

AUKE CREEK WEIR
2003 ANNUAL REPORT

Operations, Fish Counts, and Historical Summaries

by

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Auke Creek Weir 2003 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. The National Marine Fisheries Service (NMFS), and its' predecessor agency, U.S. Bureau of Commercial Fisheries, began salmon research at Auke Creek, near Juneau, Alaska, in 1961. Emigrant and immigrant counts of several species were made over the last four decades (Appendices 1 and 2). Pink salmon fry populations in Auke Creek were estimated annually, 1972-79, and counted at Auke Creek weir since 1980. Fyke nets were used in some years, 1961-79, to estimate sockeye salmon smolts leaving Auke Lake. Sockeye smolt estimates are available for some years between 1961 and 1979, and total smolt counts are available since 1980. Chum salmon fry were counted annually since 1985. Coho salmon smolt estimates were made in 1976, 1977, and 1979, and the total coho smolt emigration was counted since 1980. Dolly Varden and cutthroat trout were counted in 1970, and since 1980. Steelhead emigrants were counted since 1990. Weir counts of sockeye salmon adults at Auke Creek began in 1963; pink and chum salmon were counted 1967-68, and all salmon were counted since 1971. Chinook salmon have returned to Auke Creek since 1987 as a result of releases of juveniles from other hatcheries. Immigrant Dolly Varden and cutthroat and steelhead trout were counted since 1997.

Auke Creek has been the site of many research projects on wild and hatchery salmonids. The present weir at Auke Creek was constructed in 1980, and provided the capability to capture all emigrant and immigrant salmonids. Annual operation and maintenance costs associated with Auke Creek Research Station are provided by NMFS through the salmon research program of Auke Bay Laboratory. 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 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 collections on migrant salmonids. The agreement was revised in December 2000, and is in effect through October 2005. Auke Creek weir usually operates from early March through late October. 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. The annual fish count data are available in the Auke Creek data file at the NMFS Auke Bay Laboratory. Data collected on specific projects outside the scope of the cooperative agreement are usually not included in the annual report. Those data may be available from project investigators or their respective agencies. No fish were released from Auke Creek hatchery in 2003. All chinook and most chum salmon adults captured in 2003 were strays from other hatcheries.

The emigration weir at Auke Creek was operated from March 3 through June 30 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 and chum salmon fry, were captured March 4. Coho salmon smolts and cutthroat trout were marked and tagged during emigration.

The immigration weir was installed June 30 to capture salmonids entering Auke Creek. The weir was modified to capture small immigrants, specifically cutthroat and steelhead trout, Dolly Varden, chinook salmon mini-jacks, and coho salmon juveniles. 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. The main weir and trout traps were lined with heavy

plastic mesh, 6mm openings, to prevent passage of small fish. Salmon adults cannot enter the trout traps because of the small entrance openings. In accordance with the annual operation plan, various personnel assisted with the counting and processing of fish at the weir. Weir operations ended October 31, and the weir was removed from operation. Three pink/chum hybrids were captured at Auke Creek in 2003.

Water temperature in Auke Creek was measured daily at the weir site. Overall, water temperatures were above average through mid June, and close to average for the rest of the year (Figure 1, Appendix 3). The surface of Auke Lake froze in late December 2002, and the lake was ice free on April 14, 2003. The

average ice free date for Auke Lake is April 18 (Figure 2, Appendix 4). Auke Lake was frozen over in late December 2003. Stream flows were low to moderate during the entire weir season. This was the only year since 1971 when there were no floods. From early March through June there was 11 in. of precipitation recorded at the Auke Bay weather station, March 3.9 in., April 0.8 in., May 2.7 in., and June 3.6 in. The average is 15 in. during this 4-month period. Precipitation from July through October totaled 28 inches. About 5 in. were recorded each month, July, August, and October, and 13 in. was recorded in September. The 36-year average for July-October at Auke Bay is 29 in.

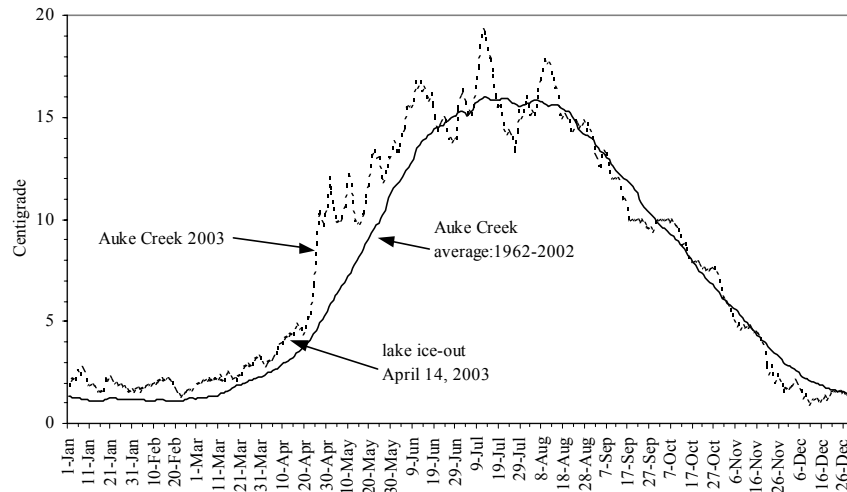


Figure 1. The 2003 and average, 1962-2003, daily water temperatures in Auke Creek, and date of ice-out at Auke Lake.

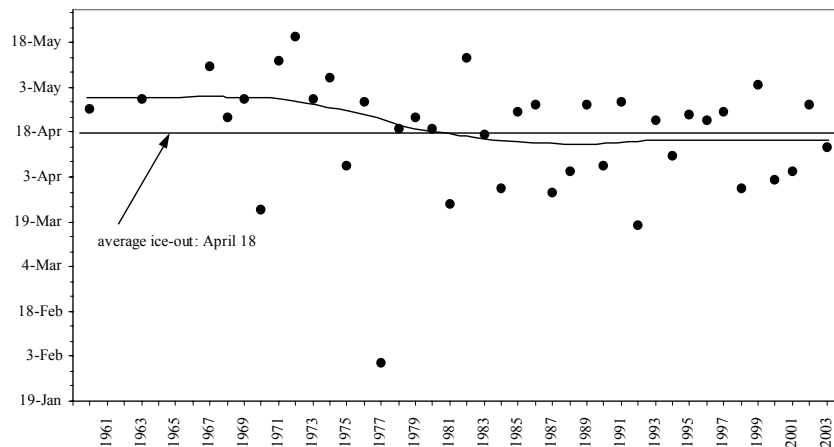


Figure 2. Dates of ice-out on Auke Lake, and average and trend (curved) lines. The trend line was smoothed by local regression.

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. There are distinct runs of pink salmon in August and September, referred to as the early and late runs in both the even- and odd-numbered years. 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 during channel construction. 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 immigrants at 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 from 1972-80 by hydraulic censuses in the freshwater and intertidal areas. 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 2003, a total of 95,132 pink salmon fry were counted during the emigration from the freshwater area, about 20,000 fewer than the 1973-2002 average (Table 1). This was the highest

number of even-year brood fry since 1993. The average for all years is 115,081 (Figure 3). The fry emigration was above average daily numbers through mid April, after which the numbers decreased rapidly. A total of 38,251 fry emigrated in March. Most fry emigrated in April, 56,870 fish, although only 9,500 left after April 15 (Figure 4, Appendix 5). No wild fry were marked or tagged in 2003. No hatchery fish were produced.

