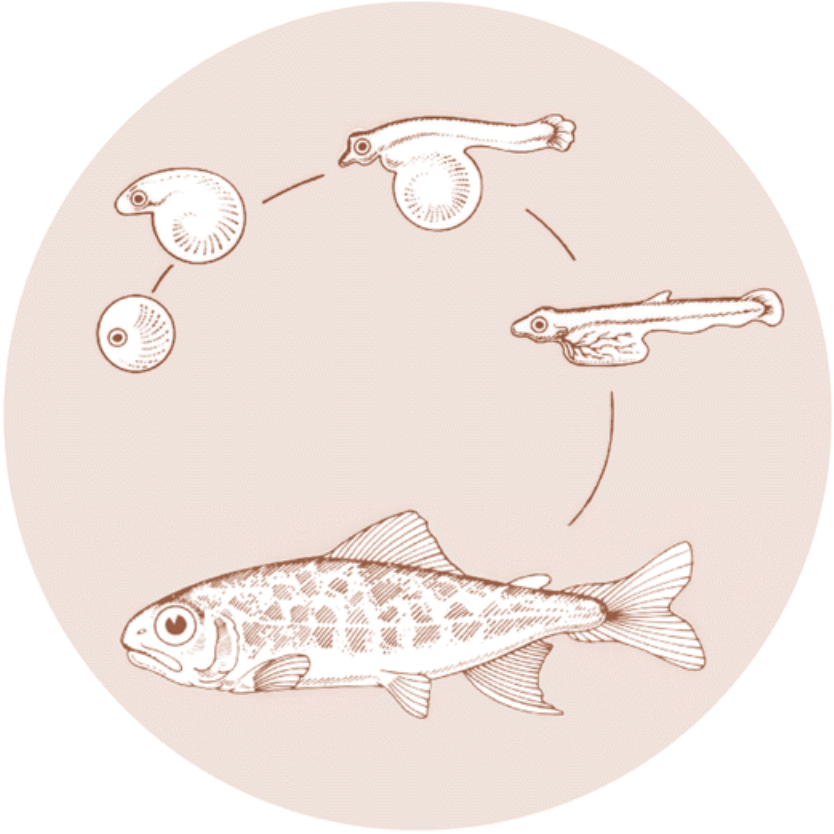
July 1993

EFFECTS OF ACCLIMATION OF THE SURVIVAL OF SPRING CHINOOK SALMON

Annual Report 1992



DOE/BP-00467-1

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EFFECTS OF ACCLIMATION OF THE SURVIVAL OF SPRING CHINOOK SALMON

ANNUAL REPORT 1992

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Prepared for:

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Project Number 89-30
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JULY 1993

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4TH ANNUAL PROGRESS REPORT
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PROJECT NO. 89-30

INTRODUCTION:

Many hatcheries, particularly those raising spring and summer chinook yearlings, are supplied with groundwater from wells or springs. Generally the smolts are released from rearing ponds supplied with groundwater directly into a tributary of ambient temperature surface water. Often the groundwater supply is relatively constant in temperature while the receiving water displays significant temperature variation. It is speculated that pre-release exposure to the varying temperature regime and the chemical characteristics of the ambient receiving water could enhance post-release survival, possibly through improved smoltification.

In one experiment with yearling coho salmon (Hopley, et-al,, 1978) those exposed to ambient river water for 6 weeks prior to release survived at a significantly higher rate than those released at a comparable size and time without acclimation. In an informal field application, emigration of chum salmon from egg boxes was stimulated by a change from well water to surface water, even though the temperature of each supply was equal. In field applications spring chinook yearlings have been stimulated to migratory behavior by addition of small amounts of ambient creek water to the spring water-supplied rearing pond,

The potential for improved survival of smolts exposed to ambient river water before release has been shown experimentally and, circumstantially, by field application. No definitive research has been done for spring or summer chinook or steelhead. This project was designed to conduct acclimation experiments using spring chinook yearlings to determine if the experimental treatment will result in increased survival,

This report covers work conducted from June 1, 1992 to May 31, 1993. The reader is directed to the first, second and third annual reports submitted for this project for information on work preformed during proceeding years.

