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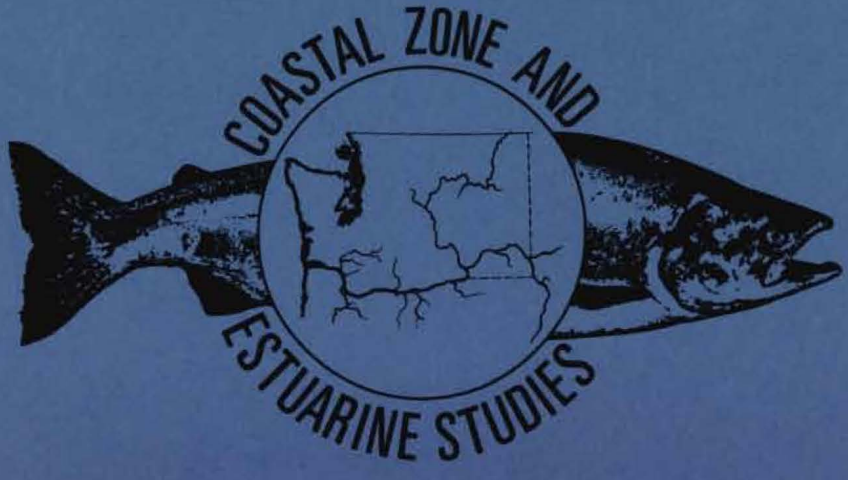

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INTRODUCTION

In 1985, the National Marine Fisheries Service (NMFS), under contract to the U.S. Army Corps of Engineers (COE) continued to evaluate the effects of collection and transportation on juvenile salmonids at dams on the Columbia and Snake Rivers. This year, the major research objectives were: (1) continue evaluation of previous transport efforts by recovery of adults, tagged as juveniles, from the various fisheries, hatcheries, natal spawning areas, and dams and (2) determine the relative condition of juvenile spring chinook salmon, sampled from various points within the collection/transportation system at Lower Granite Dam, by monitoring their ability to survive an extended rearing period (120+ days) in artificial seawater.

ADULT RETURNS TO THE COLUMBIA AND SNAKE RIVERS

Returns of tagged adult fall chinook salmon, transported as juveniles from McNary Dam between 1981 and 1983, were monitored throughout 1985. We also monitored the return of tagged adult spring/summer chinook salmon and steelhead transported from Lower Granite Dam in 1983-1984 and 1984, respectively.

Tagged adults were recovered by operating automatic tag detection equipment and trapping facilities in fishways at Bonneville, McNary, and Lower Granite Dams. The Bonneville Dam facilities were operated from 1 June to 15 October (there were periods of non-operation due to construction and testing of the new adult collection facility in the Washington shore fishway; however, these activities did not impact the recovery of fall chinook salmon--the targeted species). The facilities at McNary Dam were operated from 15 June to 15 November, and the facilities at Lower Granite Dam were operated from

1 March to 20 November. Additional tagged adults were recovered from hatcheries, natal spawning areas, Columbia and Snake River sport fisheries, and commercial fisheries in both the Columbia River and ocean harvest areas.

Several problems occurred during 1985 that limit our ability to present up-to-date adult return data in this report: (1) fall chinook salmon marked at McNary Dam in 1981 and subsequently recovered in the Alaska ocean fisheries were reported to another agency in error, and we have not yet received data from the approximately 100 coded-wire tags (CWT); (2) in December 1985, our computer in Pasco, Washington, was destroyed by water damage from broken water pipes (stored data were saved, and we are in the process of transferring the data to a new computer, which requires reprogramming to access data files); and (3) CWTs from spring chinook salmon marked at Lower Granite Dam in 1983 and 1984 and later recovered in Idaho hatcheries are not meaningful because of errors in data or fish handling. Steps are being taken to remove sources of error and restore an orderly flow of recovery data from the Idaho Department of Fish and Game to the NMFS. Because of the aforementioned problems, no adult recovery summary tables are presented in this report.

Fall Chinook Salmon - McNary Dam

During 1985, 113 tagged fish were recovered at dams and in various fisheries. During adult spawning migrations in 1985, a total of 69 fall chinook salmon returning to the Columbia River were trapped at Bonneville and McNary Dams. All returns were from tests in 1982 and 1983. Since the 1984 report (Matthews et al. 1985), an additional 44 tags from the 1982 test were recovered in Columbia River and ocean fisheries. The above data have been entered in our tag return data base and are included in Figure 1 which provides a summary of transportation benefits for fall chinook salmon from 1978 to 1983.

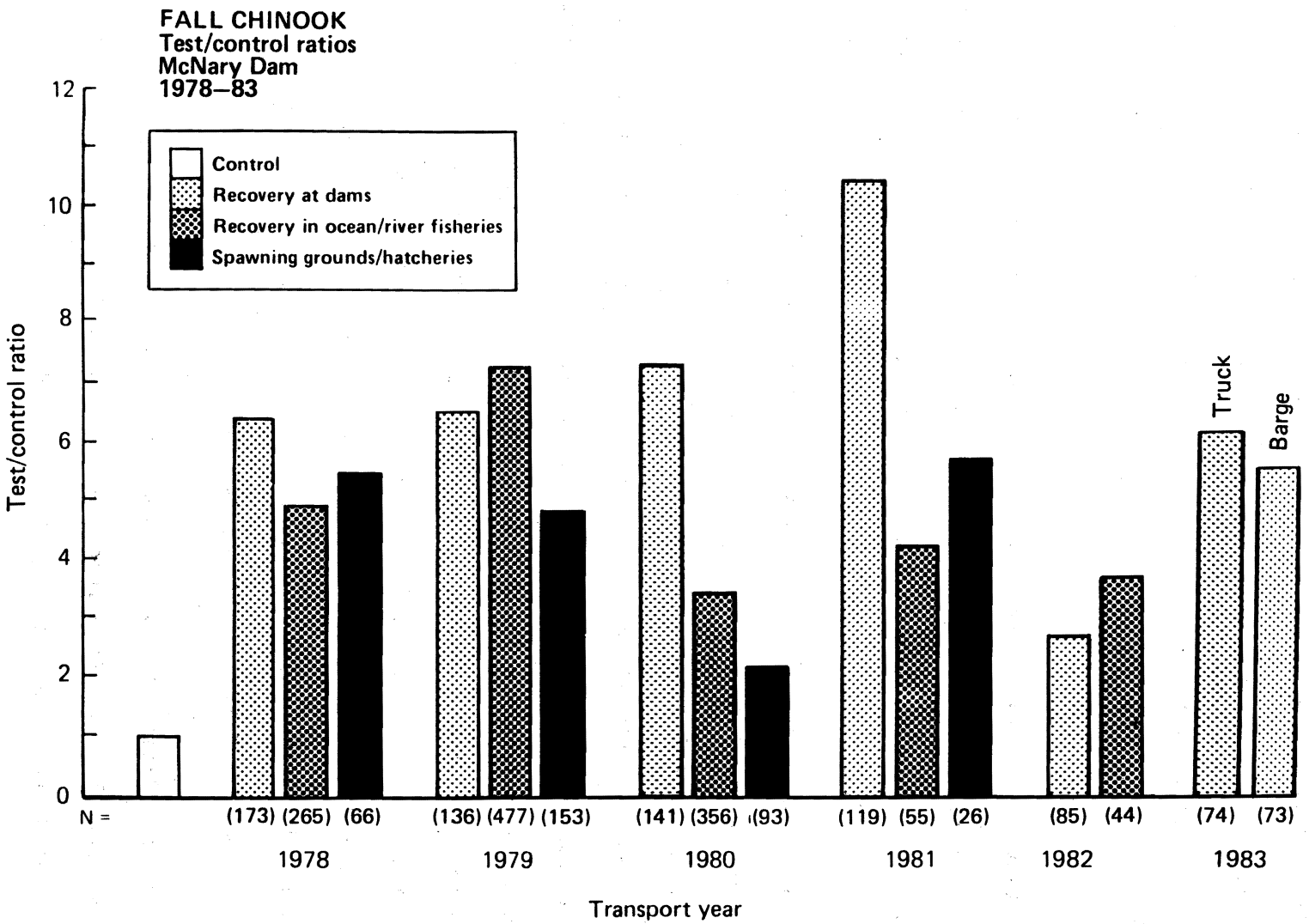

Figure 1.--Transport/control ratios for McNary Dam truck transportation tests with fall chinook salmon, 1978-1983 (includes barge test group for 1983).

During 1982 and 1983, fall chinook salmon were marked in sublots coinciding with early, middle, and late phases of smolt migration (Park et al. 1983, 1984), Each lot represented approximately a 2-week time frame. The objectives were to determine if survival was comparable throughout the migration and if transport benefits were realized in each of the three phases of migration.

The adult return and recovery data are preliminary and can only indicate trends; final returns from the 1982 and 1983 releases are expected in 1986 and 1987. In 1982, survival of controls was highest during the middle phase, whereas survival of transported fish was highest during the late phase (Table 1). Though transport/control ratios showed transport benefit during all phases, by far the highest ratio was realized during the late phase (about 7:1). In 1983, survival of controls was very poor during the middle phase, and survival of trucked and barged fish was more uniform throughout the season. Survival was highest during the middle phase, and resulted in very high benefit ratios (18:1 for trucked fish and 13:1 for barged fish).

Schreck et al. (1983) determined that stress (as measured by plasma cortisol) associated with collection of fall chinook salmon was highest during the late phase of migration in 1982 (Schreck characterized the late phase of the migration as 2-10 August, which differs only slightly from our characterization of 26 July to 6 August). There may be some short-term effects of stress (perhaps even some mortality) during collection, however, the differential stress noted over the three phases apparently has minimal long-term effect on survival of transported fish.

Spring Chinook Salmon and Steelhead - Lower Granite Dam

In 1983 and 1984, spring chinook salmon and steelhead (1984 only) smolts were marked with CWTs to identify four to seven sublots for each year's release (Park et al. 1984; Matthews et al. 1985). The fish were marked to

Table 1.--Return of adult fall chinook salmon marked as smolts at McNary Dam during early, middle, and late phases of downstream migration, 1982-1983. Data are based on recoveries in all fisheries and returns to dams on the Columbia River.

Year and group	Early N	Early (%)	Mid N	Mid (%)	Late N	Late (%)	Total N	Total (%)
1982								
Control	6	(0.069)	21	(0.111)	7	(0.063)	34	(0.088)
Truck	7	(0.130)	24	(0.128)	68	(0.438)	99	(0.249)
1983								
Control	6	(0.040)	2	(0.013)	5	(0.047)	13	(0.032)
Truck	30	(0.199)	33	(0.236)	9	(0.145)	72	(0.204)
Barge	29	(0.193)	30	(0.197)	15	(0.141)	74	(0.190)

index the relative success of the barge transportation program. No controls of either species were marked. A comparison will be made between sublots within each year when return data are complete.

During 1985, 99 2-ocean age and 11 1-ocean age spring chinook salmon returned to Lower Granite Dam from the sublots released in 1983 and 1984. When the 9 jacks that returned in 1984 were added to the total, we have 119 adult chinook salmon returns so far. In addition, we have 234 adult steelhead returns from the 1984 releases.

The incomplete adult returns to date only allow preliminary analyses. It is not possible to state the returns of spring chinook salmon and steelhead to the Snake River in terms of benefit ratios because no control groups were paired with the transport groups. The return rate (0.24%) for spring chinook salmon marked in 1983 was the highest since 1975 (Table 2). This is correlated with the large return of 2-ocean age unmarked fish to Lower Granite Dam in 1985. However, without a measure of total rate of return based on trap efficiency, overall survival compared to that in other years cannot be determined. This could be determined from the return of marked fish reported from hatcheries in Idaho, although no spring chinook salmon recovery data for Idaho hatcheries will be available for 1985. The rate of return of 1-ocean age steelhead was 0.7%. Compared to previous years, survival of the 1984 transport group was also apparently high (Table 3). It should be noted, though, that the estimated return rate for steelhead is heavily influenced by whether the make-up of the run is mostly "A" run fish (primarily 1-ocean age) or mostly "B" run fish (primarily 2-ocean age). This will not be known until returns of 2-ocean fish are complete (spring 1987).

Table 2.--A comparison of observed return rates for spring chinook salmon transported in prior years with the observed return rate for smolts transported in 1983. The percent return is based on 1- and 2-ocean age fish in all years.

Year	Transport mode	Number of observed returns	Percent return
1983	Barge	108	0.241
1978	Barge	56	0.099
1975	Truck	176	0.257
1973	Truck	341	0.241
1971	Truck	173	0.262

Table 3.--A comparison of observed return rates for steelhead transported in prior years with the observed return rate for smolts transported in 1984. The percent return is based on 1-ocean age fish in all years.

Year	Transport mode	Number of observed returns	Percent return
1984	Barge	234	0.698
1978	Barge	328	0.744
1975	Truck	235	0.389
1973	Truck	352	0.956
1972	Truck	202	0.739
1971	Truck	166	0.369

EXTENDED SEAWATER HOLDING STUDY, LOWER GRANITE DAM

Introduction

Adult runs of upriver spring chinook salmon have declined drastically in the Snake River basin since 1975. Collection and transportation of juvenile migrants at Snake and Columbia River dams has been used in varying degrees to increase smolt survival and enhance the runs of adult fish. The percent returns of transported spring chinook salmon have been good in some years (1968, 1975, and 1983), but in other years (1972 and 1976 through 1980) the returns have been dismal. Park (1985) noted that in years when the return of transported smolts was poor, the return of non-transported smolts was also poor. In the years noted, the corresponding return of jacks was poor which leads us to believe that some anomaly affects a variety of upriver spring chinook salmon stocks following their arrival in the Columbia River estuary and ocean.

It is increasingly apparent that BKD is present at high levels in a latent or sub-clinical state in hatchery spring chinook salmon in the Snake River Basin. A severe epizootic of bacterial kidney disease (BKD) following stress associated with seawater entry is a factor that could drastically affect the survival of both transported and non-transported fish--thus severely limiting potential transport benefits. These infections can be activated by stress, and the disease progression is chronic in nature. Therefore, if stresses associated with collection, bypass, transportation practices, or seawater adaptation activate sub-clinical BKD infections, smolts should begin dying 20 to 90 days later during estuary or early ocean residence.

Recent studies strongly support the concept that BKD plays a major role in severely limiting the ocean survival of spring chinook salmon. Banner et

al. (1983) found that spring chinook salmon smolts from three Oregon hatcheries suffered BKD-attributed losses ranging from 45 to 81% after 200 days in seawater. Similarly, Congleton et al. (1985) presented data indicating that spring chinook salmon smolts from several Idaho hatcheries suffered BKD-attributed mortalities ranging from 33 to 85% after 130 days in seawater. In both studies, test fish were exposed to stresses associated with capture and loading at the hatcheries and subsequent transfer to the seawater facilities. It is not yet known whether relatively unstressed naturally-migrating smolts, or smolts exposed to various types of stresses of collection and transportation, would suffer similar mortalities.

In 1984, the NMFS began to look at this problem. In an initial study, naturally-migrating spring chinook salmon smolts were sampled from several areas of the collection and transport system at Lower Granite Dam and held in an artificial seawater recirculation system at the dam for 43 days (Matthews et al. 1985). The test was intended for 120 days but was involuntarily terminated when a main water valve was inexplicably closed. Limited information from this study demonstrated that BKD does impact to an undetermined extent the survival of collected and transported spring chinook salmon smolts. In spring 1985, we repeated the study at Lower Granite Dam and successfully held the test fish in the artificial seawater recirculation system for 140+ days. Results of this study are reported here.

