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**Tagged Steelhead Trout (*Salmo gairdneri* RICHARDSON)
Collected in the North Pacific by the
Oshoro-Maru, 1982-1985**

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Abstract

Twenty-two steelhead trout (*Salmo gairdneri*) containing coded wire tags (CWT's) were captured in gillnets fished by the Oshoro-Maru in the Gulf of Alaska and along 180° during 1982-85. These fish originated from North American streams and hatcheries in British Columbia, Idaho, and Washington. One fish was age 0.1, 16 were age 1.1 and 5 were age 1.2. In 1985, 17% of the steelhead caught had missing adipose fins but did not contain tags. This high proportion of marked hatchery fish and the known fresh water ages of marked fish indicated that many of the steelhead caught by the Oshoro-Maru and other vessels in the Northeast Pacific originated from North American hatcheries.

Introduction

During cruises of the training ship Oshoro-Maru into waters of the subarctic Pacific in 1980 and 1981, thirteen steelhead trout with CWT's were caught in gillnets fished in the North Pacific and the Gulf of Alaska¹⁾. These fish, some of the first CWT steelhead recovered in the open ocean, originated from hatcheries in North America (Washington, British Columbia, Oregon, and Idaho). This paper presents new information on steelhead trout captured in gillnets during 1982-1985, and provides additional data on the distribution, migration and origin of this salmonid in the North Pacific.

Methods

Gillnets were fished in the central North Pacific along 180°, and in the Gulf of Alaska either along 55°N (1982 and 1983) or 155°W (1984 and 1985). Locations of the sets in each year are shown in Figure 1. A total of 12 to 19 sets were made in each year during the months of June and July (Table 1).

Gillnets were usually 6.3 to 6.6 km in length, consisting of 25, 29, 33, 37, 42, 48, 55, 63, 72, 82, 93, 106, 115, 121, 130, 138, 157, 179 and 204 mm (stretch) mesh. Gillnets were fished overnight at each station.

All salmonids were inspected for missing adipose fins during sorting, measuring and analysis of internal organs. Heads were removed from fish with missing adipose fins and were preserved for retrieval of tags. CWT's were recovered and decoded by

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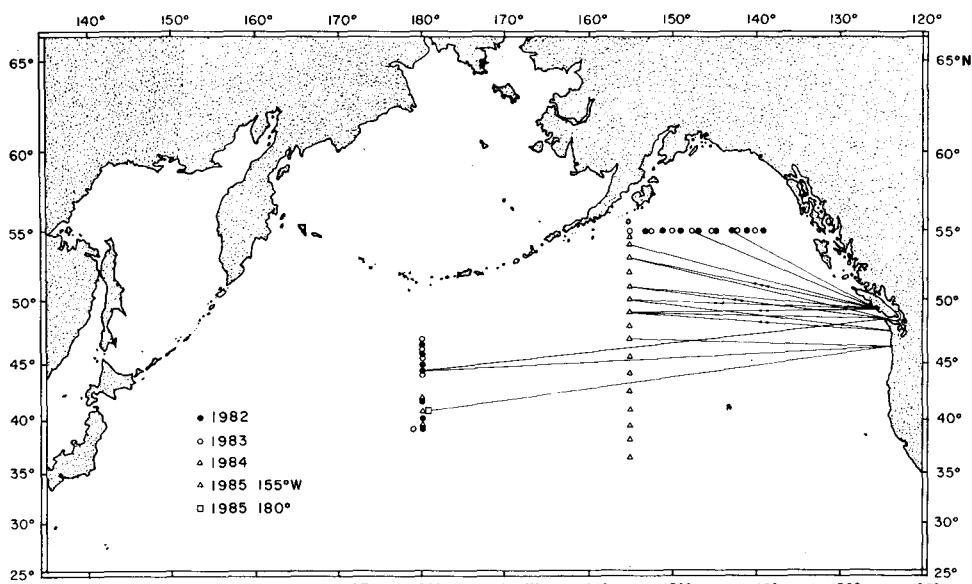


Fig. 1. Recovery of marked steelhead trout by the Oshoro-Maru in gillnet during 1982-1985 in the North Pacific Ocean. Lines connect location of fresh water release and capture. Lines without arrows represent single fish. When more than one fish was captured at a station, the number of arrowheads along the line shows the total number of fish caught at that station.

Table 1. The dates and numbers of gillnet sets along 180° and in the Gulf of Alaska, 1982-1985.

| | 1982 | 1983 | 1984 | 1985 |
|----------------------|------------|------------|------------|-----------|
| Dates Hauled | | | | |
| 180° | 12-20 June | 12-20 June | 12-14 June | 15 June |
| Gulf of Alaska | 17-24 July | 1- 7 July | 16-31 July | 4-19 July |
| No. Sets | | | | |
| 180° | 7 | 5 | 3 | 1 |
| Gulf of Alaska | 8 | 7 | 16 | 16 |
| Cruise Track in Gulf | 55°N | 55°N | 155°W | 155°W |

the Oregon Department of Fish and Wildlife or the National Marine Fisheries Service.

