Canadian Manuscript Report of

Fisheries and Aquatic Sciences 2372

1996

THE 1992 FISHWHEEL PROJECT ON THE NASS RIVER AND AN EVALUATION OF FISHWHEELS AS AN INSEASON MANAGEMENT AND STOCK ASSESSMENT TOOL FOR THE NASS RIVER

prepared by

Michael R. Link, Karl K. English, and Robert C. Bocking

LGL Limited
environmental research associates[1]

for the

Nisga'a Tribal Council[2]

[1] 9768 Second St., Sidney, BC V8L 3Y8

[2] P.O. Box 231, New Aiyansh, BC V0J 1A0

Cat. No. Fs 97-4/2372E ISSN 0706-6473

Correct citation for this publication:

Link, Michael R., Karl K. English, and Robert C. Bocking. The 1992 fishwheel project on the Nass River and an evalution of fishwheels as an inseason management and stock assessment tool for the Nass River. Can. Manuscr. Rep. Fish. Aquat. Sci. 2372: x + 82 p.

TABLE OF CONTENTS

LIST OF TABLES v

LIST OF FIGURES v

LIST OF APPENDICES viii

ABSTRACT ix

RÉSUMÉ x

INTRODUCTION 1

METHODS 4
- STUDY AREA 4
- FISHWHEEL CONSTRUCTION AND OPERATION 4
  - Design 4
  - Maintenance 6
  - Staffing Requirements 6
- SITE SELECTION 6
  - River Width 7
  - Water Depth 7
  - Water Velocity 7
  - Shoreline Features 8
  - Accessability 8
- EFFORT AND CATCH 9
- TAGGING 9
- TAG RECOVERY 10
- POPULATION ESTIMATION 10
  - Mark-Recapture Assumptions 11
- RUN RECONSTRUCTION 11
- AGE, LENGTH AND SEX SAMPLING 13

RESULTS 13
- SITE EVALUATIONS AND COST OF OPERATION 13
- EFFORT AND CATCH 14
- TAGGING 15
- TAG RECOVERY 16
- POPULATION ESTIMATION 16
- RUN RECONSTRUCTION 16
- AGE, LENGTH AND SEX SAMPLING 17

TABLE OF CONTENTS - Cont'd

DISCUSSION 19
OPERATIONAL EVALUATION 19
Sites 19
Design 19
Cost 20
USE OF FISHWHEELS AS A STOCK ASSESSMENT TOOL 21
USE OF FISHWHEELS FOR POPULATION ESTIMATION 21
USE OF FISHWHEELS AS A TEST FISHING INDEX OF ABUNDANCE . . . 24

SUMMARY AND CONCLUSIONS 25

ACKNOWLEDGEMENTS 25

REFERENCES 26

TABLES 28

FIGURES 38

APPENDICES 58

LIST OF TABLES

Table 1. Estimates of salmon escapement to the Nass River, 1966-92 29

Table 2. Numbers of each salmon species caught and tagged at two fishwheels located on the Nass River in 1992 30

Table 3. Summary of tag recoveries for the tags applied on the lower Nass River in 1992 31

Table 4. Adjusted Petersen population estimates derived from tagging of adult salmon at the Nass River fishwheels and recovery of tags at the Meziadin fishway, 1992 32

Table 5. Means and standard errors for sockeye travel times from the fishwheels to the Meziadin fishway for each release and recovery period, 1992 33

Table 6. The estimated proportion of adult chinook, sockeye and coho captured with two fishwheels in 1992 34

Table 7. Sex and age composition of salmon sampled at the Nass River fishwheels, 1992 35

Table 8. Mean length by age of salmon sampled at the Nass River fishwheels, 1992 36

Table 9. Mean length by age of coho salmon sampled at the Nass River fishwheels prior to and after 20 August, 1992 37

LIST OF FIGURES

Figure 1. Nass Watershed study area 39

Figure 2. Location of Nisga'a communities, fishwheel sites and place names along the Nass River below Grease Harbour 40

Figure 3. Fishwheel effort and speed for two fishwheels on the Nass River, 1992 41

Figure 4. Fishwheel catches and CPE for sockeye captured with two fishwheels on the Nass River, 1992 42

LIST OF FIGURES - Cont'd

Figure 5. Fishwheel catches and CPE for chinook and coho salmon captured with two fishwheels on the Nass River, 1992 43

Figure 6. Fishwheel catches and CPE for pink and chum salmon captured with two fishwheels on the Nass River, 1992 44

Figure 7. Fishwheel catches and CPE for steelhead captured in two fishwheels on the Nass River, 1992 45

Figure 8. Daily sockeye catches and Nass River discharge at Shumal Creek, 1992 46

Figure 9. Proportion of total fishwheel catch tagged by week ending 47

Figure 10. Travel time to the Meziadin fishway for sockeye salmon tagged at the Nass River fishwheels and mean travel time for each 4-d tagging period 48

Figure 11. Daily fishwheel catch per effort and reconstructed run at the fishwheel site, expressed as a percent of the seasonal totals for 1992 49

Figure 12. Fishwheel sockeye catch and estimate of the portion of the sockeye run caught each day from 19 June through 5 September 1992 50

Figure 13. Age-length distribution for sockeye salmon sampled at the Nass River fishwheels, 1992 51

Figure 14. Weekly age composition for sockeye salmon sampled at the fishwheels and Meziadin fishway in 1992 52

Figure 15. Length frequency for chinook salmon sampled and radio-tagged (no ages) at the Nass River fishwheels, 1992 53

Figure 16. Age-length distribution of coho sampled a the Nass River fishwheels, 1992 54

Figure 17. Length frequency distributions of sockeye salmon sampled at the Nass River fishwheels, the Monkley Dump test fishery and the Meziadin fishway 55

LIST OF FIGURES - Cont'd

Figure 18. Daily sockeye counts and tagged sockeye observed at the Meziadin fishway, 1992 56

Figure 19. Relationship between sockeye catchability at Monkley Dump gillnet test fishery and total sockeye escapement to the Nass River, 1964-92 57

LIST OF APPENDICES

Table A-1	List of materials for the construction of the two fishwheels used on the Nass River in 1992	59
Figure A-1	Top view of a fishwheel used on the Nass River in 1992	60
Figure A-2	Side view of a fishwheel used on the Nass River in 1992	61
Figure A-3	Front view of a fishwheel used on the Nass River in 1992	62
Table B-1	Summary of daily fishwheel effort, effort used to calculate CPE and fishwheel speed	63
Table C-1	Daily catches, numbers tagged and CPE for sockeye salmon captured with two fishwheels on the Nass River in 1992	66
Table C-2	Daily catches, numbers tagged and CPE for chinook salmon captured with two fishwheels on the Nass River in 1992	69
Table C-3	Daily catches, numbers tagged and CPE for coho salmon captured with two fishwheels on the Nass River in 1992	72
Table C-4	Daily catches, numbers tagged and CPE for steelhead, pink and chum salmon captured with two fishwheels on the Nass River in 1992	74
Table D-1	Daily counts and number of tag recoveries for sockeye and coho passing through the Meziadin fishway, 1992	78
Table E-1	Numbers of fish by age and length from sockeye salmon sampled at the Nass River fishwheels, 1992	80
Table E-2	Summary of weekly age composition of sockeye sampled at the Nass River fishwheels, 1992	81
Table E-3	Summary of the numbers and mean length of sockeye salmon successfully aged from the Nass River fishwheel catch, 1992	82

ABSTRACT

Link, M. R., K. K. English, and R. C. Bocking. 1996. The 1992 fishwheel project on the Nass River and an evaluation of fishwheels as an inseason management and stock assessment tool for the Nass River. Can. Manuscr. Rep. Fish. Aquat. Sci. 2372: 82 p.

Fishwheels were evaluated as a tool to: 1) live-capture salmon for stock assessment studies and 2) provide an index of the timing and abundance of Nass River salmon stocks. Two fishwheels were installed and operated on the Nass River near the village of Gitwinksihlkw, B.C., from 5 June to 29 September 1992. The fishwheels operated for a total 3,696 h or 66% of the time they were in place. Catches included 9,046 sockeye, 5,699 pink, 559 coho, 444 chinook, 42 chum, and 40 steelhead. Of these, 4,836 sockeye, 507 coho, 334 chinook, 35 steelhead, and 6 chum were tagged. We used counts of marked and unmarked fish from the Meziadin fishway to compute population estimates for sockeye (705,000) and coho (59,000). The fishwheels caught an estimated 1.3% of the sockeye return, 2.1% of the chinook, and 0.9% of the coho. Daily tag release and recovery data were used to reconstruct sockeye migration timing in the lower river and assess the within-season variability in the proportion of the run caught by the fishwheels. The proportion of the total run captured in the fishwheels was higher early in the year during periods of very high sockeye abundance and high river flows than later when both fish abundance and water levels had declined. The 1992 sockeye and chinook studies suggest that fishwheels may provide a better index of abundance than the current gillnet test fishery because fishwheel catch rates do not appear to saturate at high fish abundance. Additional years of data are required to determine if the fishwheels will exhibit similar capture efficiencies within and between years to allow for their use as an inseason management tool.

RÉSUMÉ

Link, M. R., K. K. English, and R. C. Bocking. 1996. The 1992 fishwheel project on the Nass River and an evaluation of fishwheels as an inseason management and stock assessment tool for the Nass River. Can. Manuscr. Rep. Fish. Aquat. Sci. 2372: 82 p.

Cette étude avait pour objet d'évaluer l'utilité des tourniquets pour : 1) capturer des saumons aux fins de l'évaluation des stocks; 2) indiquer les temps de migration et les taux d'abondance des stocks de saumon dans la rivière Nass. Entre le 5 juin et le 29 septembre 1992, deux tourniquets ont été installés et mis en opération dans la rivière Nass, près du village de Gitwinksihlkw, en Colombie-Britannique. Ces tourniquets ont été fonctionnels pendant un total de 3 696 heures, soit 66 % de la période pendant laquelle ils ont été en place. Les captures effectuées se sont réparties comme suit : 9 046 saumons rouges, 5 699 saumons roses, 444 saumons quinnats, 559 saumons cohos, 42 saumons kétas, et 40 truites arc-en-ciel anadromes. De ces nombres, 4 836 saumons rouges, 334 saumons quinnats, 507 saumons cohos, 35 truites arc-en-ciel et 6 saumons kétas ont été étiquetés. Nous avons utilisé les chiffres de saumons marqués et non marqués pour la passe migratoire de Meziadin afin d'établir le chiffre de population des saumons rouges (705 000) et des saumons cohos (59 000). Les tourniquets ont capturé un taux estimatif de 1,3 % de l'effectif de remonte de saumon rouge, de 2,1 % de l'effectif de remonte de saumon quinnat et de 0,9 % de l'effectif de remonte de saumon coho. Les chiffres d'étiquetage et de récupération ont été utilisés pour reconstituer les temps de migration du saumon rouge dans le cours inférieur de la rivière, et les variations infrasaisonnières dans l'effectif de remonte capté par les tourniquets. La proportion de capture des tourniquets a été plus élevée au début de l'année, durant les périodes de très haute abondance de saumon rouge et de haut régime des eaux, que plus tard dans la saison, alors que les taux d'abondance et le régime des eaux avaient baissé. Les études effectuées sur le saumon rouge et le saumon quinnat en 1992 indiquent que les tourniquets peuvent fournir une meilleure indication du taux d'abondance des stocks de saumon que le moyen actuel de la pêche de sondage au filet maillant parce que les taux de capture des tourniquets ne semblent pas connaître de saturation en période de haute abondance. Il faudra plusieurs autres années de collecte de données pour déterminer si les tourniquets sont aussi performants à l'intérieur d'une même année et d'une année à l'autre avant qu'on puisse permette leur utilisation comme outil de gestion infrasaisonnier.

INTRODUCTION

This project was initiated to examine the feasibility of using fishwheels as a management and stock assessment tool on the Nass River. The project was a part of the Interim Measures Program (IMP), a program established by the Nisga'a Nation and the Canadian Government established to perform fisheries research in the Nisga'a Land Claim Area.

As a management tool, fishwheels were evaluated to determine if they could provide a better index of the sockeye salmon (*Oncorhynchus nerka*) escapement than the current gillnet test fishery. As a stock assessment tool, the fishwheels were evaluated as a method to capture sockeye, chinook (*O. tshawytscha*), coho (*O. kisutch*), chum (*O. keta*), and steelhead (*O. mykiss*) for large-scale radio and spaghetti tagging projects. The tagging projects were designed to evaluate the fishwheels and estimate the abundance, distribution and timing of Nass River salmon stocks.

Management of the Nass River salmon stocks involves both active and passive management of several fisheries. Sockeye salmon are harvested in a multitude of fisheries beginning with interception gillnet and seine fisheries in southeast Alaska. Returning sockeye then move through gillnet and seine fisheries in Canadian statistical areas 3 and 4 before entering the Nass River. Once in the river, sockeye are harvested in a native in-river set and drift gillnet fishery. The majority of harvest is taken by Nisga'a fishers between Gingolx and Grease Harbour (Fig. 1). A small harvest is taken by Gitanyow fishers near the mouth of the Tchitin River.

The Department of Fisheries and Oceans (DFO) currently manages the Nass River sockeye to an escapement goal for the dominant Meziadin Lake stock. The Meziadin Lake sockeye stock has accounted for 77% of the total estimated escapement of sockeye to the Nass River over the last 26 years and has an escapement goal of 160,000 (Table 1). Initial pre-season forecasts of total run strength are based on the average number of recruits per spawner in the brood years that contribute to a given year's recruits and these forecasts are generally imprecise. A better indication of run strength comes from preliminary catch information from the Alaskan fisheries in mid to late June.

To manage the Canadian commercial fishery targeting on Nass River sockeye on an inseason basis, DFO operates a gillnet test fishery at the mouth of the Nass River (Monkley Dump, Fig. 2). This test fishery provides a daily index of the abundance of sockeye migrating through the lower river. Meziadin Lake sockeye are subsequently enumerated visually at a fishway on the Meziadin River after a large portion of the sockeye have migrated through the commercial fishery. The test fishery is also used to collect electrophoretic samples which are used for post-season stock composition analysis. The stock composition data are used to determine the proportion of the lower river sockeye escapement that returned to the remainder of the sockeye systems in the Nass watershed: Bowser, Damdochax and Fred Wright lakes, Gingit Creek and other lower Nass stocks (Rutherford et al. 1994).

Nass River pink salmon are harvested in the major southern southeast Alaskan and northern B.C. commercial fisheries that target on other Canadian and Alaskan pink salmon populations. Nass River chinook and coho salmon are harvested in the northern troll fisheries directed at mixed chinook and coho stocks; they are also harvested in the net fisheries targeting on sockeye and pink salmon. Because of the mixed stock nature of these fisheries, the Nass chinook and coho are not actively managed to target escapements. There are no directed fisheries on Nass River chum salmon as they are currently classed as severely depleted. We are not aware of any information on the marine distribution of Nass River steelhead, but they are probably taken incidentally in all of the fisheries mentioned above.

Frequent deviations from the target sockeye escapement to Meziadin Lake suggest that the gillnet test fishery has not been a very effective index of sockeye abundance (see Table 1 to compare achieved escapements with the target of 160,000). The test fishery tends to overestimate the escapement in years with below average escapement to the river and underestimate the escapement in years with above average escapement to the river.

A preliminary analysis of the test fishing data from the last 28 years indicates that the proportion of fish that the test fishery captures decreases with increasing escapement, down to a minimum beyond an escapement of approximately 400,000 fish (ie. the catchability coefficient of the test fishery, q, is density dependent and a non-linear function of abundance). This phenomenon may be caused by the fish caught early in a set subsequently decreasing the efficiency of the gear. The more abundant the fish are, the greater this saturation effect. Fishwheels are generally believed to be less affected by this type of gear saturation because the fish do not remain in the fishwheel baskets for more than half a rotation (i.e., self cleaning gear).

In addition to addressing some of the concerns over the apparent limitations of the current gillnet test fishery, the fishwheels offered potential support to the 1992 radio tagging study. This program was initiated to determine the distribution, timing and abundance of chinook salmon for all stocks returning to the Nass River watershed (Koski et al. 1996). The fishwheels provided a means to non-destructively capture sufficient numbers of chinook and to tag them at a rate that was approximately proportional to their abundance.

As a result of the concerns over the limitations of the gillnet test fishery for managing sockeye salmon and the need to capture a large number of chinook for a radio tagging study, the federal and provincial governments and the Nisga'a Tribal Council endorsed this study to examine the feasibility of using fishwheels on the Nass River.

The specific objectives of the 1992 Nass River fishwheel project were:

1. evaluate the suitability of using fishwheels to index the abundance and timing of Nass River salmon returns;

2. use the tagged fish from the fishwheels to estimate the total abundance of salmon returns to the river using a mark-recapture technique; and

3. provide support for a chinook salmon stock assessment program by capturing chinook for radio tagging.

To meet these objectives, fishing sites were located, fishwheels installed, fish captured and tagged with spaghetti and radio tags, and the movements and destinations of these fish determined from tag tracking and recovery efforts.

The first documented use of fishwheels was to capture shad in rivers in the eastern United States as early as 1829 (Donaldson and Cramer 1971). Fishwheels were introduced to the Columbia River on the west coast of the United States in 1879. They were used there for over 50 years to commercially harvest all species of salmon. By 1934 both the Washington and Oregon state legislatures had capitulated to the powerful net fishery lobby and outlawed the use of fishwheels on the Columbia River. Fishwheels were introduced to Alaska in the late 1800s and early 1900s and are still used there for commercial and subsistence harvesting of chinook, chum and coho salmon.

The first documented application of the use fishwheels for fisheries research and management purposes was on the Taku River in southeast Alaska in the late 1950s (Meehan 1961). Although we were unable to locate any documentation, a fishwheel was used on the Nass River near Grease Harbour in the late 1950s for gathering fisheries research information. Fishwheels are currently being used for harvesting and stock assessment on the Yukon and Taku Rivers, and annual escapement monitoring programs on the Kenai and Kasilof Rivers of Cook Inlet, Alaska (McGregor et al. 1991; Milligan et al. 1985; King and Tarbox 1989).

Fishwheels offer several valuable uses to fishery managers. First, if effective long term fishing sites are available, fishwheels may sample sufficient and consistent proportions of the migrating fish within and between years to be used as a tool to index fish abundance. The timely nature of this information may be used to manage harvesting on an inseason basis similar to the way test fisheries are currently used to manage many fisheries. Second, fishwheels offer a powerful technique to non-destructively and non-size-selectively capture migrating salmon for use in stock assessment or related studies. Once captured, fish can be enumerated, marked, sampled and released uninjured. Finally, unlike the current net fisheries, a live-capture technique offers a method to selectively harvest fish species. This last use has recently become more important as fishery managers more often face the difficult task of trying to harvest abundant, healthy or enhanced species amidst much less abundant, severely depressed species.

METHODS

STUDY AREA

The Nass River drains 20,500 km^2 and is the third largest watershed that lies entirely within British Columbia. The river originates in the Skeena Mountains and flows south and southwest for 400 km, entering the Pacific Ocean at Portland Inlet on the north coast of British Columbia (Fig. 1).

The Nass River supports significant populations of salmon. Sockeye salmon are the dominant species with an average estimated escapement of 190,000 for the period 1966 to 1991 (Table 1). Pink salmon are the next most abundant with an average escapement of 81,300. Coho salmon escapements have averaged 19,000 for the same period; chinook salmon 9,900, and chum salmon 3,700. Escapement values for sockeye probably represent most of the stock since a high portion of the total return is enumerated at the Meziadin fishway. Information from the 1992 radio tagging project (Koski et al. 1996) suggest that historical chinook escapement estimates may represent only 40% of the total number of fish reaching the spawning areas. The accuracy of the estimates for the other species is unknown.

FISHWHEEL CONSTRUCTION AND OPERATION

Design

The fishwheel design used in this study was similar to the fishwheels that have been used on the Yukon and Taku rivers over the last 10 years (Milligan et al. 1985; McGregor et al. 1991). Although there were several modifications made to the design of the fishwheels built for this study, the general design was derived from the senior author's experience with the fishwheels used on the Taku River for the period 1986 to 1991. Table A-1 contains a list of materials and diagrams of the design of the fishwheels built for the Nass River in 1992. Two baskets were affixed to the axle through most of the season. At low water we replaced one of the uprights with a third basket.

The overall length of each fishwheel was 11 m and the width was 7 m. The pontoons were framed with standard dimension lumber and closed cell foam billets were fitted inside the pontoons to be used as floatation. A 1.25 cm plywood deck was attached to the framed pontoon. The pontoons were joined at the bow and stern with four, rough cut 10 x 40 cm planks.

There were two basket sizes used in 1992. The larger 3.8 m baskets were used for most of the season and were capable of fishing down to 3.5 m below the surface. The smaller 2.4 m baskets were installed to fish during the low water conditions encountered in the late summer and were capable of fishing in 2.1 m of water. The baskets were lined with 9.5 cm mesh seine netting (black salmon bunt).

The axles were made of 12.5 cm x 12.5 cm steel tube with a 60 cm long, 4.9 cm diameter solid steel shaft fitted into and welded to each end of the steel tube. The solid steel shaft was fitted with a 4.9 cm pillow block bearing. The bearing assemblies were bolted to the mid-section of the pontoons. The baskets were attached to the axle by bolting them to 7.6 cm angle iron brackets that were welded to the axle.

The fishwheels were positioned parallel to the current with their bows pointing upstream. A cedar spar-log mounted across the bow held the fishwheel off the shore (Fig. A-1). Each fishwheel was anchored to shore with 50-100 m of 1.6 cm diameter wire rope. The anchor line was fastened at one end to a wire rope bridle that was attached to the wheel, and at the other end, to the base of a live tree. An independent, non-load bearing safety line made of 2.9 cm dia. polypropylene rope was tied to the front cross walk and to shore at the base of a different live tree. The river current propelled the fishwheel from speeds of one to seven revolutions per minute (RPM).

A fishwheel was stopped by placing a 10 x 40 cm plank across the front of the pontoons, within reach of the baskets. The basket would come to rest on this plank and stop the fishwheel from turning. The fishwheels were initially stopped to do maintenance, repairs and tag fish. In early July extensions were affixed to the rear pontoons which allowed enough room for fish tagging and sampling to be done while the fishwheels ran. From early July until the completion of the project, the wheels were only stopped to do repairs and maintenance.

To regulate the speed of the fishwheels, "paddles" of various sizes were affixed to the uprights. The paddles were made of 2" x 4", 2" x 6" or 2" x 12" lumber strung between and at right angles to, the uprights (Fig. A-3). Occasionally, a larger more elaborate hinged paddle, called a "flipper paddle", was installed on the fishwheels when the river velocity became too slow to turn the fishwheel at a desirable speed. The hinged design allowed the paddle to swing vertical as it was lifted out of the water, thereby, reducing its resistance in the water. The greater surface area of the flipper paddle would generate more torque when in contact with the river, the hinged design would reduce the resistance as the uprights came up through the water and the fishwheel would spin at a higher speed than when the smaller dimension lumber paddles were used.

Fish were captured as the baskets were lifted out of the water by the current. Captured fish would slide toward the axle as the wheel revolved and the basket was raised into the air. The captured fish would then come into contact with a plywood slide positioned inside the basket and this slide would direct the fish toward one of the two the live-boxes attached to left and right side of the fishwheel (Fig. A-1). The fish would slide out of the basket, across a slide built above the axle, and into the live-box affixed to the outside of the fishwheel. The fish would remain in the live-box until the crew came to sample and tag the fish.

Maintenance

Wooden fishwheels operating in fast moving rivers require regular maintenance and numerous repairs. As a result, the fishwheel project was labour intensive. The amount of maintenance and labour required was usually proportional to the operating speed of the wheel and the amount of floating debris in the river. The stress on the fishwheel components appeared to increase non-linearly with the speed the fishwheel. When the fishwheel speed exceeded 4 RPM, the frequency of breakdowns increased substantially. At speeds less than 4 RPM, structural failure was rare. The frequency of collisions between floating debris and the fishwheels increased with density of debris in the river. In addition, the severity of the damage that occurred during collisions between the fishwheels and debris increased with increasing fishwheel speed.

The most frequent maintenance was greasing the axle (daily) and replacing broken lumber on the baskets and uprights. This maintenance usually took two people, 10 min to 2 h per day to carry out. Occasionally, logs and other floating debris would collide with the fishwheel and destroy entire baskets and/or live-boxes. These breakdowns would usually require full, 4-6 person crews, working for several hours and occasionally up to several days to repair.

Staffing Requirements

The two fishwheels were constructed using a crew of six people for 9 d. It took an additional day, using a similar crew, to position and install the each fishwheel at its fishing site. Once installed, the fishwheels were staffed with a crew of three to eight people. The crew was initially comprised of one senior technician/supervisor and four technician trainees. During the peak fish migration periods, an additional technician and two trainees were added to the crew. These additional people were used to help with the continual tagging sessions that were necessary to tag the catch. Once the peak fish migration periods were over in late July, the crew was usually comprised of one senior technician and two or three technician trainees. Occasionally, others were added to the crew to help with moving the fishwheels to new sites and to help reconstruct the wheels after major breakdowns.

The tagging and sampling schedule varied with the catches in the fishwheels. There was always a minimum of one trip to the fishwheels each day to check for fish and to do regular maintenance. The usual schedule was to visit the fishwheels three times to sample and tag fish, early morning, mid-afternoon and late evening. For 3 d during the peak of the sockeye migration, each fishwheel was staffed continuously from late morning until early evening.

SITE SELECTION

The selection of suitable sites for the Nass River fishwheels was a multi-step process. Given the project objectives, we needed to find at least two sites where fishwheels could be operated for a minimum of three months (June to August) and sample upstream migrating salmon roughly proportional to their abundance. The two sites were required to be within 2-5 km of each other in order to staff both fishwheels with a single crew. Our preference was to position the fishwheels as close to the mouth of the river as possible so that they could provide similar information to that currently collected by the Monkley Dump gillnet test fishery (Fig. 1). Once a general area and a number of sites had been identified, a river reconnaissance was conducted to measure physical features of the potential fishwheel sites. These features included: river width, water depth, water velocity, shoreline topography (primarily slope) and accessability. These criteria and how they were used to evaluate prospective fishwheel sites are outlined below and were based primarily on the senior author's experience with the installation and operation of fishwheels on the Taku River in southeast Alaska.

River Width

Fishwheels work well in a narrowing of the river where its velocity increases and cross-sectional area decreases. In these situations, fish are forced to migrate closer to shore and are concentrated in less cross-sectional area than when the river is wide and slow.

The Nass River narrows substantially as it flows alongside the Tseax lava flow near the town of Gitwinksihlkw (Fig. 2). This area was selected as an area to examine closely for fishwheel sites because of its characteristics as a high velocity, narrowing of the river and its proximity to the Monkley Dump test fishing site. Another area that was examined closely for potential fishwheel sites was the area in and around Grease Harbour (Fig. 2). This area is characterized by a narrowing of the river, high velocity and high, steep rock walls.

Water Depth

In order for a fishwheel to turn, the water must be deeper than its radius minus the height of the axle above the water (i.e. the depth of the underwater portion of the basket). A Lorance X-60 sounder was used to determine the depth of the water at prospective fishwheel sites. The depth was determined for a stretch of 20 m along the shore and out to 7 m offshore. Examining a stretch of river longer than the fishwheel was done to allow for fine tuning of the position of the fishwheel once at the fishing site. Often, as the water rises and falls, the fishwheel must be moved short distances up or down river to avoid having the pontoons hang up on rock outcrops that are at various depths. Sites were deemed adequate if the water depth was not expected to become less than the depth of the baskets (underwater) for the duration of the project.

Water Velocity

The surface water velocity was examined at each site to determine if the fishwheel would revolve in the range of speed where it is the most efficient. Although there is no precise estimate of which speeds fishwheels are the most efficient, they appear to fish best at speeds between 2 and 4 RPM. Below 2 RPM, the baskets appear to spend too much time underwater, allowing fish to plenty of time to sense the basket and escape. When the fishwheel revolves at speeds above 4 RPM, the basket structure is severely stressed and results in frequent material failures. Also, at speeds close to 4 RPM and above, the baskets become very noisy as they collide with the water. This noise is likely to scare fish away from the fishwheel.

To achieve speeds of 2 to 4 RPM with the large basket fishwheel, the surface water velocity needed to be between 1 and 3 m per second and for the small basket fishwheel, speeds of 0.5 to 2 m/s were required. A site was deemed adequate if at high water, the water velocity was between 2 and 3 m per second.

Shoreline Features

Two features of the shoreline are critical to efficient fishwheel operation. First, the bank adjacent to where the wheel is to be positioned should be vertical or very close to vertical. This allows the fishwheel basket to fish very close to shore, limited only by the width of the shore-side pontoon and live-box. The less steep the bank is, the farther the fishwheel must be placed away from shore in order for the baskets not hit the bottom while underwater. The farther from shore the fishwheel must be placed, the greater room for fish to swim between the fishwheel and the shore. Since fish density decreases with the distance from shore, the closer to shore the baskets fish, the more efficient the fishwheel.

A second critical shoreline feature is that the river bank should hydraulically deflect debris. Floating logs and trees are extremely destructive when they collide with fishwheels. A point of land jutting out into the river upstream of the fishwheel site will divert much of the current and debris out into the middle of the river.

Although not used in 1992, a fin-boom can be used to accomplish similar results as a natural debris deflector. A fin boom is composed of one or more floating logs tethered to shore at one end and held out in the river by one or more rudders affixed to each log. A fin boom would have prevented some of the damage to the fishwheels in 1992. One was never constructed due to a shortage of time once the fishwheels began catching fish.

Accessability

Sites were deemed accessible if they were within 15 min boat travel of a location that was accessible by motor vehicle. The project required frequent trips to and from the fishwheels to transport materials and crew. Sites farther away than 15 min boat travel were considered too costly to staff. These sites were not eliminated from consideration, but instead, they were given a low priority.

EFFORT AND CATCH

Fishing effort by the fishwheels was measured in two ways. First, total effort was measured as the time each wheel was fishing from midnight to midnight. Second, the effort used to calculate catch per unit effort (CPE) was measured as the number of hours each fishwheel fished to obtain the daily catch. These two values were different because the time of the last sampling session on each day varied; this affected that day's and the following day's effort and catch. Effort was adjusted by halving for periods when only one live-box was attached to a fishwheel. We used the daily catch of each species to estimate daily CPE.

Fishwheel RPM was also recorded, but was not used to adjust effort estimates. We were unable to quantify effort in terms of RPM and fishing time because the relationship between RPM and catchability was not known.

TAGGING

The objective of the tagging program was to tag as large a proportion of the total daily catch of each species as possible (except pink salmon, which were not tagged). In general, the proportion of the catch tagged was close to 100%, but decreased to approximately 50% for sockeye when the daily catch exceeded 200 fish. Sockeye caught prior to 30 June were tagged at rate of approximately 20% due to a shortage of tags.

Spaghetti tags were used to tag sockeye, chinook, coho, chum salmon and steelhead. Petersen tags were used to tag sockeye early in the season when spaghetti tags were unavailable. Most of the chinook salmon caught in the fishwheels were tagged with radio transmitters as part of a separate project to assess the distribution of chinook salmon in the Nass watershed (Koski et al. 1996). Fourteen steelhead and five chum salmon were also radio tagged.

The spaghetti tags were yellow, 2 mm PVC tubing (FT-4 spaghetti tag, Floy Tag Manufacturing Co., Seattle, Washington, USA, 98105). Each tag was 35 cm long and had a unique five digit number (tags were consecutively numbered) printed in black ink along with the following address: NTC NEW AIYANSH, B.C. VOJ 1AO. Petersen tags were standard white, blue and green Petersen disks. Radio tags were 150 MHz cylindrical transmitters, 8 cm long and 1.6 cm in diameter (Lotek Engineering Inc., Aurora, Ontario, L4G 4J9). In addition to the radio transmitter, an operculum tag was applied as an external mark on the radio-tagged chinook (Ketchum kurl-lock tag, Ketchum Manufacturing Sales Ltd., Ottawa, Ontario, K2A 2G6).

Petersen and spaghetti tags were applied through the dorsal musculature of the fish, approximately 1 cm below the posterior end of the dorsal fin. Spaghetti tags where tied off with a single overhand hitch. The tagging procedure was usually carried out by three people. Fish were dipnetted out of the live-box and placed in a v-shaped plywood trough lined with soft 1.25 cm thick foam and filled with river water. Fish were tagged and/or sampled and gently released back into the river. The procedure took approximately 20 s to complete and rarely took more than 90 s. Fish were not anaesthetized prior to tagging or sampling. Prior to the end of August, fish were handled with bare hands to reduce scale abrasion and desliming. In September, the water temperature fell to levels (<7 C) that made handling fish with bare hands for prolonged periods difficult and fingerless neoprene gloves were worn by the tagging crew.

TAG RECOVERY

Tagged fish were recovered throughout the Nass River watershed using a variety of techniques at different locations. The majority of tagged sockeye and coho were counted and/or recovered at the Meziadin fishway. Additional recoveries of tagged salmon were obtained from the in-river net and sport fisheries, the commercial fisheries in Area 3-12, at the Kwinageese weir, on spawning ground surveys and as recaptures in the fishwheels.

