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Coastal Zone and Estuarine Studies

**A STUDY TO DEFINE THE
MIGRATIONAL
CHARACTERISTICS
OF
CHINOOK AND COHO SALMON
AND STEELHEAD TROUT
IN THE
COLUMBIA RIVER ESTUARY**

**by
Earl M. Dawley
Carl W. Sims
and
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INTRODUCTION

The National Marine Fisheries Service (NMFS), in cooperation with the Pacific Northwest Regional Commission (PNWRC), initiated a 3-year study of the migrational characteristics of juvenile salmon and steelhead trout in the Columbia River estuary in February 1977. The overall objectives of this study are to: (1) monitor the survival of the various stocks of hatchery fish released into the Columbia River, (2) develop a sampling system capable of evaluating hatchery production techniques and procedures, and (3) define the migrational characteristics of juvenile salmonids to and through the estuary.

Research activities in 1977 concentrated on the development of an operational sampling system in the upper Columbia River estuary at Jones Beach, Oregon, along with defining migrational timing, rates of movement, and relative survival of hatchery releases to the estuary. Research in these areas will continue in 1978 and 1979. In addition, new studies will be initiated to determine if the sampling system can provide survival estimates that are statistically related to actual adult returns. If this is in fact true, the estuary sampling system at Jones Beach can provide a new and unique method of evaluating hatchery production techniques based on juvenile survival to the estuary rather than on the much later adult returns. The system would also be able to provide yearly abundance estimates and forecasts of year-class survival. Planning for 1978 also includes establishment of a second sampling site in the lower estuary. This will provide needed information on migrational timing through the estuary and estuarine residence requirements of migrating juveniles.

This report summarizes the results of research conducted during 1977.

METHODS

The outmigration of juvenile salmonids in the Columbia River estuary was sampled at Jones Beach, Oregon, in 1977. Jones Beach is located near Westport, Oregon, about 74 km (46.5 miles) upstream from the river mouth. Preparations for the 1977 field season began in early March. Fish handling and holding facilities were completed and sampling initiated on April 14; sampling continued through September 29.

A 95-meter long variable-mesh beach seine of the type described by Sims and Johnsen (1974) was the primary sampling gear used. The beach seine was fished on a daily schedule from April 14 through August 26 and on a 5-day per week schedule thereafter. A standard effort of 10 sets per day was maintained throughout the sampling period. Sampling began each day at 0615 hours and continued at 45-minute intervals until 1330 hours.

A purse seine was used to sample the deep water channel areas adjacent to the Jones Beach site from May 4 through June 10. The net and fishing technique used was as described by Johnsen and Sims (1973). Purse seine catches were transferred by boat to the fish processing facility on the beach.

SAMPLE PROCESSING

Both beach seine and purse seine catches were processed at fish holding facilities on the shore at Jones Beach. All juvenile salmonids were anesthetized with MS-222, identified, enumerated, and examined for

marks and coded wire tags. In addition, a subsample was measured for fork-length. After processing and recovery from the effects of the anesthetic, all fish were released back into the river downstream from the sampling site.

Prior to May 12, all juvenile salmonids with clipped adipose fins (signifying the presence of a coded wire tag (CWT)) were sacrificed for tag identification. After that date, a CWT detector was used to separate adipose clipped fish without CWT's from those with tags, and the total number of adipose clips was subsampled to restrict the maximum number of fish sacrificed in any one day to about 200 fish. Coded wire tags were extracted from the fish with a magnet after the snout had been dissolved with concentrated KOH. After reading and verification, all tags were returned to the appropriate agency.

RELEASES OF MARKED HATCHERY FISH

Recoveries of marked and/or tagged hatchery fish were used to identify various stocks and to define sampling efficiencies and relative survival. Median date of mark recoveries were used to calculate travel time and rates of downstream movement.

This study required and obtained the participation and cooperation of the various state and federal fisheries agencies. Meetings were held during the winter of 1976-77 with representatives of the PNWRC, U.S. Fish and Wildlife Service (FWS), NMFS Environmental and Technical Services Division, Oregon Department of Fish and Wildlife (ODFW), and the Washington Department of Fisheries (WDF) to coordinate releases of marked hatchery fish with our scheduled estuary sampling effort. Many hatchery stocks of salmon and steelhead trout were scheduled for marking in 1977 as part of the stock

evaluation study funded by the PNWRC. The fisheries agencies also provided additional stocks of fish for freeze branding that had not previously been scheduled for marking in 1977. These groups included 160,000 fall chinook salmon at Spring Creek Hatchery, 50,000 spring chinook salmon at Little White Salmon Hatchery, 50,000 fall chinook salmon at Cowlitz River Hatchery, and 40,000 coho salmon at Willard Hatchery.

RESULTS AND DISCUSSION

Beach seine sampling operations at the Jones Beach site produced a catch of 358,531 juvenile salmonids in 1977. This catch included 330,060 "0"-age chinook salmon, 4,926 yearling chinook salmon, 23,048 coho salmon, and 497 steelhead trout (Table 1). As reported by Sims and Johnsen (1974), the beach seine proved very effective at catching "0"-age chinook salmon and rather ineffective at catching larger migrants. Yearling chinook salmon, coho salmon, and steelhead trout were more effectively sampled with the purse seine.

Purse seine sampling at Jones Beach was severely limited in 1977 by equipment failure and logistics problems. Only 38 sets were made during the entire sampling period. Catches included 3,818 "0"-age chinook salmon, 1,861 yearling chinook salmon, 8,259 coho salmon, and 3,679 steelhead trout (Table 2). Purse seine effort in 1978 and 1979 will be significantly increased to provide a more effective sample of yearling chinook and coho salmon and steelhead trout.

Table 1.--Weekly beach seine catches of juvenile salmon and steelhead trout at Jones Beach, Oregon, April 14 to September 29, 1977.

| BEACH SEINE | | | | | | | | | |
|-------------|----------------------------|-----------------|---------------------------------|------------------|---------------------------------|--------|---------------------------------|-----------|---------------------------------|
| Period | Fishing effort No. sets | "0"-age chinook | | Yearling Chinook | | Coho | | Steelhead | |
| | | Catch | Adjusted ^{1/} total | Catch | Adjusted ^{1/} total | Catch | Adjusted ^{1/} total | Catch | Adjusted ^{1/} total |
| Apr 14-20 | 31 | 4,101 | 8,727 | 1,462 | 3,563 | 72 | 171 | 8 | 24 |
| 21 - 27 | 41 | 3,297 | 5,995 | 737 | 1,374 | 281 | 382 | 24 | 43 |
| 28 - May 4 | 61 | 10,422 | 11,996 | 485 | 546 | 2,916 | 3,368 | 79 | 90 |
| 5 - 11 | 61 | 32,184 | 39,087 | 381 | 418 | 13,375 | 14,920 | 210 | 248 |
| 12 - 18 | 62 | 60,252 | 67,259 | 178 | 201 | 4,146 | 4,668 | 80 | 90 |
| 19 - 25 | 66 | 58,736 | 62,420 | 502 | 544 | 1,422 | 1,502 | 33 | 35 |
| 26 - June 1 | 70 | 38,117 | 38,117 | 563 | 563 | 535 | 535 | 34 | 34 |
| 2 - 8 | 67 | 23,350 | 24,079 | 146 | 155 | 194 | 212 | 9 | 9 |
| 9 - 15 | 70 | 12,266 | 12,266 | 38 | 38 | 45 | 45 | 4 | 1 |
| 16 - 22 | 68 | 8,342 | 8,582 | 53 | 55 | 14 | 14 | 2 | 2 |
| 23 - 29 | 70 | 7,632 | 7,632 | 57 | 57 | 25 | 25 | 4 | 4 |
| 30 - July 6 | 46 | 7,413 | 11,529 | 10 | 15 | 2 | 2 | 1 | 1 |
| 7 - 13 | 67 | 14,858 | 16,442 | 11 | 11 | 12 | 12 | 1 | 1 |
| 14 - 20 | 49 | 6,109 | 8,919 | 36 | 40 | 2 | 3 | 0 | 0 |
| 21 - 27 | 50 | 9,407 | 13,023 | 28 | 40 | 1 | 1 | 1 | 2 |
| 28 - Aug. 3 | 70 | 11,878 | 11,878 | 40 | 40 | 4 | 4 | 4 | 4 |
| 4 - 10 | 68 | 8,330 | 8,425 | 30 | 30 | 1 | 1 | 0 | 0 |
| 11 - 17 | 68 | 4,998 | 5,138 | 18 | 18 | 0 | 0 | 3 | 3 |
| 18 - 24 | 69 | 1,947 | 1,999 | 13 | 13 | 0 | 0 | 0 | 0 |
| 25 - 31 | 49 | 1,659 | 2,433 | 15 | 21 | 0 | 0 | 0 | 0 |
| Sept. 1 - 7 | 40 | 1,598 | 2,798 | 26 | 47 | 0 | 0 | 0 | 0 |
| 8 - 14 | 50 | 1,669 | 2,361 | 40 | 52 | 0 | 0 | 0 | 0 |
| 15 - 21 | 49 | 635 | 897 | 21 | 27 | 0 | 0 | 0 | 0 |
| 22 - 29 | 57 | 860 | 1,247 | 36 | 55 | 1 | 1 | 0 | 0 |
| Totals | 1,399 | 330,060 | 373,249 | 4,926 | 7,923 | 23,048 | 25,866 | 497 | 591 |

^{1/} Adjusted total for 10 sets per day, 7 days a week. When less than 7 days a week were fished the adjusted average from 2 days prior to 2 days following the missing day was used.

Table 2.--Purse seine catches of juvenile salmon and steelhead trout at Jones Beach, Oregon, May 4 to June 10, 1977.

| Time period | Fishing effort No. sets. | Catch | | | |
|--------------|-----------------------------|-----------------|------------------|--------------|--------------|
| | | "0"-age chinook | Yearling chinook | coho | steelhead |
| Apr 28-May 4 | 3 | 16 | 85 | 105 | 207 |
| 5 - 11 | 10 | 239 | 360 | 2,126 | 1,442 |
| 12 - 18 | 1 | 91 | 107 | 556 | 207 |
| 19 - 25 | 0 | - | - | - | - |
| 26 - Jun 1 | 5 | 1,181 | 729 | 1,489 | 1,053 |
| 2 - 8 | 8 | 944 | 292 | 2,102 | 388 |
| 9 - 15 | 11 | 1,347 | 288 | 1,881 | 382 |
| Total | 38 | 3,818 | 1,861 | 8,259 | 3,679 |

RECOVERIES OF MARKED FISH

Marked fish from more than 175 experimental releases throughout the Columbia River system were recovered at Jones Beach during 1977. The various mark release sites represented in Jones Beach recoveries are shown in Figure 1. All mark recapture data have been summarized and are presented in Appendix Tables 1 through 10.

Adipose clipped fish were checked for CWTs with a magnetic tag detector. The apparent tag loss rate was 6% for chinook and coho salmon and 18% for steelhead trout.

SAMPLING VARIABILITY

The reliability of "0"-age chinook salmon sampling at Jones Beach has been examined by comparing beach seine catch rate variability for selected groups of marked hatchery fish (Table 3). Although the catch rate of dissimilar groups of fall chinook salmon released at different locations was found to be significantly different at times (Spring Creek releases vs. Aumsville Pond releases below Willamette Falls), the "G" statistic analysis indicates that the catch rate variability of identical groups of fall chinook salmon released at the same location was not statistically different at the 99% confidence level. Results of this test indicate that the beach seine method used to sample fall chinook salmon at Jones Beach is statistically sound.

