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Abundance and Size of Cutthroat Trout at Baranof Lake, Southeast Alaska, 1994

by

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and

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Alaska Department of Fish and Game

Division of Sport Fish

Symbols and Abbreviations

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Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
metric ton	mt
milliliter	ml
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
ounce	oz
pound	lb
quart	qt
yard	yd

Spell out acre and ton.

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
hour (spell out for 24-hour clock)	h
minute	min
second	s

Spell out year, month, and week.

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

All commonly accepted abbreviations.	e.g., Mr., Mrs., a.m., p.m., etc.
All commonly accepted professional titles.	e.g., Dr., Ph.D., R.N., etc.
and	&
at	@
Compass directions:	
east	E
north	N
south	S
west	W
Copyright	©
Corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
et alii (and other people)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.,
id est (that is)	i.e.,
latitude or longitude	lat. or long.
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
number (before a number)	# (e.g., #10)
pounds (after a number)	# (e.g., 10#)
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S. state and District of Columbia abbreviations	use two-letter abbreviations (e.g., AK, DC)

Mathematics, statistics, fisheries

alternate hypothesis	H_A
base of natural logarithm	e
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	F, t, χ^2, etc.
confidence interval	C.I.
correlation coefficient	R (multiple)
correlation coefficient	r (simple)
covariance	cov
degree (angular or temperature)	°
degrees of freedom	df
divided by	÷ or / (in equations)
equals	=
expected value	E
fork length	FL
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	log_2, etc.
mideye-to-fork	MEF
minute (angular)	'
multiplied by	x
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
standard length	SL
total length	TL
variance	Var

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ABSTRACT

A two-event mark-recapture experiment was used to estimate abundance of a monospecific population of cutthroat trout *Oncorhynchus clarki* in Baranof Lake, Baranof Island, Southeast Alaska in 1994. The abundance of cutthroat trout ≥180 mm fork length was estimated at 12,186 (SE = 888). Abundance and density (38 fish per hectare) of fish ≥180 mm fork length are the highest of any large lake (i.e., Florence, Wilson, Hasselborg, and Turner lakes) carefully studied to-date in Southeast Alaska. Catch rate and length distribution of fish caught by two types of passive sampling gears in the lake were examined by time (summer sampling periods), area (ends and middle), and depth (10-m intervals) to better understand gear performance and fish distributions. Time, area, and depth were important factors. Larger fish were more common at shallow (0–10 m) depths in the spring, when spawning occurs. Also, we could detect no decline in CPUE of our sampling gears between 0 and 30-m depth in the lake. Length distributions of fish caught with hook-and-line gear in 1981 and 1994 showed that mean length of cutthroat trout caught in 1981 was greater than in 1994.

Key words: Cutthroat trout, *Oncorhynchus clarki*, monospecific population, Baranof Lake, Southeast Alaska, abundance, length composition, depth distribution, gear studies, CPUE.

INTRODUCTION

Freshwater harvests of cutthroat trout *Oncorhynchus clarki* declined in large reaches of Southeast Alaska from 1985 through 1993 under increased angler effort and invariant regulation (Mills 1979 to 1994; Figure 1; Appendix A1). The harvest data could suggest changing angler attitudes or declining abundances, or both. In response to this overall trend in Southeast Alaska, the Alaska Board of Fisheries in 1994 tightened harvest regulations.

The current study at Baranof Lake is part of a research project designed to assess trout and char fisheries resources in Southeast Alaska. Baranof Lake was chosen because it is one of the most heavily fished cutthroat trout lakes in Southeast Alaska, supports a unique mono-specific ecology of cutthroat trout, and because its deep alpine-lake morphology lends itself to our research to estimate carrying capacity and sustainable harvests in varied types of lakes in Southeast Alaska. Interestingly, Baranof Lake provides a local exception to the regional trend in declining harvests (Figure 1).

Limnological and biological data from Baranof Lake were last collected in 1981 (Schmidt 1982). That study included collecting cutthroat trout with hook-and-line gear during June and July, 1981.

The objectives of this research were to:

(1) estimate abundance and length composition of cutthroat trout ≥180 mm FL; and

(2) compare the mean length of cutthroat trout caught with hook-and-line gear in 1994 to that from hook-and-line fishing in 1981.

Results from this study will assist us in evaluating the efficacy of fishing regulations adopted in 1994, and identify long-term changes in fish size in the lake.

We also present an analyses of the catch-per-unit effort (CPUE) and fish length data collected with two passive sampling gears employed in 1994. These studies were conducted to help us understand the relative efficiency of our passive sampling gears, and to provide insight into how fish of different lengths (≥180 mm FL) were distributed by geographic reaches and depth zones in the lake.

STUDY AREA

Baranof Lake (57°05′ N, 134°51′ W) is located 25 km east of Sitka on Baranof Island at the head of Warm Springs Bay (Figure 2). The lake is about 4.8 km long and 0.6 km wide, with a surface area of 324 ha, a maximum depth of 87 m, and a mean depth of 38 m (Figure 3; Schmidt 1982). It has one

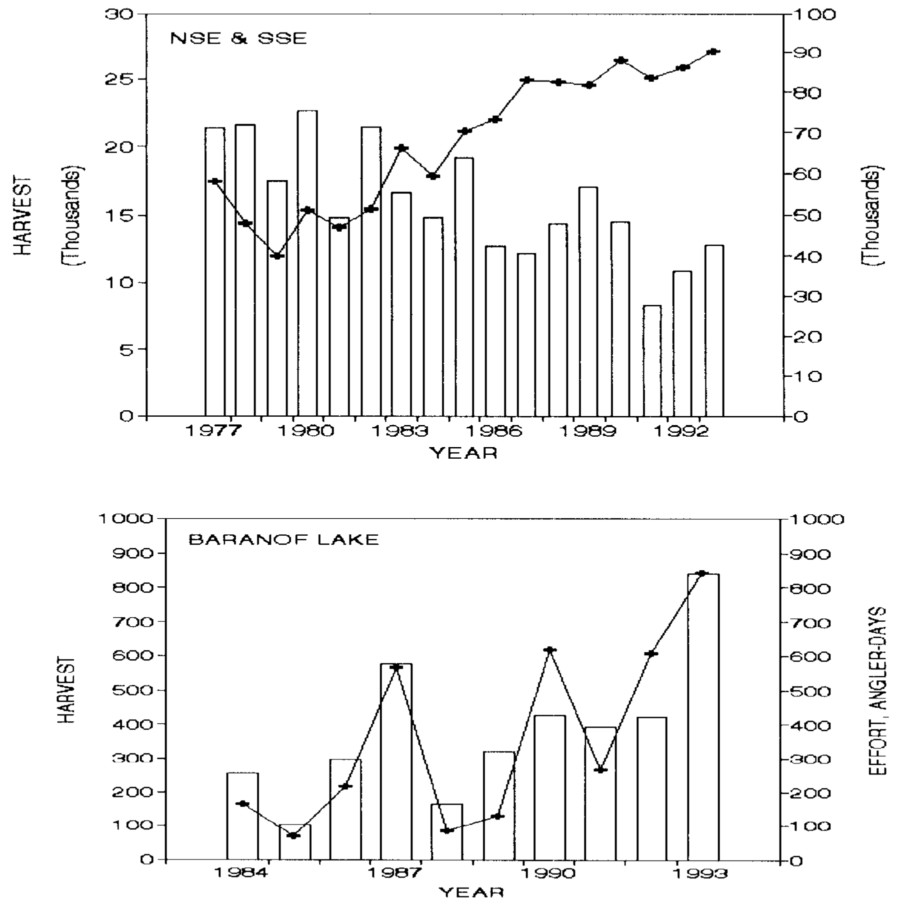


Figure 1.–Angler effort (lines) and freshwater harvests (bars) of cutthroat trout in Southeast Alaska (NSE and SSE), and Baranof Lake (Mills 1979–94). Bag limits were reduced from 10 fish/day to 4 fish/day in 1980, then increased to 5 fish/day in 1985.

major inlet (Baranof River), five minor tributaries, and a 0.4-km-long outlet which terminates in a 28-km barrier falls at the head of Warm Springs Bay. Anecdotal information suggests cutthroat trout were stocked into the lake in 1918. Coho and pink salmon were introduced in 1919 and 1920 but did not survive (Sprague 1921). Baranof Lake is one of few Southeast Alaska lakes to have only one fish species.

