

AUKE CREEK WEIR
2002 ANNUAL REPORT

Operations, Fish Counts, and Historical Summaries

by

Sidney G. Taylor
National Marine Fisheries Service
and
Judith L. Lum
Alaska Department of Fish and Game

This report may be cited in the following manner:
Taylor, S.G. and J.L. Lum 2003. Auke Creek Weir 2002 Annual Report, Operations, Fish Counts, and Historical Summaries. Unpublished Report 29 p. National Marine Fisheries Service, Auke Bay Laboratory, 11305 Glacier Highway, Juneau, Alaska 99801-8626.

Table of Contents

Auke Creek Weir 2002 Annual Report	1
Figure 1. Dates of ice-out on Auke Lake	1
Figure 2. Daily and average water temperatures in Auke Creek, and freeze-up and ice-out dates on Auke Lake ..	2
Pink Salmon	2
Figure 3. Number of wild pink salmon fry, Auke Creek, 1972-2002.	3
Figure 4. Daily migration of pink salmon fry at Auke Creek, 2002, and the long-term average	3
Figure 5. Median migration dates of pink salmon fry at Auke Creek, 1973-2002.	3
Figure 6. Wild and hatchery pink salmon at Auke Creek, 1967-68 and 1971-2002.	4
Figure 7. Upstream migration of wild Auke Creek pink salmon adults, 2002	4
Figure 8. Median emigration dates of pink salmon adults at Auke Creek	4
Table 1. Number of wild and hatchery pink salmon fry and adults at Auke Creek	5
Sockeye Salmon	6
Figure 9. Number of wild sockeye salmon smolts, age-1 and age-2, leaving Auke Lake, 1980-2002	6
Figure 10. Daily migration of age-1 and -2 sockeye smolts at Auke Creek, 2002	6
Figure 11. Number of age-1 and age-2 sockeye smolts by brood year at Auke Lake	6
Figure 12. Average weight of age-1 and age-2 sockeye salmon smolts leaving Auke Lake, 1962-2002	7
Figure 13. Proportion of age-2 sockeye salmon smolts produced by brood year at Auke Lake	7
Figure 14. Total annual biomass of sockeye salmon smolts leaving Auke Lake	7
Figure 15. Number of sockeye salmon smolts produced per spawner by brood year in Auke Lake	8
Figure 16. Wild and hatchery, age-0 and lake stocked, sockeye salmon adults at Auke Creek, 1963-2002.	8
Table 2. Wild and hatchery sockeye salmon smolts and adults at Auke Creek	9
Chum Salmon	10
Figure 17. Chum salmon adults at Auke Creek, 1967-68, and 1971-2002	10
Table 3. Chum salmon fry and adults at Auke Creek	11
Coho Salmon	12
Figure 18. Number of coho salmon smolts by age class at Auke Creek, 1980-2002.	12
Figure 19. Median migration dates of coho smolts at Auke Creek, 1980-2002.	12
Figure 20. Daily migration of coho salmon smolts at Auke Creek, 2002.	12
Figure 21. Coho salmon smolts, uninfected and infected with <i>Phylonema sp.</i>	12
Figure 22. Auke Creek coho salmon jacks, 1971-2002	13
Figure 23. Weir counts and fishery catch of Auke Creek coho salmon from Auke Creek	13
Figure 24. Ocean survival of wild coho salmon smolts from Auke Creek	13
Table 4. Coho salmon smolts captured and released with coded wire tags at Auke Creek, weir recovery of jacks and adults, weir and fishery recovery and ocean survival of tagged fish	14
Dolly Varden	15
Figure 25. Downstream migrant Dolly Varden at Auke Creek	15
Figure 26. Migration of Dolly Varden at Auke Creek, 2002.	15
Figure 27. Fork lengths, daily samples and weekly averages, of Dolly Varden at Auke Creek, 2002.	15
Table 5. Dolly Varden at Auke Creek, 1970, and 1980-2002.	16
Cutthroat and Steelhead trout	17
Figure 28. Number of downstream migrant wild cutthroat trout at Auke Creek.	17
Figure 29. Average and 2002 downstream migrations of cutthroat trout at Auke Creek	17
Figure 30. Fork lengths, daily samples and weekly averages, of cutthroat trout at Auke Creek, 2002	18
Figure 31. Growth of cutthroat trout between downstream and upstream migrations at Auke Creek, 2002	18
Table 6. Number of migrant wild and hatchery cutthroat trout at Auke Creek	19
Chinook Salmon	20
Figure 32. Chinook salmon mini-jacks and adults at Auke Creek, 1987-2002.	20
Table 7. Number of adipose marked and unmarked chinook salmon at Auke Creek, 1987-2002.	21
Appendices	22
Appendix 1. Downstream migrant wild salmonids at Auke Creek, 1961-2002	22

Appendix 2. Salmon adults captured at Auke Creek weir, 1963-2002	23
Appendix 3. Dates of ice-out on Auke Lake	24
Appendix 4. Daily water temperatures at Auke Creek, 2002	25
Appendix 5. Monthly totals and daily counts of downstream migrant wild salmonids at Auke Creek, 2002	26
Appendix 6. Monthly totals and daily counts of upstream migrant salmonids at Auke Creek, 2002	28

Auke Creek Weir 2002 Report

The Auke Lake system has endemic populations of pink, chum, sockeye and coho salmon, and supports populations of Dolly Varden char and cutthroat and steelhead trout. Chinook salmon have returned to Auke Creek since 1987 as a result of off-site releases of juveniles from other hatcheries. The National Marine Fisheries Service, and its' predecessor agency, U.S. Bureau of Commercial Fisheries, began salmon research at Auke Creek, 19 km north of Juneau, Alaska, in 1961. Fyke nets were used that year to estimate the production of sockeye salmon smolts from Auke Lake. Downstream migrant sockeye smolt counts are available for some years between 1961 and 1980, and annually since 1980. Pink salmon fry populations in Auke Creek were estimated annually, 1972-79, and counted at Auke Creek weir since 1980. Dolly Varden and cutthroat trout were counted in 1970, and all downstream migrants were counted since 1980 (Appendix 1). Weir counts of sockeye salmon adults at Auke Creek began in 1963; pink and chum salmon were counted 1967-68, and all fish were counted since 1971 (Appendix 2). Auke Creek has been the site of many projects on wild and enhanced fish since construction of the hatchery in 1971. Projects at Auke Creek between 1971 and 1983 operated under several cooperative agreements. An interagency cooperative agreement relating to Auke Creek weir was established in 1983 between the National Marine Fisheries Service (NMFS), University of Alaska-Fairbanks (UAF), and Alaska Department of Fish and Game (ADF&G). The agreement provided the authority to jointly fund a full-time person to assist with the operation of the fish counting weir at Auke Creek. The primary objective is to operate the weir on a daily basis and maintain the long-term data collection on migrant salmonids. The agreement was revised in December 2000, and is in effect through October 2005. Auke Creek weir usually operates from March 1 through October 31. A report of fish counts

from daily weir operation, and other information related to salmonid research involving the facilities at the weir is prepared each year. This report includes data from activities in 2002. The original data are available in the Auke Creek data file at the Auke Bay Laboratory. Data collected by investigators on specific projects are usually not included in this report, but are available from those individuals. No fish were released from Auke Creek hatchery in 2002. Most chum and all chinook salmon adults captured at Auke Creek were strays from other hatcheries.

The emigration weir at Auke Creek was operated from March 1 through June 28 and captured pink, sockeye, chum, and coho salmon, Dolly Varden char, and cutthroat and steelhead trout leaving Auke Creek. All fish were counted and released. The first emigrants, pink salmon fry, were captured March 2. Coho salmon smolts and cutthroat trout were marked and tagged during the migration.

The immigration weir was installed June 28 to capture salmonids entering Auke Creek. The weir was modified to capture small fish, specifically Dolly Varden, cutthroat trout, and chinook salmon mini-jacks. Before 1997, small fish passed through the adult weir panels and were not counted. Aluminum plates, 0.3 x 46 x 91 cm, with 1.3 x 10 cm horizontal slots were placed on the bottom half of the lowest weir panels to prevent passage of small fish. Small fish were captured in two trout traps attached to the upstream side of the weir. Salmon adults cannot enter the trout traps because of the small

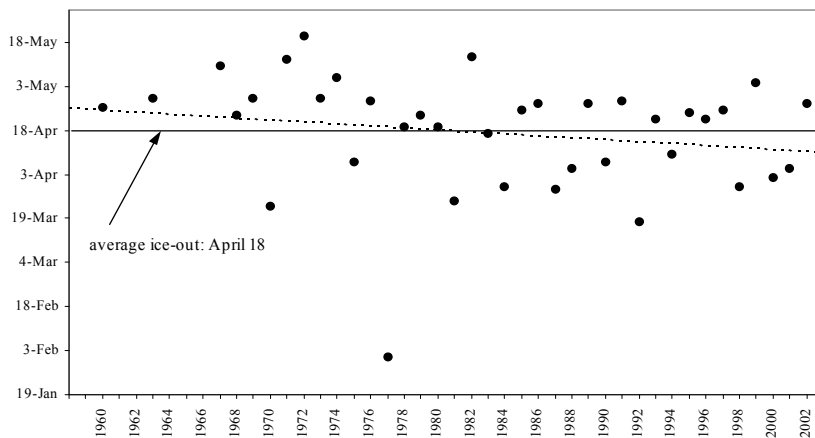


Figure 1. Dates of ice-out on Auke Lake, and average (solid) and trend (dashed) lines over all years.

entrances. In accordance with the annual operation plan, various personnel assisted with the counting and processing of fish at the weir. Weir operations ceased October 31, and the weir was removed from operation. Thirteen pink/chum hybrids were captured at Auke Creek in 2002.

The surface of Auke Lake froze on November 28, 2001, and the lake was ice free on April 28, 2002. The average ice free date for Auke Lake is April 18 (Figure 1, Appendix 3). Auke Lake froze from December 26-31, 2002, and thawed in early January 2003. Stream flows were low during most of March, all of April, and most of May. From early March through late May there was 6 inches of precipitation recorded at the Auke Bay weather station, 1.8 inches in March, 0.9 inches in April, and 3.3 inches in

May. This was the driest 90 day period on record at Auke Bay.

Water temperature in Auke Creek was measured daily at the weir site (Appendix 4). Overall, water temperatures were close to average through early April. From mid April through late September, temperatures tended to be lower than average. An El Nino event continued the warm, rainy weather into the fall and early winter, and it was noticeable in Auke Creek temperatures. From October 15 through December 31, 78 days, record high water temperatures were equaled or set on 53 days in 2002 (Figure 2). This was the warmest October 15 - December 31 period on record for Auke Creek.

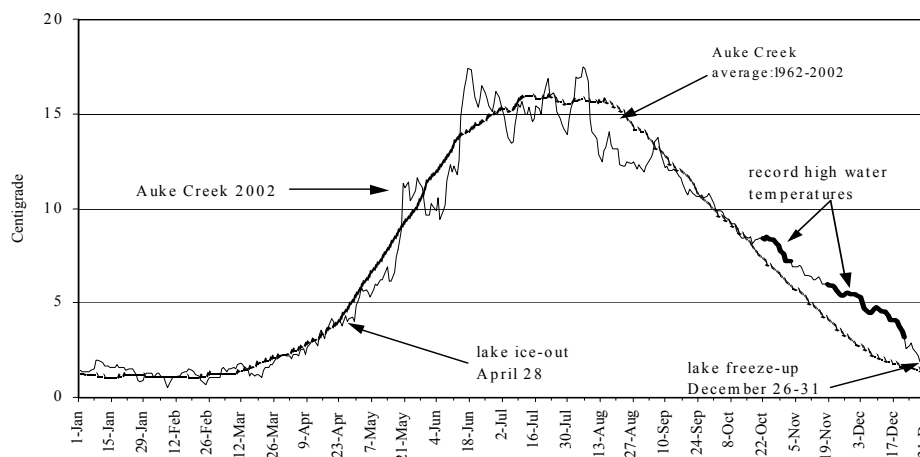


Figure 2. Daily and average water temperatures in Auke Creek, and dates of ice-out and freeze-up at Auke Lake.