MIGRATIONAL TIMING

Timing of the 1977 juvenile outmigration to the estuary has been defined based on beach seine samples at the Jones Beach site. The temporal catch distributions for "0"-age chinook salmon, yearling chinook salmon, coho salmon, and steelhead trout are shown in Figure 2. The accuracy of

LEGEND FOR FIGURE 1

- | | |
|-------------------------------|------------------------------------|
| 1. Klaskanine Hatchery | 26. Cascade Hatchery |
| 2. Tongue Point | 27. Carson Hatchery |
| 3. Grays River Hatchery | 28. Little White Salmon Hatchery |
| 4. Elokomin Hatchery | 29. Willard Hatchery |
| 5. Big Creek Hatchery | 30. Spring Creek Hatchery |
| 6. Abernathy Research Station | 31. Big White Pond |
| 7. Cowlitz Trout Hatchery | 32. Klickitat Hatchery |
| 8. Cowlitz Salmon Hatchery | 33. The Dalles Dam |
| 9. Toutle River Hatchery | 34. Oak Springs Hatchery |
| 10. Kalama Falls Hatchery | 35. Round Butte Hatchery |
| 11. Lewis River Hatchery | 36. John Day Dam |
| 12. Eagle Creek Hatchery | 37. Ringold Hatchery |
| 13. Molalla River | 38. Priest Rapids Spawning Channel |
| 14. Tualatin River | 39. Leavenworth Hatchery |
| 15. Aumsville Pond | 40. Rocky Reach Spawning Channel |
| 16. N. Fork Santiam - Minto | 41. Wells Salmon Pond |
| 17. S. Santiam Hatchery | 42. Winthrop Hatchery |
| 18. McKenzie Hatchery | 43. Little Goose Dam |
| 19. Dexter Pond | 44. Lower Granite Dam |
| 20. Sandy Hatchery | 45. Clarkston, Washington |
| 21. Skamania Hatchery | 46. Dworshak Hatchery |
| 22. Washougal Hatchery | 47. Kooskia Hatchery |
| 23. Dalton Point | 48. White Bird, Idaho |
| 24. Bonneville Dam | 49. Riggins, Idaho |
| 25. Bonneville Hatchery | 50. Rapid River Hatchery |
| | 51. Pahsimeroi Hatchery |

Table 3.--A chi-square analysis of 1977 beach seine catch rate variability at Jones Beach, Oregon, for selected groups of marked fall chinook salmon.

| | <u>Replicate Groups (CWT No.)</u> | | | <u>G² _{1/}</u> | <u>99% Confidence interval</u> |
|--|-----------------------------------|------------------|------------------|------------------------------------|--------------------------------|
| <u>Spring Creek</u> | | | | | |
| | <u>(5/44/1)</u> | <u>(5/45/1)</u> | <u>(5/49/1)</u> | | |
| No. released | 96,767 | 95,813 | 75,822 | 5.091 n.s. | .00311 to .00415 |
| No. captured | 331 | 324 | 302 | | |
| Capture rate | 0.00342 | 0.00338 | 0.00398 | | |
| <u>Big White</u> | | | | | |
| | <u>(5/41/1)</u> | <u>(5/42/1)</u> | | | |
| No. released | 87,707 | 91,438 | | 2,531 n.s. | .00460 to .00584 |
| No. captured | 478 | 449 | | | |
| Capture rate | 0.00545 | 0.00491 | | | |
| <u>Aumsville Pond - below Willamette Falls</u> | | | | | |
| | <u>(9/16/6)</u> | <u>(9/16/7)</u> | <u>(9/16/11)</u> | | |
| No. released | 92,006 | 43,560 | 46,452 | 1.171 n.s. | .00474 to .00636 |
| No. captured | 528 | 232 | 251 | | |
| Capture rate | 0.00574 | 0.00533 | 0.00540 | | |
| <u>Aumsville Pond - above Willamette Falls</u> | | | | | |
| | <u>(9/16/12)</u> | <u>(9/16/13)</u> | | | |
| No. released | 44,608 | 43,104 | | 0.114 n.s. | .00366 to .00530 |
| No. captured | 193 | 193 | | | |
| Capture rate | 0.00433 | 0.00448 | | | |

1/ G² statistic used to test homogeneity of capture rates at the $\alpha = 0.05$ level of significance.

n.s. = nonsignificant and, therefore, one would conclude that capture rates are the same among releases.

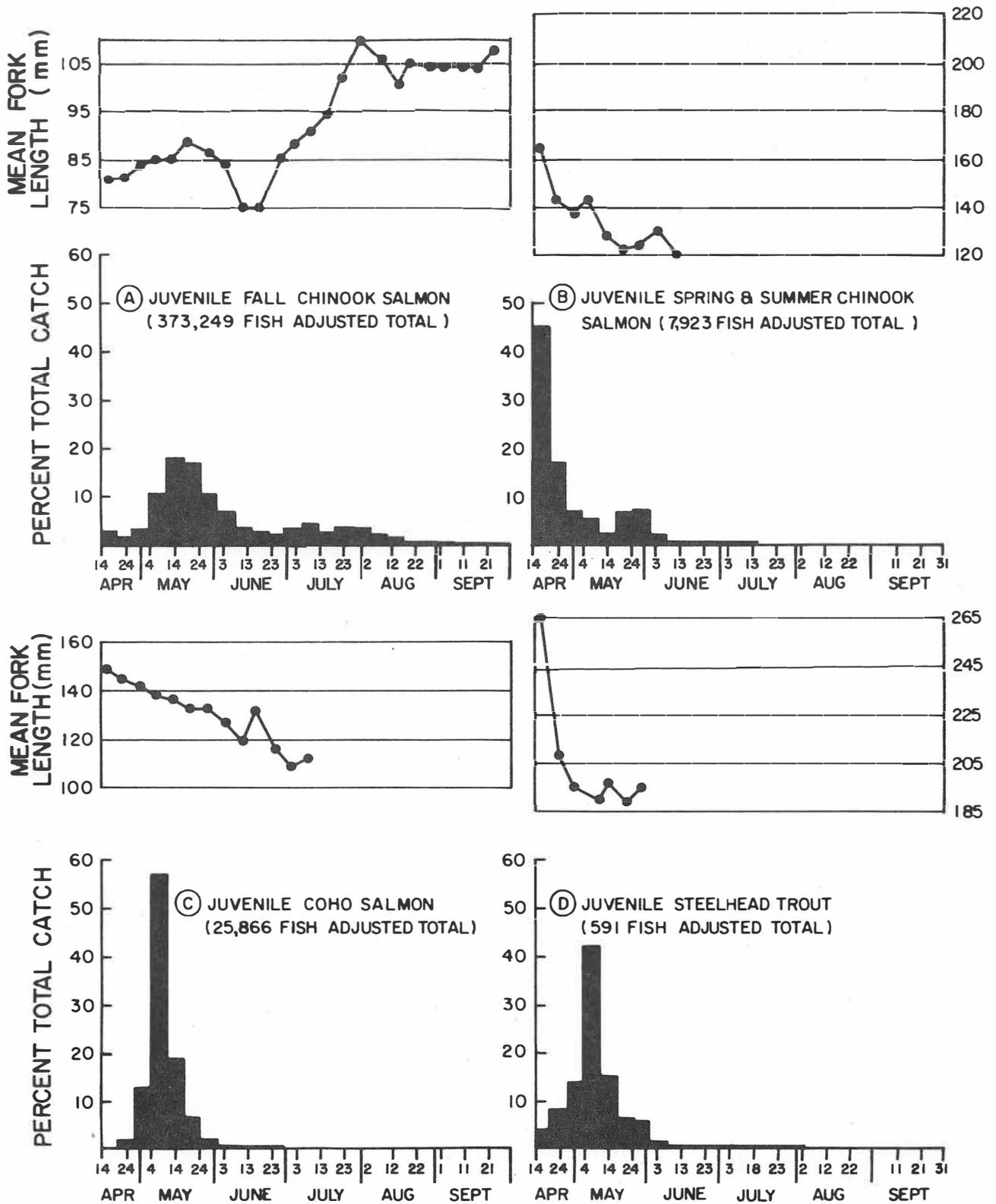


Figure 2. — Temporal and size (mean fork-length) distribution of beach seine catches of "0"-age chinook salmon, yearling chinook salmon, coho salmon, and steelhead trout at Jones Beach, Oregon, 1977.

timing information for yearling chinook salmon and steelhead trout based on beach seine catches is limited because the beach seine does not effectively sample these species. Increased purse seine sampling schedule for 1978 and 1979 will solve this problem.

The peak of the "0"-age chinook salmon migration at Jones Beach occurred during May 12 to 18; there was a second, much smaller, peak in mid-July. Timing of the "0"-age chinook salmon migration at Jones Beach in 1977 was very different than that observed in the late 1960's and early 1970's (Figure 3). Many factors may be responsible for this change. Hatchery production fish are considerably larger now than in previous years; and in 1977, hatchery production fish were released considerably earlier than was the practice during 1966 to 1972.

Yearling chinook salmon catches at Jones Beach peaked during the first few days of sampling operations in mid-April. This would indicate that we began sampling too late in 1977 to cover the early part of the migration. Sampling in 1978 is scheduled to begin on March 1 to provide for a more complete coverage of the yearling chinook salmon migration. Most of the tagged fish recovered in April were from hatchery releases in the Willamette, Kalama, and Cowlitz Rivers. A small peak of mid-Columbia and Snake River fish occurred in late May.

In 1977, the outmigration of coho salmon and steelhead trout peaked at Jones Beach in early May. Timing of these species was very similar to that observed in the 1966 to 1972 period.

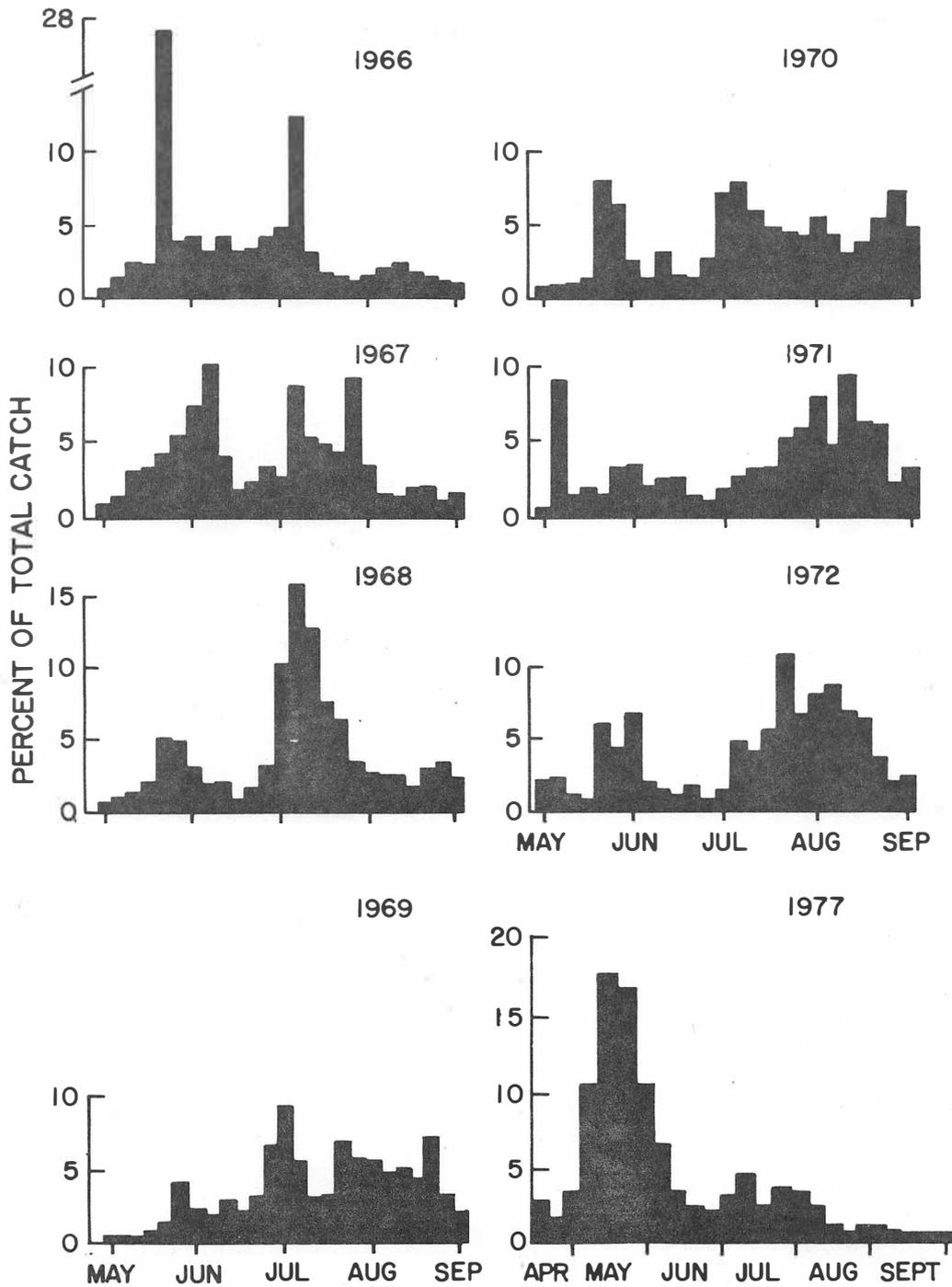


Figure 3. -- Temporal catch distribution of juvenile "0"-age chinook salmon at Jones Beach, Oregon, 1966-72 and 1977.

