

SALMON OF THE NORTH PACIFIC OCEAN—PART IV SPAWNING POPULATIONS OF NORTH PACIFIC SALMON

3. CHUM SALMON IN THE FAR EAST

by

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INTRODUCTION

Chum salmon (*Oncorhynchus keta* (Walbaum)) originating in the Far Eastern regions of Asia are grouped into two major categories: summer chum populations (northern populations) and autumn chum populations (southern populations). The approximate boundary between the geographical distribution of spawning streams of summer and autumn chums is found at the Amur River, the east coast of Sakhalin and the central Kuril Islands.

The coastal runs of summer chums occur somewhat earlier than those of autumn chums. They approach the coast during the period from the end of May or June to August and enter spawning streams during the period from July to the end of August or September. Autumn chums approach the coast from September on and migrate into streams mostly during October through December.

A part of the summer chums (principally those bound for the Okhotsk district and the Amur River) appears in waters off the Pacific coast of northern Japan during the period from April to August, and moves towards the north, entering the Okhotsk Sea. These fish do not spawn in Japanese streams.

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Bull. 23, Int. North Pac. Fish. Comm., 1967.

TABLE 1. Percentage contributed by each area to total coastal catch of the Far Eastern region (coastal only). (Yonemori and Kondo, 1961.)

Year	East Kam. coast	West Kam. coast	Okhotsk coast	Amur River	Sakhalin coast	Primore coast	Japanese coast
1955	14.7	22.9	28.4	16.9	7.3	0.2	9.6
1956	14.3	14.0	43.7	17.6	4.0	0.1	6.3
1957	10.0	5.3	35.6	13.9	13.3	—	21.9
1958	10.6	2.7	31.6	25.4	6.4	—	23.3
1959	16.0	18.0	26.7	24.3	1.8	—	13.2
1960	7.9	6.4	43.0	29.7	1.9	—	11.1
Average	12.25	11.55	34.83	21.30	5.79	0.05	14.23

GEOGRAPHICAL DISTRIBUTION OF SPAWNING POPULATIONS

The geographical distribution of Far Eastern chum salmon ranges from the Lena River flowing into the Arctic Ocean at approximately 125°E, 73°N to the Nagasaki Prefecture of Kyushu, approximately 130°E, 33°N, and, on the Pacific side of Honshu, to the Tone River of Chiba Prefecture.

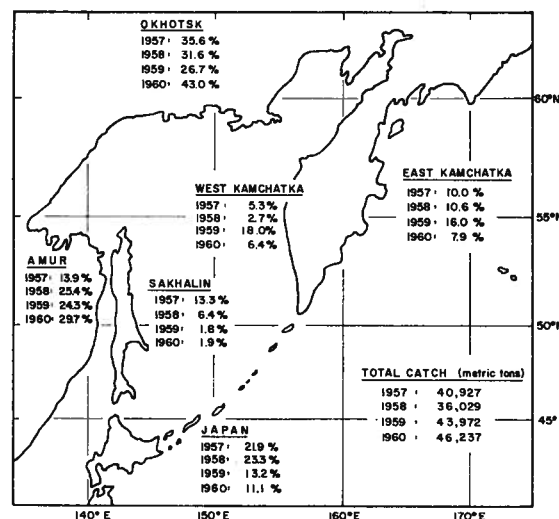


FIGURE 1. Geographical distribution of coastal catches of chum salmon, 1957-60 (data from Tables 1 and 5).

Varying numbers of chum salmon spawn in streams within this range year after year, but commercial catches are from areas such as East and West Kamchatka, the northern coast of the Okhotsk Sea, the Amur River, Sakhalin, and northern Japan (Fig. 1). Coastal catches from the Amur and Okhotsk districts have comprised over 50% of the total coastal catch of chum salmon in Asia in recent years (Table 1), indicating the great importance of these districts as chum salmon producing areas.

Among the major chum salmon spawning streams are the Anadyr, Apuka, Oliutorka, Ozernaia, Kamchatka and Zhupanova Rivers of the Bering Sea and Pacific coasts of Kamchatka (Fig. 2); the Bolshaia, Kikhchik and Icha Rivers of West Kamchatka (Fig. 2); the Okhota, Kukhtui, Urak and Ulia Rivers of

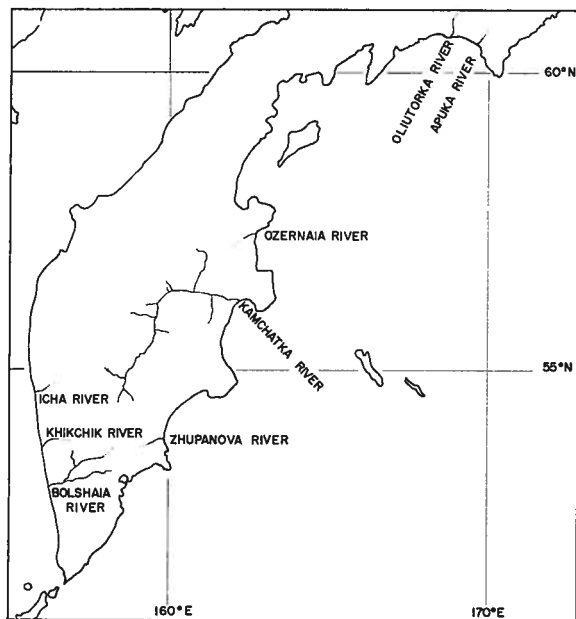


FIGURE 2. Locations of chum salmon spawning rivers in Anadyr, Oliutorskii and Kamchatka Peninsula areas.

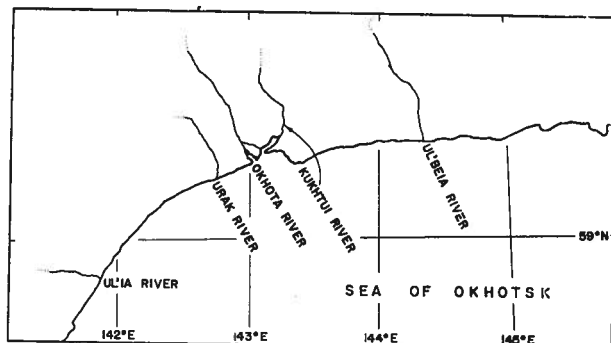


FIGURE 3. Locations of chum salmon spawning rivers in the Okhotsk district.

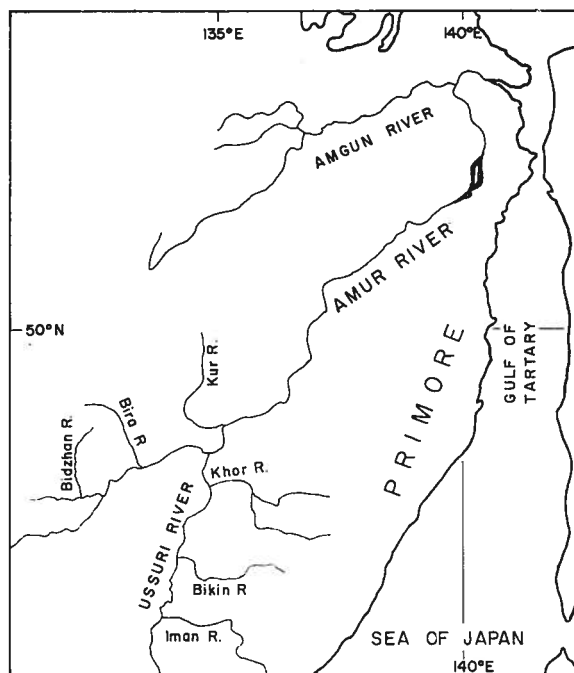


FIGURE 4. Locations of chum salmon spawning rivers in the Amur River.