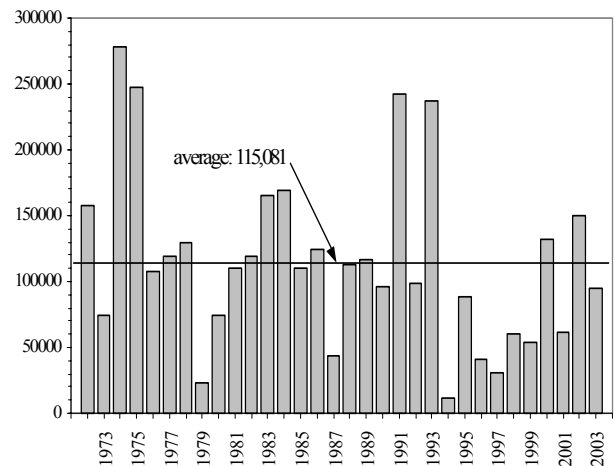


Figure 3. Number of wild pink salmon fry at Auke Creek.

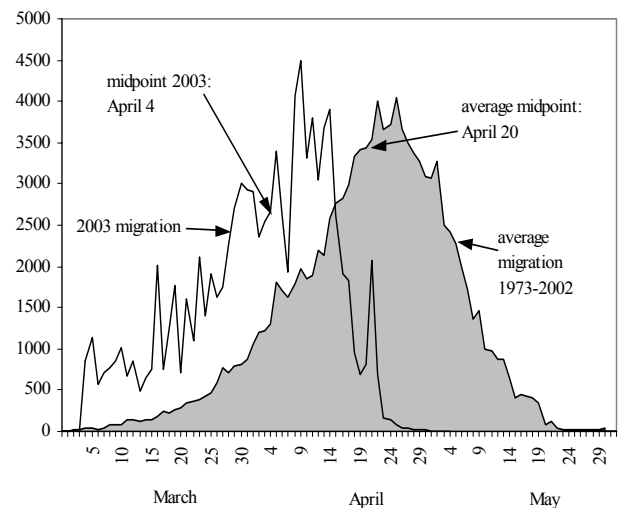


Figure 4. The 2003 and 1973-2002 average emigration of pink salmon at Auke Creek.

There is a trend over the last three decades for Auke Creek pink salmon fry to emigrate earlier in the year, and the 2003 emigration followed that trend (Figure 5). The median date of the 2003 emigration, April 4, was the second earliest on record. The earliest median date of emigration is April 1 and the latest May 7.

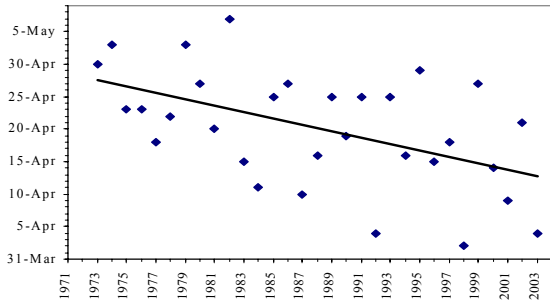


Figure 5. Median emigration dates of pink salmon at Auke Creek, and the trend line across years.

Pink salmon were reared in many hatchery projects at Auke Creek, and fry were released annually beginning in 1972, except for 1994, 1996, and since 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. Several 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 2003, 10,580 pink salmon adults were captured at Auke Creek weir (Figure 6). The 2003 immigration of was above average for Auke Creek, and 27% greater than the 2001 parent brood. The average is 7,549 wild pink salmon, and 10,274 when hatchery fish are included (Table 1).

In 2003, pink salmon adults were captured from late July through mid September, and released to spawn in the creek (Appendix 6). A total 286 pink salmon entered Auke Creek in July. Most pink salmon, 6,098, entered Auke Creek during August; and 4,196 did so in September. Based on the increase in the proportion of bright, silver females with loose scales, August 28 was considered the start of the late run. At that time, early run females were ready to spawn, and late run females were not. The early wild run was 5,536 fish, 2,890 males and 2,646 females, and the late run 5,044 fish, 2,354 males and 2,690 females. The proportion of pink salmon adults in the early run continued the 2-decade trend of being greater than that of the late run. The early run was 52% of the 2003 return, less than the average of 62% over the last 22 years, but greater than the early run average of 27% before 1982.

In 2003 the median date of pink salmon immigration was earlier than the average for the first 13 years for which records are available, continuing the post-1981 trend. The median date of the 2003 pink salmon immigration at Auke Creek was August 28. From 1967-1981 the average date of immigration was September 7, and since 1982 the average is August 26 (Figure 7).

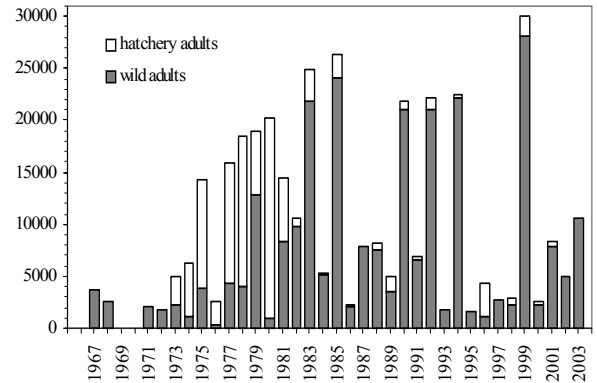


Figure 6. Wild and hatchery pink salmon adults at Auke Creek, 1967-68 and 1971-2003.

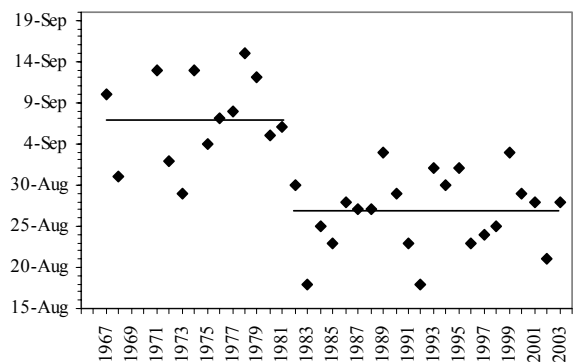


Figure 7. Median immigration dates of pink salmon at Auke Creek. The lines are the averages of the periods.

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
2003	95,132		95,132	10,580		10,580
mean	115,081	232,543	311,289	7,549	3,533	10,274

Sockeye Salmon

In Auke Lake, sockeye salmon spawn in the larger tributaries and on submerged gravel beds in the lake. The production of sockeye smolts from Auke Lake was first estimated in 1961 at 90,816, the highest on record. From 1964 through 1979, wild smolt numbers were estimated several times and ranged from 8,862 to 65,242. However, the pre-1980 smolt estimates lack continuity, and some are known to be incomplete. Based on the pre-1980 adult counts, it is obvious there has been a significant decrease in the number of smolts since the 1960s and early 1970s. 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 juveniles stocked in Auke Lake in 1974-1975 and 1987-1989 contributed to the smolt emigrations in 1975-77 and 1988-91. Sockeye enhancement from 1988-1992 included the release of age-zero (under-yearling) smolts reared in the hatchery at Auke Creek and net pens in Auke Bay.

In 2003, a total of 21,154 sockeye smolts were counted at the weir during the emigration from Auke Lake. The average number of wild smolts produced in Auke Lake, 1980-2003, is 17,104 (Figure 8, Table 2).

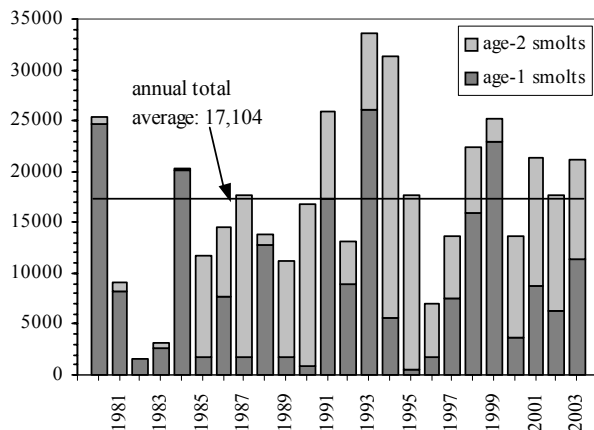


Figure 8. Number of wild sockeye salmon smolts, age-1 and -2, leaving Auke Lake, 1980-2003.