Methods

A schematic of the artificial seawater recirculation system used in this study and described by Matthews et al. (1985) is shown in Fig. 2. Artificial seawater was recirculated sequentially through a series of devices designed to

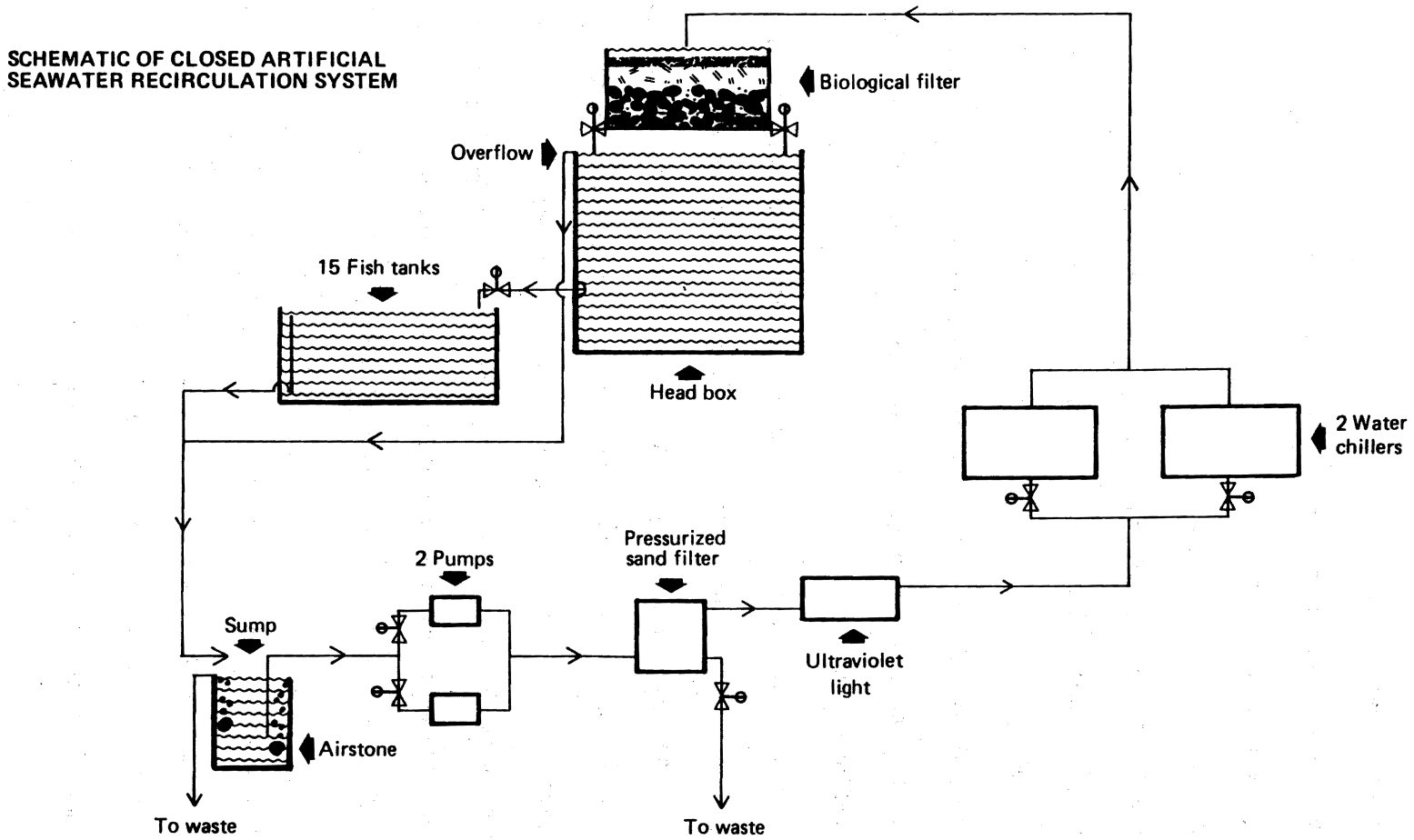

Figure 2.--Schematic of closed artificial seawater recirculation system designed to hold spring chinook salmon smolts for 120+ days at Lower Granite Dam, 1984.

purify, filter, chill, and re-aerate the water. An alarm system was installed this year to alert employees to interrupted water flow. Water quality variables within the system, including temperature, oxygen, pH, salinity, and un-ionized ammonia (NH_3), were recorded daily.

On 26 April, near the peak of the outmigration, we sampled and placed in the holding tanks three randomized replicates each of approximately 100 spring chinook salmon smolts from the areas described below:

1. C-slot Gatewell Group (control). This group represented smolts that volitionaly entered these gatewells and, therefore, were exposed to minimal stresses (Park et al. 1983).

2. Pre-separator Group (PRS). This group represented smolts that were exposed to stresses in passing from the gatewells and through the bypass gallery, downwell, and pipe areas.

3. Transport Group. This group represented smolts that passed through the same areas as the previous group and, in addition, were exposed to any stresses associated with passage through the fish separator and raceway complex and an 8-h simulated truck transport in a small experimental fish transport tanker (Achord et al. 1984) at 0.5 lb fish/gal water.

4. Mark + Transport Group. This group represented smolts that were exposed to the same stresses as the previous group. Further, they were handled and marked utilizing our pre-anesthesia concept (Park et al. 1983, 1984).

The 12 test replicates of smolts were sampled and transferred to the fish holding tanks utilizing water-to-water transfer techniques developed for short-term seawater challenge stress tests (Park et al. 1983). The fish were held in fresh water for 2 days before salinity was gradually increased by 1.5

to 3.0 ppt daily over a 26-day period until full-strength (30 ppt) seawater was achieved. Thereafter, we replaced approximately 2% of the artificial seawater daily throughout the study.

All test fish were fed to satiation three times daily with Oregon moist pellet (OMP) fish formula. Excess feed along with fish excrement was vacuumed from the tank bottoms every third day.

Mortalities were removed daily, weighed, measured to fork length, checked for descaling and other external abnormalities, and frozen. Later, each mortality was necropsied and critically examined for the presence of BKD lesions and other abnormalities. The sensitive and highly-specific indirect fluorescent antibody technique (IFAT) was used to diagnose the presence of BKD organisms in all mortalities (Novotny and Zaugg 1979). In addition, we developed a system based upon numbers of BKD organisms per microscopic field for estimating the relative intensity or severity of infections among the mortalities. In this procedure, each mortality was given a numerical rating based on the following observations:

0 = no BKD organisms found in a minimum of 300 microscopic fields.

-1 = an average of less than 1 BKD organism per microscopic field.

1 = an average of 1 to 10 BKD organisms per microscopic field.

2 = an average of 10 to 100 BKD organisms per microscopic field.

3 = an average of 100 to 300 BKD organisms per microscopic field

4 = an average of 300+ BKD organisms per microscopic field.

This information provided not only a BKD incidence level among the mortalities but also a rough estimate of the likelihood that the disease was responsible for the individual deaths. To calculate this estimate, mortalities with ratings of 2 through 4 were combined and considered the

minimum number of mortalities likely attributable to BKD; likewise, mortalities with ratings of 1 through 4 were combined and considered the maximum number of mortalities likely attributable to BKD.

At the end of the study, all surviving fish were individually weighed and measured to fork length. In addition, we randomly sampled 10 fish from each test replicate for IFAT analysis.

We used two tests for statistical analyses of the mortality data. First, the log-rank test (Anderson et al. 1980) with the chi-square statistic was used to test for homogeneity within the test group replicates and for overall differences among the test groups during the entire period. This test is more efficient than a summary comparison because information is used from individual time-intervals. Second, we used a contingency table analysis utilizing the G-statistic (Sokal and Rohlf 1981) to test for differences from the beginning of the test until Week 12 and from Week 12 to the end of the test.

Analysis of variance (ANOVA) was used to statistically compare length/weight relationships at the end of the study. Significance in all statistical tests was established at $P<0.05$.

Results and Discussion

The recirculation system performed well. All critical water-quality variables that we measured stayed within the desired ranges for the duration of the study (Appendix Table 3). When we terminated the study in September, the surviving fish showed no ill effects from being held in this system; they looked as if they had been sampled directly from the ocean. The population had an average increase of 35-40 mm in length and their weight nearly doubled (Table 4, Appendix Table 2). ANOVA statistical analysis indicated no

Table 4.--The average length and weight (± S.E.), by test group and replicate, of surviving fish at the termination of the extended seawater holding study.

Groups:	C-Slot (control)	PRS	Transport	Mark + transport
		Length (mm)		
Replicate				
1	151	153	147	154
2	146	147	156	148
3	149	152	153	153
Test average	149 ± 1.5	151 ± 1.9	152 ± 2.4	152 ± 2.2
		Weight (g)		
Replicate				
1	41.8	44.5	39.9	45.3
2	37.9	38.1	45.8	42.3
3	41.0	44.2	45.8	43.0
Test average	40.1 ± 1.3	42.3 ± 1.8	44.1 ± 2.4	43.6 ± 2.5

significant differences ($P < 0.05$) in length/weight relationships among any of the test groups.

The four replicated test groups were held in the experimental system for 146 days, of which 116 were spent in full-strength seawater. By the end of the test, mortality levels were high in all test groups, ranging from 60.3% in the C-slot Gatewell Group to 75.9% in the Transport Group (Fig. 3). These levels are similar to those reported by Banner et al. (1983) and Congleton et al. (1985) in their tests in natural flow-through seawater.

Mortality levels were low and similar in all groups through Week 6. By Week 9, the mortality rates in all groups except the C-slot Gatewell Group were increasing. At Week 12, the maximum difference in the mortality levels among all test groups was reached. From this point and for the duration of the study, the mortality rate in the C-slot Gatewell Group increased to approximately the same rate as in the other test groups.

The log-rank statistical analysis of within test-group replicates indicated replicate homogeneity in all test groups except the C-slot Gatewell Group. In this group, one of the replicates showed a significantly different overall mortality rate than the other two ($P<0.05$). Nevertheless, all replicates were included in further statistical tests.

Table 5 presents the log-rank statistical comparisons among the four test groups for the entire study. The Pre-separator Group incurred a significantly higher mortality than the C-slot Gatewell Group. Past research has repeatedly demonstrated that passage of spring chinook salmon smolts between the gatewells and pre-separator at Lower Granite Dam results in an increase in stress (Park et al. 1983; Congleton et al. 1985; Matthews et al. 1985). Further, the Transport and Mark + Transport Groups incurred significantly

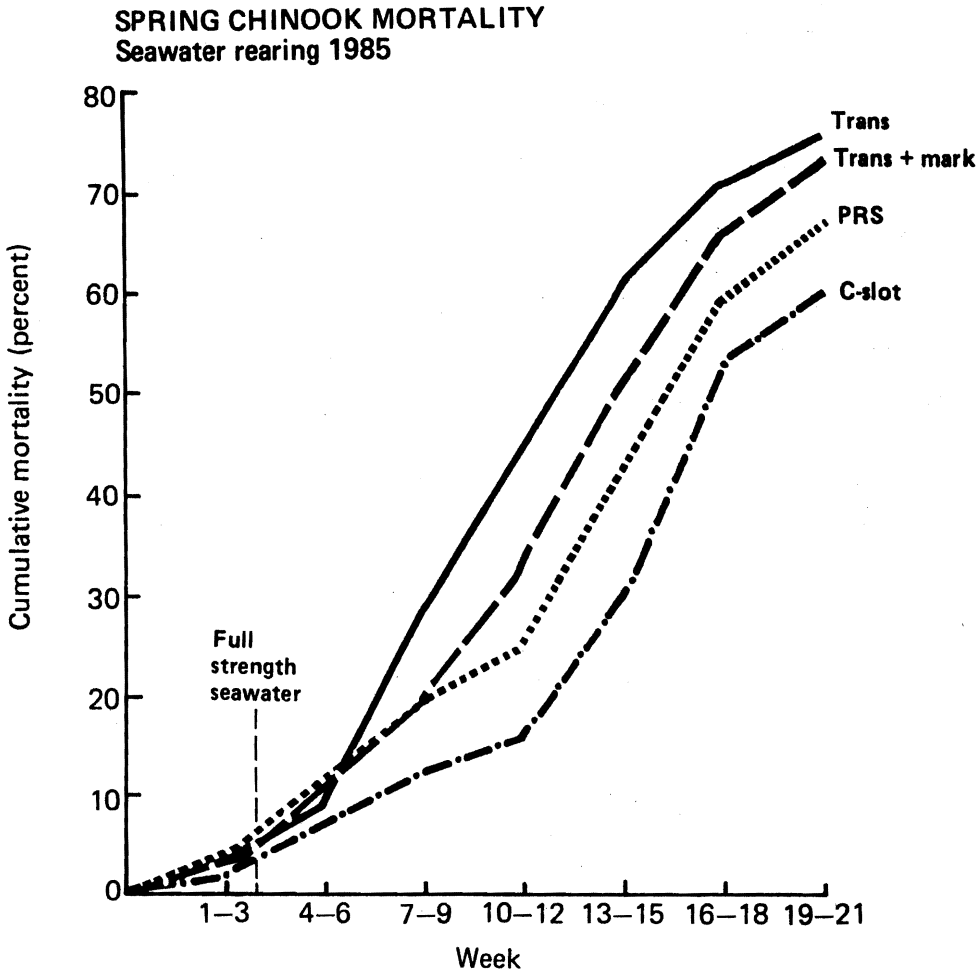

Figure 3.--Cumulative percent mortality of spring chinook salmon smolts from designated areas of the collection and transport system at Lower Granite Dam held in an artificial seawater recirculation system for 21 weeks.

Table 5.--Among group log-rank tests utilizing the chi-square statistic for significance of mortalities during the extended seawater holding study.

Comparison	X^2	$P(X^2)$
C-slot vs. pre-separator	3.91	< 0.05
C-slot vs. transport	35.58	< 0.001
C-slot vs. mark + transport	21.39	< 0.001
Pre-separator vs. transport	12.06	< 0.001
Pre-separator vs. mark + transport	4.37	< 0.005
Transport vs. mark + transport	2.70	N.S.*

* N.S. = not significant.

higher mortalities than the Pre-separator Group. Again, past research has demonstrated that certain activities in collection and transport beyond the pre-separator, such as handling, marking, or loading into trucks or barges, result in increased stress in this species (Park et al. 1983; Congleton et al. 1985).

The largest difference in mortality levels among the four test groups occurred by Week 12. A statistical comparison by contingency table analysis of the data at this point indicates the same relationships as the log-rank analysis for the entire test. However, the same analysis utilizing the differential mortality data between Week 12 and the end of the study indicated no significant difference among the treatment groups during this time. This analysis indicates that all of the statistical differences measured among the test groups by the log-rank test occurred by Week 12. Thereafter, previous differential collection and transport stresses had no further effect on the mortality rates within the groups.

The mortalities in all test groups during the entire study were overwhelmingly associated with BKD (Table 6, Appendix Table 1). IFAT analysis indicated BKD organisms were present in 98.8% of all mortalities. Based on the classification ratings, we roughly estimated that between 73.3 (minimum) and 84.6% (maximum) of mortalities in all test groups were likely attributable to the disease. For BKD to be so dominant during this study, one of the following general scenarios was likely: (1) a high percentage of the fish population carried the disease at sub-clinical levels prior to placement in the system, with relatively minor horizontal transmission; (2) a medium percentage of the population carried the disease at sub-clinical levels, with the remainder of the infection from horizontal transmission; or (3) a low percentage of the population carried the disease at sub-clinical levels, with

Table 6.--The association of BKD with mortalities during the extended seawater holding study as determined by IFAT analysis.

	C-slot	PRS	Trans	Mark + trans	Totals
Incidence (% ± SE)[a/]	99.5 ± 0.5	97.9 ± 1.1	97.5 ± 0.8	100.0	98.8 ± 0.4
Probable cause of death (% ± SE)					
maximum[b/]	87.9 ± 5.1	84.7 ± 2.3	75.6 ± 1.1	89.4 ± 1.9	84.6 ± 2.0
minimum[c/]	79.1 ± 3.3	75.8 ± 4.9	60.6 ± 6.0	77.0 ± 1.0	73.3 ± 2.8

a/ Minimum of 1 BKD organism/300 microscopic fields.

b/ 1-300 BKD organism/microscopic field.

c/ 10-300 BKD organisms/microscopic field.

the remainder of the infection from a high level of horizontal transmission. We believe that the first scenario is the most likely. Recent studies indicate that greater than 90% of the spring chinook salmon smolts emigrating from Idaho hatcheries carry the disease at sub-clinical levels (Mulcahy 1986[1/]). In addition, our IFAT analysis demonstrated BKD in every early mortality during this study.

