

Fishery Data Series No. 97-23

**Status of Sea-run Cutthroat Trout, Sea-run Dolly
Varden, and Steelhead Populations at Sitkoh Creek,
Southeast Alaska, during 1996**

by

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October 1997

Alaska Department of Fish and Game

Division of Sport Fish



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Weights and measures (metric)		General		Mathematics, statistics, fisheries	
centimeter	cm	All commonly accepted abbreviations.	e.g., Mr., Mrs., a.m., p.m., etc.	alternate hypothesis	H_A
deciliter	dL	All commonly accepted professional titles.	e.g., Dr., Ph.D., R.N., etc.	base of natural logarithm	e
gram	g	and	&	catch per unit effort	CPUE
hectare	ha	at	@	coefficient of variation	CV
kilogram	kg	Compass directions:		common test statistics	F, t, χ^2 , etc.
kilometer	km	east	E	confidence interval	C.I.
liter	L	north	N	correlation coefficient	R (multiple)
meter	m	south	S	correlation coefficient	r (simple)
metric ton	mt	west	W	covariance	cov
milliliter	ml	Copyright	©	degree (angular or temperature)	°
millimeter	mm	Corporate suffixes:		degrees of freedom	df
Weights and measures (English)		Company	Co.	divided by	÷ or / (in equations)
cubic feet per second	ft ³ /s	Corporation	Corp.	equals	=
foot	ft	Incorporated	Inc.	expected value	E
gallon	gal	Limited	Ltd.	fork length	FL
inch	in	et alii (and other people)	et al.	greater than	>
mile	mi	et cetera (and so forth)	etc.	greater than or equal to	≥
ounce	oz	exempli gratia (for example)	e.g.,	harvest per unit effort	HPUE
pound	lb	id est (that is)	i.e.,	less than	<
quart	qt	latitude or longitude	lat. or long.	less than or equal to	≤
yard	yd	monetary symbols (U.S.)	\$, ¢	logarithm (natural)	ln
Spell out acre and ton.		months (tables and figures): first three letters	Jan, ..., Dec	logarithm (base 10)	log
Time and temperature		number (before a number)	# (e.g., #10)	logarithm (specify base)	log ₂ , etc.
day	d	pounds (after a number)	# (e.g., 10#)	mid-eye-to-fork	MEF
degrees Celsius	°C	registered trademark	®	minute (angular)	'
degrees Fahrenheit	°F	trademark	™	multiplied by	x
hour (spell out for 24-hour clock)	h	United States (adjective)	U.S.	not significant	NS
minute	min	United States of America (noun)	USA	null hypothesis	H_0
second	s	U.S. state and District of Columbia abbreviations	use two-letter abbreviations (e.g., AK, DC)	percent	%
Spell out year, month, and week.				probability	P
Physics and chemistry				probability of a type I error (rejection of the null hypothesis when true)	α
all atomic symbols				probability of a type II error (acceptance of the null hypothesis when false)	β
alternating current	AC			second (angular)	"
ampere	A			standard deviation	SD
calorie	cal			standard error	SE
direct current	DC			standard length	SL
hertz	Hz			total length	TL
horsepower	hp			variance	Var
hydrogen ion activity	pH				
parts per million	ppm				
parts per thousand	ppt, ‰				
volts	V				
watts	W				

FISHERY DATA SERIES NO. 97-23

**STATUS OF SEA-RUN CUTTHROAT TROUT, SEA-RUN DOLLY
VARDEN, AND STEELHEAD POPULATIONS AT SITKOH CREEK,
SOUTHEAST ALASKA, DURING 1996**

by

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ABSTRACT

Suspected declines in cutthroat trout *Oncorhynchus clarki* abundances in Southeast Alaska and a lack of research at the Sitkoh system (Chichagof Island) prompted an examination in 1996. A weir was operated on Sitkoh Creek just above salt water from 31 March to 29 June 1996, and a total of 3,955 sea-run cutthroat trout and 48,252 sea-run Dolly Varden *Salvelinus malma* emigrated. All cutthroat and steelhead trout *Oncorhynchus mykiss* and a sample of the Dolly Varden were measured for length. The mean fork length for sea-run cutthroat trout was 284 mm and for Dolly Varden was 266 mm (SE 1.8). The abundance and length distribution of sea-run cutthroat trout and Dolly Varden in the Sitkoh system appears similar to other sea-run populations in Southeast Alaska. A total of 926 steelhead trout was passed upstream, which exceeded all but one of the five years of historical data (range 520–1,108). Scars on steelhead thought to be due to fishing gear occurred one-third as frequently in 1996 as in 1993. The length distribution of steelhead in 1996 appears similar to that in the historical data. The proportion of steelhead observed during foot surveys in 1996 (0.22) was over twice the proportions observed in 1982 and 1993 (0.086 and 0.085, respectively), likely due to ideal conditions in 1996, and snorkel surveys observed about twice the proportion (0.48) as did foot surveys conducted at the same time.

Key words: Alaska, Sitkoh Creek, cutthroat trout, Dolly Varden, steelhead trout, sea-run, weir, abundance, length, scars.

INTRODUCTION

The Sitkoh system receives the third-highest freshwater fishing effort in the Sitka area (Mills 1985–1994; Howe et al. 1995). The U.S. Forest Service (USFS) maintains two popular public-use cabins on Sitkoh Lake, and the area is accessible by float plane and boat from Sitka and Juneau. Concern over increasing fishing effort and declining cutthroat trout *Oncorhynchus clarki* catches in Southeast Alaska prompted the Alaska Board of Fisheries to adopt more restrictive cutthroat trout regulations in 1994, and Sitkoh Lake was included in these regulations. Despite the popularity and accessibility of the Sitkoh system, the populations of cutthroat trout have been studied only in the 1930s (Banta 1936, 1937; Chipperfield 1938) and in 1982 (Schmidt 1982).

The Sitkoh Lake system is an important overwintering site for sea-run cutthroat trout and also for sea-run Dolly Varden *Salvelinus malma*. Unpublished USFS reports cite rumors of commercial Dolly Varden catches from Sitkoh Creek of 14,000–18,000 lb prior to 1936 (Banta 1936; Chipperfield 1937). The exact fishing methods were not specified. This mass converts to about 32,000–41,000 fish, using the 1996 observed

mean fork length of 266 mm, and a mean weight for Dolly Varden of this length of 0.48 lb (Blackett 1968). A weir operated by the USFS during 1936 captured 1,940 Dolly Varden and 93 cutthroat trout, but it was installed relatively late (17 April). A weir operated the following year, from 28 March through 31 May, caught 9,703 Dolly Varden and 439 cutthroat trout (Banta 1936, 1937; Chipperfield 1938). However, the weir reportedly had holes periodically, and the gap between slats was large enough to let some fish through. Steelhead trout *Oncorhynchus mykiss* are also abundant at Sitkoh Creek and have been studied the most, with weirs in 1936, 1937, 1982, 1990, and 1993. Steelhead trout runs ranged from 520 to 1,108 fish (Harding and Jones 1994).

Information on the abundance, length distribution, and run timing of cutthroat trout, Dolly Varden, and steelhead trout in the Sitkoh system will be used to monitor the status of these populations. My research objectives in 1996 were: (1) to count the spring emigration of overwintering Dolly Varden and cutthroat trout from Sitkoh Creek, (2) to count the spring immigration of steelhead trout into Sitkoh Creek, and (3) to estimate the size composition of emigrating Dolly Varden and cutthroat trout and

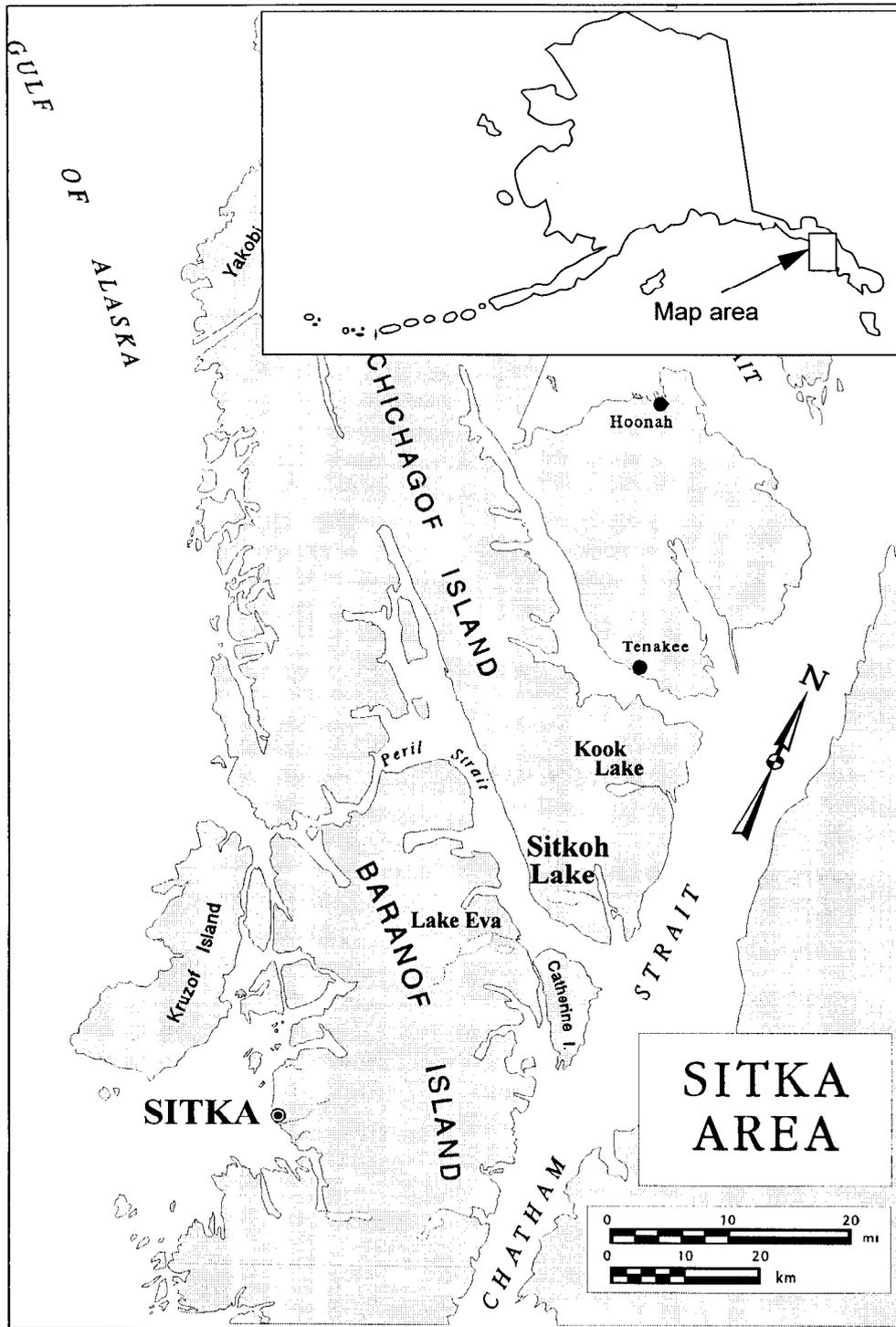


Figure 1.—Location of Sitkoh Lake on Chichagof Island, northern Southeast Alaska.

immigrating steelhead trout. I took this opportunity to also compare the known steelhead immigration with foot and snorkel surveys of

Sitkoh Creek, and to examine the steelhead for scars that might be related to commercial fishing gear or predation.

METHODS

The Sitkoh Lake drainage lies across southern Chichagof Island in Southeast Alaska (Figure 1), and empties into Chatham Strait via Sitkoh Bay (57° 31' 11" N lat., 134° 57' 30" W long.). Sitkoh Lake (ADF&G Anadromous Stream Catalog No. 113-59-10040-0010) has a surface area of 189 ha; its maximum depth is 42 m, and its elevation approximately 59 m (Figure 2). Sitkoh Creek (ADF&G Anadromous Stream Catalog No. 113-59-10040) is about 6.4 km long, 10 to 30 m wide, and 0.1 to 3 m deep.

A weir was placed in Sitkoh Creek at about 400 m above tidewater, at the exact site of previous weirs in 1936, 1937, 1982, 1990, and 1993 (Figure 2).

The weir was built of 18-mm-diameter steel pickets, with a 31-mm maximum gap between each picket. The upstream face of the weir was overlain with 18- by 21-mm rectangular-opening plastic mesh (extruded polyethylene). The mesh was attached to the weir with cable ties, and the entire interface of the mesh and the stream bed was covered with sandbags. We observed fish around 145 mm fork length occasionally wedged in the mesh openings, so we assumed that the weir blocked all larger fish and allowed smaller fish to pass. Traps were placed both on the upstream and downstream sides of the weir to capture all fish moving either way.

The weir operated from 31 March through 29 June, with one washout during 4–6 April. No

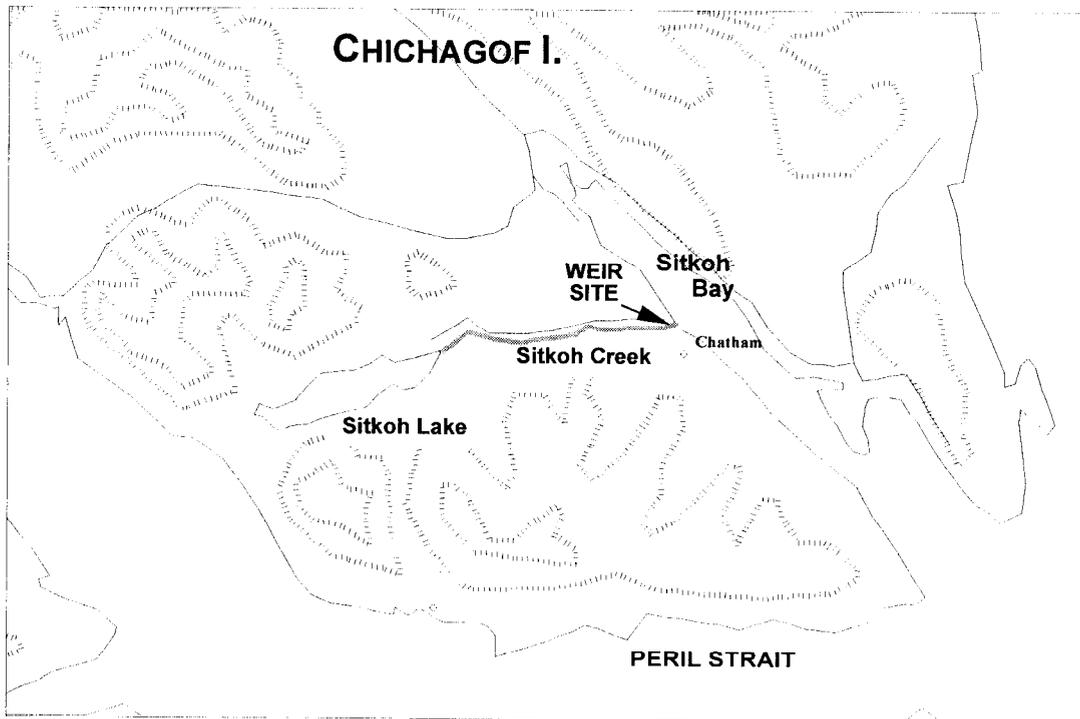


Figure 2.—Location of weir site on Sitkoh Creek.

adjustments were made to the weir counts for the washout, since no fish were migrating before or after the washout, and no fish were observed in the creek at that time. Weir integrity was checked

at least daily, and fish in either trap were processed whenever necessary to avoid crowding. Water temperature and depth were recorded at about 0800 hr each day.