The emigration of sockeye salmon began in late April, about 160 fish, and about 19,000 smolts emigrated in May. Emigration midpoint was May 19, 4 days earlier than average. Age-2 smolts migrated earlier than the age-1's, median dates May 11 and May 24 (Figure 9). The last

smolts were counted June 30, although fewer than 400 left the lake during the last two weeks of the emigration (Appendix 5). All sockeye salmon smolts in 2003 were from natural spawning in the Auke Lake system. Scale analysis revealed that 54% of the smolts, 11,418 fish, were age-1 (2001 brood), and 46%, 9,736 fish, age-2 (2000 brood).

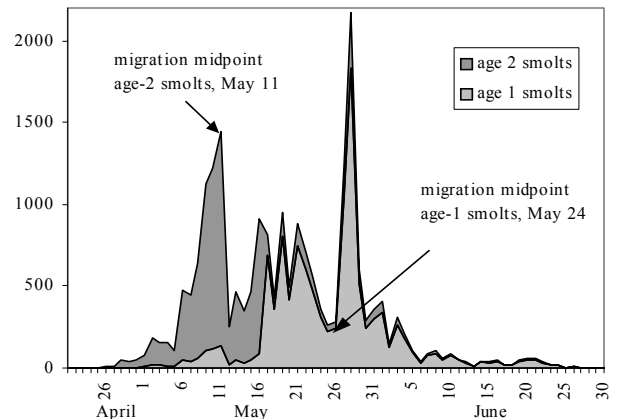


Figure 9. Daily emigration of age-1 and -2 sockeye salmon at Auke Creek, 2003. (Daily numbers are stacked in figure)

The 2000 brood has completed the freshwater phase of its' life history, and produced a total of 16,095 smolts. Production of smolts from the 2000 brood was less than the average brood-year production of 17,265 over the last 23 years (Figure 10). The 2001 brood has produced only age-1 smolts; the age-2 smolts will emigrate in 2004.

Average size of age-1 and -2 sockeye

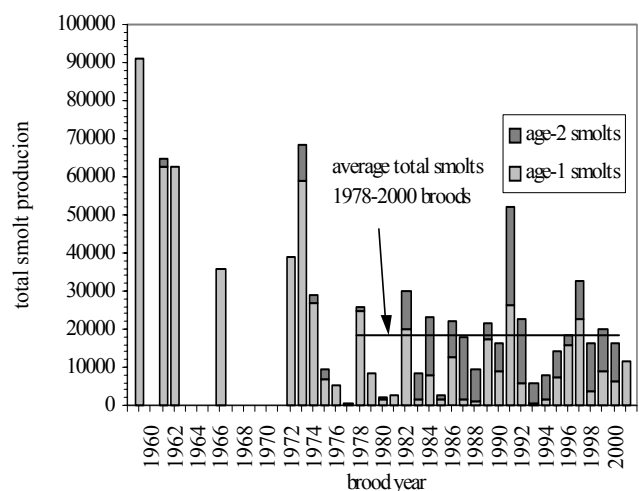


Figure 10. Number of age-1 and -2 sockeye smolts by brood year at Auke Creek

salmon smolts from Auke Lake in 2003 were quite different from each other. Age-1 smolts averaged 74 mm and 3.4 gm, and age-2 smolts were 107 mm and 9.8 gm. The age-2 smolts were the smallest since 1994. The average for age-1 and -2 sockeye smolts from Auke Lake are 75 mm and 3.7 gm and 106 mm and 11.5 gm.

Over the last 4 decades there was a trend of increasing size of sockeye smolts at Auke Lake (Figure 11). This trend is most noticeable in the average weights. For the periods 1961-1980, 1981-1990, and 1991-2003, age-1 smolts averaged 2.3, 4.3, and 4.3 gm, an 87% average gain between the first and second periods, and no change between second and third. The heaviest age-1 smolts, 6.8 gm, were in 1998. There were few

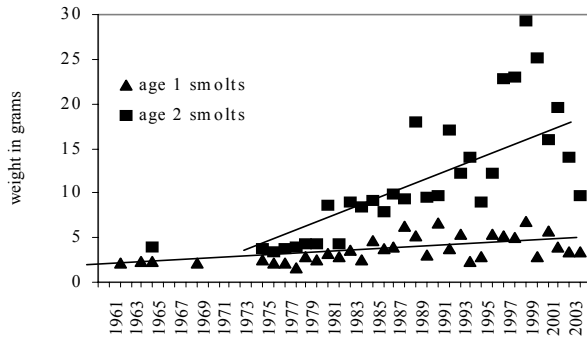


Figure 11. Average weights of age-1 and -2 sockeye salmon smolts by emigration year at Auke Creek. The lines are linear trends for each age group.

age-2 smolts produced from 1961-1980, and the average was 4.5 gm. For the 1981-1990 and 1991-2003 periods, age-2 smolts averaged 9.5 and 17.2 gm. Average weight of age-2 smolts increased 111% between the 1961-1980 and 1981-1990 periods, and 81% between the 1981-1990 and 1991-2003 periods. From 1980 through 2003, the weight of age-1 and -2 sockeye smolts, estimated from linear regression lines of annual average weights, increased 0.8 and 4.4%/yr.

There is a trend of increasing proportion of age-2 smolts produced from each brood year. Before 1980, age-2 smolts represented <5% of a brood year's production, and some broods produced no age-2 smolts. Since the 1980 brood year, the average proportion of age-2 smolts has reached 54% of the total brood year production (Figure 12).

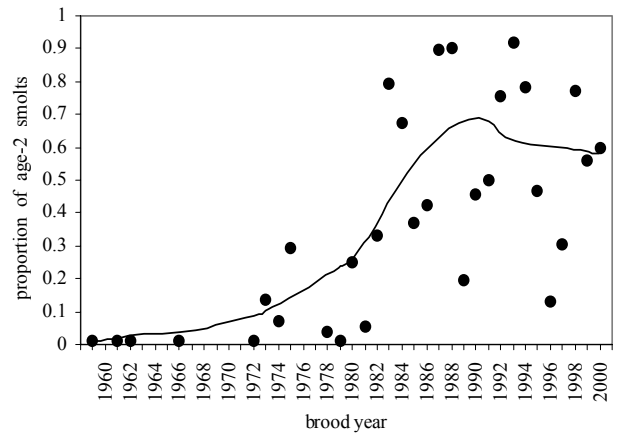


Figure 12. Proportion of age-2 sockeye salmon smolts by brood year at Auke Creek. The line represents the trend smoothed by local regression.

Total biomass-zooplankton models indicate Auke Lake has the capacity to produce 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 2003 was 133 kg. This was less than the average of 147 kg for Auke Lake smolts for the years data are available (Figure 13). The 2003 smolt biomass was less than average because of the decrease in weight of age-2 smolts.

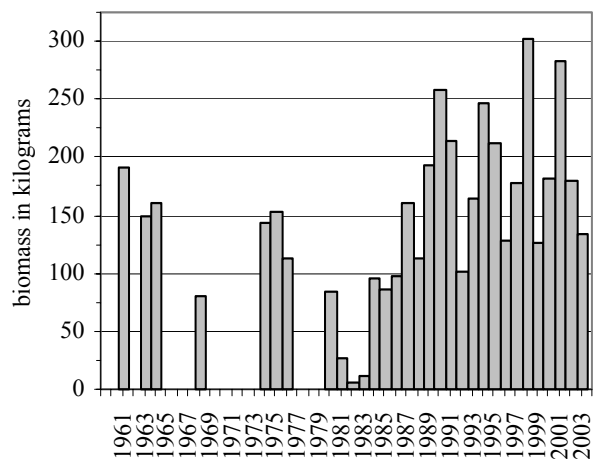


Figure 13. Total annual biomass of sockeye salmon smolts leaving Auke Lake.

One measure of freshwater survival, the number of smolts produced per spawner, indicates that for Auke Lake sockeye, 1978-2000 brood years, only 5 broods produced more than 10 smolts per spawner, and the average over the last 23 broods is 8 smolts (Figure 14). The 2000 brood produced a total of 6.5 smolts per spawner. The 2001 brood produced 2 age-1 smolts per spawner; however, that production is expected to increase when the age-2 smolts emigrate in 2004.