RATE OF DOWNSTREAM MOVEMENT

Recoveries of marked and/or tagged fish in 1977 provided considerable information relative to passage time and rates of downstream movement to the estuary (Table 4). The effect of the record low river flow through out the Columbia Basin in 1977 was obvious. The six groups of fall chinook salmon released at or near Spring Creek Hatchery in 1977 required from 19 to 49 days to reach the estuary. The average rate of downstream movement for these fish was 6.3 miles per day. In 1970, a year of average river flow, fall chinook salmon released from Spring Creek Hatchery reached the estuary in 14 days and moved downstream at an average rate of 10.8 miles per day (Sims, 1978).

As in previous years, the rate of downstream movement in 1977 was closely related to the size of the fish at time of release. Recaptures from releases of tagged (CWT) fall chinook salmon from Spring Creek Hatchery illustrate this point (Figure 4). Several groups of various size fall chinook were released at or near the hatchery between April 27 and May 31. The fish ranged in size at time of release from 111 to 42 fish to the pound. A strong correlation of increased rate of movement with increase in size of fish is evident ($r = 0.92$).

SIZE CHARACTERISTICS OF THE JUVENILE MIGRATION

Size characteristics of the juvenile migrants at Jones Beach in 1977 are illustrated in Figure 2. With the exception of a 2-week period in mid-June, the average size of "0"-age chinook salmon in the beach seine catches at Jones Beach gradually increased over the period of sampling. Average fork-length for "0"-age chinook salmon in April was about 80 mm.

Table 4. — Rates of downstream movement of various groups of marked hatchery chinook salmon captured at Jones Beach, Oregon, from Apr. 14 to Sept. 29, 1977.

| FALL CHINOOK | | | | | | | | | | | |
|-----------------------------------|-------------------------|---|--------------|-----------------|----------------------------|-----------------------|----------------------------------|-----------------------------------|------------------------|-------------------------------------|--------------------------------|
| Hatchery | Brand CWT (AG,D1/D2) | Release Site | Release Date | Number Released | Size at Release (#/lb.) | Adjusted No. Cap'd | Distance from Release Site (mi.) | River Flow ^{1/} KCF5- | Median Date of Capture | Aver. No. Days to Reach Jones Beach | Rate of Movement Miles Per Day |
| Spring Creek (FWS) | 5/41/1 | Big White | 4/15 | 87,707 | 77 | 478 | 121 | 122 | 5/11 | 26 | 4.7 |
| | 5/42/1 | Big White | 4/15 | 91,438 | 82 | 449 | 121 | 122 | 5/10 | 25 | 4.8 |
| | 5/43/1 | Hatchery | 3/18 | 146,403 | 111 | 245 | 119 | - | 5/6 | 49 | 2.4 |
| | 5/44/1 | Hatchery | 4/8 | 96,767 | 86 | 331 | 119 | 113 | 5/2 | 24 | 5.0 |
| | 5/45/1 | Hatchery | 4/8 | 95,813 | 86 | 324 | 119 | 113 | 5/3 | 25 | 4.8 |
| | RDU, 5/49/1 | Hatchery | 4/8 | 75,822 | 79 | 302 | 119 | 113 | 4/27 | 19 | 6.3 |
| | RD, 5/50/1 | Below Bonneville | 4/11 | 76,057 | 83 | 407 | 101 | 115 | 4/30 | 19 | 5.3 |
| Little White Salmon (FWS) | 5/46/1 | Hatchery | 5/24 | 145,059 | 42 | 43 | 119 | 146 | 5/31 | 7 | 17.0 |
| | 5/47/1 | Hatchery | 5/15 | 280,391 | 122 | 291 | 118 | 144 | 6/21 | 37 | 3.2 |
| Bonneville Hatchery (ODF&W) | 9/16/5 | Bonneville | 5/5 | 183,202 | 91 | 811 | 101 | 137 | 5/19 | 14 | 7.2 |
| Aumsville Pond (ODF&W) | 9/16/6 | Below Falls Willamette R. | 4/2-4 | 92,006 | 73 | 530 | 76 | 107 | 5/21 | 48 | 1.6 |
| | 9/16/7 | Below Falls Willamette R. | 4/2-4 | 43,560 | 70 | 232 | 80 | 107 | 5/19 | 46 | 1.7 |
| | 9/16/11 | Below Falls Willamette R. | 4/2-4 | 46,452 | 76 | 251 | 80 | 107 | 5/18 | 45 | 1.8 |
| | 9/16/12 | Above Falls Willamette R. (Sullivan Plant) | 4/2-4 | 44,603 | 76 | 193 | 81 | 107 | 5/19 | 46 | 1.7 |
| | 9/16/13 | Above Falls Willamette R. (Sullivan Plant) | 4/2-4 | 43,104 | 72 | 193 | 81 | 107 | 5/18 | 45 | 1.8 |
| Lewis River Hatchery (WDF) | 13/16/14 | Hatchery | 7/16 | 42,202 | 110 | 60 | 56 | 98 | 9/8 | 62 | 0.9 |
| Kalama Falls Hatchery (WDF) | 63/16/39 | Hatchery | 6/22 | 145,749 | 113 | 1019 | 29 | 98 | 7/25 | 33 | 0.9 |
| Toutle Hatchery (WDF) | 63/16/40 | Hatchery | 6/29 | 132,500 | 117 | 882 | 71 | 96 | 8/6 | 38 | 1.9 |
| Washougal Hatchery (WDF) | 63/16/41 | Hatchery | 6/28 | 128/627 | 64 | 267 | 82 | 95 | 8/10 | 43 | 1.9 |
| SPRING CHINOOK | | | | | | | | | | | |
| South Santiam Hatchery (ODF&W) | 9/5/9 | Below Foster Falls | 3/8 | 98,591 | 11 | 88 | - | - | 4/17 | 40 | |
| | 9/5/10 | Below Willamette Falls | 3/17 | 88,930 | 12 | 155 | 81 | - | 4/17 | 31 | 2.6 |
| Cowlitz River Hatchery (WDF) | 13/9/11 | Hatchery | 3/8 | 88,051 | 4 | 109 | 71 | - | 4/16 | 39 | 1.8 |
| | 13/9/12 | Hatchery | 3/8 | 88,691 | 4 | 82 | 71 | - | 4/16 | 39 | 1.8 |
| | 13/9/14 | Hatchery | 3/8 | 61,782 | 4 | 62 | 71 | - | 4/17 | 40 | 1.8 |
| | 13/11/4 | Hatchery | 3/8 | 61,658 | 4 | 51 | 71 | - | 4/17 | 40 | 1.8 |
| Kalama Falls Hatchery (WDF) | 13/11/5 | Hatchery | 3/29 | 60,162 | 7 | 224 | 29 | - | 4/16 | 18 | 1.6 |
| | 63/16/55 | Hatchery | 6/23 | 97,376 | 76 | 198 | 29 | 98 | 7/14 | 21 | 1.4 |

^{1/} Twenty day average following date of release.

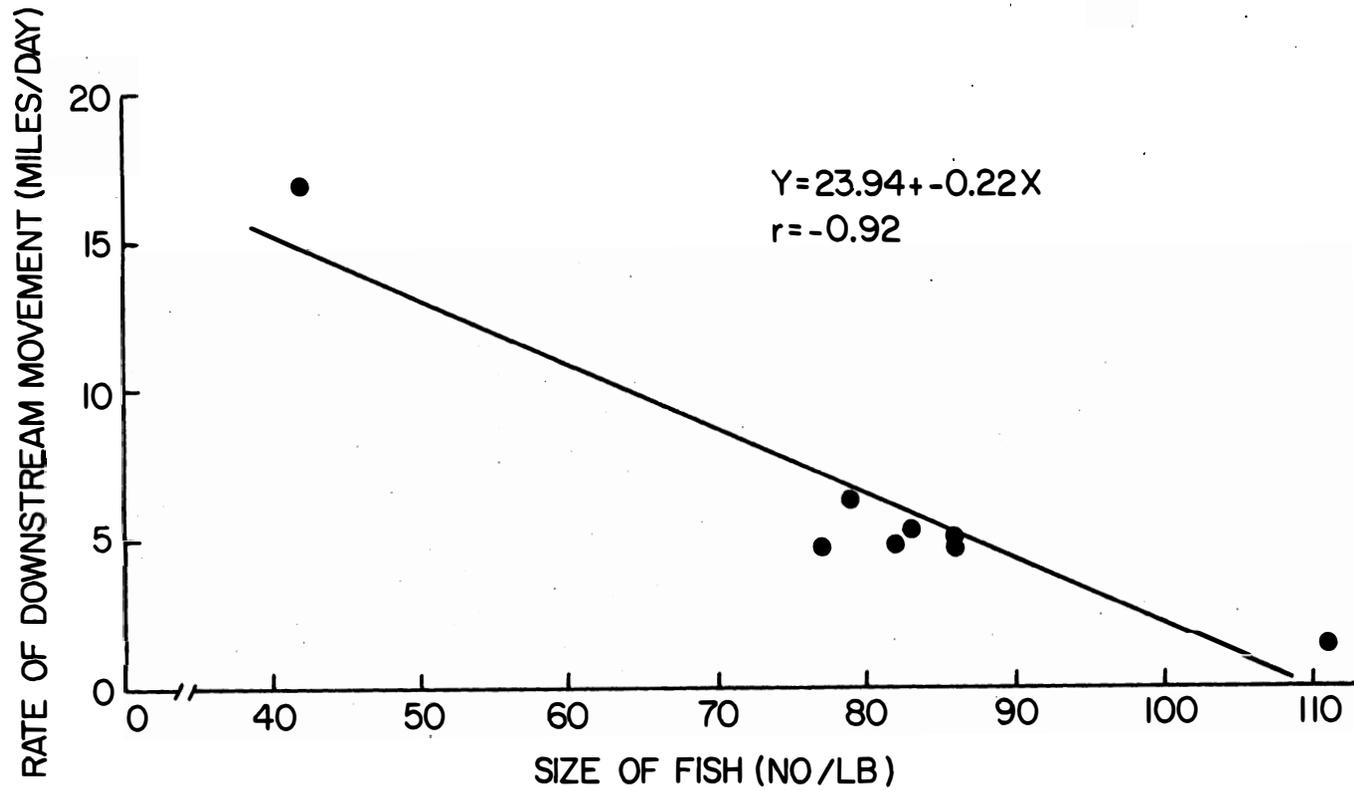


Figure 4.--- Relationship of size at release and rate of downstream movement for eight groups of hatchery "0"-age chinook salmon released into the Columbia River in 1977.

By the end of September, mean fork-length of this species had increased to about 107 mm. The average size of yearling chinook salmon, coho salmon, and steelhead trout in the beach seine catches at Jones Beach decreased as the season progressed. The size characteristics of four groups of tagged (CWT) fall chinook salmon released at four different hatcheries in 1977 are shown in Figure 5. The average size of fall chinook salmon from Bonneville and Little White Salmon Hatchery releases taken in the beach seine became larger as the season progressed; while the average size of fall chinook salmon released at Spring Creek and Kalama Hatcheries and subsequently taken in the beach seine during the latter part of the sampling period decreased. The reason for this anomaly is not known.

RELATIVE SURVIVAL OF HATCHERY RELEASES

The relative survival of various groups of marked hatchery fish has been estimated based on comparative catch rates at Jones Beach (Table 5). The barging of fall chinook salmon smolts from Spring Creek Hatchery to a release site below Bonneville Dam appears to have had a significant impact on survival to the estuary. Based on catch rates at Jones Beach, transporting these fish resulted in a 35 percent increase in survival to the estuary. In another experiment, fall chinook salmon smolts released below Willamette Falls by ODFW showed a 25 percent increase in survival over fish released above the falls.

