

THE BIOLOGICAL BOARD OF CANADA

UNDER THE CONTROL OF
THE MINISTER OF FISHERIES

BULLETIN No. XIV

PACIFIC SALMON MIGRATION: THE TAGGING
OF THE PINK SALMON AND THE CHUM
SALMON IN BRITISH COLUMBIA
IN 1928

BY
ANDREW L. PRITCHARD
Pacific Biological Station

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INTRODUCTION

As early as 1903, a large fishery in British Columbia was dependent on the Pink salmon. The Chum first came into prominence about 1907. With the growing demand for canned salmon and the decrease of the Sockeye (*Oncorhynchus nerka*) in some localities, the species under discussion gradually increased in importance. In 1926 seventy-one per cent. of the entire pack of the province consisted of Pink and Chum, the former constituting about thirty-seven per cent. of that amount and the latter thirty-four per cent. In view of this situation, a study of the life histories of the two species and the factors affecting them appeared essential in order that such knowledge might form the basis for the development of adequate conservational measures.

The life of the Pacific salmon may be roughly divided into two parts: the freshwater and the marine. Investigation of the former is comparatively simple since the fish are then in an area which is limited, accessible and suitable for observation. The marine phase is more difficult to examine because the fish may range far afield in almost inaccessible places. A further difficulty obtains in the case of the Pinks and Chums in that they do not "take a spoon" or troll, and hence are rarely seen until they reappear as mature individuals ready to spawn. The tagging programme which is outlined below was initiated in order to gain as much information as possible on the behaviour and migrations of these salmon during that part of their life in the sea which it is possible to observe.

PREVIOUS TAGGING WORK ON THE SPECIES

The United States Bureau of Fisheries has undertaken work of a similar nature on these species in Alaskan waters in 1923, 1924, 1925, and 1926. The results contained in the reports of that organization for 1926 and 1927 give some insight into the migrations in that area. The articles giving the results are as follows:

GILBERT, C. H. and W. H. RICH. Second experiment in tagging salmon in the Alaska fisheries reservation summer of 1923. *Bull. U.S. Bur. Fish.*, XLII, 27, 1926; RICH, W. H. Salmon tagging experiments in Alaska, 1924 and 1925. *Bull. U.S. Bur. Fish.*, XLII, 109, 1926; RICH, W. H. and A. J. SOUMELLA. Salmon tagging experiments in Alaska, 1926. *Bull. U.S. Bur. Fish.*, XLIII, (11), 71, 1927.

Only relatively few individuals were found to penetrate the waters of British Columbia. The present paper is the first to treat of the migration of the Pink and Chum in Canadian waters.

THE TAG AND ITS USE

In British Columbia the tag employed to mark salmon is an aluminum band about three-eighths of an inch broad, less than one-sixteenth of an inch thick

and two and three-quarters inches long (figure 1). On the face of this appears the serial number and the initial letters of the province.



FIGURE 1.—Illustration of one of the British Columbia tags which has been used and returned.

When about to use this tag, the tagger bends it into a triangular shape so as to fit it between the points of a special pair of pliers (figure 2). He then slips it over the upper edge of the tail, and by applying pressure to the handles of the pliers drives the sharp pointed arm through the tail. The point, on issuing at the opposite side, is passed through the rectangular opening in the other arm of the tag, is turned back against the pliers and riveted. A fish thus tagged is shown in figure 3.

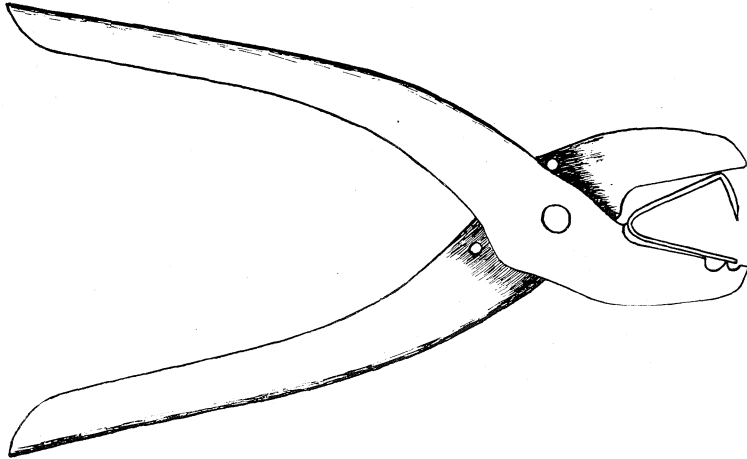


FIGURE 2.—Pliers with tag in position (after Williamson, H. C., Report on the tagging operations in 1925, *Contr. Canad. Biol. Fish.*, N.S., III, 9, 1927).

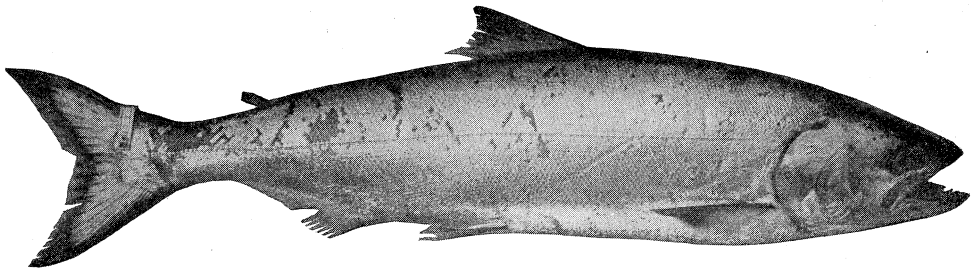


FIGURE 3.—Diagram of salmon with tag affixed (after Williamson, 1927).