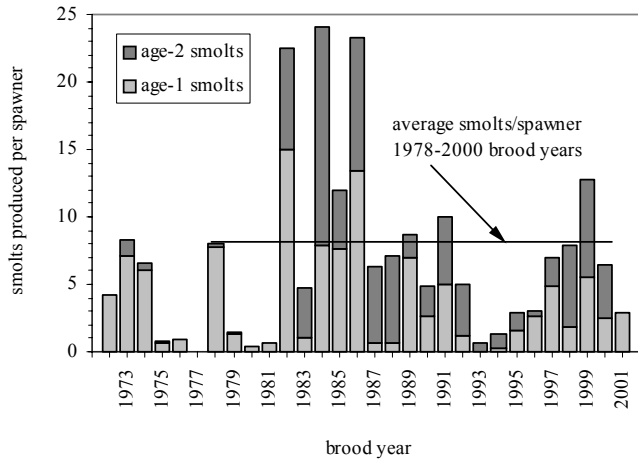


Figure 14. Number of sockeye salmon smolts produced per brood year spawner at Auke Lake. The 2001 brood will produce age-2 smolts in 2004.

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 15). 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 2003, 3,239 adult and 158 jack sockeye salmon returned to Auke Creek. The adult run was greater than the average wild run since 1982, but less than the historical average for all years, 4,607 adults. Most sockeye adults, 3,037 fish, migrated upstream in July (Appendix 6). Estimated survival, smolt to weir recovery of adults, for 2003 returns was 22%.

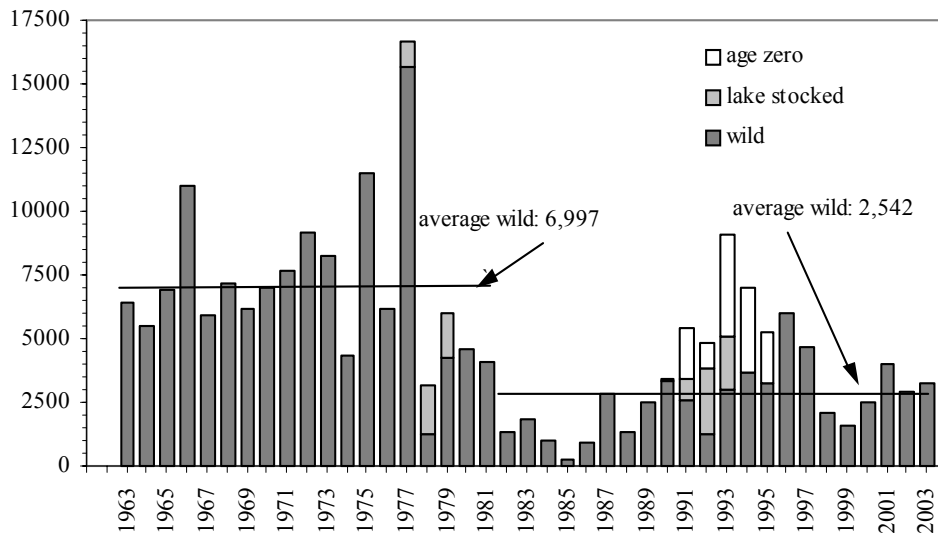


Figure 15. Wild and hatchery sockeye salmon adults at Auke Creek. Hatchery fish were produced from lake stocked and age zero smolts reared at Auke Creek.

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

Year	smolts				adults			
	wild	stocked	age-0	total	wild	stocked	age-0	total
1961	90,816			90,816				
1962								
1963					6,391			6,391
1964	65,242			65,242	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
2003	21,154			21,154	3,239			3,239
mean ¹	17,104				4,607			5,158

¹Mean number of wild smolts is from 1980-2003.

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. Chum salmon adults were counted at Auke Creek in 1967 and 1968, and since 1971. 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 the use of a small population for brood stock development, marine survival of juveniles, and age heritability. Hatchery chum salmon fry were released in 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. In those years all chum adults were captured and spawned for hatchery incubation, thus, no wild fry were captured at Auke Creek from 1977-1984. Chum salmon adults, from releases of Macaulay hatchery juveniles at Amalga Harbor and other release sites, have strayed into Auke Creek since 1994.

In 2003, 5,373 fry and 1,578 adult chum salmon were counted and released at Auke Creek (Table 3). About 50% of the fry emigrated in March, slightly earlier than the pink salmon (Appendix 5). Based on run timing and number of adult chums, it was suspected that most of the adults were strays from Macaulay hatchery releases. Before 1994, chum salmon in Auke Creek immigrated after mid August, usually during the last week of August and early September. In 2003, the 23 chum salmon that entered Auke Creek after the third week of August were counted as Auke Creek fish.

Year	fry		adults			total
	wild	Auke C. hatchery	strays ¹	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
2003	5,373		1,555		23	1,578
mean	5,204	32,830	1,774	794	61	817

¹Estimated Macaulay hatchery-reared chums that strayed to Auke Creek.

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

Coho Salmon

Coho salmon spawn in the tributaries to Auke Lake and in the upper 100-m of Auke Creek. Juvenile rearing occurs in Auke Lake and probably most of the watershed, although the exact areas are not known. Total smolt numbers were estimated in 1976, 1977, and 1979, the first years when smolts were adipose fin clipped and tagged with coded wires (Table 4). Smolts were not counted or tagged in 1978. The total coho smolt emigration was counted since 1980. In 1976, 1977, and 1979 the total number of smolts was estimated from the return of jacks and adults from each smolt cohort. In the return years 1976-1980 there were marked and unmarked coho salmon from Auke Creek, and strays from enhancement projects in the Juneau area. The number of Auke Creek smolts was estimated after determining the number of marked and unmarked stray jacks and adults at the weir, and subtracting the latter two from the total immigration. The number of unmarked, Auke Creek smolts was estimated from the ratio of marked smolts and marked and unmarked jacks and adults of Auke Creek origin. 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 were 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 coho jacks and adults with the double fin marks were killed when they returned to Auke Creek.

There is a trend of decreasing coho salmon smolt production at Auke Lake. A total of 3,574 coho salmon smolts left Auke Lake in 2003, the second lowest emigration (Figure 16). The highest total smolt count was 10,022 in 1980; the average total count is 6,181 (Table 4). In 2003, 3,533 smolts were tagged with coded wires and marked by adipose fin clip. Average sizes of age-1 and -2 smolts were 104 mm and 11 gm, and 124 mm and 18 gm. Samples collected throughout the run revealed that 2,039 smolts were age-1 (2001 brood) and 1,535 were age-2 (2000 brood). The 2003 emigration of age-2 smolts was the lowest ever at Auke Creek. Total production of smolts

from the 2000 brood, 2,248 fish, was the lowest on record at Auke Creek. Average production of the 1978-99 broods was 6,155 smolts.

Coho smolts began emigration during the first week of May, and the emigration midpoint was May 18. The average emigration midpoint of coho smolts at Auke Creek is May 20 (Figure 17). Emigration of age-1 smolts was later than age-2 smolts, and emigration midpoints of age-1 and -2 smolts were May 23 and May 14 (Figure 18).

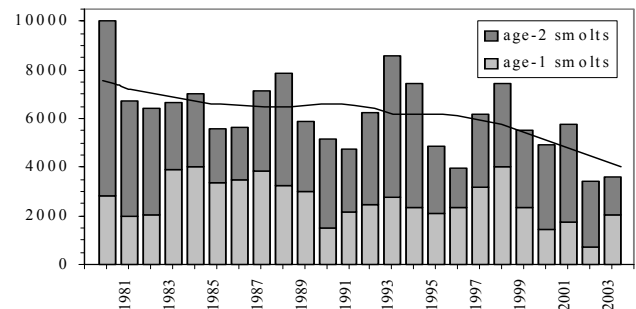


Figure 16. Number of coho salmon smolts by age class at Auke Creek, 1980-2003. The curved line is the trend smoothed by local regression.

