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Collected in the North Pacific by the Oshoro-Marū,  
1980-1981

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**Tagged Steelhead Trout (*Salmo gairdneri* RICHARDSON)  
Collected in the North Pacific by the Oshoro-Marū,  
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**Abstract**

Thirteen steelhead trout (*Salmo gairdneri*) with coded-wire tags (CWT's) were captured in gillnets fished by the Oshoro-Marū in the Gulf of Alaska along 145°W in 1980 and 1981 and along 180° in 1981. These fish originated from hatcheries in Oregon, Washington and Idaho, U.S.A., and British Columbia, Canada. About 7% of all steelhead caught had CWT's. One age 1.0 steelhead entered the ocean about two months before it was captured after migrating at sea at least 1,641 km. Scales of the steelhead caught in gillnets indicated that most were "wild", non-hatchery fish, having spent 2 or 3 years in fresh water, and 0, 1 or 2 years in the ocean.

**Introduction**

During the cruises of the Oshoro-Marū, the research vessel of the Faculty of Fisheries, Hokkaido University, to subarctic waters of the North Pacific in 1980 and 1981, efforts were made to recover tagged salmonids caught in gillnets. Steelhead trout were the most common species containing coded-wire tags (CWT's), small, magnetic wire tags injected into the snouts of smolts before they are released from hatcheries. Recovery of these fish provided new information and expanded our knowledge of the migrations and distributions of steelhead in the North Pacific Ocean.

**Materials and Methods**

The positions of gillnet stations from 39°N to 46°N along 180° from June 12 to August 6, 1980 and June 11 to June 20, 1981, and from 48°N to 56°N along 145°W from July 10 to July 22, 1980 and 1981 are shown in Figure 1. Gillnets were 6,300 to 6,500 m long and 6 m deep, consisting of 16 (1980) or 18-19 (1981) different mesh sizes from 37 mm (1980) or 25 or 30 mm (1981) to 204 mm (stretch) mesh.

At each station a gillnet was set in the evening, usually 1730-1900 hr local time, and hauled in the early morning (starting 0400-0500 hr) after drifting at the surface during the night.

Salmonids were inspected for missing adipose fins and external tags during sorting, measuring and analysis of internal organs. The heads of fish with missing adipose fins were removed and preserved, and later examined for coded-

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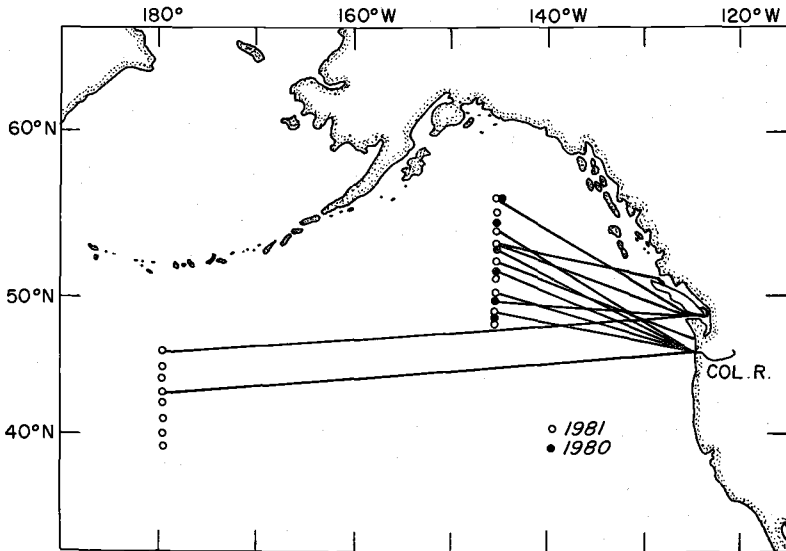


Fig. 1. Location of gillnet stations in 1980 and 1981. Lines connect the locations of ocean entrance of juvenile steelhead to locations of offshore capture.

Table 1. Incidence of missing adipose fins and coded wire-tags in salmonids captured by the Oshoro-Maru in 1980 and 1981.