Project Goal:

"To determine if acclimation of spring chinook smolts in ambient temperature surface water prior to release will increase survival (smelt-to-adult) compared to smolts raised only in constant temperature spring water."

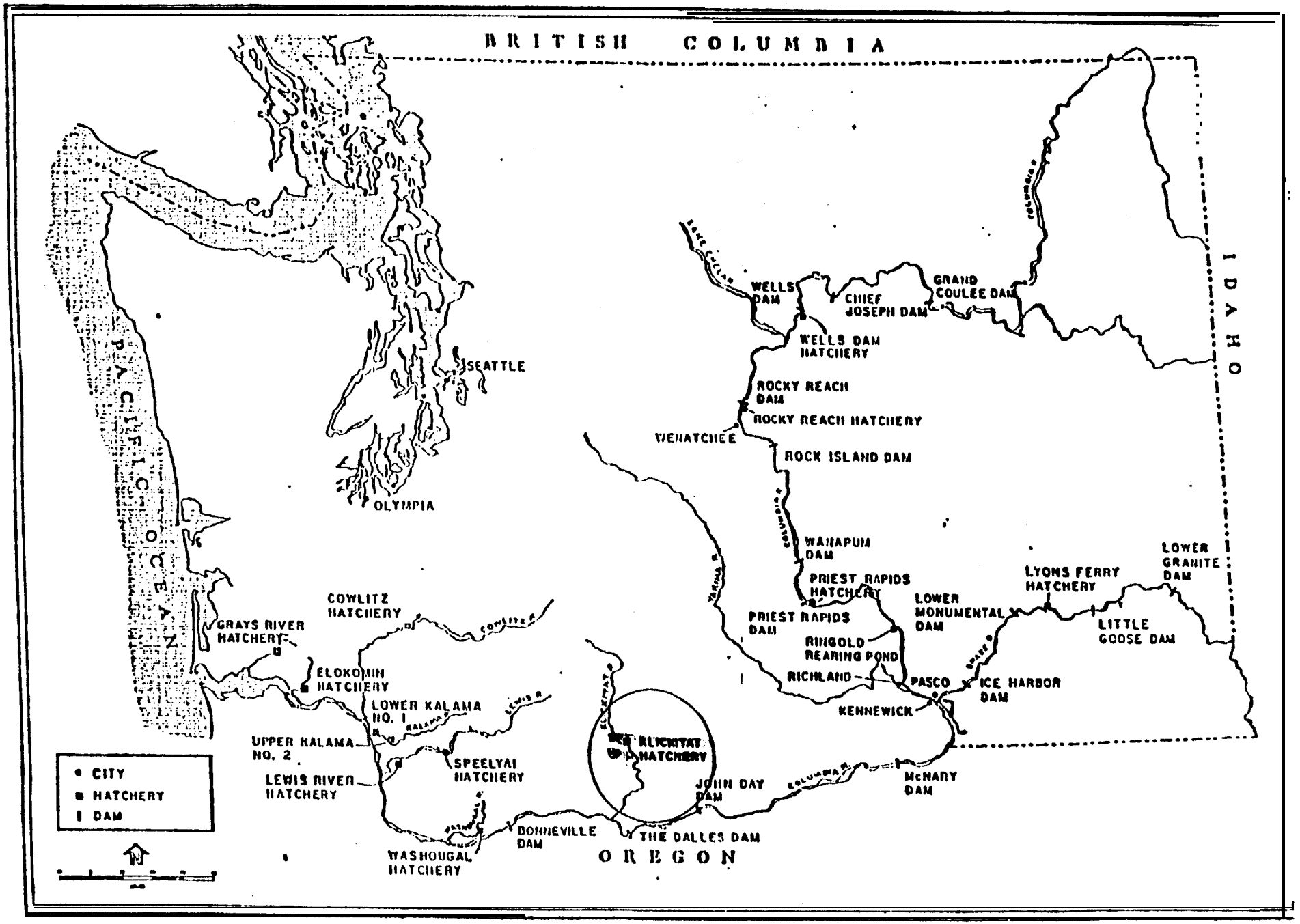

FIGURE 1 HATCHERY LOCATION

SP.CHINOOK ACCLIMATION STUDY
4TH ANNUAL PROGRESS REPORT
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METHODS AND MATERIALS:

