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STEELHEAD CREEL AND ESCAPEMENT STATISTICS, IN-RIVER DISTRIBUTION, AND RECREATIONAL USE SURVEY, KARTA RIVER, SOUTHEAST ALASKA, 1989[1]

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ABSTRACT

Steelhead *Oncorhynchus mykiss* escapement into the Karta River was counted as it passed through a tripod and picket weir. Between March 24 and June 9, 1989, a total of 1,220 upstream migrants (837 females, 383 males) and 842 downstream migrants (575 females, 267 males) were counted. Age classes 3.2 and 3.3 were dominant among initial spawning fish, and age classes 3.2S1, 3.3S1, and 4.2S1 were dominant among repeat spawners. Steelhead ranged in weight from 0.5 to 8.6 kilograms, while lengths varied from 420 to 795 millimeters. Steelhead in-river distribution was determined by radio telemetry, and indicated that Karta River steelhead were distributed primarily in the mainstem section of the river, followed by three tributaries in descending order of importance: Senator Wirth Creek, Andersen Creek, and McGilvery Creek. Male steelhead spent an average of 45.5 days (standard error = 2.39) in freshwater, while female steelhead spent an average of 35.5 days (standard error = 2.03). A creel survey of sport fishermen along the Karta River from March 13 to June 4, 1989 estimated that 174 adult steelhead were caught, with 50 fish (standard error = 19) retained and 124 (standard error = 49.7) released. The overall harvest rate for steelhead during this survey was 0.11 fish per hour. On-site and mail-in recreational use data were collected to determine the opinions and needs of recreational users of the area, in order to assess the need for changes in fishing regulations by the Alaska Department of Fish and Game, and/or for additional recreational facilities or land use management restrictions by the United States Forest Service. These data indicated that most anglers using this system: were non-residents (69 percent non-residents and 31 percent residents); used the area less than five times; arrived in groups that usually consisted of less than six people; actually spent one to two days on the river; saw less than nine other people and preferred to see less than six people; felt that fishing pressure was about right; wanted to see improvements in recreational facilities; agreed with various proposed fishing regulation changes; approved of endemic steelhead enhancement, and; accessed the area by float plane.

KEY WORDS: Southeast Alaska, Karta River, Prince of Wales Island, steelhead, *Oncorhynchus mykiss*, escapement weir, Age-Weight-Length (AWL), in-river distribution, radio telemetry, creel survey, recreational use survey, management.

INTRODUCTION

The Prince of Wales Island (PWI) complex (Figure 1) is the third largest island in the United States and the second largest island in Alaska (7,174 square kilometers). Intensive logging activity on this island over the last 30 years has resulted in construction of the most extensive road system in Southeast Alaska. The Prince of Wales arterial road system includes over 1,609 kilometers of road and enters every major drainage on the northern two-thirds of the island. In addition, this road system is connected to the Alaska State Marine Highway Transportation System with ferry terminal facilities located at Hollis, Alaska.

The current road system has opened up former wilderness areas that were rarely fished to heavy exploitation of the freshwater fishery resources. The remaining wilderness areas on PWI include South Prince of Wales, Maurelle Island, and Warren Islands. Development on PWI has been sponsored by the United States Forest Service (USFS) and private industries such as Sealaska, Inc., that represent the largest of the non-governmental organizations. There are seven major communities on PWI with populations of over 2,000, and 10 other logging communities with over 1,000 residents.

Prince of Wales Island contains a vast number of streams, lakes, and rivers with all five species of Pacific salmon (*Oncorhynchus* spp.) available somewhere on the island. The lakes and streams also possess rainbow and steelhead trout *Oncorhynchus mykiss*, cutthroat trout *O. clarki*, Dolly Varden *Salvelinus malma*, and Arctic grayling *Thymallus arcticus*. The majority of the anadromous fish streams have been identified and catalogued, while most of the higher elevation lakes have been stocked with rainbow trout or Arctic grayling.

The present decline in logging operations has depressed the economy on PWI and has necessitated a broadening of economic bases by the communities located on this island. Tourism is currently viewed as a significant source for economic growth. Several of these communities consider the excellent sport fishery on and around PWI a major attraction, with particular emphasis currently placed on wild steelhead trout populations.

The number of fishing lodges catering to recreational clientele are increasing rapidly on PWI. There were two fishing lodges on the island in 1982 and eight in 1989, with plans for more in the near future. In addition, there were 34 sport fishing charter operations registered for PWI in 1989, many freshwater guides, and an additional 64 registered charter boats from Ketchikan that regularly fish portions of PWI. The growing sport fishing effort has resulted in use of all fresh- and saltwater sport fisheries. Freshwater fishing activities in the Karta River drainage, illustrated through historic effort and harvest estimates, typify the increase in use of PWI freshwater resources (Table 1). The substantial public and department concerns for the resources present in this system resulted in the operation of an intensive steelhead research program to monitor both sport fishing and recreational use impacts occurring in this river.

A cooperative project between the Alaska Department of Fish and Game (ADF&G), Division of Sport Fish, and the USFS, Thorne Bay Ranger District, was established in 1989 to conduct creel/recreational use surveys on the Thorne and Karta Rivers. This study was designed to collect background information necessary to evaluate current and proposed changes to sport fishing regulations, and to help guide USFS