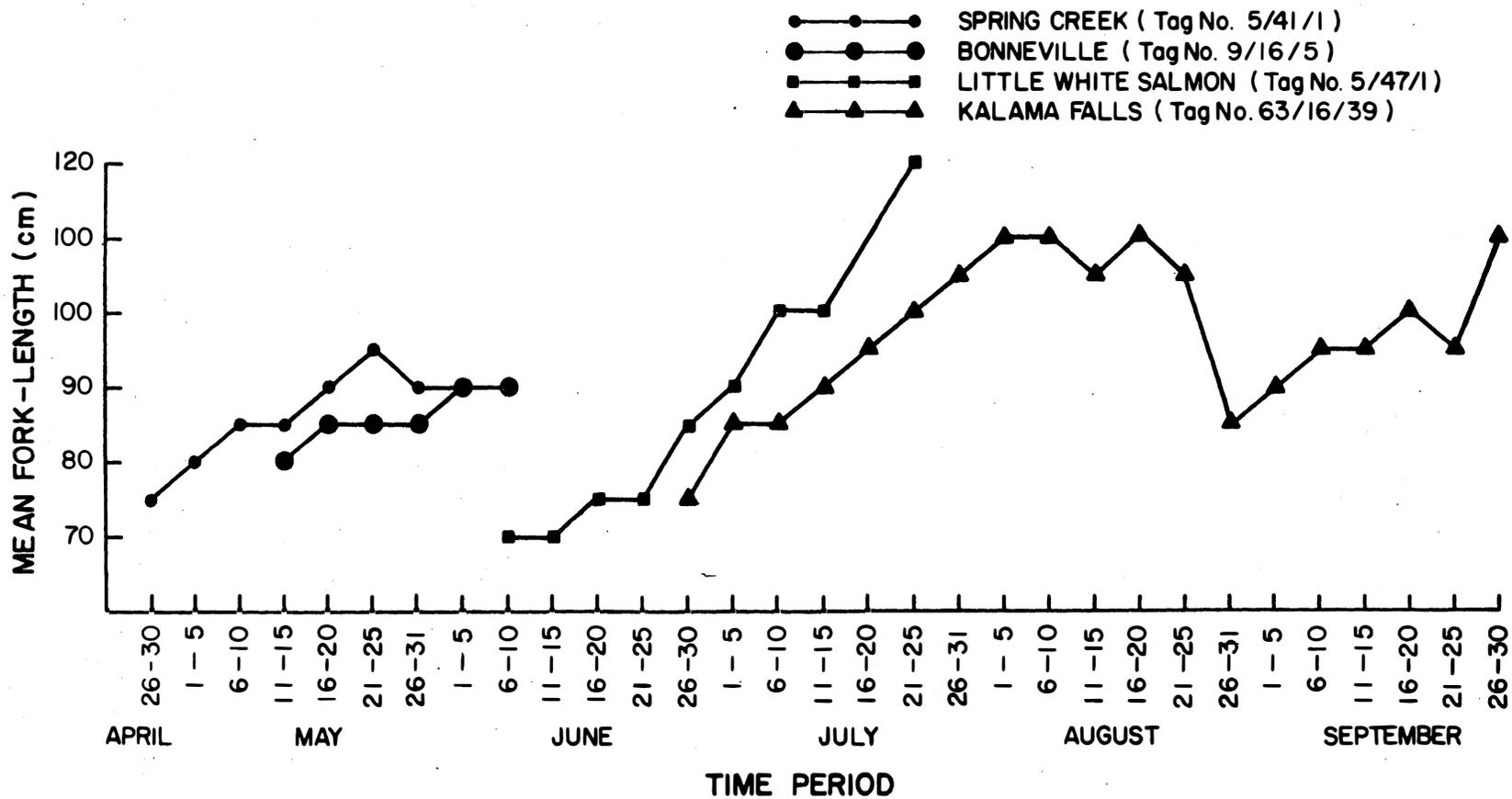


Figure 5. — Temporal size distribution of four groups of marked (CWT) "0"-age chinook salmon recovered at Jones Beach, Oregon, 1977.

Table 5. -- Recovery rate and relative survival of coded wire tagged groups of hatchery reared chinook salmon captured at Jones Beach, Oregon, 1977.

| Hatchery and place of release | Tag number | Date of release | Recovery rate (%) | Relative Survival rate (%) | Size at release no./lb |
|-------------------------------|------------|-----------------|-------------------|----------------------------|------------------------|
| Spring Creek - Fall chinook | | | | | |
| Big White rearing pond | 5/42/1 | 4/18 | 0.49 | 91 | 82 |
| Big White rearing pond | 5/41/1 | 4/18 | 0.54 | 100 | 77 |
| Spring Creek - Fall chinook | | | | | |
| Hatchery | 5/44/1 | 4/8 | 0.34 | 63 | 86 |
| Hatchery (barge control) | 5/49/1 | 4/8 | 0.40 | 74 | 79 |
| Barged below Bonneville Dam | 5/50/1 | 4/11 | 0.54 | 100 | 83 |
| Aumsville Pond - Fall chinook | | | | | |
| Willamette R. below falls | 9/16/6 | 4/2-4 | 0.57 | 100 | 73 |
| Willamette R. below falls | 6/16/7 | 4/2-4 | 0.53 | 95 | 70 |
| Willamette R. below falls | 9/16/11 | 4/2-4 | 0.54 | 94 | 76 |
| Willamette R. above falls | 9/16/12 | 4/2-4 | 0.43 | 75 | 76 |
| Willamette R. above falls | 9/16/13 | 4/2-4 | 0.45 | 79 | 79 |
| Cowlitz - Spring chinook | | | | | |
| Hatchery | 13/9/11 | 3/8 | 0.12 | 100 | 4 |
| Hatchery | 13/9/12 | 3/8 | 0.09 | 75 | 4 |
| Hatchery | 13/9/14 | 3/8 | 0.10 | 83 | 4 |
| Hatchery | 13/11/4 | 3/8 | 0.08 | 67 | 4 |

SUMMARY AND CONCLUSIONS

Research results obtained in 1977 are as follows:

1. The beach seine sampling system effectively sampled hatchery releases of "0"-age chinook salmon but proved ineffective at sampling yearling chinook and coho salmon, and steelhead trout.
2. Purse seine sampling proved much more effective at sampling yearling chinook and coho salmon and steelhead trout.
3. The timing of the "0"-age chinook salmon migration at Jones Beach was very different from that observed in the late 1960's and early 1970's. The majority of "0"-age chinook salmon passed the Jones Beach site in May 1977. In the past, the major part of the outmigration occurred during July or August.
4. Rate of downstream movement was significantly slowed by low river flows in 1977.
5. Larger fish moved downstream significantly faster than smaller fish.
6. The average size of "0"-age chinook salmon in the beach seine catches at Jones Beach generally increased as the sampling season progressed while the average size of yearling chinook and coho salmon and steelhead trout decreased.
7. Barging juvenile fall chinook salmon to a release site below Bonneville Dam significantly increased survival to the estuary.
8. Fall chinook salmon released below Willamette Falls survived to the estuary at a higher rate than those released above the Falls.

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APPENDIX

APPENDIX TABLE 1.--Release and recapture information for juvenile salmon and steelhead trout marked by USFWS and caught by beach seine at Jones Beach (Col. River, R.M. 46.5) from Apr. 14 to Sept. 29, 1977.

APPENDIX TABLE 2.--Release and recapture information for juvenile salmon and steelhead trout marked by the USFWS and caught by purse seine at Jones Beach (Col. River, R.M. 46.5) from May 4 to June 10, 1977.

APPENDIX TABLE 3.--Release and recapture information for juvenile salmon and steelhead trout marked by ODFW and caught by beach seine at Jones Beach (Col. River, R.M. 46.5) from Apr. 14 to Sept. 29, 1977.

APPENDIX TABLE 4.--Release and recapture information for juvenile salmon and steelhead trout marked by the ODFW and caught by purse seine at Jones Beach (Col. River, R.M. 46.5) from May 4 to June 10, 1977.

APPENDIX TABLE 5.--Release and recapture information for juvenile salmon and steelhead trout marked by WDF and caught by beach seine at Jones Beach (Col. River, R.M. 46.5) from Apr. 14 to Sept. 29, 1977.

APPENDIX TABLE 6.--Release and recapture information for juvenile salmon and steelhead trout marked by the WDF and caught by purse seine at Jones Beach (Col. River, R.M. 46.5) from May 4 to June 10, 1977.

APPENDIX TABLE 7.--Release and recapture information for juvenile salmon and steelhead trout marked by NMFS and caught by beach seine at Jones Beach (Col. River, R.M. 46.5) from April 14 to September 29, 1977.

APPENDIX TABLE 8.--Release and recapture information for juvenile salmon and steelhead trout marked by the NMFS and caught by purse seine at Jones Beach (Col. River, R.M. 46.5) from May 4 to June 10, 1977.

APPENDIX TABLE 9.--Release and recapture information for juvenile salmon and steelhead trout marked by WDG and caught at Jones Beach (Col. River, R.M. 46.5) from Apr. 14 to Sept. 29, 1977.

APPENDIX TABLE 10.--Release and recapture information for juvenile salmon and steelhead trout marked by IDFG and caught at Jones Beach (Col. River, R.M. 46.5) from Apr. 14 to Sept. 29, 1977.

APPENDIX TABLE 11.--Incidental beach seine catches at Jones Beach, Oregon, 1977.

APPENDIX FIGURE 1.--Water temperature ($^{\circ}\text{C}$) at the Jones Beach sampling site during 1977.

APPENDIX FIGURE 2.--River flow in the Columbia River (measured at Bonneville Dam) during 1977.

Appendix Table 1.--Release and recapture information for juvenile salmon and steelhead trout marked by USFWS and caught by beach seine at Jones Beach (Col. River, R.M. 46.5) from Apr. 14 to Sept. 29, 1977.

| Mark (Brands, Pigment, Clip, or CWT) | Hatchery Origin | Species ^{1/} | Release Location | Release Date (Mo/Da) | No. Marked | Size at Release (mm) (#/lb) | Total No. Captured (Adjusted) ^{2/} | % Captured (Adjusted) | Median Capture Date (Mo/Da) | Mean Length (mm) on Median Date | Purpose of Mark |
|--|-----------------------|-----------------------|-----------------------|----------------------------|------------------|-----------------------------------|---|--------------------------|--------------------------------------|---|-----------------------|
| <u>CWT:</u> | | | | | | | | | | | |
| <u>(Ag./D1/D2)</u> | | | | | | | | | | | |
| 5/41/1 | Spring Cr | F Ch | Big White Rearing | 4/18 | 87,707 | 91* 77 | 478 | .545 | 5/11 | 85 | Control, Morpholine |
| 5/42/1 | " " | " " | " " | 4/18 | 91,438 | 87* 82 | 449 | .491 | 5/10 | 87 | Morpholine |
| 5/43/1 | " " | " " | Spring Cr | 3/18 | 146,403 | 78* 111 | 245 | .167 | 5/6 | 95 | Hatchery Evaluation |
| 5/44/1 | " " | " " | " " | 4/8 | 96,767 | 86* 86 | 331 | .342 | 5/2 | 87 | Vaccinated Vibrio |
| 5/45/1 | " " | " " | " " | 4/8 | 95,813 | 86* 86 | 324 | .338 | 5/3 | 93 | Control, Vibrace |
| 5/49/1,RDU | " " | " " | " " | 4/8 | 75,822 | 75 79 | 302 | .398 | 4/27 | 97 | Control, Transport |
| 5/50/1,RIC | " " | " " | Below Bonneville | 4/11 | 76,057 | 75 83 | 407 | .535 | 4/30 | 79 | Barge Transport |
| 14/3/3 | Carson | Sp Ch | Carson | 9/15 | 89,833 | 106* 45 | 3 | .003 | 4/15 | 83 | Time of Release |
| 14/11/11 | " " | " " | " " | 3/15 | 94,519 | 136* 21 | 5 | .005 | 4/25 | 127 | " " " |
| 14/12/11 | " " | " " | " " | 4/15 (4/28) | 97,886 (105,377) | 144* 18 | 1 | .001 | 5/10 | 143 | " " " |
| 5/51/1 | Willard | Coho | Willard | 4/18 | 20,625 | 116 23 | 1 | .005 | 5/26 | 123 | Control Transport |
| 5/52/1 | " " | " " | " " | 4/18 | | 116 23 | | | | | " " |
| 5/53/1 | " " | " " | Below Bonneville | 4/22 | 19,785 | 116 24 | 1 | .005 | 5/9 | 123 | Barge Transport |
| 5/62/2 | Abernathy | Ch | Abernathy | 5/26 | 136,443 | 130 21 | 2 | .001 | 5/27 | 127 | Genetic Study |
| 5/46/1 | Spring Cr | F Ch | Spring Cr | 5/24 | 145,059 | 109* 42 | 43 | .030 | 5/31 | 97 | Hatchery Evaluation |
| 5/47/1 | L W S H ^{3/} | " " | L W S H ^{3/} | 6/11 | 280,391 | 76* 122 | 291 | .104 | 6/21 | 73 | " " |
| 5/20/4 | Willard | Coho | Willard | 5/2-4 | 88,339 | 122* 22 | 7 | .008 | 5/28 | 139 | Vibrio Vaccinated |
| 5/21/4 | " " | " " | " " | 5/2-4 | 93,815 | 124* 21 | 5 | .005 | 6/5 | 124 | " " |
| 5/30/3 | Abernathy | F Ch | Abernathy | 5/26 | 136,443 | 130 21 | 2 | .001 | 5/21 | 125 | Genetic Study |
| <u>Brands:</u> | | | | | | | | | | | |
| RDI | L W S H ^{2/} | Sp Ch | L W S H ^{2/} | 5/2 | 52,394 | 138 | 1 | .002 | 7/25 | 103 | Stock Identification |
| LDU, Ad | Willard | Coho | Below Bonneville | 4/22 | 21,135 | 116 24 | 2 | .009 | 5/24 | 125 | Barge Transport |
| LDN, Ad | " " | " " | Willard | 4/18 | 20,954 | 116 24 | 0 | - | - | - | Control Transport |

* Lengths estimated using USFWS weight to length conversion tables

1/ F ch = fall chinook; sp ch = spring chinook; Sm ch = summer chinook.