All fish passed through the weir were defined as sea-run. This definition was used because it is consistent with other studies (Armstrong 1971; Yanusz and Schmidt 1996) and was easy to apply. "Sea-run" describes only those cutthroat trout and Dolly Varden migrating between fresh and salt water. These fish usually use salt water for transportation to adjacent freshwater systems or for seasonal residence, whereas fully anadromous fish, such as steelhead and salmon, remain in salt water a full year or more and visit only one freshwater system.

Every cutthroat trout ≥ 180 mm fork length (FL) passed downstream through the weir was counted, examined for fin clips, tagged with a uniquely numbered Floy® (T-bar anchor) tag, measured for FL to the nearest 1 mm, had scales collected from the peduncle region (left supro-lateral), and had its adipose fin fully removed as a double mark. Every cutthroat trout < 180 mm FL was processed as above, except it was not tagged, and its left ventral fin was excised. Every Dolly Varden passed downstream through the weir was counted, and every 50th Dolly Varden passed was measured for FL to the nearest 1 mm. Steelhead passed downstream were counted only.

Every cutthroat trout passed upstream through the weir was examined for an adipose fin clip, and if unmarked, was tagged, fin clipped, and sampled as above. Previously tagged trout were noted and passed upstream. Every Dolly Varden passed upstream was counted and was given a hole punch in its caudal fin to avoid double-counting if the fish moved through the weir repeatedly. Once Dolly Varden moving upstream were marked, every Dolly Varden moving downstream was inspected for the caudal punch.

Every steelhead passed upstream was counted and measured to the nearest 1 mm FL, and was examined for scars, spawning condition (ripe if exuding gametes, green if not), and sex (determined from primary [gametes] or secondary sexual characteristics). All other species of fish were counted and passed through the weir.

Scars were assigned to seven categories (Table 1) and noted as to whether fresh or healed. Scars in categories 1–3 are thought to be caused by commercial fishing gear (Seibel et al. 1982; Taylor 1985).

Table 1.—Categories of scars on steelhead examined at Sitkoh Creek (Anonymous 1990).

CATEGORY	DESCRIPTION
1	One or more fairly well delineated linear marks between the head and the dorsal fins, approximately perpendicular to the longitudinal body axis and encircling or partially encircling the body.
2	A series of approximately parallel marks or scrape lines over a substantial portion of the body; two or more series of such marks occurring at different angles may give an appearance of crosshatch marks.
3	A fairly well delineated scrape band generally occurring between the head and dorsal fin approximately perpendicular to the longitudinal body axis or angled slightly backward from the top to the bottom of the body and containing a nearly oval shape open wound, normally in the upper portion of the body.
4	Extensive descaling of at least 25% or more of one or both sides of the body but with marks or wounds not well delineated.
5	Open, gaping wounds or puncture marks located anywhere on the body, either with no other marks and scrapes or with adjacent irregular 'scratch' or 'claw' marks, but none of the marks described in categories 1–4.
6	Any scars/marks not fitting descriptions in categories 1–5 and 7.
7	A fresh or healed appearing wound on either side of the body—usually a couple of inches in length, and angled dorsally and forward toward the head of the fish, from the anterior insertion of the dorsal fin to the front of the anal fin and behind the ventral fin. May also occur elsewhere on the fish, but the angle of cut is usually consistent with the ones described above. The fresh wound will have flesh exposed the whole length of the cut. The healed scar will have an 'indentation or pucker' type scar wherever it is located.

Size composition of migrant fish was estimated by

$$\hat{p}_i = \frac{a_i}{n} \quad (1)$$

$$V[\hat{p}_i] = \left(1 - \frac{n}{N}\right) \frac{\hat{p}_i(1 - \hat{p}_i)}{n-1} \quad (2)$$

where \hat{p}_i = estimated proportion of size group i , a_i = number in size group i , n = number successfully measured for length, and N = number of migrants passed through weir. Because all cutthroat trout and steelhead were measured, the size composition of these species is known (variance was not calculated).

Foot and snorkel surveys of Sitkoh Creek were conducted on 14 May and again on 23 May. During each survey, two foot observers waded in Sitkoh Creek; one foot observer watched while the second attempted to drive steelhead into open water for accurate counting. Two snorkel observers, wearing dry suits, snorkels, and diving masks, followed the foot observers on each occasion. Snorkel observers consulted each other on the number of fish observed in each reach to obtain an estimate for that location.

RESULTS

MIGRANT DOLLY VARDEN

The total number of Dolly Varden passed downstream through the weir was 48,252 fish (Appendix A1, Appendix B1). The first Dolly Varden was captured on 8 April, and the daily count peaked on 24 May. Most emigration occurred when water temperature was between 4 and 9.5°C, and daily counts of emigrant Dolly Varden were not well correlated ($r = -0.09$) to gage heights (Figure 3). The midpoint of the emigration occurred on 13 May, and it was five weeks between the 5th and the 95th percentile of the run (Figure 4). A total of 49 Dolly Varden passed upstream through the weir. The upstream migration began on 20 June and was continuous from 24 June until the weir was removed.

The mean FL of all emigrants sampled during 1996 was 266 mm (SE 1.8 mm) and the range was

114–558 mm ($N = 964$). The length distribution of emigrant Dolly Varden was unimodal, with a peak at the 241–260 mm FL category (Figure 5, Appendix C1). Mean weekly FL of Dolly Varden varied between weeks and generally decreased over time (Figure 6).

MIGRANT CUTTHROAT TROUT

A total of 3,955 cutthroat trout passed downstream through the weir (Appendix A1). The first trout was captured on 10 April, and the daily count peaked on 12 June. Most of the run occurred while water temperatures were between 4 and 12°C, and there was some correlation ($r = 0.33$) between the daily count and gage height (Figure 3). The midpoint of the run occurred on 29 May, and the run was relatively protracted, taking 8 weeks from the 5th to 95th percentile of the run (Figure 4). Two components (related to maturity, see below) in the run timing were apparent, and 22 May was the approximate break between components. An unusual event was finding one emigrating trout that had been tagged the previous year while emigrating from Lake Eva (21 km distant at minimum).

Nearly all (98.5%) trout were ≥ 180 mm FL (therefore tagged), and half (49%) were ≥ 287 mm FL (or 12 in total length, minimum legal length for sport anglers to retain). The mean FL of all sea-run trout was 284 mm (range 106 to 475 mm, $N = 3,897$). The length distribution of sea-run cutthroat trout was bimodal, with peaks in the 221–240 and 321–340 mm FL categories (Figure 5, Appendix C1). The mean weekly FL of sea-run cutthroat trout decreased steadily over time, with a sharp decline during the weeks around 22 May (Figure 6).

Obviously ripe trout (gametes spontaneously exuded during handling) were observed from 15 April onward; the last ripe trout was observed on 24 May, and 7% of all cutthroat trout passed downstream were ripe. The occurrence of ripe males peaked during the week of 14–20 May, and ripe females peaked three weeks earlier (Figure 7). Usually, a greater proportion of males were obviously ripe. The irregular features of the run timing, length frequency, and weekly mean length plots (Figures 4–6) are related to variations in maturity at the time (Figure 7).

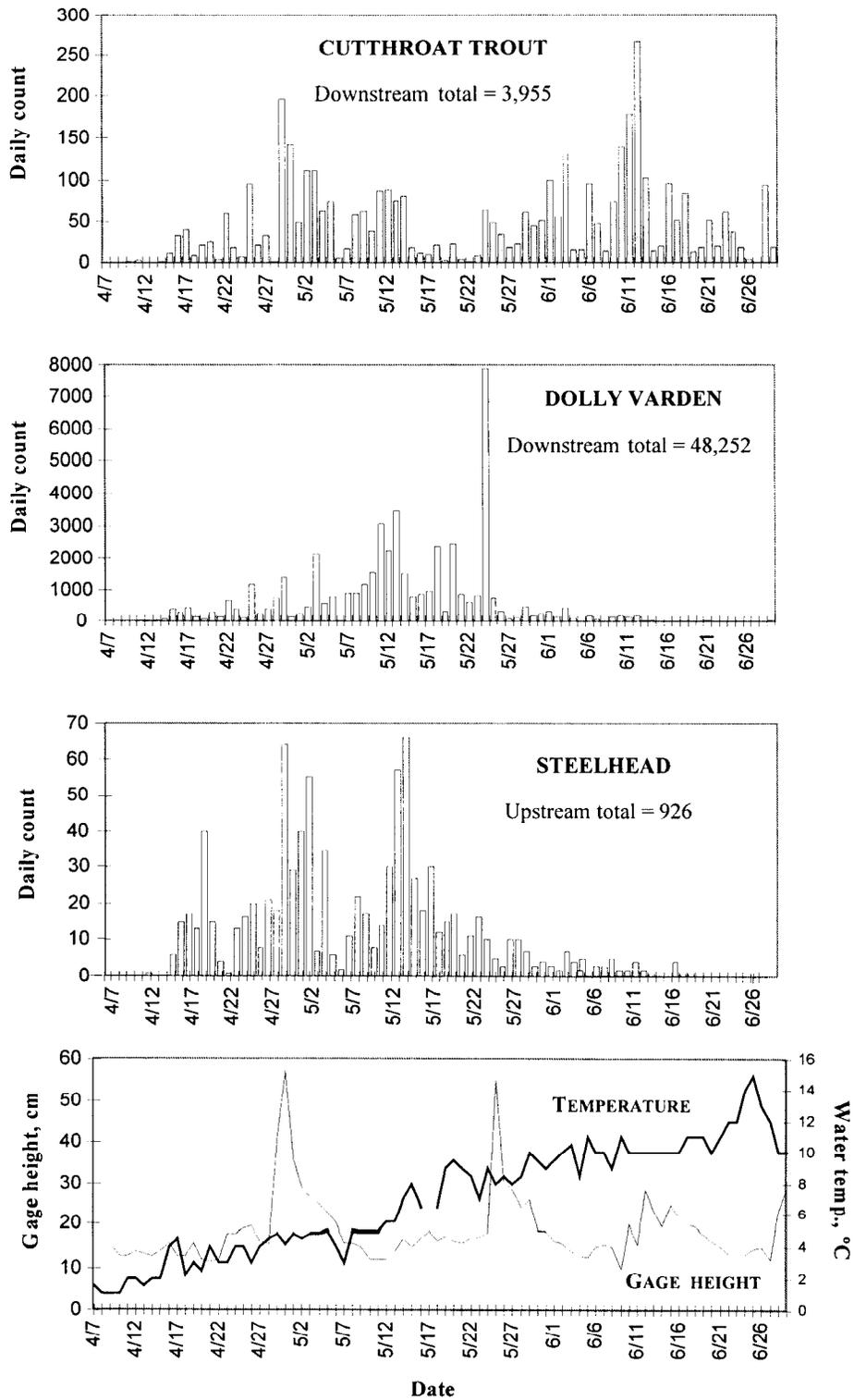


Figure 3.—Daily counts of cutthroat trout, Dolly Varden, and steelhead and daily gage height and water temperature at the Sitkoh Creek weir during 1996.

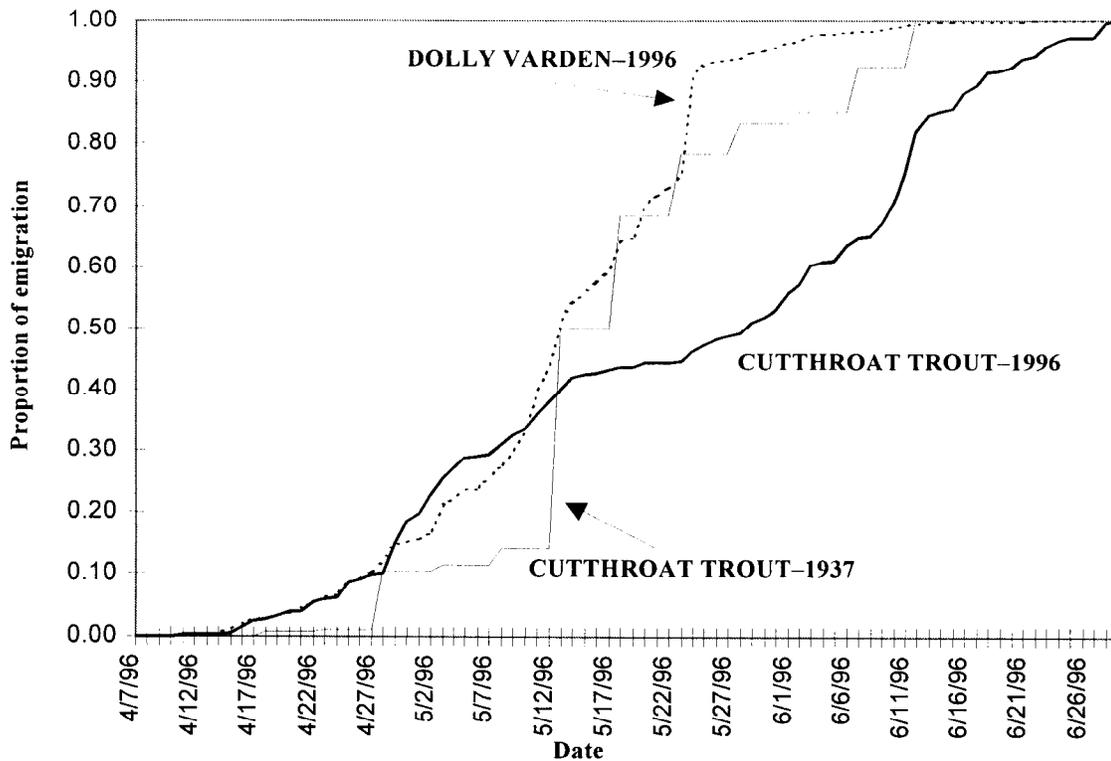


Figure 4.—Emigration timing for sea-run Dolly Varden and cutthroat trout at Sitkoh Creek. Data for 1937 from Chipperfield (1938).

