STATÚS OF FISHERY MITIGATION IN THE PORTLAND DISTRICT, CORPS OF ENGINEERS - 1979

III. The Rogue River: Cole M. Rivers Fish Hatchery

I. Name of Hatchery: Cole M. Rivers Fish Hatchery

II. River and Project: Rogue River and Tributaries - Lost Creek Project is completed; Applegate Project is under construction; Elk Creek Project is suspended as of this writing.

III. Agency managing the hatchery: Oregon Department of Fish and Wildlife

IV. Date that Agreement went into effect: 1972

V. Corps share of Operation and Maintenance: 100%

VI. Species of fish to be produced according to agreement: For Lost Creek Project - Spring Chinook, Summer Steelhead, Kokonee and/or Trout. For Applegate Project - Coho Salmon, Winter Steelhead, Kokonee and/or Trout. For Elk Creek Project - Coho Salmon, Winter Steelhead, Kokonee and/or Trout.

VII. Major species of fish present before project was built: Spring Chinook Salmon, Coho Salmon, Summer and Winter Run Steelhead, Rainbow Trout, Fall Chinook and a few Sea-Run Cutthroat Trout.

VIII. Mitigation obligation in terms of pounds and/or numbers of fish to be produced or adults to return:

A. According to the number of adults for which mitigation would be required as agreed to by the Oregon Game Commission and the U.S. Fish and Wildlife Service:

1. Lost Creek Project:
   Spring Chinook - 8300
   Summer Steelhead - 500
2. Elk Creek Project:
   Coho Salmon - 1300
   Winter Steelhead - 450
3. Applegate Project:
   Coho Salmon - 500
   Winter Steelhead - 1150

B. According to the estimated number of brood stock necessary to maintain the runs as agreed to by the Oregon Game Commission and the U.S. Fish and Wildlife Service:

1. Spring Chinook - 3000
2. Coho Salmon - 200
3. Summer Steelhead - 260
4. Winter Steelhead - 340

C. Concerning resident trout, according to what the fish agencies considered adequate: 50,000 pounds of young trout, details of number and size to be worked out later.

D. According to the Contract: (includes enhancement and mitigation obligation)

1. Lost Creek:
   Spring Chinook - 263,000 pounds at release
   Summer Steelhead - 14,300 pounds at release
   Kokonee and/or Trout - 45,420 pounds at release

2. Elk Creek:
   Coho Salmon - 5,000 pounds at release
   Winter Steelhead - 37,000 pounds at release
   Kokonee and/or Trout - 14,480 pounds at release

3. Applegate Project:
   Coho Salmon - 23,000 pounds at release
   Winter Steelhead - 28,700 pounds at release
   Kokonee and/or Trout - 10,700 pounds at release

4. Totals:
   Spring Chinook - 263,000 pounds
   Coho - 28,000 pounds
   Summer Steelhead - 14,300 pounds
   Winter Steelhead - 65,700 pounds
   Kokonee and/or Trout - 70,600 pounds

IX. Hatchery Production:

A. Spring Chinook

| Numbers | Pounds | Average Size |
|---|---|---|
| Low - 60,000 (73) | Low - 10,710 (73) | Smallest - 8.9 fish/lb. |
| High - 971,300 (77) | High - 163,740 (76) | Largest - 5.6 fish/lb. |
| Average - 525,083 | Average - 73,547 | Average - 7.1 fish/lb. |

B. Rainbow Trout

| Numbers | Pounds | Average Size |
|---|---|---|
| Low - 5,900 (74) | Low - 200 (74) | Smallest - 29.5 fish/lb. |
| High - 365,800 (78) | High - 59,510 (78) | Largest - 2.8 fish/lb. |
| Average - 141,200 | Average - 29,822 | Average - 3.6 fish/lb. |

C. Summer Steelhead

| Numbers | Pounds | Average Size |
|---|---|---|
| Low - 18,300 (74) | Low - 2,110 (74) | Smallest - 8.7 fish/lb. |
| High - 299,700 (78) | High - 59,090 (78) | Largest - 3.8 fish/lb. |
| Average - 161,280 | Average - 34,004 | Average - 4.7 fish/lb. |

D. Winter Steelhead

| Numbers | Pounds | Average Size |
|---|---|---|
| Low - 84,400 (76) | Low - 18,200 (76) | Smallest - 5.2 fish/lb. |
| High - 258,400 (78) | High - 53,500 (78) | Largest - 4.6 fish/lb. |
| Average - 195,567 | Average - 39,403 | Average - 5.0 fish/lb. |

E. Coho

| Numbers | Pounds | Average Size |
|---|---|---|
| Low - 20,100 (76) | Low - 1,420 (76) | Smallest - 16.2 fish/lb. |
| High - 250,000 (78) | High - 26,040 (78) | Largest - 9.6 fish/lb. |
| Average - 105,600 | Average - 10,113 | Average - 10.4 fish/lb. |

F. Fall Chinook (1978 only)

| Numbers | Pounds | Average Size |
|---|---|---|
| 35,600 | 3,010 | 11.8 fish/lb. |

X. Adult Returns:

A. Spring Chinook

High - 5,639 (1978)

Low - 2,218 (1977)

Average - 4,083

B. Summer Steelhead - Estimated Numbers Passing Over Gold Ray Dam

1975 - 76 run - 178

1976 - 77 run - 939

1977 - 78 run - 650

Returned to Hatchery

1978 - 79 run - 271

C. Winter Steelhead

1977 - 250

1978 - 784

D. Coho

1977 - 931
1978 - 496

E. Fall Chinook

1978 only - 28

XI. Special Problems and Considerations: Cole M. Rivers is a relatively new hatchery, and as such, no special problems (other than those encountered in the "shake-down" phase) have yet become apparent. The water source for the hatchery is from the reservoir and this might become a problem. Various studies and experiments are presently being conducted at the hatchery. When these are finished more data will be available. A special consideration is the fact that this single hatchery is designed to mitigate for three Corps projects, of which only one, Lost Creek, is completed. The contract calls for the rearing of five or six different species and runs of fish, both anadromous and resident, when all the projects are finished. At the present time, six runs and species of fish are being reared, including a small number of fall chinook which is not mentioned in the contract. Some of these fish are being paid for by the State.

XII. Corps success in meeting mitigation: It is too early to say for certain whether or not mitigation is being met. There is a hatchery evaluation study being conducted as of this writing. However, a few general observations can be made. According to the contract the Corps is obligated for spring chinook, summer steelhead and rainbow trout as long as Lost Creek is the only completed project. These species are being reared, as well as some winter steelhead and coho, and a few fall chinook. The coho and the fall chinook and a portion of both winter and summer steelhead are being funded by the State. These fish are, for the most part, being reared on a temporary basis at Cole Rivers. The pounds of spring chinook produced are well short of the pounds called for in the

contract. However, this is the result of a management decision by the Oregon Department of Fish and Wildlife, the reason being that there still is a large number of wild chinook in the river. The agency does not want to produce a large number of hatchery chinook to compete with the wild stock. In the last two years the pounds of rainbow trout produced have exceeded the pounds required in the contract for Lost Creek. In general, the pounds and numbers of fish produced over-all have been increasing each succeeding year. The numbers of adult returns of all the major species appears to be adequate to sustain the runs, at least according to the figures agreed to by the fish agencies.

