THE HISTORY OF SUBSISTENCE AND COMMERCIAL FISHERIES, STOCK ASSESSMENT AND ENHANCEMENT ACTIVITIES, AND WATERSHED DISTURBANCES IN THE KLAWOCK LAKE DRAINAGE ON PRINCE OF WALES ISLAND,

2000 ANNUAL REPORT

by

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2 This report supersedes and corrects the previous version dated December 2001.

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ABSTRACT

The Klawock Lake Sockeye Salmon (*Oncorhynchus nerka*) Subsistence Project (Study Number FIS00-043) was initiated in 2000. This project was implemented because of concerns about the apparent declines in sockeye salmon returning to Klawock Lake. This report summarizes historical information about the Klawock Lake watershed including a history of the subsistence and commercial fisheries, hatchery enhancement activities, sockeye and coho salmon stock assessments, and watershed assessments. The historical information will be used to evaluate the current status of the sockeye salmon stock and to help identify potential limiting factors in sockeye salmon production. Any limiting factors identified by this project will provide direction to begin rebuilding the Klawock Lake sockeye salmon stocks as funding becomes available.

Key words: sockeye salmon, *Oncorhynchus nerka*, Klawock River, Klawock Lake, Prince of Wales Island, stock assessment, limnology, zooplankton, hatchery, harvest, subsistence, watershed assessment, escapement, hydroacoustic

INTRODUCTION

The Klawock Lake sockeye salmon *(Oncorhynchus nerka*) stock has been important to all fishers of the area for over 100 years. Historical stock assessment efforts encompassed a wide range of activities including lake limnology, weir enumeration, smolt and adult age and size data, coded-wire-tag data, hydroacoustic estimates of sockeye salmon fry populations, and watershed assessments. Despite assessment and enhancement efforts in the Klawock watershed, sockeye salmon returns to the lake continue to remain below historical levels. Annual Klawock River sockeye salmon escapement estimates dropped from a historical high of over 65 thousand fish observed in 1936 to 10,000 fish or less annually during the past 20 years. The Klawock Lake Sockeye Salmon Subsistence Fishery Project (FIS 00-043) outlines a set of objectives to assess the condition of the Klawock sockeye salmon stock and recommends management actions to rebuild these stocks. Because the history of human activity is complex, one of the objectives is to compile a summary of historical activities. This paper summarizes historical fishery harvest data, the development of stock assessment information, hatchery and enhancement activities, and habitat alteration within the Klawock watershed.

STUDY SITE

The Klawock River system (ADF&G stream number 103-60-047) is located on the southwestern side of Prince of Wales Island (55^{o}32’58” N., 133^{o}02’39” W.; Figure 1). The lake has a surface area of 11.9 km^2, an elevation of 9.1 m, a mean depth of 17.7 m, and a max depth of 49 m (Figure 2). The lake water is organically stained and has a volume of 209 x 10^6 m^3. The mean euphotic-zone depth is 4.2 m, based on 1986–1988 limnological data. There are four main tributaries to Klawock Lake: Hatchery Creek, Half-Mile Creek, Three-Mile Creek, and an unnamed creek at the head of the lake referred to herein as Inlet Creek. Klawock Lake is divided into two basins: Basin A and Basin B. Basin A, near the outlet, contains sample stations A and C, and Basin B contains sample stations B and D (Figure 2). Basin A has a maximum depth of 30 m and is generally shallower than Basin B with a maximum depth of 49 m. Basin A is fed by three of the four larger streams on Klawock Lake. Only Inlet Creek at the head of the lake flows into Basin B. The drainage area for Basin A and B is 76.1 km^2 and 37.6 km^2 respectively. The lake empties into Klawock Inlet via the Klawock River (2.85 km). Native fish species include cutthroat trout (*Oncorhynchus clarki* spp.), Dolly Varden (*Salvelinus namaycush*), three spine stickleback (*Gasterosteus aculeatus*), cottids (*Cottus* sp.), steelhead (*O. mykiss*), and pink (*O. gorbushka*), chum (*O. keta*), coho (*O. kisutch*), and sockeye (*O. nerka*) salmon. Escapement estimates and historical high salmon escapement estimates by species are presented in Tables 1 and 2.

Additionally, a species of mysid shrimp (*Neomysis mercedis*) have been confirmed in samples collected in 1973–1974, during mid-water trawl sampling in 1987–1988 (unpublished data, Tim Zadina and Meg Cartwright).

HARVEST HISTORY

Early Commercial Harvest History – Pre-Statehood

The well-documented pattern of extensive salmon harvest at the turn of the century probably initiated the decline of salmon stocks in this region. Although, records of Klawock Lake sockeye salmon commercial harvests were sporadic before 1930, Moser (1898) and Roppel (1982) provide excellent historical reviews of early harvest and hatchery activities associated with this stock. A saltery opened in 1868 and was operated at Klawock until 1878 when the North Pacific Trading and Packing Company purchased the site. This company built the first cannery in Alaska that same year, initiating the salmon packing business in Southeast Alaska. In the late 1800s, Moser estimated that about 80,000 sockeye salmon could be taken from Klawock Lake annually. The principal sockeye salmon supply sources were the home stream (Klawock River), Hetta Lake, and Sarkar River. Cannery operations recorded significant harvests between 1886 and the late 1920s with a mean harvest of 36,000 fish (1886–1898) and a peak harvest of 62,600 sockeye salmon in 1888 (Moser 1898). There were undocumented harvests for approximately 20 years prior to these records. The stream was barricaded for years but as the run became depleted the barricades were removed and the stream was less extensively fished (Moser 1898). It was a common practice at that time to barricade streams completely with a modified weir and harvest all returning salmon. During the early years of operation the cannery packed between 12,000 and 16,000 cases of sockeye salmon per year (with approximately 13 fish per case). The total annual cannery pack cannot be attributed exclusively to Klawock River stock because other sockeye salmon stocks were included in the production. In the 10 years of active harvest prior to 1898 the mean annual harvest was 41,700 sockeye salmon (Figure 3), (Moser 1898). In 1896 a second cannery at nearby Hunter Bay began operation and increased harvest pressure on streams near the south end of Prince of Wales Island.

Commercial Harvest – Since Statehood

The ADF&G has accurate records of commercial fishery catches from 1960 to the present. However, it is difficult to separate catches destined for the Klawock drainage from other sockeye systems in the area. Efforts to estimate the commercial harvest component of Klawock River sockeye salmon using coded wire tags (CWT) were unsuccessful. Klawock Lake sockeye salmon were coded-wire-tagged as hatchery reared fry or pre-smolt, or mixed wild and hatchery smolt from 1988–1998. During that time 215,000 CWT sockeye salmon were released (Table 3). An additional 11.4 million unmarked, non-CWT sockeye salmon were also released and were represented by the CWT releases. A few tags were recovered from returning adults at the hatchery but there was no substantial organized sampling effort. Sampling occurred when only adipose fin clipped fish were recovered and no simultaneous enumeration of unmarked fish was conducted. This collection method invalidates the statistical expansion of the commercial harvest and escapement. Additional problems included minimal tag recoveries in the commercial fisheries. The majority of these commercially harvested CWT sockeye salmon were delivered to remote transfer stations that incorporated fish from multiple fishing districts. Over 11 years a total of 66 tags in the commercial fishery and 87 tags at the weir (Table 4) were recovered out of the 215,000 tagged fish released. Based on 12% marine survival, the estimated tagged fish returning as adults would be 25,800. The total tags recovered represented 0.6% of the estimated available tags. These expensive CWT efforts have yielded little useful information. The ADF&G does not recommend sockeye salmon CWT for harvest estimations. The department discontinued sockeye salmon CWT efforts in Southeast Alaska because of these adult evaluation problems, mortality associated with tagging smolts, and no funding source for the recovery of CWT sockeye salmon as returning adults.

Subsistence Harvest

Sockeye salmon returning to Klawock Lake continue to be important to the indigenous people in the region. Subsistence catches have been reported on permits issued by the Alaska Department of Fish and Game (ADF&G) since 1969. The reported catch of sockeye salmon and the total number of permits issued have fluctuated annually since 1969 (Table 5). The catch per unit effort (CPUE; the catch per returned permit) increased from 1984 to 1997 from 10 to 38 and declined for the next three years to 27 (Figure 4). The reported sockeye salmon subsistence harvest ranged from 454 to 6,661 fish each year with harvests between 1,700 to 3,000 fish more common. The majority of the reported sockeye salmon harvest (>90%) is taken in the estuary but the entire Klawock Lake drainage is open for subsistence fishing.

The ADF&G, Commercial Fisheries Division, Ketchikan Area Office issues subsistence salmon fishing permits for Klawock Lake salmon. Individual and household possession limits have varied since permits were first issued in 1969. Current permit conditions allow for individual and household possession limits of 10 and 20 sockeye salmon, respectively. The current listed legal subsistence fishing gear in this area includes hand purse seines, beach seines, and dip nets. The Klawock subsistence fishery season is open July 7 through July 31 from 8:00 a.m. Monday to 5:00 p.m. Friday (Regulation 5 AAC 01.710). This regulation was implemented in 1986 due to concerns that sockeye salmon were being taken on the weekend by people from urban areas. Regulation 5 AAC 01.750 additionally restricts the size of motor to 35 horsepower or less when subsistence fishing in the Klawock area. In 1986 the Klawock local advisory committee submitted a proposal to close Klawock Harbor to large seine power skiffs for harvesting salmon for subsistence purposes. The proposal indicated that these large power skiffs were used to harass the fish and presented a dangerous situation to other subsistence users. The board addressed this issue during a special meeting in April 1987. During deliberations, there was also concern that large horse-powered skiffs could tow large seines. An amendment was offered and passed to limit engine size (Nancy Ratner ADF&G, personal communication).

Sport Harvest

Sport fishing for sockeye salmon on the Klawock system was closed in 1986. This closure was implemented due to concern that sport fishing competed and interfered with subsistence fishing activities (Steve Hoffman ADF&G, personal communication). Prior to 1986, sport fishing harvest estimates accounted for less than 1% of the Klawock River sockeye salmon total harvest estimates (McGregor and Van Alen 1987; McGregor 1983; McGregor, McPherson, and Clark 1984; McPherson, McGregor, and Bergander 1988).

SOCKEYE SALMON STOCK ASSESSMENT

A sockeye salmon stock assessment and enhancement program was conducted from 1986–1988 with funding from the U.S./Canada Pacific Salmon Treaty. The stock assessment program included adult migration timing and survival, enumerating adult returns by brood year, lake limnology studies, and fry and smolt enumeration by size and age. Enhancement activities included sockeye salmon egg takes and fry stocking and are covered under the section on enhancement.

Adult Return Estimates

There are no estimates of escapement into the lake prior to 1930. Weir data from 1930–1938 show a mean annual sockeye salmon escapement estimate of 30,000 fish (Table 1). The highest estimated sockeye salmon escapement occurred in 1936 with a total escapement of 65,314 fish (Hawkins 1936). Stream survey and escapement notes document the presence of sockeye salmon in the lake in the 1950s and 1960s (Headlee et al. 1950–1961) but these numbers are not useful in establishing run characteristics.

In more recent times, a weir on the Klawock River, adjacent to the hatchery, has intermittently operated from 1977 to the present. Weir counts represent a minimum number of fish returning to Klawock Lake because of high water events and the discontinued use of the weir before and after the brood stock was collected (Table 2, Appendix 1). The Klawock River is subject to high flow events; generating water flows over and around the weir allowing fish to pass undetected. Prior to 2000, the weir terminus farthest from the hatchery had a gap between the structure and the upper stream bank that was lower than the top of the weir. This low area was filled in 2000 to a height equivalent to the weir top. Secondly, the pickets were often removed after brood stock collection was completed but prior to the end of fish migration. In some years (1977, 1980, 1986, and 1988) the weir was not installed until late July or August (Appendix 1). Migration timing data from when the weir was operational during July shows that approximately 20% of the run passes prior to August 1. Pickets were also removed when fish overwhelmed the weir and associated raceways. On occasion, the number of undetected fish passing through the weir was estimated without any idea of how many fish were present.