Species	1980			1981		
	145°W Only*			180° and 145°W		
	total	missing adipose fin	CWT	total	missing adipose fin	CWT
Sockeye salmon	657	1	0	1056	0	-
Chum salmon	301	2	0	1565	1	0
Pink salmon	741	0	-	1147	0	-
Coho salmon	143	0	-	1022	0	-
Chinook salmon	9	0	-	68	1	0
Steelhead trout	42	3	3=7.1%	133	14	10=7.5%

\* In 1980 a thorough inspection of fish for missing adipose fins was only attempted on this transect.

wire tagged by the Oregon Department of Fish and Wildlife. All results were subsequently reported to INPFC (International North Pacific Fisheries Commission)<sup>1)</sup>.

### Results

The number of salmonids with missing adipose fins and containing CWT's is listed in Table 1. Only steelhead trout, the fifth most abundant of the six species of salmonids captured, contained CWT's: 3 in 1980 and 10 in 1981. The incidence of CWT in steelhead was 7.1% in 1980 and 7.5% in 1981.

Table 2 gives information on the release and recapture of these 13 steelhead. They were tagged in Oregon, Washington and Idaho, U.S.A., and Vancouver Island, British Columbia, Canada. Six originated from rivers that are tributaries to the Columbia River. The recovery of tagged steelhead mainly from the Columbia River and northern streams is due to the fact that very few steelhead smolts are tagged with CWT's south of the Columbia River<sup>2)</sup>.

The one 1.0 age steelhead caught provides some remarkable information on migration rates. This fish was released in April in Idaho. The median date of recovery of this coded-wire tag group of steelhead at a station in the Columbia River 75 km from the mouth was May 10, 1980<sup>3)</sup>. It probably reached the ocean in mid-May. Therefore it apparently swam to where it was captured, over 1,641 km (886 n. mi) from the Columbia River mouth, in two months. It averaged at least 25 km (13 n. mi) per day. During this ocean migration period it increased in fork length from about 200 mm to 302 mm.

The ages of steelhead with CWT's included 1.0, 1.1, 1.2, 2.1 and 2.2 (the first digit indicates years spent in fresh water, the second digit indicates years spent in the ocean, e.g., a 1.0 fish spent one year in fresh water and migrated into the ocean during the spring of the year of recovery). Nine of these steelhead spent one year in fresh water before release (1. -) and four spent two years in fresh water (2. -). Both summer and winter runs of (1. -) steelhead were captured.

The ocean and freshwater age distribution was determined from analysis of scales by the Fisheries Agency of Japan (Table 3) for steelhead (hatchery and wild fish) caught in 1981 along 145°W and 180°<sup>4)</sup>. About one-fourth of the steelhead caught along 145°W were -. 0 fish, indicating that rapid migration of steelhead smolts into the oceanic regions of the Gulf of Alaska by July, only a few months after ocean entry, is a common event. However no -. 0 steelhead were caught along 180° in June, suggesting that young fish may not migrate this far west during by this time.

Based on the data in Table 3, the majority of the steelhead caught spent more than one year in fresh water. Most hatchery fish spend only one year in fresh water<sup>2)3)</sup> whereas most wild fish spend 2 or 3 years in fresh water<sup>6)</sup>. Thus most of the steelhead caught were apparently wild fish. Thus the proportion of the number of hatchery fish with CWT's to the total number of hatchery fish in the catches was surprisingly high, several times the total 7% CWT: total steelhead ratio. The most common ocean age was -. 1 along 145°W and -. 2 along 180°. Ocean ages older than -. 2 were rare. Only one -. 3 fish was captured by the Oshoro-Maru in 1981.

### Discussion

The conclusion of Hartt<sup>7)</sup> and Hartt and Dell<sup>8)</sup> that juvenile steelhead migrate directly offshore into oceanic waters during their first summer in the ocean is supported by our findings. Age -. 0 steelhead were captured in July along 145°W, over 890 n.mi from land after only a few months in the ocean. Also, steelhead smolts are often captured farther offshore than salmon smolts in purse seine studies off the coast of Oregon and Washington<sup>3)9)</sup>. Dawley et al.<sup>3)</sup> found that more steelhead were caught in south-facing than north-facing purse seine

