

Fishery Data Series No. 95-25

**Harvest Estimate for the Gastineau Hatchery
Roadside Sport Fishery in Juneau, Alaska
during 1994**

by

Dean E. Beers

October 1995

Alaska Department of Fish and Game

Division of Sport Fish



Symbols and Abbreviations

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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			base of natural logarithm	e
gram	g	All commonly accepted professional titles.	e.g., Dr., Ph.D., R.N., etc.	catch per unit effort	CPUE
hectare	ha	and	&	coefficient of variation	CV
kilogram	kg	at	@	common test statistics	F, t, χ^2 , etc.
kilometer	km	Compass directions:		confidence interval	C.I.
liter	L			correlation coefficient	R (multiple)
meter	m		east E	correlation coefficient	r (simple)
metric ton	mt		north N	covariance	cov
milliliter	ml		south S	degree (angular or temperature)	°
millimeter	mm		west W	degrees of freedom	df
		Copyright	©	divided by	÷ or / (in equations)
		Corporate suffixes:		equals	=
		Company	Co.	expected value	E
		Corporation	Corp.	fork length	FL
		Incorporated	Inc.	greater than	>
		Limited	Ltd.	greater than or equal to	≥
		et alii (and other people)	et al.	harvest per unit effort	HPUE
		et cetera (and so forth)	etc.	less than	<
		exempli gratia (for example)	e.g.,	less than or equal to	≤
		id est (that is)	i.e.,	logarithm (natural)	ln
		latitude or longitude	lat. or long.	logarithm (base 10)	log
		monetary symbols (U.S.)	\$, ¢	logarithm (specify base)	log ₂ , etc.
		months (tables and figures): first three letters	Jan.,...,Dec	minute (angular)	'
		number (before a number)	# (e.g., #10)	multiplied by	x
		pounds (after a number)	# (e.g., 10#)	not significant	NS
		registered trademark	®	null hypothesis	H ₀
		trademark	™	percent	%
		United States (adjective)	U.S.	probability	P
		United States of America (noun)	USA	probability of a type I error (rejection of the null hypothesis when true)	α
		U.S. state and District of Columbia abbreviations	use two-letter abbreviations (e.g., AK, DC)	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
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				

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by

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ABSTRACT

Angler effort and harvests of chinook salmon *Oncorhynchus tshawytscha*, coho salmon *Oncorhynchus kisutch*, chum salmon *Oncorhynchus keta*, and pink salmon *Oncorhynchus gorbuscha* were estimated at Gastineau Hatchery from 4 July to 16 October 1994. An estimated 24,192 (SE = 905) angler-hours were expended to harvest a total of 70 (SE = 17) large chinook salmon at least 28 inches (71 cm) in total length, 48 (SE = 13) small chinook salmon (< 28 inches in length), 3,509 (SE = 317) large coho salmon at least 16 inches (41 cm) in length, 11 (SE = 8) jack coho salmon (< 16 inches in length), 593 (SE = 66) chum salmon, and 9,197 (SE = 560) pink salmon. An estimated 2.3% (82 fish) of the coho salmon harvest were of wild origin.

Key words: Creel survey, roadside, angler effort and harvest, sport fishery, hatchery, chinook salmon, *Oncorhynchus tshawytscha*, coho salmon, *Oncorhynchus kisutch*, chum salmon, *Oncorhynchus keta*, pink salmon, *Oncorhynchus gorbuscha*, Juneau, Gastineau Hatchery, Southeast Alaska.

INTRODUCTION

Roadside sport fisheries in marine waters near Juneau offer unique fishing opportunities for Alaska residents as well as tourists visiting the area. In 1993, anglers spent an estimated 18,259 angler-days of shoreline saltwater fishing effort along the Juneau roadside (Mills 1994). This represents 29% of the total marine shoreline effort (62,128 angler-days) in Southeast Alaska and 16% of total marine effort (117,546 angler-days) in the entire Juneau area during 1993.

Demand for roadside fishing opportunities in the Juneau area is very high: about 39% of the population of Southeast Alaska resided in the Juneau borough in 1990 according to the U.S. Census Bureau, and several hundred thousand tourists visit the area annually.

Harvest data covering the entire Juneau road system fishery are obtained by postal surveys, but we also conducted a creel survey to obtain more timely and detailed information on the sport fishery for terminal runs of coho, chum, pink, and chinook salmon to Gastineau Hatchery (Figure 1).