METHODS

ABUNDANCE

A two-event mark-recapture experiment was used to estimate abundance of cutthroat trout ≥180 mm FL in Baranof Lake. The first sampling (marking) event occurred between 10 May and 2 June, and the second sampling (recapture) event occurred between 7 June and 16 June. Two 10-day trips (10 May–18 May and 24 May–2 June) were made to Baranof Lake to mark fish during sampling event one. The population was assumed to be closed during the study.

Cutthroat trout were captured with two types of passive fish traps baited with salmon eggs: large (minnow-type) traps, and hoop traps. The minnow-type traps were made of plastic aquaculture netting (vexar) and were 1.5 m in length and 0.6 m in diameter. The hoop traps were made from knotless

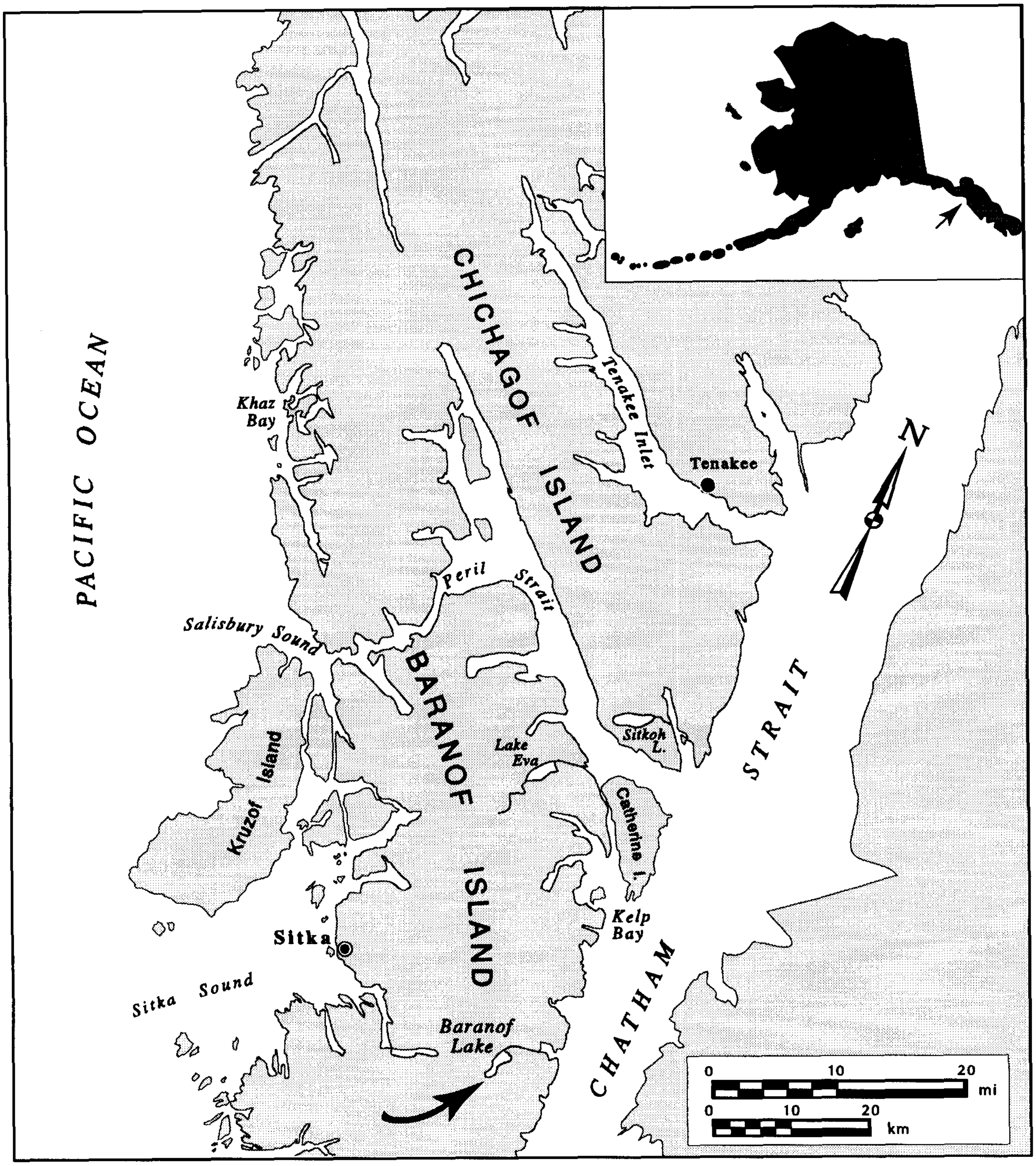


Figure 2.–Baranof Lake, on Baranof Island, Southeast Alaska.

nylon netting and metal hoops, and were 1.4 m in length and 0.6 m in diameter. Both traps were constructed of 0.25-cm mesh with 9-cm-diameter openings in each end. Cutthroat trout were also captured on hook-and-line gear on small lures and spinners that were trolled or cast by hand.

Baranof Lake was divided into three areas of roughly equal size to facilitate consistent recording of capture locations and the subsequent evaluation of experimental assumptions. Each of the three sampling areas (Figure 3) included one of the basins in the lake and one or more of the lake's

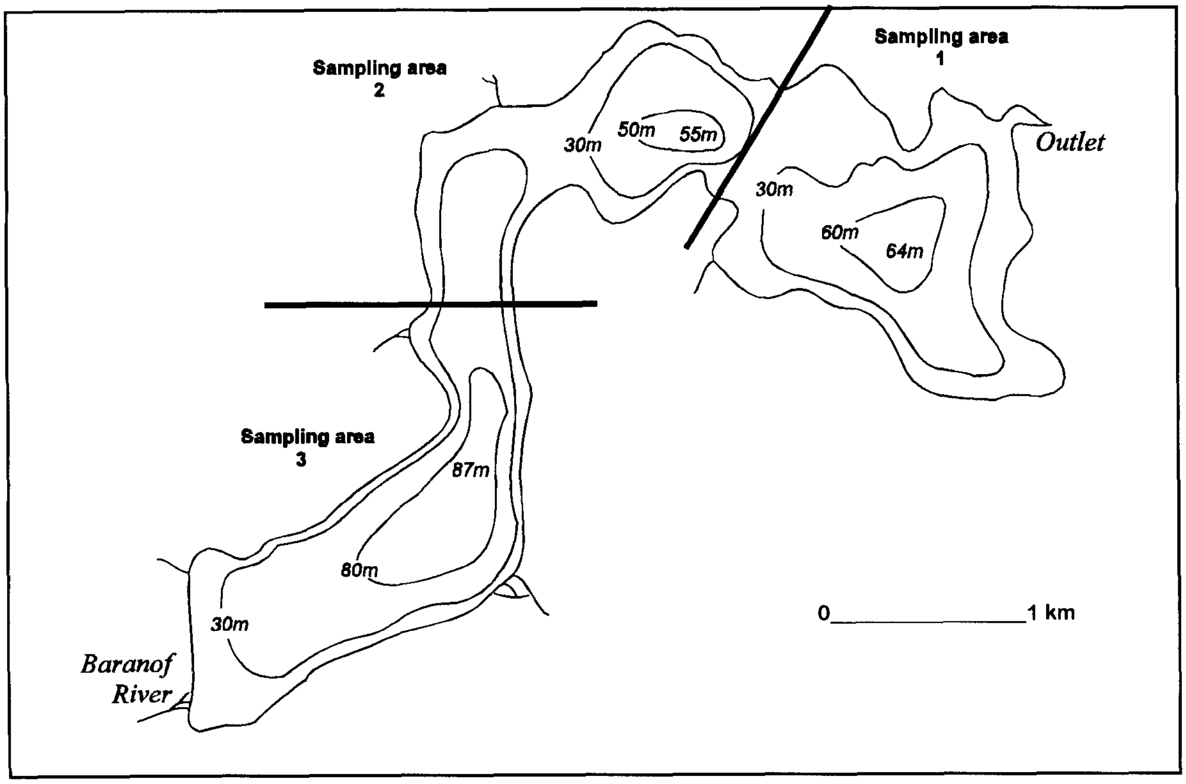


Figure 3.–Bathymetric map of Baranof Lake, showing location of sampling areas.

inlet/outlet streams. During each 10-day trip, sampling gear was systematically moved throughout the three sampling areas so that the total amount of gear was uniformly distributed across those parts of the lake <40 m in depth. The exact placement of traps was determined by randomly selecting a uniform distribution of points on enlarged maps of each area prior to each sampling trip. Traps were set on the lake bottom overnight (usually 20–22 hours); depths were estimated with a fathometer.