2/ Total catch adjusted to represent 10 sets per day, 7 days per week and 100% of Ad-clipped fish sacrificed for CWT identification.

3/ Little White Salmon National Fish Hatchery.

Appendix Table 2.--Release and recapture information for juvenile salmon and steelhead trout marked by the USFWS and caught by purse seine at Jones Beach (Col. River, R.M. 46.5) from May 4 to June 10, 1977.

| Mark (Brands, Pigment, Clip, or CWT) | Hatchery Origin | Species | Release Location | Release Date (Mo/Da) | No. Marked | Size at Release (mm) | Size at Release (#/lb) | Total No. Captured (Adjusted) ^{1/} | % Captured (Adjusted) | Median Capture Date (Mo/Da) | Mean Length (mm) on Median Date | Purpose of Mark |
|--|-----------------------|---------|-----------------------|----------------------------|---------------|----------------------------|------------------------------|---|--------------------------|--------------------------------------|---|--------------------------|
| <u>CWT:</u> (Ag./D1/D2) | | | | | | | | | | | | |
| 5/20/4 | Willard | Coho | Willard | 4/25 | 88,339 | 122* | 22 | 25 | .028 | 6/8 | 127 | Vibrio Vaccine |
| 5/21/4 | " | " | " | " | 93,815 | 124* | 21 | 25 | .027 | " | 131 | Vibrio Control |
| 5/41/1 | Spring Cr | F Ch | Spring Cr | 4/15 | 87,707 | 91* | 77 | 4 | .005 | 6/1 | 108 | Control Morpholine |
| 5/42/1 | " | " | " | " | 91,438 | 87* | 82 | 1 | .001 | 5/11 | 63 | Morpholine |
| 5/43/1 | " | " | " | 3/18 | 146,403 | 78* | 111 | 5 | .003 | 6/3 | 121 | Hatchery Evaluation |
| 5/45/1 | " | " | " | 4/8 | 95,813 | 86* | 86 | 1 | .001 | 5/6 | 117 | Control Vaccine |
| 5/46/1 | " | " | " | 5/24 | 145,059 | 109* | 42 | 9 | .006 | 6/1 | 106 | Hatchery Evaluation |
| 5/47/1 | L W S H ^{2/} | " | L W S H ^{2/} | 5/15 | 280,391 | 76* | 122 | 4 | .001 | 6/9 | 79 | " |
| 5/49/1 | Spring Cr | " | Spring Cr | 4/8 | 75,822 | 75 | 79 | 2 | .003 | 6/1 | 93 | Control Transport |
| 5/51/1 | Willard | Coho | Willard | 4/18 | 20,625 | 116 | 23 | 2 | .010 | 6/9 | 133 | Control Transport |
| 5/53/1 | " | " | Below Bonn | 4/22 | 19,785 | 116 | 24 | 2 | .010 | 6/10 | 133 | Barge Transport |
| 14/11/11 | Carson | Sp Ch | Carson | 3/15 | 94,519 | 136* | 21 | 1 | .001 | 5/5 | 103 | Time and Size at Release |
| 14/12/11 | " | " | " | 4/28 | 97,886 | 144* | 18 | 3 | .003 | 5/11 | 127 | " " " " " |
| <u>Brands:</u> | | | | | | | | | | | | |
| RDN | L W S H ^{2/} | " | L W S H ^{2/} | 5/2 | 52,394 | 138 | - | 1 | .002 | 5/11 | 153 | Stock Identification |

*Lengths estimated using USFWS weight to length conversion tables.

^{1/} Total catch adjusted to represent 100% of Ad-clipped fish sacrificed for CWT identification.

^{2/} Little White Salmon Hatchery

Appendix Table 3.--Release and recapture information for juvenile salmon and steelhead trout marked by ODFW and caught by beach seine at Jones Beach (Col. River, R.M. 46.5) from Apr. 14 to Sept. 29, 1977.

| Mark (Brands, Pigment, Clip, or CWT) | Hatchery Origin | Species | Release Location | Release Date (Mo/Da) | No. Marked | Size at Release (mm) (#/lb) | Total No. Captured (Adjusted) ^{1/} | % Captured (Adjusted) | Median Capture Date (Mo/Da) | Mean Length (mm) on Median Date | Purpose of Mark |
|--|--------------------|---------|-----------------------------|----------------------------|---------------|-----------------------------------|---|--------------------------|--------------------------------------|---|----------------------------------|
| Brands: None | | | | | | | | | | | |
| Pigment Spray: | | | | | | | | | | | |
| L V - Yellow | - | Sthd | - | - | - | - | 2 | - | 5/13 | 205 | - |
| L V - Red | - | " | - | - | - | - | 1 | - | 5/13 | 203 | - |
| CWT: | | | | | | | | | | | |
| (AG./D1/D2) | | | | | | | | | | | |
| 9/5/4 | Dexter Ponds | Sp Ch | Willamette | 3/11 | 50,194 | 10 | 43 | .086 | 4/17 | 147 | Size x Time Release |
| 9/5/5 | Marian Forks | " " | Minto | 3/18 | 46,279 | 17 | 11 | .024 | 4/20 | 153 | " " " " |
| 9/5/7 | S Santiam | " " | Below Foster | 11/15/76 | 97,640 | 9 | 3 | .003 | 4/15 | 163 | Smolt Survival Test |
| 9/5/8 | " " | " " | Below W Falls | " | 103,040 | 11 | 44 | .043 | 4/16 | 137 | " " " " |
| 9/5/9 | " " | " " | Below Foster | 3/18 | 98,591 | 11 | 88 | .089 | 4/17 | 157 | " " " " |
| 9/5/10 | " " | " " | Below W Falls | 3/17 | 88,930 | 12 | 155 | .174 | 4/17 | 141 | " " " " |
| 9/5/11 | Cascade | Coho | Tual R (Scog. Cr) | 4/19-20 | 92,522 | 29 | 1 | .001 | 6/7 | 117 | Stock Composition (Inland) |
| 9/5/12 | " | " | " " " " | " | 99,317 | 141 | 22 | .002 | 5/30 | 127 | Stock Composition |
| 9/5/14 | Sandy | " | Sandy | 4/17 | 24,893 | 135 | 16 | .004 | 6/8 | 153 | Pond Density, Hatchery Practices |
| 9/5/15 | " | " | " | 4/27 | 24,477 | 133 | 18 | .004 | 5/22 | 143 | " " " " |
| 9/6/3 | " | " | " | " | 22,854 | 134 | 17 | .004 | 5/22 | 143 | " " " " |
| 9/6/4 | " | " | " | " | 23,416 | 133 | 18 | .009 | 5/14 | 143 | " " " " |
| 9/6/6 | " | " | " | 5/6 | 57,212 | 141 | 15 | .005 | 5/24 | 144 | Diet Comp Nutritional Physiology |
| 9/6/7 | " | " | " | " | 58,753 | 142 | 15 | .002 | 6/8 | 157 | " " " " |
| 9/6/8 | " | " | " | " | 59,983 | 140 | 15 | .002 | 6/8 | 143 | " " " " |
| 9/6/9 | " | " | " | " | 60,195 | 141 | 15 | .003 | 5/17 | 147 | " " " " |
| 9/6/10 | Eagle Cr | Sp Ch | Eagle Cr | 4/29 | 85,764 | 14 | 3 | .003 | 5/22 | 137 | Stock Evaluation |
| 9/6/11 | " | " | " | 5/2 | 81,050 | 8 | 8 | .010 | 5/21 | 174 | " " " " |
| 9/6/12 | " | Sthd | " | 4/25-28 | 70,472 | 14 | 5 | .007 | 5/26 | 147 | " " " " |
| 9/16/1 | Round Butte | Sp Ch | Desch R (RM 100) | 5/2 | 31,763 | 97 | 40 | .003 | 5/25 | 113 | Stock Eval and Time and Release |
| 9/16/2 | " | " | Desch R (Rnd Butte) | " | 29,472 | 97 | 40 | .003 | 6/12 | 127 | " " " " " " |
| 9/16/3 | " | " | Desch R (RM 100) | 6/15 | 34,383 | 112 | 25 | .017 | 7/2 | 127 | " " " " " " |
| 9/16/4 | " | F Ch | " | " | 33,398 | 112 | 25 | .006 | 6/29 | 86 | Stock Evaluation |
| 9/16/5 | Bonn H | " | Bonn H | 5/5 | 183,202 | 78 | 91 | .443 | 5/19 | 86 | Hatchery Evaluation |
| 9/16/6 | Aumsville Pd | " | Willamette R below Falls | 4/2-4 | 92,006 | 73 | 528 | .574 | 5/21 | 89 | Contribution and Survival |
| 9/16/7 | " | " | " | " | 43,560 | 70 | 228 | .533 | 5/19 | 87 | " " " " |
| 9/16/8 | Klaskanine | " | Klaskanine R | May | 100,000 | 60 | 1 | .001 | 7/5 | 103 | Hatchery Evaluation |

Appendix Table 3.--Continued

| Mark (Brands, Pigment, Clip, or CWT) | Hatchery Origin | Species | Release Location | Release Date (Mo/Da) | No. Marked | Size at Release (mm) (#/lb) | Total No. Captures (Adjusted) ^{1/} | % Captured (Adjusted) | Median Capture Date (Mo/Da) | Mean Length (mm) on Median Date | Purpose of Mark |
|--|--------------------|---------|------------------------------|----------------------------|---------------|-----------------------------------|---|--------------------------|--------------------------------------|---|---------------------------|
| 9/16/9 | Big Cr | F Ch | Big Cr R | May | 162,000 | 76 | 1 | .001 | 7/25 | 117 | Diet Study |
| 9/16/10 | " " | " " | " " " | " | 143,920 | 94 | 2 | .001 | 6/29 | 103 | " " |
| 9/16/11 | Aumsville Pd | " " | Willamette R below Falls | 4/2-4 | 46,452 | 76 | 251 | .540 | 5/18 | 86 | Contribution and Survival |
| 9/16/12 | " " | " " | Willamette R. above Falls | " | 44,608 | 76 | 192 | .432 | 5/19 | 87 | Turbine Mortality |
| 9/16/13 | " " | " " | Willamette R. above Falls | " | 43,104 | 72 | 193 | .448 | 5/18 | 87 | " " |
| 9/16/14 | Round Butte | Sm Ch | Desch. R (RM 100) | 6/13 | 53,704 | 121 23 | 1 | .002 | 7/14 | 143 | Size/Time/Release |
| 9/16/15 | " " | " " | " " " " | " | 58,148 | 115 26 | 6 | .010 | 7/11 | 127 | " " " |

Clips:

| | | | | | | | | | | | |
|-----|-----------|--------|------------|---|---|---|----|---|------|-----|---|
| R V | Sandy R | Coho | Sandy R | - | - | - | 2 | - | 5/12 | 137 | - |
| L V | " " | " | " " | - | - | - | 2 | - | 5/9 | 150 | - |
| L V | - | Sthd | S. Santiam | - | - | - | 14 | - | 5/13 | 198 | - |
| R V | - | " | N Santiam | - | - | - | 2 | - | 5/13 | 237 | - |
| L P | - | " | - | - | - | - | 1 | - | 5/21 | 227 | - |
| R P | Roaring R | W Sthd | Molalla R | - | - | - | 1 | - | 5/23 | 163 | - |

^{1/} Total catch adjusted to represent 10 sets per day, 7 days per week and 100% of Ad-clipped fish sacrificed for CWT identification.

