

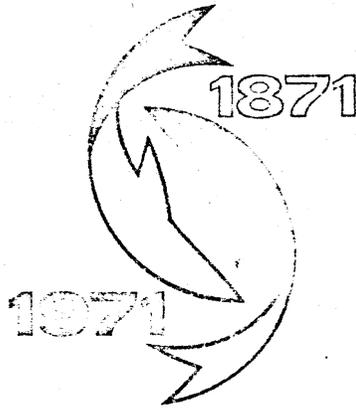
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HOMING OF TRANSPLANTED COHO SALMON

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ANADROMOUS FISH raised in one tributary but released in another usually return to the tributary where they were released. Sometimes the fish home specifically to the area near the release site, but often they scatter throughout the tributary. Little is known about the factors that induce salmon to return to a specific location, but it is commonly accepted that the character of the water from a localized source is used for identification. This paper reports on the return of transplanted coho salmon (*Oncorhynchus kisutch*) to a site where a small quantity of water with apparently identifiable characteristics aided specific homing.

Coho salmon fingerlings from the 1965 brood year were raised to smolt size at the Leavenworth National Fish Hatchery on Icicle Creek, a tributary to the Wenatchee River, about 160 river miles above the confluence of the Snake and Columbia Rivers (fig. 1).

During March, April, and May 1967, about 650,000 of these fingerlings were transported to a fish-handling facility operated by the Bureau of Commercial Fisheries on the north bank of the Snake River about half a mile below Ice Harbor Dam. The fish were held in spring water 36 to 48 hours and were marked with a hot brand (Groves and Novotny, 1965) before being released for studies of mortality in the turbines of Ice Harbor Dam.

In September 1967, coho salmon jacks congregated near the point at which drainage water from the fish-handling facility entered the river. Because no coho salmon had been known to use this area or water source for spawning, these fish were presumed to be some of the experimental fish which had been to sea and returned to spawn. Therefore, a floating



Figure 1.—Location of fish-handling facility and Leavenworth Fish Hatchery.

trap with a false weir¹ was installed in the river to capture them (fig. 2). The drainage water from the fish-handling facility (amounting to less than 200 gallons per minute) was piped through the weir to serve as attraction water. Enough fish with identifiable brands were captured to demonstrate that they were the fish that had been released in the March-May experiments.

An experiment was run to determine whether the salmon were entering the trap by accident or were actually homing to the water in which they had been held as smolts. River water was pumped through the false weir in place of the spring water to determine whether the fish were attracted by the character of the

¹ A floating trap to catch homing salmon, by Richard F. Krema and Winston E. Farr. National Marine Fisheries Service, U.S. Department of Commerce, Seattle, Wash. Manuscript in preparation.

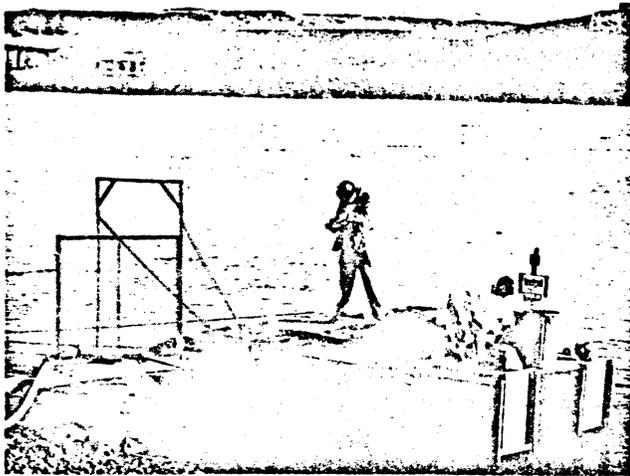


Figure 2.—Adult salmon trap in fishing position at homing site.

water or simply by the velocity of flow. A control condition in which the spring water was pumped through the weir was also tested to eliminate any possible influence of the pump on the water quality or velocity.

The attraction of the spring water was strikingly demonstrated (table 1): No fish entered the trap when river water was used; but when spring water was used (provided either by pumping or by gravity flow), a number of salmon were trapped each day. A total of 1,712 coho salmon were captured in the trap; no other species entered.