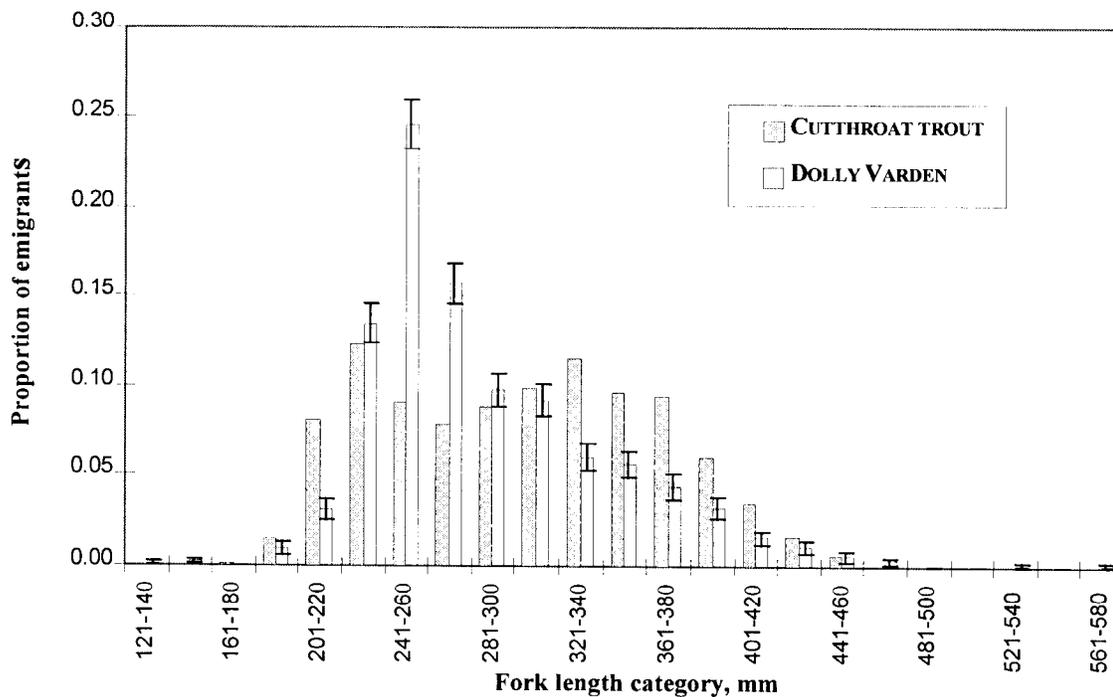


Figure 5.—Length-frequency distributions of sea-run cutthroat trout and Dolly Varden emigrating from Sitkoh Creek during 1996. Error bars are \pm one SE.

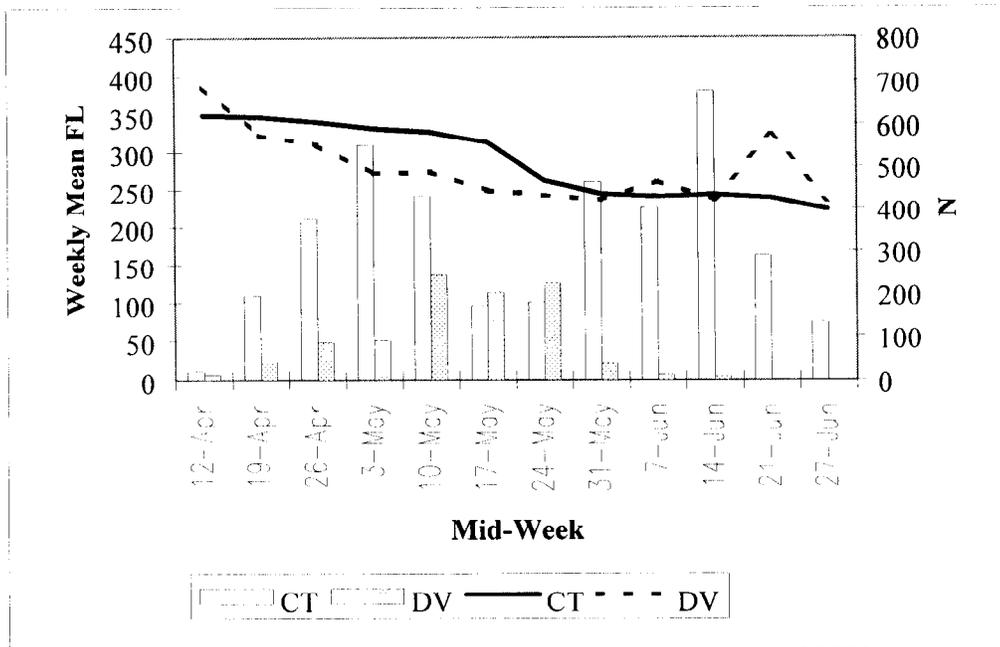


Figure 6.—Weekly mean fork length (FL, lines) and number of fish measured (N, bars) for sea-run cutthroat trout (CT) and Dolly Varden (DV) at Sitkoh Creek.

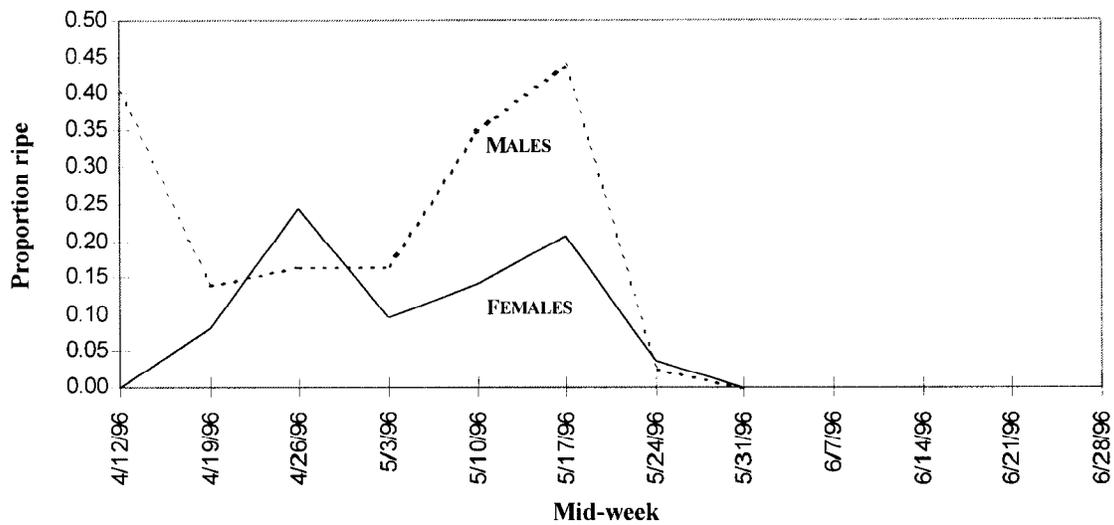


Figure 7.—Weekly proportions of obviously ripe cutthroat trout passing down through the Sitkoh Creek weir.

A total of 108 cutthroat trout passed upstream during the weir's operation, and 93% of these had been tagged when passed downstream earlier. The first cutthroat trout passed upstream on 30 May.

STEELHEAD

A total of 926 steelhead passed upstream through the weir (Appendix A1, Appendix D1). The first steelhead was captured on 12 April, and the daily count peaked on 14 May (Figure 3). The midpoint of the run occurred on 8 May, and it was 6 weeks from the 5th to 95th percentile of the run (Figure 8). The 1996 run timing was later than the 1982, 1990, and 1993 runs, but earlier than the 1936 and 1937 runs. Most of the 1996 run occurred while water temperatures were between 2.5 and 9.5°C, and there was some correlation ($r = 0.24$) between the daily count and gage height (Figure 3). Females dominated the sex composition during 1996, as in 1990 and 1993 (Table 2).

The mean FL of all immigrant steelhead during 1996 was 750 mm, and the range was 300–945 mm

Table 2.—Historical escapements and sex composition of steelhead at Sitkoh Creek. Data for 1936 and 1937 from Chipperfield (1938); 1982 data from Jones (1983); 1990 data from Jones et al. (1991); 1993 data from Harding and Jones (1994).

Year	Escapement	Proportion female	Proportion male
1936	760		
1937	1,108		
1982	690	0.50	0.50
1990	661	0.61	0.39
1993	520	0.63	0.37
1996	926	0.62	0.38

($N = 926$). The mean FL of female steelhead (759 mm) was larger than that of male steelhead (734 mm). Only 3.0% of the immigrant steelhead were ≥ 880 mm FL (or 36 in total length, the minimum legal size to retain) during 1996, similar to the proportion in 1990, but lower than in 1982 and 1993 (Table 3). Females tended to be

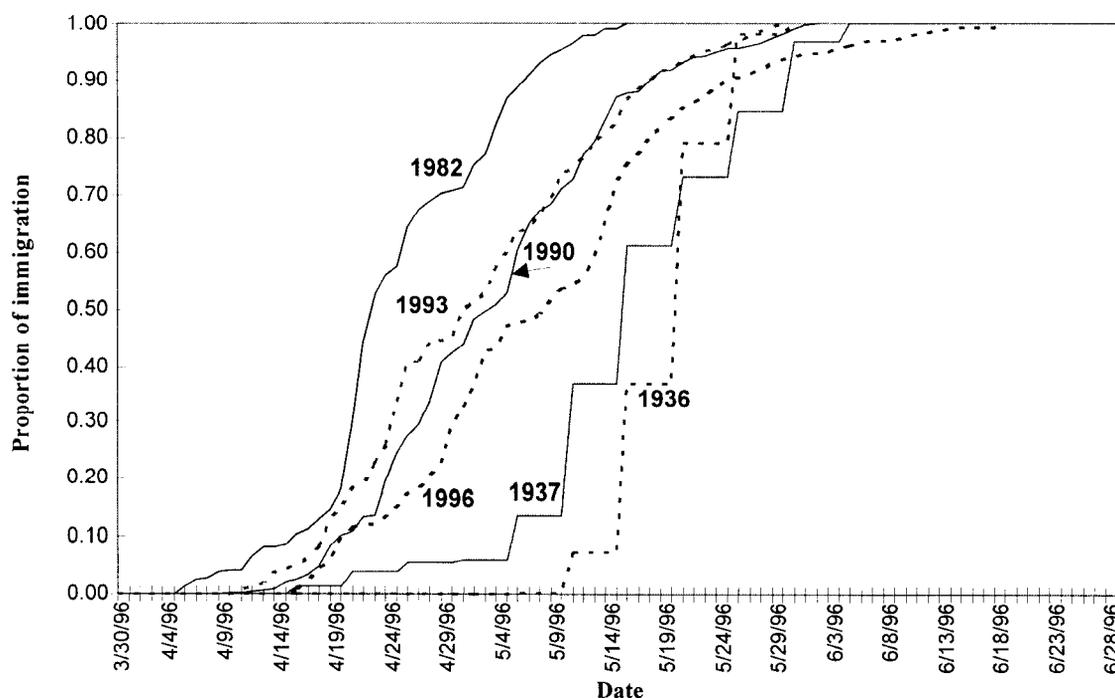


Figure 8.—Immigration timing of steelhead at Sitkoh Creek in 1996 versus historical data. Data from Chipperfield (1938), Jones et al. (1991), and Harding and Jones (1994).

Table 3.—Proportion of steelhead escapement legal to retain by sport anglers (1996 regulations), and sex composition of legal steelhead at Sitkoh Creek. Data for 1936 and 1937 from Chipperfield (1938); 1982 data from Jones (1983); 1990 data from Jones et al. (1991); 1993 data from Harding and Jones (1994).

Year	Proportion of escapement ≥ 36 in TL ^a	Sex composition of steelhead ≥ 36 in TL	
		Proportion male ^b	Proportion female ^b
1982	0.070 ^b	0.38	0.63
1990	0.029 ^b	0.21	0.79
1993	0.056 ^c	0.53	0.47
1996	0.030 ^b	0.50	0.50
Mean	0.046	0.47	0.54
SD	0.0201	0.180	0.177

^a Total length, or 880-mm fork length.

^b All fish examined.

^c Fish length sampled, SE = 0.0091, N = 303.

larger than males in 1996, a trend common to most years, and the length distribution of steelhead in 1996 varied only slightly from past years (Figure 9). The sex composition of legal-size steelhead was exactly half female and half male in 1996, also similar to previous years (Table 3).

Obviously ripe steelhead (gametes spontaneously exuded during handling) were observed from 16 April onward, the last ripe steelhead was observed on 20 June, and 18% of all steelhead passed upstream were obviously ripe. In total, 707 steelhead kelts (spawned and returning to sea) and 3,883 steelhead smolt were passed downstream during the weir operations, primarily during late May and early June (Appendix A1).

The proportions of steelhead observed during foot surveys of Sitkoh Creek compared to the weir counts were dramatically higher than the historical proportions (Table 4), mostly due to

the best counting conditions ever experienced (A. E. Schmidt, Alaska Department of Fish and Game, personal communication). The water level was exceptionally low and clear (relative to past years), the sky was overcast (minimizing glare), and there was no rain or wind to disturb the water's surface. Snorkel surveys were about twice as effective foot surveys (Table 4).

The proportion of immigrant steelhead in 1996 with scars of any category was approximately one-third the proportion observed in 1993, and fish with multiple scars were also significantly less frequent (Figure 10).

Of the scars observed in 1996, scar category 1 occurred the most frequently, with categories 5, 6, and 7 each occurring about half as frequently as category 1 (Figure 11). This scar pattern differs in several ways from the 1993 pattern, when scar category 1 was also the most frequent, but categories 6 and 7 were nearly as frequent as category 1, and category 5 was relatively infrequent.

OTHER MIGRANTS

Other migrants totaled 52 sockeye salmon *O. nerka* and eight rainbow trout *O. mykiss* passed upstream, and 30 rainbow trout passed downstream (Appendix A1).

Table 4.—Proportion of steelhead weir count observed by foot and snorkel surveys at Sitkoh Creek.

