Canadian Manuscript Report of

Fisheries and Aquatic Sciences 2609

2002

RESULTS OF THE CHINOOK ASSESSMENT STUDY CONDUCTED ON THE KLINAKLINI RIVER DURING 2000

by

R. E. Diewert, D. A. Nagtegaal and E. W. Carter

Fisheries and Oceans

Science Branch, Pacific Region

Pacific Biological Station

Nanaimo, British Columbia

V9T 6N7

Cat. No. Fs 97-4/2609E ISSN 0706-6473

Correct citation for this publication:

Diewert, R. E., D. A. Nagtegaal and E. W. Carter. 2002. Results of the chinook assessment study conducted on the Klinaklini River during 2000. Can. Manuscr. Rep. Fish. Aquat. Sci. 2609: 60 p.

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

Diewert, R. E., D. A. Nagtegaal and E.W. Carter. 2002. Results of the chinook assessment study conducted on the Klinaklini River during 2000. Can. Manuscr. Rep. Fish. Aquat. Sci. 2609: 60 p.

In 2000, the Pacific Biological Station continued a study of chinook salmon (*Oncorhynchus tshawytscha*) productivity in the Klinaklini River. Major components of this study included: i) enumeration of spawners, ii) collection of biological and environmental information, and iii) evaluation of a fishwheel as a stock assessment tool. Population estimates for chinook and coho were determined from mark-recapture data using the pooled Petersen estimator. Population estimates for all other salmon species encountered at the fishwheel were derived from fishwheel catch efficiencies determined by a tagging study. The total return of adult chinook to the Klinaklini system was estimated to be 17,202 (95% confidence interval 12,889 to 23,533) fish, the largest escapement since the study began in 1997. The majority of the spawners were aged as three and four-year-olds and approximately 59 percent showed a stream type life history. The total return of coho (*O. kisutch*) was estimated to be 25,909 (95% confidence interval 19,884 to 34,743) fish, the majority of which (81.7%) were 2-year-olds. Other species estimates included 18,451 sockeye (*O. nerka*), 34,648 pink (*O. gorbuscha*) and 2,507 chum salmon (*O. keta*). A total of 3,516 chinook adults, 139 chinook jacks, 564 coho adults and 18 coho jacks were observed migrating past the Mussel Creek fence. In addition, 89 chum, 235 pink and 349 sockeye were counted migrating into Mussel Creek. These were minimum counts as the fence was not monitored throughout the migration.

RÉSUMÉ

Diewert, R. E., D. A. Nagtegaal and E.W. Carter. 2002. Results of the chinook assessment study conducted on the Klinaklini River during 2000. Can. Manuscr. Rep. Fish. Aquat. Sci. 2609: 60 p.

En 2000, la station de biologie du Pacifique a poursuivi une étude sur la productivité du quinnat (*Oncorhynchus tshawytscha*) dans la rivière Klinaklini. Les principaux volets de cette étude étaient les suivants : i) recensement des géniteurs, ii) collecte d'information d'ordre biologique et environnemental, et iii) évaluation d'un tourniquet comme outil d'évaluation des stocks. Les estimations des populations de quinnat et de coho ont été établies à partir de données de marquage-recapture à l'aide de l'estimateur multiple de Petersen. Les estimations des populations de toutes les autres espèces de saumons observées au tourniquet ont été calculées à partir des taux d'efficacité de capture de l'engin établis grâce à une étude de marquage. La remonte totale de quinnats adultes dans le réseau de la Klinaklini a été estimée à 17 202 poissons (intervalle de confiance à 95 %, 12 889 à 23 533), ce qui représente la plus forte échappée depuis le début de l'étude, en 1997. La majorité des géniteurs étaient âgés de trois et quatre ans, et environ 59 pour cent présentaient un cycle biologique de type lotique. La remonte totale de cohos (*O. kisutch*) a été estimée à 25 909 poissons (intervalle de confiance de 95 %, 19 884 à 34 743), dont la majorité (81,7 %) étaient âgés de deux ans. D'autres espèces ont fait l'objet d'estimations : 18 451 saumons rouges (*O. nerka*), 34 648 saumons roses (*O. gorbuscha*) et 2 507 kétas (*O. keta*). Au total, 3 516 quinnats adultes, 139 mâles précoces de quinnat, 564 cohos adultes et 18 mâles précoces de coho ont été observés en migration à la barrière du crique Mussel. De plus, on a compté 89 kétas, 235 saumons roses et 349 saumons rouges qui migraient dans le crique Mussel. Il s'agit là de dénombrements minimaux, car la surveillance à la barrière n'a pas été exercée pendant toute la migration.

INTRODUCTION

Chinook stocks are invaluable to both commercial and recreational fisheries of the Pacific Northwest (Collicut and Shardlow, 1995). In spite of protective measures, chinook salmon abundance has continued to decline. This trend has resulted in the recent addition of chinook to the list of threatened and endangered species in the United States (Waples, 1991). The problem of declining stocks is similarly serious on the West Coast of Canada, and has potential ramifications regarding the sustainability of British Columbia's fishing industry (Argue et al, 1983). In an effort to raise overall chinook populations to historical levels, a chinook rebuilding plan was initiated in 1985 through the Pacific Salmon Treaty between the United States and Canada (TCCHINOOK 87-4). This plan established a mandate requiring both parties to stop the decline in escapements to naturally-spawning chinook stocks and attain escapement goals in selected lower Strait of Georgia (Cowichan, Nanaimo, Squamish) and upper Strait of Georgia (Klinaklini, Kakweiken, Nimpkish, Wakeman, and Kingcome) indicator stocks. In addition, various "key streams" were selected to represent the overall status of chinook bearing streams along the BC coast. These keystreams (Robertson, Quinsam/Campbell, Kitsumkalem, Harrison, and Big Qualicum) provide ongoing information to fisheries managers including accurate estimates of escapement and estimates of the relative contribution of hatchery and naturally reared production to these stocks.

Salmonid enumeration studies have been conducted on the lower Klinaklini watershed since 1949. These evaluations consisted initially of stream walks and overflight counts of the few clear streams in a largely clouded glacial system. Clear tributaries include Mussel Creek (gazetted as Devereux Creek), Icy, Dice, and Jump creeks. All five salmonid species are supported by the Klinaklini system as well as steelhead (*O. mykiss*), cutthroat (*O.clarki*), Dolly Varden char (*Salvelinus malma*), bull trout (*S. confluentus*), mountain whitefish (*Prosopium williamsoni*), prickly sculpin (*Cottus asper*), redside shiner (*Richardsonius balteatus*), longnose sucker (*Catostomus catostomus*), and lamprey ammocetes (Rimmer and Axford, 1990). A previous study has suggested that there may be three chinook runs to the Klinaklini system based on migration timing (Berry 1991).

In 1981, the Department of Fisheries and Oceans (DFO) began a study to determine the viability of building a salmonid enhancement facility on Mussel Creek, which joins the Klinaklini River 11 km from the mouth. Baseline information, including spawner enumeration, was collected for pink (*O. gorbuscha*), chum (*O. keta*), sockeye (*O. nerka*), coho (*O. kisutch*) and chinook salmon in Glendale Creek, the Ahnuhati River, the Klinaklini River, and Tom Browne Creek. Other data gathered included population biology characteristics and habitat biophysical parameters (Fielden and Slaney 1982; Whelen and Morgan 1984).

Preliminary surveys of juvenile salmonid habitat utilization and evaluations of potential rearing areas were completed on all study watercourses (Fielden et al. 1985). Other enhancement plans were considered for Knight Inlet with the goal of increasing salmonid production in the area. These included a pink spawning channel at Glendale Creek, a chum/pink spawning channel on the Ahnuhati River, juvenile chinook and coho outplanting to the Ahnuhati and Klinaklini rivers, and coho outplanting to Tom Browne and Glendale creeks.

As a result of this work, a pilot enhancement facility was built on Mussel Creek in 1985 and chinook and coho broodstock were collected. Approximately 265,000 chinook eggs were incubated of which 63% were released as coded-wire tagged fry and 24% as 4 to 5 g tagged smolts. For various reasons the facility was dismantled the following year. A total of five coded-wire tagged chinook were recovered from 1987-1989, three from Alaskan fisheries and two from northern BC sport and troll fisheries.

Renewed interest by DFO in 1997 resulted in a further and ongoing stock assessment study on the Klinaklini system. This report presents the results of the fourth year of this study with objectives including:

1. continued evaluation of the suitability of using a fishwheel to index the abundance and timing of chinook, coho, chum, pink, and sockeye returns to the Klinaklini system,
2. estimation of the total escapement of chinook and coho to the Klinaklini system,
3. collection of biological data for all salmonids, and
4. recording environmental information.

METHODOLOGY

STUDY AREA

Knight Inlet is a mainland fjord located approximately 220 km north of Vancouver on the British Columbia coast. The inlet extends approximately 120 km inland from Johnstone Strait (Figure 1). The fjord itself is steep sided and averages 3 km in width with depths to 530 m. The Knight Inlet watershed is bounded by mountains on either side and receives runoff from a 7,800 km^2 area.

The Klinaklini River is the largest river system in the Mainland Coast Planning unit and is composed of the east and west arms which meet at a confluence 25 km upstream from the estuary. The west Klinaklini is a fairly short river section, which is fed directly by the Klinaklini glacier. The east Klinaklini passes through a canyon area and then extends into the BC interior. An extremely braided channel containing a multitude of sand and gravel bars, meanders, oxbows and side channels characterizes the lower 30 km section of the river. The Klinaklini River is a cold, glacial system and is the main contributor of glacial flour to Knight Inlet.

Mussel Creek (gazetted as Devereux Creek) is a 19 km long clearwater stream, which joins the Klinaklini River approximately 11 km from the mouth (Figure 2). The creek is stabalized by a series of lakes and drains a watershed of 74 km^2. A section of rapids below Devereux Lake drops 120 m over a distance of 1.75 km and constitutes a potential migration barrier to pink, chum, chinook, and some sockeye (Rimmer and Axford, 1990). The lower reaches of the creek yield a gentle gradient with shallow runs connecting deeper pools, which offer excellent rearing habitat for juvenile salmonids.

Logging roads provide access to Mussel Creek and the lower Klinaklini River. These roads are maintained in excellent condition, as they are the main lines for an active logging operation. International Forest Products maintains a camp (Wahkash Contracting) along a side-channel of the Klinaklini River that is situated 2 km upstream from the estuary. The camp has a bunkhouse, several panabode homes, cookhouse, communication (satellite phone), and a large workshop repair facility. Access to the camp is by floatplane from Campbell River.

FISHWHEEL

Fishwheels have been used as an effective means for capturing live salmon in BC rivers since the late 1870's. Fishwheels were used up until the mid 1930's when excessive catch threatened the livelihood of those involved in traditional net fisheries. As a result of successful lobbying by the net fishers in 1934, fishwheels were banned from operating in BC; however, fishwheels have recently been developed as an assessment tool for fisheries managers and biologists (Link and English, 1994). A fishwheel was constructed for use in the Klinaklini River system in an effort to capture, tag, and sample chinook salmon and to evaluate overall escapement.

Design

The fishwheel designed for use on the Klinaklini system is similar to the fishwheels that have been used on the Yukon, Taku and Nass rivers in recent years (Milligan et al. 1985; Link et al. 1993). There were several modifications made to adapt the standard three basket fishwheel design to meet the specific requirements for the Klinaklini glacial system. Table 1 contains a list of materials used while schematic diagrams of the unit are presented in Figures 3 and 4.

A rotating three basket welded aluminum fishwheel design was used for the Klinaklini River chinook assessment program. The fishwheel consisted of three basic components; platform, axle/basket assembly and the holding tanks. All welding was performed with a MIG[1] process, utilizing a root pass and a cover pass procedure. During the survey period there were no failures of welds made using this procedure.

Platform

Resembling a catamaran (Figure 3), the two 9.4 m long pontoons each have a 75 cm wide tread plate surface, supported by a 10.6 cm wide by 5.9 cm deep polystyrene foam floatation structure encased in 4.9 mm aluminum sheet. The bow (upstream) of each pontoon is tapered 45 degrees to provide stable floatation under high flow conditions (Figure 4). Past

[1] Mixed Inert gas

experience with rotary screw trap pontoons utilizing a simple 45-degree slope have proved effective while ensuring low construction costs. During operation the fishwheel pontoons were attached to a solid upstream object with 14.7 mm galvanized steel cables. Structural members used to hold the pontoons apart at the bow and stern double as crosswalks joining the port and starboard pontoons. Each crosswalk was constructed of two 76 cm x 76 cm aluminum tubes covered with a 55.9 cm wide tread plate surface. The crosswalks were bolted to the pontoons with four 1.5 cm x 1.9 cm plated bolts at each corner creating a rigid fishwheel platform.

Axle/Basket assembly

Located on the inside centre section of each pontoon is a 2.8 m tall mast constructed of two 1.2 cm "H" beams. A 636 kg hand winch is mounted on each mast requiring two people cranking simultaneously to raise or lower the axle/basket assembly (Figure 4). The axle spans from mast to mast, and is made from a 3.5 m, 0.9 cm schedule 40 steel pipe. The fishwheel baskets connect to the axle by fitting into sockets made from 0.8 cm tubes 2.4 cm long welded in a row 0.59 m on centre along the length of the axle. As there are three baskets there are also three rows of sockets placed 120 degrees apart. Nylon (UHMW)[2] blocks mounted within each mast are the bearing surface that the axle rotates within. Each block is 4.7 cm square with a 1.2 cm hole in its centre to receive the axle. Each fishwheel basket is 3.5 m wide and 3.5 m long. They are built with seven evenly spaced 4.9 mm schedule 40 aluminum pipes running the length of the basket. Each basket attaches to seven axle sockets at one end and is curved at the other end to form a scoop. The baskets are framed by a leading edge, intermediate cross member and axle cross member and are covered with a 0.8 cm knotless fishing net soaked in water before installation to alleviate stretching and sagging during operation. Taught guy lines (9.8 mm galvanized cable) connect the leading edges of the baskets to each other to achieve rigidity.

Holding tanks

Live tanks are attached to the outside of the port and starboard pontoons at their middle by means of a continuous hinge. Each live tank was originally built 0.6 m wide, 1.2 m deep, and 2.9 m long from 4.9 mm aluminum sheet with an expanded metal type grate that slid vertically at each end. This design proved deficient in two areas. First, the square end of the live tank fell victim to an uprooted tree travelling downstream. To remedy the situation, the walls were folded together forming a doubly thick 45-degree slope that deflected debris. In addition, triangular gussets were installed on the top of the tank to bolster lateral strength. Second, extreme sediment loads resulted in a rapid silt build up on the floors of the live tanks. To resolve this problem, a series of 5 cm holes was drilled through the floor of each tank. While minor amounts of silt did continue to build up by settling on the remaining flat surface between the holes it was not a major concern.

An additional design modification was required as the original expanded metal gates had a sharp edge that captured fish would cut their snouts on as they looked for an escape.

---

[2] Ultra High Molecular Weight Polyethylene

The tanks were modified in the field, through the installation of new, 0.6 m by 1.2 m gates, made from 2.5 cm pipe. One served as a rear gate, sliding vertically, the other was welded horizontally to the outside of the tank with the top of the gate at water level to allow fresh aerated water into the live tank. After the installation of the pipe gates, no further snout injuries were observed. Recovery tanks were specifically designed and built to hold stressed adult chinook fish until they recovered sufficiently from handling. The recovery tanks were 0.6 m wide, 0.9 m deep and 2.3 m long and were constructed from 4.9 mm aluminum sheet. Each tank was attached aft of the live tanks by means of a continuous hinge that allowed all tanks to be swung from their vertical position to facilitate transport of the fishwheel without disassembly. The bottoms of these tanks were also perforated with 5 cm holes to alleviate sediment accumulation.

Safety features

As a safety precaution, aluminum pipe handrails encircle both the inside and outside of the fishwheel platform. Handrails ensured that personnel could not "cut the corner" when walking around the fishwheel. This prevented possible injury from the rotating baskets, which was especially dangerous when the baskets passed the mast in a scissor-like action. During this project, no injuries have resulted from fishwheel operation.

Installation

The fishwheel was transported to Knight Inlet via barge and then moved 8 km by logging road to the assembly beach. Once assembled it was easily pulled .5 km upstream with a boat powered by two 50 hp jet-drive outboard motors. Using two 17.7 m x 0.9 cm galvanized cable bridles, the fishwheel was attached using a double wrap basket hitch around the Million Dollar bridge pier on the deep side of the river (left bank). As the attachment point was near the edge of the river it was necessary to use a "stiff-leg" (a 6.4 cm schedule 40 x 5.9 m aluminum pipe) to position the fishwheel in the flow of the river. The stiff-leg was attached to the bow of the starboard pontoon with a type of ball and socket joint to allow movement. The shore end was jammed into large riprap and tied off for security. When finally positioned, the fishwheel operated approximately 5.6 m off the shore in about 4.4 m of water. A cross section of the Klinaklini River at the Million Dollar Bridge is presented in Figure 5.

Operation

The fishwheel was operated 24 hours per day. Catch by species, biological data, water depth, flow rate, water clarity (secchi depth), temperature, and fishwheel RPM were recorded twice daily at 8 AM and 7 PM. Water depth was measured from a staff gauge mounted on a concrete bridge support structure. Water Survey Canada has a remote discharge recorder at the fishwheel site that electronically monitored the water depth and discharge. Captured fish were removed from the holding tank by dipnet and transferred to a large cooler partially filled with water where processing for biological information occurred prior to release.

Tagging and Sampling

A subsample of all salmon captured by the fishwheel were tagged with a Ketchum Kurl-lock sheep ear tag[3] for external identification. In addition, a secondary mark consisting of a hole punched through the operculum was applied. Tagged fish were transported approximately 0.5 km downstream of the fishwheel and released. Recoveries at the fishwheel were recorded and tag recovery proportions used to estimate fishwheel catch efficiency.

A subsample of all salmon captured at the fishwheel were sampled for post-orbital hypural (POH) length, sex, fish condition, age, and DNA analysis. Fish condition was recorded as good, fair or poor depending on external damage and overall health. Five scales per fish were collected for ageing purposes. DNA samples were collected by taking a hole punch from the operculum and storing it in 70% Ethanol. Samples were combined and stored by week of capture.

MUSSEL CREEK FENCE

A resistance board weir similar in design to that described in Nagtegaal et al. (1994) was installed in Mussel Creek just above the Klinaklini East main logging road (Figure2). The fence was opened daily allowing fish to pass upstream. Wherever possible, fish moving upstream of the fence were visually identified, counted and inspected for Ketchum tags. No fish were sampled at the fence site in 2000.

POPULATION ESTIMATES

Escapement estimates for chinook and coho were calculated using the software package SPAS (Stratified Population Analysis System; Arnason et al. 1996). The mark recapture data were stratified by week. Release and recovery strata were pooled in various combinations to boost recovery sample size within each cell. SPAS applies a Chi-square test (referred to as complete mixing) to assess the null hypothesis that recovery probabilities are not equal across strata. Failure to reject the null hypothesis indicates that recovery probabilities are not significantly different across strata. For both species, the complete mixing test failed in all assessed combinations of strata indicating that a pooled Petersen estimator would likely be acceptable. The pooled Petersen estimate was calculated as follows:

$$N^{*} = \frac{(M+1)(c+1)}{(r+1)} - 1,$$

M = marked fish

c = catch

r = recaptured tags

[3] Ketchum Manufacturing Ltd., Ottawa, Ontario, Canada

Poisson confidence limits were chosen over the binomial and normal approximation confidence limits because the mark rate (R/C) was less than 0.10 and the number of recaptures was less than 50 fish for both chinook and coho (Krebs 1989). Poisson confidence limits (95%) for N were calculated by substituting the Poisson confidence limits for the number of recaptures (R: from Appendix 1.2 in Krebs 1989) into the pooled Petersen equation given above.

Species specific population estimates for pink, chum and sockeye were calculated by dividing total fishwheel catch by the study period catch efficiency. Fishwheel catch efficiencies were determined for each species by calculating the proportion of tagged fish that were recaptured at the fishwheel.

STREAM SURVEYS

Stream walks were conducted on several Klinaklini tributaries to make observations of spawner abundance and to carry out detailed stream reach habitat surveys. Salmon that were spawning or holding in surveyed tributaries were counted by species. All carcasses encountered were identified to species and examined for the presence of a tag or secondary mark. Stream reach habitat surveys were conducted by taking detailed measurements of habitat parameters including reach length, average width and depth, water temperature and dissolved oxygen level. The relative proportion of each habitat type (pool, riffle, glide) and substrate size category was also estimated and recorded for each stream reach surveyed.

RESULTS

FISHWHEEL

The fishwheel operated well throughout the duration of the project. Fish were successfully transferred from the baskets to holding tanks on either side of the pontoons with little difficulty. Modifications implemented over the past two years ensured that this occurred in all flow conditions. The improvised "ski-jump" type slide, situated on the pontoons, once again aided the transition of fish from the basket into the holding tank. By raising the landing spot, captured fish would exit the slide approximately 20 cm below the top of the pontoon. This modification has proven to be an excellent feature.