## THE ROGUE RIVER: COLE M. RIVERS HATCHERY

In the early nineteen-fifties, the U.S. Fish and Wildlife Service did extensive surveys to determine the numbers and species of salmonids in the Rogue River and the tributaries that would be affected by the projects. It was found that the reservoirs created by the Lost Creek Project would wipe out the major part of the spring chinook spawning areas upstream from the damsite. The spawning ground surveys, done in 1950 and 1955 indicated that 1500 spring chinook and 500 steelhead would be prevented from spawning by the dam.(1)

Later it became apparent that the spring chinook run was at the bottom of a decline at the time the surveys were done. Fish counts on the Rogue River runs started in 1942 and the population had been in a decline since before they were started. The decline was arrested about 1950. During the fifties the runs fluctuated between 15 thousand and 30 thousand. About 1960 the runs started to increase.(2)

Sometime after the surveys were done the Corps decided to move the site of the proposed Lost Creek Dam downstream, thereby including more spawning area in the reservoir. Because of the change in the proposed damsite, the fact that boats and planes were used to only a limited extent in the previous surveys and the realization that those surveys were done when the spring chinook runs were at an historical low, concerned conservation agencies did another survey. This was done in 1964 and it was an intensive survey, more intensive than is usually done.

Helicopters and boats were used, as well as ground surveys. It was found that 31% of the spring chinook which passed Gold Ray and spawned in the main stem Rogue used the stream above the Lost Creek damsite. As a result of the new survey, the numbers of spring chinook that would be blocked by the dam was raised from the 1500 which had been determined by the original survey, to 8300. (This figure excluded jacks).(3) (4)

The number of coho which would be affected by the Elk Creek Project was also revised from the earlier surveys. The coho population had been "considerably smaller" than it was in 1949 at the time of the original survey when 9440 coho were counted past Gold Ray. The revised figure was based on a count of 3830 coho and was coupled with increased knowledge of coho spawning distribution in that sector of the Rogue River.(3) (4

Following are the numbers of adult fish agreed upon by the U.S. Fish and Wildlife Service and Oregon State Game Commission for which mitigation would be required:

Lost Creek Project: 8300 spring chinook and 500 summer steelhead
Elk Creek: 1300 coho and 450 winter steelhead
Applegate River: 500 coho and 1150 winter steelhead

For a total of:
8300 spring chinook
1800 coho
500 summer steelhead
1600 winter steelhead

(3) (4)

Both the U.S. Fish and Wildlife Service and the Oregon Game Commission agreed that it was not necessary to artificially propagate all the adult fish that would be displaced by the dams. The estimated number of brood stock that would be necessary to maintain the runs are as follows:

3000 spring chinook
200 coho
260 summer steelhead
340 winter steelhead

"of good quality"

These numbers assumed a 50-50 proportion of males and females. It was also assumed that the numbers of coho and winter steelhead would be in the same proportion from Applegate and Elk Creek as would be needed to provide for the necessary mitigation in each tributary. The progeny would be returned to the stream of the parent stock. Because only a portion of the runs would be used for brood stock the managers of the hatcheries would be faced with the problem of what to do with the extra fish that returned, but this would not be a Corps responsibility. (3) (4)

Based on experience with these species of fish in various western Oregon streams, it was estimated that the percentage of adults returning from smolt released from the hatchery would be for each species:

.3% for spring chinook
.5% for summer steelhead
1% each for coho and winter steelhead

(4)

The agencies were not able to be completely specific about the trout rearing program. They did think, however, that a program producing and releasing 50,000 pounds of young trout would be adequate. The details of numbers and size of fish could be worked out later. (3) (4)

Both the U.S. Fish and Wildlife Service and the Oregon Game Commission stated that these recommendations were based on the best known hatchery practices at that time and could only be used as a guide. If experience showed that mitigation was not being accomplished, the project should bear the cost of additional efforts to provide for mitigation. Also, if it appeared that the run of spring chinook was increasing even more between the time of the report (1965) and the time of the dam closing the river, more mitigation might be necessary. But the agencies were trying to come up with the minimum facility that would do the job. (3) (4) The Game Commission also stressed that the figure involved applied to this project only and could not be used for another project in another place. (4)

The contract between the Oregon State Game Commission and the U.S. Government was signed in August of 1972. The contract specifically stated the mitigation and enhancement obligation in terms of project, species and pounds of fish produced. See Table Number I.

TABLE NUMBER I

Mitigation and Enhancement Obligation

| Species | Total Pounds at Release | Total Pounds of Fish For Each Project |
|---|---|---|
| Spring Chinook (Lost Creek) | 263,000 | |
| Summer Steelhead (Lost Creek) | 14,300 | Lost Creek - 322,720 |
| Kokanee and/or Trout (Lost Creek) | 45,420 | Elk Creek - 56,480 |
| Coho (Elk Creek) | 5,000 | Applegate - 42,400 |
| Winter Steelhead (Elk Creek) | 37,000 | |
| Kokanee and/or Trout (Elk Creek) | 14,480 | |
| Coho (Applegate) | 3,000 | |
| Winter Steelhead (Applegate) | 28,700 | |
| Kokanee and/or Trout (Applegate) | 10,700 | |

The State would operate and maintain the hatchery and release its production into the Rogue River. However, if there was sound biological reason, the contracting officer agreed and the Corps was reimbursed, the fish could be released elsewhere. Also,

should the production capacity of the hatchery prove to be greater than the mitigation requirements stated in the contract, the Government (the Corps) reserved the right to assign the excess capability to fulfill future obligations of its other projects.(5)

Pre-impoundment evaluation studies for Lost Creek Dam were done in 1974, 1975 and 1976. The post-impoundment evaluation has not yet been completed as of this writing. Concern was expressed in one of the evaluation reports that release of colder water from the reservoir might change the spawning pattern. While the colder water would enhance conditions for fish in the lower river, it could make that portion of the river just downstream from the dam too cold for spawning. This could cause a shift downstream in spawning, with the gravel near the dam being under-utilized. Since spring chinook tend to spawn further up river than do fall chinook, the shift could cause over-utilization of the downstream gravel. The spring chinook might spawn where the fall chinook are accustomed to spawn. The fall chinook then could possibly spawn on top of the redds of the spring chinook. Growth and distribution of the young salmon could also be affected by the release of the cold water.(6)

The pre-impoundment studies did indicate that fluctuations in size and time of migration of the young salmon, and in other factors concerning the fish, occur naturally. For example, in 1976 the fry emerged one or two weeks earlier than they did in 1975.(7)

Production of fish in total numbers and pounds have steadily increased since 1972. See Tables Number II - VIII.

TABLE NUMBER II

Liberation of Spring Chinook From Cole M. Rivers

| Year | Numbers | Pounds | Average Size in Fish/Lb. |
|---|---|---|---|
| 1973 | 60,000 | 10,710 | 5.6 |
| 1974 | 266,200 | 36,410 | 7.3 |
| 1975 | 290,300 | 42,240 | 6.9 |
| 1976 | 929,200 | 163,740 | 5.7 |
| 1977 | 971,300 | 109,480 | 8.9 |
| 1978 | 633,500 | 78,700 | 8.0 |

TABLE NUMBER III

Liberation of Rainbow From Cole M. Rivers

| Year | Numbers | Pounds | Average Size in Fish/Lb. |
|---|---|---|---|
| 1974 | 5,900 | 200 | 29.5 |
| 1975 | 40,200 | 12,120 | 3.3 |
| 1976 | 73,900 | 26,810 | 2.8 |
| 1977 | 220,200 | 50,470 | 4.4 |
| 1978 | 365,800 | 59,510 | 6.1 |