Date	Foot survey	Snorkel survey	Conditions
18 May 1982	0.087		
30 May 1982	0.084		
14 May 1993	0.085		
14 May 1996	0.217	0.465	} Exceptionally good
23 May 1996	0.307	0.570	

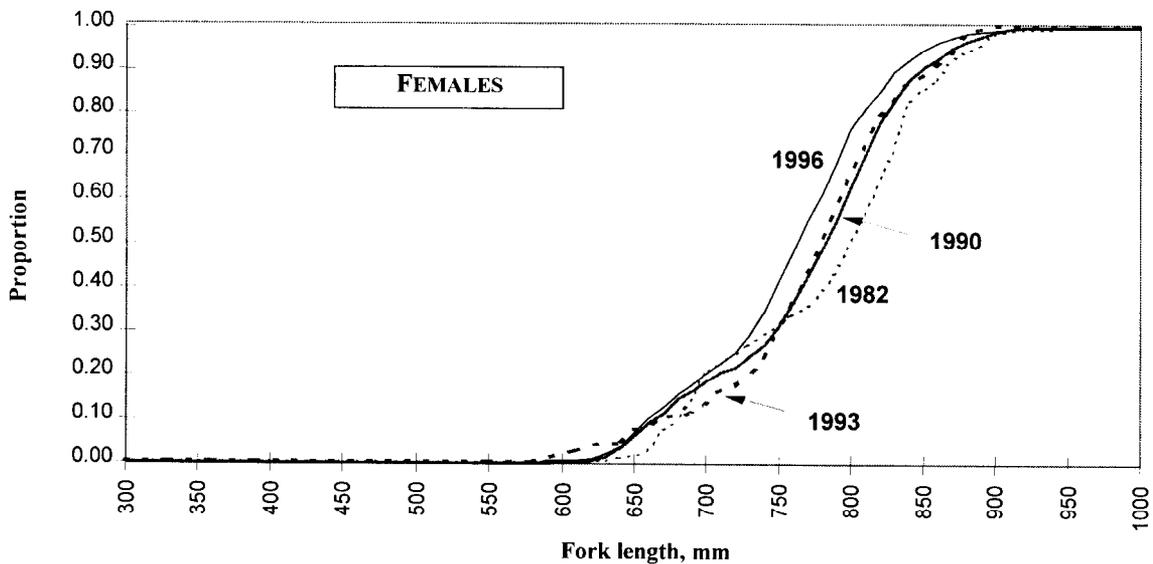
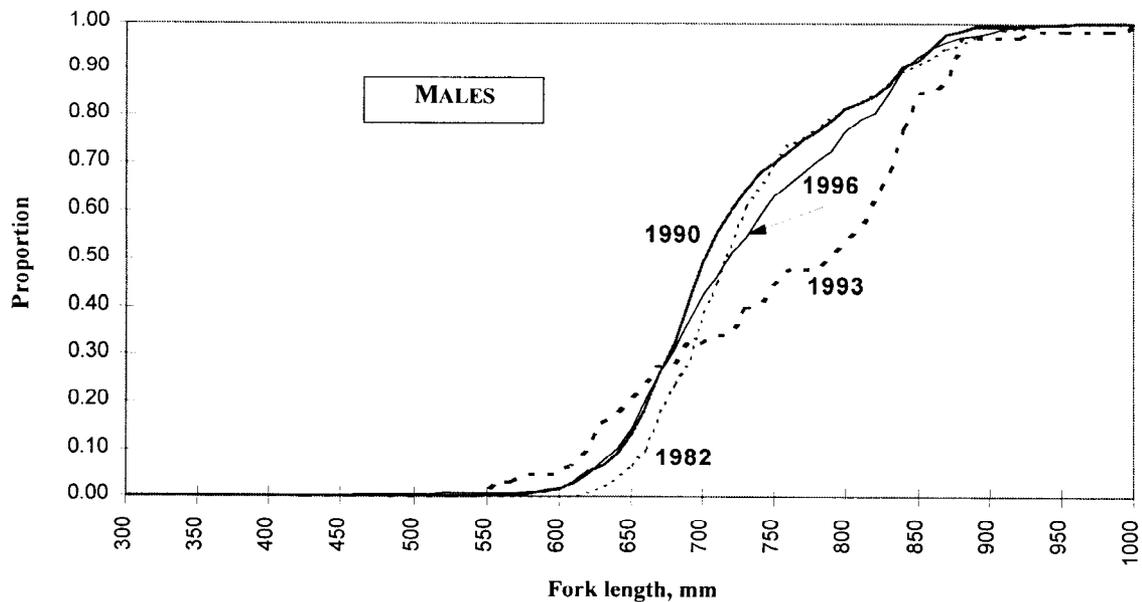


Figure 9.—Cumulative length-frequency distributions of male and female immigrant steelhead at Sitkoh Creek in 1996 versus historical data (1982 fish length sampled, N = 182; all fish measured in other years). Data from Roger Harding, Alaska Department of Fish and Game (personal communication), Jones et al. (1991), and Harding and Jones (1994).

DISCUSSION

The Dolly Varden emigration during 1996 (48,252) far exceeded the historical weir counts of 1,940 fish in 1936 and 9,703 fish in 1937, but was similar to estimates of possible commercial fishing harvests of 32,000–41,000

fish (Banta 1936, 1937). However, the 1936 weir likely did not operate during significant proportions of the emigration, the 1937 weir frequently allowed fish to pass uncounted, and weir design in both years did not stop small fish as efficiently as the 1996 weir (Banta 1936, 1937).

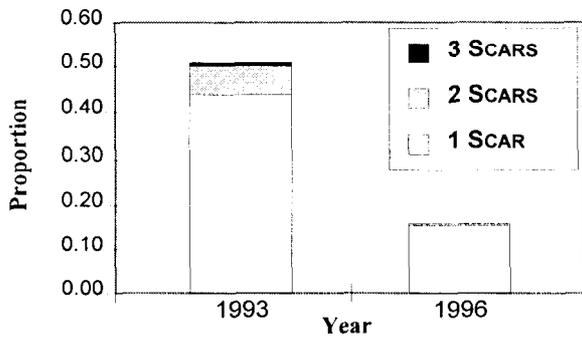


Figure 10.—Proportion of immigrant steelhead at Sitkoh Creek in 1996 and 1993 with scars fitting defined categories (see Methods section, p. 4, for scar category definitions). Data from Harding and Jones (1994).

In converting the commercial fishing estimate from pounds to number of fish, I assumed the commercial catch had the same mean FL as did the 1996 emigration. This is not likely, due to interannual variation and the selectivity of the commercial fishing gear used, which was not described. Thus, while historical Dolly Varden harvest estimates have limitations that make them unreliable, they are one of the few sources of abundance data.

Evaluating the health of a Dolly Varden population from a single year's data is risky, as varying proportions of a given Dolly Varden population may overwinter at sea annually and therefore not pass weir sites (Bernard et al. 1995). Even so, the abundance of overwintering Dolly Varden at Sitkoh Creek compares favorably with those of other systems: e.g., 38,957–117,821 fish at Lake Eva (105 ha surface area, Heiser 1966; Yanusz and Schmidt 1996), 3,052–11,728 fish at Auke Lake (92 ha surface area, Doug Jones, Alaska Department of Fish and Game, personal communication), 10,519–29,595 fish at Kook Lake (240 ha surface area, David Barto, Alaska Department of Fish and Game, personal communication), and 30,725–90,600 fish at Buskin Lake (101 ha surface area, Whalen 1993). Dolly Varden are thought to have a high fidelity to their overwintering site (Armstrong 1965; Bernard et al. 1995), so “strays” from other overwintering sites should not bias weir counts.

The mean FL of Sitkoh Dolly Varden emigrating in 1996 (266 mm) also compares favorably with that of Eva Creek Dolly Varden at 304 mm (Yanusz and Schmidt 1996) and 253 mm (Heiser 1966 [likely biased low; see Yanusz and Schmidt 1996]), and Buskin Lake Dolly Varden at 322 mm

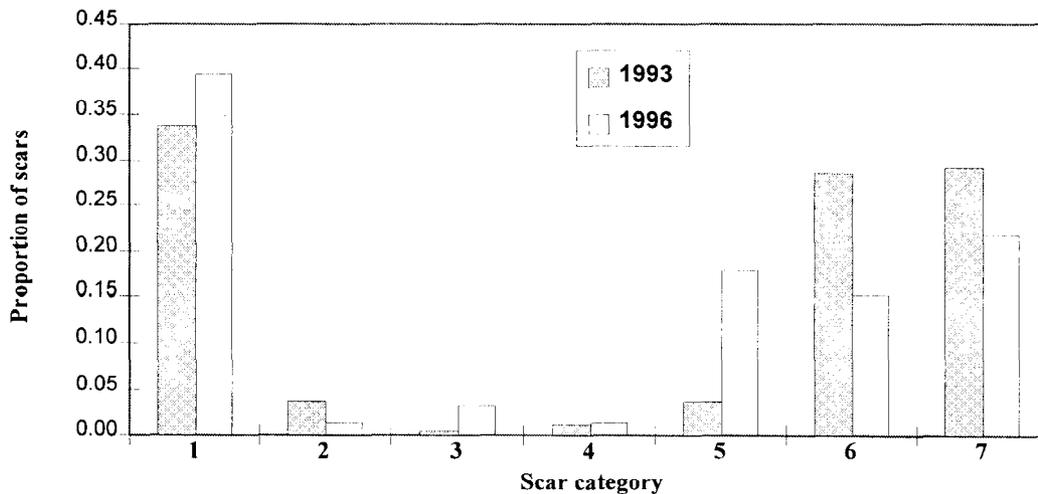


Figure 11.—The distribution of scars by category within a year, for immigrant steelhead at Sitkoh Creek in 1996 and 1993 (see Methods section for scar definitions). Data from Harding and Jones (1994).

(Whalen 1992) and 284 mm (Whalen 1993). The 1995 Eva Creek weir and the Sitkoh Creek weir designs were identical (both retained fish >150 mm FL), and systematic sampling was used at both sites, so no bias should exist. The Buskin Lake weir had larger plastic mesh (25.4 mm square) that retained fewer small (>210 mm FL) fish, so those means would be biased somewhat high, relative to the Sitkoh Creek weir design.

The mean FL of Auke Creek Dolly Varden in 1992 was 234 mm (Doug Jones, Alaska Department of Fish and Game, Douglas, personal communication), much smaller than Sitkoh Creek Dolly Varden, but the Auke Creek weir was composed of metal screen with 3.2-mm circular openings, which would retain relatively more small (>30 mm FL) fish and thus bias the means somewhat low.

The abundance of sea-run cutthroat trout at Sitkoh Creek in 1996 (3,955) was the highest ever observed, but the above cautions apply regarding historical weir data. The abundance of overwintering sea-run cutthroat trout at Sitkoh Creek far exceeds that of other systems studied to date, such as 1,233–2,562 fish at Eva Creek (Armstrong 1971; Yanusz and Schmidt 1996), 190–937 fish at Auke Creek (Doug Jones, Alaska Department of Fish and Game, personal communication), and 345–564 fish at Kook Lake (David Barto, Alaska Department of Fish and Game, personal communication).

The mean FL of sea-run cutthroat trout at Sitkoh Creek (284 mm) also compares favorably with other systems: Eva Creek, 303 mm (Yanusz and Schmidt 1996) and 284 mm (Armstrong 1971 [likely biased high; see Yanusz and Schmidt 1996]), and Auke Lake, 233–330 mm (Doug Jones, Alaska Department of Fish and Game, personal communication).

Cutthroat trout and Dolly Varden, whether sea-run or resident, are known to exhibit a wide range of life histories, even within the same system (Morrow 1980; Trotter 1987; Behnke 1992). Sitkoh Lake, like some other overwintering locations in Southeast Alaska, is used for overwintering by stocks of cutthroat trout and Dolly Varden that spawn at many different locations (Armstrong 1965; Doug Jones, Alaska

Department of Fish and Game, Douglas, personal communication). Fish with such a life history are vulnerable to harvests and habitat conditions well away from Sitkoh Creek, and monitoring of the overwintering site may not be the best strategy to protect sea-run stocks (Armstrong 1984) because deficiencies of individual stocks may be difficult to detect unless individual components can be identified through tagging or genetic studies. Management strategies will need to address many considerations in order to be effective. Because 49% of sea-run cutthroat trout were legal retention size (12 in. total length), and there is no minimum size restriction on the harvest of Dolly Varden, the potential exists for overexploitation.

A highly unusual finding was the recapture of one cutthroat trout that had been tagged the previous spring while exiting Eva Creek, which showed that this trout used two different overwintering sites. It is generally thought that cutthroat trout use only one overwintering site and that they do not cross wide (>3 km) and deep marine passages (Trotter 1989). To travel between the Eva and Sitkoh systems directly would require going a minimum distance of 21 km and crossing a body of open water 4 km wide and 300 m deep (Peril Strait). This is not unlike some other documented travels, such as cutthroat trout captured up to 31 km offshore of Washington and Oregon, in water up to 134 m deep, or 50–70 km from their home streams (Trotter 1989). The significance of switching overwintering sites is not clear. While this finding helps define the extremes of migration, the rate of occurrence (1 in 2,465 emigrants tagged at Eva Creek in 1995) was so low that effects on either population are probably negligible.

This year's relatively good steelhead run to Sitkoh Creek may be caused by favorable ocean conditions, as other anadromous salmonids are currently at relatively high abundances, or it could be a result of year-class effects. The lesser incidence of scars on steelhead in 1996 suggests that the impact of commercial fishing and/or natural predators was less significant than in 1993, and this would contribute to the large run in 1996. An international ban on high-seas gillnetting in the northern Pacific was phased in

and enforced over the period from 1989 to 1994, perhaps lessening steelhead interception on the high seas, which would be consistent with this year's data (Seibel et al. 1982; Taylor 1985; Mike Dahlberg, National Marine Fisheries Service, Auke Bay, personal communication). However, the 1996 scar distribution is skewed slightly more towards fishing gear-induced scars than the 1993 distribution (categories 1 through 3, see Seibel et al. 1982; Taylor 1985; Figure 11), which suggests either that changes in fishery interceptions are not the sole cause for the large run in 1996 or that the scar definitions inaccurately define fishery versus natural scars (Seibel et al. 1982).

No trends are apparent in the steelhead observations, such as abundance, proportion of legal fish, sex ratio, or length distributions, to imply significant harvest effects. Runs appear to have started much later in 1936 and 1937 than in recent years (Figure 8), but I could not locate detailed descriptions of steelhead weir operations for 1936 and 1937 to determine if weir design, counting procedures, or floods might also have affected comparability of historical counts.

Although only two foot-vs.-snorkel comparisons were done, the results were noticeably consistent. All possible advantages of snorkel surveys over foot surveys were not determined. A larger proportion of the run can be observed by snorkel surveyors (higher accuracy), which should help decrease the variation in estimates of run strength. Several trials and a sampling design would be required to determine if precision increased with snorkel surveys.

Also, a wider range of stream conditions would be informative. It is conceivable that the foot-vs.-snorkel ratio would change under more difficult conditions (flooding, turbidity, glare, rain), if fish abundance were low, or if fish were unusually distributed (only in deep holes or log jams). I hypothesize that snorkel surveyors would have a distinct advantage in such cases. Habitat type would also likely be a significant factor (riffles, pool depth, cover), although it was not significant in at least one study (Solazzi 1984).

ACKNOWLEDGMENTS

Brad Gruening was the field crew leader and oversaw the quality of data collected. Steve Chadwick, Jim Jasper, and Nick Segalkin were the primary field crew. Doug Jones, Roger Harding, Kurt Kondzela, Clyde Andrews, and Brian Glynn assisted with field operations as needed. Art Schmidt assisted with the study design, field operations, and foot surveys, and reviewed the manuscript. Bob Marshall provided biometric support during the study design and reviewed the manuscript. One anonymous reviewer also commented on the manuscript.