The Meziadin Lake sockeye stock comprises the majority of the Nass River sockeye escapement and as a result, the fishway provided a very large sample of fish to examine for tags applied in the lower Nass River. The number of coho passing through the fishway was also large enough in 1992 to recover a significant number of spaghetti-tagged coho.

At the Meziadin fishway, the field crew was instructed to count every tagged fish (sockeye, coho, chinook and steelhead) that passed through the fishway and to remove as many tags from fish as possible. Spaghetti tagged fish were easily identified and enumerated as they swam through the counting chutes at the fishway. Tagged fish were temporarily trapped in the counting chutes and the tags removed. The ability of crew members to remove tags was dependent on the number of fish migrating through the fishway each day. During the peak fish migration, it was particularly difficult to remove tags from fish without substantially slowing the rate of passage.

Radio-tagged chinook were located and recovered from spawning grounds using a combination of telemetry and carcass surveys. Information from the recovery of chinook salmon tagged in the fishwheels was used to estimate chinook escapement to the Nass River and major tributaries (Koski et al. 1996).

POPULATION ESTIMATION

Population estimates were generated for sockeye, coho and chinook salmon using tagging information from the fishwheels. Estimates for sockeye and coho are described in this report. Estimates of the chinook escapement are described in Koski et al. (1996). There were not enough tags applied (or recovered) to chum and steelhead to allow for a population estimate. The estimates generated here for sockeye and coho are for the number of fish estimated to have migrated upstream of the fishwheels. These estimates do not include fish returning to tributary streams below the fishwheels. However, some fish may have migrated by the fishwheels and then dropped back to systems downstream.

The sockeye population was estimated using the modified Petersen formula (Ricker 1975) and recoveries of spaghetti-tagged fish at the Meziadin fishway. Petersen tags that were applied to the early part of the run were not included in the tag total because we suspect these fish were preferentially removed from the population by the large mesh, river gillnet fishery for chinook. We estimated the population of coho passing the fishwheels with the modified Petersen formula and tag recoveries at the Meziadin fishway. Confidence limits for the mark-recapture estimates were determined using fiducial limits for the Poisson distribution (Ricker 1975).

Mark-Recapture Assumptions

Biases in Petersen estimates can occur when the principal assumptions of the estimation procedure are violated (p. 81-82, Ricker 1975). The relevant assumptions are:

1. *The marked fish suffer the same natural mortality as the unmarked fish;*

2. *The marked fish are subject to the same fishing mortality as the unmarked fish;*

3. *The marked fish are equally vulnerable to the recapture technique as are the unmarked fish;*

4. *The marked fish do not lose their marks;*

5. *The marks are applied randomly over the entire run; and/or marked fish become randomly mixed with the unmarked fish; and/or the recovery effort is proportional to the number of fish present in different reaches of the system; and*

6. *All marks are recognized and reported on recovery.*

Our assessment of the validity of each of these assumptions is presented below (see Discussion).

RUN RECONSTRUCTION

To assess the suitability of the fishwheels as a consistent inseason index of the sockeye escapement to the lower river, we reconstructed the sockeye run at the fishwheel site and compared fishwheel catch per effort with the reconstructed run. A daily run reconstruction was possible because we had a daily record of the fish caught and marked in the fishwheels and a daily record of the marked and unmarked sockeye counted through the Meziadin fishway. Simpler approaches, such as simple back-dating of the run observed at Meziadin, were deemed inappropriate because preliminary analysis indicated inseason variation in sockeye migration rates. This variation was probably the result of migration delays caused by large variations in Nass River flow and counting bottle necks at the fishway during peak migration periods.

The first step in our procedure to reconstruct the sockeye run at the fishwheels was to estimate the mean number of days required for sockeye to travel from the fishwheel tagging site to the enumeration and capture site at the Meziadin fishway. These travel times were estimated using tag release and recovery data for sequential periods of 4 d. The sensitivity of the estimates to period length was investigated for periods of 2-7 d. The mean ($TTmean_p$) and standard error (STE_p) for each period was used in the following equations to estimate the lower and upper bounds of the 95% confidence interval for the mean travel time:

$$\begin{aligned} TTlb_p &= TTmean_p - 2*STE_p \\ TTub_p &= TTmean_p + 2*STE_p \end{aligned} \qquad \textbf{(1)}$$

where $TTlb_p$ and $TTub_p$ represent the lower and upper bounds for the mean travel time associated with period p. These values were estimated for tag recovery periods at Meziadin (i.e., the travel time for fish recovered during a period of 4 d at the fishway) and tag release periods in the lower river (i.e., travel time for fish released during a period of 4 d at the fishwheels). The lower and upper bounds for each recovery period were used to define the range of fishwheel data that should be used to expand the number of tags observed at the Meziadin fishway to represent both the tagged and untagged sockeye previously caught in the fishwheels ($MEZFWC_i$).

$$MEZFWC_i = MEZTAGS_i \frac{\sum_{j=a}^{b} FWCOUNT_j}{\sum_{j=a}^{b} FWTAGS_j} \qquad \textbf{(2)}$$

$$\begin{aligned} \textit{where:}\quad a &= i - TTub_{ip} \\ b &= i - TTlb_{ip} \end{aligned}$$

where $MEZTAGS_i$ is the number of tagged sockeye observed at the Meziadin fishway on day i, $FWCOUNT_j$ is the number of sockeye caught by fishwheels on day j, $FWTAGS_j$ is the number of fish tagged at the fishwheels on day j, and ip is the tag recovery period at Meziadin. The daily catches at the fishwheels could then be expanded using the data from Meziadin to estimate the total number of sockeye passing the fishwheel location each day (RUN_j).

$$RUN_j = FWCOUNT_j \frac{\sum_{i=c}^{d} MEZCOUNT_i}{\sum_{i=c}^{d} MEZFWC_i} \qquad (3)$$

$$\textit{where: } c = j + TTlb_{jp}$$
$$d = j + TTub_{jp}$$

where $MEZCOUNT_i$ is the number of sockeye counted through the Meziadin fishway on day i, jp is the tag release period at the fishwheels, and all other variables are as described above.

The above approach accounts for inseason variability in marking rates at the fishwheels and travel times from the lower river to Meziadin, thereby, permitting a direct evaluation of the inseason variability in the portion of the total run caught by the fishwheels. Unfortunately, there are no direct estimates of the inseason variability in sockeye migration rates from the gillnet test fisheries (Monkley Dump and Mill Bay) to the fishwheel sites, so we could not conduct similar analyses for the two gillnet test fisheries operated in 1992.

AGE, LENGTH AND SEX SAMPLING

A portion of each day's catch was sampled for scales, length and sex. Fish were measured for nose-fork length using a fabric measuring tape affixed to the inside of the tagging tray. Two scales were taken from the preferred area for sockeye, three for coho, five for chinook, five for chum and five for steelhead. Scales were mounted on numbered, gummed scale cards. All scale samples were read by the Department of Fisheries and Oceans Scale Lab in Vancouver. Fish ages are presented using Gilbert-Rich notation. Sex was determined from visual inspection of the fish based on external morphology.

RESULTS

SITE EVALUATIONS AND COST OF OPERATION

Two suitable fishwheel sites were found near the village of Gitwinksihlkw (Fig. 1). Fishwheel 1 was located along a rock bluff on the north shore of the river at the head of the canyon, approximately 300 m upstream of the bridge at Gitwinksihlkw. The water depth at this site varied from 2.6 to 6.5 m and the water velocity ranged from 1 to 4 m/s. Fishwheel 2 was located at several locations along the shore on the north side of the river approximately 1 km downstream of Gitwinksihklw. The water depth at the fishwheel 2 site varied from 5 to 10 m and the water velocity varied from 0.2 to 4 m/s. Fishwheel 2 required considerably more time for repairs and fine tuning than fishwheel 1 due to it being more exposed to debris and subject to much greater fluctuations in water velocity. The water velocity at fishwheel 1 site gradually decreased with increasing water levels, apparently due to the damming effect created by the canyon. At least two adequate sites were located within 1 km downstream of Grease Harbour, but were not fished in 1992.

We found very few (<5) potential fishwheel sites in the Nass River that would have fished through the entire sockeye run in 1992 (June to September). The main limiting factor is the water depth. There were many sites that were adequate for fishing at moderate to high water levels, but due to the large decrease in river discharge in August, many of these sites had only 1.5 to 2 m of water by mid-August. The large amount of debris in the river during rising water conditions also eliminated the use of several sites that were otherwise adequate.

The suitability of a site for management purposes differs from a harvesting fishwheel site in that the latter need only target on the majority of the sockeye run which appears to migrate through the lower river during the high water periods encountered in June and July. Therefore, although the number of management/research fishwheel sites was limited on the Nass, there are numerous high water fishing sites which may be suitable for harvesting sockeye with fishwheels.

The total cost of the project was $207,000. Total labour spent on the study was 560 person days at a cost of $142,000. The labour costs include $15,000 for data analysis and report writing. The capital cost, including construction of the two fishwheels, purchase of a 17 foot aluminum river boat and purchase of all the tools to build and install the fishwheels was $37,000. Operating and maintenance costs for the project from 18 May - 30 September were $28,000. The operating costs included the transportation, food and commercial accommodation for the project manager and senior technician.

The true cost of obtaining the results described here would be higher than for just the fishwheel project alone. Information from other projects, most notably the Meziadin fishway, was invaluable in providing information on the recovery of salmon tagged at the fishwheels and contributed significantly to the results presented here.

EFFORT AND CATCH

The fishwheels were operated on the Nass River from 5 June to 29 September. The two fishwheels ran for an estimated 3,696 hours or 66% of the time they were in place (Table B-1). Fishwheel 1 operated for 2,073 hours or 74% of the time it was in place. Fishwheel 2 did not fair as well, operating only 1,623 hours or 58% of the time it was in place.

When water conditions were good, total effort remained fairly stable at 24 h per day (Fig. 3). However, these periods of high effort were punctuated with small, intermittent reductions in effort due to minor repairs and maintenance and major reductions in effort for major repairs and extremely low water conditions. For the majority of the season (5 June - 10 August), fishwheel 1 fished at a relatively constant 3.5 RPM (Fig. 3). However, during the last three weeks of August and most of September, the RPM for fishwheel 1 fluctuated dramatically from zero to six due to extremely high and low flows and the installation of smaller, faster baskets. Fishwheel 2 had a highly variable RPM that tended to decrease to ineffective speeds following each peak in the Nass discharge. By late August, fishwheel 2 had virtually stopped fishing effectively.

The sockeye catch was the largest (9,046), followed by pink (5,699), coho (559), chinook (444), chum (42) and steelhead (40) (Table 2).

Catches and CPE for sockeye peaked on two occasions (Fig. 4). The first peak occurred on 28 June with a daily catch of 483 sockeye and a CPE of 11.4 fish per hour (Table C-1). The second peak occurred on 8 July with a daily catch of 1,704 sockeye and a CPE of 40.3 fish per hour.

Chinook catches also peaked on two occasions (Fig. 5). The first peak occurred on 27-28 June with daily catches of 39 and 40 chinook (Table C-2) and CPE of 0.73 and 0.64 fish per hour. The second peak occurred on 6 July with a daily catch of 43 chinook and a CPE of 1.2 fish per hour. Coho catches occurred primarily between 1 August and 15 August. The CPE peaked on 2 August with a daily CPE of 1.7 fish per hour (with a catch of 41) and catches peaked on 8 August with a daily catch of 46 and a CPE of 0.94 fish per hour (Table C-3).

The first pink salmon was caught on 11 July and the run appeared more protracted than other species (Fig. 6). The peak catch occurred on 9 August with 291 fish caught and a CPE of 6.4 fish per hour (Table C-4). The peak CPE occurred on 20 August with a daily CPE of 9.1 fish per hour and a daily catch of 243. Chum salmon catches in the fishwheels were rare and never rose above five per day with the majority of catch occurring in late August (Fig. 6). Most steelhead were caught during August and September with a daily maximum of six fish on 11 August (Table C-4; Fig. 7).

Figure 8 shows daily sockeye catch at the fishwheels and Nass River discharge at Shumal creek (5 km upstream of Gitwinksihlkw). This figure shows the relationship between fish movement and water fluctuation where catches decreased during rising water levels and increased during falling water levels. This is the same behaviour noted by Meehan (1961) with salmon in the Taku River. Of particular interest was the high water event that occurred during the first three days of July that reduced chinook catches to zero and sockeye catches close to zero. The few sockeye caught during this event were probably caught while dropping back downstream.

TAGGING

A total of 4,836 sockeye, 507 coho and 334 chinook were tagged in the fishwheels (Table 2). These numbers represent 53%, 75% and 91% of the total catch for each species, respectively. Enough tags were applied these three species to permit mark-recapture population estimates to be made. Of the 4,836 sockeye tagged in the fishwheels, 326 of these were tagged prior to 29 June with Petersen disks. The rest were tagged with spaghetti tags.

Weekly tagging rates for sockeye ranged from 50% to 100% except for the weeks of 19 June and 26 June (Fig. 9). For these two weeks, Petersen tags were applied to a small fraction of the total catch of sockeye due to a shortage of tags.

TAG RECOVERY

Nearly all the sockeye tag recoveries were recovered or counted at the Meziadin fishway (98% of all recoveries, Table 3). For coho, 56% of all recoveries were at the fishway. Most of the recoveries of radio-tagged chinook were obtained through radio telemetry surveys of spawning grounds (Koski et al. 1996).

Of the 3,050 tagged sockeye observed at Meziadin, 19 were Petersen disk tagged and the rest were spaghetti tagged (Table D-1). Only 469 of these tagged fish were actually recovered by field crews and the remainder were simply counted as they passed through the viewing box. Of the 24 tagged coho observed at the fishway, 14 were recovered and 10 were observed passing through.

POPULATION ESTIMATION

A range of Petersen population estimates for sockeye and coho salmon were computed based on the assumption that tagged fish may be selectively removed from the population and the rate of removal is probably between 0% and 30% (Table 4). Selective removal can occur as a result of several factors: 1) immediate mortality of tagged fish, 2) selective removal of tagged fish in river fisheries, 3) tag loss, and/or 4) poor detection at the recovery site. The maximum bound for the differential tag removal rate was set at 30% because the minimum sockeye population (observed escapement plus known in-river harvests above the fishwheels) exceeded 620,000. Our best estimates of sockeye and coho escapement past the fishwheel sites were 705,000 and 60,000, respectively (Table 4). The same approach was used for sockeye and coho because the tags and tagging procedures were identical for these species. The factors that could result in selective removal of marks from a population are examined below in our discussion of the basic mark-recapture assumptions.

RUN RECONSTRUCTION

Analysis of the 469 spaghetti tags recovered at Meziadin revealed a trend toward shorter travel times (faster migration rates) from the beginning to the end of the sockeye run (Fig. 10). Mean travel times from the fishwheels to the Meziadin fishway were 18-19 d for the sockeye marked in early July. Travel times remained fairly constant through July, declined gradually through August and reached a minimum of 11 d for fish tagged and released in early September (Table 5). The standard error (STE) associated with the 4-d release periods ranged from 0.5-2.9 days with values less then 2.0 days in 75% of the periods.

Travel times based on recovery periods did not show the same pattern as the release periods (Table 5). The mean travel times were shortest (14 d) for the first recovery periods in mid-July, longer (18-20 d) in late July and early August, short again (15-16 d) in mid-August and longest in early September. The short travel times for the first recovery periods simply reflects the fact that the majority of the tagged fish available for recapture in these periods were released less than 15 d earlier. The results for the middle recovery periods are similar to the release periods, and the long travel times and high variance associated with the later recovery periods reflect the effect of a few fish with very long travel times. The reduced potential for long travel times for July-August recovery periods resulted in lower STE estimates for these periods. The STE associated with the 4 d recovery periods prior to September ranged from 0.1-1.8 d with values less than 1.2 d in 75% of these periods.

The run reconstruction analysis suggested good agreement between the total sockeye run at the fishwheels and the fishwheel CPE (Fig. 11), despite the observed daily variability in the percent of the run caught by the fishwheels (Fig. 12). One of the most interesting results from this analysis was the indication that the percent of the run caught by the fishwheels was largest at the peak of the run (1.6%). This was a clear indication that this type of gear did not saturate during the record peak migration periods of 1992. Therefore, it is unlikely that this gear would saturate in future years. One possible cause for the higher catch rates during the peak of the run is that the peak migration period followed a period of extreme high water. The portion of the sockeye population migrating close to the canyon walls would be higher during periods of high, fast water than during periods when water levels were lower and velocities in the canyon reduced. The discrepancy between the fishwheel CPE and total run during the first week was a direct result of the lower recovery rate for Petersen versus spaghetti tags.

The proportions of chinook, sockeye and coho captured in the fishwheels based on the fishwheel catches and overall population estimates, were 2.13%, 1.28%, 0.94% respectively (see Table 6 for the range in the estimated proportions). Fishwheel 1 captured a much greater proportion of each species than did fishwheel 2 (Table 6).

AGE, LENGTH AND SEX SAMPLING

Total age 4 (44.7%) and total age 5 (48.0%) were the dominant age classes for sockeye (Table 7). Age 5_2 and 6_3 sockeye were the largest of all age classes having each spent 3 yr at sea (633 and 643 mm, respectively; Table 8; Fig. 13). Age 4_2 and 5_3 sockeye were also of similar size after 2 yr at sea (means of 575 and 597 mm, respectively). Age 3_2 sockeye were substantially smaller than the older age classes (386 mm).

Age 4_2 sockeye dominated the catch until the end of July after which age 5_3 sockeye became the dominant age class (Fig 14a). The proportion of age 6_3 sockeye fluctuated over the summer and was largest later in the season. Age 5_2 fish were an important component early in the run but decreased steadily over the summer. A similar pattern for all age classes was evident from the samples obtained from the Meziadin fishway (Fig. 14b). Tables E-1, E-2 and E-3 provide a complete summary of the sockeye age data.

Of the 4-yr olds captured in the fishwheels (brood year 1988), 95.8% left the freshwater environment during their second year of life (age 4_2). Of the 5-yr olds (brood year 1987), 65.1% left freshwater during their third year of life. Accordingly, the majority of the 4-yr old and 5-yr old returns had spent the same amount of time in the ocean. The remainder of the sockeye captured in the fishwheels were total age 3 (2.2%) and total age 6 (5.1%).

The overall sex ratio for sockeye salmon sampled at the fishwheels was 53.4% male and 46.6% female (Table 7). Female sockeye tended to be younger than male sockeye with 4-yr old females comprising 51.2% of those sampled compared to 39.1% for 4-yr old males and 6-yr old females comprising 2.5% of the sample compared to 7.4% for 6-yr old males. Males and females of age five were similar in abundance (49.9% and 45.8%, respectively). The fish captured in the fishwheels were difficult to sex because there was little sexual dimorphism at this early stage of their migration. Therefore, these data have minimal value for any further analysis.

Chinook salmon sampled at the fishwheels were predominantly 4-yr old fish (brood year 1988) that left freshwater during their second year of life (55.2%, Table 7). Remaining age classes of chinook were 3_2 (10.3%), 5_2 (19.0%) and 6_2 (13.8%). These data suggest that all chinook salmon returning to the Nass in 1992 left freshwater during their second year of life. It should be noted that the radio-tagged chinook were not sampled for scales and, therefore, this sample excludes most of the large (>72 cm) chinook captured in the fishwheels.

Coho salmon captured in the fishwheels were predominantly 3-yr olds (brood year 1989) that had spent one complete year (sub twos) in freshwater (64.5%). The remaining coho captured were 4-yr old fish that left freshwater in their third year of life (34.5%) and 5-yr old fish that smolted in their fourth year of life. The overall sex ratio for coho was 57.1% male and 42.9% female.

Age 3_2 chinook were 432 mm on average, age 4_2 chinook were 632 mm, age 5_2 were 749 mm and age 6_2 chinook were 954 mm (Table 8; Fig. 15). Comparison with the length distribution of the un-aged chinook suggests that the radio-tagged chinook salmon were predominantly age 6_2 and age 5_2 with a mean length of 911 mm. Their is a tendency toward bimodality in the radio-tagged chinook length distribution (Fig. 14).

Age 3_2 coho had a mean length of 541 mm, age 4_3 coho had a mean length of 582 mm and age 5_4 coho had a mean length of 585 mm (Table 8; Fig. 16). Because of the apparent bimodality in the length frequencies for coho, we investigated temporal differences in fish length that would indicate different sized coho stocks passing by the fishwheels at different times in the season. The catch data for coho had suggested that a relatively large run of coho moved through the lower Nass during the first three weeks of August (Figure 5). On 20 August, coho catches fell to near zero and then rose again through the latter part of August and early September. To test for the presence of two discrete populations of coho, we stratified our length analysis into two components: prior to 20 August and after 20 August. While the mean lengths differed by more than 99 mm, t-tests conducted on the mean length for 3_2 and 4_3 coho were not significant ($P>0.2$; Table 9).

DISCUSSION

OPERATIONAL EVALUATION

Sites

It appears that without modifications to the river bank or changes in the design of fishwheels, the number of potential full-season fishwheels sites on the Nass River is limited. Wide fluctuations in river discharge and water velocity in 1992 rendered many sites inadequate due to water velocity that was either too fast/slow or too shallow. These water conditions affected the beginning and end of the project operations the most, and for most of the sockeye run, the water conditions allowed for several suitable sites (i.e., sufficient depth and velocity). Therefore, the site limitation may only affect the ability to capture chinook and coho salmon during the high and low water conditions encountered in the spring and fall. Improvements to the design of the fishwheel, such a more balanced basket design and/or the ability to fish variable depths, may alleviate this much of this problem (see below).

Modifications to the river bank would include: 1) clearing away small rock outcrops that do not allow placement of the fishwheel close to shore at several otherwise suitable sites, and 2) placement of structures (leads) that would divert fish out into the deeper water where the fishwheel has sufficient depth to operate (see Donaldson and Cramer (1971) for examples of fish leads used in the Columbia River).

Design

The fishwheel design used in this study worked well during moderate water flows. Problems with the design were encountered when water velocity and debris load were high and when water velocity was low. At really high water, installation of the fishwheels was difficult and breakdowns were frequent. The inability to raise the basket assembly and the live-boxes out of the river made them vulnerable to extreme water forces and collisions with debris. The baskets and live-boxes were damaged on several occasions, even when the fishwheel was shut down and partially disassembled to ride out a high water-event. A method of easily raising the basket assembly and the live-boxes clear of the damaging current and debris would have significantly reduced breakdowns and labour costs. In addition, an ability to raise the axle by as little as 1 m would have greatly extended the fishing time of fishwheel 1 at its original site. Fishwheel 1 ran aground on 15 August and caused considerable damage to the baskets and axle. Smaller baskets were installed and the fishwheel was restarted on 23 August. On 27 August it had to be moved downstream to deeper water.

At extremely low water conditions, several sites became unfishable because the water velocity became too low. The basket assembly we used, based on a four spoke wheel (two or three baskets and two or one uprights), appeared to have too large a gap between spokes, creating long lags at predictable points in each rotation. A design based on a balanced six spoke wheel with three baskets and three uprights may provide more frequent contact with the river current and allow the fishwheel to continue fishing down to lower water velocity.

One additional way to improve the fishwheel design is to use different material for the pontoons. The wooden pontoons used in 1992 worked reasonably well; their drawback was that they lacked structural strength for extreme water flows, as well as resistance to wear during normal use. These deficiencies lead to frequent maintenance and repairs. A stronger, more resistant material (i.e., aluminum) may significantly reduce the down time and maintenance costs.

Cost

The fishwheel project cost $207,000. The majority (69%) of this was labour costs ($142,000). Considering the large initial capital expenditure in the first year, future project labour costs will make up an even greater proportion of the total budget. Clearly, reducing staffing requirements offers the greatest opportunity to lower costs.

The design changes discussed above (ability to raise and lower the axle, easily removable live-boxes, balanced three basket design and aluminum pontoons) all offer the potential to greatly reduce the labour spent doing maintenance and repairs, as well as the cost of replacement materials. An additional method of reducing staffing costs would be to build larger live-boxes that are capable of accommodating greater catches and, thereby, allow for reducing the frequency of visits to the fishwheel from two per day to three per day during periods with low to moderate catches.

Aluminum pontoons for fishwheels have been experimented with on the Taku River and the result has been much longer pontoon life and decreased maintenance and repair costs. The other methods of reducing costs mentioned above have not been thoroughly examined and future projects on the Nass River should provide an opportunity and environment to properly test them.

USE OF FISHWHEELS AS A STOCK ASSESSMENT TOOL

The fishwheels were successfully used as a stock assessment tool in 1992. Sufficient numbers of adult chinook were captured for a large scale radio tagging project that determined the distribution, timing, fate and abundance of chinook in the Nass watershed (Koski et al. 1996). Enough sockeye and coho were tagged to generate population estimates with reasonably narrow confidence intervals. A total of 2,205 fish were sampled for sex, length and successfully aged.

The fishwheels catches appear to provide unbiased data on the relevant biological characteristics (age and length) of Meziadin Lake sockeye. Comparisons between the length-frequency data for sockeye from the gillnet test fisheries operated at the mouth of the Nass River, the Meziadin fishway and the fishwheels indicated that the size distribution for fish sampled at the fishwheels was very similar to that for the Meziadin fishway and slightly different than the test fisheries (Fig. 17).

USE OF FISHWHEELS FOR POPULATION ESTIMATION

The basic Petersen population estimate for the total Nass sockeye escapement (881,000 without any bias correction) was considerably higher than that estimated from test fishery stock composition data (686,000, Rutherford et al. 1994) and fishway and spawning ground enumerations (634,759, Les Jantz, DFO, Prince Rupert. pers. comm.). In the following paragraphs we examine the mark-recapture assumptions and identify possible sources of bias in our mark-recapture estimate.

1. *The marked fish suffer the same natural mortality as the unmarked fish.*

Higher differential mortality of marked fish has been suggested as one of the reasons why mark-recapture data tend to overestimate salmon escapements (Cousens et al. 1982). The basic argument is that increased stress during capture and handling will result in some immediate mortality of marked fish. Eames et al. (1981) provides a good review of this assumption for a variety of adult salmon tagging studies and concludes that mature salmon captured in freshwater environments are highly resistant to stress, so little (if any) tagging mortality will occur.

Direct information from our 1992 radio tagging program indicated that mortality and other tagging losses accounted for less than 9% of the radio-tagged chinook and more than half of these losses were probably due to tag regurgitations and non-functional tags. Given the less stressful nature of our spaghetti tagging operations for sockeye and coho, we would expect lower mortality rates than that estimated for the radio-tagged chinook (i.e., less than 5%).

2. *The marked fish are subject to the same fishing mortality as the unmarked fish.*

Several studies have documented instances of the selective removal of tagged fish in ocean and freshwater fisheries (Gazey et al. 1983, English et al. 1984). The degree of selectivity is highly dependent on the nature of the fishery (e.g., large or small mesh gillnets) and the type of tag used. The combination of large mesh gillnets used to catch chinook in the in river native fisheries and Petersen disc tags can produce a situation where there is a strong selection for tagged fish. Comparisons of tag recovery rates for disc and spaghetti tags applied to alternate fish in coastal fisheries revealed similar recovery rates for ocean fisheries by substantially lower recovery rates for disc tags at enumeration sites beyond river gillnet fisheries (English et al. 1984).

Given the above results we were not eager to use disc tags in 1992. However, disc tags were the only tags available prior to 2 July and we initially believed that in-river harvests above the tagging sites would not be substantial. Unfortunately, harvests were larger than expected and the recovery rate for disc tags (5.8%) was substantially less than the rate for spaghetti tags (67.2%). Since the number of disc tags applied was less than 7% of the total tags applied to sockeye, we chose to exclude them from the Petersen estimate rather than attempt to adjust for differential removal rates in the upstream fisheries.

There is also evidence for selective removal of spaghetti tags by gillnet fisheries. The recovery rate for the spaghetti tags applied to sockeye in the 1983 North Coast Salmon Tagging Study was five times higher in the terminal Area 4 gillnet fishery than at the Babine fence (English et al. 1984). If the mark rate in the upstream gillnet fisheries was five times that observer at the Meziadin fishway in 1992, the estimated sockeye harvests from this fishery (23,800 sockeye, see English and Bocking 1993) could have removed over 500 tags from the marked population. This selective removal of over 500 tags represents a fishing mortality bias of approximately 11%. A fishing mortality bias of 10-15% is certainly reasonable for river gillnets which are hung at a higher ratio of mesh per meter than ocean gillnets and would have a greater potential for catching tagged fish than untagged fish. This type of bias would apply to both sockeye and coho escapement estimates.

3. *The marked fish are equally vulnerable to the recapture technique as are the unmarked fish.*

The recapture technique used in this study was the observation of fish in the counting chutes at the Meziadin fishway. There is nothing about the counting chutes that would bias the recapture sample. There is the potential that a portion of the marked fish moving through the fishway were not detected, and this is discussed under the sixth assumption below.

4. *The marked fish do not lose their marks.*

English et al. (1985) and Bocking et al. (1988) reported moderate to high rates of tag loss for spaghetti tags applied to adult pink and coho salmon. In both of these studies tag loss appeared to be related to specific taggers or the tag application method (e.g., tag knot). In studies where spaghetti tags were tied off with a single overhand hitch, there have been few incidences of tag loss (McGregor et al. 1991). When salmon are spaghetti-tagged and the tag is later removed, tag entry and exit holes are readily seen and provide a form of secondary mark. There were almost 1,000 sockeye examined for marks at the Meziadin fishway in 1992 and no incidences of fish missing spaghetti tags.

5. *The marks are applied randomly over the entire run; and/or marked fish become randomly mixed with the unmarked fish; and/or the recovery effort is proportional to the number of fish present in different reaches of the system.*

This assumption is usually the most difficult to fulfill and evaluate. In this study, the release and recapture methods provided a rare opportunity to mark and recovery fish continuously over the duration of the sockeye run. The daily fishwheel catch, Meziadin fishway counts and within season variability in travel times were used to reconstruct the sockeye run at the fishwheel site. The unusually large sockeye return to the Meziadin provides us with a high degree of confidence that we examined a large portion of the run (probably in excess of 85%). The available data indicates that this assumption was valid for sockeye. Marks were applied randomly over the entire run (Fig. 18). The 14-21 d travel time from the fishwheels to Meziadin along with the accumulation of fish at the fishway provided excellent conditions for mixing of marked and unmarked fish. Recovery efforts at Meziadin were certainly proportional to the number of fish present (all fish using the fishway were counted).

One could also argue that components of this assumption were reasonably well satisfied for a portion of the upstream coho stocks, but the data are much more limited than those for sockeye. At best, our coho escapement estimate only represents that portion of the total coho population that migrated through the lower river in August and early September on its way to upper Nass tributaries. Given the difficulties encountered with operating the fishwheels at low flows, it is unlikely that tagging was proportional to coho abundance. However, the lengthy migration to Meziadin and daily enumeration of mark and unmarked fish at the fishway provide us some confidence that a reasonable estimate can be generated for the portion of the run marked. Given the large number of coho streams in the lower Nass, the limited time period covered by the tags applied, and the potential for substantial coho returns after the tagging and recovery periods, our best estimate (60,000) probably represents some fraction (possibly as little as half) of the coho escapement to the Nass River system.

6. *All marks are recognized and reported on recovery.*

Only a small portion (15%) of the total marked sockeye observed at the Meziadin fishway were recovered. It is also possible that during periods of very high fish abundance several marked fish could have been missed or not recorded. Given the depth of the counting chutes (approximately 40 cm) and the very clear water at the Meziadin fishway, it is unlikely that more than 2% (1 in 50) tagged fish would have been missed.

In summary, the results from this and previous studies would support the contention that differential natural mortality, fishing mortality, tag loss and tag detection could account for losses up to 20% of the spaghetti tags applied to sockeye and coho salmon in 1992. Consequently, we have adjusted our base Petersen estimate by reducing the total number of marks available for recapture from 4,510 to 3,608 for sockeye and 507 to 406 for coho. Our best estimate of the total sockeye escapement to the Nass River in 1992 is 705,000. Our estimate for the portion of the coho escapement covered by our tagging program is 60,000. The total coho escapement to the Nass River in 1992 could be in excess of 100,000 fish.

USE OF FISHWHEELS AS A TEST FISHING INDEX OF ABUNDANCE

Many of the aspects of fishwheel design and operation suggest that it should be an excellent in-river test fishing gear, especially for salmon species that tend to migrate close to shore. The fishwheel's most important features for test fishing are: 1) live capture, 2) no gear saturation at high abundance, and 3) continuous sampling through daytime and nighttime hours. It's greatest limitations are associated with the very specific site requirements and the potential for year to year difference in catch rates if the fishwheels must be moved or river flow conditions change. However, it is likely that these limitations will be less severe than the problem created by saturation of gillnet test fishing gear during peak migration periods. Monkley Dump test fishery data and total escapement estimates for the past 29 years provide an indication of how gillnet catchability tends to decrease with increasing abundance (Fig. 19). Prior to 1992 the catchability varied by 2.5 fold for sockeye returns between 80,000 and 425,000 fish. In 1992, catchability at the Monkley Dump test fishery dropped to 20% of maximum level or 30% of the 1964-91 mean. A large portion of this drop in sockeye catchability can probably be attributed to gear saturation during peak abundance periods. This magnitude of change in catchability is not surprising given the very limited time periods that gillnets can be fished at the test fishery site (averaging <50 min/day). We would expect that fishwheels operated 24 h per day would minimize the variability in catchability associated with gear saturation.

