

**Fishery Data Series No. 91-10**

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**Effort, Catch, Harvest, and Escapement Statistics  
For the Chinook Salmon Sport Fishery in the Lower  
Togiak River, Alaska, during 1990**

by

**Dan O. Dunaway  
and  
Allen E. Bingham**

June 1991

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Alaska Department of Fish and Game

Division of Sport Fish



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Anchorage, Alaska

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<sup>1</sup> This investigation was partially financed by the Federal Aid in Sport Fish Restoration Act (16 U.S.C. 777-777K) under Project F-10-6, Job No. S-2-2.

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## ABSTRACT

An estimated 4,429 angler-hours of effort were expended by recreational anglers fishing the lower Togiak River from 21 June through 29 July 1990. Anglers caught (landed) and harvested (kept) an estimated 746 and 445 (60 percent harvested) chinook salmon *Oncorhynchus tshawytscha*, 35 and 25 (16 percent harvested) chum salmon *Oncorhynchus keta*, 35 and 25 (71 percent harvested) sockeye salmon *Oncorhynchus nerka*, respectively. In addition, anglers retained 47 percent of the estimated catch of 76 Dolly Varden *Salvelinus malma*, and 12 percent of the estimated catch of 43 rainbow trout *Oncorhynchus mykiss*. Age 1.4 (47 percent) chinook salmon were the dominant age class in the harvest. The spawning escapement of chinook salmon, as determined by aerial survey counts of live fish, was estimated to be 6,473 fish; less than 50 percent of the 12 year average of 13,476 fish.

KEY WORDS: chinook salmon, *Oncorhynchus tshawytscha*, chum salmon *Oncorhynchus keta*, sockeye salmon *Oncorhynchus nerka*, Dolly Varden *Salvelinus malma*, rainbow trout, *Oncorhynchus mykiss*, sport harvest, sport effort, creel survey, escapement, Togiak River, Bristol Bay.

## INTRODUCTION

The Togiak River is located approximately 104 km (65 miles) northwest of Dillingham, Alaska (Figure 1). Much of the Togiak River and its uplands are within the Togiak National Wildlife Refuge. The creel survey study site included all waters of the Togiak River from the river mouth upstream to the Wilderness Boundary of the Togiak National Wildlife Refuge, approximately river kilometer 32 (river mile 20).

The sport fishery on the Togiak River commences about the third week of June with the arrival of chinook salmon *Oncorhynchus tshawytscha*, the first of the five species of Pacific salmon that return to the Togiak River. The sport fishery continues through mid-October when the coho salmon *O. kisutch* run has nearly ended and the river begins to freeze. In addition to salmon, anglers catch rainbow trout *Oncorhynchus mykiss*, Dolly Varden *Salvelinus malma*, and Arctic grayling *Thymallus arcticus*. The majority of the angling effort on the Togiak River is expended by guided anglers from fishing lodges. One lodge is located along the Togiak River, while other lodges servicing the area fly their guests in for 1-day fishing trips.

Harvest data for the Togiak River sport fishery are limited to results of the Alaska Department of Fish and Game (ADFG) Statewide Harvest Survey (Mills 1979-1990) and a few on-site creel surveys conducted by ADFG and U.S. Fish and Wildlife Service (USFWS) staff. Minard and Lisac (1984) reported results from the first on-site survey of the Togiak River sport fishery, and Dunaway (1990) presented the results of an on-site survey conducted in 1989 of the lower Togiak River sport fishery for coho salmon. Unpublished data from USFWS from 1986, 1987, and 1988 are also available in preliminary form (K. Harper, personal communication). Results from these studies indicate most of the directed salmon sport fishery takes place in the lower 32 kilometers (20 miles) of the Togiak River, below the Wilderness Boundary of the Togiak National Wildlife Refuge. However, the studies furnished little definitive information on the character of the sport fishery for chinook salmon.

Since 1977, sport effort on the Togiak River has ranged from 539 angler-days (1978) to 3,497 angler-days (1984) and averages 1,270 angler-days per year (Minard 1990). Sport harvests of chinook salmon have averaged 300 fish annually since 1977, but have averaged over 500 fish per year since 1985. Historically, commercial harvests of salmon bound for the Togiak River have been much larger than sport harvests and have averaged 22,000 chinook salmon annually (ADFG 1989). Escapement of chinook salmon into the Togiak River has been below the desired level of 10,000 fish since 1987 and the 1989 commercial harvest of 9,255 fish was the lowest since 1975 (Fried et al. 1989). Although present sport effort and harvests are not considered to be excessive, the sport fishery of the Togiak River has been at the center of a major concern involving allocation of fishery resources between commercial, sport, and subsistence users.

Effective management of the Togiak River fisheries requires information about the sport fisheries beyond that which is provided by the post-season Statewide Harvest Survey. Of immediate concern to resource managers, local

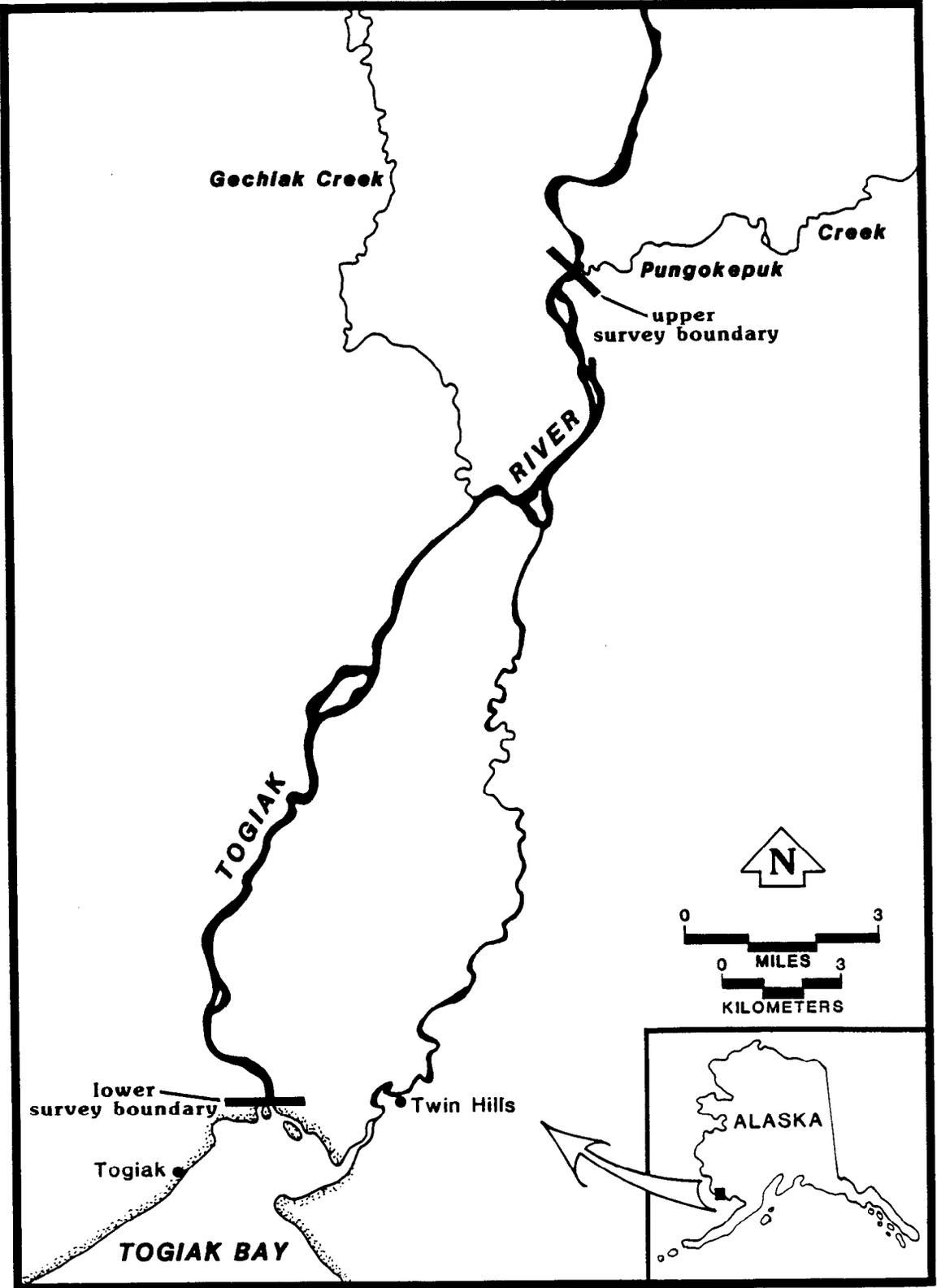


Figure 1. The Togiak River study area.

residents, and members of the sport fishing industry is the potential impact to chinook salmon stocks by the expanding sport fishery in the Togiak River. In addition, it is important to characterize the fishery in terms of angler demographics and incidence of release, particularly in fisheries where a large fraction of the catch is released. Therefore, specific objectives of the study were:

1. To estimate angling effort (in angler-hours), catch (fish kept plus released), and harvest (fish kept only), for the chinook salmon sport fishery in the lower Togiak River during the period 21 June to 29 July 1990.
2. To estimate the age, sex, and length composition of chinook salmon harvested by the sport fishery in the lower Togiak River.

In 1990, anglers on the Togiak River were allowed a daily bag and possession limit of three chinook salmon per day, only two of which could be over 711 mm (28 inches) (ADFG 1990). The daily bag and possession limits for salmon other than chinook salmon (including sockeye *O. nerka*, chum *O. keta*, pink *O. gorbuscha*, and coho salmon) were five fish per day in combination.

## METHODS

### Creel Surveys

A stratified three-stage random sampling design was used on the lower Togiak River to estimate effort (in angler-hours), catch, and harvest. A roving creel survey (Neuhold and Lu 1957) was conducted to count and interview anglers as well as sample the sport harvest. Angler counts were considered instantaneous and represent angler effort for the stratum in which the count was conducted. Angler interviews were used to estimate the catch and harvest rates. Estimates of catch and harvest are the product of the estimated effort and the catch or harvest rates.

The 39-day study period began 21 June and continued through 29 July. The angling day, for the purpose of the survey, began at 0700 hours and ended at 2259 hours (16 hours). Each angling day was split into two time-of-day strata, peak and non-peak; and each stratum was composed of two, 4-hour periods: non-peak period A 0700 to 1059 hours, peak period B 1100-1459 hours, peak period C 1500 to 1859 hours, and non-peak period D 1900 to 2259 hours. These periods were selected such that the combination count interview samples, which take approximately 4 hours to conduct, would "fit" into each time-of-day stratum in equal increments. Previous surveys of the coho salmon fishery on this river (Dunaway 1990) indicated that angler effort (hence catch and harvest) is limited during the early and late hours of the day.

The project was designed to conform to a 37.5 hour work week for staff. A total of 32 hours (four 8-hour days) of technician time was allocated for collection of effort, catch, harvest, and biological data during each 7-day week. The remaining 5.5 hours per week were used for mounting scales and

maintaining the camp and equipment. From each 7-day week, 3 days were selected without replacement for sampling the peak time-of-day stratum. A fourth day was selected at random from the remaining days in the week for sampling non-peak stratum. This sampling level resulted in the selection of 17 days for the peak stratum and 6 days for the non-peak stratum sampled over the 39 days of the survey.

For each day selected for sampling during the peak stratum, both of the possible 4-hour sampling periods (i.e., 1100-1459 hours and 1500-1859 hours) were sampled. Similarly, for the non-peak stratum, both the early and late 4-hour periods were sampled. Hours fished were recorded for individual anglers as were the species of fish caught and kept and caught and released.

