registered growers produced a return, for many of the leases are new ones and not yet in the production stage.

The above figures indicate that the industry is not functioning with a high degree of efficiency. Practically all of the suitable oyster ground in the Strait of Georgia is now under lease. A proportion of the ground on the west coast of Vancouver Island is leased but there is probably a total of another 500 acres that may be used. Few attempts have been made to grow Japanese oysters in the central and northern areas of the coast and the amount of suitable foreshore there is not known.

Future - The Oyster industry is definitely capable of considerable expansion, both in greater production of the Japanese oysters on the existing leases and in the utilization of as yet unleased ground. Also, there is ample room for a revival of the Native oyster industry. Until more is known of the extent of oyster bottom not yet used, the degree of expansion possible is difficult to estimate. Further development may lie in the utilization of sub-littoral bottom for oyster culture but the feasibility of this requires investigation.

Crabs and Shrimps

Like the molluscan fishery, the crustacean fishery has exhibited considerable and, at times, wide fluctuations in production. Likewise, the lack of statistical or general information on this species makes it difficult to assign causes of fluctuations so no idea can be given on whether the fishery has been over or under exploited.

In the case of crab, of which there is one main commercial species, it is believed that most of the larger producing areas are now being fished, although one cannot be certain of this. To date, (1947) the largest catch is just under 1,000 tons and it is doubtful, unless some new areas are developed, whether this level of production can be maintained for any length of time. At the present time approximately 200 persons are employed in this fishery.

The shrimp fishery is at present a small one with an annual catch of less than 100 tons. It is thought that this fishery is capable of considerable expansion for the type of coast line leads to the belief that favourable physical conditions are present for the existence of large populations of shrimps. The proof of this, however, must await exploration. No information is available on the number of persons engaged in this fishery.

Seaweed

An assessment of the present value of seaweed resources of the Province can only be roughly estimated from the available information on the "standing crop", and the future value and maintainence of this "standing crop" will be determined by the conservation measures taken, the development of cultural and collecting methods and a proper management. It is believed that under such a developmental program the present "standing crop" may be not only maintained, but increased. Preliminary surveys only have been carried out along this coast and these have not covered all portions of the coast nor all species of known economic value. The figures available, and presented in this report, therefore, are based on incomplete information and necessarily qualified.

Our seaweed resources may be divided into two general groups; namely, alginophytes or algin-producing plants, and agarophytes or agar-producing plants. The former includes the more conspicuous forms of brown seaweeds commonly designed as "kelp", whereas the latter includes the red seaweeds which are generally smaller in size.

Alginophytes occurring in abundance in these waters consist of the following species of "kelp": Macrocystis, Nereocystis, Laminaria, Alaria, Hedophyllum, and a few other less common forms.

During the summer of 1946 B. Farrar and R. F. Scagel, representing the B. C. Research Council and the Fisheries Research Board respectively, conducted a joint survey of coastal waters except for the West Coast of Vancouver Island, the Queen Charlotte Islands and some of the more isolated areas, during which estimates of the more easily harvestable, floating forms of "kelp"--Macrocystis and Nereocystis--were made. From these records, and some previous surveys in the Gulf of Georgia by the B. C. Research Council, some estimated tonnages of Macrocystis and Nereocystis were arrived at, being over 22,500 tons and 370,000 tons respectively. These tonnages were regarded as decidedly conservative and as a result of a more detailed investigation in the vicinity of Hardy Bay, B. C. by R. F. Scagel during 1947 for the Provincial Fisheries Department are believed to be underestimated by approximately one to two thirds, at least for Macrocystis, because of the unfavourable stage of tide at which it had been necessary previously to examine various beds of floating "kelps". On this basis, and in consideration of the areas not yet examined in detail, it is highly probable that the amount of floating "kelp" available in these waters may approach 750,000 to 1,000,000 tons annually. In addition the smaller "kelps", although presenting more difficult collecting problems, are also valuable sources of algin and more widely distributed. It does not seem improbable that the aggregation of these smaller species--such as Laminaria, Alaria and Hedophyllum-- may bring the total "kelp" available on this coast to at least 1,500,000 tons annually.

Gracilaria, an agarophyte, is abundant in these waters and under the favourable ecological conditions reaches an unprecedented length and rate of growth. While other species of agarophytes are also known in these waters, the abundance and distribution has not been determined comprehensively for any.

Conservation measures for both alginophytes and agarophytes rests primarily on an understanding of their reproductive characteristics and a knowledge of the period at which spores are liberated. In the case of Nerocystis, which is an annual, only one crop a year can be obtained so that it is necessary either to leave portions of seaweed beds uncut, or prolong cutting until reproduction has been permitted to some extent. In the case of Macrocystis the plant is perennial from the base so proper cutting policies may lead to more than one harvest in a season without damage

to reproductive parts.

Agarophytes, and red seaweeds in general, present additional complexities in their life cycles which must be thoroughly studied to determine the methods of culture and the best season at which harvesting should be carried on.

It would seem that the development of this resource might be encouraged by (1) acquiring an accurate and comprehensive estimation of the amount of the economic species already known to be present on this coast in abundance, (2) gaining a knowledge of the distribution of other species, particularly agarophytes, about which we know extremely little except for Gracilaria, and (3) carrying out an educational programme acquainting the public with this practically untouched resource and the large number of uses to which its products may be put.

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Employment

The number of people employed in the British Columbia fishing industry is shown in table 25. These figures in the future will be subjected to influence causing them to both increase and decrease. Expansion of the industry into new grounds, new or partly utilized species, and new or more specialty products will tend toward increasing employment. The application of more efficient fishing gear and handling equipment would tend toward lessening employment, although employment in the ancillery services might be expected to increase. It seems doubtful if it is in the interests of British Columbia or Canada that the employment in the fishing industry increase indefinitely. If it does, Canada's position in the export market will deteriorate and the standard of living of the individual fisherman will be lowered. The paradox in which the efficiency of equipment used in primary fishing operations is being constantly improved by technical advances and as constantly impaired by fishery regulations cannot be ignored forever.

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Table 25. Number of Men employed in the Fishing Industry

Year	Fishing	Shore Plants	Total
1917	12,967	7,624	20,591
1918	11,239	8,918	20,157
1919	12,865	7,954	20,819
1920	11,669	7,233	18,902
1921	10,623	5,081	15,704
1922	9,495	6,375	15,870
1923	8,734	6,123	14,857
1924	9,274	6,906	16,180
1925	9,944	7,438	17,382
1926	12,162	8,436	20,598
1927	13,076	8,246	21,322
1928	11,818	7,176	18,994
1929	12,675	7,760	20,435
1930	12,000	7,347	19,347
1931	9,495	4,445	13,940
1932	10,116	4,706	14,822
1933	11,066	5,790	16,856
1934	11,700	6,226	17,926
1935	10,965	6,065	17,030
1936	11,393	6,596	17,989
1937	11,184	5,583	16,767
1938	10,314	6,103	16,417
1939	9,609	6,271	15,880
1940	10,444	7,443	17,887
1941	10,217	7,914	18,131
1942	12,199	6,956	19,155
1943	11,903	6,011	17,914
1944	12,463	6,150	18,613
1945	13,292	6,038	19,330
1946	13,665	6,079	19,744
1947	12,461	5,473	17,934