The Gastineau Hatchery is owned and operated by Douglas Island Pink and Chum, Inc., a private non-profit corporation. The sport fishery at the hatchery is primarily a pink and chum fishery in July and August, and a coho salmon fishery in September and October, although smaller returns of chinook

salmon are also targeted. The fishery is located about 3 miles from downtown Juneau, and receives high use from July through September.

In 1991, the hatchery, in cooperation with the Alaska Department of Fish and Game (ADF&G) through the Sportfish Partnership Program, installed a floating dock to improve access for roadside anglers. Increases in salmon enhancement at Gastineau Hatchery and the nearby Sheep Creek hatchery have been extensive in recent years (Table 1), particularly for chinook and coho salmon, the two species most preferred by anglers in Southeast Alaska (Jones & Stokes 1991).

In 1993, ADF&G staff helped the Gastineau Hatchery develop an onsite creel survey program to estimate sport harvests at the site. Hatchery personnel conducted the survey, while ADF&G analyzed the data to estimate harvest. An estimated 118 chinook salmon (SE = 34), 7,057 coho salmon (SE = 520), 1,515 chum salmon (SE = 310), and 713 pink salmon (SE = 95) were harvested (Beers and Marshall 1994).

Sport harvests of chinook salmon in Southeast Alaska are limited by a management plan which also requires documentation of contributions of hatchery chinook salmon stocks. In 1994, ADF&G entered into an agreement with the Gastineau Hatchery to rear chinook salmon for release at several sites in the Juneau area, including the hatchery itself. Data gathered by the creel