We do not argue that horizontal transmission may have had some effect during this study, but to our knowledge, horizontal transmission of the bacterium in seawater has yet to be demonstrated. The bacterium is an obligate pathogen with salmonid fishes comprising its normal habitat. Even in river water, the bacterium can survive only up to 3 or 4 days outside the host (Austin and Rayment 1985). We assume that in seawater, the survival time is even less. Also, within the experimental recirculation system used in this study, the water was filtered and circulated through lethal levels of ultraviolet light radiation approximately once every 4 h to further reduce the level of viable BKD organisms. At most, we believe that horizontal transmission during this study may have accelerated mortalities to an unknown but likely minor degree over what might have occurred under natural conditions.

We found BKD in most of the surviving fish that we sampled at the end of the study; IFAT analysis indicated that 94.9% were infected. However, the intensity or severity of the infections was much lower in these fish than in the mortalities. Only 25.2% of the infected surviving fish had BKD cell counts of one or more organisms per microscopic field as compared to 84.6% of

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the mortalities. Nevertheless, it is apparent that more fish eventually would have died if the test had continued.

The information from this study strongly suggests that sub-clinical infections of BKD were differentially exacerbated early in the study, depending upon the level of previous stresses during collection and transporation. After Week 12, the effects of previous stresses on the fish were diminished, and the stress of seawater adaptation became the dominant factor exacerbating BKD infections equally in all test groups.

We emphasize that the data we present are from spring chinook salmon sampled on 1 day (26 April) and therefore are not representative of the entire season. However, if we assume the differential mortality noted between transport groups and the control group is valid, we have some insight as to the expected adult return from the two groups in a real transport/no transport situation.

All fish transported and inriver migrants (non-transported) alike have BKD present at levels that severely limits their survival. The transported fish have some added stress due to certain aspects of collection and handling that exacerbates sub-clinical BKD infections and, therefore, causes their survival to be reduced to about 25%. On the other had, inriver migrants survive at 40% (in our test, these fish were virtually stress free, but during actual inriver migratory situations one would assume that significant stresses would occur during spill and turbine passage). The inriver migrants survival will be further limited by dam related mortality during passage from Lower Granite Dam to Bonneville Dam so that freshwater survival is also about 40% (conservative estimate). The combined freshwater and seawater survival will be only 16% (0.40 x 0.40).

Therefore, if survival of inriver migrants is to approach that of transported fish, their inriver survival will have to be at least 60% (0.40 x 0.60 = 24%). In a more realistic survival scenario, only 30% inriver survival will be realized. In which case, 12% total survival can be expected. Mortality of transported fish must exceed 88% or a transport benefit will occur. From the foregoing comparisons, it is obvious why previous reported transported/control benefit ratios are positive. The same rationale can be used to show why spring chinook salmon transport/control ratios are small--usually less than 2:1. The results of the seawater holding study and the foregoing analysis provide evidence that transportation of spring chinook salmon could increase survival of juveniles leading to increased adult returns.

We do not believe that the mortality levels measured during this study mirror absolute values that occur under natural conditions. The extended seawater rearing method attempts to match under laboratory conditions some of the conditions (seawater residence) that these fish would experience after release. It might be argued that the fish in tanks are confined and that this confinement may reduce survival. This could be offset by the fact that confined fish are not exposed to predators. The ocean-reared fish may have an advantage in receiving natural foods--the trade-off for the test fish is that they are continually well-fed. Although the extended seawater rearing conditions are not identical to those experienced by ocean-reared fish, they are sufficiently similar to estimate relative survival.

In summation, the data, together with the performance of the recirculation system, suggest that this method can successfully detect previous differential stresses associated with passage of spring chinook

salmon smolts through dams. The data further imply that exacerbation of sub-clinical BKD infections by chronic seawater adaptation stresses is the dominant effect on these fish whether collected and transported or not.

CONCLUSIONS AND RECOMMENDATIONS

1. Survival of transported spring chinook salmon in 1983 and transported steelhead in 1984 appears to be good. However, a control group for each species is necessary to provide definitive assessment of the merits of transportation each year.

2. Results of the extended seawater rearing study suggest that exacerbation of sub-clinical BKD infections associated with the stress of seawater adaptation is the dominant factor limiting survival of upriver spring chinook salmon stocks. We strongly recommend that this study be repeated and the results confirmed.

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APPENDIX

Appendix Table 1. Fork lengths, weights, descaling, BKD lesion and IFAT rankings, and pinheads by date, tank number, and test group of individual mortalities during extended artificial seawater holding study at Lower Granite Dam, 1985.

Mort. No.	Tank No.	Date	Test Group	Fork Length (mm)	Weight (g)	Descaling	BKD lesions[a]	BKD IFAT[b]	Pinhead
1	7	Apr 27	Transport	115	16	no	3	-1	no
2	5	Apr 27	Transport	118	17	no	3	-1	no
3	11	Apr 29	Pre-separator	108	13.5	no	3	-1	no
4	9	Apr 30	Marked Transp.	118	18	no	1	4	no
5	1	Apr 30	Pre-separator	122	17.9	no	3	-1	no
6	12	May 2	C-Slot	110	14.1	yes	1	4	no
7	11	May 2	Pre-separator	98	10.8	no	1	4	no
8	10	May 2	C-Slot	113	18	no	1	4	no
9	5	May 2	Transport	95	10.4	no	3	-1	no
10	2	May 2	Transport	98	11.5	yes	3	4	no
11	1	May 2	Pre-separator	117	16.7	no	3	4	no
12	10	May 3	C-Slot	102	14.4	yes	1	4	no
13	3	May 4	Marked Transp.	133	25.7	no	3	-1	no
14	8	May 5	Marked Transp.	128	20.4	no	3	-1	no
15	7	May 5	Transport	138	24.3	no	3	-1	no
23	6	May 6	C-Slot	180	52.8	no	2	4	no
24	1	May 6	Pre-separator	150	41.8	no	3	1	no
25	11	May 7	Pre-separator	130	22.8	no	3	-1	no
26	8	May 7	Marked Transp.	185	60.8	no	3	1	no
27	2	May 7	Transport	175	51.4	no	2	1	no
28	3	May 7	Marked Transp.	145	34.1	no	3	1	no
29	7	May 8	Transport	120	14.1	yes	3	-1	no
30	11	May 8	Pre-separator	135	32.6	no	3	-1	no
31	11	May 8	Pre-separator	135	22.9	no	1	4	no
32	5	May 8	Transport	95	9.3	no	3	2	no
33	11	May 9	Pre-separator	115	12.4	no	1	4	no
34	11	May 9	Pre-separator	125	24.8	no	3	-1	no
35	7	May 10	Transport	110	12	no	3	-1	no
36	9	May 11	Marked Transp.	120	15.4	no	2	1	no
37	6	May 14	C-Slot	145	26.4	yes	1	4	no
38	11	May 14	Pre-separator	120	13.6	no	2	1	no
39	3	May 14	Marked Transp.	125	18.9	no	1	4	no
40	4	May 15	Pre-separator	120	15.3	no	1	4	no
41	12	May 17	C-Slot	115	16.3	yes	1	4	no
42	6	May 17	C-Slot	115	12.8	yes	1	4	no
44	8	May 18	Marked Transp.	135	21.2	no	1	4	no
45	6	May 18	C-Slot	115	16.1	yes	1	4	no
46	9	May 19	Marked Transp.	120	17	no	1	4	yes
47	9	May 20	Marked Transp.	185	51.6	no	1	4	no
48	5	May 21	Transport	95	4.5	??	3	-1	yes
49	5	May 21	Transport	175	46.1	no	1	4	no
50	2	May 21	Transport	115	12.6	yes	1	3	no
51	1	May 21	Pre-separator	120	18.6	no	1	4	no
52	6	May 21	C-Slot	120	16.7	yes	3	-1	no
53	6	May 23	C-Slot	125	18.8	yes	1	-1	no
54	12	May 24	C-Slot	130	19.5	no	1	4	no
55	7	May 24	Transport	145	31.4	no	2	2	no
56	4	May 24	Pre-separator	133	21.9	no	1	3	no
57	3	May 24	Marked Transp.	130	18	no	1	2	no
58	3	May 24	Marked Transp.	150	28.5	no	1	4	no
59	3	May 25	Marked Transp.	95	5.5	no	3	1	yes
60	3	May 25	Marked Transp.	120	18.4	no	2	1	no
61	3	May 25	Marked Transp.	125	141	no	1	4	no
62	8	May 26	Marked Transp.	147	21.8	no	1	4	no
63	11	May 26	Pre-separator	135	11.7	no	1	4	yes
64	7	May 27	Transport	105	11.5	no	1	4	??
65	8	May 28	Marked Transp.	125	14.2	no	1	4	yes
66	6	May 28	C-Slot	145	24.3	no	3	2	no
67	4	May 28	Pre-separator	145	24	no	1	4	no
68	1	May 28	Pre-separator	115	13	no	1	4	no
69	3	May 28	Marked Transp.	125	17.9	no	1	4	no
70	1	May 29	Pre-separator	136	20.2	no	1	4	no
71	5	May 29	Transport	115	12.8	no	1	4	no
72	9	May 30	Marked Transp.	125	16.7	no	1	4	no

Appendix Table 1. (Cont.) Fork lengths, weights, descaling, BKD lesion and IFAT rankings, and pinheads by date, tank number, and test group of individual mortalities during extended artificial seawater holding study at Lower Granite Dam, 1985.

Mort. No.	Tank No.	Date	Test Group	Fork Length (mm)	Weight (g)	Descaling	BKD lesions[a]	BKD IFAT[b]	Pinhead
73	9	May 30	Marked Transp.	128	19.1	no	1	4	no
74	9	May 30	Marked Transp.	125	16.3	no	1	4	no
75	6	May 30	C-Slot	115	13.5	no	1	3	no
76	10	May 31	C-Slot	130	19.8	no	1	4	no
77	4	May 31	Pre-separator	125	14.6	no	1	4	no
78	1	May 31	Pre-separator	120	16.3	no	1	4	no
79	2	Jun 1	Transport	120	14.4	no	1	4	no
80	3	Jun 1	Marked Transp.	125	15.1	no	1	4	no
81	4	Jun 1	Pre-separator	170	43.1	no	1	4	no
82	5	Jun 1	Transport	145	26.8	no	1	4	no
83	8	Jun 1	Marked Transp.	110	10.2	no	2	2	yes
84	8	Jun 1	Marked Transp.	160	30.8	no	1	4	no
85	9	Jun 1	Marked Transp.	120	13.5	no	2	4	no
86	10	Jun 1	C-Slot	125	17.1	no	1	4	no
87	11	Jun 1	Pre-separator	125	16.2	no	1	4	no
89	8	Jun 2	Marked Transp.	140	19.2	no	1	4	no
90	8	Jun 2	Marked Transp.	155	20.1	no	1	4	no
91	1	Jun 2	Pre-separator	168	37.8	no	1	3	no
92	4	Jun 2	Pre-separator	130	15.3	no	1	4	no
93	4	Jun 2	Pre-separator	101	5.3	no	3	-1	yes
94	10	Jun 3	C-Slot	95	5.5	no	3	-1	yes
95	9	Jun 3	Marked Transp.	110	13.1	no	3	-1	no
96	8	Jun 3	Marked Transp.	126	15.2	no	1	4	no
97	4	Jun 3	Pre-separator	150	28.5	no	2	4	no
98	5	Jun 3	Transport	95	6.2	no	3	-1	yes
99	5	Jun 3	Transport	147	38.3	no	2	-1	no
100	12	Jun 4	C-Slot	127	19.2	no	1	4	no
101	12	Jun 4	C-Slot	125	15.9	no	1	4	no
102	11	Jun 4	Pre-separator	150	30.5	no	1	4	no
103	8	Jun 4	Marked Transp.	90	5.6	no	3	1	yes
104	6	Jun 4	C-Slot	95	5.2	no	3	0	yes
105	2	Jun 4	Transport	120	16.1	no	1	4	no
106	3	Jun 4	Marked Transp.	135	17.2	no	1	4	no
107	4	Jun 4	Pre-separator	115	12.1	no	1	4	no
108	5	Jun 4	Transport	125	16.9	no	2	4	no
109	10	Jun 5	C-Slot	145	17.3	no	1	4	no
110	9	Jun 5	Marked Transp.	130	19.2	no	2	4	no
111	1	Jun 5	Pre-separator	95	5.3	no	3	1	yes
112	5	Jun 5	Transport	90	5.2	no	3	2	yes
113	1	Jun 5	Pre-separator	150	28.1	no	1	4	no
114	1	Jun 5	Pre-separator	135	29	no	1	4	no
115	12	Jun 6	C-Slot	135	22.9	no	1	4	no
116	12	Jun 6	C-Slot	130	20.2	no	1	4	no
117	8	Jun 6	Marked Transp.	118	14.3	no	1	4	no
118	6	Jun 6	C-Slot	135	23.8	no	1	4	no
119	6	Jun 6	C-Slot	130	19.5	no	1	4	no
120	2	Jun 6	Transport	130	20.5	no	1	4	no
121	2	Jun 6	Transport	125	16.7	no	1	4	no
122	6	Jun 7	C-Slot	135	26.7	no	1	4	no
123	4	Jun 7	Pre-separator	130	20.2	no	1	4	no
124	11	Jun 8	Pre-separator	130	16.2	no	1	4	no
125	6	Jun 8	C-Slot	135	22.7	no	1	4	no
126	1	Jun 8	Pre-separator	135	22.3	no	1	4	no
127	5	Jun 8	Transport	135	29.1	no	3	0	no
128	11	Jun 8	Pre-separator	150	32.8	no	1	4	no
129	6	Jun 8	C-Slot	115	14.2	no	1	4	no
130	9	Jun 8	Marked Transp.	120	15.4	no	1	4	no
131	12	Jun 9	C-Slot	140	20.3	no	1	4	no
132	11	Jun 9	Pre-separator	132	19.0	no	1	4	no
133	10	Jun 9	C-Slot	161	28.7	no	1	4	no
134	9	Jun 9	Marked Transp.	115	6.7	no	3	2	yes
135	1	Jun 9	Pre-separator	158	24.0	no	1	4	no
136	7	Jun 9	Transport	111	6.7	no	3	0	yes
137	7	Jun 9	Transport	90	5.0	no	3	2	yes
138	5	Jun 9	Transport	109	6.2	no	3	2	yes

Appendix Table 1. (Cont.) Fork lengths, weights, descaling, BKD lesion and IFAT rankings, and pinheads by date, tank number, and test group of individual mortalities during extended artificial seawater holding study at Lower Granite Dam, 1985.