Limnology

Limnology data was collected in 1974 (zooplankton only), 1979, and 1981 (water chemistry only), 1986–1988 and in 2000. Limnology samples collected during 1986–1988 were collected at stations A and B (Figure 2). In 2000, samples were collected at all four stations: A, B, C, and D (Figure 2). Limnological parameters were collected and measured using standard methods outlined by Koenings et al. 1987. Physical parameters included temperature, dissolved oxygen, and vertical light penetration. Water quality parameters included: conductivity, pH, alkalinity, turbidity, color, calcium, magnesium, iron, total phosphorous (TP), total filterable phosphorous (TFP), filterable reactive phosphorous (FRP), total particulate phosphorous (TPP), total kjeldahl nitrogen (TKN), ammonia, nitrate plus nitrite, reactive silica

(RSi), and carbon. In addition, total nitrogen (TN) was calculated by summing of total kjeldahl nitrogen (TKN) and nitrate plus nitrite from each sample (Appendix 2).

General Water Quality, Metals, and Nutrients

Klawock Lake is a typical stained, oligotrophic coastal Alaskan lake. Calcium, magnesium and iron concentrations ranged from 3.4 to 5.9 mg $\cdot$ L^{-1}, 0.4 to 0.8 mg $\cdot$ L^{-1}, and 11 to 160 *u*g $\cdot$ L^{-1} respectively (Appendix 2). These general water quality characteristics are considered low compared to other Southeast Alaskan lakes (Zadina and Heinl 1999, Zadina and Weller 1999).

Phosphorus was the primary element controlling lake productivity because it was the least abundant element of the nutrients required for algal growth in Klawock Lake. The concentration of total phosphorous ranged from 3.8 to 12.4 *u*g $\cdot$ L^{-1}. Nitrogen is also essential for phytoplankton production. The concentration of total nitrogen ranged from 86 to 148 *u*g $\cdot$ L^{-1}. These nutrient concentrations are typical of Southeast Alaska oligotrophic lakes (Zadina and Heinl 1999, Zadina and Weller 1999).

Temperature and Dissolved Oxygen

Water temperature and dissolved oxygen vertical profiles were collected in Klawock Lake in 1974, 1986–1988, and 2000 (Figures 5 and 6). Typical of coastal lakes in Southeast Alaska, Klawock Lake is dimictic, stratifying in the summer, inversely stratified in the winter, and becoming a free-flowing, isothermic water body in the fall and spring. The peak epilimnetic temperature averaged about 17^{o}C. Hypolimnetic temperatures varied between 5°C and 7^{o}C at station B, the deeper of the two sample stations. Dissolved oxygen (DO) levels range between 70% and 90% saturation (6.0 and 11.0 mg $\cdot$ L^{-1}) with a low of 42% saturation (5.13 mg $\cdot$ L^{-1}) at a depth of 25 m with a temperature of 7.4^{o}C recorded at Station A on June 27, 2000. This low DO may be attributed to a reading close to the detritus filled bottom where anaerobic activity occurs. All recordings at least 5 m above the lake bottom do not exceed the lethal DO levels for salmon.

Light Penetration and Euphotic Zone Depth

Measurements of under water light penetration (footcandles) were recorded in 1986–1988 and 2000 at stations A and B in Klawock Lake. The 1% light level was averaged over the season to obtain a mean euphotic zone depth (Table 6). Measurements and calculations of euphotic zone depth (EZD) are described by Zadina and Weller, 1999.

Primary Productivity

Primary productivity parameters include chlorophyll *a* (chl *a*) and phaeophytin *a*. Algal biomass, essential for sockeye salmon nursery lakes, is defined as the phytoplankton standing crop and is represented by the algal pigment production of chlorophyll a. Chl *a* concentrations ranged from 0.40 to 2.84 $ug \cdot L^{-1}$ in Klawock Lake. These low concentrations are also typical of Southeast Alaska oligotrophic lakes (Zadina and Heinl 1999, Zadina and Weller 1999). However, chl *a* degrades to phaeophytin *a* from changes in light, temperature, and pH. This inactive pigment can bias estimates of chl *a* and was therefore included in the tests. Phaeophytin *a* concentrations ranged from 0.14 to 1.25 $ug \cdot L^{-1}$ (Appendix 2).

Zooplankton

Secondary productivity parameters included zooplankton species composition, density, and biomass. The zooplankton assemblage of Klawock Lake was sampled in 1973–1974, 1986–1988, and 2000. The 1973–1974 sample was collected by ADF&G sport fish division and focused on benthic invertebrates and their relationship with trout production and did not include units of measurement of zooplankton (ADF&G 1974). Consequently, this zooplankton data cannot be directly compared to data collected by the limnology section of the division of commercial fisheries in subsequent years.

The Klawock Lake zooplankton community is dominated by copepods (*Cyclops* spp. and *Epischura* spp.) followed by cladocerans (*Bosmina* spp. and *Daphnia longerimus*; Figures 7 and 8). The species composition remained constant during all years sampled. In all samples, Station A had a lower mean weighted zooplankton biomass than Station B (Figure 7). Replicate tows were performed at Station A and Station B during the 1986–1988 sampling period only. In 2000, the sample design was changed and a single zooplankton tow was performed at all four stations (Stations A and C in the north basin and Stations B and D in the southern basin). In a paired *t*-test of the 2000 zooplankton data, the basin containing Stations B and D had a significantly higher mean weighted zooplankton biomass ($P < 0.05$; df=1; t stat = -14.86) than the basin containing Stations A and C.

Rearing Juvenile Sockeye Salmon Population Estimates

Hydroacoustic surveys and mid-water trawl sampling provided estimates of the distribution and abundance of rearing sockeye salmon fry. These activities were conducted using methodology described in Zadina et al. (1992) for surveys conducted prior to 1990 and Zadina and Weller (1999) from 1991 to present. Hydroacoustic and mid-water trawl sample analysis (Table 7) show significant variation in fry densities between years sampled. Coho salmon were present in mid-water trawl samples in 1987.

Smolt Estimates

In 1987–1988 and 1995 migrating sockeye salmon smolt were coded-wired-tagged in the Klawock River. Mixed hatchery and wild smolt were captured using a 2 m x 2 m x 8 m long fyke net that was attached to the back of the weir structure and set close to the farthest shore from the hatchery. The fyke net was operated intermittently often starting at dusk and fishing until shortly after midnight when enough fish were collected for tagging the next day. There was no effort to generate a population estimate from this work. A sub-sample of sockeye salmon smolt were measured to the nearest millimeter, total length and weighed to the nearest gram, wet weight. Smolt scales were analyzed to generate a population age structure estimate. The sockeye salmon smolt population was dominated by age-1 fish (70%-83% of population) in all years sampled (Table 8).

Adult Sockeye Salmon Population Age and Size Structure

ADF&G standard age, weight, and length (AWL) sampling was conducted from 1978–1997 to collect data on adult population age structure, sex ratios, and fish size at age as described in McGregor (1983). Because results are presented by brood year rather than return year, only the years 1982–1991 provide complete data. The sockeye salmon population age structure by brood year was dominated by 44% age-1.3 fish, followed by 23% age-1.2 fish (Table 9). The average sex ratio was 48% male and 52% female (Table 10). The mean length increased with total age (freshwater and marine) for males and females regardless of years spent in freshwater (Table 10).

ENHANCEMENT HISTORY

In recognition of the monetary potential of the Klawock River sockeye salmon population, the North Pacific Trading and Packing Company attempted to enhance the sockeye salmon run by building a hatchery in 1897. Early hatchery operations were plagued with problems. The original Klawock hatchery was located at the outlet of Klawock Lake. During the first year of operation, problems with the water supply resulted in only 800,000 sockeye salmon fry produced from 2.02 million eggs. The hatchery water supply was obtained from lake surface waters, which that year averaged 19 ^{o}C. In order to correct water supply problems the hatchery was relocated to Three-Mile Creek the next year. The hatchery had a capacity of 3.60 million eggs until 1908 when it was enlarged to accommodate 8.00 million eggs. Problems with operating a hatchery in this area continued, including difficulties with freezing of the water system and eggs. Fish were released as sac-fry and no attempt was made to feed fry during the first 16 years of operation. Releases were conducted by dumping buckets of 20,000–25,000 sac-fry into the lake margins and the shores of islands, in depths of three to five feet. The Bureau of Fisheries did not endorse this method and repeated attempts to get hatchery managers to hold fish longer were unsuccessful (Moser 1898). From 1897 to 1916 egg takes averaged 3.0 million eggs with a maximum of 7.82 million eggs taken in 1916. This hatchery was abandoned in 1917 not because of technical inefficiencies but due to the inability to obtain and keep a hatchery superintendent (Roppel 1982).

A bond issue was authorized for the construction of the current Klawock hatchery in 1976. Construction began in 1977 and in 1978, ADF&G, FRED reinitiated enhancement efforts at that facility. In the beginning this hatchery was operated as a chum and coho salmon production facility with a goal to produce 1 million chum and 60,000 coho salmon. Steelhead trout and sockeye salmon culture activities were commenced in 1980. The hatchery operations and facilities were passed from State ownership to the city of Klawock in 1993. Management was subsequently transferred to the city of Craig in 1994 until 1996 when it was transferred to the private non-profit Prince of Wales Hatchery Association (PWHA), thus becoming the Prince of Wales Hatchery. This transfer occurred because of serious budget cutbacks in the state operated hatchery program.

The first sockeye salmon egg-take occurred in 1979 when there were 72 thousand eggs collected as part of a wildlife vaccine program. Sockeye fry not used in that program (18,400 fish) were released into Klawock Lake in 1980. In 1986 a team composed of ADF&G commercial, sport and FRED division personnel and native representatives developed the Klawock River Sockeye Rehabilitation and Management Plan. The primary goal of the plan was to develop a run of 50,000 sockeye salmon by 1996. Sockeye salmon production began as an ongoing rehabilitation program in 1987. The current hatchery has produced a total of 11.43 million juvenile sockeye salmon ranging from 200,000 to 2.73 million annually (Table 11). The 1992 "Klawock Lake Hatchery Five Year Plan" (FRED 1992) further guided hatchery production. A variety of release strategies were employed including emergent unfed-fry, fed fry, pre-smolt, and smolt. Emergent fry releases have been the dominant strategy employed by the current sockeye salmon rehabilitation program. There has been little evaluation conducted to quantify the success of these efforts.

The proportion of hatchery production compared to natural production for juvenile or adult sockeye salmon has never been determined. In 1999 the hatchery began thermal otolith marking the hatchery-produced sockeye salmon (John Bruns PWHA, personal communication). This effort is intended to quantify the proportion of hatchery versus naturally produced sockeye salmon for out-migrating smolt and for returning adults. No results from thermal otolith marking efforts are available at this time.

Severely depressed runs combined with early adult holding and egg viability problems limited initial success of the sockeye salmon rehabilitation program (Hansen et al. 1992). In 1987 there was an 81% (4,204 fish) mortality of adult sockeye salmon brood stock held in hatchery raceways (FRED 1988). Returning sockeye salmon were captured at the weir and held in the raceway for up to six weeks. Discussion at the 1988 Sockeye Culture Workshop centered on handling stress, environmental factors (including temperature and dissolved oxygen), and sockeye salmon maturation process but no specific cause of mortality was identified. It was suggested that the holding time required for fish to mature was too long and did not replicate natural conditions. The ADF&G recommended that future brood stock collection be conducted at the spawning streams in the lake (Mike Haddix ADF&G, personal communication; FRED 1988). During the first six years of operation, the average green-to-eyed egg survival rate was 46%. Low egg survival rates were attributed to water supply problems and poor quality eggs from adults held at the hatchery (Mike Haddix ADF&G, personal communication; FRED 1988). During the subsequent years, egg takes were moved from the hatchery facility to natural-spawning areas in Klawock Lake. This strategy resulted in minimal adult handling loss and better green-to-eyed egg survival rates (Mike Haddix and Carol Denton ADF&G, personal communication).

Coho salmon represent the majority of production at the Klawock River Hatchery with over 15.0 million juvenile fish produced between 1980 and 2000 (Table 12). Under the current hatchery ownership a portion of the annual coho salmon return is used in a cost recovery program, providing funds for facility management and operations. ADF&G fish age laboratory data showed that the hatchery-produced coho salmon represented greater than 90% of the Klawock River escapement in 1991 and 1992 (Craig Farrington ADF&G, memorandum to Carol Denton, ADF&G 1992). A variety of release strategies were employed during this period, which included releasing emergent unfed-fry, fed fry, pre-smolt, and smolt. In 1991, ADF&G personnel expressed concern that releasing large numbers (greater than 1 million) of juvenile coho salmon fry and pre-smolt into Klawock Lake could negatively influence the juvenile sockeye salmon population and enhancement activities through food competition or predation (Mike Haddix ADF&G, memorandum to Steve Hansen, Klawock hatchery 1991). At that time no action was taken. In 1998 the issue resurfaced and an alternative strategy to release smolt near the outlet stream was implemented in 1999. The intent was to minimize the potential interspecific interaction between juvenile coho and sockeye salmon. However, no follow-up studies have been conducted to determine if this strategy was successful. Although sockeye salmon fry have been found in the diet of juvenile coho salmon in other systems, the predator-prey size relationship determined the extent and intensity of this interaction (Ruggerone and Rogers 1992; McIntyre et. al. 1988). Sampling the diet of juvenile coho salmon in Klawock Lake across a range of sizes through time and space is needed to determine if juvenile coho salmon predation of sockeye fry is limiting sockeye salmon production in Klawock Lake. In addition to juvenile coho salmon, cutthroat trout have been identified as efficient predators capable of limiting the production of sockeye salmon in some lakes (Beauchamp 1994; Beauchamp et al. 1995; Cartwright et al. 1998). Although cutthroat trout are present in Klawock Lake, no population estimate or stomach content analysis has been performed to date. Identification of sockeye salmon fry predators and estimates of fry consumption could be the focus of future studies.