During the marking event, cutthroat trout ≥180 mm FL in good condition (i.e., fish not showing signs of stress or injury) were measured to the nearest mm FL, tagged with a uniquely numbered Floy anchor tag if untagged, given a secondary mark (adipose fin clip) to evaluate tag loss, sampled for scales, and released in the area of capture.

During the recovery event, cutthroat trout ≥180 mm FL were measured to the nearest mm FL, examined for tags or marks, given a secondary mark (upper lobe caudal fin clip) to detect repeat captures, sampled for scales if not previously tagged, and returned to the area of capture. Cutthroat trout <180 mm FL were only counted and returned to the lake during each event.

The validity of the experiment rests on several assumptions, including that fish of different sizes ≥180 mm FL are captured with equal probability. Thus, a Kolmogorov-Smirnov (KS) two-sample test was used to compare lengths of fish captured during the marking event against lengths of fish recaptured during the recovery event. If size-selective sampling was apparent in the recovery event, the data were stratified by size group.

Another assumption is that all fish ≥180 mm FL have an equal probability of capture during the marking event *or* that complete mixing (of marks) occurred between marking and recovery events. The assumption was evaluated with contingency table analysis by testing if, given *some* mixing between areas, marked fish were recaptured with equal probability in each of the three sampling areas during the recovery event. If this hypothesis was accepted (α = 0.05) a simple Petersen model would be used to estimate abundance; if not, the stratified Petersen estimator (Darroch 1961; Seber 1982, Chapter 11):

$$\underline{\hat{\mathbf{U}}} = \mathbf{D_u}\,\mathbf{M}^{-1}\,\underline{\mathbf{a}} \qquad (1)$$

where

$\underline{\hat{\mathbf{U}}}$ = vector of the estimated number of unmarked fish in each area j during the second sampling event;

D_u = diagonal matrix of the number of unmarked fish captured in each area j during the second sampling event;

M = matrix (m_{ij}) of the number of tagged fish recovered in area j which were released in area i;

$\underline{a}$ = vector of the number of tagged fish released in area i;

and abundance $\hat{N} = \hat{U} + A$, where U and A are sums of the vector elements in $\underline{\hat{U}}$ and $\underline{a}$, respectively, was employed. Because methods to calculate variance from Darroch's method are approximate (nearly unbiased as a_i gets large) and statistical bias has not been investigated (Seber 1982), bootstrap methods were used to estimate variance and statistical bias (Efron 1982, Bernard and Hansen 1992). Tag histories were resampled 1,000 times and abundance was estimated for each sample s. The bootstrap estimate of abundance $\bar{N}^*$ and its variance were

$$\bar{N}^* = \frac{\sum_{s=1}^{B} N_s^*}{B} \qquad (2)$$

$$v\left(\bar{N}^*\right) = \frac{\sum_{s=1}^{B}\left(N_s^* - \bar{N}^*\right)^2}{B-1} \qquad (3)$$

where B is the number of bootstrap estimates made and N_s^* is the estimated abundance from the s^{th} bootstrap sample. Statistics of interest are abundance $\hat{N}$, the variance $v(\bar{N}^*)$, and statistical bias in the Darroch estimate $\left|\hat{N} - \bar{N}^*\right|$.

Other assumptions of the model include that fish do not lose their tags, that marking does not affect catchability, and that all marked fish are recognized in the recovery sample.

Catchability Studies

Analyses were conducted to determine if differences in catch efficiency could be detected between the two types of passive fish traps used, and to test for differences in the lengths of cutthroat caught at depth sampled. Both analyses were accomplished with the analysis of variance (ANOVA) procedures in SAS PROC GLM (SAS Institute Inc. 1989) using Type *III* (for unbalanced designs) or Type *IV* (unbalanced designs with missing data) estimation models (Milliken and Johnson 1984). Factor levels in the ANOVA's included lake sampling area (1 to 3), depth in 10-m intervals, and the three temporal sampling periods.

The ANOVA for trap efficiency was performed with CPUE of cutthroat trout ≥180 mm FL as the dependent variable and gear type, time period, area, and depth strata as factors in a fixed-effects design (treatment effects determined by the experimenter).

The ANOVA for fish lengths used fork length as the dependent variable and time periods, areas, depth, and gear type as factors in a fixed-effects design.

Length Composition

Because sampling gear can be selective for fish of different sizes, methods for estimating length composition of the population were conditioned on results from the KS test (above) to determine if selectivity occurred in the recovery event, and a second KS test to determine if selectivity could be determined in the marking event (Appendix A2; Bernard and Hansen 1992). Since corrections for size-selective sampling were unneeded, length composition in 20-mm length classes k was estimated

$$\hat{p}_k = \frac{n_k}{n} \quad (4)$$

$$V(\hat{p}_k) = \frac{\hat{p}_k(1-\hat{p}_k)}{n-1} \quad (5)$$

where n is the number of fish sampled for length, and n_k is the number sampled in length class k.

Abundance of cutthroat trout ≥180 mm FL in length class k was estimated

$$\hat{N}_k = p_k \hat{N} \quad (6)$$

The variance of $\hat{N}_k$ was estimated using the formula for the variance of the product of two independent random variables (Goodman 1960):

$$V(\hat{N}_k) = V(\hat{p}_k)\hat{N}^2 + V(\overline{N}^*)\hat{p}_k^2 - V(\hat{p}_k)V(\overline{N}^*) \quad (7)$$

Also, mean length and variance of cutthroat trout ≥180 mm FL in the population were estimated using standard formulae (Cochran 1977).

Length Frequency Distributions in 1981 and 1994

Lengths of 77 cutthroat trout sampled with hook-and-line gear between 8 June and 30 June 1981 were taken from 1981 Baranof Lake data files for comparison to hook-and-line length data collected in 1994. However, little hook-and-line sampling was conducted for the mark-recapture experiment in early June 1994, so additional sampling was conducted between 21 June and 26 June 1994.

Fishing in 1981 was concentrated at nearshore waters around lake inlets and nearby talus slopes, and the lake outlet (A.E. Schmidt, Alaska Department of Fish and Game, Sitka, personal communication), so hook-and-line sampling between 21 June and 26 June 1994 was directed to the shallow (roughly 0–6 m in depth) waters near the inlets, outlet, talus slopes, and rock outcrops around the lake. Sampling in 1994 was done from a boat between 0600 h and 1200 h using small lures and spinners.

Lengths sampled with hook-and-line gear during the June sampling periods in 1981 and 1994 were compared using plots of length-frequency distributions and by testing the hypothesis of equal mean lengths in each sample ($\alpha = 0.05$) with a t-test for independent samples with unequal variances (Zar 1984).

RESULTS

Abundance

During the first sampling event, 2,287 cutthroat trout between 180 and 381 mm FL were marked and released. One thousand, three hundred and sixteen (1,316) cutthroat trout between 180 and 470 mm FL (nine >350 mm FL) were examined during the recovery event; 262 of these had been marked during the first event.

Tag loss during the experiment was an estimated 1.1% (3 of 262 fish recaptured during the recovery event).

The length distributions of cutthroat trout captured during the first event and recaptured during the second event (Figure 4) were not significantly different (KS test, $D_{max} = 0.046$, $P = 0.685$). Thus, sampling was not size selective during the recovery event, and the mark-recapture data did not need to be stratified by length (Appendix A2). Little growth occurred in fish tagged during the first event and recaptured during the second event (mean = 1.3 mm, SE = 2.2 mm), and significant growth recruitment of fish into the population ≥180 mm FL was not suggested in the comparison of lengths for fish captured during the marking and recovery events (Figure 4).