While the available data are not sufficient to fully assess the capability of the fishwheels to provide a reliable index of sockeye escapement to the lower Nass River, the results from our run reconstruction analysis provide a preliminary indication that the catch indices obtained from consistent operation of fishwheels tracked the 1992 run and could provide a more reliable indicator of escapement than those derived from existing gillnet test fishery.

SUMMARY AND CONCLUSIONS

The fishwheels were successful in capturing sufficiently large numbers of salmon for tagging studies which allowed us to determine run timing and generate post-season population estimates for chinook, sockeye and coho. The fishwheels captured a fairly consistent proportion of the sockeye run across wide fluctuations in abundance and, therefore, may be more suitable than the current gillnet test fishery to index the sockeye abundance on an inseason basis. Additional years' data are required to determine the variability in the capture efficiency of the fishwheels between years.

A drawback to the fishwheel project in 1992 was that it was labour intensive and, therefore, expensive. To reduce these costs, we recommend that the 1993 project specifically test several modifications to the fishwheel design used in 1992. These include: an axle capable of being raised and lowered, a balanced three basket design based on a six spoke wheel, easily removable live-boxes and aluminum pontoons. All of these modifications have the potential to greatly reduce staffing and maintenance costs.

ACKNOWLEDGEMENTS

We would like to express our sincere thanks to the dedicated fishwheel crew that made the 1992 project so successful; Courtney Fleek was the senior technician and field supervisor; the technicians that participated so enthusiastically in the project were: Ben Gonu, Carl Johannson, Ed McKay, Arthur Nyce, Steven Nyce, Dean Ryan, Barry Stevens, Cheryl Stephens, and Leonard Squires. Dwayne McKinnis, Erin Weedmark, Tim Angus, and Stephan Jacob staffed the Meziadin fishway and recovered the tags that were used in this analysis.

We would like to thank Harry Nyce, Kim Hyatt, and the other members of the IMP technical and steering committees for recognizing the potential of fishwheels and allowing us the opportunity to properly evaluate them on the Nass River. Andy McGregor provided us with a list of materials from the Taku River fishwheel project which greatly aided the construction phase of this project.

Funding for this project was provided by the Canadian government as a part of the Nisga'a-Canada Interim Measures Program (IMP).

REFERENCES

Bocking, R.C., J.R. Irvine, K.K. English, and M. Labelle. 1988. Evaluation of random and indexing sampling designs for estimating coho salmon (Oncorhynchus kisutch) escapement to three Vancouver Island streams. Can. Tech. Rep. Fish. Aquat. Sci. 1639: 95 p.

Cousens, N.B.F., G.A. Thomas, C.G. Swann and M.C. Healey. 1982. A review of salmon escapement enumeration techniques. Can. Tech. Rep. Fish. Aquat. Sci. 1108: 122 p.

Donaldson, I. J., and F. K. Cramer. 1971. Fishwheels of the Columbia. Binfords and Mort, Publishers, Portland, Oregon. 124 p.

Eames, M., T. Quinn, K. Reidinger and D. Haring. 1981. Northern Puget Sound 1976 adult coho and chum tagging studies. State of Washington, Dep. Fish. Tech. Rep. No. 64. 217 p.

English, K.K. and R.C. Bocking. 1993. Nisga'a catch monitoring program, 1992 Nisga'a fishery. Report NF 92-03 prepared by LGL Limited, Sidney, B.C., for the Nisga'a Tribal Council, New Aiyansh, B.C.

English, K.K., W.J. Gazey, A.R. Maltby and J.A. Taylor. 1985. Part D. The 1984 North Coast Salmon Tagging Project. In: Gazey, W.J. and D.A. Birdsall (eds.) Design and execution of a stock interception study. Unpubl. Rep. by LGL Limited for Fisheries and Oceans Canada.

English, K.K., W.J. Gazey and J.Taylor. 1984. Part C. 1983 North Coast tagging study. In: Gazey, W.J. and D.A. Birdsall (eds.). Design and execution of a stock interception study. Unpubl. Rep. by LGL Limited for Fisheries and Oceans Canada.

Gazey, W.J., J. Taylor, K.K. English, T. Webb and D.A. Birdsall. 1983. Part B. 1982 North Coast tagging study. In" Gazey, W.J. and D.A. Birdsall (eds.). Design and execution of a stock interception study. Unpubl. Rep. by LGL Limited and ESSA Environmental Social Sytems Analysts Ltd. for Fisheries and Oceans Canada.

King, B. E. and K. E. Tarbox. 1989. Upper Cook Inlet salmon escapement studies, 1988. Alaska Department of Fish and Game, Division of Commercial Fisheries. Technical Fisheries Report 89-19, Juneau. 115 p.

Koski, W. R., M. R. Link and K. K. English. 1996. Distribution, timing, fate and numbers of chinook salmon returning to the Nass River watershed in 1992. Can. Tech. Rep. Fish. Aquat. Sci. 2129: xi + 141 p.

McGregor, A. J., P. A. Milligan and J. E. Clark. 1991. Adult mark-recapture studies of Taku River salmon stocks in 1989. Alaska Department of Fish and Game, Division of Commercial Fisheries, Technical Fishery Report 91-05; Juneau.

Meehan, W. R. 1961. Use of a fishwheel in salmon research and management. Trans. Amer. Fish. Soc. 90:490-494.

Milligan, P. A., W. O. Rublee, D. D. Cornett and R. A. C. Johnston. 1985. The distribution and abundance of chinook salmon (*Oncorhynchus tshawytscha*) in the Upper Yukon River Basin as determined by a radio tagging and spaghetti tagging program: 1982-1983. Can. Tech. Rep. Fish. Aquat. Sci. No. 1352. 161 p.

Ricker, W. E. 1975. Computation and interpretation of biological statistics of fish populations. Bull. Fish. Res. Bd. Can. 191: 382 p.

Rutherford, D. T., C. C. Wood, A. L. Jantz and D. R. Southgate. 1994. Biological characteristics of Nass River sockeye salmon (*Oncorhynchus nerka*) and their utility for determining stock composition of test fishery samples. Can. Tech. Rep. Fish. Aquat. Sci. No. 1988.

TABLES

Table 1. Estimates of salmon escapement to the Nass River, 1966-92 (1966-88 from Jantz et al. 1989; 1989-92 from Jantz (DFO, Prince Rupert, pers. comm.)

	Sockeye					
Year	Meziadin	Total Nass	Chinook	Coho	Pink	Chum
1966	64,684	105,959	7,135	40,225	39,075	3,650
1967	41,278	79,228	21,450	16,850	21,750	4,950
1968	71,730	94,805	17,100	28,250	25,325	3,575
1969	135,328	179,228	25,950	14,075	6,475	600
1970	77,078	113,953	14,900	30,750	21,475	2,300
1971	191,674	246,774	13,550	25,625	41,675	2,625
1972	129,525	177,216	16,400	10,500	29,900	2,500
1973	234,627	284,082	3,250	5,150	14,036	3,350
1974	165,259	193,203	2,000	8,485	19,665	4,145
1975	54,095	70,874	4,525	10,210	52,258	250
1976	102,430	142,805	4,040	21,850	20,525	5,550
1977	242,351	399,821	6,760	28,430	131,005	725
1978	111,018	147,218	7,990	22,325	45,005	15,730
1979	200,000	212,890	6,880	13,405	24,400	3,087
1980	142,000	155,265	8,422	17,150	25,465	6,760
1981	214,193	255,643	7,250	23,365	111,190	1,980
1982	250,000	306,070	5,400	17,505	31,685	9,725
1983	170,000	185,100	7,575	21,090	574,850	4,025
1984	140,000	182,350	11,920	27,150	130,800	10,200
1985	290,000	362,540	7,402	29,739	181,254	1,850
1986	115,543	187,426	16,265	26,160	35,950	2,370
1987	143,989	184,212	7,275	21,800	162,496	1,475
1988	116,984	136,760	5,972	5,581	20,650	1,000
1989	50,000	112,307	12,075	6,600	222,860	2,035
1990	120,954	155,442	11,388	16,400	29,018	595
1991	250,000	269,848	3,309	6,027	94,550	80
1992	592,118	634,759	6,730	5,157	17,185	50
66-91 Average	147,105	190,039	9,853	19,027	81,282	3,659

Table 2. Numbers of each salmon species caught and tagged at two fishwheels located on the Nass River in 1992.

	Fishwheel 1		Fishwheel 2		Total	
Species	Catch	Tagged	Catch	Tagged	Catch	Tagged
Sockeye	7151	3915	1895	921	9046	4836
Chinook [a]	277	221	167	113	444	334
Coho	452	413	107	94	559	507
Steelhead [a]	31	30	9	5	40	35
Chum [a]	25	5	17	1	42	6
Pink	2386	0	3313	0	5699	0
Total	10322	4584	5508	1134	15830	5718

[a] Tagged totals include radio-tagged fish: 260 chinook, 14 steelhead and 5 chum.

Table 3. Summary of tag recoveries for the tags applied on the lower Nass River in 1992.

		Tag recoveries							
Tag/species	Number of fish tagged	Meziadin fishway	Spawning grounds [a]	Nisga'a fishery	Sport fisheries	Fishwheel recaptures	Area 3-12 fishery	Total	Percent recovered
Spaghetti tags									
Sockeye [b]	4836	3050	1	19	2	53	0	3125	64.6
Chinook	74	3	3	0	1	3	0	10	13.5
Coho	507	24	0	1	9	7	2	43	8.5
Steelhead	21	0	0	0	0	1	0	1	4.8
Chum	1	0	0	0	0	0	0	0	0.0
Radio tags									
Chinook [c]	360	0	291	32	10	3	0	336	93.3
Steelhead	14	0	7	0	1	0	0	8	57.1
Chum	5	0	0	0	0	0	0	0	0.0
Total	5818	3077	302	52	23	67	2	3523	60.6

[a] The numbers for radio-tagged fish include fish tracked to final destinations and tagged carcasses.

[b] Includes 326 Petersen disk tags released and 19 recovered at Meziadin.

[c] Includes releases and recoveries for 100 radio-tagged chinook caught using tangle nets.

Table 4. Adjusted Petersen population estimates derived from tagging of adult salmon at the Nass River fishwheels and recovery of tags at the Meziadin fishway, 1992. Petersen disk-tagged fish and jacks were not included in this analysis.

		Sockeye	Coho
Number tagged		4,510	507
Number recovered		592,118	3,652
Number of tagged fish recovered		3,031	24
Petersen Estimates	Differential Tag Removal		
No bias correction	0%	880,953	74,229
Minimum bias correction	10%	792,877	66,821
Moderate bias correction	20%	704,801	59,412
Maximum bias correction	30%	616,726	52,004
Bounds - No Bias			
Lower 95 % CL		850,153	50,703
Upper 95 % CL		912,868	113,154
Bounds - Moderate Bias			
Lower 95 % CL		680,160	40,582
Upper 95 % CL		730,335	90,568

Table 5. Means and standard errors for sockeye travel times from the fishwheels to the Meziadin fishway for each release and recovery period, 1992.

			Travel time (d)			
	Period end date	No. tags recovered	Mean	Lower bound	Upper bound	Standard error
Release Periods						
	3-Jul	3	19	16	22	1.5
	7-Jul	141	18	17	19	0.5
	11-Jul	49	16	15	17	0.6
	15-Jul	17	21	15	27	2.9
	19-Jul	20	18	14	22	1.9
	23-Jul	22	19	15	23	2.2
	27-Jul	16	19	15	23	2.2
	31-Jul	16	17	14	20	1.5
	4-Aug	41	18	16	20	1.0
	8-Aug	27	16	14	18	0.8
	12-Aug	57	17	16	18	0.7
	16-Aug	26	18	16	20	1.0
	20-Aug	4	15	13	17	0.9
	24-Aug	4	15	11	19	2.2
	28-Aug	14	15	13	17	0.8
	1-Sep	9	11	9	13	0.8
	5-Sep	3	11	7	15	1.9
Recovery Periods						
	19-Jul	18	14	13	15	0.4
	23-Jul	103	14	14	14	0.1
	27-Jul	36	18	17	19	0.4
	31-Jul	40	19	18	20	0.7
	4-Aug	22	18	16	20	1.2
	8-Aug	21	20	17	23	1.6
	12-Aug	18	20	16	24	1.8
	16-Aug	29	15	14	16	0.6
	20-Aug	22	16	14	18	1.0
	24-Aug	49	16	15	17	0.6
	28-Aug	27	15	14	16	0.5
	1-Sep	19	21	19	23	1.0
	5-Sep	22	26	21	31	2.6
	9-Sep	25	20	16	24	2.0
	13-Sep	13	18	12	24	3.1
	17-Sep	4	30	6	54	12.2
	21-Sep	1	0	0	0	0.0
All Periods Combined		469	17	16	18	0.3

Table 6. The estimated proportion of adult chinook, sockeye and coho captured with two fishwheels in 1992. The sockeye and coho percentages were derived using the Petersen escapement estimates and 95% confidence intervals computed with the assumption of 20% differential tag mortality (Table 4). The estimated chinook run (20,815) was derived as the total return (26,015; Koski et al. 1993) minus the Nisga'a harvest below the fishwheels (5,200; R. C. Bocking, LGL Limited, pers. comm.).

	Fishwheel 1			Fishwheel 2			Total		
		Range			Range			Range	
Species	Percent	Lower	Upper	Percent	Lower	Upper	Percent	Lower	Upper
Sockeye	1.01	0.98	1.05	0.27	0.26	0.28	1.28	1.24	1.33
Chinook	1.34			0.80			2.13		
Coho	0.76	0.50	1.11	0.18	0.12	0.26	0.94	0.62	1.38

Table 7. Sex and age composition of salmon sampled at the Nass River fishwheels, 1992.

	Males		Females		Total	
Species/brood year/age	n	percent	n	percent	n	percent
Sockeye						
1989						
31	3	0.3	0	0.0	3	0.2
32	32	3.3	4	0.5	36	2.0
Total	35	3.6	4	0.5	39	2.2
1988						
41	2	0.2	2	0.2	4	0.2
42	347	36.1	425	50.6	772	42.8
43	27	2.8	3	0.4	30	1.7
Total	376	39.1	430	51.2	806	44.7
1987						
51	0	0.0	1	0.1	1	0.1
52	180	18.7	121	14.4	301	16.7
53	300	31.2	263	31.3	563	31.2
Total	480	49.9	385	45.8	865	48.0
1986						
62	1	0.1	0	0.0	1	0.1
63	70	7.3	21	2.5	91	5.0
Total	71	7.4	21	2.5	92	5.1
Total	**962**		**840**		**1802**	
Chinook [a]						
1989 32	6	15.4	0	0.0	6	10.3
1988 42	22	56.4	10	52.6	32	55.2
1987 52	7	17.9	4	21.1	11	19.0
53	0	0.0	1	5.3	1	1.7
Total	7	17.9	5	26.3	12	20.7
1986 62	4	10.3	4	21.1	8	13.8
Total	**39**		**19**		**58**	
Coho						
1989 32	127	64.5	98	66.2	225	65.2
1988 43	68	34.5	48	32.4	116	33.6
1987 54	2	1.0	2	1.4	4	1.2
Total	**197**		**148**		**345**	

[a] Radio-tagged chinook were not sampled for scales and therefore this represents a selective sample with a greater portion of smaller fish than in total catch.

Table 8. Mean length by age of salmon sampled at the Nass River fishwheels, 1992.

Species	Age	Number of samples	Mean length (cm)	Standard deviation
Sockeye	31	3	44.2	3.5
	32	36	38.6	2.1
	41	4	56.4	3.0
	42	772	57.8	3.4
	43	30	44.0	2.6
	51	1	60.0	
	52	301	63.3	3.6
	53	563	59.8	3.5
	62	1	56.0	
	63	91	64.3	4.3
Chinook	32	6	43.2	1.9
	42	32	63.2	6.2
	52	11	74.9	13.4
	62	8	95.4	4.1
	un-aged	259	91.1	8.4
Coho	32	225	54.1	9.6
	43	116	58.2	9.4
	54	4	58.5	8.8

Table 9. Mean length by age of coho salmon sampled at the Nass River fishwheel prior to and after 20 August 1992.

Period	Age	Number of samples	Mean length (cm)	Standard deviation
prior to 20 August	32	199	52.9	9.2
	43	85	55.5	9.2
	54	4	58.5	8.8
after 20 August	32	27	63.2	7.5
	43	31	65.4	5.1

FIGURES

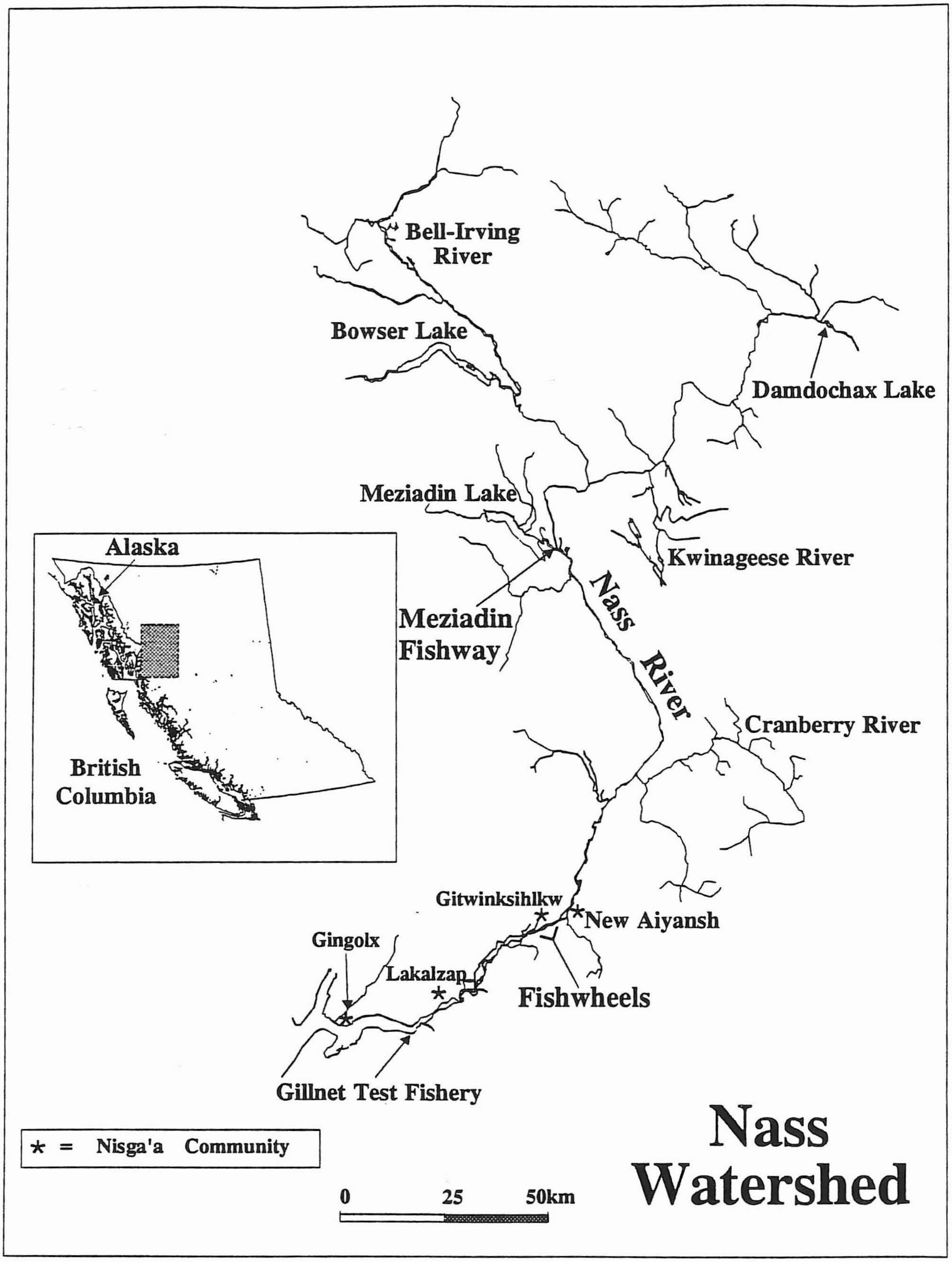


Figure 1. Nass Watershed study area.

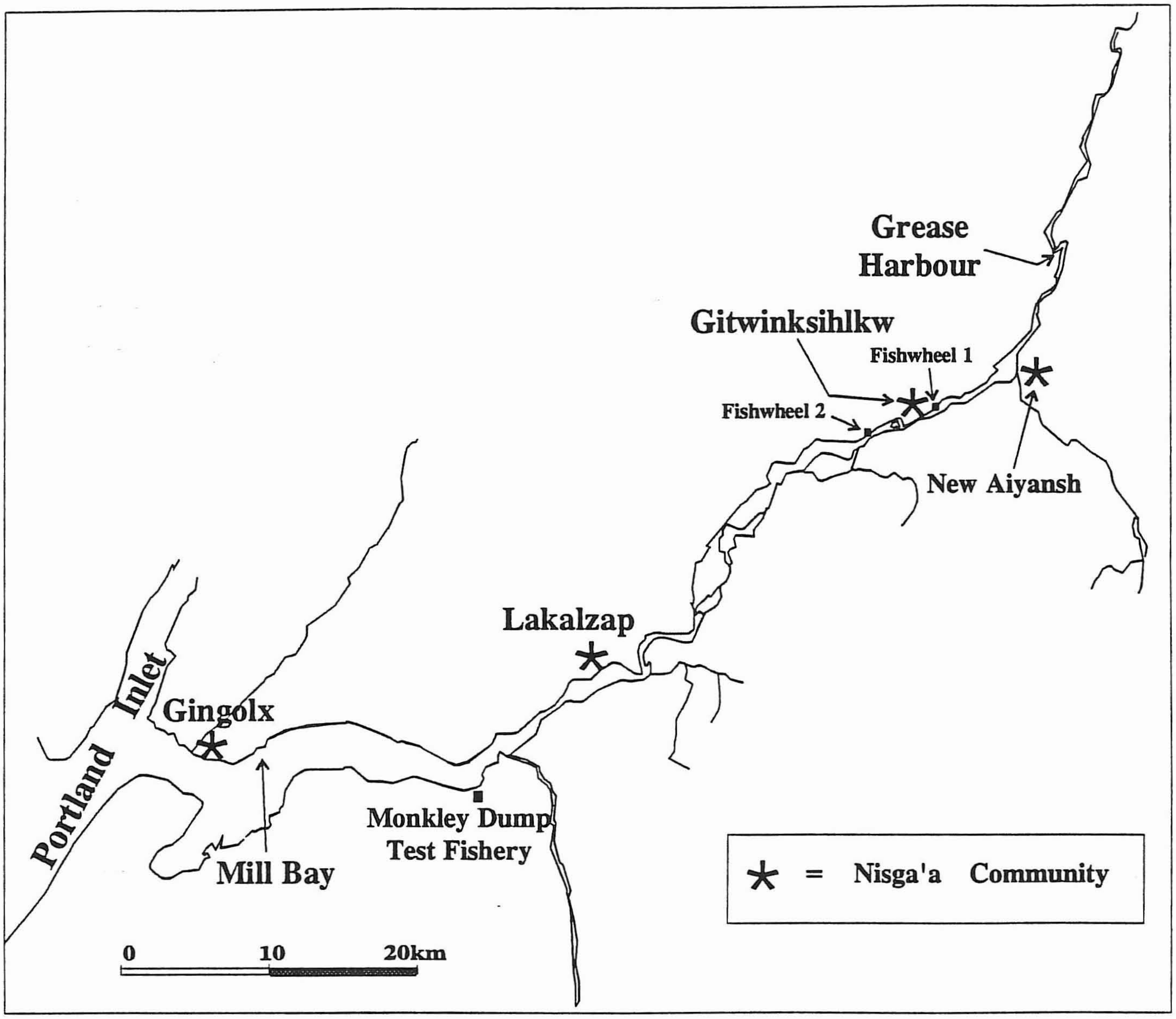
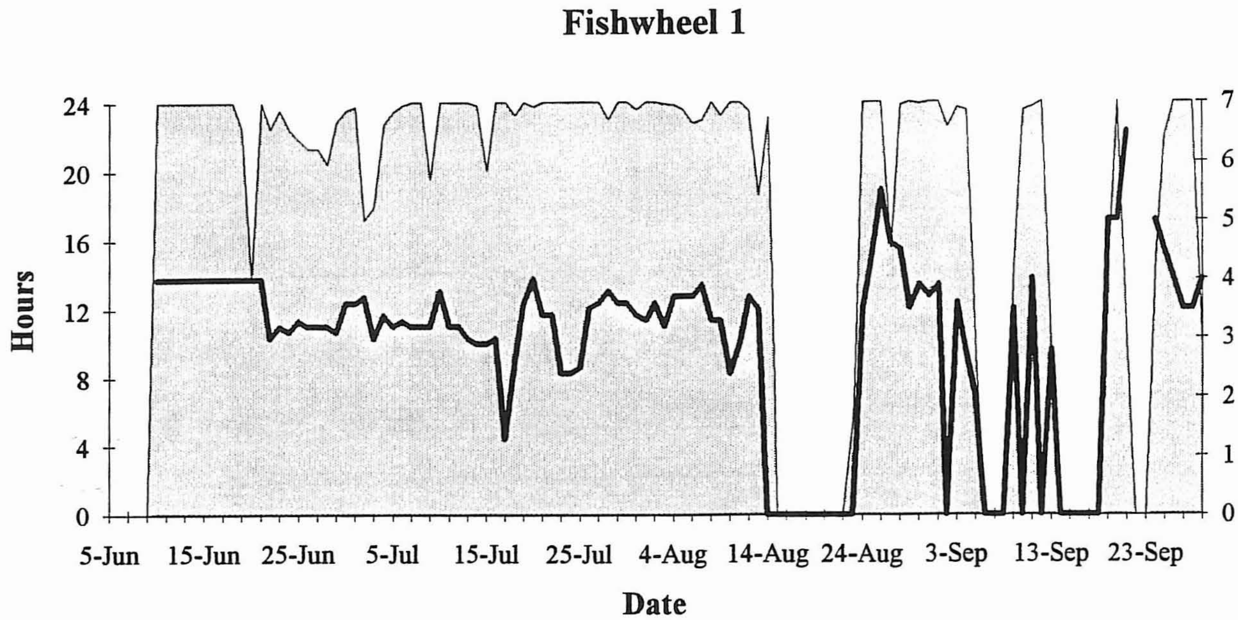


Figure 2. Location of Nisga'a communities, fishwheel sites and place names along the Nass River below Grease Harbour.



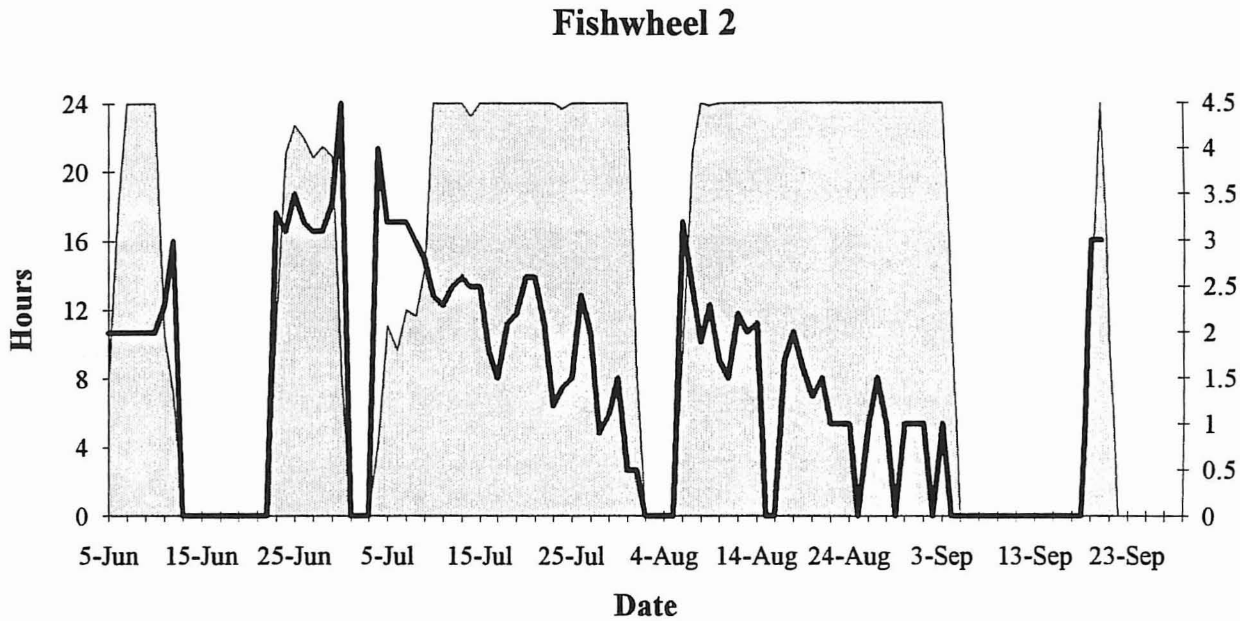
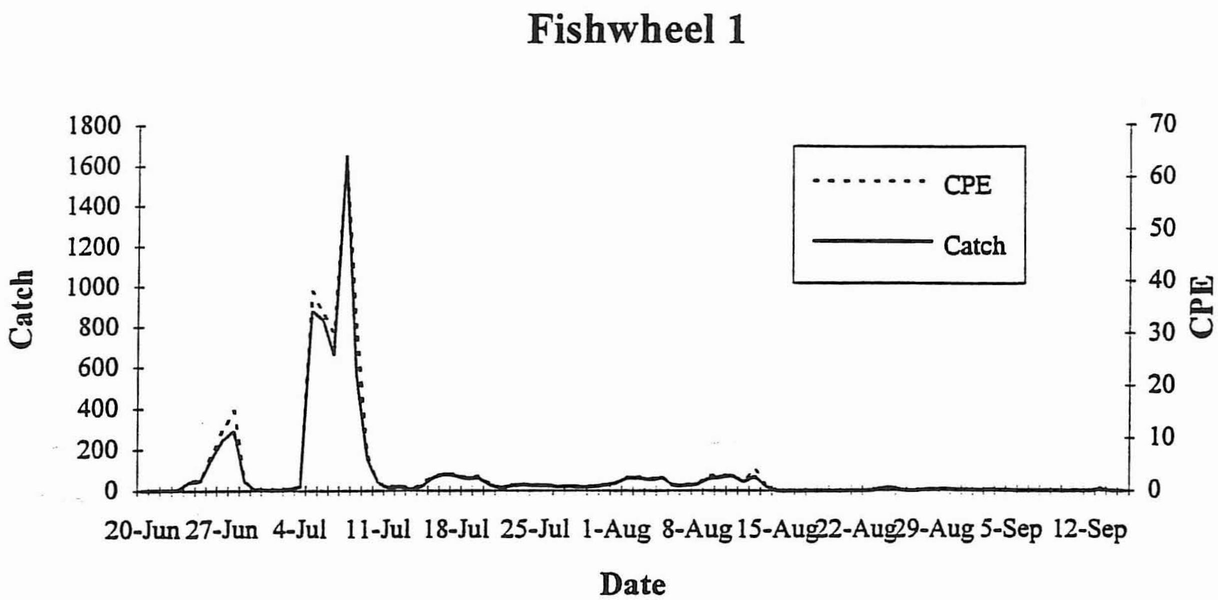


Figure 3. Fishwheel effort (hours, shaded area) and speed (RPM, dark line) for two fishwheels on the Nass River, 1992.