Completion of one objective (2) and continuation of three objectives (3,4,5) were to be achieved during 1992-1993:

OBJECTIVE 2: Secure adequate number of spring chinook juveniles.
OBJECTIVE 3: Application of coded-wire tags to juveniles.
OBJECTIVE 4: Recovery of Coded-Wire Tags.
OBJECTIVE 5: Data Analysis and Reports.

A more detailed discussion of each objective follows;

OBJECTIVE 2: Secure adequate number of spring chinook juveniles to fulfill statistical requirements and smolt sampling levels identified in the Smolt Quality Assessment Project. Populate experimental facilities as per study protocol.

Task 2.1: Secure Brood.
Subtask *2.1.4:* Secure 1992 brood.

Task 2.2: Prepare a detailed contingency plan to be implemented in the event of an epizootic in one or more of the experimental ponds. If possible advise COTR prior to treatment or disposition of fish, or within 24 hours. Details for handling events of this nature will be as **per prudent** fish culture **practices**, established **departmental** guidelines and/or **policies**.

OBJECTIVE 3: Application of coded-wire tags to juveniles.
Task 3.1: Apply Coded-Wire Tags to Juveniles.
Subtask 3.1.3: All fish from each pond will be wire-tagged with a unique tag code (1991 brood).

Task 3.2: Enumeration of Tagged Fish.
Subtask 3.2.3: During the tagging process, all tagged fish will be enumerated so a precise number of fish per tag code will be available (1991 brood).

Task 3.3: Adipose Fin Check.
Subtask 3.3.3: Fish with naturally missing adipose fins will be counted during the tagging process (1991 brood).

Task 3.4: Tag loss Assessment.
Subtask 3.4.3: After a minimum of 30 days, a random sample of 2,000 fish will be examined to assess long-term coded-wire tag loss and adipose mark quality (1991 brood).

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OBJECTIVE 4: Recovery of Coded-Wire Tags.
Task 4.1: Recovery of coded-wire tags at the hatchery rack.
Subtask 4.1.2: Snouts will be recovered from all adipose fin-clipped fish returning to the hatchery and their wire tags removed and recorded. Data will be reported in the following quarterly report.

OBJECTIVE 5: Data Analysis and Reports.
Task 5.1: Quarterly and Yearly Progress Reports.
Subtask 5.1.3: Quarterly and yearly 1992.
End of each quarter. Draft annual report due 3/31/93. Final annual report due 5/31/93.

RESULTS AND DISCUSSION:

1991 BROOD RELEASE:

The third year's test and control groups (1991 brood) were released on April 30, 1993. All study parameters are intact. The six week test group began receiving river water **on March** 19. The three week test groups began receiving river water on April 9, 1993. Detailed release information is contain in Appendix A. Water temperature profiles for the treatment groups are contained in Appendix B. Gill ATP-ase levels and a saltwater rearing test are being conducted by Aldo Palmisano (USFWS) at the Marrowstone lab (see Appendix C for summary study protocol). The results of the 1989 brood samples showed a significant difference in gill ATPase levels for the 6 week acclimation group when compared to either the control or the 3 week test group. However, there were no significant differences between the 1990 brood groups.

Bacterial Kidney Disease screening was conducted on all groups. Sixty fish from each group were sacrificed and kidney smears will be examined using florescent antibody technique analysis (FAT). The samples will also be analyzed using ELISA. This comparison will allow testing of differences between the techniques as well as continuing the base line data collection of BKD levels for inclusion in the final data analysis. Results of the Bacterial Kidney disease sampling of the 1990 brood (released May 1992) was complete and is presented in Appendix D, OBJECTIVE 3 **Task** 3.5 (new Task).