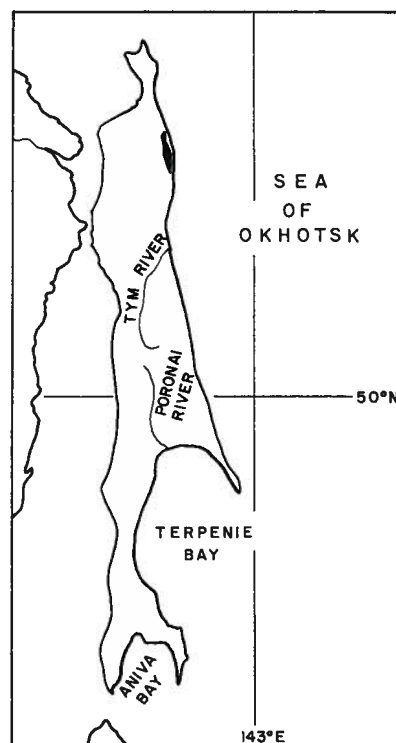


FIGURE 5. Locations of two chum salmon spawning rivers in Sakhalin.

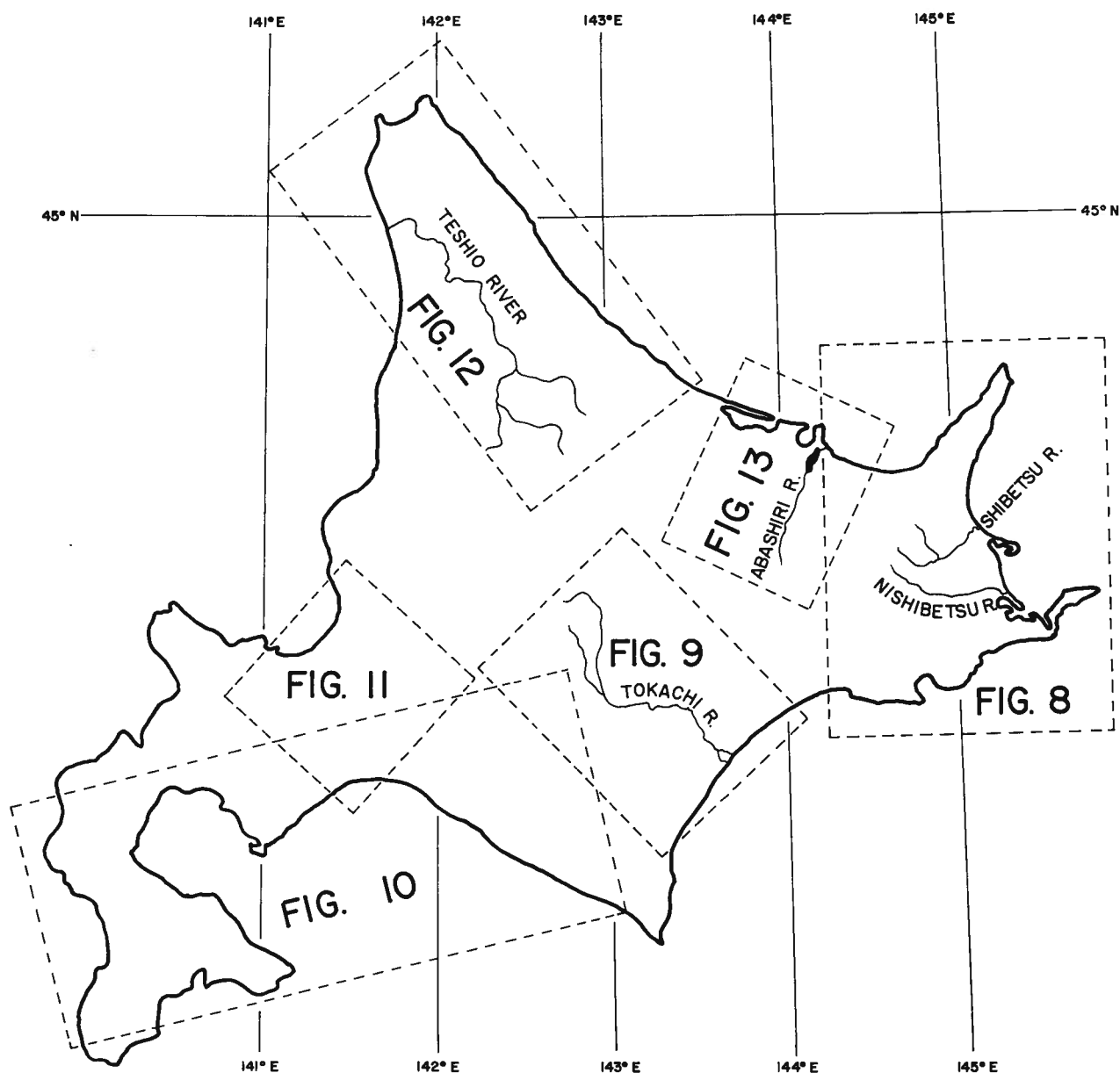


FIGURE 6. Locations of major chum salmon rivers in Hokkaido.

the Okhotsk district (Fig. 3); the Amur River of Primore (Fig. 4); the Tym and Poronai Rivers of Sakhalin (Fig. 5); and the Abashiri, Shibetsu, Nishibetsu, Teshio and Tokachi Rivers of Hokkaido (Fig. 6).

TIMING OF SPAWNING MIGRATION

As was mentioned before, summer chum salmon bound for northern areas appear in coastal waters earlier than autumn chums. They approach the coasts of East and West Kamchatka, the Okhotsk district and the Amur River as early as June and their

coastal migration continues to July and August. Autumn chums appear in the coastal waters of the Amur River area, Sakhalin and northern Japan during the period from the end of August to September and October; their upstream migration in southern Hokkaido and Honshu continues until December and sometimes until January.

Part of the summer chums appear in waters off the Pacific coast of northern Japan during the period from April to August, with the peak in June, and move toward the north, without entering Japanese streams. Most of these fish are known to migrate to the Amur

TABLE 2. Coastal catches of chum salmon in northern areas, by month, in metric tons, and units of gear operated in each area¹ (Japan-Soviet Fisheries Commission data).

Area	Month	1957		1958		1959	
		Catch	Units of gear	Catch	Units of gear	Catch	Units of gear
West coast of Kamchatka	June	12		5	110	24	87
	July	1,252	163	234	123	3,994	97
	August	834	163	700	146	3,827	116
	Sept.	56		32		86	
	Total	2,154		971		7,931	
East coast of Kamchatka	May	—		—	66	—	
	June	30		11	42	144	
	July	2,657	111	1,216	111	3,069	
	August	1,417	111	2,549	114	3,676	
	Sept.	6		35		157	
Total	4,110		3,811		7,046		
Okhotsk coast	June	—		5	20	10	20
	July	12,083	226	836	133	1,607	128
	August	12,215	226	10,514	133	10,024	128
	Sept.	267		52	133	76	128
	Total	14,565		11,407		11,717	
Sakhalin & Kurils	June	—	95	—	227	—	305
	July	—	363	430	425	52	305
	August	1,077	363	620	425	433	305
	Sept.	4,360	363	1,248	203	55	305
	Oct.	—		—		251	305
Total	5,437		2,298		791		
Amur River summer chum	June	8	16	—	27	—	5
	July	190	93	136	52	—	6
	August	106	93	528	43	—	93
	Sept.	—	93	—	26	—	93
	Total	304		664		—	
Amur River autumn chum	June	—	16	—	27	—	5
	July	—	93	—	52	—	6
	August	637	93	—	43	1,478	93
	Sept.	4,730	93	8,486	26	9,201	93
	Total	5,367		8,486		10,679	

¹ Gear includes varying numbers of coastal traps, beach seines and, in the Amur Basin, a type of weir.

River and the Okhotsk district.

The peak of the chum salmon coastal migration occurs somewhat earlier in Kamchatka and the Amur area than in other areas, namely in July. They enter the coastal waters of the Okhotsk district a little later, the peak period being August.

The peak period of chum salmon migration on the coast of Sakhalin is September, although smaller numbers of chums appear as early as July. Both summer chums and autumn chums are found in Sakhalin, and, in some years, there are two peak periods of chum salmon migration, one in August and the other in October.

Amur autumn chums approach the coast from the

end of August and the major part of their migration occurs in September. Autumn chums far outnumber summer chums in the Amur area.