PRECAUTIONARY MEASURES

The physical condition of the fish is of vital importance in all tagging investigations. Some salmon are taken in which the gill arches have been damaged by the hooks or other implements of gear. In no case, however, were any tagged in which bleeding occurred in the gill region.

During the actual act of tagging, the tagger, having wet his hands or having put on wet canvas gloves, places the salmon on wet burlap sacks and affixes the tag, all the while holding the fish as gently as possible. These precautions almost completely prevent the removal of scales and injury to the fish through violent thrashing on the deck of the boat.

Taggers are also very careful to see that the tag pierces the fleshy part of the tail and is riveted securely. Only in exceptionally large fish is the membranous portion sufficiently strong to hold the tag.

METHOD OF FISHING

While Spring salmon (*Oncorhynchus tshawytscha*) and the majority of the Coho (*Oncorhynchus kisutch*) are caught by trolling, and Sockeye (*Oncorhynchus nerka*) are taken in gill nets, Pinks and Chums are captured in gear called purse-seines. These are straight pieces of mesh about two hundred fathoms (1200 feet) in length and about ten fathoms (60 feet) in depth. The top edge or "cork line" is floated by large corks and the bottom edge or "lead line" is weighted and sunk by heavy leads. This net is placed around a school of salmon, then by means of a rope, which runs through rings on the lead line, the bottom is closed tightly, the fish being thus enclosed in a bag. This is pulled close to the boat and the salmon are taken aboard by means of a huge dipnet or "brailer".

In order that the tags may be affixed in a manner which is expeditious and efficient for this type of fishing, a "live-box" is employed. This is a crate of wooden laths, 56 inches in length, 42 inches in width and 20 inches in depth, which can be tied alongside the boat in the sea. When the salmon are emptied into this from the "brailer", they are free to swim around until the taggers are ready to handle them. They are then removed with a smaller dip-net, tagged and released, just as in the case of fish taken on the troll. The use of this box saves much inconvenience for the commercial fishermen, and safeguards against injury to the fishes through exposure to the open air for too long a time.

PROGRAMME OF 1928

The programme of 1928 was carried out in August, September and October in the region of Discovery passage, Johnstone and Broughton straits. The species tagged were Spring (*O. tshawytscha*), Coho (*O. kisutch*), Chum (*O. keta*) and Pink (*O. gorbuscha*) salmon. The majority of the first two species were caught on the troll near Blackfish sound, Alert bay, Bates pass and Christie pass. While a few Chums and Pinks were captured in the same way, nearly all were

taken in a purse-seine when they were in these waters, presumably on their spawning migration. The former were procured chiefly in the vicinity of the west coasts of Quadra and Sonora islands in September and October, the latter for the most part at Robsons bight in August.

ACKNOWLEDGEMENTS

The arrangements for the programme were made by Dr. W. A. Clemens, Director of the Pacific Biological Station, Nanaimo, B.C. We are greatly indebted to Mr. W. F. Baxter for his energy and efficiency in supervising the work. Thanks are also due to the other members of the tagging staff as well as to the fishermen who assisted them in every way in procuring material for this investigation.

Pink salmon (*Oncorhynchus gorbuscha* (Walbaum))

The following table gives a condensed record of the tagging for this species:

TABLE I.—Location, dates of tagging and numbers of Pink salmon tagged in 1928

District	Date	No. tagged	No. returned	Per cent. returned	Method of capture
Bates passage.....	Aug. 1	1	1	100	Troll
Christie passage.....	" 5 & 6	7	0	0	"
Duval point.....	" 8	2	0	0	"
Hardy bay.....	" 8	5	1	20	"
Blackfish sound including Cracroft point, Freshwater bay, Parsons bay, and Blackfish sound proper	July 21, 22, 23 Aug. 10, 12, 16 & 17	16	2	12.5	"
Robsons bight.....	Sept. 10 & 23	176	18	10.2	Purse-seine
	Total no.	207	22	10.6	

These are tabulated in detail below (table II) and illustrated graphically in figure 4. The line drawn in the map is not intended to designate the exact route followed by the salmon but merely to indicate the general direction.

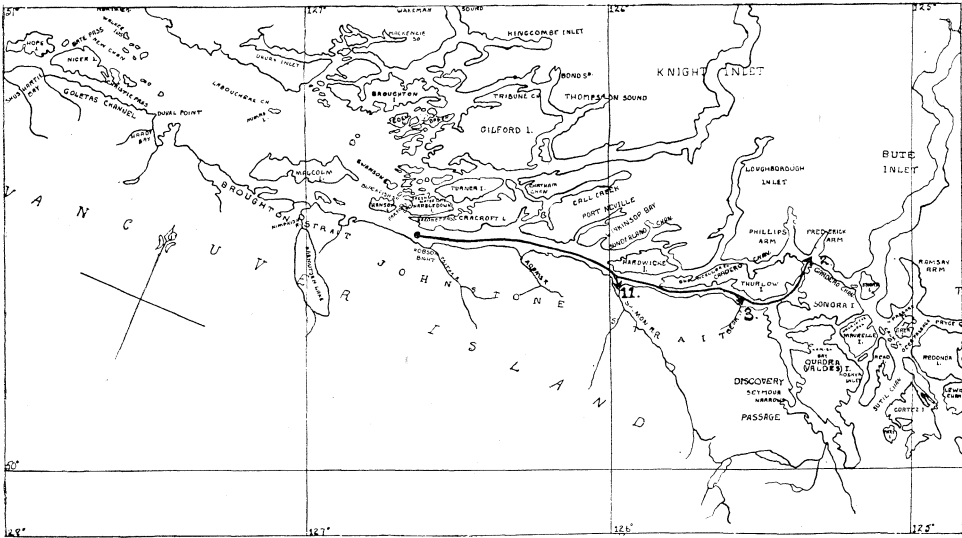


FIGURE 4.—Distribution of recaptured Pink salmon tagged at Robsons bight.

