ESTIMATED DIRECT MORTALITY AND INJURY RATE OF JUVENILE SALMONIDS IN PASSAGE THROUGH THE DALLES DAM SPILLWAY, COLUMBIA RIVER IN SPRING AND SUMMER 2002

Contract No. DACW68-02-D-0002
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NORMANDEAU ASSOCIATES
ENVIRONMENTAL CONSULTANTS

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EXECUTIVE SUMMARY

Results of several earlier juvenile salmonid spillway passage survival investigations at The Dalles Dam, using various tag-recapture techniques (*e.g.*, PIT tags, radio telemetry, balloon tags), indicated lower than expected survival (≥98%) raising some site-specific concerns for fish passage. The present investigation, utilizing the HI-Z balloon tag-recapture technique, was undertaken in May and August 2002 to (1) estimate survival (direct effects) within ≤±3%, 90% of the time, in passage through four spillbays (4, 9, and 11 or 13) with a spill volume totaling 40% of the river flow, and (2) better understand the injury/mortality mechanisms to assist in possible spillway modifications for better fish survival.

Two separate releases of hatchery-reared chinook salmon (average total length about 152 mm in May and 125 mm in August) were made, one in May (a period of high tailwater and high river flow) and the other in August (a period of low tailwater and low river flow). Treatment fish were released through Spillbays 4, 9, and 13 in May and through Spillbays 4, 9, and 11 in August. Water temperatures ranged from 10.0 to 13.5°C (50.0 to 56.3°F) in May and from 19.5 to 21.6°C (67.1 to 70.9°F) in August.

Recapture rates (physical retrieval of alive and dead fish) differed between the two release times. About 94 to 96.7% of the treatment and 99% of the control fish were recaptured in May. In contrast, only 66 to 78% of the treatment and 80.2% of the control fish were recaptured in August. The lower recapture rates in August were primarily due to loss of tagged smolts to piscivorous predation (presumably northern pikeminnow and smallmouth bass at higher water temperatures) and tag dislodgment (fish assumed dead). Predation by northern pikeminnow is high particularly at water temperatures exceeding 15.6°C (60°F); water temperatures in August exceeded 19.0°C (66.2°F). It was estimated that 10.4 to 15.2% of treatment and 7.1% of control fish were presumed preyed upon in August. The overall predation loss rate of tagged smolts in May was estimated at <1.8%; the water temperature ranged from 10.0 to 13.5°C (50.0 to 56.3°F). The latter was similar to observations made in other experiments at water temperatures <15°C (59°F). Little predation on tagged smolts was observed in the November 1995 balloon tag-recapture study; water temperatures ranged from 12.0 to 14.5°C (53.6 to 58.1°F) at that time. Preliminary analysis of data from a spillway passage survival investigation at The Dalles conducted in the fall 2002 suggests predation losses of tagged smolts were minimal at water temperatures less than 14.0°C (57.2°F). The severity of predation on tagged smolts precluded a release of the full complement of the prespecified number of fish in August and the experiment had to be curtailed. Consequently, precise survival estimates could not be generated for the August releases and thus are not presented herein. However, the recaptured fish in the August release provided some insights on injury mechanisms.

Tag dislodgment (fish assumed dead, lowering recapture rates) was also higher in August than in May. It was estimated at 4.9 to 9.9% for treatment fish and 7.1% for the control group in August and from 0.3 to 2% for treatment fish and 0% for controls in May. Two contributory factors likely influenced these results: predators attacking tagged fish and dislodging the tags and smaller sized fish (125 mm in August versus 152 mm in May), perhaps making fish more vulnerable to predation.

Survival rates (48 h) differed between spillbays for the May releases with the southern most spillbay showing the lowest survival. The lowest survival (93.8%, 90% CI=91.6 to 96.1%) was estimated for chinook salmon passing through Spillbay 13. The survival rates through Spillbays 4 and 9 were, respectively, 97.4% (90% CI=95.7 to 99.0%) and 97.4% (90% CI=95.7 to 99.1%). Precision (ε) on all the estimates was ≤±3%, 90% of the time and met the prespecified objective of the experiment. Although sample sizes were not pre-selected to statistically detect differences in survival, log

likelihood statistic, applied *a posteriori*, indicated Spillbay 13 survival was significantly (P=0.04) lower than at the other two spillbays.

Although the experimental conditions (e.g., spill volume, spillbay characteristics) were not identical, estimated direct survival rates in the present study differ somewhat from those obtained at Spillbays 3 and 4 in an earlier November 1995 experiment. In that study (November 1995) using the balloon tag-recapture technique survival through the unmodified Spillbay 3 was estimated at 95.5% (90% CI=92.7 to 98.3%) and through the modified Spillbay 4 (I-slot) it was 99.3% (90% CI=97.2 to 101.4%); however, a spill of 4,500 to 10,500 cfs was released only through the tested spillbays. In the present study spill was released through multiple spillbays equaling about 40% of the total river flow. It is noteworthy that most survival estimates were less than the expected 98%.

The recaptured fish provided insights into injury type with its probable source and corroborated survival estimates given above. Southern side Spillbays 13 (spring) and 11 (summer) inflicted higher injury rates. Adjusted for control fish, the visible passage-related injury rates (*e.g.*, missing eye, laceration, bruises, scrapes, tears, etc.) were 4.0% (Spillbay 9) to 4.5% (Spillbay 4) of the treatment fish recaptured in May while at Spillbay 13 it was 7.9%. Injury rates in August were similar to that observed in May and adjusted visible injury rates were 3.1, 4.6 and 5.1% at Spillbays 4, 9, and 11, respectively.

Another metric, "clean fish" (visible injuries, scale loss, and loss of equilibrium) was also computed to facilitate comparisons of survival and fish without any passage inflicted maladies. The trends were similar to those for the survival rates given above. The estimated clean fish probabilities differed between spillbays in May but was similar for all spillbays in August. The lowest clean fish estimate in May was observed at Spillbay 13, 0.909 (90% CI=0.881 to 0.935). The clean fish estimates were identical for the other two spillbays (4 and 9) in May; 0.944 (90% CI=0.919 to 0.965). The clean fish estimates in August ranged from 0.926 (Spillbay 11) to 0.936 (Spillbay 4). The 90% CI was 0.876 to 0.972 at Spillbay 11 and 0.888 to 0.980 at Spillbays 4 and 9. The precision on the August estimates was lower (within $\leq\pm$5%, 90% of the time) than the May estimates (within $\leq\pm$3%, 90% of the time).

Little differences (<0.011) were observed between clean fish estimates for the two northern Spillbays (4 and 9) in both study periods and within each study period estimates were virtually identical at Spillbays 4 and 9. However, clean fish estimates were lower, though statistically non-significant, for southern Spillbays 11 and 13 in both periods.

The primary contributing factors to observed injury appear to be shear forces and collision with solid objects in the stilling basin. The higher fish injury rates and lower survival in passage through the southern side spillbays under the tested hydraulic conditions may have occurred due to longer exposure to turbulence in the stilling basin. Data from the release of balloon tagged autonomous sensors suggest some fish may have collided with hard objects or been retained for a longer time in the stilling basin. Further, visual observations and data from autonomous sensors indicate a lateral flow that may transport entrained fish from the south to the north side of the stilling basin.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDIX TABLES

1.0 INTRODUCTION

Juvenile salmonids on their seaward journey encounter any or all of the following exit routes at hydro dams: turbines, spillways, and bypasses. There are two inter-related concerns associated with passage through any of these routes for overall survival. One is the proportion of fish utilizing any of these routes during emigration and the other is their subsequent post-passage condition and survival. Spill of varying magnitude and duration is used at most hydro dams on the Columbia River Basin to enhance passage effectiveness and overall survival of juvenile salmonids (Schoeneman *et al.* 1961; Heinle and Olson 1981; Wilson *et al.* 1991). However, there are considerable physical and hydraulic differences among dams which may influence spill effectiveness, fish survival, or both. Bell *et al.* (1972) and Heisey *et al.* (2003) have reported survival rates ranging from 83 to 100% in passage through spillways at hydroelectric dams on the Columbia River Basin.

Results of some recent studies at The Dalles Dam on the lower Columbia River have indicated that spill effectiveness and fish passage survival vary with spill volume (as a proportion to river flow), duration (continuous, day or nighttime), spillbays, and season (Normandeau Associates *et al.* 1996a; Dawley *et al.* 1998, 2000a,b). Data from these studies indicate that passage survival at The Dalles Dam spillway is less than a generally acceptable rate of 98%. However, the exact causal mechanisms for fish condition and survival are not well understood to offer possible explanations for lower passage survival. In an earlier investigation at The Dalles Dam, estimated direct survival rates of juvenile salmonids in passage through Spillbay 4 (I-slot, spill volume 10,500 cfs), Spillbay 6 (overflow weir, spill volume 4,500 cfs), and unmodified Spillbay 3 (spill volume 10,500 cfs) were reported at 99.3, 99.0, and 95.5%, respectively (Normandeau Associates *et al.* 1996a). The reported respective injury rates were 1.5, 2.5, and 0.4%. It was hypothesized that some portion of the injury/mortality could be attributed to fish collisions with baffles, boulders, or the end sill downstream of the spillbay. However, in that study spill was discharged only through each of the tested spillbays; this spill pattern is not presently practiced to pass fish at The Dalles Dam. At present, spill volume is set at a proportion of the prevailing total river flow (30 to 64%) spread over several spillbays. No direct estimates of fish injury/mortality are available for this spill pattern; it was unknown whether a spill survival study at full spillway discharge could be satisfactorily completed.

As part of improving the understanding of causal mechanisms for fish injury and mortality and determining if balloon tagged fish could be recaptured after passage at high spill volumes, a feasibility study was conducted in 2001 (Normandeau Associates and Mid Columbia Consulting 2001). Juvenile salmonids were released through three Spillbays (4, 9, and 11) along with autonomous sensors during full spillway operation at The Dalles Dam. This study indicated that it was feasible to successfully tag-recapture a high proportion of juvenile salmonids at full spillway operation and gather useful information on potential passage problems at The Dalles Dam. Results of a concurrent balloon tagged "sensor fish" releases indicated that alive fish may be exposed for a longer duration to severe hydraulic conditions on the southern side of the spillway and may strike solid objects in the stilling basin (Normandeau Associates and Mid Columbia Consulting 2001). Pursuant to these findings, a full-scale investigation was undertaken in 2002 to estimate the direct effects of passage of hatchery-reared chinook salmon, *Oncorhynchus tshawytscha*, in passage through three Spillbays (4, 9, and 11 or 13) with a total spill volume of about 40% of the river flow. Estimation of direct effects has assisted in addressing structural modifications at hydroelectric dams (RMC and Skalski 1994a,b; Normandeau Associates and Skalski 2000a,b,c, 2001). At a spill volume of about 30 to 40% of the river flow fish survival (indirect and direct effects) was reported to be higher than at a 64% spill rate (Dawley *et al.* 1998).

1.1 Objectives

The specific objectives of the present study were to: 1) estimate direct survival within ≤±3%, 90% of the time, of juvenile salmon upon passage through three spillbays during typical spring (May) and summer (August) spillway releases at 40% of total river flow; 2) determine and understand injury/mortality rates and mechanisms which could assist in possible spillway modifications for safer fish passage; and 3) assist Pacific Northwest National Laboratory (PNNL) with the release and recapture of balloon tagged autonomous sensor fish to characterize stilling basin hydraulic conditions experienced by alive fish.

For comparative purposes, the investigation was carried out in spring (a period of high tailwater level and high river flow) and summer (a period of low tailwater and low river flow). The range in tailwater levels and total river flows during the spring and summer tests were 78.3 to 83.4 ft and 167,200 to 306,100 cfs and 75.6 to 78.9 ft and 101,200 to 181,800 cfs, respectively (Table 1-1). Appendix Table A-1 provides hourly spill volumes when fish were released.

1.2 Project Description

The Dalles Dam is the second dam upriver (river mile 191.5 or rkm 306) on the main stem Columbia River (Figure 1-1). The powerhouse was completed in 1957 and is located between Oregon and Washington. The Dalles Dam consists of a powerhouse, a spillway, and a navigation lock. The configuration of this facility is such that the spillway is perpendicular to the river, while the powerhouse is parallel to the river (Figure 1-1). The spillway has an overall length of 1,370 ft and contains 23 gates, each 50 ft wide. Spill is regulated by bottom opening tainter gates that pass water at a maximum depth of approximately 40 ft below the upstream water surface. Each tainter gate passes approximately 1,500 cfs for each foot the gate is lifted. The typical station hydraulic head is approximately 80 ft (Figure 1-2).

Tainter gates were raised a minimum of 3 ft above the spillway crest, providing a spill volume of 3,000 cfs per bay. The total spill volume through each spillbay was about 40% of the river flow, though the discharge from tested spillbays ranged from 3,000 to 10,500 cfs (Table 1-1).

A single row of 9 ft high by 10 ft wide concrete baffles are located in the stilling basin to dissipate energy (Figure 1-3). Three baffles lie downstream of each spillbay approximately 9 ft below normal tailrace elevation. An end sill, another energy dissipation structure, lies about 45 ft downstream of the baffles. This structure is a 13 ft high continuous vertical wall and lies approximately 10 ft below normal tailrace elevation (Figures 1-2 and 1-3).

2.0 STUDY DESIGN

There are two primary components of effects on fish using any exit route: direct and indirect effects. Direct effects are manifested immediately after passage (*e.g.*, instantaneous fish mortality, injury, loss of equilibrium); indirect effects (*e.g.*, predation, disease, physiological stress) may occur over an extended period or distance after passage. The present study was designed to estimate direct effects of passage by a straightforward approach of introducing a known number of balloon tagged alive fish into each spillbay (treatment), recapturing them immediately after passage, enumerating the alive and dead fish, and then carefully examining the condition of each fish.

Treatment fish were released into Spillbays 4, 9, and a spillbay near the southern edge of the spill pattern. The spillbay selected near the southern edge of the spill was Spillbay 13 for the spring and Spillbay 11 for the summer tests. Control fish were released downstream of Spillbay 3. Fish releases were set to occur over a two-week period in the spring (May) and a two-week period during the summer (August). However, the full complement of fish allocated for the August test could not be

released due to higher than expected losses of experimental fish to predation (mostly by northern pikeminnow and smallmouth bass). The lower than expected recapture rate, primarily losses due to predation, prompted a decision to curtail the experiment.

2.1 Source and Maintenance of Specimens

Juvenile chinook salmon smolts used in the study were obtained from the Carson National Fish Hatchery, Bingen, Washington. Lots of 500 to 800 fish were transported from the hatchery via truck to the headworks of The Dalles Dam and were held in two tanks with a 200 or 600 gal capacity. The fish transport tank was equipped with a recirculation system and supplemental oxygen supply. The approximate transport time from the hatchery to the study site was 0.5 hours. Approximately 24 h prior to tagging 150 fish were transferred to a 200 gal holding tank on the upper spillway deck. All fish holding tanks/pools were supplied continuously with ambient river water and were equipped with degassing units. Fish were held a minimum of 24 h prior to tagging to alleviate handling stress and to acclimate them to ambient river conditions. Ambient river temperature during the study ranged from 10.0 to 13.5°C (50.0 to 56.3°F) in spring and 19.5 to 21.6°C (67.1 to 70.9°F) in summer (Table 2-1).

Individual treatment fish on any given day were drawn non-selectively from the supply tank on the upper spillway deck, thereby assuring that all groups were of similar size and condition. Lots of 5 to 10 fish were randomly netted from the holding tank and transferred to the adjacent tagging site with a water-sanctuary equipped net. Fish displaying abnormal behavior, severe injury, fungal infection, or descaling (>20% per side) were not used. The same fish selection criteria were applied to control groups.

In May, yearling chinook salmon smolts 115 to 197 mm long (mean approximately 152 mm TL) were used. In August, subyearling chinook salmon smolts ranged from 100 to 156 mm (mean approximately 125 mm). Figure 2-1 shows the length frequency distribution of the treatment and control fish groups.

2.2 Sample Size Requirements

One of the main considerations was to release an adequate number of fish such that the resulting survival estimates would be within $\leq\pm$3%, 90% of the time. The sample size was not pre-selected to detect differences in survival between spillbays. The sample size is a function of the recapture rate (P), expected passage survival ($\hat{\tau}$) or mortality ($1-\hat{\tau}$), survival of control fish (S), and the desired precision (ε) at a given probability of significance (α). In general, sample size requirements decrease with an increase in control survival and recapture rates. Only precision (ε) and α levels can be strictly controlled by an investigator. Based on the results of several spillbay survival experiments from other sites on the Columbia River Basin, including The Dalles Dam (Table 2-2 and Appendix Table B-1), a sample size of approximately 325 fish per treatment release (assuming 98% control survival, recapture rate of 98%, and expected passage survival of 97%) was deemed sufficient to attain a prespecified precision level (ε) of $\leq\pm$3%, 90% of the time. The projected number of fish needed for each study period was 1,600.

Past experience has suggested that the sample sizes can be adjusted as a study progresses because the results are available daily. If recapture and control survival rates are higher than initially assumed, sample size can be reduced. Conversely, if the values of these parameters are lower than initially assumed, as was the case in summer, then sample size must be increased to achieve the pre-specified statistical precision. Under the prevailing conditions it became evident that the sample size requirements would have been well beyond the planned scope in summer to achieve the prespecified precision (ε) level of $\leq\pm$3%, 90% of the time within a reasonable time. Consequently, survival estimates were not generated for the August releases; however, recaptured fish provided some

insights into the source and type of injury. This approach also minimized the use of limited available fish resources.

2.3 Release Conditions

Fish were released through three different Spillbays (4, 9, and 13 in May and 4, 9, and 11 in August). The three spillbays were selected for their location and spill patterns (Figure 2-2). Fish were released with a total spillbay discharge of 40% of the river flow covering high (spring) and low (summer) tailwater conditions. Spill volume from the tested spillbays ranged from 3,000 to 10,500 cfs and 3,000 to 7,500 cfs in spring and summer, respectively. Appendix Table A-1 provides the hourly spillway discharge and other hydraulic conditions during fish releases.

A fish release pipe was installed in each of the test spillbays plus a pipe to release control fish into the tailrace (Figures 1-2, 2-3, and 2-4). At each release site a four inch diameter flexible hose was threaded through a 6 in diameter steel pipe. The terminus of each treatment release hose was secured within a 6 in sweep elbow oriented downstream. Each treatment steel support pipe was positioned and secured with guide wires and/or brackets to ensure it remained at the desired depth, did not rotate, or was not drawn towards the spill gate. The tailrace control release pipe with hose was positioned on the end sill downstream of Spillbay 3.

The location of the release hose for the treatment fish was in the middle of the spillbay. All release hoses were approximately 10 ft upstream of the tainter gate. The terminus of the release pipe was positioned 8 ft above the ogee in Spillbays 4 and 9 and 4 ft above the ogee in Spillbays 11 and 13 (Figures 1-2, 2-3, and 2-4). Control fish were released approximately 260 ft downstream of the Spillbay 3 crest. The control release hose was secured to the end sill by a steel support beam that positioned the end of the hose approximately 3 ft (spring) and 5 ft (summer) above the water and was oriented to discharge the fish and water in the direction of the flow.

For the spring experiment fish were released between 14 and 27 May 2002; for the summer experiment fish were released between 15 and 22 August 2002. The total river flow at The Dalles ranged from 167,200 to 306,100 cfs during spring (Figure 2-2) and 101,200 to 181,800 cfs in summer. Forebay elevations ranged from 157.4 to 159.4 ft in spring and 156.9 to 159.3 ft in summer. Tailrace elevations ranged from 78.3 to 83.4 ft in spring and 75.6 to 78.9 ft in summer (Table 1-1 and Appendix Table A-1).

2.4 Tagging and Release

Fish handling and balloon tagging techniques followed those used during the feasibility study at The Dalles Dam (Normandeau Associates and Mid Columbia Consulting 2001) and other hydroelectric projects on the Columbia River Basin (Heisey *et al.* 1992; Mathur *et al.* 1996b, 1999; Normandeau Associates *et al.* 1996a,b,c). Briefly, lots of 5 to 10 fish were randomly removed from holding tanks to the adjacent tagging site using a water sanctuary equipped net. Fish displaying abnormal behavior, severe injury, fungal infection, or descaling (>20% per side) were not used. The same fish selection criteria was applied to all treatment and control groups. Fish were anesthetized in a 0.5% MS 222 solution (<5 min) and equipped with two uninflated balloon tags and a miniature radio tag.

Initially, the preferred miniature radio tag was a coded Lotek tag compatible with an underwater antenna array deployed downstream of the spillbays by U. S. Geological Service (USGS). This antenna array was deployed to ascertain the dispersal patterns of juvenile fish in the spill pool. Using compatible tags on the balloon tagged fish was to provide information on fish movement throughout the spill pool. However, the Lotek tags proved to be difficult to track when several fish were in the same area. Additionally, the underwater antenna array did not perform as planned. Consequently, the

study was conducted primarily with the standard Advanced Telemetry tags, each with a unique frequency.

Balloon tags were attached via a stainless steel pin inserted through the musculature beneath the dorsal and adipose fins. A radio tag was attached in combination with the dorsal balloon tag (Heisey *et al.* 1992). A uniquely numbered VI tag (Visual Implant, Northwest Marine Technology, Inc., Shaw Island, Washington) was also be inserted in the postocular tissue for use in tracking 48 h survival of individual recaptured fish. Fish also received a fin clip in the event the VI tag became dislodged. Balloon tagged fish were placed in a covered, 20 gal container continually supplied with ambient river water until fully recovered from anesthesia (generally 30 to 45 min, minimum 20 min). After full recovery, fish were individually placed into the induction system, tags were activated, and the fish was released. Inflation time of the tags was partially regulated by the temperature and amount of water injected into the tags just prior to release.

All treatment and control fish were released through an induction apparatus (Figure 2-3) that consisted of a small holding basin attached to a 4 in diameter flexible hose (Normandeau Associates and Skalski 1999, 2000a; Normandeau Associates and Mid Columbia Consulting 2001; Normandeau Associates *et al.* 1996a,b,c). The release hose was supplied with river water to ensure fish were transported quickly within a continuous flow of water to the desired release point (see Section 2.3). The same induction system and release hoses were used to release the sensor fish and other radio tagged juvenile salmon monitored by USGS.

All procedures for handling, tagging, release, and recapture of fish were nearly identical for all treatment and control groups. Fish were randomly selected from each day's transport. The goal was to release 30 fish through each of the three spillbays and 30 control fish for a daily total of 120 fish. During the spring, 391, 396, and 405 fish were released through Spillbays 4, 9, and 13, respectively (Table 2-1). The total release for the matching controls was 395. This release scheme proved logistically effective and provided some economy and utilized a relatively smaller number of fish without sacrificing precision. The abbreviated release during the summer consisted of 212, 211, and 204 treatment fish through Spillbays 4, 9, and 11, respectively, and 212 control fish (Table 2-1).

2.5 Fish Recapture

Upon passage, fish were tracked and retrieved when buoyed to the surface downstream of the spillbays by one of three or four recapture boat crews. Boat crews were notified of the radio tag frequency of each fish upon its release. Only crew members trained in fish handling were used to retrieve tagged fish. To minimize crew bias, no crew was specifically assigned to retrieve either control or treatment fish.

Radio signals early in the study were received on a 3-element Yagi antenna coupled to a Lotek receiver, however, most tracking was done with a 5-element Yagi antenna coupled to an Advanced Telemetry receiver. The radio signal transmission enabled the boat crew(s) to follow the movement of each fish after passage and position the boats downstream for retrieval when the balloon tag buoyed the fish to the surface; the boats were required to remain a safe distance downstream of the turbulent discharge. Active radio tags which failed to surface were tracked for a minimum of 30 minutes and then checked periodically thereafter to ascertain if fish displayed movement patterns typical of emigrating smolts or that of a predator. Recaptured fish were placed into an on-board holding facility, and tags were removed (Heisey *et al.*1992). Each fish was examined for descaling and injuries and assigned appropriate condition codes, if necessary, per the descriptions presented in Table 2-3. Tagging and data recording personnel were notified via a two-way radio system of each fish's recovery time and condition.

Each recaptured fish was immediately examined for visible injuries and later a likely causal mechanism was assigned. Limited controlled experiments (Neitzel *et al.* 2000; PNNL *et al.* 2001) to replicate and correlate injury type and characteristic to a specific causative mechanism provides some indication of the cause of observed injuries in the field. Some injury symptoms can be manifested by two different sources which may lessen the probability of accurate delineation of a cause and effect relationship (Eicher Associates 1987).

All fish recaptured alive were transferred in 5 gal pails to an on-shore holding pool for assessment of delayed effects (48 h). Pools were continuously supplied with ambient river water and shielded to prevent potential fish escape and avian predation. Each day's treatment and control fish were held together in the same pool for 48 h.

As a precautionary measure, the Corps secured the services of personnel from the U. S. Department of Agriculture to scare gulls from the tailrace. Past experience has shown that the hazing of gulls minimizes the potential loss of buoyed experimental fish, and thus maintains the use of prespecified sample sizes. However, predation by piscivores (*e.g.*, northern pikeminnow and smallmouth bass) on tagged fish could not be controlled.

2.6 Classification of Recaptured Fish

As in previous similar investigations (Normandeau Associates *et al.* 1996a,b,c, 1997; Normandeau Associates and Skalski 1998, 1999, 2000a,b,c) the immediate post-passage status of an individual recaptured fish and recovery of inflated tags dislodged from fish was classified as alive, dead, inflated tag(s) recovered, unknown, or predation. The following criteria have been established to make these designations: (1) alive--recaptured alive and remaining so for 1 h; (2) alive--fish does not surface but radio signals indicate movement patterns typical of emigrating juveniles; (3) dead--recaptured dead or dead within 1 h of release; (4) dead--only inflated tag(s) without fish are recovered and telemetric tracking, or the manner in which inflated tags surfaced, is not indicative of predation; (5) unknown--no fish or dislodged tags are recaptured, or radio signals are received only briefly, and the subsequent status cannot be ascertained; and (6) predation--fish are either observed being preyed upon, the predator is buoyed to the surface, or subsequent radio telemetric tracking indicates predation (*i.e.*, rapid movements of tagged fish in and out of turbulent waters or sudden appearance of fully inflated tags). Preyed upon fish are assumed dead in the survival calculations. However, because of the high predation rate in August, additional effort was expended to track potential predators with ingested HI-Z tagged fish.

Mortalities of recaptured fish occurring after 1 h were assigned 48 h post-passage effects although fish were observed at approximately 12 h intervals. Specimens were examined for descaling and injury, and those that died were necropsied to determine the probable cause of death. Additionally all specimens alive at 48 h were re-anesthetized and closely examined for injury and descaling. The re-examination of immobilized fish minimizes the need for extensive handling and associated stress upon immediate recapture. The initial examination allows detection of some injuries, such as bleeding and minor bruising that may not be evident after 48 h due to natural healing processes (Normandeau Associates *et al.* 1996a,b,c). Injury and descaling were categorized by type, extent, and area of body.

Fish without any visible injuries that were not actively swimming or swimming erratically at recapture were classified as "loss of equilibrium". This condition has been noted in most past studies and often disappears within 10 to 15 min after recapture if the fish is not injured (Normandeau Associates *et al.* 1996a,b,c). A malady category was established to include fish with visible injuries, major scale loss (greater than 20% on either side), or loss of equilibrium. Dead fish without any of

these symptoms were not included in this category. Fish without maladies were designated "clean fish".

This clean fish metric was established to provide a standard way to present a rate depicting how a specific passage route affected the condition of passed fish. Clean fish, the absence of maladies, was chosen rather than fish with maladies so that this metric would be more comparable to survival; however, the clean fish metric is based solely on fish physically recaptured and examined. Additionally, the clean fish metric in concert with site-specific hydraulic and physical data can provide insight into what passage conditions will provide safer fish passage.

Injuries were also categorized as minor or major, based on laboratory studies by PNNL *et al.* (2001). These are as follows:

- Minor – Injuries that were visible but not life threatening and tended to heal and disappear over the post-exposure observation period. Small bruises (approximately 0.5 cm in diameter) with minor discoloration (most commonly observed at the dorsal insertion of the operculum) were given a minor injury rating because fish quickly recovered from such injuries with no apparent ill effects.
- Major – Any injury that resulted in prolonged (48 h) loss of equilibrium was life threatening, or persisted throughout the post–exposure observation were rated major. For example, a large bruise (approximately 0.5 cm in diameter), damage to the spinal column, cuts with visible bleeding, injured eyeballs (bulging, hemorrhaged, or missing), gill damage (inverted gill arches severe enough to result in bleeding). The fish was classified as scale loss if approximately ≥20% of either side of the fish was descaled.

2.7 Survival and Clean Fish Estimation and Data Analysis

Passage survival probabilities (May data only) for each spillbay were estimated relative to the control fish survival (Heisey *et al.* 2003; Mathur *et al.* 1996b). Data from all of the daily control releases were pooled. The three treatment conditions (three spillbays) and one control condition were simultaneously analyzed and modeled by joint likelihood (Normandeau Associates *et al.* 2000). Data from individual daily trials (Appendix Tables C-1 and C-2) were used in the analysis. A likelihood ratio test was used to determine whether recapture probabilities were similar for alive (P_A) and dead (P_D) fish. The statistic tested the null hypothesis of the simplified model (H_O:P_A=P_D) versus the alternative of the generalized model (H_A:$P_A \neq P_D$). Depending upon the outcome of this analysis for the 1 h survival the parameters and their associated standard errors were calculated using that model.

Chi-square analyses were performed for homogeneity (P=0.05) in each daily treatment release with respect to recapture probabilities of alive, dead, and non-recovered fish. Test of homogeneity (P=0.05) between individual control trials was also performed using the chi-square test.

The clean fish estimate was determined for both May and August releases. The clean fish estimate was determined from fish that had no maladies (*i.e.*, no visible injuries, scale loss, or loss of equilibrium) or displayed maladies that were not attributable to passage, *i.e.*, injuries solely attributed to predator attack or tag induced (tear at tag site) (Appendix Tables C-3 and C-4). Clean fish probabilities for each spillbay were estimated relative to the control fish that were free of any maladies.

The 90% confidence intervals on the estimated survival for all fish and clean fish were calculated using the profile likelihood method (Normandeau Associates *et al.* 1996a,b,c) (Appendix D). Only recaptured fish that were visibly examined were included in the clean fish analysis. Differences in survival of fish and clean fish between spillbays were tested, *a posteriori*, by log likelihood statistics (see Appendix D).

The statistical outputs are provided in Appendix D (output discussed in the report are highlighted) and the disposition of individual fish is given in Appendix C (Tables C-5 through C-8). Only summarized information is discussed in the main body of the report.

2.8 Sluice Evaluation

A limited study was conducted at The Dalles sluice on 24 August 2002. The primary purpose of this study was to ascertain if the relatively high predation rate observed for spillbay entrained fish also occurred for sluice passed fish. The same fish handling and testing procedures used for the spillbay study were followed here.

The fish were released into the collection channel, approximately 1 ft above the water surface, just downstream of the most downstream entrance. The Project was passing 142,100 cfs, with approximately 4,500 and 56,000 cfs spill through the sluice and spillway, respectively. Forebay and tailrace elevations were 157.7 and 76.9 ft, respectively, and ambient river temperature was 21.0°C (69.8°F).

2.9 Autonomous Sensor Fish

Sensor fish, an instrumented package designed to determine exposure histories to turbulence and pressure during passage (PNNL *et al.* 2001) were also equipped with three balloon tags and a miniature radio tag and released using the identical induction release hose into the same spillbays as for the live fish. Sensor fish were also released through the control release hose. A total of 136 and 71 treatment sensor fish were released in May and August, respectively. Some 41 and 19 control sensor fish were also released during the respective test periods. The results of sensor fish passage will be provided by PNNL in a separate report. However, relevant portions of the report are included to explain some of the observed results on live fish releases.

3.0 RESULTS

3.1 Recapture Rates

Recapture rates (physical retrieval of both alive and dead fish) differed between May and August releases (Table 3-1). In May, recapture rates of treatment groups were ≥94% and for controls it was 98.7%. Most of the recaptured fish were alive. In contrast, the recapture rate for August releases of treatment groups ranged from 66 to 78% and for controls it was 80%. A high percentage of all groups of fish (7 to 15%) in summer succumbed to predation (Table 3-2). Spring predation losses ranged from 1 to 3%, nearly equally caused by gull and fish. Summer predation loss was caused primarily by fish, most likely northern pikeminnow and smallmouth bass.

For the spring releases, chi-square tests indicated homogeneity ($P>0.05$) between daily trials within each treatment group and control, suggesting the daily trial data could be pooled. August release data were not subjected to statistical testing because the experiment had to be prematurely terminated and survival estimates were not generated.

Likelihood ratio tests indicated no significant difference ($P>0.05$) between the simplified ($H_O:P_A=P_D$) and generalized ($H_A:P_A\neq P_D$) models. Thus, survival probabilities and their associated standard errors using the reduced model are presented. These values are highlighted in Appendix D (statistical outputs).

3.2 Retrieval Times

Retrieval times (the time interval between release through the induction system until the fish was retrieved) for both treatment and control groups averaged 12 to 13 min in May and 9 to 16 min in August (Figure 3-1). Average retrieval time in August was the same for control and Spillbay 4 fish (9

min). Average retrieval times for Spillbays 9 and 11 were similar (15 and 16 min). The differences in retrieval times between spillbays in August may be due to longer retention times of fish in the stilling basin, particularly those from Spillbays 9 and 11.

3.3 Survival Probabilities (May)

The estimated immediate (1 h) survival probabilities differed between spillbays (Table 3-3). The lowest survival, 0.959 (90% CI=0.939 to 0.978) was observed at Spillbay 13; survival at Spillbays 4 and 9 were virtually identical, 0.984 (90% CI=0.969 to 0.999) to 0.989 (90% CI=0.976 to 1.003). There was evidence (P=0.04, log likelihood ratio test) against the null hypothesis that all survivals were the same. Given that Spillbays 4 and 9 had virtually identical survival, the test result indicated that the survival at Spillbay 13 was different from the other two spillbays. Survival at Spillbay 13 was significantly lower ($P<0.05$) than at other spillbays. All survival probabilities had a precision (ε) of $\leq \pm 0.03$, 90% of the time.

The 48 h survival probabilities showed a similar trend (Table 3-3). Again, the lowest survival, 0.938 (90% CI=0.916 to 0.961) occurred at Spillbay 13 and was significantly lower ($P<0.05$), as indicated by log likelihood statistics, than at the other two spillbays. The respective survival probabilities at Spillbays 4 and 9 were 0.974 (90% CI=0.957 to 0.990) and 0.974 (90% CI=0.957 to 0.991). Again, all survival probabilities had a precision (ε) of $\leq +0.03$, 90% of the time (Table 3-3).

3.4 Injury Classification, Rates, and Probable Causal Mechanisms

All recaptured fish were examined for types of external injuries and those that were recaptured dead without external injuries were examined for internal injuries. Detailed descriptions of all injured fish are presented in Appendix Tables C-5 and C-6. To minimize bias, injuries which were known or suspected to be caused by predators and those attributed to the tag (tearing at tag site) were not included in quantifying spillbay passage related afflictions (Figure 3-2). Injury percentages given below are based on the total number of recaptured fish examined and not on the total number of fish released.

Visible injuries (excluding loss of equilibrium and scale loss) related to passage were present on 5.0 to 8.9% of all the examined treatment fish in May and 4.9 to 6.9% of the treatment fish examined in August (Table 3-4). Spillbays 13 (spring) and 11 (summer) had the highest overall injury rates. The control groups suffered 1.0% injury in May and 1.8% in August. Adjusting for control injuries, passage related injuries were estimated at 4.0 to 7.9% in May and at 3.1 to 5.1% in August.

Eye injuries were most prevalent (Table 3-4) at all three spillbays in May (3.4 to 5.3%) and at Spillbay 9 in August (2.1%). Most of the eye injuries were hemorrhages, however, the eye was ruptured or completely missing on several fish (Figure 3-3). Shear was the probable cause of most eye injuries. None of the control fish in May or August exhibited eye injuries.

The second and third most common injury in the spring was scrapes or bruises on the head or body and operculum damage (Figure 3-3) and (1.6 to 2.1%). In the summer, scrapes and operculum damage accounted for 1.3 to 2.5% of visible injuries at all test bays.

Shear and physical contact with solid objects were the probable causes of most injuries. Shear was the probable cause of many eye and opercular injuries (especially tears at the dorsal insertion). Physical contact with spillbay surfaces or tailwater structures in the stilling basin was the probable cause of most scrapes and bruises.

The malady category was established to include all visibly injured fish, plus fish with major scale loss, and/or only loss of equilibrium (Table 3-5). Malady rates were adjusted for controls similar to the injury rates. Spillbay 13 had the highest adjusted malady rate (9.0%) in May and Spillbay 11 had

the highest malady rate (7.2%) in August. Overall incidences of maladies (adjusted for controls) was the same (5.6%) for Spillbays 4 and 9 in May. The malady rates for Spillbays 4 and 9 in August were also similar (6.3% versus 6.5%). There was a higher incidence of fish with loss of equilibrium during the summer for the treatment groups (3.9 versus 1.1%). The malady rate for control fish in spring was 1.0%. The malady rate for control fish in the summer was 3.5%.

About 70% of the maladies to treatment fish in spring were considered major and 90% of maladies in summer fell into that category.

3.5 Clean Fish Estimates

Estimates of clean fish (*i.e.*, without visible injury, scale loss, or loss of equilibrium), designated "clean fish", were based on recaptured fish data provided in Tables 3-5 and 3-6. Clean fish estimates, along with their 90% confidence intervals are given in Table 3-7.

The estimated clean fish probabilities differed between spillbays in May but was similar for all spillbays in August. The lowest clean fish estimate in May was observed at Spillbay 13, 0.909 (90% CI=0.881 to 0.935). The clean fish estimates were identical for the other two spillbays (4 and 9) in May; 0.944 (90% CI=0.919 to 0.965). The clean fish estimates in August ranged from 0.926 (Spillbay 11) to 0.936 (Spillbay 4). The 90% CI was 0.876 to 0.972 at Spillbay 11 and 0.888 to 0.980 at Spillbays 4 and 9. The precision on the August estimates was lower (within $\leq\pm$5%, 90% of the time) than the May estimates (within $\leq\pm$3%, 90% of the time).

Little differences (<0.011) were observed between clean fish estimates for the two northern Spillbays (4 and 9) in both study periods and within each study period estimates were virtually identical at Spillbays 4 and 9. However, clean fish estimates were lower, though statistically non-significant, for southern Spillbays 11 and 13 in both periods.

Chi-square tests indicated no significant difference (P=0.132 in May and P=0.96 in August) in the frequency of treatment clean fish between the spillbays in both periods. However, when compared to the controls, the frequency of treatment clean fish was significantly lower (P=0.0001) than that of the controls.

3.6 Sluice Passed Fish

The recapture rate of the sluice passed fish in August was 91.8% (Appendix Table C-2). The status of the nine non-recaptured fish consisted of 3 (2.7%) with dislodged balloon(s), 3 (2.7%) assigned to predation, and 3 unknowns. All recaptured fish were alive. The loss of experimental fish to predation in August was much less on sluice passed fish than on those passed through the spillbays or released as controls (7 to 15%).

Three recaptured fish (2.9%) displayed loss of equilibrium and two (2%) other recaptured fish were injured. Both specimens had a small tear on their operculum (Appendix Table C-6).

3.7 Sensor Fish

Preliminary recapture data from the sensor fish passed near the southern end of the spill pattern (Spillbay 13 in spring and Spillbay 11 in summer) indicated that alive fish may have been exposed to more severe hydraulic conditions than those passed through Spillbays 4 and 9. Sensor fish passed through Spillbays 11 and 13 sounded and were subjected to rapid velocity changes approximately two to three times more frequently than those passed through Spillbay 4. Retention time in the spill basin of Spillbay 13 and 11 passed fish appeared longer than through Spillbays 4 and 9 and the hydraulic forces also appeared to be more severe. A complete analysis of the sensor fish data is to be provided in a report by PNNL.

4.0 DISCUSSION

The primary objectives and assumptions established for the spring high tailwater condition (May) investigation were met. However, the objectives for the summer (August) low tailwater condition could not be realized due to some unmet assumptions. The summer investigation had to be curtailed due to loss of experimental fish to predation (most likely by northern pikeminnow and smallmouth bass) on both the treatment and control fish, resulting in substantially lower recapture rates than anticipated and lowering the effective sample size. Prior to initiating the investigation a sample size of about 325 fish was selected with the following assumptions: recapture rate of 98.0%, expected survival rate of 97%, and control survival of 98.0% to provide a precision (ε) of $\leq\pm$3%, 90% of the time on the resulting survival rates. The realized recapture rate of summer treatment fish was ≤75% and control survival was 71%. It was estimated that 10.4% (Spillbay 4) to 15.2% (Spillbay 9) of treatment and 7.1% of control fish were lost to predation in summer. Thus, the preselected sample size was deemed inadequate to achieve the desired precision (ε) level of $\leq\pm$3%, 90% of the time on survival rates. For the spring releases, the estimated predation rate was considerably less (1.3 to 2.5%). Precision (ε) on survival estimates generated for spring released fish was within the prespecified criterion of $\leq\pm$3%, 90% of the time. Because of embedded unreliability of the observed summer data, survival estimates were not generated. Although reliable summer survival estimates were not generated, the examination of recaptured fish allowed identification of location, type, and probable mechanisms of injury.

Literature review indicated estimated spillway survival probabilities (direct effects) for juvenile salmonids have been generally less than 1.0 (Mathur *et al.* 1999; Heisey *et al.* 2003). The survival estimates (range 0.938 to 0.974) generated for the present study are towards the lower range of estimates summarized by Heisey *et al.* (2003). Heisey *et al.* (2003) summarized the results of 56 different tests on juvenile salmonid spillway passage survival from hydroelectric dams on the Columbia River Basin. Survival rates ranged from 91 to 100%; 34% of the values were less than 98%. One estimate (0.938, Spillbay 13) in the present study is among the lowest reported elsewhere. An earlier (1995) study (Normandeau Associates *et al.* 1996a) at The Dalles Dam reported a survival probability of chinook salmon smolts at 0.955 in passage through Spillbay 3 (unmodified), 0.990 at Spillbay 6 (overflow weir), and at 0.993 through Spillbay 4 (I-slot configuration). Spillbay 4 is the only spillbay common to the earlier and present study. The spill volume through Spillbays 3 and 4 was about 10,500 cfs with little discharge from adjacent spillbays during fish release and recapture. Discharge through Spillbay 6 was 4,500 cfs. The estimated survival probability of chinook salmon smolts in passage through Spillbay 4 (unmodified) in the present study was lower (0.974) but the spill volume through the tested spillbay ranged from 6,000 to 10,500 cfs and total spill discharge was about 40% of the river flow. The lowest survival in the present study (0.938) occurred in passage through the southern most spillbay tested (Spillbay 13). Differences in spill volume, patterns, and structural modifications between the 1995 and present investigation may have affected the dispersal of entrained fish subjecting them to different hydraulic conditions leading to differential survival.

The finding of lower than expected survival in the present investigation was corroborated by the results of other multiple tag-recapture methodologies utilized to estimate survival at The Dalles Dam spillway. Dawley *et al.* (1998, 2000a,b), using the PIT tag-recapture technique, reported survival rates of juvenile salmonids in passage through The Dalles spillway ranging from 75 to 100% with spill volumes ranging from 30 to 64% of the river flow. The highest survival rates (95 to 100%) were observed for subyearling chinook salmon spring migrants at 30% spill. The survival of yearling chinook salmon and coho salmon at 40% spill ranged from 92 to 95%. In a radio telemetry study conducted in 2000 by USGS (cited in Ploskey *et al.* 2001), survival of spring migrating salmonids in passage through the spillway was estimated at 92.9%; experimental fish were released well upstream from the dam over a protracted period spanning several weeks. Ploskey *et al.* (2001) reported higher survival of juvenile salmonids

passing through the northern spillbays than of those tagged fish passing through the southern spillbays. The higher survival at the northern spillbays was attributed to shorter residence times in the tailrace and fewer predation occurrences. The estimated survival rates (present study) of fish passing any of the tested spillbays were ≤97.4%, lowest (93.8%) being at the southern side of the spill pattern (Spillbay 13).

Passage through spillways can subject entrained fish to widely varying stilling basin hydraulic conditions. Some of the site-specific characteristics include obstructions in the flow path, abrasive surfaces, magnitude of water cushion, spill pattern, volume, spillway configuration, pressure changes, and shear. The actual path traversed by each alive balloon tagged fish released into each spillbay is unknown. However, data from concurrent release of balloon tagged "sensor fish" by Battelle Northwest Laboratory personnel to simulate the hydraulic conditions experienced by alive released fish provide some insights into the magnitude and duration of exposure to prevailing hydraulic conditions. Preliminary examination of the data (Carlson and Duncan 2001) indicates that fish passed via spillbays on the southern side of the spill pattern may be exposed to a higher level and duration of exposure (retention time) to stilling basin turbulence. A pronounced lateral transport of flow across the stilling basin may also increase a fish's chances for re-entrainment. Multiple entrainment cycles increase the probability of collisions with hard objects and exposure to shear forces. Survival in the present study was lowest and injury rate highest for fish entrained in Spillbay 13 (the southern most spillbay tested); some of these fish were most likely exposed to lateral transport and thus to increased turbulence and re-entrainment.

Survival is lower when a fish strikes a solid object, even at lower velocities, than when they enter standing water without obstructions. A variable mortality rate was observed by Bell *et al.* (1972) when fish struck a solid object at a velocity exceeding 20 ft/s. No fish injury was observed when fish impacted flowing water at a velocity of about 60 ft/s. They concluded that fish could be injured in any high-energy flow situation that creates momentarily localized sharp velocity changes. Based on field and laboratory tests on fish little to no injury (<1%) was observed on juvenile salmon subjected to entry velocities as high as 50 ft/s (PNNL *et al.* 2001). The estimated impact velocity of the discharge jet upon tailrace interception ranged from 62.3 to 66.0 ft/s during the May investigation and 65.3 to 66.8 ft/s during the August investigation (Appendix Table A-2) at The Dalles Dam.

Differential losses of experimental fish to predators affected the study results, particularly in August. The differences were undoubtedly related to differences in water temperatures and associated predator activity and perhaps fish size. Water temperatures were less than 14.0°C (57.2°F, range 10.0 to 13.5°C or 50.0 to 56.3°F) in May and greater than 19.0°C (66.2°F, range 19.5 to 21.6°C or 67.1 to 70.9°F) in August. Predator activity, primarily northern pikeminnow, increases substantially when water temperature ≥17.2°C or ≥63.0°F (Brown and Moyle 1981; Reiman *et al.* 1991; Vigg and Burley 1991). The effect of water temperature on predation losses of experimental fish, though not as severe as in the present study, was also evident in a concurrent spillway survival investigation at the Bonneville Dam; the configuration and spill patterns are different between The Dalles and Bonneville. The predation losses of experimental fish at Bonneville in May were estimated at <1% when the water temperature ranged from 10.5 to 13.5°C (50.9 to 56.3°F). The predation losses in August were estimated at 4.4%; the water temperatures were 19.5 to 21.6°C (67.1 to 70.9°F) in August. As well, little predation (<1%) was observed in an earlier spillway survival investigation at The Dalles (Normandeau Associates *et al.* 1996a); water temperature ranged from 12.0 to 14.5°C (53.6 to 58.1°F) during that fall study. The test specimens used at both The Dalles and Bonneville spillways were obtained from the same hatchery. However, the fish size was larger in the spring (152 mm for The Dalles, 157 mm for Bonneville) than in the summer (The Dalles, 125 mm, Bonneville, 119 mm) which could have also contributed to the increased summer predation at both projects. However, the higher predation losses at The Dalles in

summer (11.1%, treatment and controls) versus Bonneville (4.9%) may have been exacerbated by unique site-specific hydraulic conditions and bottom topography.

The topography and hydraulic characteristics may influence the dispersal pattern of entrained fish and subsequent vulnerability to predators. A limited number of fish (110) released through the sluice in August showed only about 2% were lost to predation. This suggests that the fish dispersal of post-sluice passage may be less vulnerable to predators in that area than that downstream of the spillbays. The predation on the fish passed through the sluice was suspected at about 2.7%; the spillbay test had to be abandoned in August due to excessive predation (>11%). Water temperature was similar to that for the summer spillway test.

The importance of higher water temperatures and associated predator activity was also borne out by spillbay tests conducted at The Dalles in October and November 2002 (report in preparation). Juvenile chinook salmon (105 to 205 mm, mean length 175 mm) were released through Spillbays 2 and 4. Spill volume through the two test bays was either 4,500 or 12,000 cfs and total spill ranged from 4,500 to 72,000 cfs. Although the overall predation loss was only 1% for the study, the predation loss was 3% during the first three days of testing when the water temperature was 13.5 to 14.5°C (56.3 to 58.1°F). Subsequently, predation losses were 0% during the last five days when the water temperature was 9 to 11.5°C (48.2 to 52.7°F).

It should be noted that our studies were not specifically designed to quantify predation, but the above discussion provides some information on predation potential and timing of future similar studies. Visual observations of the spill flow patterns, tailrace topography, and dispersal of post-passage balloon tagged fish indicate that conditions downstream of The Dalles Dam spillway may be more conducive for fish predation losses, especially at warmer water temperatures. A combination of deep channels and shallow areas immediately downstream of the spillway appears to encourage predation. A large proportion of the project water carrying with it entrained juvenile salmonids passes through and over an extensive shallow rock shelf that lies across approximately two-thirds of the spill basin.