Table 2. Steelhead trout with CWT's recovered

CAPTURE DATA					
Date <sup>1)</sup>	Lat. (N)	Long.	Fork Length (mm)	Body Weight (g)	Sex/Gonad Wt.(g)
1980					
July 13	53°-00'	145°-00'W			
July 14	51°-30'	145°-00'W	302		
July 15	49°-54'	145°-09'W	602		
1981					
June 17	43°-00'	179°-56'E	516	1370	M
June 20	45°-59'	179°-59'E	690	3500	F 17
July 12	55°-58'	145°-01'W	582	2380	F
July 16	54°-10'	144°-56'W	524	1580	M 1
July 17	52°-59'	145°-00'W	575	2020	M 1
July 17	52°-59'	145°-00'W	601	2130	M 9
July 17	52°-59'	145°-00'W	641	2080	M 4
July 18	52°-01'	145°-00'W	538	1730	M 3
July 20	50°-01'	145°-00'W	704	4150	F 75
July 21	49°-01'	145°-00'W	710	4250	F 17

1) All dates are ship's local mean time when gillnets were hauled.

2) S: summer run; W: Winter run.

3) WDF: Washington Department of Fisheries. IDFG: Idaho Department

Table 3. Results of scale analysis of steelhead caught by the Oshoro-Maru in 1981 along 145°W and 180°.

	N	Number of Years				
		0	1	2	3	4
145°W (July 11-22 109 fish)						
% Freshwater Age	54	0	6	57	33	4
% Ocean Age	96	24	48	27	1	0
180° (June 11-20 24 fish)						
% Freshwater Age	13	0	31	46	23	0
% Ocean Age	24	0	46	54	0	0

nets, suggesting a northerly migration or orientation. This tendency to migrate immediately offshore is not as evident in juvenile salmon (*Oncorhynchus* spp.). Hartt and Dell<sup>8)</sup> found that juvenile salmon migrated through or resided in coastal waters after entering the ocean during their first summer in the ocean. Moreover, the Oshoro-Maru, using variable and small-meshed gillnets, caught no age -0 coho salmon out of the 1022 individuals caught in 1981.

No age -0 steelhead were caught by Hartt and Dell<sup>8)</sup> in purse seines west of 155°W in the North Pacific, or by the Oshoro-Maru along 180° in 1981. This suggests that -0 steelhead may not migrate far to the west during their first summer in the ocean. Age 1.1 on the other hand, have been found much farther to the west. An age 1.1 steelhead produced by a hatchery in Idaho and tagged in the Columbia River was recovered by a commercial gillnet vessel at 50°24'N, 174°25'E<sup>1)</sup>.

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TAG/RELEASE DATA

CWT Code	Brood Yr. <sup>2)</sup>	Released	Last Month Release Date	Agency <sup>3)</sup>
63-17-60	'77	Cowlitz R.	May '78	WDG
10-21-57	'79S	Pahsimeroi R.	April '80	IDFG
62-23-31	'77	Skagit R.	May '79	WDG
63-20-18	'79S	Wind R.	April '80	WDF
12-17-29	'78S	Little Qualicum R.	April '79	BCFW
12-16-00	'79	Robertson R.	May '80	BCFW
07-22-01	'79S	Wallowa R.	April '80	ODFW
12-17-57	'79	Koegh Lk.	May '80	BCFW
62-21-31	'79W	Puyallup R.	May '80	WDG
62-23-31	'77	Skagit R.	May '79	WDG
62-51-02	'79W	Humtulpis R.	April '80	WDG
LB-OR	'77S	Columbia R.	April '79	NMFS
09-16-36	'77	Wallowa R.	April '79	ODFW

of Fish and Game. BCFW: British Columbia Fish and Wildlife. ODFW: Oregon Department of Fish and Wildlife. NMFS: National Marine Fisheries Service

Another steelhead was tagged at a size of 559 mm (probably a 1.1 age fish) by a Japanese salmon research vessel at 45°31'N, 179°28'E and recovered by a steelhead fisherman in the Sandy River, a tributary of the Columbia River.

Steelhead are caught in gillnets across the Subarctic Pacific to 165°E, near the Asian coast<sup>10)11)</sup>. Based on electrophoretic studies of enzymes, North American steelhead extend far into the western Pacific whereas the closely related *Salmo* species (e.g., *S. mykiss* or *S. penhsinensis*)<sup>12)</sup>, originating in Asian river that enter the sea of Okhotsk, is restricted to waters of the western Pacific to about 170°E<sup>11)</sup>. Thus most of the steelhead caught in the North Pacific, including the western Pacific, are probably of North American origin.

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