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Additional work completed this year included:

1) Andy Appleby (project leader) made a presentation at the BPA annual projects review meeting in Portland, OR.

2) Contract modification 006 was submitted during the year. This was for the addition of O&M funds for FY94.

3) Contract modification 005 was approved during this year. This will allow the addition of Klickitat River water to the adult holding pond and fish ladder.

4) Randomization of the 12 study ponds (1991 brood) in to various treatment and control groups and monitoring fish growth occurred during this year.

OBJECTIVE 2: Secure adequate number of spring chinook juveniles to fulfill statistical requirements and smolt sampling levels identified in the Smolt Quality Assessment Project. Populate experimental facilities as per study protocol.

Task 2.1: Secure brood
Subtask 2.1.4: Secure 1992 brood.

Adult arrivals began May 12, 1992 and ended September 17, 1992. About 1,115,000 eggs were taken from 309 female spring chinook (Klickitat stock) returning to the Klickitat hatchery. Total adult return of this stock was 329 males and 325 females. On December 6, 1992 ponding of these fry began. Size at ponding was 1,161 fish per pound. The growth of these fish is being monitored to avoid producing smolts too large for the carrying capacity of the acclimation raceways, a release size of 8-9 fish/pound is targeted. The hatchery crew took length samples every two weeks during early rearing and monthly as fish reach a larger size.

OBJECTIVE 3: Application of coded-wire tags to juveniles.

Task 3.1: Apply Coded-Wire Tags to Juveniles.
Subtask 3.1.3 All fish from each pond will be wire-tagged with a unique tag code (1991 brood). Tagging was conducted between 6/23/92 and 7/2/92. Fish were healthy at the time of tagging and appeared to handle well. No unusual difficulties were noted. Size at tagging was 55 fish per pound.

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Task 3.2: Enumeration of Tagged Fish.
Subtask 3.2.3: During the tagging process, all tagged fish will be enumerated so a precise number of fish per tag code will be available (1991 brood). Number of fish tagged into each pond are as follows:

1991 Brood Klickitat Spring Chinook

POND	TAGCODE	NUMBER	*TREATMENT*
1A	634546	20,921	Control
2A	634507	21,088	Control
3A	634506	20,867	Control
4A	634505	20,344	Control
5A	634504	21,227	3 week acc.
6A	634503	20,641	3 week acc.
7A	634502	21,121	3 week acc.
8A	634406	20,976	3 week acc.
9A	634405	20,443	6 week acc.
10A	634403	20,438	6 week acc.
11A	634363	20,125	6 week acc.
12A	634362	20,822	6 week acc.

Task 3.3: Adipose Fin Check.
Subtask 3.3.3: Fish with naturally missing adipose fins will be counted during the tagging process (1991 brood). Number of fish with naturally missing adipose fins are as follows:

POND	NUMBER OF FISH
1A	0
2A	1
3A	2
4A	2
5A	1
6A	4
7A	2
8A	0
9A	0
10A	8
11A	13
12A	1

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Task 3.4: Tag loss Assessment.
Subtask 3.4.3: After ***a*** minimum of 30 days, a random sample of 2,000 fish will be examined to assess long-term coded-wire tag loss and adipose mark quality (1991 brood).

POND	INITIAL TAG LOSS (%)	INTERMEDIATE TAG LOSS (%)
1A	**0.7**	**3.14**
2A	**0.3**	1.94
3A	**0.5**	1.89
4A	**0.7**	**3.37**
5A	**1.3**	**2.17**
6A	**0.0**	**1.57**
7A	**0.5**	**1.76**
8A	**0.4**	**3.04**
9A	0.0	0.89
10A	**0.7**	**1.38**
11A	0.0	4.69
12A	**0.4**	**1.62**

OBJECTIVE 4: Recovery of Coded-Wire Tags.
Task 4.1: Recovery of coded-wire tags at the hatchery rack.
Sub-task **4.1.1:** Snouts will be recovered from all adipose fin-clipped fish returning to the hatchery and their wire tags removed and recorded. Forty five "mini-jacks" or two year old fish from the 1990 brood and 16 "maxi-jacks" from the 1989 brood were recovered during the 1992 spawning operations. The results (which were originally reported in the 2nd quarterly report) are presented below. Fishery recoveries are not yet available.