Angler effort, catch, and harvest, their associated variances, and standard errors were estimated for the creel survey using the following procedures. A random estimator was used to estimate angler effort on a sample by sample basis. Catch and harvest estimates for each sample were obtained by a ratio estimator which was computed by combining the estimated effort (for the sample) with estimates of catch per unit effort (CPUE) and harvest per unit effort (HPUE) obtained from the angler interviews. The CPUE and HPUE estimates were obtained by the jackknife estimation approach (Efron 1982). The jackknife approach for estimating CPUE and HPUE was used since most other estimators are known to be biased (for use as ratio estimators, i.e., for expansion), and the jackknife estimate has been shown to be less biased and procedures exist for correcting some of this bias (as noted below) (see Cochran 1977, section 6.15, pages 174-177; and Smith 1980).

The CPUE and HPUE estimates presented here are only appropriate for expansion purposes (i.e., as used in a ratio estimation procedure).

The individual sample estimates of effort, catch, and harvest were then used in a stratified three-stage estimation approach to obtain total estimates, both within strata and across strata, as noted below.

The first step involved obtaining the jackknife estimated sample mean of CPUE (or HPUE) as follows:

$$\begin{aligned}
 & \text{*} \\
 \text{CPUE}_{hijk} &= \text{the jackknifed CPUE for angler } k \text{ in sample } j \text{ within day } i \text{ and} \\
 & \text{stratum } h; \\
 & \\
 & \frac{\sum_{o=1}^{m_{hij}} c_{hijo}}{o \neq k} \\
 & = \frac{\sum_{o=1}^{m_{hij}} c_{hijo}}{\sum_{o=1}^{m_{hij}} e_{hijo}}; \tag{1}
 \end{aligned}$$

where:

$m_{hij}$  = the number of anglers interviewed within sampled period during each sampled day;

$c_{hijo}$  = the catch in hours of each angler interviewed, and

$e_{hijo}$  = the angling effort in hours of each angler interviewed.

The jackknife mean CPUE for sample  $j$  within day  $i$  and stratum  $h$  was then obtained as:

$$\overline{CPUE}_{hij}^* = \frac{\sum_{k=1}^{m_{hij}} CPUE_{hijk}^*}{m_{hij}} \quad (2)$$

Then the bias correction (adapted from Efron 1982, equation 2.8, page 6) was performed:

$$\overline{CPUE}_{hij}^{*\dagger} = [m_{hij} (\overline{CPUE}_{hij} - \overline{CPUE}_{hij}^*)] + [\overline{CPUE}_{hij}^*] \quad (3)^1$$

where:

$$\overline{CPUE}_{hij} = \frac{\sum_{o=1}^{m_{hij}} c_{hijo}}{\sum_{o=1}^{m_{hij}} e_{hijo}} \quad (4)$$

The bias-corrected jackknife mean was then expanded by the estimated angler effort for the sample to obtain the estimated catch for each sample period within each sampled day:

$$\hat{C}_{hij} = \hat{E}_{hij} \overline{CPUE}_{hij}^{*\dagger} \quad (5)$$

where:

$\hat{E}_{hij}$  = estimated angler effort (in hours) for each sample period;

---

<sup>1</sup> Note that if the bias correction, equation 3, resulted in a negative value, then the uncorrected version, equation 2, was used in all following equations.

$$= H_{hij} x_{hij}; \quad (6)$$

$H_{hij}$  = number of hours in sampling period  $j$  within day  $i$  and stratum  $h$ ;

$x_{hij}$  = the number of anglers counted fishing during each sample.

The harvest for the sample was estimated similarly by substituting the appropriate harvest statistics into equations 1 to 5, above.

Estimates of angler effort, catch, and harvest for each day sampled were obtained as follows:

$$\begin{aligned} \bar{Y}_{hi} &= \text{mean of the sample estimates for each sampled day; in which } Y \text{ represents } E, C, \text{ or } H \text{ for effort, catch, and harvest, respectively;} \\ &= \frac{\sum_{j=1}^{Phi} \hat{Y}_{hij}}{Phi}; \end{aligned} \quad (7)$$

where:

$Phi$  = number of periods sampled within each sampled day; and

$\hat{Y}_{hij}$  = estimated sample value for effort ( $E$ , as obtained from equation 6, above), catch or harvest ( $C$  or  $H$ , as obtained from equation 5, above).

The estimated daily effort, catch, and harvest were obtained by expanding the number of sampling periods in the day:

$$\hat{Y}_{hi} = P_{hi} \bar{Y}_{hi}; \quad (8)$$

where:

$P_{hi}$  = the number of possible sampling periods within each day  $i$  for stratum  $h$ .

Similarly, we obtained estimates for each sampling stratum as follows:

$$\bar{Y}_h = \text{mean of the daily estimates for stratum } h; \text{ in which } Y \text{ represents } E, C, \text{ or } H \text{ for effort, catch, and harvest, respectively;}$$

$$= \frac{\sum_{i=1}^{d_h} \hat{Y}_{hi}}{d_h}; \quad (9)$$

where:

$d_h$  = the number of days sampled within each stratum.

The estimated stratum effort, catch, and harvest were obtained by expanding the number of days in each stratum:

$$\hat{Y}_h = D_h \bar{Y}_h; \quad (10)$$

where:

$D_h$  = the number of days within each stratum.

The variance of the estimated catch for stratum  $h$  was obtained by the three-stage variance equation (following the approach outlined by Cochran 1977), omitting the finite population correction factor (FPC) for the third stage units:

$$\begin{aligned} \hat{V}[\hat{C}_h] &= \left\{ (1 - f_{1h}) D_h^2 \frac{S_{1h}^2}{d_h} \right\} \\ &+ \left\{ f_{1h} \frac{D_h^2}{d_h^2} \sum_{i=1}^{d_h} (1 - f_{2hi}) P_{hi}^2 \frac{S_{2hi}^2}{P_{hi}} \right\} \\ &+ \left\{ f_{1h} \frac{D_h^2}{d_h^2} \sum_{i=1}^{d_h} f_{2hi} \frac{P_{hi}^2}{P_{hi}^2} \sum_{j=1}^{P_{hi}} \hat{V}[\hat{C}_{hij}] \right\}; \end{aligned} \quad (11)$$

where:

$f_{1h}$  = the sampling fraction for days (i.e.,  $d_h / D_h$ );

$f_{2hi}$  = the sampling fraction for periods within each day (i.e.,  $P_{hi} / P_{hi}$ );

$S_{1h}^2$  = the among day variance for the total angler catch estimate over all days sampled in each;

$$= \frac{\sum_{i=1}^{d_h} (\hat{C}_{hi} - \bar{C}_h)^2}{d_h - 1}; \quad (12)$$

$S_{2hi}^2$  = the among period variance for sampled day;

$$= \frac{\sum_{j=1}^{\Phi_{hi}} (\hat{C}_{hij} - \bar{C}_{hi})^2}{\Phi_{hi} - 1}; \quad (13)$$

$\hat{V}[\hat{C}_{hij}]$  = the within period variance for the estimated sample catch for each sample period, obtained by treating the first term on the right hand side of equation 5 as a constant<sup>2</sup> and as such, we approximated the variance by using the equation for a product of a constant and an estimate (Kish 1965, equation 2.8.5, page 60);

$$\approx \hat{E}_{hij}^2 s_{3hij}^2; \text{ and} \quad (14)$$

$s_{3hij}^{*2}$  = jackknife estimate of the variance for the jackknifed sample mean CPUE (adapted from Efron 1982, equation 3.2, page 13);

$$= \frac{(m_{hij} - 1)}{m_{hij}} \sum_{k=1}^{m_{hij}} (CPUE_{hijk}^* - \overline{CPUE}_{hij}^*)^2. \quad (15)$$

Variance estimates for the estimated harvest were obtained by replacing the appropriate harvest statistics (h's and H's) for the catch statistics (c's and C's) in equations 11 through 17.

Stratum estimates of the variance of the angler effort were obtained in a similar manner to those for catch and harvest. The primary difference occurred in the absence of the third major term in equation 11, since we could not estimate the within-period component of variance for angler effort, and accordingly our variance estimate was only approximate and assumed to be negatively biased:

---

<sup>2</sup> Only one angler count was conducted within each sampled period.

$$\hat{V}[\hat{E}_h] \approx \left[ (1 - f_{1h}) D_h^2 \frac{S_{1h}^2}{d_h} \right] + \left[ f_{1h} \frac{D_h^2}{d_h^2} \sum_{i=1}^{d_h} (1 - f_{2hi}) P_{hi}^2 \frac{S_{2hi}^2}{P_{hi}} \right] \quad (16)$$

The values for the terms in equation 18 were obtained by replacing the catch statistics (C's) by the appropriate effort statistics (E's), in equations 12 through 15.

Total angler effort, catch, or harvest across all strata and the associated variances were calculated by summing statistics across strata.

Since our estimates of angler effort, catch, and harvest are estimates of totals, then standard errors (SE's) were obtained by taking the square root of the associated variances.

The assumptions necessary for unbiased point and variance estimates of angler effort, catch, and harvest obtained by the procedures outlined above are:

1. incomplete-trip angler CPUE and HPUE represent accurate estimates of completed-trip angler CPUE and HPUE;
2. interviewed anglers accurately reported their hours of fishing effort and the number of fish by species released;
3. interviewed anglers were representative of the total angler population;
4. no significant fishing effort occurred during the hours not included in the fishing day;
5. no significant fishing effort occurred in areas not covered by the survey; and
6. catch rate and duration of fishing trip are independent (DiConstanzo 1956).

Of particular concern is the first assumption: that incomplete-trip CPUE and HPUE provide an unbiased estimate of completed-trip CPUE and HPUE. At this time, we do not have sufficient data to test this assumption.

#### Spawning Escapement Surveys

The numbers of spawning chinook salmon in the Togiak River drainage were estimated from aerial counts conducted by ADFG Commercial Fisheries Division biologists from fixed wing aircraft during peak spawning periods. Aerial counts of Togiak River chinook salmon were expanded by ADFG Commercial

Fisheries Division biologists to estimate total escapement estimate (ADFG *In press*).

### Size, Sex, and Age Sampling

Sport harvested chinook salmon encountered during the angler interview portion of the creel survey were measured to the nearest millimeter for mid-eye to fork-of-tail length, weighed to the nearest 10 grams, and sexed based on external characteristics. In addition, three scales were removed from the preferred location on each fish<sup>3</sup>. Upon removal, the scales were mounted on adhesive-coated cards which were later thermohydraulically pressed against acetate cards. The resulting scale impressions were displayed on a microfiche projector for age determination<sup>4</sup>.

The sample size required for the preselected level of precision (i.e., estimate proportions such that the estimates were within  $\pm 10\%$  of the true proportions 90% of the time), was 75 fish based on a expected harvest of approximately 200 fish. The sample size was obtained by following the procedures outlined in Thompson (1987) for estimating multinomial proportions (i.e., proportions of fish in different age or length categories by sex). For a relative precision of  $\pm 10\%$  and an alpha level of 0.10, Thompson gives the goal sample size of 101. The adjusted sample size were obtained by first adjusting for the FPC factor (using the approach suggested by Cochran 1977, equation 4.3, page 76), and then discounting for a scale regeneration rate of approximately 10%.

Estimates of mean length by age group of chinook salmon subsampled from harvest were calculated. The procedures outlined by Sokal and Rohlf (1981, Boxes 4.2 and 7.1, pages 56 and 139) were used to obtain the estimates of each mean and its standard error.