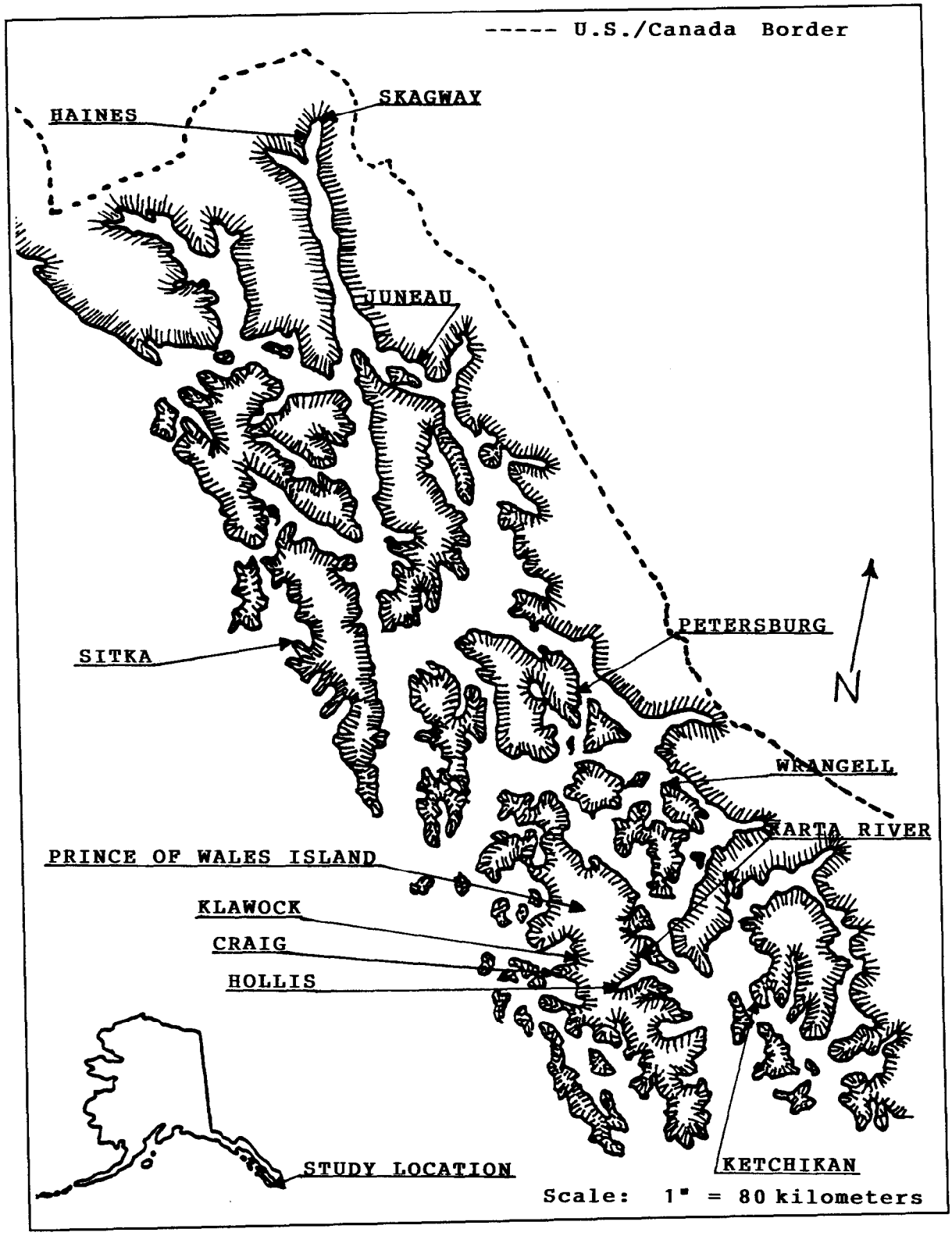


Figure 1. Southeast Alaska, showing Prince of Wales Island and the Karta River.

Table 1. Sport fishing effort and harvest estimates on the Karta River, 1977-88.

	Anglers	Trips	Days Fished	Harvest by Species: Coho Salmon	Sockeye Salmon	Pink Salmon	Chum Salmon	Dolly Varden	Steelhead	Rainbow Trout	Cutthroat Trout
1977[a]	-	-	459	31	6	6	0	133	73	90	150
1978[b]	-	-	474	113	0	139	0	0	45	18	497
1979[c]	-	-	409	0	45	0	0	482	45	0	364
1980[d]	-	-	487	9	17	9	0	361	292	34	86
1981[e]	-	-	330	18	163	0	0	36	36	0	137
1982[f]	-	-	751	94	0	0	0	63	210	126	199
1983[g]	-	-	651	0	550	8	0	160	130	168	275
1984[h]	706	613	1,203	401	212	460	0	130	260	118	35
1985[i]	776	519	1,318	25	746	0	0	260	435	156	35
1986[j]	978	617	2,014	69	458	122	46	1,095	588	302	536
1987[k]	1,170	716	1,170	103	509	119	0	321	231	167	128
1988[i]	340	454	667	36	910	0	291	146	104	73	146

[a] (Mills 1979)
[b] (Mills 1980)
[c] (Mills 1981a)
[d] (Mills 1981b)
[e] (Mills 1982)
[f] (Mills 1983)
[g] (Mills 1984)
[h] (Mills 1985)
[i] Mike Mills, ADF&G, Division of Sport Fish, Anchorage, personal communication. In the published Statewide Harvest Report for these years (1985 and 1988), this total was included in "Other Streams" because the number of respondents was low.
[j] (Mills 1987)
[k] (Mills 1988)

land management decisions. The objectives and tasks for the Karta River study were:

1. Count the in-river escapement of spring-run steelhead returning to this system between March 15, 1898 and June 15, 1898.

2. Estimate the recreational steelhead fishing effort (total number of angler-hours expended), catch (number of fish kept plus number released by anglers), harvest (number of fish kept), and angler use pattern of both residents and non-residents utilizing the Karta River steelhead fishery.

3. Identify the in-river distribution of steelhead in the Karta River through radio tagging and aerial tracking methods.

4. Estimate sex, age, and length composition of steelhead returning to the system.

METHODS

Escapement Weir

A tripod and picket fence escapement weir with upstream and downstream sampling traps was operated to enumerate upstream and downstream migrating adult steelhead endemic to the Karta River (Figure 2). Weir personnel counted migrating steelhead daily, and measured water temperature (°C) and water level (cm) at the weir gauging station at 8:00 a.m. each morning.

Age-Weight-Length (AWL)

All adult steelhead passed upstream through the weir were removed from the sampling trap via dip net and placed in a one-quarter inch foam padded V notch sampling trough that held water. Length from mid-eye to fork of tail (MEFT) was measured to the nearest mm, and ten scales were collected from the preferred area located two scale rows above the lateral line on a diagonal line from the dorsal fin to the anal fin. Each fish was then transferred into a large dip net, and weighed to the nearest pound using a hand held scale from which the dip net with individual steelhead was suspended. Each fish was tagged with a numbered green T-bar (Floy) anchor tag placed just under the dorsal fin before release above the weir. All weights were converted, and are reported to the nearest 0.1 kg. Mean length and weight, and the associated standard errors, were estimated using standard normal procedures. Parameters in the length-weight relationship were estimated using MS CHART.

Scales collected from these fish were aged using methods described by Narver and Withler (1977). Repeat spawners are classified with an "S" after the ocean age to denote a successful spawning run and survival. A steelhead with an age designation of 3.2S1 was six years old. It spent 3 years (winters) in freshwater before smolt emigration and two years (winters) in saltwater, then returned to freshwater, spawned ("S"), and survived another year in saltwater before returning to freshwater on its second spawning run. Initial spawning steelhead were those fish without an "S" in their total age designation.