Appendix Table 4.--Continued

| Marks (Brands, Pigment Clip, or CWT) | Hatchery Origin | Species | Release Location | Release Date (Mo/Da) | No. Marked | Size at Release (mm) (#1b) | Total No. Captured (Adjusted) ^{1/} | % Captured (Adjusted) | Median Capture Date (Mo/Da) | Mean Length (mm) on Median Date | Purpose of Mark |
|--|--------------------|---------|-----------------------|----------------------------|---------------|----------------------------------|---|--------------------------|--------------------------------------|---|-----------------------|
| Clips: | | | | | | | | | | | |
| LV, R P | | Sm Sthd | Rm. 100 Desch. | 5/1 | 80,000 | 4-6 | 6 | .008 | 6/8 | 263 | - |
| Ad, R Max | | Sthd | N Santiam | | | | 1 | - | 6/9 | 263 | - |
| CWT: | | | | | | | | | | | |
| (A2./D1/D2) | | | | | | | | | | | |
| 9/5/4 | Dexter Pd | Sp Ch | Dexter | 3/11 | 50,198 | 10 | 1 | .002 | 5/11 | 177 | Size x Time Release |
| 9/5/5 | Marion H | Sp Ch | Minto | 3/18 | 46,279 | 17 | 1 | .002 | 5/11 | 133 | " " " " |
| 9/5/8 | S Santiam H | Sp Ch | Below Will. F | 11/15 | 103,040 | 151 | 9 | .001 | 5/4 | 167 | Smolt Survival Test |
| 9/5/11 | Cascade H | Coho | Tualatin R | 4/19-20 | 92,522 | - 24 | 39 | .042 | 6/9 | 117 | St Comp, Inland St |
| 9/5/12 | " " | Coho | Tualatin R | 4/19-20 | 99,317 | - 21 | 26 | .026 | 6/3 | 138 | St Comp, Col R Sto |
| 9/5/13 | Sandy H | Coho | Sandy R | 5/6 | 60,607 | 141 15 | 29 | .048 | 6/8 | 162 | Diet Comp Nut Phys |
| 9/5/14 | " " | " | " " | 4/27 | 24,893 | 135 16 | 11 | .044 | 6/8 | 159 | Pond Dens, Hat Pra |
| 9/5/15 | " " | " | " " | 4/27 | 25,477 | 133 18 | 10 | .040 | 6/9 | 167 | " " " " |
| 9/6/1 | " " | " | " " | 4/27 | 25,813 | 136 16 | 8 | .031 | 6/8 | 163 | " " " " |
| 9/6/2 | " " | " | " " | 4/27 | 20,139 | 132 18 | 8 | .040 | 6/9 | 169 | " " " " |
| 9/6/3 | " " | " | " " | 4/27 | 22,854 | 134 17 | 6 | .026 | 6/8 | 157 | " " " " |
| 9/6/4 | " " | " | " " | 4/27 | 23,416 | 133 18 | 10 | .043 | 6/3 | 167 | " " " " |
| 9/6/6 | " " | " | " " | 5/6 | 57,212 | 141 15 | 30 | .052 | 6/9 | 157 | Diet Comp Nut Phys |
| 9/6/7 | " " | " | " " | 5/6 | 58,753 | 142 15 | 47 | .080 | 6/9 | 163 | Diet Comp |
| 9/6/8 | " " | " | " " | 5/6 | 59,983 | 141 15 | 23 | .038 | 6/8 | 157 | Diet Comp Nut Phys |
| 9/6/9 | " " | " | " " | 5/6 | 60,195 | 141 15 | 32 | .053 | 6/8 | 163 | " " " " |
| 9/6/11 | Eagle Cr H | W Sthd | Clackamas R Eagle C | 5/2 | 81,050 | 8 | 26 | .032 | 6/3 | 183 | St Eval |
| 9/6/12 | Eagle Cr H | Coho | Clackamas R Eagle C | 4/25-28 | 70,472 | 14 | 11 | .016 | 6/3 | 145 | " " |
| 9/16/3 | Round Butte H | Sp Ch | Deschutes R.RM100 | 6/15 | 34,383 | 112 25 | 1 | .003 | 6/9 | 123 | St Eval Time Release |
| 9/16/5 | Bonneville H | F Ch | Bonneville H | 5/5 | 183,202 | 91 | 2 | .001 | 5/31 | 93 | Hatchery Eval |
| 9/16/11 | Aumsville Pd | F Ch | Willam. R below falls | 4/2-4 | 46,452 | 76 | 4 | .009 | 6/9 | 100 | Contrib and Surv |
| 9/16/12 | Aumsville Pd | F Ch | Willam. R above falls | 4/2-4 | 44,608 | 76 | 1 | .002 | 6/9 | 97 | Turbine Mortality |

* Also WDF mark.

^{1/} Total catch adjusted to represent 100% of Ad-clipped fish sacrificed for CWT identification.

Appendix Table 5.--Release and recapture information for juvenile salmon and steelhead trout marked by WDF and caught by beach seine at Jones Beach (Col. River, R.M. 46.5) from Apr. 14 to Sept. 29, 1977.

| Mark (Brands, Pigment, Clip, or CWT) | Hatchery Origin | Species | Release Location | Release Date (Mo/Da) | No. Marked | Size at Release (mm) (#/lb) | Total No. Captured (Adjusted) ^{1/} | % Captured (Adjusted) | Median Capture Date (Mo/Da) | Mean Length (mm) on Median Date | Purpose of Mark |
|--|----------------------------------|---------|---------------------|----------------------------|---------------|-----------------------------------|---|--------------------------|--------------------------------------|---|-----------------------------|
| Brands: | | | | | | | | | | | |
| R.D. ♂ 2nd | Cowlitz | F Ch | Cowlitz R | 5/20 | 50,500 | 83 76 | 21 | .042 | 6/20 | 99 | Stock Identification |
| Clips: none | | | | | | | | | | | |
| Pigment: | | | | | | | | | | | |
| Ad & Green | Toutle | F Ch | N Fk Toutle | 6/29 | 132,500 | 117 | 1 | .001 | 7/10 | 73 | Stock Evaluation |
| CWT: (Ag./D1/D2) | | | | | | | | | | | |
| 13/9/11 | Cowlitz H. | Sp Ch | Cowlitz H | 3/8 | 88,051 | 4 | 109 | .123 | 4/16 | 195 | Density Study |
| 13/9/12 | " " | " " | " " | " | 88,691 | 4 | 82 | .092 | 4/16 | 185 | " " |
| 13/9/14 | " " | " " | " " | " | 61,782 | 4 | 62 | .100 | 4/17 | 200 | " " |
| 13/11/4 | " " | " " | " " | " | 61,658 | 4 | 51 | .083 | 4/17 | 171 | " " |
| 13/11/5 | Kalama Fls H | " " | Kalama R | 3/20 | 60,162 | 7 | 224 | .372 | 4/16 | 166 | Stock Evaluation |
| 13/13/1 | Cowlitz H | " " | Cowlitz H | 3/8 | 28,746 | 3 | 24 | .083 | 4/17 | 190 | Density Study |
| 13/13/4 | " " | " " | " " | " | 27,967 | 3 | 32 | .114 | 4/16 | 202 | " " |
| 13/3/4 | Ringold H | " " | Ringold H | 4/7 | 72,771 | 4 | 3 | .004 | 5/25 | 207 | PNRC Upper Col R Evaluation |
| 13/11/3 | Klickitat H | " " | Klickitat H | 4/30 | 100,250 | 7 | 3 | .003 | 5/8 | 164 | " " " " " |
| 13/12/3 | Wells | Sm Ch | Wells Sp Chan | 1/17 | 38,800 | 17) | 1 | .001 | 6/19 | 163 | Late Release Evaluation |
| " | " | " " | " " " | 4/29 | 50,548 | 8) | | | | | |
| 13/12/11 | Leavenworth | Sp Ch | Leavenworth | 4/19 | 99,561 | 132 - | 1 | .001 | 6/13 | 177 | Control Transportation |
| 13/14/4 | Washougal | Coho | Klickitat | 4/6 | 19,857 | 14) | 1 | .002 | 5/5 | 153 | PNRC Upper Col R Evaluation |
| " | " | " " | " " | 4/30 | 40,656 | 12) | | | | | |
| 13/14/5 | Cowlitz | " " | " " | " | 61,013 | 16 | 1 | .002 | 5/24 | 177 | - |
| 13/16/1 | Grays River | " " | W Fk Grays R | 4/29 | 41,943 | 17 | 1 | .002 | 5/3 | 133 | Early Late Stock Evaluation |
| 13/16/14 | Lewis R H | Wild Ch | N Fk Lewis R | 7/6 | 42,202 | 110 | 60 | .142 | 9/8 | | Wild Stock Evaluation |
| 63/16/3 | Grays R | F Ch | Grays R H | 6/1 | 135,781 | 74 | 1 | .001 | 6/28 | 87 | Stock Evaluation |
| 63/16/4 | Elokomin R | " " | Elokomin R H | 6/16 | 145,044 | 103 | 39 | .027 | 7/12 | 97 | " " |
| 63/16/5 | Klickitat H | " " | Klickitat H | 6/3 | 139,694 | 92 | 35 | .025 | 8/18 | 136 | " " |
| 63/16/16 | Wild Fish | Ch | Lewis R | 4/29-7/1 | 9,832 | | 6 | .061 | 8/22 | 115 | Wild Stock Evaluation |
| 63/16/39 | Kalama F | F Ch | Kalama F H | 6/22 | 145,749 | 103 | 1019 | .699 | 7/25 | 105 | Stock Evaluation |
| 63/16/40 | Toutle | " " | N Fk Toutle R | 6/29 | 132,500 | 117 | 882 | .666 | 8/6 | 104 | " " |
| 63/16/41 | Washougal | " " | Washougal H | 6/28 | 128,627 | 64 | 267 | .208 | 8/10 | 115 | " " |
| 63/16/54 | Wells Spawn Ch | Sm Ch | Below Priest Rapids | 6/2 | 99,113 | 34 | 17 | .017 | 6/11 | 97 | " " |
| 63/16/55 | Kalama Falls | " " | Kalama F H | 6/23 | 97,376 | 76 | 198 | .203 | 7/14 | 100 | " " |
| 63/16/62 | Priest Rapids (Spawn Channel) | F Ch | Priest Chan | 6/27 | 150,625 | 96 | 2 | .001 | 8/22 | 140 | PNRC Upper Col R Evaluation |
| 63/17/11 | Cowlitz H | Ch | Escapee | - | | - | 1 | - | 7/25 | 133 | '76' Brood Density |

^{1/} Total catch adjusted to represent 10 sets per day, 7 days per week and 100% of Ad-clipped fish sacrificed for CWT identification.