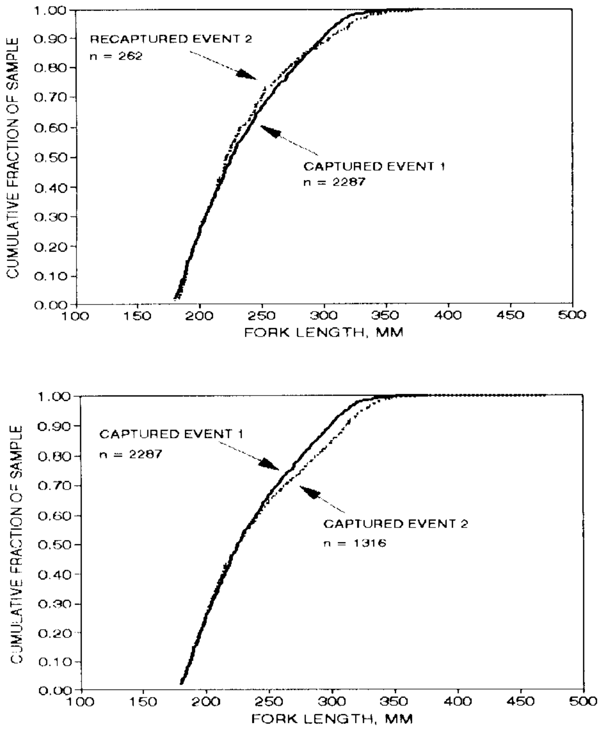


Figure 4.–Cumulative distributions of lengths of cutthroat trout marked in event 1 versus lengths of cutthroat trout recaptured in event 2 (top) and examined during event 2 (bottom), Baranof Lake, 1994.

Although partial mixing of marked fish into the population was obvious (Table 1), a hypothesis of equal marked fractions was rejected (Table 2, $\chi^2 = 38.4$, $P < 0.001$) showing that mixing was incomplete and capture probabilities were not equal across the lake during the marking event. Thus, the Darroch estimate for cutthroat trout ≥180 mm FL was $\hat{N} = 12{,}186$.

The bootstrap estimate of bias was small (<1%) and the estimated $SE(\hat{N}) = 888$. Relative variation of the estimate $\hat{N}$ was thus excellent (CV = 7.3%). Unrealistic capture probabilities were absent from all simulations, so the bootstrap estimates are stable and unbiased. Since the distribution of bootstrap estimates was significantly skewed ($g_1 = 0.487$, $P < 0.05$; Zar 1984), 95% confidence intervals for the population estimate (10,806, 14,181) were calculated by using the bootstrap percentile method (Efron and Tibshrani 1993).

Table 1.–Numbers of cutthroat trout ≥180 mm FL recovered by tagging and recovery area (m_{ij}), marked by area (a_i), and unmarked captures by area during event 2 (u_j), Baranof Lake, 1994.

Tagging	Recovery area j			
area i	1	2	3	a_i
1	60	24	4	700
2	22	68[a]	11	860
3	9	20	44[b]	727
u_j	253	345	456	

[a] Includes one fish recaptured without a Floy tag in area 2. It was assumed that this fish was also tagged and released in area 2.

[b] Includes two fish recaptured without Floy tags in area 3. It was assumed that these fish were also tagged and released in area 3.

CATCHABILITY STUDIES

Trap efficiency. A simple summary of the CPUE data by gear type and time suggests the minnow-type traps outperformed hoop traps during the first sampling period (10–18 May), while differences in efficiency were negligible during latter periods (Table 3). Catch rates in area 3 were consistently higher than in other areas, and increases in CPUE over time are suggested for hoop traps, but not for the minnow-type traps (Figure 5). Catch-at-depth appeared to vary irregularly over time (Figure 5).

A limited number of minnow-type traps were also set in the 30- to 40-m depth range (2, 3, and 5 sets by sampling period, respectively). Average CPUEs in this depth range were not consistently dissimilar from the CPUEs recorded at other times (Table 3) and depths (Figure 5) with minnow-type traps.

Because hoop traps were not set in the 30- to 40-m depth range, data for minnow-type traps at this depth range were removed for the statistical comparisons. Also, no hoop traps were set in the 20- to 30-m depth range for some time-area-gear combinations, so ANOVA was conducted using the *Type IV* estimation model. Gear type (main effect) was not significant ($F^* = 3.20$, $P = 0.07$).

Table 2.–Numbers of marked and unmarked cutthroat trout ≥180 mm FL captured in sampling event 2 by recovery area, Baranof Lake, 1994.

Area j	Number with marks	Number without marks	p_j
1	91	253	0.26
2	112	345	0.25
3	59	456	0.11

H_o: $p_1 = p_2 = p_3$

Result: $\chi^2 = 38.4$, df = 2, P < 0.001

Conclusion: reject H_o.

To determine if this result was sensitive to the missing observations, data from the 20- to 30-m depth stratum were removed from the analysis (eliminating empty factor level cells), and a *Type III* estimation model was employed. Again, gear was not significant ($F^* = 2.36$, P = 0.13).

Lake area was the most significant factor in both the Type *III* and *IV* ANOVAs (P < 0.001). Depth was an important factor in the Type *III* ANOVA ($F^* = 4.6$, P = 0.03), but in the Type *IV* analysis (all data but empty cells) depth was not important ($F^* = 0.36$, P = 0.70). Similarly, time was important in the Type *III* ANOVA ($F^* = 3.41$, P = 0.03) but not in the Type *IV* analysis ($F^* = 2.16$, P = 0.12).

Several 2- and 3-factor interaction terms were also significant in both ANOVAs, suggesting a very complicated system of area, time, gear, and depth interactions. These results do not show the two traps have the same catch efficiency; rather, differences which may exist were not detected. Also, the large number of factor levels and interactions make interpretation of the results difficult.

Size at Depth. Mean and median lengths of fish ≥180 mm FL captured by trap type, sampling period, depth strata, and lake area (Table 4, Figure 6) suggest each factor might be related to the mean sizes of fish captured, but again, the large number of potential treatment combinations make interpretation difficult. An increase in length over time also was

Table 3.–Catch-per-unit-effort of cutthroat trout ≥180 mm FL for hoop traps (HT), minnow-type traps (MT), and hook-and-line gear (HL), Baranof Lake, 1994.

Sample period	HT fish/trap[a]	MT fish/trap[b]	HL fish/hr[c]
5/10–5/18	3.7	9.6	NA
5/24–6/02	8.2	8.7	1.2
6/07–6/16	8.2	8.6	1.7
Total	6.1	8.7	1.4

[a] Sample sizes by period ranged from 74 to 84 fish.

[b] Sample sizes by period ranged from 60 to 66 fish.

[c] Sample sizes were 22 fish (2nd period) and 15 fish (3rd period).

observed in many but not all areas. Likewise, if time and depth were not considered, mean lengths were greater in Area 3 ($\bar{x} = 243$ mm) than in Area 2 ($\bar{x} = 236$ mm), or Area 1 ($\bar{x} = 230$ mm).

An ANOVA with fork length (n = 3655) as the dependent variable and four treatment factors (time period, area, depth, and gear) indicated that the main effect due to gear was not significant ($F^* = 1.4$, P = 0.23). Also, all interactions involving gear were insignificant at $\alpha = 0.1$, so gear was dropped as a factor and the analysis repeated.

Significant factors in explaining length variation were time ($F^* = 5.2$, P = 0.006), area ($F^* = 21$, P < 0.001), and depth ($F^* = 247$, P < 0.001). Of particular interest was depth; fish were consistently bigger in the 0 to 10-m depth stratum ($\bar{x} = 254$ mm) than in the 10- to 20-m stratum ($\bar{x} = 224$ mm) or in the 20- to 30-m stratum ($\bar{x} = 216$ mm). This trend occurred in nearly all time-area factor cells and was most pronounced in Area 3, near the lake's inlet.

Mean fork length for fish from the 0 to 10-m depth stratum in Area 3 was 265 mm, compared to 231 mm for fish from all other strata combined. Habitat and behavioral traits conceivably account for the spatial distributions observed in these results.

