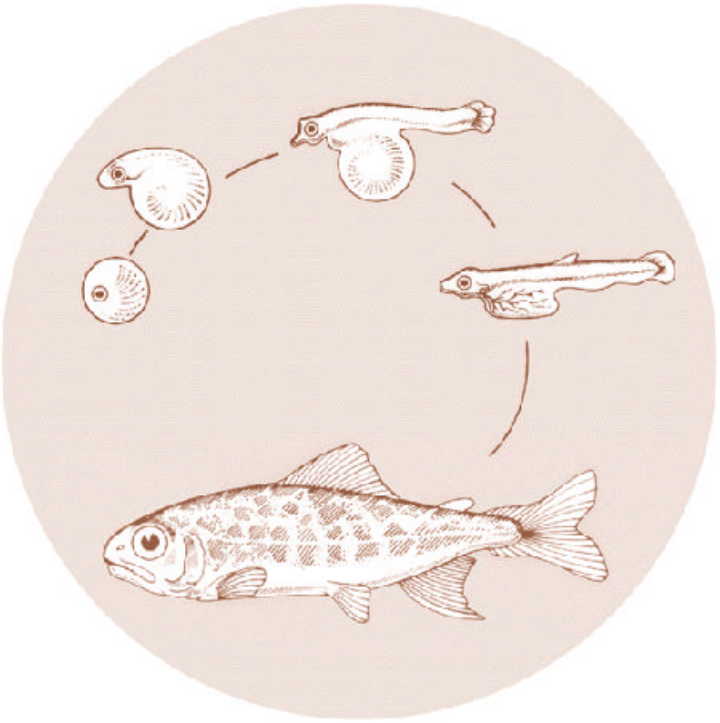
November 1988

AUGMENTED FISH HEALTH MONITORING FOR WASHINGTON DEPARTMENT OF WILDLIFE

Annual Report 1987



DOE/BP-64344-1

This report was funded by the Bonneville Power Administration (BPA), U.S. Department of Energy, as part of BPA's program to protect, mitigate, and enhance fish and wildlife affected by the development and operation of hydroelectric facilities on the Columbia River and its tributaries. The views of this report are the author's and do not necessarily represent the views of BPA.

This document should be cited as follows:

Gearheard, Jim, John Kerwin, Steve Roberts, Bruce Bolding - Washington Department of Fish & Wildlife, Augmented Fish Health Monitoring For Washington Department Of Wildlife, Annual Report 1987, Report to Bonneville Power Administration, Contract No. 1986BP64344, Project No. 198601300, 38 electronic pages (BPA Report DOE/BP-64344-1)

This report and other BPA Fish and Wildlife Publications are available on the Internet at:

http://www.efw.bpa.gov/cgi-bin/efw/FW/publications.cgi

For other information on electronic documents or other printed media, contact or write to:

Bonneville Power Administration
Environment, Fish and Wildlife Division
P.O. Box 3621
905 N.E. 11th Avenue
Portland, OR 97208-3621

Please include title, author, and DOE/BP number in the request.

AUGMENTED FISH HEALTH MONITORING FOR

WASHINGTON DEPARTMENT OF WILDLIFE

ANNUAL REPORT 1987

Prepared by

Jim Gearheard, Project Leader
John Kerwin
Steve Roberts
Bruce Bolding
Washington Department of Wildlife
600 Capitol Way, North
Olympia, WA 98501-1091

Prepared for

Ron Morinaka, Project Manager
U.S. Department of Energy
Bonnveille Power Administration
Division of Fish and Wildlife
P.O Box 3621
Portland, Oregon 97208
Contract No DE-AI79-86BP64344
Project No. 86-13

November 1988

ABSTRACT

This report documents the progress of various tasks during the second year of a five year augmented fish health monitoring project. Fish at Washington Department of Wildlife hatcheries rearing anadromous fish for the Columbia River drainage were intensively monitored either annually, semi-annually, or monthly for various pathogens of concern. We have developed a database for documentation of the presence and severity, or absence of these pathogens. In addition, we are progressing in the development of disease histories for these stat ions.

The installations have been examined for impediments to good fish health both in terms of physical (structural and water supply) problems and loading problems. Recommendations have been made to correct these difficulties.

Table of Contents

List of Tables

List of Figures

List of Graphs

List of Appendices

Augmented Fish Health Monitoring
for the
Washington Department of Wildlife
1987 Annual Report

introduction:

The Washington Department of Wildlife has completed the second year of a five year Fish Health monitoring project. This report will address findings for the period from September 1, 1987 through August 31, 1988.

As discussed in our first year report the Northwest Power Planning Council (NWPPC) has determined that there was insufficient data available to adequately prioritize artificial production improvements in the Columbia River drainage. This was evident in NWPPC program measure 704(f), hatchery survey. This project, funded by Bonneville Power Administration (BPA) was carried out by the Washington Department of Wildlife (WDW) will collect and summarize fish health data at anadromous game fish production stations in Washington state operated by the contracted agency. This project is part of a multi-agency effort to accomplish augmented fish health monitoring and data collection in a standardized manner.

During this second year increased emphasis was placed on uncovering impediments to the production of high quality smolts and documenting these problems. Many problems exist and have been known. Good data to document these problems was lacking. Eventually we hope the data will be sufficient to justify improvements at artificial production facilities that will correct fish health problems and in turn improve smolt quality. The bottom line is more effective production programs resulting in more adult fish back to spawn or to contribute to fisheries. index hatcheries with tagged fish releases will provide additional information as to whether or not increased fish health monitoring by itself will provide an improved product and greater returns. Operational changes without capital expenditures might result in a substantial increase in survival if problems are uncovered and corrected.

Description of Study Area:

This project was designed to collect and summarize fish health related data from WDW anadromous production facilities in the Columbia River drainage. Figure 1 indicates the location of these facilities. WDW rears winter run steelhead, summer run steelhead and searun cutthroat trout in these facilities although not all three species/strains are located at each of these stations. Table 1 indicates the rearing program at the facilities included in the study.

One temporary imprint net pen on the Big White Salmon River was used for the first time this year for approximately one month. The site was not added to this study.