TABLE NUMBER IV

Liberation of Summer Steelhead From Cole M. Rivers

| Year | Numbers | Pounds | Average Size in Fish/Lb. |
|---|---|---|---|
| 1974 | 18,300 | 2,110 | 8.7 |
| 1975 | 111,200 | 29,170 | 3.8 |
| 1976 | 166,300 | 38,690 | 4.3 |
| 1977 | 210,900 | 40,960 | 5.1 |
| 1978 | 299,700 | 59,090 | 5.1 |

TABLE NUMBER V

Liberation of Winter Steelhead From Cole M. Rivers

| Year | Numbers | Pounds | Average Size in Fish/Lb. |
|---|---|---|---|
| 1976 | 84,400 | 18,200 | 4.6 |
| 1977 | 243,900 | 46,510 | 5.2 |
| 1978 | 258,400 | 53,500 | 4.8 |

TABLE NUMBER VI

Liberation of Coho From Cole M. Rivers

| Year | Numbers | Pounds | Average Size in Fish/Lb. |
|---|---|---|---|
| 1976 | 20,100 | 1,420 | 14.2 |
| 1977 | 46,600 | 2,880 | 16.2 |
| 1978 | 250,100 | 26,040 | 9.6 |

TABLE NUMBER VII

Liberation of Fall Chinook From Cole M. Rivers

| Year | Numbers | Pounds | Average Size in Fish/Lb. |
|---|---|---|---|
| 1978 | 35,600 | 3,010 | 11.8 |

TABLE NUMBER VIII

Total Fish Liberated From Cole M. Rivers

| Year | Numbers | Pounds |
|---|---|---|
| 1973 | 60,000 | 10,710 |
| 1974 | 290,400 | 38,720 |
| 1975 | 441,700 | 83,530 |
| 1976 | 1,273,900 | 248,860 |
| 1977 | 1,692,900 | 250,300 |
| 1978 | 1,843,100 | 279,850 |

The hatchery started with the production of spring chinook with the addition of summer steelhead and rainbow released in 1974. Starting in 1976 coho and winter steelhead were included in the releases. And in 1978, a few fall chinook were added to the releases.(8)

The pounds of spring chinook produced have fallen short of the pounds required by the contract.(5)(8) However, this is a management decision by the Oregon Department of Fish and Wildlife (which now manages the hatchery under contract to the Corps). There are still considerable numbers of wild chinook in the river and ODFW is reluctant to produce a large number of chinook which would be in competition with the wild fish. The state is satisfied with the adult return which is sufficient for the Corps mitigation responsibilities.(9)

As of this writing Lost Creek is the only project of the Rogue which is completed. Elk Creek has been suspended and Applegate is under construction. Therefore, as of this writing, the Corps mitigation obligations are only for Lost Creek, although mitigation for Applegate will be needed soon. According to the contract the species to be reared for Lost Creek mitigation are spring chinook, summer steelhead and trout and the species for Applegate are coho and winter steelhead, as well as trout.

However, ODFW requested special use of Cole Rivers excess capacity during the time that a State hatchery, Rock Springs on the Umpqua River, was under reconstruction. The Corps granted the request and it was agreed that the State would pay for the fish food for the extra fish, the 100 percent Corps funded status of the hatchery notwithstanding. As of this writing, it is expected that Rock Springs would be functioning in 1980.(10)

For calendar year 1978 these State funded fish included all of the fall chinook. It is expected that the fall chinook would continue to be reared at Cole Rivers. All of the coho were State funded. As of 1980 the State funded coho rearing program would be moved to Rock Springs and the only coho that would then be reared at Cole Rivers would be mitigation for Applegate. The winter and the summer steelhead are partially funded by the State. Beginning in 1980 these State funded steelhead will probably be reared at Rock Springs.(10) The percentage and number of State funded fish are given in Table Number IX.

TABLE NUMBER IX(10)

Fish Released From Cole Rivers Hatchery in 1978

Funded by the State of Oregon

| Species | Numbers of Fish | Percent of Hatchery Production |
|---|---|---|
| Spring Chinook | 0 | 0% |
| Rainbow | 0 | 0% |
| Summer Steelhead | 127,083 | 42% |
| Winter Steelhead | 134,899 | 52% |
| Coho | 250,100 | 100% |
| Fall Chinook | 35,600 | 100% |

Even after taking in account the extra fish that Oregon is funding, Cole Rivers 1978 production (except for spring chinook) exceeded the production called for in the contract for Lost Creek mitigation. Rainbow production was 14,000 pounds more than that required for Lost Creek. Corps funded summer steelhead were more than twice as many pounds as called for in the contract. Winter steelhead are not required for Lost Creek mitigation.

Adult returns of spring chinook appear to be sufficient for brood stock to maintain the run. Records of steelhead returns and numbers of steelhead females spawned at the hatchery were not kept by the former Oregon Game Commission. However, there are records of the estimated numbers of steelhead passing Gold Ray Dam.[11] Starting with 1978 for summer steelhead and 1977 for winter steelhead ODFW has been keeping records on returning adults and spawning at Cole Rivers Hatchery. Winter steelhead and coho have been returning for only two years (as far as records show) which is not enough time to show a trend. See Tables X - XIV, for all the adult returns based on best available information.[11][12]

Hatchery evaluation reports are still being conducted. When they are completed there should be sufficient data to determine more accurately the success of Cole M. Rivers Hatchery in meeting Corps mitigation obligation.

TABLE NUMBER X

Spring Chinook Adult Returns to Cole M. Rivers

| Year | Males Returned | Females Returned | Jacks Returned | Total Returns | Total Brood Stock Return (males + females) |
|---|---|---|---|---|---|
| 1975[1] | | | | 4,300 | |
| 1976 | 1,328 | 1,252 | 1,595 | 4,175 | 2,580 |
| 1977 | 964 | 751 | 503 | 2,218 | 1,715 |
| 1978 | 1,888 | 1,735[3] | 2,016 | 5,639 | 3,623 |

| Year | Females Spawned | % Females Spawned | Female Mortality | % Female Mortality | Total Brood Stock Mortality | % Total Brood Stock Mortality |
|---|---|---|---|---|---|---|
| 1975[1] | 300 | | | | | |
| 1976 | 377[2] | 30.11[2] | 135 | 10.78 | 375 | 14.53 |
| 1977 | 421 | 56.06 | 254 | 33.82 | 501 | 29.21 |
| 1978 | 1,083[3] | 62.42[3] | 682[3] | 39.31[3] | 1,290 | 35.61 |

(1) Figures for 1975 are incomplete. The fish which returned were wild fish and 3,654 fish were hauled above the dam and released.

(2) Large numbers of females were sent to the processors unspawned.

(3) Apparent discrepancy in figures of total females and females spawned and died.

TABLE NUMBER XI

Summer Steelhead Adult Returns to Cole M. Rivers

| Run Year | Numbers Estimated At Gold Ray Dam (1) | Males Returned | Females Returned | Total Hatchery Return | Brood Year (2) | Estimated Numbers Returned (2) |
|---|---|---|---|---|---|---|
| 1975 1976 | 178 | - | - | - | 1973 | 1,589 |
| 1976 1977 | 939 | - | - | (3) | 1974 | 2,762 (4) |
| 1977 1978 | 650 | - | - | - | - | - |
| 1978 1979 | - | 906 | 940 | 1,845 | - | - |

(1) Prior to run year 1978-1979 summer steelhead returns and spawning records were not kept. Numbers estimated at Gold Ray Dam are best available data.

(2) Based on marking study for hatchery evaluation.

(3) 14% of the marked fish which passed Gold Ray Dam returned to the hatchery that year.

(4) Partial returns.