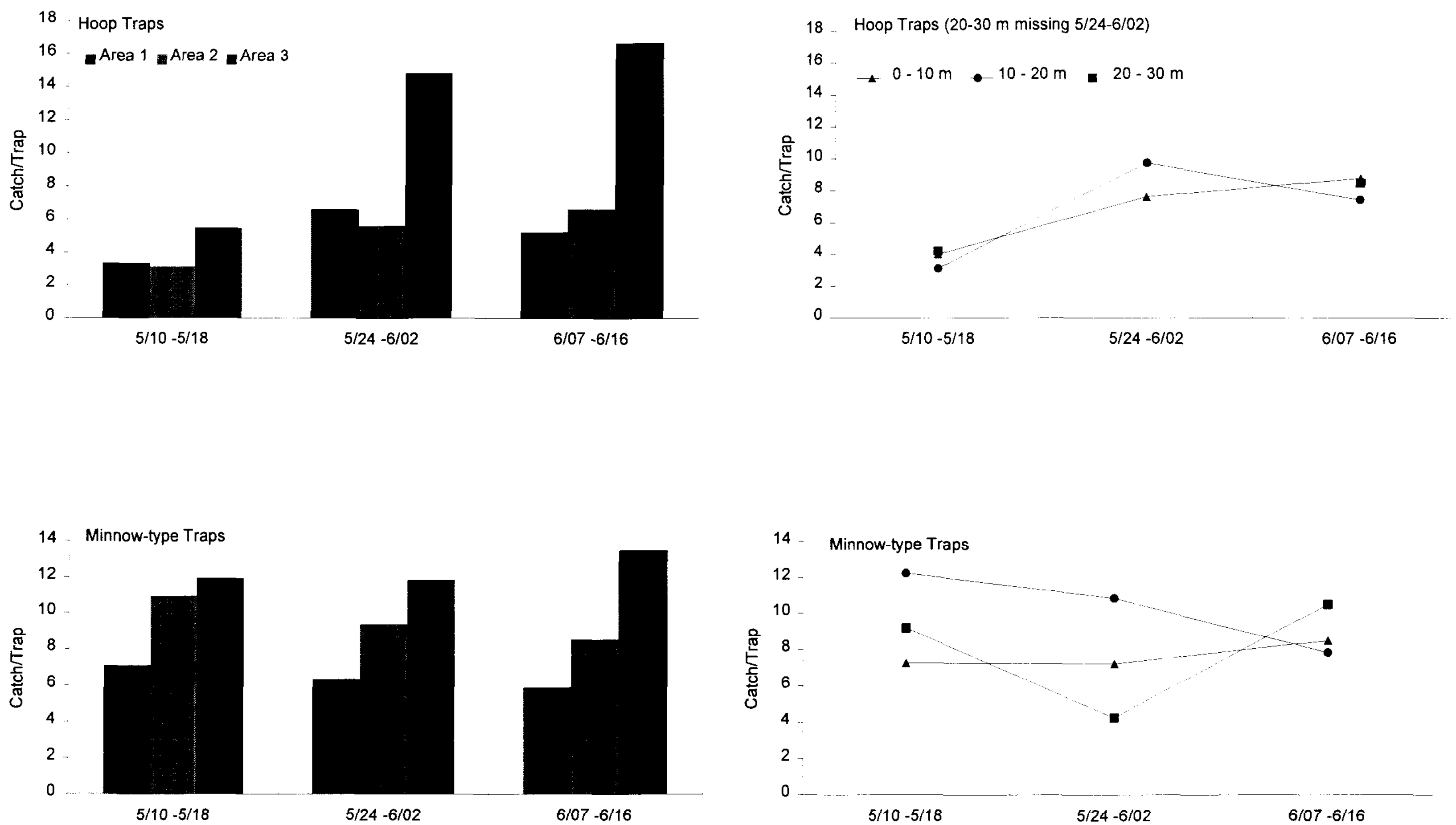
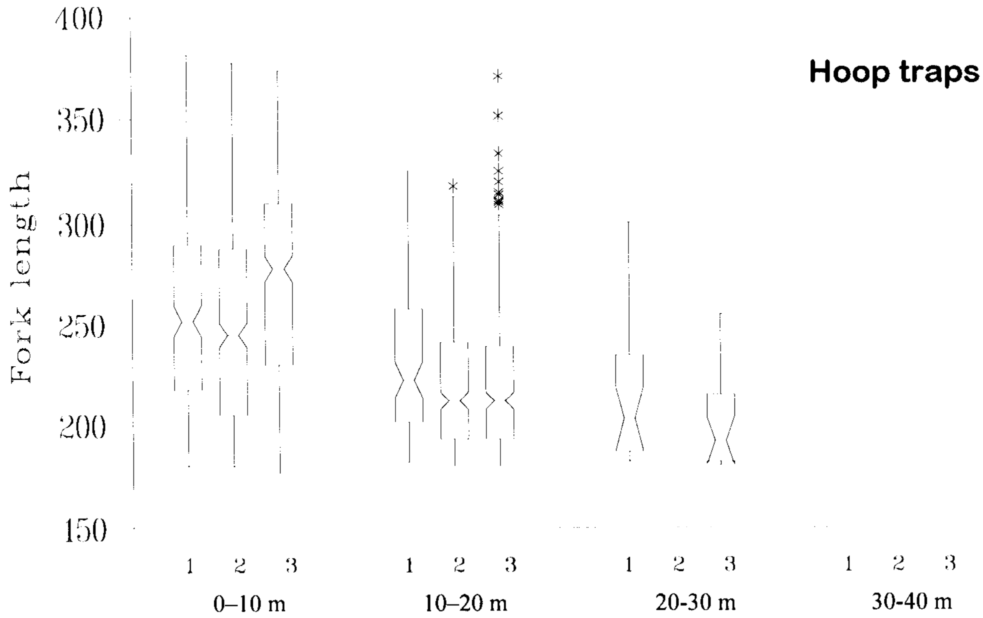


Figure 5.–Catch-per-unit effort by sampling period for cutthroat trout >180 mm FL in hoop traps (above) and in minnow-type traps (below) as a function of the lake area (left) and depths (right) fished, Baranof Lake, 1994.



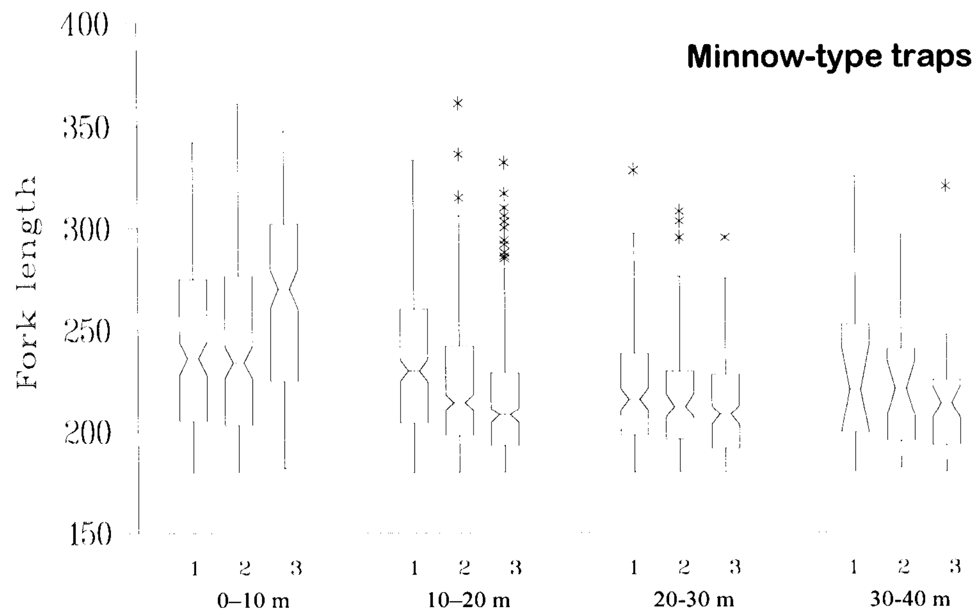


Figure 6.–Box plots of lengths of cutthroat trout ≥180 mm FL captured by trap type, depth interval, and sampling trip, Baranof Lake, 1994, without regard to area sampled. Sampling period 1 was 5/10–5/18, 2 was 5/24–6/02, and 3 was 6/07–6/16. The median length is the horizontal line segment within the box, and the top and bottom of the box are upper and lower quartiles; vertical lines extend to upper and lower adjacent values (the quartiles ± 1.5 x inter-quartile range); values beyond adjacent values are asterisks. The notches estimate 95% confidence intervals for the median when the distributions are normal (some of the data are obviously not normal).