Results of a mark and release experiment (table 2) indicated that about 8,000 jacks had returned to the site, or 1.3 percent of the 600,000 fish planted. This rate of return falls within the range obtained at fish cultural stations on the Columbia River. Successful homing by a majority of the survivors is indicated.

Similar releases were made in spring 1968. Trap recaptures in fall 1968 included both adults from the 1967 releases and jacks from releases in spring 1968.

None of the marked fish released at Ice Harbor returned to the Leavenworth Hatchery, although they were from the same stock as hatchery-released fish that did return to the hatchery. Their return to the fish-handling facility, therefore, was probably volitional and prompted by attraction to the spring water in which they had been held only briefly.

The following points are significant:

1. The number of coho salmon that returned to the spring water indicates highly successful homing; apparently a majority of the survivors found the spring water in spite of its small quantity.

2. Smolts with less than 48 hours of exposure to the spring water were able to locate it and identify it as "home" when they returned to spawn.

3. The fish returned to the spring water in which they had been held even though they had been released about half a mile upstream; the spring water was the nearest detectable point of reference.

Table 1.—Number of coho salmon captured by a trap at Ice Harbor Dam in relation to type of water used to attract fish

Source of water and date of capture	Number of salmon
Spring water (gravity flow):	
November 2.....	52
3.....	208
10.....	5
11.....	2
14.....	7
15.....	18
16.....	18
17.....	26
Total.....	336
Average number per day.....	42.0
Spring water (pumped):	
November 7.....	59
9.....	4
Total.....	63
Average number per day.....	31.5
River water (pumped):	
November 4.....	0
5.....	0
6.....	0
8.....	0
12.....	0
13.....	0
Total.....	0

Table 2.—Number of coho salmon (observed and estimated) that returned to the fish-handling facility at Ice Harbor Dam

[Number of fish out of total present during tagging period α which are subsequently recaptured during i^{th} recovery period = daily estimate]
 $\hat{n}_{\alpha i} = m_{\alpha i} \frac{T_{\alpha} C_i}{m_{\alpha} m_{\alpha i}}$ where $m_{\alpha i}$ is the number of fish tagged during the α^{th} tagging period and subsequently recovered during the i^{th} recovery period; $\hat{N} =$ total estimated population = $\sum \sum \hat{n}_{\alpha i} = 8001$; Procedures and formulas are from Shaefer (1951)]

Recovery period (i)	Tagging period (α)										Total fish ¹	Total fish recovered (Ci)	Ci/m _α	
	1	2	3	4	5	6	7	8	9	10				
Observed return (tagged fish):														
1.....	2											2	260	130.00
2.....	7	1										8	70	8.75
3.....	14	6	2									22	145	6.59
4.....	17	4	11	14								46	340	7.39
5.....	12	14	4	28	4							62	215	3.47
6.....	3	4	4	26	15	2						54	177	3.28
7.....	7	2	5	20	22	5	3					64	314	4.91
8.....	1			2	4	2	4					13	57	4.38
9.....								3	2	2		7	78	11.14
10.....										5	3	8	56	7.00
Total tagged fish recovered (M _α)--	63	31	26	90	45	9	10	2	7	3				
Total fish tagged (T _α).....	199	56	117	291	145	122	143	45	70	46				
T _α /M _α	3.16	1.81	6.81	3.23	3.22	13.56	14.30	22.50	10.00	15.33				
Estimated return (tagged and untagged fish):														
1.....	821											821	—	—
2.....	193	16										209	—	—
3.....	291	71	90									452	—	—
4.....	397	53	554	334								1,338	—	—
5.....	131	88	94	314	45							672	—	—
6.....	31	24	89	276	158	89						667	—	—
7.....	108	18	167	317	348	332	210					1,500	—	—
8.....	14			28	56	119	251					468	—	—
9.....							478	501	223			1,202	—	—
10.....									350	322		672	—	—
Total.....	1,986	270	994	1,269	607	540	939	501	573	322	8,001	—	—	—

¹ Number of tagged fish recovered = m_α.

Undoubtedly many factors play a part in the homing of coho salmon. An important one is the character of the water in which they are held immediately before release. Apparently even brief exposure of smolts to water with identifiable characteristics different from the main stream, can influence their homing as adults. It follows that springs or small tributaries in the vicinity of a fish-release site may strongly influence homing behavior and may

therefore be important in the selection of release locations.

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