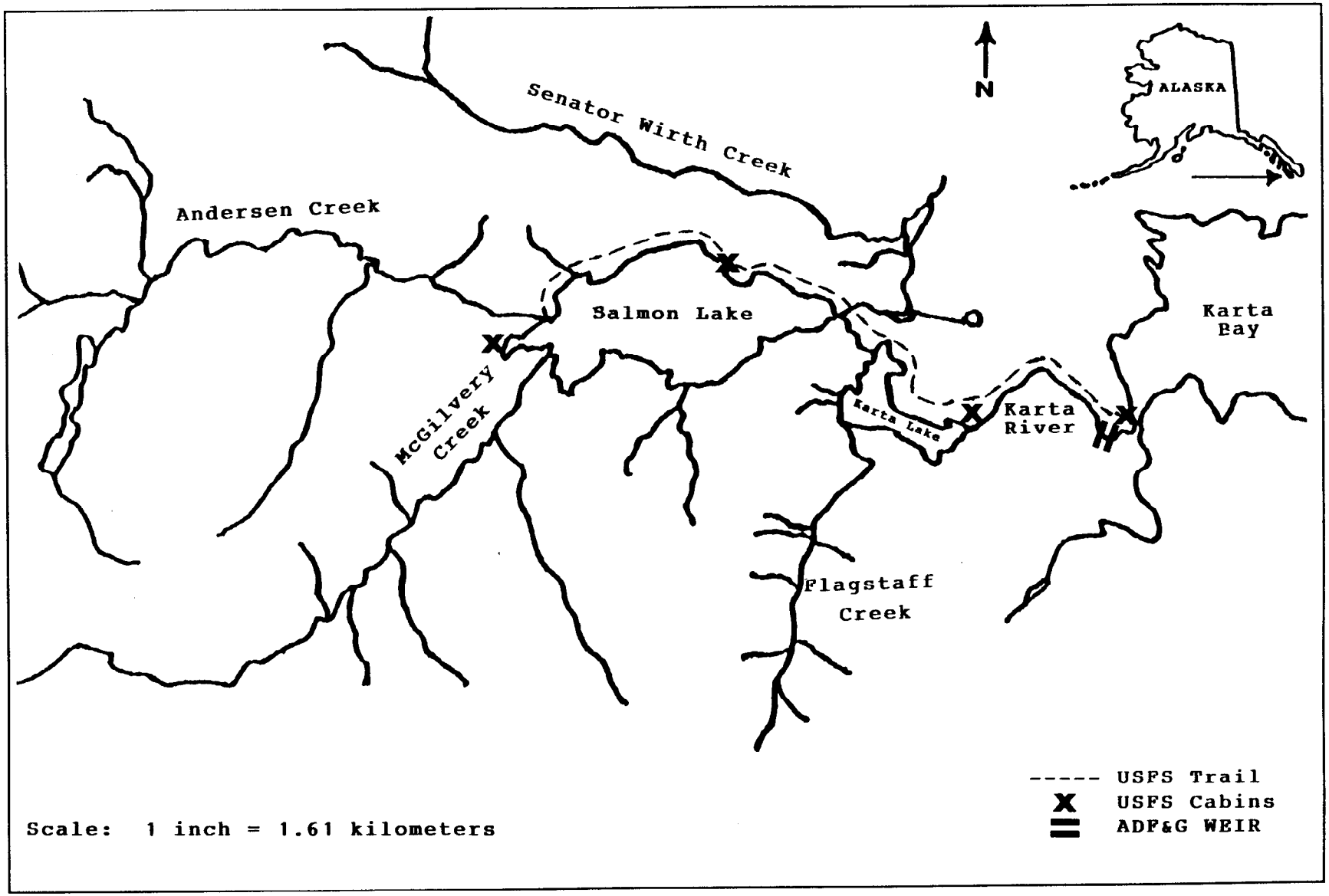


Figure 2. Karta River drainage, 1989.

Creel Survey

The recreational angler harvest of Karta River steelhead trout was assessed by a roving interview and instantaneous angler count type creel survey (Neuhold and Lu 1957). A technician, stationed at the Karta River weir camp, conducted angler interviews and counts following a randomly designed schedule between March 13 and June 4, 1989. The interviewer asked how many hours were fished, species caught, gear used, number of each species kept and/or released, residency, and access location. Instantaneous counts of anglers were made during two randomly scheduled four-hour periods each day, stratified by weekday and weekend/holiday, to produce estimates of fishing effort. These counts were multiplied by available fishing hours to produce effort in angler-hours. The catch per unit of effort (CPUE) for steelhead was estimated from angler interviews conducted daily during randomly scheduled four hour time periods, stratified by weekday and weekend/holiday.

The effort estimates and the associated variance estimates are obtained according to the following equations (essentially following the approach of Von Geldern and Tomlinson 1973).

$\hat{E}_h$ = estimated angler-hours expended on the hth day of the fishery;

$$= R_h \bar{x}_h \quad (1)$$

h = subscript denoting stratum (as defined by the combination of biweekly period and type of day: weekday versus weekend-holiday);

R_h = the total number of hours (available for fishing) on the hth day;

$\bar{x}_h$ = mean number of anglers fishing per count for the hth day;

$$= \frac{\sum_{i=1}^{d_h} (x_{hi})}{d_h} \quad (2)$$

i = subscript denoting sample within the hth day;

d_h = number of samples (i.e., counts) completed in the hth stratum;

x_{hi} = number of recreational anglers fishing counted in the ith sample in the hth stratum;

$\hat{V}_h(\hat{E}_h)$ = the variance estimate for the estimate of E_h, obtained by the standard formula for the estimation of the variance of a product of a constant and a variance estimate, and utilizing a finite population correction factor (Lehmann 1975, equation A.19, page 330);

$$= \left[\frac{(D_h - d_h)}{D_h}\right] \left[R_h^2 \left(\frac{s_h^2}{d_h}\right)\right] \quad (3)$$

D_h = number of possible counts which can be conducted on the hth day (approximately equal to R_h, as each survey takes approximately two hours to complete);

$$s_h^2 = \frac{\sum_{i=1}^{d_h} (x_{hi} - \bar{x}_h)^2}{(d_h - 1)} \quad (4)$$

Angler catch and harvest rates were estimated from interview data using a stratified random estimator, according to the following equations:

$\hat{T}_h$ = estimated total catch or harvest per unit of effort for the hth stratum for each location;

$$= \frac{\sum_{i=1}^{n_h} (\sum_{j=1}^{o_i} c_{hij})}{\sum_{i=1}^{n_h} (\sum_{j=1}^{o_i} e_{hij})} \quad (5)$$

h = subscript denoting the stratum;

i = subscript denoting period sampled within the hth stratum;

j = subscript denoting the angler interviewed in a sample;

n_h = number of periods sampled within the hth stratum;

o_i = number of anglers interviewed within the ith sample;

c_{hij} = catch of the jth angler interviewed in the ith sample in the hth stratum;

e_{hij} = effort of the jth angler interviewed in the ith sample in the jth stratum;