Pink Salmon

Pink salmon spawn throughout the Auke Lake system, mainly in Auke Creek and tributaries to Auke Lake, and in the intertidal area downstream from the weir site. In even- and odd-numbered years there are distinct runs of pink salmon in August and September, referred to as the early and late runs. Before 1963, Auke Creek upstream from the weir was mainly small rock and boulder substrate on bedrock, and there was probably limited area for spawning salmon. Spawning channels built in the upper reach of

Auke Creek in 1963 provided about 1,000 m² of spawning area. The original streambed substrate was removed down to bedrock before the channels were built. The channels were created by a series of 20x20cm timbers bolted together to form dams about 1 m high. The timbers were buttressed from the downstream side by concrete-filled sandbags. Each dam was filled with washed rock, mostly 5-10cm cobbles, purchased locally. Since 1963, floods washed large amounts of the cobbles out of the channels, and the streambed is reverting to bedrock and small boulder substrate. The

streambed downstream from the weir is intertidal, and is mainly boulders, broken shale, and smaller gravel on bedrock. There are no annual counts of pink salmon runs in Auke Creek before the channels were built. Before the first return of hatchery pink salmon in 1973, the runs averaged nearly 2,600 fish.

Pink salmon fry populations were estimated in Auke Creek since 1972. Hydraulic censuses in the freshwater and intertidal areas provided estimates through 1980. Weir counts of fry leaving the freshwater area began in 1980, and the hydraulic censuses stopped. The accuracy of hydraulic censuses of fry populations in Auke Creek is not known. The cobble and boulder substrate in Auke Creek makes it difficult to efficiently operate hydraulic sampling equipment, and the confidence intervals of fry estimates are large. The hydraulic censuses showed the average estimates and confidence intervals of freshwater and intertidal populations were $137,000 \pm 60,000$, and $63,000 \pm 29,000$.

In 2002, a total of 150,149 pink salmon fry were counted during the downstream migration from the freshwater area (Table 1). This was the highest count since 1993, and above the average 115,725 (Figure 3). The fry migration was below average daily numbers through mid April. The fry responded to a small increase in streamflow after 0.5 inches of rain, April 20-22, and nearly 51,000, 30% of the 2002 population migrated in three days. Record daily counts occurred on April 21 and 22 when 18,310 and 19,851 fry migrated. Most fry migrated in April, when the average daily count was about 4,500 (Figure 4, Appendix 5). Daily fry counts decreased in late April, and 5,800 and 270 fry were captured in May and June. The median date of the 2002 emigration, April 21, was near average for Auke Creek. The earliest median date of migration is April 1, 1998, and the latest May 7, 1982 (Figure 5). No wild fry were marked or tagged in 2002. A University of Alaska graduate student project produced fry for laboratory studies, but none were knowingly released in Auke Creek.

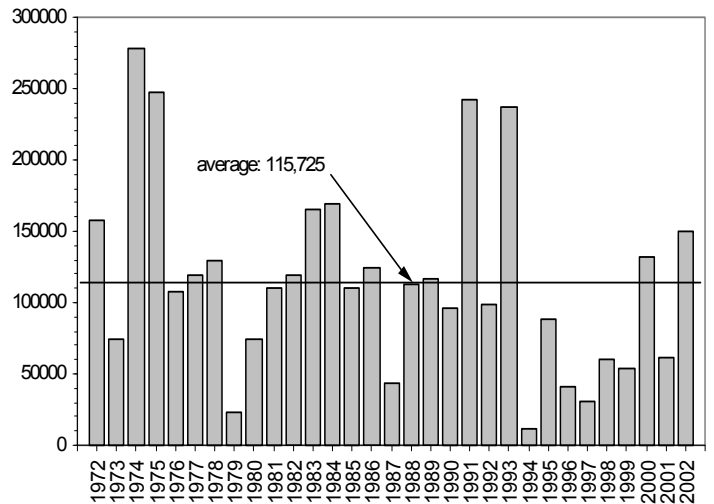


Figure 3. Number of wild pink salmon fry, Auke Creek, 1972-2002.

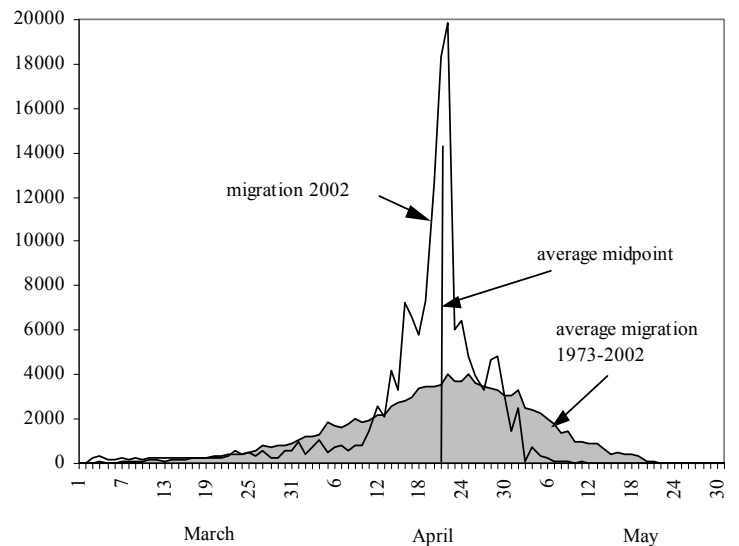


Figure 4. Daily migration of pink salmon fry at Auke Creek, 2002, and the 1973-2002 average and midpoint.

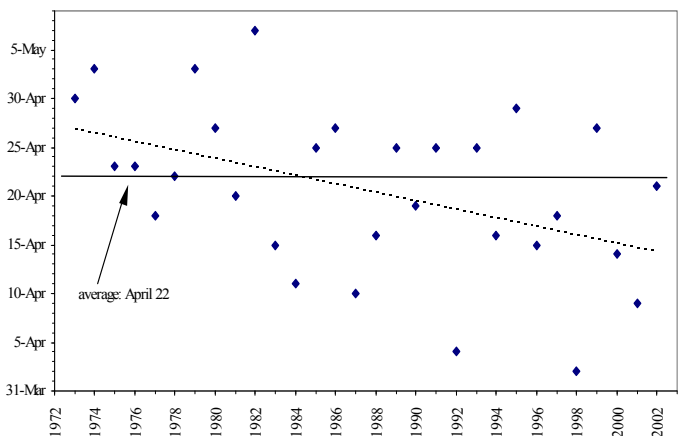


Figure 5. Median migration date of pink salmon fry at Auke Creek, 1973-2002. The horizontal line is the average, and the dotted line is the trend.

Pink salmon are the work horse of hatchery projects at Auke Creek. Hatchery-reared fry were released annually since 1972, except 1994, 1996, and after 2000 (Table 1). Enhancement experiments produced most of the pink salmon leaving Auke Creek during the first decade of hatchery experience, and returning hatchery fish were released to spawn in Auke Creek through 1984 and in 1996. Various genetics projects resulted in the release of small numbers of fry beginning in the mid-1980s, and all of these fry were to have been fin marked. Fin marked adults from genetic projects were not knowingly released in Auke Creek.

Pink salmon adults were counted at Auke Creek in 1967 and 1968, and annually since 1971. In 2002, 4,928 pink salmon adults were captured at Auke Creek weir (Figure 6). All were released to spawn in the creek.

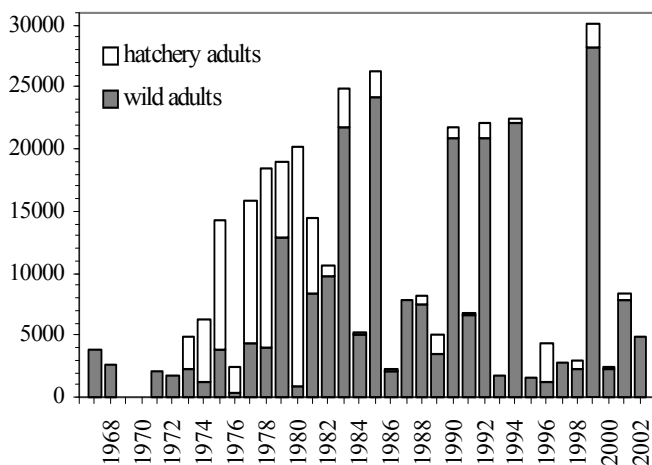


Figure 6. Wild and hatchery pink salmon adults at Auke Creek, 1967-1978 and 1971-2002.

The 2002 run of wild fish was less than average for Auke Creek, and about twice the number of the 2000 parent brood. The average run at Auke Creek is 7,460 wild pink salmon, and 10,266 when hatchery fish are included (Table 1). The average hatchery return was 3,533, although the average over the last two decades was 1,244. In 2002, pink salmon were captured at the weir from late July through mid September (Appendix 6). Most of the fish, 4,243, entered Auke Creek during August; 43 did so in July and 642 in September. Based on the increase in the

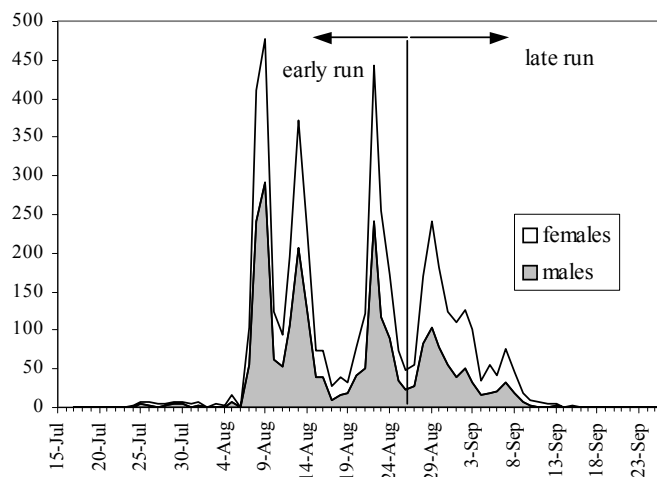


Figure 7. Upstream migration of Auke Creek pink salmon adults, 2002. (daily numbers are stacked in graph)

proportion of bright, silver females with loose scales, August 26 was considered the start of the late run (Figure 7). At that time, early run females were ready to spawn, and late run females were not. The early wild run was 3,467 fish, 1,862 males and 1,605 females, and the late run 1,461 fish, 612 males and 849 females. The late run was 30% of the 2002 return, less than the average of 38% over the last two decades. Before 1982, the late run averaged 70% of the return. The median

dates of entire upstream migrations since 1982 are about 10 days earlier than before 1982 (Figure 8).

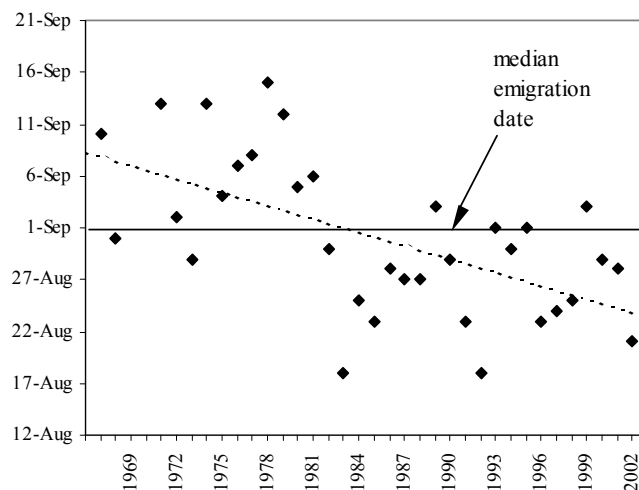


Figure 8. Median emigration dates of pink salmon adults at Auke Creek. The dashed line is the trend over all years.

Table 1. Number of wild and hatchery pink salmon fry and adults at Auke Creek.