Results

The numbers of steelhead trout caught, numbers with missing adipose fins and the numbers with CWT's are shown in Table 2. A total of 81 steelhead without adipose fins and 22 with CWT's were found. Steelhead trout were the most common fish with missing adipose fins and CWT's, even though they were not nearly as numerous in the gillnet catches as sockeye, pink, chum or coho salmon. Only one

Table 2. Numbers of steelhead caught with missing adipose fins and with CWT's, 1982-1985.

| | 1982 | 1983 | 1984 | 1985 |
|-------------------------------|------|------|------|------|
| No. caught | 123 | 128 | 160 | 345 |
| No. with missing adipose fins | 3 | 3 | 16 | 59 |
| No. with CWT's | 3 | 1 | 8 | 10 |

coho salmon was found during these four years with a missing adipose fin and CWT, and one sockeye salmon with a missing adipose fin.

The incidence of CWT's in steelhead varied from 0.7 to 0.5% of the total number of steelhead caught in different years. The percent of fish with missing adipose fins increased from 2.3-2.4% in 1982 and 1983 to 10% in 1984 and to 17% in 1985 (Table 2).

Information on the release and capture of the 22 steelhead with CWT's (Table 3) shows that fish were released from British Columbia (14, with 13 from Vancouver Island), Washington (5) and Idaho (3).

Sixteen of the 22 steelhead were caught in the ocean 11-15 months after release, 5 after 26-27 months after release, and one 3 months after release. All these fish presumably spent one year in fresh water and were therefore age 1.1, 1.2, and 0.1, respectively (where the numeral that precedes and follows the decimal point indicates the years in fresh water and the ocean respectively; age is usually determined from the number of fresh water and ocean annuli observed on the scales).

Both summer and winter run steelhead were recovered. Seven of the steelhead from Vancouver Island were wild fish released in the Somass River. Lengths of the fish ranged from 270 mm fork length for the age 1.0 fish to 778 mm for the age 1.2 fish.

Straight lines connect locations of release and ocean capture in Figure 1 of tagged steelhead. Captures ranged from as far south as 41°N near 180° but were no farther south than 47°N along 155°W. Most recoveries of CWT steelhead were between 49°N and 53°N. All three fish found between 41°N and 44°N along 180° were from Idaho or Washington. The fish found the farthest south along 155°W was from Idaho and entered the ocean via the Columbia River. The fish originating from British Columbia tended to be caught farthest to the north, between 49°N and 55°N in the Gulf of Alaska.

Discussion

The fresh water and ocean ages of steelhead caught by the Oshoro-Maru were estimated from scales by the Fishery Agency of Japan and are published in the Data Record of Oceanographic Observations and Exploratory Fishing, Faculty of Fisheries, Hokkaido University⁸⁻¹¹. This allows comparison of ages estimated from scales with those of marked steelhead. Seven of the coded wire tagged steelhead were classified as age 2.1 from scales (two fresh water annuli). All of these fish were actually age 1.1, having spent one rather than two years in fresh water. Five fish were classified as age - .2 (two years in the ocean) from scales and all of these were caught after residing two years in the ocean. One fish was classified as - .0, and it

Table 3. Summary of release and recapture data for steelhead trout containing CWT's

| Tag/Release data | | | | | | |
|------------------|----------|------------|-----------------------|-----------------|--------|--|
| | Tag code | Brood Year | Release site | Release Mo & Yr | Agency | |
| 1982 | 05-07-37 | 80 W | Elwha Rive | 04-81 | WDF | |
| | 10-21-61 | 79 S | No. Fk. Clearwater R. | 04-80 | IDFC | |
| | 12-18-24 | 79 D | Robertson Creek | 05-80 | BCFW | |
| 1983 | 12-17-53 | 82 D | Somass River | 04-83 | BCFW | |
| 1984 | 12-17-53 | 82 D | Somass River | 04-83 | BCFW | |
| | 12-17-53 | 82 D | Somass River | 04-83 | BCFW | |
| | 12-17-53 | 82 D | Somass River | 04-83 | BCFW | |
| | 12-19-26 | 82 | Nicomekl River | 04-83 | BCFW | |
| | 12-19-41 | 82 | Nanaimo River | 06-83 | BCFW | |
| | 12-20-17 | 82 | Cowichan River | 06-83 | BCFW | |
| | 12-20-27 | 82 | Somass River | 04-83 | BCFW | |
| | 62-16-39 | 82 W | Stillaguamish R. | 05-83 | WDF | |
| 1985 | 05-13-35 | 83 S | Clearwater R. | 05-84 | IDFG | |
| | 05-14-61 | 83 W | Hoh River | 05-84 | FWS | |
| | 05-14-61 | 83 W | Hoh River | 05-84 | FWS | |
| | 10-27-46 | 83 S | Pahsimeroi R. | 04-84 | IDFG | |
| | 12-17-53 | 82 D | Somass River | 04-83 | BCFW | |
| | 12-17-53 | 82 D | Somass River | 04-83 | BCFW | |
| | 12-19-45 | 82 D | Somass River | 04-83 | BCFW | |
| | 12-21-14 | 83 F | Somass River | 04-84 | BCFW | |
| | 12-21-17 | 83 S | Somass River | 04-84 | BCFW | |
| | 21-16-15 | 83 W | Hoh River | 05-84 | HOH | |