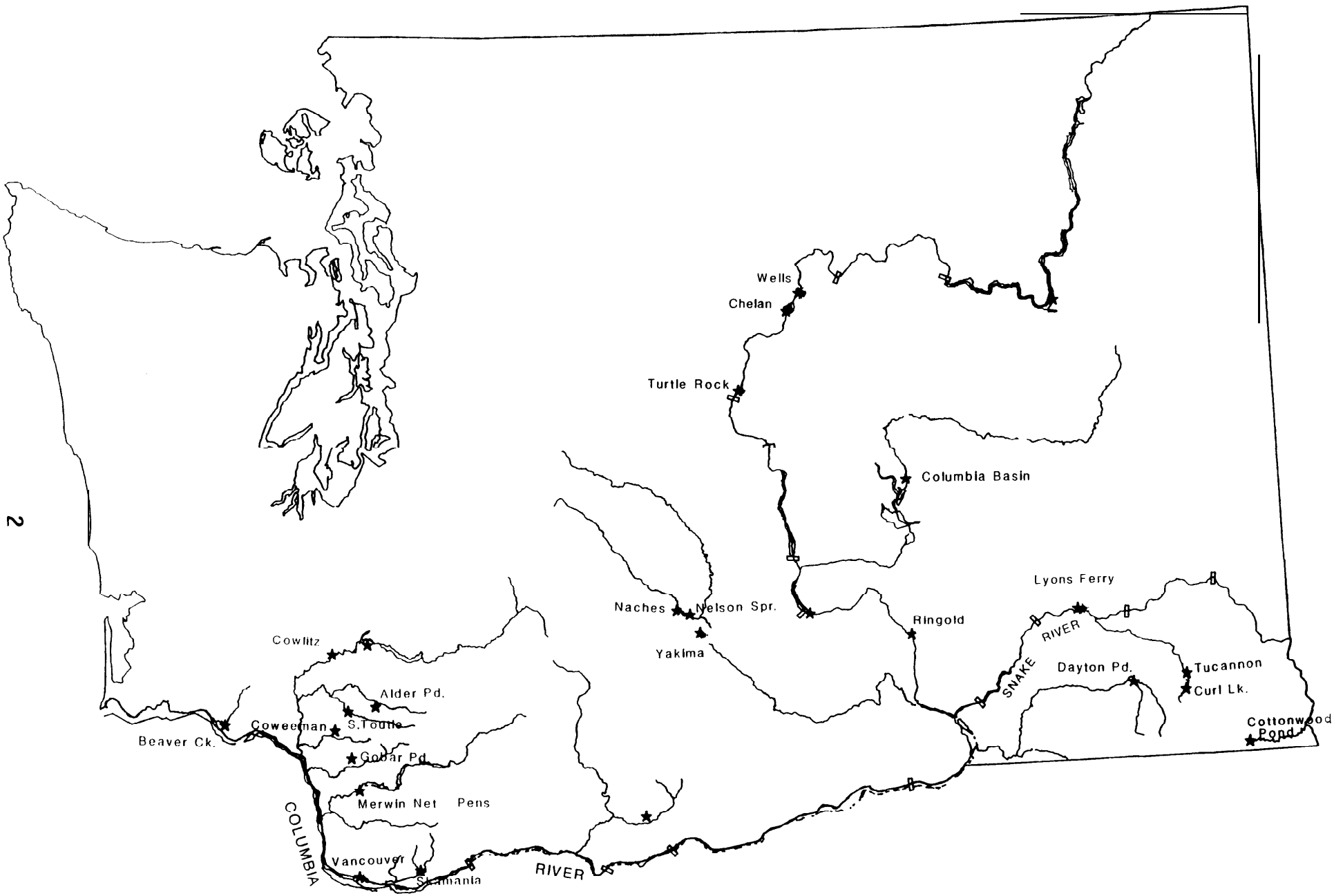


Table 1. Location of Washington Department of Wildlife Anadromous Fish Production Facilities in the Columbia River Drainage

Table I.WDW Columbia River Drainage Anadromous Fish Rearing Programs

installation	Drainage	Annual Program/ Transfers to
Beaver Ck. Hatchery	Elochoman	Winter SH Smoits Winter SH Pre-smoits for Coweeman and Gobar Summer SH Smolts Searun CT Smoits Searun CT Pre-smoits for Coweeman and Skamania. Two Broodstocks
Coweeman SH Pond	Coweeman	Winter SH Smoits.
Coweeman CT Pond	Coweeman	Searun CT Smoits.
Aider Creek Pond	N. Fork Toutie	Summer SH Smoits.
South Toutle Trap	S. Fork Toutle	Winter SH Parr.
Cowiitz Hatchery	Cowlitz	Winter SH Smoits. Summer SH Smoits. Searun CT Smoits. Three Broodstocks.
Gobar Pond	Kalama	Winter SH Smolts. Summer SH Smoits
Merwin Net Pens	Lewis	Summer SH Smolts.
Vancouver Hatchery	L. Columbia	Summer SH Smoits. Summer SH Fingerlings for Skamania. Winter SH Fingerlings for Skamania.
Skamania Hatchery	Washougal	Winter SH Smoits. Summer SH Smoits. Summer SH Pre-smoits for Aider Ck., Gobar and Merwin. Three Broodstocks.
Yakima Hatchery	Yakiam	Summer SH Smoits. One Broodstock.
Nelson Springs Raceway	Naches	Summer SH Smoits.

Table I (Continued). WDW Columbia River Drainage Anadromous Fish Rearing Programs

installation	Drainage	Annual Program/ Transfers to
Naches Hatchery	Naches	Summer SH Fingerlings for Nelson Spring
Ringoid Pond	Upper Columbia	Summer SH Smolts.
Columbia Basin Hatchery	Crab Creek	Summer SH Fingerlings for Ringold Pond.
Turtle Rock Pond	Upper Columbia	Summer SH Smolts.
Chelan Hatchery	Upper Columbia	Summer SH Smoits. Summer SH Fingerlings for Turtle Rock. One Broodstock.
Wells Hatchery	Upper Columbia	Summer SH Smoits. One Broodstock.
Lyons Ferry Hatchery	Lower Snake	Summer SH Smoits. Summer SH Pre-smolts for Cottonwood, Curl and Dayton Ponds.
Cottonwood Pond	Grande Ronde	Summer SH Smoits.
Cur I Lake	Tucannon	Summer SH Smolts.
Dayton Pond	Touchet	Summer SH Smoits.

SH = Steelhead
CT = Cutthroat

Materials and Methods:

Materials and methods were described in the 1986 annual report (Gearheard et al, 1987).

Results and Discussion:

Objective 1.0 Complete start-up phase.

Task 1.1 Acquire competent staff.

The year began with a full staff for the project on board. Don Chase, lead data manager and pathologist for the lower Columbia hatcheries accepted a position in our Data Management section and left us searching for a replacement. Fortunately the Washington State Department of Personnel had an

established register with a number of excellent candidates available. We selected John Kerwin, an experienced Leetown graduate, and put him on staff effective October 20, 1987. John has been doing an excellent job for us.

Along with John, Steve Roberts, Bruce Bolding and Jennifer Huiett have continued to handle the bulk of the workload with Jim Gearheard as the project leader.

Objective 2.0 Serve on technical steering committee.

Task 2.1 Technical steering committee.

Three meetings of the Project Technical Steering Committee were held. The first was held at Washington Department of Fisheries, Salmon Culture Office, Olympia, WA on October 8, 1987. The second was held at Oregon Department of Fish & Wildlife, Columbia River Regional Office, Clackamas, OR on March 29 – 30, 1988. The third meeting was held at the Washington Department of Wildlife conference room in Olympia, Washington on June 2, 1968. Jim Gearheard, project leader and key personnel attended all meetings. Current project progress as well as interpretations and modifications of project tasks were discussed at ail meetings.

Task 2.2 Technology transfer.

WDW has distributed the 1986 Annual Report to appropriate personnel within the Agency and to the Washington State Library. An excellent presentation to our agency's Fisheries Management Division meeting on June 10, 1988 was made by Bruce Boiding. Further disemination of project findings will be made as opportunities arise or upon direction from BPA.

Task 2.3 Facility impediments.

This objective is to provide BPA with a list of facility impediments to fish health at each hatchery as well as to itemize the expected benefits and costs. Criteria for developing a list of facility impediments was developed in the 1986 annual report (Gearheard et al., 1987). The following lists of projects contain system wide items (Table 2) as well as site specific items (Table 3) along with estimates of cost and benefits.

Table 2. System Wide Fish Health Impediments

Project	cost	Benefit	Justification
Fish health training	$ 2,000/facility	High	Increase facility personnel awareness to increase fish health; increase diagnostic capabilities.
Microcomputers and training	$ 5,000/facility currently not computerized.	Medium	Optimize feed conversions under CHOP program and provide facility database.

Table 2. (continued) System Wide Fish Health Impediments

Project	cost	Benefit	Justification
Flow measurement instrumentation	$ 10,000/faciiity	Mediurn	Provide for ability to determine rearing densities to produce higher quality smol ts.

Table 3. Site Specific Fish Health Impediments

Faci l ity	Project	Estimated Central Costs	Benefit	Justification
Aider Crk.Pd.	None			
Beaver Creek	Water development project if feasible	$ 500,000	High	Facility suffers from seasonal low flows. increased flows will improve fish health.
	Oxygen injection system	$ 500,000	High	Facility suffers from seasonal high water temperatures and low DO's resulting in chronic stress. Increased DO will increase fish health.
Cheian	Acclimation ponds 2 – Wenatchee & Entiat rivers.	$ 500,000	High	Ponds will reduce stress and disease during smolting.
Columbia Basin	increase water	$ 100,000	High	increased flows will improve rearing flow regimes resulting in improved fish quality.
	Cover springs	$ 100,000	High	Covered springs will reduce possibility of disease.
Coweeman Pds	Construct large rearing ponds (2)	$ 250,000	Medium	Pond construction will optimize rearing efficiency and drastically improve fish quality.
Cowlitz	Ozone Treatment	$ 2,000,OOO	High	Reduce C. Shasta infection improving fish quality.