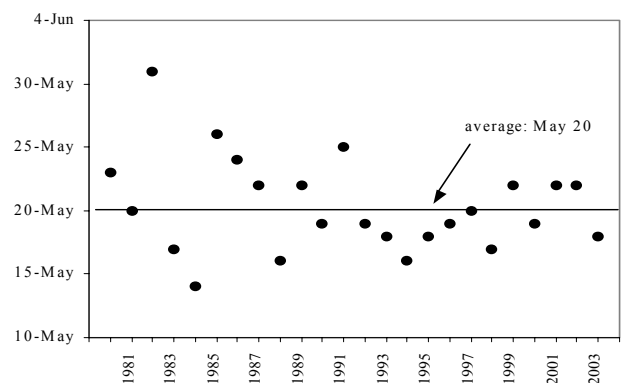


Figure 17. Median emigration dates of coho salmon smolts at Auke Creek, 1980-2003.

The 2003 immigration of coho salmon at Auke Creek included adipose marked and unmarked jacks and adults, and totaled 244 jacks and 585 adults. The jack run was about 50 fewer than average (Figure 19). The adult run was 150 fish fewer than average, and the lowest since 1996 (Figure 20). A total of 219 jacks and 551 adults were adipose fin marked, both less than average (Table 4). Most jack and adult coho salmon entered Auke Creek before the end of September. Coded wire tags were collected from carcasses recovered at the weir. All tags were from the Auke Lake stock of coho salmon. The origin of the 25 unmarked jacks and 34 unmarked adults is not known. Immigration of the marked fish was earlier than the unmarked. Most marked fish entered Auke Creek before the last week of September, and the unmarked fish did so from late September through October.

Harvest of coho salmon from Auke Creek was determined from recovery of coded wire tags in commercial and sport fishery port sampling programs. In 2003, the harvest of Auke Creek coho salmon was estimated at 300 adults, a 35% harvest rate. Average harvest and harvest rate of Auke Creek coho salmon is 502 adults and 42%.

Total survival of the coho salmon smolts tagged at Auke Creek in 2002 was 27.9% (jacks returned in 2002 and adults in 2003). 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. Total survival was the combined return of jacks 2.9% (returned in 2002), adults at the weir 16.2%, and adults harvested 8.8% (Figure 21, Table 4). The survival to jacks was the second lowest in nearly two decades. Combined survival to adults, weir plus fishery, was 25%, the fifth highest at Auke Creek. The average is 20%.

Some smolts return as jacks the same year they emigrate at Auke Creek. In 2003, the 219 marked jacks at Auke Creek represented a survival of 6.2%; second highest on record (Table 4).

In 2003, immigrant coho salmon juveniles were intentionally captured at Auke Creek weir. A total of 319 were caught and examined for missing adipose fin. None were fin clipped, and all fish were released upstream from the weir.

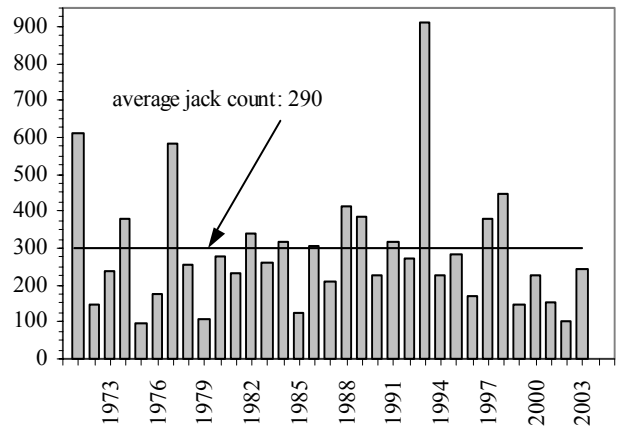


Figure 19. Coho salmon jacks at Auke Creek.

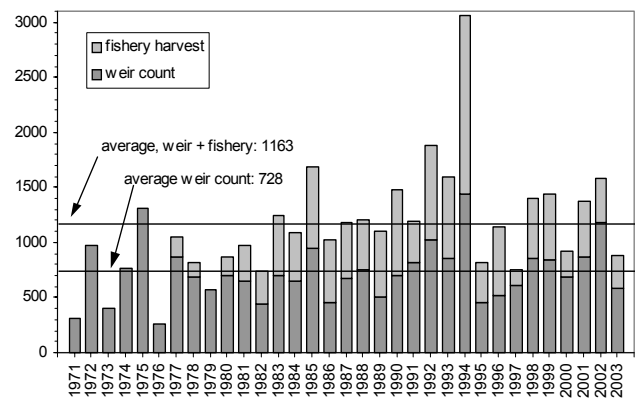


Figure 20. Weir counts and fishery harvest of wild coho salmon from Auke Creek. Averages are for years data are available.

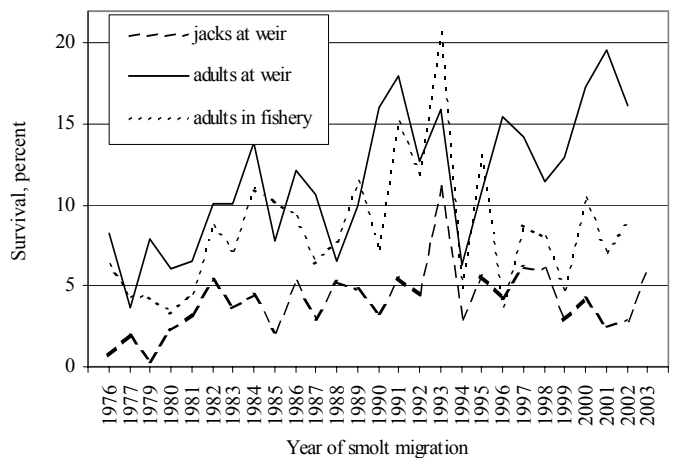


Figure 21. Ocean survival of coho salmon smolts from Auke Creek. Survivals are for tagged fish by year of smolt migration. Figure 18. Daily emigration of coho salmon smolts at Auke Creek, 2003. (Daily numbers of fish are stacked in figure)

Table 4. Coho salmon smolts and adults at Auke Creek. Smolt data includes total numbers and number released with coded wire tags. Jack and adult data includes total weir recovery of jacks and adults, weir recovery of tagged jacks and adults, and fishery harvest of tagged fish. Survival are for tagged smolts by year of smolt migration. The total smolt average does not include years when numbers were estimated.

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	10772	2992	176	262	21			0.7	8.2	6.3	15.2
1977 ¹	18686	3038	583	868	59	246	189	1.9	3.7	4.3	9.9
1978			256	683		112	131				
1979 ¹	9419	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	16.2	8.8	27.9
2003	3574	3534	244	585	219	551	300	6.2			
mean	6181		290	728	246	661	502	4.1	11.5	8.5	24.0

¹- total smolt count estimated, not all smolts were captured

Dolly Varden

Auke Lake is an important over-wintering site for Dolly Varden in the Juneau area. Some spawning and rearing occur in the system, but spawner numbers and annual smolt production are not known. Dolly Varden emigrants at Auke Creek were counted in 1970, a total of 6,249 fish, and annually since 1980. Emigrants were marked or tagged in 1970, 1980, 1983, and 1990, and marked fish were observed in subsequent years. In 1998, 1999, and 2000 the marked fish captured at Auke Creek were probably from Windfall Lake where they were marked during the 1997 emigration.

Auke Creek Dolly Varden abundance is in a decreasing trend that began in 1996 (Figure 22). The emigration of 5,067 Dolly Varden at Auke Creek in 2003 was the second lowest since 1986, and less than the average 6,304 (Table 5). In most years emigration begins in March, however, in 2003 only 4 Dolly Varden left Auke Lake that month (Figure 23). Daily counts never exceeded 50 fish until the last week of April and most fish emigrated in May (Appendix 5). The midpoint of emigration was May 3. The average midpoint for all years is May 8. Dolly Varden were sampled daily throughout the emigration by measuring the length of every tenth fish. Larger fish emigrated earlier, and average length decreased weekly from 380 mm to 185 mm during the main part of the emigration (Figure 24). Overall, the average length of emigrants was 235 mm. All fish were checked for marks or tags, none were found.