Mort. No.	Tank No.	Date	Test Group	Fork Length (mm)	Weight (g)	Descaling	BKD lesions[a]	BKD IFAT[b]	Pinhead
139	8	Jun 10	Marked Transp.	120	16.8	no	3	1	no
140	6	Jun 10	C-Slot	130	20.1	no	1	4	no
141	2	Jun 10	Transport	115	12.8	no	1	4	no
142	3	Jun 10	Marked Transp.	135	21.4	no	1	4	no
143	4	Jun 10	Pre-separator	100	10.3	no	3	-1	no
144	5	Jun 10	Transport	110	10.7	no	1	4	no
145	12	Jun 11	C-Slot	125	16.5	no	1	4	no
146	3	Jun 11	Marked Transp.	100	6.4	no	3	1	yes
147	5	Jun 11	Transport	135	26.8	no	2	4	no
148	5	Jun 11	Transport	100	9.0	no	1	1	yes
149	9	Jun 12	Marked Transp.	140	25.6	no	1	4	no
150	8	Jun 12	Marked Transp.	90	6.8	no	3	-1	yes
151	2	Jun 12	Transport	135	29.4	no	2	1	no
152	2	Jun 12	Transport	120	19.9	no	2	-1	no
153	5	Jun 12	Transport	125	20.2	no	1	4	no
154	2	Jun 12	Transport	100	8.7	no	3	1	yes
155	7	Jun 12	Transport	125	21.2	no	1	4	no
156	5	Jun 12	Transport	150	39.8	no	1	4	no
157	11	Jun 13	Pre-separator	90	4.5	no	3	1	yes
158	1	Jun 13	Pre-separator	95	7.2	no	3	0	yes
159	1	Jun 13	Pre-separator	120	15.4	no	1	4	no
160	5	Jun 13	Transport	95	6.0	no	3	4	yes
161	2	Jun 13	Transport	110	14.3	no	2	-1	no
162	3	Jun 14	Marked Transp.	105	7.3	no	2	3	yes
163	11	Jun 14	Pre-separator	95	6.4	no	2	2	yes
164	11	Jun 14	Pre-separator	145	24.9	no	1	4	no
165	9	Jun 14	Marked Transp.	110	8.4	no	3	2	yes
166	9	Jun 14	Marked Transp.	145	21.8	no	3	4	no
167	8	Jun 14	Marked Transp.	140	25.5	no	1	4	no
168	10	Jun 14	C-Slot	125	19.6	no	2	4	no
169	12	Jun 14	C-Slot	145	30.4	no	1	4	no
170	10	Jun 15	C-Slot	170	44.5	no	1	4	no
171	1	Jun 15	Pre-separator	140	30.5	no	3	-1	no
172	1	Jun 15	Pre-separator	115	14.8	no	2	4	no
173	2	Jun 15	Transport	135	28.0	no	2	1	no
174	2	Jun 15	Transport	125	17.9	no	1	4	no
175	3	Jun 15	Marked Transp.	95	6.8	no	1	4	yes
176	5	Jun 15	Transport	110	9.7	no	2	4	yes
177	5	Jun 15	Transport	150	28.8	no	1	4	no
178	2	Jun 15	Transport	120	18.9	no	2	2	no
179	3	Jun 15	Marked Transp.	125	17.7	no	1	4	no
180	12	Jun 15	C-Slot	120	no data	no	1	4	no
181	2	Jun 16	Transport	140	23.4	no	2	4	no
182	5	Jun 16	Transport	155	23.6	no	1	4	no
183	9	Jun 17	Marked Transp.	140	22.2	no	3	3	no
184	7	Jun 17	Transport	90	7.3	no	2	4	yes
185	10	Jun 18	C-Slot	130	23.3	no	2	-1	no
186	8	Jun 18	Marked Transp.	125	18.6	no	1	4	no
187	8	Jun 18	Marked Transp.	135	27.5	no	3	1	no
188	2	Jun 18	Transport	130	27.2	no	1	1	no
189	4	Jun 18	Pre-separator	130	18.8	no	1	4	no
190	4	Jun 18	Pre-separator	130	23.9	no	3	0	no
191	10	Jun 19	C-Slot	130	19.3	no	1	4	no
192	2	Jun 19	Transport	150	31.4	no	3	-1	no
193	2	Jun 19	Transport	140	23.5	no	1	4	no
194	2	Jun 19	Transport	95	9.7	no	3	2	yes
195	11	Jun 20	Pre-separator	110	12.2	no	1	4	no
196	9	Jun 20	Marked Transp.	110	11.6	no	1	4	no
197	8	Jun 20	Marked Transp.	145	30.0	no	1	4	no
198	2	Jun 20	Transport	135	31.3	no	2	1	no
199	3	Jun 20	Marked Transp.	95	5.5	no	3	1	yes
200	11	Jun 21	Pre-separator	95	7.1	no	1	4	yes
201	6	Jun 21	C-Slot	120	13.9	no	3	-1	no
202	2	Jun 21	Transport	125	16.9	no	2	4	no
203	2	Jun 21	Transport	130	27.2	no	2	-1	no

Appendix Table 1. (Cont.) Fork lengths, weights, descaling, BKD lesion and IFAT rankings, and pinheads by date, tank number, and test group of individual mortalities during extended artificial seawater holding study at Lower Granite Dam, 1985.

Mort. No.	Tank No.	Date	Test Group	Fork Length (mm)	Weight (g)	Descaling	BKD lesions[a]	BKD IFAT[b]	Pinhead
204	2	Jun 21	Transport	85	5.2	no	3	0	yes
205	5	Jun 21	Transport	95	7.6	no	3	-1	yes
206	12	Jun 22	C-Slot	145	25.2	no	1	4	no
207	11	Jun 22	Pre-separator	110	7.3	no	3	1	yes
208	10	Jun 22	C-Slot	115	10.4	no	3	-1	yes
209	2	Jun 22	Transport	90	5.4	no	3	-1	yes
210	2	Jun 22	Transport	135	26.9	no	2	-1	no
211	2	Jun 22	Transport	140	36.8	no	2	-1	no
212	5	Jun 22	Transport	125	25.9	no	1	1	no
214	12	Jun 23	C-Slot	100	6.1	no	3	-1	yes
215	9	Jun 23	Marked Transp.	155	24.5	no	1	3	no
216	8	Jun 23	Marked Transp.	128	10.0	no	2	4	no
217	2	Jun 23	Transport	130	16.8	no	2	-1	no
218	7	Jun 23	Transport	138	20.2	no	2	2	no
219	9	Jun 24	Marked Transp.	110	9.8	no	1	4	no
220	5	Jun 24	Transport	135	29.3	no	2	2	no
221	5	Jun 24	Transport	115	12.9	no	1	4	no
222	9	Jun 25	Marked Transp.	100	8.0	no	3	-1	no
223	2	Jun 25	Transport	125	22.1	no	2	2	no
224	2	Jun 25	Transport	130	21.9	no	1	4	no
225	4	Jun 25	Pre-separator	155	31.6	no	1	4	no
226	2	Jun 25	Transport	160	45.9	no	1	1	no
227	6	Jun 25	C-Slot	130	9.8	no	3	-1	no
228	7	Jun 25	Transport	120	15.5	no	1	2	no
229	9	Jun 25	Marked Transp.	105	9.0	no	1	4	yes
230	8	Jun 25	Marked Transp.	110	8.3	no	3	-1	yes
231	7	Jun 25	Transport	95	6.8	no	2	4	yes
232	9	Jun 26	Marked Transp.	145	27.8	no	1	4	no
233	4	Jun 26	Pre-separator	165	41.4	no	1	4	no
234	4	Jun 26	Pre-separator	140	20.7	no	1	4	no
235	9	Jun 27	Marked Transp.	140	20.5	no	1	4	no
236	6	Jun 27	C-Slot	130	19.2	no	2	-1	no
237	1	Jun 27	Pre-separator	140	20.1	no	1	4	no
238	2	Jun 27	Transport	130	23.2	no	2	2	no
239	2	Jun 27	Transport	140	33.5	no	2	-1	no
240	7	Jun 27	Transport	135	25.1	no	1	4	no
241	8	Jun 27	Marked Transp.	130	17.7	no	3	4	no
242	2	Jun 28	Transport	95	8.6	no	3	-1	yes
243	8	Jun 29	Marked Transp.	105	11.5	no	1	4	no
244	2	Jun 29	Transport	141	33.3	no	1	4	no
245	2	Jun 29	Transport	125	24.5	no	1	1	no
246	3	Jun 29	Marked Transp.	120	13.8	no	1	4	no
247	3	Jun 29	Marked Transp.	105	9.5	no	1	4	yes
248	9	Jun 29	Marked Transp.	125	17.8	no	1	4	no
249	1	Jun 29	Pre-separator	145	24.4	no	1	4	no
250	8	Jun 30	Marked Transp.	155	20.1	no	3	4	no
251	1	Jun 30	Pre-separator	100	6.4	no	3	0	yes
252	2	Jun 30	Transport	154	31.1	no	3	0	no
253	7	Jun 30	Transport	175	50.8	no	2	-1	no
254	7	Jun 30	Transport	166	43.6	no	1	4	no
255	5	Jun 30	Transport	144	18.4	no	1	4	no
256	2	Jul 1	Transport	145	20.4	no	1	4	no
257	9	Jul 1	Marked Transp.	104	8.6	no	1	4	yes
258	9	Jul 1	Marked Transp.	140	23.7	no	1	4	no
259	4	Jul 1	Pre-separator	85	5.1	no	3	-1	yes
260	3	Jul 2	Marked Transp.	145	30.2	no	1	2	no
261	3	Jul 2	Marked Transp.	117	12.1	no	1	4	no
262	2	Jul 2	Transport	148	33.5	no	1	4	no
263	5	Jul 3	Transport	140	24.0	no	1	4	no
264	3	Jul 3	Marked Transp.	137	26.4	no	1	4	no
265	10	Jul 3	C-Slot	117	9.9	no	3	-1	yes
266	2	Jul 3	Transport	137	33.1	no	1	1	no
267	6	Jul 3	C-Slot	162	38.2	no	1	4	no
268	1	Jul 4	Pre-separator	137	17.6	no	1	4	no
269	3	Jul 4	Marked Transp.	128	19.3	no	1	4	no

Appendix Table 1. (Cont.) Fork lengths, weights, descaling, BKD lesion and IFAT rankings, and pinheads by date, tank number, and test group of individual mortalities during extended artificial seawater holding study at Lower Granite Dam, 1985.

Mort. No.	Tank No.	Date	Test Group	Fork Length (mm)	Weight (g)	Descaling	BKD lesions[a]	BKD IFAT[b]	Pinhead
270	9	Jul 4	Marked Transp.	97	5.5	no	1	4	yes
271	2	Jul 5	Transport	110	14.0	no	2	3	no
272	3	Jul 5	Marked Transp.	142	21.9	no	1	4	no
273	5	Jul 5	Transport	100	9.3	no	2	-1	no
274	7	Jul 5	Transport	117	10.5	no	1	4	no
275	1	Jul 6	Pre-separator	100	9.8	no	1	4	no
276	1	Jul 6	Pre-separator	110	10.0	no	1	4	no
277	2	Jul 6	Transport	100	8.5	no	1	4	no
278	6	Jul 6	C-Slot	97	6.5	no	3	1	no
279	2	Jul 6	Transport	180	44.3	no	1	2	no
280	11	Jul 7	Pre-separator	147	21.1	no	1	4	no
281	9	Jul 7	Marked Transp.	148	16.5	no	1	4	no
282	3	Jul 7	Marked Transp.	118	10.0	no	1	4	yes
283	5	Jul 8	Transport	110	11.4	no	3	1	no
284	2	Jul 8	Transport	138	30.8	no	1	4	no
285	2	Jul 8	Transport	119	15.0	no	2	1	no
286	8	Jul 9	Marked Transp.	128	16.9	no	3	2	no
287	6	Jul 9	C-Slot	105	9.5	no	3	-1	yes
288	2	Jul 9	Transport	130	25.0	no	2	0	no
289	3	Jul 9	Marked Transp.	140	21.3	no	1	4	no
290	7	Jul 9	Transport	140	27.0	no	1	4	no
291	7	Jul 9	Transport	140	24.5	no	1	4	no
292	5	Jul 9	Transport	120	14.0	no	1	4	no
293	3	Jul 10	Marked Transp.	130	20.0	no	1	4	no
294	3	Jul 10	Marked Transp.	139	21.5	no	1	4	no
295	5	Jul 10	Transport	150	34.7	no	3	0	no
296	12	Jul 10	C-Slot	145	23.4	no	1	4	no
297	8	Jul 10	Marked Transp.	125	12.6	no	1	4	no
298	2	Jul 11	Transport	147	34.5	no	2	1	no
299	2	Jul 11	Transport	120	12.0	no	1	4	no
300	2	Jul 11	Transport	155	43.4	no	2	1	no
301	8	Jul 11	Marked Transp.	118	12.1	no	1	4	no
302	8	Jul 11	Marked Transp.	110	10.4	no	1	4	no
303	9	Jul 11	Marked Transp.	120	14.5	no	1	4	no
304	9	Jul 11	Marked Transp.	105	6.7	no	3	4	yes
305	12	Jul 11	C-Slot	128	15.2	no	1	4	no
306	4	Jul 11	Pre-separator	100	7.4	no	3	-1	no
307	7	Jul 11	Transport	145	26.0	no	1	4	no
308	5	Jul 12	Transport	120	13.8	no	1	4	no
309	12	Jul 12	C-Slot	130	23.0	no	1	4	no
310	8	Jul 12	Marked Transp.	130	21.1	no	1	4	no
311	1	Jul 12	Pre-separator	102	6.5	no	3	-1	yes
312	1	Jul 12	Pre-separator	130	19.7	no	1	4	no
313	7	Jul 13	Transport	110	12.1	no	1	4	no
314	7	Jul 13	Transport	130	15.2	no	1	4	no
315	7	Jul 13	Transport	110	11.2	no	1	4	no
316	5	Jul 13	Transport	138	31.3	no	2	3	no
317	3	Jul 13	Marked Transp.	118	12.3	no	1	4	no
318	10	Jul 13	C-Slot	138	19.7	no	2	4	no
319	10	Jul 13	C-Slot	133	21.4	no	1	4	no
320	8	Jul 13	Marked Transp.	140	28.4	no	1	4	no
321	1	Jul 13	Pre-separator	130	21.5	no	1	4	no
322	11	Jul 14	Pre-separator	117	9.5	no	1	4	no
323	8	Jul 14	Marked Transp.	150	18.8	no	2	4	no
324	2	Jul 14	Transport	185	50.8	no	1	1	no
325	9	Jul 15	Marked Transp.	170	50.1	no	2	-1	no
326	8	Jul 15	Marked Transp.	130	18.6	no	1	4	no
327	2	Jul 15	Transport	130	22.2	no	2	1	no
328	3	Jul 15	Marked Transp.	115	13.2	no	1	4	no
329	9	Jul 16	Marked Transp.	130	19.9	no	1	4	no
330	2	Jul 16	Transport	115	19.9	no	2	-1	no
331	2	Jul 16	Transport	145	41.1	no	1	1	no
332	11	Jul 17	Pre-separator	130	17.3	no	1	4	no
333	8	Jul 17	Marked Transp.	135	28.7	no	1	4	no
334	8	Jul 17	Marked Transp.	115	12.9	no	1	4	no

Appendix Table 1. (Cont.) Fork lengths, weights, descaling, BKD lesion and IFAT rankings, and pinheads by date, tank number, and test group of individual mortalities during extended artificial seawater holding study at Lower Granite Dam, 1985.