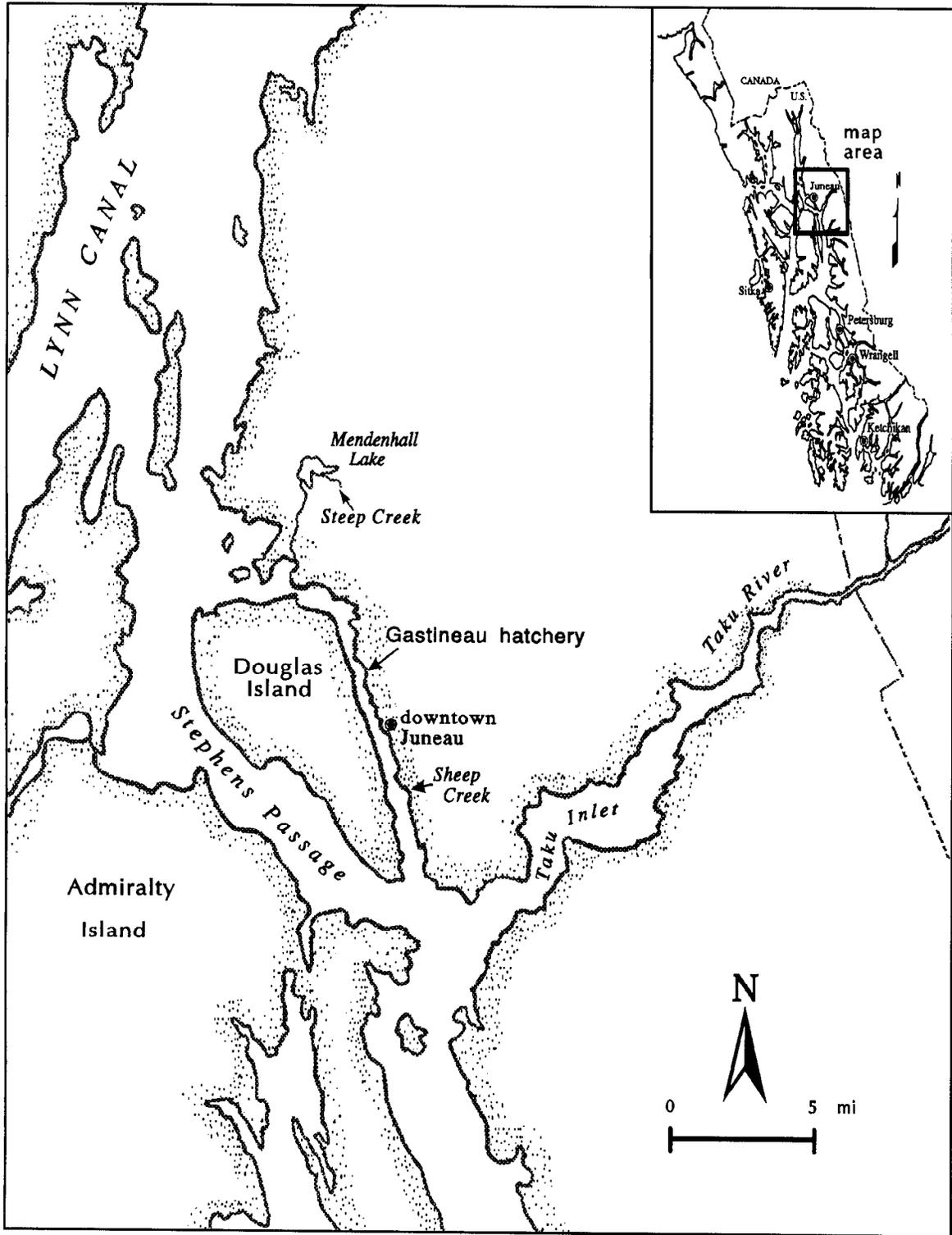


Figure 1.—Location of the Gastineau Hatchery roadside sport fishery, northern Southeast Alaska.

Table 1.— Summary of hatchery-reared salmon smolt releases at Sheep Creek and Gastineau Hatchery since 1990. All fish were reared at Gastineau or Sheep Creek hatcheries except as noted.

Year	Release site	Pink	Chum	Chinook	Coho
1990	Sheep Creek	17,962,133	3,073,538	127,155 ^a	533,233
	Gastineau Hatchery	9,669,565	11,586,928	101,462 ^a	546,255
1991	Sheep Creek	16,258,086	37,874,036	100,543 ^a	505,287
	Gastineau Hatchery	14,846,296	11,326,584	43,595	507,819
1992	Sheep Creek	31,636,411	26,585,790	0	582,739
	Gastineau Hatchery	15,420,079	11,959,067	191,765	392,508
1993	Sheep Creek	32,660,175	27,002,939	0	562,150
	Gastineau Hatchery	15,768,972	11,891,265	207,536	477,999
1994	Sheep Creek	0	14,635,458	0	563,357
	Gastineau Hatchery	8,663,398	5,869,938	256,916	380,282
1995	Sheep Creek	0	44,673,729	28,529	611,362
	Gastineau Hatchery	8,539,515	11,825,076	158,681	422,482

^a Reared at Snettisham Hatchery.

survey will provide information to properly evaluate the hatchery as a release site and terminal harvest area.

In 1994, hatchery personnel repeated the survey and ADF&G staff again provided assistance in technical planning and analysis to make the survey as valid as possible, given personnel and budget constraints. In addition, the department was interested in finding out if any significant numbers of wild coho salmon were harvested with the hatchery stocks at the site.

OBJECTIVES

Objectives of the 1994 Gastineau Hatchery roadside creel survey were::

1. Estimate angler effort and harvests for pink, chum, coho and chinook salmon from the floating dock and beach adjacent to the hatchery from 4 July through 16 October, such that estimates are within these specified true values 95% of the time: effort $\pm 10\%$, coho harvest $\pm 15\%$; pink and chum harvest $\pm 30\%$, and chinook harvest $\pm 38\%$.

2. Estimate the proportion of wild coho salmon harvested from the floating dock and the beach adjacent to the hatchery from 4 July through 16 October, such that an estimate of $\geq 5\%$ would be within $\pm 25\%$ of the true value 95% of the time.

METHODS

EFFORT AND HARVEST ESTIMATES

The survey site consists of a beach and a 100-foot floating dock and access ramp. The dock and ramp are about 150 feet from the end of the fish pass at Gastineau Hatchery. Adjacent to the dock (on the side opposite the hatchery building) is the beach, which extends approximately 200 yards to a barge landing. The area is discrete in shape and size and easily surveyed.

A stratified, two-stage roving creel survey based on expansion of sample ratios was used to estimate fishing effort and harvest from 4 July to 16 October 1994. Days were primary sampling units, and anglers within days were secondary sampling units. Two locations (dock and beach), 15 weekly (7-day) seasonal strata, and weekday

versus weekend-holiday stratifications were maintained¹. There were thus 60 discrete strata.

The sampling day was defined as beginning at early civil twilight or 0600 (whichever was later) and ending at late civil twilight as computed for the midday of the sample week, the period when most angling at this site was expected to occur. During each sampling day, anglers were counted six times. The first 'count' in each sampling day occurred, according to a random selection, at the mid-point of the first, second, or last third of the first one-sixth of each sampling day. Subsequent 'counts' were conducted at intervals equal to one-sixth the length of each sampling day. These counts were considered instantaneous and reflected fishing effort at the time of the count.