TABLE NUMBER XII

Winter Steelhead Adult Returns to Cole M. Rivers

| Year | Males Returned | Females Returned | Total Returns | Total Mortality | Released Upstream | Females Spawned |
|---|---|---|---|---|---|---|
| 1977 | 112 | 138 | 250 | 37 | 186 | 100 |
| 1978 | 411 | 373 | 784 | 34 | 129 | 96 |
| 1979 | 591 | 804 | 1,395 | 75 | 1,320 | 0 |

TABLE NUMBER XIII

Coho Adult Returns to Cole M. Rivers

| Year | Males Returned | Females Returned | Jacks Returned | Total Returns | Total Brood Stock (males + females) | Males Released | Females Released |
|---|---|---|---|---|---|---|---|
| 1977 | 389 | 457 | 85 | 931 | 846 | 9 | 11 |
| 1978 | 286 | 210 | 0 | 496 | 496 | 75 | 35 |

| Year | Total Released | Females Spawned | % Females Spawned | Female Mortality | % Female Mortality | Total Brood Stock Mortality | % Total Brood Stock Mortality |
|---|---|---|---|---|---|---|---|
| 1977 | 19 | 411 | 90 % | 30 | 6.56 | 166 | 19.62% |
| 1978 | 110 | 174 | 82.86% | 1 | .48 | 5 | 1.01% |

TABLE NUMBER XIV

1978 Fall Chinook Adult Return to Cole M. Rivers

| Males Returned | Females Returned | Total Returns | Female Mortality | % Female Mortality | Total Mortality | % Total Mortality |
|---|---|---|---|---|---|---|
| 11 | 17 | 28 | 2 | 11.76 | 4 | 14.29 |

## REFERENCES


1. U.S. Army Engineer District, Portland, Corps of Engineers; June 1966; Lost Creek Reservoir, Rogue River, Oregon, Design Memorandum Number 4, General Design, Section X.

2. Lost Creek Reservoir, Rogue River, Oregon, Design Memorandum Number 4, Appendix D; Letter from the Oregon State Game Commission dated 3 March 1965.

3. Lost Creek Reservoir, Rogue River, Oregon, Design Memorandum Number 4, Appendix D; Letter from the U.S. Fish and Wildlife Service dated 17 May 1965.

4. Lost Creek Reservoir, Rogue River, Oregon, Design Memorandum Number 4, Appendix D; Letter from the Oregon State Game Commission dated 19 May 1965.

5. Contract Number DACW57-73-C-0030 - Agreement between the United States of America and the Oregon State Game Commission.

6. Research Section, Oregon Department of Fish and Wildlife; June 1976; Annual Report, Rogue Basin Evaluation Program, to U.S. Army Corps of Engineers, Portland District.

7. Research Section, Oregon Department of Fish and Wildlife; June 1977; Annual Report, Rogue Basin Evaluation Program, U.S. Army Corps of Engineers, Portland District.

8. Fish Liberation Reports - Oregon Department of Fish and Wildlife.

9. Telephone Conversation - To: Jerry Baur, ODFW
   From: Gretchen Starke, NPPOP-RM
   Date: 30 August 1979
   Subject: Numbers of Spring Chinook Being Reared at Cole M. Rivers Hatchery and Question of Some of The Fish Being Paid For by The State.

10. Telephone Conversation - To: Gretchen Starke, NPPOP-RM
    From: Jerry Baur, ODFW
    Date: 4 September 1979
    Subject: Fish Reared at Cole M. Rivers Hatchery

11. Telephone Conversation - To: Mike Evenson, ODFW, Cole M. Rivers Hatchery
    From: Gretchen Starke, NPPOP-RM
    Date: 23 February 1979
    Subject: Records of Summer Steelhead and Spring Chinook Adult Returns to Cole Rivers Hatchery.

12. Hatchery records from Oregon Department of Fish and Wildlife.

## GLOSSARY

1. Anadromous - Refers to fish which grow to adults in the sea, but which return to spawn in fresh water where the young are hatched.

2. Chinook - A species of salmon (Oncorynchus tshawytscha) common to the Columbia and Willamette rivers and extensively reared in hatcheries. Also known as King Salmon.

3. Coho - A species of salmon (Oncorynchus kisutch) found in the Columbia system and reared in some Columbia River hatcheries. Also known as Silver Salmon.

4. Enhancement - Using man-made means, either through habitat change or hatchery production, to increase the numbers of fish in excess of that which existed prior to the construction of the project. This term can also mean increasing the numbers of fish in any situation.

5. Escapement - Those numbers of anadromous fish, which having escaped natural and man-made obstacles and the fishery, reach the hatchery or the spawning grounds.

6. Estuary - That area of the coastal water where a river or stream meets the sea and fresh water is mixed with salt water.

7. Fall Back - Fish which, having passed over a dam by means of a fish ladder, return to the downstream side of the dam through the spillway or turbines. If they survive to pass up the fish ladder again, they are counted twice.

8. Fall Chinook - Chinook Salmon (Oncorynchus tshawyscha) which enter fresh water and migrate upriver in the fall. Fall Chinook enter the Columbia from the end of August through the fall.

GLOSSARY (Continued)

9. Fingerlings - General term for young fish. The term is usually applied to those fish in between the fry stage and smolt stage in anadromous fish and between the fry stage and legal size in resident trout. In some cases, the term fingerlings may also be used for smolts.

10. Fish Horns - Horn shaped structures protruding from the upstream side of the dam, which are designed to pass fingerlings through the dam to the downstream side.

11. Fish Rack - Artificial barriers put across a stream to prevent the salmon or steelhead from moving further upstream. The fish are then held in the stream until ready to spawn when the eggs are then taken for artificial propagation.

12. Forebay - The water directly upriver of a dam.

13. Fry - Newly hatched fish still in the gravel; or young fish recently emerged from the gravel up to the size of about one inch.

14. Green - A female salmon in which the eggs are not yet mature and the fish is not ready to spawn. Occasionally, hatchery workers will kill a green female by mistake, in which case the eggs will not develop and are wasted.

15. Holding Pond - A pond designed to hold adult salmon or steelhead which have returned to the hatchery, but are not ready to spawn.

16. Incubation Channel - An artificial channel in which the fertilized eggs are incubated in a semi-natural state.

17. Jack - A salmon, nearly always male, which has reached sexual maturity and returned to fresh water at an earlier age (usually two years) than is usual.

GLOSSARY (Continued)

Jacks are considerably smaller than adults of the same species. The Oregon Department of Fish and Wildlife considers a steelhead of 20 inches or less to be a jack.

18. Juveniles - A general term for young fish, especially those in the pre-smolt stage.

19. Kokanee - The landlocked form of the sockeye (Oncorynchus nerka kennerlyi) salmon. This fish is a residential fish.

20. Legal Size Rainbow - Rainbow Trout (Salmo gairdneri) at least six inches long or longer. Trout of this size may be caught and kept legally by fishermen fishing in most streams in Oregon and Washington, although some streams may have a larger legal size.

21. Mitigation - Using man-made means, either through habitat change or hatchery production, to replace a fish population which has been lost to a project.

22. National Marine Fisheries Service (NMFS) - The Federal agency concerned with anadromous and ocean species of fish. This agency conducts research and gives support to the state agencies.

23. Oregon Department of Fish and Wildlife (ODFW) - The agency responsible for managing all fishery resources in the State of Oregon. It was organized 1 July 1975, with the merger of the Oregon Fish Commission and the Oregon Game Commission.

24. Oregon Fish Commission - The agency, prior to 1 July 1975, responsible for the management of the commercial fishery in the State of Oregon.