PATHOLOGY

The ADF&G, commercial fisheries pathology laboratory periodically performed diagnostic tests on Klawock River hatchery sockeye and coho salmon from 1978–1997. Some of the tests were fact finding while others occurred during periods when erratic behavior or abnormal mortalities were observed in hatchery-reared fish. Tests for fish pathogens included: bacterial agents *Aeromonas sp.*, *Yersinai ruckeri*, flexibacter and *Pseudomonas sp.;* bacterial diseases have included bacterial kidney disease (BKD) caused by *Renibacterium salmoninarum* and Furunculosis caused by *Aeromonas salmonicida*; one viral disease, caused by infectious hematopoietic necrosis virus (IHNV) occasionally occurred in sockeye salmon fry and was isolated from returning chum salmon; protozoan parasites included *Costia*, *Hexamita*, and *Trichondia*; and environmental diseases included gas bubble disease and mechanical gill hyperplasia. The results of this pathology work are presented in Tables 13 and 14 (Theodore Meyers, personal communication). Pathology tests to date have shown that IHN and BKD have periodically caused fish health problems at the Klawock hatchery but not at unusually high levels as to significantly impact successful fish culture when necessary precautions have been taken (Theodore Meyers, personal communication).

HABITAT ASSESSMENT

Historic Watershed Habitat Assessment

The "Anadromous Stream Catalog of Southeastern Alaska" (Edgington and Larson 1979) included a May 1977 survey of the tributaries to Klawock Lake. This survey provided detailed stream channel and bank features including available spawning area (ASA). The survey was conducted prior to logging and road building activities in the watershed. Three-Mile Creek had 5,846 m^2 of ASA, with numerous large woody debris scattered throughout the cataloged area. The presence of coho fry was also documented during this survey. No temperature or pH data were documented on Three-Mile Creek. Half-Mile Creek had 3,371 m^2 of ASA, including numerous large woody debris throughout the survey area, a water temperature of 8.8^{o}C, and a pH of 7.75. The presence of coho salmon fry was documented and sockeye salmon bones were also identified. The inlet stream at the head of the lake had 2,640 m^2 of ASA, a water temperature of 10.5^{o}C, and a pH of 7.5. Large woody debris was numerous throughout the survey area and the presence of coho salmon fry was documented. Hatchery Creek was surveyed but no measurement of ASA was provided. This survey documented excellent rearing habitat mixed with extensive marsh and muskeg areas in the Hatchery Creek drainage.

Recent Watershed Habitat Assessment

The Central Council Tlingit and Haida Tribes of Alaska conducted an assessment of the Klawock Lake watershed in 2000. This project, funded by the U.S. Environmental Protection Agency (EPA), was implemented to quantify the effects of timber harvest, road building, and land development on the watershed and associated anadromous fish habitat. The USFS provided assistance through an interdisciplinary watershed assessment team on a Proper Functioning Condition (PFC) assessment of the streams and wetlands in the Klawock basin. The Klawock Lake watershed is 118.0 km^2 and composed of approximately 41% wetlands with the rest of the area historically covered by mixed conifer forest. A draft report of the PFC assessment conducted on 15.0 km of Half-Mile and Three-Mile Creeks discussed the results of that work (Table 15) (Lehner 2001). Hatchery and Inlet Creeks were also discussed in less detail. The assessment was categorized into three condition units, Proper Functioning Condition, Functional At Risk, and Non-Functional.

The Half-Mile Creek sub-basin encompasses 13.6 km^2, of which 12.9 km^2 are managed by the USFS, 0.7 km^2 of private property owned and managed by Klawock Heenya Inc. and 0.1 km^2 owned and managed by the Sealaska Corp. Only 0.1 km^2 of land have been harvested for timber and 0.5 km of road built in the Half-Mile Creek watershed. Half-Mile Creek was rated as being in Proper Functioning Condition (Lehner 2001).

The Three-Mile Creek sub-basin encompasses 21.1 km^2, of which the USFS manages 10.0 km^2 with the remaining 11.1 km^2 of private property owned and managed by Klawock Heenya, Inc. There has been 7.2 km^2 of land harvested for timber and 29.0 km of road built in the Three-Mile Creek watershed. These activities have resulted in landslides and debris torrents that have negatively impacted stream habitat (Lehner 2001). There have also been stream channel modifications in association with a housing development located on the Three-Mile Creek alluvial fan just upstream from Klawock Lake. Three-Mile Creek was rated as Functional At Risk due to several factors. Problems typically identified in this assessment included excessive bank erosion and stream deposition, lack of channel stability, upland watershed degradation due to timber harvest and roads, stream bank and upland timber harvest, lack of large woody debris (LWD) and LWD recruitment potential, and absence of riparian and wetland plants to protect banks from future erosion (Lehner 2001).

The Hatchery Creek sub-basin encompasses 19.8 km^2, of which 13.3 km^2 is owned and managed by Klawock Heenya, Inc. and 6.5 km^2 is owned and managed by Shaan Seet, Inc. There has been 6.4 km^2 of land harvested for timber and 26.6 km of road built in the Hatchery Creek watershed. The topography of the Hatchery Creek watershed is generally gentle but landslides have occurred in steeper areas of the basin. No Proper Functioning Condition assessment was conducted in the Hatchery Creek watershed (Lehner 2001).

The Inlet Creek sub-basin encompasses 9.6 km^2, of which the USFS manages 4.9 km^2 and 4.7 km^2 is owned and managed by Klawock Heenya, Inc. There has been 1.6 km^2 of land harvested for timber and 12.9 km of road built in the Inlet Creek watershed. At the time of this writing the results of the Proper Functioning Condition assessment were not available (Lehner 2001).

LITERATURE CITED

ADF&G (Alaska Department of Fish and Game). 1974. Sport fish investigations of Alaska: Inventory and cataloging of the sport fish and sport fish waters in Southeast Alaska. Alaska Department of Fish and Game. Federal Aid in Fish Restoration Project No. F-9-6, Study G-I, Job No. G-I-A Vol. 15. pp 93-106.

Beauchamp, D. A. 1994. Spatial and temporal dynamics of piscivory: implications for food web stability and the transparency of Lake Washington. Lake Reservoir Manage. 9: 151-154.

Beauchamp, D. A., M. G. LaRiviere, and G. L. Thomas. 1995. Evaluation of competition and predation as limits to juvenile kokanee and sockeye salmon production, Lake Ozette, Washington. N. Am. J. Fish. Manage. 15: 193-207.

Cartwright, M. A., D. Beauchamp, and M. Bryant. 1998. Quantifying cutthroat trout (*Oncorhynchus clarki*) predation on sockeye salmon (*O. nerka*) fry using a bioenergetic approach. Can. J. Fish. Aquat. Sci., 55: 1285-1295.

Edgington, J. and R. Larson. 1979. Revised anadromous stream catalog of southeastern Alaska. Appendix C – District 3, Volume II. West Coast of Prince of Wales Island. Alaska Department of Fish and Game Technical Data Report Series 42: 664p.

FRED (Fisheries Rehabilitation, Enhancement, and Development Division). 1988. Proceedings of the 1988 sockeye culture workshop. Ketchikan, AK.

FRED (Fisheries Rehabilitation, Enhancement, and Development Division). 1992. Klawock Lake hatchery five year plan. Juneau, Alaska.

Hansen, S., D. Rosenberg, C. Denton, and M. Haddix. 1992. Klawock Lake hatchery 5 year plan. Alaska Department of Game, Fisheries Research and Enhancement Division.

Hawkins, A. W. 1936. Annual report, Ketchikan district. United States Bureau of Fish. Seattle WA.

Headlee, F. F., 1950–1961. Annual reports Ketchikan, Southern District. Bureau of Commercial Fisheries.

Lehner, M. J. 2001. Klawock watershed assessment draft, phase II. USDA Forest Service, Craig, AK. 67p.

Koenings, J. P., J. A. Edmundson, G. B. Kyle, and J. M. Edmundson. 1987. Limnology field and laboratory manual: methods for assessing aquatic production. Alaska Department of Fish and Game, FRED Division Report Series 71: 221p.

McGregor, A. H. 1983. Abundance, age, sex, and size of sockeye salmon (*Oncorhynchus nerka* Walbaum) catches and escapements in southeastern Alaska in 1982. Alaska Department of Fish and Game Technical Data Report Series 100: 123p.

McGregor, A. H., S. A. McPherson, and J. E. Clark. 1984. Abundance, age, sex, and size of sockeye salmon (*Oncorhynchus nerka* Walbaum) catches and escapements in southeastern Alaska in 1983. Alaska Department of Fish and Game Technical Data Report Series 132: 179p.

McGregor, A. H. and B. W. Van Alen. 1987. Abundance, age, and sex, composition of chinook, sockeye, coho, and chum salmon catches and escapements in Southeast Alaska in 1981. Alaska Department of Fish and Game Technical Data Report Series 200: 174p.

McIntyre, J. D., R. R. Reisenbichler, J. M. Emelen, R. L. Wiolmot, and J. L. Finn. 1988. Predation of Karluk River sockeye salmon by coho salmon and char. U.S. National Marine Fisheries Service Fishery Bulletin 86:611-616.

McPherson, S. A., A. J. McGregor, and F. A. Bergander. 1988. Abundance, age, sex, and size of sockeye salmon (*Oncorhynchus nerka* Walbaum) catches and escapements in southeastern Alaska in 1986. Alaska Department of Fish and Game Technical Fishery Report Series 88-08: 41p.

Moser, J. F. 1898. The salmon and salmon fisheries of Alaska: Report of the operations of the United States Fish Commission Steamer Albatross for the year ending June 30, 1898. Bulletin of the United States Fish Commission, Annual Report.

LITERATURE CITED (Continued)

Ruggerone, G. T. and D. E. Rogers. 1992. Predation on sockeye salmon fry by juvenile coho salmon in the Chignik Lakes, Alaska: Implications for salmon management. N. Am. J. of fish. Manage. 12:87-102.

Roppel, P. 1982. Alaska salmon hatcheries 1891–1959. Alaska Historical Commission studies in history, No. 20. National Marine Fisheries Service, Portland OR.

Zadina, T. P., M. H. Haddix, and J. A. Edmundson. 1992. Fisheries habitat evaluation and limnological investigations of Big Lake, Ratz Harbor, Prince of Wales Island, Alaska, 1989–1991. Alaska Department of Fish and Game, FRED Division Report Series 124: 26p.

Zadina, T. P. and S. C. Heinl. 1999. Limnological and fisheries investigations at McDonald Lake, Southeast Alaska, 1998. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report Series 1J99-15: 35p.

Zadina, T. P. and J. L. Weller. 1999. Limnological and fisheries investigations at Virginia Lake, Southeast Alaska, 1998. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report Series 1J99-16. 20p.

Table 1. Summary of total fish passed by species by year at the Klawock River weir, intermittent years 1930–2000. The numbers from 1968 to present represent a minimum escapement estimate due to incomplete fish counts in many years.

Year	Sockeye	Coho	Pink	Chum
1930	7,044	13,240	1,412,912	15,615
1931	34,184	6,322	535,748	151,543
1932	57,294	7,052	181,734	264,793
1934	16,374	7,341	406,163	16,402
1935	20,028	6,955	425,180	39,924
1936	65,314	9,382	594,692	37,416
1937	33,544	2,578	572,271	13,625
1938	15,368	4,398	357,751	22,209
1968	13,242	5,272	66,836	85,281
1969	1,557	1,135	62,336	66,079
1970	7,213	3,467	100,740	111,111
1971	11,580	2,718	54,543	905
1977	4,771	4,015	39,655	12,670
1982	4,872	3,406	4,654	182
1983	872	4,371	17,765	1,115
1985	1,042	14,547	N/A	N/A
1986	19,636	4,665	1,493	4,599
1987	7,844	11,286	5,591	3,706
1988	6,453	4,970	998	6498
1999	5,310	18,544	289,139	21,831
2000	9,428	13,336	9,271	20,824

Table 2. Klawock Lake system historical high salmon escapement estimates by species.