Mort. No.	Tank No.	Date	Test Group	Fork Length (mm)	Weight (g)	Descaling	BKD lesions[a]	BKD IFAT[b]	Pinhead
335	8	Jul 17	Marked Transp.	140	25.4	no	1	4	no
336	3	Jul 17	Marked Transp.	125	15.4	no	1	4	no
337	10	Jul 17	C-Slot	130	19.7	no	1	4	no
338	7	Jul 17	Transport	115	15.6	no	1	4	no
339	11	Jul 18	Pre-separator	150	25.8	no	1	4	no
340	8	Jul 18	Marked Transp.	130	19.9	no	1	4	no
341	3	Jul 18	Marked Transp.	85	4.8	no	3	-1	yes
342	3	Jul 18	Marked Transp.	125	12.7	no	1	4	no
343	7	Jul 18	Transport	145	20.9	no	1	4	no
344	5	Jul 18	Transport	150	24.4	no	1	4	no
345	12	Jul 19	C-Slot	125	15.4	no	1	4	no
346	11	Jul 19	Pre-separator	135	18.5	no	1	4	no
347	11	Jul 19	Pre-separator	130	19.1	no	1	4	no
348	2	Jul 19	Transport	105	11.5	no	2	2	no
349	3	Jul 19	Marked Transp.	115	11.3	no	2	1	no
350	3	Jul 19	Marked Transp.	130	21.6	no	1	3	no
351	10	Jul 20	C-Slot	135	23.5	no	2	2	no
352	8	Jul 20	Marked Transp.	130	18.1	no	1	4	no
353	2	Jul 20	Transport	125	18.2	no	3	4	no
354	5	Jul 20	Transport	110	10.2	no	1	4	no
355	12	Jul 21	C-Slot	140	19.0	no	1	4	no
356	12	Jul 21	C-Slot	145	21.7	no	1	4	no
357	12	Jul 21	C-Slot	137	13.4	no	1	4	no
358	12	Jul 21	C-Slot	151	20.3	no	1	4	no
359	11	Jul 21	Pre-separator	161	25.6	no	1	4	no
360	10	Jul 21	C-Slot	148	21.6	no	1	4	no
361	10	Jul 21	C-Slot	135	17.4	no	2	3	no
362	9	Jul 21	Marked Transp.	125	12.4	no	1	4	no
363	2	Jul 21	Transport	128	16.3	no	1	4	no
364	3	Jul 21	Marked Transp.	106	4.8	no	3	-1	yes
365	3	Jul 21	Marked Transp.	129	19.0	no	3	1	no
366	7	Jul 21	Transport	142	20.0	no	1	4	no
367	5	Jul 21	Transport	160	35.1	no	1	1	no
369	12	Jul 22	C-Slot	135	20.2	no	1	4	no
370	11	Jul 22	Pre-separator	105	10.8	no	1	4	no
371	10	Jul 22	C-Slot	135	36.9	no	1	4	no
372	8	Jul 22	Marked Transp.	120	12.9	no	1	4	no
373	5	Jul 22	Transport	160	36.2	no	1	4	no
374	5	Jul 22	Transport	130	20.4	no	1	4	no
375	5	Jul 22	Transport	155	39.2	no	1	-1	no
376	11	Jul 23	Pre-separator	135	23.5	no	1	4	no
377	9	Jul 23	Marked Transp.	115	12.2	no	1	4	no
378	3	Jul 23	Marked Transp.	120	12.4	no	1	4	no
379	3	Jul 23	Marked Transp.	150	35.9	no	1	4	no
380	9	Jul 24	Marked Transp.	130	27.4	no	1	4	no
381	2	Jul 24	Transport	130	23.0	no	1	4	no
382	2	Jul 24	Transport	140	36.7	no	1	1	no
383	3	Jul 24	Marked Transp.	125	14.3	no	3	2	no
384	7	Jul 24	Transport	130	19.2	no	2	4	no
385	12	Jul 25	C-Slot	135	24.6	no	1	4	no
386	12	Jul 25	C-Slot	145	28.5	no	1	4	no
387	9	Jul 25	Marked Transp.	145	21.9	no	1	4	no
388	8	Jul 25	Marked Transp.	135	21.7	no	1	4	no
389	8	Jul 25	Marked Transp.	140	22.4	no	1	4	no
390	8	Jul 25	Marked Transp.	115	12.8	no	1	4	no
391	2	Jul 25	Transport	140	35.1	no	2	-1	no
392	4	Jul 25	Pre-separator	105	7.3	no	1	4	no
393	4	Jul 25	Pre-separator	115	11.9	no	1	4	no
394	5	Jul 25	Transport	165	58.5	no	1	1	no
395	4	Jul 25	Pre-separator	100	7.0	no	3	1	yes
396	11	Jul 26	Pre-separator	105	8.6	no	1	4	yes
397	8	Jul 26	Marked Transp.	105	9.5	no	1	4	yes
398	8	Jul 26	Marked Transp.	120	14.5	no	2	4	no
399	8	Jul 26	Marked Transp.	130	19.4	no	1	3	no
400	6	Jul 26	C-Slot	160	26.5	no	1	4	no

Appendix Table 1. (Cont.) Fork lengths, weights, descaling, BKD lesion and IFAT rankings, and pinheads by date, tank number, and test group of individual mortalities during extended artificial seawater holding study at Lower Granite Dam, 1985.

Mort. No.	Tank No.	Date	Test Group	Fork Length (mm)	Weight (g)	Descaling	BKD lesions[a]	BKD IFAT[b]	Pinhead
401	1	Jul 26	Pre-separator	125	20.6	no	1	2	no
402	3	Jul 26	Marked Transp.	110	14.2	no	1	4	no
403	3	Jul 26	Marked Transp.	120	11.0	no	3	2	no
404	3	Jul 26	Marked Transp.	120	15.8	no	3	1	no
405	5	Jul 26	Transport	105	8.5	no	1	4	yes
406	5	Jul 26	Transport	120	15.5	no	1	4	no
407	1	Jul 26	Pre-separator	120	14.0	no	2	-1	no
408	3	Jul 26	Marked Transp.	125	16.7	no	1	4	no
409	11	Jul 27	Pre-separator	105	7.7	no	3	2	yes
410	11	Jul 27	Pre-separator	140	28.4	no	1	4	no
411	10	Jul 27	C-Slot	140	24.6	no	1	4	no
412	9	Jul 27	Marked Transp.	115	12.5	no	1	4	no
413	8	Jul 27	Marked Transp.	125	17.2	no	1	4	no
414	1	Jul 27	Pre-separator	120	15.8	no	2	1	no
415	2	Jul 27	Transport	125	15.8	no	1	4	no
416	3	Jul 27	Marked Transp.	105	8.7	no	3	1	yes
417	4	Jul 27	Pre-separator	135	20.1	no	1	4	no
418	5	Jul 27	Transport	115	14.1	no	1	4	no
419	7	Jul 27	Transport	130	27.8	no	2	-1	no
420	7	Jul 27	Transport	120	15.0	no	2	3	no
421	7	Jul 28	Transport	156	26.6	no	1	4	no
422	6	Jul 28	C-Slot	145	19.6	no	1	4	no
423	8	Jul 28	Marked Transp.	132	14.1	no	1	4	no
424	8	Jul 28	Marked Transp.	127	13.0	no	1	4	no
425	11	Jul 28	Pre-separator	149	24.8	no	2	4	no
426	11	Jul 28	Pre-separator	132	12.5	no	1	4	no
427	12	Jul 29	C-Slot	138	21.4	no	1	4	no
428	12	Jul 29	C-Slot	105	9.6	no	3	1	no
429	10	Jul 29	C-Slot	100	6.8	no	3	1	yes
430	8	Jul 29	Marked Transp.	125	18.2	no	1	4	no
431	2	Jul 29	Transport	110	13.7	no	2	2	no
432	2	Jul 29	Transport	115	14.7	no	1	4	no
433	2	Jul 29	Transport	115	17.3	no	2	-1	no
434	3	Jul 29	Marked Transp.	125	16.6	no	1	2	no
435	4	Jul 29	Pre-separator	115	11.7	no	3	2	no
436	10	Jul 29	C-Slot	110	8.6	no	1	4	yes
437	9	Jul 29	Marked Transp.	120	14.2	no	3	3	no
438	4	Jul 29	Pre-separator	105	8.4	no	3	3	yes
439	9	Jul 30	Marked Transp.	140	31.9	no	2	1	no
440	9	Jul 30	Marked Transp.	140	23.5	no	1	4	no
441	9	Jul 30	Marked Transp.	130	24.2	no	1	4	no
442	8	Jul 30	Marked Transp.	125	13.3	no	1	4	no
443	6	Jul 30	C-Slot	110	8.9	no	1	4	yes
444	11	Jul 30	Pre-separator	135	11.8	no	1	4	no
445	8	Jul 30	Marked Transp.	165	42.0	no	1	4	no
446	3	Jul 31	Marked Transp.	125	13.6	no	2	3	no
447	4	Jul 31	Pre-separator	135	22.2	no	1	4	no
448	5	Jul 31	Transport	105	11.1	no	1	4	yes
449	5	Jul 31	Transport	105	8.1	no	3	-1	yes
450	5	Jul 31	Transport	145	24.9	no	1	4	no
451	12	Aug 1	C-Slot	125	20.1	no	1	4	no
452	12	Aug 1	C-Slot	140	28.6	no	1	4	no
453	11	Aug 1	Pre-separator	135	23.3	no	1	4	no
454	11	Aug 1	Pre-separator	125	17.3	no	1	4	no
455	10	Aug 1	C-Slot	125	17.5	no	1	4	no
456	9	Aug 1	Marked Transp.	135	17.5	no	1	4	no
457	9	Aug 1	Marked Transp.	125	17.8	no	1	1	no
458	6	Aug 1	C-Slot	130	19.0	no	1	4	no
459	6	Aug 1	C-Slot	120	13.1	no	2	3	no
460	5	Aug 1	Transport	150	32.6	no	1	4	no
461	7	Aug 1	Transport	125	20.9	no	1	4	no
462	12	Aug 2	C-Slot	150	38.2	no	1	4	no
463	11	Aug 2	Pre-separator	130	23.4	no	1	2	no
464	8	Aug 2	Marked Transp.	135	25.2	no	1	4	no
465	6	Aug 2	C-Slot	125	15.6	no	1	2	no

Appendix Table 1. (Cont.) Fork lengths, weights, descaling, BKD lesion and IFAT rankings, and pinheads by date, tank number, and test group of individual mortalities during extended artificial seawater holding study at Lower Granite Dam, 1985.

Mort. No.	Tank No.	Date	Test Group	Fork Length (mm)	Weight (g)	Descaling	BKD lesions[a]	BKD IFAT[b]	Pinhead
466	6	Aug 2	C-Slot	145	31.0	no	1	4	no
467	6	Aug 2	C-Slot	145	20.4	no	1	4	no
468	1	Aug 2	Pre-separator	105	9.1	no	1	2	yes
469	2	Aug 2	Transport	110	10.0	no	2	2	yes
470	2	Aug 2	Transport	135	21.8	no	2	-1	no
471	3	Aug 2	Marked Transp.	145	25.7	no	1	4	no
472	3	Aug 2	Marked Transp.	130	19.4	no	1	4	no
473	5	Aug 2	Transport	105	10.6	no	1	4	yes
474	7	Aug 2	Transport	135	24.2	no	2	4	no
475	10	Aug 2	C-Slot	155	35.4	no	1	4	no
476	11	Aug 3	Pre-separator	135	27.5	no	1	3	no
477	9	Aug 3	Marked Transp.	90	5.5	no	2	1	yes
478	9	Aug 3	Marked Transp.	125	14.0	no	2	-1	no
479	8	Aug 3	Marked Transp.	115	11.6	no	1	3	yes
480	6	Aug 3	C-Slot	125	14.5	no	1	4	no
481	6	Aug 3	C-Slot	155	29.4	no	1	4	no
482	6	Aug 3	C-Slot	120	14.1	no	1	4	no
483	3	Aug 3	Marked Transp.	135	18.8	no	1	4	no
484	3	Aug 3	Marked Transp.	125	14.9	no	1	4	no
485	5	Aug 3	Transport	140	27.5	no	1	4	no
486	7	Aug 3	Transport	135	18.6	no	1	4	no
487	8	Aug 3	Marked Transp.	140	22.3	no	1	4	no
488	5	Aug 4	Transport	151	25.0	no	1	4	no
489	5	Aug 4	Transport	148	26.2	no	2	-1	no
490	7	Aug 4	Transport	154	32.2	no	1	4	no
491	4	Aug 4	Pre-separator	117	9.8	no	2	4	yes
492	8	Aug 4	Marked Transp.	164	25.9	no	1	4	no
493	9	Aug 4	Marked Transp.	152	25.6	no	1	4	no
494	10	Aug 4	C-Slot	135	18.4	no	1	4	no
495	10	Aug 4	C-Slot	164	30.4	no	1	4	no
496	11	Aug 4	Pre-separator	153	29.0	no	1	4	no
497	12	Aug 4	C-Slot	149	20.0	no	1	4	no
498	11	Aug 5	Pre-separator	90	6.8	no	1	4	yes
499	11	Aug 5	Pre-separator	115	9.1	no	3	2	yes
500	9	Aug 5	Marked Transp.	110	9.3	no	3	-1	yes
501	6	Aug 5	C-Slot	130	18.7	no	1	4	no
502	6	Aug 5	C-Slot	140	27.0	no	1	4	no
503	1	Aug 5	Pre-separator	130	20.1	no	1	4	no
504	5	Aug 5	Transport	95	6.7	no	3	-1	yes
505	12	Aug 6	C-Slot	145	29.4	no	1	4	no
506	11	Aug 6	Pre-separator	120	12.9	no	1	4	yes
507	10	Aug 6	C-Slot	115	15.1	no	1	4	no
508	8	Aug 6	Marked Transp.	130	16.1	no	1	4	no
509	1	Aug 6	Pre-separator	120	11.1	no	3	1	no
510	3	Aug 6	Marked Transp.	135	34.2	no	2	4	no
511	5	Aug 6	Transport	105	11.5	no	3	-1	no
512	5	Aug 6	Transport	120	10.2	no	3	1	no
513	9	Aug 6	Marked Transp.	135	11.2	no	3	2	no
514	6	Aug 6	C-Slot	175	46.2	no	1	4	no
515	1	Aug 6	Pre-separator	130	9.8	no	1	4	yes
516	7	Aug 7	Transport	125	12.5	no	1	3	no
517	4	Aug 7	Pre-separator	99	6.9	no	1	4	yes
518	4	Aug 7	Pre-separator	110	8.0	no	2	1	yes
519	3	Aug 7	Marked Transp.	128	14.1	no	1	4	no
520	6	Aug 7	C-Slot	155	25.0	no	1	4	no
521	6	Aug 7	C-Slot	149	23.7	no	1	4	no
522	11	Aug 7	Pre-separator	131	12.4	no	1	4	yes
523	11	Aug 7	Pre-separator	163	34.5	no	1	4	no
524	11	Aug 7	Pre-separator	152	20.7	no	1	4	no
525	5	Aug 8	Transport	178	56.4	no	2	1	no
526	4	Aug 8	Pre-separator	111	8.9	no	1	4	yes
527	1	Aug 8	Pre-separator	122	12.2	no	1	3	no
528	1	Aug 8	Pre-separator	115	10.8	no	3	-1	no
529	1	Aug 8	Pre-separator	156	29.3	no	1	4	no
530	6	Aug 8	C-Slot	125	16.6	no	1	4	no

Appendix Table 1. (Cont.) Fork lengths, weights, descaling, BKD lesion and IFAT rankings, and pinheads by date, tank number, and test group of individual mortalities during extended artificial seawater holding study at Lower Granite Dam, 1985.