$\hat{V}_h(\hat{T}_h)$ = estimated variance of the CPUE estimate in the hth stratum and is estimated approximately by the standard formula for the variance of the ratio of random variables (Jessen 1978, equation 5.8, page 128, omitting the finite population correction factor);

$$\approx \{\frac{\bar{c}_{h..}}{\bar{e}_{h..}}\}^2 \{[\frac{s_c^2}{(\bar{c}_{h..})^2}] + [\frac{s_e^2}{(\bar{e}_{h..})^2}] - [\frac{2\mathrm{cov}(c,e)}{\bar{c}_{h..}\bar{e}_{h..}}]\} \quad (6)$$

$\bar{c}_{h..}$ = overall mean (of means) catch per angler in the hth stratum;

$$= \frac{\sum_{i=1}^{n_h} \bar{c}_{hi.}}{n_h} \quad (7)$$

$\bar{c}_{hi.}$ = mean catch per angler for the o_i interviews within the ith sample;

$$= \frac{\sum_{j=1}^{o_i} c_{hij}}{o_i} \quad (8)$$

$\bar{e}_{h..}$ = overall mean (of means) effort per angler in the hth stratum, calculated by replacing the appropriate effort statistics into equation 7, above;

$\bar{e}_{hi.}$ = mean effort per angler for the o_i interviews within the ith sample within the hth stratum, calculated by replacing the appropriate effort statistics into equation 8, above;

s_c^2 = variance estimate associated with estimating the catch component of the CPUE or HPUE estimate, obtained by using a modified two-stage sampling approach estimator (Cochran 1977, section 10.3);

$$= \left[\frac{N_h - n_h}{N_h}\right]\left[\frac{s_{B_c}^2}{n_h}\right] + \left[\frac{1}{N_h}\right]\left[\frac{s_{W_c}^2}{n_h}\right] \quad (9)$$

N_h = total number of possible sampling periods within the hth stratum for catch;

$s_{B_c}^2$ = the between samples variance component of the variance estimate for catch;

$$= \frac{\sum_{i=1}^{n_h} (\bar{c}_{hi.} - \bar{c}_{h..})^2}{n_h - 1} \quad (10)$$

$s_{W_c}^2$ = the within sample variance component of the variance estimate for catch;

$$= \sum_{i=1}^{n_h} \left\{\left[\frac{(O_i - o_i)}{O_i}\right]\left[\frac{1}{o_i}\right]\left[\frac{\sum_{j=1}^{o_i} (c_{hij} - \bar{c}_{hi.})^2}{(o_i - 1)}\right]\right\} \quad (11)$$

s_e^2 = variance estimate associated with estimating the effort component of the CPUE estimate which is calculated by substituting the corresponding effort statistics into equations 9 through 11, above;

$cov(c,e)$ = covariance estimate between the catch and effort components of the CPUE estimate;

$$= \left[\frac{N_h - n_h}{N_h}\right]\left[\frac{cov_B(c,e)}{n_h}\right] + \left[\frac{1}{N_h}\right]\left[\frac{cov_W(c,e)}{n_h}\right] \quad (12)$$

$cov_B(c,e)$ = the between samples covariance component of the covariance estimate between catch and effort;

$$= \frac{\sum_{i=1}^{n_h} (\bar{c}_{hi.} - \bar{c}_{h..})(\bar{e}_{hi.} - \bar{e}_{h..})}{(n_h - 1)} \quad (13)$$

$cov_w(c,e)$ = the within samples covariance component of the covariance estimate between catch and effort;

$$= \sum_{i=1}^{n_h} \{ [\frac{(O_i - o_i)}{O_i}] [\frac{1}{o_i}] [\frac{\sum_{j=1}^{o_i} (c_{hij} - \bar{c}_{hi.})(e_{hij} - \bar{e}_{hi.})}{o_i - 1}] \} \quad (14)$$

The next step involved estimating the harvest for each stratum:

$\hat{H}_h$ = estimated catch (or harvest) of the hth stratum for each location;

$$= \hat{E}_h \hat{T}_h \quad (15)$$

$\hat{V}_h(\hat{H}_h)$ = estimated variance of the estimate of H_h, assuming independence of the estimates of effort and CPUE, obtained by using the formula proposed by Goodman (1960) for the estimation of the variance of a product of two random independent variables;

$$= \hat{E}_h^2 \hat{V}_h(\hat{T}_h) + \hat{T}_h^2 \hat{V}_h(\hat{E}_h) - \hat{V}_h(\hat{E}_h) \hat{V}_h(\hat{T}_h) \quad (16)$$

The final step in estimating harvest for the entire season involves combining the combined stratum estimates:

$\hat{H}$ = overall estimated catch (or harvest);

$$= \sum_{h=1}^{q} (H_h) \quad (17)$$

q = number of strata;

$\hat{V}(\hat{H})$ = estimated variance of H, assuming independence of the stratum estimates;

$$= \sum_{h=1}^{q} (\hat{V}_h(\hat{H}_h)) \quad (18)$$

Anglers were also asked what type of terminal gear they had used. Terminal gear types were classified into four types: spinners, flies, bait, and artificals. The percent usage of each type was calculated for anglers targeting on steelhead.

Recreational Use

A series of 13 questions developed by USFS staff concerning recreational use on the Karta River were asked during angler interviews (Appendix A1). In addition, a more detailed four page USFS questionnaire was given to each angler and/or recreational user along with a self addressed and stamped envelope (Appendix A2).

Individuals receiving these forms in person or at the USFS cabins located on this system (Figure 2), were asked to complete the survey at their convenience and return it via the U.S. mail.

In-River Distribution

During the operation of the steelhead escapement weir, 91 steelhead received orally implanted radio tags in the upper section of their stomachs. Fish were selected for radio tagging based upon brightness of the fish, relative sexual maturity, cross-section of population sizes (1-ocean jacks were omitted), and on sex ratio approximating the overall immigrating population. The radio tags were manufactured by Advanced Telemetry System (ATS) in frequencies 30-31 MHZ spaced 10 KHZ apart, with 60 or 90 pulse rates and motion sensor detectors. This type of tag was used by the National Marine Fisheries Service (NMFS) on the Taku River (Eiler 1989), and was recommended for use on this project by this agency. Steelhead selected for radio tagging were placed in a foam padded V-notch sampling trough ventral side up without the use of anesthesia; holding each fish ventral side up appeared to relax the fish and reduce handling stress. Anesthetics such as tricane methanesulfonate (MS-222) were not used because Federal Food and Drug Administration regulations prohibit their use in areas such as the Karta River where human consumption may occur within twenty-one days after use.

Individual radio tags were 70 mm long and tapered from 20 mm to 15 mm in diameter with a flexible 290 mm metal antenna attached to the narrow end (Figure 3). Radio tags were inserted into the stomach via the esophagus with the aid of a fiberglass tube cut from a fishing rod blank. The insertion tube was 220 mm long, with an inside diameter of 16 mm and an outside diameter of 18 mm. The smallest end of the radio tag was inserted into the fiberglass tube and the antenna was fed through the insertion tube. Water soluble surgical lubricant was applied to each radio tag and to the end of the insertion tube before placement. The antenna was threaded through the operculum behind the gills using a knitting needle for the first eleven fish processed. The antenna was allowed to protrude from the mouth of the remaining fish processed. Allowing the antenna to protrude from the mouth reduced handling time, eliminated working in the area of the gills, and increased signal strength.