GLOSSARY (Continued)

25. Oregon Game Commission - The agency, prior to 1 July 1975, responsible for the management of wild game and the sport fishery in the State of Oregon.

26. Rainbow Trout - A species of trout (Salmo gairdneri) common to Pacific Northwest waters, considered an excellent game fish. Rainbow is the resident form of the species.

27. Rearing Pond - A hatchery pond designed to hold the fingerlings as they are being reared.

28. Redd - A gravel excavation or nest dug by the female salmonid for the purpose of spawning. After spawning in the redd, the fish covers the eggs with gravel.

29. Resident Trout - Trout of any species which spends its entire life in fresh water. It usually migrates very little, if at all.

30. Salmonid - A member of the salmon family. Salmonids include salmon, trout and chars.

31. Smolts - Young anadromous fish which are ready to migrate to the sea. Apparently internal chemistry determines this stage.

32. Sockeye - A species of salmon (Oncorynchus nerka nerka) found in the Columbia system. Attempts were made to introduce this fish to a few Willamette tributaries. Also known as Blue Backs and Red Salmon.

33. Spawn - The act of reproduction in fish. The female expels the eggs from her body and the male expels the sperm while in close proximity to the female. Fertilization takes place outside the body. At the hatchery salmon are spawned artificially. The females are cut open and the eggs removed and placed in a container. The sperm from the males is then added. When hatchery

trout are spawned the process is the same, except that the female is not killed. The eggs are removed by "stripping", that is, squeezing the fish's body to force the eggs out.

34. Spawning Channel - An artificial channel constructed to permit fish to spawn naturally, but still in controlled circumstances.

35. Spillway - The area of dam over which excess water not needed for the turbines flows. Water may be deliberately spilled to pass fish downstream.

36. Spring Chinook - Chinook Slamon (Oncorynchus tshawytsha) which enter fresh water and migrate upriver in the late winter and early spring.

37. Squawfish - A species of fish (Ptychocheilus oregonensis) found in Pacific Northwest waters which is the principle predator of juvenile salmonids.

38. Steelhead - The anadromous form of the rainbow trout (Salmo gairdneri).

39. Stilling Basin - The area just below the dam into which water from the spillway or powerhouse plunges. The purpose of the stilling basin is to reduce the turbulence and velocity of the water as it flows downstream.

40. Summer Steelhead - Steelhead (Salmo gairdneri) which enter fresh water and migrate upstream during late spring to late fall.

41. Tailrace - The water downstream of a dam for as far as turbulence exists.

42. Turbidity - A condition in which fine particles of solids, such as clay or soil, are suspended in water. Turbidity affects visibility.

GLOSSARY (Continued)

43. U. S. Fish and Wildlife Service (FWS) - The Federal agency concerned with wildlife and game fish. This agency operates national fish hatcheries and gives support to the state agencies.