Year	pink salmon fry			pink salmon adults		
	wild	hatchery	total	wild	hatchery	total
1967				3,761		3,761
1968				2,638		2,638
1969						
1970						
1971				2,091		2,091
1972	157,189	186,674	343,863	1,768		1,768
1973	73,900	493,769	567,669	2,262	2,686	4,948
1974	277,624	1,014,338	1,291,962	1,139	5,121	6,260
1975	247,091	1,075,870	1,322,961	3,806	10,455	14,261
1976	108,195	259,837	368,032	334	2,191	2,525
1977	119,442	498,161	617,603	4,328	11,520	15,848
1978	129,714	264,216	393,930	3,972	14,438	18,410
1979	23,270	499,813	523,083	12,922	6,081	19,003
1980	74,047	177,619	251,666	924	19,264	20,188
1981	110,552	175,827	286,379	8,432	6,018	14,450
1982	119,548	134,843	254,391	9,831	827	10,658
1983	164,784	39,777	204,561	21,855	2,972	24,827
1984	169,552	98,930	268,482	5,115	156	5,271
1985	110,001	101,296	211,297	24,124	2,193	26,317
1986	123,887	5,165	129,052	2,089	216	2,305
1987	43,502	16,562	60,064	7,902	12	7,914
1988	113,061	66,376	179,437	7,574	566	8,140
1989	116,870	38,976	155,846	3,461	1,555	5,016
1990	96,651	80,014	176,665	20,983	823	21,806
1991	242,772	64,137	306,909	6,653	225	6,878
1992	98,447	29,086	127,533	20,972	1,129	22,101
1993	237,073	22,879	259,952	1,688	8	1,696
1994	11,603		11,603	22,167	366	22,533
1995	88,197	774,589	862,786	1,548		1,548
1996	41,359		41,359	1,155	3,219	4,374
1997	31,092	40,074	71,166	2,774		2,774
1998	60,785	39,834	100,619	2,267	612	2,879
1999	53,533	40,000	93,533	28,127	1,970	30,097
2000	132,075	40,000	172,075	2,181	310	2,491
2001	61,504		61,504	7,857	466	8,323
2002	150,149		150,149	4,928		4,928
mean	115,725	232,543	318,262	7,460	3,533	10,266

Sockeye Salmon

In Auke Lake, sockeye salmon spawn in the larger tributaries and on submerged gravel beds in the lake. The production of wild sockeye from Auke Lake was first estimated in 1961 at 90,000 smolts. From 1961 through 1979, smolt numbers were estimated several times, but some of those smolt estimates are known to be incomplete. The pre-1980 smolt estimates lack continuity, and, based on the pre-1980 escapements, it is obvious there has been a significant decrease in the number of smolts since the 1960s and early 1970s. The 1961 smolt estimate is the highest on record, and estimates from 1962 through 1979 ranged from 8,862 to 62,389. Since 1980, the entire smolt population was counted at Auke Creek weir, and the number of wild smolts ranged from 1,619 to 33,616. Hatchery-reared sockeye fry stocked in Auke Lake in 1974-1975 and 1987-1989 contributed to the smolt production in subsequent years. Sockeye enhancement in the late 1980s and early 1990s included the release of under-yearling smolts that were reared in the hatchery and in net pens in Auke Bay.

A total of 17,594 sockeye smolts were counted at the weir during the downstream migration in 2002. The average number of wild smolts produced in Auke Lake, 1980-2002, is 16,928 (Table 2, Figure 9).

The downstream migration of sockeye smolts began in early May, and about 14,000 smolts migrated during the last two weeks of the

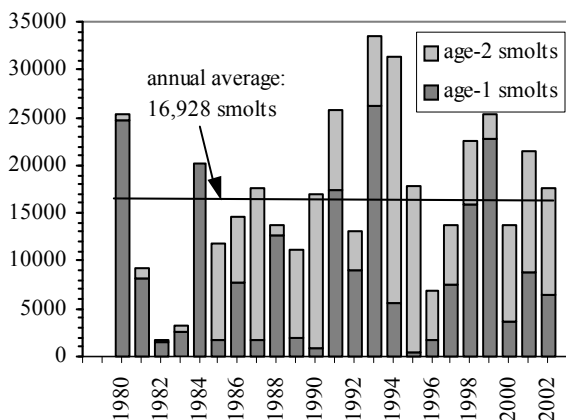


Figure 9. Number of wild sockeye smolts, age-1 and age-2, leaving Auke Lake, 1980-2002.

month (Figure 10). The migration midpoint was May 25, 2 days later than in 2001. The last smolts were counted on June 28, although fewer than 300 left the lake during the last two weeks of the month (Appendix 5). All sockeye salmon smolts in 2002 were from natural spawning in the

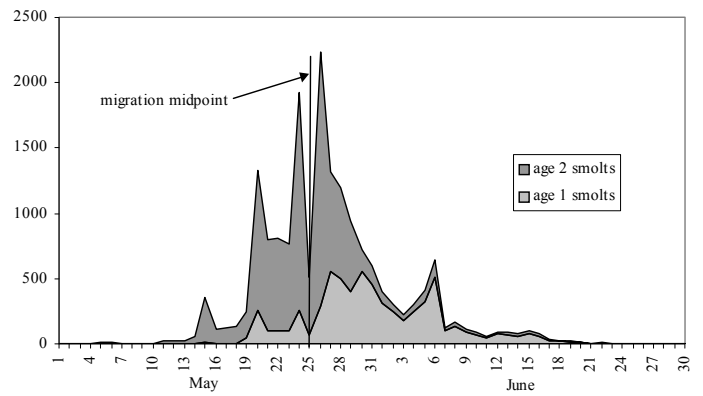


Figure 10. Daily migration of age-1 and age-2 sockeye salmon smolts at Auke Creek, 2002. (daily numbers are stacked).

Auke Lake system. Scale analysis revealed that 36% of the smolts were age-1, 2000 brood, 6,359 fish, and 64% age-2, 1999 brood, 11,235 fish. The 1999 brood has completed the freshwater phase of its' life history, and produced a total of 19,989 smolts. Smolt production from the 1999 brood was greater than the average production of 17,318 over the last 22 years (Figure 11). The 2000 brood year has produced only age-1 smolts; the age-2 smolts from this brood year will emigrate in 2003.

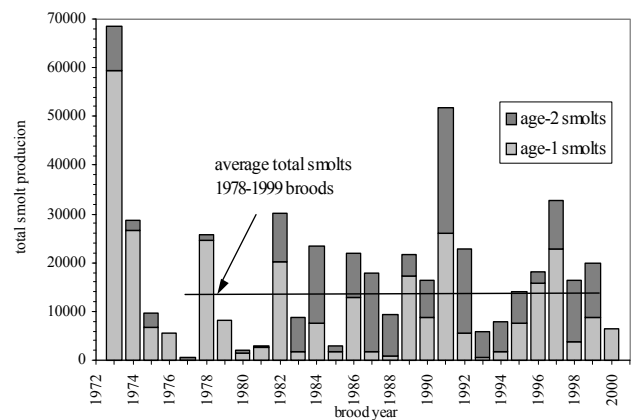


Figure 11. Number of age-1 and age-2 sockeye smolts by brood year at Auke Lake. The pre-1978 and 2000 brood year data not included in the average (represented by the horizontal line).

The sizes of age-1 and -2 sockeye smolts leaving Auke Lake in 2002 were quite different from each other. Age-1 smolts averaged 77 mm and 3.9 gm, and age-2 smolts were 131 mm and 19.6 gm. The long-term averages for age-1 and age-2 sockeye smolts leaving Auke Lake are 75 and 3.8 gm and 107 mm and 12.3 gm.

There is a trend of increasing size of sockeye smolts leaving Auke Lake over the last four decades (Figure 12). This trend has been most noticeable in the average smolt weight. For the periods 1961-1980, 1981-1990, and 1991-2002, age-1 smolts averaged 2.3, 4.3, and 4.4gm, respectively; an 87% average gain between the first and second periods and a 2% gain between the second and third period. The heaviest age-1 smolts, 6.8 gm, were in 1998. There were few, if any, age-2 smolts produced from the 1961-1980 brood years, and the average weight was 5.1gm. For the 1981-1990 and 1991-2002 periods, age-2 smolts averaged 9.5 and 17.9gm, respectively. The average weight of age-2 smolts increased 86% between the 1961-1980 and 1981-1990 periods, and 88% between the 1981-1990 and 1991-2002 periods. On average, the weight of age-1 and age-2 sockeye smolts increased 2.9 and 5.7%/year between 1980 and 2002.

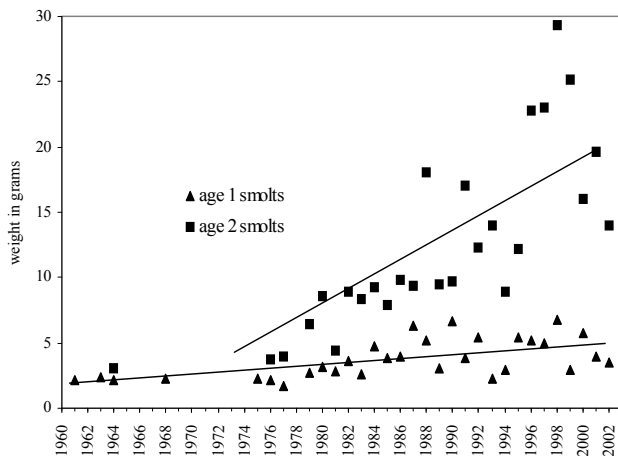


Figure 12. Average weight of age-1 and age-2 sockeye salmon smolts leaving Auke Lake, 1962-2002. The lines are linear trend lines for each age group.

There is a trend of increasing proportion of age-2 smolts produced from each brood year. Before 1980, age-2 smolts usually represented <5% of the production from a brood year, and,

often, no age-2 smolts were produced in some brood years. Since the 1980 brood year, the average proportion of age-2 smolts has reached 54% of the total produced by a brood year (Figure 13). Thus, the size and proportion of age-2

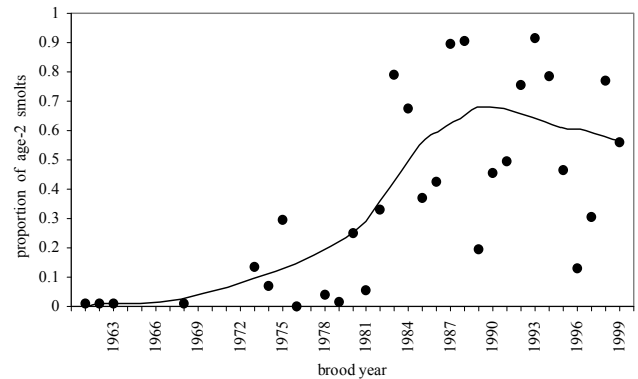


Figure 13. Proportion of age-2 sockeye salmon smolts produced by brood year at Auke Lake. The data trend, represented by the curved line, was smoothed by local regression.

smolts have increased simultaneously.

Total biomass-zooplankton models indicate Auke Lake is capable of producing about 350 kg of smolts annually. The total biomass of sockeye smolts (estimated total weight of all smolts in a migration year) from Auke Lake in 2002 was 180 kg. This was above the average of 146 kg for Auke Lake smolts for years that data are available (Figure 14). The 2002 smolt biomass is above average mainly because of the high proportion of large age-2 smolts.

One measure of freshwater survival, the number of smolts produced per spawner, indicates that for Auke Lake sockeye, 1978-1999 brood years, only 5 broods produced more than 10 smolts per spawner (Figure 15). The average over the last 21 broods is 8 smolts. The 1999 brood produced a total of 12.7 smolts per spawner. The 2000 brood has produced 2.6 age-1 smolts per spawner; and that production will increase when the age-2 smolts emigrate in 2003.

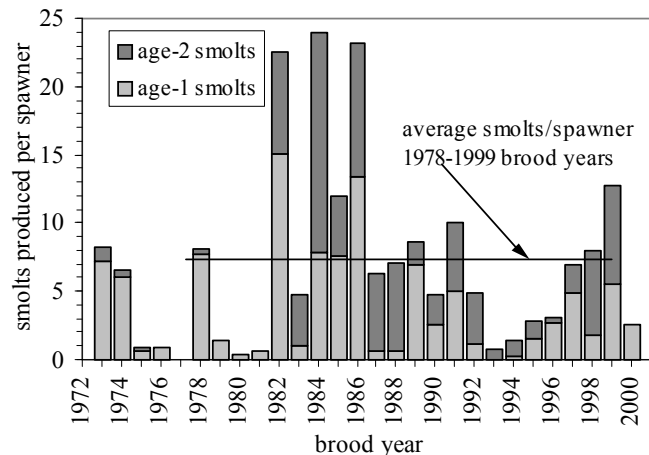


Figure 15. Number of sockeye salmon smolts produced per brood year in Auke Lake. The 2000 brood will produce age-2 smolts in 2003.