Table 3. (continued) Site Specific Fish Health Impediments

Facility	Project	Estimated Central Costs	Benefit	Justification
Cowl itz	Adult holding pond rehabilitation	$ 500,000	High	Provide ability to segregate by species and sex and reduce spread of disease.
	Adult holding pond covers	$ 100,000	Medium	Provide for increased egg quality and reduce possible disease transfer.
Gobar Pd.	None	–	–	
East Fork Lewis River	Construct imprint Pond	$ 350,000	Medium	imprint pond will reduce stress during smolting, decrease straying and improve survival.
Lyons Ferry	None			
Merwin	None	Merwin Net Pens will be discontinued with construction of Lewis River hatchery.	–	
Nelson Spgs.	None	Same as Yakima hatchery.	–	
Naches	None	Same as Yakima hatchery.	–	
Ringold	Asphalt pond	$ 300,000	Low	
	Cover springs	$ 50,000	Medium	Covered springs will reduce possibility of disease contamination.
Skamania	Adult barrier	$ 300,000	High	Adult barrier will reduce level of adults migrating upstream of hatchery intake and pathogen load in water supply; adult returns will be maximized.
	Water treatment	$ 500,000	High	Rearing water suffers from high copper contamination.
	Construction of rear new raceways	$ 750,000	Medium	Rearing raceways need replacement to maximize rearing flows.

Table 3. (continued) Site Specific Fish Health Impediments

Facility	Project	Estimated Central Costs	Benefit	Justification
	Downstream WST barrier removal	$ 150,000	Medium	impassable velocity barrier removal would allow WST broodstock returns in all years.
	Facility repiping to allow volitional release from raceways	$ 400,000	High	Eliminate handling stress and optimize release strategies while improving smoit quality.
S.Toutle Trap	Raceway development (if operation continues)	$ 250,000	Medium	No permanent raceways. Fry survival will be increased.
Turtle Rock	None	Turtle Rock steelhead production will be replaced by Eastbank hatchery development.		-
Vancouver	Construction of new raceways	$ 750,000	Medium	Round ponds require replacement by raceways to improve rearing and fish health.
	Development of new water source	$ 500,000	High	Facility requires water replacement source to maximize potential.
	Spring Redevelopment	$ 150,000	Medium	Springs require redevelopment to maximize flow potential.
Yakima	None	Yakima steelhead production will be discontinued with development of the Yakima master plan.		- -
Welis	Water treatment for rearing pds.	$ l,OOO,OOO	Medium	Columbia River water is used part of year and contains high risk pathogens.
	Asphalt ponds	$ 300,000	Low	Improve pond draining characteristics, reduce stress during pond drainage, reduce pathogen habitat.

Table 3. (continued) Site Specific Fish Health Impediments

Facility	Project	Estimated Central Costs	Benefit Justification
Lyons Ferry	None		
Dayton Pd.	None		
Curl Lake	None		
Cottonwood Pd.	None		

Objective 3.0 Fish health monitoring.

Task 3.1 Organosomatic analysis "Index" hatcheries.

Materials and methods were described in the 1986 annual report (Gearheard et ai, 1987). Table 4 provides a listing of hatchery location, species and stocks sampled.

Table 4. List of Hatcheries, Species and Stocks in Which Organosomatic Analysis was Performed

HATCHERY	SPECIES	STOCK
Cowlitz	Sea Run Cutthroat	Cowlitz
Cowlitz	Summer Steelhead	Cowlitz
Wells	Summer Steelhead	Welis
Cowlitz	Winter Steelhead	Cowlitz

Tables 5 – 7 illustrate the results of the organosomatic analysis as performed at the index facilities.

Table 5. Organosomatic Analysis of Measured Items; Length, Weight, Condition Factor, Hematocrit (Hc) by Species and Stock

Hatchery	Species	Length (mm)	SD	Weight (Gm)	SD	Factor	Hc	SD
Cowlitz	CT	182.35	23.07	55.18	25.26	0.83	37.2	5.5
Cowlitz	SW	169.37	14.37	41 .a9	12.95	0.88	36.9	6.3
Cowlitz	ss	186.42	21 .24	59.87	21 .85	0.84	36.4	5.5
Wells	ss	191 .80	14.90	66.16	16.56	0.92	53.8	5.3

Table 6. Score Ranges by Organosomatic Analysis by Organ

Organ	Score	Score
Fat	0	2
spleen	0	3
Hind Gut	0	2
Kidney	0	2
Liver	0	2

0 = Normal except for fat where 2-3 is desireable.

Table 7. Percentage of Population Scores by Species/Stock/Hatchery

Searun Cutthroat Trout/Cowiitz/Cowiitz

Score	Fat	Spleen	Hind Gut	Kidney	Liver
0	45.0%	43.4%	73.3%	96.6%	86.7%
1	50.0%	50.0%	23.3%	3.4%	13.3%
2	5.0%	5.0%	3.4%	0.0%	0.0%
3	0.0%	1.6%	0.0%	0.0%	0.0%
4	0.0%	0.0%	0.0%	0.0%	0.0%
5	- - - -	0.0%	----	0.0%	0.0%
6	----	0.0%	----	0.0%	0.0%
Tota l	100.0%	100.0%	100.0%	100.0%	100.0%

0 – Normal with Abnormal increasing Numerically to 6 except for fat where 2-3 is considered desirable.

Winter Steeihead/Cowiitz/Cowiitz

Score	Fat	Spleen	Hind Gut	Kidney	Liver
0	93.2%	80.0%	7.5%	100.0%	96.7%
1	6.8%	3.3%	58.3%	0.0%	3.3%
2	0.0%	16.7%	34.2%	0.0%	0.0%
3	0.0%	0.0%	0.0%	0.0%	0.0%
4	0.0%	0.0%	0.0%	0.0%	0.0%
5	- - - -	0.0%	----	0.0%	0.0%
6	- - - -	0.0%	----	0.0%	0.0%
Total	100.0%	100.0%	100.0%	100.0%	100.0%

0 = Normal with Abnormal Increasing Numerically to 6 except for fat where 2-3 is considered desirable.

Table 7. (continued) Percentage of Population Scores by Species/Stock/Hatchery

Summer Steeihead/Cowiitz/Cowiitz

Score	Fat	Spleen	Hind Gut	Kidney	Liver
0	70.0%	90.0%	45.0%	100.0%	98.3%
1	28.3%	3.3%	41.7%	0.0%	1.7%
2	1.7%	6.7%	13.3%	0.0%	0.0%
3	0.0%	0.0%	0.0%	0.0%	0.0%
4	0.0%	0.0%	0.0%	0.0%	0.0%
5	----	0.0%	----	0.0%	0.0%
6	----	0.0%	----	0.0%	0.0%
Tota l	100.0%	100.0%	100.0%	100.0%	100.0%

0 = Normal with Abnormal increasing Numerically to 6 except for fat where 2-3 is considered desirable.

Summer Steeihead/Weiis/Welis

Score	Fat	Spleen	Hind Gut	Kidney	Liver
0	0.0%	100.0%	100.0%	100.0%	98.3%
1	33.3%	0.0%	0.0%	0.0%	0.0%
2	66.7%	0.0%	0.0%	0.0%	0.0%
3	0.0%	0.0%	0.0%	0.0%	0.0%
4	0.0%	0.0%	0.0%	0.0%	0.0%
5	----	0.0%	----	0.0%	0.0%
6	- - - -	0.0%	----	0.0%	0.0%
Total	100.0%	100.0%	100.0%	100.0%	100.0%

0 – Normal with Abnormal increasing Numerically to 6 except for fat where 2 -3 is considered desireable.

Organosomatic Analysis Discussion

Organosomatic analysis can be an efficient method of evaluating salmonid smolt quality or assessing deviations from normal organ and physical characteristics. Pyioric fat levels on all three species examined at the Cowiitz Hatchery were much lower than that of the Wells Hatchery summer steelhead. Additionally, all three species of smoits at the Cowiitz hatchery had increased abnormal scores in spleens, hind guts, kidneys and livers. Cowiitz hematocrits were also notably lower than those of summer steelhead from Wells. it is documented that the Cowlitz Hatchery was suffering from a chronic infection of the parasite Ceratomyxa Shasta . During acute epizootics of C. Shasta losses at the Cowlitz hatchery are believed to be as high as 50%. Mortality from the effects of chronic C. Shasta during some years can be as high as 60%.