Chum salmon bound for Japanese streams approach the coast beginning with the end of August or early September, with peak runs occurring in October and November. Runs are later in southern parts of this region than in northern parts, peak runs occurring in November and December in Honshu.

CHARACTERISTICS OF SPAWNING GROUNDS

Among the chum salmon spawning grounds in the

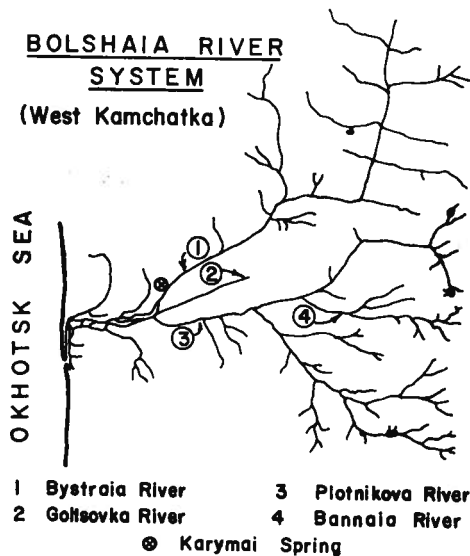


FIGURE 7. Bolshaia River salmon spawning grounds (from Semko, 1954).

Far East, those in the Bolshaia system of West Kamchatka and in the Amur River have been studied relatively well and some details are available for the Okhotsk district. Japanese chum salmon streams have also been studied. Details are not available for the small chum salmon runs to the Lena and Kolyma Rivers (Arctic Ocean).

BOLSHAIA RIVER (Semko, 1954)

The Bolshaia River (Fig. 7), the largest stream system on the west coast of Kamchatka, consists of many tributaries forming a stream network. Many of the major spawning grounds of chum salmon are found in areas about 100 km from the mouth. Among the most important spawning areas are Karymai Spring (70 km from the river mouth), Khaikov Spring (110 km) and Tratich Spring (160 km). There is also a separate spawning population in the Bannaia River, which is a tributary to the Plotnikova.

All five species of salmon spawn in the Bolshaia River system, but in general, different species utilize different areas of stream beds, without competing with others for spawning grounds.

Only coho salmon utilize stream beds of approximately similar conditions to those used by chum salmon, and the spawning areas of these two species overlap.

Whereas pink salmon choose stream areas with current velocities of 15–90 cm/sec and do not spawn in areas with current velocities outside of this range, chum salmon spawn in areas with much slower currents, if the beds are supplied with ground water.

The Karymai Spring does not freeze even in very

severe winters. The length of the spring (from the junction to the source) is 4.5 km, and the total area of stream bed is approximately 36,000 m², of which about 28,000 m² are utilized by salmon as spawning grounds. Not only chum salmon but also pinks, sockeye, coho and Dolly Varden spawn in this spring. The total annual number of chum salmon spawners entering the spring ranged from 2,480 to 68,280 during the period 1925–51.

Upstream migration of chum salmon in the Bolshaia River occurs during the period from June to August. Fish spawning in the upper reaches, in general, enter the river earlier than those spawning in the lower reaches. Actual spawning takes place during August and September in both the upper and lower reaches.

OKHOTSK DISTRICT (Sano, 1958)

Chum salmon bound for the Okhotsk district (Fig. 3) enter such streams as the Okhota, Kukhtui, Urak and Ulia Rivers for spawning.

Chum salmon go upstream in August and early September after spending some time in coastal waters; their spawning grounds are found in areas 100–200 km from the sea. The numbers of spawners in these streams have been decreasing somewhat in recent years, but the total escapement still exceeds 3.5 million fish. This district is one of the most important chum salmon producing areas in the Far East (Table 3).

The winter conditions are very severe in this region, temperature being -50°C or below, and part of the spawning grounds become frozen in years of particularly low snowfall, causing great damage to the reproduction of chum salmon.

AMUR RIVER

The Amur River (Fig. 4) is one of the most im-

TABLE 3. Abundance of chum salmon in the Okhotsk district, in millions of fish (total of all streams). (Yone-mori and Kondo, 1961.)

Year	Total run	Escapement
1947	17.2	11.5
1948	18.5	12.4
1949	29.6	19.7
1950	19.5	13.0
1951	15.3	9.4
1952	7.2	3.0
1953	8.6	3.0
1954	29.6	15.5
1955	25.4	12.4
1956	39.8	21.6
1957	19.5	8.8
1958	21.7	3.3
1959	15.8	3.5

TABLE 4. Stream catches in Hokkaido, in number of fish, for the years 1955 through 1960 (Hokkaido Salmon Hatchery data).

Area and river	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Total
(1) 1955							
JAPAN SEA COAST							
Teshio		664	2,231	2,681	214		5,790
Shokanbetsu	3	34	6				43
Ishikari		5,781	5,016	494	261	13	11,565
Shiribetsu			39	281	20		340
Toshibetsu			305	658			963
Shubuto		34	92	57			183
Atsusabe			900	2,850	175		3,925
<i>Sub-total</i>	3	6,513	8,589	7,021	670	13	22,809
PACIFIC COAST, WEST OF CAPE ERIMO							
Horobetsu			23	272	203		498
Motoura		5	19	10	64		98
Mitsuishi			3	19	10		32
Shizunai			15	1,250	838		2,103
Mukawa		180	130	7			317
Niikappu		15	2	138	111		266
Yufutsu			581	450	3		1,034
Shiraoi			49	272	24		345
Shikiu			105	236	48		389
Otoshibe			9	35	17		61
Yurappu		16	271	910	1,953		3,150
Moheji			1,212	4,221	250		5,683
Shiriuchi			5	802	267		1,074
<i>Sub-total</i>		216	2,424	8,622	3,788		15,050
PACIFIC COAST, EAST OF CAPE ERIMO							
Bekanbeushi			2,839	998	37		3,874
Kushiro		272	2,762	4,539	1,525		9,098
Charo			492	297	6		795
Onbetsu			170	54	16		240
Tokachi		23,939	29,611	12,444	816	9	66,819
Rekifune			744	984	116		1,844
Hiroo							
<i>Sub-total</i>		24,211	36,618	19,316	2,516	9	82,670
NEMURO DISTRICT							
Rausu			12	5,432	953		6,397
Shunkarikotan							
Motosakimui				66	4		70
Sakimui		2	88	1,699	31		1,820
Kotanuka				128	26		154
Uenbetsu		77	131	1,982	92		2,282
Kunbetsu		15	592	14,273	429		15,309
Ichani			1,761	6,120	201		8,082
Churui		45	26	303	23		397
Shibetsu		708	2,012	2,829	747		6,296
Tohoro		760	304	1,294	325		2,683
Shunbetsu		6	73	134	6		219
Tokotan		9	144	213	6		372
Nishibetsu		869	6,226	17,910	15,681	181	40,867
Bettoga		154	1,105	102			1,361
Furen		5	106	130			241
<i>Sub-total</i>		2,650	12,580	52,615	18,524	181	86,550

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TABLE 4. Continued.