44. Winter Steelhead - Steelhead (Salmo gairdenri) which enter water and migrate upriver during late winter to spring.

ACKNOWLEDGEMENTS

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# Figure VIII

Columbia River Fall Chinook Bonneville Count and Lower River Commercial Catch

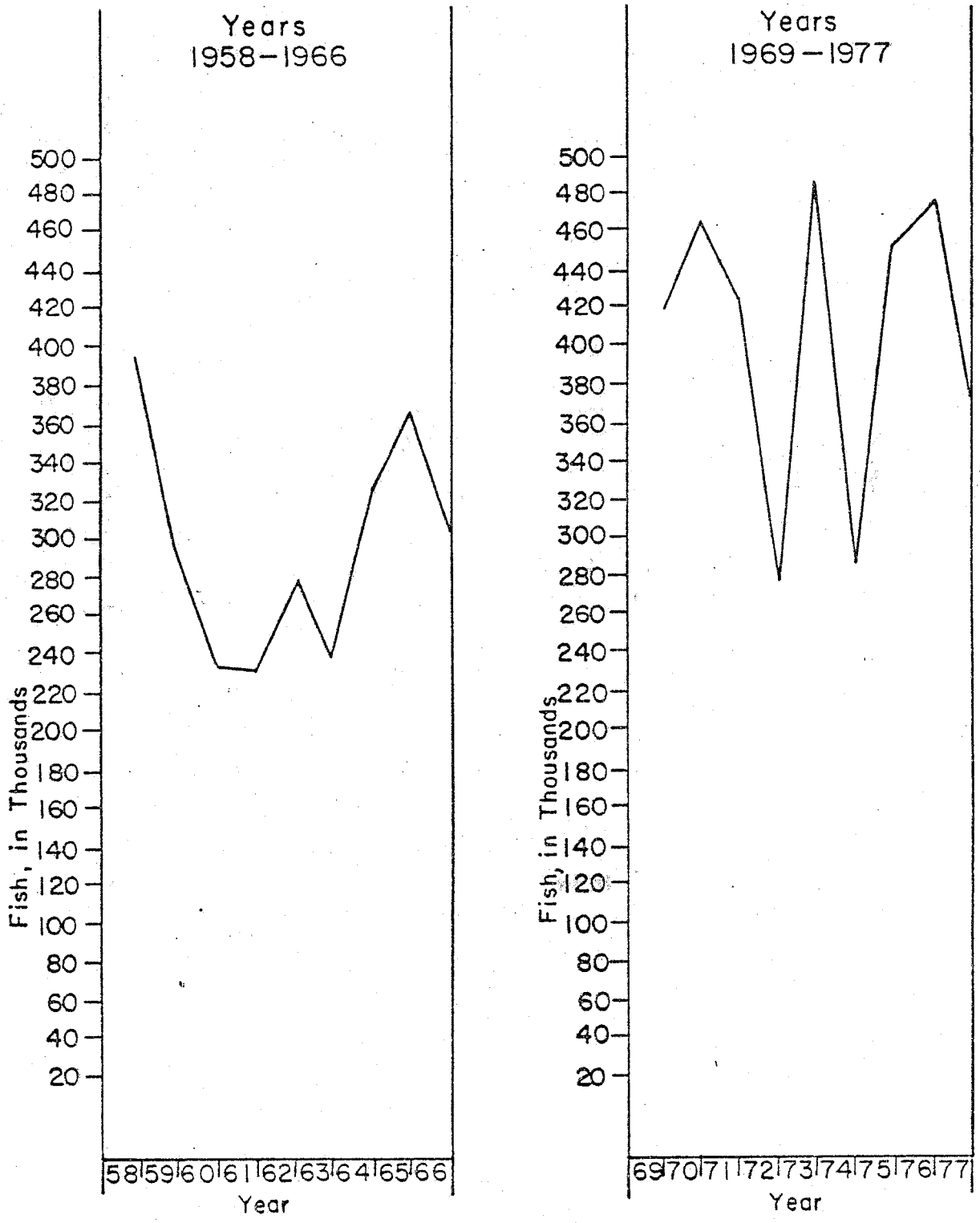


Figure VII

Fall Chinook Females Spawned and Eggs Taken at Spring Creek Hatchery

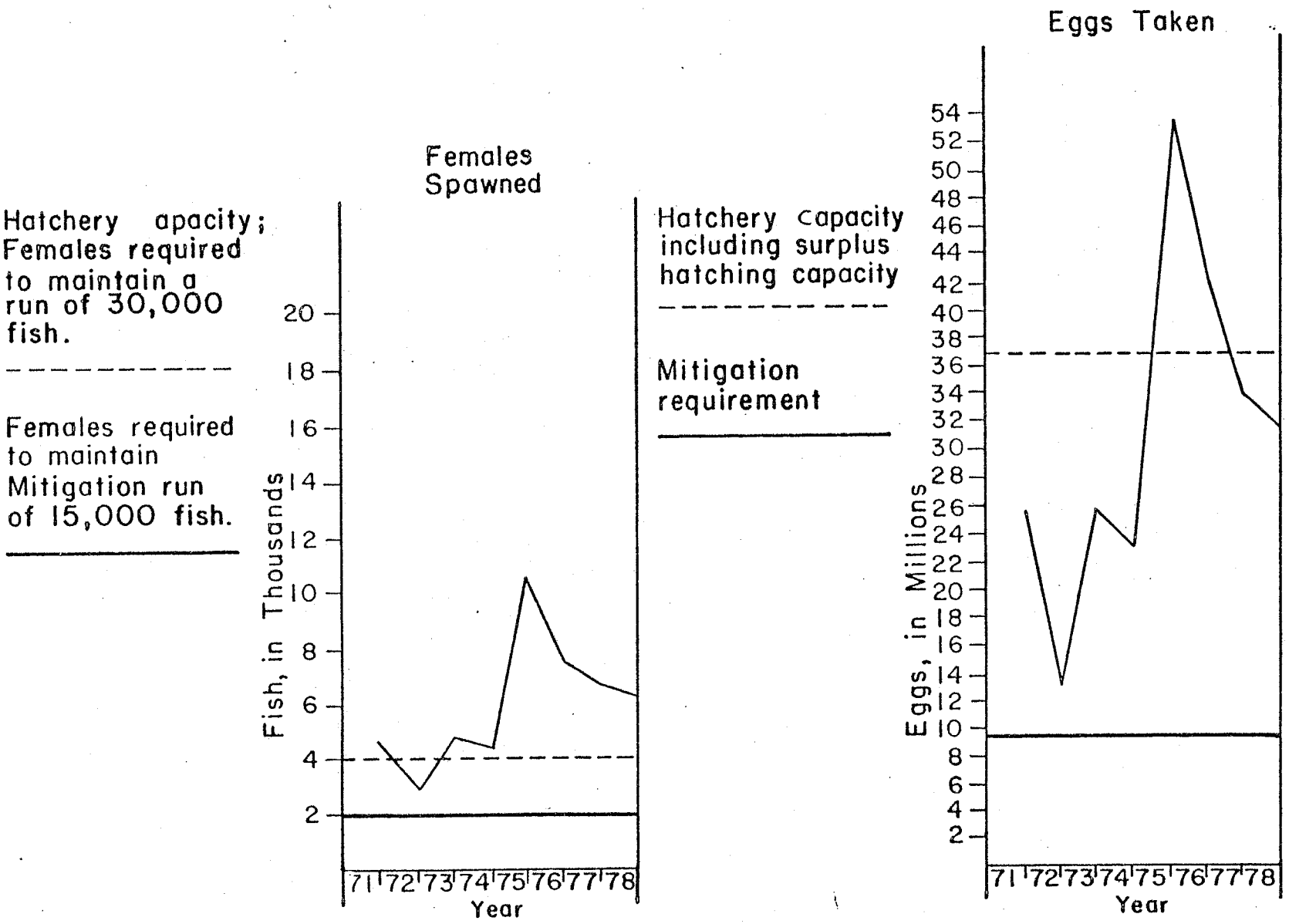


Figure VI

Fall Chinook Adults Returning to Spring Creek Hatchery

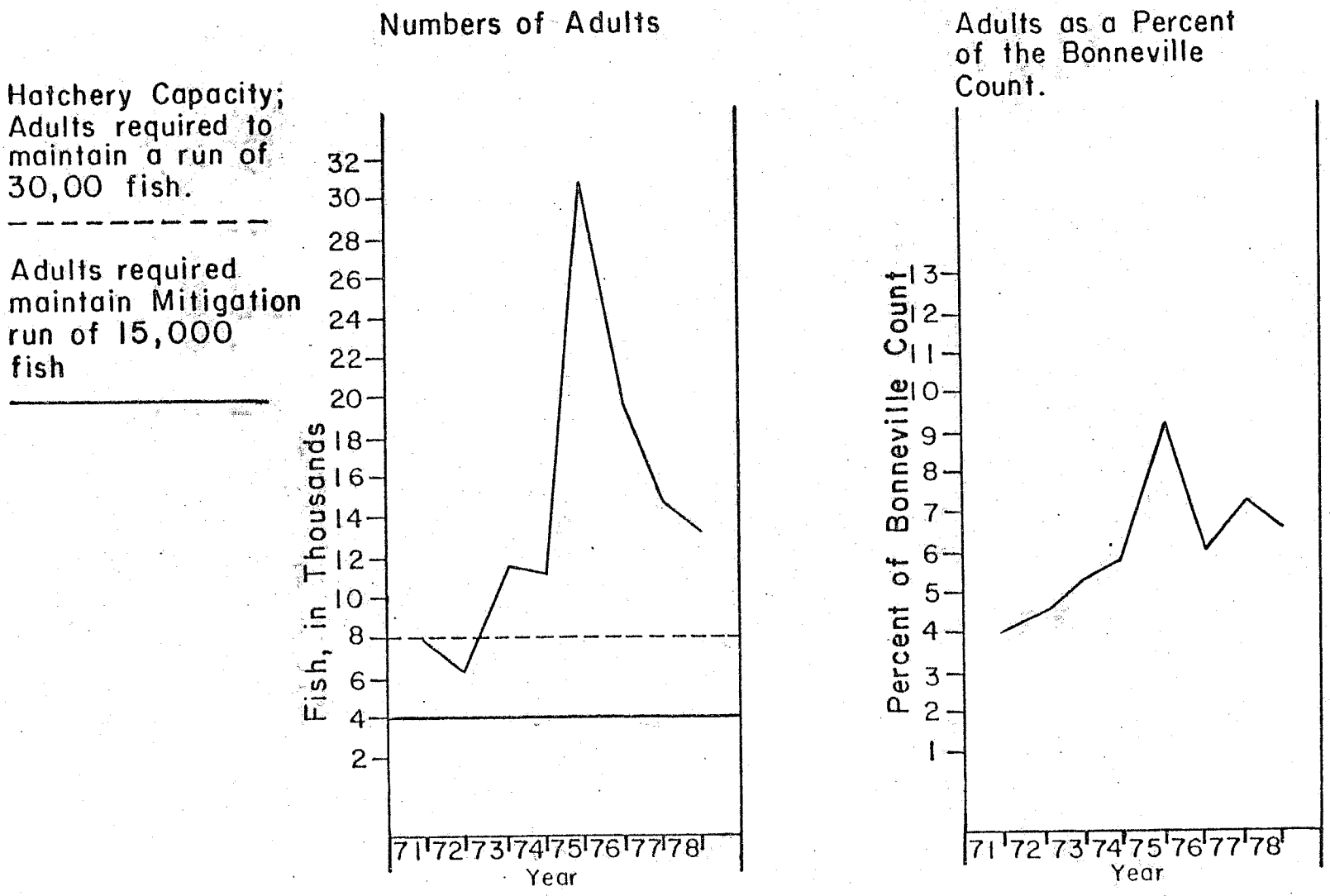


Figure IV