Continued use of organosomatic analysis in subsequent brood years will aid in further understanding the relationship between fish health and quality as they correlate with survival from smoits to adults.

Task 3.2 Test for specific pathogens.

Spawning and subsequent monitoring of broodstock from the seven WDW Columbia River drainage broodstock hatcheries was carried out from November, 1987 through May, 1988 (Table 8). Processing of assays for IHNV and IPNV was done by the Washington Department of Fisheries (WDF). Processing of assays for EIBS, bacterial and parasitic pathogens was done by WDW staff.

Table 8. Washington Department of Wildlife Broodstock Viral Pathogens Monitoring Results for 1987/88 Spawning Season

Hatchery	Species	Stock	IPNV	I HNV	Percentage EIBS 1/
Beaver Creek	W. Steelhead	Elochoman	neg.	pos .	15
Beaver Creek	SR Cutthroat	Elochoman	neg.	neg.	5
Chelan	S. Steelhead	Ringold	neg.	neg.	28
Cowlitz	W. Steelhead	Cowlltz	neg.	pos .	36
Cowlitz	SR Cutthroat	Cowlitz	neg.	neg.	0
Cowlitz	S. Steelhead	Cowlitz	neg.	pos.	8
Cowlitz	W. Steelhead – Late Timing	Cowlitz	neg.	pos .	NC
Kalama	W. Steelhead (wild stock)	Kalama	neg.	pos .	NT
Lyons Ferry	s. Steelhead	Lyons F.	neg.	neg.	5
Skamania	SR Cutthroat	Washougal	neg.	neg.	NC
Skamania	W. Steelhead	Washougal	neg.	pos .	NC
Toutle	W. Steelhead (wild stock)	Toutle	neg.	pos .	NT
Wells	S. Steelhead	Wells	pos.	neg.	8
Yakima	S. Steelhead	Yakima	neg.	neg.	22

NC – Not completed.
NT = No samples taken.

I/ EIBS data preliminary and subject to revision.

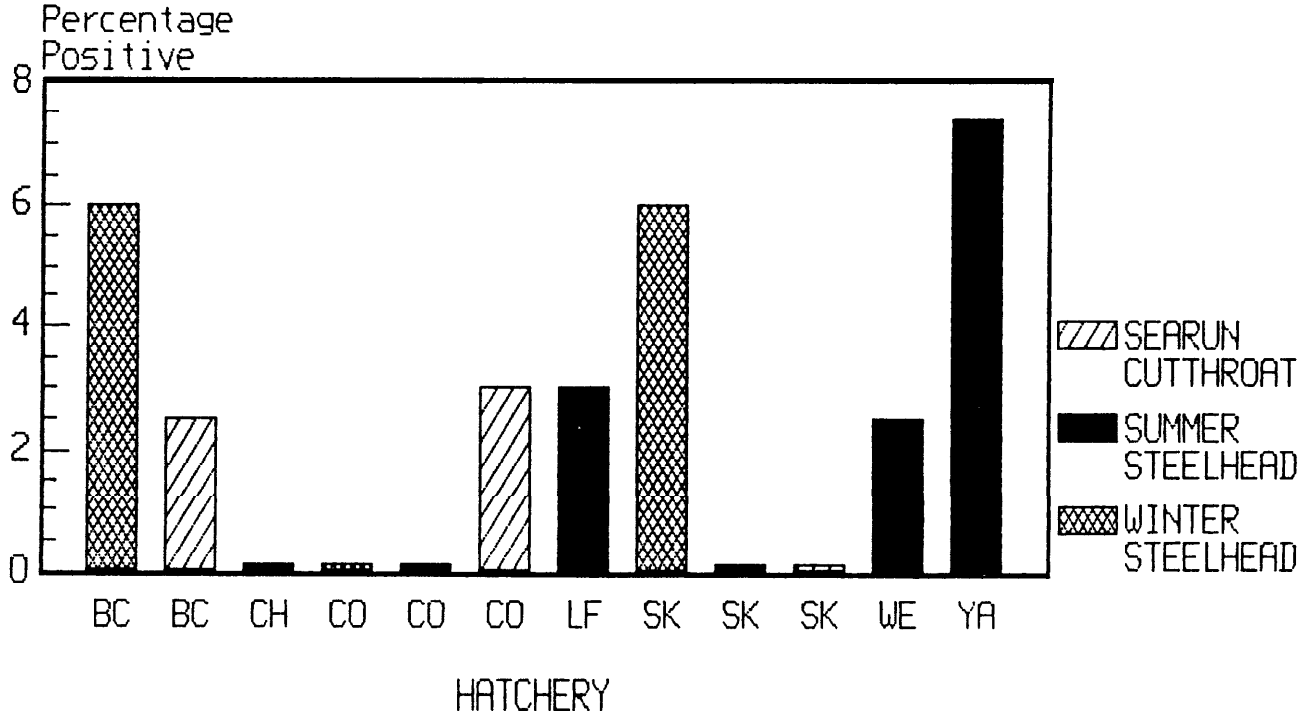
Infectious hematopoietic necrosis virus (IHNV) was isolated in seven of fifteen broodstocks and infectious pancreatic necrosis virus (IPNV) was isolated in one of fifteen broodstocks (see Table 8). Bacterial kidney disease (BKD) values, for samples completed, varied from zero percent positive in several stocks to five percent positive for Beaver Creek winter run steelhead adults (Graph 1). BKD values from 1986, not included in the 1986 report, varied from zero percent positive in several stocks to seven percent positive in Yakima summer run steelhead adults (Graph 2). Erythrocytic Inclusion Body Syndrome (EIBS) samples from the 1987-88 spawning season varied from zero to 38%. EIBS samples processed from the 1986/87 spawning season varied from 5 % positive in Beaver Creek searun cutthroat to 98 % positive In Cowlitz searun cutthroat. These samples were processed prior to the EIBS Workshop of June 1987 and the data will be reevaluated using the criteria developed from those meetings.

Smolt preliberation exams (Table 9) were done March through April, 1988 with none of the twenty six stocks sampled testing positive for IHNV or IPNV. Processing of EIBS samples from Ringold summer run steelhead and Dayton Pond summer run steelhead indicated that they were five and three percent positive respectively. Bacterial kidney disease samples for 1987 have not been processed for any stocks at the time of this report. Values for 1986 not included in the 1986 report varied from zero percent positive in several stocks to 33 percent positive in Coweeman searun cutthroat. Midterm monitoring was done in August, 1987. Results were three, two and five percent positive for Beaver Creek, Cowlitz and Skamania searun cutthroat respectively. Midterm monitoring for 1988 was accomplished during September with the results being zero percent positive for both Beaver Creek and Cowlitz and five percent positive for Skamania searun cutthroat production lots.

Table 9. Preliberation Smolt Monitoring for 1987/88 Rearing Season

Outgrowth Location	Species/ Stock	1987 EIBS	1987 BKD	1988 BKD	Midterm BKD
Alder Ck. Pd	SS/Washougai	8	3	NC	NA
Beaver Ck.	SS/Washougal	30	2/	NC	NA
Beaver Ck.	SW/Elochoman	57	5	NC	NA
Beaver Ck.	CT/Elochoman	25	7	NC	3
Chelan	SS/Wel Is	45	I/	NC	I/
Cottonwood Pd.	SS/Waliowa	35	3	NC	NA
Coweeman #I	SW/Eiochoman	27	7	NC	NA
Coweeman #2	CT/Eiochoman	42	33	NC	NA
Cowlitz	SW/Cowiitz	49	2	NC	NA
Cowlitz	SS/Cowiitz	50	23	NC	NA
Cowlitz	CT/Cowiitz	33	0	NC	2
Cowlitz	SW-Late/Cowlitz	20	13	NC	NA
Curl Lk.	SS/Lyons Ferry	17	I/	NC	NA
Dayton Pd.	SS/Wel Is	32	I/	NC	NA
Gobar Pd.	SS/WS/Washougai/ E iochoman	36	0	NC	NA
Lyons Ferry	SS/Lyons Ferry	50	0	NC	NA
Lyons Ferry	SS/Waiiowa	42	2/	NC	NA
Lyons Ferry	SS/Wel Is	40	0	NC	NA