The fishwheel was in operation from July 6 to October 26. Since there was little or no movement of chinook, pink and sockeye at the beginning of the program and many days of zero catch at the termination of sampling, it was assumed that the entire spawning migration of these species was monitored. Coho and chum continued to be caught in the fishwheel until the end of the project although in low numbers. A total of 812 chinook adults, 103 chinook jacks, 1167 coho adults, 12 coho jacks, 175 chum, 1819 pink, and 1513 sockeye were captured by the fishwheel (Table 2). Diel catch patterns similar to those observed in past years continued in 2000 with the majority of fish captured during the daylight sampling period (Table 3). Run timing for each species, based on fishwheel catch data, is presented in Figures 6a to 6d. The maximum chinook catch occurred on August 8 (68 adults) with 60 % of the run captured by the fishwheel between August 1 and August 15. An earlier but smaller peak occurred between July 18 and July 26 (Figure 6a). The maximum coho catch occurred on September 14 (42 adults). A discontinuous increase in coho catch occurred from late July through to mid September then declined to the end of the program (Figure 6b).

A total of 280 male, 103 jack and 469 female chinook salmon were measured for post orbital-hyperal length. Male chinook length ranged from 46.0 cm to 82.8 cm while jacks ranged from 28.1 cm to 44.6 cm. Female chinook length ranged from 34.0 cm to 86.3 cm. Average lengths were 65.9, 32.5 and 67.3 cm for male, jack and female chinook, respectively (Table 4; Figure 7a). A total of 184 chinook were aged by scale analysis. Ages ranged from one to five years and were dominated by three year old (42.4%) and four year old (45.1%) fish. Stream type age groups comprised 59.3% of the sample (Table 5). Fish were not sampled for flesh colour, although in a previous study (Whelen and Morgan 1984) red chinook comprised 52% of the population.

A total of 509 male, 6 jack and 601 female coho salmon were measured for post orbital-hyperal length. Male coho length ranged from 31.0 cm to 81.1 cm while jacks ranged from 14.5 cm to 30.0 cm. Female coho length ranged from 32.0 cm to 73.9 cm. Average lengths were 54.2, 28.2 and 56.4 cm for male, jack and female coho, respectively (Table 4; Figure 7b). A total of 115 coho were aged by scale analysis. Two age classes were present in the sample which was comprised of 81.7 % three year old (age 1.1) and 18.3 % three year old (age 2.1) fish (Table 5). Length frequencies of pink, chum and sockeye are presented in Table 4 and in Figures 7c, 7d and 7e, respectively.

Environmental data collected at the fishwheel-included temperature, secchi depth, flow rate, fishwheel RPM, and river depth (Table 6). The Klinaklini River is largely a glacial fed system and is influenced by summer temperatures and the resulting glacial melt. This factor results in consistently low river temperatures (study period range = 2.0 to 8.0 °C; study period average = 5.4 °C) and increased river flow in the spring and summer months. While discharge was generally lower in 2000, peak flows were recorded in July, which is consistent with the 30 year mean (Figure 8). Flow rate over the duration of the study ranged from 0.1 m/s to 1.1 m/s and averaged 0.5 m/s. Water clarity was recorded in the form of secchi depth, which ranged from 9.0 cm to 38.0 cm and averaged 20.9 cm (Table 6).

The capture efficiency of the fishwheel was determined by calculating the recovery rate of tagged fish for each species. A total of 769 chinook, 1031 coho, 86 chum, 591 pink and 707 sockeye salmon were tagged at the fishwheel. All of these fish were transported approximately 0.5 km downstream and released. Recovery rates ranged from 4.46 % for coho to 8.20 % for sockeye and averaged 5.68 % for all species combined (Table 7). Chinook, coho and chum catch efficiencies were 5.20 %, 4.46 % and 6.98 %, respectively. The species specific average number of days between release and recapture ranged from 1.0 day for chum to 16.1 days for coho. The mean number of days at large for chinook, sockeye and pink salmon were 10.9, 2.3 and 6.3 days, respectively (Table 7).

Fishwheel rotational speed was directly related to the flow rate of the river (Figure 9). This relationship was linear and statistically significant (ANOVA: $F=267.8$; $p<0.05$). The relationship between rotational speed of the fishwheel and chinook catch is presented in Figure 10a. The relationship appears to be bell shaped with low efficiencies at high and low fishwheel RPM and peak catch efficiency at approximately 1.5 RPM. The relationship between fishwheel rotational speed and catch for all species combined was not as well defined but does show catch efficiency decreasing at higher RPM (Figure 10b).

MUSSEL CREEK FENCE

The initial program design included monitoring all fish movement through the Mussel Creek fence n order to compile detailed enumeration data, monitor individuals tagged at the fishwheel for mark-recapture analysis, and to conduct biosampling for comparison with fishwheel results. These activities were not carried out in 2000 due to reduced staffing levels and equipment availability.

The fence was not monitored on a 24 hour basis but instead, the trap was opened several times a day allowing fish to migrate upstream and as much information as possible was collected through visual observation. Fish movement through the fence was sporadic and salmon tended to hold in pools below the fence prior to upstream migration. This behaviour has been observed in the past prior to the establishment of a fence above the Mussel Creek bridge. As a result, it was assumed that the fence had minimal impact on fish movement during periods of low and moderate fish abundance. However, there were periods during peak migration when large numbers of fish were observed holding below the fence. When this occurred, several panels were removed to facilitate upstream migration and visual observations were made from the bridge.

A total of 3,516 chinook adults, 139 chinook jacks, 564 coho adults and 18 coho jacks were observed migrating past the Mussel Creek fence. In addition, 89 chum, 235 pink and 349 sockeye were enumerated at the fence site (Table 8). These should be considered minimum values as not all migration past the fence was monitored and counts were not always broken out by species due to poor visibility.

Water depth and temperature measurements were taken at the Mussel Creek fence site throughout the study period. Water temperature ranged from 8.0 ^{0}C to 16.0 ^{0}C and averaged 13.2 ^{0}C. Water depth at the fence site for the same period ranged from 0.08 m. to 1.27 m and averaged 0.38 m (Figure 11).

POPULATION ESTIMATES

The pooled Petersen estimator was used to determine the escapement of chinook and coho to the Klinaklini system. Resulting population estimates were 17,202 (95% confidence interval 12,889 to 23,533) chinook and 25,909 (95% confidence interval 19,884 to 34,743) coho. Species specific population estimates for pink, chum and sockeye were determined by dividing total fishwheel catch by the efficiency values determined by tag recapture rates. Resulting population estimates were 18,451 sockeye, 34,648 pink and 2,507 chum. The chinook population estimate was the largest since the program began in 1997 while estimates for the other species have fluctuated over the same period (Table 10). Visual survey data collected by Fishery Officers stationed in the Campbell River subdistrict provide a longer time series of chinook abundance and are presented in Table 11 and Figure 12.

STREAM SURVEYS

Between September 23 and October 18, stream walks were carried out on several tributaries to the Klinaklini River. During three surveys of Mussel Creek, a total of 602 chinook, 75 coho, 13 chum, 600 pink and 271 sockeye were observed. A survey of Clearwater Creek plus a tributary system resulted in a total count of 4 chinook, 150 coho, 300 chum, 513 pink and 523 sockeye salmon. A single survey of Dice Creek resulted in counts of 18 coho, 203 pink and 6 sockeye (Table 12).

Between October 1 and October 10, detailed stream reach habitat surveys were carried out on several tributaries to the Klinaklini River. Basalt Creek flows into the Klinaklini River approximately 23 km from the head of Knight Inlet. This clear, meandering, somewhat confined creek exhibits a riffle/pool morphology. A small falls at the confluence with the Klinaklini River could present a barrier to some species at low flows. Several hundred fry were observed in the creek. Walking Stick Creek flows into Basalt Creek approximately 200 m downstream from the Basalt Creek Bridge. This small, meandering, occasionally unconfined creek originates underground, well away from any Basalt Creek or Klinaklini River influence. Many juvenile salmonids were observed in the cool water pools of the creek. Clearwater Creek flows into the Klinaklini approximately 4 km from the head of Knight Inlet. This meandering, frequently unconfined creek exhibits a riffle/glide/pool morphology with numerous small sand and gravel bars. Well developed cut banks and large woody debris were present throughout the reach. Numerous redds were observed and all five species of pacific salmon were seen throughout the entire survey site (Table 12). Dice creek flows into the Klinaklini River from the west side, approximately 5 km from the head of Knight Inlet. This meandering, occasionally unconfined creek exhibits a riffle/glide/pool morphology with several braided sections. The logging bridge located at 1.5 km is starting to collapse into the creek posing a potential problem for flow and fish passage. Numerous spawning and holding adult salmon were observed in the creek (Table 12). A summary of key data collected from each creek is presented in Table 13.

DISCUSSION

FISHWHEEL

The fishwheel was successful in capturing sufficient numbers of chinook, coho, sockeye and pink salmon for tagging studies and biological sampling. The relatively low catch of chum likely indicates that abundance was low during the study period. Virtually all fish captured were in excellent condition and incurred minimal stress due to the simplicity of the handling process and low water temperatures.

The success or failure of a fishwheel depends on several key factors. A project, jointly funded by the Ministry of Environment, Lands and Parks and the Fraser River Action Committee of the Department of Fisheries and Oceans, studied various fishwheel designs and attempted to collate available information on design features and environmental parameters that would ensure optimal fishwheel operation (Mikkelsen 1995). After considering a wide variety of issues, the report concluded that a three basket aluminum fishwheel with the capacity to allow for changes and alterations to fit local conditions was ideal for most general applications. For the current study, several alterations were made to the standard three basket fishwheel design in order to meet the specific requirements of the Klinaklini glacial system. Also, several successful modifications were made to the fishwheel in the field indicating that our design met the ideal criteria set out by Mikkelsen (1995).

From the experience of fishwheel operators and designers, the location of a fishwheel has the greatest influence on the success of the gear. Selection of an appropriate site was vital to the success of the Klinaklini assessment program. The position of the fishwheel had to meet several criteria. These included: a position close to the mouth of the Klinaklini River below which no chinook spawning occurred, shoreline topography that was amenable to proper positioning while offering easy accessibility, water depth that was slightly deeper than the sampling depth of the fishwheel, water velocity that remained within the range of operational capability of the fishwheel, and a position in the river that would provide some protection from downstream movement of large debris. Water depth, velocity, and shoreline features were recorded for several sites along the lower reaches of the Klinaklini River and a suitable site just below the Million Dollar Bridge was found that met all of the above criteria (Figure 2).

Water clarity plays a major role in the catching power of a fishwheel. It is understood that reaction time to escape the fishwheel is reduced as visibility decreases (Mikkelsen (1995). Secchi depth measurements made in the Klinaklini River at the fishwheel site in 2000 ranged from 9.0 to 38.0 cm and averaged 20.9 cm, indicating relatively low visibility. This observation indicates a reduced likelihood of fish avoidance and suggests that the fishwheel capture efficiency was relatively high.

Mikkelsen (1995) compared fishwheel rotational speed with catch and found that doubling the speed from 2 to 4 rpm does not double the efficiency but, depending on the water depth, may actually decrease efficiency. Indications were that rotational speed in the range of 2 to 3 RPM provided the best efficiency, but it was noted that visibility remained a key factor. The results from our study confirmed that rotational speed is linked to fishwheel efficiency. In both 1999 and 2000, we observed that the highest chinook catches occurred near 1.5 RPM. The relationship between fishwheel RPM and chinook catch appeared to be bell shaped with lower catch efficiencies at lower and higher RPM values (Figure 8a). We found that the rotational speed of the fishwheel could be partially controlled by raising or lowering the baskets within the limits of the upright framework. During peak flows the fishwheel had a tendency to exceed the ideal range and in these situations it was difficult to maintain optimal rotational speed. However, by increasing the lower limits of the framework and lowering the axle below the water line the baskets acted as a self-braking mechanism, slowing rotation closer to the optimum.

While the catch of chinook in the Klinaklini River fishwheel was the highest since the program began, catch efficiency was the lowest of the four-year study. It is likely that inter annual variation in environmental parameters such as flow, water clarity and fishwheel set up influence catch efficiency by effecting fishwheel operation and chinook migration patterns. It is also possible that total fish abundance plays a role in fishwheel capture efficiency. In 2000, large numbers of pink and sockeye were present in the Klinaklini system and this was reflected in fishwheel catch. While other studies have shown that the percentage of the run captured by a fishwheel was highest during periods of peak abundance indicating no gear saturation effect (Link et al., 1993: Link and English 1994), this relationship is likely both species and site specific.

In 2000, 59.3% of the chinook salmon samples showed a stream type life history. This differs from the previous year (86.9% stream type; Diewert et al. 2001) but is very similar to 1997 (Nagtegaal et al. 1998) and 1998 (Sturhahn and Nagtegaal 1999) when 60% and 41% of the samples were stream type, respectively. It has been suggested that the early growth rate of juveniles dictates which life history strategy is employed. If food sources do not limit growth then smoltification begins early with juveniles entering the ocean in their first year of life as ocean types (DFO, FRAP 1995). Inter-annual variability in freshwater habitat quality likely influences the life history strategy of juvenile chinook in the Klinaklini system.

Many of the aspects of fishwheel design and operation suggest that it has the potential to be a good in-river assessment tool. Limitations, both known and yet to be determined, may impact on the effectiveness and efficiency of this tool. While it appears that the advantages outweigh any limitations, it is important to continue the evaluation of fishwheel characteristics during all field studies employing this recently rediscovered sampling tool.

MUSSEL CREEK FENCE

The fence on Mussel Creek was not monitored on a 24 hour basis but instead, the trap was opened several times a day allowing fish to migrate upstream and as much information as possible was collected through visual observation. Data collected at the fence in 2000 were limited as fence panels were removed during peak abundance to allow unrestricted migration, and counts were not always broken out by species due to poor visibility. As a result, Mussel Creek fence data were not used to generate population estimates. However, the visual enumeration data were used to determine the minimum number of spawners in the Mussel Creek system.

POPULATION ESTIMATES

Population estimates for chinook and coho were determined using the pooled Petersen estimator. Since the true population size was not known, a direct measure of the accuracy of the estimates was not possible. However, an assessment of the underlying assumptions of equal probability of capture, simple random recovery sampling and complete mixing can usually be made by testing recovery and application samples for temporal, spatial, sex and size related biases (Schubert 2000). To carry out most of the bias assessments, different gear types must be utilized for capturing the tag application and the recovery samples. In the current study, the fishwheel was used to capture both samples thus limiting the ability to assess sample biases.

Only the temporal capture patterns were assessed to determine the presence of bias in the application and recovery samples. The Stratified Population Analysis System (SPAS) software package developed by Arnason et al. (1996) was utilized for this purpose. SPAS applied a Chi-square test (referred to as complete mixing) to assess equal probability of capture across strata. For both chinook and coho, the complete mixing test failed to detect a temporal bias in the application or recovery samples.

While size bias was not directly assessed in the current project, past studies have indicated that a size bias may be present in fishwheel samples. Meehan (1961) found that chinook captured by fishwheel on the Taku River were significantly smaller than those sampled on the spawning ground. Link and Nass (1999) and Ericksen (1995) found that fishwheels were selective for smaller chinook on the Nass and Chilkat rivers, respectively. Ericksen (1999) also reported that fishwheels were selective for smaller coho on the Chilkat River. However, Link et al. (1993) did not find any evidence of size selectivity in fishwheel catches for sockeye. Further, Nagtegaal et al. (1998) tested Klinaklini River chinook for size bias in the fishwheel tag application sample by comparing the continuous POH length frequency distributions of tagged and untagged recoveries at the Mussel Creek fence. No significant differences were found for males or females. These results indicate that fishwheel sampling selectivity likely varies by species and location and is greatly influenced by river conditions including flow and turbidity.

Our ability to completely assess sample biases in the current data set was limited due to the nature of the project. However, as no temporal bias was detected in this study and the 1997 Klinaklini survey found no evidence of temporal, size or sex biases (Nagtegaal et al. 1998), we determined that the pooled Petersen estimator was appropriate to estimate the size of the chinook and coho populations.

The detection of sampling biases usually results in the use of a stratified estimator; however, Schubert (2000) compared the performance of several mark-recapture population estimators for a sockeye salmon population of known abundance and concluded that the pooled Petersen estimator was less biased and preferred over stratified estimators. In that study, the Schaeffer estimator would not improve accuracy and it was recommended that the method be abandoned for use in population estimation. Also, it was determined that while the maximum likelihood Darroch estimator could potentially improve accuracy there was no obvious way of selecting between accurate and highly biased estimates. Parken and Atagi (1998) found that pooled and stratified estimators of Nass River summer steelhead produced similar escapement estimates but that that pooled estimator was more precise and had less statistical bias than the stratified estimator. These findings indicate the robust nature of the pooled Petersen estimator and suggest that its use to determine population abundance from mark-recapture data is generally appropriate under a wide range of circumstances.

Evaluation of the tagging time series revealed that tagging did not continue throughout the complete run for pink, chum, or sockeye. As a result, species specific population estimates were calculated by dividing total fishwheel catch by the catch efficiency for the entire study period.

The chinook population estimate was the highest since the program began in 1997 (Table 10; Figure 10). The estimates for coho, pink and sockeye were all higher than the 1999 values. No comparison of chum populations was possible as there were no tag recaptures in 1999 and therefore, no population estimate was produced. However, the 2000 population estimate for chum was approximately one third of the 1998 value (Table 10). These inter annual differences in abundance likely reflect variability in fresh water and ocean survival rates, fishery catch patterns and possibly the cyclic nature of spawning returns for pink and sockeye (Table 10).

Aerial surveys are particularly useful for obtaining counts of spawners quickly and efficiently in areas where access to the spawning grounds is difficult or impossible by other means, and when the streams to be surveyed are too numerous or widespread to obtain sufficient counts by conventional ground-based methods. Although flights are normally conducted at peak spawning periods, a peak count does not represent the total escapement, due to variability in spawning time and duration. As a result, aerial overflights provide an index at best and should be treated as such (Cousens et al 1982). Aerial overflight information was not collected for the Klinaklini system in 2000. However, several overflights of other systems flowing into Knight Inlet reported a very poor showing of chinook in the usual areas. Also, reports from recreational anglers indicated poor fishing success in the approaches to Knight Inlet. These reports suggest that either chinook abundance was greater in the Klinaklini system than in other Knight Inlet tributaries or that the overflight data and anecdotal fishing reports underestimated the abundance of Knight Inlet stocks.

ACKNOWLEDGEMENTS

We would like to express our appreciation to a number of people who made this study possible. Accommodation and meals were provided by Wahkash Contracting Ltd. and International Forest Products Ltd., whose representatives, Tim Whales, Jim Heppner, John Uzzell, Matt Roberts, and Don Neill, provided valuable assistance, access to their fuel supply, the use of their workshop facility and storage shed. Research biologist Ted Carter was instrumental in establishing program design as well providing support and guidance. Dave Key, Pisces Research Corps, facilitated design and construction of the fishwheel, provided technical assistance for the fishwheel, and counting fence, and was involved in the installation and removal of the equipment. Field technicians Sean Stenhouse, James Patterson, Kevin Pellett, Dave Burton, Bryan Rusch, Darcy Visscher, Stephan DeLeeuw and Mike Ballard provided invaluable assistance in all aspects of the program. We thank Greg Savard, DFO Fish Management; for providing historical escapement information for the Klinaklini system and Lynne Campo for providing environmental data.

LITERATURE CITED

Argue, A.L., R. Hilborn, R.M. Peterman, M. J. Staley, and C.J. Walters. 1983. Strait of Georgia chinook and coho fishery. Can. Bull. Fish. Aquat. Sci. 211: # 91p.

Arnason, A.N., C.W. Kirby, C.J. Schwartz and J.R. Irvine. 1996. Computer analysis of marking data from stratified populations for estimation of salmonid escapements and the size of other populations. Can. Tech. Rep. Fish. Aquat. Sci. 2106.

Berry, M. 1991. Stream narrative of the Klinaklini River. Unpubl. Manuscript.

Collicut, L.D. and T.F. Shardlow. 1995. Strait of Georgia sport fishery creel survey statistics for salmon and groundfish, 1991. Can. Tech. Rep. Fish. Aquatic Sci. 2137: #75 p.

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

Department of Fisheries and Oceans. 1995. Fraser River Chinook Salmon. Prepared by Fraser River Action Plan, Fishery Management Group. Vancouver, BC 24 p.

Diewert, R.E., J.C. Sturhahn' and D.A. Nagtegaal. 2001. Results of the chinook assessment study conducted on the Klinaklini River during 1999. Can. Manuscr. Rep. Fish. Aquat. Sci. 2580: 46 p.

Ericksen, R.E. 1995. Sport fishing effort, catch and harvest and inriver abundance of Chilkat River chinook salmon near Haines, Alaska, in 1994. Alaska Department of Fish and Game, Division of Sport Fish. Fishery Data Series 95-42.