Estimates of age composition (proportion) by sex for the subsampled chinook salmon were calculated. Each proportion was calculated according to the following equations:

$$\begin{aligned} \hat{p}_u &= \text{estimated proportion of the sampled chinook salmon harvested} \\ &\quad \text{that are age } u; \\ &= \frac{n_u}{n}; \end{aligned} \tag{17}$$

---

<sup>3</sup> The left side of the fish approximately two rows above the lateral line and on the diagonal row downward from the posterior insertion of the dorsal fin as used on sockeye salmon by Clutter and Whitesel (1956).

<sup>4</sup> Ages are represented in this report using the European method where the numeral preceding the decimal is the number of freshwater annuli, whereas the numeral following the decimal is the number of marine annuli. Total age from brood year is the sum of the two numerals plus one.

where:

$n_u$  = number of the sampled chinook salmon harvested that are age  $u$ ;  
and

$n$  = the number of chinook salmon harvested that were subsampled  
for lengths.

The variance of the estimate of  $p_u$  was obtained approximately by the standard equation for the variance of a binomial proportion (Cochran 1977, equation 3.8, page 52):

$$\hat{V}[p_u] \approx \left(1 - \frac{n}{\hat{H}}\right) \frac{\hat{p}_u (1 - \hat{p}_u)}{n - 1} \quad (18)$$

Note that although the harvest was sampled by a stratified multi-stage approach, we treated our samples of fish lengths and ages as if collected by a simple random sampling program. We assumed that length at age and age composition would not vary substantially from the peak stratum to the non-peak stratum, or between sampling stages.

## RESULTS

### Creel Statistics

The creel survey on the lower Togiak River was conducted from 21 June to 31 July 1990. Only four completed-trip interviews were taken and the catch and harvest estimates made in this study may be biased. Total effort in the lower river was estimated to be 4,429 angler-hours (SE = 491) during this period (Table 1, Appendix A1). An estimated 746 chinook salmon (SE = 123) were caught (landed) in the study area, of which 445 (SE = 67), or 60%, were harvested (Table 2, Appendix A2).

Anglers also caught several other species while fishing for chinook salmon. Anglers were estimated to have caught 343 and kept 56 chum salmon (Table 3, Appendix A3). Additionally, anglers caught an estimated 35 sockeye salmon of which they kept 25 (71%) (Table 3, Appendix A4). Of species other than salmon observed during the study period, the catch of Dolly Varden was estimated to be 76 fish with 35 fish being retained, while 12% of the estimated 43 rainbow trout caught were kept (Table 3, Appendices A5 and A6). The study did not include some of the better months for Dolly Varden, rainbow trout, or coho salmon angling; hence the estimates for species other than chinook salmon must be considered incomplete.

### Spawning Escapement

Aerial surveys of the Togiak River drainage chinook salmon spawning areas resulted in an estimated escapement of 6,473 fish (ADFG *In press*).

Table 1. Estimated effort (angler-hours) by stratum for the sport fishery in the lower Togiak River, 21 June to 29 July 1990.

| Stratum <sup>a</sup> | Days Sampled | Estimated Angler-Hours | SE  | 95% Confidence Interval |       | Relative Precision <sup>b</sup> |
|----------------------|--------------|------------------------|-----|-------------------------|-------|---------------------------------|
|                      |              |                        |     | Lower                   | Upper |                                 |
| N                    | 6            | 364                    | 230 | 0                       | 815   | 124%                            |
| P                    | 17           | 4,065                  | 433 | 3,215                   | 4,914 | 21%                             |
| ALL                  | 23           | 4,429                  | 490 | 3,467                   | 5,391 | 22%                             |

<sup>a</sup> Stratum N = Nonpeak; period A (0700-1059) and period D (1900-2259).  
Stratum P = Peak; period B (1100-1459) and period C (1500-1859).

<sup>b</sup> Relative Precision =  $((1.96*SE)/POINT\ EST.)*100$  where alpha = 0.05.

Table 2. Estimated catch and harvest of chinook salmon by the sport fishery in the lower Togiak River, 21 June to 29 July 1990.

| Stratum <sup>b</sup> | Catch <sup>a</sup> |     |                         |       |                 | Harvest        |    |                         |       |                 | Percent of Catch Harvested |
|----------------------|--------------------|-----|-------------------------|-------|-----------------|----------------|----|-------------------------|-------|-----------------|----------------------------|
|                      | Number of Fish     | SE  | 95% Confidence Interval |       |                 | Number of Fish | SE | 95% Confidence Interval |       |                 |                            |
|                      |                    |     | Lower                   | Upper | RP <sup>c</sup> |                |    | Lower                   | Upper | RP <sup>c</sup> |                            |
| N                    | 92                 | 77  | 0                       | - 242 | 164%            | 0              | 0  | 0                       | - 0   | 0%              | 0%                         |
| P                    | 654                | 96  | 466                     | - 842 | 29%             | 445            | 67 | 314                     | - 576 | 29%             | 68%                        |
| ALL                  | 746                | 123 | 505                     | - 986 | 32%             | 445            | 67 | 314                     | - 576 | 29%             | 60%                        |

<sup>a</sup> Catch = total fish kept + total fish released.

<sup>b</sup> Stratum N = Nonpeak; period A (0700-1059) and period D (1900-2259)  
Stratum P = Peak period B (1100-1459) and period C (1500-1859).

<sup>c</sup> RP = Relative precision;  
((1.96\*SE)/POINT EST.)\*100 where alpha = 0.05.

Table 3. Estimated catch and harvest of non-target species by the sport fishery in the lower Togiak River, 21 June to 29 July 1990.

| Stratum <sup>b</sup>  | Catch <sup>a</sup> |       |                         |                 |    | Harvest        |         |                         |     |  | Percent of Catch Harvested |
|-----------------------|--------------------|-------|-------------------------|-----------------|----|----------------|---------|-------------------------|-----|--|----------------------------|
|                       | Number of Fish     |       | 95% Confidence Interval |                 |    | Number of Fish |         | 95% Confidence Interval |     |  |                            |
|                       | SE                 | Lower | Upper                   | RP <sup>c</sup> | SE | Lower          | Upper   | RP <sup>c</sup>         |     |  |                            |
| <b>CHUM SALMON</b>    |                    |       |                         |                 |    |                |         |                         |     |  |                            |
| N                     | 0                  | 0     | 0 - 0                   | 0%              | 0  | 0              | 0 - 0   | 0%                      | 0%  |  |                            |
| P                     | 343                | 112   | 124 - 562               | 64%             | 56 | 29             | 0 - 113 | 102%                    | 16% |  |                            |
| ALL                   | 343                | 112   | 124 - 562               | 64%             | 56 | 29             | 0 - 113 | 102%                    | 16% |  |                            |
| <b>SOCKEYE SALMON</b> |                    |       |                         |                 |    |                |         |                         |     |  |                            |
| N                     | 0                  | 0     | 0 - 0                   | 0%              | 0  | 0              | 0 - 0   | 0%                      | 0%  |  |                            |
| P                     | 35                 | 17    | 2 - 69                  | 94%             | 25 | 15             | 0 - 54  | 115%                    | 71% |  |                            |
| ALL                   | 35                 | 17    | 2 - 69                  | 94%             | 25 | 15             | 0 - 54  | 115%                    | 71% |  |                            |
| <b>DOLLY VARDEN</b>   |                    |       |                         |                 |    |                |         |                         |     |  |                            |
| N                     | 0                  | 0     | 0 - 0                   | 0%              | 0  | 0              | 0 - 0   | 0%                      | 0%  |  |                            |
| P                     | 76                 | 26    | 25 - 126                | 67%             | 35 | 17             | 1 - 70  | 97%                     | 47% |  |                            |
| ALL                   | 76                 | 26    | 25 - 126                | 67%             | 35 | 17             | 1 - 70  | 97%                     | 47% |  |                            |
| <b>RAINBOW TROUT</b>  |                    |       |                         |                 |    |                |         |                         |     |  |                            |
| N                     | 0                  | 0     | 0 - 0                   | 0%              | 0  | 0              | 0 - 0   | 0%                      | 0%  |  |                            |
| P                     | 43                 | 16    | 10 - 75                 | 75%             | 5  | 5              | 0 - 15  | 192%                    | 12% |  |                            |
| ALL                   | 43                 | 16    | 10 - 75                 | 75%             | 5  | 5              | 0 - 15  | 192%                    | 12% |  |                            |

<sup>a</sup> Catch = total fish kept + total fish released.

<sup>b</sup> Stratum N = Nonpeak; period A (0700-1059) and period D (1900-2259)  
Stratum P = Peak period B (1100-1459) and period C (1500-1859).

<sup>c</sup> RP = Relative precision;  
 $((1.96*SE)/POINT\ EST.)*100$  where  $\alpha = 0.05$ .

### Size, Sex, and Age Compositions

Nearly 59% of the 75 chinook salmon sampled from the sport harvest were males (Table 4). The majority of the catch were age 1.4 fish (47%), while age 1.2 fish comprised another 26% of the catch. The mean mid-eye to fork length of sport harvested chinook salmon was 738 mm (SE = 20, n = 75) and the mean weight was 8.0 kg (SE = 0.6, n = 75). The largest chinook salmon sampled measured 1,002 mm (39 inches) in length and weighed 16.9 kg (37 lbs).

### DISCUSSION

The 1990 run of 17,828 chinook salmon in the Togiak River appears to have been slightly better than the 1989 run but less than the historic average of 36,760 fish (Table 5). The 1990 commercial harvest was less than half the historic average, and the 1990 preliminary subsistence harvest estimate of 492 fish is slightly below the historic average. The sport harvest of 445 chinook salmon was about 1.7 times greater than the 11 year average of 261 fish (Table 5, Figure 2). However, with the harvest constituting 2.5% or less of the total run, the sport fishery does not appear to pose an immediate threat to the health of the stock. In addition, guide use permit policies instituted by local Native groups that control much of the land along the lower reaches of the Togiak River may serve to limit or control growth of the sport fishery.

Considering the popularity of chinook salmon with the angling public, the rapid rate at which sport fisheries can grow, and the low levels of recent escapements, the Togiak sport fishery merits careful attention over the next several years.

### ACKNOWLEDGEMENTS

We wish to thank Mac Minard for his help with this report. We also wish to thank Keith Webster and Sandy Sonnichsen of the regional biometric staff for their help with the data analysis. Lew Coggins (ADFG Fisheries Technician II) deserves credit for collecting the data used in this report. Tom Brookover of ADFG Commercial Fisheries Division contributed data from his aerial surveys of the Togiak drainage and some historical data in Table 5. Finally, Dave Irving of the USFWS, King Salmon, Alaska graciously provided assistance to our field camp throughout the study period.