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APPENDIX A. WEIR COUNTS

Appendix A1.—Daily fish counts, water temperature, and water depth at the Sitkoh Creek weir during 1996.

Date	Depth (in cm)	Temp- erature (°C)	Dolly Varden char		Cutthroat trout		Steelhead trout			Rainbow trout		Sockeye salmon	Comments
			Down	Up	Down	Up	Kelts down	Adults up	Smolt down	Down	Up	up	
3/30/96		0	0	0	0	0	0	0	0	0	0	0	Fish tight at 16:30
3/31/96		0	0	0	0	0	0	0	0	0	0	0	Vexar open-iced up
4/1/96		0	0	0	0	0	0	0	0	0	0	0	Fish tight
4/2/96		0	0	0	0	0	0	0	0	0	0	0	
4/3/96		0	0	0	0	0	0	0	0	0	0	0	
4/4/96		1											Ice wash-out at 20:00
4/5/96		1.5											
4/6/96		1.5											Fish tight at 14:00
4/7/96		1.5	0	0	0	0	0	0	0	0	0	0	
4/8/96		1	1	0	0	0	0	0	0	0	0	0	
4/9/96	15.5	1	5	0	0	0	0	0	0	0	0	0	
4/10/96	13	1	8	0	2	0	0	0	0	0	0	0	
4/11/96	13	2	50	0	3	0	0	0	0	1	0	0	
4/12/96	14	2	23	0	0	0	0	1	0	0	0	0	
4/13/96	13.5	1.5	28	0	0	0	0	0	0	0	0	0	
4/14/96	13	2	83	0	2	0	0	0	0	0	0	0	
4/15/96	14	2	400	0	13	0	0	6	0	0	0	0	
4/16/96	16	4	285	0	34	0	0	15	0	0	0	0	
4/17/96	13	4.5	421	0	40	0	0	17	0	0	0	0	
4/18/96	13	2.2	127	0	9	0	0	13	0	0	0	0	
4/19/96	16	3	78	0	22	0	0	40	0	0	0	0	
4/20/96	12	2.5	301	0	26	0	0	15	0	0	0	0	
4/21/96	11.5	4	152	0	4	0	0	4	0	0	0	0	
4/22/96	12	3	692	0	60	0	0	1	0	2	0	0	
4/23/96	18	3	394	0	20	0	0	13	0	2	0	0	
4/24/96	18	4	111	0	7	0	0	16	0	0	0	0	
4/25/96	19	4	1,162	0	96	0	0	20	0	0	0	0	
4/26/96	19.5	3	243	0	22	0	0	8	0	0	0	0	
4/27/96	16.5	4	396	0	33	0	0	21	0	0	0	0	
4/28/96	15.5	4.5	735	0	2	0	0	18	0	0	0	0	
4/29/96	41	4.8	1,389	0	196	0	0	64	0	2	0	0	
4/30/96	57	4.2	127	0	142	0	0	29	0	0	0	0	
5/1/96	35.5	4.8	256	0	49	0	0	40	0	0	0	0	
5/2/96	29	4.5	478	0	111	0	0	55	0	0	0	0	

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-continued-

Appendix A1.-Page 2 of 3.

Date	Depth (in cm)	Temp- erature (°C)	Dolly		Cutthroat trout		Steelhead trout			Rainbow trout		Sockeye salmon	Comments
			Varden char	Up	Down	Up	Kelts down	Adults up	Smolt down	Down	Up	up	
5/3/96	26.5	4.8	2,129	0	111	0	0	7	0	0	0	0	
5/4/96	25	4.8	567	0	63	0	0	35	0	0	0	0	
5/5/96	23	5	774	0	74	0	0	6	0	0	0	0	
5/6/96	20.4	4	10	0	5	0	0	2	0	0	0	0	
5/7/96	16	3	893	0	18	0	1	11	0	0	0	0	
5/8/96	16	5	876	0	59	0	0	22	0	0	0	0	
5/9/96	15	4.9	1,185	0	63	0	0	17	0	0	0	0	
5/10/96	12	4.9	1,543	0	39	0	0	8	0	0	0	0	
5/11/96	12	4.9	3,073	0	88	0	6	14	0	1	0	0	
5/12/96	12	5.5	2,236	0	89	0	2	30	0	0	0	0	
5/13/96	14	5.5	3,446	0	75	0	30	57	0	0	0	0	
5/14/96	17	7	1,488	0	81	0	2	66	5	0	0	0	
5/15/96	15	8	770	0	20	0	3	27	0	0	0	0	
5/16/96	17	6.5	837	0	12	0	4	18	4	0	0	0	
5/17/96	18.5		945	0	10	0	9	30	4	0	0	0	
5/18/96	16.5	6.5	2,377	0	22	0	1	12	6	0	0	0	
5/19/96	17.5	9	309	0	3	0	0	15	0	0	0	0	
5/20/96	16.5	9.5	2,455	0	24	0	126	17	5	0	0	0	
5/21/96	16	9	859	0	4	0	1	6	4	0	0	0	
5/22/96	17.2	8.5	600	0	1	0	4	11	25	0	0	0	
5/23/96	17.2	7	810	0	9	0	35	16	37	0	0	0	
5/24/96	18.3	9	7,879	0	64	0	132	10	439	0	0	0	
5/25/96	55	8	737	0	48	0	34	5	241	0	0	0	
5/26/96	30.5	8.5	322	0	35	0	10	3	173	0	0	0	
5/27/96	28.5	8	81	0	20	0	1	10	31	1	0	0	
5/28/96	24.5	8.5	97	0	23	0	18	10	111	0	0	0	
5/29/96	26	10	473	0	61	0	24	7	173	1	0	0	
5/30/96	18.5	9.5	179	0	44	1	20	3	153	0	0	0	
5/31/96	18.5	9	264	0	51	0	14	4	167	1	0	0	
6/1/96	16.5	9.5	328	0	100	0	27	3	208	2	0	0	
6/2/96	16	10	156	0	56	0	69	2	150	0	0	0	
6/3/96	14	10.5	418	0	130	9	36	7	257	1	0	0	
6/4/96	13	8.5	97	0	16	3	1	4	26	0	0	0	
6/5/96	12.5	11	9	0	17	2	14	5	94	0	0	0	

-continued-

Appendix A1.—Page 3 of 3.

Date	Depth (in cm)	Temp- erature (°C)	Dolly Varden char		Cutthroat trout		Steelhead trout			Rainbow trout		Sockeye salmon	Comments
			Down	Up	Down	Up	Kelts down	Adults up	Smolt down	Down	Up	up	
6/6/96	15	10	162	0	96	3	17	2	219	1	1	0	
6/7/96	15.5	10	68	0	47	2	11	0	224	0	1	0	
6/8/96	15	9	8	0	15	9	2	3	12	0	1	1	
6/9/96	10	11	126	0	73	2	0	3	134	0	0	1	
6/10/96	20	10	186	0	139	8	19	5	380	0	0	1	blocked flow to help depth
6/11/96	15.5	10	160	0	178	3	6	2	252	4	4	0	
6/12/96	28.5	10	181	0	266	6	5	2	214	4	0	0	
6/13/96	23.5	10	32	0	103	10	1	4	36	1	0	0	53 cutthroat mortalities
6/14/96	19.5	10	25	0	15	0	2	2	12	0	0	0	
6/15/96	25	10	2	0	21	0	1	1	3	0	0	0	
6/16/96	22	10	8	0	96	7	0	0	37	1	0	5	
6/17/96	20	11	15	0	51	0	2	0	8	0	1	1	
6/18/96	19.5	11	9	0	85	1	0	4	6	0	0	2	
6/19/96	18	11	1	0	14	6	0	1	2	0	0	0	
6/20/96	16.5	10	3	1	19	3	3	1	2	0	0	0	
6/21/96	15	11	29	1	52	0	0	0	4	1	0	1	
6/22/96	13.5	12	14	0	21	1	0	0	5	0	0	6	
6/23/96		12	8	0	61	5	0	0	2	0	0	4	No depth recorded
6/24/96	13.5	14	9	1	37	4	0	0	0	0	0	8	
6/25/96	14.5	15	0	5	20	3	0	0	0	0	0	4	
6/26/96	15	13	0	2	4	4	1	0	0	0	0	5	
6/27/96	12	12	0	8	0	3	0	0	0	0	0	2	
6/28/96	23.5	10	10	21	95	10	9	0	7	4	0	10	
6/29/96	28.5	10	29	10	19	3	4	0	11	0	0	1	Washed out at 20:00
TOTAL			48,252	49	3,955	108	707	926	3,883	30	8	52	

APPENDIX B. FILE DESCRIPTIONS

Appendix B1.—Contents of electronic files submitted with this report.

FILE NAME	SOFTWARE	CONTENTS
Report files		
sofds96.doc	Word 6.0	This entire document
Raw data files		
sowrle.xls	Excel 5.0	Tag numbers, sample numbers, and lengths at Sitkoh Creek weir for cutthroat trout and Dolly Varden
sowrct.xls	Excel 5.0	Daily weir counts for all species at Sitkoh Creek
soshle.xls	Excel 5.0	Steelhead lengths at Sitkoh Creek weir
soshsc.xls	Excel 5.0	Scars on steelhead at Sitkoh Creek weir

APPENDIX C.
CUTTHROAT TROUT AND DOLLY VARDEN LENGTH
DISTRIBUTIONS

Appendix C1.—Length-frequency distributions by 20-mm fork length (FL) category (*i*) of emigrant, sea-run cutthroat trout and Dolly Varden at the Sitkoh Creek weir during 1996 (p_i = entire emigration; \bar{p}_i = sample).

FL Category <i>i</i>	Cutthroat trout		Dolly Varden	
	p_i	N	\bar{p}_i	N
61-80	0.00	0	0.00	0
81-100	0.00	0	0.00	0
101-120	0.00	0	0.00	0
121-140	0.00	2	0.00	1
141-160	0.00	1	0.00	2
161-180	0.00	4	0.00	0
181-200	0.01	57	0.01	9
201-220	0.08	311	0.03	30
221-240	0.12	473	0.13	130
241-260	0.09	350	0.25	237
261-280	0.08	299	0.16	152
281-300	0.09	339	0.10	94
301-320	0.10	381	0.09	89
321-340	0.12	444	0.06	58
341-360	0.10	373	0.06	54
361-380	0.09	365	0.04	42
381-400	0.06	232	0.03	31
401-420	0.03	134	0.02	15
421-440	0.02	64	0.01	10
441-460	0.01	22	0.01	5
461-480	0.00	1	0.00	3
481-500	0.00	1	0.00	0
501-520	0.00	0	0.00	0
521-540	0.00	0	0.00	1
541-560	0.00	0	0.00	0
561-580	0.00	0	0.00	1
581-600	0.00	0	0.00	0
601-621	0.00	0	0.00	0
621-640	0.00	0	0.00	0
TOTAL	1.00	3,853	1.00	964

APPENDIX D. INDIVIDUAL STEELHEAD DATA

Appendix D1.—Data gathered from 926 individual steelhead immigrating to Sitkoh Creek during 1996. The entire run of 926 fish was examined; for the four steelhead with more than one scar, multiple entries appear (one entry for each scar). Scar category is described in Methods section on page 4. Abbreviations: R = ripe, gametes exuded upon handling; G = green, all else; F = fresh; H = healed.

Date	Fish no.	Fork length (mm)	Sex	Maturity	Number of scars	Scar category	Scar age
4/12/96	1	695	M	R	0	0	0
4/15/96	2	760	M	R	0	0	0
4/15/96	3	820	M	G	0	0	0
4/15/96	4	790	F	G	0	0	0
4/15/96	5	635	M	G	0	0	0
4/15/96	6	740	M	G	0	0	0
4/15/96	7	800	F	G	0	0	0
4/16/96	8	840	F	G	0	0	0
4/16/96	9	830	F	G	0	0	0
4/16/96	10	850	M	G	0	0	0
4/16/96	11	760	M	G	0	0	0
4/16/96	12	820	F	R	0	0	0
4/16/96	13	810	F	G	0	0	0
4/16/96	14	750	M	G	0	0	0
4/16/96	15	920	M	G	0	0	0
4/16/96	16	680	M	G	0	0	0
4/16/96	17	840	F	G	0	0	0
4/16/96	18	870	M	G	0	0	0
4/16/96	19	715	F	G	1	7	H
4/16/96	20	770	F	G	0	0	0
4/16/96	21	840	M	G	0	0	0
4/16/96	22	820	F	G	0	0	0
4/17/96	23	800	F	R	0	0	0
4/17/96	24	760	M	G	0	0	0
4/17/96	25	810	F	G	0	0	0
4/17/96	26	770	F	G	1	7	H
4/17/96	27	860	M	G	0	0	0
4/17/96	28	780	F	R	0	0	0
4/17/96	29	755	M	G	0	0	0
4/17/96	30	710	M	G	0	0	0
4/17/96	31	775	M	G	0	0	0
4/17/96	32	710	M	G	1	7	F
4/17/96	33	850	F	G	1	1	H
4/17/96	34	840	F	G	0	0	0
4/17/96	35	770	F	G	1	5	H
4/17/96	36	830	F	G	0	0	0
4/17/96	37	680	M	G	0	0	0
4/17/96	38	780	F	G	1	7	H
4/17/96	39	900	M	G	0	0	0
4/18/96	40	740	M	G	0	0	0
4/18/96	41	750	F	G	1	1	H
4/18/96	42	910	M	G	0	0	0
4/18/96	43	660	M	G	1	3	H
4/18/96	44	860	F	G	1	1	H
4/18/96	45	735	F	G	0	0	0
4/18/96	46	730	F	G	0	0	0
4/18/96	47	800	F	G	0	0	0
4/18/96	48	735	M	G	1	1	H
4/18/96	49	780	M	G	0	0	0
4/18/96	50	725	M	G	1	5	F
4/18/96	51	755	M	G	0	0	0
4/18/96	52	810	F	G	1	5	H
4/19/96	53	625	M	G	0	0	0
4/19/96	54	680	F	G	0	0	0
4/19/96	55	785	F	G	0	0	0
4/19/96	56	645	M	G	1	6	H
4/19/96	57	705	M	G	1	5	H
4/19/96	58	620	M	G	0	0	0
4/19/96	59	735	F	G	0	0	0