1989 Brood:

Tascode	Pond	Group	Rack Recoveries 1991	1992	Total	Group Total
635602	a l	6wk.	**4**	**0**	**4**	
635604	a 2	6wk.	1	1	**2**	
635607	a 3	6wk.	**2**	**1**	**3**	
635608	a 4	6wk.	**4**	**2**	**6**	**15**
635611	a5	3wk.	**3**	**2**	**5**	
635601	a6	3wk.	**0**	**2**	**2**	
635562	a7	3wk.	**3**	1	**4**	
635561	a8	3wk.	**2**	**5**	**7**	**18**
635559	a9	cont.	1	0	1	
635556	a10	cont.	**2**	1	**3**	
635555	all	cont.	**2**	**2**	**4**	
635552	al2	cont.	**3**	**4**	**7**	**15**

Recovery information continued:

1990 Brood:

Tascode	Pond	Group	Rack Recoveries 1992	Total	Group Total
635922	a1	cont.	7	7	
634312	a2	cont.	3	3	
635925	a3	cont.	2	2	
634313	a4	cont.	2	2	14
635926	a5	6wk.	9	9	
634314	a6	6wk.	13	13	
635928	a7	6wk.	11	11	
634315	a8	6wk.	10	10	43
635931	a9	3wk.	5	5	
635932	a10	3wk.	9	9	
635935	all	3wk.	10	10	
635937	al2	3wk.	9	9	33

OBJECTIVE 5: Data Analysis and Reports.
Task 5.1: Quarterly and Yearly Progress Reports.
Subtask 5.1.3: Quarterly and yearly 1992.
At the end of each quarter. Draft annual due 3/31/93, final annual due 5/31/93. Three quarterly reports have been submitted during this year. Reports were submitted 8/31/92; 11/30/92; and 2/29/93. A draft and final annual report will be submitted at the required time (3/31/93 and 5/31/93) and will substitute for the fourth quarterly report.

WORK SCHEDULE AND PRODUCTS: OBJECTIVES 2, 3, 4 and 5

SUBTASK	PRODUCT	STATUS
Subtask 2.1.4	Secure 1992 brood	Complete
Subtask 3.1.3	Tag 1991 brood	Complete
Subtask 3.2.3	Enumerate 1991 brood	Complete
Subtask 3.3.3	Adipose Fin Check	Complete
Subtask 3.4.3	Tag Loss Assessment	Complete
Subtask 4.1.1	Recovery CWT at rack	Complete
Subtask 5.1.3	Analysis and Reports	5/31/93

With the completion of subtask 2.1.4. (secure 1992 brood) Objective 2 is now complete