TABLE II.—Returns from Pink salmon tagged in 1928

Tag no.	Date tagged	Date of recapture	Time free (days)	Locality of tagging	Locality of recapture
7303	Aug. 1	Sept. 4 or 7	34-37	Bates passage	Protection pt., Knights inlet
9144	" 8	" 3	26	Hardy bay	Ramsay & Phillips arm area
9035	July 23	July 25	2	Blackfish sound	Robsons bight
7825	Aug. 20	Aug. 28 (?)	8 (?)	Freshwater bay, Harbledown id.	Near Salmon river
7610	" 23	" 29	6	Robsons bight Johnstone strait	Johnstone straits
7641	" 23	" 28	5	" "	Near Salmon r. Johnstone straits
7664	" 23	" 28	5	" "	" " " "
7665	" 23	" 28	5	" "	" " " "
7536	" 23	" 30	7	" "	" " " "
7556	" 23	" 30	7	" "	" " " "
7672	" 23	" 30	7	" "	" " " "
7686	" 23	" 30	7	" "	" " " "
7543	" 23	Sept. 10	18	" "	" " " "
7553	" 23	" 10	18	" "	" " " "
7567	" 23	" 10	18	" "	" " " "
7612	" 23	" 10	18	" "	" " " "
7632	" 23	" 10	18	" "	" " " "
7568	" 23	Aug. 27	4	" "	Bear river
7580	" 23	" 27	4	" "	" "
7701	" 23	" 27	4	" "	" "
7533	" 23	Sept. 5	13	" "	Ramsay & Phillips arm area
7637	" 23	" 5	13	" "	" " " "

RESULTS OF INTEREST

No recaptures were made in exactly the same locality where tagging took place. This would seem to indicate that the Pinks were not tarrying in these areas but were moving toward the spawning rivers. The greatest distance traversed was from Hardy bay to Ramsay arm, about one hundred miles. This journey was completed in about thirty-four days, that is, at a minimum rate of three miles per day. The least distance was from Blackfish sound to Robsons bight, which is eight or ten miles. The rate of travel in this case was approximately the same.

Of the eighteen tags affixed in Robsons bight and later returned, by far the largest number of 12 or 66 per cent. were recaptured at Salmon river. In three cases Pinks tagged in Robsons bight on the same day were recaptured later off Salmon river at the same time. From this fact, it is evident that the fish ran from one place to another in small groups at least, if not in large schools.

CONCLUSIONS

In summary we can conclude that the principal migration of Pinks in the Johnstone and Broughton strait region takes place in an easterly and southerly direction. After they make their first appearance here as spawning schools, they do not travel far, but run chiefly to local streams. This condition was shown to be true for those in Alaska (Gilbert and Rich 1926).

The returns reported here seem to indicate that Pink salmon taken in Robsons bight are largely made up of fish on their way to Salmon river to spawn. The reason may lie, however, in the fact that commercial fishing for this species was prosecuted to a greater extent here than elsewhere, resulting in the capture of a larger number of tagged fish.

The fact that no tagged Pink salmon were taken south of Discovery passage is interesting. While the number tagged was small, the results indicate at least that the Pinks which entered Johnstone and Broughton straits did not contribute to the Fraser river runs this year.

Chum salmon (*Oncorhynchus keta* (Walbaum))

Most of the Chums were tagged off the west coast of Quadra and Sonora islands. Table III below gives a condensed record of the tagging operations.

TABLE III.—Giving location, dates of tagging and numbers of Chum salmon tagged in 1928 and the numbers and percentage of those tagged which were recaptured

District	Date	No. tagged	No. returned	Per cent. returned	Method of capture
Robsons bight.....	Sept. 10 & 23	18	3	16.7	Troll
Howe island.....	Oct. 11 & 17	86	14	15.1	Purse-seine
Cinque island.....	" 17	249	38	15.3	"
Granite point.....	" 5	81	11	13.6	"
Granite bay.....	" 5	138	22	16.0	"
Deepwater bay.....	" 4, 15 & 18	459	61	13.3	"
Total no.		1,031	149	14.4	

All the returns are listed in detail below in table IV. These are recorded first in order of locality of tagging, then in order of locality of recapture from north to south.