Effort was estimated by multiplying the average angler count for the day for each location by the hours available for sampling each day. The harvest per unit effort (HPUE) for each fish species was estimated from completed-trip interviews. The estimated harvest was obtained from the product of the effort and HPUE estimates.

When not counting anglers, the technician interviewed anglers completing their trips, without regard to angler success (angler harvest). As many completed-trip interviews as possible were obtained during each day selected for sampling. Since hatchery technicians had other assigned duties, interviews were not conducted at some times each day; however, sampling of anglers exiting the survey area was expected to occur roughly in proportion to the number exiting the site at different times of the day. The site where interviews were started each day was selected at random and remained the same for the day.

Angler effort, estimates of total harvest, associated variances and standard errors were calculated according to the procedures outlined below.

¹ Weekdays = Mondays–Fridays. Weekend/holidays = Saturdays, Sundays, Independence Day (4 July), and Labor Day (5 September).

The harvest in each stratum was estimated by

$$\hat{H}_h = D_h \bar{H}_h \quad (1)$$

$$\bar{H}_h = \frac{\sum_{i=1}^{d_h} \hat{H}_{hi}}{d_h} \quad (2)$$

where \hat{H}_{hi} is the estimated harvest in day i stratum h , d_h is the number of days sampled in stratum h , and D_h is the total number of days in stratum h .

The variance of the harvest in each stratum was estimated by

$$V[\hat{H}_h] = (1 - f_{1h}) D_h^2 \frac{\sum_{i=1}^{d_h} (\hat{H}_{hi} - \bar{H}_h)^2}{d_h(d_h - 1)} + f_{1h} \sum_{i=1}^{d_h} \hat{V}[\hat{H}_{hi}] \quad (3)$$

where $f_{ih} = d_h / D_h$.

The harvest for each sampling period was estimated by

$$\hat{H}_{hi} = \hat{E}_{hi} \overline{\text{HPUE}}_{hi}^* \quad (4)$$

where $\overline{\text{HPUE}}_{hi}^*$ is the jackknife estimate of mean HPUE during stratum h day i , and E_{hi} is the fishing effort in angler-hours during the same time.

Angler effort in each period was estimated by

$$\hat{E}_{hi} = H_h \bar{x}_{hi} \quad (5)$$

where H_h is the number of hours in a sampling day and \bar{x}_{hi} is the average number of anglers counted in day i stratum h . If $\bar{x}_{hi} = 0$ and anglers were interviewed, then \hat{H}_{hi} in (4) was set equal to the observed harvest. In contrast, if $\bar{x}_{hi} > 0$ and no

anglers were interviewed, then \overline{HPUE}_{hi}^* in (4) was set equal to the mean \overline{HPUE}_{hi}^* for the stratum.

The variance of E_{hi} was estimated by

$$V[\hat{E}_{hi}] = H_h^2 \frac{\sum_{j=2}^{r_h} (x_{hij} - x_{hi(j-1)})^2}{2 r_h (r_h - 1)} \quad (6)$$

where r_{hi} is the number of times anglers were counted in day i .

The variance of the harvest H_{hij} in a period was estimated by

$$V[\hat{H}_{hi}] = V[\hat{E}_{hi}] \overline{HPUE}_{hi}^{*2} + V[\overline{HPUE}_{hi}^*] \hat{E}_{hi}^2 - V[\hat{E}_{hi}] V[\overline{HPUE}_{hi}^*] \quad (7)$$

The \overline{HPUE}_{hij}^* and its variance were calculated according to procedures in Efron (1982). The inherent correctable bias of m_{hi}^2 (the number of interviews in a sampling period) of jackknife estimates were removed according to the procedure in Efron (1982, p. 6).

Harvest and effort (and their variances) for the entire season were the sums of the estimates for each strata.

ESTIMATION OF WILD COHO SALMON CONTRIBUTIONS

The contribution of wild coho salmon harvested at the site was based on the age composition of the fish sampled in the sport fishery. Age composition was determined from scale pattern analysis (Moser 1969). Fish were sampled opportunistically during the creel survey to avoid missing interviews, but fish were sampled approximately in proportion to the number harvested. Freshwater ages estimated from the scale pattern analysis were used to determine if the sampled fish was age 1.+ or >1.+ fish. Age composition estimates were calculated from sample data using procedures outlined in Cochran (1977).

All coho salmon smolt released at Gastineau Hatchery are age 1.+ fish; thus any age >1.+ fish (many wild fish are age 2.+) are assumed to be wild fish. Also, a portion of age 1.+ coho salmon harvested at the site could originate from wild stocks. To estimate the proportion of coho salmon likely to be age 1.+ wild fish at Gastineau Hatchery, age composition data were collected in 1994 from two nearby wild populations in the Taku River and Steep Creek (Figure 1).