Immigrant Dolly Varden were counted at Auke Creek since 1997. A total of 3,978 Dolly Varden were captured at the upstream weir in 2003. The average number of Dolly Varden immigrants at Auke Creek, 1997-2003 is 4,520 (Table 5). The immigration began July 2, and the last fish was captured October 30 (Figure 23, Appendix 6).

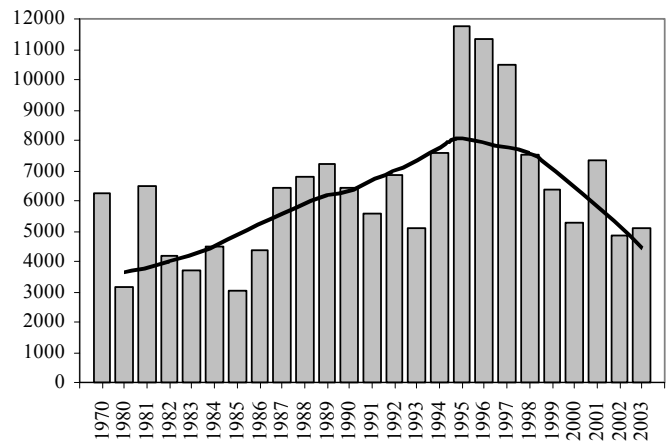


Figure 22. Emigrant Dolly Varden at Auke Creek. The curved line is the abundance trend smoothed by local regression.

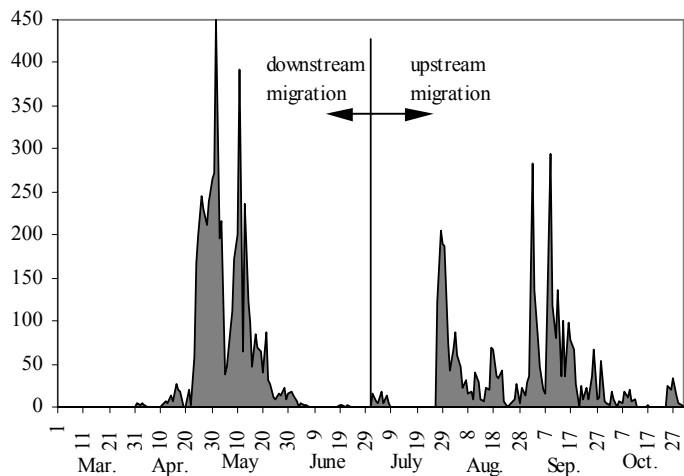


Figure 23. Migration of Dolly Varden at Auke Creek, 2003.

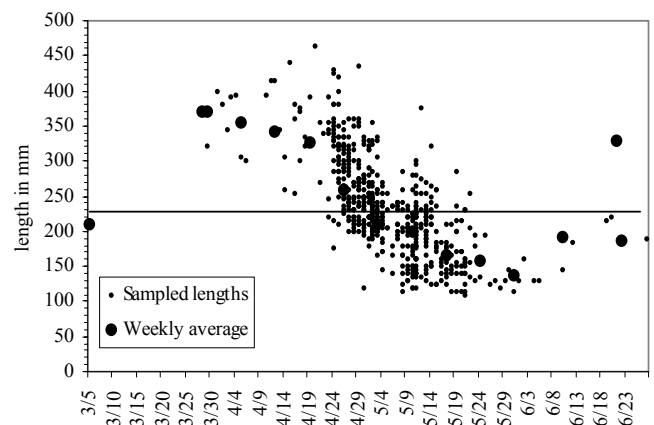


Figure 24. Fork lengths, daily samples and weekly averages, of Dolly Varden emigrants at Auke Creek, 2003. The line is the average of all fish sampled.

Table 5. Number of Dolly Varden migrants at Auke Creek, 1970, and 1980-2003 (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
2003	5,067	5,067	0	0	3,978
mean	6,304				4,520

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. Emigrant cutthroat trout were counted in 1970 and since 1980. Immigrants were counted since 1997. Mature emigrants were spawned in 1981-1982, 1985-1986, and 1991 and 1993 for hatchery incubation. The resulting progeny were fin marked and released in Auke Lake, and hatchery fish were seen in subsequent years (Table 6).

Auke Creek cutthroat trout emigrants have been in a decreasing trend since 1996 (Figure 25). A total of 254 cutthroat trout were counted during the emigration in 2003, exactly the average number of wild fish. In the 2003 emigration, the first cutthroat was captured April 2; the last was captured June 24 (Figure 26, Appendix 5). The midpoint of emigration was May 11. 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 80 cutthroat trout were missing their adipose fin when they left Auke Lake this year, 78 that were tagged in 2002 or earlier, 1 was tagged in Auke Lake during the lake population project in June 2003, and 1 had lost the PIT tag. A total of 174 trout were not fin marked, indicating they had never received a PIT tag. 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 fork length at time of emigration. The larger fish emigrated earlier than smaller ones. The average weekly size during the main part of the

emigration decreased from about 350 mm to about 215 mm (Figure 27). Overall, the average length of emigrant cutthroat trout in 2003 was 255 mm.

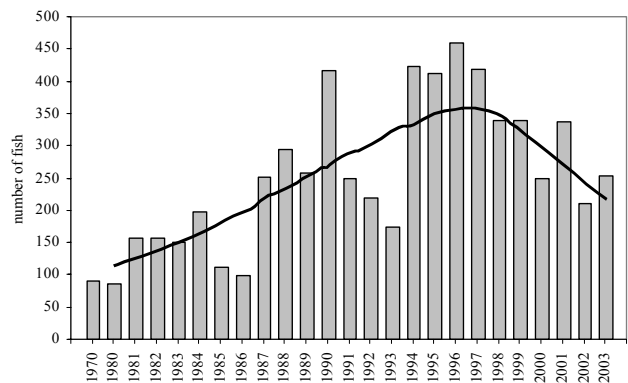


Figure 25. Number of emigrant cutthroat trout at Auke Creek. The line is the abundance trend smoothed by local regression.

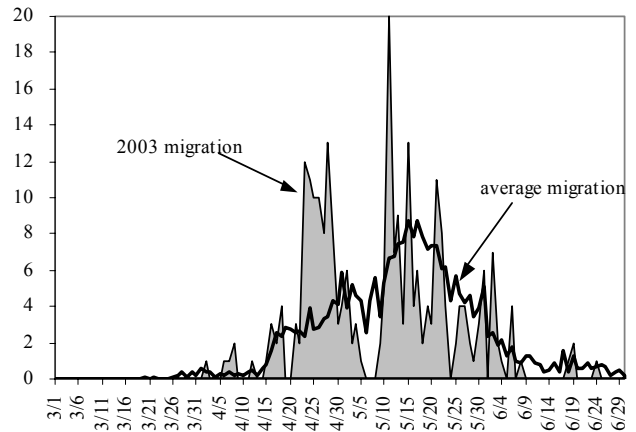


Figure 26. Average and 2003 daily emigrations of cutthroat trout at Auke Creek.

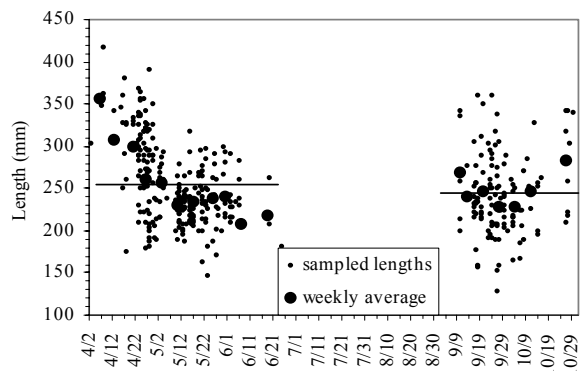


Figure 27. Daily and weekly averages of fork lengths of cutthroat trout migrants at Auke Creek, 2003. The lines are the average lengths within groups.