Appendix Table 6.--Release and recapture information for juvenile salmon and steelhead trout marked by the WDF and caught by purse seine at Jones Beach (Col. River, R.M. 46.5) from May 4 to June 10, 1977.

| Mark (Brand, Pigment Clip, or CWT) | Hatchery Origin | Species | Release Location | Release Date (Mo/Da) | No. Marked | Size at Release (mm) (#1b) | Total No. Captured (Adjusted) ^{1/} | % Captured (Adjusted) | Median Capture Date (Mo/Da) | Mean Length (mm) on Median Date | Purpose of Mark |
|--|--------------------|---------|------------------------|----------------------------|---------------|----------------------------------|---|--------------------------|--------------------------------------|---|-----------------------|
| <u>Clips:</u> | | | | | | | | | | | |
| R V | - | Ch | - | - | - | - | 1 | - | 6/8 | 173 | - |
| R V* | Rocky Reach | Coho | Below Priest Rap | 4/14 | 50,569 | 15 | 7 | .014 | " | 172 | Trans |
| L V* | " " | " | Above Priest Rap | 5/4 | 48,379 | 11 | 11 | .022 | 6/9 | 170 | Control Trans |
| <u>CWT</u> (Ag./D1/D2) | | | | | | | | | | | |
| 13/3/4 | Ringold | Sp Ch | Ringold | 4/7 | 72,771 | 4 | 1 | .001 | 5/12 | 203 | PNRC Eval. |
| 13/5/13 | Winthrop | Sm Ch | Below Priest Rap | 5/4-6 | 95,603 | 11 | 9 | .009 | 5/31 | 165 | Transport |
| 13/7/1 | Winthrop | " " | Winthrop H | 4/12 | 99,185 | 12 | 5 | .005 | 6/8 | 157 | Control Trans |
| 13/9/14 | Cowlitz | Sp Ch | Cowlitz | 3/8 | 61,782 | 4 | 1 | .002 | 5/5 | 183 | Pond Density |
| 13/11/2 | Wells | Sm Ch | Klickitat | 4/30 | 49,462 | 9 | 5 | .010 | 5/11 | 185 | - |
| 13/11/3 | Klickitat | Sp Ch | " | " | 100,250 | 7 | 4 | .004 | " | 155 | - |
| 13/11/13 | Winthrop | Sm Ch | Methow R (22 mi dm) | 4/13 | 93,537 | 15 | 11 | .004 | 6/8 | 171 | Control Haul |
| 13/12/3 | Wells Sp Chan. | " " | Wells Sp Chan. | 1/17 | 38,800 | 17 |) 1 | .001 | 6/8 | 197 | Late Release Eval |
| " " " | " " " | " " | " " " | 4/29 | 50,548 | 8 | | | | | |
| 13/12/4 | Carson | Sp Ch | Entiat H | 4/15 | 99,132 | - | 5 | .005 | " | 151 | - |
| 13/12/11 | Leavenworth | Sp Ch | Leavenworth | 4/19 | 101,000 | 132 | 4 | .004 | " | 131 | Hatchery Rel |
| 13/12/12 | " | " " | Below Priest Rap | 5/1 | 101,390 | 132 | 7 | .007 | " | 144 | Transport |
| 13/12/13 | " | " " | Leavenworth | 4/13 | 104,000 | 132 | 6 | .006 | 6/1 | 143 | Control Haul |
| 13/14/4 | Washougal | Coho | Klickitat | 4/6 | 19,857 | 14 |) 4 | .007 | 5/12 | 175 | PNRC Eval |
| " " " | " | " | " | 4/30 | 40,656 | 12 | | | | | |
| 13/14/5 | Cowlitz | " | Cowlitz | " | 61,013 | 16 | 8 | .013 | 6/3 | 125 | PNRC Eval |
| 63/16/54 | Wells Sp Chan. | Sm Ch | Below Priest Rapids | 6/2 | 99,113 | 34 | 23 | .023 | 6/9 | 104 | Stock Eval |

* Also WDF mark.

^{1/} Total catch adjusted to represent 100% of Ad-clipped fish sacrificed for CWT identification.

Appendix Table 7.--Release and recapture information for juvenile salmon and steelhead trout marked by NMFS and caught by beach seine at Jones Beach (Col. River, R.M. 46.5) from April 14 to September 29, 1977.

| Marks (Brands, Pigment Clip, or CWT) | Capture Location | Species | Release Location | Release Date (Mo/Da) | No. Marked | Size at Release (mm) (#1b) | Total No. Captured (Adjusted) ^{1/} | % Captured (Adjusted) | Median Capture Date (Mo/Da) | Mean Length (mm) on Median Date | Purpose of Mark |
|--|---------------------|---------|---------------------|----------------------------|---------------|----------------------------------|---|--------------------------|--------------------------------------|---|-----------------------|
| Brands: | | | | | | | | | | | |
| R D "V" | The Dalles D | Sp Ch | John Day | 6/13-16 | 901 | - | 1 | .110 | 6/25 | 113 | Outfall Eval |
| R D "Y" | Lower Granite D | Sp Ch | Dalton Pt | Apr-June | 43,065 | - | 2 | .005 | 5/6 | 107 | Truck Trans |
| R D "M" | " " | Sp Ch | Below Bonn | " " | 45,404 | - | 1 | .002 | 5/1 | 133 | " " |
| Ad clip "T" | Little Goose D | Sp Ch | " " | " " | 41,677 | - | 2 | .005 | 5/29 | 143 | " " |
| R A Ad "M" | Lower Granite D | Sthd | " " | " " | 42,777 | - | 1 | .002 | 5/13 | 163 | " " |
| R A Ad "T" | Little Goose D | Sthd | " " | " " | 24,272 | - | 3 | .012 | 5/29 | 195 | " " |
| R A Ad "E" | Lower Granite D | Sthd | " " | " " | 10,118 | - | 3 | .030 | 6/8 | 247 | Barge " |

^{1/} Total catch adjusted to represent 10 sets per day, 7 days per week and 100% of Ad-clipped fish sacrificed for CWT identification.

Appendix Table 8.—Release and recapture information for juvenile salmon and steelhead trout marked by the NMFS and caught by purse seine at Jones Beach (Col. River, R.M. 46.5) from May 4 to June 10, 1977.

| Mark (Brands, Pigment Clip, or CWT) | Capture Location or Hatchery Origin | Species | Release | Release Date (Mo/Da) | No. Marked | Size at Release (mm) (#1b) | Total No. Captured (Adjusted) ^{1/} | % Captured (Adjusted) | Median Capture Date (Mo/Da) | Mean Length (mm) on Median Date | Purpose of Mark |
|---|--|---------|-------------------|----------------------------|---------------|----------------------------------|---|--------------------------|--------------------------------------|---|-----------------------|
| Brands: | | | | | | | | | | | |
| Ad R D "F" | Lower Granite | Sp Ch | Dalton Point | 4/25-6/15 | 43,065 | - | 1 | .002 | 5/4 | 147 | Control Trans |
| Ad "M" | " " | " " | Bonn. Dam | 4/26-6/17 | 45,404 | - | 2 | .004 | 5/6 | 133 | Truck Trans |
| Ad R A "Z" | " " | " " | " " | 4/29-5/11 | 88,469 | - | 1 | .001 | 5/6 | 137 | Air Trans |
| R A "W" | " " | " " | " " | 5/29 | 4,264 | - | 2 | .047 | 5/31 | 130 | Barge Trans |
| R V, R A "K" | " " | " " | Clarkston | 4/25-6/3 | 31,628 | - | 1 | .003 | 5/31 | 117 | Control Trans |
| R A "K" | " " | " " | " " | 5/14 | 28 | - | 1 | 3.6 | 5/31 | 133 | Control Trans |
| R A "M" | White Bird Sep Trp | " " | Whitebird | 4/11 | 9,235 | - | 1 | .011 | 5/5 | 123 | Stock Eval |
| L D "IU" | Little Goose Dam | " " | Little Goose | 5/2 | 19,290 | - | 1 | .005 | 5/31 | 143 | Backrol Rel |
| Ad R A "3" | Lower Granite | " " | Bonn. Dam | 5/4 | 10,510 | - | 6 | .057 | 5/11 | 133 | Barge Trans |
| Ad R A "→" | Little Goose | " " | " " | 4/29-6/16 | 43,334 | - | 1 | .002 | 6/3 | 107 | Tr Trans w/salt |
| L A "XW" | unassigned | " " | - | - | - | - | 1 | - | 5/31 | 133 | - |
| Ad R D "SI" | Dworshak H | " " | Dworshak H | 5/7 | 1,015 | - | 1 | .098 | 5/11 | 167 | - |
| L A "M" | John Day Dam | " " | John Day Dam | 5/24-5/26 | 4,252 | - | 1 | .024 | 6/8 | 183 | Time & Surv |
| L A "X3" | Turtle Rock | Coho | Pasco | 5/1 | 16,646 | - | 2 | .012 | 6/5 | 163 | Oval Flume |
| R A "X3" | Turtle Rock | Coho | Pasco | 5/1 | 16,641 | - | 1 | .006 | 5/31 | 180 | Oval Flume |
| R A "△" | The Dalles Dam | Coho | John Day Dam | 5/31 | 70 | - | 1 | 1.4 | 6/8 | 143 | Time & Surv |
| Ad "M" | Riggins Trap | Sthd | Riggins | - | - | - | 1 | - | 5/5 | 223 | Time & Surv |
| Ad R A "D" | Lower Granite | " " | Tongue Point | 5/9 | 2,171 | - | 2 | .092 | 5/5 | 190 | Air Trans |
| Ad R A "M" | Lower Granite | " " | Bonn. Dam | 4/26-6/17 | 42,507 | - | 6 | .014 | 5/6 | 174 | Tr Trans w/salt |
| Ad R A "F" | Lower Granite | " " | Dalton Point | 4/25-6/15 | 40,900 | - | 12 | .029 | 6/9 | 201 | Tr Trans w/salt |
| L D "F" | Lower Granite | " " | Dalton Point | 4/25-6/17 | 83,676 | - | 1 | .001 | 6/1 | 117 | Tr Trans w/salt |
| A D, L A "K" | Lower Granite | " " | Clarkston | 4/25-5/6 | 11,179 | - | 6 | .054 | 5/10 | 197 | Control Trans |
| L V, L D "X" | Lower Granite | " " | Clarkston | 5/10-5/19 | 8,310 | - | 1 | .012 | 5/31 | 157 | " " |
| Ad, RA "W" | Whitebird Trap | " " | Whitebird | 3/15-5/30 | 1,886 | - | 1 | .053 | 5/31 | 227 | Time & Surv |
| R V, R A "D" | John Day Dam | " " | John Day Tailrace | 6/7-6/8 | 224 | - | 1 | .45 | 5/31 | 213 | Outfall Eval |
| Ad R A "→" | Little Goose Dam | " " | Bonn. Dam | 4/29-6/16 | 22,916 | - | 24 | .100 | 6/9 | 197 | Tr Trans w/salt |
| Ad R A "T" | " " | " " | " " | 5/2-6/20 | 24,272 | - | 10 | .037 | 5/6 | 196 | Truck Trans |
| L P, L A "→" | Riggins | " " | Riggins | 5/16-5/22 | 908 | - | 2 | .22 | 5/31 | 217 | Time & Surv |
| Ad R A "W" | Lower Granite | " " | Bonn. Dam | 5/26-5/27 | 10,197 | - | 42 | .411 | 5/31 | 202 | Barge Trans |

Appendix Table 8.—Continued.

| Marks (Brands, Pigment Clip, or CWT) | Capture Location or Hatchery Origin | Species | Release | Release Date (Mo/Da) | No. Marked | Size at Release (mm) (#1b) | Total No. Captured (Adjusted) ^{1/} | % Captured (Adjusted) | Median Capture Date (Mo/Da) | Mean Length (mm) on Median Date | Purpose of Mark |
|--|--|---------|-------------------|----------------------------|---------------|----------------------------------|---|--------------------------|--------------------------------------|---|-----------------------|
| Ad, R A "3" | Lower Granite | Sthd | Bonn. Dam | 5/4-5/5 | 10,115 | - | 18 | .178 | 5/11 | 190 | Barge Trans |
| Ad, R A "C" | " | " | " | 6/2-6/3 | 10,118 | - | 1 | .010 | 6/8 | 173 | " |
| Ad, R P, R A "Σ" | " | " | " | 6/2-3 | 10,118 | - | 1 | .010 | 6/8 | 203 | " |
| L D "K" | " | " | Clarkston | 4/25-5/6 | 30,330 | - | 1 | .033 | 5/31 | 163 | Control Trans |
| Ad, L A "Δ" | " | " | Clarkston | 5/23-6/3 | 10,378 | - | 1 | .010 | 6/10 | 203 | " |
| R A "△" | The Dalles Dam | " | John Day tailrace | 5/31-6/2 | 304 | - | 1 | .329 | 6/8 | 197 | Outfall Eval |
| R A "∅" | John Day Dam | " | John Day Dam | 5/25-28 | 404 | - | 3 | .743 | 6/3 | 190 | Time & Surv |
| Ad, R A "∞" | Pahsimeroi H | " | Pahsimeroi | 3/15 | 15,00 | - | 3 | .02 | 5/6 | 186 | - |
| Ad, R D "IJ" | Dworshak H | " | Dworshak | 5/8 | 17,178 | 9 | 18 | .105 | 5/11 | 178 | Barge Trans |
| Ad, L D "∞" | " | " | " | 4/7 | 10,000 | - | 1 | .01 | 5/5 | 227 | - |
| R A "+" | Unassigned | " | - | - | - | - | 1 | - | 5/31 | 167 | - |
| R A "()" | Unassigned | " | - | - | - | - | 1 | - | 5/31 | 177 | - |
| CWT: | | | | | | | | | | | |
| Or/Wt/Yel | Lower Granite D | Sp Ch | Dalton Point | Apr-Jun | 43,065 | - | 2 | .005 | 5/4 | 137 | Truck Trans |
| Gr/Wt/Yel | " | Sp Ch | Clarkston | Apr-Jun | 34,649 | - | 4 | .011 | 5/31 | 131 | " |
| Blue/Wt/Yel | " | Sthd | Below Bonn. D | Apr-Jun | 35,873 | - | 4 | .011 | 6/3 | 133 | " |
| Gr/Wt/Yel | " | Sthd | Clarkston | Apr-Jun | 22,916 | - | 3 | .008 | 5/31 | 209 | " |
| Yel/Wt/Yel | Little Goose D | Sthd | Below Bonn. D | Apr-Jun | 37,299 | - | 2 | .009 | 6/9 | 203 | " |

^{1/} Total catch adjusted to represent 100% of Ad-clipped fish sacrificed for CWT identification.