Sockeye salmon adults were counted annually at Auke Creek since 1963. From 1963 through 1981 sockeye escapements averaged about 7,000 adults, nearly 3 times greater than since 1982 (Figure 16). During the late 1970s the escapements declined, and, since 1982, the average return of wild fish was about 2,500. Sockeye enhancement research at Auke Creek hatchery, which used Auke Lake sockeye from the 1973-1974 and 1986-1991 broods, boosted subsequent escapements. Progeny from enhancement programs produced 4,600 and 18,000 adult sockeye to the Auke Creek escapements in 1977-1980 and 1990-1995, respectively. No hatchery sockeye have returned to Auke Creek since the enhancement program ended in 1995.

In 2002, 2,882 adult and 130 jack sockeye salmon returned to Auke Creek (Table 2). The adult run was greater than the average wild run since 1982, but less than the historical average for all years, 4,641 adults. Most sockeye adults migrated upstream in July, 2,562 fish, 320 migrated in August; none migrated in September (Appendix 6). Estimated survival, smolt to weir recovery of adults, for 2002 returns was 11%.

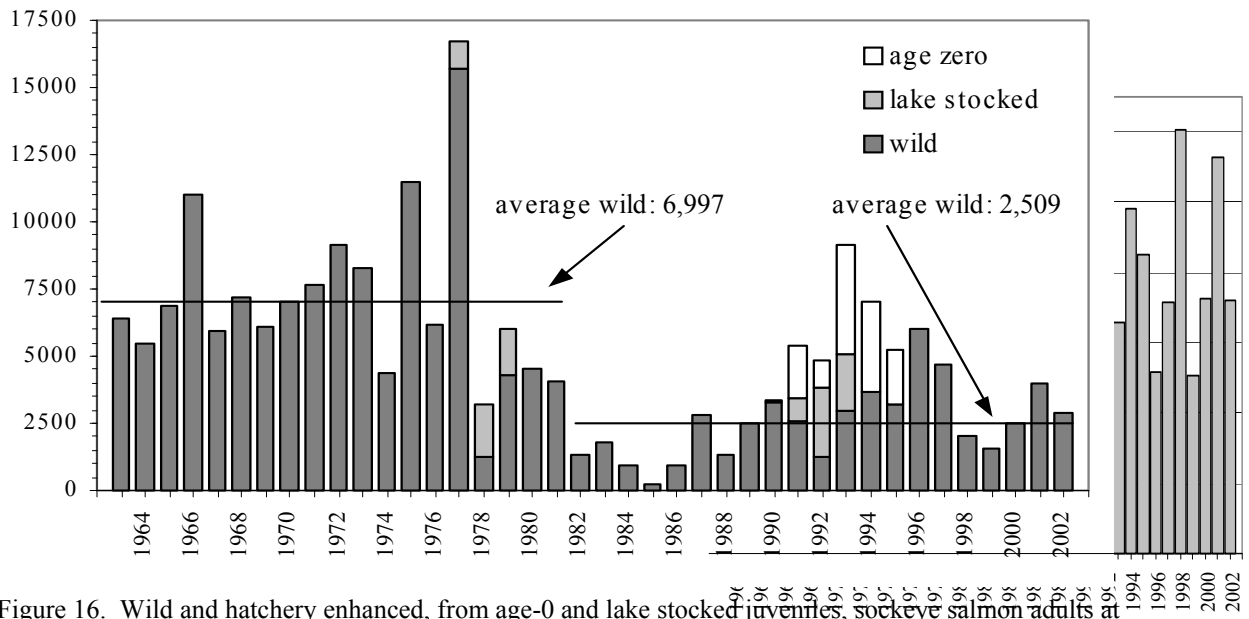


Figure 16. Wild and hatchery enhanced, from age-0 and lake stocked juveniles, sockeye salmon adults at Auke Creek, 1963-2002.

Figure 14. Total annual biomass of sockeye salmon smolts leaving Auke Lake.

Table 2. Wild and hatchery sockeye salmon smolts and adults at Auke Creek.
(hatchery = lake stocked and age-0).

Year	smolts				adults			
	wild	stocked	age-0	total	wild	stocked	age-0	total
1961	90,000			90,000				
1962								
1963					6,391			6,391
1964	62,389			62,389	5,465			5,465
1965					6,889			6,889
1966					10,986			10,986
1967					5,909			5,909
1968	35,737			35,737	7,164			7,164
1969					6,131			6,131
1970					7,034			7,034
1971					7,673			7,673
1972					9,166			9,166
1973					8,259			8,259
1974	15,399			15,399	4,371			4,371
1975	59,370	10,001		69,371	11,461			11,461
1976	35,769	8,585		44,354	6,153			6,153
1977	8,862	450		9,312	15,683	1,000		16,683
1978				8,291	1,271	1,906		3,177
1979					4,291	1,731		6,022
1980	25,299			25,299	4,564			4,564
1981	9,183			9,183	4,089			4,089
1982	1,619			1,619	1,334			1,334
1983	3,170			3,170	1,805			1,805
1984	20,251			20,251	975			975
1985	11,747			11,747	240			240
1986	14,500			14,500	952			952
1987	17,598			17,598	2,847			2,847
1988	13,812	4,992	36,500	55,304	1,337			1,337
1989	11,187	17,879	34,290	63,356	2,508			2,508
1990	16,983	11,567	49,949	78,499	3,295	88		3,383
1991	25,872	115	138,007	163,994	2,583	832	2,009	5,425

1992	13,248		57,077	70,325	1,267	2,541	1,045	4,853
1993	33,616			33,616	2,988	2,077	4,048	9,113
1994	32,009			32,009	3,696		3,296	6,993
1995	17,857			17,857	3,221		2,040	5,261
1996	7,069			7,069	5,995			5,995
1997	13,856			13,848	4,671			4,671
1998	22,496			22,496	2,068			2,068
1999	25,244			25,249	1,571			1,571
2000	13,699			13,699	2,480			2,480
2001	21,428			21,428	3,963			3,963
2002	17,594			17,594	2,882			2,882
mean ¹	16,928				4,641			5,206

¹Mean number of wild smolts is from 1980-2002.

Chum Salmon

It is not known if chum salmon are native to Auke Creek or were originally strays from other local systems. Probably few chum salmon were ever produced in the Auke Lake system, although adults were observed in all spawning areas, including the intertidal. The first year chum salmon adults were counted at Auke Creek was 1967, and they were not counted in 1969 or 1970. The average run to Auke Creek before NMFS enhancement experiments was 20 adults. Chum salmon fry were observed during the 1972-1976 emigrations, but were not counted. In 1976, NMFS started chum salmon enhancement projects, and examined use of a small population for brood stock development, marine survival of juveniles, and age heritability. Hatchery chum salmon fry were released from 1977-1984, and 1986. All hatchery fry, except in 1984, were

marked by ventral fin clip, or adipose fin clip and coded wire tag. No adults were released in Auke Creek from 1976-1983, and none spawned in the intertidal area, thus, no wild fry were produced in Auke Creek from 1977-1984. In those years all chums were spawned for hatchery incubation. Chum salmon adults, resulting from releases of Macaulay Hatchery fry at Amalga Harbor and, perhaps, other release sites, strayed into Auke Creek since 1994 (Figure 17). In 2002 a total of 1,959 fry and 1,587 adult chum salmon were counted and released at Auke Creek (Table 3). Most fry migrated in April, slightly earlier than the pink salmon (Appendix 5). Based on run timing and number of adult chums, it was suspected that most or all of these fish were strays from Macaulay Hatchery remote site releases. Before 1994, chum salmon in Auke Creek emigrated after mid August, usually during the last week of August and early September. In 2002, the 20 chum salmon that entered Auke Creek after the third week of

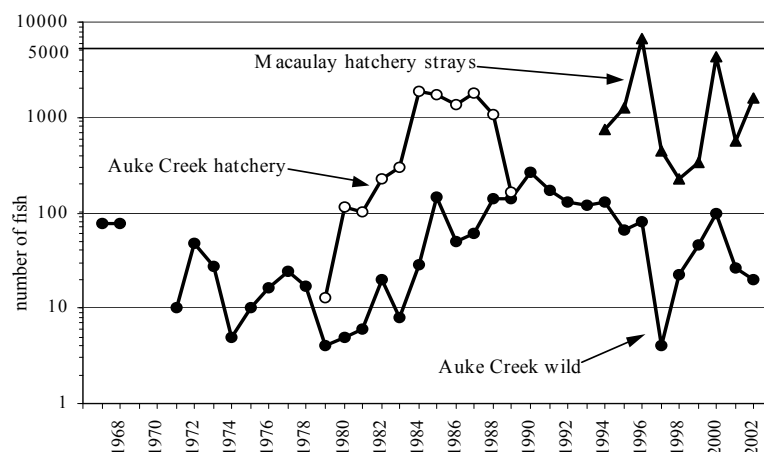


Figure 17. Chum salmon adults at Auke Creek, 1976-68 and 1971-2002.

August were counted as Auke Creek fish

Don Mortensen, NMFS, collected otoliths from 100 chum salmon carcasses at Auke Creek in August, and found that 96 had otolith marks from thermal marking at Macaulay Hatchery, and 4 had no marks. The otolith marked chum salmon were from 3 brood years and several release sites (text table).

Origin of chum salmon adults at Auke Creek, 2002, based on thermally marked otoliths. Sample size 100, four had no thermal marks.		
brood year	no. of adults	release site of juveniles
1997	2	Limestone Inlet

1997	13	Macaulay Hatchery & Amalga Harbor
1998	1	Limestone Inlet
1998	2	Boat Harbor
1998	15	Macaulay Hatchery
1998	55	Amalga Harbor
1999	8	Amalga Harbor

Table 3. Chum salmon fry and adults at Auke Creek.

Year	fry		adults			total
	wild	Auke C. hatchery	Macaulay ¹ strays	Auke C. hatchery	Auke C. wild	
1967					78	78
1968					76	76
1969						
1970						
1971					10	10
1972					47	47
1973					27	27
1974					5	5
1975					10	10
1976					16	16
1977	0	12,195			24	24
1978	0	18,446			17	17
1979	0	20,049		13	4	17
1980	0	2,491		113	5	118
1981	0	67,236		103	6	109
1982	0	54,134		231	20	251
1983	0	41,742		302	8	310
1984	0	58,452		1,888	29	1,917
1985	7,198			1,704	148	1,852
1986	825	20,725		1,342	50	1,392
1987	14,039			1,824	60	1,884
1988	8,091			1,053	140	1,193
1989	13,750			166	138	304
1990	1,916				270	270
1991	759				174	174
1992	4,783				130	130
1993	47				121	121
1994	137		736		132	868

1995	5		1,262		65	1,327
1996	4,981		6,700		81	6,781
1997	8,307		444		4	448
1998	735		225		22	247
1999	1,269		340		46	386
2000	1,337		4,344		100	4,444
2001	23,372		562		26	588
2002	1,959		1,567		20	1,587
mean	5,195	32,830	1,798	794	62	795

¹ Macaulay Hatchery-reared chums that strayed to Auke Creek.

Coho Salmon

Coho salmon spawn in the tributaries to Auke Lake and in the upper reach of Auke Creek. The total number of smolts migrating from Auke Lake was counted since 1980. Since 1976, coho smolts were adipose fin clipped and tagged with wire tags (no smolts were tagged in 1978). Coho adults were counted in 1967, and since 1971. Before 1980, low-height weirs captured salmon adults at Auke Creek. Those weirs were often under water during floods, and some pre-1980 data may be incomplete. Coho salmon spawned for hatchery incubation, 1978, 1980-1984, and 1996-1997, and all fish were tagged with coded wires and marked with an adipose and ventral fin clip to distinguish them from wild smolts. All hatchery jack and adult coho were killed at the weir. Coho data in this report are wild fish only.