Ericksen, R.E. 1999. Abundance of coho salmon in the Chilkat River in 1998. Alaska Department of Fish and Game, Division of Sport Fish. Fishery Data Series 99-29.

Fielden, R. and T. Slaney. 1982. 1981 survey of salmonids spawning in selected streams of Knight Inlet, British Columbia. Prepared for Dept. Fish. and Oceans by Aquatic Resources Ltd. 89 p.

Fielden, R., T. Slaney, and G.J. Birch. 1985. Knight Inlet juvenile salmonid reconnaissance. Prepared for Dept. Fish. and Oceans by Aquatic Resources Ltd. 210 p.

Krebs, C.J. 1989. Ecological methodology. Harper Collins Publishers, New York. N.Y.

Link, M.R., K.K. English' and R.C. Bocking. 1993. 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. Nishga'a Fisheries Report NF92-09, New Aiyansh, BC

Link, M.R. and K.K. English. 1994. The 1993 fishwheel project on the Nass River and an evaluation of fishwheels as an inseason management and stock assessment tool for the Nass River. Nishga'a Fisheries Report NF93-06, New Aiyansh, BC

Meehan, W.R. 1961. Use of a fishwheel in salmon research and management. Transactions of the American Fisheries Society. 90: 490-494.

Mikkelsen, J. 1995. Development of fishwheels for use in British Columbia. Dept. of Mech. Eng., UBC, prepared for Ministry of Environment, Land and Parks and Dept. Fisheries and Oceans. 50 p.

Milligan, P.A., W.O. Rublee, D.D. Cornett' and R.A.C. Johnston. 1985. The distribution and abundance of chum salmon (*Oncorhynchus keta*) in the upper Yukon River basin as determined by radio tagging and spaghetti tagging program: 1982-1983. Can. Tech. Rep. Fish. Aquat. Sci. 1351: 89#p.

Nagtegaal, D.A., J. Candy, and B. Riddell. 1994. A preliminary report on the chinook productivity study conducted on the Cowichan River during 1990 and 1991. Can. MS Rep. Fish. Aquat. Sci. 2315: 84 p.

Nagtegaal, D.A., E.W. Carter' and D.C. Key. 1998. Results of the chinook assessment study conducted on the Klinaklini River during 1997. Can. Manuscr. Rep. Fish. Aquat. Sci. 2452: 59 p.

Parken, C.K. and D.Y. Atagi. 2000. Preliminary estimate of the escapement of summer steelhead to the Nass River, 1998. British Columbia Ministry of Environment, Lands and Parks, Smithers, BC Skeena Fisheries Report SK-124.

Rimmer, D.W. and F.N. Axford. 1990. A preliminary evaluation of fish habitat and recreational fisheries values in the mainland coast planning unit. Environment and Lands.

Schubert, N.D. 2000. The 1994 Stellako River sockeye (*Oncorhynchus nerka*) escapement: Evaluation of pooled Petersen and stratified mark-recapture estimates of a known population. Can. Tech. Rep. Fish. Aquat. Sci. 2303: 56p.

Sturhahn, J.C. and D.A. Nagtegaal. 1999. Results of the chinook assessment study conducted on the Klinaklini River during 1998. Can. Manuscr. Rep. Fish. Aquat. Sci. 2497: 65 p.

Waples, R.S. 1991. Genetic interactions between hatchery and wild salmonids: lessons from the Pacific Northwest. Can. J. Fish. Aquat. Sci. 48 (Suppl. 1): 124-133.

Whelen, M.A. and J.D. Morgen. 1984. 1983 spawning salmonid studies in selected watercourses of Knight Inlet, British, Columbia. Prepared for Dept. Fish. and Oceans by EVS Consultants Ltd. 172 p.

Table 1. Materials list for construction of the fishwheel.

Pontoons:
5 – 1/8" x 5' x 12' 5052 aluminum sheet
4 – 1/8" x 5' x 16' 3002 aluminum tread sheet
1 – 3/8" x 3" x 20' aluminum flat bar

Mast:
2 – 3" x 20' I Beam aluminum
¼ sheet - 1/8"x 4' x 8' 5052 aluminum sheet
¼ length – 3/8" x 3' x 20' aluminum flat bar
2 – 1400 lb. boat trailer winches
50' ¼" galvanized cable
2 – 2" double pulleys
1 – 2" single pulleys
4 – ¼" cable clamps
8 – 1 ½" x 6" x 12" Nylon Blocks (UHMW)

Crosswalks:
4 – 1/8" x 3" x 3" x 20' aluminum tubing
1 – 1/8" x 4' x 12' 5052 aluminum sheet

Handrails:
500' – 1 ¼" schedule 40 6063 aluminum pipe
100' – 1 ¼" schedule 40 6061 aluminum pipe

Axle:
1 - 2" x 20' schedule 40 steel pipe
¼ - 2" x 20' schedule 40 steel pipe
¼ - 2 ½" x 20' schedule 40 steel pipe
4 - 2 15/16" locking collars
1 - 3/8" x 3' x 20' aluminum flat bar
4 - 3/8" x 6" NC plated bolts c/w locking nuts

Baskets:
27 - 1 ¼" schedule 40 6061 aluminum pipe
100' - 3/8" galvanized cable
25 - 3/8" cable clamps
6 - 3/8" x 6" turnbuckles
6 - 5/16" shackles
15 – 3/8" x 4" NC plated bolts c/w locking nuts

Table 1 (cont'd.)

Slides:
3 sheets - 1/8"x 4' x 8' 5052 aluminum sheet
30 – ¼" NC plated bolts c/w locking nuts and flat washers

Stiff-leg:
1 - 2 ½" x 20' schedule 40 6061 aluminum pipe

Live tanks:
4 - 1/8" x 5' x 10' 5052 aluminum sheet
3 - 1/4" x 2' x 20' aluminum flat bar
5 - ¾" x 20' schedule 40 6061 aluminum pipe
1 - 5/8" x 20' steel rod

Recovery tanks:
4 - 1/8" x 4' x 8' 5052 aluminum sheet
3 - 1/4" x 2' x 20' aluminum flat bar
5 - ¾" x 20' schedule 40 6061 aluminum pipe
1 - 5/8" x 20' steel rod

Table 2. Daily fishwheel counts, by species, in the Klinaklini River, 2000.

Date	Chinook Adult	Chinook Jack	Coho Adult	Coho Jack	Chum	Pink	Sockeye	Total
06-Jul	2	0	0	0	0	0	1	3
07-Jul	4	1	0	0	0	0	5	10
08-Jul	6	1	0	0	1	0	3	11
09-Jul	5	0	0	0	0	0	4	9
10-Jul	4	1	1	0	0	0	0	6
11-Jul	7	3	0	0	0	0	2	12
12-Jul	5	1	1	0	0	1	3	11
13-Jul	2	0	1	0	1	0	3	7
14-Jul	6	0	1	0	0	0	2	9
15-Jul	5	2	0	0	0	0	6	13
16-Jul	8	1	0	0	0	0	7	16
17-Jul	9	1	1	0	1	1	4	17
18-Jul	20	5	3	1	4	1	5	39
19-Jul	14	1	1	0	2	0	3	21
20-Jul	12	2	0	0	0	0	7	21
21-Jul	14	2	0	0	1	0	1	18
22-Jul	21	2	1	0	2	0	8	34
23-Jul	22	3	3	0	1	0	8	37
24-Jul	14	5	2	0	2	1	5	29
25-Jul	24	2	1	0	3	1	8	39
26-Jul	17	1	0	0	2	2	8	30
27-Jul	6	0	0	0	0	4	3	13
28-Jul	6	0	0	0	0	137	0	143
29-Jul	9	0	0	0	0	0	2	11
30-Jul	12	0	0	0	0	0	3	15
31-Jul	8	0	0	0	0	0	2	10
01-Aug	20	3	1	0	1	10	8	43
02-Aug	43	8	3	0	4	6	21	85
03-Aug	37	7	7	0	4	4	15	74
04-Aug	26	2	2	0	1	3	27	61
05-Aug	17	0	3	0	0	2	16	38
06-Aug	23	0	2	0	2	1	10	38
07-Aug	55	1	9	0	4	5	36	110
08-Aug	68	1	8	0	6	20	36	139
09-Aug	54	4	14	0	0	14	33	119
10-Aug	61	12	16	0	3	35	59	186
11-Aug	36	9	11	0	2	18	65	141
12-Aug	15	6	12	0	2	49	62	146
13-Aug	12	7	11	0	0	76	51	157
14-Aug	13	4	8	0	0	73	81	179
15-Aug	11	0	12	0	0	108	58	189
16-Aug	5	0	6	0	0	115	41	167
17-Aug	5	0	10	0	1	56	52	124
18-Aug	5	0	2	0	3	33	39	82
19-Aug	4	0	13	0	4	55	54	130

Table 2. (cont'd.)

Date	Chinook Adult	Chinook Jack	Coho Adult	Coho Jack	Chum	Pink	Sockeye	Total
20-Aug	1	0	10	0	0	56	48	115
21-Aug	0	1	12	0	0	44	46	103
22-Aug	4	1	8	0	0	37	41	91
23-Aug	4	0	12	0	1	56	45	118
24-Aug	4	0	23	1	1	32	43	104
25-Aug	2	0	12	0	2	20	23	59
26-Aug	5	0	27	0	1	34	30	97
27-Aug	2	1	26	0	2	51	39	121
28-Aug	2	0	35	0	1	20	56	114
29-Aug	2	0	32	0	2	135	52	223
30-Aug	2	1	29	0	0	72	27	131
31-Aug	1	0	21	0	0	60	35	117
01-Sep	0	0	25	0	0	66	32	123
02-Sep	0	0	21	0	0	49	26	96
03-Sep	1	0	11	0	1	21	23	57
04-Sep	0	0	28	0	1	20	19	68
05-Sep	0	0	22	0	1	18	11	52
06-Sep	0	0	17	1	0	19	6	43
07-Sep	1	0	6	0	1	11	4	23
08-Sep	0	0	29	0	0	13	5	47
09-Sep	2	0	22	0	5	35	4	68
10-Sep	0	0	5	0	1	18	2	26
11-Sep	0	0	17	0	3	7	4	31
12-Sep	0	0	18	1	0	5	0	24
13-Sep	0	0	33	0	0	6	3	42
14-Sep	1	0	42	1	1	6	2	53
15-Sep	0	0	37	0	1	10	1	49
16-Sep	0	0	23	1	1	9	1	35
17-Sep	0	0	20	0	1	0	1	22
18-Sep	0	0	11	0	2	4	1	18
19-Sep	0	0	30	0	4	6	1	41
20-Sep	0	0	30	0	3	10	0	43
21-Sep	1	0	22	0	4	10	1	38
22-Sep	1	0	24	1	4	5	1	36
23-Sep	0	0	9	0	1	2	0	12
24-Sep	0	0	4	0	0	0	0	4
25-Sep	0	0	8	0	0	0	0	8
26-Sep	0	0	12	0	0	1	1	14
27-Sep	0	0	10	1	2	1	0	14
28-Sep	0	0	11	0	0	0	0	11
29-Sep	0	0	10	0	1	2	0	13
30-Sep	0	0	16	0	1	2	0	19
01-Oct	0	0	32	0	5	4	0	41
02-Oct	0	0	26	0	4	4	1	35
03-Oct	0	0	9	0	1	0	0	10
04-Oct	0	0	8	1	0	0	1	10

Table 2. (cont'd.)

	Chinook		Coho					
Date	Adult	Jack	Adult	Jack	Chum	Pink	Sockeye	Total
05-Oct	0	0	7	0	1	2	2	12
06-Oct	0	0	2	1	2	2	2	9
07-Oct	0	0	10	0	5	0	1	16
08-Oct	1	0	8	0	0	1	0	10
09-Oct	1	0	2	0	2	0	1	6
10-Oct	0	0	7	0	3	0	1	11
11-Oct	0	0	8	1	10	0	1	20
12-Oct	1	0	8	0	6	0	1	16
13-Oct	0	0	5	0	3	1	0	9
14-Oct	0	0	6	0	1	0	0	7
15-Oct	0	0	6	0	1	0	0	7
16-Oct	0	0	2	0	4	0	0	6
17-Oct	0	0	2	0	8	1	1	12
18-Oct	1	1	10	0	3	0	0	15
19-Oct	0	0	9	0	3	0	0	12
20-Oct	0	0	7	0	2	0	0	9
21-Oct	0	0	3	1	1	0	0	5
22-Oct	0	0	2	0	2	0	0	4
23-Oct	0	0	0	0	1	0	0	1
24-Oct	0	0	0	0	0	0	0	0
25-Oct	0	0	0	0	0	0	0	0
26-Oct	0	0	2	0	1	0	0	0
Total	812	103	1167	12	175	1819	1513	5598

Table 3. Diel fishwheel catches, by species, in the Klinaklini River, 2000.

Date	Start	Finish	Day Catches					
			Chinook	Coho	Chum	Pink	Sockeye	Sthd
06-Jul	800	1900	2	0	0	0	1	0
07-Jul	800	1900	3	0	0	0	3	2
08-Jul	800	1900	3	0	1	0	0	1
09-Jul	800	1900	3	0	0	0	3	2
10-Jul	800	1900	5	1	0	0	0	2
11-Jul	800	1900	8	0	0	0	1	1
12-Jul	800	1900	5	1	0	1	2	0
13-Jul	800	1900	1	1	1	0	2	0
14-Jul	800	1900	5	1	0	0	2	2
15-Jul	800	1900	6	0	0	0	4	0
16-Jul	800	1900	8	0	0	0	6	0
17-Jul	800	1900	9	0	0	1	2	0
18-Jul	800	1900	13	3	2	0	2	0
19-Jul	800	1900	12	1	1	0	2	0
20-Jul	800	1900	12	0	0	0	6	0
21-Jul	800	1900	13	0	0	0	1	0
22-Jul	800	1900	21	1	2	0	7	1
23-Jul	800	1900	20	3	0	0	5	0
24-Jul	800	1900	18	0	2	1	4	0
25-Jul	800	1900	10	1	3	1	8	1
26-Jul	800	1900	14	0	1	1	4	0
27-Jul	800	1900	2	0	0	0	1	0
28-Jul	800	1900	5	0	0	0	0	0
29-Jul	800	1900	9	0	0	0	2	0
30-Jul	800	1900	6	0	0	0	1	0
31-Jul	800	1900	4	0	0	0	2	0
1-Aug	800	1900	19	6	1	10	8	0
2-Aug	800	1900	45	3	3	4	19	0
3-Aug	800	1900	23	7	0	1	13	0
4-Aug	800	1900	22	2	1	2	23	0
5-Aug	800	1900	15	3	0	1	14	0
6-Aug	800	1900	19	2	2	1	10	0
7-Aug	800	1900	41	9	2	4	25	0
8-Aug	800	1900	35	7	4	14	16	0
9-Aug	800	1900	39	12	0	13	27	0
10-Aug	800	1900	42	15	1	27	38	0
11-Aug	800	1900	23	1		5	25	0
12-Aug	800	1900	14	11	2	36	34	0
13-Aug	800	1900	16	9	0	66	41	0
14-Aug	800	1900	14	7	0	64	67	0
15-Aug	800	1900	8	11	0	90	33	0
16-Aug	800	1900	3	4	0	87	25	0
17-Aug	800	1900	3	6	0	44	38	0
18-Aug	800	1900	2	1	2	22	24	0
19-Aug	800	1900	2	11	2	46	43	0

Table 3. (cont'd)

Date	Start	Finish	Day Catches Chinook	Coho	Chum	Pink	Sockeye	Sthd
20-Aug	800	1900	0	9	0	42	42	0
21-Aug	800	1900	1	12	0	44	48	0
22-Aug	800	1900	2	2		26	24	0
23-Aug	800	1900	2	11	0	37	30	0
24-Aug	800	1900	2	14	0	7	20	0
25-Aug	800	1900	0	11	1	8	17	0
26-Aug	800	1900	1	20	1	23	23	0
27-Aug	800	1900	1	20	1	18	20	0
28-Aug	800	1900	2	12	1	20	33	0
29-Aug	800	1900	1	23	1	78	37	1
30-Aug	800	1900	1	19	0	37	17	0
31-Aug	800	1900	1	11	0	33	21	0
1-Sep	800	1900	0	11	0	42	20	0
2-Sep	800	1900	0	13	0	28	14	0
3-Sep	800	1900	0	5	1	16	13	0
4-Sep	800	1900	0	21	0	14	11	0
5-Sep	800	1900	0	17	1	7	2	0
6-Sep	800	1900	0	11	0	16	6	0
7-Sep	800	1900	1	5	0	4	2	0
8-Sep	800	1900	0	17	0	7	1	0
9-Sep	800	1900	2	22	5	35	4	0
10-Sep	800	1900	0	3	0	10	1	0
11-Sep	800	1900	0	13	3	3	3	0
12-Sep	800	1900	0	12	0	0	0	0
13-Sep	800	1900	0	34	0	6	3	0
14-Sep	800	1900	1	43	1	6	2	0
15-Sep	800	1900	0	30	0	5	1	0
16-Sep	800	1900	0	17	1	4	0	0
17-Sep	800	1900	0	14	0	0	0	0
18-Sep	800	1900	0	6	2	1	0	0
19-Sep	800	1900	0	10	2	3	1	0
20-Sep	800	1900	0	15	2	3	0	0
21-Sep	800	1900	0	9	1	4	0	0
22-Sep	800	1900	0	4	1	1	0	0
23-Sep	800	1900	0	0	0	0	0	0
24-Sep	800	1900	0	2	0	0	0	0
25-Sep	800	1900	0	5	0	0	0	0
26-Sep	800	1900	0	5	0	0	0	0
27-Sep	800	1900	0	3	2	0	0	0
28-Sep	800	1900	0	2	0	0	0	0
29-Sep	800	1900	0	6	0	1	0	0
30-Sep	800	1900	0	9	0	1	0	0
1-Oct	800	1900	0	12	4	3	0	0
2-Oct	800	1900	0	9	2	1	0	0
3-Oct	800	1900	0	5	0	0	0	0
4-Oct	800	1900	0	9	0	0	1	0

Table 3. (cont'd)

Date	Start	Finish	Day Catches Chinook	Coho	Chum	Pink	Sockeye	Sthd
5-Oct	800	1900	0	7	1	2	2	0
6-Oct	800	1900	0	3	1	0	0	0
7-Oct	800	1900	0	7	2	0	0	0
8-Oct	800	1900	0	0	0	0	0	0
9-Oct	800	1900	0	0	2	0	1	0
10-Oct	800	1900	0	0	0	0	1	0
11-Oct	800	1900	0	7	9	0	1	0
12-Oct	800	1900	1	1	1	0	0	0
13-Oct	800	1900	0	5	3	1	0	0
14-Oct	800	1900	0	1	0	0	0	0
15-Oct	800	1900	0	5	1	0	0	0
16-Oct	800	1900	0	0	1	0	0	0
17-Oct	800	1900	0	2	4	0	0	0
18-Oct	800	1900	0	4	2	0	0	0
19-Oct	800	1900	0	2	1	0	0	0
20-Oct	800	1900	0	6	2	0	0	0
21-Oct	800	1900	0	1	0	0	0	0
22-Oct	800	1900	0	2	0	0	0	0
23-Oct	800	1900	0	0	0	0	0	0
24-Oct	800	1900	0	0	0	0	0	0
25-Oct	800	1900	0	0	0	0	0	0
26-Oct	800	1900	0	1	2	0	0	0
Total			621	757	98	1139	1016	13

Date	Start	Finish	Night Catches Chinook	Coho	Chum	Pink	Sockeye	Sthd
06-Jul	1900	800	0	0	0	0	0	0
07-Jul	1900	800	2	0	0	0	2	0
08-Jul	1900	800	4	0	0	0	3	0
09-Jul	1900	800	2	0	0	0	1	0
10-Jul	1900	800	0	0	0	0	0	0
11-Jul	1900	800	2	0	0	0	1	0
12-Jul	1900	800	1	0	0	0	1	0
13-Jul	1900	800	1	0	0	0	1	0
14-Jul	1900	800	1	0	0	0	0	0
15-Jul	1900	800	1	0	0	0	2	0
16-Jul	1900	800	1	0	0	0	1	0
17-Jul	1900	800	1	1	1	0	2	0
18-Jul	1900	800	12	0	2	1	3	0
19-Jul	1900	800	3	0	1	0	1	0
20-Jul	1900	800	2	0	0	0	1	0
21-Jul	1900	800	3	0	1	0	0	0
22-Jul	1900	800	2	0	0	0	1	0

Table 3. (cont'd)