Injury rates and clean fish estimates showed trends similar to survival estimates. The fish injury rates were highest for the southern side spillbays (Spillbays 11 and 13). Some 7.9% of the Spillbay 13 fish suffered visible injuries (adjusted for controls) in May and 4.0 to 4.5% in passage through Spillbays 9 and 4). August adjusted injury rates were highest at Spillbay 11 , 5.1%, compared to 3.1 and 4.6 at Spillbays 4 and 9, respectively. The May clean fish estimates, as expected, were lower than the survival estimates. The clean fish estimate was 3% lower than the survival estimate at Spillbays 4 and 9 (clean fish 94.4% versus survival 97.4%). Clean fish and survival estimates were lowest for Spillbay 13; 90.0 and 93.8%, respectively.

The assignment of cause to individual injury types has been helped by research conducted by Neitzel *et al.* (2000). They reported that localized shear forces caused a variety of injuries to the eyes, opercles, and body of juvenile salmonids. Some eye injuries which had often been attributed to rapid pressure (bulged eyes) were also produced by shear forces. In the current study, almost all of the eye injuries and tears to the opercle not caused by predators, were attributed to shear forces. Injuries such as scrapes and bruises on the head or body were attributed to contact or impact with spillbay or tailwater structures (baffles, boulders, end sill). Some bruises, however, can be caused by shear forces (Neitzel *et al.* 2000). Due to the possibility of multiple causes, the term probable cause is used in designating casual mechanisms.

5.0 CONCLUSIONS

Survival of juvenile salmonids in passage through The Dalles Dam spillway was spillbay specific. The survival was significantly lower for the southern most spillbay tested in May (93.8%) than those

entrained in northern spillbays (97.4%). Survival was most likely affected by the lateral transport of flow across the stilling basin, exposing fish to increased turbulence for a longer duration and re-entrainment. The incidence of fish without maladies (clean fish) was also lower at the southern most spillbay tested during both spring and summer.

Loss of experimental fish to predators affected the study to the extent that the experiment had to be prematurely terminated in August. Predation losses (7 to 15%) increased at higher water temperatures (>19°C). Future studies to assess survival during low tailwater and low flow conditions would have a greater likelihood of success at water temperatures <14°C (57.2°F). Limited testing at the sluice in August showed fish passing the dam via this route were not as susceptible (2.3%) to piscivorous predation as those passing the spillbays.

Injury rates in May, adjusted for controls, were 4.5, 4.0, and 7.9% for Spillbays 4, 9, and 13, respectively. August injury rates were 3.1, 4.6, and 5.1% for Spillbays 4, 9, and 11, respectively. Malady rates (visible injuries, major scale loss, or loss of equilibrium) were generally higher than injury rates for all tests. Malady rates in May were 5.6 to 9.0% and 6.3 to 7.2% in August.

The predominant injury for most test conditions was eye hemorrhage. Bruises, scrapes, and lacerations were next in prominence. Shear induced and mechanical contact were the primary causative agents for these injuries.

The higher injury/mortality noted at the southern most Spillbays (11 and 13) appeared to be associated with longer retention time and lateral northerly transport of flow in the stilling basin.

Because multiple tag-recapture methodologies point to a trend of higher injury/mortality rate at the southern most bays, additional investigation is recommended preferably at water temperatures <14.0° (<57.2°F) to determine causative factors and formulate remedial actions.

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TABLES

Table 1-1

Summary of physical conditions during spillway passage studies at The Dalles Dam, spring and summer 2002.

Discharge (kcfs)				Total Spill	Spill as Percent	River Flow	Elevation (ft)		Net Head
Spillbay 4	Spillbay 9	Spillbay 11	Spillbay 13	(kcfs)	of Total Flow	(kcfs)	Forebay	Tailwater	(ft)
					May (Spring)				
7.5-10.5	4.5-7.5	--	3.0-6.0	63.0-110.0	27.8-41.8	167.2-306.1	157.4-158.9	78.3-83.4	74.8-80.0
					August (Summer)				
4.5-7.5	3.0-4.5	3.0-4.5	--	40.0-68.0	34.5-41.9	101.2-181.8	156.9-159.3	75.6-78.9	78.7-82.9

Table 2-1

Daily river temperature and release schedule of spring (14 to 27 May) and summer (15 to 22 August) releases of juvenile chinook salmon smolts into three spillbays (treatment) and downstream of Spillbay 3 (control) at The Dalles Dam, 2002.

	River Temperature		Spillbay				
Date	**(°C)**	**(°F)**	**4**	**9**	**11**	**13**	**Control**
			May (Spring)				
14 May	10.5	50.9	32	12	--	2	5
15 May	10.5	50.9	30	30	--	0	30
16 May	10.0	50.0	30	15	--	30	0
17 May	12.0	53.6	30	30	--	30	30
18 May	12.0	53.6	30	30	--	29	30
19 May	12.0	53.6	0	0	--	51	50
20 May	12.0	53.6	30	40	--	30	30
21 May	12.5	54.5	30	30	--	31	30
22 May	12.5	54.5	30	30	--	30	30
23 May	12.5	54.5	30	49	--	38	30
24 May	13.0	55.4	30	40	--	39	40
25 May	13.0	55.4	30	30	--	26	30
26 May	13.0	55.4	30	30	--	49	30
27 May	13.5	56.3	29	30	--	20	30
Totals			***391***	***396***	***--***	***405***	***395***
			August (Summer)				
15 Aug	21.6	70.9	2	2	4	--	2
16 Aug	20.5	68.9	30	29	20	--	30
17 Aug	20.0	68.0	30	30	30	--	30
18 Aug	20.5	68.9	30	30	30	--	30
19 Aug	21.0	69.8	30	30	30	--	30
20 Aug	20.0	68.0	30	30	30	--	30
21 Aug	20.0	68.0	30	30	30	--	30
22 Aug	19.5	67.1	30	30	30	--	30
Totals			***212***	***211***	***204***	***--***	***212***

Table 2-2

Required sample sizes (R) if control survival (S)=0.99, 0.98, or 0.95, recapture rate (P_A) is 0.99, 0.98, or 0.95, and expected survival probability (t) of treatment fish passed is 0.95, 0.97, and 0.99 to achieve a precision level (e) of ±0.03, 90% of the time.

	Expected Spillbay Survival (t)		
Control Survival (S)	**0.95**	**0.97**	**0.99**
	Recapture Rate=0.99		
0.99	256	205	150
0.98	314	264	212
0.95	496	451	405
	Recapture Rate=0.98		
0.99	314	264	218
0.98	373	325	274
0.95	556	514	469
	Recapture Rate=0.95		
0.99	496	451	405
0.98	556	514	469
0.95	745	709	670

Table 2-3

Condition codes assigned to fish and dislodged balloon tags for fish passage survival evaluation.

FISH CODES

A	No visible marks on fish
B	Flesh tear at tag site(s)
C	Minor scale loss, 3 to 20% (%s for entire body in immediate recovery; for detailed injury examination %s are for section only)
D	Major scale loss, >20% per side
E	Laceration(s); tear(s) on body
F	Severed body parts
G	Hemorrhaging, bruised
H	Stressed (lethargic, swimming poorly or sporadically)
I	Spasmodic movement of body
J	Very weak, barely gilling, died within 60 minutes of recovery
K	Failed to enter system
L	Fish likely preyed on based on telemetry, and/or circumstances relative to Turb'N recapture
M	Substantial bleeding at tag site
N	Bulging or missing eye(s)
P	Observed predator attack or marks indicative of predator
Q	Other information
R	Replaced due to entrapment in unrecoverable locations (i.e., in rocks, gate slot; recovery time expired)
T	Trapped inside tunnel/gate well
V	Fins damaged (ripped, split, torn) or pulled from origin
W	Abrasion/scrape
X	No recovery information at all; fish remains unrecovered
Z	Radio telemetry or other information; fish remains unrecovered

DISSECTION CODES

B	Swim bladder ruptured or expanded
D	Kidneys damaged (hemorrhaging)
E	Broken bones obvious
F	Hemorrhaging internally
L	Organ displacement
N	Heart damage, ruptured, hemorrhaging, etc.
O	Liver damage, ruptured, hemorrhaging, etc.
R	Necropsied, no obvious injuries
S	Necropsied, internal injuries observed
W	Head removed, i.e., otolith

TURB'N TAG CODES (not used in database)

A	Fully inflated
B	Partially inflated
C	Pinhole, leaking
D	Burst
E	Not inflated at all

Table 3-1

Summary of tag-recapture data of juvenile chinook salmon released through Spillbays 4, 9, 13 (spring), and Spillbays 4, 9, and 11 (summer) at The Dalles Dam, 2002. Control fish were released downstream of Spillbay 3. Proportions given in parentheses.

	Spillbay 4	Spillbay 9	Spillbay 11	Spillbay 13	Control
		May (Spring)			
Number released	391	396	--	405	395
Number recaptured alive	373 (0.954)	377 (0.952)	--	372 (0.919)	387 (0.980)
Number recaptured dead	5 (0.013)	1 (0.003)	--	8 (0.020)	3 (0.008)
Number assigned dead*	4 (0.010)	6 (0.015)	--	11 (0.027)	0 (0.000)
Unknown**	9 (0.023)	12 (0.030)	--	14 (0.035)	5 (0.013)
Number held	373	377	--	372	387
Number alive at 48 h	369	371	--	364	387
		August (Summer)			
Number released	212	211	204	--	212
Number recaptured alive	152 (0.717)	128 (0.607)	153 (0.750)	--	161 (0.759)
Number recaptured dead	12 (0.057)	12 (0.057)	6 (0.029)	--	9 (0.042)
Number assigned dead*	44 (0.208)	70 (0.332)	38 (0.186)	--	32 (0.151)
Unknown**	5 (0.024)	1 (0.005)	7 (0.034)	--	10 (0.047)
Number held	152	128	153	--	161
Number alive at 48 h	121	102	129	--	151

* Balloon(s) only recaptured, and/or stationary radio signal or signal moving in a manner indicative of predation.

** Brief or no radio signal.

Table 3-2

Summary of tagged fish injured or lost to predation during the chinook salmon spill passage survival investigation at The Dalles Dam, spring and summer 2002.

	Number of Fish Released	Number of Fish Recaptured: Alive with Predator Marks	Number of Fish Recaptured: Alive but Died in 48 h	Number of Fish Recaptured: Dead with Predator Marks	Number of Fish Assigned Dead Due to Predation*	Total Predation Number (Percent)	Gull:Fish Predation Ratio
				May (Spring)			
Spillbay 4	391	2	1	3	1	7 (1.8)	4:3
Spillbay 9	396	2	2	1	2	7 (1.8)	4:3
Spillbay 13	405	2	2	4	2	10 (2.5)	5:5
Treatment Total	*1,192*	*6*	*5*	*8*	*5*	24 *(2.0)*	*13:11*
Control	395	2	0	3	0	5 (1.3)	2:3
Total	***1,587***	***8***	***5***	***11***	***5***	***29 (1.8)***	***15:14***
				August (Summer)			
Spillbay 4	212	0	3	2	17	22 (10.4)	3:19
Spillbay 9	211	0	1	9	22	32 (15.2)	1:31
Spillbay 11	204	0	1	2	21	24 (11.8)	0:24
Treatment Total	*627*	*0*	*5*	*13*	*60*	78 *(12.4)*	*4:74*
Control	212	0	1	5	9	15 (7.1)	4:11
Total	***839***	***0***	***6***	***18***	***69***	***93 (11.1)***	***8:85***

* Based on movement history of tagged fish that were not recaptured and/or condition of the recovered balloons.

Table 3-3

Estimated 1 h and 48 h survival probabilities ($\hat{\tau}$) of juvenile chinook salmon passed through Spillbays 4, 9, and 13 at The Dalles Dam, May 2002. The standard errors (bold italicized) and 90% confidence intervals shown in parentheses. Values given herein are based on the reduced model (H_O:P_A=P_D).

	Spillbay 4	Spillbay 9	Spillbay 13
Survival at 1 h ($\hat{\tau}$)	0.984***(0.009)*** (0.969-0.999)	0.989***(0.008)*** (0.976-1.003)	0.959***(0.012)*** (0.939-0.978)
Survival at 48 h ($\hat{\tau}$)	0.974***(0.010)*** (0.957-0.990)	0.974***(0.010)*** (0.957-0.991)	0.938***(0.014)*** (0.916-0.961)

Table 3-4

Types of visible injuries (non predator-related) observed on recaptured juvenile chinook salmon passed through Spillbays 4, 9, and 13 (spring) and Spillbays 4, 9, and 11 (summer) and controls (downstream of Spillbay 3) at The Dalles Dam, 2002. Some fish had multiple injuries.

	Number Released	Number Examined	Visible Injuries Related to Passage	Injury Type				
				Damaged/ Hemorrhaged Eye(s)	Operculum Damage	Bruise/ Scrapes on Body/Head	Lacerations Body/Head	Internal Hemorrhage
				May (Spring)				
Spillbay 4	391	378	21 (5.6%)	13 (3.4%)	2 (0.5%)	6 (1.6%)	2 (0.5%)	1 (0.3%)
Spillbay 9	396	378	19 (5.0%)	13 (3.4%)	5 (1.3%)	7 (1.9%)	1 (0.3%)	1 (0.3%)
Spillbay 13	405	380	34 (8.9%)	20 (5.3%)	8 (2.1%)	7 (1.8%)	5 (1.3%)	3 (0.8%)
Treatment Total	*1,192*	*1,136*	*74* (6.5%)	*46* (4.0%)	*15* (1.3%)	*20* (1.8%)	*8* (0.7%)	*5* (0.4%)
Control	395	390	4 (1.0%)	0 (0.0%)	1 (0.3%)	3 (0.8%)	0 (0.0%)	0 (0.0%)
				August (Summer)				
Spillbay 4	212	163	8 (4.9%)	2 (1.2%)	3 (1.8%)	3 (1.8%)	0 (0.0%)	1 (0.6%)
Spillbay 9	211	140	9 (6.4%)	3 (2.1%)	2 (1.4%)	2 (1.4%)	1 (0.7%)	2 (1.4%)
Spillbay 11	204	159	11 (6.9%)	3 (1.9%)	4 (2.5%)	2 (1.3%)	2 (1.3%)	2 (1.3%)
Treatment Total	*627*	*462*	*28* (6.1%)	*8* (1.7%)	*9* (1.9%)	*7* (1.5%)	*3* (0.6%)	*5* (1.1%)
Control	212	170	3 (1.8%)	0 (0.0%)	0 (0.0%)	2 (1.2%)	0 (0.0%)	1 (0.6%)

Table 3-5

Summary of loss of equilibrium, scale loss, and visible injuries observed on recaptured juvenile chinook salmon passed through Spillbays 4, 9, and 13 (spring) and Spillbays 4, 9, and 11 (summer) and controls (downstream of Spillbay 3), The Dalles Dam, 2002. Some fish had multiple injuries.

	Number Released	Number Examined	Loss of Equilibrium (exclusively)	Major Scale Loss (exclusively)	Visible Injuries Related to Passage	Minor:Major Injury Ratio	Combined Maladies
			May (Spring)				
Spillbay 4	391	378 (96.7%)	4 (1.1%)	0 (0.0%)	21 (5.6%)	8:12	25 (6.6%)
Spillbay 9	396	378 (95.5%)	5 (1.3%)	1 (0.3%)	19 (5.0%)	4:14	25 (6.6%)
Spillbay 13	405	380 (93.8%)	3 (0.8%)	1 (0.3%)	34 (8.9%)	11:23	38 (10.0%)
Treatment Total	*1,192*	*1,136* (95.3%)	*12* (1.1%)	*2* (0.2%)	*74* (6.5%)		*88* (7.7%)
Control	395	390 (98.7%)	0 (0.0%)	0 (0.0%)	4 (1.0%)	3:1	4 (1.0%)
			August (Summer)				
Spillbay 4	212	164 (77.4%)	7 (4.3%)	1 (0.6%)	8 (4.9%)	0:8	16 (9.8%)
Spillbay 9	211	140 (66.4%)	5 (3.6%)	0 (0.0%)	9 (6.4%)	1:8	14 (10.0%)
Spillbay 11	204	159 (77.9%)	6 (3.8%)	0 (0.0%)	11 (6.9%)	2:9	17 (10.7%)
Treatment Total	*627*	*463* (73.8%)	*18* (3.9%)	*1* (0.2%)	*28* (6.0%)		*47* (10.2%)
Control	212	170 (80.2%)	2 (1.2%)	1 (0.6%)	3 (1.8%)	0:4	6 (3.5%)

Table 3-6

Summary of juvenile chinook salmon without maladies (clean fish) and with maladies (loss of equilibrium, >20% scale loss per side, and visible injuries) after passage through Spillbays 4, 9, and 13 (spring) and Spillbays 4, 9, and 11 (summer) at The Dalles Dam, 2002. Control fish were released downstream of Spillbay 3. Percentages given in parentheses.

	Number Examined	Number Without Maladies[1]		Number with Passage Related Maladies
May (Spring)				
Spillbay 4	378	348 / 5	(93.4%)	25 (6.6%)
Spillbay 9	378	349 / 4	(93.4%)	25 (6.6%)
Spillbay 13	380	333 / 9	(90.0%)	38 (10.0%)
Total	*1,136*	*1,030 / 18*	*(92.3%)*	*88 (7.7%)*
Control	390	381 / 5	(99.0%)	4 (1.0%)
August (Summer)				
Spillbay 4	164	132 / 16	(90.2%)	16 (9.8%)
Spillbay 9	140	115 / 11	(90.0%)	14 (10.0%)
Spillbay 11	159	138 / 4	(89.3%)	17 (10.7%)
Total	*463*	*385 / 31*	*(89.8%)*	*47 (10.2%)*
Control	170	158 / 6	(96.5%)	6 (3.5%)

1 - Fish without maladies/with maladies not attributed to passage (*i.e.*, predator inflicted, tag induced).

Table 3-7

Clean fish estimates of chinook salmon smolts passing through spillbays at The Dalles Dam, May and August 2002. The standard errors (bold italicized) and 90% confidence intervals shown in parentheses. Values given herein are based on the reduced model (H_O:P_A=P_D).

	Spillbay 4	Spillbay 9	Spillbay 11	Spillbay 13
May	0.944***(0.014)*** (0.919-0.965)	0.944***(0.014)*** (0.919-0.965)	--	0.909***(0.016)*** (0.881-0.935)
August	0.936***(0.028)*** (0.888-0.980)	0.933***(0.030)*** (0.881-0.980)	0.926***(0.029)*** (0.876-0.972)	--

FIGURES

APPENDIX A

HYDRAULIC/PHYSICAL CONDITIONS DURING TESTING; IMPACT VELOCITY DATA

Appendix Table A-1

Spill and flow conditions at The Dalles Dam during the May and August 2002 juvenile chinook salmon passage studies.

Date	Hour	Spill (kcfs)			Total Spill (kcfs)	Percent Spill	Total Flow (kcfs)	Elevation (ft)		Net Head (ft)
		Bay 4	Bay 9	Bay 13				Forebay	Tailwater	
					May					
5/14/02	0900	9.0	6.0	4.5	94	40	232.6	158.9	80.1	78.8
5/14/02	1000	9.0	6.0	4.5	94	41	231.9	158.8	80.1	78.7
5/14/02	1100	9.0	6.0	3.0	94	40	236.2	158.0	80.1	77.9
5/14/02	1200	7.5	6.0	3.0	86	41	209.8	158.2	79.7	78.5
5/14/02	1300	7.5	6.0	3.0	78	39	199.5	158.1	79.5	78.6
5/14/02	1400	7.5	6.0	3.0	78	39	199.0	158.1	79.5	78.6
5/14/02	1500	7.5	6.0	3.0	78	39	198.7	158.1	79.5	78.6
5/14/02	1600	7.5	6.0	3.0	78	39	199.0	158.1	79.5	78.6
5/14/02	1700	7.5	6.0	3.0	78	39	201.2	158.0	79.5	78.5
Range		*7.5 -9.0*	*6.0*	*3.0-4.5*	*78-94*	*39-41*	*198.7-236.2*	*158.0-158.9*	*79.5-80.1*	*77.9-78.8*
5/15/02	0800	9.0	6.0	4.5	96	39	245.8	158.4	80.3	78.1
5/15/02	0900	9.0	6.0	4.5	96	39	246.3	158.5	80.4	78.1
5/15/02	1000	9.0	6.0	4.5	96	39	247.8	158.6	80.4	78.2
5/15/02	1100	9.0	6.0	4.5	96	39	244.9	158.7	80.6	78.1
5/15/02	1200	9.0	6.0	3.0	96	39	246.4	158.6	80.6	78.0
5/15/02	1300	9.0	6.0	3.0	86	38	228.4	158.5	80.5	78.0
5/15/02	1400	9.0	6.0	3.0	86	38	228.8	158.4	80.5	77.9
5/15/02	1500	7.5	6.0	3.0	86	38	226.0	158.3	80.6	77.7
5/15/02	1600	7.5	6.0	3.0	76	38	201.8	158.2	80.2	78.0
5/15/02	1700	7.5	6.0	3.0	76	37	203.8	157.9	80.1	77.8
Range		*7.5-9.0*	*6.0*	*3.0-4.5*	*76-96*	*37-39*	*201.8-247.8*	*157.9158.7*	*80.1-80.6*	*77.7-78.2*
5/16/02	0700	7.5	4.5	3.0	68	40	168.4	157.5	78.7	78.8
5/16/02	0800	7.5	4.5	3.0	68	40	169.2	157.9	78.6	79.3
5/16/02	0900	7.5	4.5	3.0	68	40	171.2	157.9	78.5	79.4
5/16/02	1000	7.5	4.5	3.0	72	40	181.3	158.1	78.5	79.6
5/16/02	1100	7.5	4.5	3.0	72	40	178.4	158.2	78.6	79.6
5/16/02	1200	7.5	4.5	3.0	72	40	179.1	158.2	78.6	79.6
5/16/02	1300	7.5	4.5	3.0	72	40	181.4	158.3	78.4	79.9

Appendix Table A-1

Continued.

Date	Hour	Spill (kcfs)			Total Spill (kcfs)	Percent Spill	Total Flow (kcfs)	Elevation (ft)		Net Head (ft)
		Bay 4	Bay 9	Bay 13				Forebay	Tailwater	
5/16/02	1400	7.5	4.5	3.0	72	40	180.3	158.3	78.3	80.0
5/16/02	1500	7.5	6.0	3.0	72	40	181.1	158.3	78.3	80.0
5/16/02	1600	7.5	6.0	3.0	76	40	188.8	158.2	78.4	79.8
5/16/02	1700	7.5	6.0	3.0	76	40	188.4	158.2	78.4	79.8
Range		*7.5*	*4.5-6.0*	*3.0*	*68-76*	*40.0*	*168.4-188.8*	*157.5-158.3*	*78.3-78.7*	*78.8-80.0*
5/17/02	0800	7.5	6.0	3.0	76	38	201.6	158.2	80.1	78.1
5/17/02	0900	9.0	6.0	3.0	76	39	197.2	158.2	80.1	78.1
5/17/02	1000	9.0	6.0	3.0	85	39	216.2	158.3	80.3	78.0
5/17/02	1100	9.0	6.0	3.0	85	39	217.7	158.6	80.2	78.4
5/17/02	1200	7.5	6.0	3.0	85	39	217.5	158.4	80.2	78.2
5/17/02	1300	7.5	6.0	3.0	82	39	210.1	158.3	80.1	78.2
5/17/02	1400	7.5	4.5	3.0	76	37	204.9	158.2	80.0	78.2
5/17/02	1500	7.5	4.5	3.0	74	39	189.7	158.2	79.6	78.6
5/17/02	1600	7.5	4.5	3.0	71	37	191.0	158.1	79.7	78.4
5/17/02	1700	9.0	6.0	3.0	71	34	208.7	157.9	79.9	78.0
5/17/02	1800	6.0	4.5	3.0	88	37	239.4	157.6	80.7	76.9
Range		*6.0-9.0*	*4.5-6.0*	*3.0*	*71-88*	*34-39*	*189.7-239.4*	*157.6-158.6*	*79.6-80.7*	*76.9-78.6*
5/18/02	0800	6.0	4.5	3.0	84	37	230.1	158.1	81.1	77.0
5/18/02	0900	6.0	4.5	3.0	78	36	214.6	158.2	80.7	77.5
5/18/02	1000	6.0	4.5	3.0	76	36	209.4	158.2	80.6	77.6
5/18/02	1100	6.0	4.5	3.0	70	37	190.5	158.1	80.3	77.8
5/18/02	1200	6.0	4.5	3.0	63	37	172.6	157.9	79.8	78.1
5/18/02	1300	7.5	6.0	3.0	63	37	172.0	157.9	79.7	78.2
5/18/02	1400	7.5	6.0	3.0	63	37	169.8	157.9	79.6	78.3
5/18/02	1500	7.5	6.0	3.0	63	37	172.0	157.8	79.4	78.4
5/18/02	1600	7.5	6.0	3.0	63	38	167.2	157.8	79.4	78.4
5/18/02	1700	7.5	6.0	3.0	63	37	169.0	157.8	79.4	78.4
Range		*6.0-7.5*	*4.5-6.0*	*3.0*	*63-84*	*36-38*	*167.2-230.1*	*157.8-158.2*	*79.4-81.1*	*77.0-78.4*

Appendix Table A-1

Continued.

Date	Hour	Spill (kcfs)			Total Spill (kcfs)	Percent Spill	Total Flow (kcfs)	Elevation (ft)		Net Head (ft)
		Bay 4	Bay 9	Bay 13				Forebay	Tailwater	
5/19/02	0700	7.5	6.0	3.0	80	38	212.8	158.9	80.1	78.8
5/19/02	0800	7.5	6.0	3.0	80	38	210.3	159.1	80.1	79.0
5/19/02	0900	7.5	6.0	3.0	80	38	211.5	159.3	80.2	79.1
5/19/02	1000	7.5	6.0	3.0	80	38	210.2	159.4	80.2	79.2
5/19/02	1100	9.0	6.0	3.0	80	38	210.0	159.4	80.2	79.2
5/19/02	1200	9.0	6.0	4.5	84	39	214.4	159.3	80.2	79.1
5/19/02	1300	9.0	6.0	4.5	84	39	213.3	159.2	80.2	79.0
5/19/02	1400	9.0	6.0	4.5	84	40	212.1	159.1	80.2	78.9
5/19/02	1500	9.0	6.0	3.0	80	40	201.1	159.0	80.0	79.0
Range		*7.5-9.0*	*6.0*	*3.0-4.5*	*80-84*	*38-40*	*201.1-214.4*	*158.9-159.4*	*80.0-80.2*	*78.8-79.2*
5/20/02	0700	9.0	6.0	3.0	80	40	202.4	158.5	79.8	78.7
5/20/02	0800	9.0	6.0	3.0	92	39	233.7	158.6	80.3	78.3
5/20/02	0900	7.5	6.0	3.0	96	40	241.9	158.8	80.6	78.2
5/20/02	1000	7.5	6.0	3.0	96	40	242.4	158.8	80.5	78.3
5/20/02	1100	9.0	6.0	3.0	96	40	241.7	158.7	80.5	78.2
5/20/02	1200	9.0	6.0	3.0	90	39	228.9	158.6	80.3	78.3
5/20/02	1300	9.0	6.0	3.0	88	39	223.5	158.4	80.3	78.1
5/20/02	1400	9.0	6.0	3.0	88	39	224.2	158.3	80.3	78.0
5/20/02	1500	9.0	6.0	3.0	84	39	215.5	158.3	80.1	78.2
5/20/02	1600	9.0	6.0	3.0	84	38	219.8	158.2	80.2	78.0
Range		*7.5-9.0*	*6.0*	*3.0*	*80-96*	*38-40*	*202.4-242.4*	*158.2-158.8*	*79.8-80.6*	*78.0-78.7*
5/21/02	0700	9.0	6.0	3.0	106	39	269.9	158.4	82.1	76.3
5/21/02	0800	9.0	6.0	3.0	96	36	264.6	158.6	81.8	76.8
5/21/02	0900	9.0	6.0	3.0	85	32	264.2	158.4	82.0	76.4
5/21/02	1000	9.0	6.0	3.0	85	32	262.0	158.4	81.9	76.5
5/21/02	1100	9.0	6.0	3.0	85	30	278.8	158.3	82.5	75.8
5/21/02	1200	9.0	6.0	3.0	85	30	279.7	158.2	82.6	75.6
5/21/02	1300	9.0	6.0	3.0	85	31	277.2	158.0	82.7	75.3
5/21/02	1400	9.0	6.0	3.0	85	33	258.3	157.8	82.2	75.6
5/21/02	1500	9.0	6.0	3.0	85	33	259.4	157.7	82.0	75.7

Appendix Table A-1

Continued.

Date	Hour	Spill (kcfs)			Total Spill (kcfs)	Percent Spill	Total Flow (kcfs)	Elevation (ft)		Net Head (ft)
		Bay 4	Bay 9	Bay 13				Forebay	Tailwater	
5/21/02	1600	9.0	6.0	3.0	85	34	249.5	157.4	82.2	75.2
5/21/02	1700	9.0	6.0	3.0	85	32	267.2	157.5	82.3	75.2
Range		*9.0*	*6.0*	*3.0*	*85-106*	*30-39*	*249.5-279.7*	*157.4-158.6*	*81.8-82.7*	*75.2-76.8*
5/22/02	0700	9.0	6.0	3.0	85	29	289.9	158.8	83.2	75.6
5/22/02	0800	9.0	6.0	3.0	85	28	306.1	158.3	83.4	74.9
5/22/02	0900	9.0	6.0	3.0	85	28	300.2	158.0	83.2	74.8
5/22/02	1000	9.0	7.5	4.5	85	29	288.2	158.1	82.7	75.4
5/22/02	1100	9.0	7.5	4.5	85	32	263.8	158.1	82.4	75.7
5/22/02	1200	9.0	7.5	4.5	85	34	248.8	158.0	82.2	75.8
5/22/02	1300	9.0	7.5	4.5	85	35	240.6	157.9	82.2	75.7
5/22/02	1400	9.0	7.5	4.5	85	34	247.6	157.9	82.1	75.8
5/22/02	1500	9.0	7.5	4.5	85	32	263.0	157.9	82.1	75.8
5/22/02	1600	9.0	7.5	4.5	100	40	252.2	158.0	81.9	76.1
5/22/02	1700	9.0	7.5	4.5	100	40	250.4	158.0	81.9	76.1
Range		*9.0*	*6.0-7.5*	*3.0-4.5*	*85-100*	*28-40*	*240.6-306.1*	*157.9-158.8*	*81.9-83.4*	*74.8-76.1*
5/23/02	0800	10.5	7.5	4.5	100	39	256.4	158.1	81.3	76.8
5/23/02	0900	10.5	7.5	4.5	100	39	258.4	158.1	81.3	76.8
5/23/02	1000	10.5	7.5	4.5	100	39	257.5	158.3	81.3	77.0
5/23/02	1100	10.5	7.5	4.5	100	40	251.8	158.1	81.4	76.7
5/23/02	1200	10.5	7.5	4.5	100	38	262.1	158.0	81.3	76.7
5/23/02	1300	10.5	7.5	4.5	100	38	263.8	157.8	81.3	76.5
5/23/02	1400	10.5	7.5	4.5	100	38	261.5	157.7	81.3	76.4
5/23/02	1500	10.5	7.5	4.5	100	40	251.5	157.5	81.2	76.3
5/23/02	1600	10.5	7.5	4.5	100	39	259.6	157.6	81.1	76.5
5/23/02	1700	10.5	7.5	4.5	100	40	249.7	157.5	81.0	76.5
Range		*10.5*	*7.5*	*4.5*	*100.0*	*38-40*	*249.7-263.8*	*157.5-158.3*	*81.0-81.4*	*76.3-77.0*
5/24/02	0800	10.5	7.5	6.0	110	39	280.6	158.2	81.6	76.6
5/24/02	0900	10.5	7.5	4.5	110	39	279.3	158.1	81.5	76.6
5/24/02	1000	10.5	7.5	4.5	110	40	274.1	158.1	81.4	76.7
5/24/02	1100	9.0	6.0	4.5	110	42	264.8	158.0	81.5	76.5

Appendix Table A-1

Continued.

Date	Hour	Spill (kcfs)			Total Spill (kcfs)	Percent Spill	Total Flow (kcfs)	Elevation (ft)		Net Head (ft)
		Bay 4	Bay 9	Bay 13				Forebay	Tailwater	
5/24/02	1200	9.0	6.0	4.5	110	40	273.5	158.0	81.5	76.5
5/24/02	1300	9.0	6.0	4.5	110	40	275.7	157.9	81.5	76.4
5/24/02	1400	9.0	6.0	4.5	110	40	273.7	157.8	81.5	76.3
5/24/02	1500	9.0	6.0	4.5	110	40	276.9	157.8	81.6	76.2
5/24/02	1600	9.0	6.0	4.5	110	41	271.0	157.7	81.3	76.4
5/24/02	1700	9.0	6.0	4.5	110	41	268.7	157.9	81.3	76.6
5/24/02	1800	9.0	6.0	4.5	110	41	271.6	157.8	81.7	76.1
Range		*9.0-10.5*	*6.0-7.5*	*4.5-6.0*	*110.0*	*39-42*	*264.8-280.6*	*157.7-158.2*	*81.3-81.7*	*76.1-76.7*
5/25/02	0800	9.0	7.5	4.5	104	40	263.1	157.9	81.4	76.5
5/25/02	0900	9.0	7.5	4.5	104	40	261.3	158.0	81.4	76.6
5/25/02	1000	9.0	7.5	4.5	104	41	254.7	158.3	81.3	77.0
5/25/02	1100	9.0	7.5	4.5	92	39	236.7	158.0	80.8	77.2
5/25/02	1200	9.0	7.5	4.5	92	40	231.8	157.9	80.7	77.2
5/25/02	1300	9.0	7.5	4.5	92	40	230.1	157.8	80.7	77.1
5/25/02	1400	9.0	6.0	4.5	92	40	229.6	157.8	80.7	77.1
5/25/02	1500	9.0	6.0	4.5	92	39	236.6	157.8	80.7	77.1
5/25/02	1600	9.0	6.0	4.5	92	40	232.2	157.7	80.6	77.1
5/25/02	1700	9.0	6.0	3.0	95	39	241.3	157.6	80.6	77.0
Range		*9.0*	*6.0-7.5*	*3.0-4.5*	*92-104*	*39-41*	*229.6-263.1*	*157.6-158.3*	*80.6-81.4*	*76.5-77.2*
5/26/02	0700	7.5	6.0	3.0	100	39	259.4	158.2	80.9	77.3
5/26/02	0800	7.5	6.0	3.0	100	38	261.1	158.4	81.1	77.3
5/26/02	0900	7.5	6.0	3.0	100	38	259.8	158.6	81.1	77.5
5/26/02	1000	7.5	6.0	3.0	100	39	257.3	158.7	81.1	77.6
5/26/02	1100	7.5	6.0	3.0	100	40	251.5	158.5	81.0	77.5
5/26/02	1200	9.0	6.0	3.0	100	40	251.2	158.4	81.2	77.2
5/26/02	1300	9.0	6.0	3.0	100	40	248.9	158.2	81.2	77.0
5/26/02	1400	9.0	6.0	4.5	96	40	241.4	157.9	81.1	76.8
5/26/02	1500	9.0	6.0	4.5	96	39	246.6	157.6	80.9	76.7
5/26/02	1600	9.0	6.0	3.0	96	42	229.4	157.5	80.5	77.0
Range		*7.5-9.0*	*6.0*	*3.0-4.5*	*96-100*	*38-42*	*229.4-261.1*	*157.5-158.7*	*80.5-81.2*	*76.7-77.6*

Appendix Table A-1

Continued.

Date	Hour	Spill (kcfs) Bay 4	Bay 9	Bay 13	Total Spill (kcfs)	Percent Spill	Total Flow (kcfs)	Elevation (ft) Forebay	Tailwater	Net Head (ft)
5/27/02	0700	7.5	6.0	3.0	80	38	208.8	157.4	80.3	77.1
5/27/02	0800	7.5	6.0	3.0	80	38	212.5	157.6	80.3	77.3
5/27/02	0900	7.5	6.0	3.0	80	38	210.2	157.8	80.4	77.4
5/27/02	1000	7.5	6.0	3.0	80	38	212.0	158.0	80.4	77.6
5/27/02	1100	7.5	6.0	3.0	82	38	218.5	158.0	80.6	77.4
5/27/02	1200	9.0	6.0	3.0	82	37	223.2	158.1	80.6	77.5
5/27/02	1300	9.0	6.0	3.0	86	37	231.2	158.1	80.8	77.3
Range		*7.5-9.0*	*6.0*	*3.0*	*80-86*	*37-38*	*208.8-231.2*	*157.4-158.1*	*80.3-80.8*	*77.1-77.6*
				May Average	**87.9**	**38.0**	**231.6**	**158.2**	**80.7**	**77.5**
				Maximum	**110.0**	**42.0**	**306.1**	**159.4**	**83.4**	**80.0**
				Minimum	**63.0**	**28.0**	**167.2**	**157.4**	**78.3**	**74.8**

Date	Hour	Spill (kcfs) Bay 4	Bay 9	Bay 11	Total Spill (kcfs)	Percent Spill	Total Flow (kcfs)	Elevation (ft) Forebay	Tailwater	Net Head (ft)
					August					
8/15/02	1400				70	39	178.4	157.6	78.5	79.1
8/15/02	1500				70	39	179.3	157.6	78.8	78.8
8/15/02	1600				70	39	181.8	157.6	78.9	78.7
Range					*70.0*	*39.0*	*178.4-181.8*	*157.6-157.6*	*78.5-78.9*	*78.7-79.1*
8/16/02	0800	6.0	4.5	3.0	56	41	138.0	157.8	77.4	80.4
8/16/02	0900	6.0	4.5	3.0	54	41	132.0	157.9	77.2	80.7
8/16/02	1000	6.0	4.5	3.0	54	41	130.5	158.2	76.9	81.3
8/16/02	1100	6.0	4.5	3.0	54	42	129.6	158.6	76.6	82.0
8/16/02	1200	6.0	4.5	3.0	54	42	129.1	158.8	76.4	82.4
8/16/02	1300	6.0	4.5	3.0	54	42	129.0	159.1	76.4	82.7
8/16/02	1400	6.0	4.5	3.0	54	41	132.4	159.2	76.3	82.9
8/16/02	1500	6.0	4.5	4.5	58	39	148.0	159.2	76.5	82.7
8/16/02	1600	6.0	4.5	4.5	62	41	152.9	159.2	76.7	82.5

Appendix Table A-1

Continued.

Date	Hour	Spill (kcfs)			Total Spill (kcfs)	Percent Spill	Total Flow (kcfs)	Elevation (ft)		Net Head (ft)
		Bay 4	Bay 9	Bay 11				Forebay	Tailwater	
8/16/02	1700	6.0	4.5	4.5	62	40	153.4	159.3	76.6	82.7
Range		*6.0*	*4.5*	*3.0-4.5*	*54-62*	*39-42*	*129.0-153.4*	*157.8-159.3*	*76.3-77.4*	*80.4-82.9*
8/17/02	0700	4.5	3.0	3.0	44	38	116.2	157.4	76.7	80.7
8/17/02	0800	4.5	3.0	3.0	44	38	115.8	157.3	76.6	80.7
8/17/02	0900	4.5	3.0	3.0	44	38	116.4	157.4	76.6	80.8
8/17/02	1000	4.5	3.0	3.0	44	38	115.3	157.4	76.4	81.0
8/17/02	1100	4.5	3.0	3.0	44	39	113.4	157.5	76.4	81.1
8/17/02	1200	4.5	3.0	3.0	44	40	108.8	157.6	76.4	81.2
8/17/02	1300	4.5	3.0	3.0	44	40	110.1	157.7	76.4	81.3
8/17/02	1400	4.5	3.0	3.0	44	40	110.0	157.9	76.4	81.5
8/17/02	1500	4.5	3.0	3.0	44	41	107.6	158.1	76.5	81.6
8/17/02	1600	4.5	4.5	3.0	46	40	114.6	158.3	76.7	81.6
Range		*4.5*	*3.0-4.5*	*3.0*	*44-46*	*38-41*	*107.6-116.4*	*157.3-158.3*	*76.4-76.7*	*80.7-81.6*
8/18/02	0800	4.5	4.5	3.0	40	39	102.7	157.2	75.7	81.5
8/18/02	0900	4.5	4.5	3.0	40	40	101.2	157.4	75.6	81.8
8/18/02	1000	4.5	4.5	3.0	40	39	101.7	157.4	75.6	81.8
8/18/02	1100	4.5	4.5	3.0	40	35	112.8	157.4	75.7	81.7
8/18/02	1200	4.5	4.5	3.0	49	36	135.8	157.4	76.0	81.4
8/18/02	1300	4.5	4.5	3.0	49	36	137.1	157.4	76.0	81.4
8/18/02	1400	4.5	4.5	3.0	49	36	136.8	157.4	76.0	81.4
8/18/02	1500	4.5	4.5	3.0	49	34	142.1	157.4	76.0	81.4
8/18/02	1600	4.5	4.5	3.0	49	35	141.0	157.5	76.3	81.2
Range		*4.5*	*4.5*	*3.0*	*40-49*	*34-40*	*101.2-142.1*	*157.2-157.5*	*75.6-76.3*	*81.2-81.8*
8/19/02	0800	6.0	4.5	3.0	52	35	147.2	157.2	76.9	80.3
8/19/02	0900	4.5	3.0	3.0	52	36	143.8	157.0	76.7	80.3
8/19/02	1000	4.5	3.0	3.0	44	35	126.5	156.9	76.7	80.2
8/19/02	1100	4.5	3.0	3.0	44	35	125.6	157.0	76.7	80.3
8/19/02	1200	4.5	3.0	3.0	44	35	125.8	157.0	76.7	80.3
8/19/02	1300	4.5	3.0	3.0	44	35	126.2	157.1	76.7	80.4
8/19/02	1400	4.5	3.0	3.0	44	35	125.7	157.1	76.7	80.4

Appendix Table A-1

Continued.

Date	Hour	Spill (kcfs)			Total Spill (kcfs)	Percent Spill	Total Flow (kcfs)	Elevation (ft)		Net Head (ft)
		Bay 4	Bay 9	Bay 11				Forebay	Tailwater	
8/19/02	1500	4.5	3.0	3.0	44	36	123.7	157.2	76.7	80.5
8/19/02	1600	4.5	3.0	3.0	44	35	125.7	157.4	76.9	80.5
Range		*4.5-6.0*	*3.0-4.5*	*3.0*	*44-52*	*35-36*	*123.7-147.2*	*156.9-157.4*	*76.7-76.9*	*80.2-80.5*
8/20/02	0800	6.0	4.5	4.5	60	39	154.8	157.0	76.4	80.6
8/20/02	0900	6.0	4.5	4.5	60	39	152.5	157.2	76.4	80.8
8/20/02	1000	6.0	4.5	4.5	60	39	154.2	157.3	76.3	81.0
8/20/02	1100	6.0	4.5	4.5	60	40	148.7	157.4	76.4	81.0
8/20/02	1200	6.0	4.5	4.5	60	40	150.8	157.4	76.4	81.0
8/20/02	1300	6.0	4.5	4.5	60	40	151.1	157.7	76.5	81.2
8/20/02	1400	6.0	4.5	4.5	60	39	153.6	157.7	76.6	81.1
8/20/02	1500	6.0	4.5	4.5	60	39	152.4	158.0	76.5	81.5
8/20/02	1600	6.0	4.5	4.5	60	40	151.1	158.1	76.6	81.5
8/20/02	1700	6.0	4.5	4.5	60	39	154.7	158.3	76.6	81.7
Range		*6.0*	*4.5*	*4.5*	*60.0*	*39-40*	*148.7-154.8*	*157.0-158.3*	*76.3-76.6*	*80.6-81.7*
8/21/02	0900	6.0	4.5	4.5	62	40	155.6	158.1	76.9	81.2
8/21/02	1000	6.0	4.5	4.5	62	40	156.2	158.1	77.1	81.0
8/21/02	1100	6.0	4.5	4.5	62	40	156.5	158.1	77.1	81.0
8/21/02	1200	6.0	4.5	4.5	62	39	157.2	158.2	77.1	81.1
8/21/02	1300	6.0	4.5	4.5	62	41	152.3	158.2	77.2	81.0
8/21/02	1400	6.0	4.5	4.5	62	39	157.9	158.2	77.1	81.1
8/21/02	1500	6.0	4.5	4.5	62	41	151.5	158.3	77.1	81.2
8/21/02	1600	6.0	4.5	4.5	62	40	154.5	158.3	77.1	81.2
8/21/02	1700	6.0	4.5	4.5	62	40	153.6	158.3	77.2	81.1
Range		*6.0*	*4.5*	*4.5*	*62.0*	*39-41*	*151.5-157.9*	*158.1-158.3*	*76.9-77.2*	*81.0-81.2*
8/22/02	0700	6.0	4.5	4.5	52	36	145.8	157.3	76.4	80.9
8/22/02	0800	6.0	4.5	3.0	52	38	137.7	157.6	76.6	81.0
8/22/02	0900	6.0	4.5	4.5	58	39	147.5	157.6	76.9	80.7
8/22/02	1000	6.0	4.5	4.5	58	39	148.1	157.7	76.9	80.8
8/22/02	1100	6.0	4.5	4.5	61	38	158.5	157.7	77.2	80.5
8/22/02	1200	6.0	4.5	4.5	64	40	160.8	157.9	77.2	80.7

Appendix Table A-1

Continued.

Date	Hour	Spill (kcfs) Bay 4	Spill (kcfs) Bay 9	Spill (kcfs) Bay 11	Total Spill (kcfs)	Percent Spill	Total Flow (kcfs)	Elevation (ft) Forebay	Elevation (ft) Tailwater	Net Head (ft)
8/22/02	1300	7.5	4.5	4.5	64	38	166.3	157.9	77.5	80.4
8/22/02	1400	7.5	4.5	4.5	68	40	171.9	158.2	77.6	80.6
8/22/02	1500	7.5	4.5	4.5	68	38	176.9	158.1	77.8	80.3
8/22/02	1600	7.5	4.5	4.5	68	39	174.1	158.2	77.6	80.6
Range		*6.0-7.5*	*4.5*	*3.0-4.5*	*52-68*	*36-40*	*137.7-176.9*	*157.3-158.2*	*76.4-77.8*	*80.3-81.0*
				August Average	**54.7**	**38.6**	**140.4**	**157.8**	**76.7**	**81.0**
				Maximum	**70**	**42.0**	**181.8**	**159.3**	**78.9**	**82.9**
				Minimum	**40**	**35.0**	**101.2**	**156.9**	**75.6**	**78.7**

Appendix Table A-2

Estimated impact velocities of Spillbay 4, 9, 11, and 13 discharges during May and August 2002 juvenile chinook salmon passage studies at The Dalles Dam. Estimated velocities calculated by Duncan Hay.

		Test Discharge (kcfs)			Impact Velocity (ft/sec)		
Date	**Time**	**Spillbay 4**	**Spillbay 9**	**Spillbay 13**	**Spillbay 4**	**Spillbay 9**	**Spillbay 13**
5/14/02	0900	9.0	6.0	4.5	65.6	65.2	64.5
5/14/02	1000	9.0	6.0	4.5	65.6	65.2	64.5
5/14/02	1100	9.0	6.0	3.0	65.4	65.0	64.0
5/14/02	1200	7.5	6.0	3.0	65.3	65.3	64.2
5/14/02	1300	7.5	6.0	3.0	65.4	65.3	64.3
5/14/02	1400	7.5	6.0	3.0	65.4	65.4	64.3
5/14/02	1500	7.5	6.0	3.0	65.4	65.4	64.3
5/14/02	1600	7.5	6.0	3.0	65.4	65.3	64.3
5/14/02	1700	7.5	6.0	3.0	65.3	65.3	64.3
		Minimum	**6.0**	**3.0**	**65.3**	**65.0**	**64.0**
		Maximum	**6.0**	**4.5**	**65.6**	**65.4**	**64.5**
		Average	**6.0**	**3.3**	**65.4**	**65.3**	**64.3**
5/15/02	0800	9.0	6.0	4.5	65.4	65.0	64.3
5/15/02	0900	9.0	6.0	4.5	65.3	65.0	64.3
5/15/02	1000	9.0	6.0	4.5	65.4	65.0	64.3
5/15/02	1100	9.0	6.0	4.5	65.3	64.9	64.2
5/15/02	1200	9.0	6.0	3.0	65.3	64.9	63.8
5/15/02	1300	9.0	6.0	3.0	65.3	64.9	63.9
5/15/02	1400	9.0	6.0	3.0	65.3	64.9	63.9
5/15/02	1500	7.5	6.0	3.0	64.9	64.9	63.8
5/15/02	1600	7.5	6.0	3.0	65.0	65.0	64.0
5/15/02	1700	7.5	6.0	3.0	65.0	65.0	63.9
		Minimum	**6.0**	**3.0**	**64.9**	**64.9**	**63.8**
		Maximum	**6.0**	**4.5**	**65.4**	**65.0**	**64.3**
		Average	**6.0**	**3.6**	**65.2**	**64.9**	**64.0**
5/16/02	0700	7.5	4.5	3.0	65.6	65.2	64.6
5/16/02	0800	7.5	4.5	3.0	65.8	65.3	64.6
5/16/02	0900	7.5	4.5	3.0	65.8	65.3	64.8
5/16/02	1000	7.5	4.5	3.0	65.9	65.4	64.8
5/16/02	1100	7.5	4.5	3.0	65.8	65.4	64.8
5/16/02	1200	7.5	4.5	3.0	65.8	65.4	64.8
5/16/02	1300	7.5	4.5	3.0	66.0	65.5	64.9
5/16/02	1400	7.5	4.5	3.0	66.0	65.5	64.9
5/16/02	1500	7.5	6.0	3.0	66.0	66.0	64.9
5/16/02	1600	7.5	6.0	3.0	65.9	65.9	64.9
5/16/02	1700	7.5	6.0	3.0	65.9	65.9	64.9
		Minimum	**4.5**	**3.0**	**65.6**	**65.2**	**64.6**
		Maximum	**6.0**	**3.0**	**66.0**	**66.0**	**64.9**
		Average	**4.9**	**3.0**	**65.9**	**65.5**	**64.8**

Appendix Table A-2

Continued.