Tracking was conducted on a weekly basis within the Karta River drainage using aerial, foot, and boat surveys. Foot and boat surveys were conducted on days preceding aerial flights to locate fish holding below Karta Lake and to minimize flight time and areas to be surveyed. Foot and boat surveys of the Karta River drainage were conducted from the weir upstream. All tag frequencies in use were entered into a hand-held receiver equipped with wand style antenna. Once a tagged fish was located, its location was recorded in relation to area above the weir, and its frequency was erased from the memory of the receiver.

Aerial tracking the following day searched for all frequencies not located by foot or boat surveys. Aerial surveys were conducted using a pontoon configured Cessna 185 equipped with two portable antennas five feet in length. Each antenna was mounted upright in a vertical position from the end of an aluminum plate one inch wide and two feet long that was attached across the pontoon just forward of the front strut support. Coaxial wire leads from the antennas passed into the plane via the cabin air intake system and were attached to a hand-held receiver equipped with head set. The float plane flew over the Karta River drainage at

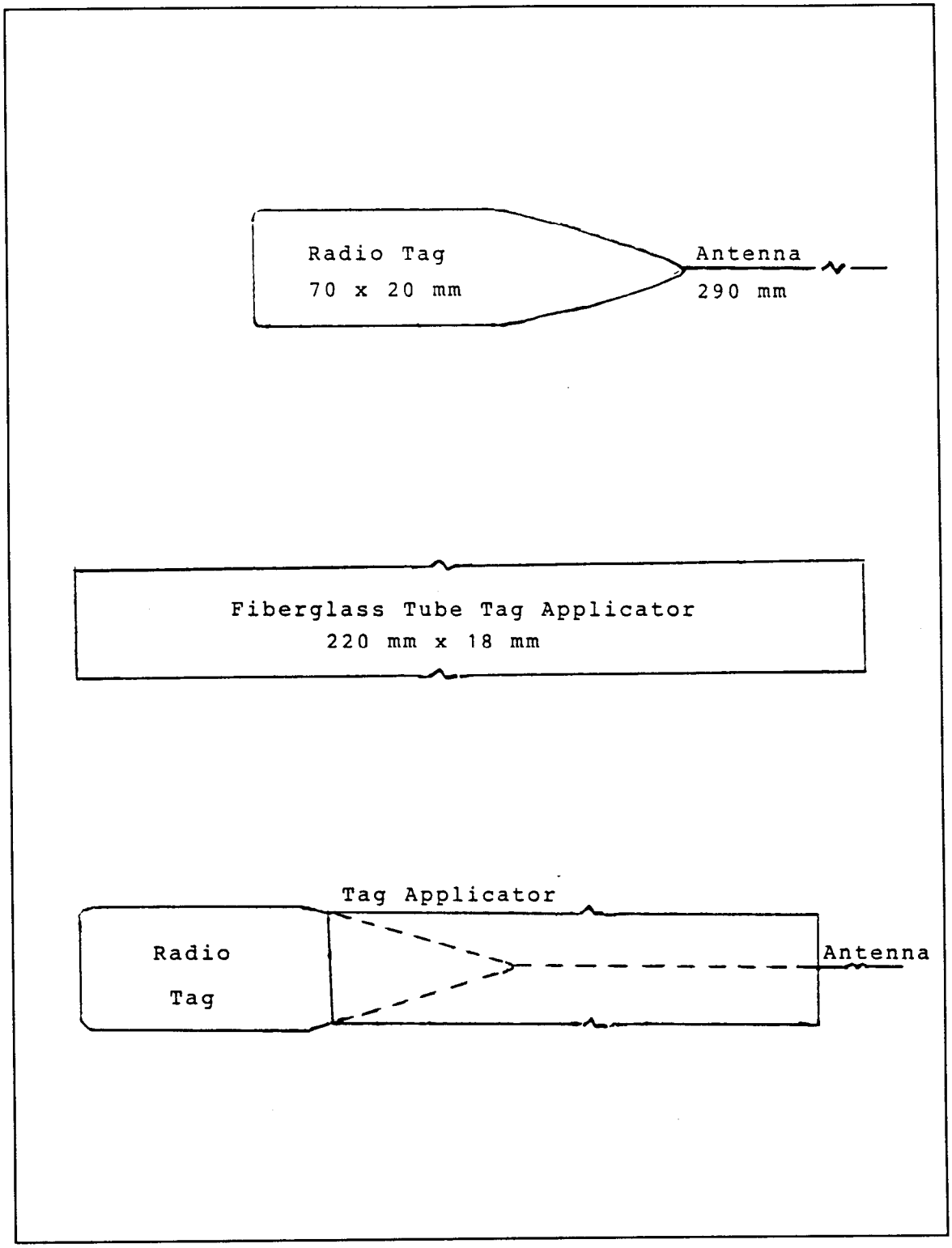


Figure 3. Karta River steelhead radio tag and applicator used in 1989 study.

altitudes of less than 300 meters whenever wind and weather conditions permitted. Aerial surveys were divided into areas that were flown until all unlocated radio tag frequencies were scanned and located. The areas consisted of: 1) Karta Lake; 2) between Karta and Salmon Lakes including Senator Wirth Creek; 3) Salmon Lake; 4) Andersen Creek; and 5) McGilvery Creek. Flagstaff Creek, a tributary to Karta Lake, was surveyed only when an individual radio tag frequency was not located in other areas (Figure 2).

Signal strength was used to determine location during aerial surveys. During foot or boat surveys, signal strength with the antenna attached to the receiver was used to determine general location. After general location was identified, the antenna was detached from the coaxial cable connected to the receiver and signal strength was checked using the receiver and coaxial cable alone. This combination had a range of 10-12 meters and enabled actual location to be determined more precisely.

RESULTS

Escapement Weir

The Karta River weir operated from March 24 through June 9, 1989 for a total of 78 days. During this period, a total of 1,220 upstream migrating steelhead were counted and released upstream with a Floy anchor tag placed under the dorsal fin. The sex composition of this return was dominated by female steelhead (837 females to 383 males), many of which were repeat female spawners. The timing of the escapement into this system followed a fairly well defined normal curve, with peak immigration for both males and females occurring during the last week of April (Figure 4). Water temperature ranged from approximately 1.1°C during March to over 15.6°C during May. Water temperature was above 4.5°C during the period of peak escapement in April (Figure 5). Water levels taken at the weir gauging station varied from 7.6 cm during May to over 50.8 cm during the period of peak steelhead escapement (Figure 6). A total of 842 post-spawn steelhead were passed downstream from early May through June 9; most of these fish were also females. Peak emigrations occurred on May 31, and on June 10 during weir shutdown. A total of 742 of the 842 downstream migrating fish bore a Floy anchor tag, indicating that a run of at least 100 fish had entered the system before installation of the weir (Figure 7).