Area and river	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Total
(1) 1955 (cont.)							
OKHOTSK COAST							
Iwaobetsu			28	223	89		340
Shari		4	260				264
Mokoto		8	1,300	1,246	310		2,864
Abashiri		724	10,007	17,194	6,457		34,382
Tokoro		1,509	5,164	2,329	368		9,370
Yubetsu			1,561	15,844	9,874		27,279
Shokotsu		375	366	701	44		1,486
Okoppe			337				337
Horonai		11	1,148	856			2,015
Tokushibetsu		724	91				815
Horobetsu		1,062	391	804			2,257
Tonbetsu		91	1,470	4,006	128		5,695
<i>Sub-total</i>		<i>4,508</i>	<i>22,123</i>	<i>43,203</i>	<i>17,270</i>		<i>87,104</i>
GRAND TOTAL	3	38,098	82,334	130,777	42,768	203	294,183
(2) 1956							
JAPAN SEA COAST							
Teshio		536	951	363	15		1,865
Ishikari	154	2,973	1,899	263	26		5,315
Shiribetsu			33	195	14		242
Toshibetsu			449	267			716
Atsusabe			502	1,498	174		2,174
<i>Sub-total</i>	<i>154</i>	<i>3,509</i>	<i>3,834</i>	<i>2,586</i>	<i>229</i>		<i>10,312</i>
PACIFIC COAST, WEST OF CAPE ERIMO							
Horobetsu			83	121	35		239
Motoura		6	42	25	14		87
Mitsuishi			44	30	25		99
Shizunai			659	703	161		1,523
Niikappu		3	59	84	29		175
Mukawa		74	50				124
Yufutsu		35	708	584	59		1,386
Shiraoi		6	51	75	28		160
Shikiu		6	97	84	12		199
Yurappu		15	87	261	101		464
Otoshibe			25	27	2		54
Nodaoi		29	46	13			88
Moheji			953	2,693	169		3,815
Shiriuchi				218	31		249
<i>Sub-total</i>		<i>174</i>	<i>2,904</i>	<i>4,918</i>	<i>666</i>		<i>8,662</i>
PACIFIC COAST, EAST OF CAPE ERIMO							
Bekanbeushi		6	1,994	1,570			3,570
Kushiro		105	4,861	8,634	1,697		15,297
Charo		47	1,002	135			1,184
Onbetsu		2	413	12			427
Tokachi		14,316	41,175	3,784	120		59,395
Rekifune			1,056	635	235		1,926
Hiroo			4	6			10
<i>Sub-total</i>		<i>14,476</i>	<i>50,505</i>	<i>14,776</i>	<i>2,052</i>		<i>81,809</i>
NEMURO DISTRICT							
Rausu				4,589	1,198		5,787
Uenbetsu		92	285	1,374	30		1,781

Continued . . .

TABLE 4. Continued.

Area and river	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Total
(2) 1956 (cont.)							
Motosakimui				14			14
Sakimui		9	91	1,230	6		1,336
Kunbetsu		29	492	3,432	50		4,003
Kotanuka				12			12
Churui		22	66	48			136
Ichani			192	847	2		1,041
Shibetsu		603	3,282	3,615	1,406	30	9,036
Tohoro		242	614	478	98		1,432
Shunbetsu		15	34	250	21		320
Tokotan		25	65	100			190
Nishibetsu		1,249	5,472	6,428	3,491	98	16,738
Furen		487	577	14			978
Bettoga		228	4,413	982			5,623
Shunkarikotan			151	71			222
<i>Sub-total</i>		<i>3,001</i>	<i>15,734</i>	<i>23,484</i>	<i>6,302</i>	<i>128</i>	<i>48,649</i>
OKHOTSK COAST							
Iwaobetsu			49	137	4		190
Shari			132	103	13		248
Mokoto		11	142	118	97		368
Abashiri	5	517	6,127	5,949	363		12,961
Tokoro		1,418	3,703	871	18		6,010
Shokotsu		90	188	99			377
Yubetsu			1,674	5,986	2,426		10,086
Mutsube			16	2			18
Horonai		8	204	116			328
Tokushibetsu		105	34				139
Horobetsu		679	730				1,409
Tonbetsu		14	218	195			427
<i>Sub-total</i>	<i>5</i>	<i>2,842</i>	<i>13,217</i>	<i>13,576</i>	<i>2,921</i>		<i>32,561</i>
GRAND TOTAL	159	24,002	86,194	59,340	12,170	128	181,993
(3) 1957							
JAPAN SEA COAST							
Teshio		783	1,738	338			2,859
Ishikari	67	4,685	8,620	507	160		14,039
Shiribetsu			34	197	12		243
Toshibetsu			114	58			172
Atsusabe			430	437	55		922
Shubuto		22	23				45
<i>Sub-total</i>	<i>67</i>	<i>5,490</i>	<i>10,959</i>	<i>1,537</i>	<i>227</i>		<i>18,280</i>
PACIFIC COAST, WEST OF CAPE ERIMO							
Horobetsu			37	167	102		306
Motoura			10	98	53		161
Mitsuishi			27	44	23		94
Shizunai			146	1,093	277		1,516
Niikappu			38	136	28		202
Mukawa		24	116				140
Yufutsu		44	1,380	1,725	157		3,306
Shiraoi			57	221	54		332
Shikiu			187	219	97		503
Yurappu		41	76	310	201		628
Nodaoi		4	3	6			13
Otoshibe			16	15	2		33

Continued . . .

TABLE 4. Continued.

Area and river	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Total
(3) 1957 (cont.)							
Moheji			1,048	5,961	130		7,139
Shiriuchi				134	5		139
<i>Sub-total</i>		113	3,141	10,129	1,129		14,512
PACIFIC COAST, EAST OF CAPE ERIMO							
Bekanbeushi		234	13,511	7,619	245		21,609
Kushiro	2	329	7,215	13,802	1,210		22,558
Charo			1,790	661	16		2,467
Onbetsu			482	203			685
Tokachi		12,704	82,895	12,543	476		108,618
Rekifune			1,218	586	218		2,022
Hiroo			66	6			72
<i>Sub-total</i>	2	13,267	107,177	35,420	2,165		158,031
NEMURO DISTRICT							
Rausu			12	4,610	2,115		6,737
Shunkarikotan		15	108	179			302
Uenbetsu		50	1,755	2,360	21		4,186
Motosakimui				12			12
Sakimui		67	1,305	3,214	5		4,591
Kunbetsu		103	4,476	16,216	59		20,854
Kotanuka				36			36
Churui		49	26	182			257
Ichani			408	2,303	38		2,749
Shibetsu		3,792	37,416	30,411	12,719		84,338
Tohoro		433	1,756	1,941	276		4,406
Shunbetsu		118	255	279	1		653
Tokotan		78	266	312	11		667
Nishibetsu		2,194	19,268	18,931	17,081	645	58,119
Furen		1,429	1,663	19			3,111
Bettoga		208	905	159			1,272
<i>Sub-total</i>		8,536	69,619	81,164	32,326	645	192,290
OKHOTSK COAST							
Iwaobetsu			8	38			46
Shari		18	394	289	158		859
Mokoto		69	406	515	67		1,057
Abashiri	6	1,874	8,898	8,610	191		19,579
Tokoro		38	2,173	4,092	186		6,489
Yubetsu		355	7,520	18,334	4,910		31,119
Shokotsu		18	105	170			293
Okoppe		9	75	3			87
Horonai		39	413	136			588
Tokushibetsu		80	179				259
Horobetsu		198	342				540
Tonbetsu		124	1,327	481			1,932
<i>Sub-total</i>	6	2,822	21,840	32,668	5,512		62,848
GRAND TOTAL	75	30,228	212,736	160,918	41,359	645	445,961
(4) 1958							
JAPAN SEA COAST							
Teshio		760	9,373	1,388	15		11,536
Ishikari		5,209	11,670	795	95		17,769
Shiribetsu		35	315	50			400
Toshibetsu			594	281			875
Atsusabe			300	453	23		776

Continued . . .

TABLE 4. Continued.