Table 4. Mean lengths (millimeters) and weights (kilograms) of chinook salmon, by sex and age group, from the sport harvest from the lower Togiak River, 1990.

|                         | Age Group |      |       |       |       |       | TOTAL <sup>a</sup> |
|-------------------------|-----------|------|-------|-------|-------|-------|--------------------|
|                         | UNKNOWN   | 1.1  | 1.2   | 1.3   | 1.4   | 1.5   |                    |
| <u>Females</u>          |           |      |       |       |       |       |                    |
| Percent                 |           |      |       | 2.86  | 34.29 | 4.29  | 41.33              |
| SE                      |           |      |       | 1.8   | 5.2   | 2.2   | 5.2                |
| Sample Size (known age) |           |      |       | 2     | 24    | 3     | 31                 |
| Mean Length             | 770       |      |       | 812   | 873   | 919   | 867                |
| SE                      | 15        |      |       | 43    | 11    | 34    | 11                 |
| Sample Size             | 2         |      |       | 2     | 24    | 3     | 31                 |
| Mean Weight             | 8.45      |      |       | 8.60  | 11.90 | 12.53 | 11.53              |
| SE                      | 1.4       |      |       | 1.0   | 0.4   | 1.4   | 0.4                |
| Sample Size             | 2         |      |       | 2     | 24    | 3     | 31                 |
| <u>Males</u>            |           |      |       |       |       |       |                    |
| Percent                 |           | 4.29 | 25.71 | 14.29 | 12.86 | 1.43  | 58.67              |
| SE                      |           | 2.2  | 4.8   | 3.9   | 3.7   | 1.3   | 5.2                |
| Sample Size (known age) |           | 3    | 18    | 10    | 9     | 1     | 44                 |
| Mean Length             | 633       | 374  | 561   | 619   | 912   | 998   | 648                |
| SE                      | 80        | 11   | 11    | 28    | 23    |       | 26                 |
| Sample Size             | 3         | 3    | 18    | 10    | 9     | 1     | 44                 |
| Mean Weight             | 4.53      | 0.90 | 3.06  | 4.04  | 12.73 | 16.50 | 5.52               |
| SE                      | 1.8       | 0.2  | 0.2   | 0.6   | 0.9   |       | 0.7                |
| Sample Size             | 3         | 3    | 18    | 10    | 9     | 1     | 44                 |
| <u>Both Sexes</u>       |           |      |       |       |       |       |                    |
| Percent                 |           | 4.29 | 25.71 | 17.14 | 47.14 | 5.71  | 100.0              |
| SE                      |           | 2.2  | 4.8   | 4.2   | 5.5   | 2.6   |                    |
| Sample Size (known age) |           | 3    | 18    | 12    | 33    | 4     | 75                 |
| Mean Length             | 688       | 374  | 561   | 651   | 883   | 939   | 738                |
| SE                      | 55        | 11   | 11    | 32    | 10    | 31    | 20                 |
| Sample Size             | 5         | 3    | 18    | 12    | 33    | 4     | 75                 |
| Mean Weight             | 6.10      | 0.90 | 3.06  | 4.80  | 12.13 | 13.52 | 8.00               |
| SE                      | 1.5       | 0.2  | 0.2   | 0.7   | 0.4   | 1.4   | 0.6                |
| Sample Size             | 5         | 3    | 18    | 12    | 33    | 4     | 75                 |

<sup>a</sup> Includes both aged and unaged samples.

Table 5. Escapement and commercial, subsistence, and sport harvests of chinook salmon on the Togiak River, 1969-1990.

| Year              | Harvest               |                    |                    |                       | Escapement Estimate <sup>b</sup> | Total Run <sup>c</sup> | Exploitation Rate    |                    |                    |
|-------------------|-----------------------|--------------------|--------------------|-----------------------|----------------------------------|------------------------|----------------------|--------------------|--------------------|
|                   | Commercial            | Subsistence        | Sport <sup>a</sup> | Total                 |                                  |                        | Sport                | Commercial         | Total              |
| 1969              | 20,092                |                    |                    | 20,092                |                                  |                        |                      |                    |                    |
| 1970              | 28,618                |                    |                    | 28,618                |                                  |                        |                      |                    |                    |
| 1971              | 26,105                |                    |                    | 26,105                |                                  |                        |                      |                    |                    |
| 1972              | 17,099                |                    |                    | 17,099                |                                  |                        |                      |                    |                    |
| 1973              | 9,225                 |                    |                    | 9,225                 |                                  |                        |                      |                    |                    |
| 1974              | 9,284                 | 1,200              |                    | 10,484                |                                  |                        |                      |                    |                    |
| 1975              | 7,206                 | 800                |                    | 8,006                 |                                  |                        |                      |                    |                    |
| 1976              | 28,513                | 500                |                    | 29,013                |                                  |                        |                      |                    |                    |
| 1977              | 33,827                | 400                | 62                 | 34,289                | 15,600                           | 49,889                 | 0.12%                | 69%                | 69%                |
| 1978              | 53,460                | 300                | 35                 | 53,795                | 30,600                           | 84,395                 | 0.04%                | 64%                | 64%                |
| 1979              | 27,744                | 200                | 78                 | 28,022                | 23,700                           | 51,722                 | 0.15%                | 54%                | 54%                |
| 1980              | 10,858                | 900                | 34                 | 11,792                | 8,045                            | 19,837                 | 0.17%                | 59%                | 59%                |
| 1981              | 22,744                | 400                | NE <sup>d</sup>    | 23,144                | 13,695                           | 36,839                 |                      | 63%                | 63%                |
| 1982              | 33,607                | 400                | 231                | 34,238                | 7,800                            | 42,038                 | 0.55%                | 81%                | 81%                |
| 1983              | 35,669                | 700                | 535                | 36,904                | 10,975                           | 47,879                 | 1.12%                | 77%                | 77%                |
| 1984              | 19,958                | 600                | 46                 | 20,604                | 19,085                           | 39,689                 | 0.12%                | 52%                | 52%                |
| 1985              | 33,110                | 600                | 925                | 34,635                | 12,010                           | 46,645                 | 1.98                 | 74%                | 74%                |
| 1986              | 16,596                | 700                | 618                | 17,914                | NE <sup>d</sup>                  | 17,914                 |                      |                    |                    |
| 1987              | 14,993                | 700                | 338                | 16,031                | 7,170                            | 23,201                 | 1.46%                | 69%                | 69%                |
| 1988 <sup>e</sup> | 13,206                | 429                | NE <sup>d</sup>    | 13,635                | 6,390                            | 20,025                 |                      | 68%                | 68%                |
| 1989 <sup>e</sup> | 9,255                 | 548                | 234                | 10,037                | 6,640                            | 16,677                 | 1.40%                | 60%                | 60%                |
| Historical        |                       |                    |                    |                       |                                  |                        |                      |                    |                    |
| Average           | 22,437                | 586                | 261                | 23,032                | 13,476                           | 36,760                 | 0.71%                | 63%                | 63%                |
| 1990 <sup>e</sup> | (10,418) <sup>f</sup> | (492) <sup>f</sup> | 445                | (11,355) <sup>f</sup> | 6,473                            | (17,828) <sup>f</sup>  | (2.50%) <sup>f</sup> | (64%) <sup>f</sup> | (64%) <sup>f</sup> |

<sup>a</sup> Estimates of sport harvest used here are the best available. Sport harvest estimated by on-site creel survey for 1984, 1985, 1986, 1987, and 1990. Sport harvest estimated by statewide mail survey 1977-1983, and 1989. No harvest estimate is available for 1988.

<sup>b</sup> Escapement estimated by fixed wing aerial surveys.

<sup>c</sup> Total run = sum of all harvests and escapement estimate.

<sup>d</sup> NE = No estimate available.

<sup>e</sup> Commercial catches for 1988, 1989, and 1990 are preliminary.

<sup>f</sup> Numbers enclosed by ( ) are preliminary figures.

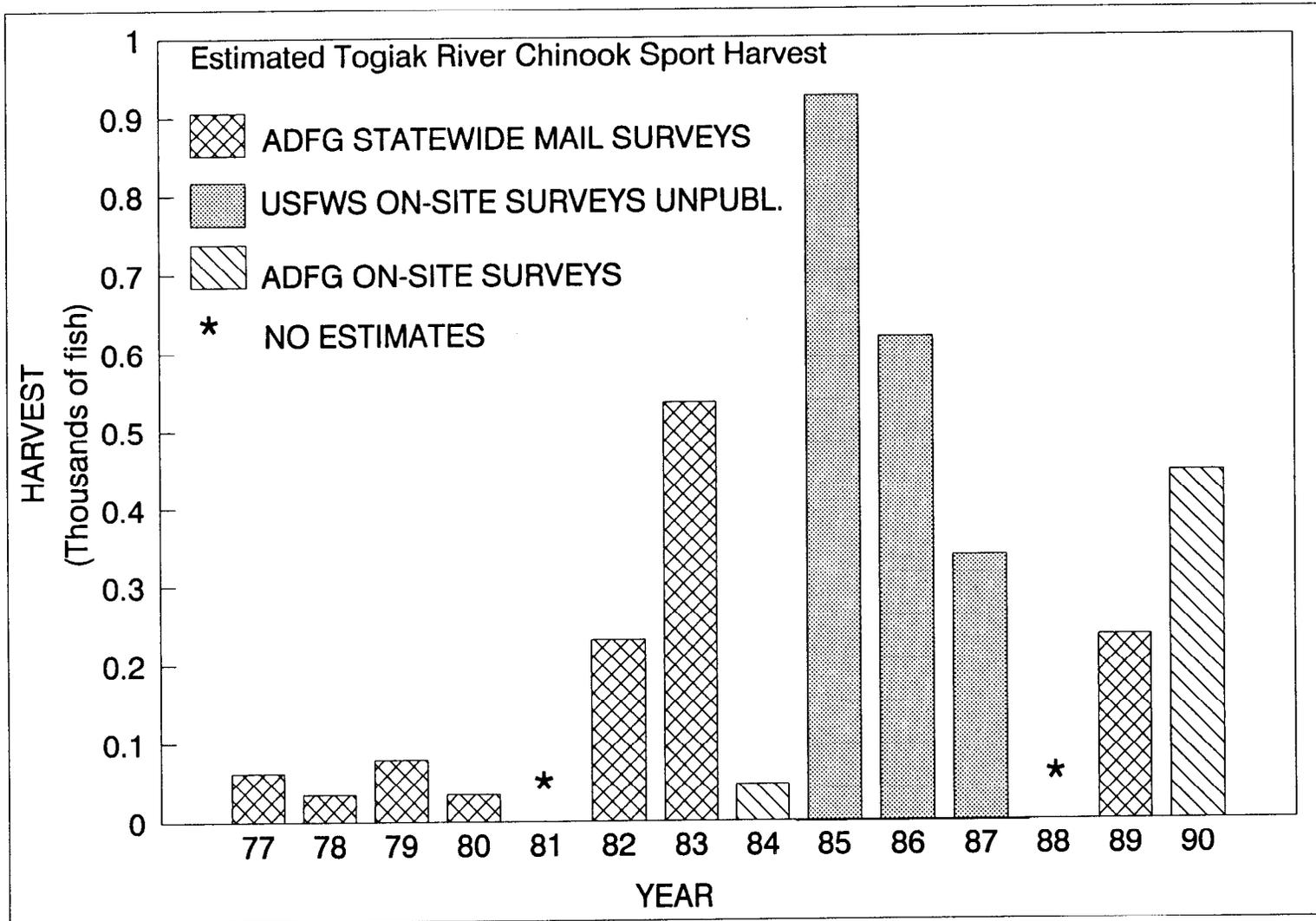


Figure 2. Estimated harvests of chinook salmon by the sport fishery in the Togiak River, 1977-1990.