Age, Weight and Length (AWL)

Measurements of length and/or weight were available from 375 of the male steelhead that passed upstream through the Karta River weir (98%), and from 713 of the female steelhead (85%). Immigrant male steelhead averaged 652 mm in length ($n = 358$, $SE = 4.07$) and 4.4 kg in weight ($n = 370$, $SE = 0.09$). Immigrant female steelhead averaged 686 mm in length ($n = 701$, $SE = 2.20$) and 5.0 kg in weight ($n = 701$, $SE = 0.05$).

Due to time constraints, only 792 of the 1,118 samples of scales collected from immigrant steelhead were aged from the Karta River run in 1989 (Appendix B.1 and B.2). The mean length and weight of male steelhead that were aged was not significantly different from those for the total immigrant male steelhead sample (Student's t-test; length: $t = 0.90$, $df = 623$; weight: $t = 0.00$, $df = 634$) at $p = 0.05$. Similarly, the mean length and weight of female steelhead that were aged was not significantly different from those for the total immigrant female

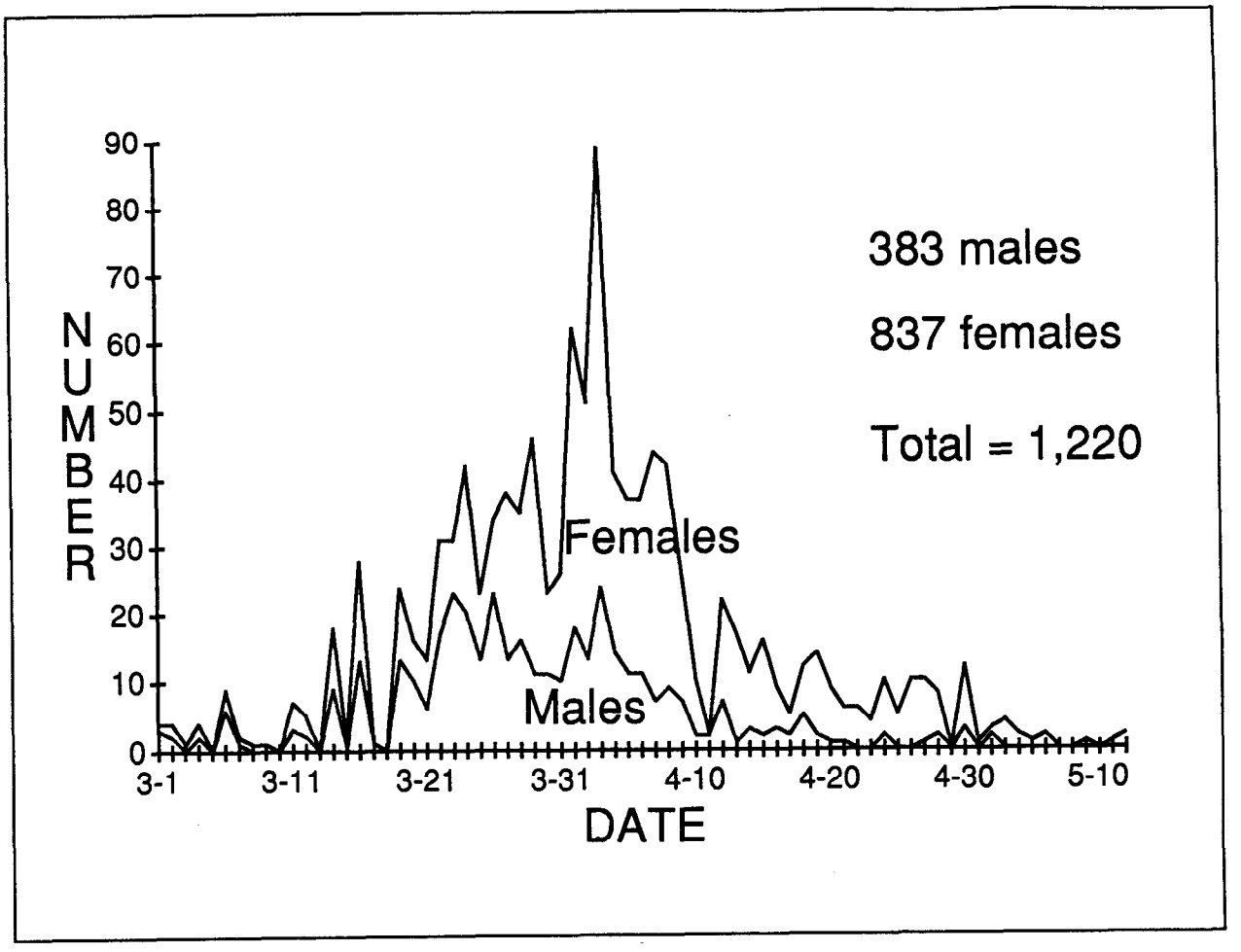


Figure 4. Karta River steelhead upstream weir passage counts by sex, March 24 to June 6, 1989.