Date	Start	Finish	Night Catches Chinook	Coho	Chum	Pink	Sockeye	Sthd
23-Jul	1900	800	5	0	1	0	3	0
24-Jul	1900	800	1	2	0	0	1	0
25-Jul	1900	800	16	0	0	0	0	0
26-Jul	1900	800	4	0	1	1	4	0
27-Jul	1900	800	4	0	0	4	2	0
28-Jul	1900	800	1	23	0	137	0	1
29-Jul	1900	800	3	0	0	0	0	0
30-Jul	1900	800	6	0	0	0	2	0
31-Jul	1900	800	4	0	0	0	0	0
01-Aug	1900	800	4	0	0	0	0	0
02-Aug	1900	800	6	0	1	2	2	0
03-Aug	1900	800	21	0	4	3	2	0
04-Aug	1900	800	6	0	0	1	4	0
05-Aug	1900	800	2	0	0	1	1	0
06-Aug	1900	800	4	0	0	0	0	0
07-Aug	1900	800	15	0	2	1	12	0
08-Aug	1900	800	34	1	2	6	20	0
09-Aug	1900	800	19	2	0	1	6	0
10-Aug	1900	800	31	1	2	8	21	0
11-Aug	1900	800	22	5	2	13	36	0
12-Aug	1900	800	7	1	0	13	28	0
13-Aug	1900	800	3	2	0	10	10	0
14-Aug	1900	800	3	1	0	9	16	0
15-Aug	1900	800	3	1	0	18	25	0
16-Aug	1900	800	2	2	0	28	16	0
17-Aug	1900	800	2	4	1	12	14	0
18-Aug	1900	800	3	1	1	11	15	0
19-Aug	1900	800	2	2	2	9	11	0
20-Aug	1900	800	1	1	0	14	6	0
21-Aug	1900	800	0	0	0	0	0	0
22-Aug	1900	800	3	6	0	11	17	0
23-Aug	1900	800	2	1	1	19	15	0
24-Aug	1900	800	2	10	1	25	23	0
25-Aug	1900	800	2	1	1	12	6	0
26-Aug	1900	800	4	7	0	11	7	0
27-Aug	1900	800	2	6	1	33	19	0
28-Aug	1900	800	0	0	0	0	23	0
29-Aug	1900	800	1	9	1	57	15	0
30-Aug	1900	800	2	10	0	35	10	0
31-Aug	1900	800	0	10	0	27	14	0
01-Sep	1900	800	0	14	0	24	12	0
02-Sep	1900	800	0	8	0	21	12	0
03-Sep	1900	800	1	6	0	5	10	0
04-Sep	1900	800	0	7	1	6	8	0
05-Sep	1900	800	0	5	0	10	9	0
06-Sep	1900	800	0	7	0	4	0	0

Table 3. (cont'd)

Date	Start	Finish	Night Catches Chinook	Coho	Chum	Pink	Sockeye	Sthd
07-Sep	1900	800	0	1	1	6	2	0
08-Sep	1900	800	0	12	0	7	4	0
09-Sep	1900	800	0	0	0	0	0	0
10-Sep	1900	800	0	2	1	8	1	0
11-Sep	1900	800	0	4	0	4	1	0
12-Sep	1900	800	0	7	0	5	0	0
13-Sep	1900	800	0	0	0	0	0	0
14-Sep	1900	800	0	0	0	0	0	0
15-Sep	1900	800	0	7	1	5	0	0
16-Sep	1900	800	0	7	0	5	1	0
17-Sep	1900	800	0	6	1	0	1	0
18-Sep	1900	800	0	5	0	3	1	0
19-Sep	1900	800	0	20	2	3	0	0
20-Sep	1900	800	0	15	1	7	0	0
21-Sep	1900	800	1	13	3	6	1	0
22-Sep	1900	800	1	22	3	4	1	0
23-Sep	1900	800	0	9	1	2	0	0
24-Sep	1900	800	0	2	0	0	0	0
25-Sep	1900	800	0	3	0	0	0	0
26-Sep	1900	800	0	7	0	1	1	0
27-Sep	1900	800	0	8	0	1	0	0
28-Sep	1900	800	0	9	0	0	0	0
29-Sep	1900	800	0	4	1	1	0	0
30-Sep	1900	800	0	7	1	1	0	0
01-Oct	1900	800	0	20	1	1	0	0
02-Oct	1900	800	0	17	2	3	1	0
03-Oct	1900	800	0	4	1	0	0	0
04-Oct	1900	800	0	0	0	0	0	0
05-Oct	1900	800	0	0	0	0	0	0
06-Oct	1900	800	0	0	1	2	2	0
07-Oct	1900	800	0	3	3	0	1	0
08-Oct	1900	800	1	8	0	1	0	0
09-Oct	1900	800	0	2	0	0	0	0
10-Oct	1900	800	0	7	3	0	0	0
11-Oct	1900	800	0	2	1	0	0	0
12-Oct	1900	800	0	6	5	0	1	0
13-Oct	1900	800	0	0	0	0	0	0
14-Oct	1900	800	0	5	1	0	0	0
15-Oct	1900	800	0	1	0	0	0	0
16-Oct	1900	800	0	2	3	0	0	0
17-Oct	1900	800	0	0	4	1	1	0
18-Oct	1900	800	0	6	1	0	0	0
19-Oct	1900	800	0	7	2	0	0	0
20-Oct	1900	800	0	0	0	0	0	0
21-Oct	1900	800	0	3	1	0	0	0
22-Oct	1900	800	0	0	2	0	0	0

Table 3. (cont'd)

Date	Start	Finish	Night Catches					
			Chinook	Coho	Chum	Pink	Sockeye	Sthd
23-Oct	1900	800	0	0	0	0	0	0
24-Oct	1900	800	0	0	0	0	0	0
25-Oct	1900	800	0	0	0	0	0	0
26-Oct	1900	800	0	2	0	0	0	0
Total			294	422	77	680	497	1

Table 4. Length-frequency of salmon sampled at the fishwheel, Klinaklini River, 2000.

Length	Chinook			Coho			Pink		Chum		Sockeye	
(cm)	M	J	F	M	J	F	M	F	M	F	M	F
22	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	1	0	0	0	0	0
27	0	0	0	0	1	0	0	0	1	0	0	0
28	0	2	0	0	0	0	0	0	0	0	0	0
29	0	3	0	0	1	0	0	0	0	0	0	0
30	0	5	0	0	4	0	0	3	0	0	0	0
31	0	3	0	5	0	0	1	3	0	0	1	0
32	0	9	0	1	0	1	2	1	0	0	1	1
33	0	7	0	3	0	0	3	9	0	0	0	0
34	0	12	1	3	0	0	7	15	0	0	0	0
35	0	11	0	1	0	0	16	25	0	0	0	2
36	0	9	0	2	0	1	22	31	0	0	2	0
37	0	4	2	7	0	0	43	48	0	0	0	4
38	0	6	0	3	0	0	44	60	0	0	2	7
39	0	5	2	12	0	2	68	83	0	0	16	11
40	0	8	0	10	0	0	56	103	0	0	27	21
41	0	5	0	5	0	1	77	123	0	0	37	41
42	0	6	0	5	0	2	86	142	0	0	50	53
43	0	5	0	8	0	4	75	94	0	0	62	47
44	0	2	0	7	0	4	62	69	0	0	44	62
45	0	1	1	7	0	4	73	38	0	0	43	60
46	1	0	1	13	0	6	56	34	0	0	26	69
47	4	0	3	10	0	10	34	15	0	0	36	69
48	2	0	2	11	0	8	40	8	0	0	42	80
49	3	0	4	18	0	18	35	9	0	1	39	66
50	5	0	4	13	0	20	16	2	0	0	40	65
51	2	0	7	15	0	23	10	1	0	1	33	31
52	2	0	6	21	0	26	6	0	0	1	23	24
53	4	0	7	16	0	22	9	0	0	1	24	15

Table 4. (cont'd)

Length (cm)	Chinook M	Chinook J	Chinook F	Coho M	Coho J	Coho F	Pink M	Pink F	Chum M	Chum F	Sockeye M	Sockeye F
54	6	0	5	22	0	30	1	2	0	1	15	10
55	4	0	6	24	0	29	2	0	1	2	8	4
56	8	0	2	12	0	41	1	0	0	1	0	6
57	7	0	10	28	0	48	1	0	1	1	4	5
58	12	0	9	30	0	54	0	0	3	4	4	4
59	11	0	8	34	0	53	1	0	0	7	1	3
60	9	0	2	32	0	46	1	0	6	7	0	1
61	8	0	19	29	0	50	0	0	4	15	0	0
62	11	0	4	33	0	28	0	0	3	7	1	0
63	8	0	6	21	0	27	0	0	4	9	0	0
64	9	0	12	11	0	15	0	1	5	12	0	0
65	4	0	19	12	0	11	0	0	6	9	0	0
66	11	0	15	7	0	9	0	1	6	4	0	1
67	5	0	17	8	0	5	0	0	9	2	0	0
68	11	0	17	4	0	1	0	0	7	5	0	0
69	8	0	33	1	0	1	0	0	5	4	0	0
70	12	0	35	2	0	0	0	0	1	2	0	1
71	14	0	33	0	0	0	0	0	1	0	0	0
72	16	0	28	0	0	0	0	0	4	1	0	0
73	12	0	43	0	0	0	0	0	1	0	0	0
74	14	0	23	2	0	1	0	0	1	0	0	0
75	14	0	21	0	0	0	0	0	1	0	0	0
76	9	0	18	0	0	0	0	0	0	0	1	0
77	12	0	13	0	0	0	0	0	0	0	0	0
78	5	0	7	0	0	0	0	0	0	0	0	0
79	3	0	8	0	0	0	0	0	0	0	0	0
80	7	0	5	0	0	0	0	0	0	0	0	0
81	2	0	6	1	0	0	0	0	0	0	0	0
82	3	0	0	0	0	0	0	0	0	0	0	0
83	2	0	2	0	0	0	0	0	0	0	0	0
84	0	0	1	0	0	0	0	0	0	0	0	0
85	0	0	1	0	0	0	0	0	0	0	0	0
86	0	0	1	0	0	0	0	0	0	0	0	0
87	0	0	0	0	0	0	0	0	0	0	0	0
88	0	0	0	0	0	0	0	0	0	0	0	0
89	0	0	0	0	0	0	0	0	0	0	0	0
90	0	0	0	0	0	0	0	0	0	0	0	0
91	0	0	0	0	0	0	0	0	0	0	0	0
92	0	0	0	0	0	0	0	0	0	0	0	0
Total	280	103	469	509	6	601	849	920	70	97	582	763
Mean	65.9	32.5	67.3	54.2	28.2	56.4	42.3	40.5	64.5	62.1	45.7	46.0

Table 5. Age-frequency of chinook and coho sampled at the fishwheel, Klinaklini River, 2000.

	Chinook				Coho			
	Frequency				Frequency			
Age[1]	M	F	J	%	M	F	J	%
0.1	0	0	1	0.5	0	0	0	0.0
0.2	9	10	0	10.3	0	0	0	0.0
0.3	11	41	0	28.3	0	0	0	0.0
0.4	2	1	0	1.6	0	0	0	0.0
1.1	1	0	1	1.1	43	49	2	81.7
1.2	10	16	0	14.1	0	0	0	0.0
1.3	27	53	0	43.5	0	0	0	0.0
1.4	0	1	0	0.5	0	0	0	0.0
2.1	0	0	0	0.0	7	14	0	18.3
Total	60	122	2	100.0	50	63	2	100.0

[1] Age notation consists of fresh water years followed by salt water years, the sum of which gives total age.

Table 6. Environmental data collected at the fishwheel site, Klinaklini River, 2000.

DATE	TIME	TEMP. (Deg.C)	SECCHI DEPTH (cm)	FLOW RATE (mps)	REV'S FOR 5 MIN.	RPM	DEPTH (cm)
6-Jul	7:00 AM	6	23	0.659	10	2.0	490
6-Jul	7:00 PM	8	23	0.612	10	2.0	495
7-Jul	7:00 AM	6	20	0.657	10	2.0	500
7-Jul	7:00 PM	8	25	0.713	10	2.0	510
8-Jul	7:00 AM	6	25	0.606	9	1.8	514
8-Jul	7:00 PM	8	24	0.521	9	1.8	517
9-Jul	7:00 AM	6	25		8	1.6	516
9-Jul	7:00 PM	8	24	0.516	8	1.6	516
10-Jul	7:00 AM	6	22	0.567	9	1.8	517
10-Jul	7:00 PM	8	25	0.655	9	1.8	516
11-Jul	7:00 AM	7	23	0.615	10	2.0	520
11-Jul	7:00 PM	8	23	0.738	10	2.0	524
12-Jul	7:00 AM	6	23	0.677	9	1.8	520
12-Jul	7:00 PM	7	26	0.609	8	1.6	516
13-Jul	7:00 AM	6	27	0.622	10	2.0	516
13-Jul	7:00 PM	6	27	0.734	10	2.0	530
14-Jul	7:00 AM	6	24	0.677	8	1.6	528
14-Jul	7:00 PM	6	28	0.470	7	1.4	514
15-Jul	7:00 AM	6	28	0.496	8	1.6	499
15-Jul	7:00 PM	8	23		9	1.8	500
16-Jul	7:00 AM	6	23	0.543	9	1.8	500
16-Jul	7:00 PM	8	23	0.628	11	2.2	500
17-Jul	7:00 AM	6	20	0.571	9	1.8	505
17-Jul	7:00 PM	7	20	0.640	10	2.0	500
18-Jul	7:00 AM	6	23	0.579	8	1.6	510
18-Jul	7:00 PM	8	23	0.676	8	1.6	520
19-Jul	7:00 AM	6	20	0.680	10	2.0	527
19-Jul	7:00 PM	8	19	0.731	10	2.0	535
20-Jul	7:00 AM	7	20	0.755	8	1.6	542
20-Jul	7:00 PM	8	15	0.876	10	2.0	550
21-Jul	7:00 AM	5	15	0.844	9	1.8	558
21-Jul	7:00 PM	8	17	0.916	10	2.0	560
22-Jul	7:00 AM	6	20	1.051	12	2.4	560
22-Jul	7:00 PM	7	23	0.889	10	2.0	560
23-Jul	7:00 AM	6	20	0.786	9	1.8	559
23-Jul	7:00 PM	7	18	0.757	8	1.6	556
24-Jul	7:00 AM	6	20	0.700	8	1.6	553
24-Jul	7:00 PM			0.692	7	1.4	554
25-Jul	7:00 AM	6	21	0.664	7	1.4	555
25-Jul	7:00 PM	6	21	0.701	7	1.4	552
26-Jul	7:00 AM	6	20	0.681	6	1.2	551
26-Jul	7:00 PM	6	21	0.676	7	1.4	550
27-Jul	7:00 AM	5	21	0.782	8	1.6	563
27-Jul	7:00 PM	5	17	1.028	12	2.4	589
28-Jul	7:00 AM	6	18				615

Table 6. (cont'd)

DATE	TIME	TEMP. (Deg.C)	SECCHI DEPTH (cm)	FLOW RATE (mps)	REV'S FOR 5 MIN.	RPM	DEPTH (cm)
28-Jul	7:00 PM	6	16		12	2.4	610
29-Jul	11:00 AM	6	15		12	2.4	571
29-Jul	7:00 PM	6	16		13	2.6	570
30-Jul	7:00 AM	5	15		14	2.8	565
30-Jul	7:00 PM	6	15				566
31-Jul	7:00 AM	5	14		13	2.6	570
31-Jul	7:00 PM	6	20		14	2.8	679
1-Aug	7:00 AM	5	16		12	2.4	578
1-Aug	7:00 PM	6	18		10	2.0	669
2-Aug	7:00 AM	5	18		8	1.6	554
2-Aug	7:00 PM	6	16		8	1.6	541
3-Aug	7:00 AM	5	19		8	1.6	541
3-Aug	3:00 PM	7	17		8	1.6	542
3-Aug	7:00 PM	7	17		9	1.8	542
4-Aug	7:00 AM	5	16		10	2.0	599
4-Aug	3:00 PM	7	19	1.028	10	2.0	570
4-Aug	7:00 PM	7					572
5-Aug	7:00 AM	6	17	0.983	11	2.2	576
5-Aug	3:00 PM	8	19	1.056	10	2.0	570
5-Aug	7:00 PM	6	18	1.040	11	2.2	580
6-Aug	7:00 AM	6	21	1.014	9	1.8	578
6-Aug	3:00 PM			0.923	8	1.6	568
6-Aug	7:00 PM	7	19	0.944	9	1.8	576
7-Aug	7:00 AM	6	19	0.857	8	1.6	562
7-Aug	3:00 PM	7	20	0.845	8	1.6	554
7-Aug	7:00 PM						
8-Aug	7:00 AM	6	21	0.814	8	1.6	558
8-Aug	3:00 PM	7	19	0.796	9	1.8	552
8-Aug	7:00 PM	7	18	0.803	8	1.6	560
9-Aug	7:00 AM	6	18	0.923	9	1.8	556
9-Aug	4:00 PM	8	22	0.763	7	1.4	544
9-Aug	7:00 PM	7	22	0.795	8	1.6	550
10-Aug	8:00 AM	5	23	0.749	7	1.4	536
10-Aug	3:00 PM	8	23	0.675	7	1.4	520
10-Aug	7:30 PM	6	21	0.678	6	1.2	524
11-Aug	7:00 AM	6	26	0.594	6	1.2	514
11-Aug	2:30 PM	8	22	0.598	7	1.4	506
12-Aug	7:00 AM	5	24	0.567	5	1.0	503
12-Aug	3:00 PM						
12-Aug	7:00 PM	7	29	0.596	5	1.0	498
13-Aug	7:30 AM	5	23	0.519	5	1.0	498
13-Aug	2:15 PM	8	26	0.598	4	0.8	482
13-Aug	7:00 PM	7	24	0.543	4	0.8	488
14-Aug	7:00 AM	5	19	0.514	4	0.8	480
14-Aug	2:00 PM	7	17	0.433	4	0.8	472
14-Aug	7:00 PM	7	25	0.579	4	0.8	476
15-Aug	7:00 AM	5	24	0.474	3	0.6	477

Table 6. (cont'd)

DATE	TIME	TEMP. (Deg.C)	SECCHI DEPTH (cm)	FLOW RATE (mps)	REV'S FOR 5 MIN.	RPM	DEPTH (cm)
15-Aug	2:00 PM	7	23	0.445	3	0.6	469
15-Aug	7:00 PM	7	28	0.527	3	0.6	477
16-Aug	7:00 AM	5	25	0.426	3	0.6	478
16-Aug	2:00 PM	7	29	0.350	4	0.8	468
16-Aug	7:00 PM	7	29	0.513	4	0.8	468
17-Aug	7:00 AM	5	25	0.571	4	0.8	469
17-Aug	2:00 PM	6	26	0.659	4	0.8	469
17-Aug	7:00 PM	6	27	0.544	4	0.8	467
18-Aug	7:00 AM	5	28	0.619	5	1.0	488
18-Aug	2:00 PM	5	26	0.595	5	1.0	499
18-Aug	7:00 PM	5	28	0.555	5	1.0	500
19-Aug	7:00 AM	5	24	0.591	5	1.0	499
19-Aug	2:00 PM	5	26	0.523	5	1.0	488
19-Aug	7:00 PM		27	0.708	4	0.8	480
20-Aug	7:00 AM	5	25	0.642	3	0.6	469
20-Aug	2:00 PM	5	27	0.724	4	0.8	469
20-Aug	7:00 PM	5	25	0.569	4	0.8	468
21-Aug	1:00 PM	6	34	0.471	4	0.8	
21-Aug	7:00 PM	5	36	0.329	4	0.8	460
22-Aug	7:00 AM	5	38	0.415	6	1.2	468
22-Aug	7:00 PM	6	35	0.398	4	0.8	476
23-Aug	7:00 AM	5	35	0.421	6	1.2	488
23-Aug	2:00 PM	6	36	0.433	6	1.2	498
23-Aug	7:00 PM	6	38	0.502	7	1.4	502
24-Aug	7:00 AM	5	33	0.515	8	1.6	516
24-Aug	3:00 PM	6	34	0.497	8	1.6	522
24-Aug	7:00 PM	6	30	0.630	8	1.6	526
25-Aug	8:00 AM	5	35	0.709	9	1.8	540
25-Aug	6:30 PM	5	22	0.297	11	2.2	564
26-Aug	8:00 AM	5	24	0.705	8	1.6	550
26-Aug	7:00 PM	5	28	0.558	6	1.2	538
27-Aug	8:30 AM	4	23	0.379	6	1.2	518
27-Aug	7:00 PM	5	23	0.316	4	0.8	505
28-Aug	10:20 AM	5	20	0.247	4	0.8	488
28-Aug	7:20 PM	5	23	0.251	2	0.4	478
29-Aug	9:00 AM	4	24	0.228	3	0.6	488
29-Aug	6:00 PM	6	20	0.245	4	0.8	494
30-Aug	9:00 AM	5	19	0.262	4	0.8	494
30-Aug	6:00 PM	6	23	0.274	5	1.0	496
31-Aug	10:45 AM	5	23	0.303	4	0.8	488
31-Aug	5:30 PM	6	23	0.307	5	1.0	476
1-Sep	9:15 AM	4	23	0.298	3	0.6	470
1-Sep	7:00 PM	6	24	0.267	2	0.4	461
2-Sep	9:15 AM	4	22	0.342	2	0.4	450
2-Sep	7:15 PM	6	23	0.359	4	0.8	446
3-Sep	8:30 AM	4	18	0.399	3	0.6	440