In 2003 there were 129 immigrant cutthroat trout at Auke Creek, about 50% of average. No cutthroat immigrated in July or August, 91 did so in September, and 38 in October (Appendix 6). Most 126, were examined for adipose fin marks and PIT tags before release. A total of 28 immigrants were missing the adipose fin and had a PIT tag, 98 were unmarked, and 3 escaped before they were checked. Estimates of marine residence, seasonal growth, and growth rate were made from individual PIT tagged immigrants captured in 2003. Seasonal growth and growth rate were made for the period between emigration and immigration. The average marine

residence of cutthroat trout in 2003 was 137 days, range 93-188 days. Average growth was 59 mm, range 34-89 mm, and average growth rate was 0.44 mm/day, range 0.17-0.77 mm/day. Immigrant cutthroat trout did not display the seasonal time-size-migration pattern seen during emigration. Average immigrant fork length was 243 mm (Figure 27).

Four steelhead trout juveniles were captured at Auke Creek during emigration in 2003. All emigrated during the middle two weeks of May. Fork lengths of steelhead trout emigrants ranged from 167-205 mm. No steelhead trout immigrants were captured in Auke Creek in 2003.

Table 6. Number of cutthroat trout at 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
2003	254		254	28	98	3	129
mean	254		333				248

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. No juveniles were released near Auke Creek in 2003.

At Auke Creek, chinook are captured at the weir, and classified as mini-jacks or adults based on size. All mini-jacks are males, ≤ 250 mm fork length, that mature and return to fresh water the same year they were released as smolts. Adults are >250 mm and remain at large for one year or more. All chinook are killed at the weir.

As agreed at the 2003 annual meeting, chinook were not examined for marks or tags in 2003.

In 2003, 162 chinook salmon adults and no mini-jacks were captured at Auke Creek (Table 7). The number of chinook adults was one of the lowest at Auke Creek (Figure 28). Chinook adults were captured intermittently from late July through early September (Appendix 6). All chinook were killed and offered to local charities.

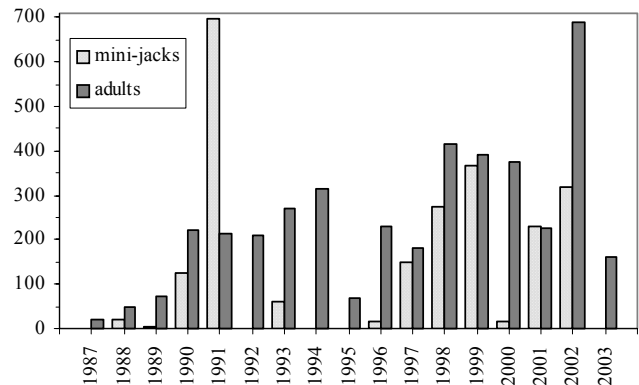


Figure 28. Number of chinook salmon at Auke Creek.

Table 7. Number of chinook salmon at Auke Creek, 1987-2003. 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
2003 ¹	0	0	0			162
mean	42	122	152	60	214	242

¹ Fish were not sampled for fin marks in 2003.

APPENDICES

Appendix 1. Emigrant wild salmonids at Auke Creek, 1961-2003. The sockeye and coho salmon averages are 1980-2003, and chums 1985-2003.

Year	Sockeye Salmon Smolts	Pink Salmon Fry	Chum Salmon Fry	Coho Salmon Smolts	Dolly Varden	Cut- throat trout	Steel- head trout
1961	90,816						
1964	65,242						
1965							
1966							
1967							
1968	35,737						
1969							
1970					6,249	90	
1971							
1972		157,189					
1973		73,900					
1974	15,399	277,624					
1975	59,370	247,091					
1976	35,769	108,195		10,772			
1977	8,862	119,442	0	18,686			
1978		129,714	0				
1979		23,270	0	9,419			
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	340	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
2003	21,154	95,132	5,373	3,574	5,067	254	4
average	17,104	115,081	5,204	6,181	6,304	254	11

Appendix 2. Immigrant salmonids at Auke Creek, 1963-2003. Hatchery fish are included: sockeye

1977-79, 1989-95; pink 1973-94, 1996, 1998-2001; chum 1979-91, 1994-2003; chinook, all years.

Year	Sockeye salmon	Pink salmon	Chum salmon	Coho salmon	Chinook salmon	Dolly Varden	Cut- throat	Steel- head
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
2003	3,239	10,580	1,578	585	162	3978	129	0
average	5,158	10,274	815	728	242	4,520	248	5

Appendix 3. Daily water temperatures at Auke Creek, 2003

day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1.9	1.8	1.9	2.8	12.0	13.3	16.2	16.0	13.2	10.0	6.0	1.8
2	2.1	1.7	2.0	3.0	11.3	13.3	16.3	15.2	13.0	10.0	5.8	1.9
3	2.3	1.6	2.1	3.1	10.5	13.7	15.7	15.3	12.7	10.0	5.5	2.2
4	2.2	1.7	2.1	3.2	10.2	14.3	15.2	15.2	12.7	10.0	5.3	1.9
5	2.6	1.8	2.1	3.3	9.9	14.5	15.3	15.5	13.3	10.0	5.0	1.7
6	2.4	1.9	2.2	3.5	10.0	15.5	15.2	16.3	13.2	9.9	4.8	1.6
7	2.8	1.9	2.2	3.7	10.1	15.5	15.5	16.8	13.2	10.0	4.9	1.3
8	2.6	1.9	2.2	3.9	10.7	15.5	16.5	17.3	12.3	9.7	4.6	1.4
9	2.1	2.0	2.3	3.9	11.7	15.8	17.5	17.8	12.0	9.7	4.8	1.1
10	1.9	2.0	2.2	4.2	12.2	16.7	18.5	17.7	12.0	9.5	4.7	1.0
11	1.9	2.0	2.3	4.2	11.7	16.5	19.3	17.7	12.0	9.2	4.7	1.2
12	1.9	2.1	2.2	4.3	10.8	16.7	19.2	17.2	12.0	8.8	4.8	1.2
13	1.8	2.2	2.1	4.4	10.0	16.3	18.8	16.8	11.5	8.8	4.6	1.2
14	1.6	2.1	2.4	4.4	9.8	16.5	18.0	16.5	11.0	8.6	4.5	1.1
15	1.6	2.2	2.5	4.7	9.8	16.0	17.8	16.0	11.0	8.1	4.5	1.1
16	1.6	2.2	2.3	4.8	10.2	15.8	17.0	15.2	10.5	8.0	4.4	1.2
17	1.7	2.1	2.2	4.6	10.3	16.2	16.0	15.0	10.0	8.0	4.2	1.4
18	2.2	2.0	2.2	4.6	11.2	15.5	15.5	15.2	10.0	8.0	3.9	1.2
19	2.2	1.7	2.1	4.4	11.7	15.0	15.5	15.0	10.0	7.9	3.5	1.5
20	2.3	1.6	2.4	4.7	12.7	14.3	15.2	14.8	10.0	7.8	2.8	1.6
21	2.1	1.4	2.4	5.2	13.2	14.7	14.3	14.3	10.0	7.6	2.4	1.6
22	2.0	1.4	2.8	5.5	13.3	14.8	14.2	14.3	9.9	7.6	2.9	1.6
23	1.9	1.5	2.8	6.3	13.0	15.0	14.3	14.8	10.0	7.6	2.5	1.6
24	1.9	1.6	2.9	6.9	13.0	14.8	14.2	14.7	9.8	7.5	2.0	1.6
25	1.9	1.7	2.8	8.9	12.0	14.0	14.0	14.5	9.6	7.6	2.4	1.5
26	1.8	1.7	2.9	10.2	11.8	14.0	13.3	14.7	9.7	7.6	2.1	1.5
27	1.8	1.6	3.2	10.3	12.3	13.8	14.3	14.8	9.5	7.6	1.9	1.3
28	1.7	1.8	3.3	9.7	12.7	14.0	15.3	14.3	9.4	7.4	1.6	1.3
29	1.6		3.3	10.3	13.0	14.0	15.0	14.7	9.9	7.0	1.8	1.4
30	1.6		3.2	10.7	13.5	15.5	15.3	14.3	10.0	6.6	1.8	1.5
31	1.6		3.0		13.8		15.7	14.0		6.2		1.4
Ave.	2.0	1.8	2.5	5.5	11.6	15.1	15.9	15.5	11.1	8.5	3.8	1.4

Appendix 4. 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	2003	April 14
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 5. Monthly totals and daily counts of emigrant wild salmonids at Auke Creek.