#### LITERATURE CITED

- ADFG. 1989. Commercial Fisheries annual management report, 1988. Alaska Department of Fish and Game, Commercial Fish Division, Juneau.
- \_\_\_\_\_. 1990. 1990 Alaska sport fishing regulations summary. Alaska Department of Fish and Game, Juneau.
- \_\_\_\_\_. *In press*. Salmon spawning ground surveys in the Bristol Bay area, 1990. Regional Information Report No. 2K90-04. Alaska Department of Fish and Game, Commercial Fish Division, Juneau.
- Clutter, R. I., and L. E. Whitesel. 1956. Collection and interpretation of sockeye salmon scales. Bulletin IX of the International Pacific Salmon Fisheries Commission, New Westminster, British Columbia, Canada.
- Cochran, W. G. 1977. Sampling techniques. Third Edition. John Wiley and Sons, New York.
- DiConstanzo, C. J. 1956. Creel census techniques and harvest of fishes in Clear Lake, Iowa. Ph. D. dissertation, Iowa State College, Ames, Iowa.
- Dunaway, D. O. 1990. Creel and escapement statistics for the Togiak River during 1989. Alaska Department of Fish and Game, Division of Sport Fish, Fishery Data Series No. 90-26, Anchorage.
- Efron, B. 1982. The jackknife, the bootstrap and other resampling plans. Society for Industrial and Applied Mathematics, CBMS-NSF Monograph 38, Philadelphia, Pennsylvania.
- Fried, S., B. Stratton, B. Cross, J. Woolington, and K. Rowell. 1989. Togiak district salmon, a historic overview. Alaska Department of Fish and Game, Regional Information Report No. 2K89-16, Anchorage.
- Kish, L. 1965. Survey sampling. John Wiley and Sons, New York.
- 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.
- \_\_\_\_\_. 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.
- \_\_\_\_\_. 1981a. Alaska statewide sport fish harvest studies (1979). Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress, 1980-1981, Project F-9-13, 22(SW-I-A), Juneau.
- \_\_\_\_\_. 1981b. Alaska statewide sport fish harvest studies (1980). Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress, 1980-1981, Project F-9-13, 22(SW-I-A), Juneau.

LITERATURE CITED (Continued)

- \_\_\_\_\_. 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.
- \_\_\_\_\_. 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.
- \_\_\_\_\_. 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.
- \_\_\_\_\_. 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.
- \_\_\_\_\_. 1986. Alaska statewide sport fish harvest studies (1985). 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.
- \_\_\_\_\_. 1987. Alaska statewide sport fisheries harvest report 1986. Alaska Department of Fish and Game. Fishery Data Series Report No. 2, Juneau.
- \_\_\_\_\_. 1988. Alaska statewide sport fisheries harvest report 1987. Alaska Department of Fish and Game, Fishery Data Series Report No. 52, Juneau.
- \_\_\_\_\_. 1989. Alaska statewide sport fisheries harvest report 1988. Alaska Department of Fish and Game, Fishery Data Series Report No. 122, Juneau.
- \_\_\_\_\_. 1990. Harvest and participation in Alaska sport fisheries during 1989. Alaska Department of Fish and Game. Fishery Data Series Report No. 90-44, Anchorage.
- Minard, R. E., and M. Lisac. 1984. Togiak River sport fishing studies, 1984. Bristol Bay Data Report No. 84-18. Alaska Department of Fish and Game, Anchorage.
- Minard, R. E. 1990. Bristol Bay and lower Kuskokwim management area, report to the Board of Fisheries. February 1990. Alaska Department of Fish and Game, Division of Sport Fish, Anchorage.
- Neuhold, J. M., and K. H. Lu. 1957. Creel census method. Utah State Department of Fish and Game Publication 8, Salt Lake City, Utah.
- Smith, S. J. 1980. Comparison of two methods of estimating the variance of the estimate of catch per unit effort. Canadian Journal of Fisheries and Aquatic Sciences 37:2346-2351.

LITERATURE CITED (Continued)

Sokal, R. R., and F. J. Rohlf. 1989. Biometry. W. H. Freeman and Company, New York.

Thompson, S. K. 1987. Sample size for estimating multinomial proportions. The American Statistician 41:42-46.

APPENDIX A

Selected Data Summaries of Fishery Statistics

Appendix A1. Angler counts in the lower Togiak River sport fishery, 1990.

| DATE  | TIME PERIODS      |                   |                   |                   |
|-------|-------------------|-------------------|-------------------|-------------------|
|       | NON-<br>PEAK<br>A | PEAK STRATA       |                   | NON-<br>PEAK<br>D |
|       | 0700<br>1059      | B<br>1100<br>1459 | C<br>1500<br>1859 | 1900<br>2259      |
| 06/21 |                   | 1                 | 0                 |                   |
| 06/22 | 0                 |                   |                   | 1                 |
| 06/23 |                   | 11                | 10                |                   |
| 06/24 |                   |                   |                   |                   |
| 06/25 |                   | 8                 | 8                 |                   |
| 06/26 |                   |                   |                   |                   |
| 06/27 |                   |                   |                   |                   |
| 06/28 |                   |                   |                   |                   |
| 06/29 |                   | 4                 | 6                 |                   |
| 06/30 |                   | 16                | 19                |                   |
| 07/01 |                   |                   |                   |                   |
| 07/02 | 0                 |                   |                   | 0                 |
| 07/03 |                   | 18                | 18                |                   |
| 07/04 |                   |                   |                   |                   |
| 07/05 |                   | 25                | 15                |                   |
| 07/06 |                   |                   |                   |                   |
| 07/07 |                   |                   |                   |                   |
| 07/08 | 0                 |                   |                   | 0                 |
| 07/09 |                   | 23                | 24                |                   |
| 07/10 |                   |                   |                   |                   |
| 07/11 |                   | 28                | 17                |                   |
| 07/12 |                   | 26                | 8                 |                   |
| 07/13 |                   |                   |                   |                   |
| 07/14 | 7                 |                   |                   | 3                 |
| 07/15 |                   |                   |                   |                   |
| 07/16 |                   |                   |                   |                   |
| 07/17 |                   | 25                | 26                |                   |
| 07/18 |                   | 11                | 12                |                   |
| 07/19 |                   |                   |                   |                   |
| 07/20 |                   | 10                | 21                |                   |
| 07/21 |                   | 15                | 6                 |                   |
| 07/22 | 0                 |                   |                   | 3                 |
| 07/23 |                   |                   |                   |                   |
| 07/24 |                   | 9                 | 8                 |                   |
| 07/25 |                   |                   |                   |                   |
| 07/26 |                   |                   |                   |                   |
| 07/27 | 0                 |                   |                   | 0                 |
| 07/28 |                   | 3                 | 8                 |                   |
| 07/29 |                   | 2                 | 2                 |                   |

Appendix A2. Summary of daily angler effort (angler-hours), catch rates (CPUE, fish caught per angler-hour), and harvest rates (HPUE, fish kept per angler-hour) by sampling period for chinook salmon in the sport fishery in the lower Togiak River, 1990.

| Stratum <sup>a</sup> | Date   | Period <sup>b</sup> | Hours<br>in<br>Period | Anglers<br>Counted | Est.<br>Effort<br>in<br>Period | Anglers<br>Inter-<br>viewed | Estimates by Period |          |          |          |       |          |          |          |
|----------------------|--------|---------------------|-----------------------|--------------------|--------------------------------|-----------------------------|---------------------|----------|----------|----------|-------|----------|----------|----------|
|                      |        |                     |                       |                    |                                |                             | CPUE                |          | Catch    |          | HPUE  |          | Harvest  |          |
|                      |        |                     |                       |                    |                                |                             | Mean                | Variance | Estimate | Variance | Mean  | Variance | Estimate | Variance |
| N                    | 900622 | A                   | 4                     | 0                  | 0                              | 0                           |                     |          | 0.0      | 0.0      |       |          | 0.0      | 0.0      |
| N                    | 900622 | D                   | 4                     | 1                  | 4                              | 0                           |                     |          |          |          |       |          |          |          |
| N                    | 900702 | A                   | 4                     | 0                  | 0                              | 0                           |                     |          | 0.0      | 0.0      |       |          | 0.0      | 0.0      |
| N                    | 900702 | D                   | 4                     | 0                  | 0                              | 0                           |                     |          | 0.0      | 0.0      |       |          | 0.0      | 0.0      |
| N                    | 900708 | A                   | 4                     | 0                  | 0                              | 0                           |                     |          | 0.0      | 0.0      |       |          | 0.0      | 0.0      |
| N                    | 900708 | D                   | 4                     | 0                  | 0                              | 0                           |                     |          | 0.0      | 0.0      |       |          | 0.0      | 0.0      |
| N                    | 900714 | A                   | 4                     | 7                  | 28                             | 11                          | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| N                    | 900714 | D                   | 4                     | 3                  | 12                             | 2                           | 1.000               | 1.000    | 12.0     | 144.0    | 0.000 | 0.000    | 0.0      | 0.0      |
| N                    | 900722 | A                   | 4                     | 0                  | 0                              | 0                           |                     |          | 0.0      | 0.0      |       |          | 0.0      | 0.0      |
| N                    | 900722 | D                   | 4                     | 3                  | 12                             | 2                           | 0.177               | 0.031    | 2.1      | 4.5      | 0.000 | 0.000    | 0.0      | 0.0      |
| N                    | 900727 | A                   | 4                     | 0                  | 0                              | 0                           |                     |          | 0.0      | 0.0      |       |          | 0.0      | 0.0      |
| N                    | 900727 | D                   | 4                     | 0                  | 0                              | 0                           |                     |          | 0.0      | 0.0      |       |          | 0.0      | 0.0      |
| P                    | 900621 | B                   | 4                     | 1                  | 4                              | 0                           |                     |          | 0.0      | 0.0      |       |          | 0.0      | 0.0      |
| P                    | 900621 | C                   | 4                     | 0                  | 0                              | 0                           |                     |          |          |          |       |          |          |          |
| P                    | 900623 | B                   | 4                     | 11                 | 44                             | 5                           | 0.050               | 0.003    | 2.2      | 4.8      | 0.050 | 0.002    | 2.2      | 4.8      |
| P                    | 900623 | C                   | 4                     | 10                 | 40                             | 2                           | 0.167               | 0.000    | 6.7      | 0.0      | 0.167 | 0.000    | 6.7      | 0.0      |
| P                    | 900625 | B                   | 4                     | 8                  | 32                             | 4                           | 0.194               | 0.032    | 6.2      | 32.4     | 0.194 | 0.032    | 6.2      | 32.4     |
| P                    | 900625 | C                   | 4                     | 8                  | 32                             | 3                           | 0.131               | 0.013    | 4.2      | 13.4     | 0.131 | 0.013    | 4.2      | 13.4     |
| P                    | 900629 | B                   | 4                     | 4                  | 16                             | 4                           | 0.240               | 0.010    | 3.8      | 2.5      | 0.180 | 0.004    | 2.9      | 0.9      |
| P                    | 900629 | C                   | 4                     | 6                  | 24                             | 2                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900630 | B                   | 4                     | 16                 | 64                             | 9                           | 0.065               | 0.002    | 4.1      | 6.9      | 0.065 | 0.002    | 4.1      | 6.9      |
| P                    | 900630 | C                   | 4                     | 19                 | 76                             | 8                           | 0.162               | 0.004    | 12.3     | 20.5     | 0.125 | 0.002    | 9.5      | 10.5     |
| P                    | 900703 | B                   | 4                     | 18                 | 72                             | 10                          | 0.394               | 0.022    | 28.4     | 113.3    | 0.227 | 0.012    | 16.3     | 62.9     |
| P                    | 900703 | C                   | 4                     | 18                 | 72                             | 6                           | 0.197               | 0.005    | 14.2     | 28.2     | 0.140 | 0.002    | 10.0     | 12.3     |
| P                    | 900705 | B                   | 4                     | 25                 | 100                            | 11                          | 0.118               | 0.007    | 11.8     | 70.0     | 0.118 | 0.007    | 11.8     | 70.0     |
| P                    | 900705 | C                   | 4                     | 15                 | 60                             | 15                          | 0.113               | 0.001    | 6.8      | 4.8      | 0.050 | 0.001    | 3.0      | 1.9      |
| P                    | 900709 | B                   | 4                     | 23                 | 92                             | 19                          | 0.214               | 0.008    | 19.7     | 64.3     | 0.165 | 0.005    | 15.1     | 39.6     |
| P                    | 900709 | C                   | 4                     | 24                 | 96                             | 12                          | 0.083               | 0.001    | 8.0      | 7.8      | 0.072 | 0.001    | 6.9      | 4.6      |
| P                    | 900711 | B                   | 4                     | 28                 | 112                            | 18                          | 0.150               | 0.006    | 16.8     | 70.4     | 0.059 | 0.001    | 6.6      | 8.9      |
| P                    | 900711 | C                   | 4                     | 17                 | 68                             | 6                           | 0.058               | 0.001    | 4.0      | 5.5      | 0.058 | 0.001    | 4.0      | 5.5      |
| P                    | 900712 | B                   | 4                     | 26                 | 104                            | 21                          | 0.152               | 0.007    | 15.8     | 78.6     | 0.041 | 0.000    | 4.3      | 5.1      |
| P                    | 900712 | C                   | 4                     | 8                  | 32                             | 10                          | 0.049               | 0.001    | 1.6      | 1.2      | 0.025 | 0.001    | 0.8      | 0.6      |
| P                    | 900717 | B                   | 4                     | 25                 | 100                            | 14                          | 0.073               | 0.005    | 7.3      | 48.6     | 0.073 | 0.005    | 7.3      | 48.6     |
| P                    | 900717 | C                   | 4                     | 26                 | 104                            | 13                          | 0.120               | 0.004    | 12.5     | 40.5     | 0.096 | 0.003    | 10.0     | 36.2     |
| P                    | 900718 | B                   | 4                     | 11                 | 44                             | 11                          | 0.167               | 0.005    | 7.4      | 10.0     | 0.134 | 0.005    | 5.9      | 9.9      |
| P                    | 900718 | C                   | 4                     | 12                 | 48                             | 8                           | 0.049               | 0.003    | 2.4      | 7.6      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900720 | B                   | 4                     | 10                 | 40                             | 7                           | 0.081               | 0.006    | 3.3      | 10.2     | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900720 | C                   | 4                     | 21                 | 84                             | 7                           | 0.245               | 0.009    | 20.6     | 65.3     | 0.245 | 0.009    | 20.6     | 65.3     |
| P                    | 900721 | B                   | 4                     | 15                 | 60                             | 13                          | 0.246               | 0.012    | 14.8     | 44.4     | 0.215 | 0.011    | 12.9     | 38.6     |