There is a trend of decreasing coho salmon smolt production at Auke Lake. A total of 3,434 coho salmon smolts left Auke Lake in 2002, a new record low number (Figure 18). The highest coho smolt count at Auke Creek was 10,022 in 1980; the average is 6,294 (Table 4, Figure 18). In 2002, 3,401 smolts were tagged with coded wires and marked by adipose fin clip. Samples collected throughout the run revealed that 713 smolts were age-1 (2000 brood) and 2,721 were age-2 (1999) brood. The number of age-1 smolts was the lowest ever at Auke Creek. Average sizes of age-1 and age-2 smolts were 104 mm and 11 gm, and 118 mm and 16 gm.

The smolt migration began during the first week of May, however, only 189 migrated during the first two weeks. Over 2,900 smolts migrated between May 15 and 31 (Appendix 5). The migration midpoint was May 22. The average midpoint of migration of coho smolts at Auke Creek is May 20 (Figure 19). The migration of age-2 smolts preceded that of age-1 smolts by about one week (Figure 20). The midpoints of the age-2 and -1 smolts were May 22 and May 27, respectively.

During the fish handling, we noted that coho smolts were heavily parasitized by the nematode *Phylonema* sp. At least 44% of the smolts were disfigured with a swollen abdomen and could not swim well (Figure 21).

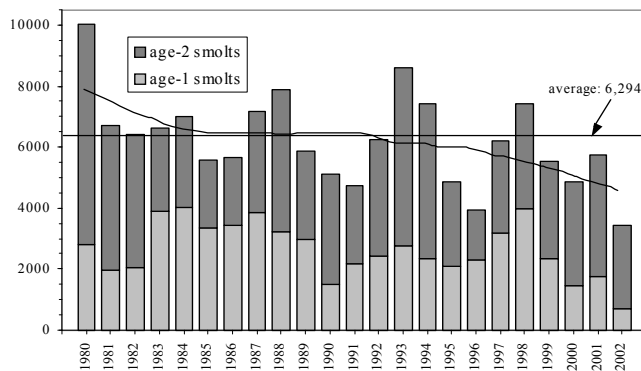


Figure 18. Number of coho salmon smolts by age class at Auke Creek, 1980-2002. The curved line represents the trend in total smolt counts smoothed by local regression.

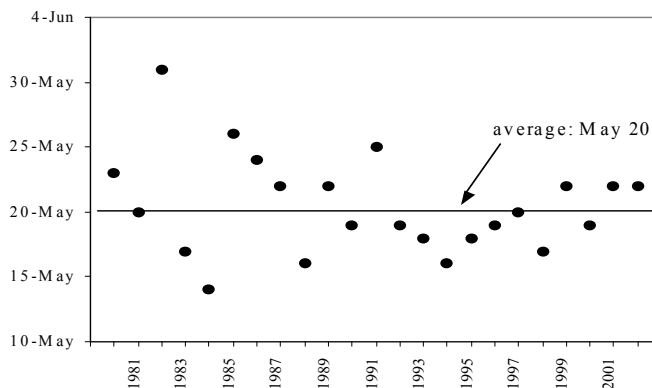


Figure 19. Median migration dates of coho salmon smolts at Auke Creek, 1980-2002.

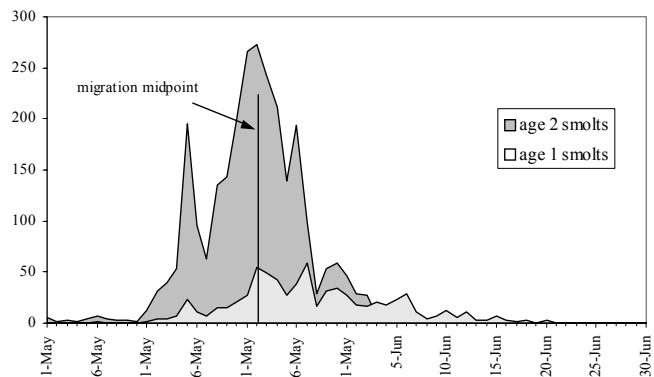


Figure 20. Daily migration of coho salmon smolts at Auke Creek, 2002. The daily numbers of are stacked.

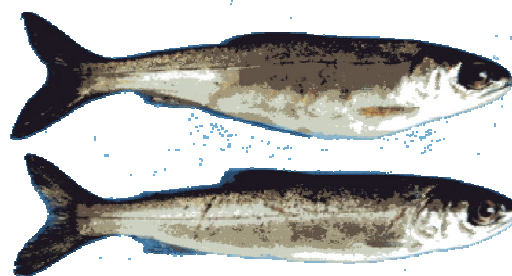


Figure 21. In 2002, at least 44% of the coho smolts were infected with *Phylonema* sp. (upper). Both smolts pictured were 115 mm: the infected smolt was 18 gm, the uninfected smolt was 15 gm.

The 2002 run of coho salmon at Auke Creek included adipose marked and unmarked jacks and adults. The total run of coho salmon was 104 jacks and 1,176 adults. The jack run was less than average, and was the second lowest on record (Figure 22). The adult run was above average, and the third highest on record (Figure 23). The return of marked coho to Auke Creek was 97 jacks and 1,112 adults. The return of marked jacks was less than average, and that of adults greater (Table 4). Most jack and adult coho salmon entered Auke Creek before the end of September (Appendix 6). Coded wire tags were collected from carcasses recovered on the weir. All tags were from the Auke Lake stock of coho salmon. There were 7 unmarked jacks and 64 unmarked adults. The timing of the unmarked fish was later than the marked fish. Only 4 unmarked fish entered Auke Creek in September. The origin of the unmarked jacks and adults is not known.

Harvest of coho salmon from Auke Creek is determined from recovery of wire tags in commercial and sport fishery port sampling programs. In 2002, an estimated 402 Auke Creek coho salmon adults were caught. This was below average for Auke Creek coho salmon, and represents a 27% catch rate. The average catch is 510 adults, and the average catch rate is 42%.

Total survival of the coho salmon smolts tagged at Auke Creek in 2001 was the seventh highest on record. Survival was estimated from the number of smolts marked at Auke Creek, and the number of marked jacks and adults at the weir and adults in the fishery. The total survival, 29.1%, was the combined return of jacks 2.5% (returned in 2001), adults at the weir 19.6%, and adults harvested 7.1% (Figure 24). The survival to jacks was the lowest in nearly two decades. Combined survival to adults, 26.7% (weir plus fishery) was above the average of 19.8%, and was the fourth highest at Auke Creek (Table 4).

Some smolts return as jacks the same year they emigrate at Auke Creek. The 97 marked jacks at Auke Creek in 2002 represent a survival of 2.9%, below average and one of the lowest on record (Table 4).

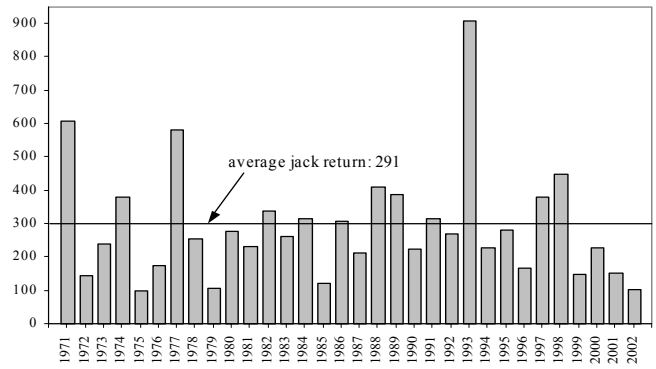


Figure 22. Auke Creek coho salmon jacks, 1971-2002.

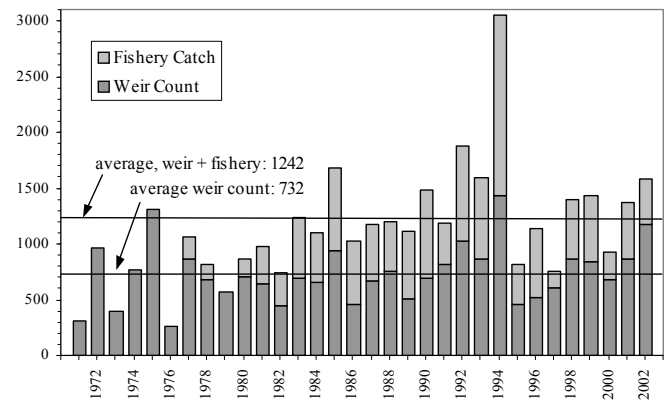


Figure 23. Weir counts and fishery catch of wild coho salmon from Auke Creek. Averages are for years data are available.

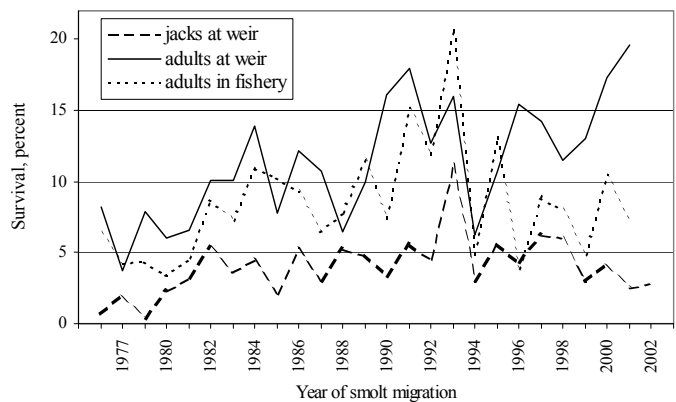


Figure 24. Ocean survival of coho salmon smolts from Auke Creek. Survivals are for tagged fish by year of smolt migration.

Table 4. Number of coho salmon smolts captured then released with coded wire tags at Auke Creek, weir recovery of jacks and adults, weir and fishery recovery of tagged fish, and ocean survival of tagged fish. Ocean survival is for tagged smolts by year of smolt migration. Averages are for years that data are available.

year	smolts		weir recovery		tagged fish recovered			ocean survival, %			
	total	tagged	jack	adult	jacks weir	adults weir	adults fishery	jacks weir	adults weir	adults fishery	total
1971			608	308							
1972			146	967							
1973			238	399							
1974			379	768							
1975			98	1310							
1976 ¹		2992	176	262	21			0.7	8.2	6.3	15.2
1977 ¹		3038	583	868	59	246	189	1.9	3.7	4.3	9.9
1978			256	683		112	131				
1979 ¹		3872	107	566	12			0.3	7.9	4.4	12.6
1980	10022	9821	276	698	226	306	170	2.3	6.0	3.4	11.7
1981	6721	6372	231	646	203	592	330	3.2	6.5	4.6	14.3
1982	6445	6245	338	447	335	417	292	5.4	10.1	8.7	24.2
1983	6631	6115	261	694	224	630	545	3.7	10.0	7.3	21.0
1984	7012	6751	315	651	304	614	444	4.5	13.9	11.0	29.4
1985	5601	5545	122	942	118	937	741	2.1	7.7	10.3	20.1
1986	5666	5502	307	454	288	429	570	5.2	12.1	9.3	26.7
1987	7166	6883	212	668	206	668	511	3.0	10.7	6.5	20.2
1988	7888	7751	412	756	406	736	445	5.2	6.5	7.8	19.5
1989	6911	6819	386	502	329	502	604	4.8	9.9	11.5	26.3
1990	5132	5020	225	697	165	678	785	3.3	16.1	7.4	26.8
1991	5764	5671	317	820	314	808	371	5.5	18.0	15.1	38.6
1992	6262	6106	271	1020	271	1020	855	4.4	12.7	12.0	29.1
1993	8103	7844	910	859	876	774	730	11.2	16.0	20.6	47.8
1994	7416	7255	229	1437	212	1253	1618	2.9	6.3	5.0	14.2
1995	4869	4798	283	460	269	455	360	5.6	10.7	13.0	29.4
1996	3962	3919	168	515	168	515	626	4.3	15.5	3.8	23.5
1997	6207	6080	381	609	376	606	148	6.2	14.2	8.8	29.2
1998	7430	7379	449	862	447	862	538	6.1	11.5	8.0	25.5
1999	5491	5123	149	845	149	845	589	2.9	13.0	4.8	20.7
2000	4891	4862	227	683	206	666	244	4.2	17.3	10.4	32.0
2001	5742	5687	153	865	142	842	506	2.5	19.6	7.1	29.1
2002	3434	3401	104	1176	97	1112	402	2.9			
mean	6294		291	732	247	665	510	4.0	11.4	8.4	23.9

¹- total smolt count not available, not all smolts were marked or tagged

Dolly Varden

Auke Lake is an important over-wintering site for Dolly Varden in the Juneau area. Some spawning and rearing undoubtedly occur in the system, but spawner numbers and annual smolt production are not known. Dolly Varden migrating downstream at Auke Creek were counted in 1970, a total of 6,249 fish, and annually since 1980. Downstream migrants were marked or tagged in 1970, 1980, 1983, and 1990, and marked fish were observed in subsequent years. In 1998 and 1999, marked fish captured at Auke Creek were probably from Windfall Lake where they were marked during the 1997 emigration.