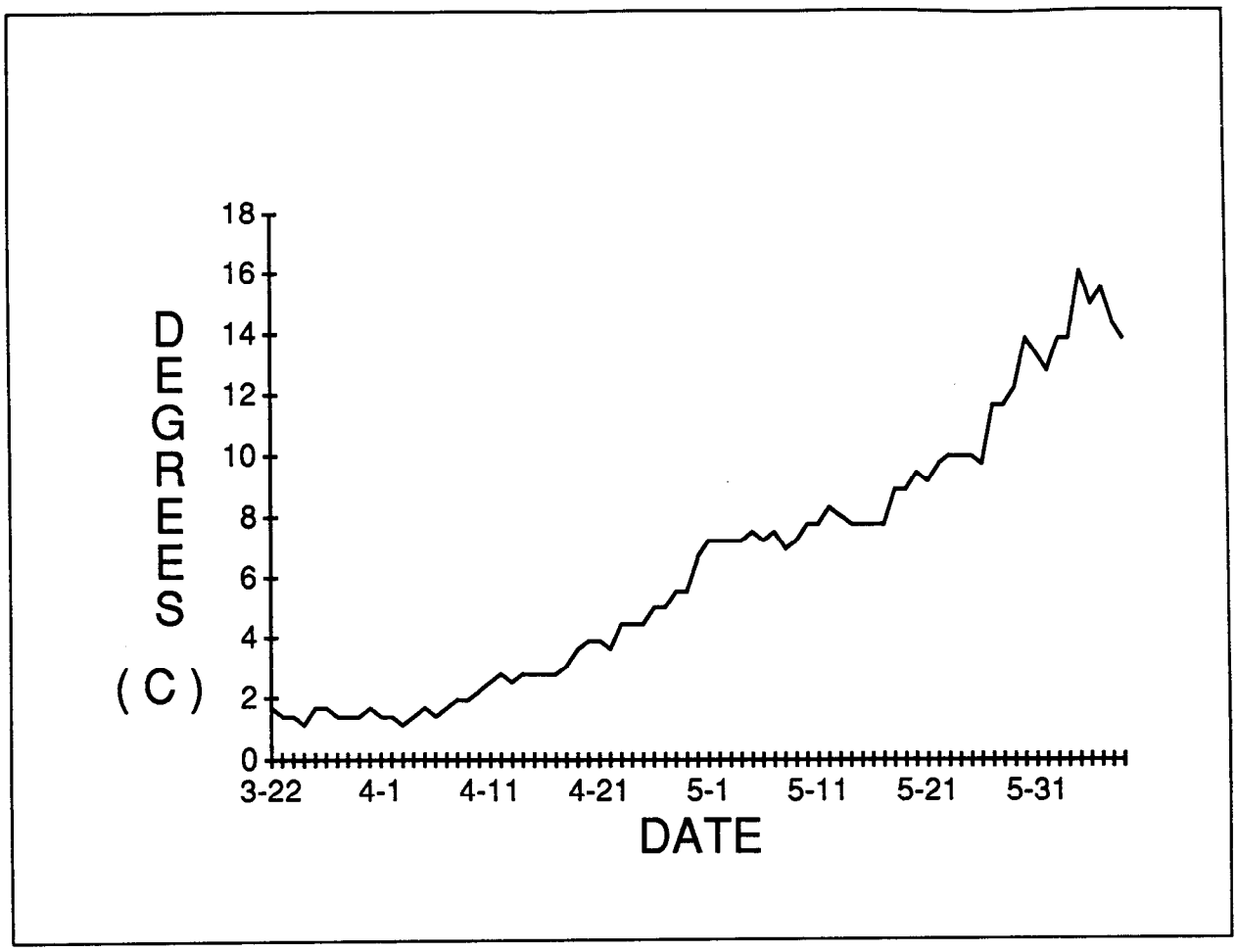


Figure 5. Karta River steelhead escapement weir water temperatures, March 22 1989 through June 8, 1989.

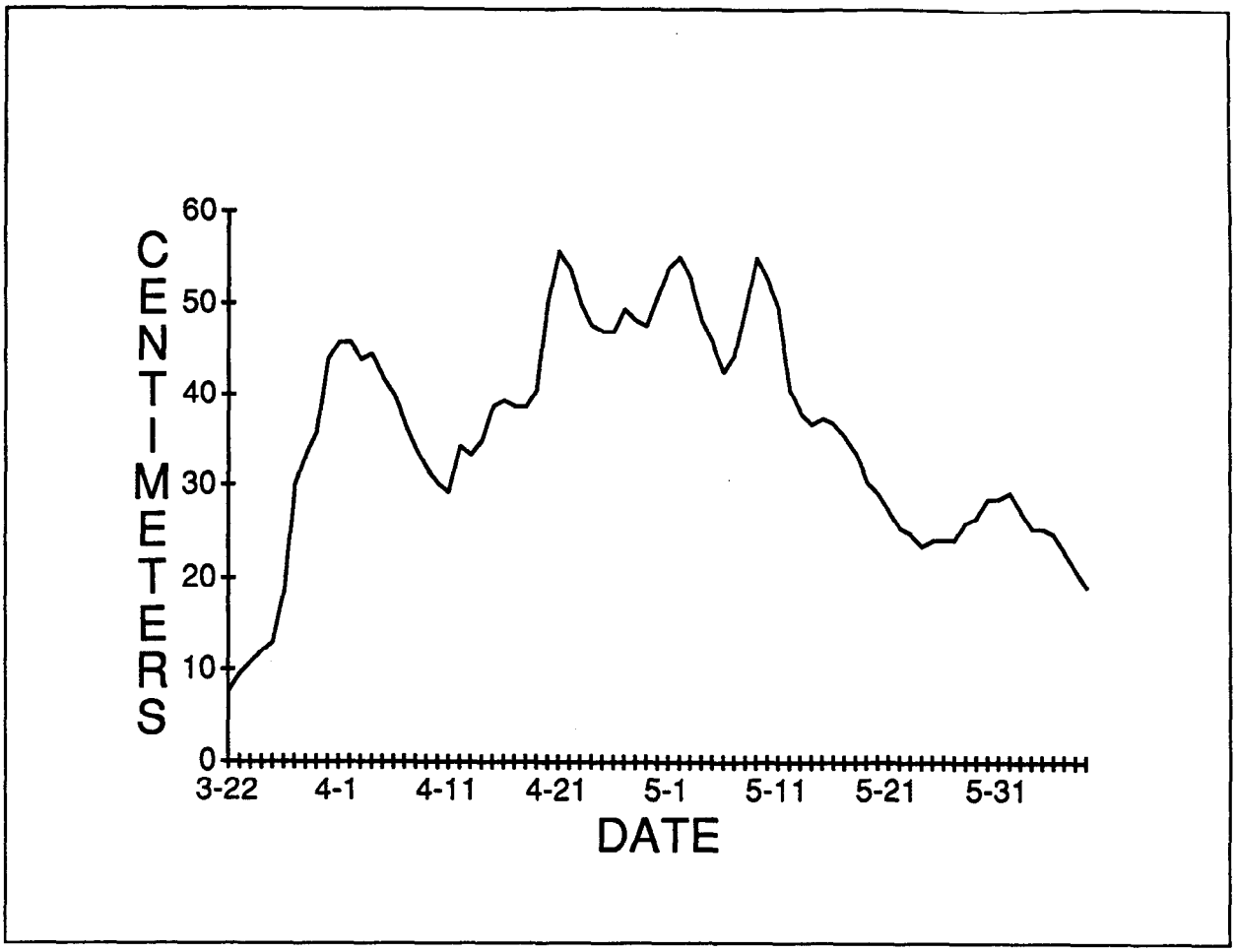


Figure 6. Karta River steelhead escapement weir water levels from March 22, 1989 through June 9, 1989.