Table 6. (cont'd)

DATE	TIME	TEMP. (Deg.C)	SECCHI DEPTH (cm)	FLOW RATE (mps)	REV'S FOR 5 MIN.	RPM	DEPTH (cm)
3-Sep	7:00 PM	6	22	0.363	4	0.8	440
4-Sep	8:30 AM	5	24	0.544	5	1.0	399
4-Sep	6:00 PM	6	23	0.395	4	0.8	399
5-Sep	8:15 AM	5	22	0.576	6	1.2	399
5-Sep	7:00 PM	5	22	0.422	4	0.8	399
6-Sep	7:30 AM	5	22	0.375	2	0.4	399
6-Sep	5:00 PM	5	22		4	0.8	400
7-Sep	8:00 AM	5	20	0.373	6	1.2	400
7-Sep	6:30 PM	6	18		10	2.0	500
8-Sep	7:00 AM	5	17	0.447	6	1.2	519
8-Sep	4:00 PM	5	17	0.395	6	1.2	500
9-Sep	7:00 PM	4	18	0.223			468
9-Sep	7:15 PM	5	18	0.159	4	0.8	465
10-Sep	8:00 AM	4	22	0.359	5	1.0	450
10-Sep	6:46 PM	6	24	0.416	4	0.8	440
11-Sep	7:15 AM	4	24	0.511	6	1.2	435
11-Sep	6:30 PM	5	24	0.613	7	1.4	425
1-Aug	7:00 PM	6	24	0.609	6	1.2	508
12-Sep	8:00 AM	4	24	0.645	7	1.4	425
12-Sep	6:30 PM	6	23	0.518	6	1.2	430
13-Sep	11:30 AM	5	24	0.362	5	1.0	425
13-Sep	7:00 PM	5	24	0.416	5	1.0	435
14-Sep	7:00 PM	4	24	0.404	4	0.8	445
15-Sep	7:45 AM	4	24	0.430	6	1.2	470
15-Sep	6:30 PM	6	24	0.441	6	1.2	480
16-Sep	7:40 AM	5	23	0.460	7	1.4	490
16-Sep	7:00 PM	6	21	0.485	8	1.6	488
17-Sep	8:00 AM	5	24	0.592	9	1.8	499
17-Sep	3:00 PM	6	24	0.705	10	2.0	520
18-Sep	8:00 AM	5	17	0.908	10	2.0	548
18-Sep	3:00 PM	6	18	0.800	10	2.0	548
19-Sep	7:30 AM	4	16	0.749	8	1.6	500
19-Sep	3:15 PM	6	20	0.573	7	1.4	519
20-Sep	8:00 AM	4	16	0.590	6	1.2	499
20-Sep	3:15 PM	6	18	0.331	7	1.4	498
21-Sep	8:00 AM	4	14	0.584	6	1.2	497
21-Sep	3:30 PM	6	12	0.607	6	1.2	488
22-Sep	8:00 AM	8	16	0.319	4	0.8	468
22-Sep	2:30 PM	5	10	0.135	4	0.8	449
23-Sep	8:00 AM	3	9	0.298	2	0.4	439
23-Sep	3:00 PM	5	9	0.109	2	0.4	419
24-Sep	8:00 AM	4	9	0.175			409
24-Sep	3:15 PM	5	11	0.288	2	0.4	419
25-Sep	8:30 AM	4	15	0.271	4	0.8	419
25-Sep	2:30 PM	5	16	0.176	4	0.8	419
26-Sep	8:00 AM	4	17	0.316	4	0.8	420

Table 6. (cont'd)

DATE	TIME	TEMP. (Deg.C)	SECCHI DEPTH (cm)	FLOW RATE (mps)	REV'S FOR 5 MIN.	RPM	DEPTH (cm)
26-Sep	3:00 PM	6	18	0.215	4	0.8	421
27-Sep	8:00 AM	4	19	0.198	3	0.6	420
27-Sep	3:00 PM	6	19	0.207	4	0.8	418
28-Sep	8:30 AM	4	19	0.163	2	0.4	408
28-Sep	2:45 PM	4	21	0.174	4	0.8	408
29-Sep	8:30 AM	4	19	0.370	6	1.2	439
29-Sep	4:00 PM	5	18	0.334	7	1.4	470
30-Sep	10:30 AM	4	11	0.713	8	1.6	545
30-Sep	4:00 PM	5	9	0.688	8	1.6	545
1-Oct	7:30 AM	3	17	0.460	6	1.2	509
1-Oct	4:30 PM	4	16	0.347	4	0.8	490
2-Oct	8:00 AM	3	17	0.260	3	0.6	468
2-Oct	4:30 PM	4	18	0.251	3	0.6	
3-Oct	8:00 AM	3	17	0.354	5	1.0	445
3-Oct	4:00 PM	5	16	0.322	4	0.8	430
4-Oct	4:00 PM	5	13	0.225	3	0.6	410
5-Oct	4:00 PM	5	13	0.608	6	1.2	395
6-Oct	9:30 AM	3	16	0.516	6	1.2	395
6-Oct	4:00 PM	5	13	0.454	5	1.0	385
7-Oct	8:45 AM	3	16	0.584	5	1.0	385
7-Oct	4:00 PM	4	17	0.528	5	1.0	385
8-Oct	8:30 AM	4	17	0.414	3	0.6	400
8-Oct	4:20 PM	4	17	0.463	3	0.6	405
9-Oct	8:30 AM	4	16	0.363	4	0.8	410
9-Oct	4:30 PM	4	17	0.626	6	1.2	
10-Oct	9:00 AM	4	16	0.660	6	1.2	395
10-Oct	6:30 PM	5		0.315	6	1.2	405
11-Oct	9:00 AM	5	17	0.394	6	1.2	389
11-Oct	4:30 PM	4	16	0.468	6	1.2	390
12-Oct	8:30 AM	2	19	0.636	6	1.2	390
12-Oct	4:30 PM	5	14	0.366	5	1.0	390
13-Oct	4:00 PM	4	17	0.573	6	1.2	385
14-Oct	8:30 AM	4	15	0.553	6	1.2	385
14-Oct	4:00 PM	5	17	0.517	6	1.2	380
15-Oct	8:30 AM	4	18	0.860	8	1.6	380
15-Oct	4:00 PM	4	17	0.825	10	2.0	380
16-Oct	9:00 AM	3	17	0.828	9	1.8	385
16-Oct	4:00 PM	4	18	0.764	8	1.6	375
17-Oct	8:30 AM	5	18	0.769	8	1.6	380
17-Oct	4:30 PM	4	17	0.570	6	1.2	385
18-Oct	9:00 AM	5	16	0.430	4	0.8	430
18-Oct	4:30 PM	5	20	0.283	4	0.8	430
19-Oct	9:30 AM	5	19	0.691	6	1.2	402
19-Oct	4:30 PM	5	16	0.520	5	1.0	405
20-Oct	4:30 PM	5	20	0.507	6	1.2	450
21-Oct	9:00 AM	4	19	0.600	5	1.0	420

Table 6. (cont'd)

DATE	TIME	TEMP. (Deg.C)	SECCHI DEPTH (cm)	FLOW RATE (mps)	REV'S FOR 5 MIN.	RPM	DEPTH (cm)
21-Oct	5:00 PM	4	20	0.578	5	1.0	415
22-Oct	8:30 AM	4	20	0.672	7	1.4	385
22-Oct	4:30 PM	4	19	0.709	8	1.6	380
23-Oct	9:00 AM	4	20	0.654	6	1.2	395
23-Oct	4:30 PM	4	20	0.510	4	0.8	390
24-Oct	9:30 AM	4	20	0.389	5	1.0	390
24-Oct	5:00 PM	5	19	0.521	5	1.0	390
25-Oct	9:00 AM	4	19	0.549	6	1.2	390
25-Oct	4:30 PM	5	20	0.626	5	1.0	385
26-Oct	9:00 AM	4	20	0.725	7	1.4	385
26-Oct	4:00 PM	5	20	0.344	6	1.2	390

Table 7. Summary of fishwheel catch efficiencies, by species, Klinaklini River, 2000.

Species	Number Tagged	Number Recaptured[1]	Recapture Rate (%)	Mean Days at Large
Chinook	769	40	5.20	10.9
Coho	1031	46	4.46	16.1
Sockeye	707	58	8.20	2.3
Pink	591	31	5.25	6.3
Chum	86	6	6.98	1.0
Total:	3184	181	5.68	

[1] Fish captured and tagged at the fishwheel, released 0.5 km downstream, and recovered at the fishwheel.

Table 8. Mussel Creek fence counts, 2000.

Date	Chinook			Coho			Chum		Pink		Sockeye	
	Adult[1]	Jack	Tagged	Adult[1]	Jack	Tagged	Total[1]	Tagged	Total[1]	Tagged	Total[1]	Tagged
01-Aug	47	8	0	0	0	0	0	0	0	0	0	0
02-Aug	23	1	2	0	0	0	0	0	0	0	3	1
03-Aug	53	3	0	0	0	0	1	0	0	0	2	0
04-Aug	26	2	1	0	0	0	0	0	0	0	1	0
05-Aug	38	3	3	0	0	0	0	0	0	0	0	0
06-Aug	38	3	3	0	0	0	0	0	0	0	0	0
07-Aug	36	5	1	0	0	0	0	0	0	0	1	0
08-Aug	62		2	0	0	0	0	0	0	0	3	0
09-Aug	103	10	3	0	0	0	0	0	0	0	5	0
10-Aug		No Data		0	0	0	0	0	0	0	0	0
11-Aug	207	15	7	0	0	0	0	0	0	0	2	0
12-Aug	25	5	1	0	0	0	0	0	0	0	5	0
13-Aug	205	15	5	0	0	0	1	0	0	0	5	0
14-Aug	358	20	8	10	0	0	1	0	0	0	10	0
15-Aug	38	5	3	2	0	0	0	0	0	0	10	1
16-Aug	127	10	7	0	0	0	0	0	5	0	10	0
17-Aug	5	0	0	0	0	0	0	0	0	0	25	0
18-Aug	143	5	3	1	0	0	0	0	20	0	75	0
19-Aug	5	0	0	2	0	0	0	0	20	0	22	0
20-Aug	83	10	3	5	0	1	0	0	18	0	21	0
21-Aug	6	0	0	0	0	0	0	0	10	0	7	0
22-Aug	2	0	2	2	0	1	0	0	0	0	0	0
23-Aug	0	0	0	0	0	0	0	0	0	0	0	0
24-Aug	4	1	1	5	0	2	0	0	6	1	22	0
25-Aug	38	0	6	11	0	0	2	0	21	0	34	0
26-Aug	7	0	1	2	0	1	1	0	0	0	3	1
27-Aug	3	0	1	0	0	0	0	0	1	0	10	0
28-Aug	1	0	0	0	0	0	1	0	1	0	2	0
29-Aug	0	0	0	2	0	0	1	0	9	1	10	0
30-Aug	1	0	0	0	0	0	0	0	2	0	11	1
31-Aug	0	0	0	10	0	0	0	0	5	0	10	0
01-Sep	120	0	0	15	0	0	0	0	10	0	10	0
02-Sep	52	2	2	28	0	0	0	0	2	0	2	0
03-Sep	0	0	0	2	1	0	0	0	5	0	8	0
04-Sep	0	0	0	2	1	0	0	0	0	0	0	0
05-Sep	2	0	0	2	1	0	0	0	2	0	0	0
06-Sep	3	0	3	0	0	0	0	0	0	0	0	0
07-Sep						No Data						
08-Sep	50	0	0	10	2	0	0	0	10	0	10	0
09-Sep	0	0	0	0	0	0	0	0	1	0	0	0
10-Sep	0	0	0	1	0	0	0	0	4	0	0	0
11-Sep	0	0	0	0	0	0	0	0	3	0	1	0
12-Sep						No Data						
13-Sep	0	0	0	0	0	0	0	0	7	0	0	0
14-Sep						No Data						

Table 8. (cont'd)

Date	Chinook			Coho			Chum		Pink		Sockeye	
	Adult[1]	Jack	Tagged	Adult[1]	Jack	Tagged	Total[1]	Tagged	Total[1]	Tagged	Total[1]	Tagged
15-Sep	0	0	0	0	0	0	0	0	9	0	0	0
16-Sep	5	0	0	0	0	0	0	0	0	0	1	0
17-Sep	107	0	0	4	0	0	0	0	0	0	1	0
18-Sep	30	0	0	2	0	0	0	0	2	0	1	0
19-Sep	60	0	0	2	0	0	0	0	0	0	0	0
20-Sep	107	0	0		0	0	0	0	0	0	0	0
21-Sep	0	0	0	0	0	0	0	0	0	0	0	0
22-Sep	101	3	1		0	0	1	0	4	0	0	0
23-Sep	190	0	0	40	0	0	8	0	20	0	0	0
24-Sep	150	0	0	10	0	0	0	0	0	0	0	0
25-Sep	101	0	0	10	0	0	1	0	2	0	0	0
26-Sep	108	0	0	40	0	0	8	0	4	0	0	0
27-Sep	153	0	0	31	0	0	15	0	2	0	0	0
28-Sep	180	0	0	170	0	0	24	0	0	0	0	0
29-Sep	90	10	0	45	5	0	0	0	15	0	1	0
30-Sep	15	3	0	20	5	0	0	0	0	0	0	0
01-Oct	50	0	0	20	0	0	5	0	5	0	3	0
02-Oct	75	0	0	20	0	0	5	0	5	0	1	0
03-Oct	75	0	0	20	0	0	5	0	5	0	1	0
04-Oct	4	0	0	1	0	0	0	0	0	0	0	0
05-Oct	1	0	0	1	0	0	0	0	0	0	0	0
06-Oct	0	0	0	0	0	0	0	0	0	0	0	0
07-Oct	0	0	0	0	0	0	0	0	0	0	0	0
08-Oct	0	0	0	0	0	0	0	0	0	0	0	0
09-Oct	1	0	0	3	0	0	0	0	0	0	0	0
10-Oct	0	0	0	1	0	0	0	0	0	0	0	0
11-Oct	0	0	0	0	0	0	0	0	0	0	0	0
12-Oct	0	0	0	2	0	0	0	0	0	0	0	0
13-Oct	1	0	0	1	1	0	6	0	0	0	0	0
14-Oct	1	0	0	3	1	0	1	0	0	0	0	0
15-Oct	0	0	0	0	0	0	1	0	0	0	0	0
16-Oct	0	0	0	2	0	0	1	0	0	0	0	0
17-Oct	0	0	0	1	0	0	0	0	0	0	0	0
18-Oct	0	0	0	2	0	0	0	0	0	0	0	0
19-Oct	0	0	0	1	0	0	0	0	0	0	0	0
20-Oct	0	0	0	0	1	0	0	0	0	0	0	0
Total	3516	139	69	564	18	5	89	0	235	2	349	4

[1] Includes tagged fish.

Fence removed on October 7. Values from this date forward are bridge counts.

Table 9. Population estimates, by species, for the Klinaklini River, 2000.

Species	Fishwheel Catch	Catch Efficiency	Population Estimate	Lower 95% CL	Upper 95% CL
[1] Chinook	915		17,202	12,889	23,533
[1] Coho	1179		25,909	19,884	34,743
[2] Sockeye	1513	8.20 %	18,451		
[2] Pink	1819	5.25 %	34,648		
[2] Chum	175	6.98 %	2,507		

[1] Pooled Petersen estimator used to determine population size.
[2] Fishwheel catch efficiency used to determine population size.

Table 10. Population estimates, by species, for the Klinaklini River, 1997 to 2000.

Year	Species				
	Chinook	Coho	Pink	Chum	Sockeye
[1] 1997	4,906	na	na	na	na
[2] 1998	9,980	26,901	72,126	9,543	13,912
[3] 1999	11,068	10,380	306	na	1,802
2000	17,202	25,909	34,648	2,507	18,451

[1] Data from Nagtegaal et al., 1998.
[2] Data from Sturhahn and Nagtegaal, 1999.
[3] Data from Diewert et al., 2001.

Table 11. Visual survey data collected for the Klinaklini system by Fishery Officers stationed in the Campbell River subdistrict.

			Chinook					
			Jacks		Adults			
	Method[1]	Date	Count	Estimate	Count	Estimate	River	Segment[2]
1979	H	Sept. 15					Mussel	
Estimate for Season[3]				3000				
1980	F	Aug. 29					Mussel	
Estimate for Season				500				
1981	F	July 26					Mussel	
	F	Aug. 29					Mussel	
	F	Sept. 22					Mussel	
	F	Oct. 5					Mussel	
Estimate for Season				1000				
1982	No observation							
Estimate for Season				No Est				
1983	H	July 23					Mussel	
	H	Oct. 28					Mussel	
Estimate for Season				1220				
1984	H					1000	Mussel[4]	
Estimate for Season[3]				1000				
1985	H	June 25					Mussel	
	H	Aug. 7					Mussel	
	H	15					Mussel	
	H	Sept. 15				650	Mussel	
Estimate for Season				650				
1986	H	Oct. 15				500	Mussel	
Estimate for Season				500				

Table 11. (cont'd)

	Method[1]	Date	Chinook Jacks Count	Jacks Estimate	Adults Count	Adults Estimate	River	Segment[2]
1987	H	June 25				1	Mussel	
	H	Aug. 7				5	Mussel	
	H	15				50	Mussel	
	H	Sept. 15				600	Mussel	
Estimate for Season				706				
1988	H	Sept. 12				1000	Mussel	
Estimate for Season				1000				
1989	H	Oct. 2				250	Mussel	
Estimate for Season				250				
1990	No observations							
Estimate for Season				No Est				
1991	H	July 12				45	Mussel	
	H	22				110	Mussel	
	H	Aug. 16				57	Mussel	
	H	Sept. 21				114	Mussel	
	H	Oct. 9				8	Mussel	
Estimate for Season				500				
1992	H	Aug. 13				650	Mussel	
	H	Sept. 18				700	Mussel	
Estimate for Season				700				
1993	H	Aug. 29				585	Mussel	
	H	Sept. 29				99	Mussel	
	H	29				60	Icey	
	H	Oct. 26				65	Mussel	
Estimate for Season				809				

Table 11. (cont'd)

			Chinook				
			Jacks		Adults		
	Method[1]	Date	Count	Estimate	Count	Estimate	River Segment[2]
1994	H	Sept. 17				719	Mussel
	H	Nov. 11					Icy/Dice
	H	Nov. 11				1	Mussel
Estimate for Season[3]				720			
1995	H	Aug. 4			69	250	Mussel
	H	Aug. 4			6	10	Icy/Dice
	H	Aug. 25			800	800	Mussel
	H	Sept. 22			1400	1400	Mussel
	H	Sept. 22			450	450	Icy/Dice
	H	Oct. 30			11	11	Icy/Dice
	H	Oct. 30			20	20	Jumper
Estimate for Season				3290			
1996	H	Aug. 22			257	800	Mussel
	H	22			0	0	Icy/Dice
	H	Oct. 18				776	Mussel
Estimate for Season[3]				2600			Icy/Dice/Mussel
1997	H						
Estimate for Season[3]				2100			Icy/Dice/Mussel
1998	H	Aug 20			740	1036	Icy/Dice/Mussel
		Sep 18			7	10	
		Oct 22			0	0	
Estimate for Season[3]				1046			Icy/Dice/Mussel
1999	H						
Estimate for Season[3]				400			Icy/Dice/Mussel
2000	H						
Estimate for Season[3]				No Est			Icy/Dice/Mussel

[1] S - Swim survey, H - Helicopter survey, F - boat survey
[2] Refer to Fig. 2
[3] Total escapement estimate for adult chinook
[4] In November a 200 m slide into Mussel Cr. Likely destroyed most of the chinook spawn.

Table 12. Summary of stream walk visual counts carried out on the Klinaklini system, 2000.

Stream	Area	Date	Chinook	Coho	Chum	Pink	Sockeye
Mussel Creek	Fence to Powder Keg	23-Sep	600	50	12	600	250
Mussel Creek	Devereux Lake to Laura Lake	10-Oct	1	16	0	0	7
Mussel Creek	Fence to Powder Keg	18-Oct	1	9	1	0	14
Clearwater Creek	3.0 km	02-Oct	4	150	300	500	500
UnNamed Creek (Clearwater trib.)		03-Oct	0	0	0	13	23
Dice Creek	Lower 1.5 kms	10-Oct	0	18	0	203	6

Table 13. Stream reach habitat survey data from the Klinaklini system, 2000.