Area and river	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Total
(4) 1958 (cont.)							
Shubuto		11	58				69
<i>Sub-total</i>		6,015	22,310	2,967	133		31,425
PACIFIC COAST, WEST OF CAPE ERIMO							
Horobetsu			97	471	86		654
Motoura		1	67	296	50		414
Mitsuishi			29	404	16		449
Shizunai		24	370	4,108	339		4,841
Niikappu		5	34	626	79		744
Mukawa		46	337	146			529
Yufutsu		44	1,705	3,117	561		5,427
Shiraoi			67	449	33		549
Shikiu			128	408	37		573
Yurappu		62	138	766	1,070		2,036
Nodaoi		4	6	3			13
Otoshibe			32	65	30		127
Moheji			1,373	8,430	260		10,063
Shiriuchi				173	127		300
<i>Sub-total</i>		186	4,383	19,462	2,688		26,719
PACIFIC COAST, EAST OF CAPE ERIMO							
Bekanbeushi		530	15,473	6,857	225		23,085
Kushiro		339	6,766	19,743	1,867		28,715
Charo			776	738			1,514
Onbetsu			369	143			512
Tokachi		13,037	59,819	7,538	110		80,504
Rekifune			966	564	94		1,624
Hiroo			43	4			47
<i>Sub-total</i>		13,906	84,212	35,587	2,296		136,001
NEMURO DISTRICT							
Rausu			11	82	2,325		9,063
Shunkarikotan		18	52	1,133	1		153
Uenbetsu		89	618	8	48		1,888
Motosakimui				1,447			8
Sakimui		69	1,242		15		2,773
Kunbetsu		142	5,012	4,278	106		9,538
Kotanuka			9	25			34
Churui		134	201	283			618
Ichani		15	513	3,625	76		4,229
Shibetsu		1,287	19,188	35,949	26,702		83,126
Tohoro		134	1,338	1,499	207		3,178
Shunbetsu		11	144	624	29		808
Tokotan		39	415	449	47		950
Nishibetsu		713	10,656	33,159	58,449	5,142	108,119
Furen		756	2,502	388			3,646
Bettoga		75	1,544	408			2,027
<i>Sub-total</i>		3,482	43,445	90,084	88,005	5,142	230,158
OKHOTSK COAST							
Iwaobetsu				35			35
Shari		15	344	522	415		1,296
Mokoto		82	286	240	269		877
Abashiri		939	3,792	8,290	769		13,790
Tokoro		515	4,513	4,554	111		9,693
Yubetsu		342	8,148	19,296	4,594		32,380

Continued . . .

TABLE 4. Continued.

Area and river	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Total
(4) 1958 (cont.)							
Shokotsu			624	169			793
Mutsube			147	28			175
Horonai			649	587	14		1,250
Tokushibetsu		173	1,000	43			1,216
Horobetsu		24	778	159			961
Tonbetsu		5	1,881	1,587			3,473
<i>Sub-total</i>		2,095	22,162	35,510	6,172		65,939
GRAND TOTAL		25,684	176,512	183,610	99,294	5,142	490,242
(5) 1959							
JAPAN SEA COAST							
Teshio		138	1,633	366			2,137
Ishikari	52	2,756	3,304	608	49		6,769
Shiribetsu			19	231			250
Toshibetsu			918	176			1,094
Atsusabe			378	556	28		962
Shubuto		17	85	49			151
<i>Sub-total</i>	52	2,911	6,337	1,986	77		11,363
PACIFIC COAST, WEST OF CAPE ERIMO							
Horobetsu			82	397	156		635
Motoura		15	39	396	117		567
Mitsuishi			62	202	18		282
Shizunai		17	569	817	284		1,687
Niikappu			96	288	11		395
Mukawa		47	415	115			577
Yufutsu		27	1,555	379	42		2,003
Shiraoi		3	49	345	13		410
Shikiu			73	298	131		502
Oshamanbe		16	68	80	17		181
Yurappu		12	85	298	824		1,219
Moheji			1,498	6,346	1,201		9,045
Shiriuchi			2	210	101		313
<i>Sub-total</i>		137	4,593	10,171	2,915		17,816
PACIFIC COAST, EAST OF CAPE ERIMO							
Bekanbeushi		87	7,350	2,345			9,782
Kushiro		562	9,013	10,748	2,106		22,429
Charo			565	348	46		959
Onbetsu			196	81			277
Tokachi		10,505	16,476	1,817			28,798
Rekifune			326	584	384		1,294
<i>Sub-total</i>		11,154	33,926	15,923	2,536		63,539
NEMURO DISTRICT							
Rausu			14	1,801	773		2,648
Shunkarikotan		12	29	139	12		192
Uenbetsu		35	220	492	7		754
Motosakimui				43	9		52
Sakimui		62	559	1,625	33		2,279
Kunbetsu		338	1,662	3,970	138		6,108
Kotanuka				22			22
Churui		24	370	130			524
Ichani			480	661	41		1,182
Shibetsu		2,600	15,231	7,281	8,200		33,312

Continued . . .

TABLE 4. Continued.

Area and river	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Total.
(5) 1959 (cont.)							
Tohoro		183	2,601	1,545	243		4,572
Shunbetsu		17	138	311	39		505
Tokotan		25	290	246			561
Nishibetsu		792	11,436	39,511	54,235	9,422	115,396
Furen		181	1,555	255			1,991
Bettoga		191	2,954	292			3,437
<i>Sub-total</i>		4,460	37,539	58,384	63,730	9,422	173,535
OKHOTSK COAST							
Shari		5	63	116	357		541
Mokoto		12	197	377	711		1,297
Abashiri		202	5,257	23,500	4,364		33,323
Tokoro		533	3,890	4,254	399		9,076
Yubetsu		20	5,430	15,670	14,054		35,174
Shokotsu		20	163	109	86		378
Okoppe			111	8			119
Horonai		10	453	1,024	65		1,552
Omu			46				46
Tokushibetsu		131	650	184			965
Fureppu			4				4
Horobetsu		68	359	44			471
Tonbetsu		41	1,010	1,614	365		3,030
<i>Sub-total</i>		1,042	17,633	46,900	20,401		85,976
GRAND TOTAL	52	19,704	100,028	133,364	89,659	9,422	352,229
(6) 1960							
JAPAN SEA COAST							
Teshio		529	2,104	527			3,160
Ishikari	5	743	2,273	282	142		3,445
Shiribetsu			18	57			75
Toshibetsu		64	682	262			1,008
Atsusabe			190	293			483
<i>Sub-total</i>	5	1,336	5,267	1,421	142		8,171
PACIFIC COAST, WEST OF CAPE ERIMO							
Horobetsu			162	314	157		633
Motoura			112	138	98		348
Mitsuishi			84	247	64		395
Shizunai			438	1,463	333		2,234
Niikappu		5	94	251	1		351
Mukawa		36	63	28			127
Yufutsu			190	138			328
Shiraoi			28	123	10		161
Shikiu			138	78	44		260
Yurappu			62	213	169		444
Moheji			690	5,198	1,196		7,084
Shiriuchi				152	9		161
Oshamanbe		27	52	35			114
<i>Sub-total</i>		68	2,113	8,378	2,081		12,640
PACIFIC COAST, EAST OF CAPE ERIMO							
Bekanbeushi		17	1,920	422			2,359
Kushiro		137	3,440	17,530	1,636		22,743
Charo		4	539	981	228		1,752
Onbetsu			304	303			607

Continued . . .

TABLE 4. Continued.

Area and river	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Total
(6) 1960 (cont.)							
Tokachi		6,118	37,991	7,213	42		51,364
Rekifune			340	460	367		1,162
<i>Sub-total</i>		6,276	44,534	26,909	2,273		79,992
NEMURO DISTRICT							
Rausu			45	3,014	3,389		6,448
Shunkarikotan		9	12	44	12		77
Uenbetsu		38	111	155	25		329
Motosakimui				9	9		18
Sakimui		11	67	121	19		218
Kunbetsu		58	343	227	102		730
Kotanuka							
Churui		21	101	11			133
Ichani			59	118			177
Shibetsu		567	3,485	3,907	354		8,313
Tohoro		129	625	988	83		1,825
Shunbetsu		7	112	65			184
Tokotan		6	75	127			208
Nishibetsu		455	5,056	25,193	9,750	3,399	43,853
Furen		42	923	39			1,004
Bettoga		72	1,594	975			2,641
<i>Sub-total</i>		1,415	12,608	34,993	13,743	3,399	66,158
OKHOTSK COAST							
Iwaobetsu			2	117	417		536
Shari			131	208	584		923
Mokoto			101	364	1,380		1,845
Abashiri		51	5,975	48,238	17,340		71,604
Tokoro		392	1,707	4,429	2,142		8,670
Yubetsu		103	1,632	16,258	31,806		49,799
Shokotsu		35	408	350	1,512		2,305
Horonai		20	348	587	107		1,062
Tokushibetsu		49	220	42			311
Horobetsu		71	360	34			465
Tonbetsu		16	468	436			920
Obetsu			3				3
<i>Sub-total</i>		737	11,355	71,063	55,288		138,443
GRAND TOTAL	5	9,832	75,877	142,764	73,527	3,399	305,404

portant chum salmon producing areas in the Far East. Both summer chums and autumn chums spawn in this system. Summer chums are found mostly in lower areas, particularly in the Amgun River. Although some summer chums used to reach areas as far as 700–800 km from the sea, most of the spawners have spawned in areas within about 100 km from the river mouth in recent years, as their stocks have decreased. In contrast, most of the autumn chums reach the upper areas of the system as far as 1,000 km or more from the sea, and they are not in competition with summer chums for spawning grounds. Some of the autumn chums reach the Kumar River, which is about 2,000 km from the sea.