The downstream migration of 4,858 Dolly Varden at Auke Creek in 2002 was the lowest since 1986, and below the average: 6,356 (Figure 25, Table 5). Auke Creek Dolly Varden abundance is in a decreasing trend that began in 1996. In some years, downstream migration begins in March, however, no Dolly Varden left Auke Lake that month in 2002 (Figure 26). Daily counts never exceeded 30 fish until the last day of April, and most fish migrated in May (Appendix 5). The midpoint of the migration was May 12. The average midpoint for all years is May 8. Dolly Varden were sampled daily throughout the migration by measuring the length of every tenth fish. Larger fish migrate earlier, and average length decreased weekly from about 350 to 175 mm during the main part of the migration (Figure 27). Overall, the average size of downstream migrants was 253 mm. All fish were checked for marks or tags. None were found.

Serious attempts to count upstream migrants began in 1997. A total of 4,341 Dolly Varden were captured in the upstream traps in 2002. The average number of Dolly Varden migrating upstream at Auke Creek, 1997-2002, is 4,610 (Table 5). The migration began July 6, and the last fish was captured October 31 (Appendix 6, Figure 26).

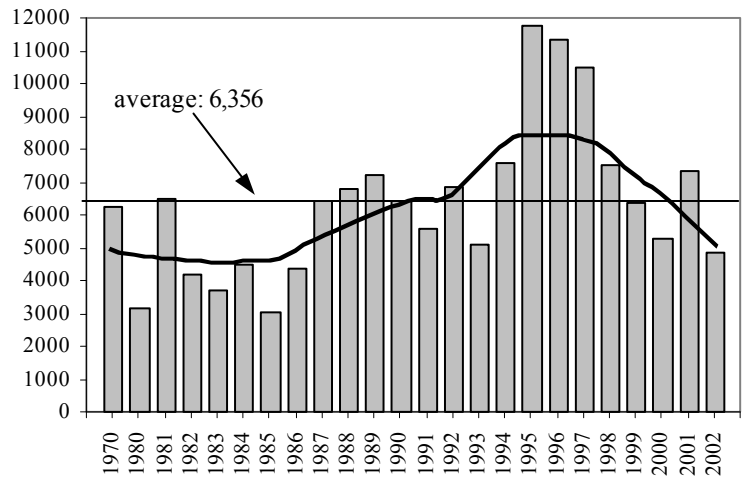


Figure 25. Downstream migrant Dolly Varden at Auke Creek. The curved line is the abundance trend smoothed by local regression.

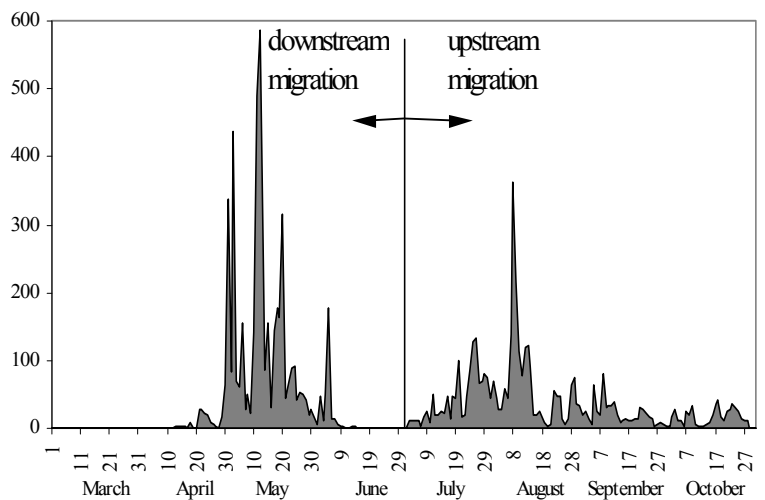


Figure 26. Migration of Dolly Varden at Auke Creek, 2002.

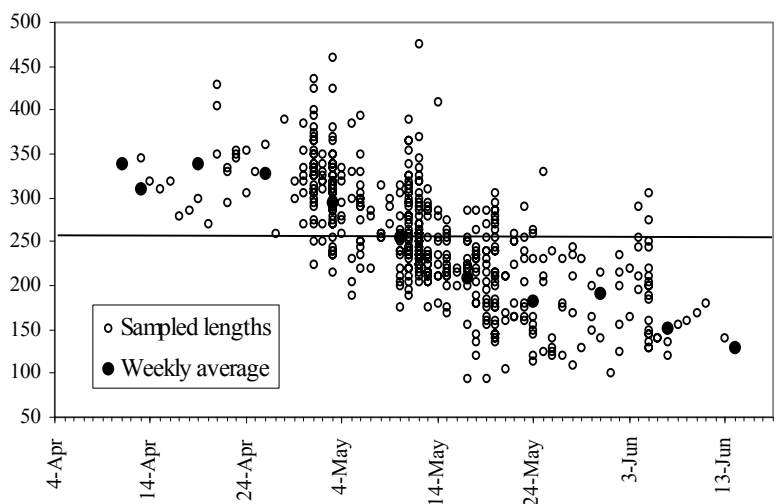


Figure 27. Fork lengths, daily samples and weekly averages, of Dolly Varden at Auke Creek, 2002. The line is the average of all fish sampled.

Table 5. Number of migrant Dolly Varden at Auke Creek, 1970, and 1980-2002 (weir mortalities = mort)

year	downstream migration				upstream
	total	unmarked	marked	mort	total
1970 ¹	6,249	0	6,007	242	
1980 ¹	3,132	92	2,928	112	
1981	6,461	5,776	685	0	
1982	4,172	3,929	222	21	
1983 ¹	3,718	2,131	1,587	0	
1984	4,512	4,229	283	0	
1985	3,052	3,006	46	0	
1986	4,351	4,351	0	0	
1987	6,444	6,420	2	21	
1988	6,770	6,770	0	0	
1989	7,230	7,155	2	73	
1990 ¹	6,426	2,318	4,107	0	
1991	5,559	4,631	881	47	
1992	6,839	6,715	110	14	
1993	5,075	5,064	7	4	
1994	7,604	7,600	4	0	
1995	11,728	11,728	0	0	
1996	11,323	11,323	0	0	
1997	10,506	10,506	0	0	5,705
1998 ²	7,532	7,440	70	22	4,993
1999 ²	6,393	6,377	16	0	4,709
2000 ²	5,254	5,248	6	0	3,665
2001	7,356	7,356	0	0	4,249
2002	4,858	4858	0	0	4,341
mean	6,356				4,610

¹ Years Dolly Varden were marked and/or tagged at Auke Creek

² Marked Dolly Varden recovered but not marked at Auke Creek

Cutthroat and Steelhead Trout

Little was known of the life history of cutthroat trout in the Auke Lake system before the start of tagging programs in 1994, and lake population estimates in 1998. It is apparent that Auke Lake cutthroat trout have the most complex life history of any fish in the system. Recent studies at Auke Creek and Auke Lake have produced world class information on these fish. Anecdotal information suggests the pre-1960 population of cutthroat trout in Auke Lake was larger than it is now. Downstream migrant cutthroat trout were counted in 1970 and since 1980. Upstream migrants were counted since 1997. Mature fish migrating downstream were spawned in 1981-1982, 1985-1986, and 1991 and 1993 for hatchery incubation. The resulting progeny were fin marked and stocked in Auke Lake, and hatchery fish were observed in subsequent migrations (Table 6).

Auke Creek cutthroat trout have been in a decreasing trend since 1996. A total of 210 cutthroat trout were counted during the downstream migration in 2002, the lowest number since 1993. The average number of wild cutthroat, 1970-2002, is 254 (Figure 28, Table 6). In the 2002 downstream migration, the first cutthroat was captured April 11, and the last was captured June 28 (Appendix 5). The midpoint of downstream migration was May 20 (Figure 29). All cutthroat were examined for a missing adipose fin, visible implant tags posterior to the eye or in the skin covering the anal fin rays, and dye marks on the ventral, pectoral or anal fins. Fish missing the adipose fin were checked electronically for a passive integrated transponder (PIT) tag. A total of 84 cutthroat trout were missing their adipose fin when they left Auke Lake this year, 80 that were tagged in 2001 or earlier, 4 tagged in Auke Lake during the lake population project in June 2002. A total of 126 trout were not fin marked, indicating they had never received a PIT tag during studies at Auke Creek or Lake. All unmarked fish were marked by excision of the adipose fin, and tagged with an individually numbered PIT tag, then released.

All cutthroat trout were measured for length at time of downstream migration. The larger fish migrated earlier than smaller ones. The average weekly size during the main part of the emigration decreased from about 315 mm to about 215 mm (Figure 30). Overall, the average length of downstream migrant cutthroat trout in 2002 was 246 mm.

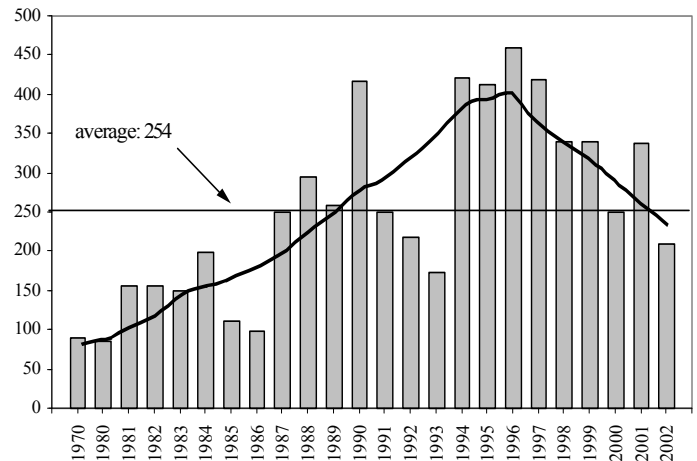


Figure 28. Number of downstream migrant cutthroat trout at Auke Creek. The curved line is the abundance trend smoothed by local regression.

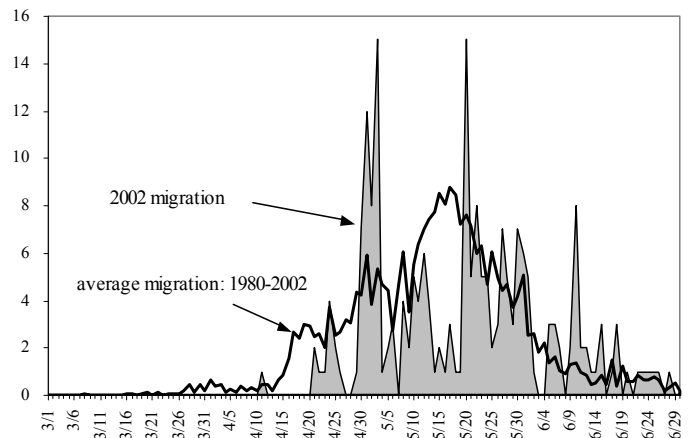


Figure 29. Average and 2002 daily downstream migration of cutthroat trout at Auke Creek.