TABLE IV.—Returns from Chum salmon tagged in 1928

Tag number	Date tagged	Date of recapture	Time free (days)	Locality of tagging	Locality of recapture
*5595	Feb. 17	Oct. 12	254	Gabriola beacon near Nanaimo	Deep Water bay
†7300	Aug. 1	Aug. 30	29	Bates pass	Sointula cannery returns
7707	" 23	Nov. 14	83	Robsons bight Johnstone sts.	Squamish, Howe sd.
7938	Sept. 10	Sept. 14	10	" " " "	East pt., Roberts
7939	" 10	Oct. 3	23	" " " "	Jack pt., Nanaimo
10041	Oct. 17	Sept. 19/29 (?)	338 (?)	Off Howe id. w. coast Sonora id..	London, Ont. (shipment of fish)
9427	" 11	Oct. 12/28	1	" " " " "	Deep Water bay, w. c. Quadra id.
10033	" 17	" 20	3	" " " " "	Deep Water bay, west coast, Quadra id.
9464	" 11	" 18	7	" " " " "	" " "
9401	" 11	" 20	9	" " " " "	" " "
9432	" 11	Nov. 14	34	" " " " "	Squamish, Howe sound
9467	" 11	" 14	34	" " " " "	" " "
9402	" 11	Oct. 31	20	" " " " "	Fraser r. above Westminster bridge
9434	" 11	Nov. 2	22	" " " " "	" " "
10045	" 17	" 13	27	" " " " "	" " "
9416	" 11	Oct. 29	18	" " " " "	Fraser r., at Haney
9470	" 11	" 23	12	" " " " "	Qualicum, Vancouver id.
9459	" 11	" 29	18	" " " " "	" " "
9466	" 11	Nov. 6	26	" " " " "	" " "

TABLE IV.—Returns from Chum salmon tagged in 1928—*Continued*

Tag number	Date tagged	Date of recapture	Time free (days)	Locality of tagging	Locality of recapture
10061	Oct. 17	Oct. 18	1	Cinque id. w. coast of Sonora id.	Deep Water bay, west coast of Quadra id.
10273	" 17	" 18	1	" " " " "	" " " "
10171	" 17	" 19	2	" " " " "	" " " "
10270	" 17	" 20	3	" " " " "	" " " "
10281	" 17	" 24	7	" " " " "	" " " "
10257	" 17	" 29	12	" " " " "	Jervis inlet
10192	" 17	Nov. 12	26	" " " " "	" "
10080	" 17	Oct. 27	10	" " " " "	Deserted bay, Jervis inlet
10184	" 17	Nov. 9	23	" " " " "	Squamish, Howe sound
10091	" 17	" 1	15	" " " " "	Fraser r. off Sandheads
10072	" 17	" 15	29	" " " " "	" " mouth
10250	" 17	" 6	20	" " " " "	" " opp. Steveston
10164	" 17	" 7	21	" " " " "	" " at Steveston
10173	" 17	" 9	23	" " " " "	" " " "
10208	" 17	" 6	20	" " " " "	" " Deas id.
10143	" 17	Oct. 29	12	" " " " "	" " near Lions id. " " above Westminster bridge
10105	" 17	" 3	17	" " " " "	" " " "
10226	" 17	" 3	17	" " " " "	" " " "
10180	" 17	" 6	20	" " " " "	" " " "
10204	" 17	" 6	20	" " " " "	" " " "
10151	" 17	" 13	27	" " " " "	" " " "
10218	" 17	Nov. 6	20	" " " " "	Port Kells
10274	" 17	Oct. 26	9	" " " " "	Bush pt., Whidbey id. U.S.A.
10099	" 17	Nov. 6	20	" " " " "	Samish Hatch trap, Washington, U.S.A.
10163	" 17	Oct. 25	8	" " " " "	Discovery bay, s. shore, Puget sd. U.S.A.
10081	" 17	" 31	14	" " " " "	Deep bay, Vancouver id.
10104	" 17	Oct. 31	14	" " " " "	Deep bay, Vancouver id.
10107	" 17	" 20	3	" " " " "	Qualicum, " "
10075	" 17	" 23	6	" " " " "	" " " "
10205	" 17	" 23	6	" " " " "	" " " "
10260	" 17	" 23	6	" " " " "	" " " "
10135	" 17	" 25	8	" " " " "	" " " "
10185	" 17	" 25	8	" " " " "	" " " "
10131	" 17	" 29	12	" " " " "	" " " "
10128	" 17	" 31	14	" " " " "	" " " "
**10047	" 17	Nov. 6	20	" " " " "	" " " "
10108	" 17	" 6	20	" " " " "	" " " "
††10077	" 17	Oct. 29	12	" " " " "	Off Finger ids., Nanaimo
9919	" 5	" 25	20	Granite pt. w. coast Quadra is.	Bute inlet
9936	" 5	" 30	25	" " " " "	Granite bay, west coast of Quadra id.
9681	" 5	" 19	14	" " " " "	Deep Water bay, west coast of Quadra id.
9899	5	" 20	15	" " " " "	" " " "