The proportion of age >1.+ wild fish in the Taku River/Steep Creek sample was estimated by

$$\hat{p} = \frac{s^{>1.}}{S} \quad (8)$$

The total number of wild fish sampled at Gastineau Hatchery was estimated by

$$\hat{n}_w = \frac{n^{>1.}}{\hat{p}} \quad (9)$$

where $n^{>1.}$ is the number of age >1.+ fish sampled. The variance was estimated by a formula for the product of two independent random variables (Goodman 1960):

$$(\hat{n}_w) = V(n^{>1.}) \left(\frac{1}{p}\right)^2 + V\left(\frac{1}{p}\right) (n^{>1.})^2 - V(n^{>1.}) V\left(\frac{1}{p}\right) \quad (10)$$

Because the number of age >1.+ fish in the hatchery sample ($n^{>1.}$) was a rare event, it was assumed to be a Poisson random variable and therefore $V(n^{>1.}) = n^{>1.}$. The variance of $\frac{1}{p}$ was estimated using a Monte Carlo simulation where the distribution of p was assumed to follow the binomial distribution $bin(s^{>1.}; S, \hat{p})$.

The total harvest of wild coho salmon at Gastineau Hatchery was estimated by

$$\hat{H}_w = \hat{n}_w \left[\frac{\hat{H}_r}{N} \right] \quad (11)$$

where \hat{H}_T is the harvest estimated in the creel survey, and N is number of fish sampled for age at the hatchery. The variance of the estimated total harvest of wild coho salmon was estimated using the formula for a product of a constant ($\frac{1}{N}$) times two independent random variables:

$$(\hat{H}_w) = \left(\frac{1}{N}\right)^2 \begin{bmatrix} V(\hat{n}_w)\hat{H}_T^2 + V(\hat{H}_T)\hat{n}_w^2 \\ -V(\hat{n}_w)V(\hat{H}_T) \end{bmatrix} \quad (12)$$

Confidence intervals for \hat{H}_w were estimated using a Monte Carlo simulation ($n = 1000$) assuming p follows the binomial distribution (above), n_w was the quotient of the Poisson variable $n^{>1,+}$ (taking on values >0) and the binomial variable p , and \hat{H}_T follows the normal distribution $N[H_T, V(H_T)]$.

RESULTS

Sampling information, including angler counts and numbers of completed interviews, is presented in Appendix A1.

An estimated 3,509 (SE = 317, RP = 18%) large coho at least 16 inches (41 cm) in length, 593 (SE = 66, RP = 22%) chum, 9,197 (SE = 560, RP = 12%) pink, and 70 (SE = 17, RP = 49%) chinook salmon were harvested at Gastineau Hatchery from 4 July to 9 October (Table 2). The study was terminated a week early because of low numbers of anglers (R. Focht, Gastineau Hatchery manager, Juneau, personal communication).

Effort for all species totaled 24,192 angler-hours (SE = 905, RP = 8%). The highest levels of effort were expended during the pink salmon fishery in late July and during the coho salmon fishery, which peaked in early September. In addition, 48 (SE = 13) small chinook less than 28 inches (71 cm) and 11 (SE = 8) jack coho less than 16 inches (41 cm) in length were harvested.

Three coho salmon were determined to be age 2.+ (wild origin) in the sample of 230 sets of scales taken in the sport fishery. An estimated 2.4 (SE = 3.1) fish in the sample were age 1.+ wild fish.

Thus, an estimated 82 (SE = 47, RP = 113%) coho salmon—about 2% of the total coho salmon harvest at Gastineau Hatchery—were of wild stock origin. Ninety-five percent confidence interval for the estimate of 82 are (25, 190).

Computer files listed in Appendix A2 contain raw data along with associated SAS code and datasets used during the analysis of data presented.

DISCUSSION

Effort (angler-hours) was substantially higher in 1994 than in 1993 (Beers and Marshall 1994). During each of the first eleven weeks of the study, higher levels of effort (angler-hours) were recorded than in the same weeks in 1993. A strong pink salmon return from mid-July to mid-August attracted large numbers of anglers to the site. Despite the large amount of effort, harvests of coho and chum salmon were below 1993 levels, while estimated chinook salmon harvests were the same.