* All dates are ships local mean time when gillnets were hauled
 S : summer run IDFG : Idaho Department of Fish and Game
 W : winter run FWS : U.S. Fish and Wildlife Service

These data are summarized by the Pacific Marine Fisheries Commission²⁾ and reported by Thrower and Fowler⁷⁾.

was caught three months after release. Therefore the scales appeared to provide overestimates of the fresh water age but correct ocean ages of these steelhead.

This problem of determining fresh water ages from scales was also apparent from other adipose clipped fish. Of the total of 35 fish with missing adipose fins whose fresh water age was determined from scales, 23 (66%) were classified as age 2.-, 6 as age 3.- and only 6 as age 1.-. The fact that nearly all steelhead with missing adipose fins are released after only one year in fresh water (age 1.-), suggests that a problem may exist in estimation of fresh water ages of ocean caught steelhead from scales.

In our previous paper¹⁾, we concluded that the majority of steelhead caught in 1980 and 1981 by the Oshoro-Maru spent more than one year in fresh water based on the published age estimates and were therefore mostly wild fish which reside longer in fresh water than hatchery fish¹²⁾. We acknowledge that this previous conclusion is wrong. We now believe that a large proportion of the steelhead caught by the

PEARCY & MASUDA : Tagged steelhead trout collected by the Oshoro-Maru

collected on cruises of the Oshoro-Maru in the North Pacific Ocean, 1982-1985.

| Capture data | | | | | |
|--------------|---|-----------|--------|-------|-----|
| Date* | Location | | FL(mm) | Wt(g) | Sex |
| | Lat. (N) | Long. (W) | | | |
| June 17 | 43-54 | 179-56 | 572 | 2280 | M |
| June 17 | 43-54 | 179-56 | 778 | 5200 | F |
| July 22 | 55-00 | 143-00 | 740 | 4550 | M |
| July 04 | 55-00 | 147-30 | 270 | 180 | F |
| July 17 | 54-00 | 155-00 | 602 | 2030 | F |
| July 18 | 52-59 | 155-00 | 586 | 2240 | F |
| July 18 | 52-59 | 155-00 | 549 | 1550 | M |
| July 22 | 49-00 | 154-59 | 625 | 2860 | F |
| July 20 | 51-00 | 154-59 | 586 | 1950 | M |
| July 18 | 52-59 | 155-00 | 532 | 1510 | M |
| July 18 | 52-59 | 155-00 | 574 | 1940 | F |
| July 20 | 51-00 | 154-59 | 503 | 1540 | M |
| June 15 | 41-00 | 180-00 | 632 | 2540 | M |
| July 10 | 49-00 | 155-00 | 598 | 2150 | M |
| July 10 | 49-00 | 155-00 | 599 | 1970 | M |
| July 12 | 47-00 | 155-00 | 598 | 2880 | M |
| July 09 | 50-00 | 155-00 | 690 | 3900 | F |
| July 09 | 50-00 | 155-00 | 685 | 3000 | M |
| July 10 | 49-00 | 155-00 | 652 | 3000 | F |
| July 08 | 51-00 | 155-00 | 562 | 1760 | F |
| July 10 | 49-00 | 155-00 | 594 | 1940 | F |
| July 09 | 50-00 | 155-00 | 540 | 1900 | F |
| F : fall run | BCFW : British Columbia Fish and Wildlife | | | | |
| D : wild | HOH : Hoh Indian Tribe | | | | |
| | WDF : Washington Department of Fisheries | | | | |

Dahlberg³, Wertheimer and Dahlberg^{4,5}, Dahlberg and Fowler⁶, and Dahlberg,

Oshoro-Maru in 1980-1985 originated from hatcheries in North America.

This conclusion is reinforced by the large number (59) and high proportion of adipose clipped fish recovered in 1985. Many hatcheryreared steelhead from North America are marked as juveniles by removal of one or more fins. The increased occurrence of steelhead with missing adipose fins but without CWT's in 1985 compared to 1982, 1983 and 1984 is undoubtedly related to the removal of adipose fins from large numbers of steelhead smolts to distinguish hatchery from wild steelhead starting in 1984. For California, Oregon, Washington, British Columbia and Alaska the total numbers of adipose clipped fish without CWT's increased markedly after 1983, whereas the number with adipose clips and CWT's remained fairly constant². The large numbers of steelhead smolts released with adipose clips but no CWT's in 1984 explain the high incidence of mainly age 1.1 hatchery steelhead with missing adipose fins caught by the Oshoro-Maru in 1985.

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