		Test Discharge (kcfs)			Impact Velocity (ft/sec)		
Date	**Time**	**Spillbay 4**	**Spillbay 9**	**Spillbay 13**	**Spillbay 4**	**Spillbay 9**	**Spillbay 13**
5/17/02	0800	7.5	6.0	3.0	65.1	65.1	64.0
5/17/02	0900	9.0	6.0	3.0	65.4	65.1	64.0
5/17/02	1000	9.0	6.0	3.0	65.4	65.0	63.9
5/17/02	1100	9.0	6.0	3.0	65.5	65.1	64.0
5/17/02	1200	7.5	6.0	3.0	65.1	65.1	64.0
5/17/02	1300	7.5	6.0	3.0	65.1	65.1	64.0
5/17/02	1400	7.5	4.5	3.0	65.1	64.7	64.1
5/17/02	1500	7.5	4.5	3.0	65.3	64.9	64.3
5/17/02	1600	7.5	4.5	3.0	65.3	64.8	64.2
5/17/02	1700	9.0	6.0	3.0	65.5	65.1	64.1
5/17/02	1800	6.0	4.5	3.0	64.3	64.2	63.6
		Minimum	**4.5**	**3.0**	**64.3**	**64.2**	**63.6**
		Maximum	**6.0**	**3.0**	**65.5**	**65.1**	**64.3**
		Average	**5.5**	**3.0**	**65.2**	**64.9**	**64.0**
5/18/02	0800	6.0	4.5	3.0	64.2	64.1	63.5
5/18/02	0900	6.0	4.5	3.0	64.4	64.3	63.7
5/18/02	1000	6.0	4.5	3.0	64.5	64.4	63.8
5/18/02	1100	6.0	4.5	3.0	64.6	64.5	63.9
5/18/02	1200	6.0	4.5	3.0	64.8	64.7	64.1
5/18/02	1300	7.5	6.0	3.0	65.2	65.2	64.1
5/18/02	1400	7.5	6.0	3.0	65.2	65.3	64.2
5/18/02	1500	7.5	6.0	3.0	65.4	65.3	64.3
5/18/02	1600	7.5	6.0	3.0	65.4	65.3	64.3
5/18/02	1700	7.5	6.0	3.0	65.4	65.3	64.3
		Minimum	**4.5**	**3.0**	**64.2**	**64.1**	**63.5**
		Maximum	**6.0**	**3.0**	**65.4**	**65.3**	**64.3**
		Average	**5.3**	**3.0**	**64.9**	**64.8**	**64.0**
5/19/02	0700	7.5	6.0	3.0	65.2	65.2	64.2
5/19/02	0800	7.5	6.0	3.0	65.3	65.2	64.2
5/19/02	0900	7.5	6.0	3.0	65.3	65.3	64.2
5/19/02	1000	7.5	6.0	3.0	65.3	65.3	64.2
5/19/02	1100	9.0	6.0	3.0	65.6	65.3	64.2
5/19/02	1200	9.0	6.0	4.5	65.6	65.2	64.6
5/19/02	1300	9.0	6.0	4.5	65.6	65.2	64.5
5/19/02	1400	9.0	6.0	4.5	65.6	65.6	64.5
5/19/02	1500	9.0	6.0	3.0	65.6	65.3	64.2
		Minimum	**6.0**	**3.0**	**65.2**	**65.2**	**64.2**
		Maximum	**6.0**	**4.5**	**65.6**	**65.6**	**64.6**
		Average	**6.0**	**3.5**	**65.4**	**65.3**	**64.3**

Appendix Table A-2

Continued.

		Test Discharge (kcfs)			Impact Velocity (ft/sec)		
Date	**Time**	**Spillbay 4**	**Spillbay 9**	**Spillbay 13**	**Spillbay 4**	**Spillbay 9**	**Spillbay 13**
5/20/02	0700	9.0	6.0	3.0	65.6	65.3	64.2
5/20/02	0800	9.0	6.0	3.0	65.4	65.0	64.0
5/20/02	0900	7.5	6.0	3.0	65.0	65.0	63.9
5/20/02	1000	7.5	6.0	3.0	65.0	65.0	63.9
5/20/02	1100	9.0	6.0	3.0	65.3	65.0	63.9
5/20/02	1200	9.0	6.0	3.0	65.4	65.0	64.0
5/20/02	1300	9.0	6.0	3.0	65.4	65.0	64.0
5/20/02	1400	9.0	6.0	3.0	65.4	65.0	63.9
5/20/02	1500	9.0	6.0	3.0	65.5	65.1	64.0
5/20/02	1600	9.0	6.0	3.0	65.4	65.0	64.0
		Minimum	**6.0**	**3.0**	**65.0**	**65.0**	**63.9**
		Maximum	**6.0**	**3.0**	**65.6**	**65.3**	**64.2**
		Average	**6.0**	**3.0**	**65.3**	**65.0**	**64.0**
5/21/02	0700	9.0	6.0	3.0	64.5	64.1	63.0
5/21/02	0800	9.0	6.0	3.0	64.7	64.3	63.2
5/21/02	0900	9.0	6.0	3.0	64.5	64.1	63.1
5/21/02	1000	9.0	6.0	3.0	64.6	64.2	63.1
5/21/02	1100	9.0	6.0	3.0	64.2	63.8	62.8
5/21/02	1200	9.0	6.0	3.0	64.2	63.8	62.7
5/21/02	1300	9.0	6.0	3.0	64.1	63.7	62.6
5/21/02	1400	9.0	6.0	3.0	64.3	63.9	62.8
5/21/02	1500	9.0	6.0	3.0	64.4	64.0	62.9
5/21/02	1600	9.0	6.0	3.0	64.2	63.8	62.8
5/21/02	1700	9.0	6.0	3.0	64.2	63.8	62.7
		Minimum	**6.0**	**3.0**	**64.1**	**63.7**	**62.6**
		Maximum	**6.0**	**3.0**	**64.7**	**64.3**	**63.2**
		Average	**6.0**	**3.0**	**64.4**	**64.0**	**62.9**
5/22/02	0700	9.0	6.0	3.0	64.0	63.6	62.6
5/22/02	0800	9.0	6.0	3.0	63.8	63.4	62.3
5/22/02	0900	9.0	6.0	3.0	63.8	63.4	62.4
5/22/02	1000	9.0	7.5	4.5	64.1	64.2	63.0
5/22/02	1100	9.0	7.5	4.5	64.2	64.3	63.2
5/22/02	1200	9.0	7.5	4.5	64.3	64.4	63.3
5/22/02	1300	9.0	7.5	4.5	64.3	64.4	63.2
5/22/02	1400	9.0	7.5	4.5	64.4	64.5	63.3
5/22/02	1500	9.0	7.5	4.5	64.4	64.5	63.3
5/22/02	1600	9.0	7.5	4.5	64.5	64.6	63.4
5/22/02	1700	9.0	7.5	4.5	64.5	64.6	63.4
		Minimum	**6.0**	**3.0**	**63.8**	**63.4**	**62.3**
		Maximum	**7.5**	**4.5**	**64.5**	**64.6**	**63.4**
		Average	**7.1**	**4.1**	**64.2**	**64.2**	**63.0**

Appendix Table A-2

Continued.

		Test Discharge (kcfs)			Impact Velocity (ft/sec)		
Date	**Time**	**Spillbay 4**	**Spillbay 9**	**Spillbay 13**	**Spillbay 4**	**Spillbay 9**	**Spillbay 13**
5/23/02	0800	10.5	7.5	4.5	65.2	64.9	63.7
5/23/02	0900	10.5	7.5	4.5	65.2	64.9	63.7
5/23/02	1000	10.5	7.5	4.5	65.2	64.9	63.8
5/23/02	1100	10.5	7.5	4.5	65.1	64.8	63.7
5/23/02	1200	10.5	7.5	4.5	65.2	64.9	63.7
5/23/02	1300	10.5	7.5	4.5	65.1	64.8	63.7
5/23/02	1400	10.5	7.5	4.5	65.1	64.8	63.7
5/23/02	1500	10.5	7.5	4.5	65.1	64.8	63.7
5/23/02	1600	10.5	7.5	4.5	65.2	64.9	63.7
5/23/02	1700	10.5	7.5	4.5	65.2	64.9	63.8
		Minimum	**7.5**	**4.5**	**65.1**	**64.8**	**63.7**
		Maximum	**7.5**	**4.5**	**65.2**	**64.9**	**63.8**
		Average	**7.5**	**4.5**	**65.2**	**64.9**	**63.7**
5/24/02	0800	10.5	7.5	6.0	65.1	64.8	63.9
5/24/02	0900	10.5	7.5	4.5	65.1	64.8	63.6
5/24/02	1000	10.5	7.5	4.5	65.1	64.8	63.7
5/24/02	1100	9.0	6.0	4.5	64.7	64.3	63.6
5/24/02	1200	9.0	6.0	4.5	64.7	64.3	63.6
5/24/02	1300	9.0	6.0	4.5	64.7	64.3	63.6
5/24/02	1400	9.0	6.0	4.5	64.6	64.3	63.6
5/24/02	1500	9.0	6.0	4.5	64.6	64.2	63.5
5/24/02	1600	9.0	6.0	4.5	64.7	64.4	63.6
5/24/02	1700	9.0	6.0	4.5	64.7	64.4	63.7
5/24/02	1800	9.0	6.0	4.5	64.5	64.2	63.5
		Minimum	**6.0**	**4.5**	**64.5**	**64.2**	**63.5**
		Maximum	**7.5**	**6.0**	**65.1**	**64.8**	**63.9**
		Average	**6.4**	**4.6**	**64.8**	**64.4**	**63.6**
5/25/02	0800	9.0	7.5	4.5	64.7	64.8	63.6
5/25/02	0900	9.0	7.5	4.5	64.7	64.8	63.7
5/25/02	1000	9.0	7.5	4.5	64.8	64.9	63.8
5/25/02	1100	9.0	7.5	4.5	65.0	65.1	64.0
5/25/02	1200	9.0	7.5	4.5	65.1	65.2	64.0
5/25/02	1300	9.0	7.5	4.5	65.1	65.1	64.0
5/25/02	1400	9.0	6.0	4.5	65.1	64.7	64.0
5/25/02	1500	9.0	6.0	4.5	65.1	64.7	64.0
5/25/02	1600	9.0	6.0	4.5	65.1	64.7	64.0
5/25/02	1700	9.0	6.0	3.0	65.1	64.7	63.6
		Minimum	**6.0**	**3.0**	**64.7**	**64.7**	**63.6**
		Maximum	**7.5**	**4.5**	**65.1**	**65.2**	**64.0**
		Average	**6.9**	**4.4**	**65.0**	**64.9**	**63.9**

Appendix Table A-2

Continued.

		Test Discharge (kcfs)			Impact Velocity (ft/sec)		
Date	**Time**	**Spillbay 4**	**Spillbay 9**	**Spillbay 13**	**Spillbay 4**	**Spillbay 9**	**Spillbay 13**
5/26/02	0700	7.5	6.0	3.0	64.7	64.7	63.6
5/26/02	0800	7.5	6.0	3.0	64.6	64.6	63.6
5/26/02	0900	7.5	6.0	3.0	64.7	64.6	63.6
5/26/02	1000	7.5	6.0	3.0	64.7	64.7	63.6
5/26/02	1100	7.5	6.0	3.0	64.7	64.7	63.6
5/26/02	1200	9.0	6.0	3.0	64.9	64.6	63.5
5/26/02	1300	9.0	6.0	3.0	64.9	64.5	63.5
5/26/02	1400	9.0	6.0	4.5	64.9	64.5	63.8
5/26/02	1500	9.0	6.0	4.5	64.9	64.5	63.8
5/26/02	1600	9.0	6.0	3.0	64.9	64.7	63.7
		Minimum	**6.0**	**3.0**	**64.6**	**64.5**	**63.5**
		Maximum	**6.0**	**4.5**	**64.9**	**64.7**	**63.8**
		Average	**6.0**	**3.3**	**64.8**	**64.6**	**63.6**
5/27/02	0700	7.5	6.0	3.0	64.8	64.8	63.7
5/27/02	0800	7.5	6.0	3.0	64.8	64.8	63.8
5/27/02	0900	7.5	6.0	3.0	64.8	64.8	63.8
5/27/02	1000	7.5	6.0	3.0	64.9	64.9	63.8
5/27/02	1100	7.5	6.0	3.0	64.8	64.8	63.7
5/27/02	1200	9.0	6.0	3.0	65.2	64.8	63.7
5/27/02	1300	9.0	6.0	3.0	65.1	64.7	63.6
		Minimum	**6.0**	**3.0**	**64.8**	**64.7**	**63.6**
		Maximum	**6.0**	**3.0**	**65.2**	**64.9**	**63.8**
		Average	**6.0**	**3.0**	**64.9**	**64.8**	**63.7**

		Test Discharge (kcfs)			Impact Velocity (ft/sec)		
Date	**Time**	**Spillbay 4**	**Spillbay 9**	**Spillbay 11**	**Spillbay 4**	**Spillbay 9**	**Spillbay 11**
8/15/02	1400						
8/15/02	1500						
8/15/02	1600						
8/16/02	0800	6.0	4.5	3.0	66.0	65.9	65.3
8/16/02	0900	6.0	4.5	3.0	66.0	66.0	65.4
8/16/02	1000	6.0	4.5	3.0	66.3	66.2	65.6
8/16/02	1100	6.0	4.5	3.0	66.5	66.4	65.8
8/16/02	1200	6.0	4.5	3.0	66.7	66.6	66.0
8/16/02	1300	6.0	4.5	3.0	66.7	66.6	66.1
8/16/02	1400	6.0	4.5	3.0	66.8	66.7	66.1
8/16/02	1500	6.0	4.5	4.5	66.7	66.6	66.4
8/16/02	1600	6.0	4.5	4.5	66.6	66.5	66.3
8/16/02	1700	6.0	4.5	4.5	66.7	66.6	66.3
		Minimum	**4.5**	**3.0**	**66.0**	**65.9**	**65.3**
		Maximum	**4.5**	**4.5**	**66.8**	**66.7**	**66.4**
		Average	**4.5**	**3.5**	**66.5**	**66.4**	**65.9**

Appendix Table A-2

Continued.

		Test Discharge (kcfs)			Impact Velocity (ft/sec)		
Date	**Time**	**Spillbay 4**	**Spillbay 9**	**Spillbay 11**	**Spillbay 4**	**Spillbay 9**	**Spillbay 11**
8/17/02	0700	4.5	3.0	3.0	65.9	65.7	65.5
8/17/02	0800	4.5	3.0	3.0	65.9	65.7	65.6
8/17/02	0900	4.5	3.0	3.0	66.0	65.8	65.6
8/17/02	1000	4.5	3.0	3.0	66.1	65.8	65.7
8/17/02	1100	4.5	3.0	3.0	66.1	65.9	65.7
8/17/02	1200	4.5	3.0	3.0	66.1	65.9	65.7
8/17/02	1300	4.5	3.0	3.0	66.1	65.9	65.8
8/17/02	1400	4.5	3.0	3.0	66.1	66.0	65.8
8/17/02	1500	4.5	3.0	3.0	66.1	66.0	65.8
8/17/02	1600	4.5	4.5	3.0	66.1	66.3	65.7
		Minimum	**3.0**	**3.0**	**65.9**	**65.7**	**65.5**
		Maximum	**4.5**	**3.0**	**66.1**	**66.3**	**65.8**
		Average	**3.2**	**3.0**	**66.0**	**65.9**	**65.7**
8/18/02	0800	4.5	4.5	3.0	66.4	66.6	66.0
8/18/02	0900	4.5	4.5	3.0	66.4	66.7	66.1
8/18/02	1000	4.5	4.5	3.0	66.4	66.7	66.1
8/18/02	1100	4.5	4.5	3.0	66.4	66.6	66.0
8/18/02	1200	4.5	4.5	3.0	66.2	66.5	65.9
8/18/02	1300	4.5	4.5	3.0	66.2	66.5	65.9
8/18/02	1400	4.5	4.5	3.0	66.2	66.5	65.9
8/18/02	1500	4.5	4.5	3.0	66.2	66.5	65.9
8/18/02	1600	4.5	4.5	3.0	66.1	66.4	65.8
		Minimum	**4.5**	**3.0**	**66.1**	**66.4**	**65.8**
		Maximum	**4.5**	**3.0**	**66.4**	**66.7**	**66.1**
		Average	**4.5**	**3.0**	**66.3**	**66.6**	**66.0**
8/19/02	0800	6.0	4.5	3.0	66.1	66.0	65.4
8/19/02	0900	4.5	3.0	3.0	65.8	65.6	65.5
8/19/02	1000	4.5	3.0	3.0	65.8	65.6	65.4
8/19/02	1100	4.5	3.0	3.0	65.8	65.6	65.5
8/19/02	1200	4.5	3.0	3.0	65.8	65.6	65.5
8/19/02	1300	4.5	3.0	3.0	65.8	65.6	65.5
8/19/02	1400	4.5	3.0	3.0	65.8	65.6	65.5
8/19/02	1500	4.5	3.0	3.0	65.9	65.7	65.5
8/19/02	1600	4.5	3.0	3.0	65.8	65.6	65.4
		Minimum	**3.0**	**3.0**	**65.8**	**65.6**	**65.4**
		Maximum	**4.5**	**3.0**	**66.1**	**66.0**	**65.5**
		Average	**3.2**	**3.0**	**65.8**	**65.7**	**65.5**
8/20/02	0800	6.0	4.5	4.5	66.3	66.2	66.0
8/20/02	0900	6.0	4.5	4.5	66.3	66.2	66.0
8/20/02	1000	6.0	4.5	4.5	66.4	66.3	66.1
8/20/02	1100	6.0	4.5	4.5	66.4	66.3	66.0

Appendix Table A-2

Continued.

		Test Discharge (kcfs)			Impact Velocity (ft/sec)		
Date	**Time**	**Spillbay 4**	**Spillbay 9**	**Spillbay 11**	**Spillbay 4**	**Spillbay 9**	**Spillbay 11**
8/20/02	1200	6.0	4.5	4.5	66.4	66.3	66.0
8/20/02	1300	6.0	4.5	4.5	66.4	66.3	66.1
8/20/02	1400	6.0	4.5	4.5	66.4	66.3	66.0
8/20/02	1500	6.0	4.5	4.5	66.5	66.4	66.1
8/20/02	1600	6.0	4.5	4.5	66.4	66.3	66.1
8/20/02	1700	6.0	4.5	4.5	66.5	66.4	66.1
		Minimum	**4.5**	**4.5**	**66.3**	**66.2**	**66.0**
		Maximum	**4.5**	**4.5**	**66.5**	**66.4**	**66.1**
		Average	**4.5**	**4.5**	**66.4**	**66.3**	**66.1**
8/21/02	0900	6.0	4.5	4.5	66.3	66.2	66.0
8/21/02	1000	6.0	4.5	4.5	66.2	66.1	65.9
8/21/02	1100	6.0	4.5	4.5	66.2	66.1	65.9
8/21/02	1200	6.0	4.5	4.5	66.2	66.1	65.9
8/21/02	1300	6.0	4.5	4.5	66.2	66.1	65.8
8/21/02	1400	6.0	4.5	4.5	66.2	66.1	65.9
8/21/02	1500	6.0	4.5	4.5	66.2	66.1	65.9
8/21/02	1600	6.0	4.5	4.5	66.2	66.1	65.9
8/21/02	1700	6.0	4.5	4.5	66.2	66.1	65.8
		Minimum	**4.5**	**4.5**	**66.2**	**66.1**	**65.8**
		Maximum	**4.5**	**4.5**	**66.3**	**66.2**	**66.0**
		Average	**4.5**	**4.5**	**66.2**	**66.1**	**65.9**
8/22/02	0700	6.0	4.5	4.5	66.4	66.3	66.0
8/22/02	0800	6.0	4.5	3.0	66.3	66.2	65.6
8/22/02	0900	6.0	4.5	4.5	66.2	66.1	65.8
8/22/02	1000	6.0	4.5	4.5	66.2	66.1	65.9
8/22/02	1100	6.0	4.5	4.5	66.1	66.0	65.7
8/22/02	1200	6.0	4.5	4.5	66.1	66.0	65.8
8/22/02	1300	7.5	4.5	4.5	66.3	65.9	65.6
8/22/02	1400	7.5	4.5	4.5	66.3	65.9	65.6
8/22/02	1500	7.5	4.5	4.5	66.2	65.8	65.5
8/22/02	1600	7.5	4.5	4.5	66.3	65.9	65.6
		Minimum	**4.5**	**3.0**	**66.1**	**65.8**	**65.5**
		Maximum	**4.5**	**4.5**	**66.4**	**66.3**	**66.0**
		Average	**4.5**	**4.4**	**66.2**	**66.0**	**65.7**

APPENDIX B

SUMMARY OF SURVIVAL RATES AT OTHER HYDROELECTRIC DAMS

Appendix Table B-1

Sample size, recapture and control survival rates, and estimated 48 h survival (direct effects) of anadromous fishes in passage through non-turbine exit routes at hydroelectric dams. Estimates based on balloon tag-recapture methodology (Heisey *et al.* 1992).

Station	Exit Route	Species	Sample Size	Head (ft)	Test Discharge (cfs)	Recapture Rates (%) Control	Recapture Rates (%) Treatment	Control Survival (%)	Passage Survival (%)	Source
Crescent, NY	Spillway	Juvenile herring	110	13	40	90.0	93.6	82.1	88.3	Mathur *et al.* (1996a)
Cabot, MA	Sluice	American shad	150	69	225	96.0	96.0	93.9	98.3	NAI (1995)
Bellows Falls, VT	Sluice	Atlantic salmon	100	59	300	99.0	95.0	100.0	96.0	Heisey *et al.* (1993)
Vernon, VT/NH	"Fish tube" (Sluice)	Atlantic salmon	100	27	40	100.0	93.3	100.0	93.3	Heisey *et al.* (1996)
Wilder, VT	Sluice	Atlantic salmon	100	52	200	99.0	100.0	99.0	97.0	Heisey *et al.* (1993)
	Sluice	Atlantic salmon	45	52	300	100.0	97.8	100.0	91.0	Heisey *et al.* (1993)
	Sluice	Atlantic salmon	100	52	500	99.0	99.0	99.0	97.0	Heisey *et al.* (1993)
The Dalles, WA	Spillway	Chinook salmon	270	81	10,500	97.0	94.1	97.0	95.5	NAI *et al.* (1996a)
	Spillway[b]	Chinook salmon	271	81	10,500	97.0	97.4	97.0	99.3	NAI *et al.* (1996a)
	Spillway[b]	Chinook salmon	210	81	4,500	96.2	94.3	96.2	99.0	NAI *et al.* (1996a)
	Spillway	*Chinook salmon*	*391*	*75-80*	*7,500-10,500*	*98.7*	*96.7*	*98.0*	*97.4*	*Present study*
	Spillway	*Chinook salmon*	*396*	*75-80*	*4,500-7,500*	*98.7*	*95.4*	*98.0*	*97.4*	*Present study*
	Spillway	*Chinook salmon*	*405*	*75-80*	*3,000-6,000*	*98.7*	*93.8*	*98.0*	*93.8*	*Present study*
Wanapum, WA	Sluice	Chinook salmon	195	79	2,000	100.0	97.9	100.0	97.4	NAI *et al.* (1996c)
	Spillway	Chinook salmon	235	79	4,300	100.0	99.6	99.6	99.6	NAI *et al.* (1996c)
	Spillway[a]	Chinook salmon	235	79	4,300	100.0	97.9	99.6	95.7	NAI *et al.* (1996c)
	Spillway[b]	Chinook salmon	155	79	2,000	100.0	97.4	100.0	92.0	NAI *et al.* (1996c)
	Spillway[b]	Chinook salmon	160	79	4,000	96.7	98.8	96.7	96.9	NAI *et al.* (1996c)
	Spillway	Chinook salmon	180	82	2,800	100.0	100.0	94.5	100.0	NAI and Skalski (1999)
	Spillway	Chinook salmon	244	82	6,000	100.0	99.6	95.8	99.3	NAI and Skalski (1999)
	Spillway	Chinook salmon	130	82	11,500	98.4	99.2	94.3	94.6	NAI and Skalski (1999)
	Spillway[a]	Chinook salmon	200	82	2,800	100.0	100.0	96.5	99.0	NAI and Skalski (1999)
	Spillway[a]	Chinook salmon	199	82	6,000	100.0	98.5	95.3	97.6	NAI and Skalski (1999)
	Spillway[a]	Chinook salmon	191	82	11,500	98.4	96.7	94.3	92.8	NAI and Skalski (1999)
	Spillway	Chinook salmon	180	82	2,800	100.0	100.0	97.5	99.4	NAI and Skalski (2000b)
	Spillway	Chinook salmon	169	82	6,000	100.0	100.0	95.8	97.6	NAI and Skalski (2000b)
	Spillway	Chinook salmon	198	82	7,500	100.0	100.0	94.3	99.5	NAI and Skalski (2000b)
	Spillway[a]	Chinook salmon	180	82	2,800	100.0	100.0	96.5	98.3	NAI and Skalski (2000b)
	Spillway[a]	Chinook salmon	170	82	6,000	100.0	98.8	95.3	98.2	NAI and Skalski (2000b)
	Spillway[a]	Chinook salmon	210	82	7,500	100.0	99.0	82.3	97.6	NAI and Skalski (2000b)
	Bypass Pipe	Chinook salmon	500	76-80	420	99.6	99.8	99.6	100.0	NAI and Skalski (2000c)
Bonneville, WA	Spillway	Chinook salmon	280	60	12,000	96.1	96.8	96.1	100.0	NAI *et al.* (1996b)
	Spillway[a]	Chinook salmon	280	60	12,000	96.1	99.3	96.1	100.0	NAI *et al.* (1996b)

Appendix Table B-1

Continued.

Station	Exit Route	Species	Sample Size	Head (ft)	Test Discharge (cfs)	Recapture Rates		Control Survival	Survival (%)	Source
						Control	Treatment			
Lower Granite, WA	Spillway[a]	Chinook salmon	120	90	3,400	100.0	100.0	100.0	97.5	Mathur *et al.* (1999)
	Surface Bypass Collector[a]	Chinook salmon	120	90	3,400	100.0	99.2	100.0	95.8	Mathur *et al.* (1999)
	Spillway[a]	Chinook salmon	130	90	3,400	92.1	94.6	92.1	97.6	NAI *et al.* (2000)
	Surface Bypass Collector[a]	Chinook salmon	133	90	3,400	92.1	97.8	92.1	97.0	NAI *et al.* (2000)
Little Goose, WA	Spillway	Steelhead	150	90	5,600	100.0	100.0	100.0	100.0	NAI *et al.* (1997)
	Spillway	Steelhead	150	90	9,500	100.0	100.0	100.0	100.0	NAI *et al.* (1997)
	Spillway	Steelhead	100	90	1,800	99.0	100.0	99.0	100.0	NAI *et al.* (1997)
	Spillway[c]	Steelhead	40	90	5,600	100.0	98.0	100.0	100.0	NAI *et al.* (1997)
	Spillway[c]	Steelhead	120	90	9,500	100.0	99.0	100.0	98.3	NAI *et al.* (1997)
	Spillway[a]	Steelhead	150	90	5,600	100.0	99.0	100.0	98.0	NAI *et al.* (1997)
	Spillway[a]	Steelhead	150	90	9,500	100.0	100.0	100.0	100.0	NAI *et al.* (1997)
	Spillway[a]	Steelhead	100	90	1,800	99.0	100.0	99.0	99.0	NAI *et al.* (1997)
	Spillway[a,c]	Steelhead	39	90	5,600	100.0	100.0	100.0	100.0	NAI *et al.* (1997)
	Spillway[a,c]	Steelhead	120	90	9,500	100.0	99.0	100.0	99.2	NAI *et al.* (1997)
Rock Island, WA	Spillway[b,d]	Chinook salmon	250	41	1,850	NA	98.0	NA	95.1	NAI and Skalski (1998)
	Spillway[b]	Chinook salmon	250	41	10,000	NA	100.0	NA	98.4	NAI and Skalski (1998)
	Spillway[b]	Chinook salmon	200	41-49	2,500	100.0	99.5	99.5	99.5	NAI and Skalski (2000a)
	Spillway[b]	Chinook salmon	200	41-49	10,000	100.0	100.0	99.5	99.5	NAI and Skalski (2000a)
	Spillway[a,b,e]	Chinook salmon	200	40-43	2,500	100.0	99.5	100.0	99.0	NAI and Skalski (2001)
	Spillway[a,b]	Chinook salmon	200	40-43	2,500	100.0	100.0	100.0	100.0	NAI and Skalski (2001)

a Spillbay with flow deflector.
b Overflow weir or slot to attract surface oriented juvenile salmonids.
c Fish released into head pond vortices upstream of tainter gates.
d Spill directed onto concrete slab; survival is relative to survival at another spillbay.
e Periphery release.

APPENDIX C

INDIVIDUAL TRIAL DATA; FISH INJURY DATA; AND DAILY FISH DISPOSITION DATA

Appendix Table C-1

Daily tag-recapture data for juvenile chinook salmon passed through Spillbays 4, 9, and 13 and controls at The Dalles Dam, May 2002. Injuries or mortalities due to predation are shown in parentheses.

	05/14	05/15	05/16	05/17	05/18	05/19	05/20	05/21	05/22	05/23	05/24	05/25	05/26	05/27	Totals
Spillbay 4															
Released	32	30	30	30	30	--	30	30	30	30	30	30	30	29	**391**
Recovered alive	29	27(1)	27	30(1)	29	--	29	29	29	27(1)	30	29	30	28	**373(3)**
Recovered dead	0	1	0	0	1	--	0	0	1(1)	2(2)	0	0	0	0	**5(3)**
Assigned dead	0	0	0	0	0	--	1	0	0	1(1)	0	1	0	1	**4(1)**
Unknown	3	2	3	0	0	--	0	1	0	0	0	0	0	0	**9**
Held	29	27	27	30	29	--	29	29	29	27	30	29	30	28	**373**
Alive - 48 h	28	27	26	30	29	--	28	29	29	26	30	29	30	28	**369**
Spillbay 9															
Released	12	30	15	30	30	--	40	30	30	49	40	30	30	30	**396**
Recovered alive	11(1)	29	13	27(1)	27	--	40	30	29(1)	47	39(1)	28	28	29	**377(4)**
Recovered dead	0	0	0	0	1(1)	--	0	0	0	0	0	0	0	0	**1(1)**
Assigned dead	0	1	0	0	1	--	0	0	1(1)	1(1)	1	0	0	1	**6(2)**
Unknown	1	0	2	3	1	--	0	0	0	1	0	2	2	0	**12**
Held	11	29	13	27	27	--	40	30	29	47	39	28	28	29	**377**
Alive - 48 h	10	28	13	25	27	--	40	30	29	47	38	28	27	29	**371**
Spillbay 13															
Released	2	--	30	30	29	51	30	31	30	38	39	26	49	20	**405**
Recovered alive	2	--	26	29	26	47	27	26(2)	28	38(2)	36	23	46	18	**372(4)**
Recovered dead	0	--	0	0	0	2(1)	0	2	1(1)	0	1(1)	1(1)	0	1	**8(4)**
Assigned dead	0	--	3	0	1	2	2	1	0	0	1(1)	0	1(1)	0	**11(2)**
Unknown	0	--	1	1	2	0	1	2	1	0	1	2	2	1	**14**
Held	2	--	26	29	26	47	27	26	28	38	36	23	46	18	**372**
Alive - 48 h	2	--	26	27	24	47	26	25	28	37	36	23	45	18	**364**
Control															
Released	5	30	--	30	30	50	30	30	30	30	40	30	30	30	**395**
Recovered alive	4	29(1)	--	30	29	48	30	29	30	29(1)	40	29	30	30	**387(2)**
Recovered dead	0	0	--	0	1(1)	0	0	0	0	1(1)	0	1(1)	0	0	**3(3)**
Assigned dead	0	0	--	0	0	0	0	0	0	0	0	0	0	0	**0**
Unknown	1	1	--	0	0	2	0	1	0	0	0	0	0	0	**5**
Held	4	29	--	30	29	48	30	29	30	29	40	29	30	30	**387**
Alive - 48 h	4	29	--	30	29	48	30	29	30	29	40	29	30	30	**387**

Appendix Table C-2

Daily tag-recapture data for juvenile chinook salmon passed through Spillbays 4, 9, 11, controls, and the sluice at The Dalles Dam, August 2002. Injuries or mortalities due to predation shown in parentheses.

	8/15	8/16	8/17	8/18	8/19	8/20	8/21	8/22	8/24	Totals
Spillbay 4										
Released	2	30	30	30	30	30	30	30	--	**212**
Recovered alive	2	18	23	27	18	26	19	19	--	**152**
Recovered dead	0	0	1(1)	0	3	1(1)	3(2)	4(1)	--	**12(5)**
Assigned dead	0	11(2)	6(2)	2(2)	9(7)	4(1)	7(3)	5	--	**44(17)**
Unknown	0	1	0	1	0	0	1	2	--	**5**
Held	2	18	23	27	18	26	19	19	--	**152**
Alive - 48 h	1	11	19	25	18	21	15	11	--	**121**
Spillbay 9										
Released	2	29	30	30	30	30	30	30	--	**211**
Recovered alive	1	28	18	16	20	21	17(1)	7	--	**128(1)**
Recovered dead	0	0	1(1)	1(1)	1	2(2)	1(1)	6(4)	--	**12(9)**
Assigned dead	1	1	11(2)	13(5)	9(7)	7(1)	12(6)	16(1)	--	**70(22)**
Unknown	0	0	0	0	0	0	0	1	--	**1**
Held	1	28	18	16	20	21	17	7	--	**128**
Alive - 48 h	0	22	15	15	20	15	9	6	--	**102**
Spillbay 11										
Released	4	20	30	30	30	30	30	30	--	**204**
Recovered alive	3	16	23	23	24	20(1)	24	20	--	**153(1)**
Recovered dead	0	0	1(1)	1(1)	0	1	1	2	--	**6(2)**
Assigned dead	1	1	6(4)	6(5)	5(2)	8(6)	3(2)	8(2)	--	**38(21)**
Unknown	0	3	0	0	1	1	2	0	--	**7**
Held	3	16	23	23	24	20	24	20	--	**153**
Alive - 48 h	3	13	21	20	23	19	21	9	--	**129**
Control										
Released	2	30	30	30	30	30	30	30	--	**212**
Recovered alive	0	16	24	24	26	24	24(1)	23	--	**161(1)**
Recovered dead	0	0	1(1)	0	0	3(2)	2(1)	3(1)	--	**9(5)**
Assigned dead	0	11	5(1)	4(2)	4(3)	3(2)	2(1)	3	--	**32(9)**
Unknown	2	3	0	2	0	0	2	1	--	**10**
Held	0	16	24	24	26	24	24	23	--	**161**
Alive - 48 h	0	15	23	24	26	24	18	21	--	**151**
Sluice										
Released	--	--	--	--	--	--	--	--	110	**110**
Recovered alive	--	--	--	--	--	--	--	--	101	**101**
Recovered dead	--	--	--	--	--	--	--	--	0	**0**
Assigned dead	--	--	--	--	--	--	--	--	6(3)	**6(3)**
Unknown	--	--	--	--	--	--	--	--	3	**3**
Held	--	--	--	--	--	--	--	--	101	**101**
Alive - 48 h	--	--	--	--	--	--	--	--	*	

* About 50% of held fish died from fungal infection not related to sluice passage.

Appendix Table C-3

Daily malady data for juvenile chinook salmon passed through Spillbays 4, 9, and 13 and controls at The Dalles Dam, May 2002.

	05/14	05/15	05/16	05/17	05/18	05/19	05/20	05/21	05/22	05/23	05/24	05/25	05/26	05/27	Totals
Spillbay 4															
Released	32	30	30	30	30	--	30	30	30	30	30	30	30	29	**391**
Examined	29	28	27	30	30	--	29	29	30	29	30	29	30	28	**378**
Passage related maladies	2	1	3	2	2	--	3	3	1	3	2	1	2	0	**25**
Visible injuries	1	1	3	2	2	--	3	2	1	1	2	1	2	0	**21**
Loss of equilibrium only	1	0	0	0	0	--	0	1	0	2	0	0	0	0	**4**
Scale loss only	0	0	0	0	0	--	0	0	0	0	0	0	0	0	**0**
Without maladies/or with maladies not attributed to passage*	27/0	26/1	24/0	28/0	28/0	--	26/0	26/0	28/1	23/3	28/0	28/0	28/0	28/0	**348/5**
Without maladies that died	0	0	0	0	0	--	0	0	0	0	0	0	0	0	**0**
Spillbay 9															
Released	12	30	15	30	30	--	40	30	30	49	40	30	30	30	**396**
Examined	11	29	13	27	28	--	40	30	29	47	39	28	28	29	**378**
Passage related maladies	2	2	1	2	3	--	4	0	2	2	4	1	1	1	**25**
Visible injuries	1	2	1	1	3	--	3	0	2	2	3	0	1	0	**19**
Loss of equilibrium only	1	0	0	1	0	--	1	0	0	0	1	0	0	1	**5**
Scale loss only	0	0	0	0	0	--	0	0	0	0	0	1	0	0	**1**
Without maladies/or with maladies not attributed to passage*	9/0	27/0	12/0	24/1	24/1	--	36/0	30/0	26/1	45/0	34/1	27/0	27/0	28/0	**349/4**
Without maladies that died	0	0	0	1	0	--	0	0	0	0	0	0	1	0	**2**
Spillbay 13															
Released	2	--	30	30	29	51	30	31	30	38	39	26	49	20	**405**
Examined	2	--	26	29	26	49	27	28	29	38	37	24	46	19	**380**
Passage related maladies	0	--	2	2	5	4	2	2	3	6	5	3	3	1	**38**
Visible injuries	0	--	2	2	4	3	2	2	3	6	3	3	3	1	**34**
Loss of equilibrium only	0	--	0	0	0	1	0	0	0	0	2	0	0	0	**3**
Scale loss only	0	--	0	0	1	0	0	0	0	0	0	0	0	0	**1**
Without maladies/or with maladies not attributed to passage*	2/0	--	24/0	27/0	21/0	44/1	25/0	24/2	25/1	30/2	31/1	20/1	43/0	17/1	**333/9**
Without maladies that died	0	--	0	1	1	0	0	0	0	0	0	0	0	0	**2**

Appendix Table C-3

Continued.

	05/14	05/15	05/16	05/17	05/18	05/19	05/20	05/21	05/22	05/23	05/24	05/25	05/26	05/27	Totals
Control															
Released	5	30	--	30	30	50	30	30	30	30	40	30	30	30	**395**
Examined	4	29	--	30	30	48	30	29	30	30	40	30	30	30	**390**
Passage related maladies	0	0	--	0	1	0	1	2	0	0	0	0	0	0	**4**
Visible injuries	0	0	--	0	1	0	1	2	0	0	0	0	0	0	**4**
Loss of equilibrium only	0	0	--	0	0	0	0	0	0	0	0	0	0	0	**0**
Scale loss only	0	0	--	0	0	0	0	0	0	0	0	0	0	0	**0**
Without maladies/or with maladies not attributed to passage*	4/0	28/1	--	30/0	28/1	48/0	29/0	27/0	30/0	28/2	40/0	29/1	30/0	30/0	**381/5**
Without maladies that died	0	0	--	0	0	0	0	0	0	0	0	0	0	0	**0**

* Includes fish with maladies attributed to predators and/or tags (*i.e.* , tear at tag site).

Appendix Table C-4

Daily malady data for juvenile chinook salmon passed through Spillbays 4, 9, 11, and controls at The Dalles Dam, August 2002.

	8/15	8/16	8/17	8/18	8/19	8/20	8/21	8/22	Totals
Spillbay 4									
Released	2	30	30	30	30	30	30	30	**212**
Examined	2	18	24	27	21	27	22	23	**164**
Passage related maladies	1	2	3	1	4	2	1	2	**16**
Visible injuries	0	2	1	0	4	0	0	0	**7**
Loss of equilibrium only	1	0	1	1	0	2	1	1	**7**
Scale loss only	0	0	1	0	0	0	0	1	**2**
Without maladies/or with maladies not attributed to passage*	1/0	10/6	19/2	25/1	17/0	23/2	17/4	20/1	**132/16**
Without maladies that died	1	1	1	1	0	2	2	9	**17**
Spillbay 9									
Released	2	29	30	30	30	30	30	30	**211**
Examined	1	28	19	17	21	23	18	13	**140**
Passage related maladies	0	2	3	1	0	2	4	2	**14**
Visible injuries	0	2	2	0	0	1	3	1	**9**
Loss of equilibrium only	0	0	1	1	0	1	1	1	**5**
Scale loss only	0	0	0	0	0	0	0	0	**0**
Without maladies/or with maladies not attributed to passage*	1/0	25/1	15/1	15/1	21/0	19/2	12/2	7/4	**115/11**
Without maladies that died	1	4	0	1	1	4	3	1	**15**
Spillbay 11									
Released	4	20	30	30	30	30	30	30	**204**
Examined	3	16	24	24	24	21	25	22	**159**
Passage related maladies	0	2	3	3	1	1	3	4	**17**
Visible injuries	0	1	2	2	1	0	3	2	**11**
Loss of equilibrium only	0	1	1	1	0	1	0	2	**6**
Scale loss only	0	0	0	0	0	0	0	0	**0**
Without maladies/or with maladies not attributed to passage*	3/0	14/0	20/1	20/1	23/0	19/1	22/0	17/1	**138/4**
Without maladies that died	0	2	1	1	1	0	1	9	**15**
Control									
Released	2	30	30	30	30	30	30	30	**212**
Examined	0	16	25	24	26	27	26	26	**170**
Passage related maladies	0	1	1	0	1	1	2	0	**6**
Visible injuries	0	1	1	0	0	0	1	0	**3**
Loss of equilibrium only	0	0	0	0	1	0	1	0	**2**
Scale loss only	0	0	0	0	0	1	0	0	**1**
Without maladies/or with maladies not attributed to passage*	0/0	15/0	23/1	24/0	25/0	24/2	22/2	25/1	**158/6**
Without maladies that died	0	0	0	0	0	0	4	4	**8**

* Includes fish with maladies attributed to predators and/or tags (*i.e.*, tear at tag site).

Appendix Table C-5

Incidence of injury, scale loss, and temporary loss of equilibrium observed on treatment juvenile salmonids passed through Spillbays 4, 9, and 13 and control site (downstream of Spillbay 3) The Dalles Dam, May 2002. "G Predation" is predation by gulls; "F Predation" is predation by fish.

Date	Fish ID	Injury Description	Status	Probable Cause of Injury	Injury Designation	Photo
		Spillbay 4				
14 May	KM8	Hemorrhaged left eye; loss of equilibrium; tear at right pectoral fin	Dead 24 h	Shear	Major	Yes
14 May	KP8	Loss of equilibrium	Alive			No
15 May	KV2	Gull bill marks*	Alive	G Predation		No
15 May	KW6	Scrape and major scale loss on left side	Dead 1 h	Contact	Major	Yes
16 May	LU1	Bulging left eye (not observed at 48 h); hemorrhaged right eye; loss of equilibrium	Alive	Shear	Major	Yes
16 May	LW1	Minor hemorrhage right eye	Alive	Shear	Minor	No
16 May	LW8	Tear near anal fin	Dead 24 h		Major	Yes
17 May	NC5	Gull bill marks; damaged pupil**	Alive	G Predation		Yes
17 May	NC6	Hemorrhaged left eye (not observed at 48 h)	Alive	Shear	Minor	No
18 May	MN1	Major scale loss right side; hemorrhage on head; internal hemorrhage	Dead 1 h	Contact	Major	Yes
18 May	MN6	Damaged right eye (not observed at 48 h)	Alive	Shear	Minor	No
20 May	TM9	Hemorrhaged left eye; enlarged pupil	Alive	Shear	Major	Yes
20 May	TN9	Hemorrhaged right eye; loss of equilibrium	Dead 24 h	Shear	Major	Yes
20 May	TP1	Hemorrhaged right eye	Alive	Shear	Minor	No
21 May	VP3	Minor hemorrhage right eye	Alive	Shear	Minor	Yes
21 May	VP4	Loss of equilibrium	Alive			No
21 May	VR0	Hemorrhaged right eye; scrape behind right eye	Alive		Major	Yes
22 May	LF0	Bruise on back (not observed at 48 h)	Alive	Contact	Minor	No
22 May	LF9	Fish bite marks*	Dead 1 h	F Predation		No
23 May	YD0	Loss of equilibrium	Alive			No
23 May	YD7	Bruise along body (not observed at 48 h); loss of equilibrium	Alive	Contact	Minor	No
23 May	YD8	Fish bite marks*	Dead 1 h	F Predation		No
23 May	YE4	Gull bill marks*	Dead 1 h	G Predation		Yes
23 May	YE5	Loss of equilibrium	Alive			No
23 May	YE9	Gull bill marks*	Dead 24 h	G Predation		Yes
24 May	Z66	Small bruise below dorsal fin (not observed at 48 h)	Alive	Contact	Minor	No
24 May	Z82	Hemorrhaged right eye; torn right operculum; major scale loss right side	Alive	Shear	Major	No
25 May	TK2	Hemorrhaged left eye	Alive	Shear	Major	Yes
26 May	WJ2	Torn right operculum; loss of equilibrium	Alive	Shear	Major	No
26 May	WJ3	Hemorrhaged right eye	Alive	Shear	Major	Yes

Appendix Table C-5

Continued.

Date	Fish ID	Injury Description	Status	Probable Cause of Injury	Injury Designation	Photo
		Spillbay 9				
14 May	KM9	Loss of equilibrium	Alive			No
14 May	KS0	Minor hemorrhage left eye; gull bill marks; internal hemorrhage in anterior body cavity	Dead 24 h	G Predation		Yes
15 May	152 mm	Hemorrhaged left eye	Alive	Shear	Major	No
15 May	KY5	Scrapes on both sides (not observed at 24 h); loss of equilibrium	Dead 24 h	Contact	Major	No
16 May	LX0	Hemorrhaged left eye	Alive	Shear	Major	No
17 May	147 mm	No visible injuries	Dead 24 h			No
17 May	LZ3	Loss of equilibrium	Alive			No
17 May	LZ5	Bruise on head (not observed at 48 h); tear at left operculum	Alive	Contact	Major	No
17 May	NE1	Gull bill marks; loss of equilibrium*	Dead 24 h	G Predation		Yes
18 May	158 mm	Scrape along right side; hemorrhaged right eye; torn right operculum	Alive	Contact	Major	Yes
18 May	UN9	Hemorrhaged left eye; scrape on left side	Alive	Shear/Contact	Major	Yes
18 May	UZ0	Fish bite marks*	Dead 1 h	F Predation		Yes
18 May	UZ5	Hemorrhaged right eye	Alive	Shear	Major	Yes
20 May	146 mm	Minor hemorrhage right eye	Alive	Shear	Minor	No
20 May	TY0	Hemorrhaged right eye; scale loss; enlarged pupil; loss of equilibrium	Alive	Shear	Major	No
20 May	TY4	Loss of equilibrium	Alive			No
20 May	VM3	Bruised nose	Alive	Contact	Major	Yes
22 May	LB4	Torn left operculum; loss of equilibrium	Alive	Shear	Major	No
22 May	LD3	Single gull bill mark*	Alive	G Predation		No
22 May	LD9	Minor hemorrhage left eye	Alive	Shear	Minor	Yes
23 May	YJ6	Minor hemorrhage left eye	Alive	Shear	Minor	No
23 May	YJ9	Torn left operculum; bruise on right side of head (not observed at 48 h)	Alive	Shear/Contact	Major	No
24 May	Z32	Torn left operculum; bruise on head (not observed at 48 h)	Alive	Contact	Major	No
24 May	Z42	Hemorrhaged left eye; loss of equilibrium	Alive	Shear	Major	Yes
24 May	Z52	Loss of equilibrium	Alive			No
24 May	Z54	Gull bite marks*	Alive	G Predation		No
24 May	Z57	Bruise right side of head; loss of equilibrium	Dead 24 h	Contact	Major	No
25 May	TD8	Major scale loss	Alive		Major	No
26 May	WK3	Hemorrhaged right eye (not observed at 48 h); loss of equilibrium	Alive	Shear	Minor	No
26 May	YA9	No obvious injuries	Dead 24 h			No
27 May	Y38	Loss of equilibrium	Alive			No

Appendix Table C-5

Continued.