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Date	Fish no.	Fork length (mm)	Sex	Maturity	Number of scars	Scar category	Scar age
4/19/96	60	755	M	G	1	5	H
4/19/96	61	670	M	G	1	1	H
4/19/96	62	815	F	R	1	5	H
4/19/96	63	660	M	G	0	0	0
4/19/96	64	780	F	G	0	0	0
4/19/96	65	815	F	G	0	0	0
4/19/96	66	670	M	G	0	0	0
4/19/96	67	660	M	G	0	0	0
4/19/96	68	675	F	G	0	0	0
4/19/96	69	910	F	G	0	0	0
4/19/96	70	790	F	G	1	3	H
4/19/96	71	840	M	G	0	0	0
4/19/96	72	690	M	G	1	3	H
4/19/96	73	740	M	G	1	5	H
4/19/96	74	850	M	G	0	0	0
4/19/96	75	765	M	G	0	0	0
4/19/96	76	670	M	R	0	0	0
4/19/96	77	715	M	G	1	7	H
4/19/96	78	800	F	G	1	6	H
4/19/96	79	750	F	G	0	0	0
4/19/96	80	765	M	G	0	0	0
4/19/96	81	840	F	G	1	7	H
4/19/96	82	940	M	G	1	1	H
4/19/96	83	670	F	G	1	1	H
4/19/96	84	640	M	G	0	0	0
4/19/96	85	670	F	G	0	0	0
4/19/96	86	790	F	R	0	0	0
4/19/96	87	820	F	G	0	0	0
4/19/96	88	885	M	G	0	0	0
4/19/96	89	800	M	G	0	0	0
4/19/96	90	825	M	G	0	0	0
4/19/96	91	800	F	G	0	0	0
4/19/96	92	745	F	G	0	0	0
4/20/96	93	790	M	G	0	0	0
4/20/96	94	810	M	G	2	6	H
4/20/96	94	810	M	G	2	5	H
4/20/96	95	780	M	G	1	0	0
4/20/96	96	660	M	G	1	0	0
4/20/96	97	700	M	G	1	0	0
4/20/96	98	690	M	G	0	0	0
4/20/96	99	860	F	R	0	0	0
4/20/96	100	870	F	G	0	0	0
4/20/96	101	690	F	G	0	0	0
4/20/96	102	715	F	G	0	0	0
4/20/96	103	840	M	G	0	0	0
4/20/96	104	700	M	G	0	0	0
4/20/96	105	715	M	G	0	0	0
4/20/96	106	805	M	G	1	5	F
4/20/96	107	690	M	R	0	0	0
4/21/96	108	665	M	G	0	0	0
4/21/96	109	780	F	G	0	0	0
4/21/96	110	700	M	G	1	6	F
4/21/96	111	810	F	G	0	0	0
4/22/96	112	775	F	G	0	0	0
4/23/96	113	750	M	G	1	1	H
4/23/96	114	720	F	G	0	0	0
4/23/96	115	775	F	G	0	0	0
4/23/96	116	800	F	G	1	5	F
4/23/96	117	750	M	G	0	0	0

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Date	Fish no.	Fork length (mm)	Sex	Maturity	Number of scars	Scar category	Scar age
4/23/96	118	645	M	G	0	0	0
4/23/96	119	805	M	G	1	6	H
4/23/96	120	810	M	R	0	0	0
4/23/96	121	825	M	G	0	0	0
4/23/96	122	900	M	G	0	0	0
4/23/96	123	655	F	G	0	0	0
4/23/96	124	670	M	R	1	1	H
4/23/96	125	700	M	G	0	0	0
4/24/96	126	660	M	G	0	0	0
4/24/96	127 ^a	730		G	1	1	F
4/24/96	128	860	M	G	0	0	0
4/24/96	129	835	F	G	1	1	H
4/24/96	130	655	M	G	1	4	H
4/24/96	131	695	F	G	0	0	0
4/24/96	132	800	M	G	0	0	0
4/24/96	133	850	M	G	0	0	0
4/24/96	134	740	M	G	1	5	H
4/24/96	135	730	F	G	1	5	H
4/24/96	136	835	F	G	0	0	0
4/24/96	137	790	F	G	0	0	0
4/24/96	138	770	M	G	1	1	H
4/24/96	139	780	M	R	0	0	0
4/24/96	140	770	M	G	0	0	0
4/24/96	141	800	M	G	1	6	H
4/25/96	142	745	M	G	0	0	0
4/25/96	143	880	F	G	1	7	F
4/25/96	144	740	F	G	0	0	0
4/25/96	145	740	F	G	0	0	0
4/25/96	146	750	F	G	0	0	0
4/25/96	147	750	M	G	0	0	0
4/25/96	148	870	M	G	0	0	0
4/25/96	149	730	F	G	0	0	0
4/25/96	150	630	M	G	0	0	0
4/25/96	151 ^b	620	F	G	1	1	H
4/25/96	152	700	M	G	0	0	0
4/25/96	153	685	M	G	0	0	0
4/25/96	154	670	M	G	0	0	0
4/25/96	155	795	M	G	0	0	0
4/25/96	156	720	M	G	0	0	0
4/25/96	157	720	M	G	1	1	H
4/25/96	158	725	M	G	0	0	0
4/25/96	159	780	F	G	0	0	0
4/25/96	160	810	M	G	0	0	0
4/25/96	161	795	F	G	0	0	0
4/26/96	162	625	M	R	0	0	0
4/26/96	163 ^c	825	M	G	0	0	0
4/26/96	164	820	F	G	0	0	0
4/26/96	165	905	M	G	1	7	H
4/26/96	166	805	F	R	0	0	0
4/26/96	167	785	M	G	0	0	0
4/26/96	168	750	F	G	0	0	0
4/26/96	169	810	F	G	0	0	0
4/27/96	170	610	M	R	1	7	H
4/27/96	171	795	M	G	0	0	0
4/27/96	172	785	F	G	0	0	0
4/27/96	173	665	M	G	1	1	H
4/27/96	174	635	M	G	0	0	0
4/27/96	175	615	M	G	0	0	0
4/27/96	176	690	M	G	0	0	0
4/27/96	177	800	M	G	1	5	F
4/27/96	178	820	F	G	0	0	0
4/27/96	179	710	M	G	0	0	0

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Date	Fish no.	Fork length (mm)	Sex	Maturity	Number of scars	Scar category	Scar age
4/27/96	180	825	M	G	0	0	0
4/27/96	181	820	F	G	0	0	0
4/27/96	182	670	M	G	1	1	H
4/27/96	183	750	M	G	0	0	0
4/27/96	184	740	F	G	1	7	H
4/27/96	185	800	M	G	0	0	0
4/27/96	186	595	M	G	0	0	0
4/27/96	187	745	M	G	0	0	0
4/27/96	188	640	M	G	0	0	0
4/27/96	189	720	M	G	1	1	H
4/27/96	190	945	M	G	0	0	0
4/28/96	191	680	M	G	0	0	0
4/28/96	192	850	M	G	0	0	0
4/28/96	193	620	M	G	0	0	0
4/28/96	194	625	M	G	1	1	H
4/28/96	195 ^d	810	F	G	1	6	H
4/28/96	196	860	F	G	0	0	0
4/28/96	197	600	M	G	0	0	0
4/28/96	198	770	F	R	0	0	0
4/28/96	199	765	F	G	0	0	0
4/28/96	200	715	M	G	1	5	F
4/28/96	201	650	M	G	0	0	0
4/28/96	202	795	F	G	0	0	0
4/28/96	203	610	M	G	0	0	0
4/28/96	204	705	F	G	1	1	H
4/28/96	205	665	M	G	0	0	0
4/28/96	206	720	M	R	0	0	0
4/28/96	207	740	F	G	0	0	0
4/28/96	208	790	F	G	0	0	0
4/29/96	209	700	M	G	0	0	0
4/29/96	210	795	M	G	1	1	H
4/29/96	211	740	M	G	1	5	H
4/29/96	212	715	M	G	0	0	0
4/29/96	213	760	M	G	0	0	0
4/29/96	214	735	F	G	0	0	0
4/29/96	215	843	F	G	0	0	0
4/29/96	216	790	F	G	0	0	0
4/29/96	217	770	F	G	0	0	0
4/29/96	218	850	M	G	0	0	0
4/29/96	219	870	F	G	1	6	H
4/29/96	220	660	M	G	1	1	H
4/29/96	221	750	M	G	0	0	0
4/29/96	222	845	F	R	0	0	0
4/29/96	223	760	F	G	1	1	H
4/29/96	224	890	F	R	0	0	0
4/29/96	225	790	M	G	1	1	H
4/29/96	226	800	F	G	1	5	H
4/29/96	227	720	M	G	0	0	0
4/29/96	228	710	F	R	0	0	0
4/29/96	229	660	M	G	0	0	0
4/29/96	230	840	M	G	0	0	0
4/29/96	231	700	M	G	0	0	0
4/29/96	232	830	M	G	0	0	0
4/29/96	233	830	F	G	1	6	H
4/29/96	234	775	F	G	1	1	H
4/29/96	235	760	F	R	0	0	0
4/29/96	236	690	F	G	0	0	0
4/29/96	237	750	M	G	0	0	0
4/29/96	238	785	F	G	0	0	0
4/29/96	239	810	F	G	0	0	0
4/29/96	240	775	M	G	0	0	0
4/29/96	241	660	M	G	0	0	0
4/29/96	242	765	M	G	0	0	0

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Date	Fish no.	Fork length (mm)	Sex	Maturity	Number of scars	Scar category	Scar age
4/29/96	243	830	F	G	0	0	0
4/29/96	244	780	M	R	1	5	H
4/29/96	245	745	F	G	1	1	H
4/29/96	246	790	F	G	1	1	H
4/29/96	247	775	F	G	0	0	0
4/29/96	248	725	M	G	0	0	0
4/29/96	249	640	F	G	0	0	0
4/29/96	250	730	F	G	0	0	0
4/29/96	251	620	M	G	0	0	0
4/29/96	252	750	F	G	0	0	0
4/29/96	253	815	M	G	0	0	0
4/29/96	254	730	M	G	0	0	0
4/29/96	255	670	M	G	0	0	0
4/29/96	256	845	F	G	0	0	0
4/29/96	257	675	M	G	0	0	0
4/29/96	258	815	F	G	0	0	0
4/29/96	259	735	F	G	0	0	0
4/29/96	260	800	M	R	0	0	0
4/29/96	261	655	M	G	0	0	0
4/29/96	262	825	M	G	0	0	0
4/29/96	263	830	M	G	0	0	0
4/29/96	264	855	M	G	0	0	0
4/29/96	265	865	M	G	0	0	0
4/29/96	266	750	M	G	0	0	0
4/29/96	267	800	M	G	0	0	0
4/29/96	268	810	F	G	1	5	H
4/29/96	269	815	M	G	1	5	H
4/29/96	270	825	F	G	0	0	0
4/29/96	271	690	M	G	0	0	0
4/29/96	272	790	F	G	0	0	0
4/30/96	273 ^e	750	M	R	0	0	0
4/30/96	274	765	M	G	0	0	0
4/30/96	275	760	F	G	0	0	0
4/30/96	276	675	M	G	1	1	H
4/30/96	277	860	F	G	0	0	0
4/30/96	278	810	F	G	0	0	0
4/30/96	279	655	F	G	0	0	0
4/30/96	280	800	F	G	1	7	H
4/30/96	281	775	F	G	0	0	0
4/30/96	282	675	M	G	0	0	0
4/30/96	283	785	F	G	0	0	0
4/30/96	284	800	M	G	1	1	H
4/30/96	285	735	F	G	0	0	0
4/30/96	286	800	F	G	0	0	0
4/30/96	287	790	F	G	0	0	0
4/30/96	288	750	F	G	0	0	0
4/30/96	289	845	M	G	0	0	0
4/30/96	290	820	M	G	0	0	0
4/30/96	291	800	F	G	0	0	0
4/30/96	292	815	F	G	0	0	0
4/30/96	293	785	F	G	0	0	0
4/30/96	294	680	F	G	0	0	0
4/30/96	295	725	F	G	1	7	H
4/30/96	296	710	F	G	0	0	0
4/30/96	297	670	M	G	0	0	0
4/30/96	298	840	M	R	0	0	0
4/30/96	299	800	M	G	1	7	H
4/30/96	300	760	F	G	0	0	0
4/30/96	301	740	M	G	1	1	F
5/1/96	302	790	F	G	0	0	0
5/1/96	303	680	F	G	0	0	0
5/1/96	304	720	M	G	0	0	0
5/1/96	305	660	M	G	0	0	0

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Date	Fish no.	Fork length (mm)	Sex	Maturity	Number of scars	Scar category	Scar age
5/1/96	306	700	M	G	0	0	0
5/1/96	307	780	F	G	1	7	H
5/1/96	308	735	M	G	0	0	0
5/1/96	309	650	M	G	0	0	0
5/1/96	310	790	M	G	0	0	0
5/1/96	311	810	F	G	0	0	0
5/1/96	312	770	F	G	0	0	0
5/1/96	313	775	F	G	2	1	H
5/1/96	313	775	F	G	2	7	H
5/1/96	314	735	M	G	1	0	0
5/1/96	315	810	F	G	1	7	H
5/1/96	316	770	F	G	0	0	0
5/1/96	317	750	F	G	0	0	0
5/1/96	318	880	M	G	0	0	0
5/1/96	319	740	F	G	0	0	0
5/1/96	320	650	M	G	0	0	0
5/1/96	321	630	M	G	0	0	0
5/1/96	322	660	F	G	0	0	0
5/1/96	323	765	M	G	0	0	0
5/1/96	324	870	F	G	0	0	0
5/1/96	325	770	F	G	0	0	0
5/1/96	326	745	F	G	2	2	H
5/1/96	326	745	F	G	2	1	H
5/1/96	327	725	M	G	1	0	0
5/1/96	328	760	F	G	0	0	0
5/1/96	329	740	M	G	0	0	0
5/1/96	330	705	M	G	0	0	0
5/1/96	331	645	F	G	0	0	0
5/1/96	332	835	F	G	1	7	H
5/1/96	333	650	M	G	0	0	0
5/1/96	334	730	M	G	0	0	0
5/1/96	335	800	F	G	0	0	0
5/1/96	336	745	F	G	0	0	0
5/1/96	337	865	F	G	1	1	H
5/1/96	338	845	M	G	1	5	F
5/1/96	339	660	M	G	0	0	0
5/1/96	340	680	M	G	0	0	0
5/1/96	341	845	F	G	0	0	0
5/2/96	342	800	F	G	0	0	0
5/2/96	343	910	F	G	1	1	H
5/2/96	344	790	F	G	0	0	0
5/2/96	345	645	M	G	0	0	0
5/2/96	346	730	M	G	1	1	H
5/2/96	347	900	F	G	0	0	0
5/2/96	348	665	F	G	0	0	0
5/2/96	349	760	F	G	0	0	0
5/2/96	350	745	M	G	0	0	0
5/2/96	351	780	F	G	0	0	0
5/2/96	352	765	F	G	0	0	0
5/2/96	353	760	F	G	0	0	0
5/2/96	354	780	F	G	0	0	0
5/2/96	355	760	F	G	1	7	H
5/2/96	356	675	F	G	0	0	0
5/2/96	357	805	F	G	0	0	0
5/2/96	358	785	F	G	0	0	0
5/2/96	359	770	F	G	0	0	0
5/2/96	360	780	F	G	0	0	0
5/2/96	361	690	M	G	0	0	0
5/2/96	362	800	F	G	1	7	H
5/2/96	363	830	F	G	0	0	0
5/2/96	364	790	M	G	0	0	0
5/2/96	365	880	M	G	0	0	0
5/2/96	366	700	F	G	0	0	0
5/2/96	367	700	M	G	1	1	H