TABLE IV.—Returns from Chum salmon tagged in 1928—*Continued*

Tag number	Date tagged	Date of recapture	Time free (days)	Locality of tagging	Locality of recaptures
9689	Oct. 5	" 16	11	Granite pt. w. coast Quadra is.	Shannon r. near Powell r.
9907	" 5	Nov. 9	35	" " " " "	Head of Howe sound
9699	" 5	" 2	28	" " " " "	Fraser r. opp. Steveston
9920	" 2	Oct. 25	23	" " " " "	" above Westminster bridge
9914	" 5	" 14	9	" " " " "	Westbeach, (Whid bey is.)
9897	" 5	" 26	21	" " " " "	Comox, Vancouver id.
9912	" 5	Nov. 3	29	" " " " "	Nanaimo, Vancouver id.
†† 9842	" 5	Oct. 9	4	Granite bay, w. coast Quadra id.	Deep Water bay, w. coast Quadra id.
9851	" 5	" 10	5	" " " " "	" " " "
9770	" 5	" 24	19	" " " " "	" " " "
9777	" 5	" 24	19	" " " " "	" " " "
†† 9824	" 5	" 17	12	" " " " "	Malaspina inlet
9802	" 5	Nov. 1	27	" " " " "	Sliammon r. near Powell r.
9792	" 5	Oct. 30	25	" " " " "	Myrtle pt., " "
†† 9788	" 5	" 25	20	" " " " "	Jervis inlet
9805	" 5			" " " " "	Howe sound
9854	" 5	Nov. 1	27	" " " " "	Squamish, Howe sound
9817	" 5	Oct. 15	10	" " " " "	Fraser r., Canoe pass.
9853	" 5	" 16	11	" " " " "	" " "
9755	" 5	" 26	21	" " " " "	" " "
9863	" 5	" 30	25	" " " " "	" at Sunbury
9759	" 5	" 30	25	" " " " "	" above Westminster bridge
9849	" 5	" 30	25	" " " " "	" " "
9776	" 5	Nov. 6	32	" " " " "	" at Harrison mills
9883	" 5	Oct. 16	11	" " " " "	Qualicum beach, Vancouver id.
9827	" 5	" 29	24	" " " " "	" " "
9761	Oct. 5	Oct. 24	19	Granite bay, w. coast Quadra id.	Off Five Finger ids. near Nanaimo
9800	" 5	" 15	10	" " " " "	Nanaimo, Vancouver id.
9882	" 5	" 23	18	" " " " "	Near " " "
9492	" 15	Nov. 5	21	Deep Water bay, west coast Quadra id.	Alert bay
9960	" 15	Oct. 17	2	" " " " "	Kamish, Granite bay
9344	" 15	" 16	1	" " " " "	Deep Water bay, w. coast Quadra id.
9340	" 15	" 17	2	" " " " "	" " " "
9992	" 15	" 18	3	" " " " "	" " " "
9397	" 15	" 19	4	" " " " "	" " " "
9398	" 15	" 20	5	" " " " "	" " " "
9733	" 4	" 9	5	" " " " "	" " " "
9366	" 15	" 24	9	" " " " "	" " " "
9396	" 15	" 24	9	" " " " "	" " " "
9379	" 15	" 29	14	" " " " "	" " " "
10368	" 18	" 25	7	" " " " "	Jervis inlet

TABLE IV.—Returns from Chum salmon tagged in 1928—*Continued*

Tag number	Date tagged	Date of recapture	Time free (days)	Locality of tagging	Locality of recapture
10384	Oct. 18	Nov. 20	33	Deep Water bay, west coast	
				Quadra id.	Head of Jarvis inlet
9493	" 15	Oct. 25	10	" " " " "	Anvil id. Howe sound
10391	" 18	Nov. 12	25	" " " " "	Howe sound
10021	" 15	" 14	30	" " " " "	Head of Howe sound
10381	" 18	" 1	14	" " " " "	Fraser r. at Sandheads
10406	" 18	" 6	19	" " " " "	" " "
9304	" 15	Oct. 29	14	" " " " "	" opp. Steveston
9979	" 15	" 29	14	" " " " "	" " "
9274	" 15	Nov. 2	18	" " " " "	" " "
10462	" 18	" 9	22	" " " " "	" " "
10386	" 17	" 14	28	" " " " "	" Deas island
10393	" 18	" 13	26	" " " " "	" near Cotton-
					wood pt.
10390	" 18	" 6	19	" " " " "	" North arm.
9729	" 4	Oct. 23	19	" " " " "	" main channel
10329	" 18	" 30	12	" " " " "	" opp. Sunbury
10306	" 18	Nov. 6	19	" " " " "	" " "
9395	" 15	Oct. 30	15	" " " " "	" above West-
					minster bridge
10413	" 18	Nov. 2	15	" " " " "	" " "
9338	" 15	" 7	23	" " " " "	" " "
9958	" 15	" 7	23	" " " " "	" " "
10427	" 18	" 12	25	" " " " "	opp. New West-
					minster
9386	" 15	" 16	32	" " " " "	" above West-
					minster bridge
10325	" 18	" 15	28	" " " " "	" at Port Kells
9267	" 15	" 5	21	" " " " "	" " Hammond
10326	" 18	" 8	21	" " " " "	" " "
9978	" 15	" 8	24	" " " " "	" " Silverdale
9964	" 15	"		" " " " "	Whidbey id. on w. beach
9740	" 4	Oct. 13	9	" " " " "	Discovery bay, s. shore
					of Puget sound
9305	" 15	" 15	0	" " " " "	Comox, Vancouver id.
10000	" 15	" 15	0	" " " " "	" " "
9721	" 15	Nov. 12	28	" " " " "	Union bay, Baynes sd.
9294	" 15	" 15	31	" " " " "	Off Baynes Sound
10437	" 18	Oct. 22	4	" " " " "	Qualicum, Vancouver id.
10372	" 18	" 23	5	" " " " "	" " "
10373	" 18	" 23	5	" " " " "	" " "
10417	" 18	" 23	5	" " " " "	" " "
10015	" 15	" 23	8	" " " " "	" " "
10318	" 15	" 23	8	" " " " "	" " "
10402	" 18	" 29	11	" " " " "	" " "
10457	" 18	" 29	11	" " " " "	" " "
9335	" 15	" 29	14	" " " " "	" " "
10324	" 18	Nov. 6 or 7	19 or 20	" " " " "	" " "
9318	" 15	" 4	20	" " " " "	" " "