Table 4.–Mean lengths of cutthroat trout ≥180 mm FL captured by gear type, sampling period, lake area, and depth, Baranof Lake, 1994. Sample size leading to each estimated mean length is >20 fish (range 23–208 fish) except as noted in superscripts. Standard errors on each estimated mean length where n>20 fish averaged 4.2 mm (range 2.0–6.3 mm); where n<20 fish, standard errors averaged 11.2 mm.

Period	Lake area[a]	Depth (m) 0-10	10-20	20-30	All
		Hoop Traps			
5/10–5/18	1	221	217	217[3]	219
	2	259	237	218[18]	246
	3	276	252[19]	188[2]	270
5/24–6/02	1	235	226		231
	2	260	218		245
	3	253	219		241
6/07–6/16	1	266	219	200[17]	251
	2	270	219	209[3]	249
	3	271	223		244
All	1	243	222	202	235
	2	264	222	217	247
	3	264	224	188	247
		Minnow-type Traps			
5/10–5/18	1	226	222	212	221
	2	245	232	225	234
	3	259	258	222	252
5/24–6/02	1	223	222	212	222
	2	241	219	220	223
	3	264	235		251
6/07–6/16	1	250	227	224	235
	2	268	213	210	229
	3	297	211	210	221
All	1	232	223	216	226
	2	251	222	218	229
	3	268	230	214	238

[a] Area 1 includes the lake outlet, area 3 the inlet.

LENGTH COMPOSITION

Since length distributions of cutthroat trout captured during the first and second events were dissimilar (KS test, D_{max} = 0.062; P = 0.003; Figure 4), only length data collected during the second event were used to estimate the length composition (Appendix A2). About 92% of the population ≥180 mm FL was <320 mm FL (Table 5), which is just under 350 mm *total* length (i.e., 14 inches), the current minimum size limit for harvest at Baranof Lake.

LENGTH FREQUENCY DISTRIBUTIONS IN 1981 AND 1994

The lengths of 201 fish caught with hook-and-line gear in 1994 were used for the interannual comparison; 15 fish were caught 10 June and 11 June, and 186 fish were caught from 21 June to 26 June. Relatively longer fish ≥180 mm FL were caught with hook-and-line gear in 1981 than in 1994 (Figure 7).

The mean lengths of fish caught with hook-and-line gear during similar temporal periods in 1981 and 1994 were 309 mm FL (SE = 8 mm) and 289 mm FL (SE = 2.5 mm), respectively (Table 6). Variances of the 1981

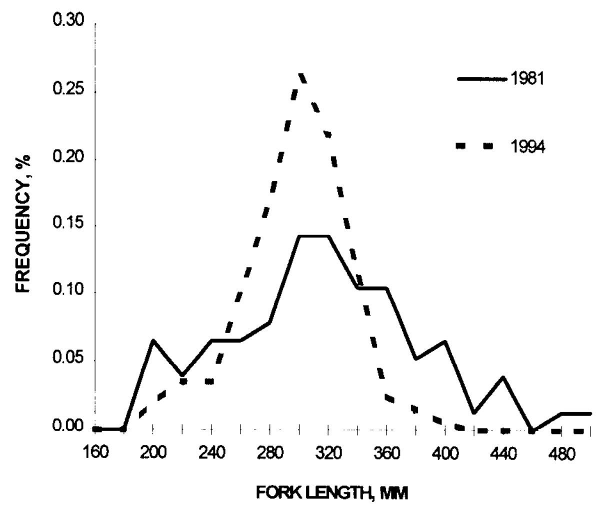


Figure 7.–Length frequency distributions of cutthroat trout ≥180 mm FL caught in Baranof Lake with hook-and-line gear June 8–30, 1981 and June 10–26, 1994.

Table 5.–Length composition statistics for cutthroat trout ≥180 mm FL, Baranof Lake, 1994. The proportion (p_k), abundance (N_k), standard error (SE), and coefficient of variation (CV) for each length class are shown.

Length k, mm FL[a]	n_k	p_k	$SE[p_k]$	$CV[p_k]$	N_k	$SE[N_k]$	$CV[N_k]$
180 – 199	317	.241	.012	.049	2935	258	.088
200 – 219	269	.204	.011	.054	2491	226	.091
220 – 239	176	.134	.009	.070	1630	165	.101
240 – 259	132	.100	.008	.083	1222	134	.110
260 – 279	110	.084	.008	.091	1019	119	.117
300 – 319	112	.085	.008	.090	1037	120	.116
320 – 339	71	.054	.006	.116	657	90	.136
340 – 359	23	.018	.004	.207	213	47	.219
360 – 379	4	.003	.002	.499	37	19	.503
≥380	1	.001	.001	1.000	9	9	1.000
	1316						

[a] Range = 180–470 mm FL, mean = 240 mm FL, SD = 47, CV = 0.198.

and 1994 length samples were not equal ($F = 3.55$, $df = 76, 200$, $P < 0.05$), and mean length of fish sampled in 1981 was significantly greater (Welch's approximate $t = 2.61$, $df = 92$, $P < 0.05$) than that of fish caught in 1994.

DISCUSSION

Baranof Lake is unique in Southeast Alaska in that it contains a monospecific population of cutthroat trout. Given the size (324 ha), depth (maximum depth = 87 m), and low productivity of Baranof Lake (morphoedaphic index = 0.20), we did not expect to discover such a large population of cutthroat trout. The abundance estimate of 12,186 cutthroat trout ≥180 mm FL in Baranof Lake (for an overall density of about 38 fish/ha) ranks it as the most productive large lake we have studied with respect to cutthroat trout in Southeast Alaska.

For comparison, estimated abundance and density (fish ≥180 mm; fish/ha) in other large lakes in Southeast Alaska are, approximately: Florence Lake (9,000; 21), Wilson Lake (7,300; 14), Hasselborg Lake (9,000; 7), and Turner Lake (2,000; 2) (Jones and Harding 1991; Jones et al. 1992; Harding and Jones 1993, 1994; Laker 1994; Harding *In prep*; Hoffman and Marshall 1994). Although the amount of critical habitat in each lake (e.g., littoral areas between, say, 0 and 50 m, length of spawning areas, etc.) is likely to yield better productivity indices, total abundance in Baranof Lake is impressive.

Estimated harvest of cutthroat trout in Baranof Lake 1984 through 1993 (Figure 1) averaged 380 fish yearly and reached 841 fish in 1993—the highest harvest of cutthroat trout reported for any lake in Southeast Alaska (Mills 1985-1994). The harvest of 841 fish implies an exploitation rate of about 7%. Although this rate is probably sustainable, we note for comparison that only about 8% of the population was ≥ 320 mm FL (approximately 350 mm TL) in 1994 (Table 5), and that size-selective harvesting and high exploitation rates can lead to significant declines in relative abundance of older fish in a recreational fishery (Quinn and Szarzi 1994). Indeed, relatively fewer large fish were caught in 1994 than in 1981 (Figure 7).

Baranof Lake was designated a *High-use lake* in 1994 regulations, meaning bag limits are now two fish as in general regulations, while the minimum size limit was increased to 14 inches (350 mm TL) to insure mature fish are allowed to spawn at least once. Since relative abundance of fish >14 inches in length is not high (about 1 in 13 fish), the

Table 6.–Summary of length and catch-per-unit effort (CPUE) data for cutthroat trout ≥180 mm FL collected with hook-and-line gear in nearshore waters ≤10 m, Baranof Lake, 1981 and 1994.