APPENDIX A

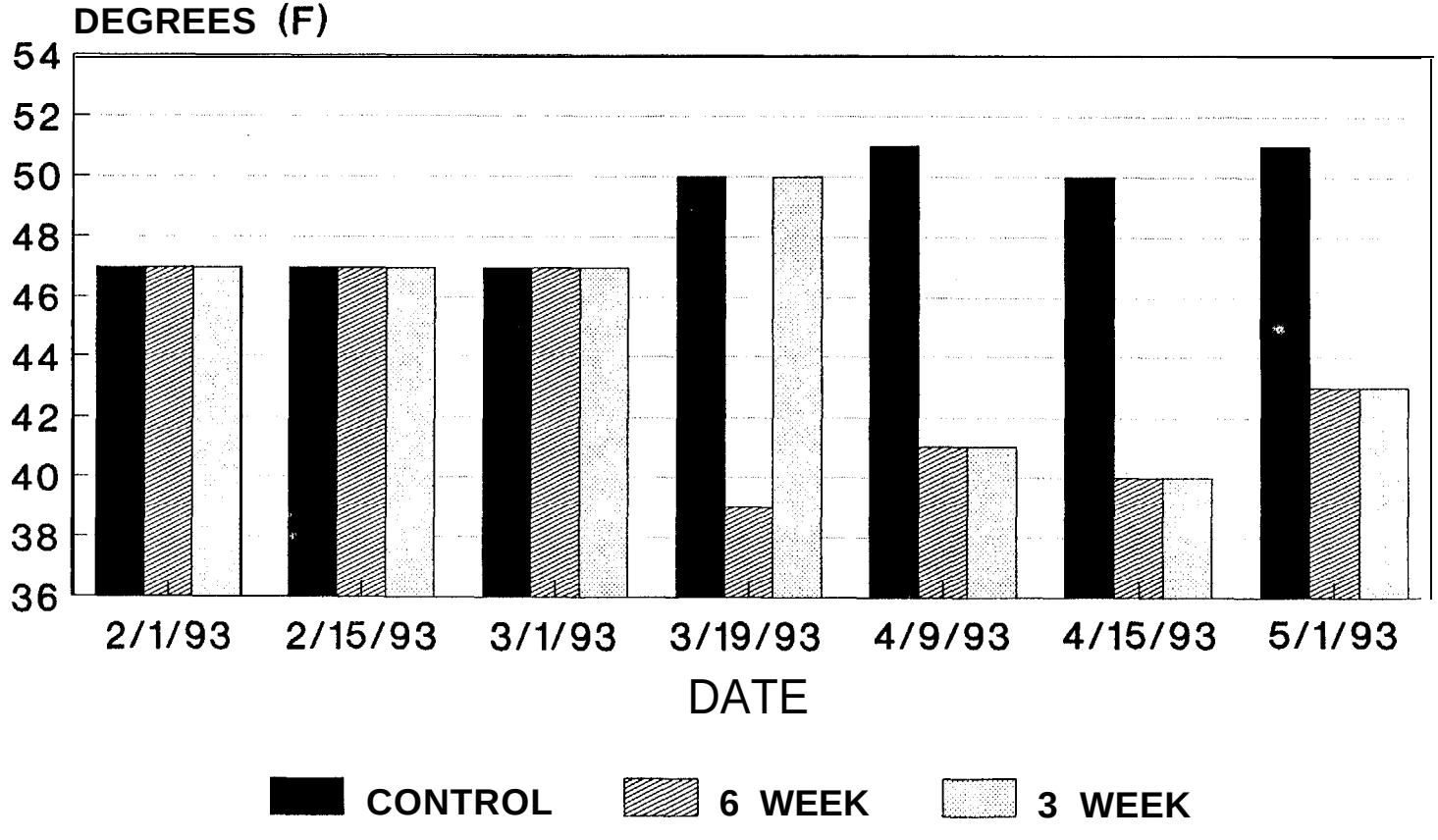
RELEASE INFORMATION FOR 1991 BROOD SPRING CHINOOK
ACCLIMATION STUDY
RELEASED FROM KLICKITAT HATCHERY APRIL 30, 1993

POND	TAGCODE	STUDY GROUP	DATE REL.	SIZE (MM)	SIZE (F/LB)	C.V. LENGTH	TAGS REL.	AD ONLY	UNTAGGED REL.	TOTAL REL.
1A	634546	control	4/30/93	165	8.3	10.4	18949	651	0	19600
2A	634507	control	4/30/93	168	7.6	10.6	19418	482	0	19900
3A	634506	control	4/30/93	162	8.7	10.6	19128	472	0	19600
4A	634505	control	4/30/93	168	7.8	11.8	16418	682	0	19100
5A	634504	3wk	4/30/93	166	8.1	10.6	19361	539	0	19900
6A	634503	3wk	4/30/93	166	8.1	10.9	19588	312	0	19900
7A	634502	3wk	4/30/93	165	a.4	10	19549	551	0	20100
8A	634406	3wk	4/30/93	167	8.1	10.3	19062	638	0	19700
9A	634405	6wk	4130193	166	8	11.3	18861	239	0	19100
10A	634403	6wk	4/30/93	169	7.6	9.9	18836	264	0	19100
11A	634363	6wk	4/30/93	164	8.2	11.4	17834	966	0	18800
12A	634362	6wk	4/30/93	164	8.3	11.2	19184	316	0	19500

BASED ON 100 FISH PER POND SAMPLED AT RELEASE.