2003	pink fry	coho smolts	sockeye smolts	chum fry	Dolly Varden	cutthroat	steelhead
March	38,251	0	0	2,565	4	0	0
April	56,870	3	158	2,776	1,754	96	0
May	11	3,135	18,899	32	3,268	139	4
June	0	436	2,097	0	41	19	0
total	95,132	3,574	21,154	5,373	5,067	254	4
March 1							
2							
3	0			0			
4	856			32			
5	1,140			62	1		
6	565			45			
7	702			68			
8	776			63			
9	850			39			
10	1,013			66			
11	670			65			
12	848			83			
13	493			44			
14	649			58			
15	762			61			
16	2,010			103			
17	757			76			
18	1,238			104			
19	1,778			90			
20	709			80			
21	1,613			117			
22	1,106			91			
23	2,122			61			
24	1,411			100			
25	1,917			120			
26	1,618			119			
27	1,755			125			
28	2,257			180	1		
29	2,701			166	1		
30	3,010			198			
31	2,925			149	1		
April 1	2,915			82	4		
2	2,360			99	2	1	
3	2,538			98	4		
4	2,655			128	3		
5	3,403			170	1		
6	2,629			207	1	1	
7	1,937			148		1	
8	4,060			193		2	
9	4,494			208			
10	3,316			166	1		
11	3,794			152	3		
12	3,057			149	6	1	
13	3,676			140	5		
14	3,899			237	14		
15	2,632			121	6	1	
16	1,915			101	26	3	
17	1,834			71	21	2	
18	957			63	17	4	
19	693			29	1		
20	811			37	1		
21	2,064		1	39	19	3	
22	693	1		50	3	2	
23	171			34	59	12	
24	152		1	14	167	11	
25	91		2	12	199	10	
26	36		9	8	245	10	

2003	pink fry	coho smolts	sockeye smolts	chum fry	Dolly Varden	cutthroat	steelhead
27	32		12	0	230	8	
28	21	1	45	6	211	13	
29	13		39	4	239	8	
April 30	22	1	49	10	266	3	
May 1	4	3	81	3	271	4	
2	2	9	182	6	449	6	
3	1	6	159	3	195	2	
4	0	12	153	1	215	3	
5		10	102	3	38	1	
6		28	478	0	47	0	
7		35	450		88	0	
8		63	641		112	0	
9	2	77	1,124	2	172	2	
10		87	1,218	2	200	5	
11		173	1,447	3	393	20	1
12	1	79	249	4	64	7	
13		252	468	2	237	9	
14		354	350	0	122	3	
15		148	464		99	13	2
16		176	912		47	4	
17		155	812		85	6	
18	1	159	429	1	70	2	
19		112	950	1	65	4	
20		86	496		39	3	
21		231	880		87	11	
22		118	707	1	32	8	
23		137	563		26	4	1
24		76	362		11	0	
25		97	262		10	2	
26		48	283		15	4	
27		115	1,253		13	4	
28		50	2,170		23	2	
29		20	602		10	1	
30		83	292		16	3	
31		136	360		17	6	
June 1		69	404		14	0	
2		73	148		7	7	
3		100	312		0	2	
4		55	216		4	1	
5		24	111		2	0	
6		7	39		2	4	
7		24	86		0	0	
8		14	106		0	1	
9		8	55		0	0	
10		13	90		1	0	
11		4	52		0		
12		6	34		1		
13		3	12		0		
14		7	43				
15		6	38				
16		5	44				
17		2	22			0	
18		1	21		0	1	
19		7	49		3	2	
20		3	58		2	0	
21		2	61		1		
22		1	38		3		
23		0	20		0		
24		1	21			1	
25		0	2				
26		1	7				
27			3		1		
28							
29			3				
30			2				
total	95,132	3,574	21,154	5,373	5,067	254	4

Appendix 6. Monthly totals and daily counts of immigrant salmonids at Auke Creek, 2003.

Hatchery reared chum and chinook salmon are included.

	Sockeye adults	Pink adults	Chum adults	Coho adults	Chinook adults	Dolly Varden	Cutthroat trout
June	38	0	0	0	0	0	0
July	3,037	286	648	0	16	845	0
August	139	6,098	927	1	102	888	0
Sept.	25	4,196	3	519	44	2,037	91
Oct.	0	0	0	65	0	208	38
total	3,239	10,580	1,578	585	162	3,978	129
June 20	29						
21	9						
22							
23							
24							
25							
26							
27							
28							
29							
30							
July 1							
2	2					15	
3	0					6	
4	96					5	
5	137					17	
6	75					5	
7	25					14	
8	1					4	
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27	1936	9	66		0	123	
28	488	38	165		8	204	
29	171	63	222		1	190	
30	83	102	104		1	187	
31	23	74	91		6	75	
Aug 1	11	28	91		2	43	
2	11	37	72		2	67	
3	8	20	93		2	86	
4	4	36	85		0	61	
5	3	18	71		1	46	
6	3	22	48		1	23	
7	5	25	51		1	31	
8	4	17	25		1	15	
9	2	11	28			18	
10	0	41	18			9	
11	5	65	27			40	
12	2	39	29			30	
13		36	28			8	
14	2	53	22			6	
15	2	95	24			22	
16	4	83	41			19	
17	18	342	58			68	
18	18	511	37		8	67	
19	4	187	19		7	35	
20	6	247	12		33	33	
21	13	1153	8		3	43	
22	3	740	8		0	7	
23	3	252	14		10	1	

	Sockeye adults	Pink adults	Chum adults	Coho adults	Chinook adults	Dolly Varden	Cutthroat trout
Aug. 24		166	8		5	3	
25		200	2		4	4	
26	1	248	2		4	9	
27	1	175	1		0	27	
28		160			7	4	
29	3	243	2		7	22	
30		255			0	13	
31	3	593	3	1	4	28	
Sept. 1	6	534			12	36	
2	7	2062	1		7	284	
3	3	700			5	137	
4	2	243	1		6	79	
5		87			2	47	
6		70			4	20	
7		46			1	16	
8	4	249			5	105	
9	1	114			0	293	
10	1	33		31	0	119	7
11	1	9		40	1	80	
12		17		44	1	135	
13		8		22		36	
14		14		14		100	
15		5		49		35	
16		1		37		97	7
17				8		79	7
18				1		66	5
19		1		3		26	9
20		1		2		1	2
21		1		9		24	0
22		1		6		8	4
23				21		22	7
24				11		8	9
25				65		35	6
26				49		67	11
27				12		10	5
28				44		11	2
29			1	40		54	9
30				11		7	1
Oct. 1				4		4	1
2				6		2	1
3				4		17	8
4				9		9	2
5				5		1	0
6				5		6	3
7				10		4	2
8				9		17	2
9				3		11	1
10				1		19	2
11						7	1
12						10	1
13				2			
14				3			4
15						1	1
16							
17						2	
18							
19							
20				1			
21							
22							
23							
24							
25						25	
26				2		19	3
27				1		34	4
28						14	1
29						4	1
30						2	
31							
Total	3,239	10,580	1,578	585	162	3,978	129