Date	n	Range, mm FL	Mean	SE	CPUE, fish/hour[a]
6/08 – 6/30/81[b]	77	190–499	309	7.6	na
6/10[c] – 6/26/94	201	188–385	289	2.5	3.9
5/27[d] – 6/12/94	36	188–367	299	6.0	1.4
6/21 – 6/26/94	186	190–385	289	2.6	4.4

[a] Complete CPUE data for 1981 unavailable.
[b] Schmidt (1982).
[c] Sampling dates were 6/10–6/12 and 6/21–6/26.
[d] Sampling dates were 5/27–5/29 and 6/10–6/12.

regulation may reduce harvests in the lake. However, unlike other areas of Southeast Alaska, a 1:1 relationship between angler effort and harvests still exists in Baranof Lake (Figure 1). Coupled with the current high abundance, moderate exploitation rates, and size structure of the population (there still are relatively large, if not trophy-sized fish), this also suggests the population has not been overexploited in the past.

The analysis comparing catch rates by gear type, depth, time, and area fished was conducted to improve our knowledge of gear effectiveness and the distribution of fish with depth in Baranof Lake. Unlike the experiment to estimate abundance (which was planned *a priori*) this study was envisioned after fishing was concluded. Trap type did not appear important, and depth did not appear important from 0 to 30 m, perhaps due to the lack of competition for habitat niches by other species in the Baranof Lake. For example, in cutthroat trout lakes where Dolly Varden char *Salvelinus malma* also reside, the char are typically concentrated in relatively deeper water than are the cutthroat trout (Roger Harding, Alaska Department of Fish and Game, Juneau, personal communication).

A central result of the CPUE analysis was the dominating effects of area and time on CPUE, and the need to control for these effects in such comparisons. Also, a high degree of heterogeneity in micro-habitat structure (and distributions of fish) within lake "areas" (i.e., 1–3) is a very plausible reason for the low degree of explanation (r^2 = 0.28) provided by the ANOVA. A design that reduced unexplained variation due to the effects of this heterogeneity might thus improve future analyses.

The analysis comparing lengths of fish caught by gear type, depth, time, and area fished was also conducted to improve our knowledge of gear effectiveness and the distribution of fish by size in the lake. This study was also envisioned after fishing was concluded. Again, gear did not appear a significant factor, but time, area, and depth (and several interactions) were important, and yielded a highly complicated result best clarified in the future, presumably by an efficient experimental design. However, fish were consistently longer in shallow (0-10 m) depth strata, and in Area 3 near the lake's inlet. One reasonable explanation for these observations is that spawning activities were underway during our sampling, leading to the aggregations of the larger trout in shallow water, and near the lake inlet. Based on work at Florence Lake, spawning activity occurs from mid-May through mid-June (Harding *In prep*).

Results from this research demonstrate that variation in fishing effort over time by lake area can strongly influence the number and size of fish collected (e.g., Table 4, Figure 5), making comparisons difficult. Future studies to compare length frequency distributions should thus standardize these (and other) variables carefully.

For example, differences in the time of day that hook-and-line sampling occurred in 1981 and

1994 may also have influenced CPUE and the size of fish captured. In 1994 we noted (Table 6) a large change in hook-and-line catch rates for 27 May to 12 June (CPUE = 1.4 fish/hr, time of day = 1300 h to 1700 h) relative to the period 21 June to 26 June (CPUE = 4.4 fish/hr, time of day = 0600 h to 1200 h), even though angling methods and habitats sampled were fairly similar during each seasonal sampling period.

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LITERATURE CITED

Bernard, D. R., and P. A. Hansen. 1992. Mark-recapture experiments to estimate abundance of fish. Alaska Department of Fish and Game, Special Publication No. 92-4, Anchorage.

Cochran, W. G. 1977. Sampling techniques, third edition. John Wiley and Sons, New York.

Darroch, J. N. 1961. The two-sample capture-recapture census when tagging and samp-ling are stratified. Biometrika 48:241-60.

Efron, B. 1982. The jackknife, the bootstrap, and other resampling plans. Society of Industrial Applied Mathematics Publication No. 38, Philadelphia.

Efron, B. and R. Tibshirani. 1993. An intro-duction to the bootstrap. Monographs on Statistics and Applied Probability No. 57. Chapman and Hall, New York.

Goodman, L. A. 1960. On the exact variance of products. Journal of the American Stat-istical Association 55:708-713.

Harding, R. D. *In prep.* Abundance and length composition of cutthroat trout in Florence, Turner, and Young Lakes, Southeast Alaska, 1994. Alaska Department of Fish and Game, Fishery Data Series.

Harding, R. D. and J. D. Jones. 1994. Abun-dance of cutthroat trout in Florence Lake, Alaska, 1993. Alaska Department of Fish and Game, Fishery Data Series No. 94-35, Anchorage.

Harding, R. D. and J. D. Jones. 1993. Cutthroat trout studies at Florence Lake, Southeast Alaska, 1992. Alaska Department of Fish and Game, Fishery Data Series No. 93-44, Anchorage.

Hoffman, S. H., and R. P. Marshall. 1994. Abundance and size of cutthroat trout in Wilson Lake, 1993. Alaska Department of Fish and Game, Fishery Data Series 94-48, Anchorage.

Jones, J. D. and R. Harding. 1991. Cutthroat trout studies: Turner/Florence Lakes, Alaska during 1990. Alaska Department of Fish and Game, Fishery Data Series No. 91-53, Juneau.

Jones, J. D., R. P. Marshall, and R. Harding. 1992. Cutthroat trout studies at Florence and Hasselborg lakes, Southeast Alaska, 1991. Alaska Department of Fish and Game, Fishery Data Series No. 92-43, Juneau.

Laker, M. W. 1994. Evaluation of models and assumptions for closed population abun-dance estimators from cutthroat trout mark-recapture data. M.S. Thesis. University of Alaska, Fairbanks, Alaska.

Milliken, G. A. and D. E. Johnson. 1984. Analysis of messy data, volume 1: designed experiments. Wadsworth, Inc. Belmont, California.

Mills, M. J. 1979. Alaska statewide sport fish harvest studies. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress, 1978-1979, Project F-9-11, 20 (SW-I-A), Juneau.

Mills, M. J. 1980. Alaska statewide sport fish harvest studies. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress, 1979-1980, Project F-9-12, 21 (SW-I-A), Juneau.

Mills, M. J. 1981a. Alaska statewide sport fish har-vest studies (1979). Alaska Department of Fish and Game, Federal Aid in Fish Restor-ation, Annual Report of Progress, 1980-1981, Project F-9-13, 22 (SW-1-A), Juneau.

LITERATURE CITED (Continued)

Mills, M. J. 1981b. Alaska statewide sport fish harvest studies (1980). Alaska Department of Fish and Game, Federal Aid in Fish Restor-ation, Annual Report of Progress, 1980-1981, Project F-9-13, 22 (SW-1-A), Juneau.

Mills, M. J. 1982. Alaska statewide sport fish harvest studies (1981). Alaska Department of Fish and Game, Federal Aid in Fish Restoration, Annual Report of Progress, 1981-1982, Project F-9-14, 23 (SW-I-A), Juneau.

Mills, M. J. 1983. Alaska statewide sport fish harvest studies (1982). Alaska Department of Fish and Game, Federal Aid in Fish Restoration, Annual Report of Progress, 1982-1983, Project F-9-15, 24 (SW-I-A), Juneau.

Mills, M. J. 1984. Alaska statewide sport fish harvest studies (1983). Alaska Department of Fish and Game, Federal Aid in Fish Restoration, Annual Report of Progress, 1983-1984, Project F-9-16, 25 (SW-I-A), Juneau.

Mills, M. J. 1985. Alaska statewide sport fish harvest studies (1984). Alaska Department of Fish and Game, Federal Aid in Fish Restoration, Annual Report of Progress, 1984-1985, Project F-9-17, 26 (SW-I-A), Juneau.

Mills, M. J. 1986. Alaska Department of Fish and Game, Federal Aid in Fish Restoration, Annual Report of Progress, 1985-1986, Project F-10-1, 27 (RT-2), Juneau.

Mills, M. J. 1987. Alaska statewide sport fish harvest report (1986). Alaska Department of Fish and Game, Fishery Data Series No. 2, Anchorage.