Basalt Creek October 1, 2000

Reach #	1	Water Temp (°C):	6.7	Dissolved Oxygen:	12.1 @ 99%
Reach Length:	250 m	Crown closure (%):	< 2	fines (< 2mm):	55%
Surveyed Length:	250 m	Ave. gradient (%):	< 1	small gravel (2-16 mm):	25%
% pool:	50	Ave. channel width (m):	20	large gravel (17-64 mm):	5%
% riffle/rapid:	20	Ave. wet width (m):	12	small cobble (65-128 mm):	
% glide/run:	20	Ave. max riffle depth (cm):	15	large cobble (129-265 mm):	5%
% other:	10	Ave. max pool depth (cm):	80	boulders (>256 mm)	5%

Basalt Creek October 1, 2000

Reach #	2	Water Temp (°C):	8.7	Dissolved Oxygen:	12.4
Reach Length:	950 m	Crown closure (%):	80	fines (< 2mm):	30%
Surveyed Length:	750 m	Ave. gradient (%):	< 3	small gravel (2-16 mm):	20%
% pool:	30	Ave. channel width (m):	5	large gravel (17-64 mm):	10%
% riffle/rapid:	40	Ave. wet width (m):	3	small cobble (65-128 mm):	20%
% glide/run:	25	Ave. max riffle depth (cm):	15	large cobble (129-265 mm):	10%
% other:	5	Ave. max pool depth (cm):	100	boulders (>256 mm)	5%

Walking Stick Creek October 1, 2000

Reach #	1	Water Temp (°C):	6.2	Dissolved Oxygen:	9.7 @ 77%
Reach Length:	550 m	Crown closure (%):	90	fines (< 2mm):	30%
Surveyed Length:	550 m	Ave. gradient (%):	< 2	small gravel (2-16 mm):	30%
% pool:	80	Ave. channel width (m):	4	large gravel (17-64 mm):	20%
% riffle/rapid:	15	Ave. wet width (m):	2	small cobble (65-128 mm):	5%
% glide/run:	5	Ave. max riffle depth (cm):	5	large cobble (129-265 mm):	10%
% other:	0	Ave. max pool depth (cm):	40	boulders (>256 mm)	5%

No Name (Clearwater tributary) October 2, 2000

Reach #	1	Water Temp (°C):	10.1	Dissolved Oxygen:	10.4 @ 71%
Reach Length:	500 m	Crown closure (%):	30	fines (< 2mm):	10%
Surveyed Length:	500 m	Ave. gradient (%):	< 1	small gravel (2-16 mm):	40%
% pool:	80	Ave. channel width (m):	5	large gravel (17-64 mm):	25%
% riffle/rapid:	20	Ave. wet width (m):	3	small cobble (65-128 mm):	10%
% glide/run:	0	Ave. max riffle depth (cm):	10	large cobble (129-265 mm):	15%
% other:	0	Ave. max pool depth (cm):	40	boulders (>256 mm)	0%

Table 13. (cont'd)

Clearwater Creek — October 2, 2000

Reach #	1	Water Temp (°C):	8.0	Dissolved Oxygen:	11.3 @ 94%
Reach Length:	3000 m	Crown closure (%):	75	fines (< 2mm):	25%
Surveyed Length:	3000 m	Ave. gradient (%):	< 2	small gravel (2-16 mm):	20%
% pool:	15	Ave. channel width (m):	8	large gravel (17-64 mm):	20%
% riffle/rapid:	50	Ave. wet width (m):	6.5	small cobble (65-128 mm):	20%
% glide/run:	30	Ave. max riffle depth (cm):	30	large cobble (129-265 mm):	10%
% other:	5	Ave. max pool depth (cm):	120	boulders (>256 mm)	5%

Clearwater Creek – Unnamed Tributary — October 4, 2000

Reach #		Water Temp (°C):	7.6	Dissolved Oxygen:	10.2 @ 84%
Reach Length:		Crown closure (%):	10	fines (< 2mm):	25%
Surveyed Length:	22.6 m	Ave. gradient (%):		small gravel (2-16 mm):	15%
% pool:	40	Ave. channel width (m):	9.5	large gravel (17-64 mm):	20%
% riffle/rapid:	50	Ave. wet width (m):		small cobble (65-128 mm):	5%
% glide/run:	10	Ave. max riffle depth (cm):		large cobble (129-265 mm):	10%
% other:	0	Ave. max pool depth (cm):		boulders (>256 mm)	15%

Devereux Creek (Mussel Creek) — October 6, 2000

Reach #	Fence	Water Temp (°C):	9.1	Dissolved Oxygen:	9.6 @ 83%
Reach Length:	500	Crown closure (%):		fines (< 2mm):	70%
Surveyed Length:	30	Ave. gradient (%):	< 1	small gravel (2-16 mm):	1%
% pool:	0	Ave. channel width (m):	29	large gravel (17-64 mm):	1%
% riffle/rapid:	0	Ave. wet width (m):	19	small cobble (65-128 mm):	1%
% glide/run:	100	Ave. max riffle depth (cm):	50	large cobble (129-265 mm):	1%
% other:	0	Ave. max pool depth (cm):		boulders (>256 mm)	26%

Devereux Creek (Mussel Creek) — October 10, 2000

Reach #	5	Water Temp (°C):	11.1	Dissolved Oxygen:	10.2 @ 96%
Reach Length:	2400	Crown closure (%):	70	fines (< 2mm):	10%
Surveyed Length:	2100	Ave. gradient (%):	< 2	small gravel (2-16 mm):	40%
% pool:	20	Ave. channel width (m):	9	large gravel (17-64 mm):	25%
% riffle/rapid:	60	Ave. wet width (m):	7	small cobble (65-128 mm):	10%
% glide/run:	20	Ave. max riffle depth (cm):	20	large cobble (129-265 mm):	10%
% other:	0	Ave. max pool depth (cm):	45	boulders (>256 mm)	5%

Table 13. (cont'd)

Dice Creek				October 6, 2000	
Reach #	1	Water Temp (^{o}C):	7.3	Dissolved Oxygen:	12.4 @ 100%
Reach Length:	1500	Crown closure (%):	< 5	fines (< 2mm):	40%
Surveyed Length:	1500	Ave. gradient (%):	< 3	small gravel (2-16 mm):	20%
% pool:	10	Ave. channel width (m):	18	large gravel (17-64 mm):	20%
% riffle/rapid:	25	Ave. wet width (m):	6	small cobble (65-128 mm):	15%
% glide/run:	40	Ave. max riffle depth (cm):	15	large cobble (129-265 mm):	5%
% other:	15	Ave. max pool depth (cm):	120	boulders (>256 mm)	0%

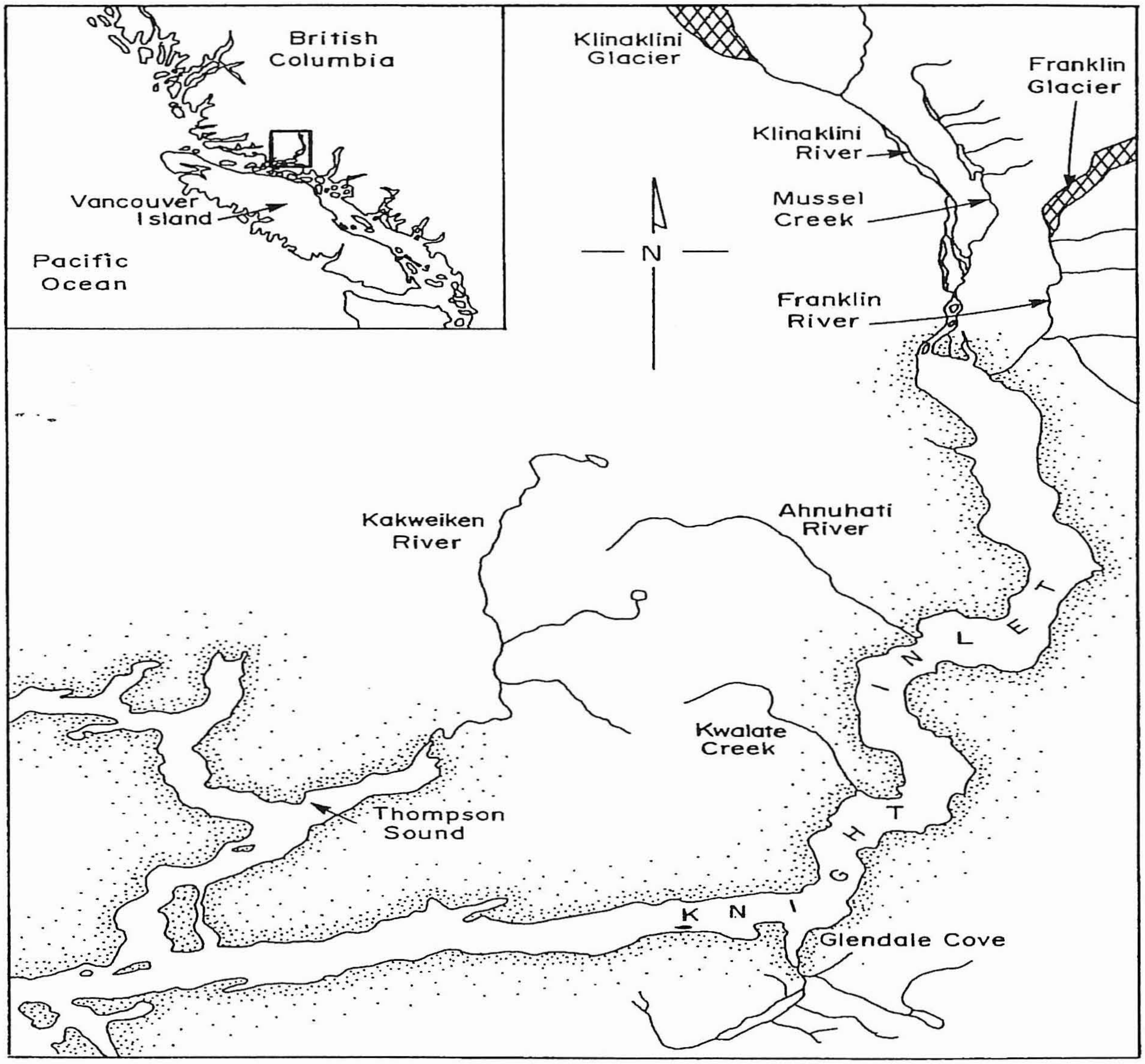

Figure 1 Knight Inlet study area.

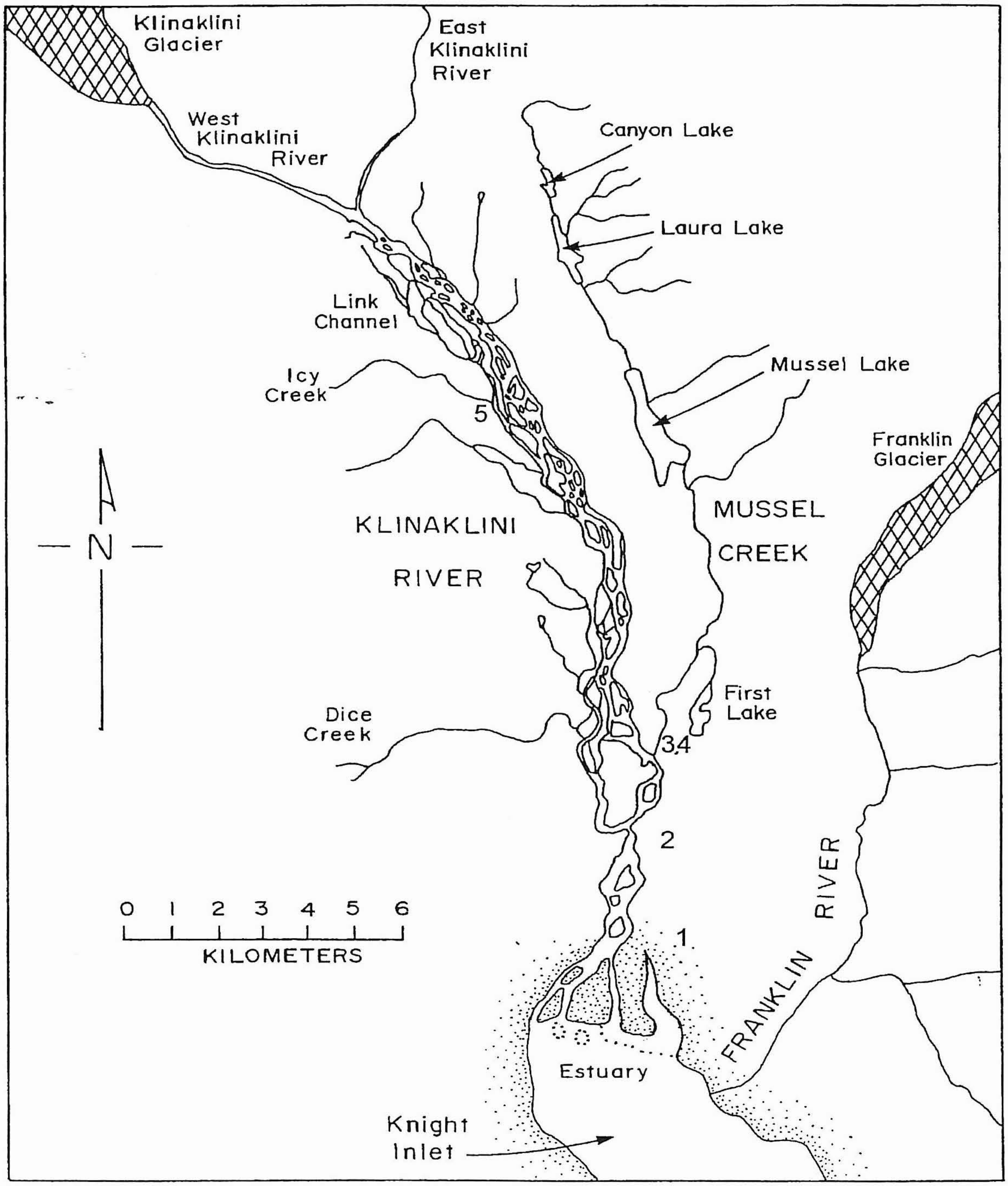

Figure 2. Location of 1)Interfor camp, 2)fishwheel, 3)Mussel Creek counting fence.

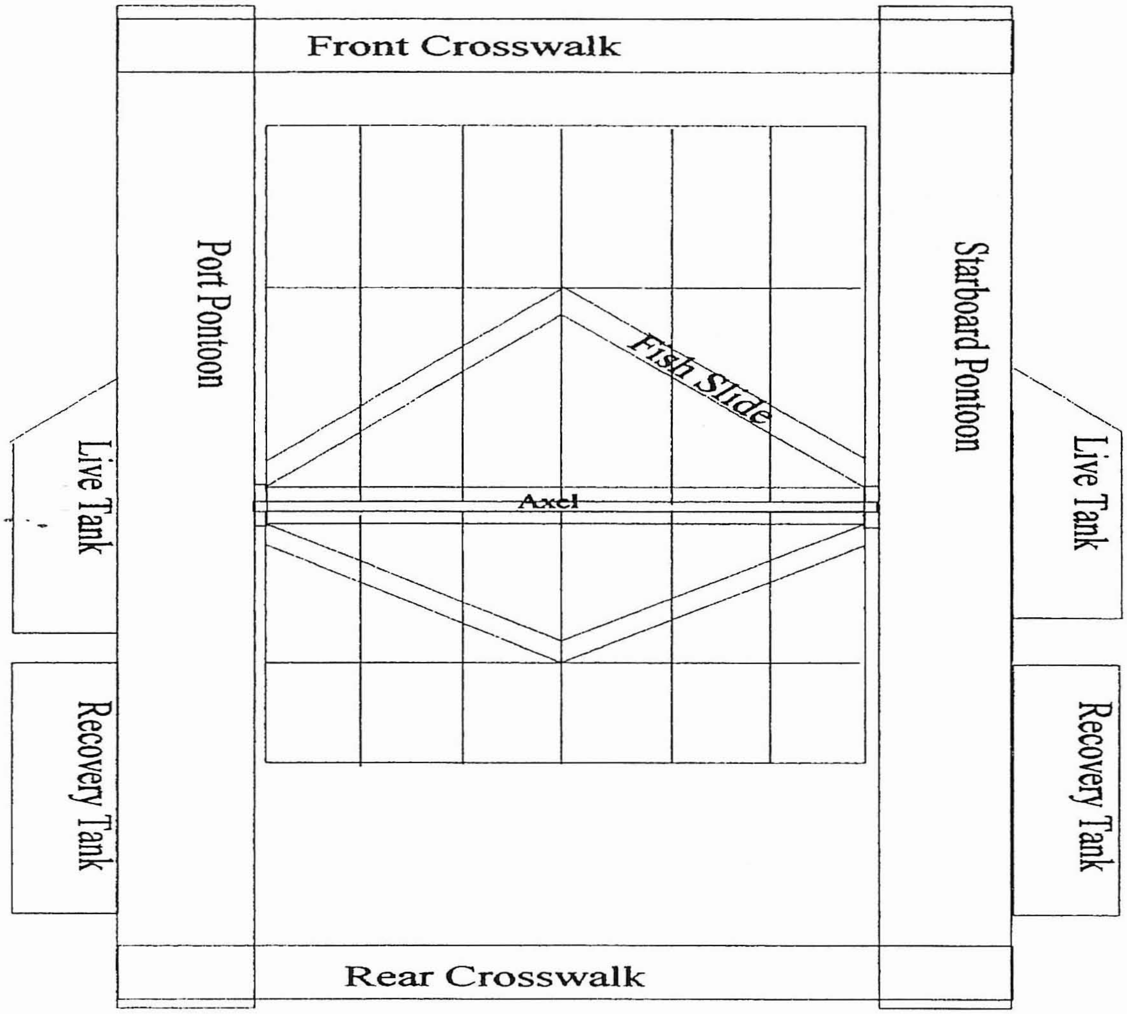

Figure 3. Schematic diagram of fishwheel (aerial view).

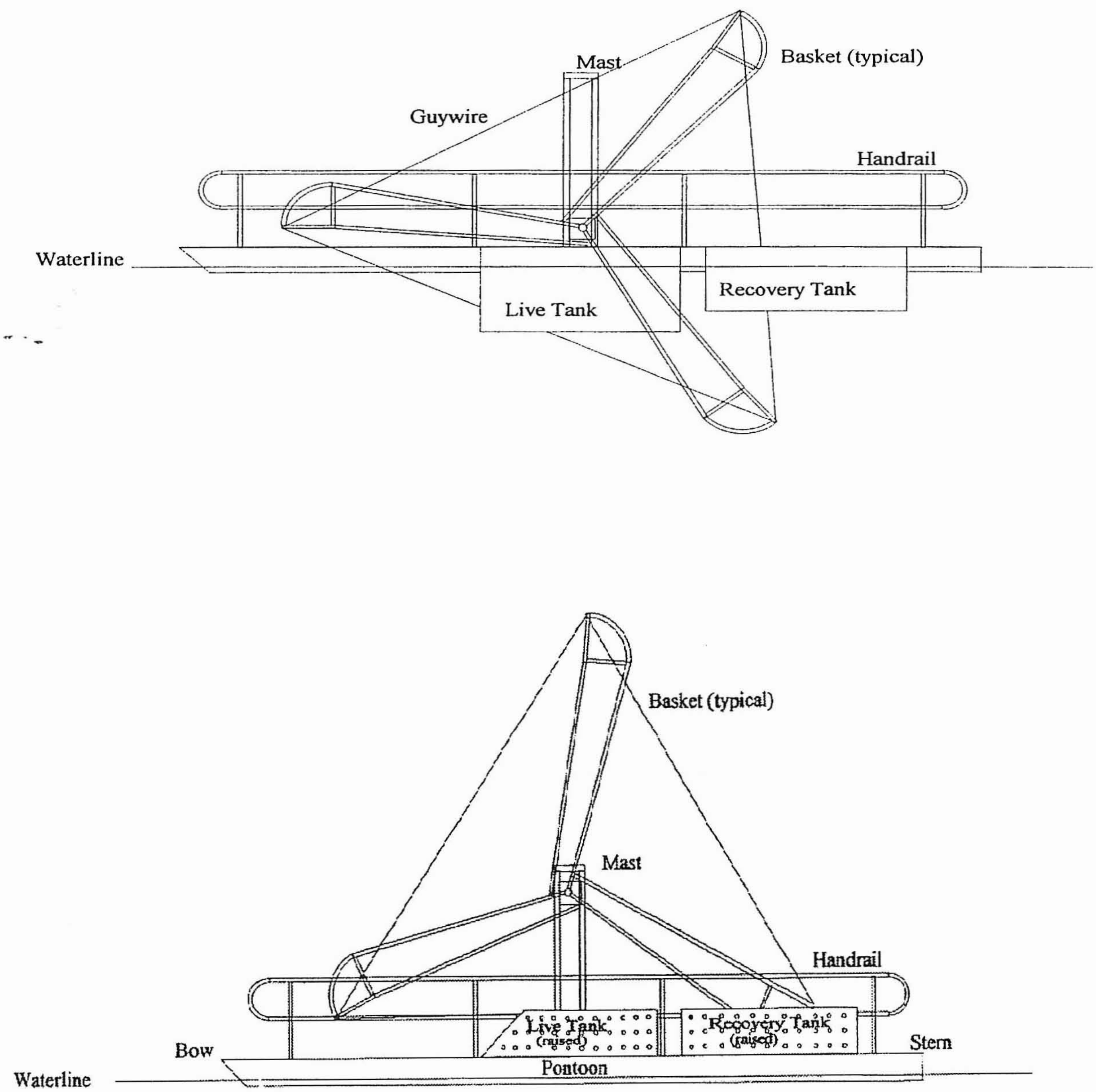

Figure 4. Schematic diagram of fishwheel in the lowered (top) and raised (bottom) position.