Species	Historical High	Year
Pink	1.4 million	1930
Chum	265 thousand	1932
Sockeye	65 thousand	1936
Coho	18.5 thousand	1999

Table 3. Summary of Klawock Lake sockeye salmon coded wire tagging (CWT) efforts, intermittent years 1988–1998.

Year	Tag Code	Tagged	Tag Retention
1988	04-29-35	10,093	94.5
1988	04-29-36	9,611	96.8
1987	04-27-03	9,673	94.3
1987	04-27-04	2,700	98.7
1987	04-27-16	7,622	99.0
1990	04-01-01-09-15	7,782	80.0
1991	04-01-01-09-14	11,962	95.8
1991	04-01-02-05-05	8,053	96.4
1991	04-33-09	9,255	97.8
1991	04-33-10	10,198	99.3
1992	04-37-56	9,689	93.6
1992	04-37-57	9,129	91.6
1992	04-39-02	10,727	98.1
1992	04-39-03	9,069	97.4
1993	04-01-01-10-04	10,650	93.4
1993	04-01-02-05-06	9,766	88.7
1993	04-01-02-05-07	9,676	98.3
1995	04-39-62	1,195	93.8
1995	04-42-52	10,078	96.3
1997	05-31-24	24,062	96.5
1998	04-01-03-13-12	24,407	98.7
Total		215,397	

Data retrieved from ADF&G tag laboratory database, October 10, 2001.

Table 4. Summary of Klawock Lake sockeye salmon CWT recoveries by district, gear, and year, 1988–1998.

District	Gear	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	Grand Total
101	Drift				1								1
102	Purse								1				1
103	Purse										2		2
	Weir		13	21		2				4	7	3	50
	Sport		1										1
	Escape.				34				1	2			37
	Total		14	21	34	2			1	6	9	3	90
104	Purse	1		6	3		3	7	11	14			45
	Troll							1					1
	Total	1		6	3		3	8	11	14			46
Unknown	Purse		1	2	8		3						14
	Misc.				1								1
	Total		1	2	9		3						15
Grand Total		1	15	29	47	2	6	8	13	20	9	3	153

Data derived from ADF&G Tag Laboratory database, October 10, 2001.

Table 5. Summary of Klawock Lake subsistence fishery salmon harvest by species, 1969–2000 based on returned permits.

Year	No. of permits	Sockeye	Coho	Pink	Chum
1969	35	1,455	N/A	N/A	N/A
1970	32	798	N/A	N/A	N/A
1971	38	314	N/A	N/A	N/A
1972	79	1,978	N/A	N/A	N/A
1973	64	755	N/A	N/A	N/A
1974	60	1,362	N/A	N/A	N/A
1975	59	1,377	N/A	N/A	N/A
1976	71	1,108	N/A	N/A	N/A
1977	63	1,286	N/A	N/A	N/A
1978	87	1,017	N/A	N/A	N/A
1979	111	2,980	N/A	N/A	N/A
1980	159	3,522	N/A	N/A	N/A
1981	152	4,183	N/A	N/A	N/A
1982	225	6,661	N/A	N/A	N/A
1983	130	1,736	N/A	N/A	N/A
1984	235	2,366	N/A	N/A	N/A
1985	138	2,336	0	10	107
1986	156	2,762	0	196	243
1987	117	2,118	0	150	150
1988	96	1,851	0	10	125
1989	122	3,088	0	139	45
1990	100	2,631	86	286	190
1991	77	1,989	24	298	57
1992	133	4,322	15	121	60
1993	162	5,763	29	260	63
1994	133	4,848	72	220	11
1995	118	3,489	1	111	133
1996	159	5,553	59	13	85
1997	126	4,746	2	173	3
1998	125	4,670	128	144	30
1999	123	3,509	49	99	127
2000	112	3,000	19	99	152

Data retrieved from ADF&G ALEX/IFDB database, October 10, 2001.

Table 6. Euphotic zone depth (EZD) by station by month and yearly mean for Klawock Lake, 1986–2000.

Date	Station A	Station B
May-86	6.1	N/A
Nov-86	3.1	2.7
1986 Mean	4.6	2.7
Apr-87	4.6	5.7
Nov-87	2.8	2.5
1987 Mean	3.7	4.1
Mar-88	3.3	N/A
Aug-88	N/A	4.0
Nov-88	3.8	4.8
1988 Mean	3.6	4.4
May-00	4.7	4.5
Jun-00	5.2	5.0
Aug-00	4.1	4.7
Sep-00	3.6	4.0
2000 Mean	4.4	4.6

N/A - not available

Table 7. Summary of hydroacoustic population and mid-water trawl abundance estimates of rearing sockeye salmon fry in Klawock Lake, 1987–1999.

Sample Date	Total Population Estimate	Species	Percent of Species	Total No. of Species	Age	Mean Length (mm)	Mean Weight (g)
9/21/86	1,009,000	Sockeye	90.38%	912,000	0	46.1	1.04
		Stickleback	7.69%	78,000	N/A	74.3	6.50
		Cottids	1.92%	19,000	N/A	66.0	3.00
3/24/87	503,000	Sockeye	92.59%	466,000	0	31.3	0.23
					1	52.6	1.48
					3	110.0	14.40
		Stickleback	3.70%	19,000	N/A	96.0	10.10
		Coho	3.70%	19,000	2	130.0	24.00
7/08/87	Tow Net	Sockeye	95.65%		0	37.0	0.55
	Only	Cottids	4.35%		N/A	35.0	0.40
10/22/87	311,000	Sockeye	87.50%	272,000	0	58.1	2.24
		Stickleback	12.50%	39,000	N/A	93.0	8.60
4/14/88	350,000	Sockeye	100.00%	350,000	0	29.5	0.21
					1	52.6	1.37
					2	101.0	9.70
10/26/88	375,000	Sockeye	97.06%	364,000	0	66.8	3.24
					1	87.3	7.53
		Stickleback	2.94%	11,000	N/A	108.0	12.70
4/20/95	383,000	Sockeye	84.09%	322,000	0	36.1	0.39
					1	70.9	3.04
					2	94.6	7.78
		Stickleback	15.91%	61,000	N/A	82.9	5.73
9/7/2000	311,000	Sockeye	100.00%	311,000	0	48.0	0.84

N/A – not available

Table 8. Sockeye salmon smolt age composition, length, and weight data, 1987–1988 and 1995.

Year	Age	Percent	Length (mm)	Weight (g)
1987	1	70%	79.2	4.3
	2	29%	115.9	12.8
1988	1	82%	87.1	6.0
	2	15%	110.2	11.0
	3	3%	129.4	17.4
1995	1	83%	83.0	5.0
	2	17%	114.0	11.5

Table 9. Adult sockeye salmon population age structure by brood year, 1982–1991.

Brood Year	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	Average
Age 1.1	3	100	N/A	15	99	71	101	37	26	143	66
%	1%	13%	0%	11%	25%	10%	14%	12%	4%	27%	12%
Age 1.2	145	198	34	28	100	251	109	36	170	44	112
%	27%	27%	39%	21%	25%	35%	15%	12%	26%	8%	23%
Age 1.3	233	334	17	69	170	273	395	160	344	231	223
%	44%	45%	19%	53%	43%	38%	55%	53%	53%	43%	44%
Age 2.1	29	0	4	1	11	32	22	4	13	6	12
%	5%	0%	5%	1%	3%	4%	3%	1%	2%	1%	3%
Age 2.2	69	50	25	14	14	45	79	25	48	55	42
%	13%	7%	28%	11%	4%	6%	11%	8%	7%	10%	11%
Age 2.3	56	59	8	4	5	51	16	41	52	58	35
%	10%	8%	9%	3%	1%	7%	2%	14%	8%	11%	7%

Table 10. Mean adult sockeye salmon length (mm) and (sample size) by age and sex.

	1.1	1.2	1.3	2.1	2.2	2.3
Sex	mm (n)	mm (n)	mm (n)	mm (n)	mm (n)	mm (n)
Male	368 (744)	504 (881)	571 (1,435)	389 (126)	511 (310)	566 (206)
Female	378 (53)	497 (804)	554 (2,333)	413 (19)	502 (336)	558 (311)

Table 11. Summary of recent hatchery sockeye salmon releases into Klawock Lake by strategy, time released, and totals, 1980, 1987–2000.

Release	Emergent Fry	Fed Fry	Fingerling	Pre-smolt	Total
1979		July 18,364			18,364
1987	March-April 809,000				809,000
1988	April-May 592,000				592,465
1989	May-June 2,426,000		July 45,000		2,470,684
1990	May 99,600	August 104,000			203,691
1991			July-August 197,000	December 19,700	216,579
1992	June 447,000		Aug.-Nov.-Dec 702,000		1,148,353
1993	June 279,000			December 198,000	476,472
1994			August 532,000		532,180
1995	June 2,616,000	August 100,000		December 12,000	2,728,201
1996	June 300,000	August 24,000			324,000
1997		May-June 245,000			245,021
1998			June 581,000		581,047
1999	April-June 868,000				868,025
2000	May 6,000	April-May 353,000			359,431
Total	8,443,000	845,000	2,056,000	229,000	11,615,000

Data retrieved from the ADF&G tag laboratory database, March 15, 2001.

Table 12. Summary of Klawock hatchery coho salmon releases by strategy, 1980–2001.

Year	Pre-smolt	Release	Smolt	Release	Location
1980			13,000	June	River
1981			37,000	March-May	River
1982			44,000	Feb	Lake
1982			22,000	May	River
1983			101,000	March	Lake Trib.
1983	21,000	Aug			River
1984	855,000	Feb-March			River
1985	1,131,000	Jan-Sept			Lake
1986	818,000	Feb			Lake
1987	926,000	Jan			Lake
1988	1,005,000	Feb			Lake
1989	2,321,000	Jan-Dec			Lake
1990	634,000	Jan			Lake
1991	1,438,000	Jan-Dec			Lake
1991			70,000	May	River
1992	641,000	Jan			Lake
1993	301,000	June			Lake
1994			260,000	June	River
1995			354,000	June	Lake
1996			1,324,000	May-June	River
1998			622,000	May-June	Lake
1999			1,330,000	May	Net Pens
2000			436,000	May	Net Pens
2001			1,596,000	May	Net Pens

Data retrieved from the ADF&G tag laboratory database, November 7, 2001.

Table 13. Summary of pathological sampling of sockeye salmon by sample size (number positive) for each test at the Klawock hatchery 1979–1997.

Year	Bacterial				Fungal	Parasite	Viral
	A. SAL	BKD	Pseud	Y. Ruck	Phoma	Trich	IHNV
1979							24 (0)
1986							40 (37)
1987							63 (61)
1988		178 (25)					95 (1)
1989							44 (00)
1991		5 (5)					11 (0)
1992		5 (0)	5 (1)		5 (1)		6 (0)
1993	5 (5)	1 (0)				5 (1)	5 (0)
1994							62 (13)
1995		5 (0)					10 (0)
1996							6 (6)
1997	60 (0)	60 (9)		60 (0)			68 (63)
Totals	65 (5)	254 (39)	5 (1)	60 (0)	5 (1)	5 (1)	434 (181)

A.SAL=*Aeromonas salmonicida*, BKD= bacterial kidney disease, Pseud=*Pseudomonus*, Y. Ruck=*Yersinia reckeri*, Trich=*Tricodina*, INHV=infectious haemopoietic necrosis.

Table 14. Summary of fish pathological sampling by species at the Klawock hatchery by disease and sample size (number positive).

	Pathology Test	Chum	Coho	Pink	Sockeye	RBT/SH
Bacterial	Aeromonus sp.	10 (0)	93 (40)	80 (2)	65 (5)	192 (11)
	Bacterial Kidney Disease	16 (0)	228 (55)	80 (4)	254 (39)	220 (1)
	Flexibacter		10 (6)			5 (5)
	Pseudomonus sp.		13 (3)		5 (1)	
	Yersinia ruckeri				120 (0)	
Environmental	Gas Bubble Disease		52 (26)		15 (13)	16 (5)
	Gill Hyperplasia		45 (40)		10 (8)	5 (5)
Fungal	Phoma				5 (1)	
Parasite	Costia		10 (5)			
	Hexamita		4 (1)			
	Trichondia		28 (11)		5 (1)	
	Tricophyra					10 (4)
Viral	Herpes					28 (0)
	IHNV	276 (4)			434 (181)	149 (0)
	VHSV					3 (0)

Table 15. Summary of Proper Functioning Condition assessment results.