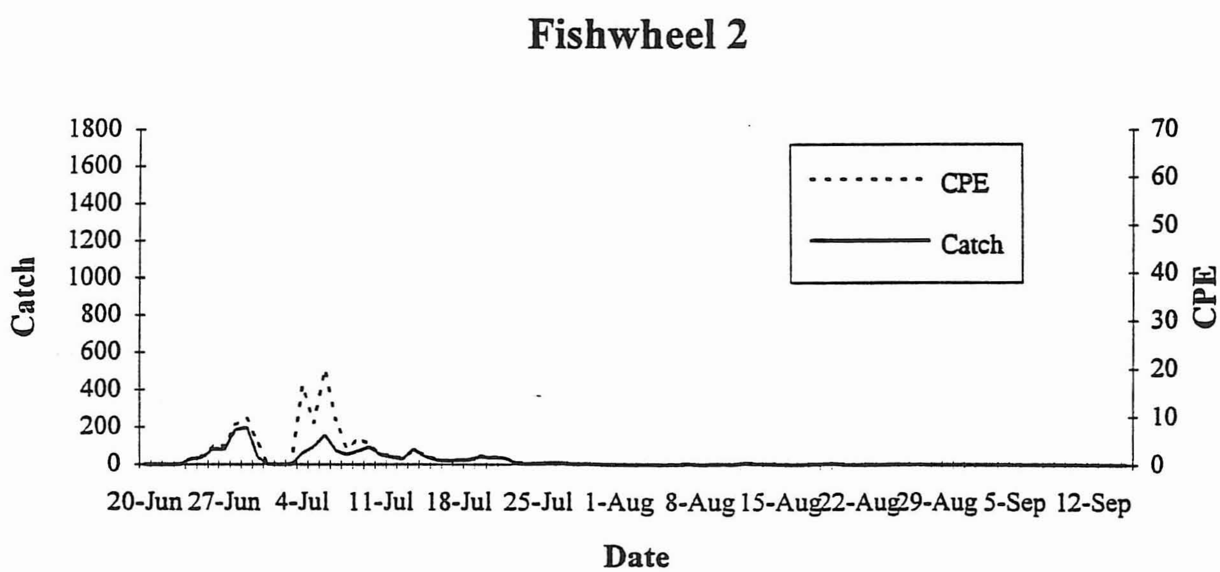
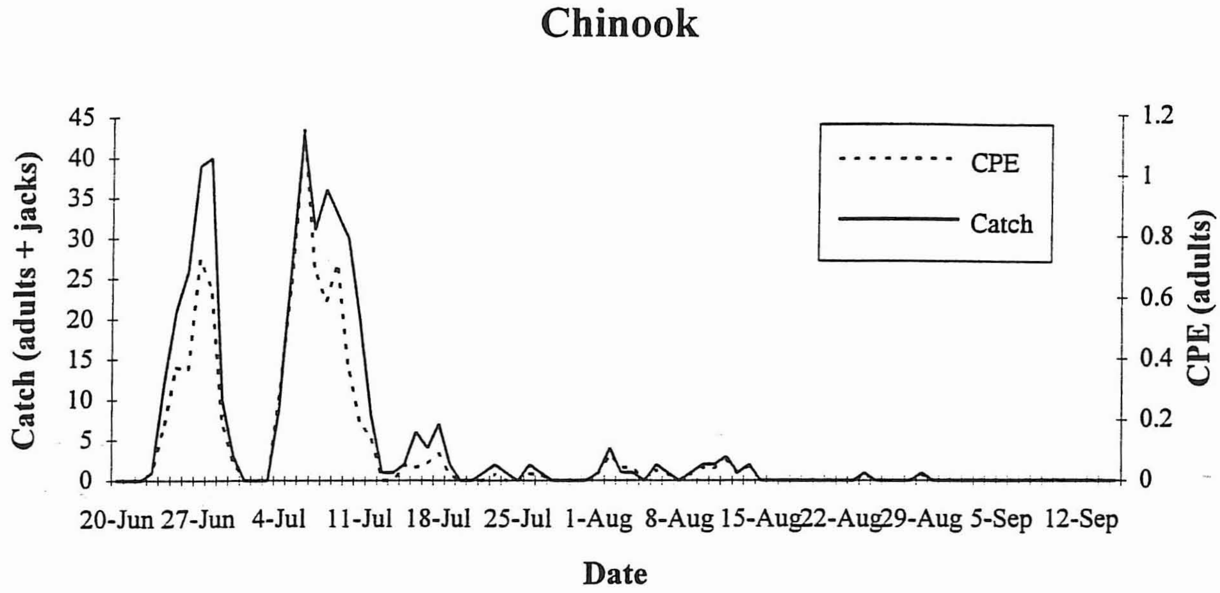


Figure 4. Fishwheel catches and CPE (catch per wheel hour) for sockeye captured with two fishwheels on the Nass River, 1992.



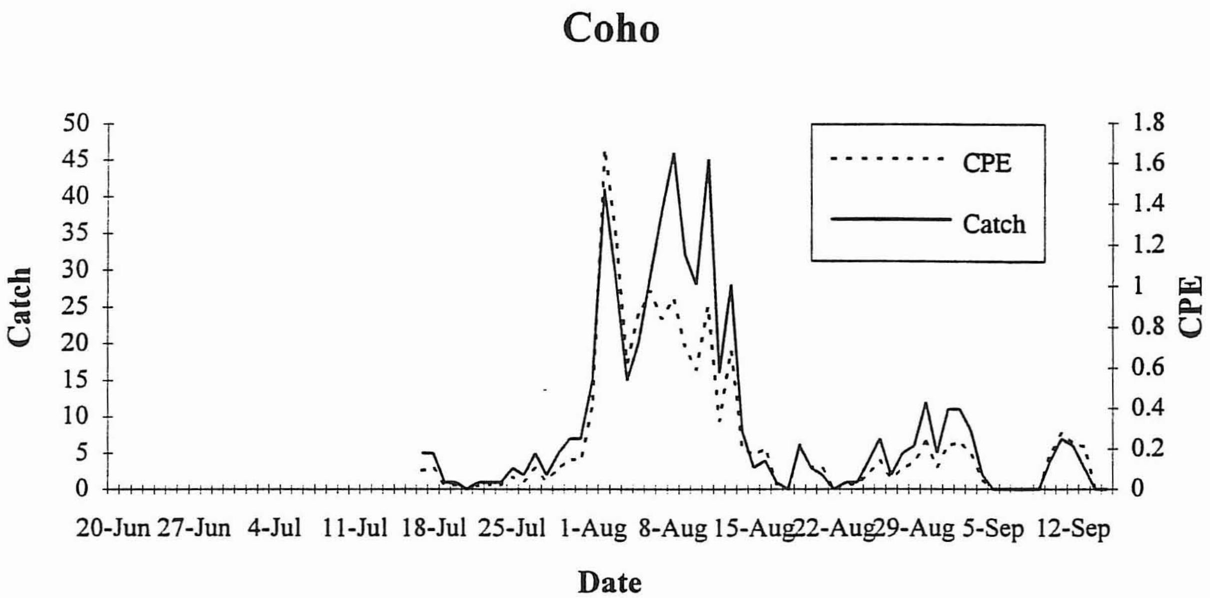
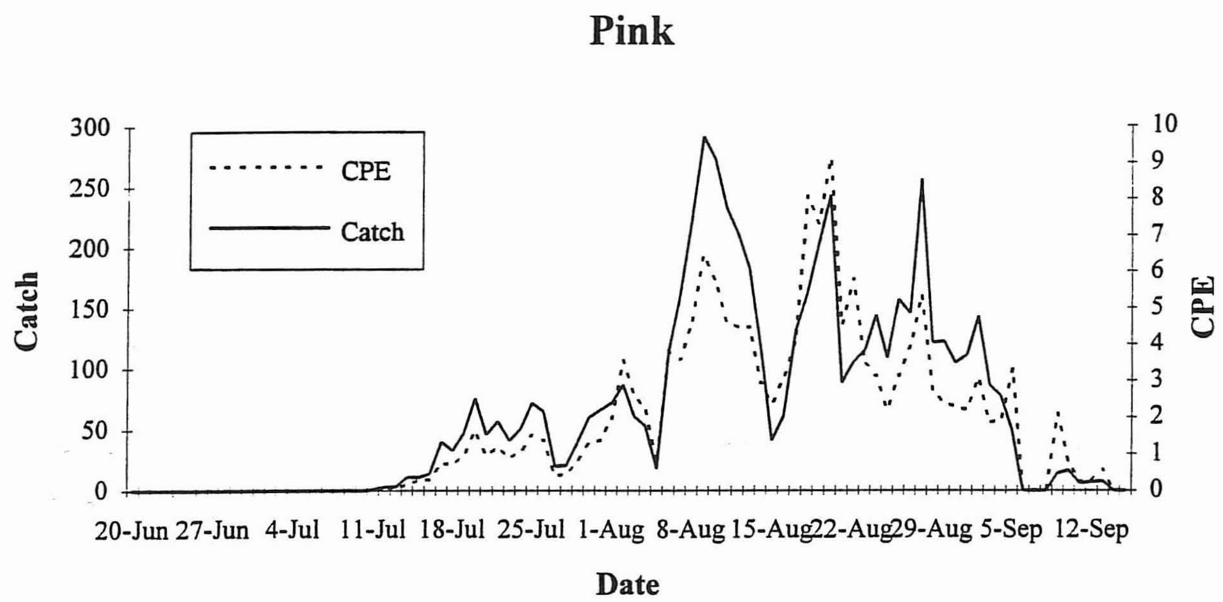


Figure 5. Fishwheel catches and CPE (catch per wheel hour) for chinook and coho salmon captured with two fishwheels on the Nass River, 1992.



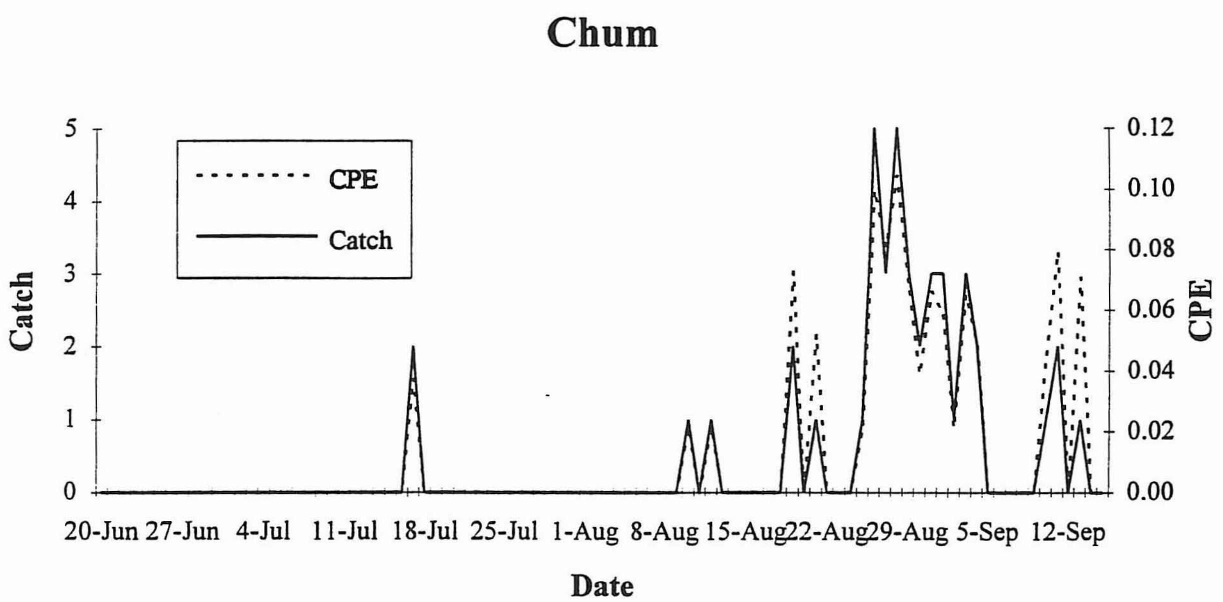


Figure 6. Fishwheel catches and CPE (catch per wheel hour) for pink and chum salmon captured with two fishwheels on the Nass River, 1992.

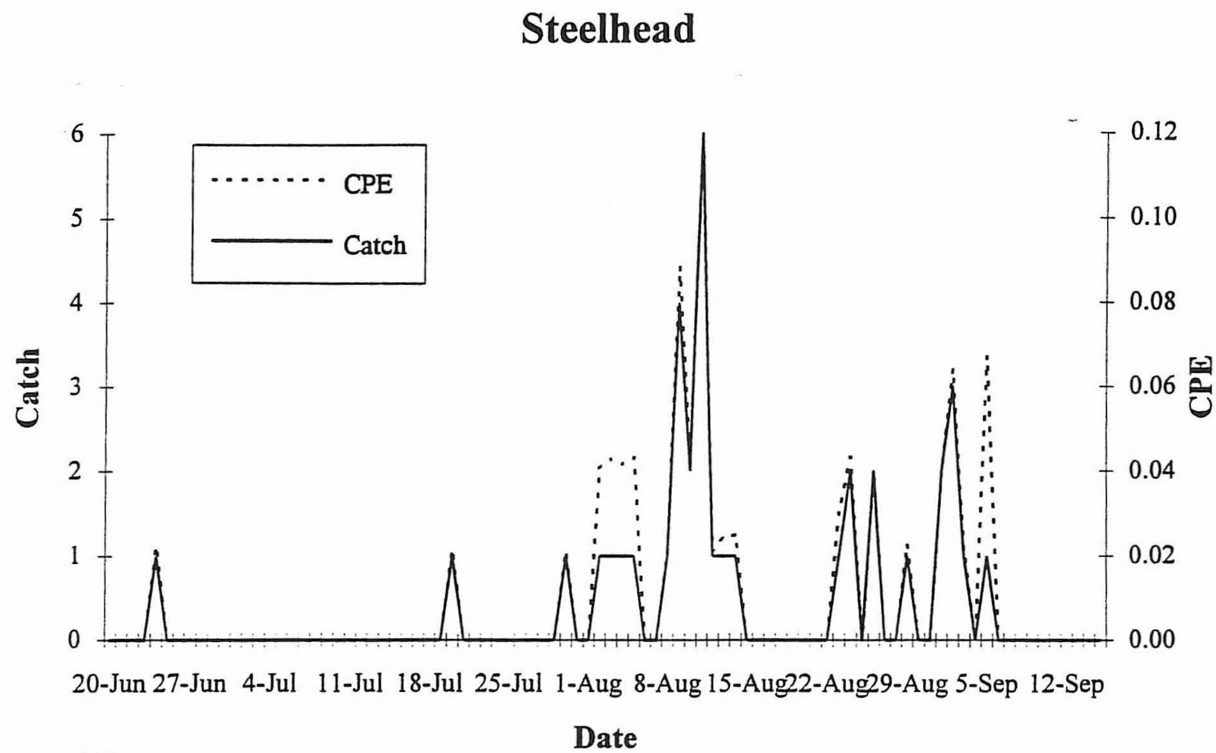


Figure 7. Fishwheel catches and CPE (catch per wheel hour) for steelhead captured in two fishwheels on the Nass River, 1992.

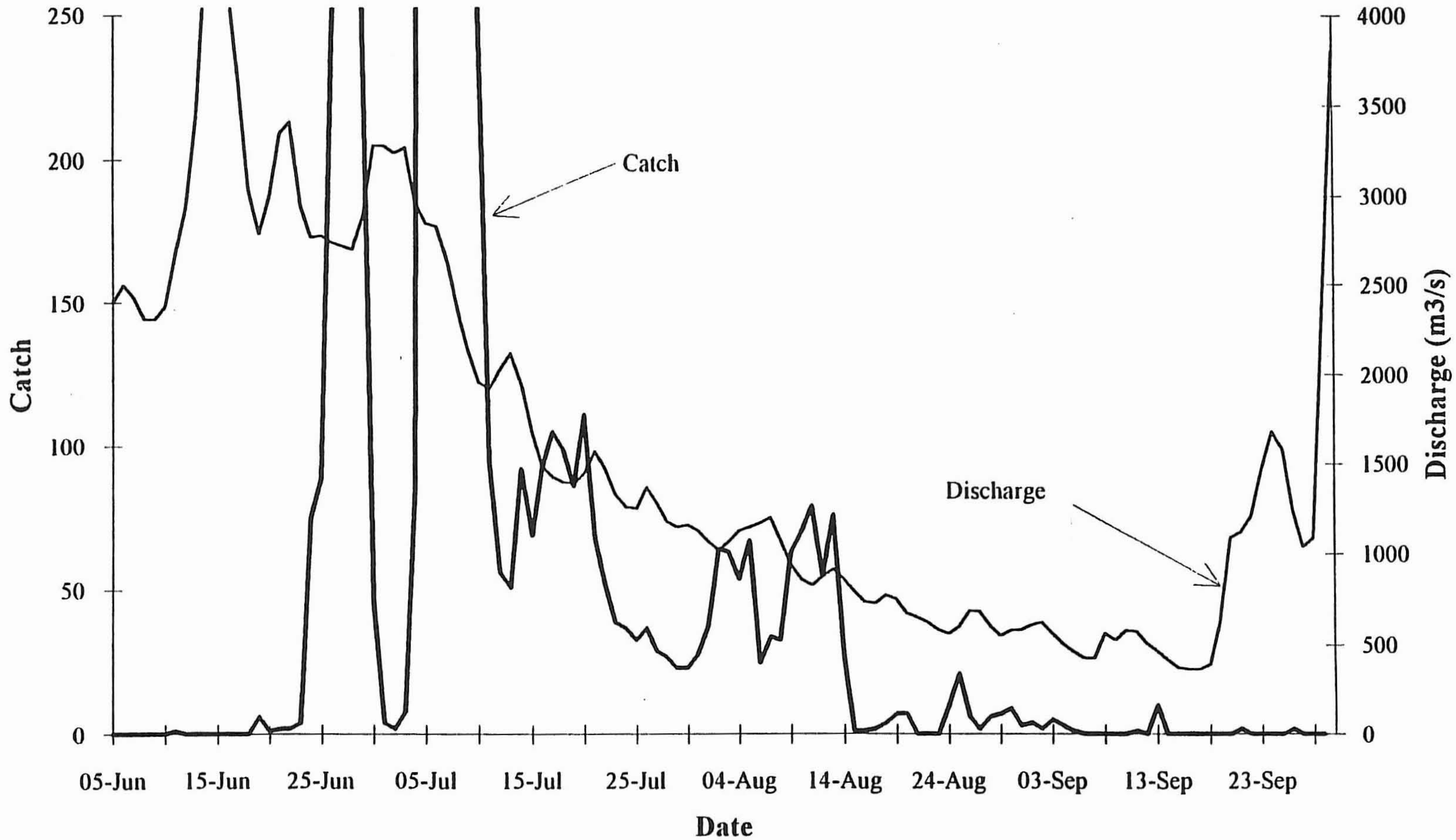


Figure 8. Daily sockeye catches and Nass River discharge at Shumal Creek, 1992.

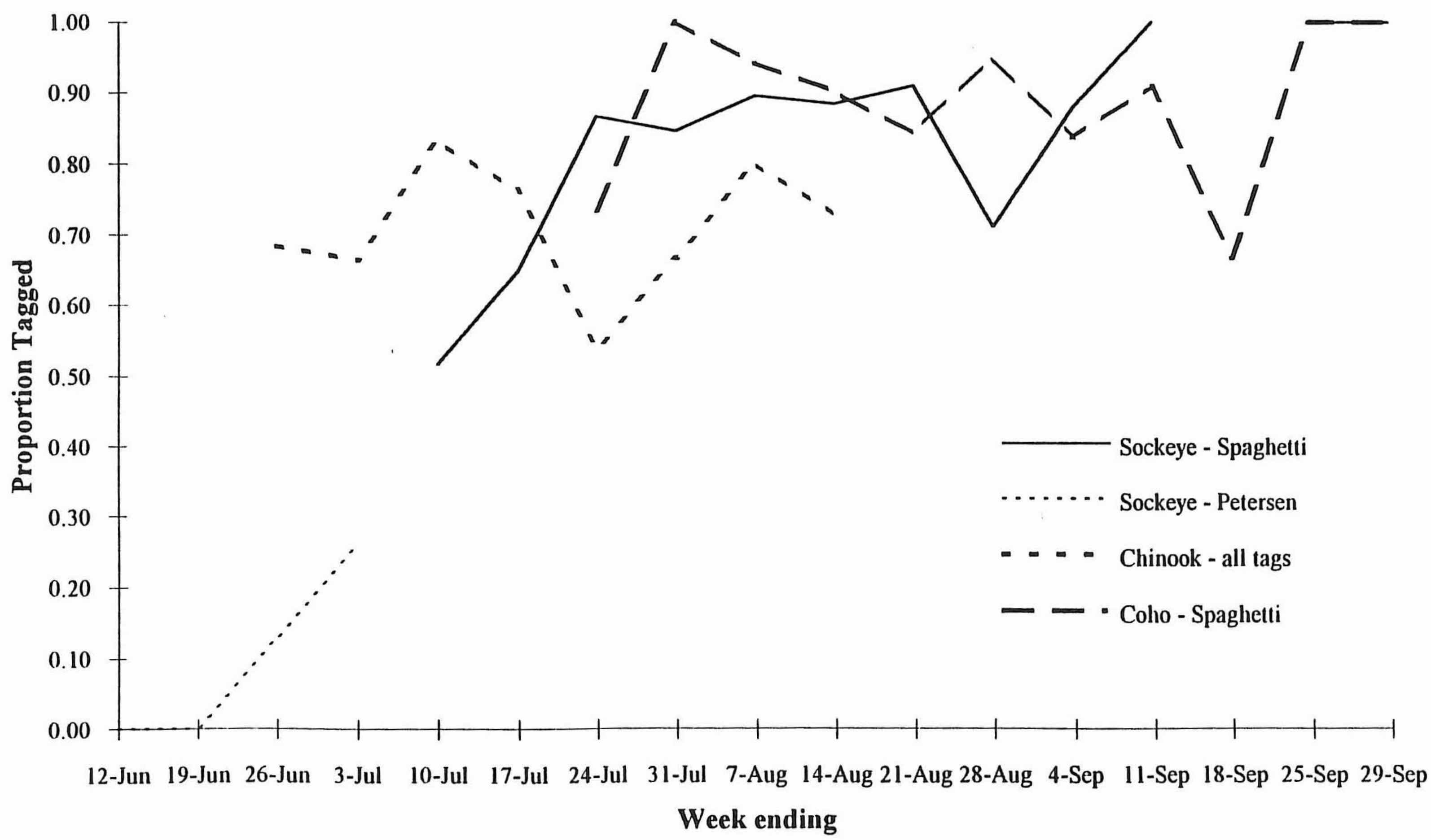
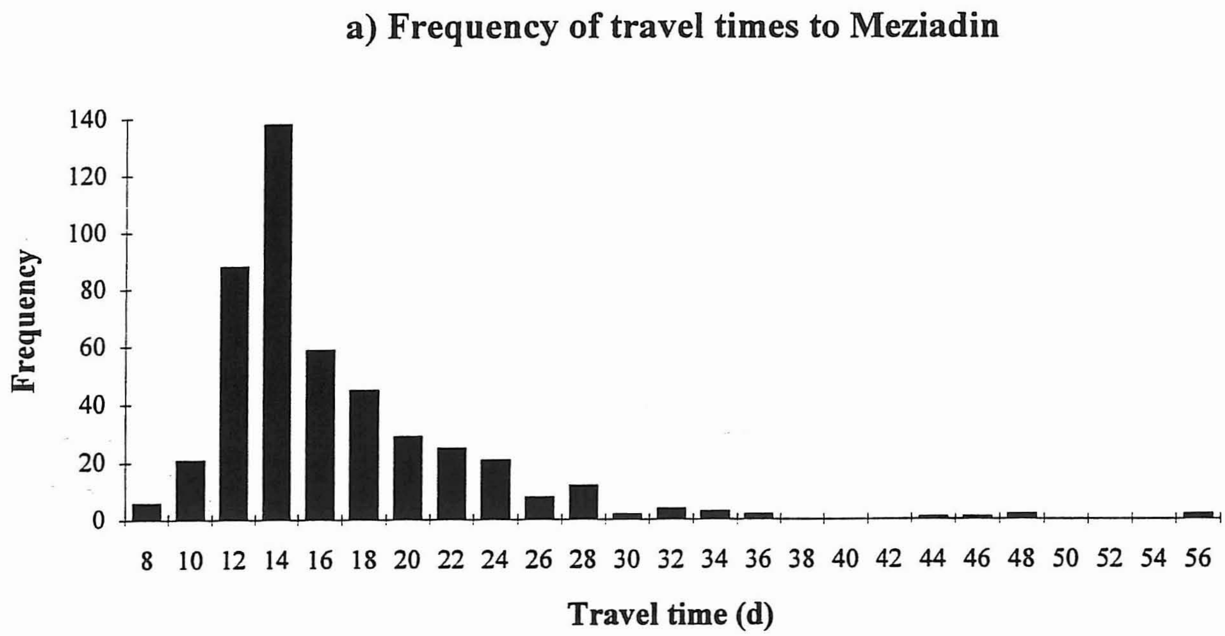


Figure 9. Proportion of total fishwheel catch tagged by week ending.



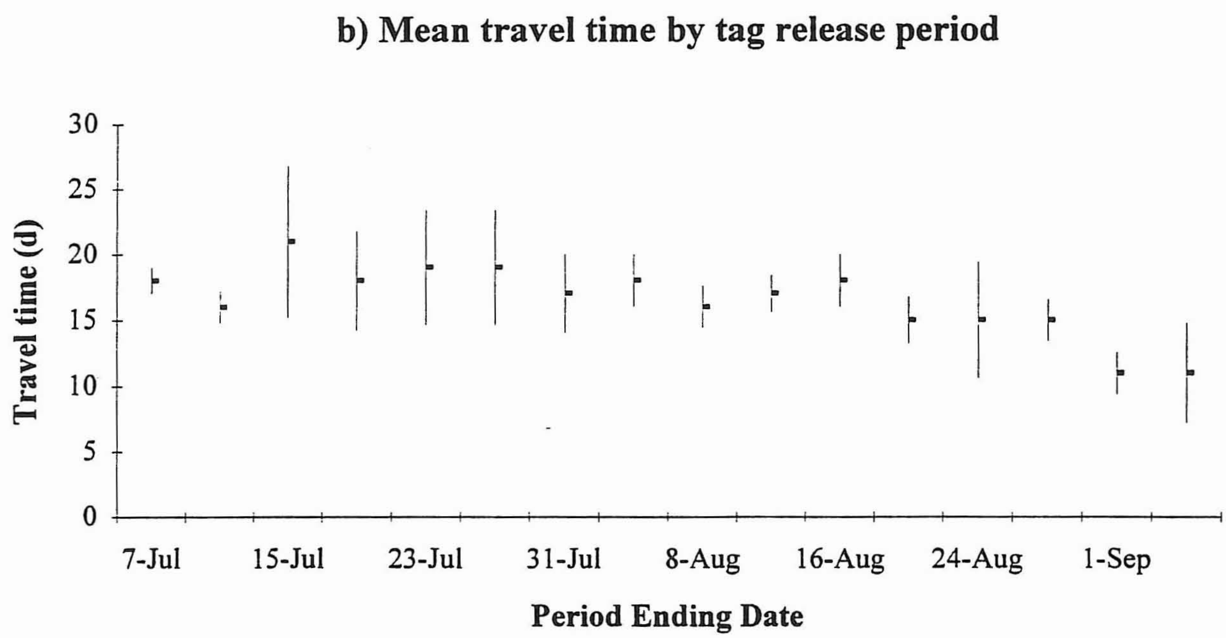


Figure 10. a) Travel times (d) to the Meziadin fishway for sockeye salmon tagged at the Nass River fishwheels, b) Mean travel time (with confidence intervals) for each 4-d tagging period.

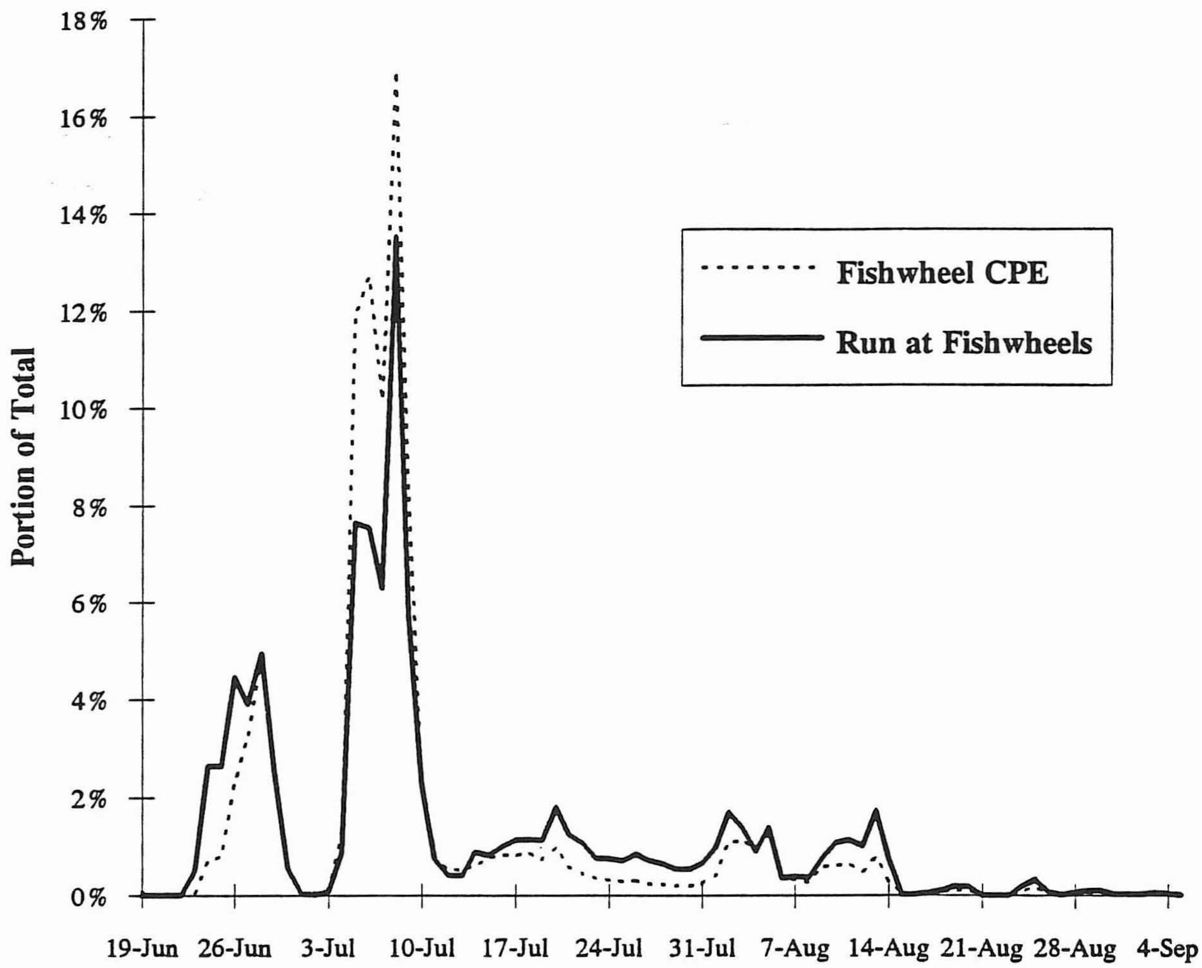


Figure 11. Daily fishwheel catch per effort and reconstructed run at the fishwheel site, expressed as a percent of the seasonal totals for 1992.

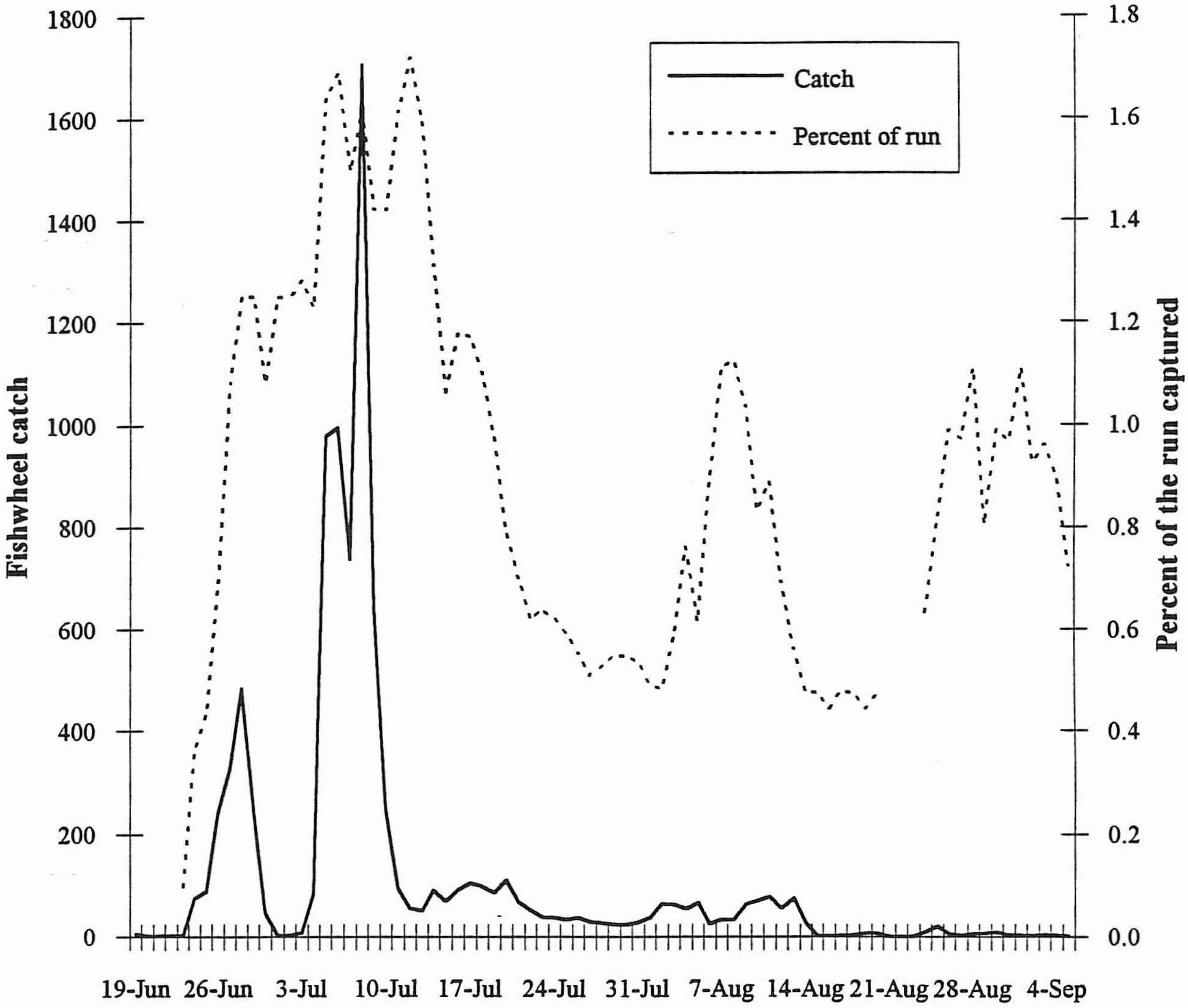


Figure 12. Fishwheel sockeye catch and estimate of the portion of sockeye run caught each day from 19 June through 5 September 1992.