GRAPH 1.
Washington Department of Wildlife
Bacterial Kidney Disease Broodstock
Sampling 1987-88 Season



GRAPH 2.
Washington Department of Wildlife
Bacterial Kidney Disease Broodstock
Sampling 1986-87 Season

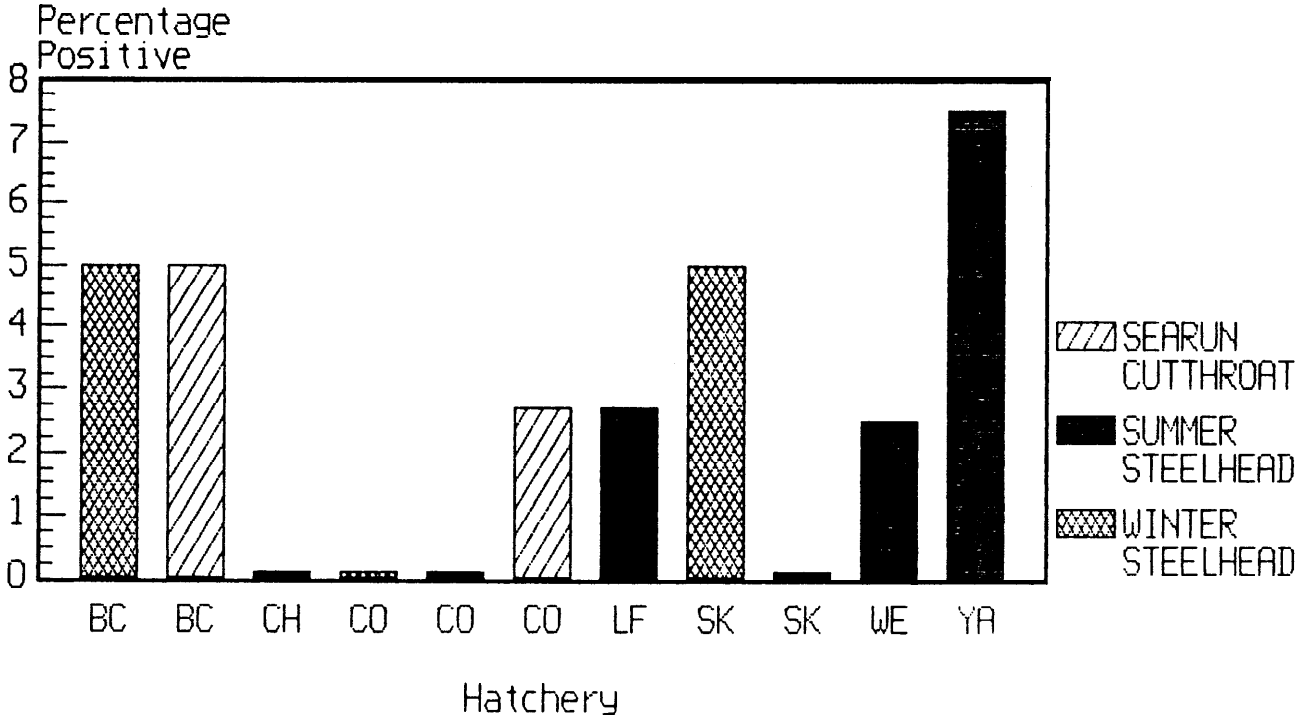


Table 9. (continued) Preliberation Smolt Monitoring for 1987/88 Rearing Season

Outgrowth Location	Species/ Stock	1987 EIBS	1987 BKD	1988 BKD	Midterm BKD
Merwin Net Pens	SS/Eiochoman	7	5	NC	NA
Nelson Spr.	SS/Yakima	27	0	NC	NA
Ringoid	SS/Ringoid	22	0	NC	NA
Skamania	SS/Washougal	22	2/	NC	NA
Skamania	SW/Eiochoman	30	14	NC	NA
Skamania	CT/Eiochoman	33	12	NC	5
S. Toutie Trap	SS/Washougai	40	2	NC	NA
Turtle Rock	SS/Ringoid	55	1/	NC	NA
Vancouver	SS/Washougai	24	5	NC	NA
Welis	SS/Welis	42	0	NC	NA
Yakima	SS/Yakima	17	0	NC	NA

1/ Slides not readable.
2/ Samples lost.

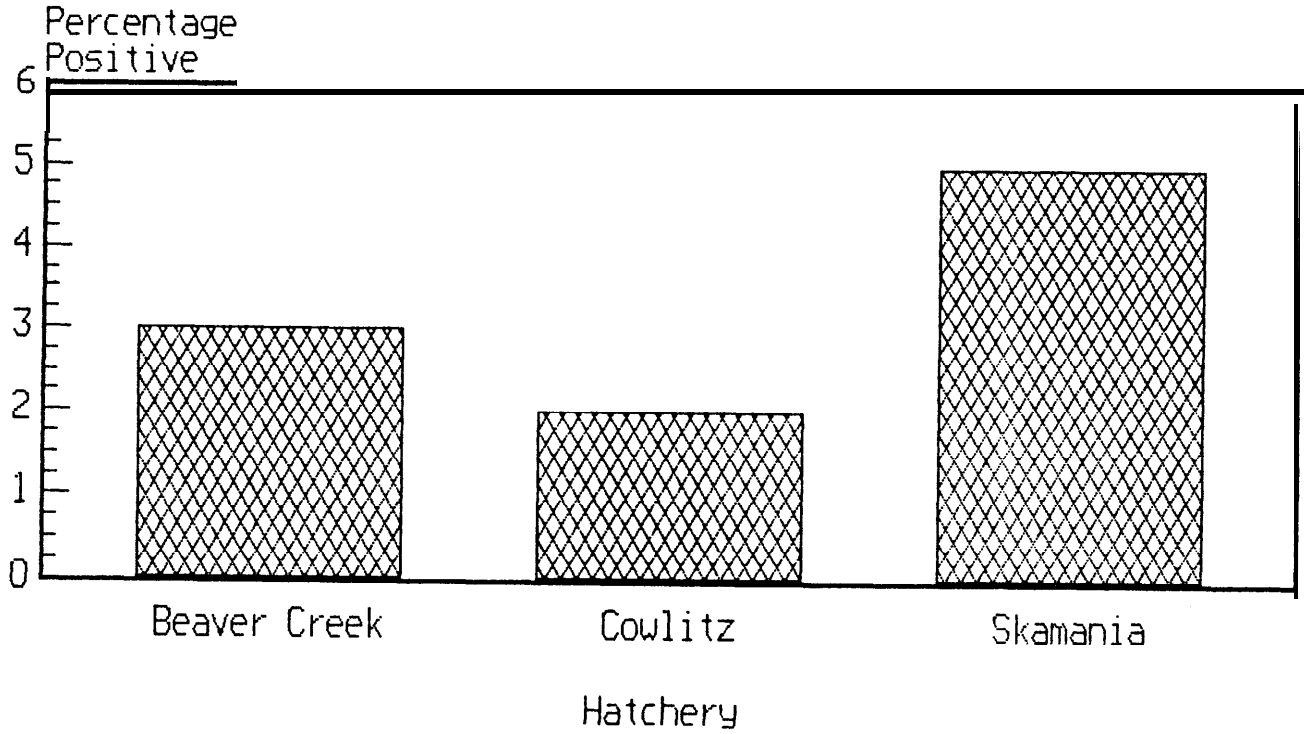
NC - Not completed.
NA - Not applicable.

Samples for Myxobolus cerebralis were taken from numerous sites from December, 1987 through April, 1988, (Table 10) with sampling of additional sites currently in progress. No results have been determined at the time of this report. At the disretion of the pathologists, there was no need to sample for proliferative kidney disease. Ceratomyxa shasta was found only at the Cowlitz hatchery, where it caused mortality in ail stocks of juvenile fish as determined by the presence of clinical signs and spores in moribund and dead fry.