Although the sampling design was similar to that used in 1993 (Beers and Marshall 1994), analysis of interview data collected at the beach location revealed inadequate amounts of sampling and probable nonrandom sampling techniques used by technicians. Thus, interview data (HPUE) collected at the beach site were not used in the analysis; HPUEs from the dock portion of the survey were applied to beach angler counts to estimate total harvest. Removing the beach site location stratum reduced the number of discrete strata by half to 30; in addition, the study concluded a week early because of a lack of effort and harvest, which further reduced the number of discrete strata to a total of 28. These adjustments to the analysis reduced the precision of the coho estimates below the $\pm 15\%$ objective to $\pm 18\%$ and may negatively bias the estimate, since HPUEs on the beach are likely higher because snagging is legal for a large portion of the beach. Additional negative bias occurred because anglers fished outside the sampling periods, primarily at night during the peak of the run.

The contribution of wild stocks to the coho salmon harvest was not considered unusual, because these

Table 2.—Summary of estimated angler weekly effort and harvest of large chinook, large coho, chum, and pink salmon at the Gastineau Hatchery roadside fishery in 1994.

Weekly period	Angler-hours	Large coho harvest		Large chinook harvest		Chum harvest		Pink harvest		
		Var ^a	harvest	Var ^a	harvest	Var ^a	harvest	Var ^a	harvest	
7/04-7/10	1,756	170,143	0	0	19	86	29	88	257	5,306
7/11-7/17	2,162	31,064	3	7	19	72	77	451	1,204	26,053
7/18-7/24	2,466	75,847	0	0	3	9	101	436	1,717	35,622
7/25-7/31	2,273	95,501	0	0	0	0	161	1,589	1,820	144,246
8/01-8/07	2,360	16,905	0	0	6	25	166	1,249	1,750	42,209
8/08-8/14	1,670	20,370	17	164	4	14	10	48	971	22,290
8/15-8/21	1,344	39,312	66	878	5	23	0	0	833	26,946
8/22-8/28	2,139	41,227	305	3,066	4	14	49	485	428	8,769
8/29-9/04	1,738	84,686	1,036	42,356	0	0	0	0	75	569
9/05-9/11	2,472	48,383	927	28,064	0	0	0	0	142	1,682
9/12-9/18	1,680	26,117	709	14,174	10	48	0	0	0	0
9/19-9/25	1,106	159,572	159	3,667	0	0	0	0	0	0
9/26-10/02	802	4,650	159	934	0	0	0	0	0	0
10/03-10/09	224	4,838	128	6,904	0	0	0	0	0	0
TOTALS	24,192	818,615	3,509	100,214	70	291	593	4,346	9,197	313,692

^a Variance of effort or harvest estimate.

stocks are likely passing through the area as the fishery occurs. We believe the interception of 82 (25, 190) wild coho salmon in 1994 had minimal impact on nearby wild stocks.

CONCLUSIONS AND RECOMMENDATIONS

Although effort and harvest are not estimated for other Juneau roadside fisheries individually, the Gastineau Hatchery fishery is thought to receive the highest level of use of any roadside sport fishery in the Juneau area. It plays an important role in providing fishing opportunities for urban anglers and tourists who may not have time or economic resources to participate in remote roadside or marine boat fisheries. Also, pressure on local wild stocks of salmon in the Juneau roadside system is likely lessened because of the opportunity provided at the hatchery. Documentation of hatchery contributions to the sport fishery is an important tool and can be used to supplement Juneau area harvest and catch information provided by the Statewide Harvest Survey.

Major changes in roadside harvest patterns in the Juneau area from wild stocks to hatchery fish have occurred in recent years, particularly for chinook and coho salmon. The 1994 survey at the hatchery shows that roadside anglers benefited greatly from enhancement efforts at Gastineau Hatchery.

The success and continuation of the Gastineau Hatchery fishery is directly tied to the ability of the hatchery to meet production goals. In recent years, harvest and catch information from this fishery has had little impact on U.S./Canada treaty obligations or inseason management decisions, but if tighter restrictions for chinook salmon are enacted in the future, management of terminal hatchery sites could become a more important tool in the regional management plan.

If Gastineau Hatchery plans to continue the survey in 1995, greater effort is needed to correctly implement the survey as designed in the operational plan. Poor sampling techniques the past two seasons have compromised the validity of the survey. A concerted effort to conduct the survey as planned is necessary to properly document the success of enhancement efforts at the site.