Date	Fish ID	Injury Description	Status	Probable Cause of Injury	Injury Designation	Photo
		Spillbay 13				
16 May	LS2	Bruise on nose (not observed at 48 h); loss of equilibrium	Alive	Contact	Minor	No
16 May	LT0	Hemorrhaged left eye	Alive	Shear	Major	No
17 May	NF3	Hemorrhaged left eye; torn left operculum	Dead 24 h	Shear	Major	Yes
17 May	NF8	No obvious injuries	Dead 24 h			No
17 May	NJ1	Minor hemorrhage left eye	Alive	Shear	Minor	Yes
18 May	UP4	Flared and torn left gill; loss of equilibrium	Alive	Shear	Major	No
18 May	UP9	Hemorrhaged and bulging right eye	Alive	Shear	Major	Yes
18 May	UR6	No obvious injuries	Dead 24 h			No
18 May	UR7	Major scale loss both sides	Alive			No
18 May	US2	Bruise on head, loss of equilibrium	Dead 24 h	Contact	Major	No
18 May	US8	Bulging left eye (not observed at 48 h); loss of equilibrium	Alive	Shear	Minor	No
19 May	151 mm	Minor hemorrhage left eye	Alive	Shear	Minor	No
19 May	MR0	Loss of equilibrium	Alive			No
19 May	MR3	Missing right eye; torn operculum; lacerations to head; internal hemorrhaging	Dead 1 h	Shear/Contact	Major	Yes
19 May	MS4	Minor hemorrhage right eye	Alive	Shear	Minor	No
19 May	MU7	Possible fish bite marks (no right eye, lacerations to head, torn gill cover)*	Dead 1 h	F Predation		Yes
20 May	TR0	Minor hemorrhage right eye; enlarged pupil; major scale loss right side	Alive	Contact	Major	No
20 May	TR7	Internal hemorrhage in kidney area	Dead 24 h		Major	No
21 May	UT7	Partial decapitation; major scale loss right side	Dead 1 h	Shear	Major	Yes
21 May	VV2	Gull bill marks*	Dead 24 h	G Predation		Yes
21 May	VW1	Gull bill marks*	Alive	G Predation		No
21 May	VX2	Blow to head (deep laceration); hemorrhaged left gills; major scale loss both sides	Dead 1 h	Contact	Major	Yes
22 May	LJ0	Bruise on head (not observed at 48 h); loss of equilibrium	Alive	Contact	Minor	No
22 May	LK1	Gull bill marks*	Dead 1 h	G Predation		Yes
22 May	LL2	Hemorrhaged right eye (not observed at 48 h)	Alive	Shear	Minor	No
22 May	LL3	Hemorrhaged right eye	Alive	Shear	Major	Yes
23 May	ML1	Hemorrhaged left eye	Alive	Shear	Major	Yes
23 May	ML2	Gull bill marks*	Dead 24 h	G Predation		Yes
23 May	ML3	Gull bill marks*	Alive	G Predation		No
23 May	ML5	Scratch marks on both sides (not observed at 48 h)	Alive	Contact	Minor	No
23 May	ML6	Hemorrhaged right eye	Alive	Shear	Major	Yes

Appendix Table C-5

Continued.

Date	Fish ID	Injury Description	Status	Probable Cause of Injury	Injury Designation	Photo
23 May	YA2	Torn right operculum	Alive	Shear	Major	No
23 May	YA6	Torn left operculum; bruise on right side (not observed at 48 h)	Alive	Shear	Major	No
23 May	YB2	Hemorrhaged left eye; loss of equilibrium	Alive	Shear	Major	Yes
24 May	TB7	Loss of equilibrium	Alive			No
24 May	TC5	Hemorrhaged left eye	Alive	Shear	Major	Yes
24 May	TC7	Torn right operculum	Alive	Shear	Major	No
24 May	Z90	Fish bite marks*	Dead 1 h	F Predation		Yes
24 May	Z94	Loss of equilibrium	Alive			No
24 May	Z99	Hemorrhaged right eye; torn right operculum, major scale loss right side	Alive	Shear/Contact	Major	Yes
25 May	TL6	Hemorrhaged left eye (not observed at 48 h)	Alive	Shear	Minor	No
25 May	TL8	Minor hemorrhage in right eye	Alive	Shear	Minor	Yes
25 May	WA6	Fish bite marks*	Dead 1 h	F Predation		Yes
25 May	WB4	Hemorrhaged right eye	Alive	Shear	Major	Yes
26 May	YE1	Flap of skin on nose (not observed at 48 h); loss of equilibrium	Alive	Contact	Minor	No
26 May	YE8	Hemorrhaged left eye; bruise on left side of body; loss of equilibrium	Alive	Contact	Major	Yes
26 May	YJ9	Internal hemorrhage in anterior body cavity; tear at tag site	Dead 24 h		Major	No
27 May	UY0	Bruise on head; crushed spot on top of head; tear behind jaw	Dead 1 h	Contact	Major	Yes
27 May	YO2	Tear at tag site; loss of equilibrium*	Alive			No
		Controls				
15 May	LP1	Gull bill marks*	Alive	G Predation		No
18 May	UV1	Cut behind left operculum	Alive	Contact	Major	No
18 May	UX2	Fish bite marks*	Dead 1 h	F Predation		Yes
20 May	TW5	Bruise behind head (not observed at 48 h)	Alive	Contact	Minor	No
21 May	VT9	Scrapes on both sides (not observed at 48 h); loss of equilibrium	Alive	Contact	Minor	No
21 May	VU4	Bruise behind head (not observed at 48 h)	Alive	Contact	Minor	No
23 May	MJ9	Gull bill marks*	Alive	G Predation		Yes
23 May	MK8	Fish bite marks, predator (pikeminnow) recaptured with fish MK8 in stomach*	Dead 1 h	F Predation		Yes
25 May	WE1	Fish bite marks*	Dead 1 h	F Predation		Yes

* Non-passage related.

** Both passage and predator related.

Appendix Table C-6

Incidence of injury, scale loss, and temporary loss of equilibrium observed on treatment juvenile salmonids passed through Spillbays 4, 9, and 11 and control site (downstream of Spillbay 3) The Dalles Dam, August 2002.

Date	Fish ID	Injury Description	Status	Probable Cause of Injury	Injury Designation	Photo
		Spillbay 4				
15 Aug	KT5	No visible injuries	Dead 48 h			No
15 Aug	KT6	Loss of equilibrium	Alive			No
16 Aug	102 mm	Major tear at tag site*	Dead 48 h			No
16 Aug	108 mm	Major tear at tag site*	Dead 48 h			No
16 Aug	112 mm	Major tear at tag site, fungus on pectoral fin*	Dead 48 h			No
16 Aug	114 mm	Major tear at tag site*	Dead 48 h			No
16 Aug	122 mm	No visible injuries	Dead 48 h			No
16 Aug	DB3	Major tear at tag site*	Dead 48 h			No
16 Aug	DB5	Bruised and torn left opercle	Alive	Shear/Contact	Major	No
16 Aug	DC8	Damaged left eye, bruised snout	Dead 24 h	Contact	Major	Yes
16 Aug	DD5	Major tear at tag site*	Dead 48 h			No
17 Aug	DW0	Major tear at tag site*	Dead 48 h			No
17 Aug	DW4	Loss of equilibrium	Dead 1 h			No
17 Aug	DX2	Predation marks*	Dead 24 h	Fish predation		Yes
17 Aug	DX4	No visible injuries	Dead 24 h			No
17 Aug	DY7	Slight hemorrhage around heart	Dead 24 h		Major	No
17 Aug	DY9	Loss of equilibrium, major scale loss	Alive	Contact	Major	No
18 Aug	C12	No visible injuries	Dead 24 h			No
18 Aug	C23	Loss of equilibrium	Alive			No
18 Aug	C38	Major tear at tag site*	Dead 48 h			No
19 Aug	AV2	Hemorrhaged left eye	Alive	Shear	Major	Yes
19 Aug	AV4	Loss of equilibrium, torn right operculum	Dead 1 h	Shear	Major	No
19 Aug	AV5	Torn left operculum,	Dead 1 h	Shear	Major	No
19 Aug	AV7	Hemorrhaged nose and right gill, scrape on right side	Dead 1 h	Contact	Major	Yes
20 Aug	C81	Loss of equilibrium	Dead 24 h			No
20 Aug	C85	Predation marks*	Dead 24 h	Gull predation		Yes
20 Aug	C87	No visible injuries	Dead 48 h			No

Appendix Table C-6

Continued.

Date	Fish ID	Injury Description	Status	Probable Cause of Injury	Injury Designation	Photo
20 Aug	C88	No visible injuries	Dead 48 h			No
20 Aug	C97	Loss of equilibrium	Alive			No
20 Aug	C99	Loss of equilibrium, predation marks*	Dead 24 h	Fish predation		Yes
21 Aug	LF3	Loss of equilibrium	Dead 24 h			No
21 Aug	LF5	No visible injuries	Dead 24 h			No
21 Aug	LH1	Loss of equilibrium, predation marks*	Dead 1 h	Fish predation		No
21 Aug	LH7	Predation marks*	Dead 1 h	Gull predation		Yes
21 Aug	LH8	No visible injuries	Dead 24 h			No
21 Aug	ZL0	Major tear at tag site	Dead 48 h			No
21 Aug	ZL1	Probable gull predation, recovered from tree*	Dead 1 h	Gull predation		No
22 Aug	Y61	No visible injuries	Dead 24 h			No
22 Aug	Y63	Predation marks*	Dead 1 h	Fish predation		No
22 Aug	Y64	No visible injuries	Dead 24 h			No
22 Aug	Y65	No visible injuries	Dead 24 h			No
22 Aug	Y66	No visible injuries	Dead 48 h			No
22 Aug	Y67	Major scale loss	Dead 24 h			No
22 Aug	Y69	No visible injuries	Dead 24 h			No
22 Aug	Y71	No visible injuries	Dead 1 h			No
22 Aug	Y72	Loss of equilibrium	Dead 1 h			No
22 Aug	Y76	No visible injuries	Dead 48 h			No
22 Aug	Y88	No visible injuries	Dead 1 h			No
22 Aug	Y89	No visible injuries	Dead 24 h			No
		Spillbay 9				
15 Aug	110 mm	No visible injuries	Dead 48 h			No
16 Aug	122 mm	No visible injuries	Dead 48 h			No
16 Aug	125 mm	No visible injuries	Dead 48 h			No
16 Aug	DK1	No visible injuries	Dead 48 h			No
16 Aug	DK2	Loss of equilibrium, bruise on top of head	Alive	Contact	Minor	No
16 Aug	DK4	No visible injuries	Dead 24 h			No

Appendix Table C-6

Continued.

Date	Fish ID	Injury Description	Status	Probable Cause of Injury	Injury Designation	Photo
16 Aug	DK7	Torn left opercle	Dead 48 h	Shear	Major	Yes
16 Aug	DL1	Major tear at tag site*	Dead 48 h			No
17 Aug	AJ8	Loss of equilibrium, bruise on left side of head	Dead 48 h	Contact	Major	No
17 Aug	AK1	Loss of equilibrium	Dead 48 h			No
17 Aug	AK2	Predation marks*	Dead 1 h	Fish predation		Yes
17 Aug	DA5	Laceration on top of head	Dead 24 h	Contact	Major	Yes
18 Aug	AE4	Loss of equilibrium	Alive			No
18 Aug	AE7	Predation marks*	Dead 1 h	Fish predation		Yes
18 Aug	DT4	No visible injuries	Dead 24 h			No
19 Aug	AW2	No visible injuries	Dead 1 h			No
20 Aug	AZ0	Loss of equilibrium, likely predation*	Dead 1 h	Fish predation		No
20 Aug	AZ2	Hemorrhaged internally	Dead 24 h		Major	No
20 Aug	AZ5	No visible injuries	Dead 24 h			No
20 Aug	AZ8	No visible injuries	Dead 48 h			No
20 Aug	C56	No visible injuries	Dead 48 h			No
20 Aug	C57	Predation marks*	Dead 1 h	Fish predation		Yes
20 Aug	C60	No visible injuries	Dead 48 h			No
20 Aug	C64	Loss of equilibrium	Dead 48 h			No
21 Aug	KM1	No visible injuries	Dead 24 h			No
21 Aug	KM5	Predation marks*	Dead 1 h	Fish predation		Yes
21 Aug	KN1	No visible injuries	Dead 24 h			No
21 Aug	KN2	No visible injuries	Dead 48 h			No
21 Aug	KN7	Bulged left eye	Dead 24 h	Shear	Major	Yes
21 Aug	KN8	Scrape on right operculum	Dead 48 h	Contact	Major	No
21 Aug	KP2	Predation marks*	Dead 48 h	Fish predation		No
21 Aug	KP8	Loss of equilibrium	Dead 24 h			No
21 Aug	KP9	Hemorrhaged right eye	Dead 48 h	Shear	Major	No
22 Aug	KX6	Loss of equilibrium, hemorrhaged left eye and right gills	Dead 1 h	Shear	Major	No
22 Aug	KX8	Loss of equilibrium, predation marks*	Dead 1 h	Gull predation		No

Appendix Table C-6

Continued.

Date	Fish ID	Injury Description	Status	Probable Cause of Injury	Injury Designation	Photo
22 Aug	KY0	No visible injuries	Dead 24 h			No
22 Aug	KY1	Predation marks*	Dead 1 h	Fish predation		Yes
22 Aug	KY7	Predation marks*	Dead 1 h	Fish predation		Yes
22 Aug	KZ5	Predation marks, loss of equilibrium*	Dead 1 h	Fish predation		Yes
22 Aug	KZ9	Loss of equilibrium	Dead 1 h			No
		Spillbay 11				
16 Aug	128 mm	No visible injuries	Dead 48 h			No
16 Aug	DU1	Loss of equilibrium	Alive			No
16 Aug	DU4	Bruised right operculum, hemorrhaged internally	Dead 24 h		Major	Yes
16 Aug	DV0	No visible injuries	Dead 24 h			No
17 Aug	AF1	Loss of equilibrium	Alive			No
17 Aug	AH9	Loss of equilibrium, scrape on right side	Alive	Contact	Minor	No
17 Aug	AJ1	No visible injuries	Dead 24 h			No
17 Aug	DZ0	Predation marks*	Dead 1 h	Fish predation		Yes
17 Aug	DZ5	Hemorrhaged heart and left gills	Dead24 h		Major	No
18 Aug	C04	Predation marks*	Dead 1 h	Fish predation		Yes
18 Aug	C08	Scrape on left opercle	Dead 24 h	Contact	Major	No
18 Aug	DR9	Loss of equilibrium	Alive			No
18 Aug	DS0	No visible injuries	Dead 48 h			No
18 Aug	DS4	Torn left opercle, scrape on left side	Dead24 h	Shear/Contact	Major	Yes
19 Aug	AP6	No visible injuries	Dead 24 h			No
19 Aug	AR0	Scrape on head and back	Alive	Contact	Minor	No
20 Aug	ZB7	Predation marks*	Dead 24 h	Fish predation		No
20 Aug	ZC7	Loss of equilibrium	Dead 1 h			No
21 Aug	ZH2	Large cut on head, tear below left eye	Dead 1 h	Contact	Major	Yes
21 Aug	ZH6	No visible injuries	Dead 24 h			No
21 Aug	ZJ3	Hemorrhaged right eye	Dead 48 h	Shear	Major	No
21 Aug	ZJ4	Torn right gill	Dead 24 h	Shear	Major	No
22 Aug	KU1	Loss of equilibrium	Alive			No

Appendix Table C-6

Continued.

Date	Fish ID	Injury Description	Status	Probable Cause of Injury	Injury Designation	Photo
22 Aug	KU4	No visible injuries	Dead 48 h			No
22 Aug	KU6	No visible injuries	Dead 24 h			No
22 Aug	KU8	No visible injuries	Dead 24 h			No
22 Aug	KV0	No visible injuries	Dead 24 h			No
22 Aug	KV2	Loss of equilibrium	Dead 1 h			No
22 Aug	KV3	No visible injuries	Dead 24 h			No
22 Aug	KV7	Infection around tag site*	Dead 48 h			No
22 Aug	KV8	No visible injuries	Dead 24 h			No
22 Aug	KW0	Ruptured right eye, fungus infection	Dead 24 h	Shear	Major	Yes
22 Aug	KW4	No visible injuries	Dead 24 h			No
22 Aug	KW6	Cut behind left eye, hemorrhaged eye and nose	Dead 24 h	Shear/Contact	Major	No
22 Aug	KW8	No visible injuries	Dead 48 h			No
22 Aug	KW9	No visible injuries	Dead 1 h			No
		Controls				
16 Aug	DF5	Loss of equilibrium, scrape on left side	Dead 24 h	Contact	Major	Yes
17 Aug	AB2	Hemorrhaged right gill	Dead 48 h	Shear	Major	No
17 Aug	AC9	Predation marks*	Dead 1 h	Fish predation		Yes
19 Aug	AN4	Loss of equilibrium	Alive			No
20 Aug	ZE4	Predation marks*	Dead 1 h	Fish predation		Yes
20 Aug	ZF3	Loss of equilibrium, major scale loss	Dead 1 h	Contact	Major	Yes
20 Aug	ZF9	Predation marks*	Dead 1 h	Fish predation		Yes
21 Aug	LA2	No visible injuries	Dead 48 h			No
21 Aug	LA3	No visible injuries	Dead 48 h			No
21 Aug	LJ0	Major bruise on nose	Dead 48 h	Contact	Major	No
21 Aug	LJ3	Loss of equilibrium, gull predation marks*	Dead 24 h	Gull predation		No
21 Aug	LJ4	Loss of equilibrium	Dead 24 h			No
21 Aug	LK0	No visible injuries	Dead 1 h			No
21 Aug	LK5	No visible injuries	Dead 48 h			No
21 Aug	LL9	Predation marks*	Dead 1 h	Fish predation		Yes

Appendix Table C-6

Continued.

Date	Fish ID	Injury Description	Status	Probable Cause of Injury	Injury Designation	Photo
22 Aug	KS1	No visible injuries	Dead 1 h			No
22 Aug	KS4	No visible injuries	Dead 24 h			No
22 Aug	KS5	Predation marks*	Dead 1 h	Fish predation		Yes
22 Aug	Y53	No visible injuries	Dead 24 h			No
22 Aug	Y58	No visible injuries	Dead 1 h			No
		Sluice				
24 Aug	KR2	No visible injuries	Dead 48 h			No
24 Aug	LA4	Loss of equilibrium	Dead 48 h			No
24 Aug	UA4	No visible injuries	Dead 48 h			No
24 Aug	UA6	No visible injuries	Dead 24 h			No
24 Aug	UA7	Loss of equilibrium	Dead 48 h			No
24 Aug	UB1	No visible injuries	Dead 24 h			No
24 Aug	UB2	No visible injuries	Dead 24 h			No
24 Aug	UB3	No visible injuries	Dead 24 h			No
24 Aug	UB7	Torn right opercle, loss of equilibrium	Dead 24 h	Shear	Major	No
24 Aug	UC2	No visible injuries	Dead 48 h			No
24 Aug	UC3	No visible injuries	Dead 48 h			No
24 Aug	UC4	No visible injuries	Dead 24 h			No
24 Aug	UC5	No visible injuries	Dead 48 h			No
24 Aug	UC7	No visible injuries	Dead 48 h			No
24 Aug	UC8	No visible injuries	Dead 24 h			No
24 Aug	UD3	No visible injuries	Dead 48h			No
24 Aug	UD5	No visible injuries	Dead 48h			No
24 Aug	UD7	No visible injuries	Dead 24 h			No
24 Aug	Y00	No visible injuries	Dead 48 h			No
24 Aug	Y05	No visible injuries	Dead 24 h			No
24 Aug	Y06	Torn right opercle	Dead 24 h	Shear	Major	No
24 Aug	Y07	No visible injuries	Dead 48 h			No
24 Aug	Y08	No visible injuries	Dead 24 h			No

Appendix Table C-6

Continued.

Date	Fish ID	Injury Description	Status	Probable Cause of Injury	Injury Designation	Photo
24 Aug	Y10	No visible injuries	Dead 48 h			No
24 Aug	Y11	No visible injuries	Dead 48 h			No
24 Aug	Y12	No visible injuries	Dead 48 h			No
24 Aug	Y13	No visible injuries	Dead 24 h			No
24 Aug	Y14	No visible injuries	Dead 24 h			No
24 Aug	Y17	No visible injuries	Dead 24 h			No
24 Aug	Y20	No visible injuries	Dead 48 h			No
24 Aug	Y21	No visible injuries	Dead 24 h			No
24 Aug	Y22	No visible injuries	Dead 48 h			No
24 Aug	Y25	No visible injuries	Dead 48 h			No
24 Aug	Y30	No visible injuries	Dead 48 h			No
24 Aug	Y31	No visible injuries	Dead 48 h			No
24 Aug	Y33	No visible injuries	Dead 24 h			No
24 Aug	Y35	No visible injuries	Dead 24 h			No
24 Aug	Y37	No visible injuries	Dead 48 h			No
24 Aug	Y38	No visible injuries	Dead 48 h			No
24 Aug	Y44	No visible injuries	Dead 24 h			No
24 Aug	Y90	No visible injuries	Dead 48 h			No
24 Aug	Y91	No visible injuries	Dead 24 h			No
24 Aug	Y93	No visible injuries	Dead 24 h			No
24 Aug	Y94	No visible injuries	Dead 48 h			No
24 Aug	Y96	No visible injuries	Dead 24 h			No
24 Aug	Y97	Loss of equilibrium	Dead 48 h			No

* Non-passage related.

Appendix Table C-7

Short-term turbine passage survival data on individual chinook salmon released at Spillbays 4, 9 and 13 at the Dalles Dam, May 2002. Fish were tagged with Normandeau's HI-Z Turb-N tags. Description of condition codes and details on injured fish are presented in Table 2-3.

Fish No.	Time			No. of Turb-N Tags recovered	Fish Data			
	Released	Recovered	At Large (min.)		Alive/ Dead	Condition Codes	Total Length (mm)	Comments
14 May 2002 - Testlot 1 : Spillbay 4 - Water temp=10.5 C								
KM0	9:52	9:59	7	2	ALIVE	A	142	
KM1	9:53	10:12	19	2	ALIVE	A	149	
KM2	10:19	10:33	14	2	ALIVE	A	155	
KM3	10:16	10:28	12	2	ALIVE	A	148	
KM4	11:00	11:24	24	2	ALIVE	A	161	
KM5	10:59	11:25	26	2	ALIVE	A	143	
KM8	13:45	14:24	39	1	ALIVE	CHG	135	
KM9	15:37	16:46	69	2	ALIVE	HT	155	
KN0	11:37	11:46	9	2	ALIVE	A	140	
KN1	11:36	11:44	8	2	ALIVE	A	146	
KN2	11:35	11:49	14	2	ALIVE	A	144	
KN3	11:33	11:56	23	2	ALIVE	A	143	
KN4	11:38	11:52	14	2	ALIVE	A	152	
KN5	12:03	12:09	6	2	ALIVE	A	155	
KN6	12:02	12:11	9	2	ALIVE	A	144	
KN7	12:05	12:22	17	2	ALIVE	A	167	
KN8	12:03	12:11	8	2	ALIVE	A	143	
KN9	12:04	12:28	24	2	ALIVE	A	150	
KP0	12:44	13:02	18	2	ALIVE	A	157	
KP1	12:45	12:57	12	2	ALIVE	A	145	
KP2	12:46	13:00	14	2	ALIVE	A	147	
KP3	12:45	12:53	8	2	ALIVE	A	146	
KP4	12:46	13:02	16	2	ALIVE	A	144	
KP5	13:14	13:30	16	2	ALIVE	A	151	
KP6	13:13	13:28	15	2	ALIVE	A	148	
KP7	13:14	13:29	15	2	ALIVE	A	152	
KP8	13:10	13:22	12	2	ALIVE	HC	147	
KP9	13:21	13:33	12	2	ALIVE	A	152	
KR0	13:47	.	.	0	UNKNOWN	X	148	
KR1	13:44	14:01	17	2	ALIVE	A	142	
KR2	13:46	14:08	22	2	ALIVE	A	162	
KR4	13:48	14:09	21	2	ALIVE	A	140	
KR5	14:28	14:35	7	2	ALIVE	A	157	
KR6	14:30	14:48	18	2	ALIVE	A	148	
KR7	14:31	14:39	8	2	ALIVE	A	152	
KR8	14:30	.	.	0	UNKNOWN	X	143	
KR9	14:29	.	.	0	UNKNOWN	X	135	
KS0	15:38	16:04	26	2	DEAD	GL	152	
KS1	15:36	15:44	8	2	ALIVE	A	142	
KS2	15:39	16:41	62	2	ALIVE	AT	152	
KS4	15:36	.	.	0	UNKNOWN	X	145	
KS5	17:08	17:17	9	2	ALIVE	A	143	
KS6	17:10	17:22	12	2	ALIVE	A	144	
KS7	17:10	17:16	6	2	ALIVE	A	142	
KS8	17:05	17:23	18	2	ALIVE	A	154	
KS9	17:06	17:24	18	2	ALIVE	A	142	
KT0	17:48	17:55	7	2	ALIVE	A	148	
KT1	17:45	17:50	5	2	ALIVE	A	159	
KT2	17:46	17:57	11	2	ALIVE	A	153	
KT3	17:47	17:54	7	2	ALIVE	A	134	
KT4	17:49	.	.	0	UNKNOWN	X	137	
15 May 2002 - Testlot 2 : Spillbay 9 - Water temp=10.5 C								
HR9	10:21	10:28	7	2	ALIVE	A	153	
KU0	10:44	10:55	11	2	ALIVE	A	145	
KU1	10:44	11:03	19	2	ALIVE	A	143	
KU2	10:43	10:52	9	2	ALIVE	A	145	
KU3	10:43	10:53	10	2	ALIVE	A	151	
KU4	10:42	10:56	14	2	ALIVE	A	157	
KU5	11:13	11:30	17	2	ALIVE	A	162	
KU6	11:13	11:21	8	2	ALIVE	A	142	
KU7	11:14	11:22	8	2	ALIVE	A	152	
KU8	11:14	11:25	11	2	ALIVE	A	163	

Appendix Table C-7

Continued.

Fish No.	Time			No. of Turb-N Tags recovered	Fish Data			
	Re-leased	Re-covered	At Large (min.)		Alive/ Dead	Condition Codes	Total Length (mm)	Comments
KU9	11:12	11:25	13	2	ALIVE	A	167	
KV0	11:43	11:56	13	2	ALIVE	A	142	
KV1	11:41	.	.	0	UNKNOWN	X	151	
KV2	11:43	11:58	15	2	DEAD	P	136	
KV3	11:44	12:03	19	2	ALIVE	A	166	
KV4	11:42	11:58	16	2	ALIVE	A	140	
KV5	12:28	12:51	23	2	ALIVE	A	150	
KV6	12:29	12:43	14	2	ALIVE	A	147	
KV7	12:30	12:41	11	2	ALIVE	A	152	
KV8	12:30	12:46	16	2	ALIVE	A	150	
KW0	13:03	13:23	20	2	ALIVE	A	162	
KW1	13:04	13:12	8	2	ALIVE	A	147	
KW2	13:02	13:14	12	2	ALIVE	A	147	
KW3	13:02	13:13	11	2	ALIVE	A	150	
KW4	13:03	.	.	0	UNKNOWN	X	151	
KW5	13:47	14:00	13	2	ALIVE	A	145	
KW6	13:48	14:04	16	2	DEAD	WHJ	137	
KW7	13:45	13:56	11	2	ALIVE	A	142	
KW8	13:44	14:11	27	2	ALIVE	M	154	
KW9	13:45	14:05	20	2	ALIVE	A	165	
KX0	14:22	14:47	25	2	ALIVE	A	157	
KX1	14:23	14:41	18	2	ALIVE	A	136	
KX2	14:24	14:36	12	2	ALIVE	A	152	
KX3	14:24	14:39	15	2	ALIVE	A	144	
KX4	14:23	14:44	21	2	ALIVE	A	141	
KX5	14:55	15:10	15	2	ALIVE	A	140	
KX6	14:56	15:14	18	2	ALIVE	A	145	
KX7	14:55	15:09	14	2	ALIVE	A	157	
KX8	14:56	15:17	21	2	ALIVE	A	143	
KX9	14:57	15:14	17	2	ALIVE	A	153	
KY0	8:35	8:53	18	2	ALIVE	A	146	
KY1	8:34	8:47	13	2	ALIVE	A	148	
KY2	8:37	9:03	26	2	ALIVE	A	162	
KY3	8:36	8:47	11	2	ALIVE	A	153	
KY4	8:36	9:01	25	2	ALIVE	A	137	
KY5	9:07	9:24	17	2	ALIVE	HW	140	
KY6	9:09	9:20	11	2	ALIVE	C	148	
KY7	9:10	9:25	15	2	ALIVE	A	142	
KY8	9:09	9:18	9	2	ALIVE	A	138	
KY9	9:07	9:36	29	2	ALIVE	A	187	
KZ0	9:41	9:50	9	2	ALIVE	A	151	
KZ1	9:42	9:54	12	2	ALIVE	A	149	
KZ2	9:40	9:55	15	2	ALIVE	A	152	
KZ3	9:40	10:06	26	2	ALIVE	A	155	
KZ4	9:41	.	.	0	DEAD	Z	148	
KZ5	10:23	10:38	15	2	ALIVE	A	156	
KZ6	10:20	10:35	15	2	ALIVE	A	147	
KZ8	10:22	10:32	10	2	ALIVE	A	148	
KZ9	10:22	10:30	8	2	ALIVE	A	177	
LM0	15:33	15:48	15	2	ALIVE	A	155	
LM1	15:32	15:51	19	2	ALIVE	A	144	
LM2	15:33	16:09	36	2	ALIVE	A	152	
LM3	15:33	15:39	6	2	ALIVE	A	146	
LM4	15:34	15:58	24	2	ALIVE	A	145	
LM5	16:12	16:29	17	2	ALIVE	A	138	
LM6	16:14	16:24	10	2	ALIVE	A	165	
LM7	16:11	16:20	9	2	ALIVE	A	154	
LM8	16:13	16:22	9	2	ALIVE	A	152	
LM9	16:13	.	.	0	UNKNOWN	X	148	
LN0	16:50	17:00	10	2	ALIVE	A	140	
LN1	16:52	16:57	5	2	ALIVE	A	138	
LN2	16:51	16:59	8	2	ALIVE	A	152	
LN3	16:51	17:06	15	2	ALIVE	A	150	
LN4	16:50	17:01	11	2	ALIVE	A	155	
LN5	17:05	17:23	18	2	ALIVE	A	147	
LN6	17:07	17:55	48	2	ALIVE	A	158	
LN7	17:04	17:25	21	2	ALIVE	A	157	
LN8	17:06	17:17	11	2	ALIVE	A	150	
LN9	17:06	17:17	11	2	ALIVE	A	157	
LP0	17:33	17:47	14	2	ALIVE	A	147	

Appendix Table C-7

Continued.

Fish No.	Time Released	Time Recovered	At Large (min.)	No. of Turb-N Tags recovered	Fish Data: Alive/ Dead	Condition Codes	Total Length (mm)	Comments
LP1	17:31	17:45	14	2	DEAD	AL	138	
LP2	17:32	17:39	7	2	ALIVE	A	140	
LP3	17:33	17:47	14	2	ALIVE	A	163	
LP4	17:32	18:04	32	2	ALIVE	A	141	
LP5	17:39	17:47	8	2	ALIVE	A	145	
LP6	17:41	17:51	10	2	ALIVE	A	149	
LP7	17:41	17:50	9	2	ALIVE	A	147	
LP8	17:38	17:49	11	2	ALIVE	A	166	
LP9	17:37	17:46	9	2	ALIVE	A	159	
U96	12:09	12:33	24	2	ALIVE	A	151	
16 May 2002 - Testlot 3 : Spillbay 13 - Water temp=11.0 C								
LR0	7:41	8:09	28	2	ALIVE	A	152	
LR1	7:42	.	.	0	UNKNOWN	X	156	
LR2	7:43	7:58	15	2	ALIVE	A	154	
LR3	7:42	8:00	18	2	ALIVE	A	147	
LR4	7:41	8:15	34	2	ALIVE	A	144	
LR5	8:23	.	.	0	TAG & PIN		147	
LR6	8:21	11:24	183	2	ALIVE	A	157	
LR7	8:22	8:39	17	2	ALIVE	A	150	
LR8	8:23	8:37	14	2	ALIVE	A	158	
LR9	8:21	8:34	13	2	ALIVE	A	152	
LS0	9:24	9:47	23	2	ALIVE	A	146	
LS1	9:23	9:36	13	2	ALIVE	A	147	
LS2	9:22	9:36	14	2	ALIVE	HG	160	
LS3	9:21	9:46	25	2	ALIVE	A	155	
LS4	9:23	9:42	19	2	ALIVE	A	146	
LS5	10:14	10:32	18	2	ALIVE	A	147	
LS6	10:13	10:55	42	2	ALIVE	A	156	
LS7	10:13	10:44	31	2	ALIVE	A	160	
LS8	10:13	10:27	14	2	ALIVE	A	148	
LS9	10:15	10:40	25	2	ALIVE	A	147	
LT0	10:55	11:23	28	2	ALIVE	GH	151	
LT1	10:59	11:14	15	2	ALIVE	A	153	
LT2	10:57	11:14	17	2	ALIVE	A	167	
LT3	10:58	11:12	14	2	ALIVE	A	147	
LT4	10:59	.	.	0	TAG & PIN		143	
LT5	11:28	11:51	23	2	ALIVE	A	135	
LT6	11:28	11:41	13	2	ALIVE	A	156	
LT7	11:27	11:43	16	2	ALIVE	CBH	142	
LT8	11:27	11:48	21	2	ALIVE	A	162	
LT9	11:26	.	.	0	TAG & PIN		139	
LU0	12:21	12:35	14	2	ALIVE	A	135	
LU1	12:24	12:33	9	2	ALIVE	GHN	137	
LU2	12:22	12:38	16	2	ALIVE	A	148	
LU3	12:22	12:29	7	2	ALIVE	A	154	
LU4	12:23	12:39	16	2	ALIVE	A	153	
LU5	12:48	13:03	15	2	ALIVE	A	150	
LU6	12:50	13:03	13	2	ALIVE	A	152	
LU7	12:50	13:06	16	2	ALIVE	A	157	
LU8	12:49	12:57	8	2	ALIVE	A	155	
LU9	12:49	13:00	11	2	ALIVE	A	156	
LV0	13:25	13:39	14	2	ALIVE	A	147	
LV1	13:25	13:45	20	2	ALIVE	A	144	
LV2	13:24	.	.	0	UNKNOWN	X	146	
LV3	13:24	.	.	0	UNKNOWN	X	136	
LV4	13:22	13:33	11	2	ALIVE	A	133	
LV5	14:07	14:20	13	2	ALIVE	A	151	
LV6	14:07	14:30	23	2	ALIVE	A	151	
LV7	14:09	.	.	0	UNKNOWN	X	160	
LV8	14:06	14:22	16	2	ALIVE	A	145	
LV9	14:08	14:26	18	2	ALIVE	A	160	
LW0	14:56	15:15	19	2	ALIVE	A	156	
LW1	14:56	15:18	22	2	ALIVE	A	140	
LW2	14:57	15:12	15	2	ALIVE	A	145	
LW3	14:54	15:06	12	2	ALIVE	A	153	
LW4	14:55	15:04	9	2	ALIVE	A	157	
LW5	15:24	15:35	11	2	ALIVE	A	147	

Appendix Table C-7

Continued.

Fish No.	Time Released	Time Recovered	At Large (min.)	No. of Turb-N Tags recovered	Fish Data Alive/ Dead	Condition Codes	Total Length (mm)	Comments
LW6	15:25	15:39	14	2	ALIVE	A	150	
LW7	15:26	15:42	16	2	ALIVE	A	150	
LW8	15:23	15:39	16	2	ALIVE	VH	151	
LW9	15:27	15:38	11	2	ALIVE	A	162	
LX0	16:37	16:57	20	2	ALIVE	G	153	
LX1	16:38	16:55	17	2	ALIVE	A	138	
LX2	16:36	16:50	14	2	ALIVE	A	148	
LX3	16:38	16:56	18	2	ALIVE	A	147	
LX4	16:36	16:51	15	2	ALIVE	A	136	
LX5	17:08	.	.	0	UNKNOWN	X	150	
LX6	17:10	17:32	22	2	ALIVE	A	153	
LX7	17:08	17:29	21	2	ALIVE	A	152	
LX8	17:07	17:28	21	2	ALIVE	A	146	
LX9	17:09	17:33	24	2	ALIVE	A	136	
LY1	17:52	18:02	10	2	ALIVE	A	153	
LY2	17:50	18:05	15	2	ALIVE	A	152	
LY3	17:52	.	.	0	UNKNOWN	X	138	
LY4	17:53	18:01	8	2	ALIVE	A	175	
U97	17:51	18:06	15	2	ALIVE	A	156	
17 May 2002 - Testlot 4 : Control - Water temp=12.0 C								
LY5	18:05	18:12	7	2	ALIVE	A	145	
LY6	18:05	18:23	18	2	ALIVE	A	146	
LY7	18:03	18:17	14	2	ALIVE	A	152	
LY8	18:04	18:19	15	2	ALIVE	A	155	
LY9	18:06	18:20	14	2	ALIVE	A	157	
LZ0	8:20	8:39	19	2	ALIVE	A	148	
LZ1	8:19	8:50	31	2	ALIVE	A	167	
LZ2	8:18	8:42	24	2	ALIVE	A	151	
LZ3	8:19	9:00	41	2	ALIVE	BH	142	
LZ4	8:18	.	.	0	UNKNOWN	X	156	
LZ5	9:38	9:44	6	1	ALIVE	GBE	157	
LZ6	9:37	9:50	13	2	ALIVE	A	156	
LZ7	9:36	9:57	21	2	ALIVE	A	148	
LZ8	9:38	9:47	9	2	ALIVE	A	150	
LZ9	9:37	9:45	8	2	ALIVE	A	160	
NA0	9:55	10:07	12	2	ALIVE	A	146	
NA1	9:58	10:11	13	2	ALIVE	A	142	
NA2	9:56	10:11	15	2	ALIVE	A	142	
NA3	9:55	10:08	13	2	ALIVE	A	147	
NA4	9:58	10:04	6	2	ALIVE	A	173	
NA5	10:49	11:02	13	2	ALIVE	A	156	
NA6	10:51	11:14	23	2	ALIVE	A	130	
NA7	10:51	11:03	12	2	ALIVE	A	141	
NA8	10:50	.	.	0	UNKNOWN	X	168	
NA9	10:49	11:09	20	2	ALIVE	A	173	
NB0	12:18	12:25	7	2	ALIVE	A	147	
NB1	12:18	12:23	5	2	ALIVE	A	144	
NB2	12:18	12:32	14	2	ALIVE	A	155	
NB3	12:20	12:29	9	2	ALIVE	A	167	
NB4	12:19	12:25	6	2	ALIVE	A	136	
NB5	12:37	12:45	8	2	ALIVE	A	153	
NB6	12:36	12:49	13	2	ALIVE	A	146	
NB7	12:37	12:45	8	2	ALIVE	A	156	
NB8	12:36	12:48	12	2	ALIVE	A	150	
NB9	12:35	12:51	16	2	ALIVE	A	152	
NC0	13:06	13:22	16	2	ALIVE	A	156	
NC1	13:07	13:14	7	2	ALIVE	A	148	
NC2	13:06	13:13	7	2	ALIVE	A	171	
NC3	13:05	13:10	5	2	ALIVE	A	147	
NC4	13:08	13:18	10	2	ALIVE	A	148	
NC5	13:23	13:35	12	2	DEAD	PH	142	
NC6	13:24	13:33	9	2	ALIVE	CG	147	
NC7	13:25	13:39	14	2	ALIVE	A	157	
NC8	13:23	13:41	18	2	ALIVE	A	147	
NC9	13:24	13:36	12	2	ALIVE	A	145	
ND0	13:41	13:57	16	2	ALIVE	A	162	
ND1	13:40	13:48	8	2	ALIVE	A	151	

Appendix Table C-7

Continued.

Fish No.	Time				Fish Data			
	Re-leased	Re-covered	At Large (min.)	No. of Turb-N Tags recovered	Alive/ Dead	Condition Codes	Total Length (mm)	Comments
ND2	13:41	13:56	15	2	ALIVE	A	153	
ND3	13:40	14:01	21	2	ALIVE	A	150	
ND4	13:39	13:57	18	2	ALIVE	A	170	
ND5	14:07	14:15	8	2	ALIVE	A	147	
ND6	14:09	14:15	6	2	ALIVE	A	147	
ND7	14:05	14:12	7	2	ALIVE	A	150	
ND8	14:06	14:12	6	2	ALIVE	A	155	
ND9	14:08	14:15	7	2	ALIVE	A	137	
NE0	11:30	11:51	21	2	ALIVE	A	157	
NE1	11:35	11:58	23	2	DEAD	PH	143	
NE2	11:38	11:56	18	2	ALIVE	A	148	
NE3	11:37	11:54	17	2	ALIVE	A	165	
NE4	11:37	12:06	29	2	ALIVE	A	148	
NE5	10:19	10:45	26	2	ALIVE	A	143	
NE6	10:19	.	.	0	UNKNOWN	X	152	
NE7	10:17	10:35	18	2	ALIVE	A	158	
NE8	10:18	10:33	15	2	ALIVE	A	153	
NE9	10:18	10:30	12	2	ALIVE	A	147	
NF0	14:24	14:57	33	2	ALIVE	A	152	
NF1	14:26	14:44	18	2	ALIVE	A	149	
NF2	14:24	14:36	12	2	ALIVE	A	142	
NF3	14:25	14:36	11	2	ALIVE	GE	152	
NF4	14:25	14:47	22	2	ALIVE	A	173	
NF5	14:56	15:07	11	2	ALIVE	A	142	
NF6	14:56	15:37	41	2	ALIVE	AT	153	
NF7	14:57	.	.	0	UNKNOWN	X	158	
NF8	14:58	15:13	15	2	ALIVE	A	142	
NF9	14:58	15:16	18	2	ALIVE	A	172	
NH0	15:24	15:50	26	2	ALIVE	A	158	
NH1	15:25	15:38	13	2	ALIVE	A	146	
NH2	15:23	15:44	21	2	ALIVE	A	152	
NH3	15:24	15:42	18	2	ALIVE	A	163	
NH4	15:25	15:41	16	2	ALIVE	A	172	
NH5	16:04	16:16	12	2	ALIVE	A	146	
NH6	16:03	16:22	19	2	ALIVE	A	148	
NH7	16:04	16:13	9	2	ALIVE	A	140	
NH8	16:05	16:25	20	2	ALIVE	A	154	
NH9	16:05	16:19	14	2	ALIVE	A	166	
NJ0	16:25	16:35	10	2	ALIVE	A	152	
NJ1	16:26	16:39	13	2	ALIVE	A	153	
NJ2	16:27	16:37	10	2	ALIVE	A	154	
NJ3	16:27	16:37	10	2	ALIVE	A	152	
NJ4	16:26	16:40	14	2	ALIVE	A	147	
NJ5	16:50	17:07	17	2	ALIVE	A	152	
NJ6	16:51	17:05	14	2	ALIVE	A	162	
NJ7	16:56	17:07	11	2	ALIVE	A	142	
NJ8	16:51	17:14	23	2	ALIVE	A	147	
NJ9	16:52	17:13	21	2	ALIVE	A	152	
NK0	17:24	17:34	10	2	ALIVE	A	138	
NK1	17:24	17:44	20	2	ALIVE	A	157	
NK2	17:22	17:32	10	2	ALIVE	A	137	
NK3	17:25	17:28	3	2	ALIVE	A	143	
NK4	17:23	17:36	13	2	ALIVE	A	138	
NK5	17:21	17:45	24	2	ALIVE	A	143	
NK6	17:20	17:37	17	2	ALIVE	A	156	
NK7	17:19	17:38	19	2	ALIVE	A	164	
NK8	17:17	17:27	10	2	ALIVE	A	157	
NK9	17:18	17:29	11	2	ALIVE	A	153	
NL0	18:02	18:20	18	2	ALIVE	A	150	
NL1	18:00	18:14	14	2	ALIVE	A	148	
NL2	18:01	18:09	8	2	ALIVE	A	164	
NL3	18:00	18:18	18	2	ALIVE	A	148	
NL4	18:02	18:14	12	2	ALIVE	A	150	
UU0	18:26	18:32	6	2	ALIVE	A	182	
UU1	18:25	18:35	10	2	ALIVE	A	145	
UU2	18:25	18:39	14	2	ALIVE	A	147	
UU3	18:27	18:44	17	2	ALIVE	A	146	
UU4	18:27	18:42	15	2	ALIVE	A	145	
UU5	18:30	18:46	16	2	ALIVE	A	142	
UV4	18:30	18:45	15	2	ALIVE	A	152	

Appendix Table C-7

Continued.

Fish No.	Time Released	Time Recovered	At Large (min.)	No. of Turb-N Tags recovered	Fish Data Alive/ Dead	Condition Codes	Total Length (mm)	Comments
UV5	18:29	18:50	21	2	ALIVE	A	141	
UV6	18:31	18:44	13	2	ALIVE	A	153	
UV9	18:29	18:44	15	2	ALIVE	A	148	
18 May 2002 - Testlot 5 : Spillbay 4 - Water temp=12.0 C								
MM0	17:15	17:36	21	2	ALIVE	A	143	
MM1	17:16	17:42	26	2	ALIVE	A	148	
MM2	17:14	17:44	30	2	ALIVE	A	157	
MM3	17:14	17:29	15	2	ALIVE	A	138	
MM4	17:16	17:32	16	2	ALIVE	A	153	
MM5	17:19	17:36	17	2	ALIVE	A	147	
MM6	17:17	17:30	13	2	ALIVE	A	139	
MM7	17:18	17:32	14	2	ALIVE	A	142	
MM8	17:19	17:43	24	2	ALIVE	A	151	
MM9	17:18	17:42	24	2	ALIVE	A	146	
MN0	17:48	18:01	13	2	ALIVE	A	146	
MN1	17:51	18:09	18	2	DEAD	DG	167	
MN2	17:48	17:59	11	2	ALIVE	A	177	
MN3	17:49	18:08	19	2	ALIVE	A	140	
MN4	17:50	17:57	7	2	ALIVE	A	163	
MN5	17:52	18:03	11	2	ALIVE	A	151	
MN6	17:54	18:05	11	2	ALIVE	G	138	
MN7	17:55	18:05	10	2	ALIVE	A	152	
MN8	17:53	18:04	11	2	ALIVE	A	146	
MN9	17:52	18:05	13	2	ALIVE	A	167	
UM0	10:54	11:02	8	2	ALIVE	A	145	
UM1	10:54	11:00	6	2	ALIVE	A	145	
UM2	10:55	11:10	15	2	ALIVE	A	146	
UM3	10:55	11:15	20	2	ALIVE	A	148	
UM4	10:58	11:01	3	2	ALIVE	A	168	
UM5	11:11	11:25	14	2	ALIVE	A	155	
UM6	11:13	11:24	11	2	ALIVE	A	153	
UM7	11:11	.	.	0	UNKNOWN	X	162	
UM8	11:12	11:29	17	2	ALIVE	A	150	
UM9	11:13	11:22	9	2	ALIVE	A	148	
UN0	12:14	12:39	25	2	ALIVE	A	155	
UN1	12:12	12:20	8	2	ALIVE	A	149	
UN2	12:14	12:24	10	2	ALIVE	A	157	
UN3	12:13	12:20	7	2	ALIVE	A	150	
UN4	12:12	12:29	17	2	ALIVE	A	175	
UN5	12:42	12:50	8	2	ALIVE	A	158	
UN6	12:41	12:47	6	2	ALIVE	A	147	
UN7	12:41	12:48	7	2	ALIVE	A	174	
UN8	12:42	12:53	11	2	ALIVE	A	140	
UN9	12:43	12:58	15	2	ALIVE	GC	161	
UP0	13:18	.	.	0	UNKNOWN	X	152	
UP1	13:19	13:32	13	2	ALIVE	A	159	
UP2	13:20	13:35	15	2	ALIVE	A	145	
UP3	13:20	13:30	10	2	ALIVE	A	154	
UP4	13:19	13:37	18	2	ALIVE	HE	140	
UP5	13:52	14:19	27	2	ALIVE	A	150	
UP6	13:50	14:00	10	2	ALIVE	A	140	
UP7	13:52	14:03	11	2	ALIVE	A	153	
UP8	13:51	14:08	17	2	ALIVE	A	156	
UP9	13:50	14:21	31	2	ALIVE	A	165	
UR0	14:27	14:36	9	2	ALIVE	A	154	
UR1	14:28	.	.	0	TAG & PIN		146	
UR2	14:29	14:50	21	2	ALIVE	A	157	
UR3	14:28	14:40	12	2	ALIVE	A	162	
UR4	14:29	14:56	27	2	ALIVE	A	163	
UR5	15:05	15:47	42	2	ALIVE	A	152	
UR6	15:06	15:21	15	2	ALIVE	A	159	
UR7	15:06	15:30	24	2	ALIVE	HD	148	
UR9	15:04	15:16	12	2	ALIVE	A	139	
US0	15:37	15:45	8	2	ALIVE	A	163	
US1	15:35	.	.	0	UNKNOWN	X	144	
US2	15:36	15:43	7	2	ALIVE	HG	153	
US3	15:36	15:59	23	2	ALIVE	A	165	

Appendix Table C-7

Continued.