All upstream migrant cutthroat in 2002, 241, were examined for adipose fin marks and PIT tags before release upstream. The 1997-2002 average count of upstream migrant cutthroat is 268. No cutthroat migrated upstream in July or August, 178 did so in September, and 63 in October (Appendix 6). In 2002, 89 cutthroat trout captured during upstream migration were missing the adipose fin and had a PIT tag, and 152 were unmarked. Marine residence, seasonal growth, and growth rate between down- and upstream migration in 2002 were determined from individual fish with PIT tags. On average, marine residence, referred to as the time between emigration and

immigration, of cutthroat trout was 121 days (range 77 to 167 days). Average seasonal growth was 55 mm (range 20-96 mm), and average growth rate was 0.47 mm/day (range 0.15-0.8 mm/day) (Figure 31).

Steelhead trout juveniles were captured at Auke Creek weir in 2002. Fifteen steelhead migrated downstream, 14 during the last two weeks of May, and one in June. Three migrated upstream between late September and mid October. Fork lengths of steelhead captured at Auke Creek weir ranged from 167-221 mm.

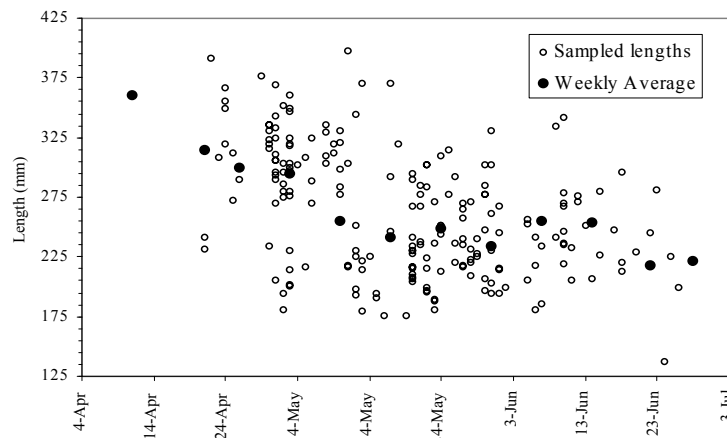


Figure 30. Fork lengths, daily samples and weekly averages, of cutthroat trout emigrants at Auke Creek, 2002.

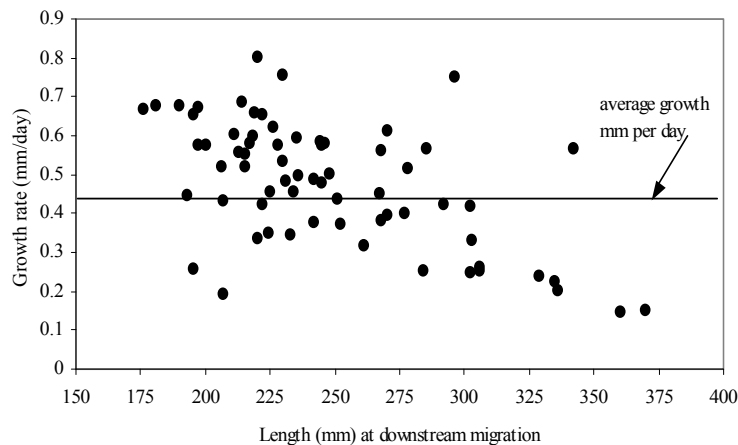


Figure 31. Growth of cutthroat trout between downstream and upstream migrations at Auke Creek, 2002.

Table 6. Number of cutthroat trout in the downstream and upstream migrations Auke Creek.

	downstream			upstream			
	wild	hatchery	total	adipose mark	no mark	not checked	total
1970	90		90				
1980	85		85				
1981	157		157				
1982	157		157				
1983	150	78	228				
1984	198	104	302				
1985	112	49	161				
1986	99	39	138				
1987	251	691	942				
1988	294	396	690				
1989	258	152	410				
1990	417	89	506				
1991	250	23	273				
1992	219	7	226				
1993	174	16	190				
1994	422	9	431				
1995	412	58	470				
1996	459	140	599				
1997	418	82	500	213	254		467
1998	340	34	374	164	196	1	361
1999	340	11	351	118	79	8	205
2000	249	1	250	37	68		105
2001	337		337	106	122		228
2002	210		210	89	152		241
mean	254	110	337	121	145	5	268

Chinook Salmon

Chinook salmon are not native to the Auke Lake system. Chinook captured at Auke Creek are hatchery fish from releases of juveniles in the Juneau area, including Auke Bay near the mouth of Auke Creek. These releases began as a 3-year cooperative study in 1986 to examine survival and homing and straying of hatchery chinook. The original study plan and fish transport permit required that all chinook be killed when they entered Auke Creek. This was to prevent the possible chinook-sockeye disease interactions, particularly infectious hematopoietic necrosis virus. The project continues under an arrangement between Sport Fish Division, ADF&G, and Douglas Island Pink and Chum Incorporated.

At Auke Creek, chinook were captured at the weir since 1987, and classified as mini-jacks or adults, based on body size and ocean

residence. Mini-jacks are males, generally ≤ 250 mm fork length, that mature and return to fresh water the same year they were released as smolts. Adults are ≥ 400 mm and remain at large for one year or more. At the weir, chinook are killed and examined for a missing adipose fin. The heads from all marked fish are sent to the ADF&G tag lab.

In 2002, a total of 1,007 chinook salmon were captured at Auke Creek, including 319 mini-jacks and 688 adults (Table 7). The number of mini-jacks was the third highest at Auke Creek. The number of chinook adults was the new high record (Figure 32). Chinook adults entered Auke Creek almost daily from late July through mid September (Appendix 6). Heads from adipose marked fish, 20 mini-jacks and 72 adults, were sent to the ADF&G tag lab. All chinook were killed and offered to local charities.

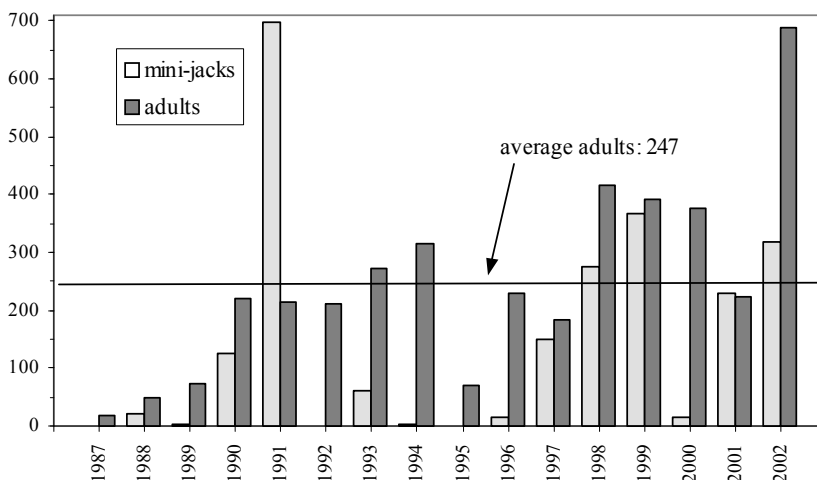


Figure 32. Chinook salmon mini-jacks and adults at Auke Creek, 1987-2002.

Table 7. Number of adipose marked and unmarked chinook salmon at Auke Creek, 1987-2002. Mini jacks returned the same year of smolt release, and adults are 1-ocean or older.

year	mini-jacks			adults		
	marked	unmarked	total	marked	unmarked	total
1987				19		19
1988	15	6	21	50		50
1989		4	4	53	21	74
1990	36	91	127	132	89	221
1991	239	460	699	96	117	213
1992		1	1	52	158	210
1993	22	40	62	62	210	272
1994	1	1	2	91	223	314
1995		1	1	20	49	69
1996	1	15	16	87	143	230
1997	23	126	149	42	141	183
1998	45	231	276	69	347	416
1999	41	326	367	49	343	392
2000		15	15	36	341	377
2001	21	207	228	28	196	224
2002	20	299	319	72	616	688
mean	42	122	152	60	214	247

APPENDICES

Appendix 1. Downstream migrant wild salmonids at Auke Creek, 1961-2002. The sockeye average is 1980-2002, and chums 1985-2002.

Year	Sockeye Salmon Smolts	Pink Salmon Fry	Chum Salmon Fry	Coho Salmon Smolts	Dolly Varden	Cut- throat trout	Steel- head trout
1961	90,000						
1964	62,389						
1965							
1966							
1967							
1968	35,737						
1969							
1970					6,249		
1971							
1972		157,189					
1973		73,900					
1974	15,399	277,624					
1975	59,370	247,091					
1976	35,769	108,195					
1977	8,862	119,442	0				
1978		129,714	0				
1979		23,270	0				
1980	25,299	74,047	0	10,022	3,132	85	
1981	9,183	110,552	0	6,721	6,461	157	
1982	1,619	119,548	0	6,445	4,172	157	
1983	3,170	164,784	0	6,631	3,718	150	
1984	20,251	169,552	0	7,012	4,512	198	
1985	11,747	110,001	7,198	5,601	3,052	112	
1986	14,500	123,887	825	5,666	4,351	99	
1987	17,598	43,502	14,039	7,166	6,444	251	
1988	13,812	113,061	8,091	7,888	6,770	294	
1989	11,187	116,870	13,750	6,911	7,230	258	
1990	16,983	96,651	1,916	5,132	6,426	417	6
1991	25,872	242,772	759	5,764	5,559	250	12
1992	13,248	98,447	4,783	6,262	6,839	219	10
1993	33,616	237,073	47	8,103	5,075	174	5
1994	32,009	11,603	137	7,416	7,604	422	8
1995	17,857	88,197	5	4,869	11,728	412	26
1996	7,069	41,359	4,981	3,963	11,323	459	24
1997	13,856	31,092	8,307	6,207	10,506	418	9
1998	22,496	60,785	735	7,430	7,532	336	15
1999	25,244	53,533	1,269	5,491	6,393	340	5
2000	13,699	132,075	1,337	4,891	5,254	249	6
2001	21,428	61,504	23,372	5,742	7,356	337	8
2002	17,594	150,149	1,959	3,434	4,858	210	15
average	16,928	115,725	5,195	6,294	6,356	261	11

Appendix 2. Number of immigrant sockeye, pink, chum, coho, and chinook salmon adults, Dolly Varden, and cutthroat and steelhead trout at Auke Creek. Hatchery fish are included: sockeye 1977-79, 1989-95; pink 1973-94, 1996, 1998-2001; chum 1979-91, 1994-2002; chinook, \geq 1-ocean age, all years.

Year	Sockeye salmon	Pink salmon	Chum salmon	Coho salmon	Chinook salmon	Dolly Varden	Cutthroat	Steelhead
1963	6,391							
1964	5,465							
1965	6,889							
1966	10,986							
1967	5,909	3,761	78					
1968	7,164	2,638	76					
1969	6,131							
1970	7,034							
1971	7,673	2,090	10	308				
1972	9,166	1,768	47	967				
1973	8,259	4,948	27	399				
1974	4,371	6,260	5	768				
1975	11,461	14,261	10	1,310				
1976	6,153	2,525	16	262				
1977	16,683	15,848	24	868				
1978	3,177	18,410	17	683				
1979	6,022	19,003	13	566				
1980	4,564	20,187	118	698				
1981	4,089	14,450	109	646				
1982	1,334	10,658	251	447				
1983	1,805	24,827	310	694				
1984	975	5,271	1,927	651				
1985	240	26,317	1,852	942				
1986	952	2,305	1,392	454				
1987	2,827	7,914	1,884	668	19			
1988	1,337	8,140	1,093	756	50			
1989	2,508	5,016	304	502	74			
1990	3,383	21,806	270	697	221			
1991	5,425	6,878	174	820	213			
1992	4,853	22,101	130	1,020	210			
1993	9,113	1,696	121	859	272			
1994	6,993	22,533	868	1,437	314			
1995	5,261	1,548	1,327	460	69			
1996	5,995	4,374	6,781	515	230			
1997	4,671	2,774	444	609	183	5705	467	
1998	2,068	2,879	247	862	416	4993	361	
1999	1,571	30,097	386	845	392	4709	205	3
2000	2,480	2,491	4,444	683	377	3665	105	4
2001	3,959	8,323	588	865	224	4249	228	11
2002	2,882	4,928	1,587	1,176	688	4341	241	3
average	5,205	10,265	792	732	247	4,610	268	5

Appendix 3. Dates of ice-out on Auke Lake.