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Appendix A2. (Page 2 of 2).

| Stratum <sup>a</sup> | Date   | Period <sup>b</sup> | Hours<br>in<br>Period | Anglers<br>Counted | Est.<br>Effort<br>in<br>Period | Anglers<br>Inter-<br>viewed | Estimates by Period |          |          |          |       |          |          |          |
|----------------------|--------|---------------------|-----------------------|--------------------|--------------------------------|-----------------------------|---------------------|----------|----------|----------|-------|----------|----------|----------|
|                      |        |                     |                       |                    |                                |                             | CPUE                |          | Catch    |          | HPUE  |          | Harvest  |          |
|                      |        |                     |                       |                    |                                |                             | Mean                | Variance | Estimate | Variance | Mean  | Variance | Estimate | Variance |
| P                    | 900721 | C                   | 4                     | 6                  | 24                             | 12                          | 0.032               | 0.001    | 0.8      | 0.7      | 0.032 | 0.001    | 0.8      | 0.7      |
| P                    | 900724 | B                   | 4                     | 9                  | 36                             | 6                           | 0.367               | 0.028    | 13.2     | 36.7     | 0.367 | 0.028    | 13.2     | 36.7     |
| P                    | 900724 | C                   | 4                     | 8                  | 32                             | 5                           | 0.830               | 0.052    | 26.6     | 53.7     | 0.193 | 0.010    | 6.2      | 10.1     |
| P                    | 900728 | B                   | 4                     | 3                  | 12                             | 2                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900728 | C                   | 4                     | 8                  | 32                             | 8                           | 0.060               | 0.005    | 1.9      | 4.9      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900729 | B                   | 4                     | 2                  | 8                              | 2                           | 0.500               | 0.028    | 4.0      | 1.8      | 0.167 | 0.028    | 1.3      | 1.8      |
| P                    | 900729 | C                   | 4                     | 2                  | 8                              | 0                           |                     |          |          |          |       |          |          |          |

<sup>a</sup> Stratum N = Nonpeak, Stratum P = Peak

<sup>b</sup> Period A (0700-1059) and period D (1900-2259) = Nonpeak stratum.  
 Period B (1100-1459) and period C (1500-1859) = Peak stratum.

Appendix A3. Summary of daily angler effort (angler-hours), catch rates (CPUE, fish caught per angler-hour), and harvest rates (HPUE, fish kept per angler-hour) for chum salmon in the sport fishery in the lower Togiak River, 1990.

| Stratum <sup>a</sup> | Date   | Period <sup>b</sup> | Hours<br>in<br>Period | Anglers<br>Counted | Est.<br>Effort<br>in<br>Period | Anglers<br>Inter-<br>viewed | Estimates by Period |          |          |          |       |          |          |          |
|----------------------|--------|---------------------|-----------------------|--------------------|--------------------------------|-----------------------------|---------------------|----------|----------|----------|-------|----------|----------|----------|
|                      |        |                     |                       |                    |                                |                             | CPUE                |          | Catch    |          | HPUE  |          | Harvest  |          |
|                      |        |                     |                       |                    |                                |                             | Mean                | Variance | Estimate | Variance | Mean  | Variance | Estimate | Variance |
| N                    | 900622 | A                   | 4                     | 0                  | 0                              | 0                           |                     |          | 0.0      | 0.0      |       |          | 0.0      | 0.0      |
| N                    | 900622 | D                   | 4                     | 1                  | 4                              | 0                           |                     |          |          |          |       |          |          |          |
| N                    | 900702 | A                   | 4                     | 0                  | 0                              | 0                           |                     |          | 0.0      | 0.0      |       |          | 0.0      | 0.0      |
| N                    | 900702 | D                   | 4                     | 0                  | 0                              | 0                           |                     |          | 0.0      | 0.0      |       |          | 0.0      | 0.0      |
| N                    | 900708 | A                   | 4                     | 0                  | 0                              | 0                           |                     |          | 0.0      | 0.0      |       |          | 0.0      | 0.0      |
| N                    | 900708 | D                   | 4                     | 0                  | 0                              | 0                           |                     |          | 0.0      | 0.0      |       |          | 0.0      | 0.0      |
| N                    | 900714 | A                   | 4                     | 7                  | 28                             | 11                          | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| N                    | 900714 | D                   | 4                     | 3                  | 12                             | 2                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| N                    | 900722 | A                   | 4                     | 0                  | 0                              | 0                           |                     |          | 0.0      | 0.0      |       |          | 0.0      | 0.0      |
| N                    | 900722 | D                   | 4                     | 3                  | 12                             | 2                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| N                    | 900727 | A                   | 4                     | 0                  | 0                              | 0                           |                     |          | 0.0      | 0.0      |       |          | 0.0      | 0.0      |
| N                    | 900727 | D                   | 4                     | 0                  | 0                              | 0                           |                     |          | 0.0      | 0.0      |       |          | 0.0      | 0.0      |
| P                    | 900621 | B                   | 4                     | 1                  | 4                              | 0                           |                     |          | 0.0      | 0.0      |       |          | 0.0      | 0.0      |
| P                    | 900621 | C                   | 4                     | 0                  | 0                              | 0                           |                     |          | 0.0      | 0.0      |       |          | 0.0      | 0.0      |
| P                    | 900623 | B                   | 4                     | 11                 | 44                             | 5                           | 0.050               | 0.003    | 2.2      | 4.8      | 0.050 | 0.003    | 2.2      | 4.8      |
| P                    | 900623 | C                   | 4                     | 10                 | 40                             | 2                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900625 | B                   | 4                     | 8                  | 32                             | 4                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900625 | C                   | 4                     | 8                  | 32                             | 3                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900629 | B                   | 4                     | 4                  | 16                             | 4                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900629 | C                   | 4                     | 6                  | 24                             | 2                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900630 | B                   | 4                     | 16                 | 64                             | 9                           | 0.031               | 0.001    | 2.0      | 4.2      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900630 | C                   | 4                     | 19                 | 76                             | 8                           | 0.017               | 0.000    | 1.3      | 2.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900703 | B                   | 4                     | 18                 | 72                             | 10                          | 0.028               | 0.001    | 2.0      | 4.6      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900703 | C                   | 4                     | 18                 | 72                             | 6                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900705 | B                   | 4                     | 25                 | 100                            | 11                          | 0.593               | 0.048    | 59.3     | 480.4    | 0.158 | 0.003    | 15.8     | 30.5     |
| P                    | 900705 | C                   | 4                     | 15                 | 60                             | 15                          | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900709 | B                   | 4                     | 23                 | 92                             | 19                          | 0.084               | 0.002    | 7.7      | 18.3     | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900709 | C                   | 4                     | 24                 | 96                             | 12                          | 0.074               | 0.002    | 7.1      | 14.3     | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900711 | B                   | 4                     | 28                 | 112                            | 18                          | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900711 | C                   | 4                     | 17                 | 68                             | 6                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900712 | B                   | 4                     | 26                 | 104                            | 21                          | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900712 | C                   | 4                     | 8                  | 32                             | 10                          | 0.216               | 0.020    | 6.9      | 20.9     | 0.024 | 0.001    | 0.8      | 0.6      |
| P                    | 900717 | B                   | 4                     | 25                 | 100                            | 14                          | 0.037               | 0.001    | 3.7      | 12.2     | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900717 | C                   | 4                     | 26                 | 104                            | 13                          | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900718 | B                   | 4                     | 11                 | 44                             | 11                          | 0.099               | 0.005    | 4.3      | 10.1     | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900718 | C                   | 4                     | 12                 | 48                             | 8                           | 0.109               | 0.013    | 5.2      | 29.9     | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900720 | B                   | 4                     | 10                 | 40                             | 7                           | 0.555               | 0.036    | 22.2     | 56.8     | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900720 | C                   | 4                     | 21                 | 84                             | 7                           | 0.036               | 0.001    | 3.0      | 7.7      | 0.036 | 0.001    | 3.0      | 7.7      |
| P                    | 900721 | B                   | 4                     | 15                 | 60                             | 13                          | 0.092               | 0.004    | 5.5      | 15.6     | 0.031 | 0.001    | 1.9      | 3.4      |
| P                    | 900721 | C                   | 4                     | 6                  | 24                             | 12                          | 0.135               | 0.005    | 3.2      | 3.1      | 0.034 | 0.001    | 0.8      | 0.7      |
| P                    | 900724 | B                   | 4                     | 9                  | 36                             | 6                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |

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Appendix A3. (Page 2 of 2).

| Stratum <sup>a</sup> | Date   | Period <sup>b</sup> | Hours<br>in<br>Period | Anglers<br>Counted | Est.<br>Effort<br>in<br>Period | Anglers<br>Inter-<br>viewed | Estimates by Period |          |          |          |       |          |          |          |
|----------------------|--------|---------------------|-----------------------|--------------------|--------------------------------|-----------------------------|---------------------|----------|----------|----------|-------|----------|----------|----------|
|                      |        |                     |                       |                    |                                |                             | CPUE                |          | Catch    |          | HPUE  |          | Harvest  |          |
|                      |        |                     |                       |                    |                                |                             | Mean                | Variance | Estimate | Variance | Mean  | Variance | Estimate | Variance |
| P                    | 900724 | C                   | 4                     | 8                  | 32                             | 5                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900728 | B                   | 4                     | 3                  | 12                             | 2                           | 0.500               | 0.250    | 6.0      | 36.0     | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900728 | C                   | 4                     | 8                  | 32                             | 8                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900729 | B                   | 4                     | 2                  | 8                              | 2                           | 0.500               | 0.250    | 4.0      | 16.0     | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900729 | C                   | 4                     | 2                  | 8                              | 0                           |                     |          |          |          |       |          |          |          |

<sup>a</sup> Stratum N = Nonpeak, Stratum P = Peak

<sup>b</sup> Period A (0700-1059) and period D (1900-2259) = Nonpeak stratum.  
 Period B (1100-1459) and period C (1500-1859) = Peak stratum.