Fish No.	Time				Fish Data			
	Re-leased	Re-covered	At Large (min.)	No. of Turb-N Tags recovered	Alive/ Dead	Condition Codes	Total Length (mm)	Comments
US4	15:35	15:55	20	2	ALIVE	A	155	
US5	15:45	16:06	21	2	ALIVE	A	150	
US6	15:46	16:03	17	2	ALIVE	A	145	
US7	15:45	16:17	32	2	ALIVE	A	162	
US8	15:44	16:00	16	2	ALIVE	HN	155	
US9	15:44	16:17	33	2	ALIVE	A	147	
UT0	16:34	16:51	17	2	ALIVE	A	142	
UT1	16:35	16:47	12	2	ALIVE	A	160	
UT2	16:35	16:44	9	2	ALIVE	A	150	
UT3	16:36	16:44	8	2	ALIVE	A	142	
UT4	16:34	16:46	12	2	ALIVE	A	148	
UT5	16:39	17:06	27	2	ALIVE	A	150	
UT6	16:37	16:54	17	2	ALIVE	A	152	
UT7	16:38	17:00	22	2	ALIVE	A	146	
UT8	16:38	16:49	11	2	ALIVE	A	155	
UT9	16:37	16:45	8	2	ALIVE	A	162	
UV0	8:07	8:14	7	2	ALIVE	A	154	
UV1	8:07	8:18	11	2	ALIVE	HE	140	
UV2	8:10	8:21	11	2	ALIVE	A	165	
UV3	8:09	8:20	11	2	ALIVE	A	177	
UV4	8:09	8:16	7	2	ALIVE	A	141	
UV5	8:13	8:26	13	2	ALIVE	A	152	
UV6	8:11	8:21	10	2	ALIVE	A	143	
UV7	8:13	8:24	11	2	ALIVE	A	148	
UV8	8:13	8:22	9	2	ALIVE	A	138	
UV9	8:12	8:20	8	2	ALIVE	A	145	
UW0	8:43	9:05	22	2	ALIVE	A	147	
UW1	8:42	8:58	16	2	ALIVE	A	152	
UW2	8:45	8:55	10	2	ALIVE	A	150	
UW3	8:42	9:00	18	2	ALIVE	A	153	
UW4	8:44	9:04	20	2	ALIVE	A	167	
UW5	8:38	9:00	22	2	ALIVE	A	146	
UW6	8:37	9:01	24	2	ALIVE	A	147	
UW7	8:40	8:56	16	2	ALIVE	A	156	
UW8	8:38	9:02	24	2	ALIVE	A	146	
UW9	8:39	8:54	15	2	ALIVE	A	165	
UX0	9:22	9:40	18	2	ALIVE	A	155	
UX1	9:20	9:36	16	2	ALIVE	A	152	
UX2	9:21	9:44	23	2	DEAD	W	150	
UX3	9:21	9:44	23	2	ALIVE	A	158	
UX4	9:23	9:37	14	2	ALIVE	A	156	
UX5	9:24	9:50	26	2	ALIVE	A	153	
UX6	9:27	9:42	15	2	ALIVE	A	152	
UX7	9:25	9:43	18	2	ALIVE	A	146	
UX8	9:25	9:38	13	2	ALIVE	A	152	
UX9	9:26	9:45	19	2	ALIVE	A	156	
UZ0	9:59	10:23	24	2	DEAD	P	144	
UZ1	9:58	10:06	8	2	ALIVE	A	148	
UZ2	9:57	10:03	6	2	ALIVE	A	169	
UZ3	9:59	10:04	5	2	ALIVE	A	158	
UZ4	9:58	10:06	8	2	ALIVE	A	150	
UZ5	10:12	10:18	6	2	ALIVE	A	150	
UZ6	10:13	10:20	7	2	ALIVE	A	135	
UZ7	10:12	10:20	8	2	ALIVE	A	142	
UZ8	10:13	.	.	0	DEAD	Z	140	
UZ9	10:13	10:30	17	2	ALIVE	A	136	
19 May 2002 - Testlot 6 : Spillbay 13 - Water temp=12.0 C								
MP0	7:52	8:19	27	2	ALIVE	A	153	
MP1	8:00	8:12	12	2	ALIVE	A	156	
MP2	7:58	8:35	37	1	ALIVE	B	157	
MP3	7:59	8:07	8	2	ALIVE	A	159	
MP4	7:58	8:20	22	2	ALIVE	A	177	
MP5	8:01	8:19	18	2	ALIVE	A	157	
MP6	8:02	8:14	12	2	ALIVE	A	149	
MP7	8:03	8:12	9	2	ALIVE	A	150	
MP8	8:01	8:25	24	2	ALIVE	A	174	
MP9	8:02	8:11	9	2	ALIVE	A	137	

Appendix Table C-7

Continued.

Fish No.	Time			No. of Turb-N Tags recovered	Fish Data			
	Re-leased	Re-covered	At Large (min.)		Alive/ Dead	Condition Codes	Total Length (mm)	Comments
MR0	8:42	8:49	7	2	ALIVE	H	155	
MR1	8:41	8:48	7	2	ALIVE	A	152	
MR2	8:42	8:51	9	2	ALIVE	A	147	
MR3	8:40	9:19	39	2	DEAD	EGN	182	
MR4	8:41	9:29	48	2	ALIVE	TA	166	
MR5	8:45	9:01	16	2	ALIVE	A	152	
MR6	8:44	.	.	0	TAG & PIN		153	
MR7	8:44	8:53	9	2	ALIVE	A	153	
MR8	8:44	9:01	17	2	ALIVE	A	153	
MR9	8:45	8:54	9	2	ALIVE	C	172	
MS0	9:39	10:07	28	2	ALIVE	A	147	
MS1	9:40	9:54	14	2	ALIVE	A	152	
MS2	9:41	9:50	9	2	ALIVE	A	145	
MS3	9:40	9:50	10	2	ALIVE	A	148	
MS4	9:39	9:58	19	2	ALIVE	A	144	
MS5	9:42	9:59	17	2	ALIVE	A	157	
MS7	9:42	9:54	12	2	ALIVE	A	153	
MS8	9:42	9:52	10	2	ALIVE	A	143	
MS9	9:43	9:57	14	2	ALIVE	A	167	
MT0	10:42	10:48	6	2	ALIVE	A	146	
MT1	10:41	.	.	0	TAG & PIN		156	
MT2	10:41	11:09	28	2	ALIVE	A	143	
MT3	10:42	10:56	14	2	ALIVE	A	148	
MT4	10:41	10:52	11	2	ALIVE	A	159	
MT5	10:44	11:03	19	2	ALIVE	A	163	
MT6	10:45	10:55	10	2	ALIVE	A	157	
MT7	10:44	10:59	15	2	ALIVE	A	147	
MT8	10:45	11:12	27	2	ALIVE	A	161	
MT9	10:43	11:04	21	2	ALIVE	A	138	
MU0	11:27	11:46	19	2	ALIVE	A	148	
MU1	11:30	11:38	8	2	ALIVE	A	153	
MU2	11:28	11:44	16	2	ALIVE	A	155	
MU3	11:29	11:38	9	2	ALIVE	A	174	
MU4	11:29	11:43	14	2	ALIVE	A	170	
MU5	11:33	11:49	16	2	ALIVE	A	178	
MU6	11:32	11:50	18	2	ALIVE	A	156	
MU7	11:31	11:55	24	2	DEAD	PE	151	
MU8	11:33	11:48	15	2	ALIVE	A	143	
MU9	11:30	12:02	32	2	ALIVE	A	166	
MV0	12:14	12:25	11	2	ALIVE	A	147	
MV1	12:11	12:30	19	2	ALIVE	A	152	
MV2	12:13	12:30	17	2	ALIVE	A	141	
MV4	12:11	12:27	16	2	ALIVE	A	166	
MV5	12:14	12:19	5	2	ALIVE	A	158	
MV6	12:17	12:26	9	2	ALIVE	A	146	
MV7	12:17	12:23	6	2	ALIVE	A	166	
MV8	12:18	12:23	5	2	ALIVE	A	146	
MV9	12:19	12:32	13	2	ALIVE	A	140	
MW0	13:00	13:14	14	2	ALIVE	A	158	
MW1	12:59	13:15	16	2	ALIVE	A	154	
MW2	13:00	13:17	17	2	ALIVE	A	142	
MW3	12:58	13:13	15	2	ALIVE	A	145	
MW4	12:59	13:09	10	2	ALIVE	A	167	
MW5	13:01	13:19	18	2	ALIVE	A	152	
MW6	13:04	13:11	7	2	ALIVE	A	157	
MW7	13:03	13:19	16	2	ALIVE	A	146	
MW8	13:02	13:25	23	2	ALIVE	A	180	
MW9	13:03	13:16	13	2	ALIVE	A	180	
MX0	13:38	13:44	6	2	ALIVE	A	156	
MX1	13:38	13:46	8	2	ALIVE	A	158	
MX2	13:37	13:44	7	2	ALIVE	A	151	
MX3	13:37	13:56	19	2	ALIVE	A	148	
MX4	13:36	13:55	19	2	ALIVE	A	150	
MX5	13:41	13:58	17	2	ALIVE	A	143	
MX6	15:39	.	.	0	UNKNOWN	X	140	
MX7	13:41	13:51	10	2	ALIVE	A	160	
MX8	13:39	13:44	5	2	ALIVE	A	153	
MX9	13:40	13:48	8	2	ALIVE	A	140	
MY0	14:13	.	.	0	UNKNOWN	X	142	
MY1	14:14	14:34	20	2	ALIVE	A	156	

Appendix Table C-7

Continued.

Fish No.	Time Released	Time Recovered	At Large (min.)	No. of Turb-N Tags recovered	Fish Data: Alive/ Dead	Condition Codes	Total Length (mm)	Comments
MY2	14:15	14:24	9	2	ALIVE	A	156	
MY3	14:14	14:20	6	2	ALIVE	A	153	
MY4	14:15	14:28	13	2	ALIVE	A	143	
MY5	14:16	14:26	10	2	ALIVE	A	157	
MY6	14:18	14:26	8	2	ALIVE	A	156	
MY7	14:17	14:37	20	2	ALIVE	A	148	
MY8	14:18	14:35	17	2	ALIVE	A	151	
MY9	14:17	14:22	5	2	ALIVE	A	156	
MZ0	15:02	15:13	11	2	ALIVE	A	158	
MZ1	15:00	15:15	15	2	ALIVE	A	148	
MZ2	15:02	15:19	17	2	ALIVE	A	147	
MZ3	15:00	15:31	31	2	ALIVE	A	148	
MZ4	15:01	15:21	20	2	ALIVE	A	163	
MZ5	15:04	15:10	6	2	ALIVE	A	143	
MZ6	15:05	15:12	7	2	ALIVE	A	143	
MZ7	15:05	15:24	19	2	ALIVE	A	154	
MZ8	15:06	15:30	24	2	ALIVE	A	172	
MZ9	15:03	15:26	23	2	ALIVE	A	144	
UU6	11:32	11:50	18	2	ALIVE	A	147	
UU7	11:32	11:46	14	2	ALIVE	A	148	
UU8	12:18	12:30	12	2	ALIVE	A	173	
20 May 2002 - Testlot 7 : Spillbay 9 - Water temp=12.0 C								
NL5	16:34	16:47	13	2	ALIVE	A	142	
TM0	7:52	8:08	16	2	ALIVE	A	150	
TM1	7:51	7:59	8	2	ALIVE	A	162	
TM2	7:50	.	.	0	TAG & PIN		168	
TM3	7:52	8:04	12	2	ALIVE	A	158	
TM4	7:53	8:12	19	2	ALIVE	A	152	
TM5	7:55	8:06	11	2	ALIVE	A	160	
TM6	7:57	8:13	16	2	ALIVE	A	147	
TM7	7:55	8:06	11	2	ALIVE	A	156	
TM8	7:56	8:06	10	2	ALIVE	A	155	
TM9	7:54	8:02	8	2	ALIVE	G	153	
TN0	8:35	8:48	13	2	ALIVE	A	146	
TN1	8:33	8:44	11	2	ALIVE	A	155	
TN2	8:35	8:53	18	2	ALIVE	A	144	
TN3	8:34	8:51	17	2	ALIVE	A	187	
TN4	8:33	8:40	7	2	ALIVE	A	154	
TN5	9:02	9:11	9	2	ALIVE	A	151	
TN6	9:01	9:17	16	2	ALIVE	A	161	
TN7	9:00	9:10	10	2	ALIVE	A	153	
TN8	9:02	9:07	5	2	ALIVE	A	150	
TN9	9:03	9:20	17	2	ALIVE	HG	149	
TP0	9:32	9:38	6	2	ALIVE	A	146	
TP1	9:34	9:45	11	2	ALIVE	G	143	
TP2	9:35	9:42	7	2	ALIVE	A	156	
TP3	9:33	9:40	7	2	ALIVE	A	143	
TP4	9:33	9:44	11	2	ALIVE	A	147	
TP5	9:36	9:45	9	2	ALIVE	A	151	
TP6	9:38	9:50	12	2	ALIVE	A	158	
TP7	9:37	9:43	6	2	ALIVE	A	153	
TP8	9:38	9:43	5	2	ALIVE	A	146	
TP9	9:36	9:47	11	2	ALIVE	A	148	
TR0	10:11	10:18	7	2	ALIVE	A	152	
TR1	10:10	10:28	18	2	ALIVE	A	158	
TR2	10:11	10:21	10	2	ALIVE	A	156	
TR3	10:10	10:15	5	2	ALIVE	A	173	
TR4	10:10	10:23	13	2	ALIVE	A	143	
TR5	10:14	10:25	11	2	ALIVE	A	148	
TR6	10:14	.	.	0	UNKNOWN	X	166	
TR7	10:13	10:31	18	2	ALIVE	A	153	
TR8	10:13	10:20	7	2	ALIVE	A	146	
TR9	10:12	10:19	7	2	ALIVE	A	156	
TS0	11:10	11:37	27	2	ALIVE	A	150	
TS1	11:09	.	.	0	TAG & PIN		141	
TS2	11:11	11:18	7	2	ALIVE	A	163	
TS3	11:11	11:21	10	2	ALIVE	A	146	

Appendix Table C-7

Continued.

Fish No.	Time			No. of Turb-N Tags recovered	Fish Data			
	Re-leased	Re-covered	At Large (min.)		Alive/ Dead	Condition Codes	Total Length (mm)	Comments
TS4	11:12	11:23	11	2	ALIVE	A	176	
TS5	11:14	.	.	0	TAG & PIN		145	
TS6	11:13	11:20	7	2	ALIVE	A	147	
TS7	11:15	11:31	16	2	ALIVE	A	158	
TS8	11:13	11:26	13	2	ALIVE	A	163	
TS9	11:14	11:29	15	2	ALIVE	A	148	
TT0	12:07	12:19	12	2	ALIVE	A	137	
TT1	12:05	12:24	19	2	ALIVE	A	150	
TT2	12:05	12:20	15	2	ALIVE	A	162	
TT3	12:06	12:14	8	2	ALIVE	A	155	
TT4	12:06	12:28	22	2	ALIVE	A	166	
TT5	12:08	12:17	9	2	ALIVE	A	156	
TT6	12:09	12:29	20	2	ALIVE	A	146	
TT7	12:08	12:22	14	2	ALIVE	A	166	
TT8	12:09	12:16	7	2	ALIVE	A	162	
TT9	12:07	12:46	39	2	ALIVE	TA	145	
TU0	13:05	13:21	16	2	ALIVE	A	146	
TU1	13:04	13:14	10	2	ALIVE	A	143	
TU2	13:02	13:10	8	2	ALIVE	A	135	
TU3	13:03	13:11	8	2	ALIVE	A	137	
TU4	13:04	13:23	19	2	ALIVE	A	148	
TU5	13:08	13:18	10	2	ALIVE	A	154	
TU6	13:07	13:15	8	2	ALIVE	A	150	
TU7	13:06	13:18	12	2	ALIVE	A	148	
TU8	13:08	13:18	10	2	ALIVE	A	155	
TU9	13:06	13:15	9	2	ALIVE	A	168	
TV0	13:30	13:37	7	2	ALIVE	A	157	
TV1	13:30	13:50	20	2	ALIVE	A	148	
TV2	13:28	13:34	6	2	ALIVE	A	158	
TV3	13:31	13:36	5	2	ALIVE	A	151	
TV4	13:29	13:41	12	2	ALIVE	A	153	
TV5	13:34	13:40	6	2	ALIVE	A	150	
TV6	13:35	13:45	10	2	ALIVE	A	142	
TV7	13:33	13:38	5	2	ALIVE	A	147	
TV8	13:32	13:50	18	2	ALIVE	A	147	
TV9	13:33	13:47	14	2	ALIVE	A	138	
TW0	14:02	14:16	14	2	ALIVE	A	163	
TW1	14:03	14:21	18	2	ALIVE	A	157	
TW2	14:04	14:16	12	2	ALIVE	A	154	
TW3	14:05	14:13	8	2	ALIVE	A	155	
TW4	14:06	14:11	5	2	ALIVE	A	160	
TW5	14:10	14:19	9	2	ALIVE	G	145	
TW6	14:09	14:23	14	2	ALIVE	A	162	
TW7	14:08	14:17	9	2	ALIVE	A	158	
TW8	14:08	14:19	11	2	ALIVE	A	146	
TW9	14:11	14:21	10	2	ALIVE	A	143	
TX1	14:41	14:46	5	2	ALIVE	A	165	
TX2	14:40	15:06	26	2	ALIVE	A	153	
TX3	14:41	14:53	12	2	ALIVE	A	176	
TX4	14:42	14:57	15	2	ALIVE	A	179	
TX5	14:44	15:01	17	2	ALIVE	A	143	
TX6	14:44	15:03	19	2	ALIVE	A	147	
TX7	14:44	15:06	22	2	ALIVE	A	144	
TX8	14:43	14:55	12	2	ALIVE	A	135	
TX9	14:13	14:58	45	2	ALIVE	A	177	
TY0	15:23	15:34	11	2	ALIVE	GH	148	
TY1	15:24	15:33	9	2	ALIVE	A	159	
TY2	15:23	15:33	10	2	ALIVE	A	147	
TY3	15:24	15:37	13	2	ALIVE	A	153	
TY4	15:25	15:30	5	2	ALIVE	H	160	
TY5	15:26	15:39	13	2	ALIVE	A	152	
TY6	15:27	15:42	15	2	ALIVE	A	137	
TY7	15:27	15:44	17	2	ALIVE	A	142	
TY8	15:26	15:36	10	2	ALIVE	A	157	
TY9	15:27	15:36	9	2	ALIVE	A	148	
TZ0	15:52	16:11	19	2	ALIVE	A	153	
TZ1	15:53	15:59	6	2	ALIVE	A	160	
TZ2	15:53	16:00	7	2	ALIVE	A	150	
TZ3	15:51	15:58	7	2	ALIVE	A	154	
TZ4	15:54	16:11	17	2	ALIVE	A	162	

Appendix Table C-7

Continued.

Fish No.	Time Released	Time Recovered	At Large (min.)	No. of Turb-N Tags recovered	Fish Data: Alive/ Dead	Condition Codes	Total Length (mm)	Comments
TZ5	15:57	16:15	18	2	ALIVE	A	146	
TZ6	15:56	16:03	7	2	ALIVE	A	152	
TZ7	15:56	16:07	11	2	ALIVE	A	152	
TZ8	15:51	16:13	22	2	ALIVE	A	142	
TZ9	15:55	16:09	14	2	ALIVE	A	161	
VM0	16:31	16:49	18	2	ALIVE	A	152	
VM1	16:27	16:48	21	2	ALIVE	A	146	
VM2	16:29	16:46	17	2	ALIVE	A	150	
VM3	16:28	16:54	26	2	ALIVE	A	148	
VM4	16:31	16:43	12	2	ALIVE	A	152	
VM5	16:34	16:45	11	2	ALIVE	A	153	
VM6	16:36	16:55	19	2	ALIVE	A	143	
VM7	16:32	16:42	10	2	ALIVE	A	136	
VM8	16:35	16:50	15	2	ALIVE	A	163	
VM9	16:33	16:43	10	2	ALIVE	A	145	
21 May 2002 - Testlot 8 : Spillbay 9 - Water temp=12.5 C								
LA0	16:53	17:04	11	2	ALIVE	A	140	
LA1	16:52	17:09	17	2	ALIVE	A	142	
LA2	16:51	17:06	15	2	ALIVE	A	146	
LA3	16:51	16:59	8	2	ALIVE	A	154	
LA4	16:52	17:01	9	2	ALIVE	A	160	
LA5	17:08	17:23	15	2	ALIVE	A	147	
LA6	17:08	17:16	8	2	ALIVE	A	162	
LA7	17:09	17:17	8	2	ALIVE	A	157	
LA8	17:07	17:14	7	2	ALIVE	A	163	
LA9	17:09	17:17	8	2	ALIVE	A	155	
UT7	14:29	14:38	9	2	DEAD	FD	157	
UT8	14:26	14:42	16	2	ALIVE	A	158	
VN0	7:58	8:11	13	2	ALIVE	A	158	
VN1	7:59	.	.	0	UNKNOWN	X	153	
VN2	7:57	8:03	6	2	ALIVE	A	157	
VN3	7:57	8:09	12	2	ALIVE	A	147	
VN4	7:58	8:08	10	2	ALIVE	A	151	
VN5	8:00	8:17	17	2	ALIVE	A	150	
VN6	8:01	8:17	16	2	ALIVE	A	147	
VN7	8:00	8:05	5	2	ALIVE	A	146	
VN8	8:01	8:16	15	2	ALIVE	A	142	
VN9	8:00	8:14	14	2	ALIVE	A	138	
VP0	8:45	8:57	12	2	ALIVE	A	152	
VP1	8:46	9:04	18	2	ALIVE	A	151	
VP2	8:46	8:59	13	2	ALIVE	A	163	
VP3	8:44	8:52	8	2	ALIVE	A	140	
VP4	8:45	9:07	22	2	ALIVE	HC	151	
VP5	8:48	9:03	15	2	ALIVE	A	148	
VP6	8:47	8:55	8	2	ALIVE	A	140	
VP7	8:49	8:55	6	2	ALIVE	A	145	
VP8	8:48	9:01	13	2	ALIVE	A	170	
VP9	8:49	9:00	11	2	ALIVE	A	148	
VR0	9:12	9:27	15	2	ALIVE	G	153	
VR1	9:13	9:42	29	2	ALIVE	A	151	
VR2	9:11	9:19	8	2	ALIVE	A	152	
VR3	9:13	9:24	11	2	ALIVE	A	156	
VR4	9:14	9:20	6	2	ALIVE	A	170	
VR5	9:16	9:28	12	2	ALIVE	A	158	
VR6	9:15	9:27	12	2	ALIVE	A	143	
VR7	9:15	9:23	8	2	ALIVE	A	163	
VR8	9:15	9:22	7	2	ALIVE	A	143	
VR9	9:16	9:27	11	2	ALIVE	A	138	
VS0	9:56	10:17	21	2	ALIVE	A	138	
VS1	9:56	10:11	15	2	ALIVE	A	163	
VS2	9:54	10:07	13	2	ALIVE	A	152	
VS3	9:54	10:02	8	2	ALIVE	A	152	
VS4	9:55	10:04	9	2	ALIVE	A	138	
VS5	10:00	10:05	5	2	ALIVE	A	177	
VS6	9:59	10:13	14	2	ALIVE	A	145	
VS7	9:59	10:08	9	2	ALIVE	A	140	
VS8	9:58	.	.	0	UNKNOWN	X	148	

Appendix Table C-7

Continued.

Fish No.	Time				Fish Data			
	Re-leased	Re-covered	At Large (min.)	No. of Turb-N Tags recovered	Alive/ Dead	Condition Codes	Total Length (mm)	Comments
VS9	9:58	10:12	14	2	ALIVE	A	136	
VT0	10:46	11:00	14	2	ALIVE	A	146	
VT1	10:49	11:18	29	2	ALIVE	A	148	
VT2	10:47	11:30	43	2	ALIVE	TA	158	
VT3	10:47	11:04	17	2	ALIVE	A	142	
VT4	10:48	11:01	13	2	ALIVE	A	146	
VT5	10:52	11:12	20	2	ALIVE	A	153	
VT6	10:51	11:15	24	2	ALIVE	A	153	
VT7	10:53	11:15	22	2	ALIVE	A	157	
VT8	10:51	11:13	22	2	ALIVE	A	152	
VT9	10:50	11:27	37	2	ALIVE	THW	158	
VU0	11:45	11:55	10	2	ALIVE	A	152	
VU1	11:44	12:00	16	2	ALIVE	A	157	
VU2	11:44	11:50	6	2	ALIVE	A	153	
VU3	11:46	11:53	7	2	ALIVE	A	151	
VU4	11:43	11:51	8	2	ALIVE	G	142	
VU5	11:49	12:07	18	2	ALIVE	A	185	
VU6	11:51	12:03	12	2	ALIVE	A	168	
VU7	11:49	12:11	22	2	ALIVE	A	142	
VU8	11:48	11:55	7	2	ALIVE	A	137	
VU9	11:50	11:59	9	2	ALIVE	A	147	
VV0	12:46	13:02	16	2	ALIVE	A	163	
VV1	12:45	12:58	13	2	ALIVE	A	155	
VV2	12:44	13:09	25	2	DEAD	AP	148	
VV3	12:43	12:57	14	2	ALIVE	A	138	
VV5	12:49	12:59	10	2	ALIVE	A	153	
VV6	12:47	13:14	27	2	ALIVE	A	152	
VV7	12:48	13:12	24	2	ALIVE	A	156	
VV8	12:48	13:06	18	2	ALIVE	A	156	
VV9	12:47	13:04	17	2	ALIVE	A	155	
VW0	13:26	13:41	15	2	ALIVE	A	158	
VW1	13:25	13:33	8	2	ALIVE	W	152	
VW2	13:25	13:41	16	2	ALIVE	A	143	
VW3	13:24	.	.	0	UNKNOWN	X	143	
VW4	13:25	.	.	0	TAG & PIN		151	
VW5	13:27	13:35	8	2	ALIVE	A	157	
VW6	13:29	13:51	22	2	ALIVE	A	150	
VW7	13:28	13:47	19	2	ALIVE	A	147	
VW8	13:27	13:36	9	2	ALIVE	A	154	
VW9	13:28	13:44	16	2	ALIVE	C	159	
VX0	14:23	14:41	18	2	ALIVE	A	156	
VX1	14:24	14:33	9	2	ALIVE	A	150	
VX2	14:25	14:44	19	2	DEAD	GD	162	
VX3	14:25	14:34	9	2	ALIVE	A	160	
VX4	14:24	14:49	25	2	ALIVE	A	164	
VX5	14:27	14:43	16	2	ALIVE	A	157	
VX6	14:27	14:47	20	2	ALIVE	A	178	
VX7	14:28	14:36	8	2	ALIVE	A	164	
VX8	14:29	14:39	10	2	ALIVE	A	146	
VX9	14:28	.	.	0	UNKNOWN	X	150	
VY0	15:28	15:41	13	2	ALIVE	A	144	
VY1	15:31	15:47	16	2	ALIVE	A	151	
VY2	15:31	15:40	9	2	ALIVE	A	155	
VY3	15:30	15:49	19	2	ALIVE	A	157	
VY4	15:29	16:04	35	2	ALIVE	A	153	
VY5	15:34	16:07	33	2	ALIVE	A	142	
VY6	15:35	15:53	18	2	ALIVE	A	153	
VY7	15:34	15:50	16	2	ALIVE	A	140	
VY8	15:36	15:43	7	2	ALIVE	A	156	
VY9	15:33	15:49	16	2	ALIVE	A	157	
VZ0	16:22	16:30	8	2	ALIVE	A	160	
VZ1	16:21	16:40	19	2	ALIVE	A	153	
VZ2	16:20	16:27	7	2	ALIVE	A	153	
VZ3	16:22	16:30	8	2	ALIVE	A	153	
VZ4	16:23	16:34	11	2	ALIVE	A	156	
VZ5	16:35	16:44	9	2	ALIVE	A	148	
VZ6	16:37	16:47	10	2	ALIVE	A	137	
VZ7	16:36	16:45	9	2	ALIVE	A	145	
VZ8	16:37	16:45	8	2	ALIVE	A	158	
VZ9	16:36	16:46	10	2	ALIVE	A	153	

Appendix Table C-7

Continued.

Fish No.	Time			No. of Turb-N Tags recovered	Fish Data			
	Re-leased	Re-covered	At Large (min.)		Alive/ Dead	Condition Codes	Total Length (mm)	Comments
22 May 2002 - Testlot 9 : Spillbay 9 - Water temp=12.5 C								
LB0	7:59	8:13	14	2	ALIVE	A	142	
LB1	8:00	8:20	20	2	ALIVE	A	168	
LB2	7:59	8:08	9	2	ALIVE	A	164	
LB3	8:01	8:17	16	2	ALIVE	A	167	
LB4	7:58	8:05	7	2	ALIVE	HE	143	
LB5	8:04	8:19	15	2	ALIVE	A	143	
LB6	8:02	8:14	12	2	ALIVE	A	152	
LB7	8:03	8:15	12	2	ALIVE	A	150	
LB8	8:02	8:13	11	2	ALIVE	A	147	
LB9	8:03	8:21	18	2	ALIVE	A	143	
LC0	8:32	8:41	9	2	ALIVE	A	154	
LC1	8:29	8:39	10	2	ALIVE	A	150	
LC2	8:33	8:42	9	2	ALIVE	A	151	
LC3	8:31	8:43	12	2	ALIVE	A	166	
LC4	8:32	8:55	23	2	ALIVE	A	142	
LC5	8:36	8:45	9	2	ALIVE	A	145	
LC6	8:34	8:45	11	2	ALIVE	A	146	
LC7	8:36	8:50	14	2	ALIVE	A	147	
LC8	8:35	8:46	11	2	ALIVE	A	148	
LC9	8:35	8:44	9	2	ALIVE	A	155	
LD0	8:57	9:09	12	2	ALIVE	A	148	
LD1	8:59	9:06	7	2	ALIVE	A	149	
LD2	9:00	9:28	28	2	ALIVE	A	152	
LD3	8:58	9:08	10	2	ALIVE	A	158	
LD4	9:03	9:13	10	2	ALIVE	A	146	
LD5	8:59	9:07	8	2	ALIVE	A	173	
LD6	9:02	9:09	7	2	ALIVE	A	156	
LD7	9:01	.	.	0	DEAD	PZ	152	
LD8	9:03	9:12	9	2	ALIVE	A	147	
LD9	9:00	9:11	11	1	ALIVE	B	170	
LE0	10:08	10:17	9	2	ALIVE	A	143	
LE1	10:07	10:16	9	2	ALIVE	A	147	
LE2	10:08	10:30	22	2	ALIVE	A	160	
LE3	10:09	10:20	11	2	ALIVE	A	157	
LE4	10:09	10:21	12	2	ALIVE	A	150	
LE5	10:11	10:29	18	2	ALIVE	A	137	
LE6	10:12	10:22	10	2	ALIVE	A	173	
LE7	10:12	10:25	13	2	ALIVE	A	141	
LE8	10:13	10:22	9	2	ALIVE	A	143	
LE9	10:11	10:20	9	2	ALIVE	A	140	
LF0	10:44	10:56	12	2	ALIVE	G	145	
LF2	10:43	10:52	9	2	ALIVE	A	153	
LF3	10:42	10:58	16	2	ALIVE	A	154	
LF4	10:43	10:52	9	2	ALIVE	A	151	
LF5	10:47	10:58	11	2	ALIVE	A	138	
LF6	10:45	10:57	12	2	ALIVE	A	170	
LF7	10:46	11:06	20	2	ALIVE	A	153	
LF8	10:48	11:11	23	2	ALIVE	A	148	
LF9	10:46	11:16	30	2	DEAD	P	158	
LH0	11:37	11:46	9	2	ALIVE	A	157	
LH1	11:34	11:48	14	2	ALIVE	A	160	
LH2	11:37	11:44	7	2	ALIVE	A	152	
LH3	11:36	11:53	17	2	ALIVE	A	150	
LH4	11:35	11:43	8	2	ALIVE	A	148	
LH5	11:54	12:18	24	2	ALIVE	A	155	
LH6	11:53	12:00	7	2	ALIVE	A	156	
LH7	11:53	12:04	11	2	ALIVE	A	148	
LH8	11:51	12:03	12	2	ALIVE	A	145	
LH9	11:52	12:05	13	2	ALIVE	A	144	
LJ0	12:53	13:16	23	2	ALIVE	GH	143	
LJ1	12:54	13:10	16	2	ALIVE	A	153	
LJ2	12:55	13:17	22	2	ALIVE	A	154	
LJ3	12:55	13:10	15	2	ALIVE	A	143	
LJ4	12:53	13:02	9	2	ALIVE	A	157	
LJ5	13:22	13:43	21	2	ALIVE	A	148	
LJ6	13:21	13:34	13	2	ALIVE	A	157	
LJ7	13:23	.	.	0	UNKNOWN	X	139	

Appendix Table C-7

Continued.

Fish No.	Time				Fish Data			
	Re-leased	Re-covered	At Large (min.)	No. of Turb-N Tags recovered	Alive/ Dead	Condition Codes	Total Length (mm)	Comments
LJ8	13:21	13:41	20	2	ALIVE	A	157	
LJ9	13:23	13:28	5	2	ALIVE	A	143	
LK0	14:02	14:20	18	2	ALIVE	A	158	
LK1	14:02	14:15	13	2	DEAD	PHJ	156	
LK2	14:01	14:10	9	2	ALIVE	A	143	
LK3	14:03	14:12	9	2	ALIVE	A	145	
LK4	14:00	14:07	7	2	ALIVE	A	137	
LK5	14:23	14:28	5	2	ALIVE	A	158	
LK6	14:20	14:26	6	2	ALIVE	A	155	
LK7	14:22	14:39	17	2	ALIVE	A	158	
LK8	14:19	14:27	8	2	ALIVE	A	158	
LK9	14:21	14:31	10	2	ALIVE	A	162	
LL0	14:49	15:02	13	1	ALIVE	B	164	
LL1	14:49	15:00	11	2	ALIVE	A	147	
LL2	14:48	15:10	22	2	ALIVE	G	150	
LL3	14:48	15:12	24	2	ALIVE	A	140	
LL4	14:48	14:54	6	2	ALIVE	A	156	
LL5	15:27	15:48	21	2	ALIVE	A	162	
LL6	15:26	15:42	16	2	ALIVE	A	147	
LL7	15:26	15:55	29	2	ALIVE	A	158	
LL8	15:27	15:36	9	2	ALIVE	A	147	
LL9	15:25	15:36	11	2	ALIVE	A	153	
MA0	16:19	16:22	3	2	ALIVE	A	174	
MA1	16:20	16:23	3	2	ALIVE	A	157	
MA2	16:18	16:30	12	2	ALIVE	A	142	
MA3	16:19	16:39	20	2	ALIVE	A	140	
MA4	16:18	16:35	17	2	ALIVE	A	140	
MA5	16:21	16:31	10	2	ALIVE	A	156	
MA6	16:22	16:25	3	2	ALIVE	A	144	
MA7	16:22	16:30	8	2	ALIVE	A	144	
MA8	16:22	16:33	11	2	ALIVE	A	135	
MA9	16:21	16:38	17	2	ALIVE	A	133	
MB0	16:52	16:58	6	2	ALIVE	A	157	
MB1	16:51	16:56	5	2	ALIVE	A	150	
MB2	16:50	17:04	14	2	ALIVE	A	160	
MB3	16:49	16:54	5	2	ALIVE	A	155	
MB4	16:51	16:57	6	2	ALIVE	A	154	
MB5	16:55	17:04	9	2	ALIVE	A	150	
MB6	16:54	17:02	8	2	ALIVE	A	140	
MB7	16:53	16:57	4	2	ALIVE	A	153	
MB8	16:55	16:59	4	2	ALIVE	A	148	
MB9	16:56	17:04	8	2	ALIVE	A	140	
MC0	17:13	17:26	13	2	ALIVE	A	164	
MC1	17:15	17:19	4	2	ALIVE	A	142	
MC2	17:14	17:20	6	2	ALIVE	A	149	
MC3	17:13	17:21	8	2	ALIVE	A	150	
MC4	17:12	17:16	4	2	ALIVE	A	158	
MC5	17:17	17:22	5	2	ALIVE	A	143	
MC6	17:18	17:24	6	2	ALIVE	A	143	
MC7	17:15	17:20	5	2	ALIVE	A	153	
MC8	17:17	17:21	4	2	ALIVE	A	142	
MC9	17:16	17:20	4	2	ALIVE	A	156	
NL6	10:44	10:55	11	2	ALIVE	A	152	
23 May 2002 - Testlot 10 : Spillbay 9 - Water temp=12.5 C								
MD0	8:07	8:15	8	2	ALIVE	A	157	
MD1	8:06	8:11	5	2	ALIVE	A	156	
MD2	8:07	8:15	8	2	ALIVE	A	148	
MD3	8:08	8:24	16	2	ALIVE	A	158	
MD4	8:06	8:21	15	2	ALIVE	A	160	
MD5	8:11	8:30	19	2	ALIVE	A	171	
MD6	8:10	8:23	13	2	ALIVE	A	148	
MD7	8:10	8:22	12	2	ALIVE	A	137	
MD8	8:09	8:17	8	2	ALIVE	A	137	
MD9	8:11	8:35	24	2	ALIVE	A	140	
ME0	8:42	9:00	18	2	ALIVE	A	138	
ME1	8:44	8:59	15	2	ALIVE	A	182	
ME2	8:44	8:51	7	2	ALIVE	A	144	

Appendix Table C-7

Continued.

Fish No.	Time				Fish Data			
	Re-leased	Re-covered	At Large (min.)	No. of Turb-N Tags recovered	Alive/ Dead	Condition Codes	Total Length (mm)	Comments
ME4	8:43	8:50	7	2	ALIVE	A	148	
ME5	8:47	8:59	12	2	ALIVE	A	154	
ME6	8:48	8:56	8	2	ALIVE	A	147	
ME7	8:47	8:57	10	2	ALIVE	A	144	
ME8	8:46	8:53	7	2	ALIVE	A	163	
ME9	8:46	8:54	8	2	ALIVE	A	160	
MF0	9:18	9:27	9	2	ALIVE	A	163	
MF1	9:19	9:31	12	2	ALIVE	A	148	
MF2	9:17	9:29	12	2	ALIVE	A	163	
MF3	9:19	9:40	21	2	ALIVE	A	162	
MF4	9:20	9:27	7	2	ALIVE	A	157	
MF5	9:22	9:29	7	2	ALIVE	A	146	
MF6	9:21	9:34	13	2	ALIVE	A	147	
MF7	9:21	9:31	10	2	ALIVE	A	153	
MF8	9:23	9:35	12	2	ALIVE	A	143	
MF9	9:22	9:36	14	2	ALIVE	A	163	
MH0	10:07	10:12	5	2	ALIVE	A	147	
MH1	10:09	10:14	5	2	ALIVE	A	155	
MH2	10:08	10:18	10	2	ALIVE	A	162	
MH3	10:06	10:15	9	2	ALIVE	A	152	
MH4	10:07	10:12	5	2	ALIVE	A	156	
MH5	10:12	10:20	8	2	ALIVE	A	156	
MH6	10:10	10:16	6	2	ALIVE	A	173	
MH7	10:11	10:18	7	2	ALIVE	C	172	
MH8	10:14	10:22	8	2	ALIVE	A	144	
MH9	10:13	10:19	6	2	ALIVE	A	145	
MJ0	10:38	10:43	5	2	ALIVE	A	163	
MJ1	10:37	10:44	7	2	ALIVE	A	148	
MJ2	10:36	11:00	24	2	ALIVE	A	147	
MJ3	10:36	10:41	5	2	ALIVE	A	156	
MJ4	10:38	10:42	4	2	ALIVE	A	148	
MJ5	10:39	10:45	6	2	ALIVE	A	174	
MJ6	10:42	10:46	4	2	ALIVE	A	146	
MJ7	10:40	10:47	7	2	ALIVE	A	144	
MJ8	10:43	10:49	6	2	ALIVE	A	146	
MJ9	10:41	10:51	10	2	DEAD	WL	143	
MK0	11:07	11:16	9	2	ALIVE	A	157	
MK1	11:09	11:12	3	2	ALIVE	A	166	
MK2	11:08	11:15	7	2	ALIVE	A	162	
MK3	11:06	11:14	8	2	ALIVE	A	141	
MK4	11:05	11:10	5	2	ALIVE	A	144	
MK5	11:11	11:23	12	2	ALIVE	A	148	
MK6	11:10	11:14	4	2	ALIVE	A	144	
MK7	11:12	11:21	9	2	ALIVE	A	153	
MK8	11:12	11:30	18	2	DEAD	P	151	
MK9	11:10	11:15	5	2	ALIVE	A	145	
ML0	12:39	12:46	7	2	ALIVE	A	162	
ML1	12:37	12:44	7	2	ALIVE	G	145	
ML2	12:38	12:49	11	2	DEAD	AP	170	
ML3	12:39	12:53	14	2	DEAD	P	150	
ML4	12:37	13:02	25	2	ALIVE	A	151	
ML5	12:40	12:50	10	2	ALIVE	W	158	
ML6	12:41	12:53	12	2	ALIVE	N	154	
ML7	12:42	12:48	6	2	ALIVE	A	151	
ML8	12:42	12:52	10	2	ALIVE	A	163	
ML9	12:41	12:51	10	2	ALIVE	A	148	
YA0	13:16	13:33	17	2	ALIVE	A	140	
YA2	13:15	13:37	22	1	ALIVE	BE	156	
YA3	13:14	13:27	13	2	ALIVE	A	166	
YA4	13:15	13:23	8	2	ALIVE	A	151	
YA5	13:12	13:18	6	2	ALIVE	A	152	
YA6	13:12	13:18	6	2	ALIVE	GHE	157	
YA7	13:13	13:22	9	2	ALIVE	A	166	
YA8	13:11	13:47	36	2	ALIVE	A	150	
YA9	13:11	13:29	18	2	ALIVE	A	148	
YB1	14:06	14:29	23	2	ALIVE	A	164	
YB2	14:03	14:19	16	2	ALIVE	GH	153	
YB3	14:06	14:24	18	2	ALIVE	A	157	
YB4	14:05	14:11	6	2	ALIVE	A	157	
YB5	14:07	14:14	7	2	ALIVE	A	160	

Appendix Table C-7

Continued.

Fish No.	Time				Fish Data			
	Re-leased	Re-covered	At Large (min.)	No. of Turb-N Tags recovered	Alive/ Dead	Condition Codes	Total Length (mm)	Comments
YB6	14:09	14:19	10	2	ALIVE	A	158	
YB7	14:09	14:15	6	2	ALIVE	A	154	
YB8	14:08	14:22	14	2	ALIVE	A	150	
YB9	14:08	14:23	15	2	ALIVE	A	150	
YC0	14:53	15:16	23	2	ALIVE	A	156	
YC1	14:54	15:03	9	2	ALIVE	A	158	
YC2	14:56	15:02	6	2	ALIVE	A	143	
YC3	14:55	15:17	22	2	ALIVE	A	143	
YC4	14:55	15:05	10	2	ALIVE	A	157	
YC5	14:58	15:10	12	2	ALIVE	A	173	
YC6	14:57	15:04	7	2	ALIVE	A	145	
YC7	14:57	15:13	16	2	ALIVE	A	148	
YC8	14:57	15:04	7	2	ALIVE	A	152	
YC9	14:56	15:06	10	2	ALIVE	A	153	
YD0	15:34	15:40	6	2	ALIVE	H	150	
YD1	15:34	15:38	4	2	ALIVE	A	143	
YD2	15:35	15:41	6	2	ALIVE	A	155	
YD3	15:36	15:42	6	2	ALIVE	A	147	
YD4	15:35	15:44	9	2	ALIVE	A	145	
YD5	15:37	.	.	0	DEAD	ZL	158	
YD6	15:39	15:46	7	2	ALIVE	A	140	
YD7	15:38	15:45	7	2	ALIVE	HG	152	
YD8	15:38	16:09	31	2	DEAD	P	147	
YD9	15:39	16:03	24	2	ALIVE	A	144	
YE0	16:31	16:40	9	2	ALIVE	A	146	
YE1	16:33	16:51	18	2	ALIVE	A	150	
YE2	16:31	16:45	14	2	ALIVE	A	146	
YE3	16:32	16:38	6	2	ALIVE	A	139	
YE4	16:33	16:50	17	2	DEAD	P	141	
YE5	16:35	16:54	19	2	ALIVE	H	172	
YE6	16:35	16:48	13	2	ALIVE	A	175	
YE7	16:34	16:39	5	2	ALIVE	A	137	
YE8	16:36	16:51	15	2	ALIVE	A	155	
YE9	16:34	16:44	10	2	DEAD	PH	143	
YF0	17:13	17:22	9	2	ALIVE	A	134	
YF1	17:12	17:33	21	2	ALIVE	A	145	
YF2	17:13	17:33	20	2	ALIVE	A	144	
YF3	17:12	17:25	13	2	ALIVE	A	152	
YF4	17:12	17:27	15	2	ALIVE	A	152	
YF5	17:15	17:28	13	2	ALIVE	A	156	
YF6	17:16	17:21	5	2	ALIVE	A	150	
YF7	17:15	17:30	15	2	ALIVE	A	150	
YF8	17:16	17:22	6	2	ALIVE	A	136	
YF9	17:14	17:23	9	2	ALIVE	A	152	
YH0	17:56	18:08	12	2	ALIVE	A	147	
YH1	17:56	18:12	16	2	ALIVE	A	147	
YH2	17:56	18:04	8	2	ALIVE	A	166	
YH3	17:55	18:07	12	2	ALIVE	A	158	
YH4	17:54	18:03	9	2	ALIVE	A	154	
YH5	17:53	18:12	19	2	ALIVE	A	153	
YH6	17:52	18:01	9	2	ALIVE	A	146	
YH7	17:52	18:04	12	2	ALIVE	A	146	
YH8	17:51	18:02	11	2	ALIVE	A	157	
YH9	17:53	18:10	17	2	ALIVE	A	147	
YJ0	18:19	18:36	17	2	ALIVE	A	151	
YJ1	18:21	18:34	13	2	ALIVE	A	155	
YJ2	18:19	.	.	0	UNKNOWN	X	145	
YJ3	18:20	18:28	8	2	ALIVE	A	150	
YJ4	18:21	18:29	8	2	ALIVE	A	146	
YJ5	18:24	18:36	12	2	ALIVE	A	183	
YJ6	18:23	18:30	7	2	ALIVE	A	167	
YJ7	18:22	18:36	14	2	ALIVE	A	146	
YJ8	18:24	.	.	0	DEAD	ZL	148	
YJ9	18:23	18:43	20	2	ALIVE	EG	155	
24 May 2002 - Testlot 11 : Spillbay 13 - Water temp=13.0 C								
TA0	16:12	16:43	31	2	ALIVE	A	156	
TA1	16:13	16:27	14	2	ALIVE	A	148	

Appendix Table C-7

Continued.