year	date	year	date	year	date
1960	April 26	1980	April 19	2000	April 2
1961		1981	March 26	2001	April 6
1962		1982	May 14	2002	April 28
1963	April 29	1983	April 18		
1964		1984	March 29		
1965		1985	April 26		
1966		1986	April 28		
1967	May 11	1987	March 30		
1968	April 23	1988	April 5		
1969	April 30	1989	April 28		
1970	March 24	1990	April 8		
1971	May 13	1991	April 29		
1972	May 20	1992	March 18		
1973	April 30	1993	April 23		
1974	May 7	1994	April 11		
1975	April 8	1995	April 25		
1976	April 28	1996	April 22		
1977	February 1	1997	April 26		
1978	April 20	1998	March 31		
1979	April 24	1999	May 5		
average for all years:					April 18

Appendix 4. Daily water temperatures at Auke Creek, 2002

day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1.9	2.3	1.6	3.6	7.3	12.0	17.6	14.8	13.8	9.9	5.7	1.5
2	1.7	2.3	1.7	3.5	6.8	12.7	17.6	15.6	13.2	9.8	5.6	1.4
3	2.1	2.3	1.7	3.7	6.7	12.7	17.6	16.3	13.1	9.9	5.5	1.6
4	2.2	2.1	1.6	3.9	6.6	12.2	17.1	16.3	13.0	10.0	5.4	1.6
5	1.9	1.9	1.7	4.0	6.6	12.5	16.3	16.4	12.6	10.2	5.3	1.5
6	1.9	1.6	1.7	4.0	6.8	12.4	15.4	16.5	12.4	10.2	5.0	1.5
7	2.0	1.5	1.8	4.1	6.9	12.5	14.6	16.7	12.3	9.9	4.8	1.6
8	2.2	1.3	1.9	4.0	6.7	13.3	13.6	16.4	12.0	9.8	4.9	1.5
9	2.1	1.2	2.0	4.1	6.7	14.1	13.6	16.1	12.1	9.5	4.9	1.6
10	1.9	1.0	1.9	4.2	6.8	13.4	13.9	16.3	12.5	9.2	4.9	1.6
11	1.9	1.1	2.0	4.4	7.3	13.6	13.9	16.8	12.4	9.2	4.8	1.6
12	1.8	1.3	2.1	4.6	7.6	13.6	13.8	16.8	12.2	8.9	4.5	1.6
13	1.8	1.3	2.2	4.6	7.8	13.5	13.9	17.4	11.5	8.6	4.4	1.6
14	1.6	1.2	2.2	4.9	8.2	13.8	14.0	18.0	11.6	8.5	4.5	1.4
15	1.7	1.1	2.4	5.0	7.8	14.7	14.5	18.2	11.8	8.3	4.4	1.2
16	1.7	1.1	2.4	5.1	8.2	15.3	15.2	18.1	11.9	8.1	4.4	0.9
17	1.8	1.0	2.5	5.8	8.6	15.4	15.7	18.0	12.0	8.0	4.3	1.0
18	2.0	1.0	2.5	5.8	9.2	15.8	15.6	16.9	11.8	7.7	4.3	0.9
19	2.1	1.1	2.4	5.7	9.6	16.2	15.8	16.7	11.8	7.6	4.2	1.0
20	2.0	1.1	2.2	6.2	9.6	16.3	17.0	16.6	11.5	7.5	4.2	1.1
21	1.9	1.2	2.4	6.6	10.1	16.2	18.1	16.7	11.3	7.3	4.3	1.2
22	2.0	1.2	2.4	7.2	9.9	16.0	18.3	16.8	11.3	7.1	4.3	1.3
23	2.2	1.0	2.6	6.8	9.4	15.9	16.5	16.1	11.1	7.0	4.2	1.3
24	2.1	0.9	2.8	6.8	9.4	16.1	16.3	15.8	10.8	6.8	4.0	1.4
25	2.0	1.0	3.1	6.9	9.3	16.5	15.2	15.3	10.6	6.6	3.5	1.5
26	2.0	1.3	3.1	7.1	10.3	16.7	14.5	15.2	10.5	6.3	3.1	1.6
27	2.2	1.4	3.1	7.0	11.8	17.7	14.5	14.9	10.5	6.0	2.2	1.6
28	2.1	1.5	3.1	7.0	12.2	17.6	14.4	14.8	10.3	6.0	1.6	1.6
29	2.0		3.3	6.9	12.3	17.0	14.5	14.8	10.1	6.0	1.7	1.6
30	1.9		3.2	6.9	12.0	17.3	14.7	14.4	10.0	5.8	1.5	1.6
31	2.2		3.5		12.2		14.5	14.2		5.7		1.5

Appendix 5. Monthly totals and daily counts of downstream migrant wild salmonids at Auke Creek, 2002.

	Pink fry	Coho smolts	Sockeye smolts	Chum fry	Dolly Varden	Cut-throat	Steel-head
March	8,586	0	0	590	0	0	0
April	135,494	0	1	1,343	214	20	0
May	5,799	3,125	14,261	24	4,306	146	14
June	270	309	3,332	2	338	44	1
total	150,149	3,434	17,594	1,959	4,858	210	15
Mar. 2	25						
3	205			9			
4	311			13			
5	141			2			
6	190			5			
7	220			13			
8	196			9			
9	260			12			
10	165			9			
11	252			13			
12	243			15			
13	256			20			
14	211			12			
15	227			17			
16	219			17			
17	236			17			
18	226			11			
19	250			7			
20	235			8			
21	223			12			
22	326			15			
23	525			17			
24	395			40			
25	462			41			
26	325			41			
27	544			28			
28	248			46			
29	281			35			
30	589			47			
31	600			59			
Apr. 1	993			75			
2	435			84			
3	687			81			
4	1,015			72			
5	446			59			
6	749			64			
7	777			50			
8	549			59			
9	838			48			
10	785			46			
11	1,423			48	1	1	
12	2,537			49			
13	2,128			54	3		
14	4,170			57	2		
15	3,304			47	2		
16	7,207			60	2		
17	6,600			48	1		
18	5,754			32	8		
19	7,338			34	1		
20	12,618			59	1		
21	18,310			65	28	2	
22	19,851			32	29	1	
23	5,999			28	21	1	
24	6,424			15	19	4	
25	4,787			18	8	2	
26	3,928			11	5	1	
27	3,287			16	2	0	
28	4,655			7	1	0	

	Pink fry	Coho smolts	Sockeye smolts	Chum fry	Dolly Varden	Cut- throat	Steel- head
Apr. 29	4,830			11	17	1	
30	3,070			14	63	7	
May 1	1,483	6		6	336	12	
2	2,501	2		10	82	8	
3	101	3	1	1	437	15	
4	746	2	3	1	68	1	
5	349	5	8	3	60	2	
6	256	7	7	0	156	3	
7	56	4	3	0	28	0	
8	46	3	5		49	4	
9	52	3	5		23	2	
10	26	2	2		140	5	
11	55	14	21		489	4	
12	34	35	27		587	6	
13	21	44	25		245	4	
14	17	59	58		86	1	
15	7	218	353		155	2	1
16	9	106	107		30	1	
17	7	70	119		143	3	
18	7	150	133		176	1	
19	6	157	245		162	1	
20	1	217	1,325		314	15	3
21	7	293	792		43	5	3
22	6	328	805		67	8	
23	1	291	766	1	89	5	1
24	1	254	1,925		92	5	
25	2	167	510	2	41	2	
26		232	2,240		53	3	1
27		157	1,321		49	7	3
28		45	1,196		41	5	1
29		84	943		20	3	
30		93	720		28	7	1
31	2	74	596		17	6	
June 1	2	46	400		5	5	
2		44	301		48	1	
3		27	222		12	0	
4		25	300		51	0	
5	10	32	405		177	3	
6	171	39	638	1	13	3	
7	44	15	118	1	14	2	
8	28	6	165		6	0	
9	9	10	116		3	2	
10	4	17	88		2	8	
11	1	7	54		1	2	
12		14	93		0	2	
13		4	86		2	1	
14		4	75		4	1	
15	1	9	95			3	
16		3	73			0	
17		1	28			1	
18		3	22			3	
19			17			0	
20		3	11			1	
21			4				
22			6			1	
23			2			1	
24			3			1	1
25			2			1	
26			1			1	
27			2				
28			5			1	
total	150,149	3,434	17,594	1,959	4,858	210	15

Appendix 6. Monthly totals and daily counts of upstream migrant salmonids at Auke Creek, 2002. Hatchery reared chum and chinook salmon are included.

	Sockety e adults	Pink adults	Chum adults	Coho adults	Chinook adults	Dolly Varden	Cut- throat	Steel- head
July	2,562	43	468	0	44	1,245	0	0
August	320	4,243	1,118	1	569	1,989	0	0
Sept.	0	642	1	975	75	621	178	1
Oct.	0	0	0	200	0	486	63	2
Nov.	0	0	0	0	0	0	0	0
total	2,882	4,928	1,587	1,176	688	4,341	241	3
July 1	0							
2	0							
3	125					10		
4	340					10		
5	177					12		
6	259					12		
7	57					2		
8	79					17		
9	92					25		
10	31					9		
11	51					49		
12	52					18		
13	91					19		
14	174					24		
15	194		1			23		
16	107		2			47		
17	54		5			13		
18	23		4			47		
19	4		7		3	43		
20	15					100		
21	1		1			17		
22	5		10			18		
23	7		21			46		
24	46	2	49			86		
25	232	8	54			127		
26	94	6	22		8	134		
27	48	4	23		6	67		
28	133	5	53		6	69		
29	27	7	68		2	81		
30	38	7	104		7	75		
31	6	4	44		12	45		
Aug. 1	4	7	66		4	69		
2	9	1	36		1	43		
3	13	5	49		2	29		
4	0	3	47		6	28		
5	10	17	25		1	58		
6	5	1	33		2	45		
7	14	104	218		0	139		
8	149	411	139		33	362		
9	60	476	72		105	217		
10	8	125	60		22	112		
11	6	95	45		1	78		
12	13	195	70		24	118		
13	12	372	66		68	121		
14	2	226	40		71	90		
15	2	74	26		15	18		
16	0	74	17		5	18		
17	0	27	19		5	26		
18	0	39	9		3	13		
19	0	31	8		16	7		
20	1	78	11		3	2		
21	2	121	15		22	6		
22	0	443	11		44	56		
23	7	254	13		12	47		
24	0	172	4		23	46		
25	1	73	3		14	14		
Aug. 26	0	48	5		3	6		

	Sockey e adults	Pink adults	Chum adults	Coho adults	Chinook adults	Dolly Varden	Cut- throat	Steel- head
27	0	54	2		10	15		
28	0	170	3		19	63		
29	1	241	2		12	74		
30	1	181	1		13	37		
31	0	125	3	1	10	32		
Sept. 1		111			37	19		
2		127	1		16	24		
3		101	0		4	13		
4		34	0		2	6		
5		55			4	64		
6		42			3	24		
7		75			5	20		
8		47				81		
9		18			3	31	1	
10		10		35		34	15	
11		7		32	1	32	15	
12		5		13	0	40	8	
13		5		5		19	7	
14		1		47		7	8	
15		3		51		10	17	
16		0		13		15	8	
17		1		17		10	5	
18		0		69		11	10	
19		0		179		14	8	
20		0		114		14	12	
21				116		30	19	1
22				114		28	13	
23				50		22	11	
24				6		16	6	
25				22		13	10	
26				0		2		
27				23		5	3	
28				16		7		
29				26		6	2	
30				27		4	0	
Oct. 1				9		4	5	
2				18		17	2	
3				12		29	3	
4				19		12	5	
5				11		12	3	
6				14		3	7	
7				41		24	2	
8				28		18	6	
9				5		32	4	
10				6		5	3	
11				1		4	1	
12				0		4	0	1
13				6		4	3	
14				1		6	1	1
15				1		8	0	
16				0		18	4	
17				12		35	3	
18				7		41	2	
19				3		16	6	
20				0		10	1	
21				1		24	1	
22				2		29	1	
23				1		35	0	
24				0		31		
25				0		26		
26				1		14		
27				1		11		
28				0		12		
29						1		
30						0		
31						1		
total	2,882	4,928	1,587	1,176	688	4,341	241	3