APPENDIX B

WATER TEMPERATURES FOR KLICKITAT FOR 1991 BROOD SPRING CHINOOK



AVERAGE OF MAXIMUM AND MININUM
Ponds al-a4 cont. Ponds a5-a8 3wk.,
Ponds a9-a12 6wk.

APPENDIX C

Research Proposal

Protocol: Dingell-Johnson Smolt Quality Project, 1993.
(DJ93 ver. 1/29/93; rev 3/4, 3/12 ANP)

Title: Standardized seawater rearing to evaluate the effects of hatchery rearing practices on salmon smolts.

Sponsor: U.S. Fish and Wildlife Service
Reverted Dingell-Johnson Funding

Testing Facility:
National Fishery Research Center - Seattle (NFRS)
Marrowstone Field Station (MFS)
Nordland, WA 98358
Aldo N. Palmisano, Project Leader
(206) 379-9103

Signed: _____

Date: _____

Proposed Starting Date: April, 1993 (estimated).

Completion of Experiments: October, 1993 (estimated).

Test System Justification:
The test system includes groups of spring chinook salmon (*Oncorhynchus tshawytscha*) from the Rlickitat Hatchery. Juvenile salmon *were* switched from well water to river water for 0 (controls), 3 or 6 wks before release from the hatchery to stimulate smolting. Each fish has been coded-wire tagged. to identify raceway of origin, and tags will be recovered in returning adults to estimate survival to maturity. Fish have been monitored for bacterial kidney disease (BKD) by an ELISA technique. I will sample 50 fish from each of the four replicates *of* each treatment and control group (12 groups total) and use them to determine total percent mortality in seawater, causes of mortality, and growth. I will evaluate the osmoregulatory capability of the fish before and after seawater entry by measuring plasma electrolytes and gill Na+/K+ ATPase activities on subsamples from each group, and I will analyze their livers to estimate their physiological energy stores. I will determine if correlations exist between the parameters monitored and adult-returns when they become available.

APPENDIX D

BACTERIAL KIDNEY DISEASE SCREENING RESULTS.
KLICKITAT HATCHERY 1990 BROODSPRING CHINOOK.

POND NUMBER	STUDY GROUP	PERCENT LEVEL OF INCIDENCE BELOW DECT.	LOW	MOD.	HIGH	AVERAGE PERCENT BY STUDY GROUP BELOW DECT.	LOW	MOD.	HIGH
A1	CONTROL	7.1	64.3	28.6	0	23.5	41.1	22.2	13.4
A2	CONTROL	20	46.7	20	13.4				
A3	CONTROL	26.7	40	26.7	6.7				
A4	CONTROL	40	13.3	13.3	33.4				
A5	6WK	20	46.7	26.7	6.7	21.4	53.2	11.9	13.6
A6	6WK	20	40	6.7	33.4				
A7	6WK	14.3	57.1	14.3	14.3				
A8	6WK	31.3	68.8	0	0				
A9	3WK	18.8	50	25	6.3	30.0	43.5	16.3	10.3
A10	3WK	42.9	50	7.1	0				
A11	3WK	23.1	38.5	15.4	23.1				
A12	3WK	35.3	35.3	17.6	11.8				

RESULTS BASED ON 15 FISH PEA POND SAMPLES TAKEN ON DAY OF RELEASE.
ANALYSIS CONDUCTED USING ELISA.

CRITERIA FOR DISCRIMINATION BETWEEN LEVELS OF INCIDENCE

BELOW DECTATABLE	loss than 0.1 O.D. VALUE
LOW	0.1 ---0.199 O.D. VALUE
MODERATE	0.2---0.449 0.0. VALUE
HIGH	0.45 OR HIGHER 0.0. VALUE