Appendix Table 9.--Release and recapture information for juvenile salmon and steelhead trout marked by WDG and caught at Jones Beach (Col. River, R.M. 46.5). from Apr. 14 to Sept. 29, 1977.

| Mark (Brands, Pigment, Clip, or CWT) | Hatchery Origin | Species | Release Location | Release Date (Mo/Da) | No. Marked | Size at Release (mm) (#/lb) | Total No. Captured (Adjusted) | % Captured (Adjusted) | Median Capture Date (Mo/Da) | Mean Length (mm) on Median Date | Purpose of Mark |
|--|--------------------|---------|---------------------|----------------------------|---------------|-----------------------------------|-------------------------------------|--------------------------|-----------------------------------|---|-----------------------|
| | | | | | | <u>Beach Seine</u> | <u>1/</u> | | | | |
| <u>CWT:</u> (Ag./D1/D2) | | | | | | | | | | | |
| 13/14/6 | Skamania | Sthd | L Washougal R. | - | - | - | 1 | - | 5/12 | 177 | - |
| 13/14/8 | Cowlitz | " | - | - | - | - | 1 | - | 5/28 | 167 | - |
| <u>Clips:</u> D L P | | Sthd | Below Bonneville | - | - | - | 1 | - | 6/5 | 247 | Barge Transport |
| | | | | | | <u>Purse Seine</u> | <u>2/</u> | | | | |
| <u>CWT:</u> (Ag/D1/D2) | | | | | | | | | | | |
| 13/14/6 | Skamania | Sthd | - | - | - | - | 7 | - | 5/5 | 199 | - |
| 13/14/7 | Klickitat | " | - | - | - | - | 3 | - | 5/31 | 211 | - |
| 13/14/8 | Cowlitz | " | - | - | - | - | 7 | - | 6/3 | 196 | - |

1/ Total catch adjusted to represent 10 sets per day, 7 days per week and 100% of Ad-clipped fish sacrificed for CWT identification.

2/ Total catch adjusted to represent 100% of Ad-clipped fish sacrificed for CWT identification.

Appendix Table 10.--Release and recapture information for juvenile salmon and steelhead trout marked by IDFG and caught at Jones Beach (Col. River, R.M. 46.5) from Apr. 14 to Sept. 29, 1977.

| Mark (Brands, Pigment, Clip, or CWT) | Hatchery Origin | Species | Release Location | Release Date (Mo/Da) | No. Marked | Size at Release (mm) (#/lb) | Total No. Captured (Adjusted) | % Captured (Adjusted) | Median Capture Date (Mo/Da) | Mean Length (mm) on Median Date | Purpose of Mark |
|--|--------------------|---------|---------------------|----------------------------|---------------|-----------------------------------|-------------------------------------|--------------------------|--------------------------------------|---|-----------------------|
| | | | | | | | <u>Beach Seine</u> | <u>1/</u> | | | |
| <u>Brands:</u> | | | | | | | | | | | |
| RD "IJ" | Ad Kooskia | Sp Ch | Below Bonn | 4/21 | 48,000 | 13/20 | 2 | .004 | 5/6 | 117 | Barge Transport |
| RD "π" | Ad Pahasimeroi | Sthd | Pahasimeroi | 3/15 | 15,000 | | 4 | .027 | 4/16 | 207 | - |
| <u>CWT:</u> | | | | | | | | | | | |
| (Ag./D1/D2) | | | | | | | | | | | |
| 10/2/7 | Rapid R | Sp Ch | Spring Creek | | 126,900 | | 1 | .001 | 6/14 | 137 | - |
| 10/13/7 | Dworshak | Sthd | Dworshak | 4/7 | 30,000 | | 1 | .003 | 5/11 | 157 | - |
| 10/13/10 | " | " | " | | - | | 2 | - | 5/11 | 140 | - |
| | | | | | | | <u>Purse Seine</u> | <u>2/</u> | | | |
| <u>Brands:</u> | | | | | | | | | | | |
| Ad RD "IJ" | Kooskia | Sp Ch | Below Bonn | 4/21 | 48,000 | 13/20 | 4 | .008 | 5/10 | 137 | Barge Transport |
| <u>CWT:</u> | | | | | | | | | | | |
| (Ag./D1/D2) | | | | | | | | | | | |
| 10/2/6 | Rapid River | Sp Ch | Spring Creek | April | 128,000 | - | 4 | .003 | 5/31 | 140 | - |
| 10/2/7 | " " | " " | " " | 3/7 | 126,900 | - | 3 | .002 | 5/31 | 141 | - |
| 10/2/17 | Kooskia | " " | Kooskia H | 4/20-4/30 | 60,000 | - | 4 | .007 | 5/11 | 153 | - |
| 10/2/18 | " | " " | " | " | 60,000 | - | 1 | .002 | 5/31 | 103 | - |
| 10/2/35 | Niagara Sp | Sthd | Niagara | 4/5-4/10 | 59,300 | - | 2 | .003 | 6/10 | 213 | - |
| 10/2/36 | " " | " " | " | " | 55,400 | - | 4 | .007 | 6/9 | 210 | - |
| 10/13/7 | Dworshak | " | Dworshak H | 4/7 | 30,000 | - | 2 | .007 | 5/10 | 177 | - |
| 10/13/9 | " | " | " " | - | 30,900 | - | 2 | .006 | 5/11 | 173 | - |
| 10/13/10 | " | " | " " | - | 60,200 | - | 4 | .007 | 5/11 | 203 | - |
| 10/13/11 | " | " | " " | - | 61,700 | - | 4 | .006 | 5/11 | 182 | - |
| 10/13/13 | " | " | " " | - | 62,200 | - | 3 | .005 | 5/11 | 181 | - |

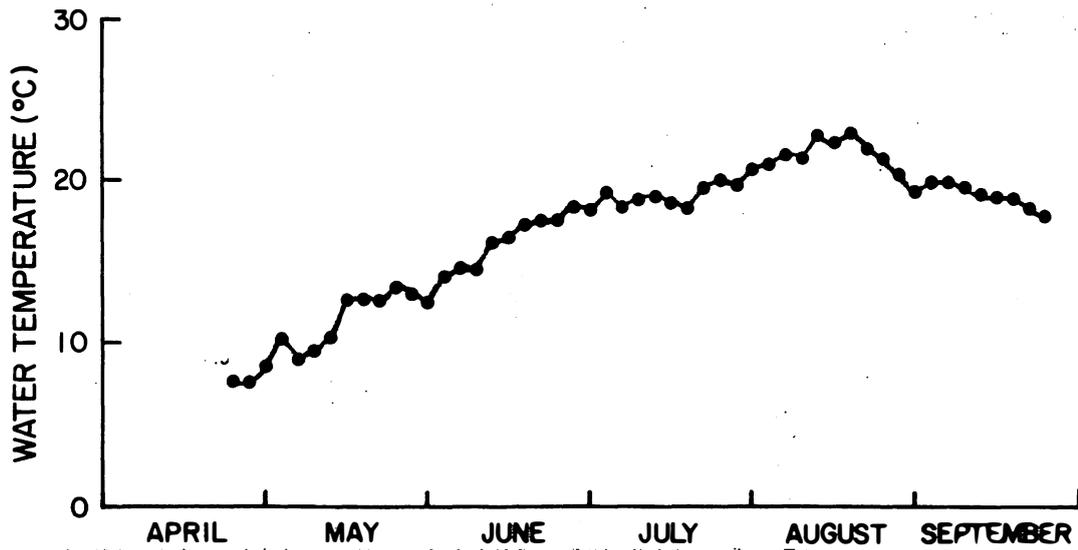
1/ Total catch adjusted to represent 10 sets per day, 7 days per week and 100% of Ad-clipped fish sacrificed for CWT identification.

2/ Total catch adjusted to represent 100% of Ad-clipped fish sacrificed for CWT identification.

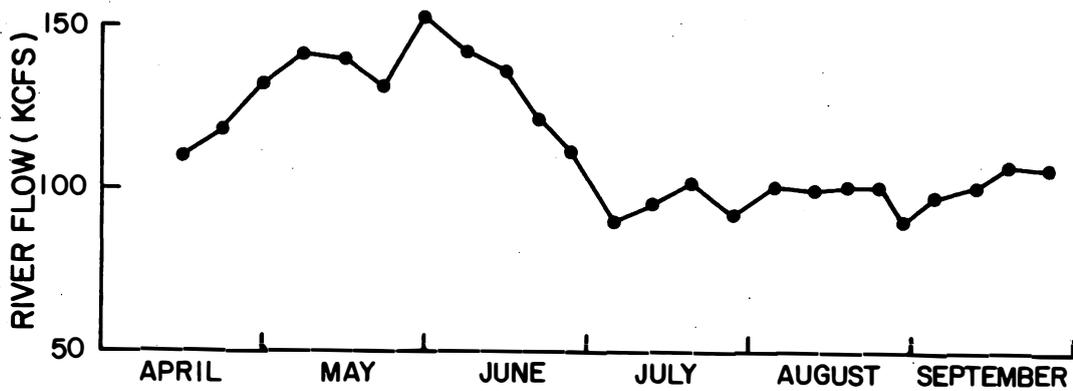
Appendix Table 11. -- Incidental beach seine catches at Jones Beach, Oregon, 1977.

| Species | Number of fish | | | | | |
|-----------------|----------------|-------|------|------|------|-------|
| | Apr. | May | Jun. | Jul. | Aug. | Sep. |
| Shad * | 31 | 1313 | 918 | 257 | 7077 | 21712 |
| Chub * | 33 | 266 | 625 | 944 | 1227 | 3332 |
| Carp | 21 | 81 | 121 | 46 | 31 | 16 |
| Sucker | 42 | 19 | 61 | 53 | 58 | 93 |
| Squawfish | 0 | 0 | 23 | 69 | 289 | 133 |
| Whitefish | 7 | 3 | 38 | 155 | 85 | 53 |
| Stickleback * | 5970 | 10626 | 2461 | 3506 | 5311 | 5820 |
| Largemouth Bass | 0 | 1 | 4 | 2 | 1 | 0 |
| Cutthroat trout | 52 | 54 | 20 | 14 | 30 | 85 |
| Starry flounder | 96 | 111 | 102 | 295 | 734 | 283 |
| Yellow perch | 6 | 12 | 2 | 0 | 0 | 0 |
| Crappie | 1 | 4 | 2 | 0 | 0 | 0 |
| Sculpin | 1 | 4 | 9 | 0 | 0 | 0 |
| Goldfish | 0 | 1 | 0 | 0 | 0 | 0 |

* Estimated catches



Appendix Figure 1. Water temperature ($^{\circ}$ C) at the Jones Beach sampling site during 1977.



Appendix Figure 2. River flow in the Columbia River (measured at Bonneville Dam) during 1977.