PFC Category	Half-Mile Cr.	Three-Mile Cr.	Total miles
Non Functional	N/A	2.7	2.7
Functional at risk w/ downward trend	N/A	2.8	2.8
Functional at risk w/ no trend	N/A	0.5	0.5
Functional at risk w/ upward trend	N/A	1.1	1.1
Proper Functioning Condition	1.6	0.7	2.3
Total	1.6	7.8	9.4

N/A – not available

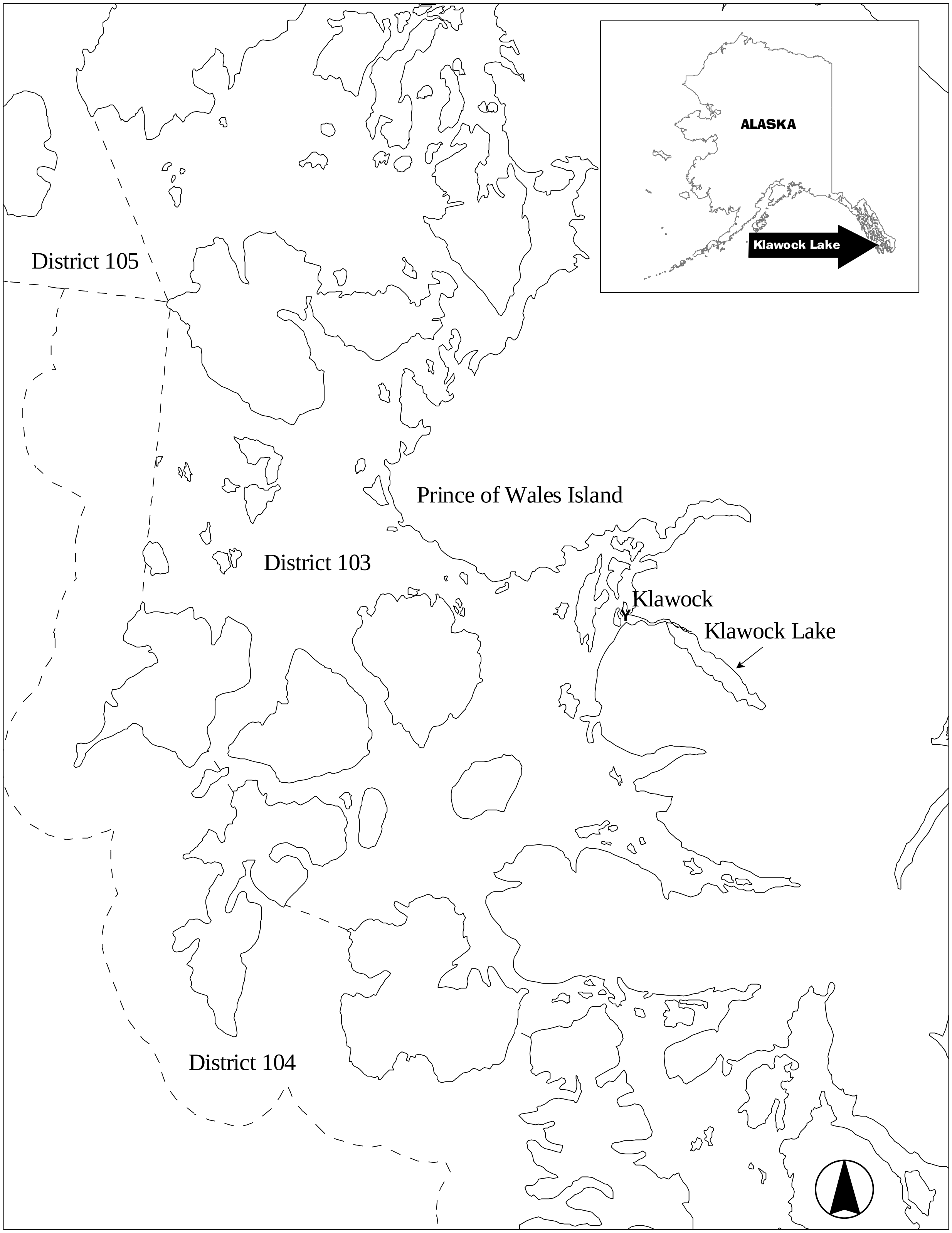

Figure 1. The geographic location of Klawock Lake, within the State of Alaska, and relative to commercial fishing districts on west Prince of Wales Island.

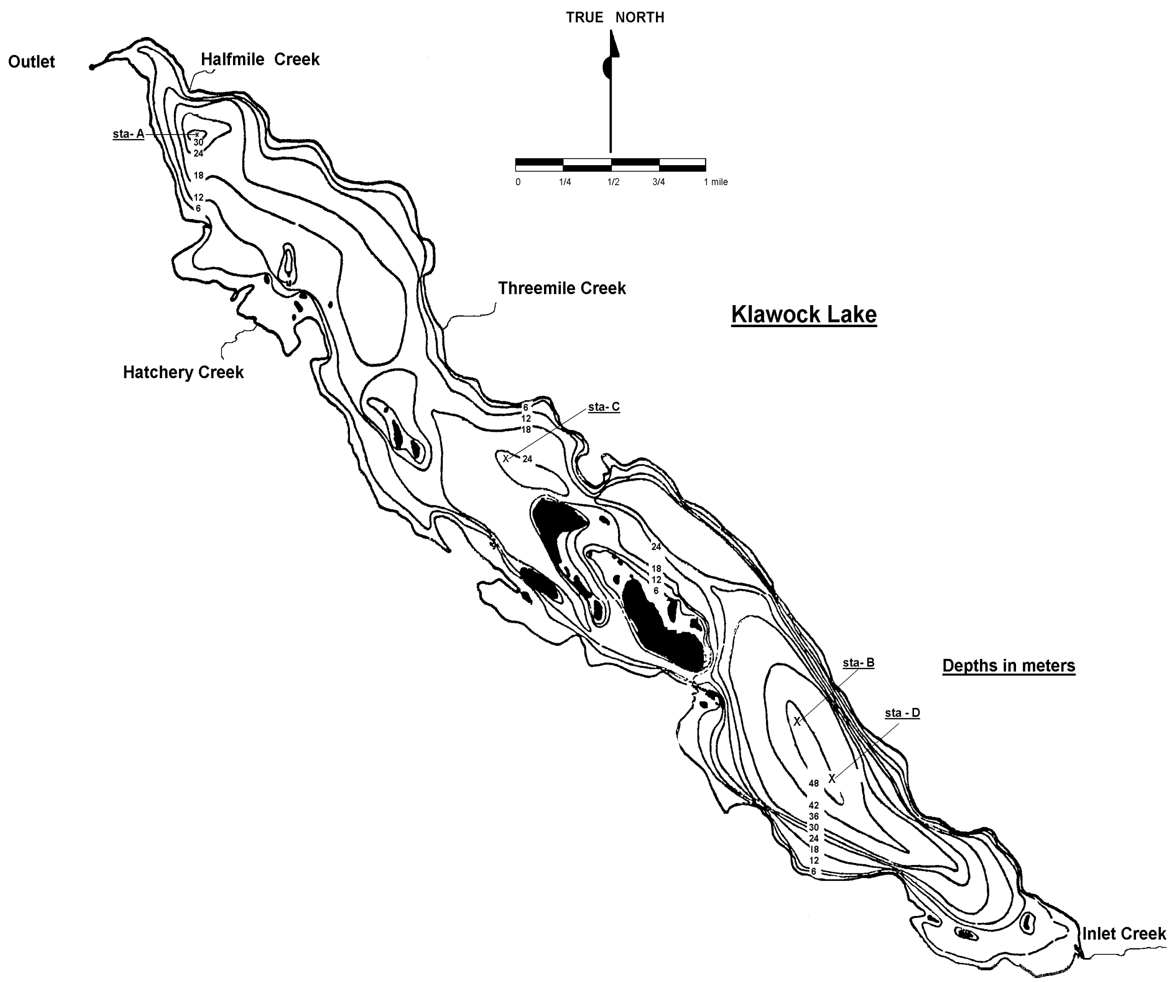

Figure 2. Bathymetric map of Klawock Lake, Southeast Alaska with limnological sampling stations and inlet stream references.

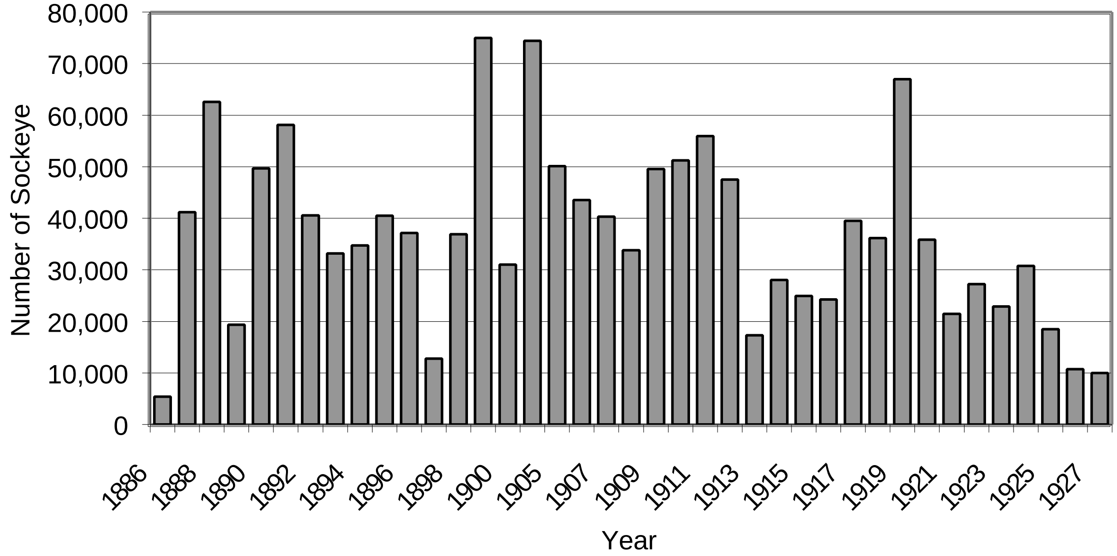

Figure 3. Early sockeye salmon harvest numbers by year reported for Klawock Inlet, based on cannery can pack records, 1886–1900 and 1904–1927.

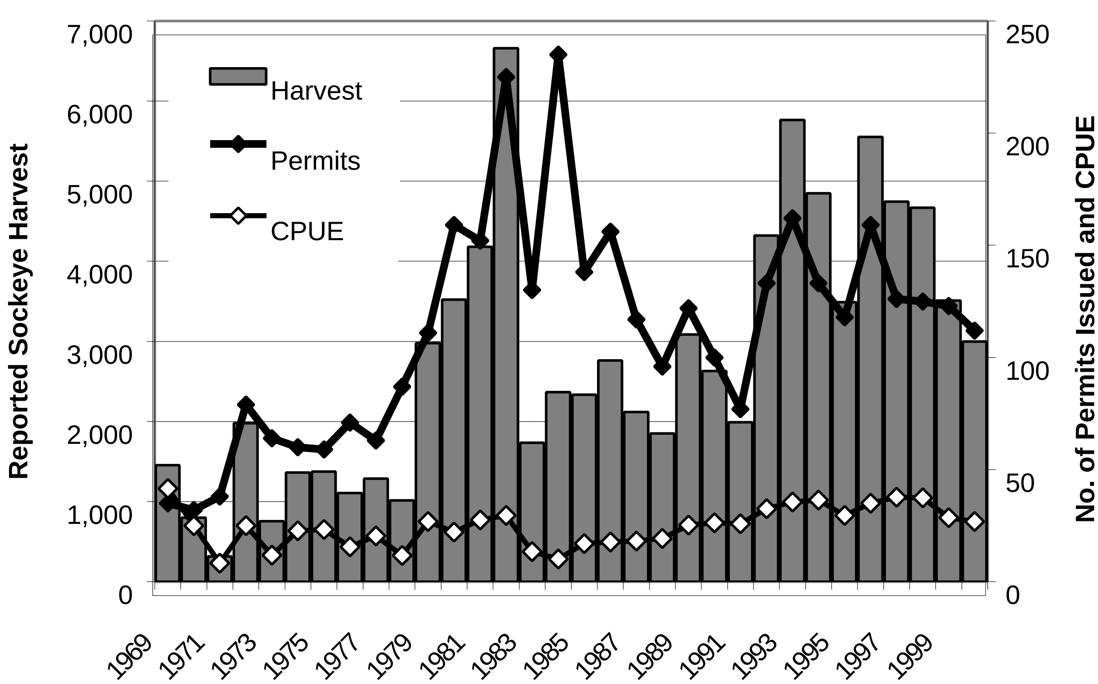

Figure 4. The annual reported harvest, number of permits, and catch per unit effort (CPUE) for the Klawock River sockeye salmon subsistence fishery, 1969–2000.