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Date	Fish no.	Fork length (mm)	Sex	Maturity	Number of scars	Scar category	Scar age
5/2/96	368	670	F	G	0	0	0
5/2/96	369	750	F	G	1	1	H
5/2/96	370	870	F	G	0	0	0
5/2/96	371	840	M	G	1	7	H
5/2/96	372	690	M	G	1	7	H
5/2/96	373	830	F	G	0	0	0
5/2/96	374	760	F	G	0	0	0
5/2/96	375	620	F	G	0	0	0
5/2/96	376	810	F	G	0	0	0
5/2/96	377	850	F	G	0	0	0
5/2/96	378	810	F	G	1	6	H
5/2/96	379	830	F	G	0	0	0
5/2/96	380	790	F	G	0	0	0
5/2/96	381	670	M	G	0	0	0
5/2/96	382	840	M	G	0	0	0
5/2/96	383	820	M	G	0	0	0
5/2/96	384	580	M	G	1	1	H
5/2/96	385	750	F	G	0	0	0
5/2/96	386	700	F	G	0	0	0
5/2/96	387	780	F	G	0	0	0
5/2/96	388	840	M	G	1	6	H
5/2/96	389	780	F	G	0	0	0
5/2/96	390	750	F	G	0	0	0
5/2/96	391	760	F	G	0	0	0
5/2/96	392	880	F	G	0	0	0
5/2/96	393	590	F	G	0	0	0
5/2/96	394	710	M	G	0	0	0
5/2/96	395	760	M	G	0	0	0
5/2/96	396	690	F	G	0	0	0
5/3/96	397	740	F	R	1	5	H
5/3/96	398	640	M	G	1	7	H
5/3/96	399	730	F	G	0	0	0
5/3/96	400	800	F	G	0	0	0
5/3/96	401	825	F	G	0	0	0
5/3/96	402	515	M	G	0	0	0
5/3/96	403	760	F	G	1	1	H
5/4/96	404	660	F	G	0	0	0
5/4/96	405	850	M	G	0	0	0
5/4/96	406	665	M	R	1	1	H
5/4/96	407	800	F	G	1	1	H
5/4/96	408	780	F	G	0	0	0
5/4/96	409	765	F	R	0	0	0
5/4/96	410	710	F	G	0	0	0
5/4/96	411	705	M	R	0	0	0
5/4/96	412	770	F	R	0	0	0
5/4/96	413	795	M	G	0	0	0
5/4/96	414	750	M	R	0	0	0
5/4/96	415	735	M	G	0	0	0
5/4/96	416	800	F	G	0	0	0
5/4/96	417	745	F	G	1	1	H
5/4/96	418	800	F	G	1	5	H
5/4/96	419	730	M	G	1	1	H
5/4/96	420	810	F	G	0	0	0
5/4/96	421	860	M	G	0	0	0
5/4/96	422	715	F	R	0	0	0
5/4/96	423	750	F	G	0	0	0
5/4/96	424	825	M	G	1	1	H
5/4/96	425	810	F	G	0	0	0
5/4/96	426	660	M	R	0	0	0
5/4/96	427	710	M	G	1	1	H
5/4/96	428	830	F	G	0	0	0
5/4/96	429	650	F	G	0	0	0
5/4/96	430	675	F	G	0	0	0
5/4/96	431	760	F	G	0	0	0

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Date	Fish no.	Fork length (mm)	Sex	Maturity	Number of scars	Scar category	Scar age
5/4/96	432	720	F	G	1	1	H
5/4/96	433	770	F	G	0	0	0
5/4/96	434	660	M	G	0	0	0
5/4/96	435	760	F	G	0	0	0
5/4/96	436	670	F	G	0	0	0
5/4/96	437	630	M	G	0	0	0
5/4/96	438	780	F	G	0	0	0
5/5/96	439	830	F	G	0	0	0
5/5/96	440	680	M	G	0	0	0
5/5/96	441	825	F	R	0	0	0
5/5/96	442	735	M	G	0	0	0
5/5/96	443	745	F	G	0	0	0
5/5/96	444	740	F	G	0	0	0
5/6/96	445	630	M	G	0	0	0
5/6/96	446	785	F	R	0	0	0
5/7/96	447	690	M	G	0	0	0
5/7/96	448	785	F	G	2	1	H
5/7/96	448	785	F	G	2	7	H
5/7/96	449	810	M	G	1	5	F
5/7/96	450	770	F	R	0	0	0
5/7/96	451	745	F	G	0	0	0
5/7/96	452	800	F	G	0	0	0
5/7/96	453	825	M	G	0	0	0
5/7/96	454	620	F	G	0	0	0
5/7/96	455	810	F	G	0	0	0
5/7/96	456	770	F	G	0	0	0
5/7/96	457	620	M	G	0	0	0
5/8/96	458	650	M	R	0	0	0
5/8/96	459	680	F	G	0	0	0
5/8/96	460	675	M	R	0	0	0
5/8/96	461	810	M	G	0	0	0
5/8/96	462	840	F	G	0	0	0
5/8/96	463	830	M	G	0	0	0
5/8/96	464	715	M	G	0	0	0
5/8/96	465	810	M	G	0	0	0
5/8/96	466	710	M	G	0	0	0
5/8/96	467	665	F	G	0	0	0
5/8/96	468	660	F	G	0	0	0
5/8/96	469	765	F	G	0	0	0
5/8/96	470	810	F	R	0	0	0
5/8/96	471	710	M	R	0	0	0
5/8/96	472	790	F	G	0	0	0
5/8/96	473	730	F	G	0	0	0
5/8/96	474	730	F	R	1	5	F
5/8/96	475	760	F	G	0	0	0
5/8/96	476	685	M	G	0	0	0
5/8/96	477	720	F	G	0	0	0
5/8/96	478	715	M	G	0	0	0
5/8/96	479	695	M	G	0	0	0
5/9/96	480	905	M	G	0	0	0
5/9/96	481	840	M	R	0	0	0
5/9/96	482	670	M	G	0	0	0
5/9/96	483	770	F	G	0	0	0
5/9/96	484	760	F	G	0	0	0
5/9/96	485	660	F	G	0	0	0
5/9/96	486	685	F	G	0	0	0
5/9/96	487	725	M	R	0	0	0
5/9/96	488	630	F	G	0	0	0
5/9/96	489	835	M	R	0	0	0
5/9/96	490	755	F	G	0	0	0
5/9/96	491	710	M	G	0	0	0
5/9/96	492	640	M	R	0	0	0
5/9/96	493	635	F	G	0	0	0
5/9/96	494	715	M	G	0	0	0

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Date	Fish no.	Fork length (mm)	Sex	Maturity	Number of scars	Scar category	Scar age
5/9/96	495	860	F	R	0	0	0
5/9/96	496	780	M	R	0	0	0
5/10/96	497	745	F	G	1	4	H
5/10/96	498	765	F	R	0	0	0
5/10/96	499	800	F	G	1	5	F
5/10/96	500	800	F	G	1	1	H
5/10/96	501	645	M	G	0	0	0
5/10/96	502	680	F	G	0	0	0
5/10/96	503	740	F	G	0	0	0
5/10/96	504	655	M	G	1	1	H
5/11/96	505	715	F	G	0	0	0
5/11/96	506	835	F	R	0	0	0
5/11/96	507	745	F	G	0	0	0
5/11/96	508	870	F	G	0	0	0
5/11/96	509 ^f	665	M	G	1	6	F
5/11/96	510	630	M	G	0	0	0
5/11/96	511	710	F	G	0	0	0
5/11/96	512	855	M	G	0	0	0
5/11/96	513	800	F	G	1	6	H
5/11/96	514	770	F	G	0	0	0
5/11/96	515	645	F	G	0	0	0
5/11/96	516	765	F	R	0	0	0
5/11/96	517	780	F	G	0	0	0
5/11/96	518	800	F	G	0	0	0
5/12/96	519	777	F	R	0	0	0
5/12/96	520	670	F	G	0	0	0
5/12/96	521	800	F	R	0	0	0
5/12/96	522	830	M	G	1	6	H
5/12/96	523 ^B	800	F	R	0	0	0
5/12/96	524	670	M	G	0	0	0
5/12/96	525	650	F	G	1	5	H
5/12/96	526	680	F	R	0	0	0
5/12/96	527	800	F	G	0	0	0
5/12/96	528	730	F	G	0	0	0
5/12/96	529	850	F	G	0	0	0
5/12/96	530	630	M	G	0	0	0
5/12/96	531	745	F	G	0	0	0
5/12/96	532	745	F	G	0	0	0
5/12/96	533	785	F	G	0	0	0
5/12/96	534	645	F	G	0	0	0
5/12/96	535	795	F	G	0	0	0
5/12/96	536	760	F	G	0	0	0
5/12/96	537	850	M	G	0	0	0
5/12/96	538	705	M	G	0	0	0
5/12/96	539	730	F	G	0	0	0
5/12/96	540	660	M	G	0	0	0
5/12/96	541	825	F	G	0	0	0
5/12/96	542	630	F	G	0	0	0
5/12/96	543	665	F	G	0	0	0
5/12/96	544	755	M	R	0	0	0
5/12/96	545	660	M	G	0	0	0
5/12/96	546	730	F	G	1	6	H
5/12/96	547	700	M	G	0	0	0
5/12/96	548	740	F	G	0	0	0
5/13/96	549	700	F	G	0	0	0
5/13/96	550	860	M	G	0	0	0
5/13/96	551	695	M	R	0	0	0
5/13/96	552	680	M	G	1	7	H
5/13/96	553	845	M	G	0	0	0
5/13/96	554	760	F	G	1	6	H
5/13/96	555	650	F	G	0	0	0
5/13/96	556	665	M	R	0	0	0
5/13/96	557	740	F	R	1	2	H

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Date	Fish no.	Fork length (mm)	Sex	Maturity	Number of scars	Scar category	Scar age
5/13/96	558	760	M	G	1	5	F
5/13/96	559	795	F	G	1	6	H
5/13/96	560	855	F	G	0	0	0
5/13/96	561	690	M	G	0	0	0
5/13/96	562	810	F	R	0	0	0
5/13/96	563	780	F	G	0	0	0
5/13/96	564	760	F	G	0	0	0
5/13/96	565	820	F	G	1	1	H
5/13/96	566	650	M	R	0	0	0
5/13/96	567	770	F	G	0	0	0
5/13/96	568	730	F	R	1	6	H
5/13/96	569	810	F	G	0	0	0
5/13/96	570	830	F	G	0	0	0
5/13/96	571	750	F	G	0	0	0
5/13/96	572 ^B	770	F	G	0	0	0
5/13/96	573	750	F	R	1	7	H
5/13/96	574	835	F	G	0	0	0
5/13/96	575	790	F	G	0	0	0
5/13/96	576	790	F	G	0	0	0
5/13/96	577	740	F	G	0	0	0
5/13/96	578	885	F	G	0	0	0
5/13/96	579	700	F	G	0	0	0
5/13/96	580	640	F	G	0	0	0
5/13/96	581	715	M	G	0	0	0
5/13/96	582	730	F	G	0	0	0
5/13/96	583	770	F	G	0	0	0
5/13/96	584	730	F	R	0	0	0
5/13/96	585	765	F	G	0	0	0
5/13/96	586	785	F	G	0	0	0
5/13/96	587	670	F	G	0	0	0
5/13/96	588	655	F	G	0	0	0
5/13/96	589	835	M	G	0	0	0
5/13/96	590	830	M	G	0	0	0
5/13/96	591	735	F	G	0	0	0
5/13/96	592	700	F	G	0	0	0
5/13/96	593	775	F	G	1	1	H
5/13/96	594	785	F	G	0	0	0
5/13/96	595	650	F	G	0	0	0
5/13/96	596	665	F	G	0	0	0
5/13/96	597	775	F	R	1	7	H
5/13/96	598	780	F	G	0	0	0
5/13/96	599	780	F	R	0	0	0
5/13/96	600	880	F	G	0	0	0
5/13/96	601	660	F	G	0	0	0
5/13/96	602	750	F	G	1	7	H
5/13/96	603	590	F	G	0	0	0
5/13/96	604	750	F	G	0	0	0
5/13/96	605	300	F	G	0	0	0
5/14/96	606	740	F	G	0	0	0
5/14/96	607	840	M	R	0	0	0
5/14/96	608	700	M	R	0	0	0
5/14/96	609	680	M	R	0	0	0
5/14/96	610	840	F	R	0	0	0
5/14/96	611	830	F	R	0	0	0
5/14/96	612	850	F	R	0	0	0
5/14/96	613	800	F	R	0	0	0
5/14/96	614	830	F	R	0	0	0
5/14/96	615	690	F	G	0	0	0
5/14/96	616	760	F	G	0	0	0
5/14/96	617	800	F	G	0	0	0
5/14/96	618	780	F	G	0	0	0
5/14/96	619	750	F	G	0	0	0
5/14/96	620	900	F	G	0	0	0

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Date	Fish no.	Fork length (mm)	Sex	Maturity	Number of scars	Scar category	Scar age
5/14/96	621	810	F	G	0	0	0
5/14/96	622	650	F	G	0	0	0
5/14/96	623	825	M	G	0	0	0
5/14/96	624	780	M	G	0	0	0
5/14/96	625	850	F	G	0	0	0
5/14/96	626	775	F	G	0	0	0
5/14/96	627	740	F	G	0	0	0
5/14/96	628	790	M	G	0	0	0
5/14/96	629	795	F	G	1	6	H
5/14/96	630	680	F	G	0	0	0
5/14/96	631	700	F	G	0	0	0
5/14/96	632	770	F	G	0	0	0
5/14/96	633	765	F	G	0	0	0
5/14/96	634	860	F	G	0	0	0
5/14/96	635	830	M	G	0	0	0
5/14/96	636	860	F	G	0	0	0
5/14/96	637	850	F	G	0	0	0
5/14/96	638	840	M	G	0	0	0
5/14/96	639	695	F	G	0	0	0
5/14/96	640	860	M	G	0	0	0
5/14/96	641	770	F	G	0	0	0
5/14/96	642	625	F	G	0	0	0
5/14/96	643	645	F	R	0	0	0
5/14/96	644	690	M	R	0	0	0
5/14/96	645	825	F	G	0	0	0
5/14/96	646	690	M	G	0	0	0
5/14/96	647	640	M	G	0	0	0
5/14/96	648	805	F	G	0	0	0
5/14/96	649	750	F	R	0	0	0
5/14/96	650	685	M	R	0	0	0
5/14/96	651	760	F	R	0	0	0
5/14/96	652	830	F	G	0	0	0
5/14/96	653	705	M	G	0	0	0
5/14/96	654	675	M	G	1	1	H
5/14/96	655	740	M	R	0	0	0
5/14/96	656	770	M	G	0	0	0
5/14/96	657	640	F	R	0	0	0
5/14/96	658 ^h	790	F	G	0	0	0
5/14/96	659	730	F	G	0	0	0
5/14/96	660	740	F	G	1	6	H
5/14/96	661	710	M	G	0	0	0
5/14/96	662	800	F	G	0	0	0
5/14/96	663	800	F	G	0	0	0
5/14/96	664	725	F	R	0	0	0
5/14/96	665	760	F	G	0	0	0
5/14/96	666	765	F	R	0	0	0
5/14/96	667	690	M	G	0	0	0
5/14/96	668	765	F	G	0	0	0
5/14/96	669	650	F	R	0	0	0
5/14/96	670 ^h	790	F	G	0	0	0
5/14/96	671	670	F	G	0	0	0
5/15/96	672	785	F	G	0	0	0
5/15/96	673	735	F	G	0	0	0
5/15/96	674	710	F	G	0	0	0
5/15/96	675	630	M	G	0	0	0
5/15/96	676	750	F	R	0	0	0
5/15/96	677	725	F	G	0	0	0
5/15/96	678	790	F	G	0	0	0
5/15/96	679	700	M	G	0	0	0
5/15/96	680	685	M	G	0	0	0
5/15/96	681	655	F	G	0	0	0
5/15/96	682	890	F	G	0	0	0
5/15/96	683	800	F	G	1	6	H