Figure V

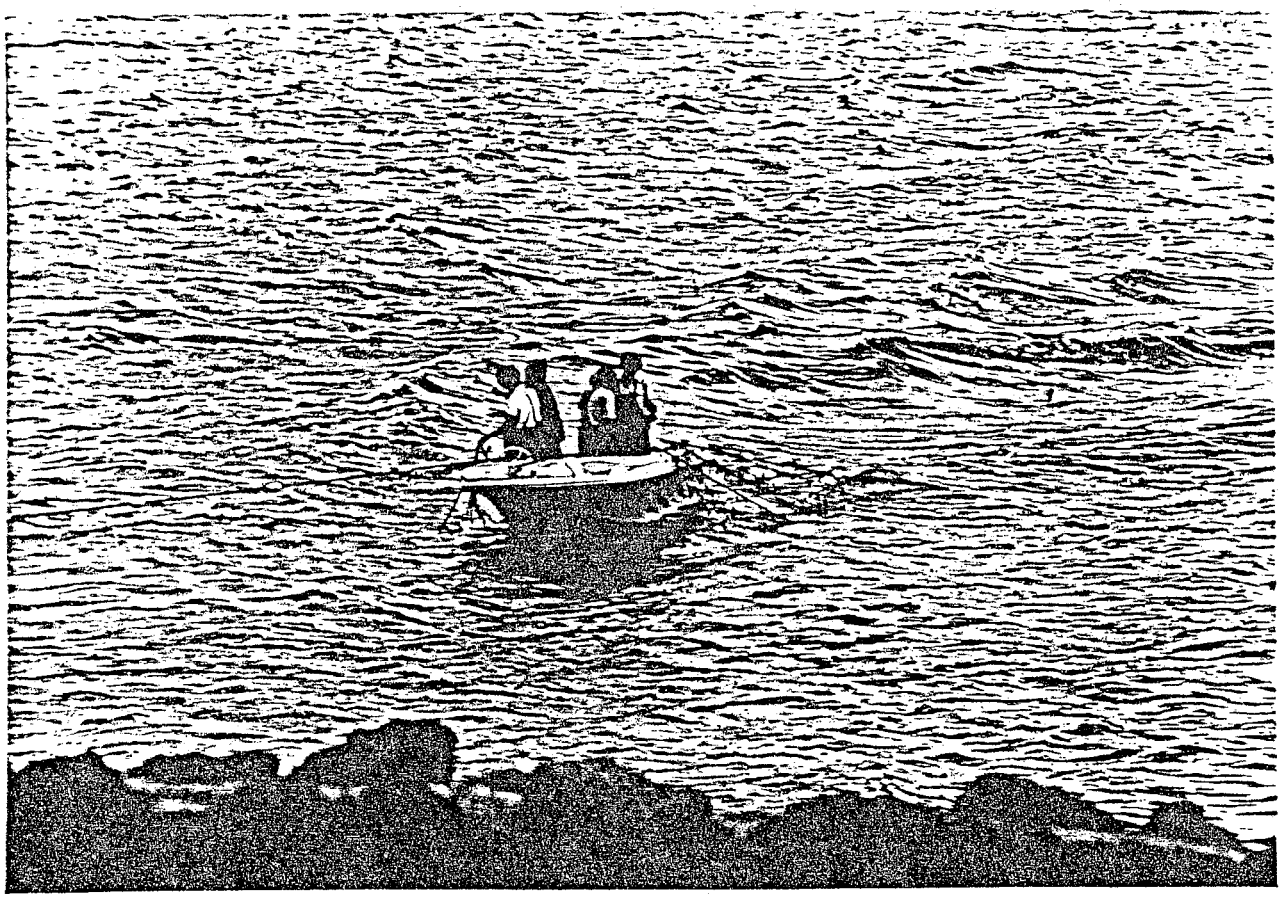


Figure II

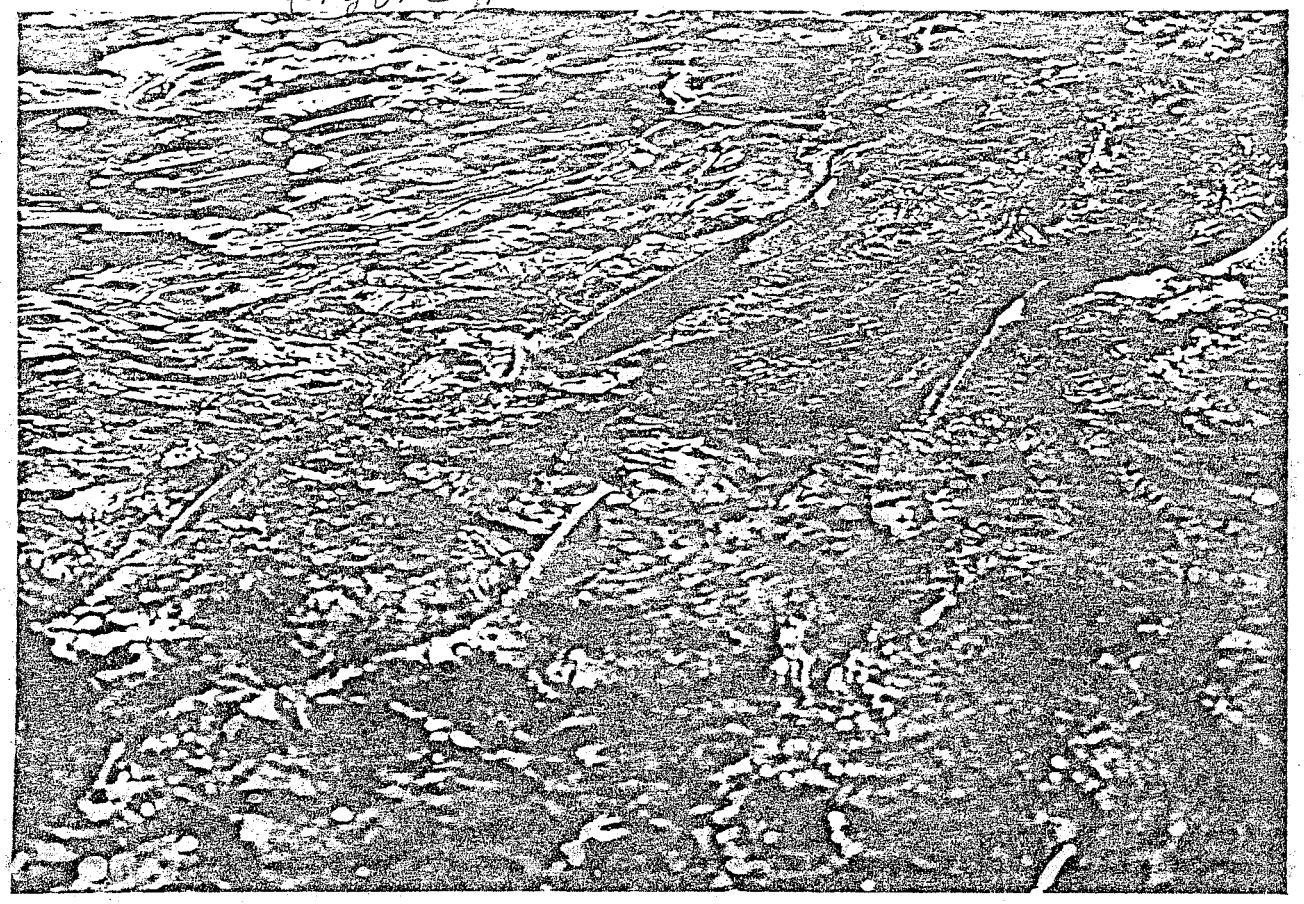
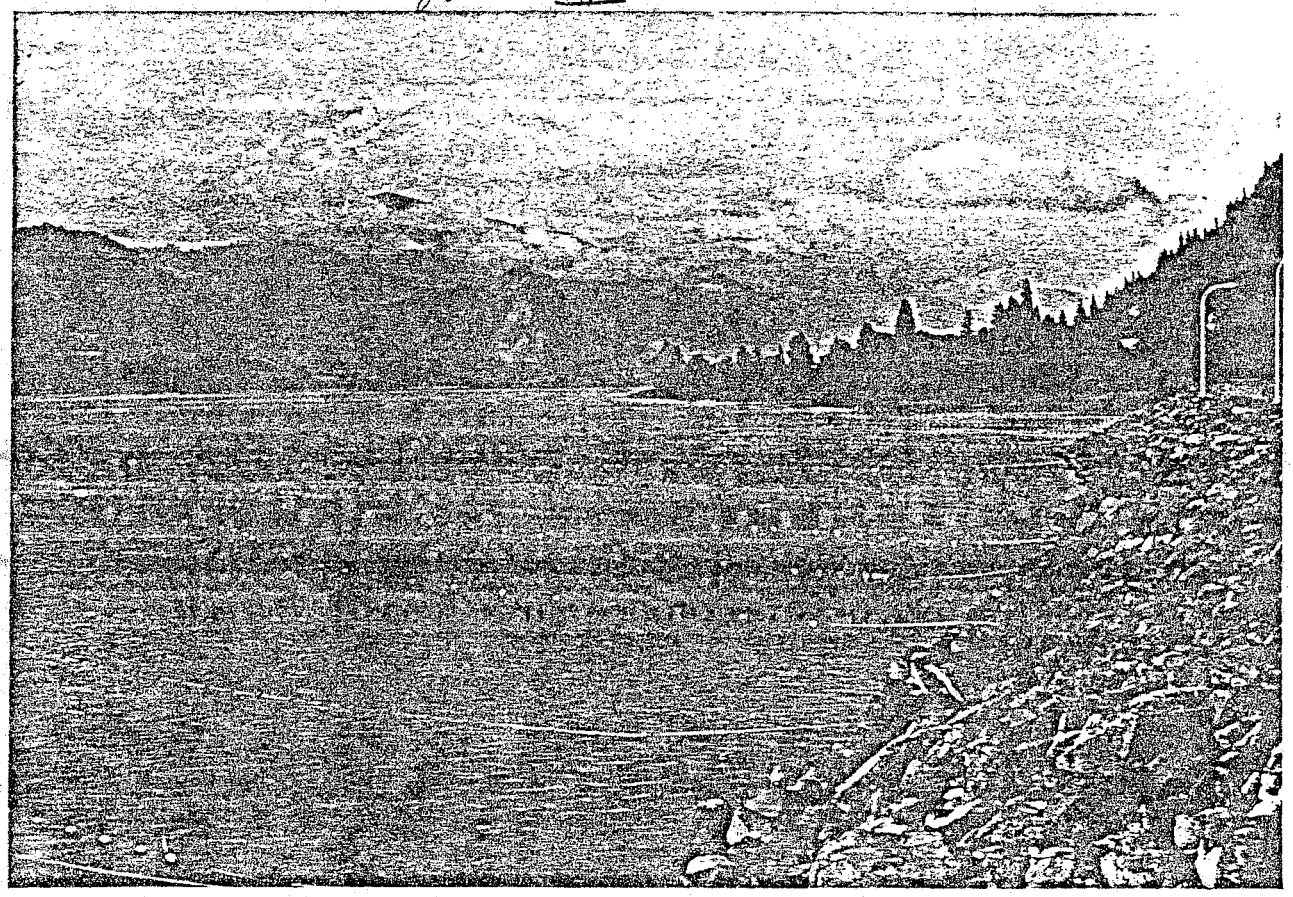
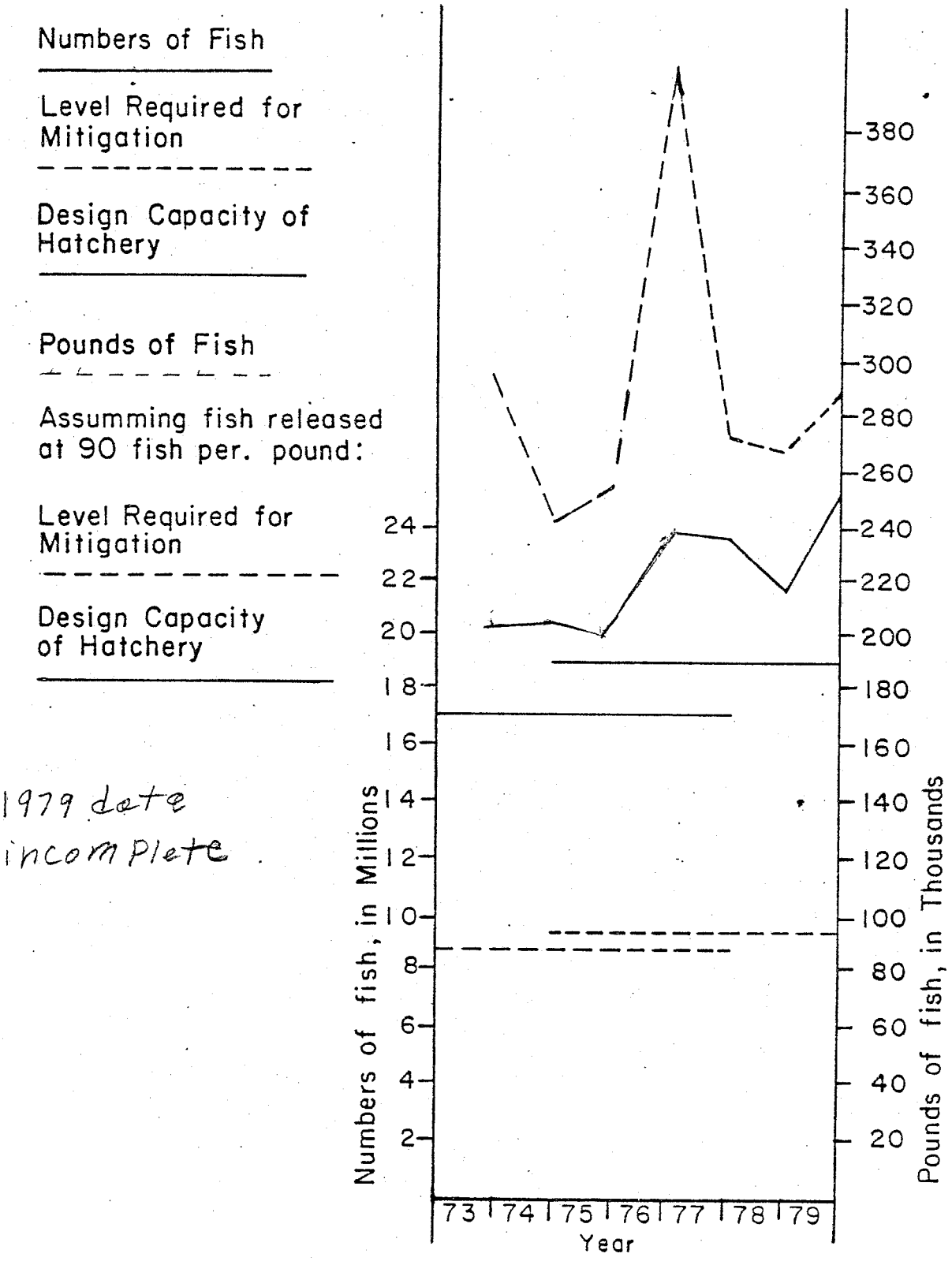


Figure III



# Figure I

## Fall Chinook Released from Spring Creek Hatchery




1979 date incomplete