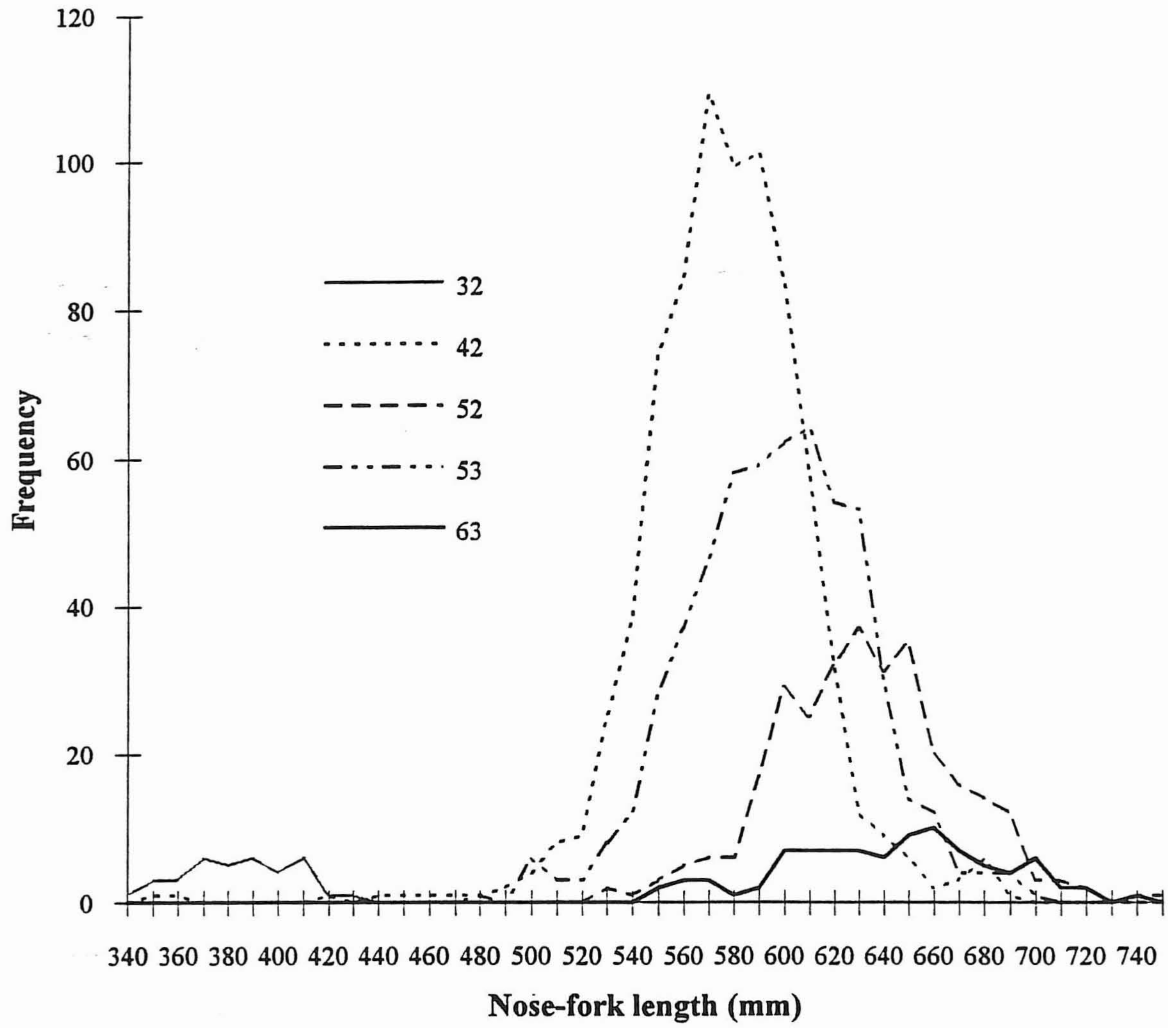


Figure 13. Age-length distribution for sockeye salmon sampled at the Nass River fishwheels, 1992.

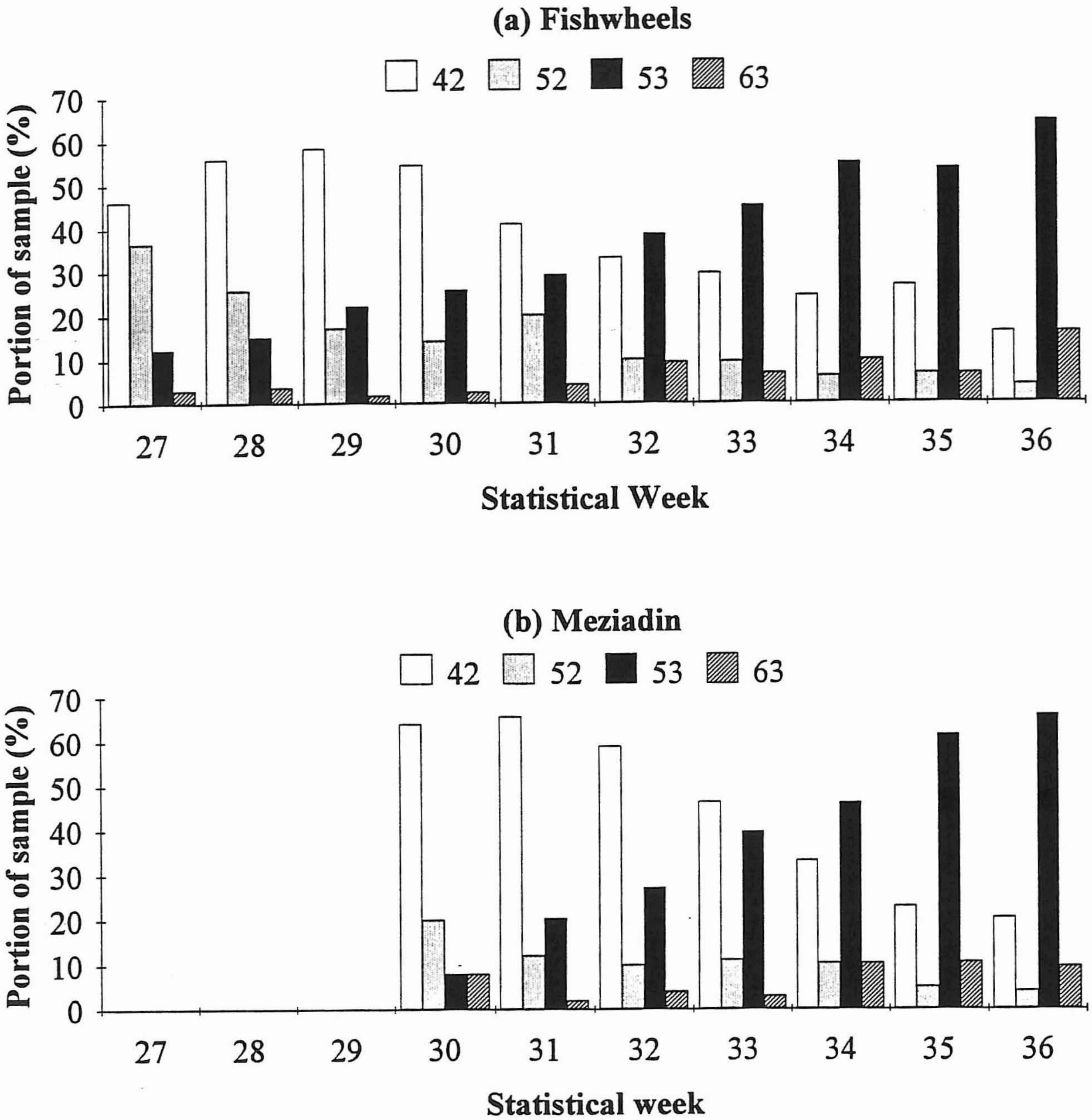
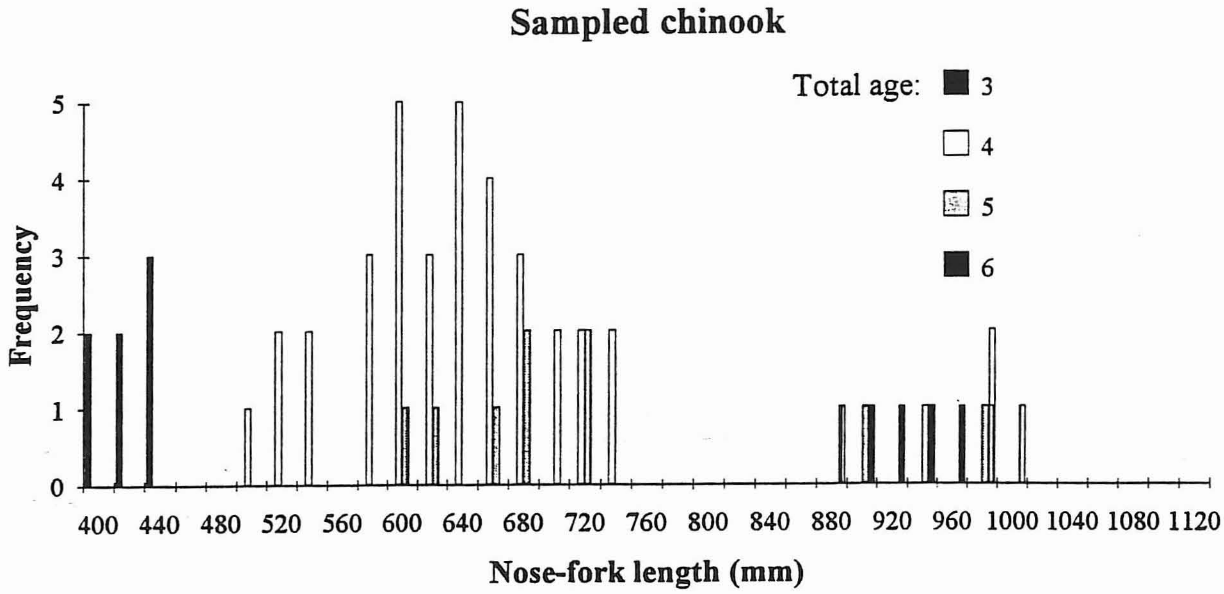


Figure 14. Weekly age composition for sockeye salmon sampled at the fishwheels and Meziadin fishway in 1992. Statistical week 27 was the week ending 27 June 1992.



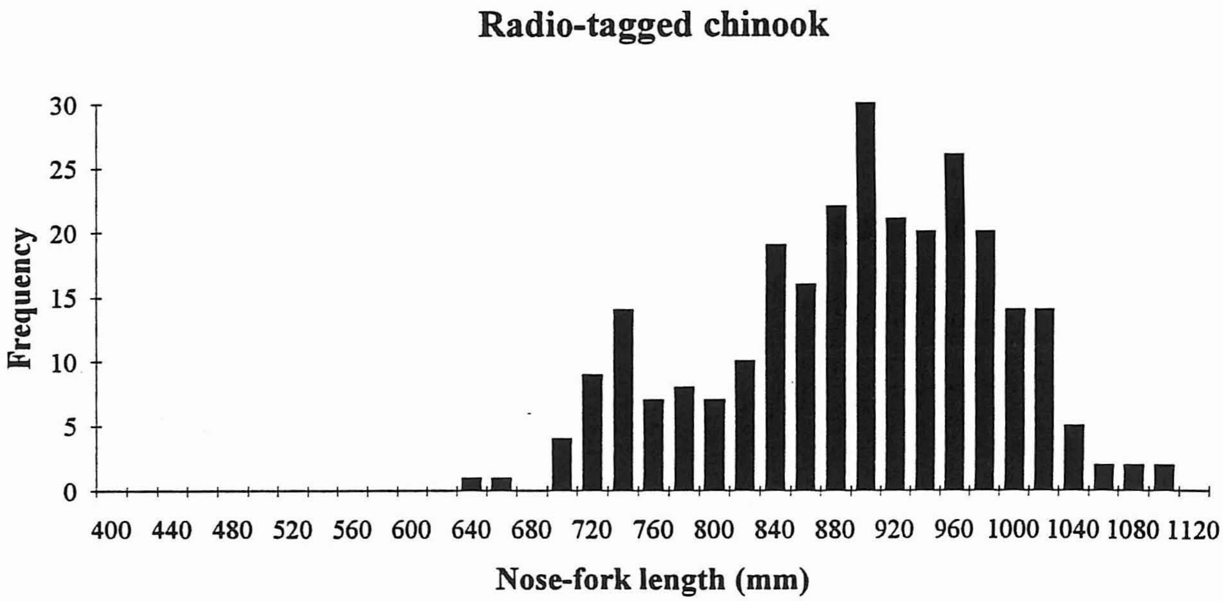


Figure 15. Length frequency for chinook salmon sampled (by age class) and radio tagged (no ages) at the Nass River fishwheels, 1992.

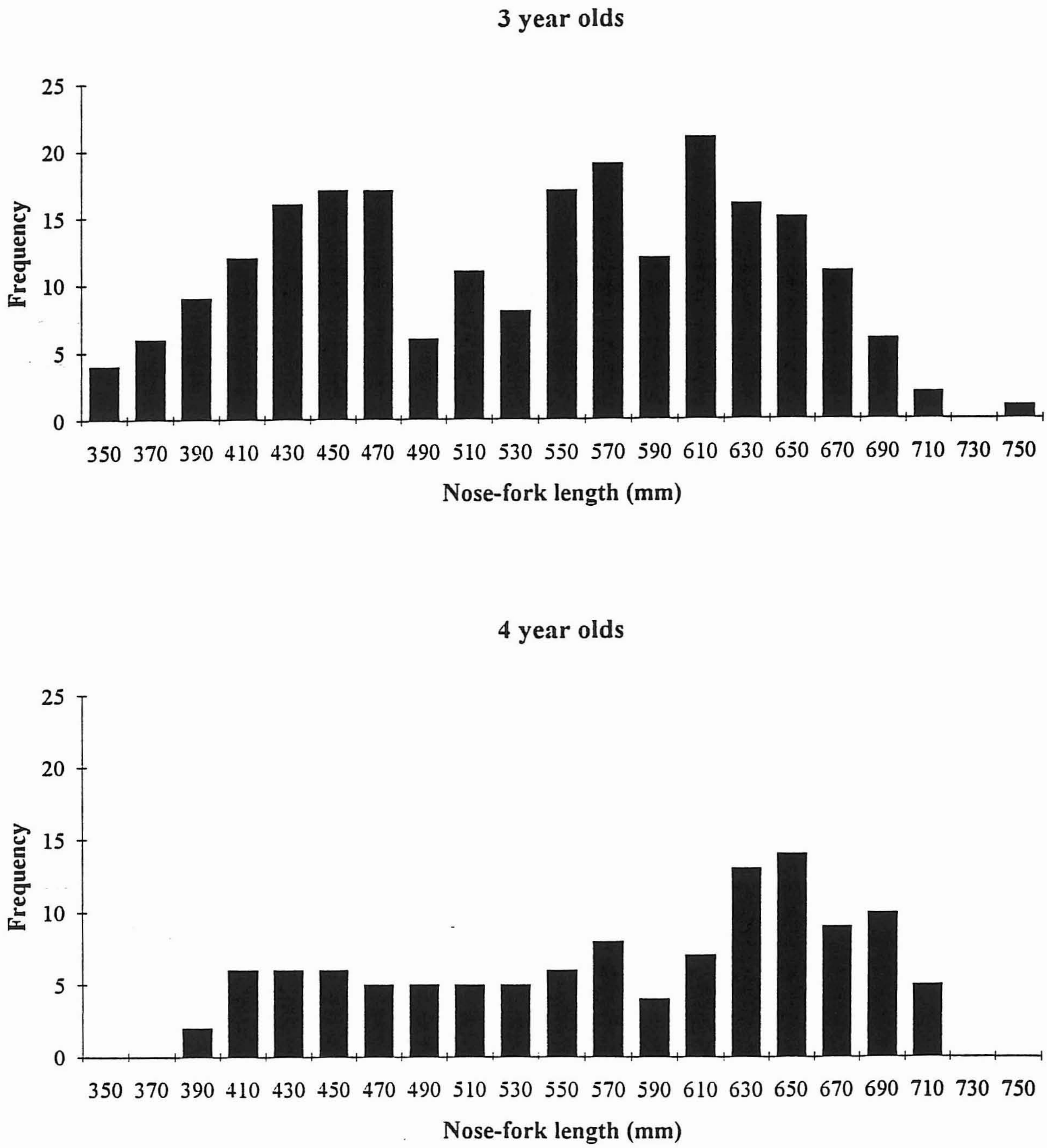
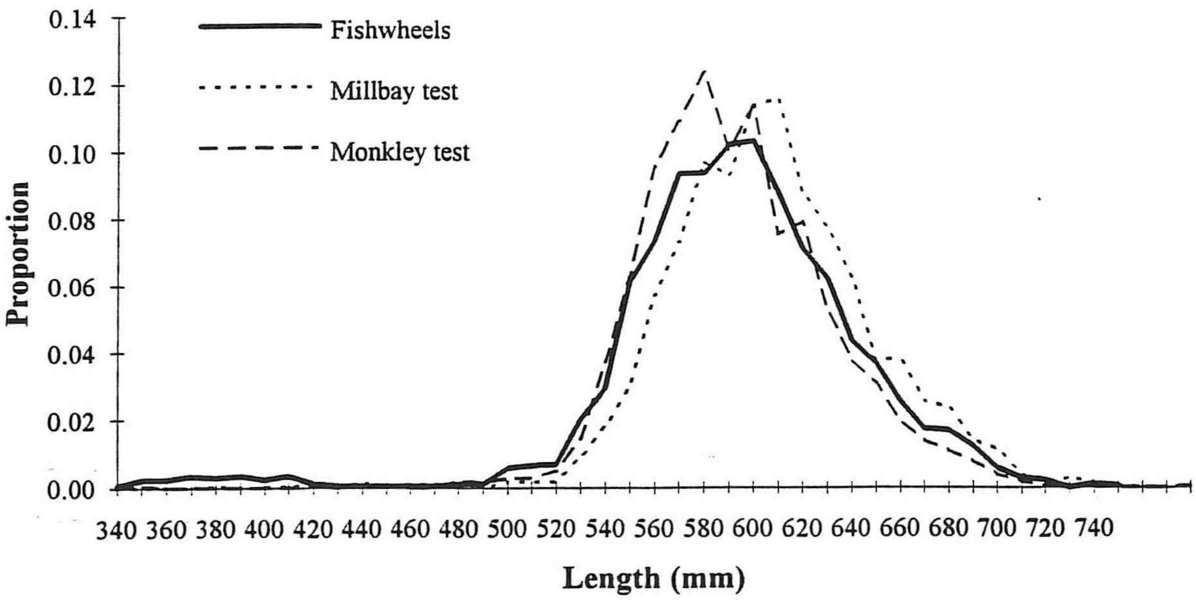


Figure 16. Age-length distribution of coho sampled at the Nass River fishwheels, 1992.



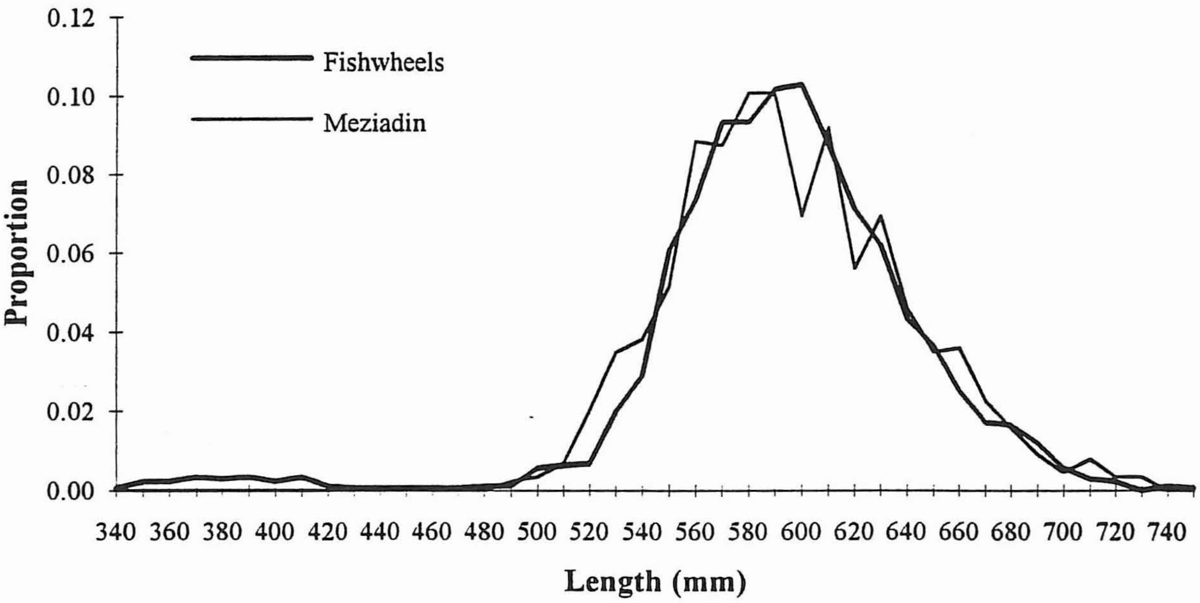


Figure 17. Length frequency distributions of sockeye salmon sampled at the Nass River fishwheels, the Monkley dump test fishery and the Meziadin fishway (nose-fork length).

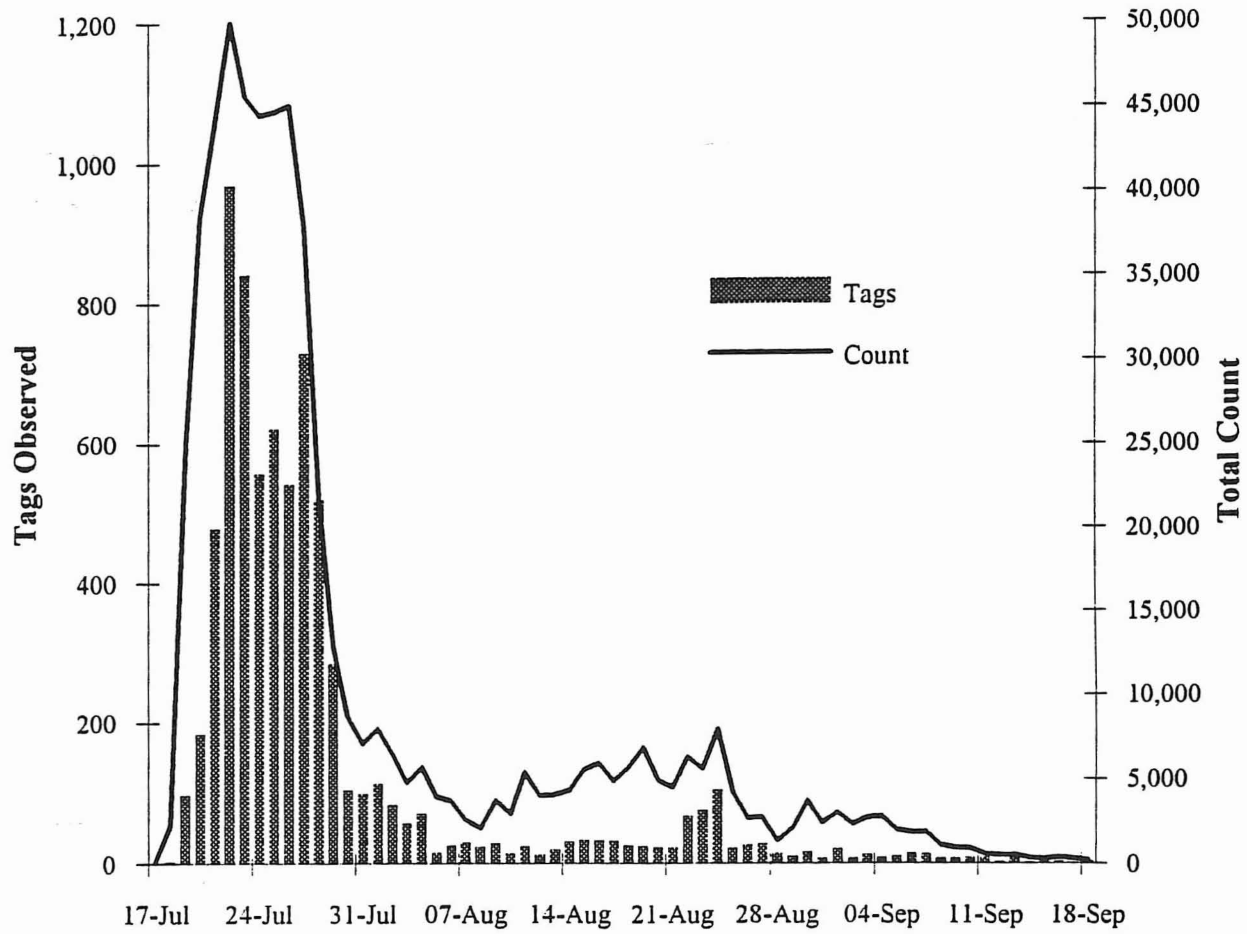


Figure 18. Daily sockeye counts and tagged sockeye observed at the Meziadin fishway, 1992.

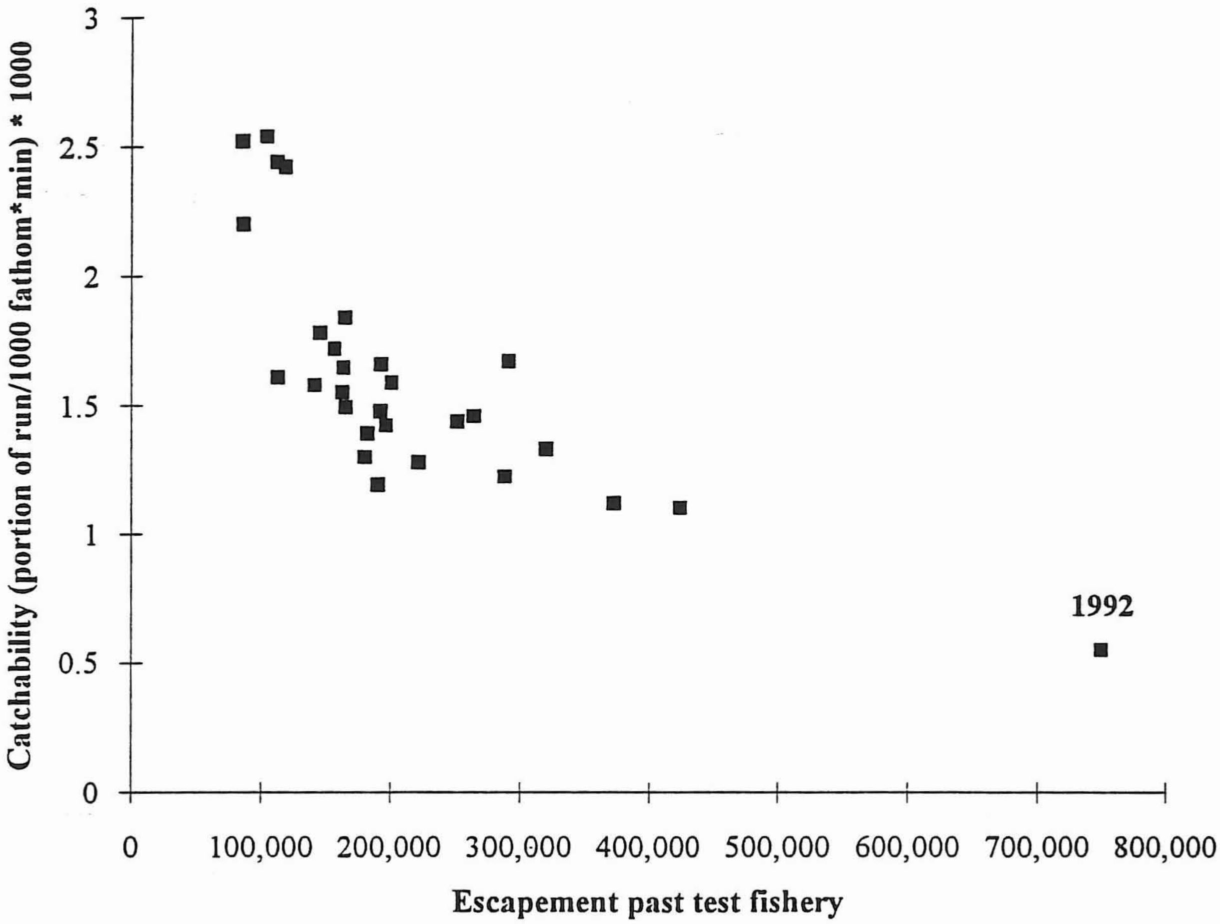


Figure 19. Relationship between sockeye catchability at Monkley Dump gillnet test fishery and total sockeye escapement to the Nass River, 1964-92.

APPENDICES

Table A-1. List of materials for the construction of the two fishwheels used on the Nass River in 1992.

Item	Description	Quantity	Use
Axles			
	12.5 cm x 12.5 cm square steel tube	8.5 m	two axles
	4.9 cm dia. cold rolled steel	1.3 m	axle ends, fit into bearing assembly
	7.6 cm x 7.6 cm angle iron	13.0 m	rib brackets, welded onto main axle
	4.9 cm (shaft) pillow block bearings	4	fit over axle ends, mounted to pontoons
Rigging			
	1.6 cm (5/8") wire rope	150 m	shore anchor line
	2.5 cm (1") poly-propylene rope	200 m	safety line to shore
	1.6 cm (5/8") shackles	6	fasteners for bridle and anchor line
	2.5 cm (1") shackles	2	safety line
	1.6 cm (5/8") cable clamps	20	bridle and anchor line
	1.6 cm (5/8") thimbles	8	bridle and anchor line
	15 cm custom braced eye bolts	4	attach anchor line to pontoons
	1.6 cm (5/8") D-ring	2	join bridle and anchor line
Lumber			
	1.3 cm plywood (1/2"x4'x8')	50	decking, holding boxes, bracing.
	1.6 cm plywood (5/8"x4'x8')	8	fish slides inside baskets
	10x40 cm (4"x12"x16') planks	8	cross-walks
	2"x12"x12'	56	pontoons (with wide rear deck)
	4"x4"x8'	8	axle and live box mounts
	2"x6"x10"	16	uprights, holding boxes and paddles
	2"x6"x8'	24	live boxes
	2"x4"x16'	8	basket braces
	2"x4"x14"	8	basket braces
	2"x4"x12"	8	basket ribs
	2"x4"x10"	42	basket ribs, slide braces
	2"x4"x8'	28	live boxes and assorted bracing
Flotation			
	10"x20"x8' closed cell foam billets	16	flotation framed inside pontoons
Hardware			
	8.9 cm (3.5") common nails	20 kg	assorted fastening
	3/8"x3.5" bolts, with washers and nuts	40	bolt baskets to axle,
	3/8"x5" bolts, washers and nuts	40	bolt upright framing to baskets
	3/8"x6" bolts, washers and nuts	20	bolt upright framing to baskets
	1/2"x6" bolts, washers and nuts	4	bolt upright and bracing together
	3/8"x4" lag bolts	16	bolt live boxes to pontoon
	3/8"x5" lag bolts	32	assorted fastening
	14" custon steel spar log keeper	4	hold spar log in place

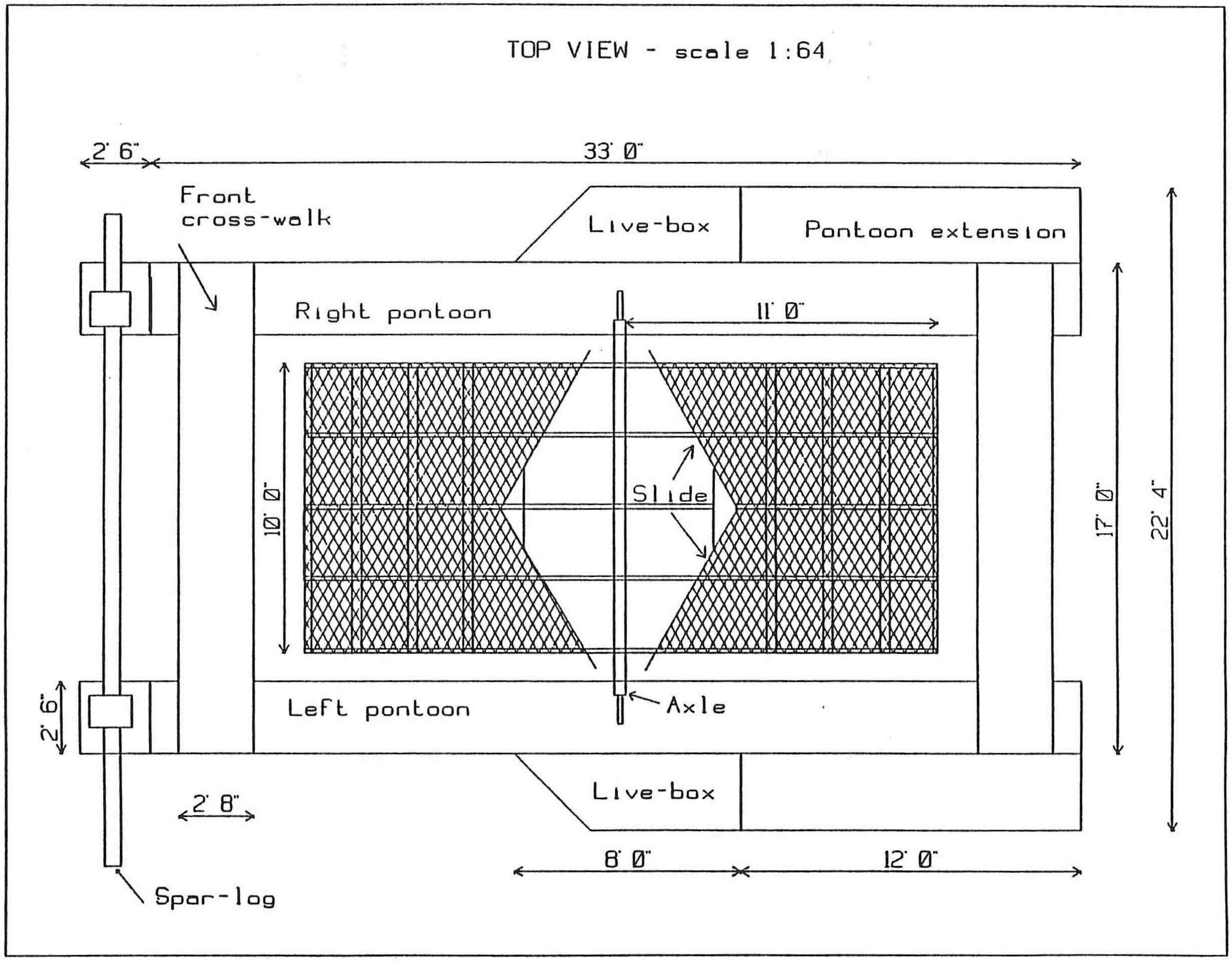


Figure A-1. Top view of a fishwheel used on the Nass River in 1992.