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LITERATURE CITED

- Beers, D. E., and R. P. Marshall. 1994. Harvest estimates for Picnic Cove and Gastineau Hatchery roadside sport fisheries in Juneau, Alaska during 1993. Alaska Department of Fish and Game, Fishery Data Series No. 94-31, Juneau.
- Cochran, W. G. 1977. Sampling Techniques, third edition. John Wiley and Sons, New York.
- Efron, B. 1982. The jackknife, the bootstrap and other resampling plans. Society for Industrial and Applied Mathematics, CBMS-NSF Monograph 38, Philadelphia, Pennsylvania.
- Goodman, L. A. 1960. On the exact variance of products. Journal of the American Statistical Association 55:708-713.
- Jones & Stokes Associates, Inc. 1991. Southeast Alaska sport fishing economic study. Final Research Report. December 1991. (JSA 88-028.) Sacramento, California. Prepared for Alaska Department of Fish and Game, Sport Fish Division, Research and Technical Services Section, 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.
- Moser, K. H. 1969. Identification of Pacific salmon and steelhead trout by scale characteristics. U.S. Fish and Wildlife Service circular 317, Washington, D.C.

APPENDIX A

Appendix A1.--Summary of sampling results by date at Gastineau Hatchery in 1994.

WEEK	STRATUM ^a	DATE	ANGLER COUNTS			INTERVIEW SAMPLING INFORMATION						
			No.	Mean	SD	No.	Effort	Large chinook harvest	Large coho harvest	Pink harvest	Chum harvest	
7/04-7/10	WD	07JUL94	6	7.17	4.58	42	86.5	2	0	11	2	
7/04-7/10	WD	08JUL94	5	21.80	13.81	56	112.6	2	0	17	1	
7/04-7/10	WE/H	04JUL94	6	11.83	5.91	44	84.7	0	0	7	0	
7/04-7/10	WE/H	09JUL94	6	13.67	9.40	48	111.4	0	0	23	2	
7/04-7/10	WE/H	10JUL94	6	18.67	15.60	58	132.7	0	0	20	5	
7/11-7/17	WD	11JUL94	6	17.83	13.12	63	180.7	0	0	33	1	
7/11-7/17	WD	12JUL94	5	14.80	7.26	62	120.9	3	0	37	5	
7/11-7/17	WD	14JUL94	5	17.40	10.67	66	180.2	2	1	83	2	
7/11-7/17	WE/H	16JUL94	6	22.00	15.87	82	133.2	1	0	113	8	
7/11-7/17	WE/H	17JUL94	5	21.80	8.87	54	102.4	0	0	122	8	
7/18-7/24	WD	18JUL94	6	16.33	9.58	75	138.7	0	0	141	8	
7/18-7/24	WD	21JUL94	5	28.00	11.49	85	162.5	0	0	83	4	
7/18-7/24	WD	22JUL94	6	17.67	15.78	69	163.7	0	0	109	8	
7/18-7/24	WE/H	23JUL94	6	24.00	16.49	73	132.0	1	0	116	5	
7/18-7/24	WE/H	24JUL94	6	20.33	18.01	42	84.7	0	0	46	4	
7/25-7/31	WD	26JUL94	6	21.00	19.31	70	143.6	0	0	123	8	
7/25-7/31	WD	27JUL94	7	27.71	15.93	78	187.0	0	0	163	18	
7/25-7/31	WD	29JUL94	6	12.33	9.42	52	126.1	0	0	31	14	
7/25-7/31	WE/H	30JUL94	6	18.50	10.75	63	110.8	0	0	82	1	
7/25-7/31	WE/H	31JUL94	6	18.33	10.73	49	95.0	0	0	116	5	
8/01-8/07	WD	02AUG94	5	24.60	6.07	83	220.2	2	0	127	14	
8/01-8/07	WD	03AUG94	6	20.83	6.77	79	148.6	0	0	156	15	
8/01-8/07	WD	05AUG94	5	20.80	9.09	45	90.2	0	0	58	10	
8/01-8/07	WE/H	06AUG94	6	19.00	10.92	45	81.0	0	0	87	0	
8/01-8/07	WE/H	07AUG94	6	17.17	12.42	67	122.9	0	0	47	3	