The upstream migration of autumn chums occurs

mostly in September and October, and some fish bound for the uppermost spawning grounds continue to migrate upstream until the end of November. Summer chum salmon go upstream during August and September. Their numbers have greatly decreased in recent years. Since they do not particularly choose areas supplied with ground water for spawning, damage by freezing and other winter conditions is far greater than in the case of autumn chums.

The main spawning grounds of summer chums are found in the Amgun and Iski Rivers; those of autumn chums are found in the Kur, Bira and Bidzhan Rivers, and such tributaries to the Ussuri River as the Khor, Bikin and Iman Rivers.

RIVERS OF NORTHERN JAPAN (data of the Hokkaido Salmon Hatchery)

Since the streams of northern Japan are relatively small, chum salmon spawning grounds are in lower areas in most of them, but they are as far from the sea as 100–200 km in such relatively large rivers as the Ishikari, Tokachi and Teshio.

Upstream migration in Hokkaido streams occurs during the period from the end of August to December (Table 4), and chum salmon runs in some of the Honshu streams occur even in January.

In the many salmon streams of Hokkaido and Honshu, most of the spawners are caught by the hatcheries for artificial propagation, and only small numbers reach their natural spawning grounds. Natural spawning has been observed in such streams as the Nishibetsu, Shibetsu, Tokachi, Kushiro, Teshio and Yubetsu. Somewhat larger numbers of chum salmon spawn on natural spawning grounds in years of high abundance and high water levels.

Some details regarding the chum salmon spawning grounds of Hokkaido streams are given below.

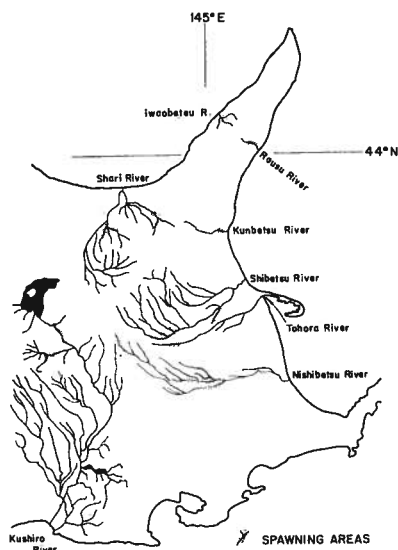


FIGURE 8. Chum salmon spawning grounds in northeastern Hokkaido.

Iwaobetsu River (Fig. 8)

This stream is located on the Shiretoko Peninsula, the northeastern end of Hokkaido. The entire stream is supplied with ground water, and good numbers of pink and masu salmon spawn here. A small number of chum salmon also go upstream for spawning. Fish enter the stream during the period from October to December and spawn immediately after their entrance into the spawning grounds which are within 2–3 km

from the river mouth. Some spawn even in the immediate vicinity of the mouth. The number of chum salmon taken in this stream for artificial propagation has been a little over 500 per year in recent years; the amount of natural spawning has been small.

Rausu River (Fig. 8)

This river is located on the Shiretoko Peninsula, on the opposite side to the Iwaobetsu River. The spawning grounds are up to 20 km from the river mouth. The spawning season is in November–December and the number of fish caught for propagation is from 2,000–3,000 to 4,000–5,000.

Kunbetsu River (Fig. 8)

Spawning occurs up to 4 km from the river mouth, where favourable spawning grounds are observed in many places. The number of spawners caught for propagation amounts to 10,000–15,000 fish. More natural spawning occurs in years of high water levels.

Shibetsu River (Fig. 8)

This is one of the larger rivers in the Nemuro district. The number of fish caught for propagation is only 5,000–6,000, but considerable numbers spawn naturally. Spawning grounds are mostly in the Chinana tributary and the upper part of the main stream.

Tohoru River (Fig. 8)

This stream also flows into Nemuro Bay. Chum salmon migration takes place during the period from September to December with the peak occurring in October. The natural spawning grounds of this stream are limited to areas approximately 40 km and above from the river mouth, and little spawning occurs in the lower areas. The spawning season is from October to December; 3,000–4,000 fish are taken annually for artificial propagation.

Nishibetsu River (Fig. 8)

The Nishibetsu River, one of the largest in the Nemuro district, has been receiving large numbers of chum salmon in recent years, and over 40,000–50,000 chum salmon spawners have been taken annually for artificial propagation. Upstream migration occurs during the period from September to as late as January, and the major spawning grounds are found in two areas approximately 40 km and 80 km from the river mouth. These have excellent environmental conditions. Considerable numbers of spawners reach these grounds in years of high abundance or high water levels. Spawning takes place from October until January. The grounds have fairly good supplies of ground water and do not freeze even during the period of lowest air temperature (-27°C).

Kushiro River (Fig. 8)

This is one of the larger rivers of Hokkaido which flow to the Pacific. The catch for propagation

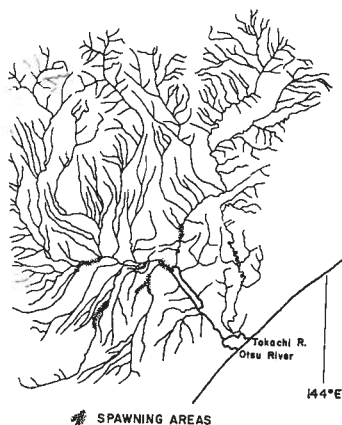


FIGURE 9. Chum salmon spawning grounds in the Tokachi River (Pacific coast of Hokkaido).

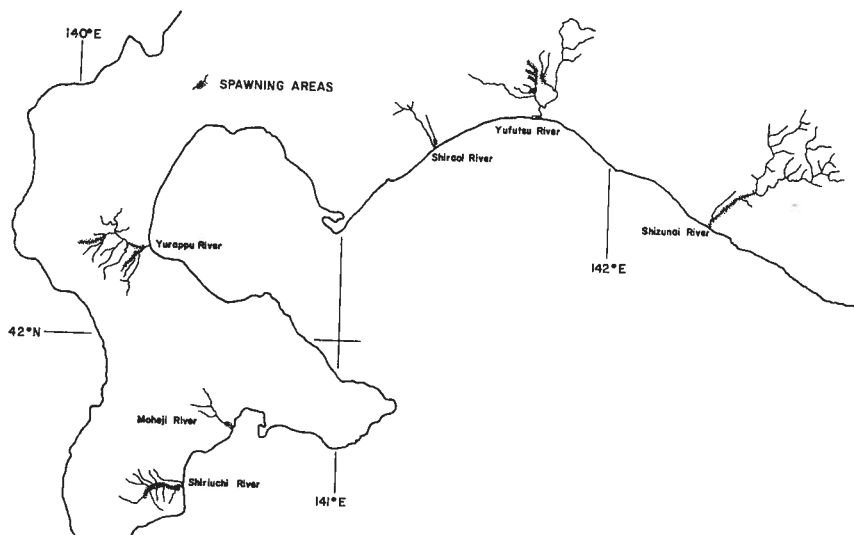


FIGURE 10. Chum salmon spawning grounds in rivers of Hokkaido's south coast.

amounts to 15,000–16,000 fish and the spawning season extends from September to December with a peak in November.

Tokachi River (Fig. 9)

The Tokachi River is the largest chum salmon stream in Hokkaido. Upstream migration continues over a period of about five months (September through January) and the number of chum salmon taken for artificial propagation ranges from 40,000–50,000 to 80,000 annually. The peak period of migration is October and November. Spawning grounds are found in main stream areas about 50 km from the river mouth, in the Satsunai and Makubetsu Rivers, in main stream areas 100 km from the river mouth, and in the entire length of a small tributary, the Nemu River.