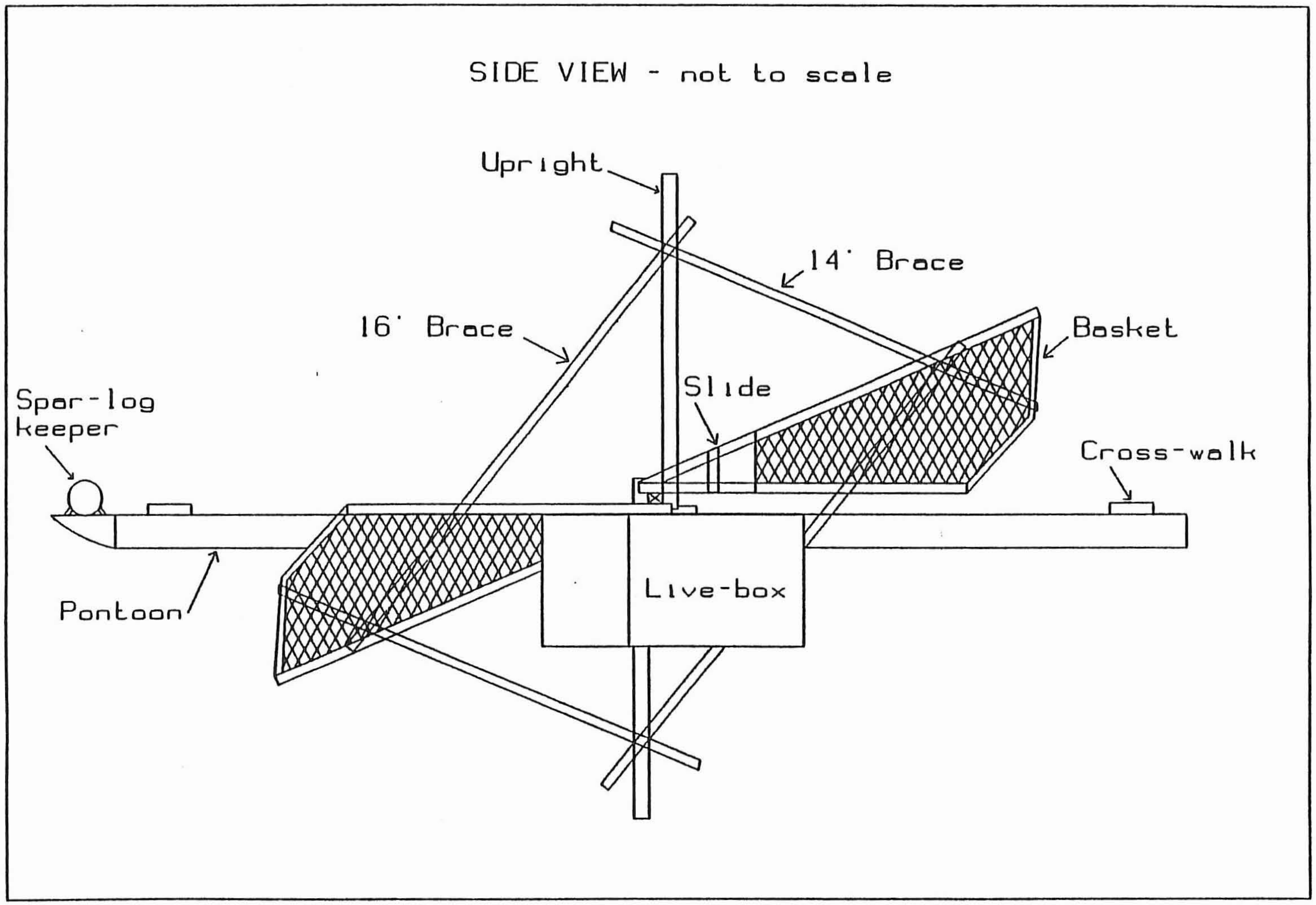


Figure A-2. Side view of a fishwheel used on the Nass River in 1992.

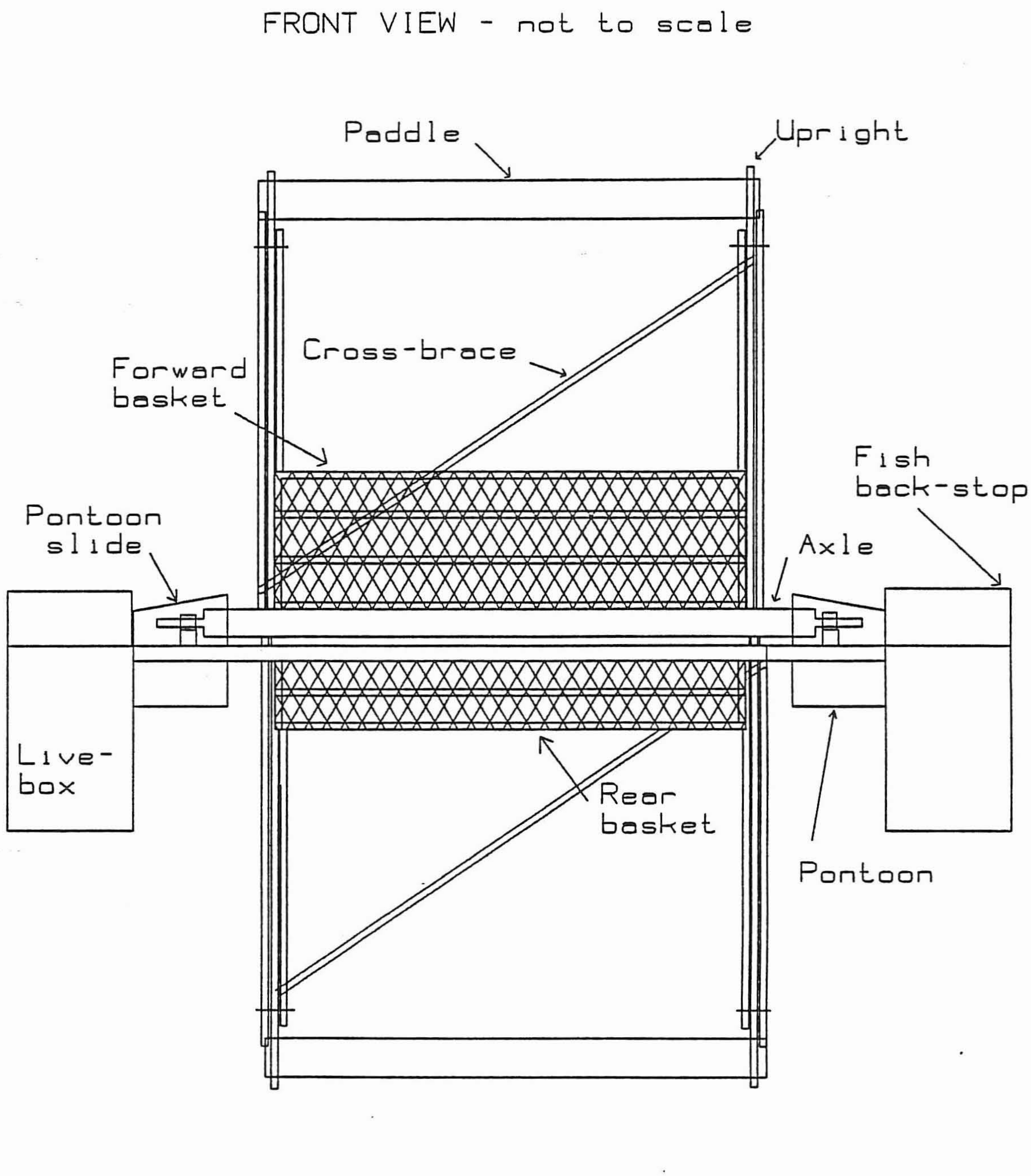


Figure A-3. Front view of a fishwheel used on the Nass River in 1992.

Table B-1. Summary of daily fishwheel effort (hours), effort used to calculate CPE and fishwheel speed (RPM). Lines through columns indicate dates when the number of baskets or the size of the baskets was changed.

	Fishwheel 1				Fishwheel 2					
Date	Total	Percent of time running	Effort for CPE [a]	RPM	Total	Percent of time running	Effort for CPE [a]	RPM	Total hours	Comments
5-Jun					8.0	33		2.0	8.0	#2 started @1600
6-Jun					18.0	75		2.0	18.0	tried to move upstream.
7-Jun					24.0	100	24.0	2.0	24.0	
8-Jun					24.0	100	24.0	2.0	24.0	
9-Jun					24.0	100	24.0	2.0	24.0	
10-Jun	24.0	100		4.0	24.0	100	24.0	2.0	48.0	#1 started @1900
11-Jun	24.0	100		4.0	10.5	44	14.5	2.3	34.5	#2 moved upriver 8 m.
12-Jun	24.0	100		4.0	7.0	29	0.0	3.0	31.0	#2 hit by log.
13-Jun	24.0	100		4.0	0.0	0		0.0	24.0	very high water
14-Jun	24.0	100		4.0	0.0	0		0.0	24.0	
15-Jun	24.0	100		4.0	0.0	0		0.0	24.0	
16-Jun	24.0	100		4.0	0.0	0		0.0	24.0	
17-Jun	24.0	100		4.0	0.0	0		0.0	24.0	
18-Jun	24.0	100		4.0	0.0	0		0.0	24.0	
19-Jun	22.5	94	24.0	4.0	0.0	0		0.0	22.5	
20-Jun	13.8	57	28.0	4.0	0.0	0		0.0	13.8	moved #1 upriver 20 m
21-Jun	24.0	100	24.0	4.0	0.0	0		0.0	24.0	
22-Jun	22.5	94	26.5	3.0	0.0	0		0.0	22.5	
23-Jun	23.6	98	23.1	3.2	11.4	48	10.2	3.3	35.0	moved #2 upriver 6 m
24-Jun	22.4	93	23.9	3.1	21.1	88	21.1	3.1	43.5	
25-Jun	21.9	91	22.8	3.3	22.8	95	22.6	3.5	44.6	
26-Jun	21.3	89	22.8	3.2	21.9	91	21.3	3.2	43.3	
27-Jun	21.3	89	21.6	3.2	20.8	87	20.9	3.1	42.2	Installed devices to stop
28-Jun	20.5	85	19.5	3.2	21.5	90	22.8	3.1	42.0	fish from jumping out.
29-Jun	22.9	95	21.4	3.1	20.9	87	21.0	3.4	43.8	
30-Jun	23.5	98	25.1	3.6	8.4	35	9.6	4.5	31.9	#2: down, high water.
1-Jul	23.8	99	23.8	3.6	0.0	0		0.0	23.8	
2-Jul	17.2	71	10.9	3.7	0.0	0		0.0	17.2	
3-Jul	18.0	75	21.6	3.0	0.0	0		0.0	18.0	
4-Jul	22.8	95	24.5	3.4	4.4	18	3.8	4.0	27.2	#2: outside livebox
5-Jul	23.5	98	23.3	3.2	11.1	46	11.1	3.2	34.5	knocked off.
6-Jul	23.8	99	24.8	3.3	9.7	40	8.1	3.2	33.5	
7-Jul	24.0	100	22.0	3.2	12.0	50	8.3	3.2	36.0	
8-Jul	24.0	100	26.0	3.2	11.6	48	16.3	3.0	35.6	
9-Jul	19.5	81	18.6	3.2	14.4	60	13.7	2.8	33.9	#2: new outside livebox.
10-Jul	24.0	100	23.2	3.8	24.0	100	22.3	2.4	48.0	
11-Jul	24.0	100	24.5	3.2	24.0	100	25.8	2.3	48.0	
12-Jul	24.0	100	21.8	3.2	24.0	100	21.6	2.5	48.0	
13-Jul	24.0	100	19.1	3.0	24.0	100	22.0	2.6	48.0	
14-Jul	23.8	99	33.0	2.9	23.3	97	28.7	2.5	47.1	
15-Jul	20.0	83	16.2	2.9	24.0	100	22.0	2.5	44.0	#1: 3rd basket installed.
16-Jul	24.0	100	22.6	3.0	24.0	100	23.3	1.8	48.0	
17-Jul	24.0	100	27.9	1.3	24.0	100	25.9	1.5	48.0	
18-Jul	23.3	97	22.8	2.6	24.0	100	23.7	2.1	47.3	
19-Jul	24.0	100	24.4	3.6	24.0	100	24.4	2.2	48.0	
20-Jul	23.8	99	23.2	4.0	24.0	100	23.6	2.6	47.8	

Table B-1. Summary of daily fishwheel effort (hours), effort used to calculate CPE and fishwheel speed (RPM). Lines through columns indicate dates when the number of baskets or the size of the baskets was changed.

	Fishwheel 1				Fishwheel 2					
Date	Total	Percent of time running	Effort for CPE [a]	RPM	Total	Percent of time running	Effort for CPE [a]	RPM	Total hours	Comments
21-Jul	24.0	100	23.9	3.4	24.0	100	23.7	2.6	48.0	
22-Jul	24.0	100	23.8	3.4	24.0	100	24.0	2.1	48.0	
23-Jul	24.0	100	23.0	2.4	24.0	100	22.8	1.2	48.0	
24-Jul	24.0	100	24.2	2.4	23.7	99	23.8	1.4	47.7	
25-Jul	24.0	100	23.8	2.5	24.0	100	23.9	1.5	48.0	
26-Jul	24.0	100	23.9	3.5	24.0	100	23.9	2.4	48.0	
27-Jul	24.0	100	24.3	3.6	24.0	100	24.3	2.0	48.0	
28-Jul	23.0	96	23.0	3.8	24.0	100	23.7	0.9	47.0	
29-Jul	24.0	100	24.0	3.6	24.0	100	24.3	1.1	48.0	
30-Jul	24.0	100	23.7	3.6	24.0	100	23.8	1.5	48.0	
31-Jul	23.6	98	23.8	3.4	24.0	100	23.9	0.5	47.6	
1-Aug	24.0	100	24.4	3.3	8.2	34	12.3	0.5	32.2	#2 down, water too low.
2-Aug	24.0	100	24.6	3.6	0.0	0		0.0	24.0	
3-Aug	23.9	100	23.3	3.2	0.0	0		0.0	23.9	
4-Aug	23.8	99	24.0	3.7	0.0	0		0.0	23.8	
5-Aug	23.6	98	23.2	3.7	0.0	0		0.0	23.6	
6-Aug	22.8	95	23.3	3.7	9.8	41	6.5	3.2	32.6	#2 started with 3 baskets,
7-Aug	23.0	96	23.2	3.9	21.0	88	21.8	2.5	44.0	moved upstream 100m
8-Aug	24.0	100	26.4	3.3	24.0	100	22.5	1.9	48.0	
9-Aug	23.3	97	20.7	3.3	23.8	99	24.6	2.3	47.1	
10-Aug	24.0	100	23.7	2.4	24.0	100	23.6	1.7	48.0	
11-Aug	24.0	100	25.1	2.9	24.0	100	25.1	1.5	48.0	
12-Aug	23.5	98	23.3	3.7	24.0	100	23.9	2.2	47.5	
13-Aug	18.6	77	17.4	3.5	24.0	100	23.6	2.0	42.6	
14-Aug	23.1	96	16.6	0.0	24.0	100	23.3	2.1	47.1	#1: last day for large
15-Aug	0.0	0		0.0	24.0	100	17.3	0.0	24.0	baskets, water too low.
16-Aug	0.0	0		0.0	24.0	100	19.8	0.0	24.0	
17-Aug	0.0	0		0.0	24.0	100	32.3	1.7	24.0	
18-Aug	0.0	0		0.0	24.0	100	20.1	2.0	24.0	
19-Aug	0.0	0		0.0	24.0	100	27.7	1.6	24.0	
20-Aug	0.0	0		0.0	24.0	100	26.7	1.3	24.0	
21-Aug	0.0	0		0.0	24.0	100	19.4	1.5	24.0	
22-Aug	0.0	0		0.0	24.0	100	18.2	1.0	24.0	
23-Aug	5.5	23	0.0	0.0	24.0	100	33.2	1.0	29.5	#1 with smaller baskets
24-Aug	24.0	100	23.1	3.5	24.0	100	23.3	1.0	48.0	
25-Aug	24.0	100	24.6	4.4	24.0	100	24.5	0.0	48.0	
26-Aug	24.0	100	25.1	5.5	24.0	100	25.3	1.0	48.0	
27-Aug	15.5	65	14.3	4.6	24.0	100	22.8	1.5	39.5	moved #1 down-stream
28-Aug	23.8	99	23.8	4.5	24.0	100	24.3	1.0	47.8	5 m.
29-Aug	24.0	100	22.3	3.5	24.0	100	21.9	0.0	48.0	
30-Aug	23.9	100	25.5	3.9	24.0	100	25.7	1.0	47.9	
31-Aug	24.0	100	22.8	3.7	24.0	100	22.8	1.0	48.0	
1-Sep	24.0	100	25.3	3.9	24.0	100	25.3	1.0	48.0	
2-Sep	22.6	94	22.7	0.0	24.0	100	24.3	0.0	46.6	
3-Sep	23.7	99	23.1	3.6	24.0	100	23.3	1.0	47.7	
4-Sep	23.5	98	24.1	2.7	10.5	44	16.6	0.0	34.0	

Table B-1. Summary of daily fishwheel effort (hours), effort used to calculate CPE and fishwheel speed (RPM). Lines through columns indicate dates when the number of baskets or the size of the baskets was changed.

	Fishwheel 1				Fishwheel 2					
Date	Total	Percent of time running	Effort for CPE [a]	RPM	Total	Percent of time running	Effort for CPE [a]	RPM	Total hours	Comments
5-Sep	9.2	38	14.9	2.0	0.0	0		0.0	9.2	both wheels down,
6-Sep	0.0	0		0.0	0.0	0		0.0	0.0	water too low.
7-Sep	0.0	0		0.0	0.0	0		0.0	0.0	
8-Sep	0.0	0		0.0	0.0	0		0.0	0.0	
9-Sep	14.4	60	6.8	3.5	0.0	0		0.0	14.4	#1 restarted.
10-Sep	23.5	98	22.3	0.0	0.0	0		0.0	23.5	
11-Sep	23.7	99	25.3	4.0	0.0	0		0.0	23.7	
12-Sep	24.0	100	26.1	0.0	0.0	0		0.0	24.0	
13-Sep	9.0	38	14.2	2.8	0.0	0		0.0	9.0	#1 shut down.
14-Sep	0.0	0		0.0	0.0	0		0.0	0.0	
15-Sep	0.0	0		0.0	0.0	0		0.0	0.0	
16-Sep	0.0	0		0.0	0.0	0		0.0	0.0	
17-Sep	0.0	0		0.0	0.0	0		0.0	0.0	
18-Sep	0.0	0		0.0	0.0	0		0.0	0.0	
19-Sep	14.5	60	5.5	5.0	14.0	58	6.0	3.0	28.5	
20-Sep	24.0	100	26.5	5.0	24.0	100	26.5	3.0	48.0	
21-Sep	10.0	42	15.5	6.5	9.5	#2 shut down for season.			19.5	#1 shut down,
22-Sep	0.0	0							0.0	heavy debris load.
23-Sep	0.0	0							0.0	
24-Sep	15.0	63	8.0	5.0					15.0	#1 restarted.
25-Sep	22.0	92	23.0	4.5					22.0	
26-Sep	24.0	100	26.5	4.0					24.0	
27-Sep	24.0	100	15.0	3.5					24.0	
28-Sep	24.0	100	25.5	3.5					24.0	
29-Sep	9.5	40	22.5	4.0					9.5	# 1 shut down.
Total [b]	**2073**	**77**			**1623**	**67**			**3696**	

[a] The total effort is the time the wheel was fishing from midnight to midnight whereas the effort used to calculate the CPE is the number of hours the wheel fished to obtain that date's catch. These two values are different because the time of the last sampling session on each day varied and this affected the following day's effort and catch. Effort was halved for wheel #2 for the period when only one live box was attached to the wheel (4 July-9 July). The CPE effort is listed only for dates when there were catches.

[b] The overall percent running is based on wheel #1 operating from 10 June to 29 September (112 d) and wheel #2 from 5 June to 21 September (102 d).

Table C-1. Daily catches, numbers tagged and CPE (catch/wheel hour) for sockeye salmon captured with two fishwheels on the Nass River in 1992.

	Fishwheel 1							Fishwheel 2							Fishwheels 1 and 2						
Date	Daily catch	Cum. catch	Daily tagged	Cum. tagged	Daily CPE	Daily prop. of CPE	Cum. prop. of CPE	Daily catch	Cum. catch	Daily tagged	Cum. tagged	Daily CPE	Daily prop. of CPE	Cum. prop. of CPE	Daily catch	Cum. catch	Daily tagged	Cum. tagged	Daily CPE	Daily prop. of CPE	Cum. prop. of CPE
5-Jun								0	0	0	0	0.00	0.00	0.00	0	0	0	0	0.00	0.00	0.00
6-Jun								0	0	0	0	0.00	0.00	0.00	0	0	0	0	0.00	0.00	0.00
7-Jun								0	0	0	0	0.00	0.00	0.00	0	0	0	0	0.00	0.00	0.00
8-Jun								0	0	0	0	0.00	0.00	0.00	0	0	0	0	0.00	0.00	0.00
9-Jun								0	0	0	0	0.00	0.00	0.00	0	0	0	0	0.00	0.00	0.00
10-Jun	0	0	0	0	0.00	0.00	0.00	0	0	0	0	0.00	0.00	0.00	0	0	0	0	0.00	0.00	0.00
11-Jun	0	0	0	0	0.00	0.00	0.00	1	1	0	0	0.07	0.00	0.00	1	1	0	0	0.07	0.00	0.00
12-Jun	0	0	0	0	0.00	0.00	0.00	0	1	0	0	0.00	0.00	0.00	0	1	0	0	0.00	0.00	0.00
13-Jun	0	0	0	0	0.00	0.00	0.00	0	1	0	0	0.00	0.00	0.00	0	1	0	0	0.00	0.00	0.00
14-Jun	0	0	0	0	0.00	0.00	0.00	0	1	0	0	0.00	0.00	0.00	0	1	0	0	0.00	0.00	0.00
15-Jun	0	0	0	0	0.00	0.00	0.00	0	1	0	0	0.00	0.00	0.00	0	1	0	0	0.00	0.00	0.00
16-Jun	0	0	0	0	0.00	0.00	0.00	0	1	0	0	0.00	0.00	0.00	0	1	0	0	0.00	0.00	0.00
17-Jun	0	0	0	0	0.00	0.00	0.00	0	1	0	0	0.00	0.00	0.00	0	1	0	0	0.00	0.00	0.00
18-Jun	0	0	0	0	0.00	0.00	0.00	0	1	0	0	0.00	0.00	0.00	0	1	0	0	0.00	0.00	0.00
19-Jun	6	6	0	0	0.25	0.00	0.00	0	1	0	0	0.00	0.00	0.00	6	7	0	0	0.25	0.00	0.00
20-Jun	1	7	0	0	0.04	0.00	0.00	0	1	0	0	0.00	0.00	0.00	1	8	0	0	0.04	0.00	0.00
21-Jun	2	9	0	0	0.08	0.00	0.00	0	1	0	0	0.00	0.00	0.00	2	10	0	0	0.08	0.00	0.00
22-Jun	2	11	0	0	0.08	0.00	0.00	0	1	0	0	0.00	0.00	0.00	2	12	0	0	0.08	0.00	0.00
23-Jun	3	14	0	0	0.13	0.00	0.00	1	2	0	0	0.10	0.00	0.00	4	16	0	0	0.12	0.00	0.00
24-Jun	43	57	0	0	1.80	0.01	0.01	32	34	0	0	1.52	0.01	0.01	75	91	0	0	1.67	0.01	0.01
25-Jun	49	106	0	0	2.15	0.01	0.01	40	74	0	0	1.77	0.01	0.03	89	180	0	0	1.96	0.01	0.02
26-Jun	155	261	34	34	6.81	0.02	0.04	86	160	19	19	4.03	0.03	0.06	241	421	53	53	5.47	0.02	0.04
27-Jun	247	508	36	70	11.45	0.04	0.07	82	242	34	53	3.92	0.03	0.09	329	750	70	123	7.74	0.03	0.07
28-Jun	295	803	78	148	15.15	0.05	0.12	188	430	75	128	8.26	0.07	0.16	483	1233	153	276	11.44	0.05	0.12
29-Jun	46	849	0	148	2.15	0.01	0.13	200	630	50	178	9.53	0.08	0.23	246	1479	50	326	5.80	0.02	0.14
30-Jun	4	853	3	151	0.16	0.00	0.13	43	673	0	178	4.48	0.04	0.27	47	1526	3	329	1.36	0.01	0.15
1-Jul	4	857	4	155	0.17	0.00	0.13	0	673	0	178	0.00	0.00	0.27	4	1530	4	333	0.17	0.00	0.15
2-Jul	2	859	2	157	0.18	0.00	0.13	0	673	0	178	0.00	0.00	0.27	2	1532	2	335	0.18	0.00	0.15
3-Jul	8	867	8	165	0.37	0.00	0.13	0	673	0	178	0.00	0.00	0.27	8	1540	8	343	0.37	0.00	0.15
4-Jul	23	890	23	188	0.94	0.00	0.14	62	735	59	237	16.32	0.13	0.40	85	1625	82	425	3.00	0.01	0.17
5-Jul	881	1771	427	615	37.84	0.12	0.26	97	832	48	285	8.75	0.07	0.47	978	2603	475	900	28.46	0.12	0.28
6-Jul	836	2607	614	1229	33.67	0.11	0.37	159	991	58	343	19.68	0.16	0.62	995	3598	672	1572	30.23	0.13	0.41
7-Jul	659	3266	565	1794	29.95	0.10	0.46	77	1068	68	411	9.24	0.07	0.70	736	4334	633	2205	24.27	0.10	0.51
8-Jul	1650	4916	574	2368	63.46	0.20	0.67	54	1122	0	411	3.31	0.03	0.72	1704	6038	574	2779	40.29	0.17	0.68
9-Jul	564	5480	219	2587	30.36	0.10	0.76	75	1197	29	440	5.48	0.04	0.77	639	6677	248	3027	19.81	0.08	0.76
10-Jul	155	5635	67	2654	6.69	0.02	0.79	97	1294	32	472	4.35	0.03	0.80	252	6929	99	3126	5.54	0.02	0.78
11-Jul	41	5676	17	2671	1.67	0.01	0.79	54	1348	25	497	2.10	0.02	0.82	95	7024	42	3168	1.89	0.01	0.79
12-Jul	15	5691	12	2683	0.69	0.00	0.79	41	1389	28	525	1.90	0.02	0.83	56	7080	40	3208	1.29	0.01	0.80
13-Jul	23	5714	21	2704	1.21	0.00	0.80	28	1417	26	551	1.27	0.01	0.84	51	7131	47	3255	1.24	0.01	0.80
14-Jul	7	5721	3	2707	0.21	0.00	0.80	85	1502	58	609	2.96	0.02	0.87	92	7223	61	3316	1.49	0.01	0.81

Page 1 of 3

Table C-1. Daily catches, numbers tagged and CPE (catch/wheel hour) for sockeye salmon captured with two fishwheels on the Nass River in 1992.