Table 10. Myxobolus cerebral is Sampling Locations for 1987/88

SAMPLE LOCATION	RIVER DRAINAGE	SPECIES	STOCK	DATE SAMPLED
Merwin Res.	Lewis R.	WST-smoits	Elochoman	03/17/88
Gobar Pond	Kaiama R.	WST/SST-smoits	Eiochoman	04/04/88
Alder Pond	Toutle R.	SST/smolts	Elochoman	04/13/88
Beaver Ck.	Eiochoman	WST-smolts	Eiochoman	02/03/88
Cottonwood	Grande Ronde	SST-smolts	Wallowa	04/25/88
Cowlitz	Cowlitz	WST-smolts	Cowlitz	03/22/88
Cowlitz	Cowlitz	SST-smolts	Cowlitz	03/23/88
Curl Lk.	Tucannon	SST-smolts	Lyons Ferry	04/26/88
Skamania	Washougal	WST/SST-smoits	Washougal	3/18/88
Skamania	Washougal	WST-smoits	Washougal	02/03/88
Turtle Rk.	Columbia	SST-smoits	Ringoid	12/17/88
Welis	Columbia	SST-smolts	Welis	02/17/88

GRAPH 3.
W.D.W. Searun Cutthroat
Bacterial Kidney Disease Midterm
Sampling August 1987



Standard techniques for ail sampling and laboratory analysis were described in the 1986 annual report (Gearheard et al, 1987).

Objective 4.0 Monitoring hatchery water supplies.

Task 4.1 Sample hatchery water supplies.

A sampling plan was completed in the 1986 annual report (Gearheard et al., 1987). BPA is soliciting a laboratory to perform the water analysis.

Task 4.2 Monitoring flow and loading densities.

Flow loading index and density loading index data have been collected for all BPA project facilities for the 1987 broodyear. The data was collected and entered into a Lotus l-2-3 worksheet (for example see Appendix A) from which flow and density indexes have been calculated for each pond of fish within each lot of fish. A computer program to summarize the pond data for each hatchery, lot, month, and pond type will be developed in the next year.

Objective 5.0 Record analyze and report fish health monitoring and related data.

Currently, monthly monitoring data and specific pathogen testing information has been entered into a dBASE III+ database. The flow and density data has been entered into Lotus l-2-3 worksheets for each facility.

Objective 6.0 Estimate the project's benefits.

Task 6.1.1 Severity of pathogens and mortality caused.

Completed in 1986 annual report.

Task 6.1.2 Total number and percent loss of each lifestage of fish species.

Lot production mortalities

Lot production data from WDW hatchery reports were entered into a Lotus l-2-3 worksheet. Calculations were made that includes total number and percentage loss for each facility (for example see Appendix B). The average egg mortality for the 1986 broodyear was 12.1% with a range of 6.3 % in winter steelhead at the Cowlitz hatchery to 28.0% in sea run cutthroat at the Beaver Creek hatchery. The average fry mortality for the 1986 broodyear was 12.9% with a range of 0.8% in summer steelhead at Wells hatchery to 55.4% in sea run cutthroat at the Cowlitz hatchery. The resulting egg and fry mortality yielded at overall average mortality from egg to smoit of 21.5%

A summary of the egg and fry mortality for the 1986 broodyear is contained in the following table.

Table 11. A Summary of Egg and Fry Mortality for the 1986 Broodyear.

Hatchery	Species/Stock	Starting NO.	Egg Mort. NO.	Egg Mort. %	Fry Mort. No.	Fry Mort. %	Total Mort. No.	Total Mort. %
Beaver Ck.	SS/Elochoman	137,664	20,000	14.0	14,158	12.0	34,158	26.0
	WS/Elochoman	1,600,OOO	235,255	14.7	264.5	34.5	499,727	49.2
	CT/Elochoman	274,000	76,643	28.0	21,522	18.3	98,165	46.3
Chelan	SS/Wel Is	266,400	10,800	4.1	21,300	8.4	32,100	12.1
Chelan/Turtle Rock	SS/Ringold	875,500	71,400	8.2	30,000	3.7	101,400	11.6
Col. Basin/ Ringold	SS/Ringold				24,000	7.1	24,000	7.1
cowitz	Ss/Cowl itz	537,400	42,679	7.9	47,918	9.7	90,597	17.6
	WS/Cowl itz	1,801,800	113,129	6.3	241.599	14.3	354,728	20.6
	CT/Cowl itz	457,233	83,189	18.2	176,043	55.4	259,232	63.6
Lyons Ferry	SS/Lyons Ferry	705,000	193,000	27.5	46,500	9.1	240,200	9.1
	SS/Wallowa	450,000	16,100	3.6	9,100	2.1	25,200	5.6
	SS/Wel Is	464,800	45,600	9.8	16,200	3.9	61,800	13.3
Naches/Nelson Spring	SS/Yakima				2,700	2.8	2,700	2.8
Skamania	SS/Washougal	1,941,748	155,423	8.0	45,435	17.9	200,858	25.9
	CT/Cowlitz 1/	54,408	3,178	5.8	2,905	5.7	6,083	11.5
	WS/Washougal	300,000	59,906	19.9	5,196	2.5	65,102	22.4
Vancouver	SS/Washougal 1/	109,568	7,600	6.9	16,784	16.5	24,484	23.4
Wells	SS/Wells	2,209,OOO	237,000	10.7	10,100	0.8	247,100	11.2
Yak ima	SS/Yakima	335,300	42,400	12.6	58,500	20.0	100,900	30.1
Average				12.1		12.9		21.5

1 / Egg mortality only includes eyed to hatch.

Lyons Ferry Hatchery

Two stocks of summer steelhead, Wallowa and Wells, were reared at Lyons Ferry hatchery during 1983 to 1985. Both stocks were received at Lyons Ferry as eyed eggs from the respective hatcheries. The average eyed egg to hatch mortality for broodyears 1983 to 1985 was 6.2 % for the Wallowa stock and 5.6 % for Wells stock. The average fry to smolt mortality for broodyears 1983 to 1985 was 5.8 % for the Wallowa stock and 6.6 % for the Wells stock. The total eyed egg to smolt mortality was 11.6 % for the Wallowa stock and 11.8 % for Wells stock. A summary of the egg and fry mortality is shown in Table 12. A broodstock is being developed at this facility.

Table 12. A Summary of Egg and Fry Mortality for the 1986 Broodyear at Lyons Ferry Hatchery

Stock	Broodyear	Starting No.	Egg Mort. No.	Egg Mort. %	Fry Mort. No.	Fry Mort. %	Total Mort. No.	Total Mort. %
Wai Iowa	1983 1/	911,500	58,800	6.5	60,200	7.1	119,100	13.1
	1984 1/	830,400	34,800	4.2	25,900	3.3	60,700	7.3
	1985 1/	377,800	29,400	7.8	25,800	7.1	54,200	14.3
				6.2		5.8		11.6

Stock	Broodyear	Starting No.	Egg Mort. No.	Egg Mort. %	Fry Mort. No.	Fry Mort. %	Total Mort. No.	Total Mort. %
Wel is	1983 1/	474,400	17,800	3.7	30,800	6.8	48,600	10.2
	1984 1/	373,600	33,300	8.9	31,300	9.2	64,600	17.3
	1985 1/	471,200	19,500	4.1	17,200	3.8	36,700	7.8
				5.6		6.6		11.8

1/ Egg mortality only includes eyed to hatch.

Adult prespawning mortalities.

Adult prespawning mortality data from WDW hatchery reports were entered into a Lotus l-2-3 worksheet. Calculations were made that includes total number and percentage loss for each broodstock hatchery. Work has been completed for all Washington hatcheries for brood year 1986. The average overall prespawning steelhead broodstock mortality was 4.5% (Table 13).

Cowlitz River Sumner Steelhead Broodstock.

Cowiitz summer steelhead are trapped at the Cowiitz hatchery during the months of July thruogh October inclusive. During 1986 the total prespawning mortality for the adult summer steelhead was 12.2% (Table 13).

Cowlitz River Winter Steelhead Broodstocks.

Returning normal timing winter steelhead are trapped at the Cowlitz hatchery during the months of November through March inclusive. In 1986, the total prespawning mortality for the normal timing winter steelhead adults was 2.4%. Late timing winter steelhead adults are trapped during late April through early May and are distinguished from the normal timing winter run adults not only through their entry timing but also body condition and size. There were no prespawning mortalities associated with the 1986 brood year of late timing winter run adults (Table 13).