Fish No.	Time			No. of Turb-N Tags recovered	Fish Data			
	Re-leased	Re-covered	At Large (min.)		Alive/ Dead	Condition Codes	Total Length (mm)	Comments
TA2	16:13	.	.	0	UNKNOWN	X	166	
TA4	16:12	16:25	13	2	ALIVE	A	162	
TA5	16:15	16:31	16	2	ALIVE	A	148	
TA6	16:15	16:29	14	2	ALIVE	A	146	
TA7	16:16	16:40	24	2	ALIVE	A	168	
TA8	16:17	16:33	16	2	ALIVE	A	140	
TA9	16:16	16:31	15	2	ALIVE	A	170	
TB0	16:59	17:09	10	2	ALIVE	A	142	
TB1	16:59	.	.	0	DEAD	LZ	146	
TB2	17:00	17:17	17	2	ALIVE	A	135	
TB3	16:58	17:22	24	2	ALIVE	A	144	
TB4	16:58	17:23	25	2	ALIVE	A	148	
TB5	17:03	17:12	9	2	ALIVE	A	163	
TB6	17:01	17:10	9	2	ALIVE	A	178	
TB7	17:01	17:15	14	2	ALIVE	H	152	
TB8	17:02	17:20	18	2	ALIVE	A	152	
TB9	17:02	17:17	15	2	ALIVE	A	158	
TC0	18:09	18:15	6	2	ALIVE	A	147	
TC1	18:11	18:28	17	2	ALIVE	A	152	
TC2	18:08	18:14	6	2	ALIVE	A	156	
TC3	18:10	18:17	7	2	ALIVE	A	145	
TC4	18:09	18:34	25	2	ALIVE	A	148	
TC5	18:13	18:30	17	2	ALIVE	HG	146	
TC6	18:13	18:28	15	2	ALIVE	A	166	
TC7	18:11	18:24	13	2	ALIVE	E	167	
TC8	18:12	18:18	6	2	ALIVE	A	154	
TC9	18:12	18:22	10	2	ALIVE	A	146	
UY9	14:49	14:58	9	2	ALIVE	A	143	
YK0	8:28	8:34	6	2	ALIVE	A	158	
YK1	8:27	8:33	6	2	ALIVE	A	153	
YK2	8:26	8:35	9	2	ALIVE	A	162	
YK3	8:26	8:32	6	2	ALIVE	A	143	
YK4	8:25	8:30	5	2	ALIVE	A	138	
YK5	8:30	8:41	11	2	ALIVE	A	157	
YK6	8:29	8:38	9	2	ALIVE	A	148	
YK7	8:31	8:46	15	2	ALIVE	A	153	
YK8	8:30	8:38	8	2	ALIVE	A	137	
YK9	8:32	8:40	8	2	ALIVE	A	149	
YL0	9:00	9:05	5	2	ALIVE	A	162	
YL1	9:02	9:08	6	2	ALIVE	A	136	
YL2	9:02	9:10	8	2	ALIVE	A	168	
YL3	9:03	9:13	10	2	ALIVE	A	180	
YL4	9:01	9:18	17	2	ALIVE	A	157	
YL5	9:05	9:13	8	2	ALIVE	A	151	
YL6	9:04	9:10	6	2	ALIVE	A	153	
YL7	9:05	9:14	9	2	ALIVE	A	153	
YL8	9:06	9:16	10	2	ALIVE	A	148	
YL9	9:07	9:13	6	2	ALIVE	A	165	
Z00	9:34	9:39	5	2	ALIVE	A	146	
Z01	9:32	9:38	6	2	ALIVE	A	147	
Z02	9:34	9:40	6	2	ALIVE	A	142	
Z03	9:33	9:37	4	2	ALIVE	A	148	
Z04	9:33	9:38	5	2	ALIVE	A	146	
Z05	9:37	9:49	12	2	ALIVE	A	170	
Z06	9:35	9:46	11	2	ALIVE	A	157	
Z07	9:37	9:50	13	2	ALIVE	A	153	
Z08	9:36	9:56	20	2	ALIVE	A	151	
Z09	9:38	9:43	5	2	ALIVE	A	152	
Z10	10:14	10:22	8	2	ALIVE	A	146	
Z11	10:14	10:24	10	2	ALIVE	A	150	
Z12	10:04	10:21	17	2	ALIVE	A	138	
Z13	10:13	10:19	6	2	ALIVE	A	136	
Z14	10:04	10:24	20	2	ALIVE	A	152	
Z15	10:17	10:29	12	2	ALIVE	A	152	
Z16	10:15	10:32	17	2	ALIVE	A	140	
Z17	10:18	10:28	10	2	ALIVE	A	140	
Z18	10:16	10:27	11	2	ALIVE	A	140	
Z19	10:17	10:27	10	2	ALIVE	A	155	
Z20	11:01	11:23	22	2	ALIVE	A	152	
Z21	11:02	11:20	18	2	ALIVE	A	158	

Appendix Table C-7

Continued.

Fish No.	Time				Fish Data			
	Re-leased	Re-covered	At Large (min.)	No. of Turb-N Tags recovered	Alive/ Dead	Condition Codes	Total Length (mm)	Comments
Z22	11:03	11:14	11	2	ALIVE	A	155	
Z23	11:03	11:18	15	2	ALIVE	A	158	
Z24	11:04	11:25	21	2	ALIVE	A	167	
Z25	11:07	11:23	16	2	ALIVE	A	157	
Z26	11:05	11:21	16	2	ALIVE	A	148	
Z27	11:05	11:09	4	2	ALIVE	A	161	
Z28	11:06	11:20	14	2	ALIVE	A	154	
Z29	11:06	11:25	19	2	ALIVE	A	137	
Z30	11:37	11:48	11	2	ALIVE	A	162	
Z31	11:38	.	.	0	TAG & PIN		160	
Z32	11:36	11:46	10	2	ALIVE	EG	156	
Z33	11:38	11:54	16	2	ALIVE	A	144	
Z34	11:37	11:53	16	2	ALIVE	A	180	
Z35	11:42	12:01	19	2	ALIVE	A	147	
Z36	11:41	11:59	18	2	ALIVE	A	157	
Z37	11:40	11:59	19	2	ALIVE	A	150	
Z38	11:41	11:58	17	2	ALIVE	A	147	
Z39	11:39	11:51	12	2	ALIVE	A	145	
Z40	12:20	12:26	6	2	ALIVE	A	151	
Z41	12:22	12:29	7	2	ALIVE	A	153	
Z42	12:21	12:32	11	2	ALIVE	GH	152	
Z43	12:22	12:31	9	2	ALIVE	A	156	
Z44	12:21	12:36	15	2	ALIVE	A	163	
Z45	12:24	12:32	8	2	ALIVE	A	156	
Z46	12:25	12:36	11	2	ALIVE	A	180	
Z47	12:25	12:37	12	2	ALIVE	A	150	
Z48	12:22	12:39	17	2	ALIVE	A	153	
Z49	12:23	12:35	12	2	ALIVE	A	142	
Z50	13:03	13:15	12	2	ALIVE	A	137	
Z51	13:02	13:11	9	2	ALIVE	A	138	
Z52	13:03	13:26	23	1	ALIVE	BH	152	
Z53	13:01	13:16	15	2	ALIVE	A	141	
Z54	13:02	13:20	18	2	DEAD	P	150	
Z55	13:07	13:23	16	2	ALIVE	A	143	
Z56	13:06	13:17	11	2	ALIVE	A	149	
Z57	13:05	13:13	8	2	ALIVE	GH	173	
Z58	13:06	13:21	15	2	ALIVE	A	143	
Z59	13:05	13:18	13	2	ALIVE	A	155	
Z60	13:47	14:00	13	2	ALIVE	A	147	
Z61	13:46	13:55	9	2	ALIVE	A	147	
Z62	13:45	13:56	11	2	ALIVE	A	156	
Z63	13:46	13:59	13	2	ALIVE	A	156	
Z64	13:45	13:56	11	2	ALIVE	A	150	
Z65	13:50	14:04	14	2	ALIVE	A	141	
Z66	13:49	14:02	13	2	ALIVE	G	144	
Z67	13:50	14:03	13	2	ALIVE	A	147	
Z68	13:49	14:02	13	2	ALIVE	A	152	
Z69	13:48	13:55	7	2	ALIVE	A	148	
Z70	14:16	14:26	10	2	ALIVE	A	153	
Z71	14:19	14:29	10	2	ALIVE	A	161	
Z72	14:17	14:24	7	2	ALIVE	A	167	
Z73	14:18	14:27	9	2	ALIVE	A	142	
Z74	14:19	14:31	12	2	ALIVE	A	155	
Z75	14:20	14:29	9	2	ALIVE	A	163	
Z76	14:25	14:31	6	2	ALIVE	A	188	
Z77	14:22	14:30	8	2	ALIVE	A	157	
Z78	14:21	14:38	17	2	ALIVE	A	164	
Z79	14:21	14:36	15	2	ALIVE	A	150	
Z81	14:50	14:59	9	2	ALIVE	A	152	
Z82	14:50	14:59	9	2	ALIVE	HG	150	
Z83	14:51	15:00	9	2	ALIVE	A	156	
Z84	14:52	15:04	12	2	ALIVE	A	162	
Z85	14:54	15:03	9	2	ALIVE	A	162	
Z86	14:55	15:06	11	2	ALIVE	A	152	
Z87	14:53	15:08	15	2	ALIVE	A	157	
Z88	14:54	15:02	8	2	ALIVE	A	156	
Z89	14:55	15:02	7	2	ALIVE	A	149	
Z90	15:38	15:56	18	1	DEAD	P	150	
Z91	15:38	15:51	13	2	ALIVE	A	164	
Z92	15:39	15:52	13	2	ALIVE	A	164	

Appendix Table C-7

Continued.

Fish No.	Time				Fish Data			
	Released	Recovered	At Large (min.)	No. of Turb-N Tags recovered	Alive/ Dead	Condition Codes	Total Length (mm)	Comments
Z93	15:39	15:56	17	2	ALIVE	A	152	
Z94	15:40	16:56	76	2	ALIVE	H	157	
Z95	15:42	15:58	16	2	ALIVE	A	162	
Z96	15:43	15:55	12	2	ALIVE	A	150	
Z97	15:42	16:01	19	2	ALIVE	A	158	
Z98	15:41	16:04	23	2	ALIVE	A	148	
Z99	15:40	15:59	19	2	ALIVE	A	150	
25 May 2002 - Testlot 12 : Spillbay 9 - Water temp=13.0 C								
TD0	8:11	8:22	11	2	ALIVE	A	155	
TD1	8:12	8:23	11	2	ALIVE	A	138	
TD2	8:13	8:25	12	2	ALIVE	A	147	
TD3	8:13	8:23	10	2	ALIVE	A	140	
TD4	8:12	8:24	12	2	ALIVE	A	153	
TD5	8:14	8:32	18	2	ALIVE	A	185	
TD6	8:15	8:27	12	2	ALIVE	A	180	
TD7	8:16	.	.	0	UNKNOWN	X	142	
TD8	8:16	8:29	13	2	ALIVE	D	156	
TD9	8:17	8:42	25	2	ALIVE	A	141	
TE0	8:54	9:05	11	2	ALIVE	A	146	
TE1	8:52	9:05	13	2	ALIVE	A	135	
TE2	8:52	9:14	22	2	ALIVE	A	140	
TE3	8:53	9:06	13	2	ALIVE	A	149	
TE4	8:51	.	.	0	UNKNOWN	X	150	
TE5	8:55	9:05	10	2	ALIVE	A	143	
TE6	8:56	9:08	12	2	ALIVE	A	143	
TE7	8:56	9:07	11	2	ALIVE	A	164	
TE8	8:56	9:01	5	2	ALIVE	A	162	
TE9	8:57	9:08	11	2	ALIVE	A	149	
TF0	9:24	9:34	10	2	ALIVE	A	152	
TF1	9:22	9:33	11	2	ALIVE	A	146	
TF2	9:24	9:30	6	2	ALIVE	A	158	
TF3	9:23	9:32	9	2	ALIVE	A	148	
TF4	9:22	9:29	7	2	ALIVE	A	143	
TF5	9:26	9:51	25	2	ALIVE	A	158	
TF6	9:25	9:35	10	2	ALIVE	A	138	
TF7	9:27	9:37	10	2	ALIVE	A	147	
TF8	9:27	9:36	9	1	ALIVE	B	141	
TF9	9:26	9:33	7	2	ALIVE	A	144	
TH0	10:40	10:52	12	2	ALIVE	A	150	
TH1	10:42	11:00	18	2	ALIVE	A	154	
TH2	10:40	10:52	12	2	ALIVE	A	148	
TH3	10:41	10:58	17	2	ALIVE	A	163	
TH4	10:43	10:52	9	2	ALIVE	A	158	
TH5	10:45	.	.	0	TAG & PIN		152	
TH6	10:46	11:00	14	2	ALIVE	A	144	
TH7	10:45	11:03	18	2	ALIVE	A	146	
TH8	10:43	10:54	11	2	ALIVE	A	140	
TH9	10:44	10:56	12	2	ALIVE	A	155	
TJ0	11:23	11:39	16	2	ALIVE	A	142	
TJ1	11:20	11:27	7	2	ALIVE	A	158	
TJ2	11:21	11:33	12	2	ALIVE	A	170	
TJ3	11:22	11:30	8	2	ALIVE	A	152	
TJ4	11:22	11:28	6	2	ALIVE	A	149	
TJ5	11:24	11:33	9	2	ALIVE	A	133	
TJ6	11:26	11:40	14	2	ALIVE	A	153	
TJ7	11:25	11:34	9	2	ALIVE	A	147	
TJ8	11:26	11:35	9	2	ALIVE	A	168	
TJ9	11:24	11:31	7	2	ALIVE	A	127	
TK0	11:52	12:02	10	2	ALIVE	A	162	
TK1	11:51	11:58	7	2	ALIVE	A	156	
TK2	11:52	12:25	33	2	ALIVE	A	134	
TK3	11:53	12:13	20	2	ALIVE	A	152	
TK4	11:51	11:59	8	2	ALIVE	A	185	
TK5	11:57	12:09	12	2	ALIVE	A	197	
TK6	11:54	12:10	16	2	ALIVE	A	150	
TK7	11:55	12:05	10	2	ALIVE	A	157	
TK8	11:54	12:02	8	2	ALIVE	A	151	

Appendix Table C-7

Continued.

Fish No.	Time Released	Time Recovered	At Large (min.)	No. of Turb-N Tags recovered	Fish Data Alive/ Dead	Condition Codes	Total Length (mm)	Comments
TK9	11:56	12:08	12	2	ALIVE	A	148	
TL0	12:44	13:15	31	2	ALIVE	A	150	
TL1	12:46	12:57	11	2	ALIVE	A	148	
TL2	12:45	12:59	14	2	ALIVE	A	138	
TL3	12:43	13:10	27	2	ALIVE	A	152	
TL4	12:45	13:01	16	2	ALIVE	A	145	
TL5	12:48	13:07	19	2	ALIVE	A	176	
TL6	12:48	13:01	13	2	ALIVE	G	136	
TL8	12:49	13:04	15	2	ALIVE	A	167	
TL9	12:49	12:58	9	2	ALIVE	A	153	
WA0	13:34	13:42	8	2	ALIVE	A	157	
WA1	13:33	13:41	8	2	ALIVE	A	153	
WA2	13:33	.	.	0	UNKNOWN	X	147	
WA3	13:35	13:54	19	2	ALIVE	A	152	
WA4	13:32	13:46	14	2	ALIVE	A	156	
WA6	13:37	13:54	17	2	DEAD	P	145	
WA7	13:37	13:55	18	2	ALIVE	A	144	
WA8	13:36	.	.	0	UNKNOWN	X	155	
WA9	13:36	13:50	14	2	ALIVE	A	152	
WB0	14:30	15:00	30	2	ALIVE	A	154	
WB3	14:33	14:53	20	2	ALIVE	A	162	
WB4	14:31	14:39	8	2	ALIVE	G	158	
WB5	14:35	14:56	21	2	ALIVE	A	149	
WB6	14:33	15:39	66	2	ALIVE	A	148	
WB7	14:35	14:43	8	2	ALIVE	A	150	
WB8	14:34	15:15	41	2	ALIVE	A	146	
WB9	14:34	14:51	17	2	ALIVE	A	160	
WC0	16:08	16:14	6	2	ALIVE	A	152	
WC1	16:10	16:16	6	2	ALIVE	A	173	
WC2	16:09	16:18	9	2	ALIVE	A	152	
WC3	16:09	16:20	11	2	ALIVE	A	147	
WC4	16:08	16:27	19	2	ALIVE	A	143	
WC5	16:11	16:24	13	2	ALIVE	A	136	
WC6	16:12	16:26	14	2	ALIVE	A	174	
WC7	16:14	16:20	6	2	ALIVE	A	147	
WC8	16:13	16:28	15	2	ALIVE	A	146	
WC9	16:13	16:18	5	2	ALIVE	A	157	
WD0	16:39	16:48	9	2	ALIVE	A	149	
WD1	16:41	16:58	17	2	ALIVE	A	158	
WD2	16:39	16:53	14	2	ALIVE	A	142	
WD3	16:40	16:57	17	2	ALIVE	A	158	
WD4	16:42	17:05	23	2	ALIVE	A	137	
WD5	16:42	17:00	18	2	ALIVE	A	140	
WD6	16:44	17:04	20	2	ALIVE	A	143	
WD7	16:44	17:01	17	2	ALIVE	A	147	
WD8	16:45	17:00	15	2	ALIVE	A	166	
WD9	16:43	16:54	11	2	ALIVE	A	147	
WE0	17:11	17:33	22	2	ALIVE	A	149	
WE1	17:14	17:35	21	2	DEAD	P	141	
WE2	17:14	17:25	11	2	ALIVE	A	144	
WE3	17:12	17:25	13	2	ALIVE	A	134	
WE4	17:13	17:18	5	2	ALIVE	A	146	
WE5	17:16	17:26	10	2	ALIVE	A	156	
WE6	17:15	17:23	8	2	ALIVE	A	157	
WE7	17:17	17:29	12	2	ALIVE	A	155	
WE8	17:19	17:30	11	2	ALIVE	A	159	
WE9	17:18	17:29	11	2	ALIVE	A	176	
26 May 2002 - Testlot 13 : Spillbay 13 - Water temp=13.0 C								
NL7	16:01	16:17	16	2	ALIVE	A	166	
NL8	16:53	17:14	21	2	ALIVE	A	151	
WF0	7:53	8:05	12	2	ALIVE	A	153	
WF1	7:52	7:59	7	2	ALIVE	A	147	
WF2	7:51	7:57	6	2	ALIVE	A	147	
WF3	7:52	8:02	10	2	ALIVE	A	152	
WF4	7:50	8:15	25	2	ALIVE	A	165	
WF5	7:54	8:15	21	2	ALIVE	A	158	
WF6	7:55	8:13	18	2	ALIVE	A	157	

Appendix Table C-7

Continued.

Fish No.	Time				Fish Data			
	Re-leased	Re-covered	At Large (min.)	No. of Turb-N Tags recovered	Alive/ Dead	Condition Codes	Total Length (mm)	Comments
WF7	7:56	8:02	6	2	ALIVE	A	158	
WF8	7:55	8:07	12	2	ALIVE	A	159	
WF9	7:54	8:10	16	2	ALIVE	A	157	
WH0	8:22	8:28	6	2	ALIVE	A	143	
WH1	8:22	8:26	4	2	ALIVE	A	150	
WH2	8:24	8:30	6	2	ALIVE	A	155	
WH3	8:24	8:32	8	2	ALIVE	A	142	
WH4	8:23	8:28	5	2	ALIVE	A	158	
WH5	8:26	8:33	7	2	ALIVE	A	170	
WH6	8:27	8:43	16	2	ALIVE	A	162	
WH7	8:25	8:34	9	2	ALIVE	A	144	
WH8	8:26	8:31	5	2	ALIVE	A	150	
WH9	8:27	8:35	8	2	ALIVE	A	152	
WJ0	8:49	8:58	9	2	ALIVE	A	143	
WJ1	8:51	8:58	7	2	ALIVE	A	138	
WJ2	8:52	9:05	13	2	ALIVE	EH	153	
WJ3	8:51	8:57	6	2	ALIVE	A	150	
WJ4	8:50	9:02	12	2	ALIVE	A	147	
WJ5	8:55	9:11	16	2	ALIVE	A	140	
WJ6	8:54	8:59	5	2	ALIVE	A	142	
WJ7	8:55	9:12	17	2	ALIVE	A	168	
WJ8	8:53	9:10	17	2	ALIVE	A	143	
WJ9	8:54	9:07	13	2	ALIVE	A	145	
WK0	9:32	9:46	14	2	ALIVE	A	146	
WK1	9:34	9:42	8	2	ALIVE	A	161	
WK2	9:33	9:41	8	2	ALIVE	A	147	
WK3	9:32	9:40	8	2	ALIVE	HG	140	
WK4	9:34	9:42	8	2	ALIVE	A	162	
WK5	9:36	9:44	8	2	ALIVE	A	162	
WK6	9:38	9:52	14	2	ALIVE	A	165	
WK7	9:35	9:44	9	2	ALIVE	A	150	
WK8	9:37	9:54	17	2	ALIVE	A	180	
WK9	9:37	9:44	7	2	ALIVE	A	147	
WL0	10:04	10:09	5	2	ALIVE	A	153	
WL1	10:04	10:11	7	2	ALIVE	A	147	
WL2	10:03	10:11	8	2	ALIVE	A	142	
WL3	10:03	10:10	7	2	ALIVE	A	145	
WL4	10:02	.	.	0	UNKNOWN	X	138	
WL5	10:08	10:32	24	2	ALIVE	A	148	
WL6	10:05	10:13	8	2	ALIVE	A	158	
WL7	10:06	10:14	8	2	ALIVE	A	172	
WL8	10:07	10:15	8	2	ALIVE	A	174	
WL9	10:07	10:14	7	2	ALIVE	A	142	
YA0	10:50	11:10	20	2	ALIVE	A	142	
YA1	10:52	10:59	7	2	ALIVE	A	144	
YA2	10:50	11:04	14	2	ALIVE	A	140	
YA3	10:49	10:57	8	2	ALIVE	A	158	
YA4	10:51	11:02	11	2	ALIVE	A	148	
YA5	10:54	11:07	13	2	ALIVE	A	167	
YA6	10:53	11:07	14	2	ALIVE	A	167	
YA7	10:55	11:12	17	2	ALIVE	A	154	
YA8	10:52	.	.	0	UNKNOWN	X	144	
YA9	10:53	11:09	16	2	ALIVE	A	137	
YB0	11:40	11:56	16	2	ALIVE	A	152	
YB1	11:37	12:07	30	2	ALIVE	A	145	
YB2	11:37	12:05	28	2	ALIVE	A	138	
YB3	11:38	11:54	16	2	ALIVE	A	153	
YB4	11:38	11:58	20	2	ALIVE	A	162	
YB5	11:43	12:03	20	2	ALIVE	A	170	
YB6	11:41	11:50	9	2	ALIVE	A	157	
YB7	11:42	11:59	17	2	ALIVE	A	163	
YB8	11:43	12:04	21	2	ALIVE	A	153	
YB9	11:41	12:01	20	2	ALIVE	A	134	
YC0	12:16	12:37	21	2	ALIVE	A	145	
YC1	12:17	12:37	20	2	ALIVE	A	160	
YC2	12:18	12:26	8	2	ALIVE	A	162	
YC3	12:18	12:30	12	2	ALIVE	A	159	
YC4	12:16	12:21	5	2	ALIVE	A	153	
YC5	12:19	12:26	7	2	ALIVE	A	152	
YC6	12:21	12:33	12	2	ALIVE	A	142	

Appendix Table C-7

Continued.

Fish No.	Time				Fish Data			
	Re-leased	Re-covered	At Large (min.)	No. of Turb-N Tags recovered	Alive/ Dead	Condition Codes	Total Length (mm)	Comments
YC7	12:20	12:29	9	2	ALIVE	A	157	
YC8	12:20	12:32	12	2	ALIVE	A	145	
YC9	12:22	12:35	13	2	ALIVE	A	137	
YD0	12:48	12:54	6	2	ALIVE	A	152	
YD1	12:49	12:55	6	2	ALIVE	A	154	
YD2	12:49	12:56	7	2	ALIVE	A	153	
YD3	12:50	13:09	19	2	ALIVE	A	142	
YD4	12:47	12:52	5	2	ALIVE	A	156	
YD5	12:52	12:57	5	2	ALIVE	A	147	
YD6	12:53	13:00	7	2	ALIVE	A	148	
YD7	12:54	13:03	9	2	ALIVE	A	156	
YD8	12:51	13:02	11	2	ALIVE	A	155	
YD9	12:52	12:59	7	2	ALIVE	A	157	
YE0	13:41	13:55	14	2	ALIVE	A	163	
YE1	13:42	13:51	9	2	ALIVE	HE	138	
YE2	13:42	.	.	0	UNKNOWN	X	171	
YE3	13:43	.	.	0	UNKNOWN	X	167	
YE4	13:43	13:55	12	2	ALIVE	A	162	
YE5	13:44	13:51	7	2	ALIVE	A	167	
YE6	13:46	13:52	6	2	ALIVE	A	189	
YE7	13:45	14:00	15	2	ALIVE	A	157	
YE8	13:44	13:58	14	2	ALIVE	WGH	149	
YE9	13:45	13:51	6	2	ALIVE	A	150	
YF0	14:25	14:38	13	2	ALIVE	A	149	
YF1	14:26	14:36	10	2	ALIVE	A	138	
YF2	14:26	.	.	1	DEAD	L	142	
YF3	14:24	14:37	13	2	ALIVE	A	147	
YF4	14:25	14:30	5	2	ALIVE	A	164	
YF5	14:27	14:34	7	2	ALIVE	A	146	
YF6	14:29	14:37	8	2	ALIVE	A	157	
YF7	14:28	14:41	13	2	ALIVE	A	163	
YF8	14:29	14:45	16	2	ALIVE	A	153	
YF9	14:28	14:44	16	2	ALIVE	A	164	
YH0	15:02	15:10	8	2	ALIVE	A	166	
YH1	15:01	15:12	11	2	ALIVE	A	157	
YH2	15:02	15:24	22	2	ALIVE	A	157	
YH3	15:03	15:16	13	2	ALIVE	A	162	
YH4	15:01	15:17	16	2	ALIVE	A	148	
YH5	15:04	15:21	17	2	ALIVE	A	151	
YH6	15:05	15:18	13	2	ALIVE	A	173	
YH8	15:05	15:21	16	2	ALIVE	A	163	
YH9	15:04	15:20	16	2	ALIVE	A	158	
YJ0	15:59	16:11	12	2	ALIVE	A	146	
YJ2	16:00	16:25	25	2	ALIVE	A	163	
YJ3	16:01	16:12	11	2	ALIVE	A	162	
YJ4	16:00	16:41	41	2	ALIVE	A	152	
YJ5	16:04	16:15	11	2	ALIVE	A	152	
YJ6	16:03	16:19	16	2	ALIVE	A	151	
YJ7	16:03	16:13	10	2	ALIVE	A	158	
YJ8	16:04	16:14	10	2	ALIVE	A	148	
YJ9	16:02	16:21	19	2	ALIVE	HB	182	
YK0	16:48	16:55	7	2	ALIVE	A	157	
YK1	16:49	16:58	9	2	ALIVE	A	157	
YK2	16:50	17:03	13	2	ALIVE	A	162	
YK4	16:50	17:01	11	2	ALIVE	A	158	
YK5	16:51	16:59	8	2	ALIVE	A	169	
YK6	16:51	16:59	8	2	ALIVE	A	168	
YK7	16:52	17:16	24	2	ALIVE	A	157	
YK8	16:52	17:06	14	2	ALIVE	A	167	
YK9	16:53	17:00	7	2	ALIVE	A	168	
27 May 2002 - Testlot 14 : Spillbay 13 - Water temp=13.5 C								
TL1	7:47	7:54	7	2	ALIVE	A	163	
TL2	7:46	8:01	15	2	ALIVE	A	177	
TL3	7:48	7:55	7	2	ALIVE	A	144	
TL4	7:48	8:09	21	2	ALIVE	A	186	
TL5	7:50	7:58	8	2	ALIVE	A	150	
TL6	7:51	8:02	11	2	ALIVE	A	147	

Appendix Table C-7

Continued.

Fish No.	Time			No. of Turb-N Tags recovered	Fish Data			
	Re-leased	Re-covered	At Large (min.)		Alive/ Dead	Condition Codes	Total Length (mm)	Comments
TL7	7:52	8:05	13	2	ALIVE	A	158	
TL8	7:50	7:59	9	2	ALIVE	A	136	
TL9	7:51	8:02	11	2	ALIVE	A	148	
UY0	7:49	7:57	8	2	DEAD	G	156	
Y00	8:17	8:24	7	2	ALIVE	A	163	
Y01	8:16	8:38	22	2	ALIVE	A	152	
Y02	8:18	8:29	11	2	ALIVE	H	138	
Y03	8:15	.	.	0	UNKNOWN	X	146	
Y04	8:17	8:36	19	2	ALIVE	A	145	
Y05	8:19	8:34	15	2	ALIVE	A	174	
Y06	8:20	8:28	8	2	ALIVE	A	147	
Y07	8:20	8:33	13	2	ALIVE	A	148	
Y08	8:19	8:25	6	2	ALIVE	A	167	
Y09	8:21	8:27	6	2	ALIVE	A	141	
Y10	8:54	9:01	7	2	ALIVE	A	157	
Y11	8:55	9:03	8	2	ALIVE	A	152	
Y12	8:55	9:03	8	2	ALIVE	A	156	
Y13	8:54	9:03	9	2	ALIVE	A	142	
Y14	8:56	9:02	6	2	ALIVE	A	160	
Y15	8:57	9:12	15	2	ALIVE	A	151	
Y16	8:57	9:04	7	2	ALIVE	A	158	
Y17	8:59	9:15	16	2	ALIVE	A	153	
Y18	8:58	9:05	7	2	ALIVE	A	153	
Y19	8:58	9:07	9	2	ALIVE	A	172	
Y20	9:24	9:32	8	2	ALIVE	A	159	
Y21	9:25	9:42	17	2	ALIVE	A	152	
Y22	9:23	9:31	8	2	ALIVE	A	146	
Y23	9:23	9:49	26	2	ALIVE	A	147	
Y24	9:24	9:36	12	2	ALIVE	A	153	
Y25	9:27	9:35	8	2	ALIVE	A	158	
Y26	9:27	9:37	10	2	ALIVE	A	153	
Y27	9:26	9:38	12	2	ALIVE	A	153	
Y28	9:28	.	.	0	DEAD	Z	136	
Y29	9:26	9:34	8	2	ALIVE	A	161	
Y30	10:10	10:20	10	2	ALIVE	A	147	
Y31	10:09	10:19	10	2	ALIVE	A	148	
Y32	10:07	10:18	11	2	ALIVE	A	152	
Y33	10:09	10:22	13	2	ALIVE	A	149	
Y34	10:08	10:19	11	2	ALIVE	A	158	
Y35	10:12	10:17	5	2	ALIVE	A	158	
Y36	10:11	10:21	10	2	ALIVE	A	158	
Y37	10:12	10:25	13	2	ALIVE	A	150	
Y38	10:11	10:26	15	2	ALIVE	H	147	
Y39	10:13	10:20	7	2	ALIVE	A	140	
Y40	10:47	10:55	8	2	ALIVE	A	155	
Y41	10:46	.	.	0	DEAD	Z	148	
Y42	10:45	10:55	10	2	ALIVE	A	147	
Y43	10:46	10:51	5	2	ALIVE	A	152	
Y44	10:44	10:53	9	2	ALIVE	A	154	
Y45	10:48	10:56	8	2	ALIVE	A	158	
Y46	10:49	10:59	10	2	ALIVE	A	163	
Y47	10:50	10:57	7	2	ALIVE	A	148	
Y49	10:48	10:56	8	2	ALIVE	A	147	
Y50	11:34	11:40	6	2	ALIVE	A	115	
Y51	11:33	11:45	12	2	ALIVE	A	145	
Y52	11:35	11:52	17	2	ALIVE	A	146	
Y53	11:34	11:43	9	2	ALIVE	A	159	
Y54	11:32	11:53	21	2	ALIVE	A	151	
Y55	11:37	11:48	11	2	ALIVE	A	165	
Y56	11:36	11:50	14	2	ALIVE	A	155	
Y57	11:37	11:51	14	2	ALIVE	A	142	
Y58	11:35	11:47	12	2	ALIVE	A	142	
Y59	11:36	11:54	18	2	ALIVE	A	163	
Y60	12:08	12:16	8	2	ALIVE	A	154	
Y61	12:10	12:23	13	2	ALIVE	A	148	
Y62	12:08	12:20	12	2	ALIVE	A	156	
Y63	12:09	12:18	9	2	ALIVE	A	144	
Y64	12:10	12:24	14	2	ALIVE	A	152	
Y65	12:13	12:26	13	2	ALIVE	A	143	
Y66	12:11	12:17	6	2	ALIVE	A	172	

Appendix Table C-7

Continued.

Fish No.	Time			No. of Turb-N Tags recovered	Fish Data			
	Re-leased	Re-covered	At Large (min.)		Alive/ Dead	Condition Codes	Total Length (mm)	Comments
Y67	12:12	12:26	14	2	ALIVE	A	176	
Y68	12:12	12:23	11	2	ALIVE	A	170	
Y69	12:09	12:23	14	2	ALIVE	A	186	
Y70	12:46	12:51	5	2	ALIVE	A	137	
Y71	12:45	12:58	13	2	ALIVE	A	157	
Y72	12:45	12:59	14	2	ALIVE	A	142	
Y73	12:46	12:52	6	2	ALIVE	A	153	
Y74	12:47	12:54	7	2	ALIVE	A	160	
Y75	12:48	12:54	6	2	ALIVE	A	132	
Y76	12:50	12:54	4	2	ALIVE	A	136	
Y77	12:48	12:53	5	2	ALIVE	A	136	
Y78	12:49	12:54	5	2	ALIVE	A	165	
Y79	12:49	12:56	7	2	ALIVE	A	167	
Y80	13:09	13:14	5	2	ALIVE	A	146	
Y81	13:08	13:14	6	2	ALIVE	A	149	
Y82	13:09	13:13	4	2	ALIVE	A	152	
Y83	13:07	13:12	5	2	ALIVE	A	148	
Y84	13:07	13:11	4	2	ALIVE	A	152	
Y85	13:10	13:19	9	2	ALIVE	A	142	
Y86	13:12	13:16	4	2	ALIVE	A	150	
Y87	13:11	13:16	5	2	ALIVE	A	143	
Y88	13:11	13:15	4	2	ALIVE	A	147	
Y89	13:13	13:17	4	2	ALIVE	A	168	
Y90	13:33	13:37	4	2	ALIVE	A	154	
Y91	13:27	13:40	13	2	ALIVE	A	148	
Y92	13:32	13:37	5	2	ALIVE	A	144	
Y93	13:33	13:41	8	2	ALIVE	A	145	
Y94	13:34	13:40	6	2	ALIVE	A	153	
Y95	13:37	13:42	5	2	ALIVE	A	143	
Y96	13:36	13:53	17	2	ALIVE	A	170	
Y97	13:35	13:40	5	2	ALIVE	A	156	
Y98	13:38	13:54	16	2	ALIVE	A	169	
Y99	13:35	13:40	5	2	ALIVE	A	152	

Appendix Table C-8

Short-term turbine passage survival data on individual chinook salmon released in Spillbays 4, 9 and 11 at the Dalles Dam, August 2002. Fish were tagged with Normandeau's HI-Z Turb-N tags. Description of condition codes and details on injured fish are presented in Table 2-3.

Fish No.	Time			No. of Turb-N Tags recovered	Fish Data			
	Released	Recovered	At Large (min.)		Alive/ Dead	Condition Codes	Total Length (mm)	Comments
15 August 2002 - Testlot 1 : Spillbay 11 - Water temp=21.6 C								
DA0	15:18	.	.	0	TAG & PIN		134	
DA1	16:04	.	.	0	UNKNOWN	X	92	
DA2	16:04	.	.	0	UNKNOWN	X	116	
KT5	14:33	14:39	6	2	ALIVE	A	107	
KT6	14:32	14:37	5	2	ALIVE	H	107	
KT7	14:50	14:56	6	1	ALIVE	BC	131	
KT8	14:50	.	.	0	TAG & PIN		106	
KT9	15:17	15:28	11	2	ALIVE	A	126	
UY2	15:16	15:25	9	2	ALIVE	A	118	
UY3	15:15	15:23	8	2	ALIVE	A	117	
16 August 2002 - Testlot 2 : Control - Water temp=20.5 C								
DA3	13:01	.	.	0	UNKNOWN	X	113	
DB0	8:11	8:20	9	2	ALIVE	A	122	
DB1	8:11	.	.	0	DEAD	LZ	126	
DB2	8:23	.	.	0	TAG & PIN		123	
DB3	8:10	8:14	4	2	ALIVE	A	124	
DB4	8:10	8:16	6	2	ALIVE	A	117	
DB5	8:09	8:21	12	2	ALIVE		112	
DB6	8:22	8:29	7	2	ALIVE	A	127	
DB7	8:21	8:30	9	2	ALIVE	A	111	
DB8	8:21	8:26	5	1	ALIVE	B	110	
DB9	8:20	8:31	11	2	ALIVE	A	113	
DC0	9:06	.	.	0	TAG & PIN		108	
DC1	9:07	.	.	0	TAG & PIN		118	
DC2	9:07	.	.	0	TAG & PIN		107	
DC3	9:05	9:12	7	2	ALIVE	A	100	
DC4	9:06	.	.	0	TAG & PIN		102	
DC5	9:10	.	.	0	TAG & PIN		111	
DC6	9:09	9:15	6	2	ALIVE	A	118	
DC7	9:10	.	.	0	TAG & PIN		107	
DC8	9:09	.	.	0	TAG & PIN		101	
DC9	9:08	9:15	7	2	ALIVE	A	105	
DD0	10:18	10:24	6	2	ALIVE	A	106	
DD1	10:18	.	.	0	DEAD	ZL	103	
DD2	10:16	10:23	7	2	ALIVE	A	126	
DD3	10:17	.	.	0	DEAD	Z	108	
DD4	10:17	10:22	5	2	ALIVE	A	120	
DD5	10:47	10:51	4	2	ALIVE	A	127	
DD6	10:48	10:54	6	2	ALIVE	A	127	
DD7	10:49	.	.	0	UNKNOWN	X	122	
DD8	10:48	10:55	7	2	ALIVE	A	115	
DD9	10:47	10:53	6	2	ALIVE	A	138	
DE0	11:26	11:33	7	2	ALIVE	A	126	
DE1	11:27	11:29	2	2	ALIVE	A	122	
DE2	11:25	.	.	0	DEAD	Z	105	
DE3	11:26	.	.	0	DEAD	Z	115	
DE4	11:25	11:31	6	2	ALIVE	A	127	
DE5	11:28	11:38	10	2	ALIVE	A	104	
DE6	11:08	.	.	0	TAG & PIN		107	
DE7	11:27	.	.	0	DEAD	Z	127	
DE9	11:29	.	.	0	TAG & PIN		113	
DF0	12:08	.	.	0	TAG & PIN		110	
DF1	12:08	12:14	6	2	ALIVE	A	128	
DF2	12:08	12:15	7	2	ALIVE	A	131	
DF3	12:09	.	.	0	TAG & PIN		102	
DF4	12:10	.	.	0	TAG & PIN		102	
DF5	12:11	12:22	11	1	ALIVE	BH	106	
DF6	12:12	12:19	7	2	ALIVE	A	130	
DF7	12:10	12:17	7	2	ALIVE	A	102	
DF8	12:12	.	.	0	TAG & PIN		102	

Appendix Table C-8

Continued.

Fish No.	Time				Fish Data			
	Re-leased	Re-covered	At Large (min.)	No. of Turb-N Tags recovered	Alive/ Dead	Condition Codes	Total Length (mm)	Comments
DF9	12:13	12:19	6	2	ALIVE	A	123	
DH0	13:00	13:07	7	2	ALIVE	A	117	
DH1	12:59	.	.	0	UNKNOWN	X	104	
DH2	12:58	13:05	7	2	ALIVE	A	132	
DH3	13:00	.	.	0	TAG & PIN		123	
DH4	12:59	13:03	4	2	ALIVE	A	135	
DH5	13:03	13:10	7	2	ALIVE	A	147	
DH6	13:03	13:08	5	2	ALIVE	A	107	
DH7	13:02	.	.	0	TAG & PIN		105	
DH8	13:02	13:06	4	2	ALIVE	A	103	
DH9	13:01	.	.	0	UNKNOWN	X	105	
DJ0	13:58	14:24	26	2	ALIVE	A	128	
DJ1	14:00	14:27	27	2	ALIVE	A	122	
DJ2	13:59	14:23	24	2	ALIVE	A	123	
DJ3	14:00	14:17	17	2	ALIVE	A	124	
DJ4	13:59	14:16	17	2	ALIVE	A	118	
DJ5	13:57	14:30	33	2	ALIVE	A	115	
DJ6	13:57	14:11	14	2	ALIVE	A	121	
DJ7	13:56	.	.	0	TAG & PIN		124	
DJ8	13:58	14:07	9	2	ALIVE	A	127	
DJ9	13:56	14:05	9	2	ALIVE	A	113	
DK0	15:12	15:29	17	2	ALIVE	A	105	
DK1	15:13	15:36	23	2	ALIVE	A	114	
DK2	15:11	15:28	17	2	ALIVE	HG	123	
DK3	15:13	15:42	29	2	ALIVE	A	112	
DK4	15:11	15:24	13	1	ALIVE	B	105	
DK5	15:15	15:26	11	2	ALIVE	A	107	
DK6	15:14	15:31	17	2	ALIVE	A	127	
DK7	15:15	15:38	23	2	ALIVE	A	127	
DK8	15:14	15:28	14	2	ALIVE	A	118	
DK9	15:15	15:25	10	2	ALIVE	C	123	
DL0	15:47	16:15	28	2	ALIVE	A	132	
DL1	15:46	16:03	17	1	ALIVE	B	135	
DL2	15:47	16:14	27	2	ALIVE	A	127	
DL4	15:47	16:09	22	2	ALIVE	A	123	
DL5	15:49	15:57	8	2	ALIVE	A	132	
DL6	15:50	16:14	24	2	ALIVE	A	108	
DL7	15:50	16:03	13	2	ALIVE	A	116	
DL8	15:49	16:10	21	2	ALIVE	A	115	
DL9	15:48	16:26	38	2	ALIVE	A	110	
DU0	16:58	.	.	0	UNKNOWN	X	125	
DU1	16:57	17:18	21	2	ALIVE	HM	140	
DU2	16:56	17:12	16	2	ALIVE	A	134	
DU3	16:56	.	.	0	UNKNOWN	X	115	
DU4	16:57	17:11	14	2	ALIVE	MH	129	
DU5	16:59	17:12	13	2	ALIVE	A	135	
DU6	17:00	17:15	15	2	ALIVE	A	113	
DU7	16:59	17:21	22	2	ALIVE	A	110	
DU8	17:00	17:16	16	2	ALIVE	A	135	
DU9	17:00	17:08	8	2	ALIVE	C	128	
DV0	17:43	17:58	15	2	ALIVE	A	126	
DV1	17:42	17:50	8	2	ALIVE	A	133	
DV2	17:43	.	.	0	UNKNOWN	X	125	
DV3	17:44	.	.	0	TAG & PIN		120	
DV4	17:42	17:52	10	2	ALIVE	A	119	
DV5	17:46	17:58	12	2	ALIVE	A	121	
DV6	17:46	17:59	13	2	ALIVE	A	132	
DV7	17:45	18:08	23	2	ALIVE	A	118	
DV8	17:45	17:53	8	2	ALIVE	A	140	
DV9	17:44	18:11	27	2	ALIVE	A	120	
17 August 2002 - Testlot 3 : Control - Water temp=20.0 C								
AA0	15:19	15:26	7	2	ALIVE	A	130	
AA1	15:18	15:25	7	2	ALIVE	A	131	
AA2	15:20	15:28	8	2	ALIVE	A	134	
AA3	15:20	.	.	0	TAG & PIN		123	

Appendix Table C-8

Continued.

Fish No.	Time			No. of Turb-N Tags recovered	Fish Data			
	Re-leased	Re-covered	At Large (min.)		Alive/ Dead	Condition Codes	Total Length (mm)	Comments
AA4	15:19	15:25	6	2	ALIVE	A	128	
AA5	15:25	15:36	11	2	ALIVE	A	125	
AA6	15:22	15:30	8	2	ALIVE	A	127	
AA7	15:23	.	.	0	DEAD	Z	126	
AA8	15:22	15:28	6	2	ALIVE	A	120	
AA9	15:21	15:37	16	2	ALIVE	A	139	
AB0	15:59	16:09	10	2	ALIVE	A	123	
AB1	15:59	16:05	6	2	ALIVE	A	120	
AB2	16:01	16:17	16	2	ALIVE	A	122	
AB3	16:00	16:06	6	2	ALIVE	A	119	
AB4	15:59	16:12	13	2	ALIVE	A	118	
AB5	16:02	16:11	9	2	ALIVE	A	137	
AB6	16:03	16:12	9	2	ALIVE	C	132	
AB7	16:03	16:21	18	2	ALIVE	A	139	
AB8	16:01	16:06	5	2	ALIVE	A	128	
AB9	16:04	.	.	0	DEAD	Z	127	
AC0	16:33	.	.	0	DEAD	ZL	133	
AC1	16:34	16:42	8	2	ALIVE	A	132	
AC2	16:33	16:38	5	2	ALIVE	A	122	
AC3	16:35	16:39	4	2	ALIVE	A	126	
AC4	16:34	16:41	7	2	ALIVE	A	133	
AC5	16:44	16:53	9	2	ALIVE	A	128	
AC6	16:43	16:51	8	2	ALIVE	A	122	
AC7	16:44	.	.	0	TAG & PIN		118	
AC8	16:43	16:47	4	2	ALIVE	A	121	
AC9	16:42	16:49	7	2	DEAD	P	123	
AF0	10:28	11:06	38	2	ALIVE	A	132	
AF1	10:29	10:47	18	2	ALIVE	H	130	
AF2	10:27	11:07	40	2	ALIVE	A	136	
AF3	10:28	10:38	10	2	ALIVE	A	131	
AF4	10:27	10:58	31	2	ALIVE	A	128	
AF5	10:31	10:40	9	2	ALIVE	A	131	
AF6	10:29	.	.	0	DEAD	Z	131	
AF7	10:29	.	.	0	DEAD	ZL	134	
AF8	10:30	.	.	0	DEAD	ZL	133	
AF9	10:30	10:39	9	2	ALIVE	A	127	
AH0	11:57	12:03	6	2	ALIVE	A	132	
AH1	11:59	12:07	8	2	ALIVE	A	127	
AH2	11:58	12:20	22	2	ALIVE	A	126	
AH3	11:59	.	.	0	DEAD	Z	134	
AH4	11:58	12:13	15	2	ALIVE	A	125	
AH5	12:00	.	.	0	DEAD	ZL	122	
AH6	12:01	12:18	17	2	ALIVE	A	116	
AH7	11:59	12:24	25	2	ALIVE	A	122	
AH8	12:00	12:18	18	2	ALIVE	A	122	
AH9	12:01	12:16	15	2	ALIVE	GHW	145	
AJ1	12:49	13:09	20	2	ALIVE	A	122	
AJ2	12:47	.	.	0	DEAD	Z	122	
AJ3	12:48	.	.	0	DEAD	Z	124	
AJ4	12:48	.	.	0	DEAD	ZL	125	
AJ5	12:51	.	.	0	DEAD	Z	121	
AJ6	12:50	12:56	6	2	ALIVE	A	121	
AJ7	12:51	13:10	19	2	ALIVE	A	117	
AJ8	12:50	12:57	7	2	ALIVE	HG	127	
AJ9	12:51	.	.	0	TAG & PIN		128	
AK0	14:00	14:07	7	2	ALIVE	A	122	
AK1	14:00	14:16	16	2	ALIVE	H	120	
AK2	14:01	14:21	20	2	DEAD	P	126	
AK3	14:00	.	.	0	DEAD	Z	127	
AK4	13:59	14:11	12	2	ALIVE	A	126	
AK5	14:04	14:15	11	2	ALIVE	A	124	
AK6	14:02	14:11	9	2	ALIVE	A	125	
AK7	14:04	.	.	0	DEAD	Z	123	
AK8	14:03	14:09	6	2	ALIVE	A	121	
AK9	14:03	.	.	0	DEAD	Z	120	
AL1	14:38	14:55	17	2	ALIVE	A	138	
AL2	14:37	14:43	6	2	ALIVE	A	132	
AL3	14:38	.	.	0	DEAD	Z	117	

Appendix Table C-8

Continued.