Mort. No.	Tank No.	Date	Test Group	Fork Length (mm)	Weight (g)	Descaling	BKD lesions[a]	BKD IFAT[b]	Pinhead
531	8	Aug 8	Marked Transp.	101	9.4	no	1	4	yes
532	9	Aug 8	Marked Transp.	117	11.4	no	1	4	no
533	11	Aug 8	Pre-separator	137	12.8	no	1	4	no
534	11	Aug 8	Pre-separator	147	21.5	no	1	4	no
535	11	Aug 8	Pre-separator	162	29.2	no	1	4	no
536	11	Aug 8	Pre-separator	129	13.0	no	1	4	no
537	12	Aug 8	C-Slot	133	14.3	no	1	4	no
538	10	Aug 9	C-Slot	155	12.8	no	1	4	yes
539	11	Aug 9	Pre-separator	158	19.5	no	1	4	no
540	11	Aug 9	Pre-separator	80	5.9	no	3	-1	yes
541	12	Aug 9	C-Slot	163	32.5	no	1	4	no
542	5	Aug 9	Transport	126	15.5	no	1	4	no
543	4	Aug 9	Pre-separator	120	8.5	no	2	1	no
544	2	Aug 9	Transport	134	12.5	no	2	1	no
545	12	Aug 10	C-Slot	155	25.4	no	1	4	no
546	10	Aug 10	C-Slot	135	14.6	no	1	3	no
547	10	Aug 10	C-Slot	138	20.7	no	1	2	no
548	10	Aug 10	C-Slot	148	21.3	no	1	1	no
549	9	Aug 10	Marked Transp.	155	30.3	no	3	1	no
550	9	Aug 10	Marked Transp.	152	32.4	no	3	1	no
551	9	Aug 10	Marked Transp.	135	15.3	no	1	4	no
552	9	Aug 10	Marked Transp.	114	9.7	no	1	4	no
553	6	Aug 10	C-Slot	170	39.4	no	1	4	no
554	6	Aug 10	C-Slot	162	31.4	no	1	3	no
555	12	Aug 11	C-Slot	151	16.2	no	1	4	no
556	12	Aug 11	C-Slot	137	12.8	no	1	4	no
557	12	Aug 11	C-Slot	130	10.8	no	3	1	yes
558	12	Aug 11	C-Slot	138	13.4	no	3	1	yes
559	11	Aug 11	Pre-separator	152	18.6	no	1	4	no
560	10	Aug 11	C-Slot	154	19.0	no	3	4	no
561	11	Aug 11	Pre-separator	143	14.8	no	1	4	no
562	10	Aug 11	C-Slot	152	23.2	no	1	4	no
563	9	Aug 11	Marked Transp.	145	28.5	no	1	3	no
564	8	Aug 11	Marked Transp.	151	23.6	no	1	4	no
565	8	Aug 11	Marked Transp.	152	16.2	no	1	3	no
566	8	Aug 11	Marked Transp.	144	22.1	no	1	4	no
567	6	Aug 11	C-Slot	168	34.2	no	1	4	no
568	1	Aug 11	Pre-separator	127	11.5	no	1	4	no
569	2	Aug 11	Transport	140	21.7	no	1	-1	no
570	3	Aug 11	Marked Transp.	124	8.4	no	1	4	yes
571	3	Aug 11	Marked Transp.	157	22.2	no	1	4	no
572	4	Aug 11	Pre-separator	128	10.0	no	1	2	yes
573	10	Aug 12	C-Slot	132	10.4	no	1	4	no
574	10	Aug 12	C-Slot	152	19.2	no	1	4	no
575	9	Aug 12	Marked Transp.	150	20.0	no	2	1	no
576	8	Aug 12	Marked Transp.	135	11.1	no	1	4	no
577	6	Aug 12	C-Slot	148	13.7	no	1	2	no
578	3	Aug 12	Marked Transp.	152	19.0	no	1	4	no
579	7	Aug 12	Transport	154	77.8	no	1	4	no
580	12	Aug 13	C-Slot	115	13.5	no	1	4	no
581	12	Aug 13	C-Slot	155	36.1	no	1	4	no
582	11	Aug 13	Pre-separator	135	23.5	no	1	4	no
583	10	Aug 13	C-Slot	142	22.4	no	1	4	no
584	10	Aug 13	C-Slot	135	20.3	no	1	4	no
585	8	Aug 13	Marked Transp.	115	15.7	no	1	4	no
586	6	Aug 13	C-Slot	125	19.0	no	1	4	no
587	6	Aug 3	C-Slot	110	10.9	no	3	1	no
588	4	Aug 13	Pre-separator	120	13.8	no	1	3	no
589	4	Aug 13	Pre-separator	110	13.0	no	1	3	no
590	4	Aug 13	Pre-separator	130	21.8	no	1	4	no
591	5	Aug 13	Transport	135	16.7	no	3	4	no
592	12	Aug 14	C-Slot	135	17.3	no	1	4	no
593	9	Aug 14	Marked Transp.	110	10.2	no	2	-1	no
594	9	Aug 14	Marked Transp.	125	12.8	no	1	3	no
595	8	Aug 14	Marked Transp.	140	36.8	no	1	4	no

Appendix Table 1. (Cont.) Fork lengths, weights, descaling, BKD lesion and IFAT rankings, and pinheads by date, tank number, and test group of individual mortalities during extended artificial seawater holding study at Lower Granite Dam, 1985.

Mort. No.	Tank No.	Date	Test Group	Fork Length (mm)	Weight (g)	Descaling	BKD lesions[a]	BKD IFAT[b]	Pinhead
596	8	Aug 14	Marked Transp.	132	12.9	no	3	-1	yes
597	6	Aug 14	C-Slot	130	20.7	no	1	3	no
598	1	Aug 14	Pre-separator	110	10.1	no	1	3	no
599	2	Aug 14	Transport	110	10.4	no	1	4	no
600	2	Aug 14	Transport	120	16.9	no	3	1	no
601	3	Aug 14	Marked Transp.	135	20.7	no	1	4	no
602	4	Aug 14	Pre-separator	125	14.2	no	1	3	no
603	7	Aug 14	Transport	160	39.4	no	2	-1	no
604	12	Aug 15	C-Slot	155	35.5	no	1	4	no
605	11	Aug 15	Pre-separator	145	29.9	no	2	4	no
606	6	Aug 15	C-Slot	140	22.7	no	1	4	no
607	1	Aug 15	Pre-separator	115	18.3	no	1	4	no
608	1	Aug 15	Pre-separator	135	19.1	no	1	4	no
609	2	Aug 15	Transport	135	27.1	no	2	1	no
610	3	Aug 15	Marked Transp.	135	25.2	no	1	1	no
611	3	Aug 15	Marked Transp.	135	24.6	no	1	4	no
612	4	Aug 15	Pre-separator	110	10.6	no	3	2	yes
613	4	Aug 15	Pre-separator	135	18.8	no	1	3	no
614	5	Aug 15	Transport	105	9.4	no	3	-1	yes
615	7	Aug 15	Transport	135	23.5	no	1	3	no
616	10	Aug 16	C-Slot	135	13.9	no	3	2	no
617	10	Aug 16	C-Slot	110	11.1	no	1	4	no
618	10	Aug 16	C-Slot	115	12.9	no	2	1	no
619	10	Aug 16	C-Slot	115	13.8	no	3	2	no
620	10	Aug 16	C-Slot	135	19.6	no	1	4	no
621	8	Aug 16	Marked Transp.	135	32.7	no	1	3	no
622	8	Aug 16	Marked Transp.	140	22.4	no	1	4	no
623	8	Aug 16	Marked Transp.	125	15.9	no	1	4	no
624	4	Aug 16	Pre-separator	130	19.9	no	1	3	no
625	4	Aug 16	Pre-separator	140	25.7	no	1	4	no
627	8	Aug 16	Marked Transp.	125	11.5	no	1	4	no
628	7	Aug 16	Transport	140	23.3	no	1	4	no
629	1	Aug 16	Pre-separator	150	32.0	no	2	1	no
630	1	Aug 16	Pre-separator	95	11.4	no	2	1	no
631	12	Aug 16	C-Slot	135	17.2	no	3	-1	no
632	11	Aug 17	Pre-separator	120	11.8	no	2	3	no
633	10	Aug 17	C-Slot	125	15.1	no	1	4	no
634	10	Aug 17	C-Slot	115	13.2	no	3	-1	no
635	9	Aug 17	Marked Transp.	145	20.6	no	3	-1	no
636	8	Aug 17	Marked Transp.	150	18.9	no	3	2	no
637	6	Aug 17	C-Slot	120	12.8	no	3	-1	no
638	3	Aug 17	Marked Transp.	105	9.6	no	2	-1	yes
639	5	Aug 17	Transport	165	60.3	no	1	-1	no
640	12	Aug 18	C-Slot	174	38.0	no	1	4	no
641	11	Aug 18	Pre-separator	132	17.7	no	1	4	no
642	11	Aug 18	Pre-separator	164	28.0	no	1	4	no
643	10	Aug 18	C-Slot	168	29.0	no	2	1	no
644	10	Aug 18	C-Slot	142	28.2	no	1	4	no
645	10	Aug 18	C-Slot	157	22.7	no	1	4	no
646	10	Aug 18	C-Slot	115	6.7	no	3	-1	yes
647	10	Aug 18	C-Slot	146	15.2	no	1	4	no
648	10	Aug 18	C-Slot	159	17.7	no	1	4	no
649	9	Aug 18	Marked Transp.	128	10.0	no	2	2	no
650	8	Aug 18	Marked Transp.	127	14.3	no	1	4	no
651	8	Aug 18	Marked Transp.	122	18.9	no	1	4	yes
652	6	Aug 18	C-Slot	156	24.4	no	1	3	no
653	6	Aug 18	C-Slot	135	13.0	no	2	-1	no
654	6	Aug 18	C-Slot	150	19.9	no	2	3	no
655	6	Aug 18	C-Slot	152	26.9	no	2	1	no
656	6	Aug 18	C-Slot	154	22.5	no	1	4	no
657	1	Aug 18	Pre-separator	138	11.7	no	3	-1	no
658	2	Aug 18	Transport	137	18.8	no	2	-1	no
659	3	Aug 18	Marked Transp.	151	22.4	no	1	3	no
660	3	Aug 18	Marked Transp.	160	17.2	no	2	2	no
661	3	Aug 18	Marked Transp.	154	20.3	no	3	-1	no

Appendix Table 1. (Cont.) Fork lengths, weights, descaling, BKD lesion and IFAT rankings, and pinheads by date, tank number, and test group of individual mortalities during extended artificial seawater holding study at Lower Granite Dam, 1985.

Mort. No.	Tank No.	Date	Test Group	Fork Length (mm)	Weight (g)	Descaling	BKD lesions[a]	BKD IFAT[b]	Pinhead
733	4	Aug 27	Pre-separator	124	10.4	no	2	1	yes
734	9	Aug 27	Marked Transp.	151	19.1	no	2	4	no
735	9	Aug 28	Marked Transp.	173	38.1	no	1	4	no
736	1	Aug 28	Pre-separator	186	30.2	no	2	1	no
737	1	Aug 28	Pre-separator	123	11.9	no	2	2	yes
738	1	Aug 28	Pre-separator	145	17.0	no	3	4	no
739	3	Aug 28	Marked Transp.	162	28.5	no	1	4	no
740	7	Aug 28	Transport	156	20.8	no	3	-1	no
741	5	Aug 29	Transport	152	22.2	no	1	4	no
742	7	Aug 29	Transport	172	41.3	no	1	4	no
743	4	Aug 29	Pre-separator	143	23.1	no	3	0	no
744	4	Aug 29	Pre-separator	129	10.7	no	1	4	yes
745	3	Aug 29	Marked Transp.	154	26.2	no	1	4	no
746	6	Aug 29	C-Slot	184	61.7	no	2	2	no
747	12	Aug 29	C-Slot	202	55.0	no	1	4	no
748	8	Aug 30	Marked Transp.	135	12.4	no	3	1	no
749	8	Aug 30	Marked Transp.	121	12.1	no	3	-1	no
750	9	Aug 30	Marked Transp.	128	13.7	no	1	4	no
751	10	Aug 30	C-Slot	158	25.0	no	1	4	no
752	10	Aug 30	C-Slot	165	28.5	no	1	4	no
753	11	Aug 30	Pre-separator	148	22.9	no	1	4	no
754	12	Aug 30	C-Slot	143	15.3	no	1	2	yes
755	7	Aug 31	Transport	162	26.0	no	1	4	no
756	4	Aug 31	Pre-separator	145	17.5	no	1	4	yes
757	3	Aug 31	Marked Transp.	120	9.3	no	3	1	yes
758	1	Aug 31	Pre-separator	149	21.7	no	1	4	no
759	1	Aug 31	Pre-separator	142	19.5	no	1	4	no
760	1	Aug 31	Pre-separator	192	45.5	no	2	-1	no
761	8	Aug 31	Marked Transp.	170	48.9	no	2	1	no
762	10	Aug 31	C-Slot	140	15.9	no	2	1	no
763	4	Sep 1	Pre-separator	138	26.5	no	1	4	no
764	10	Sep 1	C-Slot	153	23.1	no	1	3	no
765	6	Sep 1	C-Slot	157	31.4	no	1	4	no
766	1	Sep 1	Pre-separator	137	16.9	no	3	-1	no
767	8	Sep 2	Marked Transp.	149	26.4	no	3	-1	no
768	2	Sep 2	Transport	148	19.6	no	1	4	no
769	2	Sep 2	Transport	162	28.3	no	1	4	no
770	6	Sep 2	C-Slot	146	21.5	no	2	-1	no
771	5	Sep 2	Transport	112	10.9	no	1	4	yes
772	10	Sep 3	C-Slot	153	25.2	no	2	2	no
774	9	Sep 3	Marked Transp.	164	27.4	no	1	3	no
775	4	Sep 3	Pre-separator	122	16.4	no	2	2	no
776	4	Sep 3	Pre-separator	148	31.3	no	2	-1	no
777	4	Sep 3	Pre-separator	162	27.3	no	1	4	no
778	6	Sep 3	C-Slot	157	27.8	no	2	3	no
779	11	Sep 5	Pre-separator	148	30.3	no	2	-1	no
780	10	Sep 5	C-Slot	150	31.2	no	1	4	no
781	8	Sep 5	Marked Transp.	137	22.7	no	1	4	no
782	6	Sep 5	C-Slot	158	31.0	no	1	4	no
783	4	Sep 5	Pre-separator	162	44.4	no	1	2	no
784	7	Sep 5	Transport	130	16.7	no	2	1	no
785	10	Sep 5	C-Slot	120	13.0	no	3	1	no
786	12	Sep 5	C-Slot	135	28.9	no	3	2	no
787	11	Sep 6	Pre-separator	115	10.3	no	3	-1	yes
788	8	Sep 6	Marked Transp.	125	30.1	no	3	1	no
789	8	Sep 6	Marked Transp.	110	11.9	no	1	4	no
790	6	Sep 6	C-Slot	130	30.6	no	1	4	no
791	12	Sep 7	C-Slot	120	12.2	no	3	1	no
792	6	Sep 7	C-Slot	125	14.8	no	1	4	no
793	8	Sep 8	Marked Transp.	140	20.1	no	1	4	no
794	6	Sep 8	C-Slot	135	23.5	no	3	-1	no
795	3	Sep 8	Marked Transp.	153	22.8	no	2	2	no
796	4	Sep 8	Pre-separator	125	18.0	no	1	-1	no
797	10	Sep 9	C-Slot	160	38.5	no	1	4	no
798	8	Sep 9	Marked Transp.	130	13.2	no	3	-1	no

Appendix Table 1. (Cont.) Fork lengths, weights, descaling, BKD lesion and IFAT rankings, and pinheads by date, tank number, and test group of individual mortalities during extended artificial seawater holding study at Lower Granite Dam, 1985.