Beaver Creek Winter Steelhead Broodstock.

Returning winter steelhead are trapped at the Beaver Creek hatchery during the months November through February inclusive. in 1986, the total prespawning mortality for the adult winter steelhead was 2.1% (Table 13).

Lyons Ferry Sumner Steelhead Broodstock.

Returning summer steelhead are trapped at the Lyons Ferry hatchery during late summer and early fall. In 1986, the total prespawning mortality for the adult steelhead was 0% (Table 13).

Ringold Summer Steelhead Brwdstock.

Returning summer steelhead are trapped at Ringold rearing pond during late summer and early fail and transported to Cheian hatchery. in 1986, the total prespawning mortality for the adult steelhead was 6.1% (Table 13).

Skamania Summer Steelhead Broodstock.

Returning summer steelhead are trapped at the hatchery during late summer and early fall. In 1986, the total prespawning mortality for the adult steelhead was 12.2% (Table 13).

Skamania Winter Steelhead Broodstock.

Returning winter steelhead adults are trapped at the hatchery rack primarily during November through January. The adults must negotiate a nearly impassable velocity barrier (Table 2 Facility Impediments) approximately 100 meters downstream of the hatchery ladder prior to entering the trap. in 1986, total prespawning mortality for the adult winter steelhead was 0.0% (Table 13). However, because of the difficulty of passing the downstream barrier the overall egg quality was considered poor.

Wells Summer Steelhead Brwdstock.

Returning summer steelhead are trapped at west bank fish ladder at Wells dam during late summer and early fall. In 1986, the average total prespawning mortality for the adult steelhead was 0.6 % (Table 13).

Yakima Sumner Steelhead Brwdstock.

Returning summer steelhead are trapped at Prosser dam and transported to Yakima hatchery during late summer and early fall. The average total prespawning mortality for the adult steelhead was 9.1% (Table 13).

Table 13. A summary of Prespawning Mortality for 1986.

Hatchery	Species-Stock	No. Trapped	No.	%
Beaver Ck.	WS-Eiochoman	1,214	26	2.1
	CT-Elochoman	741	8	0.1
Chelan	SS-Ringold	588	36	6.1
Cowl itz	SCT-Cowlitz	1,313	62	4.7
	SS-Cowlltz	713	87	12.2
	WS-Cowiitz	1,280	31	2.4
Lyons Ferry	SS-Lyons Ferry	385	0	0.0
Skamania	SS-Washougai	713	87	12.2
	WS-Washougal	493	0	0.0
Wel Is	SS-Wel Is	650	4	0.6
Yak ima	SS-Yak ima	132	12	9.1
Average		747	32	4.5%

Toutie River Winter Steelhead Brwdstock

Winter steelhead returning to the north and south forks of the Toutle River were captured by hook and line using volunteer and department labor during March and April. Ail adults were held in transport tubes prior to moving them by tank truck to the adult holding trap on Brownell (sometimes referred to as Jordan) Ck. The total prespawning mortality in 1988 for the adult winter steelhead was 0.0%.

Task 6.1.3

Daily pond mortality sheets, hatchery pond inventory records, and fish pathologist records (Roberts, et al., 1987) were examined for data including hatchery, date, species, disease, numer and percent mortality. Also, the type and amount of medication used to treat the epzizootlcs were noted. The following information is for the period from July 1, 1986 to June 30, 1987.

Epizootics of serious disease were noted at a number of hatcheries during the July 1, 1986 to June 30, 1987. The disease ranged from chronic mortality from Ceratomyxosis at Cowlitz hatchery to furunculosis in summer steelhead at Columbia Basin and Beaver Creek hatcheries.

A summary of the epizootics which occurred at WDW Columbia basin hatcheries and rearing ponds follows in Table 14.

Table 14. Summary of Epizwtics at WDW Columbia Basin Hatcheries and Rearing Ponds, July 1, 1986 to June 30, 1987.

Hatchery	Date	Species	Disease	Mortality No.	Mortality %	Medication Type	Medication Amount
Beaver Ck.	7-86	SW	FUR	NA	NA	NA	NA
	6-87	SW	FUR	NA	NA	NA	NA

Table 14. (continued) Summary of Epizwtics at WDW Columbia Basin Hatcheries and Rearing Ponds, July 1, 1986 to June 30, 1987.

Cowiitz 1 /	6-87	SW	IHN	92,595	29.3	NA	
Col. Basin	6-87	ss	FUR	16,200	5.2	Romet-30	16 #
Gobar Pd.	4-87	ss	IHN	NA	NA	None	
Nelson Spgs.	2-87	ss	BCWD	700	0.8	TM-50	NA
Skamania	3-87	ss	IHN	23,857	6.9	None	

1 / Includes 60,895 fry destroyed to prevent additional infection of ponds downstream on reuse water.

FUR = Furunculosis

IHN - infectious Haematopoietic Necrosis

BCWD = Bacteria Cold Water Disease

NA = Not available

Task 6.1.4

Data from WDW hatchery reports were entered into a Lotus l-2-3 worksheet. Calculations were made that includes total pounds of feed fed per total pounds of fish produced (i.e. feed conversion). Work has been completed for ail Washington operations for the 1986 broodyears.

The average feed conversion for the 1986 broodyear summer steelhead lots was 1.28 with a range from 0.77 for Naches – Nelson Springs to 1.76 for summer steelhead at Cowlitz. A summary of feed conversions for the 1986 broodyear for the Washington facilities is contained in Table 15.

Table 15. Feed Conversion for Steelhead Lots, 1986 Brwdyears.

Hatchery	Species-Stock	Feed Conversion 1986
Beaver Ck.	SS-Washougal	1.73
	WS-Eiochoman	1.23
Chelan	SS-We l l s	1.Ol
Cheian – Turtle Rock	SS-Ringold	1.25
Columbia Basin – Ringoid	SS-Ringold	1.57
Cowlitz	SS-Cowiitz	1.76
	WS-Cowiitz	1.59
Lyons Ferry	SS-Lyons Ferry	1.03
	SS-Waiiowa	1.29
	SS-Yak ima	0.77
Naches – Nelson Springs	SS-Yak ima	0.77
Skamania	SS-Washougai	0.81
	WS-Elochoman	1.28
Welis	SS-Wel is	1.32
Yakima	SS-Yak ima	1.16
	Average	1.28

Feed conversion data was also completed for Lyons Ferry hatchery summer steelhead lots for the 1983 to 1985 broodyears. The average feed conversion for the two lots of steelhead reared was 1.51, 1.14, and 1.32 for 1983, 1984, and 1985 respectively. A summary of feed conversions for Lyons Ferry hatchery for 1983 to 1985 broodyears in shown in Table 16.

Table 16. Feed Conversions for Lyons Ferry Hatchery 1983 – 1985 Brwdyears

Hatchery	Species/Stock	Feed Conversion 1983	1984	1985
Lyons Ferry	SS/Waliowa	1.35	0.96	1.41
	SS/Wel is	1.68	1.32	1.24
	Average	1.51	1.14	1.32

Task 6.1.5 Total survival of smolts to adults from index hatcheries will be monitored.

Tag and marking data for contribution and hatchery rack return is currently being compiled for Wells Hatchery summer and Cowlitz summer and winter steelhead. Data will continue to be compiled during the next contract year and in future annual reports.

Acknowledgements

Thanks to the Bonneville Power Administration for their financial support of this project. Washington Department of Wildlife hatchery managers and their staffs for providing valuable assistance in accessing records, collecting samples and data. Further thanks go to Kathy Hopper and the staff at the Washington Department of Fisheries, fish virology laboratory for their continuing efforts in testing collected samples for viral agents.

Literature Cited

Gearheard, J., S. Roberts, D. Chase, and B. Bolding, 1987 Augmented Fish Health Monitoring for Washington Department of Wildlife, 1986 Annual Report. BPA Project No. 86-54.

Roberts, S., W. Brunson, and D. Chase, 1987. Pathology of Fish Diseases and Promotion of Fish Health. Progress Report, D-J Project F-56-R-19. 44 pgs.