Fish No.	Time Released	Time Recovered	At Large (min.)	No. of Turb-N Tags recovered	Fish Data: Alive/ Dead	Condition Codes	Total Length (mm)	Comments
AL4	14:36	14:57	21	2	ALIVE	A	132	
AL5	14:39	.	.	0	TAG & PIN		131	
AL6	14:47	14:57	10	2	ALIVE	A	125	
AL7	14:40	14:48	8	2	ALIVE	A	122	
AL8	14:40	.	.	0	DEAD	ZL	127	
AL9	14:39	14:52	13	2	ALIVE	A	122	
DA4	12:47	12:54	7	2	ALIVE	A	123	
DA5	14:37	14:49	12	2	ALIVE	A	136	
DW0	7:50	7:56	6	2	ALIVE	A	130	
DW1	7:50	.	.	0	DEAD	ZP	127	
DW2	7:51	.	.	0	TAG & PIN		127	
DW3	7:51	8:00	9	2	ALIVE	A	134	
DW4	7:51	7:58	7	2	ALIVE	CH	125	
DW5	7:53	8:01	8	2	ALIVE	A	136	
DW6	7:52	8:00	8	2	ALIVE	A	132	
DW7	7:54	8:11	17	2	ALIVE	A	134	
DW8	7:53	8:07	14	2	ALIVE	A	132	
DW9	7:53	8:02	9	2	ALIVE	A	125	
DX0	8:46	.	.	0	DEAD	ZL	130	
DX1	8:44	8:53	9	2	ALIVE	A	128	
DX2	8:45	8:57	12	2	DEAD	P	121	
DX3	8:45	8:55	10	2	ALIVE	A	118	
DX4	8:46	8:58	12	2	ALIVE	A	123	
DX5	8:49	8:56	7	2	ALIVE	A	131	
DX6	8:48	8:55	7	2	ALIVE	A	127	
DX7	8:47	8:59	12	2	ALIVE	A	115	
DX8	8:48	.	.	0	TAG & PIN		121	
DX9	8:47	8:54	7	2	ALIVE	A	126	
DY0	9:21	9:30	9	2	ALIVE	A	123	
DY1	9:20	9:29	9	2	ALIVE	A	117	
DY2	9:22	.	.	0	TAG & PIN		121	
DY3	9:22	9:29	7	2	ALIVE	A	123	
DY4	9:21	9:28	7	2	ALIVE	A	117	
DY5	9:23	.	.	0	TAG & PIN		116	
DY6	9:24	9:30	6	2	ALIVE	A	136	
DY7	9:24	9:33	9	2	ALIVE	A	131	
DY8	9:25	9:32	7	2	ALIVE	A	126	
DY9	9:23	9:30	7	2	ALIVE	HD	135	
DZ0	9:50	10:20	30	2	DEAD	P	123	
DZ1	9:51	10:13	22	2	ALIVE	A	127	
DZ2	9:49	10:13	24	2	ALIVE	A	127	
DZ3	9:50	10:13	23	2	ALIVE	A	132	
DZ4	9:51	10:13	22	2	ALIVE	A	123	
DZ5	9:52	10:02	10	2	ALIVE	A	134	
DZ6	9:52	9:59	7	2	ALIVE	A	137	
DZ7	9:52	10:13	21	2	ALIVE	A	124	
DZ8	9:53	.	.	0	DEAD	L	130	
DZ9	9:53	10:13	20	2	ALIVE	A	123	
18 August 2002 - Testlot 4 : Spillbay 9 - Water temp=20.5 C								
AD0	8:05	.	.	0	DEAD	Z	126	
AD1	8:05	8:23	18	2	ALIVE	A	144	
AD2	8:05	8:29	24	2	ALIVE	A	132	
AD3	8:05	.	.	0	DEAD	ZL	132	
AD4	8:06	8:12	6	2	ALIVE	A	118	
AD5	8:07	.	.	0	DEAD	L	127	
AD6	8:08	8:15	7	2	ALIVE	A	127	
AD7	8:08	8:33	25	2	ALIVE	A	124	
AD8	8:08	.	.	0	DEAD	ZL	123	
AD9	8:07	.	.	0	DEAD	ZL	137	
AE0	8:59	9:13	14	2	ALIVE	A	122	
AE1	8:57	.	.	0	DEAD	Z	131	
AE2	8:58	.	.	0	DEAD	Z	124	
AE3	8:58	9:13	15	2	ALIVE	A	122	
AE4	8:59	9:11	12	2	ALIVE	H	120	
AE5	9:00	.	.	0	DEAD	Z	123	

Appendix Table C-8

Continued.

Fish No.	Time			No. of Turb-N Tags recovered	Fish Data			
	Re-leased	Re-covered	At Large (min.)		Alive/ Dead	Condition Codes	Total Length (mm)	Comments
AE6	9:02	9:10	8	2	ALIVE	A	121	
AE7	9:02	9:38	36	2	DEAD	P	120	
AE8	9:01	.	.	0	TAG & PIN		121	
AE9	9:01	9:11	10	2	ALIVE	A	156	
C00	14:10	14:33	23	2	ALIVE	A	125	
C01	14:10	14:32	22	2	ALIVE	A	133	
C02	14:12	14:23	11	2	ALIVE	A	132	
C03	14:11	.	.	0	DEAD	ZL	128	
C04	14:10	14:27	17	2	DEAD	P	125	
C05	14:13	.	.	0	DEAD	Z	120	
C06	14:13	14:23	10	2	ALIVE	A	140	
C07	14:13	14:34	21	2	ALIVE	A	128	
C08	14:14	14:48	34	1	ALIVE	B	122	
C09	14:12	14:35	23	2	ALIVE	A	126	
C10	15:24	.	.	0	DEAD	ZL	132	
C11	15:25	15:31	6	2	ALIVE	A	132	
C12	15:25	15:37	12	2	ALIVE	A	136	
C13	15:24	15:31	7	2	ALIVE	A	140	
C14	15:25	15:36	11	2	ALIVE	A	123	
C15	15:30	15:38	8	2	ALIVE	A	127	
C16	15:30	15:40	10	2	ALIVE	A	125	
C17	15:29	15:46	17	2	ALIVE	A	123	
C18	15:30	15:37	7	2	ALIVE	A	130	
C19	15:29	15:35	6	2	ALIVE	A	122	
C20	15:57	16:04	7	2	ALIVE	A	123	
C21	15:57	16:03	6	2	ALIVE	A	124	
C22	15:58	16:04	6	2	ALIVE	A	130	
C23	15:56	16:07	11	2	ALIVE	H	120	
C24	15:57	16:05	8	2	ALIVE	A	122	
C25	16:04	16:11	7	2	ALIVE	A	125	
C26	16:03	.	.	0	UNKNOWN	X	132	
C27	16:04	16:10	6	2	ALIVE	A	146	
C28	16:02	16:11	9	2	ALIVE	A	137	
C29	16:05	.	.	0	DEAD	ZL	123	
C30	16:41	16:46	5	2	ALIVE	A	122	
C31	16:42	16:55	13	2	ALIVE	A	125	
C32	16:40	16:46	6	2	ALIVE	A	126	
C33	16:41	16:47	6	2	ALIVE	A	140	
C34	16:42	16:50	8	2	ALIVE	A	133	
C35	16:45	16:50	5	2	ALIVE	A	124	
C36	16:45	16:52	7	2	ALIVE	A	132	
C37	16:45	16:51	6	2	ALIVE	A	125	
C38	16:46	16:51	5	2	ALIVE	A	126	
C39	16:46	16:54	8	2	ALIVE	A	120	
DA7	11:40	11:48	8	2	ALIVE	A	131	
DA8	13:29	.	.	0	DEAD	L	128	
DM0	10:26	.	.	0	DEAD	ZL	134	
DM1	10:24	10:37	13	2	ALIVE	A	123	
DM2	10:25	10:31	6	2	ALIVE	A	122	
DM3	10:25	10:39	14	2	ALIVE	A	128	
DM4	10:24	.	.	0	UNKNOWN	X	126	
DM5	10:26	10:33	7	2	ALIVE	A	123	
DM6	10:27	.	.	0	UNKNOWN	X	128	
DM7	10:26	10:35	9	2	ALIVE	A	120	
DM8	10:27	10:36	9	2	ALIVE	A	122	
DM9	10:27	10:32	5	2	ALIVE	A	120	
DN0	11:09	11:18	9	2	ALIVE	A	132	
DN1	11:09	11:17	8	2	ALIVE	A	132	
DN2	11:08	11:14	6	2	ALIVE	A	122	
DN3	11:09	11:17	8	2	ALIVE	C	127	
DN4	11:10	11:16	6	2	ALIVE	A	127	
DN5	11:15	11:24	9	2	ALIVE	A	130	
DN6	11:14	11:19	5	2	ALIVE	A	142	
DN7	11:14	11:19	5	2	ALIVE	A	120	
DN8	11:16	11:20	4	2	ALIVE	A	126	
DN9	11:15	11:21	6	2	ALIVE	A	120	
DP0	11:35	.	.	0	DEAD	ZL	128	
DP1	11:36	11:43	7	2	ALIVE	A	128	

Appendix Table C-8

Continued.

Fish No.	Time				Fish Data			
	Re-leased	Re-covered	At Large (min.)	No. of Turb-N Tags recovered	Alive/ Dead	Condition Codes	Total Length (mm)	Comments
DP2	11:37	11:44	7	2	ALIVE	A	123	
DP3	11:36	11:43	7	2	ALIVE	A	121	
DP4	11:36	.	.	0	TAG & PIN		132	
DP5	11:39	11:47	8	2	ALIVE	A	128	
DP6	11:39	11:45	6	2	ALIVE	A	123	
DP7	11:38	11:43	5	2	ALIVE	A	120	
DP9	11:38	.	.	0	DEAD	Z	128	
DR0	12:41	12:49	8	2	ALIVE	A	129	
DR1	12:42	13:10	28	2	ALIVE	A	131	
DR2	12:12	12:48	36	2	ALIVE	A	132	
DR3	12:42	12:53	11	2	ALIVE	A	127	
DR4	12:41	12:56	15	2	ALIVE	A	134	
DR5	12:45	12:57	12	2	ALIVE	A	125	
DR6	12:44	13:18	34	2	ALIVE	A	136	
DR7	12:43	13:00	17	2	ALIVE	A	127	
DR8	12:44	12:53	9	2	ALIVE	A	133	
DR9	12:43	12:53	10	2	ALIVE	H	128	
DS0	13:27	14:35	68	2	ALIVE	A	130	
DS1	13:26	.	.	0	DEAD	ZL	128	
DS2	13:27	13:35	8	2	ALIVE	A	138	
DS3	13:27	13:56	29	2	ALIVE	A	127	
DS4	13:26	13:41	15	2	ALIVE	A	125	
DS6	13:28	.	.	0	DEAD	ZL	134	
DS7	13:29	13:35	6	2	ALIVE	A	127	
DS8	13:29	13:47	18	2	ALIVE	A	133	
DS9	13:29	.	.	0	DEAD	ZPQ	130	
DT0	9:43	9:48	5	2	ALIVE	A	132	
DT1	0:42	.	.	0	TAG & PIN		131	
DT2	9:42	.	.	0	DEAD	Z	128	
DT3	9:41	9:47	6	2	ALIVE	A	122	
DT4	9:41	10:49	68	2	ALIVE	A	127	
DT5	9:44	.	.	0	DEAD	ZL	127	
DT6	9:43	9:57	14	2	ALIVE	A	127	
DT7	9:45	.	.	0	DEAD	Z	131	
DT8	9:44	9:57	13	2	ALIVE	A	133	
DT9	9:45	9:57	12	2	ALIVE	A	129	
19 August 2002 - Testlot 5 : Control - Water temp=21.0 C								
AM0	8:47	8:55	8	2	ALIVE	A	123	
AM1	8:45	8:52	7	2	ALIVE	A	133	
AM2	8:47	8:54	7	2	ALIVE	A	131	
AM3	8:46	8:52	6	2	ALIVE	A	123	
AM4	8:46	8:56	10	2	ALIVE	A	131	
AM5	8:49	8:57	8	2	ALIVE	C	130	
AM6	8:48	8:56	8	2	ALIVE	A	132	
AM7	8:50	.	.	0	DEAD	ZL	178	
AM8	8:48	9:01	13	2	ALIVE	A	121	
AM9	8:49	8:58	9	2	ALIVE	A	128	
AN0	9:22	9:35	13	2	ALIVE	A	120	
AN1	9:23	9:36	13	2	ALIVE	A	120	
AN2	9:22	9:30	8	2	ALIVE	A	120	
AN3	9:21	.	.	0	DEAD	ZL	123	
AN4	9:21	9:27	6	2	ALIVE	H	126	
AN5	9:25	9:34	9	2	ALIVE	A	130	
AN6	9:24	9:30	6	2	ALIVE	A	137	
AN7	9:25	9:33	8	2	ALIVE	C	124	
AN8	9:25	9:32	7	2	ALIVE	A	131	
AN9	9:24	9:29	5	2	ALIVE	A	123	
AP0	9:56	10:14	18	2	ALIVE	A	137	
AP1	9:54	10:03	9	2	ALIVE	A	126	
AP2	9:56	10:10	14	2	ALIVE	A	136	
AP3	9:55	10:08	13	2	ALIVE	A	137	
AP4	9:55	10:04	9	2	ALIVE	A	126	
AP5	9:57	.	.	0	TAG & PIN		137	
AP6	9:59	10:07	8	2	ALIVE	A	121	
AP7	9:57	10:04	7	2	ALIVE	A	127	

Appendix Table C-8

Continued.

Fish No.	Time			No. of Turb-N Tags recovered	Fish Data			
	Re-leased	Re-covered	At Large (min.)		Alive/ Dead	Condition Codes	Total Length (mm)	Comments
AP8	9:58	10:06	8	2	ALIVE	A	127	
AP9	9:58	.	.	0	TAG & PIN		128	
AR0	10:41	10:58	17	2	ALIVE	W	120	
AR1	10:41	.	.	0	UNKNOWN	X	126	
AR2	10:42	10:58	16	2	ALIVE	A	123	
AR3	10:41	10:57	16	2	ALIVE	A	122	
AR4	10:42	10:55	13	2	ALIVE	A	127	
AR5	10:45	.	.	0	TAG & PIN		125	
AR6	10:43	10:57	14	2	ALIVE	A	134	
AR7	10:44	10:56	12	2	ALIVE	A	135	
AR8	10:46	10:56	10	2	ALIVE	A	132	
AR9	10:44	10:54	10	2	ALIVE	A	131	
AS0	11:21	11:33	12	2	ALIVE	A	126	
AS1	11:20	.	.	0	DEAD	QPZ	120	
AS2	11:19	11:27	8	2	ALIVE	A	122	
AS3	11:20	11:37	17	2	ALIVE	A	128	
AS4	11:20	.	.	0	DEAD	ZL	123	
AS5	11:24	11:34	10	2	ALIVE	A	132	
AS6	11:23	11:34	11	2	ALIVE	A	123	
AS7	11:22	11:40	18	2	ALIVE	A	128	
AS8	11:23	11:34	11	2	ALIVE	A	130	
AS9	11:22	11:37	15	2	ALIVE	A	124	
AT0	12:14	12:33	19	2	ALIVE	A	121	
AT1	12:15	12:21	6	2	ALIVE	A	123	
AT2	12:14	.	.	1	TAG & PIN		122	
AT3	12:13	12:19	6	2	ALIVE	A	135	
AT4	12:13	12:18	5	2	ALIVE	A	136	
AT5	12:24	.	.	0	DEAD	ZL	139	
AT6	12:22	12:29	7	2	ALIVE	A	134	
AT7	12:22	12:32	10	2	ALIVE	A	140	
AT8	12:23	.	.	0	DEAD	Z	126	
AT9	12:23	12:31	8	2	ALIVE	A	128	
AU0	13:06	13:12	6	2	ALIVE	A	130	
AU1	13:05	13:10	5	2	ALIVE	A	128	
AU2	13:04	.	.	0	DEAD	ZL	124	
AU3	13:04	.	.	0	DEAD	ZL	122	
AU4	13:05	.	.	0	DEAD	PZ	120	
AU5	13:09	13:22	13	2	ALIVE	A	125	
AU6	13:07	13:14	7	2	ALIVE	A	129	
AU7	13:07	13:14	7	2	ALIVE	A	122	
AU8	13:08	13:17	9	2	ALIVE	A	120	
AU9	13:08	.	.	0	DEAD	ZL	123	
AV0	14:14	14:19	5	2	ALIVE	A	121	
AV1	14:15	14:21	6	2	ALIVE	A	122	
AV2	14:13	14:25	12	2	ALIVE	A	140	
AV3	14:15	.	.	0	DEAD	ZL	121	
AV4	14:14	14:30	16	2	DEAD	JH	121	
AV5	14:18	14:25	7	2	DEAD	JC	121	
AV6	14:18	.	.	0	DEAD	ZL	135	
AV7	14:18	14:30	12	2	DEAD	GW	123	
AV8	14:17	14:23	6	2	ALIVE	A	125	
AV9	14:17	14:24	7	2	ALIVE	A	143	
AW0	14:58	15:10	12	2	ALIVE	A	127	
AW1	14:59	15:17	18	2	ALIVE	A	120	
AW2	15:00	15:11	11	2	DEAD	J	127	
AW3	14:59	.	.	0	DEAD	L	134	
AW4	14:58	15:12	14	2	ALIVE	A	137	
AW5	15:01	15:13	12	2	ALIVE	A	122	
AW6	15:01	.	.	0	DEAD	ZL	133	
AW7	15:02	.	.	0	DEAD	Z	127	
AW8	15:01	15:07	6	2	ALIVE	A	125	
AW9	15:00	15:05	5	2	ALIVE	A	123	
AX0	15:40	15:56	16	2	ALIVE	A	128	
AX1	15:42	15:55	13	2	ALIVE	A	126	
AX2	15:41	15:49	8	2	ALIVE	A	129	
AX3	15:41	15:55	14	2	ALIVE	A	126	
AX4	15:42	15:52	10	2	ALIVE	A	131	
AX5	15:45	.	.	0	DEAD	ZL	131	

Appendix Table C-8

Continued.

Fish No.	Time Released	Time Recovered	At Large (min.)	No. of Turb-N Tags recovered	Fish Data Alive/ Dead	Condition Codes	Total Length (mm)	Comments
AX6	15:44	15:51	7	2	ALIVE	A	120	
AX7	15:43	15:56	13	2	ALIVE	A	120	
AX9	15:43	15:52	9	2	ALIVE	A	126	
AY0	16:30	16:45	15	2	ALIVE	A	122	
AY1	16:29	16:45	16	2	ALIVE	A	127	
AY2	16:28	16:34	6	2	ALIVE	A	126	
AY3	16:29	.	.	0	DEAD	ZL	133	
AY4	16:30	16:36	6	2	ALIVE	A	129	
AY5	16:35	.	.	0	DEAD	ZL	127	
AY6	16:33	.	.	0	DEAD	Z	129	
AY7	16:35	.	.	0	DEAD	ZL	122	
AY8	16:35	.	.	0	DEAD	QP	121	
AY9	16:34	16:45	11	2	ALIVE	A	120	
C40	8:18	8:24	6	2	ALIVE	A	133	
C41	8:18	8:25	7	2	ALIVE	A	131	
C42	8:19	8:25	6	2	ALIVE	A	132	
C43	8:20	8:29	9	2	ALIVE	A	130	
C44	8:19	8:26	7	2	ALIVE	A	124	
C45	8:23	.	.	0	DEAD	Z	123	
C46	8:21	.	.	0	DEAD	ZL	120	
C47	8:22	8:28	6	2	ALIVE	A	132	
C48	8:20	8:27	7	2	ALIVE	A	121	
C49	8:22	8:31	9	2	ALIVE	A	124	
DA9	15:44	15:58	14	2	ALIVE	A	121	
20 August 2002 - Testlot 6 : Spillbay 9 - Water temp=20.0 C								
AZ0	8:18	8:40	22	2	DEAD	HJ	120	
AZ1	8:18	8:37	19	2	ALIVE	A	130	
AZ2	8:18	9:03	45	2	ALIVE	A	124	
AZ3	8:17	8:34	17	2	ALIVE	A	126	
AZ4	8:17	8:30	13	2	ALIVE	C	123	
AZ5	8:19	8:28	9	2	ALIVE	A	124	
AZ6	8:20	8:39	19	2	ALIVE	A	132	
AZ7	8:19	8:35	16	2	ALIVE	A	128	
AZ8	8:21	8:33	12	2	ALIVE	A	120	
AZ9	8:20	8:33	13	2	ALIVE	A	123	
C50	8:59	.	.	0	TAG & PIN		126	
C51	8:58	.	.	0	DEAD	Z	125	
C52	9:00	9:09	9	2	ALIVE	A	120	
C53	8:59	9:20	21	2	ALIVE	A	123	
C54	9:00	.	.	0	TAG & PIN		123	
C55	9:04	9:15	11	2	ALIVE	C	121	
C56	9:04	9:14	10	2	ALIVE	A	120	
C57	9:05	9:25	20	2	DEAD	P	120	
C58	9:05	.	.	0	DEAD	Z	120	
C59	9:04	9:27	23	2	ALIVE	A	138	
C60	9:45	9:55	10	2	ALIVE	A	127	
C61	9:46	.	.	0	TAG & PIN		143	
C62	9:47	9:59	12	2	ALIVE	A	133	
C63	9:47	10:07	20	2	ALIVE	A	124	
C64	9:46	9:54	8	1	ALIVE	HM	120	
C65	9:53	10:09	16	2	ALIVE	A	120	
C66	9:52	9:58	6	2	ALIVE	A	127	
C67	9:51	.	.	0	TAG & PIN		135	
C68	9:51	10:00	9	2	ALIVE	A	126	
C69	9:52	.	.	0	DEAD	L	120	
C70	10:45	10:50	5	2	ALIVE	A	123	
C71	10:44	10:52	8	2	ALIVE	A	136	
C72	10:45	11:05	20	2	ALIVE	C	127	
C73	10:44	10:54	10	2	ALIVE	C	125	
C74	10:43	10:49	6	2	ALIVE	A	127	
C75	10:47	.	.	0	DEAD	Z	123	
C76	10:46	11:20	34	2	ALIVE	A	132	
C77	10:46	.	.	0	DEAD	Z	126	
C78	10:48	10:52	4	2	ALIVE	A	120	
C79	10:47	10:55	8	2	ALIVE	A	132	

Appendix Table C-8

Continued.

Fish No.	Time			No. of Turb-N Tags recovered	Fish Data			
	Re-leased	Re-covered	At Large (min.)		Alive/ Dead	Condition Codes	Total Length (mm)	Comments
C80	11:32	11:36	4	2	ALIVE	A	120	
C81	11:32	11:38	6	2	ALIVE	HC	118	
C82	11:34	11:40	6	2	ALIVE	A	127	
C83	11:33	11:38	5	2	ALIVE	A	124	
C84	11:31	11:42	11	2	ALIVE	B	125	
C85	11:35	11:39	4	2	ALIVE	A	118	
C86	11:35	11:47	12	2	ALIVE	A	128	
C87	11:34	12:00	26	2	ALIVE	A	122	
C88	11:34	11:41	7	2	ALIVE	A	118	
C89	11:34	11:39	5	2	ALIVE	A	120	
C90	12:14	.	.	0	DEAD	ZL	133	
C91	12:15	12:19	4	2	ALIVE	A	121	
C92	12:12	12:19	7	2	ALIVE	A	120	
C93	12:14	12:20	6	2	ALIVE	A	137	
C95	12:13	12:22	9	2	ALIVE	A	123	
C96	12:10	.	.	0	TAG & PIN		127	
C97	12:11	12:26	15	2	ALIVE	H	121	
C98	12:09	12:18	9	2	ALIVE	A	120	
C99	12:11	12:19	8	2	DEAD	HP	124	
LA0	12:11	12:22	11	2	ALIVE	A	122	
ZA0	13:10	13:19	9	2	ALIVE	A	128	
ZA1	13:11	13:22	11	2	ALIVE	A	128	
ZA2	13:10	13:32	22	2	ALIVE	A	144	
ZA3	13:09	.	.	0	DEAD	L	131	
ZA4	13:10	13:19	9	2	ALIVE	A	132	
ZA5	13:11	13:38	27	2	ALIVE	A	126	
ZA6	13:13	.	.	0	DEAD	L	148	
ZA7	13:15	13:35	20	2	ALIVE	A	136	
ZA8	13:12	.	.	0	UNKNOWN	X	137	
ZA9	13:13	13:21	8	2	ALIVE	A	136	
ZB0	13:51	14:15	24	2	ALIVE	A	140	
ZB1	15:51	.	.	0	DEAD	L	121	
ZB2	13:50	13:55	5	2	ALIVE	A	133	
ZB3	13:50	14:08	18	2	ALIVE	A	128	
ZB4	13:51	14:03	12	2	ALIVE	A	121	
ZB5	13:52	.	.	0	DEAD	Z	137	
ZB6	13:53	14:09	16	2	ALIVE	A	132	
ZB7	13:52	14:00	8	2	ALIVE	A	132	
ZB8	13:52	14:03	11	2	ALIVE	A	128	
ZB9	13:15	.	.	0	DEAD	ZL	130	
ZC0	14:53	15:06	13	2	ALIVE	A	129	
ZC1	14:54	15:09	15	2	ALIVE	A	129	
ZC2	14:53	15:08	15	2	ALIVE	A	128	
ZC3	14:52	.	.	0	DEAD	P	136	
ZC4	14:52	.	.	0	TAG & PIN		123	
ZC5	14:55	15:07	12	2	ALIVE	A	118	
ZC6	14:56	15:19	23	2	ALIVE	A	123	
ZC7	14:56	15:04	8	2	DEAD	JCH	122	
ZC8	14:55	15:33	38	2	ALIVE	A	129	
ZC9	14:54	.	.	0	DEAD	ZL	120	
ZD0	16:21	16:32	11	2	ALIVE	A	146	
ZD1	16:22	16:33	11	2	ALIVE	A	123	
ZD2	16:23	16:29	6	2	ALIVE	A	124	
ZD3	16:21	16:25	4	2	ALIVE	A	123	
ZD4	16:22	16:27	5	2	ALIVE	A	124	
ZD5	16:30	16:37	7	2	ALIVE	A	133	
ZD6	16:31	16:40	9	2	ALIVE	A	120	
ZD7	16:29	16:34	5	2	ALIVE	A	128	
ZD8	16:29	.	.	0	DEAD	ZL	123	
ZD9	16:31	16:37	6	2	ALIVE	A	123	
ZE0	16:55	17:06	11	2	ALIVE	A	120	
ZE1	16:54	16:59	5	2	ALIVE	A	118	
ZE2	16:54	16:59	5	2	ALIVE	A	121	
ZE3	16:55	17:05	10	2	ALIVE	A	119	
ZE4	16:55	17:19	24	2	DEAD	P	126	
ZE5	17:10	17:29	19	2	ALIVE	A	131	
ZE6	17:11	17:26	15	2	ALIVE	A	131	
ZE7	17:09	17:24	15	2	ALIVE	A	128	

Appendix Table C-8

Continued.

Fish No.	Time Released	Time Recovered	At Large (min.)	No. of Turb-N Tags recovered	Fish Data Alive/ Dead	Condition Codes	Total Length (mm)	Comments
ZE8	17:09	17:14	5	2	ALIVE	A	122	
ZE9	17:10	17:15	5	2	ALIVE	A	138	
ZF0	17:41	.	.	0	DEAD	ZL	126	
ZF1	17:42	17:49	7	2	ALIVE	A	122	
ZF2	17:40	17:45	5	2	ALIVE	A	125	
ZF3	17:41	17:55	14	2	DEAD	JHD	118	
ZF4	17:41	17:51	10	2	ALIVE	A	127	
ZF5	17:59	18:04	5	2	ALIVE	A	118	
ZF6	17:58	18:04	6	2	ALIVE	A	126	
ZF7	17:58	18:10	12	2	ALIVE	A	123	
ZF8	17:59	.	.	0	TAG & PIN		132	
ZF9	17:58	18:26	28	2	DEAD	P	126	
21 August 2002 - Testlot 7 : Spillbay 9 - Water temp=20.0 C								
KM0	15:37	.	.	0	DEAD	ZL	123	
KM1	15:38	15:53	15	2	ALIVE	A	128	
KM2	15:36	.	.	0	DEAD	ZL	135	
KM3	15:38	15:47	9	2	ALIVE	A	138	
KM4	15:37	.	.	0	DEAD	ZL	136	
KM5	15:41	15:52	11	2	DEAD	P	121	
KM6	15:40	.	.	0	DEAD	ZL	136	
KM7	15:41	.	.	0	DEAD	Z	126	
KM8	15:39	.	.	0	DEAD	Z	128	
KM9	15:40	15:45	5	2	ALIVE	A	150	
KN0	17:05	.	.	0	DEAD	Z	118	
KN1	17:06	17:15	9	1	ALIVE	BC	124	
KN2	17:06	17:12	6	2	ALIVE	A	118	
KN3	17:04	.	.	0	DEAD	ZL	122	
KN4	17:04	17:15	11	2	ALIVE	A	121	
KN5	17:07	17:26	19	2	ALIVE	A	130	
KN6	17:08	.	.	0	DEAD	ZL	133	
KN7	17:08	17:20	12	2	ALIVE	N	126	
KN8	17:07	17:14	7	2	ALIVE	C	126	
KN9	17:07	17:23	16	2	ALIVE	C	128	
KP0	17:40	.	.	0	DEAD	Z	138	
KP1	17:41	17:58	17	2	ALIVE	A	132	
KP2	17:40	17:47	7	2	ALIVE	A	117	
KP3	17:40	17:46	6	2	ALIVE	A	148	
KP4	17:41	.	.	0	TAG & PIN		120	
KP5	17:44	.	.	0	TAG & PIN		130	
KP6	17:44	17:58	14	2	ALIVE	C	121	
KP7	17:42	17:48	6	2	ALIVE	A	118	
KP8	17:43	17:58	15	2	ALIVE	H	120	
KP9	17:45	17:54	9	2	ALIVE	G	131	
LA1	9:09	9:21	12	2	ALIVE	A	141	
LA2	14:35	14:41	6	2	ALIVE	A	126	
LA3	14:58	15:05	7	2	ALIVE	C	123	
LF0	11:44	12:01	17	2	ALIVE	A	133	
LF1	11:45	11:55	10	2	ALIVE	A	133	
LF2	11:44	.	.	0	DEAD	ZL	117	
LF3	11:43	11:59	16	1	ALIVE	BH	128	
LF4	11:43	11:51	8	2	ALIVE	A	122	
LF5	11:47	12:00	13	2	ALIVE	A	127	
LF6	11:45	.	.	0	DEAD	Z	131	
LF7	11:47	11:59	12	2	ALIVE	A	118	
LF8	11:46	11:52	6	2	ALIVE	A	120	
LF9	11:46	11:53	7	2	ALIVE	A	120	
LH0	12:28	12:43	15	2	ALIVE	A	125	
LH1	12:30	12:36	6	1	DEAD	JHB	117	
LH2	12:29	12:37	8	2	ALIVE	A	117	
LH3	12:29	12:39	10	2	ALIVE	A	121	
LH4	12:28	12:37	9	2	ALIVE	A	120	
LH5	12:32	.	.	0	UNKNOWN	X	130	
LH6	12:30	.	.	0	TAG & PIN		127	
LH7	12:30	12:40	10	2	DEAD	JHP	125	
LH8	12:31	12:38	7	2	ALIVE	A	143	

Appendix Table C-8

Continued.

Fish No.	Time			No. of Turb-N Tags recovered	Fish Data			
	Re-leased	Re-covered	At Large (min.)		Alive/ Dead	Condition Codes	Total Length (mm)	Comments
LH9	12:31	12:38	7	2	ALIVE	A	135	
LJ0	13:27	13:31	4	2	ALIVE	A	123	
LJ1	13:27	13:43	16	2	ALIVE	A	117	
LJ2	13:26	13:34	8	2	ALIVE	A	128	
LJ3	13:28	13:39	11	1	ALIVE	HB	128	
LJ4	13:29	13:35	6	1	ALIVE	BH	123	
LJ5	13:30	13:42	12	2	ALIVE	C	143	
LJ6	13:30	13:36	6	2	ALIVE	A	128	
LJ7	13:29	13:36	7	2	ALIVE	A	138	
LJ8	13:30	.	.	0	TAG & PIN		126	
LJ9	13:31	13:38	7	2	ALIVE	A	118	
LK0	13:50	14:03	13	2	DEAD	JA	121	
LK1	13:49	14:01	12	2	ALIVE	A	128	
LK2	13:48	14:04	16	2	ALIVE	A	138	
LK3	13:50	13:54	4	2	ALIVE	A	134	
LK4	13:49	13:55	6	2	ALIVE	A	134	
LK5	13:52	14:08	16	2	ALIVE	A	127	
LK6	13:53	.	.	0	UNKNOWN	X	128	
LK7	13:53	14:09	16	2	ALIVE	A	119	
LK8	13:52	13:59	7	2	ALIVE	A	127	
LK9	13:54	13:59	5	2	ALIVE	A	133	
LL1	14:35	.	.	0	UNKNOWN	X	123	
LL2	14:36	14:43	7	2	ALIVE	A	120	
LL3	14:37	14:56	19	2	ALIVE	A	131	
LL4	14:37	14:53	16	2	ALIVE	A	117	
LL6	14:59	.	.	0	DEAD	ZL	123	
LL7	14:58	15:03	5	2	ALIVE	A	122	
LL8	14:59	15:11	12	2	ALIVE	A	122	
LL9	14:59	15:05	6	2	DEAD	JHP	127	
ZH0	8:24	.	.	0	UNKNOWN	X	132	
ZH1	8:25	.	.	0	UNKNOWN	X	133	
ZH2	8:24	8:35	11	2	DEAD	E	137	
ZH3	8:26	8:47	21	2	ALIVE	A	127	
ZH4	8:25	8:38	13	2	ALIVE	A	133	
ZH5	8:26	8:44	18	2	ALIVE	A	124	
ZH6	8:27	8:43	16	2	ALIVE	A	137	
ZH7	8:29	8:36	7	2	ALIVE	A	131	
ZH8	8:28	8:46	18	2	ALIVE	A	125	
ZH9	8:28	8:37	9	2	ALIVE	A	122	
ZJ0	9:07	9:21	14	2	ALIVE	A	130	
ZJ1	9:05	9:24	19	2	ALIVE	A	128	
ZJ2	9:06	9:30	24	2	ALIVE	A	143	
ZJ3	9:05	9:13	8	2	ALIVE	A	120	
ZJ4	9:07	9:24	17	2	ALIVE	A	122	
ZJ5	9:10	9:25	15	2	ALIVE	A	130	
ZJ6	9:09	9:21	12	2	ALIVE	A	130	
ZJ8	9:08	9:20	12	2	ALIVE	A	125	
ZJ9	9:08	9:27	19	2	ALIVE	A	120	
ZK0	9:39	.	.	0	DEAD	ZL	136	
ZK1	9:40	9:59	19	2	ALIVE	A	137	
ZK2	9:40	9:49	9	2	ALIVE	A	134	
ZK3	9:39	9:51	12	2	ALIVE	A	128	
ZK4	9:44	.	.	0	DEAD	ZL	125	
ZK5	9:41	9:50	9	2	ALIVE	A	129	
ZK6	9:43	.	.	0	TAG & PIN		120	
ZK7	9:42	9:49	7	2	ALIVE	A	132	
ZK8	9:42	9:53	11	2	ALIVE	A	128	
ZK9	9:42	9:59	17	2	ALIVE	A	130	
ZL0	10:55	11:00	5	2	ALIVE	A	127	
ZL1	10:55	11:30	35	2	DEAD	P	128	
ZL2	10:55	.	.	0	TAG & PIN		118	
ZL3	10:56	.	.	0	TAG & PIN		132	
ZL4	10:54	11:00	6	2	ALIVE	A	119	
ZL5	10:58	11:00	2	2	ALIVE	A	120	
ZL6	10:58	.	.	0	DEAD	L	130	
ZL7	10:57	11:03	6	2	ALIVE	A	138	
ZL8	10:57	.	.	0	DEAD	ZL	126	
ZL9	10:58	11:05	7	2	ALIVE	A	140	

Appendix Table C-8

Continued.

Fish No.	Time Released	Time Recovered	At Large (min.)	No. of Turb-N Tags recovered	Fish Data: Alive/ Dead	Condition Codes	Total Length (mm)	Comments
22 August 2002 - Testlot 8 : Spillbay 9 - Water temp=19.5 C								
KR1	10:41	.	.	0	TAG & PIN		124	
KS0	12:58	13:11	13	2	ALIVE	A	127	
KS1	12:58	13:04	6	2	DEAD	AJ	121	
KS2	12:59	13:09	10	2	ALIVE	A	134	
KS3	12:57	13:03	6	2	ALIVE	A	122	
KS4	12:59	13:08	9	2	ALIVE	A	131	
KS5	13:00	13:14	14	2	DEAD	P	133	
KS6	13:00	13:09	9	2	ALIVE	A	128	
KS7	13:01	13:18	17	2	ALIVE	A	136	
KS8	13:01	13:11	10	2	ALIVE	A	126	
KS9	13:00	.	.	0	TAG & PIN		137	
KT0	13:34	13:41	7	2	ALIVE	A	131	
KT1	13:33	13:43	10	2	ALIVE	A	131	
KT2	13:35	13:46	11	2	ALIVE	A	121	
KT3	13:35	13:52	17	2	ALIVE	A	137	
KT4	13:34	.	.	0	UNKNOWN	X	130	
KT5	13:36	13:43	7	2	ALIVE	A	120	
KT6	13:37	.	.	0	DEAD	Z	134	
KT7	13:37	.	.	0	TAG & PIN		128	
KT8	13:36	13:50	14	2	ALIVE	A	135	
KT9	13:38	13:48	10	2	ALIVE	A	127	
KU0	7:31	7:44	13	2	ALIVE	C	136	
KU1	7:32	7:41	9	2	ALIVE	H	138	
KU2	7:30	8:04	34	2	ALIVE	A	135	
KU3	7:30	7:42	12	2	ALIVE	A	144	
KU4	7:31	7:32	1	2	ALIVE	A	136	
KU5	7:35	.	.	0	DEAD	L	126	
KU6	7:34	7:53	19	2	ALIVE	A	126	
KU7	7:33	.	.	0	DEAD	ZL	144	
KU8	7:33	7:51	18	2	ALIVE	A	136	
KU9	7:34	7:51	17	2	ALIVE	A	147	
KV0	8:21	8:31	10	2	ALIVE	A	128	
KV1	8:21	8:34	13	2	ALIVE	A	137	
KV2	8:20	8:31	11	2	DEAD	HJ	140	
KV3	8:22	8:40	18	2	ALIVE	A	128	
KV4	8:20	.	.	0	TAG & PIN		136	
KV5	8:23	.	.	0	DEAD	Z	128	
KV6	8:24	8:35	11	2	ALIVE	A	143	
KV7	8:23	8:45	22	2	ALIVE	A	137	
KV8	8:22	8:37	15	1	ALIVE	B	131	
KV9	8:23	8:30	7	2	ALIVE	A	142	
KW0	9:00	9:12	12	2	ALIVE	A	126	
KW1	8:59	.	.	0	TAG & PIN		133	
KW2	8:59	9:12	13	2	ALIVE	A	143	
KW3	9:00	.	.	0	DEAD	Z	126	
KW4	8:59	9:07	8	2	ALIVE	A	123	
KW5	9:03	.	.	0	DEAD	Z	120	
KW6	9:04	9:20	16	2	ALIVE	GHE	121	
KW7	9:03	.	.	0	TAG & PIN		133	
KW8	9:04	9:11	7	2	ALIVE	A	128	
KW9	9:02	9:23	21	2	DEAD	AJ	141	
KX0	9:42	.	.	0	DEAD	Z	121	
KX1	9:43	.	.	0	TAG & PIN		143	
KX2	9:42	.	.	0	TAG & PIN		126	
KX3	9:43	10:07	24	2	ALIVE	A	126	
KX4	9:43	.	.	0	TAG & PIN		126	
KX5	9:44	10:17	33	2	ALIVE	A	132	
KX6	9:44	9:54	10	2	DEAD	JHG	131	
KX7	9:45	9:55	10	2	ALIVE	A	128	
KX8	9:46	10:05	19	2	DEAD	JBH	124	
KX9	9:46	10:00	14	2	ALIVE	A	131	
KY0	10:38	10:51	13	2	ALIVE	A	122	
KY1	10:39	11:07	28	2	DEAD	P	123	
KY2	10:38	10:54	16	2	ALIVE	A	118	
KY3	10:39	.	.	0	DEAD	Z	117	

Appendix Table C-8

Continued.

Fish No.	Time Re-leased	Time Re-covered	Time At Large (min.)	No. of Turb-N Tags recovered	Fish Data Alive/ Dead	Fish Data Condition Codes	Fish Data Total Length (mm)	Fish Data Comments
KY4	10:40	.	.	0	TAG & PIN		123	
KY5	10:42	.	.	0	UNKNOWN	X	123	
KY7	10:41	11:03	22	1	DEAD	BP	128	
KY8	10:40	.	.	0	TAG & PIN		128	
KY9	10:42	10:51	9	2	ALIVE	A	148	
KZ0	11:37	.	.	0	DEAD	Z	117	
KZ1	11:36	.	.	0	DEAD	Z	122	
KZ2	11:36	.	.	0	DEAD	Z	120	
KZ3	11:35	.	.	0	TAG & PIN		127	
KZ4	11:36	.	.	0	DEAD	ZL	144	
KZ5	11:40	11:49	9	2	DEAD	PHJ	124	
KZ6	11:40	.	.	0	DEAD	Z	126	
KZ7	11:38	.	.	0	DEAD	Z	136	
KZ8	11:39	.	.	0	TAG & PIN		128	
KZ9	11:39	11:56	17	2	DEAD	JH	128	
Y50	14:13	14:27	14	2	ALIVE	A	123	
Y51	14:14	14:20	6	2	ALIVE	A	120	
Y52	14:14	14:18	4	2	ALIVE	A	118	
Y53	14:15	14:22	7	2	ALIVE	A	120	
Y54	14:14	14:22	8	2	ALIVE	A	118	
Y55	14:16	14:25	9	2	ALIVE	A	130	
Y56	14:16	14:26	10	2	ALIVE	A	118	
Y57	14:17	14:29	12	2	ALIVE	A	129	
Y58	14:17	14:33	16	2	DEAD	AJ	140	
Y59	14:16	14:24	8	2	ALIVE	A	136	
Y60	15:01	15:08	7	2	ALIVE	A	132	
Y61	15:01	15:22	21	2	ALIVE	A	134	
Y62	15:00	.	.	0	TAG & PIN		124	
Y63	15:00	16:00	60	2	DEAD	P	127	
Y64	14:59	15:07	8	2	ALIVE	A	136	
Y65	15:02	15:09	7	2	ALIVE	A	133	
Y66	15:03	15:18	15	2	ALIVE	A	127	
Y67	15:02	15:13	11	2	ALIVE	C	133	
Y68	15:03	15:10	7	2	ALIVE	A	125	
Y69	15:02	15:16	14	2	ALIVE	A	120	
Y70	15:43	15:49	6	2	ALIVE	A	134	
Y71	15:43	15:51	8	2	DEAD	AJ	133	
Y72	15:44	15:54	10	2	DEAD	HJ	120	
Y73	15:44	15:56	12	2	ALIVE	A	147	
Y74	15:42	.	.	0	DEAD	Z	122	
Y75	15:45	15:52	7	2	ALIVE	A	146	
Y76	15:46	16:01	15	2	ALIVE	A	126	
Y77	15:46	.	.	0	TAG & PIN		121	
Y78	15:45	15:57	12	2	ALIVE	A	142	
Y79	15:45	.	.	0	UNKNOWN	X	125	
Y80	16:37	.	.	0	TAG & PIN		124	
Y81	16:38	16:46	8	2	ALIVE	A	125	
Y82	16:38	16:47	9	2	ALIVE	A	125	
Y83	16:37	.	.	0	TAG & PIN		122	
Y84	16:37	.	.	0	UNKNOWN	X	119	
Y85	16:39	16:48	9	2	ALIVE	A	119	
Y86	16:39	16:45	6	2	ALIVE	A	132	
Y87	16:40	16:54	14	2	ALIVE	A	135	
Y88	16:40	16:47	7	2	DEAD	AJ	136	
Y89	16:39	16:53	14	2	ALIVE	A	127	
24 August 2002 - Testlot 9 : Sluice - Water temp=21.0 C								
KR2	10:03	10:12	9	2	ALIVE	A	116	
KR3	10:03	10:15	12	2	ALIVE	A	117	
KR4	11:08	11:22	14	2	ALIVE	A	131	
LA4	8:07	8:18	11	2	ALIVE	H	121	
LA5	15:25	15:31	6	2	ALIVE	A	110	
LA6	15:26	15:36	10	2	ALIVE	A	115	
UA0	12:52	12:59	7	2	ALIVE	A	113	
UA1	12:51	12:57	6	2	ALIVE	A	116	
UA2	12:53	.	.	0	TAG & PIN		113	

Appendix Table C-8

Continued.

Fish No.	Time			No. of Turb-N Tags recovered	Fish Data			
	Re-leased	Re-covered	At Large (min.)		Alive/ Dead	Condition Codes	Total Length (mm)	Comments
UA3	12:53	13:07	14	2	ALIVE	A	118	
UA4	12:51	12:58	7	2	ALIVE	A	114	
UA5	12:56	13:01	5	2	ALIVE	A	115	
UA6	12:55	13:02	7	2	ALIVE	A	110	
UA7	12:56	14:38	102	2	ALIVE	H	111	
UA8	12:55	13:06	11	2	ALIVE	A	120	
UA9	12:54	.	.	0	UNKNOWN	X	142	
UB0	13:30	13:53	23	2	ALIVE	A	111	
UB1	13:29	13:49	20	2	ALIVE	A	123	
UB2	13:32	13:51	19	2	ALIVE	A	119	
UB3	13:33	13:39	6	2	ALIVE	A	125	
UB4	13:31	13:40	9	2	ALIVE	A	124	
UB5	13:35	13:41	6	2	ALIVE	A	115	
UB6	13:37	13:48	11	2	ALIVE	C	126	
UB7	13:38	13:47	9	2	ALIVE	H	145	
UB8	13:37	13:44	7	2	ALIVE	C	136	
UB9	13:36	13:46	10	2	ALIVE	A	112	
UC0	14:06	14:14	8	2	ALIVE	A	112	
UC1	14:05	.	.	0	UNKNOWN	X	116	
UC2	14:07	14:21	14	2	ALIVE	A	128	
UC3	14:07	14:17	10	2	ALIVE	A	123	
UC4	14:09	14:16	7	2	ALIVE	A	137	
UC5	14:11	14:24	13	2	ALIVE	A	111	
UC6	14:12	14:22	10	2	ALIVE	C	131	
UC7	14:11	14:16	5	2	ALIVE	A	118	
UC8	14:10	14:23	13	2	ALIVE	A	112	
UC9	14:10	14:17	7	2	ALIVE	A	118	
UD0	14:47	14:53	6	2	ALIVE	A	125	
UD1	14:47	14:56	9	2	ALIVE	A	116	
UD2	14:46	15:08	22	2	ALIVE	A	117	
UD3	14:45	14:55	10	2	ALIVE	A	118	
UD4	14:45	14:52	7	2	ALIVE	A	112	
UD5	14:50	15:02	12	2	ALIVE	A	111	
UD6	14:49	14:59	10	2	ALIVE	A	115	
UD7	14:48	15:02	14	2	ALIVE	A	110	
UD8	14:51	15:03	12	2	ALIVE	A	121	
UD9	14:51	15:00	9	2	ALIVE	C	125	
UE0	15:20	15:25	5	2	ALIVE	A	134	
UE1	15:17	15:23	6	2	ALIVE	A	110	
UE2	15:18	15:30	12	2	ALIVE	A	112	
UE3	15:20	15:26	6	2	ALIVE	A	128	
UE4	15:21	15:41	20	2	ALIVE	A	120	
UE5	15:24	15:41	17	2	ALIVE	A	116	
UE6	15:24	15:31	7	2	ALIVE	A	111	
UE7	15:22	15:43	21	2	ALIVE	A	123	
UE8	15:23	15:30	7	2	ALIVE	A	115	
UE9	15:23	15:34	11	2	ALIVE	A	116	
Y00	8:09	8:21	12	2	ALIVE	A	138	
Y01	8:09	8:45	36	2	ALIVE	A	125	
Y03	8:10	8:14	4	2	ALIVE	A	120	
Y04	8:08	8:17	9	2	ALIVE	A	126	
Y05	8:20	8:33	13	2	ALIVE	A	117	
Y07	8:19	8:30	11	2	ALIVE	A	122	
Y08	8:20	8:36	16	2	ALIVE	A	113	
Y09	8:18	8:27	9	2	ALIVE	A	118	
Y10	8:55	9:13	18	2	ALIVE	A	114	
Y11	8:56	.	.	0	DEAD	LZ	115	
Y12	8:55	9:46	51	2	ALIVE	A	117	
Y13	8:56	9:12	16	2	ALIVE	A	117	
Y14	8:57	9:09	12	2	ALIVE	A	123	
Y15	9:23	9:36	13	2	ALIVE	A	124	
Y16	9:20	9:25	5	2	ALIVE	A	130	
Y17	9:21	9:30	9	2	ALIVE	A	125	
Y18	9:22	9:33	11	2	ALIVE	A	125	
Y19	9:22	9:30	8	2	ALIVE	C	132	
Y20	10:01	10:05	4	2	ALIVE	A	122	
Y21	10:00	10:07	7	2	ALIVE	A	122	
Y22	9:59	10:04	5	2	ALIVE	A	118	

Appendix Table C-8

Continued.

Fish No.	Time			No. of Turb-N Tags recovered	Fish Data			
	Re-leased	Re-covered	At Large (min.)		Alive/ Dead	Condition Codes	Total Length (mm)	Comments
Y23	9:59	10:05	6	2	ALIVE	A	118	
Y24	10:00	10:07	7	2	ALIVE	A	120	
Y25	10:04	10:09	5	2	ALIVE	A	121	
Y26	10:04	10:17	13	2	ALIVE	A	118	
Y28	10:03	10:08	5	2	ALIVE	A	119	
Y30	10:27	.	.	0	TAG & PIN		115	
Y31	10:28	10:39	11	2	ALIVE	A	111	
Y32	10:28	10:46	18	2	ALIVE	A	113	
Y33	10:26	10:48	22	2	ALIVE	A	114	
Y34	10:26	10:39	13	2	ALIVE	A	133	
Y35	10:32	10:45	13	2	ALIVE	A	135	
Y36	10:32	.	.	0	DEAD	ZL	114	
Y37	10:31	10:42	11	2	ALIVE	A	137	
Y38	10:30	10:42	12	2	ALIVE	A	120	
Y39	10:30	10:38	8	2	ALIVE	A	117	
Y40	11:04	11:13	9	2	ALIVE	A	115	
Y41	11:04	.	.	0	DEAD	ZL	128	
Y42	11:06	11:13	7	2	ALIVE	A	132	
Y44	11:05	11:21	16	2	ALIVE	A	123	
Y45	11:10	11:15	5	2	ALIVE	A	118	
Y46	11:09	11:25	16	2	ALIVE	A	130	
Y47	11:07	.	.	0	TAG & PIN		122	
Y49	11:09	11:18	9	2	ALIVE	A	119	
Y90	11:53	12:02	9	2	ALIVE	A	124	
Y91	11:52	12:08	16	2	ALIVE	A	112	
Y92	11:51	12:10	19	2	ALIVE	A	114	
Y93	11:51	12:15	24	2	ALIVE	A	117	
Y94	11:53	12:00	7	2	ALIVE	A	112	
Y95	12:05	.	.	0	UNKNOWN	X	113	
Y96	11:55	12:03	8	2	ALIVE	A	120	
Y97	12:04	12:29	25	2	ALIVE	H	115	
Y98	11:56	12:06	10	2	ALIVE	A	122	
Y99	12:06	12:12	6	2	ALIVE	A	119	

APPENDIX D

STATISTICAL OUTPUTS

Appendix D

One hour survival estimates for juvenile chinook salmon released through The Dalles Dam Spillbays 4, 9, and 13, May 2002.