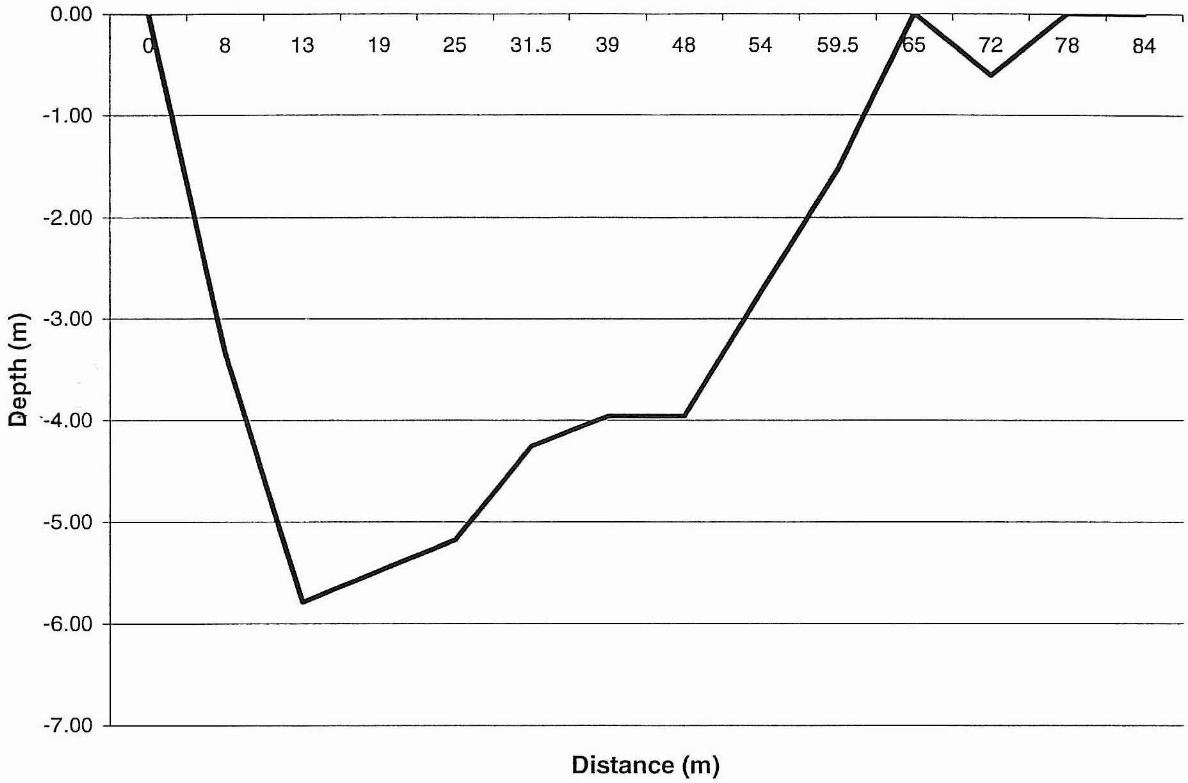

Figure 5. Cross section of the Klinaklini River at the Million Dollar Bridge.

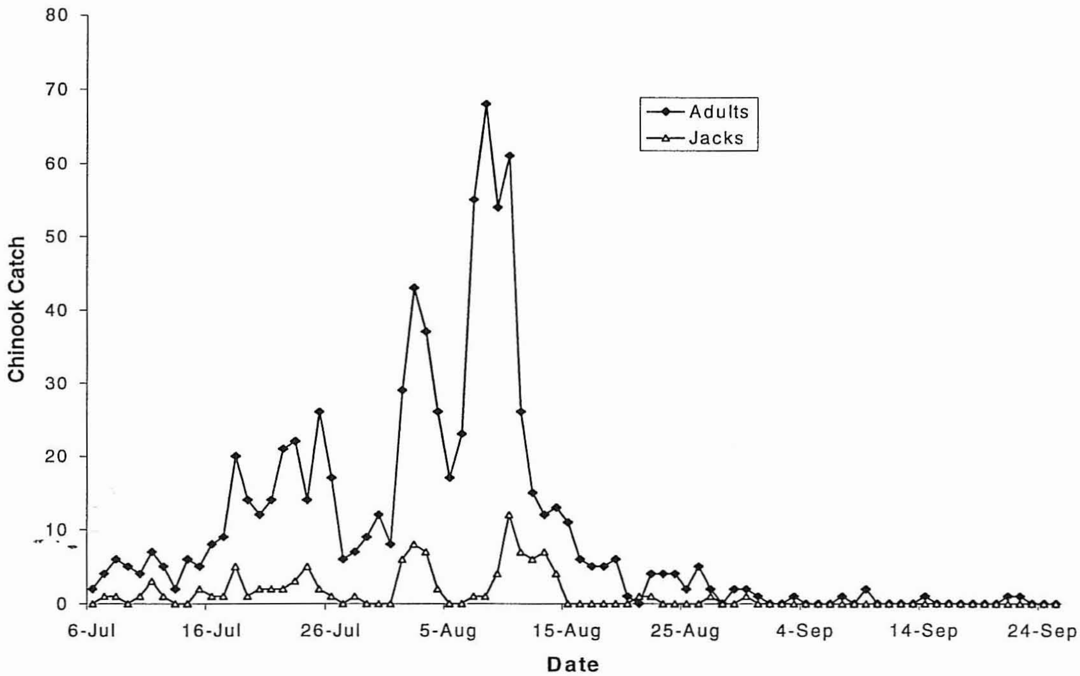

Figure 6a. Chinook run timing, based on fishwheel catch data, Klinaklini River, 2000.

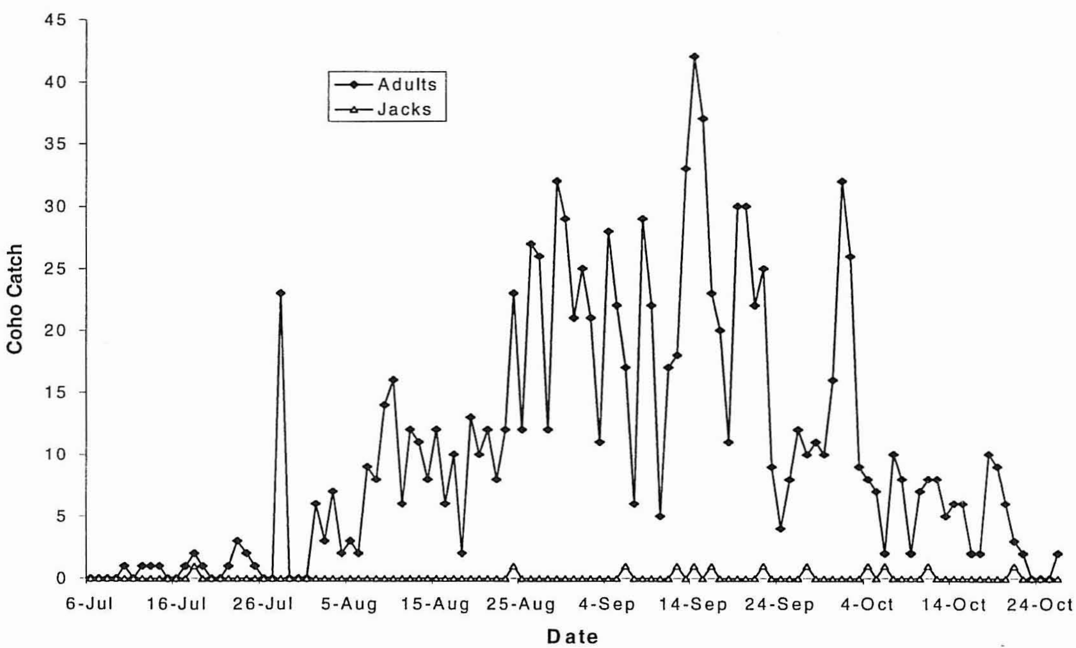

Figure 6b. Coho run timing, based on fishwheel catch data, Klinaklini River, 2000.

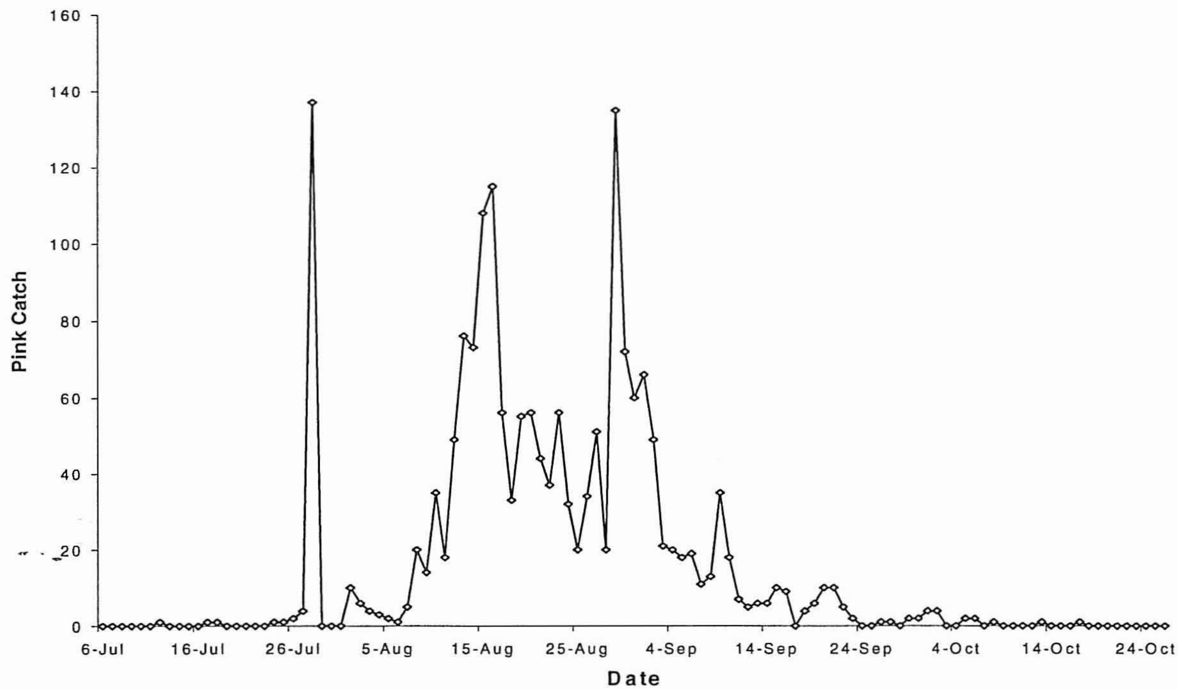

Figure 6c. Pink run timing, based on fishwheel catch data, Klinaklini River, 2000.

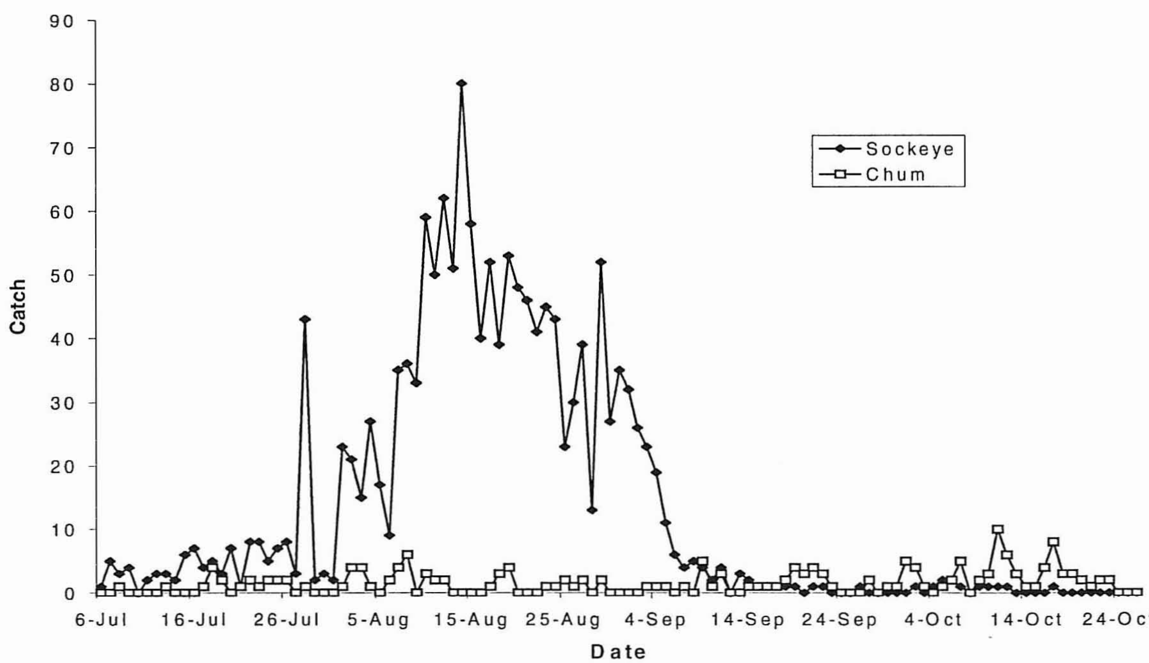

Figure 6d. Sockeye and chum run timing, based on fishwheel catch data, Klinaklini River, 2000.

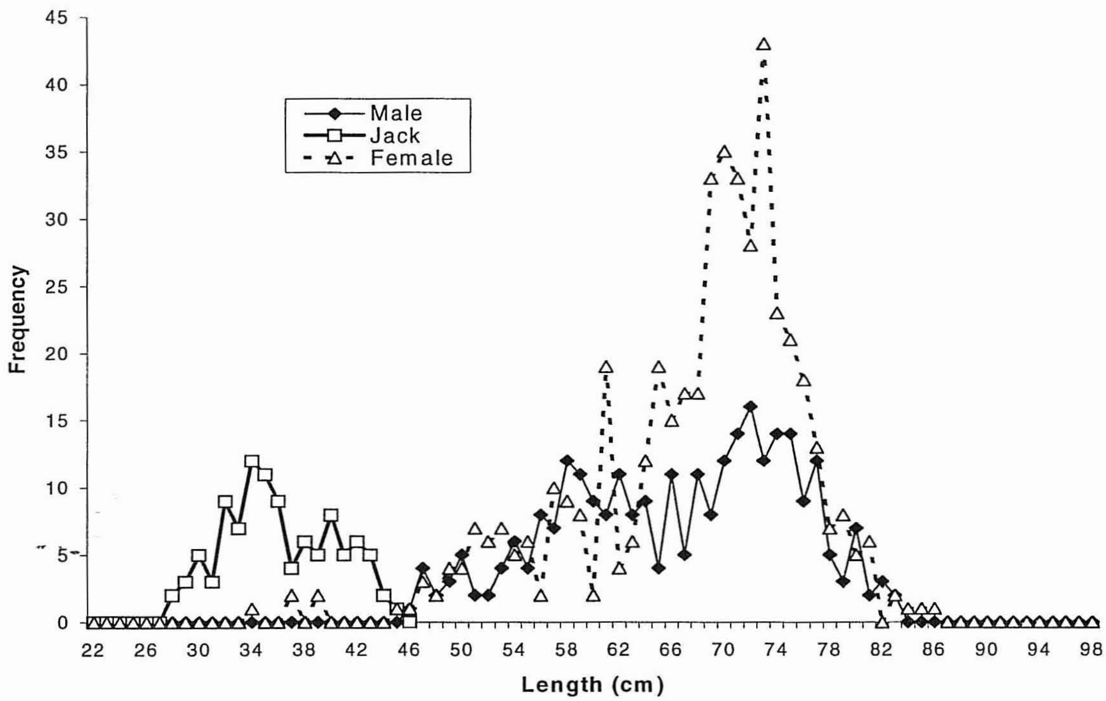

Figure 7a. Length frequency distribution of chinook captured by the fishwheel.

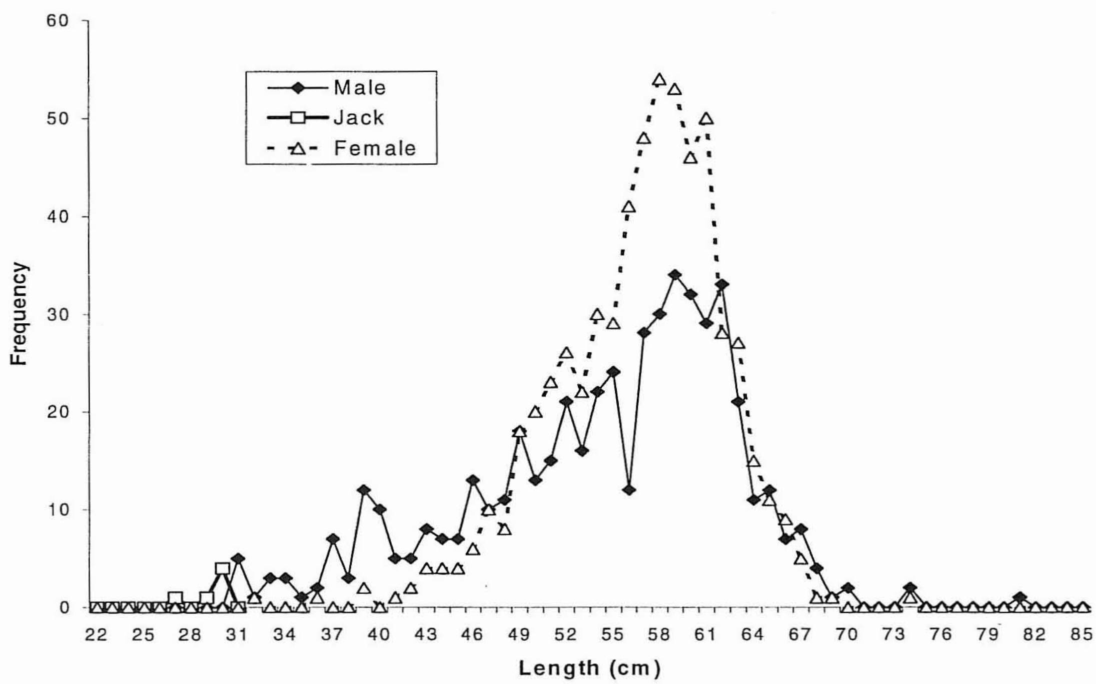

Figure 7b. Length frequency distribution of coho captured by the fishwheel.

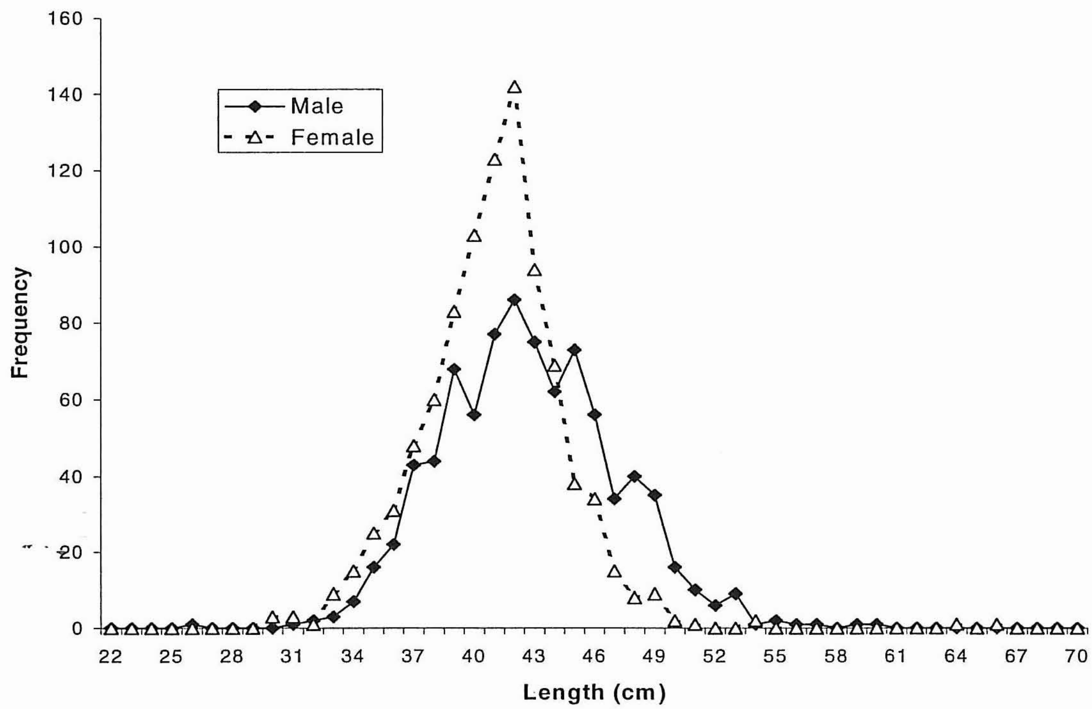

Figure 7c. Length frequency distribution of pink captured by the fishwheel.