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Date	Fish no.	Fork length (mm)	Sex	Maturity	Number of scars	Scar category	Scar age
5/15/96	684	880	M	G	0	0	0
5/15/96	685	680	F	G	0	0	0
5/15/96	686	830	M	G	0	0	0
5/15/96	687	715	M	G	0	0	0
5/15/96	688	650	F	G	0	0	0
5/15/96	689	690	M	G	0	0	0
5/15/96	690	650	F	G	0	0	0
5/15/96	691	760	F	G	1	7	F
5/15/96	692	680	F	G	0	0	0
5/15/96	693	635	M	G	0	0	0
5/15/96	694	740	F	G	0	0	0
5/15/96	695 ⁱ	705	F	G	0	0	0
5/15/96	696	645	M	G	0	0	0
5/15/96	697	740	M	G	0	0	0
5/15/96	698	750	F	G	0	0	0
5/16/96	699	855	M	R	0	0	0
5/16/96	700	590	F	G	0	0	0
5/16/96	701	660	F	G	0	0	0
5/16/96	702	830	F	G	0	0	0
5/16/96	703	715	M	G	1	1	H
5/16/96	704	600	M	G	0	0	0
5/16/96	705	720	F	G	0	0	0
5/16/96	706	745	F	G	0	0	0
5/16/96	707	785	F	G	1	1	H
5/16/96	708	750	F	G	0	0	0
5/16/96	709	825	F	G	0	0	0
5/16/96	710	760	F	G	0	0	0
5/16/96	711	650	F	G	0	0	0
5/16/96	712	780	F	G	0	0	0
5/16/96	713	660	F	G	0	0	0
5/16/96	714	870	M	G	0	0	0
5/16/96	715	750	F	G	0	0	0
5/16/96	716	740	M	G	0	0	0
5/17/96	717	840	M	G	0	0	0
5/17/96	718	720	F	R	0	0	0
5/17/96	719	690	M	G	0	0	0
5/17/96	720	795	F	G	0	0	0
5/17/96	721	790	F	G	0	0	0
5/17/96	722	640	F	G	0	0	0
5/17/96	723	830	F	G	0	0	0
5/17/96	724	800	F	G	0	0	0
5/17/96	725	680	F	G	0	0	0
5/17/96	726	840	F	G	1	7	H
5/17/96	727	800	M	G	0	0	0
5/17/96	728	640	F	G	0	0	0
5/17/96	729	640	F	G	0	0	0
5/17/96	730	870	F	G	0	0	0
5/17/96	731	860	F	R	0	0	0
5/17/96	732	455	M	G	0	0	0
5/17/96	733	790	F	G	1	3	H
5/17/96	734	700	F	G	0	0	0
5/17/96	735	690	M	R	0	0	0
5/17/96	736	645	F	G	0	0	0
5/17/96	737	850	F	G	0	0	0
5/17/96	738	650	M	G	0	0	0
5/17/96	739	690	F	G	1	1	H
5/17/96	740	720	M	G	0	0	0
5/17/96	741	780	F	G	0	0	0
5/17/96	742	780	F	G	0	0	0
5/17/96	743	675	M	G	0	0	0
5/17/96	744	690	F	G	0	0	0
5/17/96	745	810	F	G	0	0	0
5/17/96	746	670	M	G	0	0	0

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Date	Fish no.	Fork length (mm)	Sex	Maturity	Number of scars	Scar category	Scar age
5/18/96	747	710	F	G	0	0	0
5/18/96	748	680	F	G	0	0	0
5/18/96	749	630	M	R	0	0	0
5/18/96	750	640	M	R	0	0	0
5/18/96	751	770	F	G	0	0	0
5/18/96	752	740	F	R	0	0	0
5/18/96	753	800	F	G	0	0	0
5/18/96	754	770	F	G	0	0	0
5/18/96	755	720	F	G	0	0	0
5/18/96	756	700	F	G	0	0	0
5/18/96	757 ^j	660	M	R	0	0	0
5/18/96	758	790	F	R	0	0	0
5/19/96	759	655	F	G	0	0	0
5/19/96	760	715	F	G	0	0	0
5/19/96	761 ^k	790	F	G	0	0	0
5/19/96	762	755	F	G	0	0	0
5/19/96	763	920	M	G	0	0	0
5/19/96	764	815	F	G	0	0	0
5/19/96	765 ^l	785	M	R	0	0	0
5/19/96	766	810	M	G	0	0	0
5/19/96	767	805	F	G	0	0	0
5/19/96	768	695	F	G	0	0	0
5/19/96	769	750	F	G	0	0	0
5/19/96	770	805	F	G	0	0	0
5/19/96	771	605	M	R	0	0	0
5/19/96	772	805	F	G	0	0	0
5/19/96	773 ^m	650	M	G	0	0	0
5/20/96	774	660	F	G	0	0	0
5/20/96	775	770	F	G	0	0	0
5/20/96	776	690	M	G	0	0	0
5/20/96	777	850	F	R	0	0	0
5/20/96	778 ⁿ	690	F	G	0	0	0
5/20/96	779	670	M	R	0	0	0
5/20/96	780	760	F	G	0	0	0
5/20/96	781	630	F	R	0	0	0
5/20/96	782	860	F	R	0	0	0
5/20/96	783	680	M	R	0	0	0
5/20/96	784	840	M	G	0	0	0
5/20/96	785	730	F	R	0	0	0
5/20/96	786 ^o	840	F	R	1	6	H
5/20/96	787	680	F	R	0	0	0
5/20/96	788	760	F	R	1	6	H
5/20/96	789	710	F	R	0	0	0
5/20/96	790	740	F	R	0	0	0
5/21/96	791	730	F	G	0	0	0
5/21/96	792	880	M	G	1	7	H
5/21/96	793	675	M	G	1	7	H
5/21/96	794	800	F	G	0	0	0
5/21/96	795	675	M	G	0	0	0
5/21/96	796	800	F	G	0	0	0
5/22/96	797	660	F	G	0	0	0
5/22/96	798	620	M	R	0	0	0
5/22/96	799	730	F	G	0	0	0
5/22/96	800	880	F	G	0	0	0
5/22/96	801	810	F	R	0	0	0
5/22/96	802	820	F	G	0	0	0
5/22/96	803	920	F	R	0	0	0
5/22/96	804	740	F	R	0	0	0
5/22/96	805	780	F	R	0	0	0
5/22/96	806	800	F	R	0	0	0
5/22/96	807	690	F	R	0	0	0

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Date	Fish no.	Fork length (mm)	Sex	Maturity	Number of scars	Scar category	Scar age
5/23/96	808	760	F	G	1	3	H
5/23/96	809	800	F	G	0	0	0
5/23/96	810	765	F	R	0	0	0
5/23/96	811	700	F	G	1	1	H
5/23/96	812	700	F	G	0	0	0
5/23/96	813	820	F	R	0	0	0
5/23/96	814 ^p	770	F	R	1	1	H
5/23/96	815	835	F	R	0	0	0
5/23/96	816	880	F	G	0	0	0
5/23/96	817	800	F	G	0	0	0
5/23/96	818	760	F	G	0	0	0
5/23/96	819	840	M	R	0	0	0
5/23/96	820	810	F	G	0	0	0
5/23/96	821	855	F	G	0	0	0
5/23/96	822	735	F	G	0	0	0
5/23/96	823	780	F	G	0	0	0
5/24/96	824	760	F	G	0	0	0
5/24/96	825	670	M	G	0	0	0
5/24/96	826	650	F	G	0	0	0
5/24/96	827	790	F	G	0	0	0
5/24/96	828	790	F	G	0	0	0
5/24/96	829	675	M	G	0	0	0
5/24/96	830	645	F	G	0	0	0
5/24/96	831	750	F	R	0	0	0
5/24/96	832	740	F	R	0	0	0
5/24/96	833	825	F	G	0	0	0
5/25/96	834	705	F	G	1	1	H
5/25/96	835	780	F	G	0	0	0
5/25/96	836	705	F	G	0	0	0
5/25/96	837 ^q	745	F	R	0	0	0
5/25/96	838	830	F	R	0	0	0
5/26/96	839	760	F	R	0	0	0
5/26/96	840	830	F	G	0	0	0
5/26/96	841	820	F	G	0	0	0
5/27/96	842	750	M	R	0	0	0
5/27/96	843	750	F	R	1	7	H
5/27/96	844	680	F	R	0	0	0
5/27/96	845	670	F	G	0	0	0
5/27/96	846	830	F	R	0	0	0
5/27/96	847	640	F	R	0	0	0
5/27/96	848	655	F	G	0	0	0
5/27/96	849	765	F	R	0	0	0
5/27/96	850	660	F	G	0	0	0
5/27/96	851	730	F	G	1	1	H
5/28/96	852	695	M	G	0	0	0
5/28/96	853	700	F	G	0	0	0
5/28/96	854	750	F	G	0	0	0
5/28/96	855	740	F	G	0	0	0
5/28/96	856	660	M	G	0	0	0
5/28/96	857	790	F	R	0	0	0
5/28/96	858	720	F	R	0	0	0
5/28/96	859 ^r	660	F	G	0	0	0
5/28/96	860	740	F	G	0	0	0
5/28/96	861	660	M	G	0	0	0
5/29/96	862	770	F	R	0	0	0
5/29/96	863	750	F	R	0	0	0
5/29/96	864	700	F	R	1	7	H
5/29/96	865	705	F	G	0	0	0
5/29/96	866	690	M	G	0	0	0
5/29/96	867	790	F	G	0	0	0
5/29/96	868	820	F	G	0	0	0
5/30/96	869	715	M	G	0	0	0

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Date	Fish no.	Fork length (mm)	Sex	Maturity	Number of scars	Scar category	Scar age
5/30/96	870	770	F	G	0	0	0
5/30/96	871	780	F	R	0	0	0
5/31/96	872	760	F	G	0	0	0
5/31/96	873 ^s	780	F	G	0	0	0
5/31/96	874	670	F	G	0	0	0
5/31/96	875	830	F	G	0	0	0
6/1/96	876 ^l	850	F	R	0	0	0
6/1/96	877	660	F	G	0	0	0
6/1/96	878	760	F	R	0	0	0
6/2/96	879	690	F	G	0	0	0
6/2/96	880	695	M	R	0	0	0
6/3/96	881	695	M	R	0	0	0
6/3/96	882	700	F	R	0	0	0
6/3/96	883	645	M	G	0	0	0
6/3/96	884	635	F	G	0	0	0
6/3/96	885	735	F	G	0	0	0
6/3/96	886	755	F	R	0	0	0
6/3/96	887	710	F	R	0	0	0
6/4/96	888	760	F	G	0	0	0
6/4/96	889	625	F	R	0	0	0
6/4/96	890	840	F	R	0	0	0
6/4/96	891	715	F	G	0	0	0
6/5/96	892	725	F	G	0	0	0
6/5/96	893	660	M	G	0	0	0
6/5/96	894	690	F	G	0	0	0
6/5/96	895	720	M	G	0	0	0
6/5/96	896	640	F	G	0	0	0
6/6/96	897	775	F	R	0	0	0

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Date	Fish no.	Fork length (mm)	Sex	Maturity	Number of scars	Scar category	Scar age
6/6/96	898	830	F	G	0	0	0
6/8/96	899	655	F	R	0	0	0
6/8/96	901	745	F	G	0	0	0
6/9/96	902	790	F	R	0	0	0
6/9/96	903	720	F	R	0	0	0
6/9/96	904	840	M	R	1	1	H
6/10/96	905	735	F	R	0	0	0
6/10/96	906	820	F	R	0	0	0
6/10/96	907	825	F	R	0	0	0
6/10/96	908	915	F	R	0	0	0
6/10/96	909	670	F	G	0	0	0
6/11/96	910	820	F	G	0	0	0
6/11/96	911	650	F	G	0	0	0
6/12/96	912	770	F	R	0	0	0
6/12/96	913	760	F	R	0	0	0
6/13/96	914	820	F	G	0	0	0
6/13/96	915	690	F	G	0	0	0
6/13/96	916	640	F	R	0	0	0
6/13/96	917	650	F	R	0	0	0
6/14/96	918 ^u	655	F	G	0	0	0
6/14/96	919	795	F	R	0	0	0
6/15/96	920	780	F	R	0	0	0
6/18/96	921	810	F	R	0	0	0
6/18/96	922	730	M	R	0	0	0
6/18/96	923	740	F	R	0	0	0
6/18/96	924	735	M	R	0	0	0
6/19/96	925	750	F	R	0	0	0
6/20/96	926	620	M	R	1	1	H

- ^a Sex not noted.
- ^b Vertical scar past dorsal.
- ^c Yarn fly in gill plate.
- ^d Bite marks also?
- ^e Hook in gill plate.
- ^f Fresh cuts on back between head and dorsal, eagle?
- ^g Torn gill plate from hook wound.
- ^h Mortality.
- ⁱ Torn lip.
- ^j Dorsal fin cut.
- ^k Split tail and hook wound in mouth, both healed.
- ^l Back is notched-fresh.
- ^m Operculum scarred from net-healed.
- ⁿ Eye bugged out-fresh.
- ^o Dorsal fin split.
- ^p Torn mouth from hook-healed.
- ^q Torn gill plate-fresh.
- ^r Bleeding gills.
- ^s Fresh chunk from peduncle.
- ^t Hook mark on belly.
- ^u Torn gill plate.