Appendix A4. Summary of daily angler effort (angler-hours), catch rates (CPUE, fish caught per angler-hour), and harvest rates (HPUE, fish kept per angler-hour) for sockeye salmon in the sport fishery in the lower Togiak River, 1990.

| Stratum <sup>a</sup> | Date   | Period <sup>b</sup> | Hours<br>in<br>Period | Anglers<br>Counted | Est.<br>Effort<br>in<br>Period | Anglers<br>Inter-<br>viewed | Estimates by Period |          |          |          |       |          |          |          |
|----------------------|--------|---------------------|-----------------------|--------------------|--------------------------------|-----------------------------|---------------------|----------|----------|----------|-------|----------|----------|----------|
|                      |        |                     |                       |                    |                                |                             | CPUE                |          | Catch    |          | HPUE  |          | Harvest  |          |
|                      |        |                     |                       |                    |                                |                             | Mean                | Variance | Estimate | Variance | Mean  | Variance | Estimate | Variance |
| N                    | 900622 | A                   | 4                     | 0                  | 0                              |                             |                     | 0.0      | 0.0      |          |       | 0.0      | 0.0      |          |
| N                    | 900622 | D                   | 4                     | 1                  | 4                              |                             |                     |          |          |          |       |          |          |          |
| N                    | 900702 | A                   | 4                     | 0                  | 0                              |                             |                     | 0.0      | 0.0      |          |       | 0.0      | 0.0      |          |
| N                    | 900702 | D                   | 4                     | 0                  | 0                              |                             |                     | 0.0      | 0.0      |          |       | 0.0      | 0.0      |          |
| N                    | 900708 | A                   | 4                     | 0                  | 0                              |                             |                     | 0.0      | 0.0      |          |       | 0.0      | 0.0      |          |
| N                    | 900708 | D                   | 4                     | 0                  | 0                              |                             |                     | 0.0      | 0.0      |          |       | 0.0      | 0.0      |          |
| N                    | 900714 | A                   | 4                     | 7                  | 28                             | 11                          | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| N                    | 900714 | D                   | 4                     | 3                  | 12                             | 2                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| N                    | 900722 | A                   | 4                     | 0                  | 0                              |                             |                     | 0.0      | 0.0      |          |       | 0.0      | 0.0      |          |
| N                    | 900722 | D                   | 4                     | 3                  | 12                             | 2                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| N                    | 900727 | A                   | 4                     | 0                  | 0                              |                             |                     | 0.0      | 0.0      |          |       | 0.0      | 0.0      |          |
| N                    | 900727 | D                   | 4                     | 0                  | 0                              |                             |                     | 0.0      | 0.0      |          |       | 0.0      | 0.0      |          |
| P                    | 900621 | B                   | 4                     | 1                  | 4                              | 0                           |                     |          |          |          |       |          |          |          |
| P                    | 900621 | C                   | 4                     | 0                  | 0                              | 0                           |                     |          | 0.0      | 0.0      |       |          | 0.0      | 0.0      |
| P                    | 900623 | B                   | 4                     | 11                 | 44                             | 5                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900623 | C                   | 4                     | 10                 | 40                             | 2                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900625 | B                   | 4                     | 8                  | 32                             | 4                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900625 | C                   | 4                     | 8                  | 32                             | 3                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900629 | B                   | 4                     | 4                  | 16                             | 4                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900629 | C                   | 4                     | 6                  | 24                             | 2                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900630 | B                   | 4                     | 16                 | 64                             | 9                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900630 | C                   | 4                     | 19                 | 76                             | 8                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900703 | B                   | 4                     | 18                 | 72                             | 10                          | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900703 | C                   | 4                     | 18                 | 72                             | 6                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900705 | B                   | 4                     | 25                 | 100                            | 11                          | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900705 | C                   | 4                     | 15                 | 60                             | 15                          | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900709 | B                   | 4                     | 23                 | 92                             | 19                          | 0.033               | 0.001    | 3.1      | 4.4      | 0.033 | 0.001    | 3.1      | 4.4      |
| P                    | 900709 | C                   | 4                     | 24                 | 96                             | 12                          | 0.036               | 0.000    | 3.5      | 3.1      | 0.024 | 0.001    | 2.3      | 2.4      |
| P                    | 900711 | B                   | 4                     | 28                 | 112                            | 18                          | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900711 | C                   | 4                     | 17                 | 68                             | 6                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900712 | B                   | 4                     | 26                 | 104                            | 21                          | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900712 | C                   | 4                     | 8                  | 32                             | 10                          | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900717 | B                   | 4                     | 25                 | 100                            | 14                          | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900717 | C                   | 4                     | 26                 | 104                            | 13                          | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900718 | B                   | 4                     | 11                 | 44                             | 11                          | 0.064               | 0.004    | 2.8      | 8.6      | 0.064 | 0.004    | 2.8      | 8.6      |
| P                    | 900718 | C                   | 4                     | 12                 | 48                             | 8                           | 0.058               | 0.003    | 2.8      | 7.3      | 0.058 | 0.003    | 2.8      | 7.3      |
| P                    | 900720 | B                   | 4                     | 10                 | 40                             | 7                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900720 | C                   | 4                     | 21                 | 84                             | 7                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |

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Appendix A4. (Page 2 of 2).

| Stratum <sup>a</sup> | Date   | Period <sup>b</sup> | Hours<br>in<br>Period | Anglers<br>Counted | Est.<br>Effort<br>in<br>Period | Anglers<br>Inter-<br>viewed | Estimates by Period |          |          |          |       |          |          |          |
|----------------------|--------|---------------------|-----------------------|--------------------|--------------------------------|-----------------------------|---------------------|----------|----------|----------|-------|----------|----------|----------|
|                      |        |                     |                       |                    |                                |                             | CPUE                |          | Catch    |          | HPUE  |          | Harvest  |          |
|                      |        |                     |                       |                    |                                |                             | Mean                | Variance | Estimate | Variance | Mean  | Variance | Estimate | Variance |
| P                    | 900721 | B                   | 4                     | 15                 | 60                             | 13                          | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900721 | C                   | 4                     | 6                  | 24                             | 12                          | 0.137               | 0.010    | 3.3      | 6.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900724 | B                   | 4                     | 9                  | 36                             | 6                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900724 | C                   | 4                     | 8                  | 32                             | 5                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900728 | B                   | 4                     | 3                  | 12                             | 2                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900728 | C                   | 4                     | 8                  | 32                             | 8                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900729 | B                   | 4                     | 2                  | 8                              | 2                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900729 | C                   | 4                     | 2                  | 8                              | 0                           |                     |          |          |          |       |          |          |          |

<sup>a</sup> Stratum N = Nonpeak, Stratum P = Peak

<sup>b</sup> Period A (0700-1059) and period D (1900-2259) = Nonpeak stratum.  
 Period B (1100-1459) and period C (1500-1859) = Peak stratum.

Appendix A5. Summary of daily angler effort (angler-hours), catch rates (CPUE, fish caught per angler-hour), and harvest rates (HPUE, fish kept per angler-hour) for Dolly Varden in the sport fishery in the lower Togiak River, 1990.

| Stratum <sup>a</sup> | Date   | Period <sup>b</sup> | Hours<br>in<br>Period | Anglers<br>Counted | Est.<br>Effort<br>in<br>Period | Anglers<br>Inter-<br>viewed | Estimates by Period |          |          |          |       |          |          |          |
|----------------------|--------|---------------------|-----------------------|--------------------|--------------------------------|-----------------------------|---------------------|----------|----------|----------|-------|----------|----------|----------|
|                      |        |                     |                       |                    |                                |                             | CPUE                |          | Catch    |          | HPUE  |          | Harvest  |          |
|                      |        |                     |                       |                    |                                |                             | Mean                | Variance | Estimate | Variance | Mean  | Variance | Estimate | Variance |
| N                    | 900622 | A                   | 4                     | 0                  | 0                              |                             |                     | 0.0      | 0.0      |          |       | 0.0      | 0.0      |          |
| N                    | 900622 | D                   | 4                     | 1                  | 4                              |                             |                     |          |          |          |       |          |          |          |
| N                    | 900702 | A                   | 4                     | 0                  | 0                              |                             |                     | 0.0      | 0.0      |          |       | 0.0      | 0.0      |          |
| N                    | 900702 | D                   | 4                     | 0                  | 0                              |                             |                     | 0.0      | 0.0      |          |       | 0.0      | 0.0      |          |
| N                    | 900708 | A                   | 4                     | 0                  | 0                              |                             |                     | 0.0      | 0.0      |          |       | 0.0      | 0.0      |          |
| N                    | 900708 | D                   | 4                     | 0                  | 0                              |                             |                     | 0.0      | 0.0      |          |       | 0.0      | 0.0      |          |
| N                    | 900714 | A                   | 4                     | 7                  | 28                             | 11                          | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| N                    | 900714 | D                   | 4                     | 3                  | 12                             | 2                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| N                    | 900722 | A                   | 4                     | 0                  | 0                              |                             |                     | 0.0      | 0.0      |          |       | 0.0      | 0.0      |          |
| N                    | 900722 | D                   | 4                     | 3                  | 12                             | 2                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| N                    | 900727 | A                   | 4                     | 0                  | 0                              |                             |                     | 0.0      | 0.0      |          |       | 0.0      | 0.0      |          |
| N                    | 900727 | D                   | 4                     | 0                  | 0                              |                             |                     | 0.0      | 0.0      |          |       | 0.0      | 0.0      |          |
| P                    | 900621 | B                   | 4                     | 1                  | 4                              | 0                           |                     |          |          |          |       |          |          |          |
| P                    | 900621 | C                   | 4                     | 0                  | 0                              | 0                           |                     |          | 0.0      | 0.0      |       |          | 0.0      | 0.0      |
| P                    | 900623 | B                   | 4                     | 11                 | 44                             | 5                           | 0.050               | 0.003    | 2.2      | 4.8      | 0.050 | 0.003    | 2.2      | 4.8      |
| P                    | 900623 | C                   | 4                     | 10                 | 40                             | 2                           | 0.083               | 0.007    | 3.3      | 11.1     | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900625 | B                   | 4                     | 8                  | 32                             | 4                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900625 | C                   | 4                     | 8                  | 32                             | 3                           | 0.048               | 0.020    | 1.5      | 20.0     | 0.048 | 0.020    | 1.5      | 20.0     |
| P                    | 900629 | B                   | 4                     | 4                  | 16                             | 4                           | 0.120               | 0.005    | 1.9      | 1.2      | 0.120 | 0.005    | 1.9      | 1.2      |
| P                    | 900629 | C                   | 4                     | 6                  | 24                             | 2                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900630 | B                   | 4                     | 16                 | 64                             | 9                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900630 | C                   | 4                     | 19                 | 76                             | 8                           | 0.037               | 0.001    | 2.8      | 8.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900703 | B                   | 4                     | 18                 | 72                             | 10                          | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900703 | C                   | 4                     | 18                 | 72                             | 6                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900705 | B                   | 4                     | 25                 | 100                            | 11                          | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900705 | C                   | 4                     | 15                 | 60                             | 15                          | 0.012               | 0.000    | 0.7      | 0.6      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900709 | B                   | 4                     | 23                 | 92                             | 19                          | 0.050               | 0.001    | 4.6      | 5.8      | 0.034 | 0.001    | 3.1      | 4.3      |
| P                    | 900709 | C                   | 4                     | 24                 | 96                             | 12                          | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900711 | B                   | 4                     | 28                 | 112                            | 18                          | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900711 | C                   | 4                     | 17                 | 68                             | 6                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900712 | B                   | 4                     | 26                 | 104                            | 21                          | 0.014               | 0.000    | 1.4      | 2.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900712 | C                   | 4                     | 8                  | 32                             | 10                          | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900717 | B                   | 4                     | 25                 | 100                            | 14                          | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900717 | C                   | 4                     | 26                 | 104                            | 13                          | 0.074               | 0.005    | 7.7      | 58.6     | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900718 | B                   | 4                     | 11                 | 44                             | 11                          | 0.033               | 0.001    | 1.5      | 2.1      | 0.033 | 0.001    | 1.5      | 2.1      |
| P                    | 900718 | C                   | 4                     | 12                 | 48                             | 8                           | 0.109               | 0.013    | 5.2      | 29.9     | 0.109 | 0.013    | 5.2      | 29.9     |
| P                    | 900720 | B                   | 4                     | 10                 | 40                             | 7                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900720 | C                   | 4                     | 21                 | 84                             | 7                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900721 | B                   | 4                     | 15                 | 60                             | 13                          | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900721 | C                   | 4                     | 6                  | 24                             | 12                          | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900724 | B                   | 4                     | 9                  | 36                             | 6                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |

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Appendix A5. (Page 2 of 2).

| Stratum <sup>a</sup> | Date   | Period <sup>b</sup> | Hours<br>in<br>Period | Anglers<br>Counted | Est.<br>Effort<br>in<br>Period | Anglers<br>Inter-<br>viewed | Estimates by Period |          |          |          |       |          |          |          |
|----------------------|--------|---------------------|-----------------------|--------------------|--------------------------------|-----------------------------|---------------------|----------|----------|----------|-------|----------|----------|----------|
|                      |        |                     |                       |                    |                                |                             | CPUE                |          | Catch    |          | HPUE  |          | Harvest  |          |
|                      |        |                     |                       |                    |                                |                             | Mean                | Variance | Estimate | Variance | Mean  | Variance | Estimate | Variance |
| P                    | 900724 | C                   | 4                     | 8                  | 32                             | 5                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900728 | B                   | 4                     | 3                  | 12                             | 2                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900728 | C                   | 4                     | 8                  | 32                             | 8                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900729 | B                   | 4                     | 2                  | 8                              | 2                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900729 | C                   | 4                     | 2                  | 8                              | 0                           |                     |          |          |          |       |          |          |          |

<sup>a</sup> Stratum N = Nonpeak, Stratum P = Peak

<sup>b</sup> Period A (0700-1059) and period D (1900-2259) = Nonpeak stratum.  
 Period B (1100-1459) and period C (1500-1859) = Peak stratum.

Appendix A6. Summary of daily angler effort (angler-hours), catch rates (CPUE, fish caught per angler-hour), and harvest rates (HPUE, fish kept per angler-hour) for rainbow trout in the sport fishery in the lower Togiak River, 1990.

| Stratum <sup>a</sup> | Date   | Period <sup>b</sup> | Hours<br>in<br>Period | Anglers<br>Counted | Est.<br>Effort<br>in<br>Period | Anglers<br>Inter-<br>viewed | Estimates by Period |          |          |          |       |          |          |          |
|----------------------|--------|---------------------|-----------------------|--------------------|--------------------------------|-----------------------------|---------------------|----------|----------|----------|-------|----------|----------|----------|
|                      |        |                     |                       |                    |                                |                             | CPUE                |          | Catch    |          | HPUE  |          | Harvest  |          |
|                      |        |                     |                       |                    |                                |                             | Mean                | Variance | Estimate | Variance | Mean  | Variance | Estimate | Variance |
| N                    | 900622 | A                   | 4                     | 0                  | 0                              |                             |                     | 0.0      | 0.0      |          |       | 0.0      | 0.0      |          |
| N                    | 900622 | D                   | 4                     | 1                  | 4                              |                             |                     |          |          |          |       |          |          |          |
| N                    | 900702 | A                   | 4                     | 0                  | 0                              |                             |                     | 0.0      | 0.0      |          |       | 0.0      | 0.0      |          |
| N                    | 900702 | D                   | 4                     | 0                  | 0                              |                             |                     | 0.0      | 0.0      |          |       | 0.0      | 0.0      |          |
| N                    | 900708 | A                   | 4                     | 0                  | 0                              |                             |                     | 0.0      | 0.0      |          |       | 0.0      | 0.0      |          |
| N                    | 900708 | D                   | 4                     | 0                  | 0                              |                             |                     | 0.0      | 0.0      |          |       | 0.0      | 0.0      |          |
| N                    | 900714 | A                   | 4                     | 7                  | 28                             | 11                          | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| N                    | 900714 | D                   | 4                     | 3                  | 12                             | 2                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| N                    | 900722 | A                   | 4                     | 0                  | 0                              |                             |                     | 0.0      | 0.0      |          |       | 0.0      | 0.0      |          |
| N                    | 900722 | D                   | 4                     | 3                  | 12                             | 2                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| N                    | 900727 | A                   | 4                     | 0                  | 0                              |                             |                     | 0.0      | 0.0      |          |       | 0.0      | 0.0      |          |
| N                    | 900727 | D                   | 4                     | 0                  | 0                              |                             |                     | 0.0      | 0.0      |          |       | 0.0      | 0.0      |          |
| P                    | 900621 | B                   | 4                     | 1                  | 4                              | 0                           |                     |          |          |          |       |          |          |          |
| P                    | 900621 | C                   | 4                     | 0                  | 0                              | 0                           |                     |          | 0.0      | 0.0      |       |          | 0.0      | 0.0      |
| P                    | 900623 | B                   | 4                     | 11                 | 44                             | 5                           | 0.050               | 0.003    | 2.2      | 4.8      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900623 | C                   | 4                     | 10                 | 40                             | 2                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900625 | B                   | 4                     | 8                  | 32                             | 4                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900625 | C                   | 4                     | 8                  | 32                             | 3                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900629 | B                   | 4                     | 4                  | 16                             | 4                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900629 | C                   | 4                     | 6                  | 24                             | 2                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900630 | B                   | 4                     | 16                 | 64                             | 9                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900630 | C                   | 4                     | 19                 | 76                             | 8                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900703 | B                   | 4                     | 18                 | 72                             | 10                          | 0.093               | 0.003    | 6.7      | 17.6     | 0.031 | 0.001    | 2.2      | 4.5      |
| P                    | 900703 | C                   | 4                     | 18                 | 72                             | 6                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900705 | B                   | 4                     | 25                 | 100                            | 11                          | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900705 | C                   | 4                     | 15                 | 60                             | 15                          | 0.037               | 0.001    | 2.2      | 5.1      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900709 | B                   | 4                     | 23                 | 92                             | 19                          | 0.017               | 0.000    | 1.5      | 2.3      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900709 | C                   | 4                     | 24                 | 96                             | 12                          | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900711 | B                   | 4                     | 28                 | 112                            | 18                          | 0.015               | 0.000    | 1.6      | 2.8      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900711 | C                   | 4                     | 17                 | 68                             | 6                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900712 | B                   | 4                     | 26                 | 104                            | 21                          | 0.041               | 0.000    | 4.3      | 5.1      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900712 | C                   | 4                     | 8                  | 32                             | 10                          | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900717 | B                   | 4                     | 25                 | 100                            | 14                          | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900717 | C                   | 4                     | 26                 | 104                            | 13                          | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900718 | B                   | 4                     | 11                 | 44                             | 11                          | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900718 | C                   | 4                     | 12                 | 48                             | 8                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900720 | B                   | 4                     | 10                 | 40                             | 7                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900720 | C                   | 4                     | 21                 | 84                             | 7                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900721 | B                   | 4                     | 15                 | 60                             | 13                          | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900721 | C                   | 4                     | 6                  | 24                             | 12                          | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |

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Appendix A6. (Page 2 of 2).

| Stratum <sup>a</sup> | Date   | Period <sup>b</sup> | Hours<br>in<br>Period | Anglers<br>Counted | Est.<br>Effort<br>in<br>Period | Anglers<br>Inter-<br>viewed | Estimates by Period |          |          |          |       |          |          |          |
|----------------------|--------|---------------------|-----------------------|--------------------|--------------------------------|-----------------------------|---------------------|----------|----------|----------|-------|----------|----------|----------|
|                      |        |                     |                       |                    |                                |                             | CPUE                |          | Catch    |          | HPUE  |          | Harvest  |          |
|                      |        |                     |                       |                    |                                |                             | Mean                | Variance | Estimate | Variance | Mean  | Variance | Estimate | Variance |
| P                    | 900724 | B                   | 4                     | 9                  | 36                             | 6                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900724 | C                   | 4                     | 8                  | 32                             | 5                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900728 | B                   | 4                     | 3                  | 12                             | 2                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900728 | C                   | 4                     | 8                  | 32                             | 8                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900729 | B                   | 4                     | 2                  | 8                              | 2                           | 0.000               | 0.000    | 0.0      | 0.0      | 0.000 | 0.000    | 0.0      | 0.0      |
| P                    | 900729 | C                   | 4                     | 2                  | 8                              | 0                           |                     |          |          |          |       |          |          |          |

<sup>a</sup> Stratum N = Nonpeak, Stratum P = Peak

<sup>b</sup> Period A (0700-1059) and period D (1900-2259) = Nonpeak stratum.

Period B (1100-1459) and period C (1500-1859) = Peak stratum.

APPENDIX B

Data Files and Programs

Appendix B. Data files and programs used to produce this report.

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\* Data Files

T0060IA0.DTA Togiak R. angler interviews 21 June to 29 July 1990.

T0060CA0.DTA Togiak R. angler counts 21 June to 29 July 1990.

T0060BA0.DTA Togiak R. chinook salmon biological data (age, weight, length, sex) from sport harvest; 21 June to 29 July 1990.

Analysis Programs

TOG90NEW.SAS Togiak R. effort, catch, harvest estimate program, 1990.

BBXPEXE A series of programs that uses biological data files to produce tables of mean lengths and weights by sex and age group for a species. The program also produces a data set which may be used in Lotus 1-2-3 (tm) to create graphs.

TOG90KSA.WK1 Applies finite population correction factor to estimates of variance of percents in BBXPEXE

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The data files are all archived with Alaska Department of Fish and Game, Sport Fish Division, Research and Technical Services Unit, 333 Raspberry Road, Anchorage, Alaska 99518-1599. Contact Gail Heineman or Donna Buchholz (267-2369) for copies of the files and descriptions of the file formats.