APPEND ICES

Appendix 1: Flow and Density Loading Spreadsheet

Hat.	Sampling Date	Pond No.	Lot. No.	Spp. Type (1-4)	Stock ID #	Pond Type	Pond Vol. (cuft)	Water Temp. (F)	Water Infl. (gpm)	No. of Fish	Mort.	Avg. Size (nolb)	Fish Length (mm)	Biom.	Cal. MDI	Cal. FLI
302	01-Mar-88	1	5	2	051SS	R	2390	54	200	23621	27	9.7	186	2435	4550	2335
302	01-Mar-88	2	5	2	051SS	R	2390	54	200	20070	12	6.1	202	3290	4942	2536
302	01-Mar-88	3	5	2	051SS	R	2390	54	200	20430	9	6.4	194	3192	4746	2436
302	01-Mar-88	9	5	2	051SS	R	2390	54	340	21173	14	5.0	228	4235	5578	4866
302	01-Mar-88	10	5	2	051SS	R	2390	54	340	20401	18	5.0	220	4080	5382	4696
302	01-Mar-88	11	5	2	051SS	R	2390	54	340	20893	20	6.0	216	3482	5284	4610
302	01-Mar-88	12	5	2	051SS	R	2390	54	340	23711	30	6.3	192	3764	4697	4098
302	01-Mar-88	6	5	2	051SS	R	2390	54	200	20216	8	6.0	204	3369	4991	2561
302	01-Mar-88	7	5	2	051SS	R	2390	54	200	23668	28	7.0	191	3381	4673	2398
302	31-Jan-88	1	5	2	051SS	R	2390	54	400	23649	51	9.2	160	2571	3914	4018
302	31-Jan-88	2	5	2	051SS	R	2390	54	400	20083	13	7.1	186	2829	4550	4671
302	31-Jan-88	3	5	2	051SS	R	2390	54	400	20440	8	7.7	197	2655	4820	4947
302	31-Jan-88	9	5	2	051SS	R	2390	54	400	21188	22	5.0	205	4238	5015	5148
302	31-Jan-88	10	5	2	051SS	R	2390	54	400	20420	31	5.0	196	4084	4795	4922
302	31-Jan-88	11	5	2	051SS	R	2390	54	400	20913	25	7.0	199	2988	4868	4997
302	31-Jan-88	12	5	2	051SS	R	2390	54	400	23745	58	7.3	188	3253	4599	4721
302	31-Jan-88	6	5	2	051SS	R	2390	54	400	20225	12	6.0	195	3371	4771	4897
302	31-Jan-88	7	5	2	051SS	R	2390	54	400	23697	46	9.0	179	2633	4379	4495
302	31-Dec-87	1	5	2	051SS	R	2390	56	400	23701	65	12.9	150	1837	3670	3500
302	31-Dec-87	2	5	2	051SS	R	2390	56	400	20097	25	9.6	160	2093	3914	3734
302	31-Dec-87	3	5	2	051SS	R	2390	56	400	20449	10	10.0	168	2045	4110	3921
302	31-Dec-87	9	5	2	051SS	R	2390	56	400	20235	20	7.0	193	2891	4722	4504
302	31-Dec-87	10	5	2	051SS	R	2390	56	400	21235	32	7.0	184	3034	4501	4294
302	31-Dec-87	11	5	2	051SS	R	2390	56	400	20424	27	8.0	169	2553	4135	3944
302	31-Dec-87	12	5	2	051SS	R	2390	56	400	20919	32	10.5	154	1992	3768	3594
302	31-Dec-87	6	5	2	051SS	R	2390	56	400	23749	18	9.0	176	2639	4306	4107
302	31-Dec-87	7	5	2	051SS	R	2390	56	400	20238	46	13.0	165	1557	4037	3851
302	30-Nov-87	1	5	2	051SS	R	2390	56	400	38181	100	17.8	129	2145	3156	3010
302	30-Nov-87	2	5	2	051SS	R	2390	56	400	34258	13	12.0	153	2855	3743	3570
302	30-Nov-87	3	5	2	051SS	R	2390	56	400	36579	16	11.2	147	3266	3596	3430
302	30-Nov-87	9	5	2	051SS	R	2390	56	400	21255	30	9.0	180	2362	4404	4201
302	30-Nov-87	10	5	2	051SS	R	2390	56	400	20456	42	9.0	183	2273	4477	4271
302	30-Nov-87	11	5	2	051SS	R	2390	56	400	20941	18	9.0	176	2327	4306	4107
302	30-Nov-87	12	5	2	051SS	R	2390	56	400	33156	40	12.2	163	2718	3988	3804

% of MDI	% of FLI	D.I.	F.I.	% Mort.	K-Fact
53.52	104.28	0.14	1.66	0.11	0.73
66.58	129.73	0.17	2.07	0.06	0.90
67.26	131.06	0.17	2.09	0.04	0.97
75.92	87.02	0.20	1.39	0.07	0.77
75.81	86.89	0.20	1.39	0.09	0.85
65.90	75.53	0.17	1.20	0.10	0.75
80.13	91.84	0.21	1.46	0.13	1.02
67.51	131.55	0.18	2.10	0.04	0.89
72.36	141.00	0.19	2.25	0.12	0.93
65.67	63.98	0.17	1.02	0.22	1.20
62.16	60.56	0.16	0.97	0.06	0.99
55.08	53.66	0.14	0.86	0.04	0.77
84.49	82.32	0.22	1.31	0.10	1.05
85.17	82.98	0.22	1.32	0.15	1.21
61.37	59.79	0.16	0.95	0.12	0.82
70.72	68.90	0.18	1.10	0.24	0.94
70.66	68.84	0.18	1.10	0.06	1.02
60.13	58.58	0.16	0.93	0.19	0.88
50.07	52.49	0.13	0.76	0.27	1.04
53.48	56.07	0.14	0.83	0.12	1.15
49.75	52.16	0.13	0.77	0.05	0.96
61.22	64.18	0.16	0.95	0.10	0.90
67.39	70.65	0.18	1.05	0.15	1.04
61.75	64.73	0.16	0.96	0.13	1.18
52.89	55.44	0.14	0.82	0.15	1.18
61.29	64.25	0.16	0.95	0.08	0.93
38.37	40.43	0.10	0.60	0.23	0.78
67.97	71.25	0.18	1.06	0.26	1.19
76.27	79.96	0.20	1.18	0.04	1.06
90.82	95.21	0.24	1.41	0.04	1.28
53.63	56.22	0.14	0.83	0.14	0.86
50.77	53.22	0.13	0.79	0.21	0.82
54.04	56.65	0.14	0.84	0.09	0.97
68.15	71.45	0.18	1.06	0.12	0.86

Appendix 2: Lot Production Spreadsheet.

Location:
Species: Summer Steel head Stock: Brood yr:

Egg Data:

Date	No.Tak/Rcd	Mort.	Shipped	Egg Balance
Jan-84				ERR
Feb-84				ERR
Mar-84				ERR
	0	0	0	0

Fish Data:

Starting No: Size: 2,500 Weight: ERR

Date	Mort.	% Mort.	Shipped No.	Shipped Weight	Balance No.	Balance Weight	Size (No/Lb)	Feed
Feb-84		ERR	0	0	ERR	0	ERR	
Mar-84		ERR	0	0	ERR	0	ERR	
Apr-84		ERR	0	0	ERR	0	ERR	
May-84		ERR	0	0	ERR	0	ERR	
Jun-84		ERR	0	0	ERR	0	ERR	
Jul-84		ERR	0	0	ERR	0	ERR	
Aug-84		ERR	0	0	ERR	0	ERR	
Sep-84		ERR	0	0	ERR	0	ERR	
Oct-84		ERR	0	0	ERR	0	ERR	
Nov-84		ERR	0	0	ERR	0	ERR	
Dec-84		ERR	0	0	ERR	0	ERR	
Jan-85		ERR	0	0	ERR	0	ERR	
Feb-85		ERR	0	0	ERR	0	ERR	
Mar-85		ERR	0	0	ERR	0	ERR	
Apr-85		ERR	0	0	ERR	0	ERR	
May-85		ERR	0	0	ERR	0	ERR	
	0	ERR	0	0	ERR			0