Shizunai River (Fig. 10)

This is a relatively large stream flowing into the Pacific Ocean. Chum salmon migrate upstream during October through December, with a peak in November. The main spawning grounds are found in areas about 20 km from the river mouth; some chum salmon spawn in tidal regions about 1–2 km from the sea. The entire stream is supplied with ground water. The number of fish taken annually for artificial propagation is 1,500–2,000 in most years and over 4,000 in some years.

Yufutsu River (Fig. 10)

There is a shallow pond in this stream at approximately 20 km from the river mouth, and the areas beyond this pond are good spawning grounds. Chum salmon migration occurs during the period from

October to December, the peak being from the end of October to early November. Spawning occurs in November and December. A total of over 2,000 adult chum salmon is taken annually for artificial propagation.

Shiraoi River (Fig. 10)

About 500 fish enter this stream each year during the period from October to December. Some of these spawn in areas 2–3 km from the river mouth.

Yurappu River (Fig. 10)

This stream flows into Uchiura Bay. The period of chum salmon migration is from September to December, migration being heaviest in November or December. Early migrants spawn in areas over 20 km from the sea, and late spawners tend to utilize lower areas, some spawning grounds being in areas

about 4–10 km from the mouth. The number of spawners entering this stream has gradually decreased in recent years, and the catch by hatcheries has been less than 4,000–5,000.

Moheji River (Fig. 10)

This river flows into Tsugaru Strait. Spawning grounds are limited to areas close to the mouth, and spawning concentrates in areas between 50 m and 2 km from the mouth. The period of upstream migration is from October to December. Since all fish are fully matured when they enter the stream, spawning takes place as soon as they arrive at the spawning grounds. The number of adult fish caught for artificial propagation has been gradually increasing in recent years, being from 7,000–8,000 to 10,000 annually.

Shiriuchi River (Fig. 10)

This is the southernmost chum salmon stream in Hokkaido, and the period of upstream migration there is from October to December. The number of spawners has decreased sharply in recent years, and only 200–300 fish are taken annually for artificial propagation. The entire stream is well supplied with ground water, forming an excellent spawning ground within approximately 20 km of the mouth, but the amount of natural spawning has been very small in recent years.

Ishikari River (Fig. 11)

This river, the largest in Hokkaido, had large runs

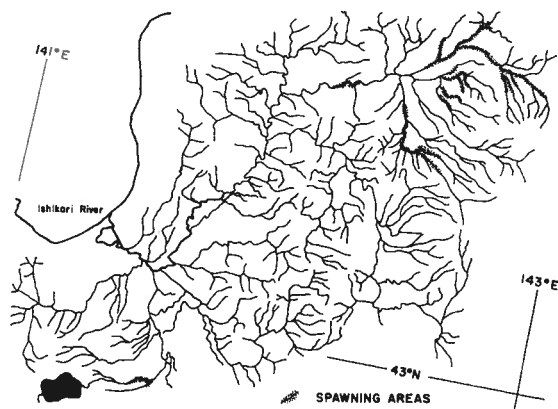


FIGURE 11. Chum salmon spawning grounds in the Ishikari River.

at one time, but they have decreased considerably in recent years. The numbers taken for propagation recently have been around 4,000–5,000, compared with 20,000 in earlier days. However, it is estimated that considerable numbers of chum salmon have spawned naturally even in recent years. The spawning grounds are observed mostly in the main stream over 150 km from the mouth, and in the upper tributaries, including the Chitose and Ryo Rivers.

Teshio River (Fig. 12)

The Teshio River mouth is in the northernmost part of Hokkaido facing the Japan Sea. The number

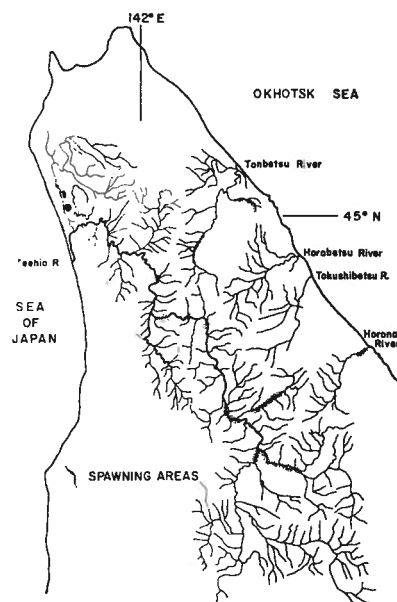


FIGURE 12. Chum salmon spawning grounds in northwestern Hokkaido.

of spawners taken for artificial propagation ranges from 2,000–3,000 to over 10,000. Considerable numbers of spawners escape to spawn naturally, particularly when the water level is high. The period of upstream migration is from September to November, and spawning occurs during October through December, some fish spawning in the upper reaches even during January. Spawning grounds are scattered over areas between approximately 40 and 150 km from the river mouth, and the largest spawning areas are found in such tributaries as the Niupu River (about 130 km from the sea) and the Nayoro River (150 km from the sea).

Tonbetsu River (Fig. 12)

This is a medium-sized river, 70–80 km in length, which flows into the Okhotsk Sea. Spawning occurs mainly in November and 5,000–6,000 spawners are taken annually for propagation. The main spawning grounds are observed in the Usotan River and in the main stream around 40 km from the river mouth, where spawning depositions occur from the end of October to December.

Horonai River (Fig. 12)

The Horonai River is intercepted by a power dam at a point approximately 4 km from the river mouth, and few chum salmon migrate beyond this point. The period of upstream migration is from September

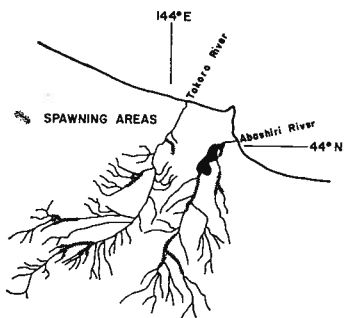


FIGURE 13. Chum salmon spawning grounds in the Tokoro and Abashiri Rivers of Hokkaido.

to December, with the peak in November. Spawning takes place in areas 1–2 km from the river mouth during November and December. Only a few chums, 1,000–1,500 per year, are taken for artificial propagation.

Tokoro River (Fig. 13)

This is one of the largest rivers flowing into the Okhotsk Sea. Approximately 10,000 chum salmon are taken annually for propagation; some spawn in the upper reaches when water levels are high. Upstream migration is usually observed from September to December with a peak in October; spawning extends from October to November. Most of the grounds are in the main stream over 40 km from the river mouth and in tributaries such as the Horouchi, Nigoro and Kuma Rivers.

Abashiri River (Fig. 13)

This river forms Abashiri Lake about 7.5 km from its mouth. Spawning occurs in tributaries flowing into the lake, such as the Memanbetsu, Bihoro, Tsubetsu, and others. The annual catch for propagation amounts to 20,000–30,000 fish, the largest of streams flowing into the Okhotsk Sea. Spawning mi-

gration is observed from September to December, with a peak in November; spawning occurs from the end of October to December.

CHUM SALMON CATCHES IN VARIOUS FAR EASTERN REGIONS

The coastal catches of chum salmon (not including catches by offshore fisheries) in recent years are shown in Table 5, by regions. Good catches were made in 1955 and 1956, but catches have been smaller since then, the total being mostly between 40,000–50,000 metric tons. The catch in 1958 was only 36,000 metric tons.

The large total catches in 1955 and 1956 were due to good fishing in northern areas. Catches have decreased since 1957 in almost all areas except the Okhotsk and Amur districts. However, relatively good catches have been obtained in some areas in some years even during the most recent period (such as in Japan in 1957 and 1958, in Sakhalin in 1957, on both coasts of Kamchatka in 1959).

Okhotsk and Amur chums have contributed very large proportions of the total catch. The catch in Japan made up considerable proportions in some years.

EAST COAST OF KAMCHATKA

A four-year cycle is recognizable in the chum salmon catch in this region since 1947, the annual catch exceeding 10,000 metric tons in 1951 and 1955. The catch in 1959 was a little over 7,000 metric tons, but was still the highest since 1956.