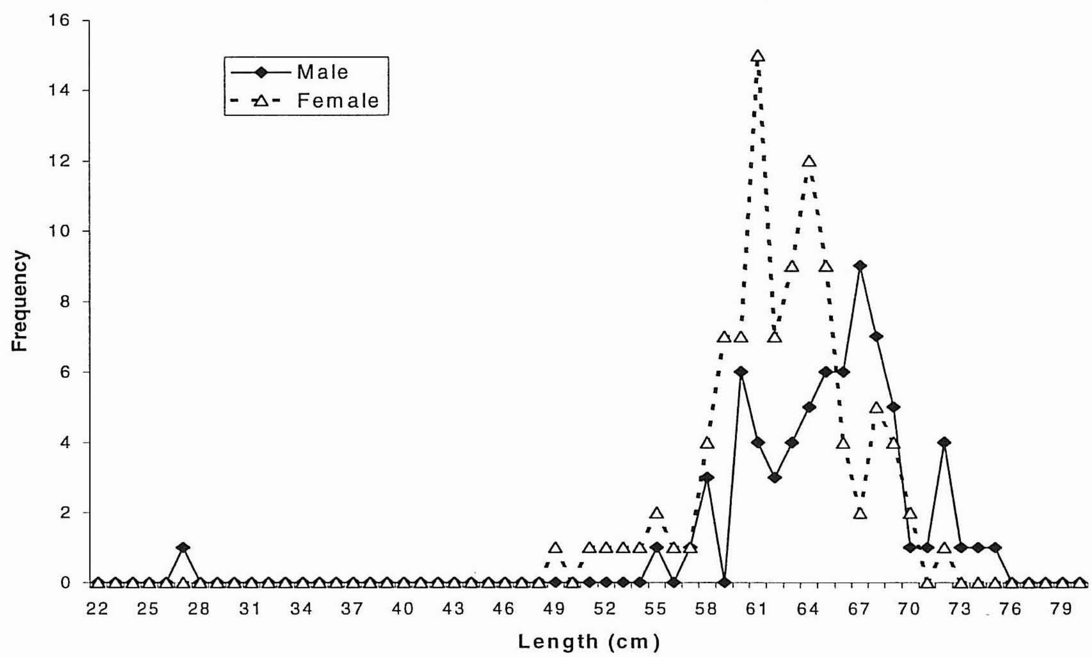

Figure 7d. Length frequency distribution of chum captured by the fishwheel.

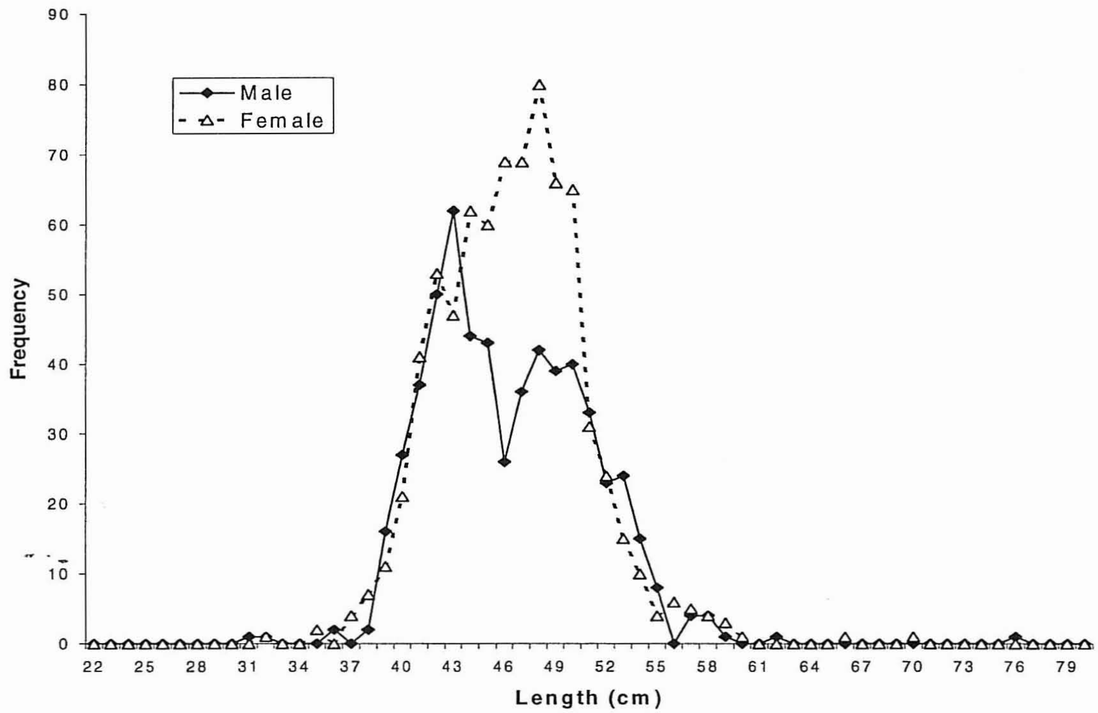

Figure 7e. Length frequency distribution of sockeye captured by the fishwheel.

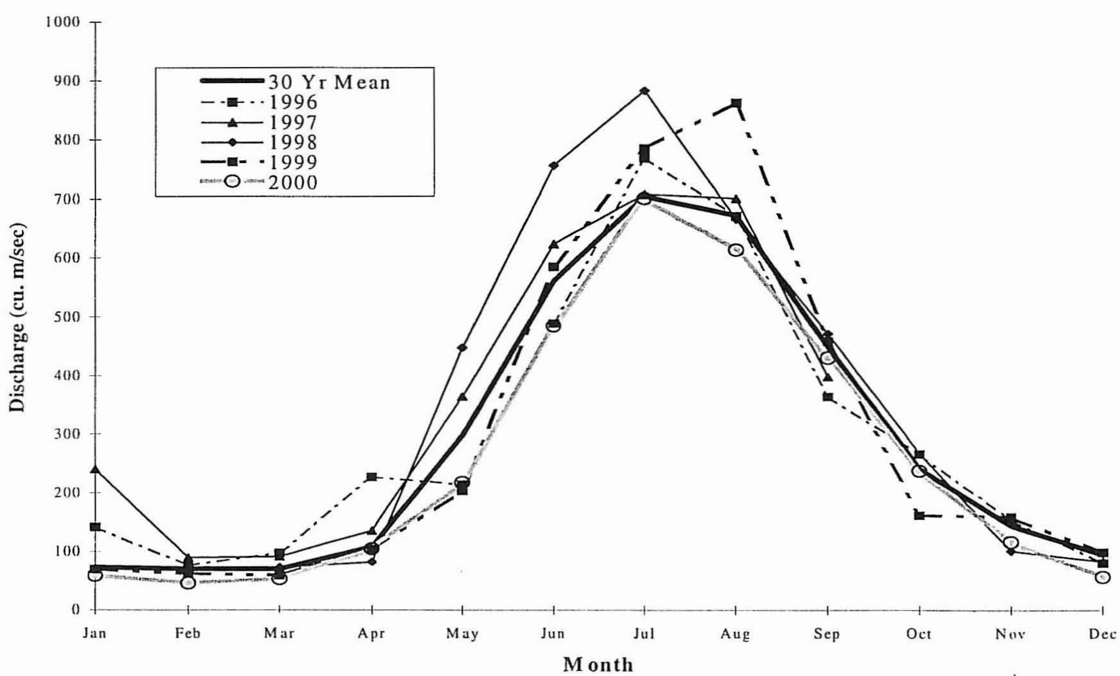

Figure 8. Klinaklini River discharge.

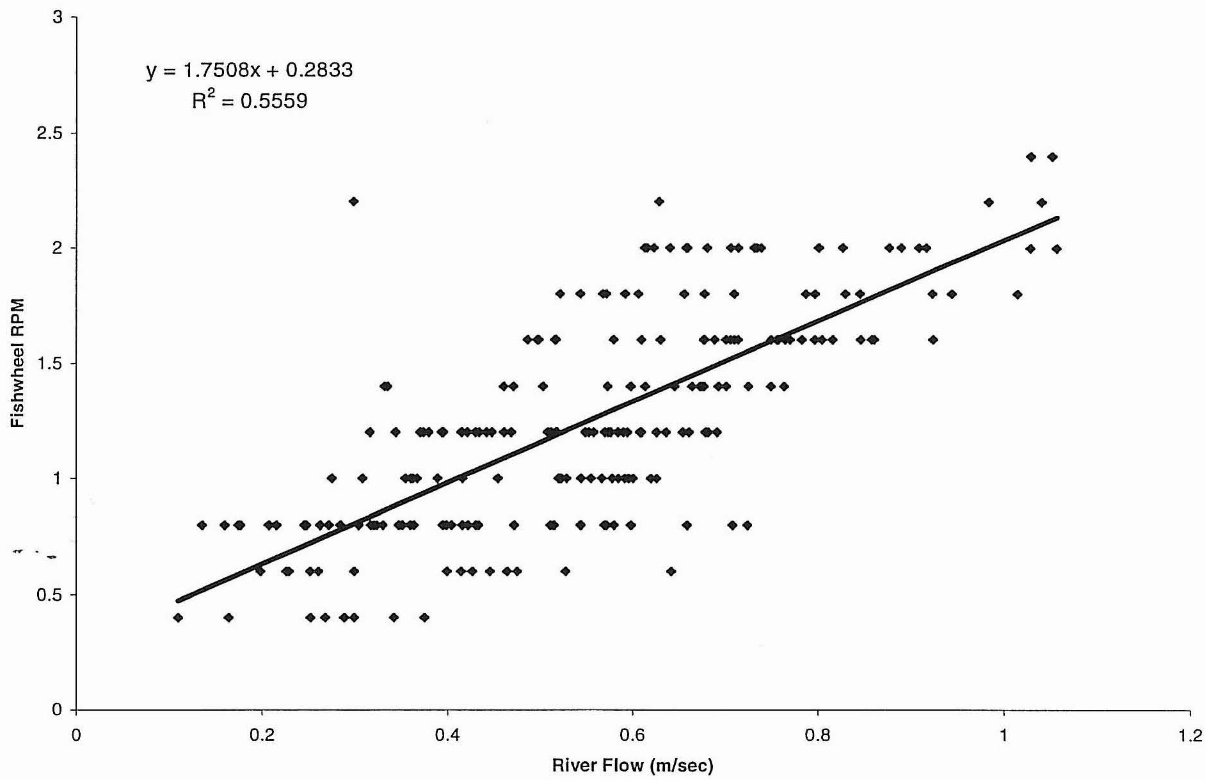

Figure 9. Fishwheel rotational speed related to river flow, Klinaklini River, 2000.

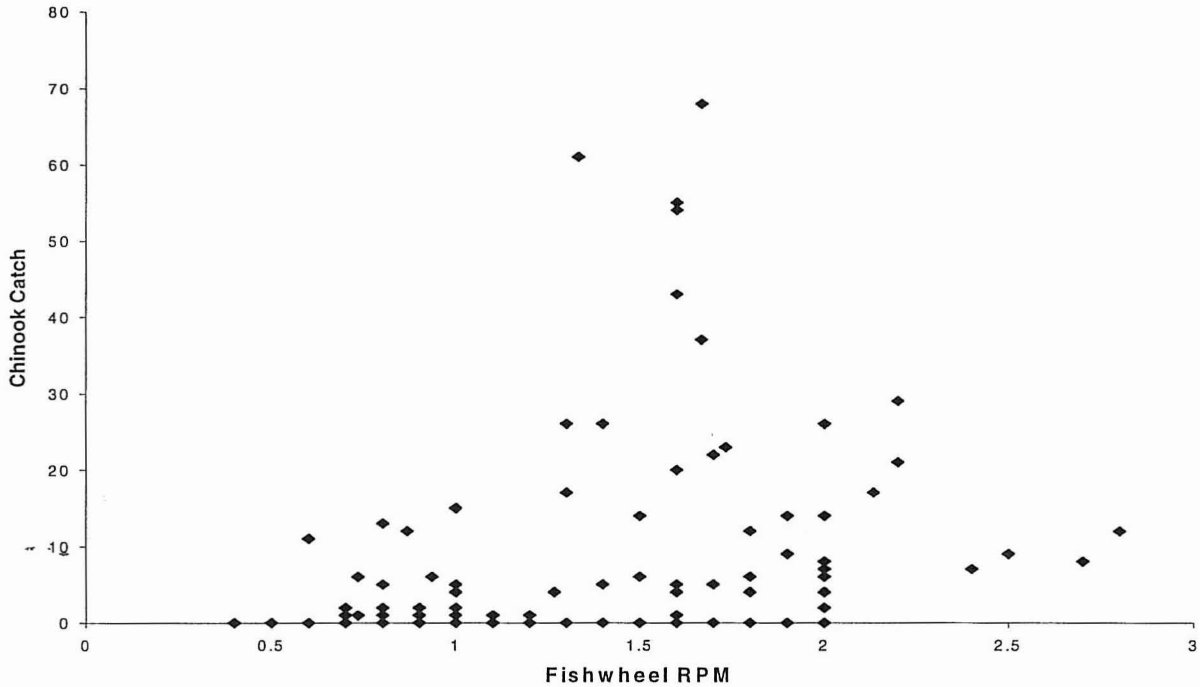

Figure 10a. Fishwheel rotational speed related to chinook catch, Klinaklini River, 2000.

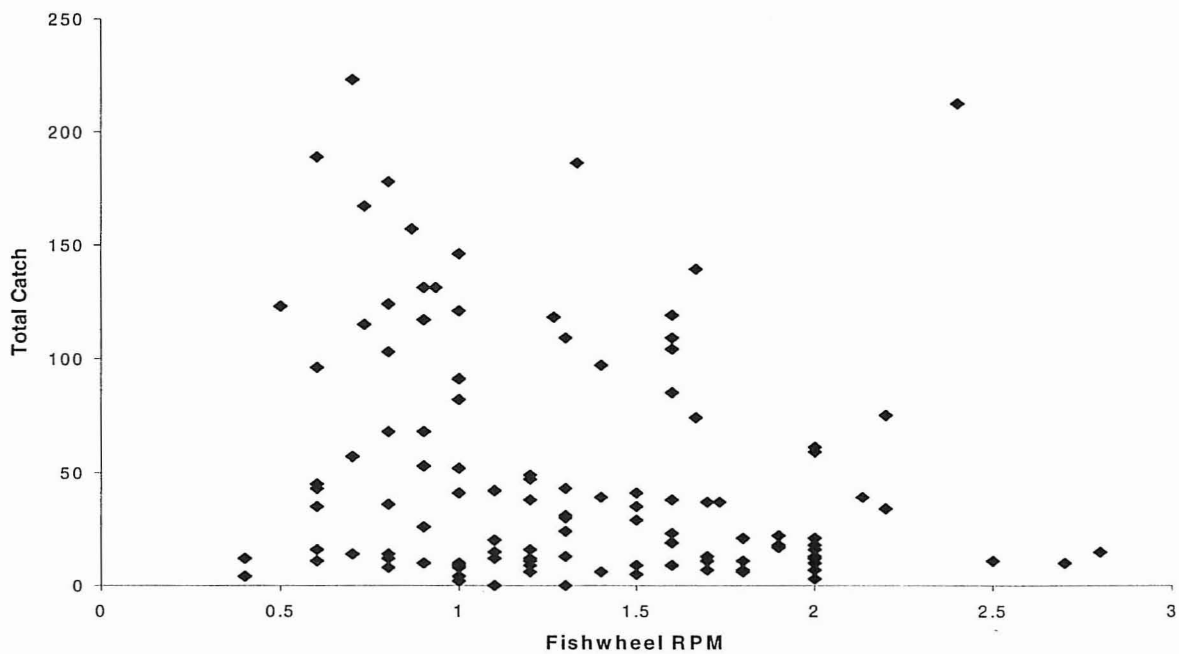

Figure 10b. Fishwheel rotational speed related to total catch, Klinaklini River, 2000.

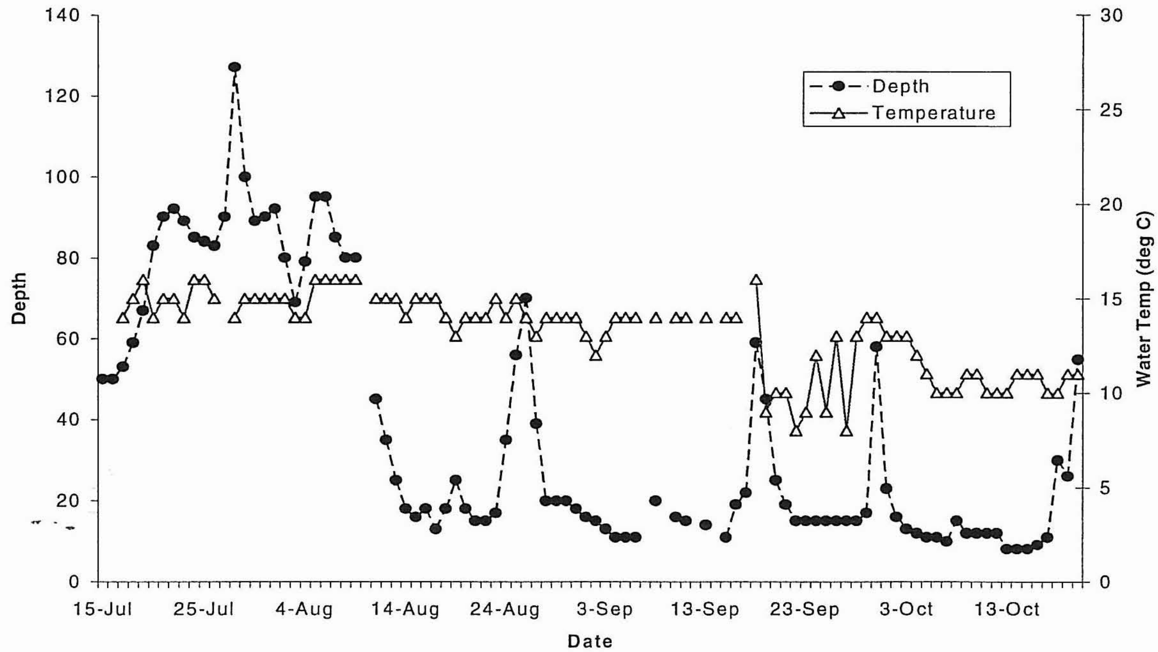

Figure 11. Mussel Creek environmental data, 2000.

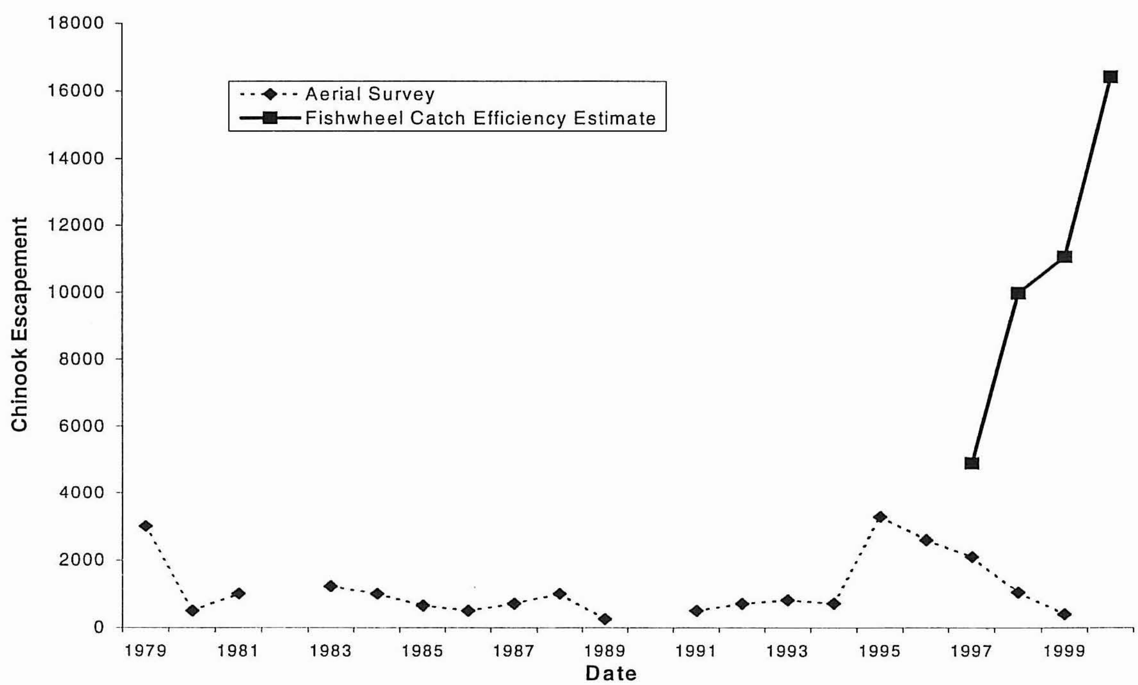

Fig. 12. Chinook escapement estimates to the Klinaklini system, 1979 to 2000.