TABLE IV.—Returns from Chum salmon tagged in 1928—*Continued*

Tag number	Date tagged	Date of recapture	Time free (days)	Locality of tagging	Locality of recaptures
9301	" 15	" 6 or 7	22 or 23	Deep Water bay, west coast Quadra id.	Qualicum, Vancouver id.
9990	" 15	" 6 or 7	22 or 23	" " " " "	" " "
10350	" 18	" 9	22	" " " " "	" " "
9331	" 15	Oct. 24	9	" " " " "	Little Qualicum r., Van- couver island
9383	" 15	" 24	9	" " " " "	Five Finger islands near Nanaimo
10452	" 18	Nov. 3	16	" " " " "	Near Nanaimo, Van- couver island

*Tagged as a Coho returned as a Chum.

†Tagged as a Chum returned as a Sockeye.

**Tagged as a Sockeye returned as a Chum.

††Tagged as a chum returned as a Coho.

DISCUSSION OF RETURNS

The returns for Cinque island, Deep Water bay, Howe island, Granite point and Granite bay are illustrated in the figures 5, 6, 7, 8 and 9 respectively. As in the case of the Pinks, the lines are not intended to designate the exact route followed by the salmon but merely to indicate the general direction.

Of the thirty-eight specimens tagged at Cinque island which were recaptured, thirteen (34.2 per cent.) had gone to points along the east coast of Vancouver island, ten to Qualicum, two to Deep bay and one to the Five Finger islands. Eighteen (47.4 per cent.) of these recaptured Cinque island fish were taken in mainland localities, fourteen in the Fraser river, three in Jervis inlet and one in Howe sound. In addition, three fish had penetrated American waters; the first to Bush point on the north shore of Whidbey island, the second to the head of Samish bay (see figure. 5), and the third to Discovery bay on the south shore of Puget sound. Five individuals were retaken in Deep Water bay, a few miles south on the same island.

Of the sixty-one returns from fish tagged at Deep Water bay, nine were recaptured in the same area from two to fourteen days later. Twenty-one (34.4 per cent.) went to areas on the east coast of Vancouver island and twenty-seven (44.3 per cent.) to points on the mainland. Just as in the case of those from Cinque island, the majority of the former (viz. 13) were retaken at Qualicum and most of the latter (viz. 22) in the Fraser river. In this case also some fish went into American waters, one to Whidbey island and one to Discovery bay on the south shore of Puget sound. The records of two individuals going northward, one to Granite bay and one to Alert bay are of interest since only three out of all those retaken were caught in localities farther north than where they were tagged.

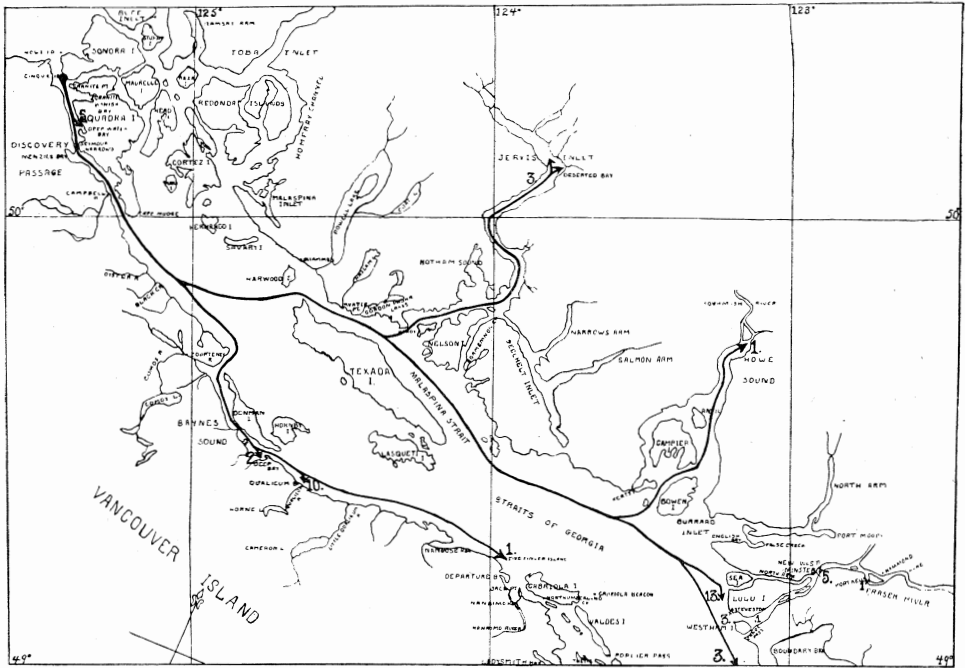


FIGURE 5.—Distribution of recaptured Chum salmon tagged at Cinque island.