Mort. No.	Tank No.	Date	Test Group	Fork Length (mm)	Weight (g)	Descaling	BKD lesions[a]	BKD IFAT[b]	Pinhead
662	4	Aug 18	Pre-separator	166	31.5	no	1	1	no
664	12	Aug 19	C-Slot	145	27.6	no	1	4	no
665	10	Aug 19	C-Slot	115	15.9	no	1	2	no
666	9	Aug 19	Marked Transp.	120	18.5	no	1	4	no
668	4	Aug 19	Pre-separator	150	39.1	no	1	3	no
669	5	Aug 19	Transport	135	21.9	no	1	4	no
670	12	Aug 20	C-Slot	142	18.3	no	3	-1	no
671	12	Aug 20	C-Slot	153	23.5	no	3	1	no
672	10	Aug 20	C-Slot	163	21.3	no	1	3	no
673	12	Aug 20	C-Slot	134	14.3	no	3	1	no
674	2	Aug 20	Transport	145	20.1	no	1	3	no
675	4	Aug 20	Pre-separator	164	32.5	no	1	4	no
676	5	Aug 20	Transport	158	26.0	no	1	4	no
677	12	Aug 20	C-Slot	136	17.4	no	2	4	no
678	12	Aug 21	C-Slot	135	11.7	no	1	4	no
679	12	Aug 21	C-Slot	136	15.9	no	2	3	no
680	6	Aug 21	C-Slot	150	24.3	no	1	4	no
681	6	Aug 21	C-Slot	159	15.5	no	3	-1	yes
682	1	Aug 21	Pre-separator	132	13.7	no	2	1	no
683	5	Aug 21	Transport	109	10.2	no	1	4	yes
685	5	Aug 21	Transport	152	24.0	no	1	4	no
686	12	Aug 22	C-Slot	149	23.0	no	2	2	no
687	11	Aug 22	Pre-separator	156	25.7	no	1	4	no
688	10	Aug 22	C-Slot	153	29.0	no	1	4	no
689	10	Aug 22	C-Slot	155	20.7	no	1	3	no
690	10	Aug 22	C-Slot	194	53.3	no	1	4	no
691	8	Aug 22	Marked Transp.	161	20.9	no	3	1	no
692	6	Aug 22	C-Slot	160	25.1	no	3	1	no
694	4	Aug 22	Pre-separator	124	9.0	no	1	3	yes
695	4	Aug 22	Pre-separator	131	11.8	no	1	4	no
696	8	Aug 23	Marked Transp.	141	22.3	no	1	4	no
697	11	Aug 23	Pre-separator	138	16.4	no	1	4	yes
698	5	Aug 23	Transport	170	39.0	no	2	1	no
699	5	Aug 23	Transport	175	31.7	no	3	-1	no
700	4	Aug 23	Pre-separator	136	17.7	no	3	2	no
701	4	Aug 23	Pre-separator	151	25.9	no	1	4	no
702	6	Aug 24	C-Slot	150	17.1	no	1	3	yes
703	6	Aug 24	C-Slot	148	21.3	no	2	4	no
704	10	Aug 24	C-Slot	149	17.9	no	3	1	yes
705	4	Aug 24	Pre-separator	154	22.0	no	1	4	no
707	11	Aug 25	Pre-separator	154	34.0	no	2	2	no
708	10	Aug 25	C-Slot	129	11.3	no	1	3	no
709	1	Aug 25	Pre-separator	150	12.6	no	1	3	no
710	7	Aug 25	Transport	152	29.5	no	1	4	no
711	4	Aug 25	Pre-separator	152	22.6	no	3	-1	no
712	5	Aug 25	Transport	168	29.3	no	1	4	no
713	5	Aug 25	Transport	173	41.2	no	1	4	no
714	12	Aug 26	C-Slot	147	16.7	no	2	1	no
715	12	Aug 26	C-Slot	151	29.5	no	1	4	no
716	10	Aug 26	C-Slot	145	17.0	no	1	4	no
717	9	Aug 26	Marked Transp.	139	12.4	no	1	-1	no
719	6	Aug 26	C-Slot	150	22.2	no	1	4	no
720	6	Aug 26	C-Slot	149	17.3	no	3	-1	no
721	7	Aug 26	Transport	153	18.6	no	3	-1	no
722	3	Aug 26	Marked Transp.	145	19.7	no	1	3	no
723	4	Aug 26	Pre-separator	138	21.0	no	3	4	no
724	4	Aug 26	Pre-separator	160	25.0	no	1	3	no
725	4	Aug 26	Pre-separator	175	35.1	no	2	4	no
726	5	Aug 26	Transport	146	21.3	no	3	1	no
727	12	Aug 27	C-Slot	172	32.8	no	1	4	no
728	12	Aug 27	C-Slot	141	14.2	no	1	4	yes
729	11	Aug 27	Pre-separator	128	12.6	no	3	1	yes
730	8	Aug 27	Marked Transp.	143	14.1	no	3	2	yes
731	6	Aug 27	C-Slot	159	24.1	no	3	1	no
732	4	Aug 27	Pre-separator	150	19.7	no	1	4	no

Appendix Table 1. (Cont.) Fork lengths, weights, descaling, BKD lesion and IFAT rankings, and pinheads by date, tank number, and test group of individual mortalities during extended artificial seawater holding study at Lower Granite Dam, 1985.

Mort. No.	Tank No.	Date	Test Group	Fork Length (mm)	Weight (g)	Descaling	BKD lesions[a]	BKD IFAT[b]	Pinhead
799	6	Sep 9	C-Slot	130	28.1	no	2	-1	no
800	7	Sep 9	Transport	125	14.8	no	2	-1	no
801	4	Sep 10	Pre-separator	150	40.6	no	1	4	no
802	12	Sep 10	C-Slot	150	36.6	no	1	4	no
803	10	Sep 10	C-Slot	140	27.0	no	1	4	no
804	9	Sep 10	Marked Transp.	130	20.5	no	2	-1	no
805	6	Sep 10	C-Slot	160	45.8	no	3	-1	no
806	4	Sep 11	Pre-separator	130	12.8	no	3	-1	yes
807	1	Sep 11	Pre-separator	125	12.5	no	3	-1	yes
808	1	Sep 11	Pre-separator	135	21.5	no	1	4	no
809	1	Sep 11	Pre-separator	105	9.7	no	1	4	yes
810	8	Sep 11	Marked Transp.	130	14.7	no	1	1	yes
811	8	Sep 11	Marked Transp.	120	11.5	no	3	1	yes
812	6	Sep 11	C-Slot	135	19.4	no	1	4	no
813	7	Sep 11	Transport	185	57.0	no	3	-1	no
814	7	Sep 12	Transport	130	21.6	no	1	4	no
815	3	Sep 12	Marked Transp.	140	23.7	no	1	4	no
816	4	Sep 12	Pre-separator	120	14.4	no	1	4	yes
817	2	Sep 12	Transport	130	16.9	no	1	4	no
818	10	Sep 12	C-Slot	140	26.3	no	1	4	no
819	6	Sep 12	C-Slot	140	24.6	no	1	-1	no
820	6	Sep 12	C-Slot	135	17.3	no	1	4	yes
821	12	Sep 13	C-Slot	145	29.3	no	1	4	no
822	12	Sep 13	C-Slot	155	45.2	no	1	4	no
824	9	Sep 14	Marked Transp.	145	29.4	no	2	-1	no
825	11	Sep 15	Pre-separator	135	30.1	no	1	2	no
826	9	Sep 15	Marked Transp.	130	30.7	no	1	4	no
827	6	Sep 15	C-Slot	155	35.6	no	3	4	no
829	4	Sep 15	Pre-separator	115	12.6	no	1	4	no
830	11	Sep 16	Pre-separator	130	14.9	no	3	-1	no
831	9	Sep 16	Marked Transp.	140	31.4	no	1	4	no
832	8	Sep 16	Marked Transp.	130	17.2	no	1	3	no
833	3	Sep 16	Marked Transp.	135	17.5	no	3	2	no
834	3	Sep 16	Marked Transp.	135	18.2	no	1	3	no
835	3	Sep 17	Marked Transp.	135	16.1	no	3	-1	yes
836	8	Sep 17	Marked Transp.	130	13.0	no	2	-1	no
838	7	Sep 17	Transport	155	41.6	no	3	-1	no
839	7	Sep 17	Transport	135	21.9	yes	2	1	no
840	5	Sep 17	Transport	205	125.0	no	1	1	no
841	7	Sep 18	Transport	120	21.1	no	1	4	no

a). BKD lesion rankings
1 = Visible lesions present
2 = Possible lesions present (questionable)
3 = No visible lesions present

b). BKD IFAT rankings
0 = No BKD organisms present in a minimum of 300 microscope fields
-1 = Less than 1 BKD organism per microscope field
1 = 1-10 BKD organisms per microscope field
2 = 10-100 " " " " "
3 = 100-3 " " " " "
4 = 300+ " " " " "

Appendix Table 2.--Fork lengths, weights, BKD lesion rankings, and BKD IFAT rankings by test group and tank number for surviving fish when the extended artificial seawater holding test was terminated 18 September 1985.

Tank number	Test group	Fork length (mm)	Weight (g)	BKD lesions[a/]	BKD IFAT[b/]
1	Pre-separator	165	48.9	-	-
"	"	145	33.0	-	-
"	"	151	41.8	-	-
"	"	141	44.5	3	-1
"	"	167	56.9	-	-
"	"	178	67.3	-	-
"	"	178	68.8	-	-
"	"	155	41.3	3	-1
"	"	178	70.5	-	-
"	"	155	42.6	-	-
"	"	148	32.4	-	-
"	"	143	41.5	1	3
"	"	140	29.5	-	-
"	"	171	59.4	-	-
"	"	149	38.8	-	-
"	"	132	31.0	3	-1
"	"	142	39.0	-	-
"	"	144	33.1	-	-
"	"	165	49.8	-	-
"	"	155	39.7	3	-1
"	"	175	59.5	-	-
"	"	142	28.7	-	-
"	"	196	90.2	-	-
"	"	158	48.3	2	-1
"	"	158	42.0	-	-
"	"	184	91.2	-	-
"	"	155	50.3	-	-
"	"	150	30.1	2	-1
"	"	121	22.3	-	-
"	"	143	32.7	-	-
"	"	148	43.4	-	-
"	"	135	29.3	2	-1
"	"	140	33.5	-	-
"	"	128	21.4	-	-
"	"	128	21.9	-	-
"	"	123	19.9	-	-
"	"	150	38.7	3	-1
2	Transport	158	44.5	1	4
"	"	158	36.1	2	-1

Appendix Table 2.--cont.

Tank no.	Test group	Fork length (mm)	Weight (g)	BKD lesions[a/]	BKD IFAT[b/]
2	Transport	133	27.8	2	-1
"	"	155	45.2	2	1
"	"	168	63.4	3	-1
"	"	147	41.5	3	0
"	"	142	36.5	2	-1
"	"	123	20.2	2	4
"	"	129	22.6	2	2
"	"	118	20.1	2	-1
"	"	138	33.7	2	-1
"	"	135	21.4	2	-1
"	"	145	38.2	-	-
"	"	127	21.3	-	-
"	"	172	65.7	-	-
"	"	145	38.3	-	-
"	"	151	41.3	-	-
"	"	131	28.2	-	-
3	Mark + transport	189	82.2	-	-
"	"	163	54.5	-	-
"	"	163	45.3	2	-1
"	"	148	42.4	-	-
"	"	132	19.7	-	-
"	"	145	40.0	3	-1
"	"	151	37.8	-	-
"	"	171	63.7	-	-
"	"	131	22.5	1	3
"	"	155	48.4	-	-
"	"	165	53.8	-	-
"	"	175	69.2	2	-1
"	"	151	48.0	-	-
"	"	170	65.0	-	-
"	"	161	44.5	3	-1
"	"	135	23.5	-	-
"	"	141	44.6	-	-
"	"	163	51.3	3	-1
"	"	148	33.4	-	-
"	"	136	31.9	-	-
"	"	139	33.2	2	2
"	"	145	33.6	-	-
"	"	131	25.1	-	-
"	"	155	30.3	1	3
"	"	157	47.5	-	-
"	"	142	24.8	-	-
"	"	199	106.4	2	-1
"	"	182	73.6	3	-1
"	"	129	18.7	-	-

Appendix Table 2.--cont.

Tank no.	Test group	Fork length (mm)	Weight (g)	BKD lesions[a/]	BKD IFAT[b/]
4	Pre-separator	155	39.2	-	-
"	"	159	51.9	-	-
"	"	165	54.3	2	-1
"	"	141	26.7	-	-
"	"	159	59.5	-	-
"	"	163	54.8	2	2
"	"	110	15.8	-	-
"	"	140	27.6	-	-
"	"	148	38.7	2	-1
"	"	162	58.9	-	-
"	"	140	29.7	-	-
"	"	152	37.1	3	-1
"	"	141	35.6	-	-
"	"	130	24.3	-	-
"	"	162	55.2	1	3
"	"	145	31.2	-	-
"	"	155	47.5	-	-
"	"	130	24.6	1	2
"	"	175	74.6	-	-
"	"	163	56.2	-	-
"	"	155	50.5	2	-1
"	"	147	38.2	-	-
"	"	135	20.0	-	-
"	"	138	28.4	3	-1
"	"	110	14.9	-	-
"	"	145	30.4	-	-
"	"	139	27.6	3	-1
"	"	157	31.0	-	-
"	"	155	38.5	-	-
"	"	135	31.8	2	-1
"	"	131	25.8	-	-
5	Transport	171	63.3	-	-
"	"	181	67.9	1	2
"	"	210	106.4	-	-
"	"	142	35.3	3	1
"	"	168	57.6	-	-
"	"	168	56.4	1	2
"	"	143	79.4	-	-
"	"	152	40.5	3	-1
"	"	135	25.6	-	-
"	"	177	61.2	2	-1
"	"	160	47.8	-	-
"	"	132	20.0	3	-1
"	"	132	31.1	-	-
"	"	120	18.4	2	-1
"	"	157	32.2	-	-

Appendix Table 2.--cont.

Tank no.	Test group	Fork length (mm)	Weight (g)	BKD lesions[a/]	BKD IFAT[b/]
5	Transport	110	13.2	3	-1
"	"	190	84.4	-	-
"	"	138	28.0	3	-1
"	"	168	51.1	-	-
"	"	178	66.6	2	-1
"	"	155	43.8	-	-
"	"	145	27.1	-	-
6	C-slot	152	42.1	2	-1
"	"	135	23.5	-	-
"	"	185	76.0	-	-
"	"	157	43.5	2	-1
"	"	151	39.9	-	-
"	"	155	49.3	-	-
"	"	150	31.2	2	-1
"	"	163	53.5	-	-
"	"	132	27.7	-	-
"	"	168	55.6	2	-1
"	"	150	42.3	-	-
"	"	138	28.0	-	-
"	"	133	24.5	3	0
"	"	128	23.1	-	-
"	"	148	40.6	-	-
"	"	140	28.6	3	-1
"	"	169	60.3	-	-
"	"	160	57.4	-	-
"	"	139	31.5	-	-
"	"	162	58.3	-	-
"	"	154	45.5	-	-
"	"	180	71.1	2	-1
"	"	168	52.5	-	-
"	"	155	49.9	-	-
"	"	163	48.7	3	-1
"	"	140	28.1	-	-
"	"	125	23.1	-	-
"	"	145	38.3	2	-1
"	"	120	17.8	-	-
7	Transport	175	79.3	1	2
"	"	175	74.3	-	-
"	"	160	59.0	2	-1
"	"	155	46.8	-	-
"	"	159	50.5	1	3
"	"	189	80.4	-	-
"	"	172	66.2	2	-1

Appendix Table 2.--cont.

Tank no.	Test group	Fork length (mm)	Weight (g)	BKD lesions[a/]	BKD IFAT[b/]
7	Transport	163	58.3	-	-
"	"	165	60.1	3	-1
"	"	153	42.2	-	-
"	"	148	50.5	3	-1
"	"	155	36.0	-	-
"	"	150	43.9	2	-1
"	"	140	34.8	-	-
"	"	141	36.0	-	-
"	"	151	45.4	2	0
"	"	140	32.5	-	-
"	"	148	32.3	-	-
"	"	155	34.6	3	-1
"	"	140	30.9	-	-
"	"	131	23.3	-	-
"	"	118	14.5	2	-1
"	"	125	20.8	-	-
8	Mark transport	189	81.5	2	-1
"	"	203	147.1	-	-
"	"	185	88.7	-	-
"	"	138	26.9	3	-1
"	"	145	30.3	-	-
"	"	141	32.6	-	-
"	"	152	44.9	3	-1
"	"	150	37.5	-	-
"	"	160	53.4	-	-
"	"	138	28.7	-	-
"	"	148	35.8	-	-
"	"	181	78.3	-	-
"	"	159	49.8	2	0
"	"	142	33.5	-	-
"	"	148	37.4	-	-
"	"	140	29.5	3	-1
"	"	119	19.1	-	-
"	"	135	28.4	-	-
"	"	130	18.2	1	3
"	"	149	36.8	-	-
"	"	167	58.5	-	-
"	"	130	25.2	3	1
"	"	132	26.2	3	0
"	"	128	19.3	-	-
"	"	115	18.1	3	-1
"	"	112	15.0	-	-

Appendix Table 2.--cont.