	Fishwheel 1							Fishwheel 2							Fishwheels 1 and 2						
Date	Daily catch	Cum. catch	Daily tagged	Cum. tagged	Daily CPE	Daily prop. of CPE	Cum. prop. of CPE	Daily catch	Cum. catch	Daily tagged	Cum. tagged	Daily CPE	Daily prop. of CPE	Cum. prop. of CPE	Daily catch	Cum. catch	Daily tagged	Cum. tagged	Daily CPE	Daily prop. of CPE	Cum. prop. of CPE
15-Jul	24	5745	18	2725	1.48	0.00	0.80	45	1547	39	648	2.05	0.02	0.88	69	7292	57	3373	1.81	0.01	0.82
16-Jul	66	5811	25	2750	2.92	0.01	0.81	26	1573	4	652	1.11	0.01	0.89	92	7384	29	3402	2.00	0.01	0.83
17-Jul	84	5895	68	2818	3.02	0.01	0.82	21	1594	18	670	0.81	0.01	0.90	105	7489	86	3488	1.95	0.01	0.83
18-Jul	75	5970	68	2886	3.29	0.01	0.83	24	1618	24	694	1.01	0.01	0.91	99	7588	92	3580	2.13	0.01	0.84
19-Jul	60	6030	49	2935	2.46	0.01	0.84	26	1644	22	716	1.06	0.01	0.92	86	7674	71	3651	1.76	0.01	0.85
20-Jul	66	6096	56	2991	2.85	0.01	0.85	45	1689	36	752	1.91	0.02	0.93	111	7785	92	3743	2.37	0.01	0.86
21-Jul	31	6127	25	3016	1.30	0.00	0.85	37	1726	36	788	1.56	0.01	0.94	68	7853	61	3804	1.43	0.01	0.87
22-Jul	14	6141	14	3030	0.59	0.00	0.86	38	1764	33	821	1.59	0.01	0.96	52	7905	47	3851	1.09	0.00	0.87
23-Jul	27	6168	26	3056	1.17	0.00	0.86	12	1776	8	829	0.53	0.00	0.96	39	7944	34	3885	0.85	0.00	0.87
24-Jul	32	6200	27	3083	1.32	0.00	0.86	5	1781	2	831	0.21	0.00	0.96	37	7981	29	3914	0.77	0.00	0.88
25-Jul	25	6225	21	3104	1.05	0.00	0.87	8	1789	4	835	0.33	0.00	0.96	33	8014	25	3939	0.69	0.00	0.88
26-Jul	26	6251	22	3126	1.09	0.00	0.87	11	1800	7	842	0.46	0.00	0.97	37	8051	29	3968	0.77	0.00	0.88
27-Jul	18	6269	17	3143	0.74	0.00	0.87	11	1811	9	851	0.45	0.00	0.97	29	8080	26	3994	0.60	0.00	0.89
28-Jul	24	6293	21	3164	1.04	0.00	0.88	3	1814	2	853	0.13	0.00	0.97	27	8107	23	4017	0.58	0.00	0.89
29-Jul	17	6310	17	3181	0.71	0.00	0.88	6	1820	6	859	0.25	0.00	0.97	23	8130	23	4040	0.48	0.00	0.89
30-Jul	20	6330	19	3200	0.84	0.00	0.88	3	1823	1	860	0.13	0.00	0.97	23	8153	20	4060	0.48	0.00	0.89
31-Jul	28	6358	23	3223	1.17	0.00	0.89	0	1823	0	860	0.00	0.00	0.97	28	8181	23	4083	0.59	0.00	0.89
1-Aug	37	6395	32	3255	1.52	0.00	0.89	1	1824	1	861	0.08	0.00	0.98	38	8219	33	4116	1.03	0.00	0.90
2-Aug	64	6459	58	3313	2.60	0.01	0.90	0	1824	0	861	0.00	0.00	0.98	64	8283	58	4174	2.60	0.01	0.91
3-Aug	63	6522	59	3372	2.71	0.01	0.91	0	1824	0	861	0.00	0.00	0.98	63	8346	59	4233	2.71	0.01	0.92
4-Aug	54	6576	51	3423	2.25	0.01	0.92	0	1824	0	861	0.00	0.00	0.98	54	8400	51	4284	2.25	0.01	0.93
5-Aug	67	6643	57	3480	2.89	0.01	0.92	0	1824	0	861	0.00	0.00	0.98	67	8467	57	4341	2.89	0.01	0.94
6-Aug	24	6667	22	3502	1.03	0.00	0.93	1	1825	1	862	0.15	0.00	0.98	25	8492	23	4364	0.84	0.00	0.95
7-Aug	27	6694	22	3524	1.17	0.00	0.93	7	1832	6	868	0.32	0.00	0.98	34	8526	28	4392	0.76	0.00	0.95
8-Aug	32	6726	28	3552	1.21	0.00	0.94	1	1833	1	869	0.04	0.00	0.98	33	8559	29	4421	0.67	0.00	0.95
9-Aug	60	6786	56	3608	2.90	0.01	0.94	3	1836	1	870	0.12	0.00	0.98	63	8622	57	4478	1.39	0.01	0.96
10-Aug	68	6854	66	3674	2.87	0.01	0.95	2	1838	2	872	0.08	0.00	0.98	70	8692	68	4546	1.48	0.01	0.96
11-Aug	76	6930	64	3738	3.03	0.01	0.96	3	1841	2	874	0.12	0.00	0.98	79	8771	66	4612	1.57	0.01	0.97
12-Aug	43	6973	31	3769	1.85	0.01	0.97	12	1853	12	886	0.50	0.00	0.99	55	8826	43	4655	1.17	0.00	0.97
13-Aug	73	7046	68	3837	4.19	0.01	0.98	3	1856	3	889	0.13	0.00	0.99	76	8902	71	4726	1.85	0.01	0.98
14-Aug	22	7068	20	3857	1.33	0.00	0.99	6	1862	3	892	0.26	0.00	0.99	28	8930	23	4749	0.70	0.00	0.99
15-Aug	0	7068	0	3857	0.00	0.00	0.99	1	1863	0	892	0.06	0.00	0.99	1	8931	0	4749	0.06	0.00	0.99
16-Aug	0	7068	0	3857	0.00	0.00	0.99	1	1864	1	893	0.05	0.00	0.99	1	8932	1	4750	0.05	0.00	0.99
17-Aug	0	7068	0	3857	0.00	0.00	0.99	2	1866	2	895	0.06	0.00	0.99	2	8934	2	4752	0.06	0.00	0.99
18-Aug	0	7068	0	3857	0.00	0.00	0.99	4	1870	4	899	0.20	0.00	0.99	4	8938	4	4756	0.20	0.00	0.99
19-Aug	0	7068	0	3857	0.00	0.00	0.99	7	1877	6	905	0.25	0.00	0.99	7	8945	6	4762	0.25	0.00	0.99
20-Aug	0	7068	0	3857	0.00	0.00	0.99	7	1884	7	912	0.26	0.00	1.00	7	8952	7	4769	0.26	0.00	0.99
21-Aug	0	7068	0	3857	0.00	0.00	0.99	0	1884	0	912	0.00	0.00	1.00	0	8952	0	4769	0.00	0.00	0.99
22-Aug	0	7068	0	3857	0.00	0.00	0.99	0	1884	0	912	0.00	0.00	1.00	0	8952	0	4769	0.00	0.00	0.99
23-Aug	0	7068	0	3857	0.00	0.00	0.99	0	1884	0	912	0.00	0.00	1.00	0	8952	0	4769	0.00	0.00	0.99

Table C-1. Daily catches, numbers tagged and CPE (catch/wheel hour) for sockeye salmon captured with two fishwheels on the Nass River in 1992.

	Fishwheel 1							Fishwheel 2							Fishwheels 1 and 2						
Date	Daily catch	Cum. catch	Daily tagged	Cum. tagged	Daily CPE	Daily prop. of CPE	Cum. prop. of CPE	Daily catch	Cum. catch	Daily tagged	Cum. tagged	Daily CPE	Daily prop. of CPE	Cum. prop. of CPE	Daily catch	Cum. catch	Daily tagged	Cum. tagged	Daily CPE	Daily prop. of CPE	Cum. prop. of CPE
24-Aug	9	7077	8	3865	0.39	0.00	0.99	1	1885	1	913	0.04	0.00	1.00	10	8962	9	4778	0.22	0.00	0.99
25-Aug	18	7095	11	3876	0.73	0.00	0.99	3	1888	2	915	0.12	0.00	1.00	21	8983	13	4791	0.43	0.00	0.99
26-Aug	4	7099	3	3879	0.16	0.00	0.99	2	1890	1	916	0.08	0.00	1.00	6	8989	4	4795	0.12	0.00	0.99
27-Aug	0	7099	0	3879	0.00	0.00	0.99	2	1892	2	918	0.09	0.00	1.00	2	8991	2	4797	0.05	0.00	0.99
28-Aug	4	7103	2	3881	0.17	0.00	0.99	2	1894	2	920	0.08	0.00	1.00	6	8997	4	4801	0.12	0.00	0.99
29-Aug	7	7110	5	3886	0.31	0.00	0.99	0	1894	0	920	0.00	0.00	1.00	7	9004	5	4806	0.16	0.00	0.99
30-Aug	9	7119	8	3894	0.35	0.00	0.99	0	1894	0	920	0.00	0.00	1.00	9	9013	8	4814	0.18	0.00	0.99
31-Aug	3	7122	3	3897	0.13	0.00	0.99	0	1894	0	920	0.00	0.00	1.00	3	9016	3	4817	0.07	0.00	0.99
1-Sep	4	7126	4	3901	0.16	0.00	1.00	0	1894	0	920	0.00	0.00	1.00	4	9020	4	4821	0.08	0.00	0.99
2-Sep	1	7127	1	3902	0.04	0.00	1.00	1	1895	1	921	0.04	0.00	1.00	2	9022	2	4823	0.04	0.00	1.00
3-Sep	5	7132	4	3906	0.22	0.00	1.00	0	1895	0	921	0.00	0.00	1.00	5	9027	4	4827	0.11	0.00	1.00
4-Sep	3	7135	3	3909	0.12	0.00	1.00	0	1895	0	921	0.00	0.00	1.00	3	9030	3	4830	0.07	0.00	1.00
5-Sep	1	7136	1	3910	0.07	0.00	1.00	0	1895	0	921	0.00	0.00	1.00	1	9031	1	4831	0.07	0.00	1.00
6-Sep	0	7136	0	3910	0.00	0.00	1.00	0	1895	0	921	0.00	0.00	1.00	0	9031	0	4831	0.00	0.00	1.00
7-Sep	0	7136	0	3910	0.00	0.00	1.00	0	1895	0	921	0.00	0.00	1.00	0	9031	0	4831	0.00	0.00	1.00
8-Sep	0	7136	0	3910	0.00	0.00	1.00	0	1895	0	921	0.00	0.00	1.00	0	9031	0	4831	0.00	0.00	1.00
9-Sep	0	7136	0	3910	0.00	0.00	1.00	0	1895	0	921	0.00	0.00	1.00	0	9031	0	4831	0.00	0.00	1.00
10-Sep	0	7136	0	3910	0.00	0.00	1.00	0	1895	0	921	0.00	0.00	1.00	0	9031	0	4831	0.00	0.00	1.00
11-Sep	1	7137	1	3911	0.04	0.00	1.00	0	1895	0	921	0.00	0.00	1.00	1	9032	1	4832	0.04	0.00	1.00
12-Sep	0	7137	0	3911	0.00	0.00	1.00	0	1895	0	921	0.00	0.00	1.00	0	9032	0	4832	0.00	0.00	1.00
13-Sep	10	7147	0	3911	0.71	0.00	1.00	0	1895	0	921	0.00	0.00	1.00	10	9042	0	4832	0.71	0.00	1.00
14-Sep	0	7147	0	3911	0.00	0.00	1.00	0	1895	0	921	0.00	0.00	1.00	0	9042	0	4832	0.00	0.00	1.00
15-Sep	0	7147	0	3911	0.00	0.00	1.00	0	1895	0	921	0.00	0.00	1.00	0	9042	0	4832	0.00	0.00	1.00
16-Sep	0	7147	0	3911	0.00	0.00	1.00	0	1895	0	921	0.00	0.00	1.00	0	9042	0	4832	0.00	0.00	1.00
17-Sep	0	7147	0	3911	0.00	0.00	1.00	0	1895	0	921	0.00	0.00	1.00	0	9042	0	4832	0.00	0.00	1.00
18-Sep	0	7147	0	3911	0.00	0.00	1.00	0	1895	0	921	0.00	0.00	1.00	0	9042	0	4832	0.00	0.00	1.00
19-Sep	0	7147	0	3911	0.00	0.00	1.00	0	1895	0	921	0.00	0.00	1.00	0	9042	0	4832	0.00	0.00	1.00
20-Sep	0	7147		3911	0.00	0.00	1.00	0	1895	0	921	0.00	0.00	1.00	0	9042	0	4832	0.00	0.00	1.00
21-Sep	2	7149	2	3913	0.13	0.00	1.00	0	1895	0	921	0.00	0.00	1.00	2	9044	2	4834	0.13	0.00	1.00
22-Sep	0	7149	0	3913	0.00	0.00	1.00								0	9044	0	4834	0.00	0.00	1.00
23-Sep	0	7149	0	3913	0.00	0.00	1.00								0	9044	0	4834	0.00	0.00	1.00
24-Sep	0	7149	0	3913	0.00	0.00	1.00								0	9044	0	4834	0.00	0.00	1.00
25-Sep	0	7149	0	3913	0.00	0.00	1.00								0	9044	0	4834	0.00	0.00	1.00
26-Sep	2	7151	2	3915	0.08	0.00	1.00								2	9046	2	4836	0.08	0.00	1.00
27-Sep	0	7151	0	3915	0.00	0.00	1.00								0	9046	0	4836	0.00	0.00	1.00
28-Sep	0	7151	0	3915	0.00	0.00	1.00								0	9046	0	4836	0.00	0.00	1.00
29-Sep	0	7151	0	3915	0.00	0.00	1.00								0	9046	0	4836	0.00	0.00	1.00
Total	7151		3915		310.06	1.00		1895		921		125.80	1.00		9046		4836		240.15	1.00	

Table C-2. Daily catches, numbers tagged and CPE (catch/wheel hour) for chinook salmon captured with two fishwheels on the Nass River in 1992. Fish that were greater than or equal to 72 cm nose-fork length were classified as adults; fish less than 72 cm were classified as jacks.

	Fishwheel 1											Fishwheel 2										
Date	Adult catch	Jack catch	Total catch	Cum. catch	Radio tagged	Spag. tagged	Total tagged	Cum. tagged	Adult CPE	Daily prop. CPE	Cum. prop. CPE	Adult catch	Jack catch	Total catch	Cum. catch	Radio tagged	Spag. tagged	Total tagged	Cum. tagged	Adult CPE	Daily prop. CPE	Cum. prop. CPE
07-Jun	0	0	0	0	0	0	0	0	0.00	0.00	0.00	1	0	1	1	0	0	0	0	0.04	0.01	0.01
08-Jun	0	0	0	0	0	0	0	0	0.00	0.00	0.00	1	0	1	2	1	0	1	1	0.04	0.01	0.01
09-Jun	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	2	0	0	0	1	0.00	0.00	0.01
10-Jun	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	2	0	0	0	1	0.00	0.00	0.01
11-Jun	0	0	0	0	0	0	0	0	0.00	0.00	0.00	1	0	1	3	0	0	0	1	0.07	0.01	0.02
12-Jun	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	3	0	0	0	1	0.00	0.00	0.02
13-Jun	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	3	0	0	0	1	0.00	0.00	0.02
14-Jun	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	3	0	0	0	1	0.00	0.00	0.02
15-Jun	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	3	0	0	0	1	0.00	0.00	0.02
16-Jun	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	3	0	0	0	1	0.00	0.00	0.02
17-Jun	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	3	0	0	0	1	0.00	0.00	0.02
18-Jun	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	3	0	0	0	1	0.00	0.00	0.02
19-Jun	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	3	0	0	0	1	0.00	0.00	0.02
20-Jun	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	3	0	0	0	1	0.00	0.00	0.02
21-Jun	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	3	0	0	0	1	0.00	0.00	0.02
22-Jun	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	3	0	0	0	1	0.00	0.00	0.02
23-Jun	1	0	1	1	1	0	1	1	0.04	0.00	0.00	0	0	0	3	0	0	0	1	0.00	0.00	0.02
24-Jun	2	2	4	5	2	0	2	3	0.08	0.01	0.01	6	2	8	11	6	0	6	7	0.28	0.04	0.06
25-Jun	5	3	8	13	5	0	5	8	0.22	0.02	0.04	12	1	13	24	12	0	12	19	0.53	0.07	0.13
26-Jun	11	4	15	28	10	0	10	18	0.48	0.05	0.09	5	6	11	35	5	0	5	24	0.23	0.03	0.16
27-Jun	20	0	20	48	20	0	20	38	0.93	0.10	0.18	11	8	19	54	9	0	9	33	0.53	0.07	0.23
28-Jun	17	9	26	74	15	0	15	53	0.87	0.09	0.28	10	4	14	68	8	0	8	41	0.44	0.06	0.29
29-Jun	3	1	4	78	3	0	3	56	0.14	0.01	0.29	5	1	6	74	5	0	5	46	0.24	0.03	0.32
30-Jun	1	0	1	79	0	0	0	56	0.04	0.00	0.30	1	1	2	76	1	0	1	47	0.10	0.01	0.34
01-Jul	0	0	0	79	0	0	0	56	0.00	0.00	0.30	0	0	0	76	0	0	0	47	0.00	0.00	0.34
02-Jul	0	0	0	79	0	0	0	56	0.00	0.00	0.30	0	0	0	76	0	0	0	47	0.00	0.00	0.34
03-Jul	0	0	0	79	0	0	0	56	0.00	0.00	0.30	0	0	0	76	0	0	0	47	0.00	0.00	0.34
04-Jul	5	1	6	85	3	0	3	59	0.20	0.02	0.32	3	0	3	79	3	0	3	50	0.79	0.11	0.44
05-Jul	18	1	19	104	15	0	15	74	0.77	0.08	0.40	4	3	7	86	2	0	2	52	0.36	0.05	0.49
06-Jul	25	2	27	131	25	0	25	99	1.01	0.11	0.50	13	3	16	102	13	0	13	65	1.61	0.22	0.71
07-Jul	13	2	15	146	13	0	13	112	0.59	0.06	0.57	8	8	16	118	7	0	7	72	0.96	0.13	0.83
08-Jul	22	11	33	179	15	12	27	139	0.85	0.09	0.66	3	0	3	121	3	0	3	75	0.18	0.02	0.86
09-Jul	19	8	27	206	19	8	27	166	1.02	0.11	0.76	4	2	6	127	1	3	4	79	0.29	0.04	0.90
10-Jul	14	5	19	225	4	15	19	185	0.60	0.06	0.83	3	8	11	138	2	9	11	90	0.13	0.02	0.92
11-Jul	5	2	7	232	3	4	7	192	0.20	0.02	0.85	5	8	13	151	3	8	11	101	0.19	0.03	0.94
12-Jul	3	1	4	236	2	2	4	196	0.14	0.01	0.86	3	1	4	155	2	2	4	105	0.14	0.02	0.96
13-Jul	0	0	0	236	0	0	0	196	0.00	0.00	0.86	0	1	1	156	0	0	0	105	0.00	0.00	0.96
14-Jul	0	1	1	237	0	0	0	196	0.00	0.00	0.86	0	0	0	156	0	0	0	105	0.00	0.00	0.96
15-Jul	1	0	1	238	1	0	1	197	0.06	0.01	0.87	1	0	1	157	1	0	1	106	0.05	0.01	0.97
16-Jul	2	4	6	244	0	0	0	197	0.09	0.01	0.88	0	0	0	157	0	0	0	106	0.00	0.00	0.97

Table C-2. Daily catches, numbers tagged and CPE (catch/wheel hour) for chinook salmon captured with two fishwheels on the Nass River in 1992. Fish that were greater than or equal to 72 cm nose-fork length were classified as adults; fish less than 72 cm were classified as jacks.

	Fishwheel 1											Fishwheel 2										
Date	Adult catch	Jack catch	Total catch	Cum. catch	Radio tagged	Spag. tagged	Total tagged	Cum. tagged	Adult CPE	Daily prop. CPE	Cum. prop. CPE	Adult catch	Jack catch	Total catch	Cum. catch	Radio tagged	Spag. tagged	Total tagged	Cum. tagged	Adult CPE	Daily prop. CPE	Cum. prop. CPE
17-Jul	1	0	1	245	1	0	1	198	0.04	0.00	0.88	2	1	3	160	2	1	3	109	0.08	0.01	0.98
18-Jul	2	2	4	249	1	2	3	201	0.09	0.01	0.89	2	1	3	163	2	0	2	111	0.08	0.01	0.99
19-Jul	1	0	1	250	1	0	1	202	0.04	0.00	0.90	0	1	1	164	0	0	0	111	0.00	0.00	0.99
20-Jul	0	0	0	250	0	0	0	202	0.00	0.00	0.90	0	0	0	164	0	0	0	111	0.00	0.00	0.99
21-Jul	0	0	0	250	0	0	0	202	0.00	0.00	0.90	0	0	0	164	0	0	0	111	0.00	0.00	0.99
22-Jul	0	0	0	250	0	0	0	202	0.00	0.00	0.90	0	1	1	165	0	0	0	111	0.00	0.00	0.99
23-Jul	1	1	2	252	0	1	1	203	0.04	0.00	0.90	0	0	0	165	0	0	0	111	0.00	0.00	0.99
24-Jul	0	1	1	253	0	0	0	203	0.00	0.00	0.90	0	0	0	165	0	0	0	111	0.00	0.00	0.99
25-Jul	0	0	0	253	0	0	0	203	0.00	0.00	0.90	0	0	0	165	0	0	0	111	0.00	0.00	0.99
26-Jul	1	1	2	255	0	1	1	204	0.04	0.00	0.91	0	0	0	165	0	0	0	111	0.00	0.00	0.99
27-Jul	1	0	1	256	0	0	0	204	0.04	0.00	0.91	1	0	1	166	1	0	1	112	0.04	0.01	0.99
28-Jul	0	0	0	256	0	0	0	204	0.00	0.00	0.91	0	0	0	166	0	0	0	112	0.00	0.00	0.99
29-Jul	0	0	0	256	0	0	0	204	0.00	0.00	0.91	0	0	0	166	0	0	0	112	0.00	0.00	0.99
30-Jul	0	0	0	256	0	0	0	204	0.00	0.00	0.91	0	0	0	166	0	0	0	112	0.00	0.00	0.99
31-Jul	0	0	0	256	0	0	0	204	0.00	0.00	0.91	0	0	0	166	0	0	0	112	0.00	0.00	0.99
01-Aug	1	0	1	257	1	0	1	205	0.04	0.00	0.91	0	0	0	166	0	0	0	112	0.00	0.00	0.99
02-Aug	2	2	4	261	1	2	3	208	0.08	0.01	0.92	0	0	0	166	0	0	0	112	0.00	0.00	0.99
03-Aug	1	0	1	262	1	0	1	209	0.04	0.00	0.93	0	0	0	166	0	0	0	112	0.00	0.00	0.99
04-Aug	1	0	1	263	1	0	1	210	0.04	0.00	0.93	0	0	0	166	0	0	0	112	0.00	0.00	0.99
05-Aug	0	0	0	263	0	0	0	210	0.00	0.00	0.93	0	0	0	166	0	0	0	112	0.00	0.00	0.99
06-Aug	1	1	2	265	0	1	1	211	0.04	0.00	0.94	0	0	0	166	0	0	0	112	0.00	0.00	0.99
07-Aug	1	0	1	266	0	1	1	212	0.04	0.00	0.94	0	0	0	166	0	0	0	112	0.00	0.00	0.99
08-Aug	0	0	0	266	0	0	0	212	0.00	0.00	0.94	0	0	0	166	0	0	0	112	0.00	0.00	0.99
09-Aug	1	0	1	267	0	1	1	213	0.05	0.01	0.95	0	0	0	166	0	0	0	112	0.00	0.00	0.99
10-Aug	2	0	2	269	1	0	1	214	0.08	0.01	0.95	0	0	0	166	0	0	0	112	0.00	0.00	0.99
11-Aug	2	0	2	271	2	0	2	216	0.08	0.01	0.96	0	0	0	166	0	0	0	112	0.00	0.00	0.99
12-Aug	2	0	2	273	2	0	2	218	0.09	0.01	0.97	1	0	1	167	1	0	1	113	0.04	0.01	1.00
13-Aug	1	0	1	274	0	1	1	219	0.06	0.01	0.98	0	0	0	167	0	0	0	113	0.00	0.00	1.00
14-Aug	2	0	2	276	0	0	0	219	0.12	0.01	0.99	0	0	0	167	0	0	0	113	0.00	0.00	1.00
15-Aug	0	0	0	276	0	0	0	219	0.00	0.00	0.99	0	0	0	167	0	0	0	113	0.00	0.00	1.00
16-Aug	0	0	0	276	0	0	0	219	0.00	0.00	0.99	0	0	0	167	0	0	0	113	0.00	0.00	1.00
17-Aug	0	0	0	276	0	0	0	219	0.00	0.00	0.99	0	0	0	167	0	0	0	113	0.00	0.00	1.00
18-Aug	0	0	0	276	0	0	0	219	0.00	0.00	0.99	0	0	0	167	0	0	0	113	0.00	0.00	1.00
19-Aug	0	0	0	276	0	0	0	219	0.00	0.00	0.99	0	0	0	167	0	0	0	113	0.00	0.00	1.00
20-Aug	0	0	0	276	0	0	0	219	0.00	0.00	0.99	0	0	0	167	0	0	0	113	0.00	0.00	1.00
21-Aug	0	0	0	276	0	0	0	219	0.00	0.00	0.99	0	0	0	167	0	0	0	113	0.00	0.00	1.00
22-Aug	0	0	0	276	0	0	0	219	0.00	0.00	0.99	0	0	0	167	0	0	0	113	0.00	0.00	1.00
23-Aug	0	0	0	276	0	0	0	219	0.00	0.00	0.99	0	0	0	167	0	0	0	113	0.00	0.00	1.00
24-Aug	1	0	1	277	1	0	1	220	0.04	0.00	1.00	0	0	0	167	0	0	0	113	0.00	0.00	1.00
25-Aug	0	0	0	277	0	0	0	220	0.00	0.00	1.00	0	0	0	167	0	0	0	113	0.00	0.00	1.00

Table C-2. Daily catches, numbers tagged and CPE (catch/wheel hour) for chinook salmon captured with two fishwheels on the Nass River in 1992. Fish that were greater than or equal to 72 cm nose-fork length were classified as adults; fish less than 72 cm were classified as jacks.

	Fishwheel 1											Fishwheel 2										
Date	Adult catch	Jack catch	Total catch	Cum. catch	Radio tagged	Spag. tagged	Total tagged	Cum. tagged	Adult CPE	Daily prop. CPE	Cum. prop. CPE	Adult catch	Jack catch	Total catch	Cum. catch	Radio tagged	Spag. tagged	Total tagged	Cum. tagged	Adult CPE	Daily prop. CPE	Cum. prop. CPE
26-Aug	0	0	0	277	0	0	0	220	0.00	0.00	1.00	0	0	0	167	0	0	0	113	0.00	0.00	1.00
27-Aug	0	0	0	277	0	0	0	220	0.00	0.00	1.00	0	0	0	167	0	0	0	113	0.00	0.00	1.00
28-Aug	0	0	0	277	0	0	0	220	0.00	0.00	1.00	0	0	0	167	0	0	0	113	0.00	0.00	1.00
29-Aug	1	0	1	278	1	0	1	221	0.04	0.00	1.00	0	0	0	167	0	0	0	113	0.00	0.00	1.00
Total	213	65	278		170	51	221		9.50	1.00		106	61	167		90	23	113		7.46	1.00	

Table C-3. Daily catches, numbers tagged and CPE (catch/wheel hour) for coho salmon captured with two fishwheels on the Nass River in 1992.

	Fishwheel 1							Fishwheel 2							Fishwheels 1 and 2						
Date	Daily catch	Cum. catch	Daily tagged	Cum. tagged	Daily CPE	Daily prop. of CPE	Cum. prop. of CPE	Daily catch	Cum. catch	Daily tagged	Cum. tagged	Daily CPE	Daily prop. of CPE	Cum. prop. of CPE	Daily catch	Cum. catch	Daily tagged	Cum. tagged	Daily CPE	Daily prop. of CPE	Cum. prop. of CPE
17-Jul	3	3	1	1	0.11	0.01	0.01	2	2	1	1	0.08	0.02	0.02	5	5	2	2	0.09	0.01	0.01
18-Jul	4	7	3	4	0.18	0.01	0.01	1	3	1	2	0.04	0.01	0.03	5	10	4	6	0.11	0.01	0.01
19-Jul	1	8	1	5	0.04	0.00	0.02	0	3	0	2	0.00	0.00	0.03	1	11	1	7	0.02	0.00	0.01
20-Jul	0	8	0	5	0.00	0.00	0.02	1	4	1	3	0.04	0.01	0.03	1	12	1	8	0.02	0.00	0.02
21-Jul	0	8	0	5	0.00	0.00	0.02	0	4	0	3	0.00	0.00	0.03	0	12	0	8	0.00	0.00	0.02
22-Jul	0	8	0	5	0.00	0.00	0.02	1	5	1	4	0.04	0.01	0.04	1	13	1	9	0.02	0.00	0.02
23-Jul	1	9	1	6	0.04	0.00	0.02	0	5	0	4	0.00	0.00	0.04	1	14	1	10	0.02	0.00	0.02
24-Jul	1	10	1	7	0.04	0.00	0.02	0	5	0	4	0.00	0.00	0.04	1	15	1	11	0.02	0.00	0.02
25-Jul	2	12	2	9	0.08	0.00	0.03	1	6	1	5	0.04	0.01	0.05	3	18	3	14	0.06	0.00	0.02
26-Jul	2	14	2	11	0.08	0.00	0.03	0	6	0	5	0.00	0.00	0.05	2	20	2	16	0.04	0.00	0.03
27-Jul	1	15	1	12	0.04	0.00	0.03	4	10	4	9	0.16	0.04	0.09	5	25	5	21	0.10	0.01	0.03
28-Jul	2	17	2	14	0.09	0.00	0.04	0	10	0	9	0.00	0.00	0.09	2	27	2	23	0.04	0.00	0.04
29-Jul	5	22	5	19	0.21	0.01	0.05	0	10	0	9	0.00	0.00	0.09	5	32	5	28	0.10	0.01	0.04
30-Jul	5	27	5	24	0.21	0.01	0.06	2	12	2	11	0.08	0.02	0.11	7	39	7	35	0.15	0.01	0.05
31-Jul	7	34	7	31	0.29	0.02	0.07	0	12	0	11	0.00	0.00	0.11	7	46	7	42	0.15	0.01	0.06
1-Aug	15	49	15	46	0.61	0.03	0.11	0	12	0	11	0.00	0.00	0.11	15	61	15	57	0.41	0.03	0.09
2-Aug	41	90	39	85	1.67	0.09	0.19	0	12	0	11	0.00	0.00	0.11	41	102	39	96	1.67	0.11	0.20
3-Aug	29	119	27	112	1.25	0.06	0.26	0	12	0	11	0.00	0.00	0.11	29	131	27	123	1.25	0.08	0.28
4-Aug	15	134	15	127	0.63	0.03	0.29	0	12	0	11	0.00	0.00	0.11	15	146	15	138	0.63	0.04	0.32
5-Aug	20	154	19	146	0.86	0.04	0.33	0	12	0	11	0.00	0.00	0.11	20	166	19	157	0.86	0.06	0.37
6-Aug	28	182	26	172	1.20	0.06	0.40	1	13	0	11	0.15	0.03	0.14	29	195	26	183	0.97	0.06	0.44
7-Aug	28	210	25	197	1.21	0.06	0.46	10	23	10	21	0.46	0.10	0.24	38	233	35	218	0.84	0.05	0.49
8-Aug	41	251	33	230	1.55	0.08	0.54	5	28	5	26	0.22	0.05	0.29	46	279	38	256	0.94	0.06	0.55
9-Aug	26	277	26	256	1.26	0.07	0.61	6	34	5	31	0.24	0.05	0.34	32	311	31	287	0.71	0.05	0.60
10-Aug	26	303	22	278	1.10	0.06	0.66	2	36	2	33	0.08	0.02	0.36	28	339	24	311	0.59	0.04	0.63
11-Aug	40	343	40	318	1.59	0.08	0.74	5	41	4	37	0.20	0.04	0.40	45	384	44	355	0.90	0.06	0.69
12-Aug	15	358	13	331	0.65	0.03	0.78	1	42	0	37	0.04	0.01	0.41	16	400	13	368	0.34	0.02	0.71
13-Aug	11	369	10	341	0.63	0.03	0.81	17	59	16	53	0.72	0.16	0.56	28	428	26	394	0.68	0.04	0.76
14-Aug	6	375	6	347	0.36	0.02	0.83	2	61	1	54	0.09	0.02	0.58	8	436	7	401	0.20	0.01	0.77
15-Aug	0	375	0	347	0.00	0.00	0.83	3	64	2	56	0.17	0.04	0.62	3	439	2	403	0.17	0.01	0.78
16-Aug	0	375	0	347	0.00	0.00	0.83	4	68	3	59	0.20	0.04	0.66	4	443	3	406	0.20	0.01	0.80
17-Aug	0	375	0	347	0.00	0.00	0.83	1	69	1	60	0.03	0.01	0.67	1	444	1	407	0.03	0.00	0.80
18-Aug	0	375	0	347	0.00	0.00	0.83	0	69	0	60	0.00	0.00	0.67	0	444	0	407	0.00	0.00	0.80
19-Aug	0	375	0	347	0.00	0.00	0.83	6	75	5	65	0.22	0.05	0.72	6	450	5	412	0.22	0.01	0.81
20-Aug	0	375	0	347	0.00	0.00	0.83	3	78	3	68	0.11	0.02	0.74	3	453	3	415	0.11	0.01	0.82
21-Aug	0	375	0	347	0.00	0.00	0.83	2	80	2	70	0.10	0.02	0.76	2	455	2	417	0.10	0.01	0.83
22-Aug	0	375	0	347	0.00	0.00	0.83	0	80	0	70	0.00	0.00	0.76	0	455	0	417	0.00	0.00	0.83
23-Aug	0	375	0	347	0.00	0.00	0.83	1	81	1	71	0.03	0.01	0.77	1	456	1	418	0.03	0.00	0.83
24-Aug	1	376	1	348	0.04	0.00	0.83	0	81	0	71	0.00	0.00	0.77	1	457	1	419	0.02	0.00	0.83
25-Aug	3	379	3	351	0.12	0.01	0.84	1	82	1	72	0.04	0.01	0.78	4	461	4	423	0.08	0.01	0.83

Table C-3. Daily catches, numbers tagged and CPE (catch/wheel hour) for coho salmon captured with two fishwheels on the Nass River in 1992.