8/08-8/14	WD	08AUG94	6	14.83	9.79	43	89.4	0	3	52	0	
8/08-8/14	WD	10AUG94	6	17.00	14.44	60	117.3	1	1	81	0	
8/08-8/14	WD	11AUG94	5	13.00	11.64	42	63.6	0	0	24	0	
8/08-8/14	WE/H	13AUG94	6	19.33	15.68	60	126.1	0	0	74	4	
8/08-8/14	WE/H	14AUG94	6	12.33	9.22	49	87.0	0	0	60	0	
8/15-8/21	WD	15AUG94	5	17.20	12.68	43	91.1	0	0	26	0	
8/15-8/21	WD	18AUG94	6	14.00	6.87	20	28.4	0	0	23	0	
8/15-8/21	WD	19AUG94	3	7.33	6.43	14	22.0	0	0	19	0	
8/15-8/21	WE/H	20AUG94	5	16.40	16.07	30	56.4	1	13	38	0	
8/15-8/21	WE/H	21AUG94	5	7.20	7.05	29	48.3	0	1	38	0	
8/22-8/28	WD	24AUG94	6	17.17	13.70	32	106.4	0	7	17	1	
8/22-8/28	WD	25AUG94	6	14.50	11.73	34	95.6	1	17	24	2	
8/22-8/28	WD	26AUG94	6	21.00	15.54	65	175.5	0	26	57	4	
8/22-8/28	WE/H	27AUG94	6	28.33	20.99	38	155.0	0	24	18	0	
8/22-8/28	WE/H	28AUG94	6	26.50	12.55	48	124.5	0	21	17	8	
8/29-9/04	WD	29AUG94	6	17.67	11.83	38	64.7	0	29	3	0	
8/29-9/04	WD	30AUG94	6	9.00	5.66	31	75.6	0	20	5	0	
8/29-9/04	WE/H	03SEP94	4	26.25	16.50	43	129.0	0	110	8	0	
8/29-9/04	WE/H	04SEP94	6	25.33	8.36	46	164.0	0	144	0	0	
9/05-9/11	WD	06SEP94	6	20.00	11.03	43	103.0	0	69	7	0	
9/05-9/11	WD	09SEP94	5	16.40	8.88	29	51.6	0	21	0	0	
9/05-9/11	WE/H	05SEP94	5	34.40	16.29	89	170.8	0	49	8	0	
9/05-9/11	WE/H	10SEP94	6	46.33	34.16	40	98.5	0	19	12	0	
9/05-9/11	WE/H	11SEP94	6	19.33	7.76	38	88.0	0	27	0	0	
9/12-9/18	WD	12SEP94	6	13.33	6.22	38	77.6	0	39	0	0	
9/12-9/18	WD	15SEP94	6	14.67	8.98	27	53.1	0	35	0	0	
9/12-9/18	WE/H	17SEP94	5	25.00	19.87	44	71.4	1	14	0	0	
9/19-9/25	WD	19SEP94	5	19.00	7.81	46	84.7	0	8	0	0	
9/19-9/25	WD	21SEP94	5	4.20	2.59	12	31.4	0	1	0	0	
9/19-9/25	WE/H	24SEP94	6	11.17	7.41	34	48.5	0	12	0	0	
9/19-9/25	WE/H	25SEP94	6	12.17	10.89	13	26.0	0	8	0	0	
9/26-10/02	WD	26SEP94	6	8.67	3.33	14	20.8	0	5	0	0	
9/26-10/02	WD	30SEP94	6	10.33	3.83	23	40.9	0	9	0	0	
9/26-10/02	WE/H	01OCT94	5	10.20	6.06	28	39.5	0	2	0	0	
9/26-10/02	WE/H	02OCT94	6	4.00	1.79	15	45.5	0	7	0	0	
10/3-10/09	WD	04OCT94	5	4.20	3.63	6	17.0	0	15	0	0	
10/3-10/09	WD	07OCT94	5	1.60	2.51	9	11.2	0	2	0	0	
10/3-10/09	WE/H	08OCT94	5	1.80	1.79	11	6.8	0	1	0	0	

^a WD = weekdays (Mondays-Fridays, except 4 July and 5 Sept.); WE/H = weekend/holidays (Saturdays, Sundays, 4 July, and 5 September).

Appendix A2.—Major computer files used for data analysis of Gastineau Hatchery roadside fisheries in 1994.

704_721	PRN	Raw ASCII data file, 4 July through 21 July
722_804	PRN	Raw ASCII data file, 22 July through 4 August
805_814	PRN	Raw ASCII data file, 5 August through 14 August
815_904	PRN	Raw ASCII data file, 15 August through 4 September
905_1009	PRN	Raw ASCII data file, 5 September through 9 October
DIPAC94	DTA	Final edited combined data set
DIPAC94	SAS	SAS program to reformat ASCII file
DIPAC94	SSD	Summary subset SAS data file: count and interview data
BOWDEN4A	SAS	SAS program to estimate effort, harvests, and variance
AGEDIP	DTA	Age and length raw data in mark-sense format