Tank no.	Test group	Fork length (mm)	Weight (g)	BKD lesions[a/]	BKD IFAT[b/]
9	Mark Transport	160	34.2	2	-1
"	"	190	91.5	-	-
"	"	159	39.4	-	-
"	"	175	75.3	2	-1
"	"	168	49.4	-	-
"	"	142	31.0	-	-
"	"	145	32.3	3	-1
"	"	195	81.3	-	-
"	"	163	64.1	-	-
"	"	149	39.6	1	2
"	"	180	74.0	-	-
"	"	145	27.3	-	-
"	"	145	41.5	1	3
"	"	133	24.6	-	-
"	"	148	36.5	-	-
"	"	124	20.6	3	-1
"	"	130	29.1	-	-
"	"	128	20.0	-	-
"	"	145	33.3	2	-1
"	"	131	22.3	-	-
"	"	150	36.6	-	-
"	"	135	32.2	2	1
"	"	185	81.6	-	-
"	"	157	49.1	-	-
"	"	148	38.5	3	-1
"	"	125	23.2	2	-1
"	"	161	36.3	-	-
"	"	164	39.4	-	-
10	C-slot	168	91.2	1	2
"	"	180	70.0	-	-
"	"	142	32.5	-	-
"	"	151	31.4	-	-
"	"	153	44.6	3	-1
"	"	155	46.8	-	-
"	"	160	49.1	-	-
"	"	142	36.6	-	-
"	"	154	43.2	2	-1
"	"	117	25.9	-	-
"	"	148	45.4	-	-
"	"	145	33.8	-	-
"	"	129	27.4	2	-1
"	"	138	27.7	-	-
"	"	150	41.9	-	-
"	"	142	28.5	-	-
"	"	138	30.7	1	2

Appendix Table 2.--cont.

Tank no.	Test group	Fork length (mm)	Weight (g)	BKD lesions[a/]	BKD IFAT[b/]
10	C-slot	165	54.8	-	-
"	"	151	41.2	-	-
"	"	143	29.0	-	-
"	"	140	30.1	3	-1
"	"	128	19.6	-	-
"	"	165	53.0	-	-
"	"	149	38.2	-	-
"	"	143	29.1	2	-1
"	"	145	39.7	-	-
"	"	175	71.3	-	-
"	"	180	60.1	-	-
"	"	130	27.3	1	1
"	"	163	50.6	-	-
"	"	139	29.9	-	-
"	"	135	25.2	-	-
"	"	154	44.1	-	-
"	"	138	28.8	-	-
"	"	140	28.6	2	-1
"	"	165	55.8	-	-
"	"	147	31.0	-	-
"	"	140	36.5	-	-
"	"	125	19.4	2	2
"	"	174	61.2	-	-
"	"	149	40.2	-	-
"	"	140	31.2	-	-
"	"	138	27.5	-	-
"	"	130	24.4	-	-
"	"	165	53.9	-	-
"	"	117	15.2	-	-
"	"	110	12.7	-	-
"	"	115	14.1	-	-
"	"	140	26.5	-	-
11	Pre-separator	189	80.6	3	-1
"	"	138	28.9	-	-
"	"	141	31.2	-	-
"	"	155	38.3	3	-1
"	"	162	73.5	-	-
"	"	180	69.7	-	-
"	"	140	30.5	3	-1
"	"	165	58.2	-	-
"	"	138	35.2	-	-
"	"	155	42.3	2	-1
"	"	162	82.8	-	-
"	"	186	82.8	-	-
"	"	173	67.0	2	-1

Appendix Table 2.--cont.

Tank no.	Test group	Fork length (mm)	Weight (g)	BKD lesions[a/]	BKD IFAT[b/]
11	Pre-separator	161	51.2	-	-
"	"	140	36.4	-	-
"	"	140	28.9	3	-1
"	"	151	37.2	-	-
"	"	190	84.6	-	-
"	"	155	43.2	2	-1
"	"	152	35.5	-	-
"	"	145	30.2	-	-
"	"	152	44.9	2	1
"	"	125	19.9	-	-
"	"	132	22.8	-	-
"	"	142	26.1	3	-1
"	"	120	22.8	-	-
"	"	105	14.2	2	-1
12	C-slot	155	45.8	1	3
"	"	165	56.3	-	-
"	"	179	70.6	-	-
"	"	141	37.0	-	-
"	"	155	48.9	-	-
"	"	165	57.7	2	2
"	"	170	58.9	-	-
"	"	140	31.0	-	-
"	"	160	55.4	-	-
"	"	140	36.3	-	-
"	"	140	33.8	2	-1
"	"	177	75.6	-	-
"	"	155	49.8	-	-
"	"	180	80.2	-	-
"	"	172	72.1	-	-
"	"	155	52.5	-	-
"	"	138	28.1	-	-
"	"	140	25.6	2	-1
"	"	145	31.2	-	-
"	"	148	37.6	-	-
"	"	144	40.6	-	-
"	"	132	24.4	-	-
"	"	135	25.6	-	-
"	"	148	32.2	-	-
"	"	145	30.9	3	-1
"	"	148	34.8	-	-
"	"	149	30.5	-	-
"	"	159	53.0	-	-
"	"	180	70.0	-	-
"	"	165	59.8	-	-
"	"	150	36.4	-	-

Appendix Table 2.--cont.

Tank no.	Test group	Fork length (mm)	Weight (g)	BKD lesions[a/]	BKD IFAT[b/]
12	C-slot	145	37.1	3	0
"	"	141	25.2	-	-
"	"	138	35.2	-	-
"	"	135	25.3	-	-
"	"	139	26.1	-	-
"	"	140	22.6	-	-
"	"	140	35.8	-	-
"	"	182	85.8	2	-1
"	"	165	44.6	-	-
"	"	139	31.1	-	-
"	"	148	30.5	-	-
"	"	152	40.3	-	-
"	"	155	45.6	-	-
"	"	138	24.5	-	-
"	"	150	43.2	-	-
"	"	155	44.9	3	-1
"	"	150	34.9	-	-
"	"	142	36.5	-	-
"	"	158	46.4	-	-
"	"	132	22.1	-	-
"	"	158	50.6	-	-
"	"	145	49.1	-	-
"	"	122	23.4	-	-
"	"	118	18.7	-	-
"	"	131	19.4	-	-
"	"	141	33.3	-	-

a/ BKD lesion rankings
1 = visible lesions present
2 = possible lesions present (questionable)
3 = no visible lesions present

b/ BKD IFAT rankings
0 = no BKD organisms present in 300 microscopic fields
-1 = less than 1 BKD organisms per microscropic field
1 = 1-10 " " " " "
2 = 10-100 " " " " "
3 = 100-300 " " " " "
4 = 300 + " " " " ".

Appendix Table 3.--Temperature, oxygen, pH, salinity, and ammonia (NH_3) levels by date in extended seawater holding study at Lower Granite Dam, 1985.

Date	Temp (°C) Tank	Temp (°C) Head box	O_2(ppm)	pH	Salinity (ppt)	NH_3(ppm)
28 April	10.0	10.0	9.0	7.60	0	-
29 "	11.0	11.0	9.0	7.70	2.0	-
30 "	10.0	10.0	9.0	-	4.2	-
01 May	13.0	13.0	9.0	-	5.9	-
02 "	13.0	12.5	9.0	-	6.9	-
03 "	11.2	11.0	9.0	-	7.9	-
04 "	10.0	9.8	9.0	-	9.4	-
05 "	12.0	13.0	8.0	-	11.5	-
06 "	14.9		8.0	-	12.7	-
07 "	14.0	14.0	8.0	-	12.8	-
08 "	14.5		8.0	-	12.2	-
09 "	14.0	14.0	8.0	7.47	13.9	0.0033
10 "	14.5	14.5	8.0	7.61	14.2	-
11 "	13.0	13.0	9.0	7.47	15.5	-
12 "	12.0	13.0	9.0	7.40	17.0	-
13 "	13.0	13.0	8.0	7.40	17.5	-
14 "	12.0	13.0	8.0	7.42	18.0	-
15 "	12.0	12.0	8.0	7.50	19.0	-
16 "	11.5	8.5	8.0	7.40	18.2	-
18 "	13.0	13.5	8.0	7.53	22.0	-
19 "	15.0	16.0	8.0	7.75	22.0	-
20 "	12.0	12.0	8.0	7.69	23.0	0.0033
21 "	10.0	8.5	8.0	7.51	24.1	-
22 "	14.0	12.5	9.0	7.52	24.8	-
23 "	11.0	12.0	9.0	7.43	24.0	-
24 "	11.5	10.0	8.0	7.47	26.0	-
25 "	11.5	10.0	8.0	7.51	30.2	-
26 "	10.0	10.5	9.0	7.42	29.5	-
27 "	10.0	10.0	8.0	7.52	28.9	-
28 "	10.0	9.5	9.0	7.51	29.9	0.0047
29 "	10.0	9.5	8.0	7.60	28.0	-
30 "	10.0	10.0	8.0	7.57	31.0	-
31 "	10.0	9.0	9.0	7.59	30.0	-
01 June	10.0	10.0	9.0	7.46	29.0	-
02 "	10.0	10.0	9.0	7.47	25.0	-
03 "	10.5	10.0	9.0	7.37	29.0	-
04 "	11.0	10.5	9.0	7.40	28.0	-
05 "	11.0	10.5	9.0	7.42	28.5	-
06 "	10.5	10.0	9.0	7.40	29.5	-
07 "	10.5	11.0	9.0		28.5	-
09 "	11.0	11.0	9.0	7.60	28.0	0.0032
10 "	10.0	11.0	9.0	7.43	29.0	-
11 "	11.0	11.0	9.0	7.45	28.0	-
12 "	11.0	11.0	9.0	7.41	29.0	-

Appendix Table 3.--cont.

Date	Temp (°C) Tank	Temp (°C) Head box	O_2(ppm)	pH	Salinity (ppt)	NH_3(ppm)
13 June	11.0	11.0	9.0	7.47	30.0	-
14 "	10.0	11.0	8.0	7.58	29.0	0.0044
15 "	14.0	12.0	8.0	7.62	30.0	-
16 "	12.0	10.0	8.0	7.19	29.5	-
17 "	9.0	9.0	8.0	7.21	28.9	-
18 "	13.0	12.0	8.0	7.27	30.1	-
19 "	13.0	12.0	8.0	7.30	29.5	-
21 "	10.5	11.0	7.0*	7.36	29.0	-
22 "	11.0	9.0	7.0	7.37	29.2	-
23 "	11.0	8.0	8.0	7.34	27.0	-
24 "	10.5	11.0	9.0	7.35	30.5	-
25 "	10.0	10.0	9.0	7.50	30.0	0.0055
26 "	11.0	10.0	9.0	7.37	29.5	0.0066
27 "	10.5	11.0	9.0	7.25	30.0	-
28 "	10.5	9.0	8.0	-	30.0	-
29 "	10.5	10.0	8.0	-	30.0	-
30 "	10.5	8.5	8.0	-	28.5	-
01 July	10.2	8.0	8.0	-	29.0	-
02 "	10.0	8.0	8.0	7.10	30.0	0.0011
03 "	11.0	10.0	9.0	7.11	29.5	0.0011
04 "	10.0	11.0	9.0	7.05	30.0	-
05 "	10.0	11.0	9.0	7.20	31.0	0.0014
06 "	10.0	11.0	9.0	7.11	31.0	0.0012
07 "	11.0	10.0	8.0	7.23	31.0	-
08 "	10.0	11.0	9.0	7.20	31.5	0.0014
09 "	10.0	11.0	9.0	7.10	30.0	0.0012
10 "	9.0	8.0	9.0	7.12	29.0	0.0012
11 "	10.0	11.0	9.0	7.15	29.5	-
12 "	10.0	11.0	9.0	7.28	29.0	0.0017
13 "	10.0	9.0	9.0	7.25	29.0	-
14 "	11.0	11.0	9.0	7.14	27.5	-
15 "	10.2	9.0	9.0	7.32	30.0	-
16 "	10.5	9.0	9.0	7.51	29.7	-
17 "	10.2	10.5	9.0	7.96	29.9	-
18 "	10.0	9.5	9.0	7.85	29.9	-
19 "	10.2	9.4	9.0	7.89	29.7	-
20 "	10.0	10.5	9.0	7.90	29.9	-
21 "	10.5	10.5	8.0	7.62	29.0	-
22 "	10.0	10.5	9.0	7.70	29.2	-
23 "	10.5	10.5	9.0	7.86	29.7	-
24 "	10.5	10.5	9.0	7.81	29.8	0.0015
25 "	10.2	10.0	9.0	7.52	30.2	-
26 "	10.0	10.5	9.0	7.85	29.8	-
27 "	10.2	10.2	9.0	7.75	29.7	-
28 "	10.5	9.0	9.0	7.29	27.0	-
29 "	10.0	10.0	9.0	7.39	28.7	-

Appendix Table 3.--cont.

Date	Temp (°C) Tank	Temp (°C) Head box	O_2(ppm)	pH	Salinity (ppt)	NH_3(ppm)
30 July	10.0	10.0	9.0	7.54	28.9	-
01 August	10.0	8.0	9.0	7.09	-	-
02 "	10.0	10.0	9.0	7.55	-	-
03 "	11.0	10.0	9.0	7.97	29.4	-
04 "	11.0	12.0	9.0	7.40	28.5	-
06 "	10.0	10.0	9.0	7.23	28.8	-
07 "	10.0	8.5	8.0	7.32	28.0	-
08 "	10.0	8.5	8.0	7.37	28.4	-
09 "	10.0	9.0	9.0	7.40	27.5	-
10 "	10.0	9.0	9.0	7.21	28.1	0.0014
11 "	11.0	9.5	10.0	7.56	27.0	-
12 "	10.5	9.5	9.0	7.24	27.5	-
13 "	11.0	10.0	10.0	7.45	28.0	-
14 "	11.5	10.0	8.0	7.58	28.0	-
15 "	11.0	10.0	9.0	7.41	28.75	-
16 "	12.0	10.0	8.0	7.22	29.2	-
17 "	12.0	10.0	9.0	7.34	27.1	-
18 "	11.5	10.0	8.0	7.43	28.0	-
19 "	11.5	10.0	8.0	7/45	30.5	0.0019
20 "	11.0	10.0	8.0	7.73	29.5	-
21 "	12.0	10.5	8.0	7.87	29.5	-
22 "	11.0	10.0	8.0	7.67	29.5	-
23 "	12.0	10.0	8.0	7.27	28.1	-
24 "	11.5	10.0	8.0	7.21	28.7	-
25 "	11.0	10.0	9.0	7.35	29.2	-
26 "	11.5	10.0	9.0	7.42	29.7	-
27 "	11.5	10.5	8.0	7.38	30.2	0.0017
28 "	12.0	11.0	8.0	7.52	30.5	-
29 "	12.9	11.0	8.0	-	30.1	-
31 "	12.0	10.5	9.0	7.40	30.0	-
01 September	11.5	11.5	8.0	7.31	30.1	-
02 "	12.0	10.0	8.0	7.26	28.9	-
03 "	12.0	10.5	9.0	7.39	30.0	-
04 "	12.0	12.0	9.0	7.40	29.9	0.0015
05 "	12.0	11.0	9.0	7.29	29.7	-
06 "	11.0	11.0	9.0	7.31	29.9	-
07	12.0	12.0	9.0	7.38	29.8	-
10 "	11.0	11.0	8.0	7.38	30.2	-
11 "	12.0	12.0	8.0	7.45	28.5	-
12 "	10.0	10.0	9.0	7.40	30.1	-
13 "	10.0	11.0	9.0	7.41	29.9	0.0015
14 "	11.0	11.0	8.0	7.32	29.9	-
15 "	11.0	11.0	8.0	7.33	30.1	-
16 "	10.0	11.0	8.0	7.41	30.1	-
17 "	10.0	11.0	9.0	7.42	29.9	-