	Fishwheel 1							Fishwheel 2							Fishwheels 1 and 2						
Date	Daily catch	Cum. catch	Daily tagged	Cum. tagged	Daily CPE	Daily prop. of CPE	Cum. prop. of CPE	Daily catch	Cum. catch	Daily tagged	Cum. tagged	Daily CPE	Daily prop. of CPE	Cum. prop. of CPE	Daily catch	Cum. catch	Daily tagged	Cum. tagged	Daily CPE	Daily prop. of CPE	Cum. prop. of CPE
26-Aug	0	379	0	351	0.00	0.00	0.84	7	89	7	79	0.28	0.06	0.84	7	468	7	430	0.14	0.01	0.84
27-Aug	1	380	0	351	0.07	0.00	0.84	1	90	1	80	0.04	0.01	0.85	2	470	1	431	0.05	0.00	0.85
28-Aug	3	383	3	354	0.13	0.01	0.85	2	92	2	82	0.08	0.02	0.87	5	475	5	436	0.10	0.01	0.85
29-Aug	5	388	5	359	0.22	0.01	0.86	1	93	1	83	0.05	0.01	0.88	6	481	6	442	0.14	0.01	0.86
30-Aug	9	397	8	367	0.35	0.02	0.88	3	96	2	85	0.12	0.03	0.90	12	493	10	452	0.23	0.02	0.88
31-Aug	3	400	2	369	0.13	0.01	0.89	2	98	1	86	0.09	0.02	0.92	5	498	3	455	0.11	0.01	0.88
1-Sep	11	411	8	377	0.43	0.02	0.91	0	98	0	86	0.00	0.00	0.92	11	509	8	463	0.22	0.01	0.90
2-Sep	6	417	6	383	0.26	0.01	0.92	5	103	4	90	0.21	0.04	0.97	11	520	10	473	0.23	0.02	0.91
3-Sep	6	423	5	388	0.26	0.01	0.94	2	105	2	92	0.09	0.02	0.98	8	528	7	480	0.17	0.01	0.92
4-Sep	2	425	2	390	0.08	0.00	0.94	0	105	0	92	0.00	0.00	0.98	2	530	2	482	0.05	0.00	0.93
5-Sep	0	425	0	390	0.00	0.00	0.94	0	105	0	92	0.00	0.00	0.98	0	530	0	482	0.00	0.00	0.93
6-Sep	0	425	0	390	0.00	0.00	0.94	0	105	0	92	0.00	0.00	0.98	0	530	0	482	0.00	0.00	0.93
7-Sep	0	425	0	390	0.00	0.00	0.94	0	105	0	92	0.00	0.00	0.98	0	530	0	482	0.00	0.00	0.93
8-Sep	0	425	0	390	0.00	0.00	0.94	0	105	0	92	0.00	0.00	0.98	0	530	0	482	0.00	0.00	0.93
9-Sep	0	425	0	390	0.00	0.00	0.94	0	105	0	92	0.00	0.00	0.98	0	530	0	482	0.00	0.00	0.93
10-Sep	4	429	3	393	0.18	0.01	0.95	0	105	0	92	0.00	0.00	0.98	4	534	3	485	0.18	0.01	0.94
11-Sep	7	436	7	400	0.28	0.01	0.96	0	105	0	92	0.00	0.00	0.98	7	541	7	492	0.28	0.02	0.96
12-Sep	6	442	6	406	0.23	0.01	0.98	0	105	0	92	0.00	0.00	0.98	6	547	6	498	0.23	0.01	0.97
13-Sep	3	445	0	406	0.21	0.01	0.99	0	105	0	92	0.00	0.00	0.98	3	550	0	498	0.21	0.01	0.99
14-Sep	0	445	0	406	0.00	0.00	0.99	0	105	0	92	0.00	0.00	0.98	0	550	0	498	0.00	0.00	0.99
15-Sep	0	445	0	406	0.00	0.00	0.99	0	105	0	92	0.00	0.00	0.98	0	550	0	498	0.00	0.00	0.99
16-Sep	0	445	0	406	0.00	0.00	0.99	0	105	0	92	0.00	0.00	0.98	0	550	0	498	0.00	0.00	0.99
17-Sep	0	445	0	406	0.00	0.00	0.99	0	105	0	92	0.00	0.00	0.98	0	550	0	498	0.00	0.00	0.99
18-Sep	0	445	0	406	0.00	0.00	0.99	0	105	0	92	0.00	0.00	0.98	0	550	0	498	0.00	0.00	0.99
19-Sep	0	445	0	406	0.00	0.00	0.99	0	105	0	92	0.00	0.00	0.98	0	550	0	498	0.00	0.00	0.99
20-Sep	4	449	4	410	0.15	0.01	0.99	2	107	2	94	0.08	0.02	1.00	6	556	6	504	0.11	0.01	0.99
21-Sep	0	449	0	410	0.00	0.00	0.99	0	107	0	94	0.00	0.00	1.00	0	556	0	504	0.00	0.00	0.99
22-Sep	0	449	0	410	0.00	0.00	0.99								0	556	0	504	0.00	0.00	0.99
23-Sep	0	449	0	410	0.00	0.00	0.99								0	556	0	504	0.00	0.00	0.99
24-Sep	0	449	0	410	0.00	0.00	0.99								0	556	0	504	0.00	0.00	0.99
25-Sep	0	449	0	410	0.00	0.00	0.99								0	556	0	504	0.00	0.00	0.99
26-Sep	3	452	3	413	0.11	0.01	1.00								3	559	3	507	0.11	0.01	1.00
27-Sep	0	452	0	413	0.00	0.00	1.00								0	559	0	507	0.00	0.00	1.00
28-Sep	0	452	0	413	0.00	0.00	1.00								0	559	0	507	0.00	0.00	1.00
29-Sep	0	452	0	413	0.00	0.00	1.00								0	559	0	507	0.00	0.00	1.00
Total	452		413		19.26	1.00		107		94		4.64	1.00		559		507		15.49	1.00	

Table C-4. Daily catches, numbers tagged and CPE (catch/wheel hour) for steelhead, pink and chum salmon captured with two fishwheels on the Nass River in 1992. Tag totals for steelhead include 12 radio and 23 spaghetti tags. There were 5 chum radio tagged and 1 spaghetti tagged.

	Fishwheel 1											Fishwheel 2										
	Steelhead				Pink					Chum		Steelhead				Pink					Chum	
Date	Daily catch	Cum. catch	Daily tagged	Cum. tagged	Daily catch	Cum. catch	Daily CPE	Daily prop. of CPE	Cum. prop. CPE	Daily catch	Cum. catch	Daily catch	Cum. catch	Daily tagged	Cum. tagged	Daily catch	Cum. catch	Daily CPE	Daily prop. of CPE	Cum. prop. CPE	Daily catch	Cum. catch
05-Jun												0	0	0		0	0	0.00	0.00	0.00	0	0
06-Jun												0	0	0	0	0	0	0.00	0.00	0.00	0	0
07-Jun												0	0	0	0	0	0	0.00	0.00	0.00	0	0
08-Jun												0	0	0	0	0	0	0.00	0.00	0.00	0	0
09-Jun												1	1	1	1	0	0	0.00	0.00	0.00	0	0
10-Jun	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	1	0	1	0	0	0.00	0.00	0.00	0	0
11-Jun	0	0	0	0	0	0	0.00	0.00	0.00	0	0	1	2	0	1	0	0	0.00	0.00	0.00	0	0
12-Jun	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	2	0	1	0	0	0.00	0.00	0.00	0	0
13-Jun	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	2	0	1	0	0	0.00	0.00	0.00	0	0
14-Jun	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	2	0	1	0	0	0.00	0.00	0.00	0	0
15-Jun	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	2	0	1	0	0	0.00	0.00	0.00	0	0
16-Jun	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	2	0	1	0	0	0.00	0.00	0.00	0	0
17-Jun	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	2	0	1	0	0	0.00	0.00	0.00	0	0
18-Jun	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	2	0	1	0	0	0.00	0.00	0.00	0	0
19-Jun	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	2	0	1	0	0	0.00	0.00	0.00	0	0
20-Jun	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	2	0	1	0	0	0.00	0.00	0.00	0	0
21-Jun	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	2	0	1	0	0	0.00	0.00	0.00	0	0
22-Jun	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	2	0	1	0	0	0.00	0.00	0.00	0	0
23-Jun	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	2	0	1	0	0	0.00	0.00	0.00	0	0
24-Jun	0	0	0	0	0	0	0.00	0.00	0.00	0	0	1	3	1	2	0	0	0.00	0.00	0.00	0	0
25-Jun	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	3	0	2	0	0	0.00	0.00	0.00	0	0
26-Jun	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	3	0	2	0	0	0.00	0.00	0.00	0	0
27-Jun	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	3	0	2	0	0	0.00	0.00	0.00	0	0
28-Jun	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	3	0	2	0	0	0.00	0.00	0.00	0	0
29-Jun	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	3	0	2	0	0	0.00	0.00	0.00	0	0
30-Jun	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	3	0	2	0	0	0.00	0.00	0.00	0	0
01-Jul	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	3	0	2	0	0	0.00	0.00	0.00	0	0
02-Jul	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	3	0	2	0	0	0.00	0.00	0.00	0	0
03-Jul	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	3	0	2	0	0	0.00	0.00	0.00	0	0
04-Jul	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	3	0	2	0	0	0.00	0.00	0.00	0	0
05-Jul	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	3	0	2	0	0	0.00	0.00	0.00	0	0
06-Jul	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	3	0	2	0	0	0.00	0.00	0.00	0	0
07-Jul	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	3	0	2	0	0	0.00	0.00	0.00	0	0
08-Jul	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	3	0	2	0	0	0.00	0.00	0.00	0	0
09-Jul	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	3	0	2	0	0	0.00	0.00	0.00	0	0
10-Jul	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	3	0	2	0	0	0.00	0.00	0.00	0	0

Table C-4. Daily catches, numbers tagged and CPE (catch/wheel hour) for steelhead, pink and chum salmon captured with two fishwheels on the Nass River in 1992. Tag totals for steelhead include 12 radio and 23 spaghetti tags. There were 5 chum radio tagged and 1 spaghetti tagged.

	Fishwheel 1											Fishwheel 2										
	Steelhead				Pink					Chum		Steelhead				Pink					Chum	
Date	Daily catch	Cum. catch	Daily tagged	Cum. tagged	Daily catch	Cum. catch	Daily CPE	Daily prop. of CPE	Cum. prop. CPE	Daily catch	Cum. catch	Daily catch	Cum. catch	Daily tagged	Cum. tagged	Daily catch	Cum. catch	Daily CPE	Daily prop. of CPE	Cum. prop. CPE	Daily catch	Cum. catch
11-Jul	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	3	0	2	1	1	0.04	0.00	0.00	0	0
12-Jul	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	3	0	2	3	4	0.14	0.00	0.00	0	0
13-Jul	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	3	0	2	3	7	0.14	0.00	0.00	0	0
14-Jul	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	3	0	2	11	18	0.38	0.00	0.00	0	0
15-Jul	0	0	0	0	2	2	0.12	0.00	0.00	0	0	0	3	0	2	9	27	0.41	0.00	0.01	0	0
16-Jul	0	0	0	0	3	5	0.13	0.00	0.00	0	0	0	3	0	2	11	38	0.47	0.00	0.01	0	0
17-Jul	0	0	0	0	18	23	0.65	0.01	0.01	1	1	0	3	0	2	22	60	0.85	0.01	0.02	1	1
18-Jul	0	0	0	0	22	45	0.96	0.01	0.02	0	1	0	3	0	2	11	71	0.46	0.00	0.02	0	1
19-Jul	0	0	0	0	22	67	0.90	0.01	0.03	0	1	0	3	0	2	25	96	1.02	0.01	0.03	0	1
20-Jul	0	0	0	0	9	76	0.39	0.00	0.03	0	1	1	4	0	2	67	163	2.84	0.02	0.05	0	1
21-Jul	0	0	0	0	6	82	0.25	0.00	0.03	0	1	0	4	0	2	40	203	1.69	0.01	0.06	0	1
22-Jul	0	0	0	0	0	82	0.00	0.00	0.03	0	1	0	4	0	2	57	260	2.38	0.02	0.08	0	1
23-Jul	0	0	0	0	4	86	0.17	0.00	0.03	0	1	0	4	0	2	37	297	1.63	0.01	0.09	0	1
24-Jul	0	0	0	0	19	105	0.79	0.01	0.04	0	1	0	4	0	2	32	329	1.34	0.01	0.10	0	1
25-Jul	0	0	0	0	17	122	0.71	0.01	0.05	0	1	0	4	0	2	55	384	2.30	0.02	0.11	0	1
26-Jul	0	0	0	0	9	131	0.38	0.00	0.05	0	1	0	4	0	2	56	440	2.34	0.02	0.13	0	1
27-Jul	0	0	0	0	3	134	0.12	0.00	0.05	0	1	0	4	0	2	17	457	0.70	0.00	0.13	0	1
28-Jul	0	0	0	0	0	134	0.00	0.00	0.05	0	1	0	4	0	2	21	478	0.89	0.01	0.14	0	1
29-Jul	0	0	0	0	16	150	0.67	0.01	0.06	0	1	0	4	0	2	24	502	0.99	0.01	0.15	0	1
30-Jul	0	0	0	0	30	180	1.27	0.01	0.07	0	1	1	5	1	3	30	532	1.26	0.01	0.16	0	1
31-Jul	0	0	0	0	61	241	2.56	0.02	0.10	0	1	0	5	0	3	5	537	0.21	0.00	0.16	0	1
01-Aug	0	0	0	0	72	313	2.95	0.03	0.12	0	1	0	5	0	3	0	537	0.00	0.00	0.16	0	1
02-Aug	1	1	1	1	87	400	3.54	0.03	0.16	0	1	0	5	0	3	0	537	0.00	0.00	0.16	0	1
03-Aug	1	2	1	2	61	461	2.62	0.02	0.18	0	1	0	5	0	3	0	537	0.00	0.00	0.16	0	1
04-Aug	1	3	1	3	53	514	2.21	0.02	0.20	0	1	0	5	0	3	0	537	0.00	0.00	0.16	0	1
05-Aug	1	4	1	4	18	532	0.78	0.01	0.21	0	1	0	5	0	3	0	537	0.00	0.00	0.16	0	1
06-Aug	0	4	0	4	85	617	3.65	0.03	0.24	0	1	0	5	0	3	29	566	4.46	0.03	0.19	0	1
07-Aug	0	4	0	4	52	669	2.24	0.02	0.27	0	1	0	5	0	3	109	675	4.99	0.04	0.22	0	1
08-Aug	0	4	0	4	121	790	4.58	0.04	0.31	0	1	1	6	1	4	102	777	4.53	0.03	0.26	0	1
09-Aug	4	8	4	8	162	952	7.84	0.07	0.38	0	1	0	6	0	4	129	906	5.25	0.04	0.29	0	1
10-Aug	2	10	1	9	156	1108	6.59	0.06	0.45	1	2	0	6	0	4	117	1023	4.96	0.03	0.33	0	1
11-Aug	6	16	6	15	130	1238	5.18	0.05	0.50	0	2	0	6	0	4	102	1125	4.07	0.03	0.36	0	1
12-Aug	1	17	1	16	110	1348	4.73	0.04	0.54	1	3	0	6	0	4	101	1226	4.22	0.03	0.39	0	1
13-Aug	1	18	1	17	74	1422	4.25	0.04	0.58	0	3	0	6	0	4	109	1335	4.62	0.03	0.42	0	1
14-Aug	1	19	1	18	15	1437	0.91	0.01	0.59	0	3	0	6	0	4	102	1437	4.38	0.03	0.45	0	1
15-Aug	0	19	0	18	0	1437	0.00	0.00	0.59	0	3	0	6	0	4	41	1478	2.37	0.02	0.47	0	1

Table C-4. Daily catches, numbers tagged and CPE (catch/wheel hour) for steelhead, pink and chum salmon captured with two fishwheels on the Nass River in 1992. Tag totals for steelhead include 12 radio and 23 spaghetti tags. There were 5 chum radio tagged and 1 spaghetti tagged.

	Fishwheel 1											Fishwheel 2										
	Steelhead				Pink					Chum		Steelhead				Pink					Chum	
Date	Daily catch	Cum. catch	Daily tagged	Cum. tagged	Daily catch	Cum. catch	Daily CPE	Daily prop. of CPE	Cum. prop. CPE	Daily catch	Cum. catch	Daily catch	Cum. catch	Daily tagged	Cum. tagged	Daily catch	Cum. catch	Daily CPE	Daily prop. of CPE	Cum. prop. CPE	Daily catch	Cum. catch
16-Aug	0	19	0	18	0	1437	0.00	0.00	0.59	0	3	0	6	0	4	61	1539	3.08	0.02	0.49	0	1
17-Aug	0	19	0	18	0	1437	0.00	0.00	0.59	0	3	0	6	0	4	131	1670	4.06	0.03	0.52	0	1
18-Aug	0	19	0	18	0	1437	0.00	0.00	0.59	0	3	0	6	0	4	162	1832	8.07	0.06	0.57	0	1
19-Aug	0	19	0	18	0	1437	0.00	0.00	0.59	0	3	0	6	0	4	203	2035	7.34	0.05	0.63	2	3
20-Aug	0	19	0	18	0	1437	0.00	0.00	0.59	0	3	0	6	0	4	243	2278	9.11	0.06	0.69	0	3
21-Aug	0	19	0	18	0	1437	0.00	0.00	0.59	0	3	0	6	0	4	88	2366	4.53	0.03	0.72	1	4
22-Aug	0	19	0	18	0	1437	0.00	0.00	0.59	0	3	0	6	0	4	105	2471	5.78	0.04	0.76	0	4
23-Aug	0	19	0	18	0	1437	0.00	0.00	0.59	0	3	1	7	1	5	115	2586	3.47	0.02	0.79	0	4
24-Aug	2	21	2	20	104	1541	4.50	0.04	0.63	0	3	0	7	0	5	40	2626	1.72	0.01	0.80	0	4
25-Aug	0	21	0	20	70	1611	2.85	0.03	0.66	1	4	0	7	0	5	38	2664	1.55	0.01	0.81	0	4
26-Aug	0	21	0	20	46	1657	1.83	0.02	0.68	0	4	2	9	0	5	111	2775	4.38	0.03	0.84	5	9
27-Aug	0	21	0	20	13	1670	0.91	0.01	0.69	0	4	0	9	0	5	132	2907	5.80	0.04	0.88	3	12
28-Aug	0	21	0	20	132	1802	5.54	0.05	0.74	3	7	0	9	0	5	124	3031	5.11	0.04	0.92	2	14
29-Aug	1	22	1	21	110	1912	4.93	0.05	0.78	3	10	0	9	0	5	11	3042	0.50	0.00	0.92	0	14
30-Aug	0	22	0	21	81	1993	3.18	0.03	0.81	1	11	0	9	0	5	41	3083	1.60	0.01	0.93	1	15
31-Aug	0	22	0	21	68	2061	2.98	0.03	0.84	2	13	0	9	0	5	36	3119	1.58	0.01	0.94	1	16
01-Sep	2	24	2	23	64	2125	2.53	0.02	0.87	2	15	0	9	0	5	47	3166	1.86	0.01	0.96	1	17
02-Sep	3	27	3	26	43	2168	1.90	0.02	0.88	1	16	0	9	0	5	100	3266	4.12	0.03	0.99	0	17
03-Sep	1	28	1	27	45	2213	1.95	0.02	0.90	3	19	0	9	0	5	41	3307	1.76	0.01	1.00	0	17
04-Sep	0	28	0	27	71	2284	2.95	0.03	0.93	2	21	0	9	0	5	6	3313	0.36	0.00	1.00	0	17
05-Sep	1	29	1	28	49	2333	3.28	0.03	0.96	0	21	0	9	0	5	0	3313	0.00	0.00	1.00	0	17
06-Sep	0	29	0	28	0	2333	0.00	0.00	0.96	0	21	0	9	0	5	0	3313	0.00	0.00	1.00	0	17
07-Sep	0	29	0	28	0	2333	0.00	0.00	0.96	0	21	0	9	0	5	0	3313	0.00	0.00	1.00	0	17
08-Sep	0	29	0	28	0	2333	0.00	0.00	0.96	0	21	0	9	0	5	0	3313	0.00	0.00	1.00	0	17
09-Sep	0	29	0	28	14	2347	2.07	0.02	0.98	0	21	0	9	0	5	0	3313	0.00	0.00	1.00	0	17
10-Sep	0	29	0	28	17	2364	0.76	0.01	0.99	1	22	0	9	0	5	0	3313	0.00	0.00	1.00	0	17
11-Sep	0	29	0	28	6	2370	0.24	0.00	0.99	2	24	0	9	0	5	0	3313	0.00	0.00	1.00	0	17
12-Sep	0	29	0	28	7	2377	0.27	0.00	0.99	0	24	0	9	0	5	0	3313	0.00	0.00	1.00	0	17
13-Sep	0	29	0	28	8	2385	0.56	0.01	1.00	1	25	0	9	0	5	0	3313	0.00	0.00	1.00	0	17
14-Sep	0	29	0	28	0	2385	0.00	0.00	1.00	0	25	0	9	0	5	0	3313	0.00	0.00	1.00	0	17
15-Sep	0	29	0	28	0	2385	0.00	0.00	1.00	0	25	0	9	0	5	0	3313	0.00	0.00	1.00	0	17
16-Sep	0	29	0	28	0	2385	0.00	0.00	1.00	0	25	0	9	0	5	0	3313	0.00	0.00	1.00	0	17
17-Sep	0	29	0	28	0	2385	0.00	0.00	1.00	0	25	0	9	0	5	0	3313	0.00	0.00	1.00	0	17
18-Sep	0	29	0	28	0	2385	0.00	0.00	1.00	0	25	0	9	0	5	0	3313	0.00	0.00	1.00	0	17
19-Sep	0	29	0	28	0	2385	0.00	0.00	1.00	0	25	0	9	0	5	0	3313	0.00	0.00	1.00	0	17
20-Sep	1	30	1	29	1	2386	0.04	0.00	1.00	0	25	0	9	0	5	0	3313	0.00	0.00	1.00	0	17

Table C-4. Daily catches, numbers tagged and CPE (catch/wheel hour) for steelhead, pink and chum salmon captured with two fishwheels on the Nass River in 1992. Tag totals for steelhead include 12 radio and 23 spaghetti tags. There were 5 chum radio tagged and 1 spaghetti tagged.

	Fishwheel 1											Fishwheel 2										
	Steelhead				Pink					Chum		Steelhead				Pink					Chum	
Date	Daily catch	Cum. catch	Daily tagged	Cum. tagged	Daily catch	Cum. catch	Daily CPE	Daily prop. of CPE	Cum. prop. CPE	Daily catch	Cum. catch	Daily catch	Cum. catch	Daily tagged	Cum. tagged	Daily catch	Cum. catch	Daily CPE	Daily prop. of CPE	Cum. prop. CPE	Daily catch	Cum. catch
21-Sep	0	30	0	29	0	2386	0.00	0.00	1.00	0	25	0	9	0	5	0	3313	0.00	0.00	1.00	0	17
22-Sep	0	30	0	29	0	2386	0.00	0.00	1.00	0	25											
23-Sep	0	30	0	29	0	2386	0.00	0.00	1.00	0	25											
24-Sep	0	30	0	29	0	2386	0.00	0.00	1.00	0	25											
25-Sep	0	30	0	29	0	2386	0.00	0.00	1.00	0	25											
26-Sep	1	31	1	30	0	2386	0.00	0.00	1.00	0	25											
27-Sep	0	31	0	30	0	2386	0.00	0.00	1.00	0	25											
28-Sep	0	31	0	30	0	2386	0.00	0.00	1.00	0	25											
29-Sep	0	31	0	30	0	2386	0.00	0.00	1.00	0	25											
Total	31		30		2386		105.4	1.00		25		9		5		3313		142.12	1.00		17	

Table D-1. Daily counts and number of tag recoveries for sockeye and coho passing through the Meziadin fishway, 1992.

			Tag recoveries					
	Daily count (adults)		Bypassed [a]		Recovered		Total	
Date	Sockeye	Coho	Sockeye	Coho	Sockeye	Coho	Sockeye	Coho
16-Jul	17	0	0	0	0	0	0	0
17-Jul	106	0	0	0	0	0	0	0
18-Jul	2296	0	1	0	0	0	1	0
19-Jul	24902	0	27	0	18	0	45	0
20-Jul	38449	0	59	0	52	0	111	0
21-Jul	44035	0	150	0	39	0	189	0
22-Jul	50042	0	270	0	2	0	272	0
23-Jul	45651	0	252	0	10	0	262	0
24-Jul	44550	0	291	0	2	0	293	0
25-Jul	44741	0	261	0	11	0	272	0
26-Jul	45125	0	195	0	10	0	205	0
27-Jul	37905	0	194	0	13	0	207	0
28-Jul	21779	0	136	0	13	0	149	0
29-Jul	12849	0	86	0	8	0	94	0
30-Jul	8704	0	35	0	7	0	42	0
31-Jul	7136	0	39	0	12	0	51	0
1-Aug	7991	0	53	0	10	0	63	0
2-Aug	6500	0	44	0	5	0	49	0
3-Aug	4815	0	30	0	4	0	34	0
4-Aug	5717	0	40	0	3	0	43	0
5-Aug	3972	0	7	0	3	0	10	0
6-Aug	3706	0	9	0	7	0	16	0
7-Aug	2632	0	13	0	6	0	19	0
8-Aug	2143	0	10	0	5	0	15	0
9-Aug	3758	3	16	0	4	0	20	0
10-Aug	2982	2	6	0	4	0	10	0
11-Aug	5423	1	9	0	8	0	17	0
12-Aug	4025	0	7	0	2	0	9	0
13-Aug	4084	6	9	0	5	0	14	0
14-Aug	4356	7	10	0	11	0	21	0
15-Aug	5579	18	18	0	6	1	24	1
16-Aug	5939	18	17	0	7	0	24	0
17-Aug	4901	13	17	0	6	0	23	0
18-Aug	5684	25	11	0	8	0	19	0
19-Aug	6869	47	14	0	4	0	18	0
20-Aug	4914	40	13	0	4	0	17	0
21-Aug	4529	35	11	0	5	0	16	0
22-Aug	6308	59	35	0	12	0	47	0
23-Aug	5619	77	38	1	15	0	53	1
24-Aug	7959	257	61	2	17	0	78	2
25-Aug	4206	187	9	0	7	0	16	0
26-Aug	2691	113	8	0	11	0	19	0
27-Aug	2767	95	13	0	6	0	19	0
28-Aug	1362	62	7	0	3	1	10	1

Table D-1. Daily counts and number of tag recoveries for sockeye and coho passing through the Meziadin fishway, 1992.

			Tag recoveries					
	Daily count (adults)		Bypassed [a]		Recovered		Total	
Date	Sockeye	Coho	Sockeye	Coho	Sockeye	Coho	Sockeye	Coho
29-Aug	2120	55	6	1	1	0	7	1
30-Aug	3735	116	8	0	4	1	12	1
31-Aug	2417	105	2	0	4	1	6	1
1-Sep	3048	139	5	1	10	0	15	1
2-Sep	2362	140	2	0	4	0	6	0
3-Sep	2754	146	3	0	6	1	9	1
4-Sep	2803	145	0	0	6	0	6	0
5-Sep	2008	94	1	0	6	2	7	2
6-Sep	1878	127	5	0	5	0	10	0
7-Sep	1920	165	1	0	9	0	10	0
8-Sep	1107	178	0	0	6	1	6	1
9-Sep	909	102	0	0	5	0	5	0
10-Sep	917	119	2	0	4	1	6	1
11-Sep	581	69	3	0	3	0	6	0
12-Sep	515	86	0	0	1	1	1	1
13-Sep	555	91	0	2	5	0	5	2
14-Sep	359	64	0	0	1	2	1	2
15-Sep	277	53	1	0	1	2	2	2
16-Sep	386	78	1	0	1	0	2	0
17-Sep	337	84	0	0	1	0	1	0
18-Sep	190	56	1	0	1	0	2	0
19-Sep	283	56	1	1	0	0	1	1
20-Sep	118	12	0	0	0	0	0	0
21-Sep	45	15	1	0	0	0	1	0
22-Sep	120	34	2	0	0	0	2	0
23-Sep	92	34	2	1	0	0	2	1
24-Sep	69	17	0	0	0	0	0	0
25-Sep	35	12	0	0	0	0	0	0
26-Sep	60	13	1	0	0	0	1	0
27-Sep	89	32	0	1	0	0	0	1
28-Sep	57	23	0	0	0	0	0	0
29-Sep	104	42	2	0	0	0	2	0
30-Sep	25	14	0	0	0	0	0	0
1-Oct	18	5	0	0	0	0	0	0
2-Oct	12	5	0	0	0	0	0	0
3-Oct	18	11	0	0	0	0	0	0
4-Oct	27	20	0	0	0	0	0	0
5-Oct	50	30	0	0	0	0	0	0
Total	592118	3652	2581	10	469	14	**3050**	**24**

[a] These are tagged fish that were seen but the fish were not captured to remove tags. These numbers include 19 Petersen tags.

Table E-1. Numbers of fish by age and length from sockeye salmon sampled at the Nass River fishwheels, 1992.

Nose-fork	Number of fish by age class										
length (cm)	31	32	41	42	43	51	52	53	62	63	Total
34-35	0	4	0	1	0	0	0	0	0	0	5
36-37	0	9	0	1	0	0	0	0	0	0	10
38-39	0	11	0	0	1	0	0	0	0	0	12
40-41	1	10	0	0	4	0	0	0	0	0	15
42-43	1	2	0	1	10	0	0	0	0	0	14
44-45	0	0	0	2	7	0	0	0	0	0	9
46-47	0	0	0	2	4	0	0	0	0	0	6
48-49	1	0	0	3	4	0	0	1	0	0	9
50-51	0	0	0	12	0	0	0	9	0	0	21
52-53	0	0	1	34	0	0	2	11	0	0	48
54-55	0	0	1	112	0	0	4	40	0	2	159
56-57	0	0	0	193	0	0	11	83	1	6	294
58-59	0	0	2	200	0	0	23	117	0	3	345
60-61	0	0	0	141	0	1	54	126	0	14	336
62-63	0	0	0	43	0	0	69	107	0	14	233
64-65	0	0	0	15	0	0	66	44	0	15	140
66-67	0	0	0	5	0	0	36	16	0	17	74
68-69	0	0	0	7	0	0	26	8	0	9	50
70-71	0	0	0	0	0	0	6	1	0	8	15
72-73	0	0	0	0	0	0	2	0	0	2	4
74-75	0	0	0	0	0	0	2	0	0	1	3
Totals	3	36	4	772	30	1	301	563	1	91	1802

Table E-2. Summary of weekly age composition of sockeye sampled at the Nass River fishwheels, 1992.

Week	Stat.	Number of fish by age class											Proportions by week									
ending	week	31	32	41	42	43	51	52	53	62	63	Total	31	32	41	42	43	51	52	53	62	63
20-Jun	26	0	0	0	0	0	0	1	0	0	0	1	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00
27-Jun	27	2	0	1	91	0	1	72	24	0	6	197	0.01	0.00	0.01	0.46	0.00	0.01	0.37	0.12	0.00	0.03
4-Jul	28	0	0	0	93	0	0	43	25	0	6	167	0.00	0.00	0.00	0.56	0.00	0.00	0.26	0.15	0.00	0.04
11-Jul	29	0	0	2	161	0	0	47	61	0	5	276	0.00	0.00	0.01	0.58	0.00	0.00	0.17	0.22	0.00	0.02
18-Jul	30	0	2	1	151	5	0	39	71	0	7	276	0.00	0.01	0.00	0.55	0.02	0.00	0.14	0.26	0.00	0.03
25-Jul	31	0	7	0	94	4	0	46	67	1	10	229	0.00	0.03	0.00	0.41	0.02	0.00	0.20	0.29	0.00	0.04
1-Aug	32	0	10	0	50	4	0	15	58	0	14	151	0.00	0.07	0.00	0.33	0.03	0.00	0.10	0.38	0.00	0.09
8-Aug	33	1	14	0	69	7	0	22	105	0	16	234	0.00	0.06	0.00	0.29	0.03	0.00	0.09	0.45	0.00	0.07
15-Aug	34	0	2	0	52	9	0	13	117	0	21	214	0.00	0.01	0.00	0.24	0.04	0.00	0.06	0.55	0.00	0.10
22-Aug	35	0	0	0	4	1	0	1	8	0	1	15	0.00	0.00	0.00	0.27	0.07	0.00	0.07	0.53	0.00	0.07
29-Aug	36	0	0	0	4	0	0	1	16	0	4	25	0.00	0.00	0.00	0.16	0.00	0.00	0.04	0.64	0.00	0.16
5-Sep	37	0	1	0	2	0	0	1	11	0	1	16	0.00	0.06	0.00	0.13	0.00	0.00	0.06	0.69	0.00	0.06
12-Sep	38	0	0	0	1	0	0	0	0	0	0	1	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
Totals		3	36	4	772	30	1	301	563	1	91	1802	0.00	0.02	0.00	0.43	0.02	0.00	0.17	0.31	0.00	0.05

Table E-3. Summary of the numbers and mean length (cm, nose-fork) of sockeye salmon successfully aged from the Nass River fishwheel catch, 1992.

	June			July			August			September			All fish		
Age class	N	Mean	SD [a]	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD
31	2	42.3	1.8	0			1	48.0		0			3	44.2	3.5
32	0			18	38.9	1.5	18	38.3	2.7	0			36	38.6	2.1
41	1	55.5		3	56.7	3.6	0			0			4	56.4	3.0
42	148	57.7	2.6	481	58.1	3.2	140	57.3	4.3	3	49.8	7.1	772	57.8	3.4
43	0			13	43.8	2.8	17	44.0	2.6	0			30	44.0	2.6
51	1	60.0		0			0			0			1	60.0	
52	107	62.8	3.4	152	63.5	3.7	41	63.9	3.8	1	65.0		301	63.3	3.6
53	39	57.8	2.6	254	59.0	3.4	264	61.0	3.3	6	60.7	3.1	563	59.8	3.5
62	0			1	56.0		0			0			1	56.0	
63	10	61.2	3.2	35	62.5	3.5	46	66.3	4.0	0			91	64.3	4.3
Totals	374	59.6	4.1	1175	58.8	5.1	652	59.6	6.6	16	58.4	6.2	2217	59.2	5.5

a - Standard deviation