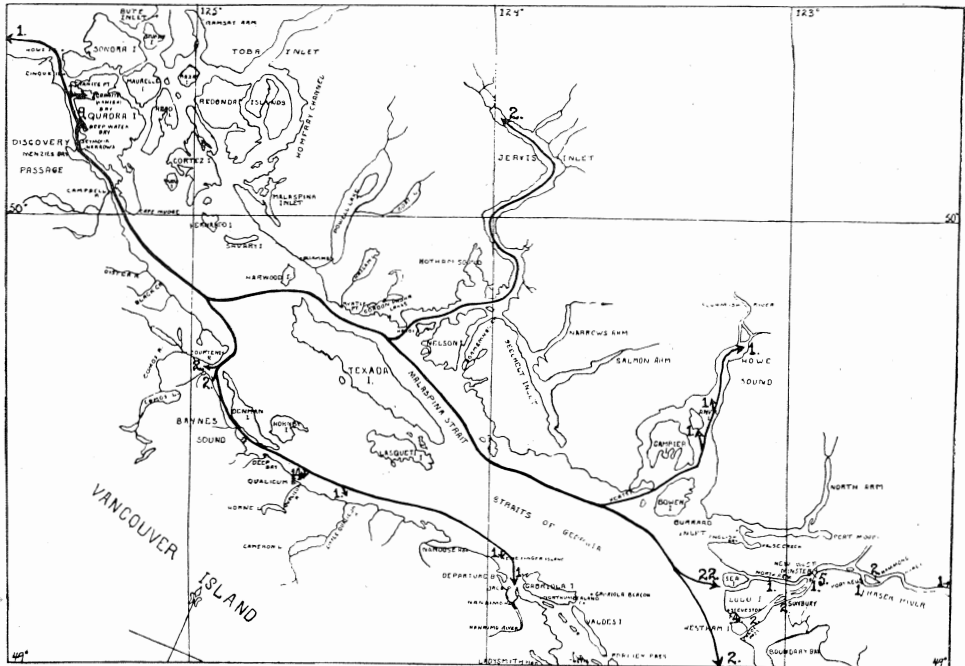


FIGURE 6.—Distribution of recaptured Chum salmon tagged at Deep Water bay.

The runs to Qualicum and the Fraser river might not have been relatively as large as the tagging returns would suggest, due to the fact that commercial fishery operations were heavier here than elsewhere in the regions in which recaptures were made.

The fish from Howe island, Granite point and Granite bay followed the same general migration routes. Those from Granite point and Granite bay appeared at several points on the mainland from which returns were not made in the other cases; *e.g.*, Malaspina inlet, Sliammon river and Myrtle point. The recovery of tag number 10041 (Howe island) from a shipment of fish in

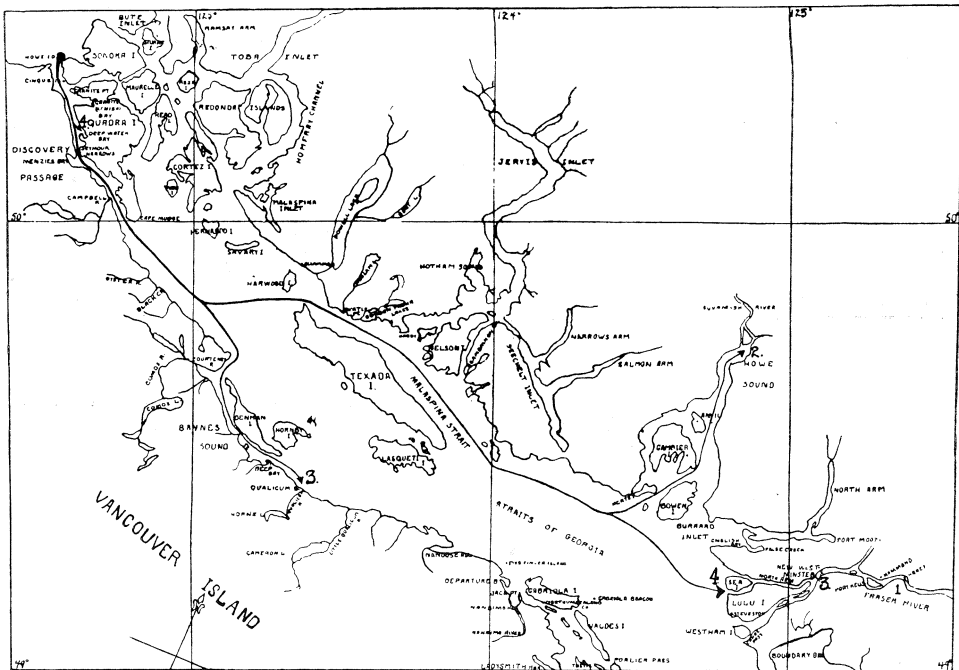


FIGURE 7.—Distribution of recaptured Chum salmon tagged at Howe island.

London, Ontario, is especially interesting, in that it demonstrates that tags once affixed tightly are hard to dislodge. The returns are illustrated in figs. 7, 8, and 9 respectively and need not be discussed in further detail.

One other record is noteworthy. The first entry in table IV is an individual which was tagged off Gabriola beacon near Nanaimo in February and recaptured in Deep Water bay in October. This was listed as a Coho weighing approximately two pounds when it was tagged but the final identification as a Chum made by the fishermen on its recapture should probably be accepted because of the difficulty in identifying the small Pacific salmon. This suggests a northerly migration of the young.