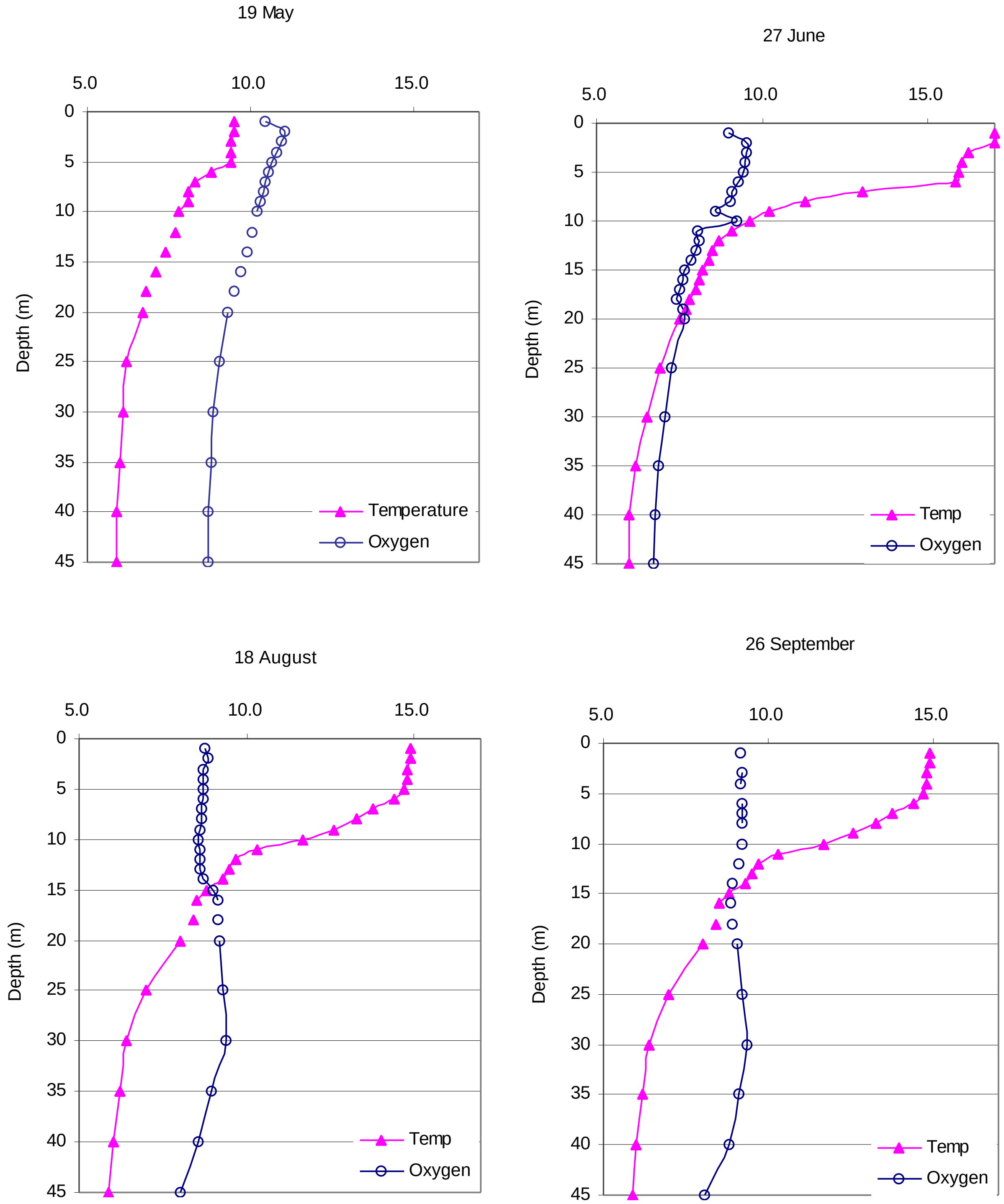

Figure 5. Temperature (°C) and dissolved oxygen (mg · L^{-1}) profiles for Station A on Klawock Lake, 2000.

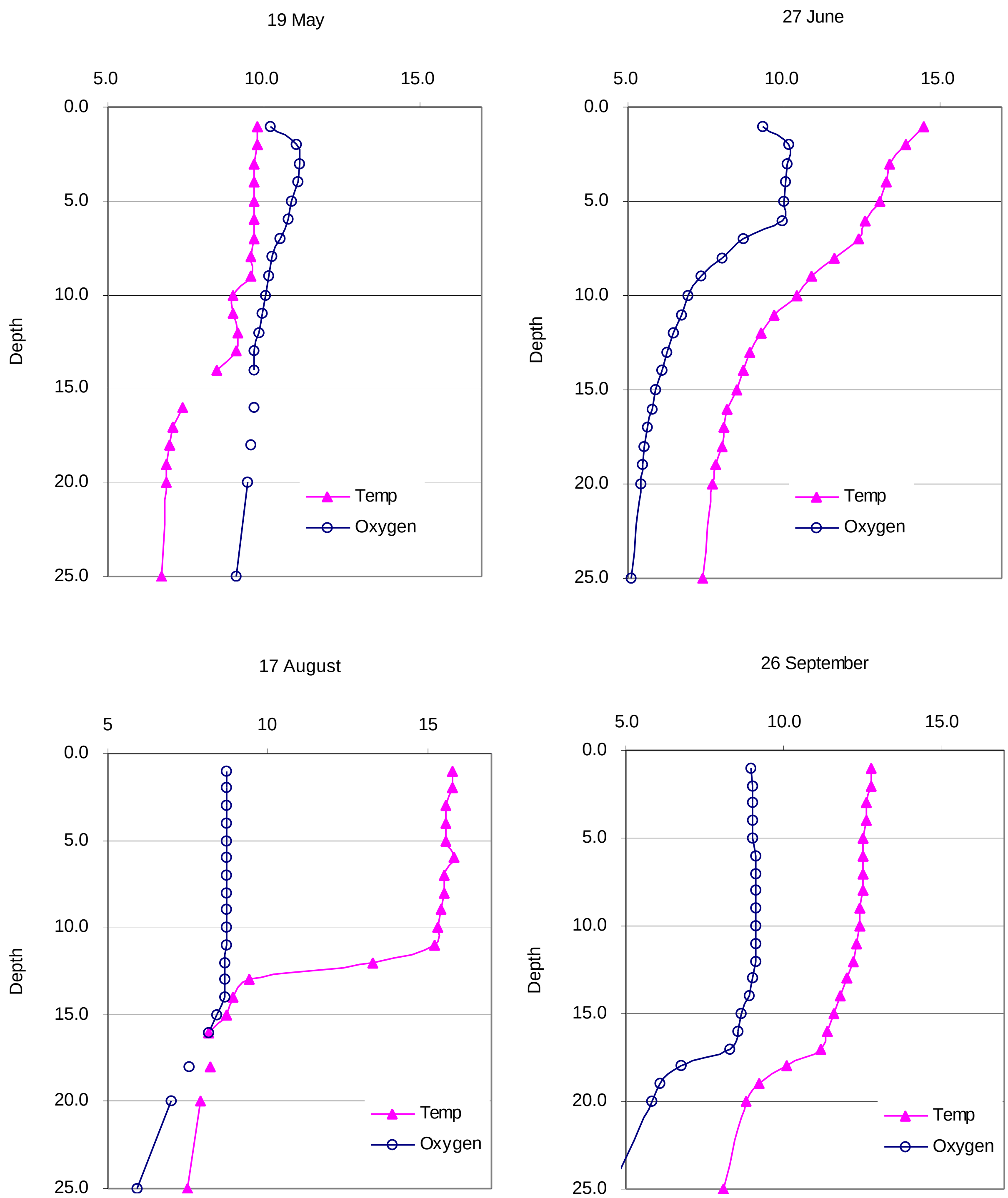

Figure 6. Temperature (°C) and dissolved oxygen ($mg \cdot L^{-1}$) profiles for Station B on Klawock Lake, 2000.

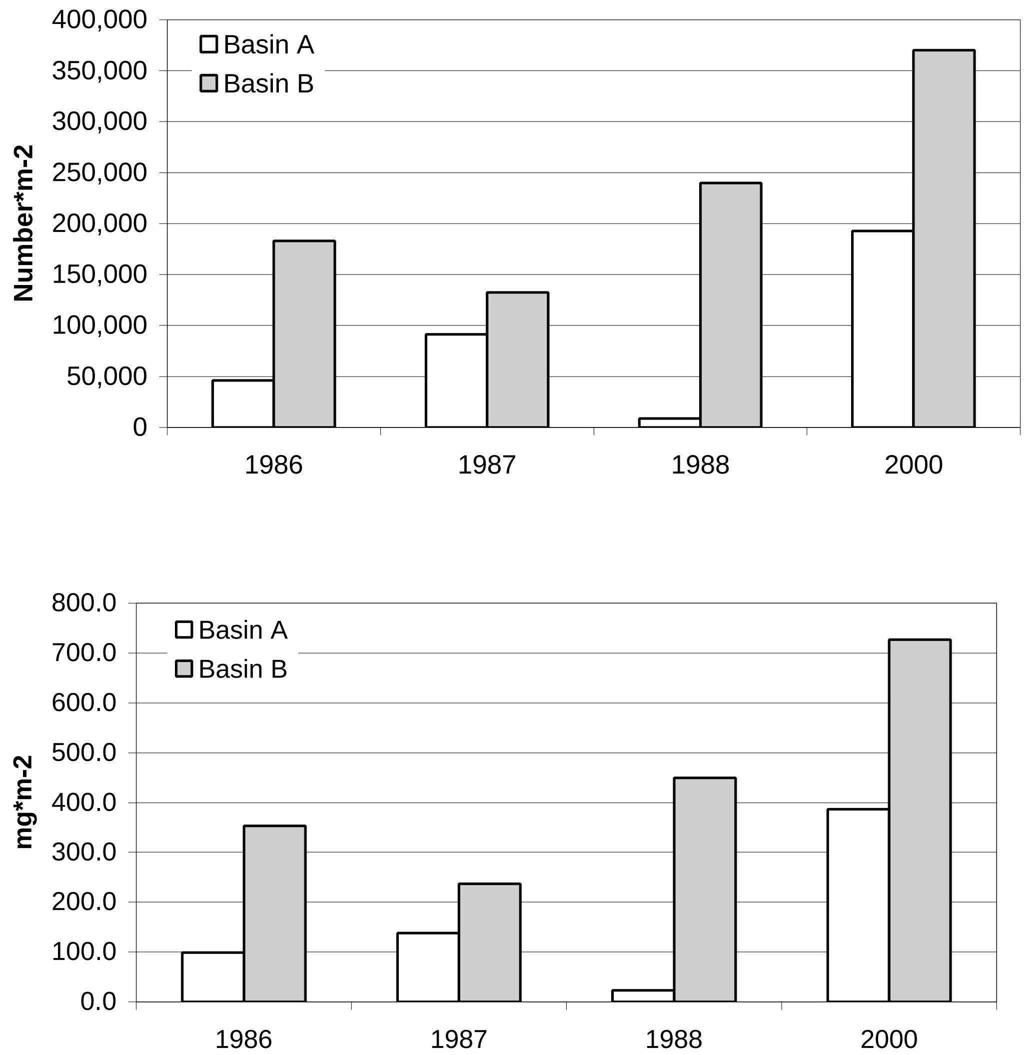

Figure 7. Mean seasonal macrozooplankton density (No. · m^{-2}) and biomass (mg · m^{-2}) at Klawock Lake and mean of years sampled, 1986–2000.