RESULTS FOR FULL MODEL (UNEQUAL LIVE/DEAD RECOVERY)

	estim. (std. err.)	
S1 =	0.9886 (0.0073)	Control group survival
Pa =	0.9895 (0.0087)	Live recovery probability
Pd =	0.6129 (0.1411)	Dead recovery probability
S2 =	0.9636 (0.0129)	Spillbay 4 survival
S3 =	0.9650 (0.0152)	Spillbay 9 survival
S4 =	0.9274 (0.0160)	Spillbay 13 survival

* -- Because of constraints in the data set, this probability is assumed equal to 1.0; not estimated.

log-likelihood : -356.1245

Tau =	0.9747 (0.0127)	Spillbay 4/Control ratio
Tau =	0.9761 (0.0141)	Spillbay 9/Control ratio
Tau =	0.9381 (0.0156)	Spillbay 13/Control ratio

Log likelihood statistic for the equality of equal turbine survivals: 6.2958

Chi-squared distribution with 2 d.f., p-value: 0.0429

Confidence intervals:

	Spillbay 4 Tau	Spillbay 9 Tau	Spillbay 13 Tau
90 percent:	(0.9538, 0.9955)	(0.9528, 0.9993)	(0.9123, 0.9638)
95 percent:	(0.9498, 0.9995)	(0.9484, 1.0038)	(0.9074, 0.9687)
99 percent:	(0.9421, 1.0073)	(0.9397, 1.0125)	(0.8978, 0.9784)

==========

RESULTS FOR REDUCED MODEL (EQUAL LIVE/DEAD RECOVERY)

	estim. (std. err.)	
S1 =	0.9923 (0.0044)	Control group survival
Pa = Pd	0.9748 (0.0039)	Recovery probability
S2 =	0.9764 (0.0078)	Spillbay 4 survival
S3 =	0.9818 (0.0068)	Spillbay 9 survival
S4 =	0.9514 (0.0109)	Spillbay 13 survival

* -- Because of constraints in the data set, this probability is assumed equal to 1.0; not estimated.

log-likelihood : -357.8991

Tau =	0.9840 (0.0090)	Spillbay 4/Control ratio
Tau =	0.9894 (0.0082)	Spillbay 9/Control ratio
Tau =	0.9588 (0.0118)	Spillbay 13/Control ratio

Log likelihood statistic for the equality of equal turbine survivals: 6.6318

Chi-squared distribution with 2 d.f., p-value: 0.0363

Confidence intervals:

	Spillbay 4 Tau	Spillbay 9 Tau	Spillbay 13 Tau
90 percent:	(0.9693, 0.9988)	(0.9759, 1.0028)	(0.9394, 0.9781)
95 percent:	(0.9664, 1.0016)	(0.9734, 1.0054)	(0.9357, 0.9818)
99 percent:	(0.9609, 1.0071)	(0.9683, 1.0104)	(0.9285, 0.9891)

==========

Likelihood ratio statistic for equality of recovery probabilities: 3.5492

Chi-squared distribution with 1 d.f., p-value: 0.0596

Appendix D

48 h survival estimates for juvenile chinook salmon released through The Dalles Dam Spillbays 4, 9, and 13, May 2002.

RESULTS FOR FULL MODEL (UNEQUAL LIVE/DEAD RECOVERY)

	estim.	std. err.	
S1 =	0.9895	(0.0064)	Control group survival
Pa =	0.9894	(0.0072)	Live recovery probability
Pd =	0.6997	(0.1025)	Dead recovery probability
S2 =	0.9534	(0.0130)	Spillbay 4 survival
S3 =	0.9489	(0.0146)	Spillbay 9 survival
S4 =	0.9077	(0.0165)	Spillbay 13 survival

* -- Because of constraints in the data set, this probability is assumed equal to 1.0; not estimated.

log-likelihood : -413.9198

Tau =	0.9635	(0.0133)	Spillbay 4/Control ratio
Tau =	0.9590	(0.0145)	Spillbay 9/Control ratio
Tau =	0.9173	(0.0167)	Spillbay 13/Control ratio

Log likelihood statistic for the equality of equal turbine survivals: 7.2617

Chi-squared distribution with 2 d.f., p-value: 0.0265

Confidence intervals:

	Spillbay 4 Tau	Spillbay 9 Tau	Spillbay 13 Tau
90 percent:	(0.9416, 0.9854)	(0.9351, 0.9828)	(0.8899, 0.9448)
95 percent:	(0.9374, 0.9896)	(0.9305, 0.9874)	(0.8846, 0.9500)
99 percent:	(0.9292, 0.9978)	(0.9216, 0.9963)	(0.8744, 0.9603)

==========

RESULTS FOR REDUCED MODEL (EQUAL LIVE/DEAD RECOVERY)

	estim.	std. err.	
S1 =	0.9923	(0.0044)	Control group survival
Pa = Pd	0.9748	(0.0039)	Recovery probability
S2 =	0.9660	(0.0093)	Spillbay 4 survival
S3 =	0.9661	(0.0092)	Spillbay 9 survival
S4 =	0.9309	(0.0128)	Spillbay 13 survival

* -- Because of constraints in the data set, this probability is assumed equal to 1.0; not estimated.

log-likelihood : -416.0384

Tau =	0.9735	(0.0103)	Spillbay 4/Control ratio
Tau =	0.9736	(0.0103)	Spillbay 9/Control ratio
Tau =	0.9382	(0.0136)	Spillbay 13/Control ratio

Log likelihood statistic for the equality of equal turbine survivals: 6.9097

Chi-squared distribution with 2 d.f., p-value: 0.0316

Confidence intervals:

	Spillbay 4 Tau	Spillbay 9 Tau	Spillbay 13 Tau
90 percent:	(0.9565, 0.9904)	(0.9568, 0.9905)	(0.9158, 0.9605)
95 percent:	(0.9533, 0.9937)	(0.9535, 0.9938)	(0.9115, 0.9648)
99 percent:	(0.9469, 1.0000)	(0.9472, 1.0001)	(0.9032, 0.9731)

==========

Likelihood ratio statistic for equality of recovery probabilities: 4.2372

Chi-squared distribution with 1 d.f., p-value: 0.0394

Appendix D

Clean fish /maladies of juvenile chinook salmon released through Spillbay 4 at the Dalles Dam, May 2002. Control fish examined: 390, fish with maladies due to passage: 4. Test fish examined: 378, fish with maladies due to passage: 25.

RESULTS FOR FULL MODEL (UNEQUAL LIVE/DEAD RECOVERY)

	estim.	std. err.	
S =	0.9897	(0.0051)	Control group fish without maladies
Pa =	1.0	N/A	Live recovery probability*
Pd =	1.0	N/A	Dead recovery probability*
Tau =	0.9435	(0.0138)	Spillbay 4 fish without maladies
1-Tau =	0.0565	(0.0138)	Spillbay 4 fish with maladies

* -- Because of constraints in the data set, this probability is assumed equal to 1.0; not estimated.

log-likelihood : -114.353712

Variance-Covariance matrix for estimated probabilities:
0.00003 -0.00002
-0.00002 0.00019

Profile likelihood intervals:

	Spillbay 4 fish without maladies	Spillbay 4 fish with maladies
90 percent:	(0.9192, 0.9650)	(0.0350, 0.0808)
95 percent:	(0.9141, 0.9690)	(0.0310, 0.0859)
99 percent:	(0.9038, 0.9768)	(0.0232, 0.0962)

==========

RESULTS FOR REDUCED MODEL (EQUAL LIVE/DEAD RECOVERY)

	estim.	std. err.	
S =	0.9897	(0.0051)	Control group fish without maladies
Pa = Pd	1.0	N/A	Recovery probability*
Tau =	0.9435	(0.0138)	Spillbay 4 fish without maladies – clean fish
1-Tau =	0.0565	(0.0138)	Spillbay 4 fish with maladies

* -- Because of constraints in the data set, this probability is assumed equal to 1.0; not estimated.

log-likelihood : -114.353712

Variance-Covariance matrix for estimated probabilities:
0.00003 -0.00002
-0.00002 0.00019

Profile likelihood intervals:

	Spillbay 4 fish without maladies	Spillbay 4 fish with maladies
90 percent:	(0.9192, 0.9650)	(0.0350, 0.0808)
95 percent:	(0.9141, 0.9690)	(0.0310, 0.0859)
99 percent:	(0.9038, 0.9768)	(0.0232, 0.0962)

==========

Likelihood ratio statistic for equality of recovery probabilities: 0.000000

Compare with quantiles of the chi-squared distribution with 1 d.f.:
For significance level 0.10: 2.706
For significance level 0.05: 3.841
For significance level 0.01: 6.635

Appendix D

Clean fish/ maladies of juvenile chinook salmon released through Spillbay 9 at the Dalles Dam, May 2002. Control fish examined: 390, fish with maladies due to passage: 4. Test fish examined: 378, fish with maladies due to passage: 25.

RESULTS FOR FULL MODEL (UNEQUAL LIVE/DEAD RECOVERY)

	estim.	std. err.	
S =	0.9897	(0.0051)	Control group fish without maladies
Pa =	1.0	N/A	Live recovery probability*
Pd =	1.0	N/A	Dead recovery probability*
Tau =	0.9435	(0.0138)	Spillbay 9 fish without maladies
1-Tau =	0.0565	(0.0138)	Spillbay 9 fish with maladies

* -- Because of constraints in the data set, this probability is assumed equal to 1.0; not estimated.

log-likelihood : -114.353712

Variance-Covariance matrix for estimated probabilities:
0.00003 -0.00002
-0.00002 0.00019

Profile likelihood intervals:

	Spillbay 9 fish without maladies	Spillbay 9 fish with maladies
90 percent:	(0.9192, 0.9650)	(0.0350, 0.0808)
95 percent:	(0.9141, 0.9690)	(0.0310, 0.0859)
99 percent:	(0.9038, 0.9768)	(0.0232, 0.0962)

==========

RESULTS FOR REDUCED MODEL (EQUAL LIVE/DEAD RECOVERY)

	estim.	std. err.	
S =	0.9897	(0.0051)	Control group fish without maladies
Pa = Pd	1.0	N/A	Recovery probability*
Tau =	0.9435	(0.0138)	Spillbay 9 fish without maladies – clean fish
1-Tau =	0.0565	(0.0138)	Spillbay 9 fish with maladies

* -- Because of constraints in the data set, this probability is assumed equal to 1.0; not estimated.

log-likelihood : -114.353712

Variance-Covariance matrix for estimated probabilities:
0.00003 -0.00002
-0.00002 0.00019

Profile likelihood intervals:

	Spillbay 9 fish without maladies	Spillbay 9 fish with maladies
90 percent:	(0.9192, 0.9650)	(0.0350, 0.0808)
95 percent:	(0.9141, 0.9690)	(0.0310, 0.0859)
99 percent:	(0.9038, 0.9768)	(0.0232, 0.0962)

==========

Likelihood ratio statistic for equality of recovery probabilities: 0.000000

Compare with quantiles of the chi-squared distribution with 1 d.f.:
For significance level 0.10: 2.706
For significance level 0.05: 3.841
For significance level 0.01: 6.635

Appendix D

Clean fish/maladies of juvenile chinook salmon released through Spillbay 13 at the Dalles Dam, May 2002. Control fish examined: 390, fish with maladies due to passage: 4. Test fish examined: 380, fish with maladies due to passage: 38.

RESULTS FOR FULL MODEL (UNEQUAL LIVE/DEAD RECOVERY)

	estim.	std. err.	
S =	0.9897	(0.0051)	Control group fish without maladies
Pa =	1.0	N/A	Live recovery probability*
Pd =	1.0	N/A	Dead recovery probability*
Tau =	0.9093	(0.0162)	Spillbay 13 fish without maladies
1-Tau =	0.0907	(0.0162)	Spillbay 13 fish with maladies

* -- Because of constraints in the data set, this probability is assumed equal to 1.0; not estimated.

log-likelihood : -145.830356

Variance-Covariance matrix for estimated probabilities:
0.00003 -0.00002
-0.00002 0.00026

Profile likelihood intervals:

	Spillbay 13 fish without maladies	Spillbay 13 fish with maladies
90 percent:	(0.8810, 0.9347)	(0.0653, 0.1190)
95 percent:	(0.8752, 0.9393)	(0.0607, 0.1248)
99 percent:	(0.8635, 0.9482)	(0.0518, 0.1365)

==========

RESULTS FOR REDUCED MODEL (EQUAL LIVE/DEAD RECOVERY)

	estim.	std. err.	
S =	0.9897	(0.0051)	Control group fish without maladies
Pa = Pd	1.0	N/A	Recovery probability*
Tau =	0.9093	(0.0162)	Spillbay 13 fish without maladies – clean fish
1-Tau =	0.0907	(0.0162)	Spillbay 13 fish with maladies

* -- Because of constraints in the data set, this probability is assumed equal to 1.0; not estimated.

log-likelihood : -145.830356

Variance-Covariance matrix for estimated probabilities:
0.00003 -0.00002
-0.00002 0.00026

Profile likelihood intervals:

	Spillbay 13 fish without maladies	Spillbay 13 fish with maladies
90 percent:	(0.8810, 0.9347)	(0.0653, 0.1190)
95 percent:	(0.8752, 0.9393)	(0.0607, 0.1248)
99 percent:	(0.8635, 0.9482)	(0.0518, 0.1365)

==========

Likelihood ratio statistic for equality of recovery probabilities: 0.000000

Compare with quantiles of the chi-squared distribution with 1 d.f.:
For significance level 0.10: 2.706
For significance level 0.05: 3.841
For significance level 0.01: 6.635

Appendix D

Clean fish/maladies of juvenile chinook salmon released through Spillbay 4 at the Dalles Dam, August 2002. Control fish examined: 170, fish with maladies due to passage: 6. Test fish examined: 164, fish with maladies due to passage: 16.

RESULTS FOR FULL MODEL (UNEQUAL LIVE/DEAD RECOVERY)

	estim.	std. err.	
S =	0.9647	(0.0142)	Control group fish without maladies
Pa =	1.0	N/A	Live recovery probability*
Pd =	1.0	N/A	Dead recovery probability*
Tau =	0.9355	(0.0277)	Spillbay 4 fish without maladies
1-Tau =	0.0645	(0.0277)	Spillbay 4 fish with maladies

* -- Because of constraints in the data set, this probability is assumed equal to 1.0; not estimated.

log-likelihood : -78.386341

Variance-Covariance matrix for estimated probabilities:
0.00020 -0.00019
-0.00019 0.00077

Profile likelihood intervals:

	Spillbay 4 fish without maladies	Spillbay 4 fish with maladies
90 percent:	(0.8875, 0.9804)	(0.0196, 0.1125)
95 percent:	(0.8777, 0.9893)	(0.0107, 0.1223)
99 percent:	(0.8577, 1.0000)	(0.0000, 0.1423)

==========

RESULTS FOR REDUCED MODEL (EQUAL LIVE/DEAD RECOVERY)

	estim.	std. err.	
S =	0.9647	(0.0142)	Control group fish without maladies
Pa = Pd	1.0	N/A	Recovery probability*
Tau =	0.9355	(0.0277)	Spillbay 4 fish without maladies – clean fish
1-Tau =	0.0645	(0.0277)	Spillbay 4 fish with maladies

* -- Because of constraints in the data set, this probability is assumed equal to 1.0; not estimated.

log-likelihood : -78.386341

Variance-Covariance matrix for estimated probabilities:
0.00020 -0.00019
-0.00019 0.00077

Profile likelihood intervals:

	Spillbay 4 fish without maladies	Spillbay 4 fish with maladies
90 percent:	(0.8875, 0.9804)	(0.0196, 0.1125)
95 percent:	(0.8777, 0.9893)	(0.0107, 0.1223)
99 percent:	(0.8577, 1.0000)	(0.0000, 0.1423)

==========

Likelihood ratio statistic for equality of recovery probabilities: 0.000000

Compare with quantiles of the chi-squared distribution with 1 d.f.:
For significance level 0.10: 2.706
For significance level 0.05: 3.841
For significance level 0.01: 6.635

Appendix D

Clean fish/maladies of juvenile chinook salmon released through Spillbay 9 at the Dalles Dam, August 2002. Control fish examined: 170, fish with maladies due to passage: 6. Test fish examined: 140, fish with maladies due to passage: 14.

RESULTS FOR FULL MODEL (UNEQUAL LIVE/DEAD RECOVERY)

	estim.	std. err.	
S =	0.9647	(0.0142)	Control group fish without maladies
Pa =	1.0	N/A	Live recovery probability*
Pd =	1.0	N/A	Dead recovery probability*
Tau =	0.9329	(0.0296)	Spillbay 9 fish without maladies
1-Tau =	0.0671	(0.0296)	Spillbay 9 fish with maladies

* -- Because of constraints in the data set, this probability is assumed equal to 1.0; not estimated.

log-likelihood : -71.468700

Variance-Covariance matrix for estimated probabilities:
0.00020 -0.00019
-0.00019 0.00088

Profile likelihood intervals:

	Spillbay 9 fish without maladies	Spillbay 9 fish with maladies
90 percent:	(0.8809, 0.9802)	(0.0198, 0.1191)
95 percent:	(0.8701, 0.9894)	(0.0106, 0.1299)
99 percent:	(0.8481, 1.0000)	(0.0000, 0.1519)

==========

RESULTS FOR REDUCED MODEL (EQUAL LIVE/DEAD RECOVERY)

	estim.	std. err.	
S =	0.9647	(0.0142)	Control group fish without maladies
Pa = Pd	1.0	N/A	Recovery probability*
Tau =	0.9329	(0.0296)	Spillbay 9 fish without maladies – clean fish
1-Tau =	0.0671	(0.0296)	Spillbay 9 fish with maladies

* -- Because of constraints in the data set, this probability is assumed equal to 1.0; not estimated.

log-likelihood : -71.468700

Variance-Covariance matrix for estimated probabilities:
0.00020 -0.00019
-0.00019 0.00088

Profile likelihood intervals:

	Spillbay 9 fish without maladies	Spillbay 9 fish with maladies
90 percent:	(0.8809, 0.9802)	(0.0198, 0.1191)
95 percent:	(0.8701, 0.9894)	(0.0106, 0.1299)
99 percent:	(0.8481, 1.0000)	(0.0000, 0.1519)

==========

Likelihood ratio statistic for equality of recovery probabilities: -0.000000

Compare with quantiles of the chi-squared distribution with 1 d.f.:
For significance level 0.10: 2.706
For significance level 0.05: 3.841
For significance level 0.01: 6.635

Appendix D

Clean fish/maladies of juvenile chinook salmon released through Spillbay 11 at the Dalles Dam, August 2002. Control fish examined: 170, fish with maladies due to passage: 6. Test fish examined: 159, fish with maladies due to passage: 17.

RESULTS FOR FULL MODEL (UNEQUAL LIVE/DEAD RECOVERY)

	estim.	std. err.	
S =	0.9647	(0.0142)	Control group fish without maladies
Pa =	1.0	N/A	Live recovery probability*
Pd =	1.0	N/A	Dead recovery probability*
Tau =	0.9258	(0.0288)	Spillbay 11 fish without maladies
1-Tau =	0.0742	(0.0288)	Spillbay 11 fish with maladies

* -- Because of constraints in the data set, this probability is assumed equal to 1.0; not estimated.

log-likelihood : -80.020782

Variance-Covariance matrix for estimated probabilities:
0.00020 -0.00019
-0.00019 0.00083

Profile likelihood intervals:

	Spillbay 11 fish without maladies	Spillbay 11 fish with maladies
90 percent:	(0.8758, 0.9722)	(0.0278, 0.1242)
95 percent:	(0.8655, 0.9813)	(0.0187, 0.1345)
99 percent:	(0.8447, 0.9996)	(0.0004, 0.1553)

==========

RESULTS FOR REDUCED MODEL (EQUAL LIVE/DEAD RECOVERY)

	estim.	std. err.	
S =	0.9647	(0.0142)	Control group fish without maladies
Pa = Pd	1.0	N/A	Recovery probability*
Tau =	0.9258	(0.0288)	Spillbay 11 fish without maladies – clean fish
1-Tau =	0.0742	(0.0288)	Spillbay 11 fish with maladies

* -- Because of constraints in the data set, this probability is assumed equal to 1.0; not estimated.

log-likelihood : -80.020782

Variance-Covariance matrix for estimated probabilities:
0.00020 -0.00019
-0.00019 0.00083

Profile likelihood intervals:

	Spillbay 11 fish without maladies	Spillbay 11 fish with maladies
90 percent:	(0.8758, 0.9722)	(0.0278, 0.1242)
95 percent:	(0.8655, 0.9813)	(0.0187, 0.1345)
99 percent:	(0.8447, 0.9996)	(0.0004, 0.1553)

==========

Likelihood ratio statistic for equality of recovery probabilities: 0.000000
Compare with quantiles of the chi-squared distribution with 1 d.f.:
For significance level 0.10: 2.706
For significance level 0.05: 3.841
For significance level 0.01: 6.635

Appendix D

Chi square tests of homogeneity of injuries of fish released through different spillbays at the Dalles Dam, May 2002.

The FREQ Procedure

Table of desc by cond

desc	cond		
Frequency, Expected, Cell Chi-Square	injured	uninjured	Total
SB11	38	342	380
	29.437	350.56	
	2.4912	0.2092	
SB4	25	353	378
	29.282	348.72	
	0.6261	0.0526	
SB9	25	353	378
	29.282	348.72	
	0.6261	0.0526	
Total	88	1048	1136

Statistics for Table of desc by cond

Statistic	DF	Value	Prob
Chi-Square	2	4.0577	0.1315
Likelihood Ratio Chi-Square	2	3.9133	0.1413
Mantel-Haenszel Chi-Square	1	3.0432	0.0811
Phi Coefficient		0.0598	
Contingency Coefficient		0.0597	
Cramer's V		0.0598	

Sample Size = 1136

Appendix D

Chi square tests of homogeneity of injuries of fish released through different spillbays at the Dalles Dam, May 2002.

The FREQ Procedure

Table of release by cond

release	cond		
Frequency, Cell Chi-Square	injured	uninjured	Total
Cntl	4 16.193	386 1.0389	390
Test	88 5.5592	1048 0.3567	1136
Total	92	1434	1526

Statistics for Table of release by cond

Statistic	DF	Value	Prob
Chi-Square	1	23.1477	<.0001
Likelihood Ratio Chi-Square	1	31.3304	<.0001
Continuity Adj. Chi-Square	1	21.9766	<.0001
Mantel-Haenszel Chi-Square	1	23.1325	<.0001
Phi Coefficient		-0.1232	
Contingency Coefficient		0.1222	
Cramer's V		-0.1232	

Fisher's Exact Test

Cell (1,1) Frequency (F)	4
Left-sided Pr <= F	3.612E-08
Right-sided Pr >= F	1.0000
Table Probability (P)	3.187E-08
Two-sided Pr <= P	5.113E-08

Sample Size = 1526

Appendix D

Chi square tests of homogeneity of injuries fish released through different spillbays at the Dalles Dam, August 2002.

The FREQ Procedure

Table of desc by cond

desc	cond		
Frequency, Expected, Cell Chi-Square	injured	uninjured	Total
SB13	17 16.14 0.0458	142 142.86 0.0052	159
SB4	16 16.648 0.0252	148 147.35 0.0028	164
SB9	14 14.212 0.0032	126 125.79 0.0004	140
Total	47	416	463

Statistics for Table of desc by cond

Statistic	DF	Value	Prob
Chi-Square	2	0.0825	0.9596
Likelihood Ratio Chi-Square	2	0.0821	0.9598
Mantel-Haenszel Chi-Square	1	0.0421	0.8374
Phi Coefficient		0.0134	
Contingency Coefficient		0.0133	
Cramer's V		0.0134	

Sample Size = 463

Appendix D

Chi square tests of homogeneity of injuries of fish released through different spillbays at the Dalles Dam, August 2002.

The FREQ Procedure

Table of release by cond

release	cond		
Frequency, Expected, Cell Chi-Square	injured	uninjured	Total
Cntl	6 14.234 4.763	164 155.77 0.4352	170
Test	47 38.766 1.7488	416 424.23 0.1598	463
Total	53	580	633

Statistics for Table of release by cond

Statistic	DF	Value	Prob
Chi-Square	1	7.1069	0.0077
Likelihood Ratio Chi-Square	1	8.3266	0.0039
Continuity Adj. Chi-Square	1	6.2699	0.0123
Mantel-Haenszel Chi-Square	1	7.0956	0.0077
Phi Coefficient		-0.1060	
Contingency Coefficient		0.1054	
Cramer's V		-0.1060	

Fisher's Exact Test

Cell (1,1) Frequency (F)	6
Left-sided Pr <= F	0.0039
Right-sided Pr >= F	0.9989
Table Probability (P)	0.0027
Two-sided Pr <= P	0.0058

Sample Size = 633

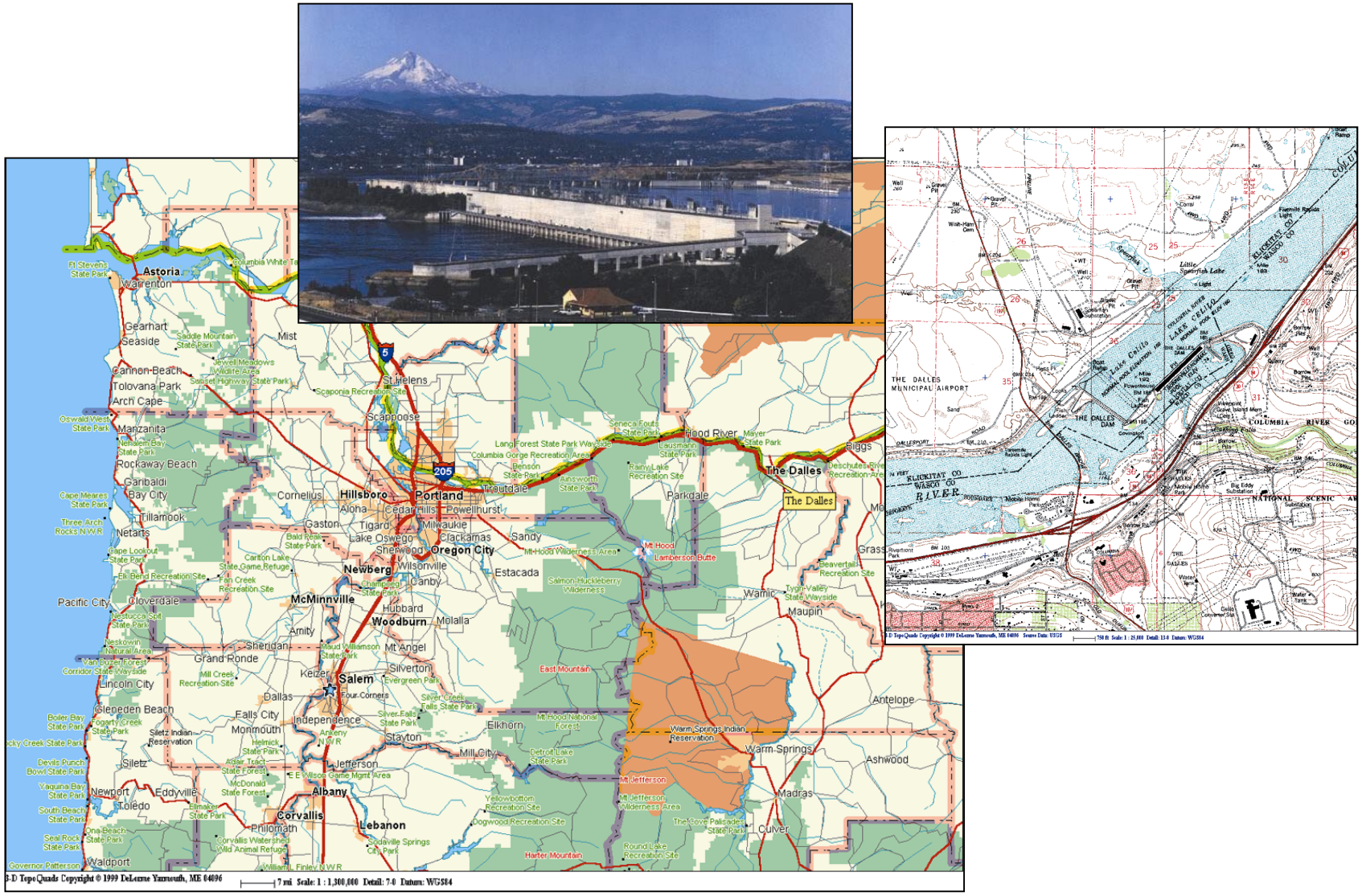


Figure 1-1

Location and general configuration of The Dalles Dam.

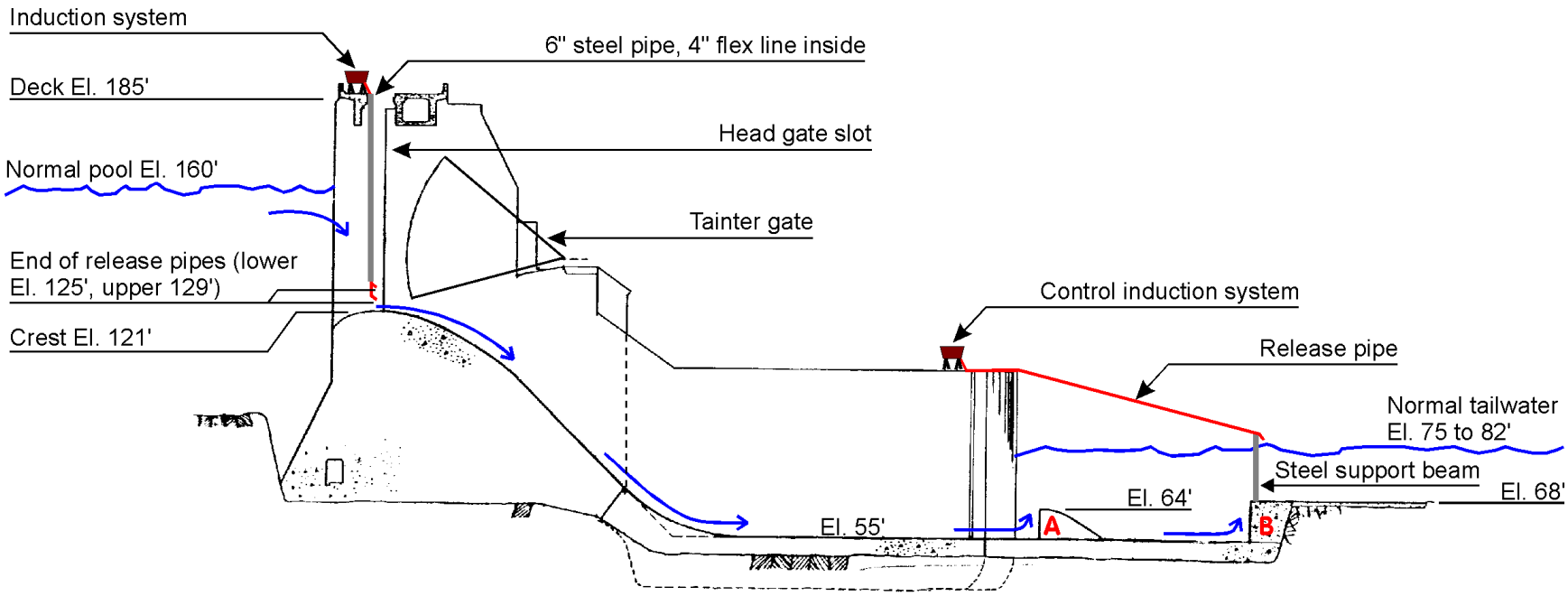


Figure 1-2

Cross section of spillbay showing release location for juvenile salmon passed through Spillbays 4, 9, 11, and 13 and energy dissipation structures (baffles-A, end sill-B) at The Dalles Dam, May (spring) and August (summer) 2002.

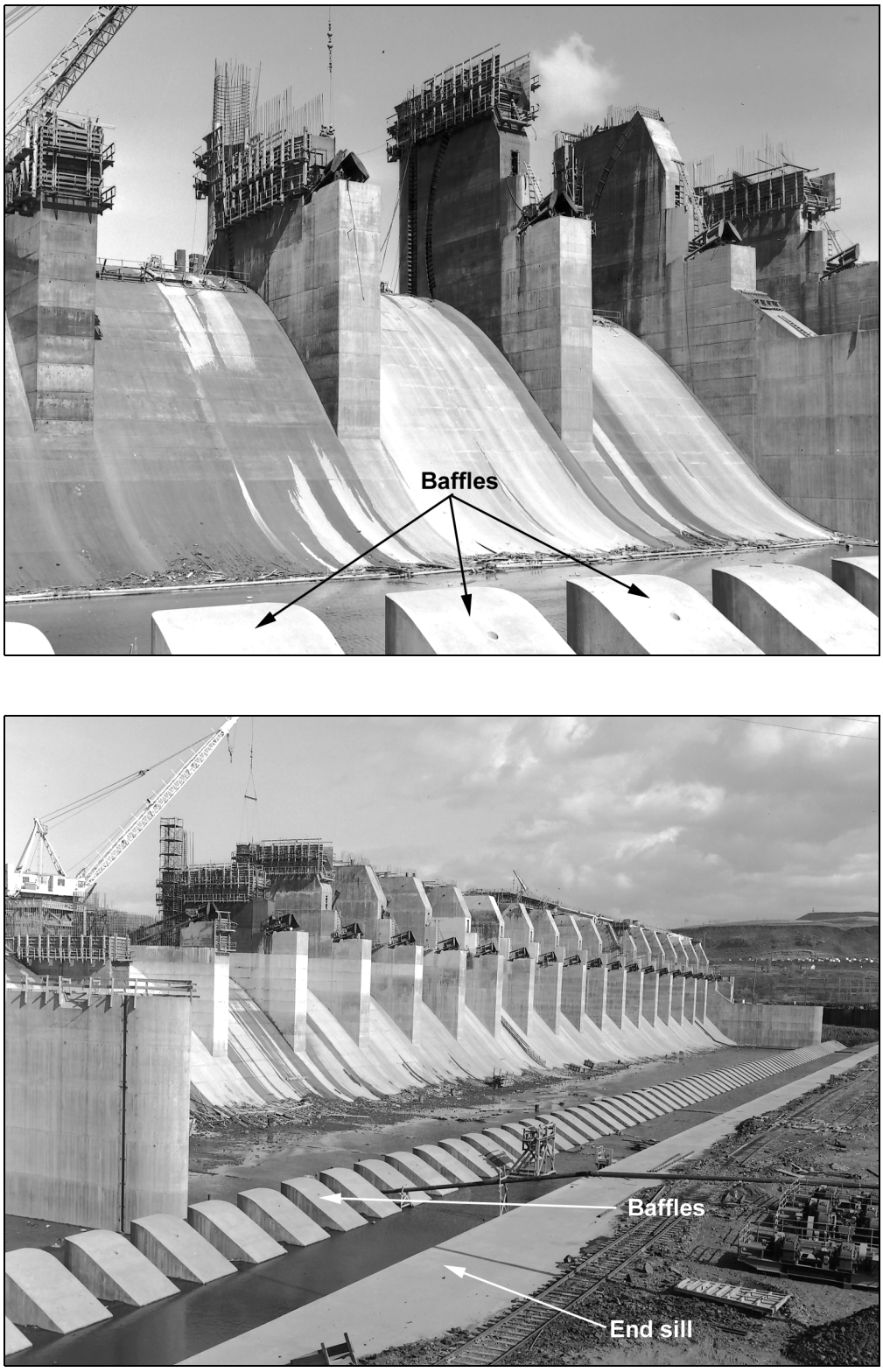


Figure 1-3

The Dalles Dam spillway with energy dissipation structures (9 ft high baffles and 13 ft high vertical end sill). Photos provided by U.S. Army Corps of Engineers.

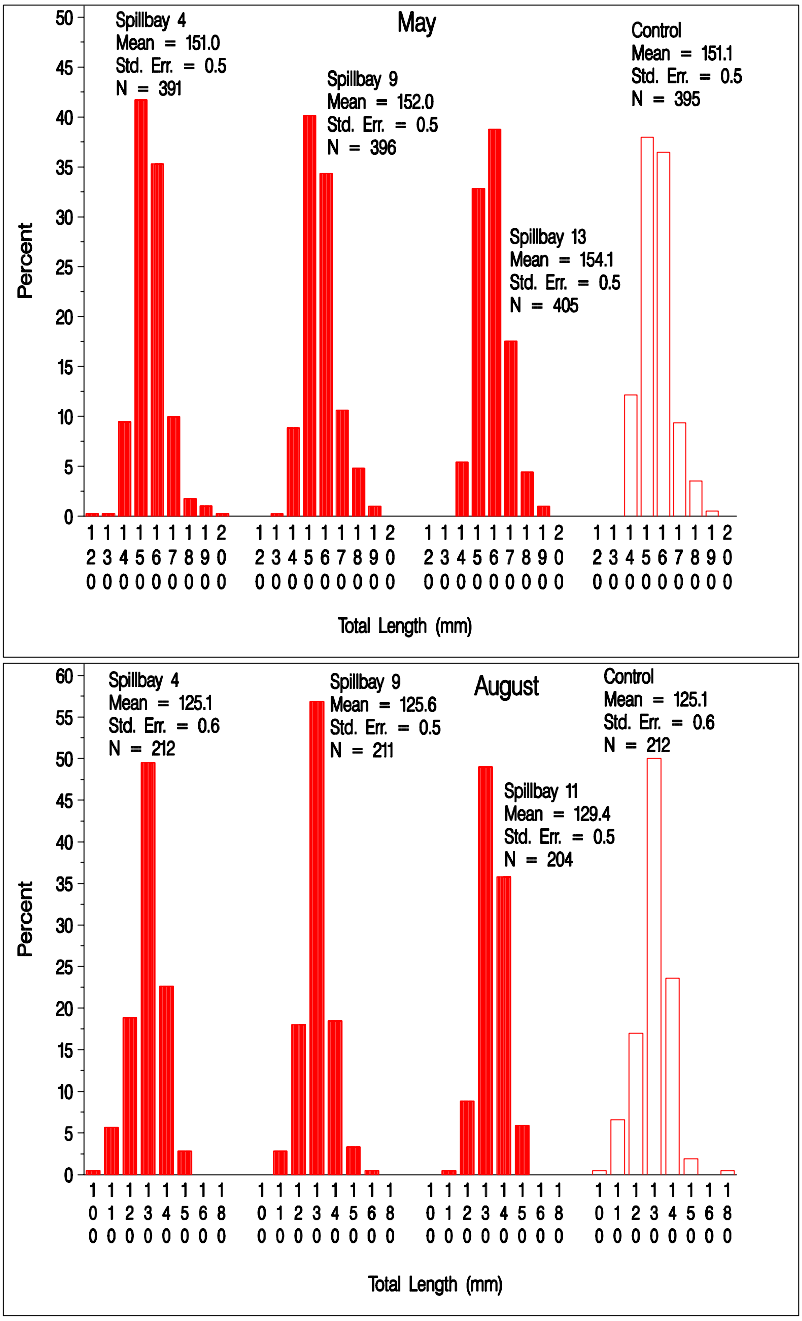


Figure 2-1 Total length (mm) frequency distribution of treatment and control chinook salmon smolts, released at Spillbays 4, 9 and 13 (spring) and Spillbays 4, 9 and 11 (summer) at Dalles Dam, 2002.

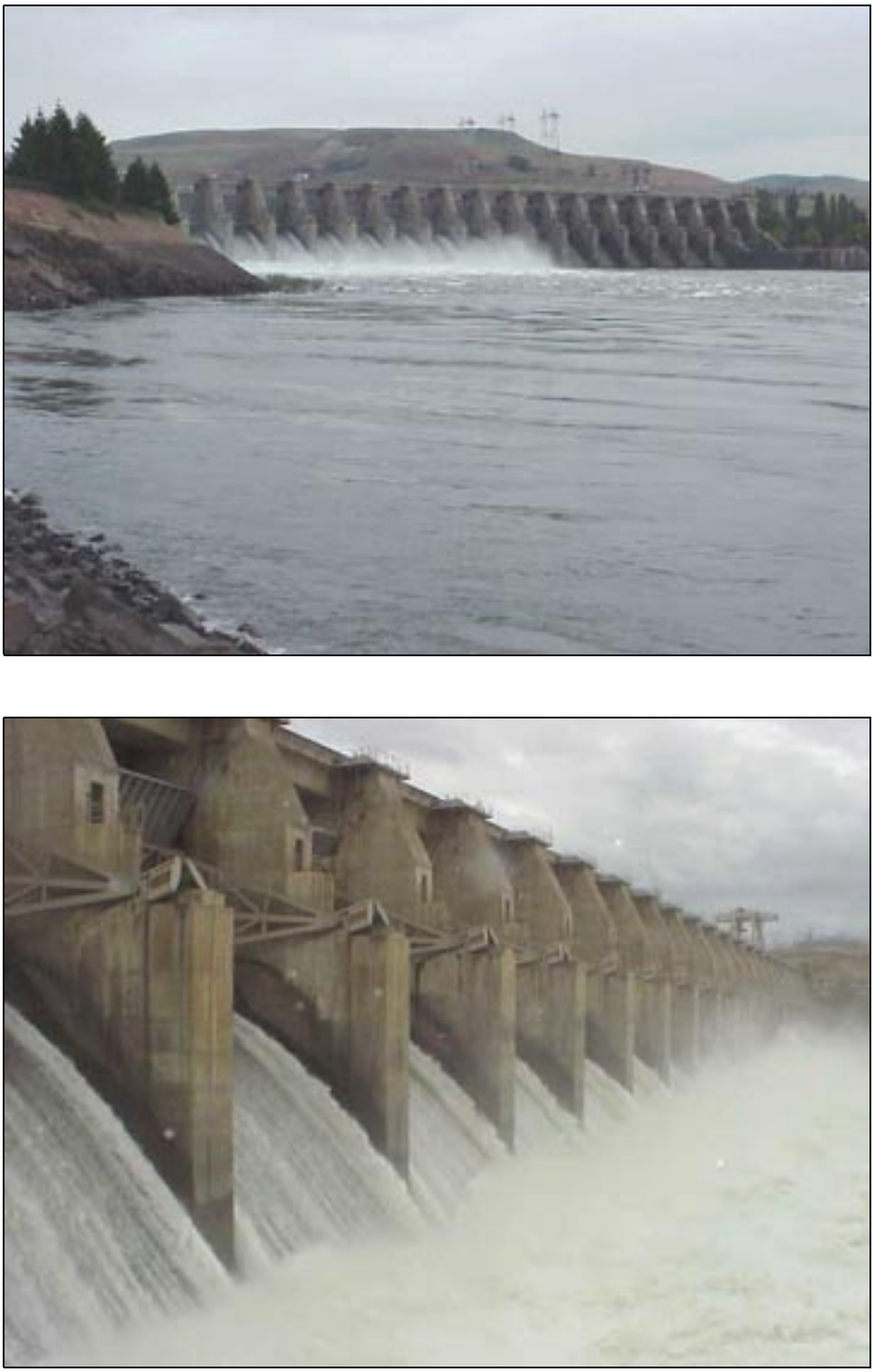


Figure 2-2

Hydraulic conditions downstream of The Dalles spillway during passage of HI-Z tagged juvenile salmonids through Spillbays 4, 9, and 13, May (spring) 2002.

Figure 2-3

Treatment system to release juvenile salmonids into spillbays at The Dalles Dam, 2002.

Figure 2-4

Control system to release juvenile salmonids downstream of The Dalles spillway with typical spring conditions, 2002.

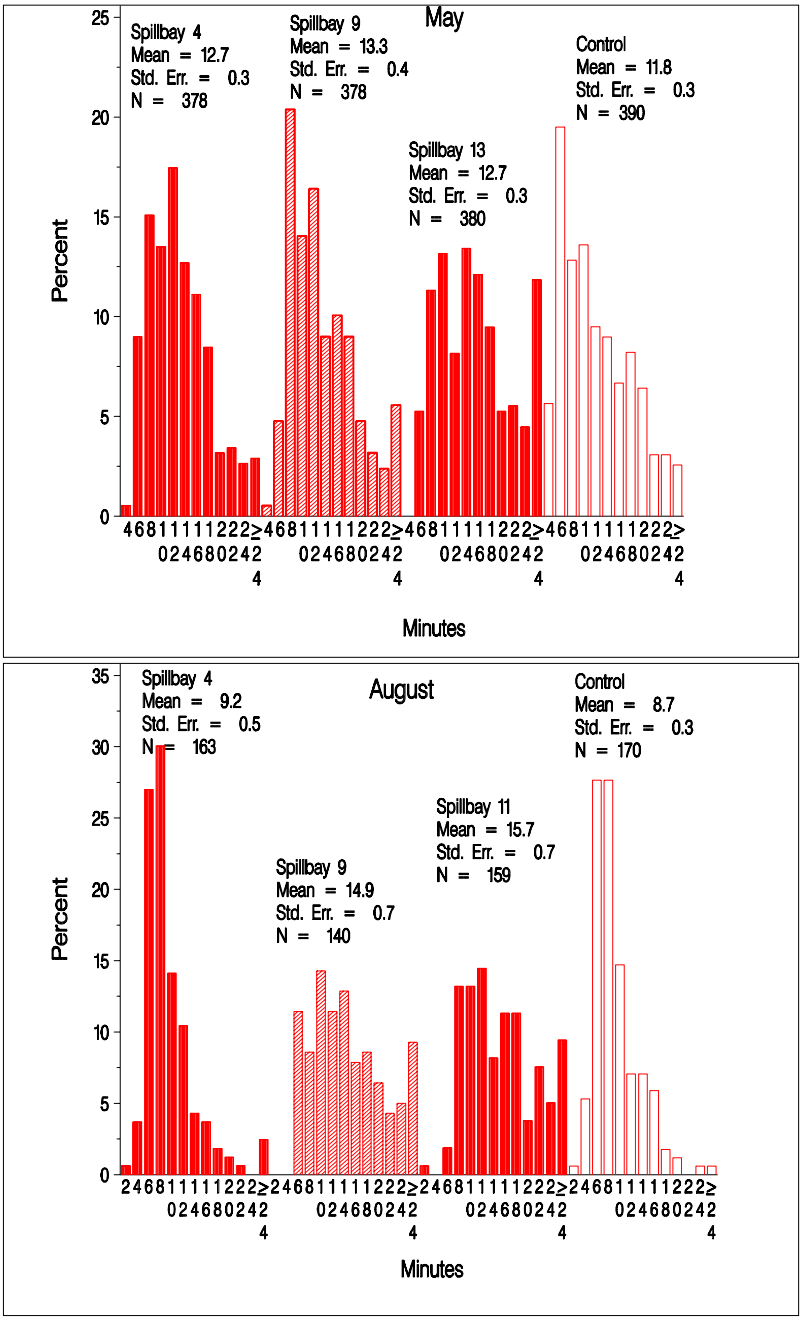
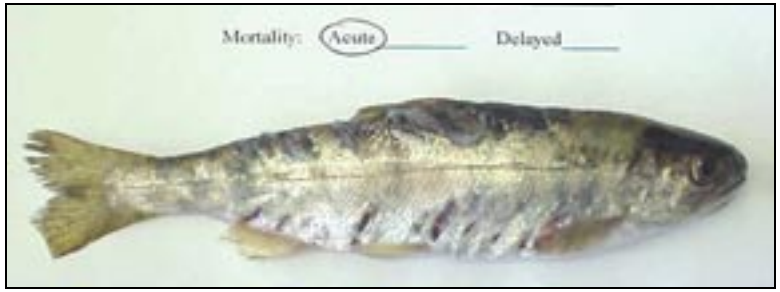


Figure 3-1 Frequency distribution of recapture times (minutes) of treatment and control chinook salmon smolts, released at Spillbays 4, 9 and 13 (spring) and Spillbays 4, 9 and and 11 (summer) at Dalles Dam, 2002.



UX2 – May; Control; acute predation

NE1 – May; Spillbay 9; gull predation, dead 24 h

Figure 3-2

Typical injuries attributed to fish (upper photo) and gull (lower photo) predation on juvenile salmonids passed through The Dalles Dam spillbays, May and August 2002.

LL3 – May; Spillbay 13; alive 48 h

Z99 – May; Spillbay 13; alive 48 h

UYO – May; Spillbay 13; acute

Figure 3-3

Examples of injuries (hemorrhaged eye – upper left photo; hemorrhaged eye and scraped operculum, and major scale loss – upper right photo; and cuts and tears on head – lower photo) observed on juvenile salmonids after passing The Dalles spillbays, May and August 2002.