Due to the limited numbers returned, our results will not warrant any

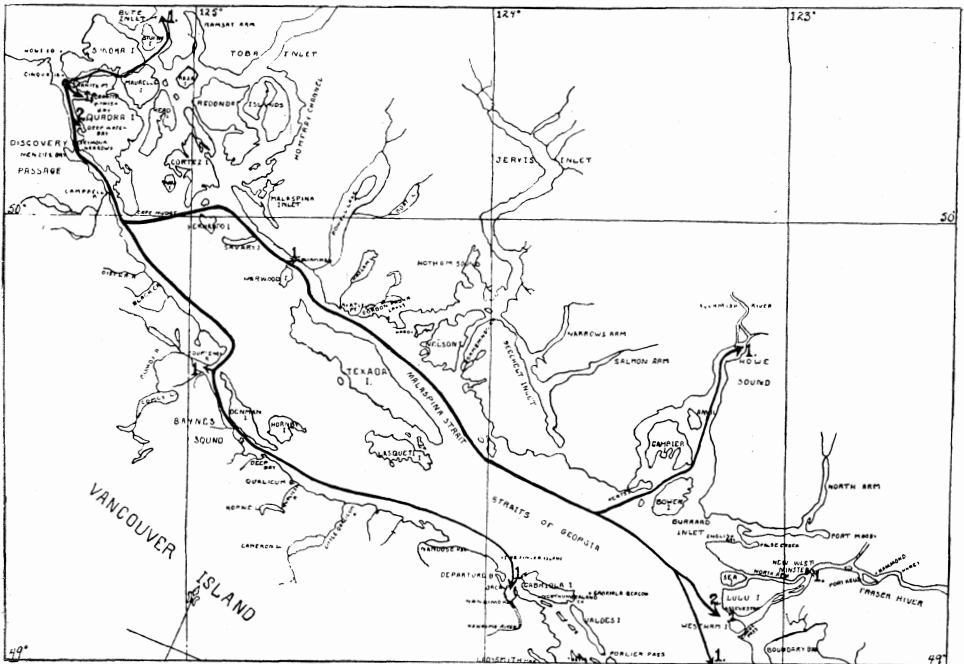


FIGURE 8.—Distribution of recaptured Chum salmon tagged at Granite point.

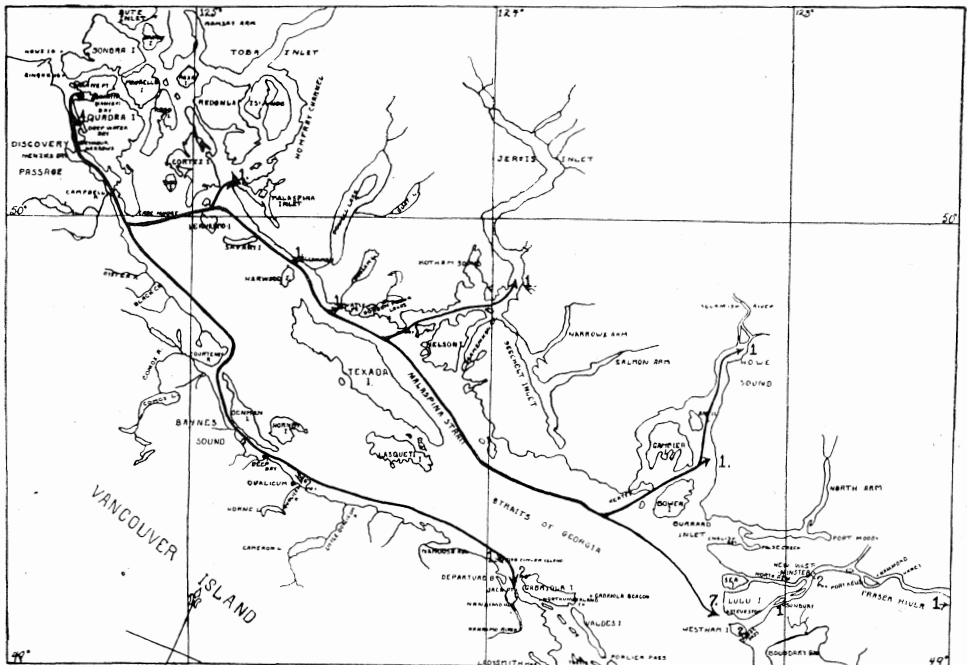


FIGURE 9.—Distribution of recaptured Chum salmon tagged at Granite bay.

conclusions as to whether there was a change in rate of travel as the season progressed. As in the case of the Pink, the fish seemed to travel at least in small groups. In several cases fish tagged on the same day in the same area were recaptured together in another locality. The greatest distance traversed in migration was from Deep Water bay to Discovery bay; *i.e.*, about 170 miles. This was accomplished most quickly of any journey, namely, in eight days, or at an average minimum rate of twenty-one miles per day.

CONCLUSIONS

From our results it is evident that the Chums travelled much farther than the Pinks after they appeared in the Johnstone and Broughton straits area. The Chums in Johnstone straits chose two main routes, both of which were southerly. The largest number went to the mainland and slightly smaller numbers to Vancouver island. Only three individuals were taken in an area farther north than where they were tagged. One of these appeared at Alert bay, one at the head of Bute inlet and a third went from Deep Water bay to Kamish or Granite bay.

The Vancouver island run went chiefly to Qualicum although a few fish were recaptured at Nanaimo. This substantiated the conclusion derived by Fraser (FRASER, C. M. Further studies of the growth rate of Pacific salmon, *Contr. Canad. Biol.*, 1918-20, 7-27, 1921) from a study of Chum scales that Qualicum and Nanaimo fish were similar and came from the north end of the island. Most of the run to the mainland seemed to reach the Fraser river though portions did go to the inlets along the shore.