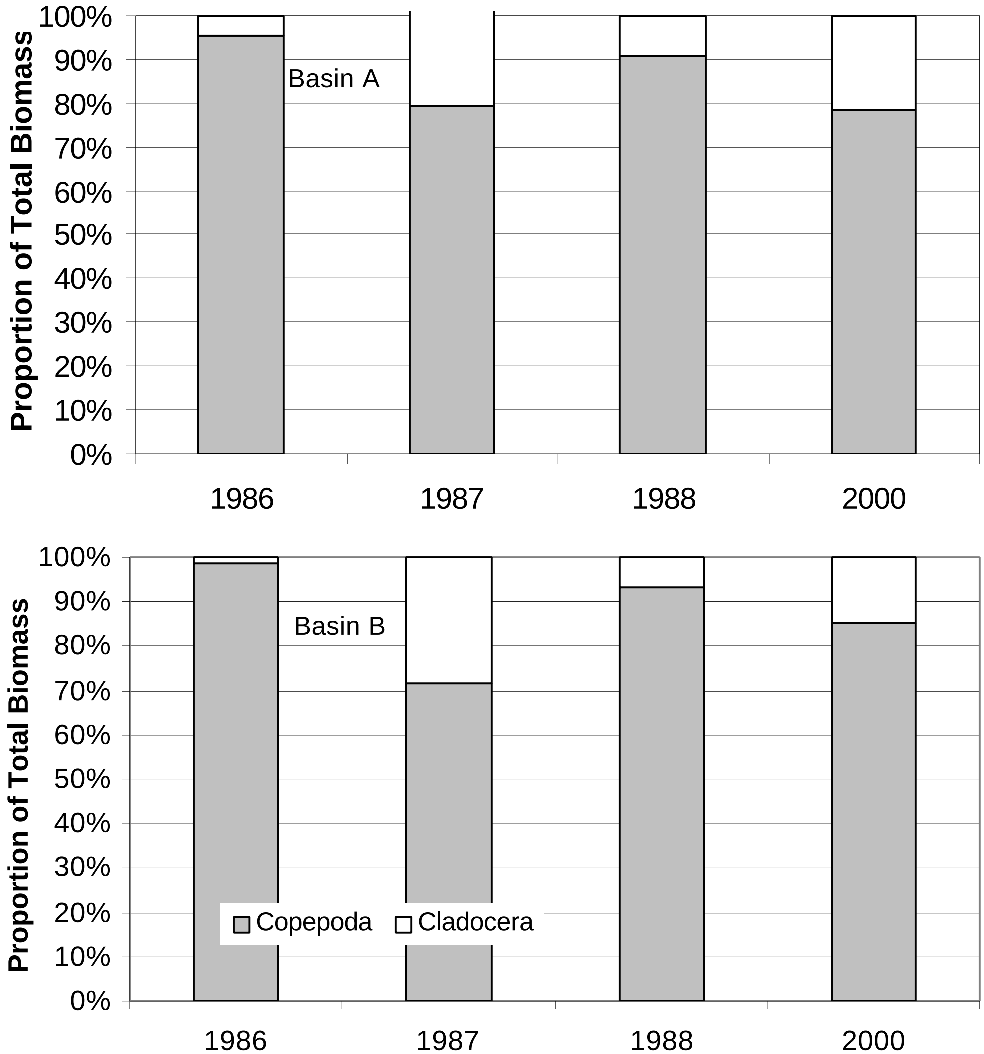

Figure 8. Mean seasonal proportion of weighted biomass by zooplankton order in Klawock Lake, 1986–1988, and 2000.

Appendix 1. Daily counts of sockeye salmon at the Klawock River.

Date	1968	1969	1970	1971	1977	1980	1982	1983	1986	1987	1988	1999	2000
14-Jun		0		0			0	0		0		0	0
15-Jun		0		0			0	0		0		0	0
16-Jun		4		0			0	0		0		0	0
17-Jun		3		0			0	0		0		0	0
18-Jun		3	7	3			0	0		0		0	0
19-Jun		6	12	2			0	0		0		0	0
20-Jun		10	4	7			0	0		0		0	0
21-Jun		2	5	10			0	0		0		0	0
22-Jun		2	6	5			0	0		0		0	0
23-Jun		4	14	8			0	0		0		0	0
24-Jun		3	21	8			0	0		0		0	0
25-Jun		5	15	12			0	0		0		0	0
26-Jun		5	8	12			0	0		0		0	0
27-Jun		16	16	11			0	0		0		0	0
28-Jun		6	23	16			7	0		0		0	0
29-Jun		3	3	14			0	0		0		0	0
30-Jun		1	15	24			0	0		0		0	0
1-Jul	8	1	5	9			0	0		0		0	0
2-Jul	8	1	10	19			0	0		0		0	0
3-Jul	3	1	2,001	7			0	0		0		0	0
4-Jul	2	14	36	10			0	0		0		0	0
5-Jul	771	1	15	31			0	0		0		0	50
6-Jul	10	1	4	12			0	0		0		0	1
7-Jul	28	5	38	19			0	0		0		0	15
8-Jul	0	5	18	2			0	0		0		4	38
9-Jul	19	80	8	4			0	0		0		14	40
10-Jul	1	33	5	3			0	0		0		35	44
11-Jul	25	35	3	0			0	0		0		26	26
12-Jul	4	25	245	0			50	0		0		24	15
13-Jul	24	10	13	0			33	0		15		8	3
14-Jul	4	3	72	2			0	0		0		1	25
15-Jul	3	9	5	3			4	0		0			93
16-Jul	8	2	14	11			19	0		0		1	18
17-Jul	38	2	320	52			6	0		0			35
18-Jul	1,473	7	5	455			0	0		0		8	39
19-Jul	1,624	8	2	43			15	0		0			715
20-Jul	129	10	0	14			9	3		0		8	56
21-Jul	159	3	0	119			14	1		0			15
22-Jul	131	11	359	6			6	0		0		27	11
23-Jul	1,039	4	239	2			2	0		0		180	30
24-Jul	110	10	0	0			1	48		0		28	152
25-Jul	220	12	0	1			9	8		0		1	13
26-Jul	26	37	0	1			3	0		0		7	
27-Jul	207	1	2	0			0	6		0		939	1
28-Jul	14	1	9	3			14	1	4	0		795	2
29-Jul	12	0	11	67			7	20	244	0		27	

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Date	1968	1969	1970	1971	1977	1980	1982	1983	1986	1987	1988	1999	2000
30-Jul	60	0	0	75			34	1	0	300		1	4
31-Jul	216	0	2	6			62	9	4	0			4
1-Aug	153	0	10	2			146		32	0			8
2-Aug	55	1	1	0			15	0	0	0			39
3-Aug	54		12	3			37	5	0	0		6	916
4-Aug	31	5		2			48	5	221	0			96
5-Aug	35	5		2			114	1	30	0			8
6-Aug	20	1		5			25	1	4,217	0			232
7-Aug	11	1,061		373			73	3	1,247	0		9	259
8-Aug	27		1	1,009	36		137		2,196	0		280	16
9-Aug	10	2		1,891	41		30	18	0	0		130	124
10-Aug	6	6	230	277	115		8	14	0	0		91	90
11-Aug	4		1,827	423	62		468	41	62	0	26	152	222
12-Aug	18		92	50	105		0	6	32	0	0	170	52
13-Aug	0		1	22	143		9	2	28	0	0	11	32
14-Aug	3			1	49		15		5	0	0	34	117
15-Aug	3		20	35	93		19	259	0	0	0	219	101
16-Aug	3		20	35	48		112	18	10	0	0	174	1,160
17-Aug	17	4		308	48		172	14	0	0	0	696	3,526
18-Aug	59	1		569	74		64	3	1,456	0	0	487	66
19-Aug	38	1	1	2,856	49	0	3	75	281	0	0	25	7
20-Aug	12	1		388	18	0	0	32	91	0	0	79	39
21-Aug	65		1	640	5	0	0	3	9	0	0	21	526
22-Aug	45		3	107	3	0	0	2	70	0	0	25	13
23-Aug	257			113	48	4	0	11	0	0	0	23	49
24-Aug	2,818		3	80	87	4	4	16	0	0	0	14	4
25-Aug	226	2		78	76	4		14	1,086	0	0	9	3
26-Aug	61		6	13	90	14	5	22	24	0	0	20	2
27-Aug	23		28	10	38	26	52	35	0	0	0		
28-Aug	23	1	88	2	342	0	340	12	0	400	0	83	4
29-Aug	945	1	21	37	277	0	53	2	0	0	0	4	4
30-Aug	396		21	44	161	0	12	4	0	0	375	1	16
31-Aug	261		9	73	47	0	7		0	0	8	2	11
1-Sep	11		42	34	155	0	2,095	0	0	0	209		15
2-Sep	0		256	19	184	99	243	0	2,196	0	259		13
3-Sep	0		50	15	77	0	62	1	147	0	0	1	8
4-Sep	0	1	28	1	39	0	9	2	455	330	0	7	20
5-Sep	0		15		27	0	109		0	0	0	8	35
6-Sep	0				138	876	5		0	0	239	9	33
7-Sep	2			2	132	280	14	0	0	0	0	7	18
8-Sep	0				107	2230	3	3	0	928	371	43	11
9-Sep	0				3	0	1	2	0	610	270	18	5
10-Sep	0				6	0			0	1,108	354	3	
11-Sep	0				1	0		1	0	936	399	1	
12-Sep	0				4	0	5	1	0	659	349	9	8
13-Sep	0				2			3	0	424	67	1	4

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Date	1968	1969	1970	1971	1977	1980	1982	1983	1986	1987	1988	1999	2000
14-Sep					1		0	1	0	452	45	2	4
15-Sep					4			11	140	340	37	3	13
16-Sep								12	0	326	65	4	2
17-Sep								9	0	67	0	4	7
18-Sep								4	0	78	28	17	1
19-Sep								1	0	64	0	175	2
20-Sep								24	0	142	31	1	
21-Sep								22	0	53	0	3	
22-Sep								2	194	77	175	4	
23-Sep								3	163	86	40	2	4
24-Sep							0	9	3	37	0	3	3
25-Sep							0		15	32	0		
26-Sep							0	1	15	42	0		
27-Sep							0		35	167	8		
28-Sep								1	0	12	0		1
29-Sep							0		0	36	48		2
30-Sep							0		6	21	0		2
1-Oct							2	0	0	2	0		1
2-Oct									17		0		
3-Oct									31		12		1
4-Oct							1		0	10	0		1
5-Oct									0	7	0		
6-Oct									31	0	0		
7-Oct									0	1	0		
8-Oct								0	0	0	0		
9-Oct									0	0	0	2	
10-Oct									3	0	0		
11-Oct								0	0	0	0		
12-Oct								1	0		11		

Appendix 2. Klawock Lake water quality data by date, station, and depth, intermittent years 1979–2000.

DATE	YEAR	STATION	DEPTH (m)	STRATA	CONDUCTIVITY (umhos/cm)	pH	ALKALINITY (mg/l)	TURBIDITY (NTU)	COLOR (Pt units)	CALCIUM (mg/l)	MAGNESIUM (mg/l)	IRON (ug * L^{-1})	TP (ug * L^{-1})	TFP (ug * L^{-1})	FRP (ug * L^{-1})	TKN (ug * L^{-1})	AMMONIA(ug * L^{-1})	NITRATE+NITRITE (ug * L^{-1})	TN (ug * L^{-1})	RSI (ug * L^{-1})	CARBON (ug * L^{-1})	TPP (ug * L^{-1})	CHL A (ug * L^{-1})	PHAEO (ug * L^{-1})
29-Aug	1979	A	N/A	Epi	22	6.7	10			3.4	0.2		4.0	3.8	0.8	130.0	4.5	8.4	138.7	844		1.0		
29-Aug	1979	A	N/A	Hyp	36	6.8	12			4.4	0.2		5.1	4.7	1.2	108.3	7.3	26.5	134.5	1,127		1.8		
28-May	1981	A	5	Epi	25	6.8	10			4.5	0.2	39	4.4	1.8	0.7	83.5	2.0	3.4	86.9	989	179	2.4	0.48	
28-May	1981	A	5	EZD																			0.19	
28-May	1981	A	30	Hyp	28					3.5	0.7	17	4.6	4.7	1.3	78.3	4.0	20.0	98.3	1,227	60	1.3		
19-May	1986	A	1	Epi	37	6.8	11	0.5	29.0			58	6.3	1.8	0.1	85.8	2.4	22.5	108.3	1,324	58		0.84	0.39
19-May	1986	A	6.5	EZD																			1.26	0.46
19-May	1986	A	19	Hyp	36	6.7	12	0.7	27.8			74	4.6	2.7	1.5	80.8	<1.1	21.0	101.8	1,306	82		0.72	1.25
4-Nov	1986	A	1	Epi	34	6.8	10	0.7	45.9			96		4.1	1.6		3.5	23.9		1,303	124	2.4	0.28	0.27
4-Nov	1986	A	2	EZD																			0.11	0.31
4-Nov	1986	A	15	Hyp	33	6.7	10	0.7	45.9			87	7.8	4.2	2.5	114.4	6.0	21.0	135.4	1,234	91	1.8	0.18	0.26
4-Nov	1986	B	1	Epi	36	6.8	10	0.5	34.6			50	5.4	3.2	1.5	70.2	3.5	28.3	98.5	1,329	55	2.8	0.22	0.30
4-Nov	1986	B	2.5	EZD																			0.20	0.25
4-Nov	1986	B	30	Hyp	38	6.7	10	0.4	27.8			26	3.5	2.6	1.3	64.7	2.7	56.5	121.2	1,364	24	2.2	0.05	0.16
27-Apr	1987	A	1	Epi	33	6.6	10	0.3	30.1			88	4.7	2.9	1.3	100.2	1.1	26.8	127.0	1,279	97		0.42	0.18
27-Apr	1987	A	2.5	MEU																			0.35	0.19
27-Apr	1987	A	5	EZD																			0.26	0.18
27-Apr	1987	A	21	Hyp	35	6.7	10	0.4	32.3			97	4.2	2.1	0.6	102.6	1.1	26.8	129.4	1,244	73		0.29	0.18
27-Apr	1987	B	1	Epi	35	6.7	9	0.2	31.2			57	3.8	2.6	1.6	105.9	1.1	32.6	138.5	1,384	64		0.17	0.17
27-Apr	1987	B	3	MEU																			0.15	0.14
27-Apr	1987	B	6	EZD																			0.15	0.20
27-Apr	1987	B	35	Hyp	35	6.7	9	0.2	30.1			72	3.7	1.8	0.1	100.2	1.1	32.6	132.8	1,428	58		0.16	0.16
9-Jul	1987	A	1	Epi	36	6.6	10	0.3	31.2	4.4	0.5	72	3.7	2.5	6.2	109.9	5.7	10.9	120.8	1,176	91		0.34	0.32