The 1948 cycle increased in abundance during the subsequent two generations, the catch in 1956 reaching as high as 11,000 metric tons, but the catch in 1960 was disappointing. In general, however, there

TABLE 5. Coastal catches of Far Eastern chum salmon (in metric tons). (Yonemori and Kondo, 1961.)

Year	East. Kam.	West Kam.	Okhotsk	Amur	Sakhalin	Primore	Japan	Total
1947	14,500	8,900	19,100	18,900	7,500	400	6,900	76,200
1948	6,700	19,300	20,600	12,200	3,600	100	8,800	71,300
1949	6,900	15,200	32,900	18,000	6,200	200	10,100	89,500
1950	5,500	8,800	21,700	17,800	7,600	100	13,700	75,200
1951	11,200	23,600	15,700	22,100	10,700	100	10,000	93,400
1952	7,900	7,900	10,900	10,600	6,600	100	8,049	52,049
1953	2,900	6,700	10,100	10,400	3,800	100	10,786	44,786
1954	5,300	14,000	25,800	4,900	2,500	100	9,554	62,154
1955	10,680	16,666	20,650	12,290	5,300	130	6,924	72,640
1956	11,810	11,510	36,010	14,560	3,330	60	5,216	82,496
1957	4,110	2,154	14,565	5,671	5,457	—	8,970	40,927
1958	3,811	971	11,407	9,150	2,298	—	8,392	36,029
1959	7,044	7,931	11,717	10,679	791	—	5,810	43,972
1960	3,646	2,965	19,863	13,753	900	—	5,110	46,237

have been no marked declining tendencies in the chum salmon catch of this region.

WEST COAST OF KAMCHATKA

In the fishery on the west coast of Kamchatka there is an overlapping of the large stocks primarily from the Bolshaia River with those migrating to the Penzhinsk area in the north, and for this reason it is not possible to detect any regular trends of abundance.

The catch was over 10,000 metric tons in 1948, 1949, 1951, 1954, 1955 and 1956. It is assumed that escapements were large in these years, which would have resulted in great numbers of seaward migrants, but the effect of such large production of seaward migrants is not apparent in the catch statistics. However, the 1955 catch was the greatest in recent years, indicating that the 1951 year class was large. Also, the catches in 1954 and 1956 were relatively high, presumably owing to larger quantities of 3- and 5-year-old fish, respectively. Furthermore, although the catch in 1959 was low, it was higher than in the years preceding and following.

OKHOTSK DISTRICT

This stock, like the autumn chum stock of the Amur, has been a big producer in recent years. In some recent years, it has contributed over 40% of the total Far Eastern coastal catch of chum salmon, and it has not fallen below an annual catch of 10,000 metric tons in any recent year.

Four-year cycles are recognizable. The catch was good in 1948, 1952, 1956 and 1960. The catch was also high in 1947 and 1949, and large catches made in 1954 and 1955 may be associated with the abundance of the 1947 and 1949 year classes. In general, there have been slight or no declining tendencies.

AMUR RIVER

The catch was relatively stable during 1947-50 and became irregular after 1951, when the largest catch in recent years was made. It seems, however, that the effect of the great abundance of spawners in 1951 is detectable even in most recent years. Autumn chums have made up the great majority of the catch in recent years, with much smaller amounts of summer chums. The catch in this district has contributed nearly 30% of the total coastal catch of Far Eastern chum salmon. The catch in 1960 was over 13,000 metric tons.

SAKHALIN AND PRIMORE

Cyclic fluctuations were recognizable until 1955, but diminished thereafter. The catch has been very low in most recent years, being less than 1,000 metric tons. Chum salmon found in these waters are princi-

pally autumn chums, including part of those bound for the Amur and northern Japan. The decline in catch was particularly marked along the Primore coast and there is very little commercial fishing in this district at present.

NORTHERN JAPAN

The coastal catch of Japanese autumn chums has not shown violent fluctuations, but some four-year cyclic fluctuation is recognizable. The catch was high in 1949 and 1950, 1953 and 1954, and 1957 and 1958. Although the catches from these two cycles were relatively low in most recent years (between 8,000 and 9,000 metric tons in 1957 and 1958), cyclic fluctuations are still detectable, and are expected to exist in future years.

PROPAGATION AND CONSERVATION

In order to secure the reproduction of chum salmon stocks in the Far East, various conservation measures have been taken in different areas. For the purpose of allowing sufficient numbers of spawners to arrive at spawning grounds, the catch of Amur River summer chums is prohibited in the river mouth and in stretches of 2 km upward and 4 km downward from the junctions of spawning tributaries, and the stream catches of autumn chums, too, are strictly limited by quotas. Much effort is made to secure the passage of spawners to spawning grounds, and the improvement of streams and the elimination of obstacles are carried out by fishery organizations in cooperation with other agencies. (Sano, 1958.)

Hatchery operations are very active. There are two hatcheries (including the Teplovskii Hatchery) in the Amur River system, 20 (including the Kalinin Hatchery) in Sakhalin, and five on the Kuril Islands. A total of 28 hatcheries, including a Kamchatka hatchery for experimental purposes, released 201,000-000 chum salmon fry in 1960.

Hatchery operations have been carried out for many years for autumn chums migrating into the streams of northern Japan. The catching of salmon is prohibited for a certain area on both sides of a river mouth and in streams (except for spawners to be used for artificial propagation).

As various industrial developments have taken place in areas along chum salmon streams, pollution and reduction of water flow have become serious problems. Efforts are being made to maintain natural conditions as much as possible, by establishing various regulations.

There is a hatchery organization with six branches in Hokkaido, each of these branches operates five to twelve hatcheries, the total number of hatcheries in Hokkaido being 50. The scale of their operations is

TABLE 6. Number of spawners caught, number of eggs collected and number of fry released in hatchery operations in Hokkaido, 1951-60 (Hokkaido Salmon Hatchery data).

Year	No. of spawners caught			No. of females used for egg collection	No. of eggs collected	No. of fry released
	Female	Male	Total			
1951	144,868	149,536	294,404	87,626	237,973,810	189,156,650
1952	145,083	167,157	312,240	84,164	220,981,580	159,517,150
1953	99,312	112,698	212,010	76,829	211,314,300	169,866,280
1954	174,237	211,559	385,796	132,802	334,235,460	269,338,070
1955	152,188	141,995	294,183	133,692	297,543,930	247,922,470
1956	83,849	98,216	182,065	62,184	168,127,540	140,453,710
1957	214,749	233,474	448,223	179,445	460,547,380	361,808,220
1958	250,129	239,240	489,369	215,432	566,417,330	417,237,700 ¹
1959	173,125	180,374	353,499	156,211	410,322,990	313,549,090 ²
1960	131,476	173,656	305,132	121,012	270,522,410	203,808,440
Average	156,902	170,791	327,693		317,798,673 ³	247,265,778

¹ Of this total, 17,740,000 fry were released in Honshu.

² Of this total, 21,126,000 fry were released in Honshu.

³ The average number of eggs collected from one fish ranged from 2,166 to 2,750 over the period.

TABLE 7. Number of spawners caught, number of eggs collected and number of fry released in hatchery operations in Honshu, 1956-60 (Fisheries Agency data).

Year	No. of spawners caught			No. of eggs collected	No. of fry released
	Female	Male	Total		
1956	43,417	33,348	77,223	40,241,000	34,615,000
1957	28,977	34,265	63,242	41,222,000	53,389,000 ¹
1958	64,614	73,423	138,037	66,198,000	80,256,000 ²
1959	39,078	35,370	74,448	70,702,000	63,823,000
1960	41,220	47,894	89,114	71,524,000	65,158,000
Average	43,461	44,860	88,321	57,977,000	59,448,000

¹ Of this total, 17,740,000 were transplanted from Hokkaido.

² Of this total, 21,126,000 were transplanted from Hokkaido.

indicated in Table 6. A total of 19 hatcheries of various sizes are situated in northern Honshu and their operations are summarized in Table 7.

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