Mills, M. J. 1988. Alaska statewide sport fish harvest report (1987). Alaska Department of Fish and Game, Fishery Data Series No.52, Anchorage.

Mills, M. J. 1989. Alaska statewide sport fish harvest report (1988). Alaska Department of Fish and Game, Fishery Data Series No. 122, Anchorage.

Mills, M. J. 1990. Harvest and participation in Alaska sport fisheries during 1989. Alaska Depart-ment of Fish and Game, Fishery Data Series No. 190-44, Anchorage.

Mills, M. J. 1991. Harvest, catch, and participation in Alaska sport fisheries during 1990. Alaska Department of Fish and Game, Fishery Data Series No. 91-58, Anchorage.

Mills, M. J. 1992. Harvest, catch, and participation in Alaska sport fisheries during 1991. Alaska Department of Fish and Game, Fishery Data Series No. 92-40, Anchorage.

Mills, M. J. 1993. Harvest, catch, and participation in Alaska sport fisheries during 1992. Alaska Department of Fish and Game, Fishery Data Series No. 93-42, Anchorage.

Mills, M. J. 1994. Harvest, catch, and participation in Alaska sport fisheries during 1993. Alaska Department of Fish and Game, Fishery Data Series No. 94-28, Anchorage.

Quinn, T. J., II, and N. J. Szarzi. 1994. Determination of sustained yield in Alaska's recreational fisheries. Pages 61-84 *in* G. Kruse, D. M. Eggers, R. J. Marasco, C. Pautzke, and T. J. Quinn (editors). 1993. Proceeding of the international symposium on management strategies for exploited fish populations. Alaska Sea Grant College Program Report No. 93-02, University of Alaska Fairbanks.

SAS Institute. 1989. SAS/STAT user's guide, version 6, fourth edition, volume 2. SAS Institute. Cary, North Carolina.

Schmidt, A. E. 1982. Collection and inter-pretation of information needed to solve special management problems. Alaska Department of Fish and Game, Federal Aid in Fish Restoration, Annual Report of Pro-gress,1981-1982, Project F-9-14, 23(G-I-R).

Seber, G. A. F. 1982. The estimation of animal abundance. Charles Griffin and Company, London.

Sprague, A.J. 1921. The Alaska salmon and their practical propogation. [Printed by] Alaska Daily Empire. Juneau [Pamphlet].

Zar, J. H. 1984. Biostatistical analysis, second edition. Prentice-Hall, Inc., Englewood Cliffs, New Jersey.

APPENDIX A

Appendix A1.–History of *general regulations* affecting trout, grayling, and char fisheries in Southeast Alaska.

Years	Daily limit	Additional restrictions	Possession limit
1940s–1959	20	3 over 20 in.	2 daily bag limits
1960–1974	15	3 over 20 in.	2 daily bag limits
1975–1979	10	2 over 20 in.	2 daily bag limits
1980–1982	4	1 over 16 in.	1 daily bag limit
1983–1984	4	1 over 16 in.	2 daily bag limits
1985–1993	5	1 over 16 in.	2 daily bag limits
1994–present [a]	2	12 in. minimum 22 in. maximum bait prohibited except Sep 15–Nov 15	1 daily bag limit

[a] Regulations for *High-use lakes* (Baranof and 22 other lakes) differ as follows: additional restrictions are instead a 14-in. minimum size limit, and bait is prohibited year-round.

Appendix A2.–Detection of size-selective sampling. From Bernard and Hansen (1992).

Result of hypothesis test on lengths of fish CAPTURED during the first event and RECAPTURED during the second event	**Result** of hypothesis test on lengths of fish CAPTURED during the first event and CAPTURED during the second event
Case I: **Accept H_0**	**Accept H_0**
There is no size-selectivity during either sampling event.	
Case II: **Accept H_0**	**Reject H_0**
There is no size-selectivity during the second sampling event but there is during the first.	
Case III: **Reject H_0**	**Accept H_0**
There is size-selectivity during both sampling events.	
Case IV: **Reject H_0**	**Reject H_0**
There is size-selectivity during the second sampling event; the status of size-selectivity during the first event is unknown.	

Case I: Calculate one unstratified abundance estimate, and pool lengths, sexes, and ages from both sampling events to improve precision of proportions in estimates of composition.

Case II: Calculate one unstratified abundance estimate, and only use lengths, sexes, and ages from the second sampling event to estimate proportions in compositions.

Case III: Completely stratify both sampling events, and estimate abundance for each stratum. Add abundance estimates across strata to get a single estimate for the population. Pool lengths, ages, and sexes from both sampling events to improve precision of proportions in estimates of composition, and apply formulae to correct for size bias to the pooled data.

Case IV: Completely stratify both sampling events and estimate abundance for each stratum. Add abundance estimates across strata to get a single estimate for the population. Use lengths, ages, and sexes from only the second sampling event to estimate proportions in compositions, and apply formulae to correct for size bias to the data from the second event.

Whenever the results of the hypothesis tests indicate that there has been size-selective sampling (Case III or IV), there is still a chance that the bias in estimates of abundance from this phenomenon is negligible. Produce a second estimate of abundance by not stratifying the data as recommended above. If the two estimates (stratified and unbiased vs. biased and unstratified) are dissimilar, the bias is meaningful, the stratified estimate should be used, and data on compositions should be analyzed as described above for Cases III or IV. However, if the two estimates of abundance are similar, the bias is negligible in the UNSTRATIFIED estimate, and analysis can proceed as if there were no size-selective sampling during the second event (Cases I or II).

Appendix A3.–Data files used in preparation of this report.

BARANOF.WPF	FILE DESCRIPTIONS FOR DATA FILES USED TO PRODUCE ESTIMATES. THIS DOCUMENT SUBMITTED WITH FDS REPORT
BARDATA.WPF	DESCRIPTION OF VARIABLES IN DATA FILES LISTED IN BARANOF.WPF. THIS DOCUMENT SUBMITTED WITH FDS REPORT
BRNGEAR.WQ!	EDITED GEAR DATA (*.WQ! FILES ARE QUATTRO-PRO FILES)
BRNHL.WQ!	1981/1994 HL SAMPLES. INCLUDES VARIANCE RATIO TEST FOR VARIANCE COMPARISON; WELCH'S APPROXIMATE T-TEST COMPARISON OF MEAN LENGTH; GRAPHICAL COMPARISON OF LENGTH FREQUENCY DISTRIBUTIONS.
BRNCATCH.WQ!	CATCH STATISTICS. INCLUDES CPUE CALCULATIONS; T-TEST COMPARISON OF MEAN CATCH/TRAP FOR HT AND LT; DAILY CATCH SUMMARY; CPUE & CATCH @ DEPTH GRAPHS.
BRNLGTD.WQ!	LENGTH BY GEAR TYPE AS FUNCTION OF DEPTH AND GEAR. INCLUDES GRAPHS FOR LENGTH OVER TIME AT DEPTH BY GEAR TYPE AND CUMULATIVE DISTRIBUTION PLOTS OF LENGTH OVER TIME BY GEAR TYPE
BRNMR12.WQ!	MR DATA, TRIPS 1,2. EDITED SPREADSHEET
BRNMR3.WQ!	MR DATA, TRIP 3. EDITED SPREADSHEET
BFGRAPHS.XLS	CPUE AND DEPTH DATA/FDS-FIGURE PLOTS
PERALL.DAT	INPUT DATA FOR CPUE ANOVA IN SAS
GEARALL.SAS	SAS PROGRAM FOR CPUE ANOVA IN SAS
ALLLENGTH.DAT	INPUT DATA FOR LENGTH ANOVA IN SAS
BOX2.CMD	SYSTAT COMMAND PLOT FILE, FOR LENGTH BOXPLOTS
PER1HP.DAT	INPUT DATA FOR BOX2.CMD (ALSO A *.SYS DATA FILE)
PER2HP.DAT	WHERE PERx=PERIOD, AND HP=HOOP OR LG=MINNOW TRAP
PER3HP.DAT	DITTO
PER1LG.DAT	DITTO
PER2LG.DAT	DITTO
PER3LG.DAT	DITTO