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DATE	YEAR	STATION	DEPTH (m)	STRATA	CONDUCTIVITY (umhos/cm)	pH	ALKALINITY (mg/l)	TURBIDITY (NTU)	COLOR (Pt units)	CALCIUM (mg/l)	MAGNESIUM (mg/l)	IRON ($ug * L^{-1}$)	TP ($ug * L^{-1}$)	TFP ($ug * L^{-1}$)	FRP ($ug * L^{-1}$)	TKN ($ug * L^{-1}$)	AMMONIA($ug * L^{-1}$)	NITRATE+NITRITE ($ug * L^{-1}$)	TN ($ug * L^{-1}$)	RSI ($ug * L^{-1}$)	CARBON ($ug * L^{-1}$)	TPP ($ug * L^{-1}$)	CHL A ($ug * L^{-1}$)	PHAEO ($ug * L^{-1}$)
9-Jul	1987	A	2.25	MEU																			0.34	0.31
9-Jul	1987	A	4.5	EZD																			0.33	0.34
9-Jul	1987	A	21	Hyp	37	6.6	10	0.5	29.0	4.4	0.5	11	4.2	2.7	3.4	115.6	6.0	32.6	148.2	1,291	118		0.04	0.27
9-Jul	1987	B	1	Epi	36	6.8	10.5	0.2	25.6	4.4	0.8	59	5.5	2.5	1.1	118.0	6.8	9.4	127.4	1,205	130		0.37	0.30
9-Jul	1987	B	2.25	MEU																			0.40	0.31
9-Jul	1987	B	4.5	EZD																			0.20	0.33
9-Jul	1987	B	27	Hyp	36	6.7	10	0.4	30.1	4.4	0.5	76	4.1	2.2	1.3	106.7	6.8	32.6	139.3	1,262	109		0.04	0.17
20-Nov	1987	A	1	Epi	35	6.5	10	0.9	38.0	4.7	0.7	172	5.5	2.5	2.0	83.7	7.3	13.7	97.4	1,277	151			
20-Nov	1987	A	21	Hyp	34	6.6	10	1.0	34.6	4.7	0.7	160	6.1	2.0	2.0	88.1	2.3	15.2	103.3	1,144	180			
20-Nov	1987	B	1	Epi	38	6.4	10	1.0	30.1	4.7	0.7	96	5.2	2.2	1.7	76.5	3.2	22.6	99.1	1,323	109			
20-Nov	1987	B	34	Hyp	37	6.5	10	0.6	29.0	4.7	0.7	77	5.5	2.2	1.9	71.0	1.3	25.6	96.6	1,350	80			
15-Mar	1988	A	1	Epi	35	6.6	9	0.6	32.3	3.8	0.2	120	5.7	2.8	1.9	23.9	5.5	27.5	51.4	1,124	137			
15-Mar	1988	A	1.75	MEU																				
15-Mar	1988	A	3.5	EZD																				
15-Mar	1988	A	19	Hyp	35	6.6	9	0.6	35.7	4.2	0.4	146	6.0	2.6	2.2	98.1	2.7	28.9	127.0	1,115	83			
11-Aug	1988	B	1	Epi	36	6.6	10	0.5	32.3			78	4.3	2.5	1.6	79.7	3.0	10.2	89.9	1,043	36			
11-Aug	1988	B	2	MEU																				
11-Aug	1988	B	4	EZD																				
11-Aug	1988	B	28	Hyp	36	6.4	10	0.3	26.7			65	4.3	1.7	1.5	77.7	2.7	34.4	112.1	1,106	36			
16-Nov	1988	A	1	Epi	37	6.6	10	2.8	39.1			160	6.4	3.4	1.9	104.7	1.1	23.7	128.4	1,420	89			
16-Nov	1988	A	2	MEU																				
16-Nov	1988	A	4	EZD																				
16-Nov	1988	A	21	Hyp	37	6.6	10	1.8	43.6			163	5.4	5.3	4.6	91.4	1.1	22.7	114.1	1,214	72			
16-Nov	1988	B	1	Epi	38	6.5	9	2.2	34.6			96	5.8	2.5	1.4	85.8	1.1	25.6	111.4	1,193	137			
16-Nov	1988	B	2.25	MEU																				

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Appendix 2. (page 3 of 4)

DATE	YEAR	STATION	DEPTH (m)	STRATA	CONDUCTIVITY (umhos/cm)	pH	ALKALINITY (mg/l)	TURBIDITY (NTU)	COLOR (Pt units)	CALCIUM (mg/l)	MAGNESIUM (mg/l)	IRON (ug * L^{-1})	TP (ug * L^{-1})	TFP (ug * L^{-1})	FRP (ug * L^{-1})	TKN (ug * L^{-1})	AMMONIA(ug * L^{-1})	NITRATE+NITRITE (ug * L^{-1})	TN (ug * L^{-1})	RSI (ug * L^{-1})	CARBON (ug * L^{-1})	TPP (ug * L^{-1})	CHL A (ug * L^{-1})	PHAEO (ug * L^{-1})
16-Nov	1988	B	4.5	EZD																				
16-Nov	1988	B	34	Hyp	38	6.5	9	1.4	34.6			104	5.1	2.3	1.8	88.6	1.1	26.5	115.1	1,214	69			
19-May	2000	A	1	1	35	6.8	11.3	0.5	30	4.9	0.5	70	5.1	2.7	2.3	101.3	9.0	27.7		1180	122		2.84	0.92
19-May	2000	A	5	EZD																			0.89	0.27
19-May	2000	A	20	HYP	35	6.8	11.2	0.6	31	4.7	0.5	70	4.8	2.7	2.4	89.5	9.2	30.5		1187	102		0.28	0.09
19-May	2000	A	2.5	MEU																			0.88	0.26
19-May	2000	B	1	1	36	6.9	11.3	1.4	31	5.1	0.4	69	5.4	2.6	2.5	98.3	6.4	20.9		1167	122		0.76	0.22
19-May	2000	B	5	EZD																			0.95	0.31
19-May	2000	B	35	HYP	35	6.8	10.5	0.5	31	5.1	0.6	63	4.9	2.7	2.4	86.5	3.0	32.7		1193	104		0.23	0.17
19-May	2000	B	2.5	MUE																			1.51	0.79
27-Jun	2000	A	1	1	35	6.6	12.1	0.7	30	4.8	0.9	60	4.9	3.5	3.0	89.5	12.6	12.4		1071	84		0.46	0.25
27-Jun	2000	A	5	EZD																			0.49	0.30
27-Jun	2000	A	20	HYP	36	6.5	12.8	1.1	31	4.5	0.8	68	4.8	2.7	2.0	94.5	15.0	29.9		1116	76		0.11	0.28
27-Jun	2000	A	2.5	MEU																			0.43	0.29
27-Jun	2000	B	1	1	37	6.7	12.3	1.8	33	5.3	0.7	42	8.4	4.5	4.1	123.0	11.8	16.8		1035	87		0.64	0.29
27-Jun	2000	B	5	EZD																			0.84	0.35
27-Jun	2000	B	30	HYP	36	6.5	12.1	1.6	32	4.7	0.6	58	12.9	4.2	3.0	120.0	13.4	35.2		1100	84		0.11	0.19
27-Jun	2000	B	2.5	MEU																			0.65	0.28
17-Aug	2000	A	1	1	38	6.5	12.0	0.5	29	5.4	0.9	85	3.8	2.4	2.0	104.2	7.3	16.5		1023	130		1.22	0.43
17-Aug	2000	A	5	EZD																			1.00	0.38
17-Aug	2000	A	20	HYP	42	6.4	13.1	0.5	28	5.9	0.8	83	5.2	3.0	2.4	89.5	8.8	31.4		1056	107		0.11	0.25
17-Aug	2000	A	2.5	MEU																			1.41	0.42
17-Aug	2000	B	1	1	38	6.4	11.6	0.5	30	5.1	0.8	76	3.6	2.4	2.2	103.3	7.9	22.0		1041	107		0.83	0.41
17-Aug	2000	B	5	EZD																			0.72	0.43
17-Aug	2000	B	35	HYP	37	6.2	10.4	0.5	30	4.7	0.7	69	4.8	2.7	2.2	89.5	3.7	45.8		1081	73		0.10	0.24

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DATE	YEAR	STATION	DEPTH (m)	STRATA	CONDUCTIVITY (umhos/cm)	pH	ALKALINITY (mg/l)	TURBIDITY (NTU)	COLOR (Pt units)	CALCIUM (mg/l)	MAGNESIUM (mg/l)	IRON (*ug* * L^{-1})	TP (*ug* * L^{-1})	TFP (*ug* * L^{-1})	FRP (*ug* * L^{-1})	TKN (*ug* * L^{-1})	AMMONIA(*ug* * L^{-1})	NITRATE+NITRITE (*ug* * L^{-1})	TN (*ug* * L^{-1})	RSI (*ug* * L^{-1})	CARBON (*ug* * L^{-1})	TPP (*ug* * L^{-1})	CHL A (*ug* * L^{-1})	PHAEO (*ug* * L^{-1})
17-Aug	2000	B	2.5	MEU																			0.70	0.37
26-Sep	2000	A	1	1	36	6.8	12.4	1.5	38	4.8	0.8	109	6.0	3.8	3.1	124.9	13.7	20.8		1197	131		0.71	0.26
26-Sep	2000	A	4	EZD																			0.57	0.25
26-Sep	2000	A	20	HYP	38	6.7	12.8	1.2	38	5.2	0.8	112	5.5	3.3	3.0	114.1	11.5	27.4		1223	113		0.14	0.22
26-Sep	2000	A	2	MEU																			0.63	0.25
26-Sep	2000	B	1	1	37	6.7	12.2	1.5	38	5.0	0.8	87	4.9	3.3	1.8	139.4	7.3	11.5		1233	128		1.94	0.05
26-Sep	2000	B	4	EZD																			1.17	0.31
26-Sep	2000	B	40	HYP	38	6.5	11.3	0.7	29	4.6	0.7	52	4.2	2.9	1.3	109.2	11.0	43.6		1190	59		0.15	0.18
26-Sep	2000	B	2	MEU																			1.45	0.22

(EZD)= euphotic zone depth, (MEU)=Mid-euphotic zone depth, (HYP)=hypolimnion, (EPI)=epilimnion, (TP)= total phosphorous, (TFP)=total filterable phosphorous, (FRP)=filterable reactive phosphorous, (TKN)=total kjeldahl nitrogen, ammonia, nitrate minus nitrite, total nitrogen (TN), reactive silica (RSi), carbon, (TPP)=total particulate phosphorous, CHL*a*=chlorophyll *a*, and phaeophyton.

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