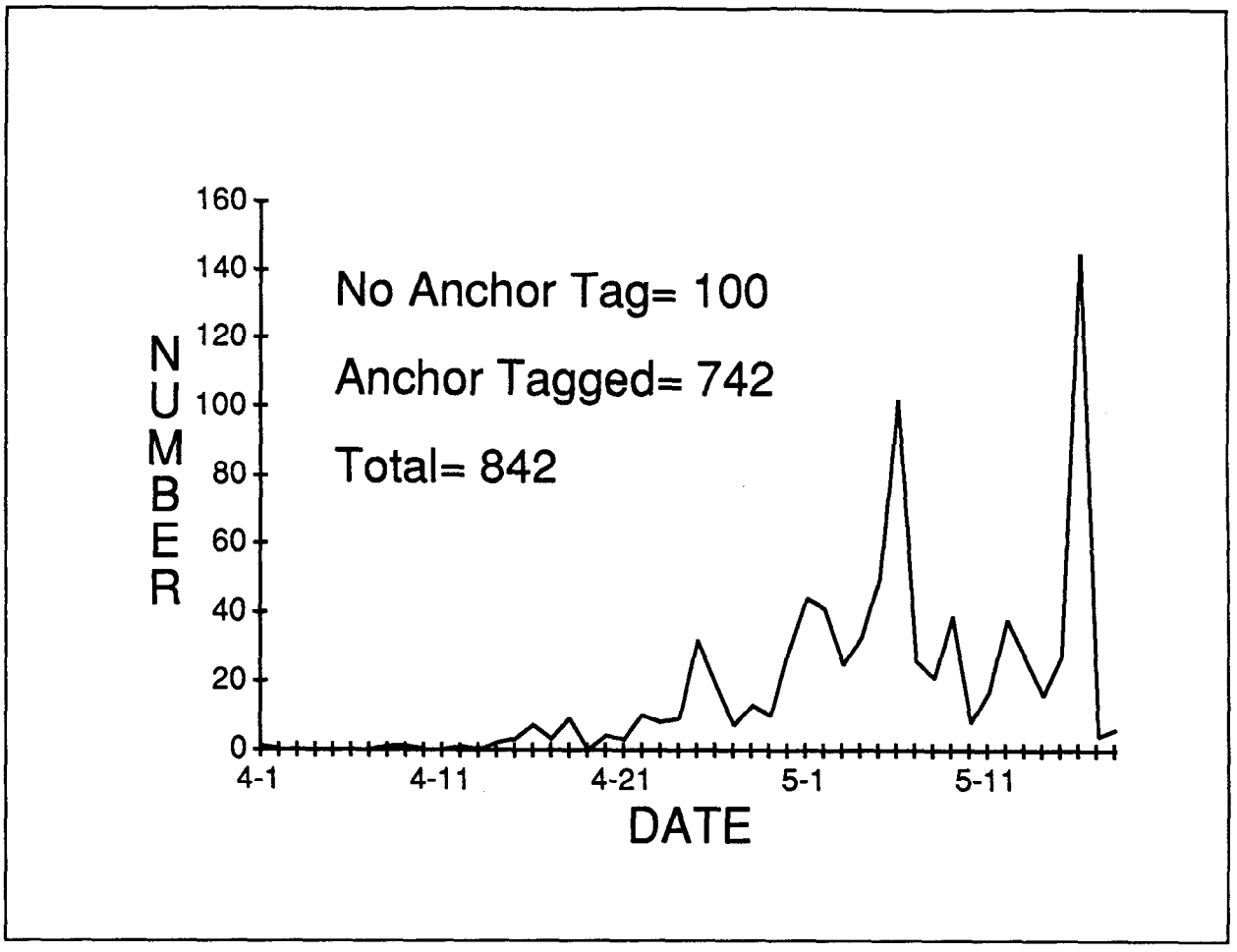


Figure 7. Karta River steelhead spawner downstream weir counts, 1989.

steelhead sample (Student's *t*-test; length: $t = 0.03$, df = 1,224; weight: $t = 1.51$, df = 1,221). Twenty-six age classes (age 2.2 to 5.3S1) were identified from the immigrant steelhead population (Table 2). Fifty-six percent of the 1989 spring run was comprised of initial spawning steelhead; 44% of the run showed one or more spawning checks on their scales.

Steelhead spawning for the first time were from nine age classes, but 68.5% were aged 3.2 or 3.3 (Figure 8). The initial spawning segment of the run was comprised of 1.5% 1-ocean fish, 52.3% 2-ocean fish, and 46% 3-ocean fish. Initial spawning female steelhead outnumbered males by a ratio of 1.6:1.

The repeat spawners in the Karta River steelhead spring run represented 17 age classes (Figure 9). Three age classes (ages 3.2S1, 3.3S1, and 4.2S1) comprised 67.0% of the repeat spawners. Repeat female steelhead spawners outnumbered males by a ratio of 2.8:1.

Paired measurements of length and weight were available from 788 (266 male and 566 female) of the aged steelhead (Table 3). The weight of the aged male steelhead ranged from 0.5 to 8.6 kg (mean = 4.4 kg, SE = 0.09) while females ranged from 1.8 to 8.6 kg (mean = 4.9 kg, SE = 0.05). Heavier fish were usually older and were generally female. Aged male steelhead (n=383) ranged in length from 420 to 825 mm (mean = 658 mm, SE = 4.5) while females (n=837) ranged from 540 to 825 mm (mean = 686 mm, SE = 2.4). The estimated length-weight parameters for the 266 aged male steelhead were: a = 6.59 (SE = 0.43), b = 3.13 (SE = 0.07), and correlation (a,b) = 0.89 (Figure 10). The estimated length-weight parameters for the 522 aged female steelhead were: a = 1.73 (SE = 0.34), b = 2.62 (SE = 0.05), and correlation (a,b) = 0.83 (Figure 10).

There was little difference between the mean lengths of immigrating spring run steelhead (n = 1,088) and those of the limited number (n = 88) of presumably winter-run fish that did not have evidence of a Floy anchor tag when they were passed downstream. The 41 winter-run male steelhead averaged 655 mm (SE = 68.9), while the 47 females were slightly larger at an average of 685 mm (SE = 51.3). The winter-run male steelhead were not significantly different in length from spring-run male steelhead at p = .05 (Student's *t*-test, $t = 0.10$, df = 397), and winter-run female were not significantly different in length from spring-run female steelhead (Student's *t*-test, $t = 0.06$, df = 746).

Creel Survey

Steelhead anglers utilizing this river spent an estimated total of 1,568 angler-hours (95% confidence intervals of 1,158 to 1,978 angler-hours) between March 14 and June 5, 1989 (Table 4). Angling efforts for other species were insignificant, and any harvest was totally ancillary to steelhead effort and harvest. Approximately 87% of the total estimated effort for steelhead occurred between March 14 and May 7, 1989. Very little effort was noted before this period, while the remaining fishing occurred during the period of May 8 through June 4, 1989 (Appendix B3).

Steelhead biweekly catch rates varied from 0.16 to 0.20 fish per hour, with an overall catch rate of 0.11 steelhead per hour fished. Steelhead harvest rates ranged from 0.02 to 0.07 fish per hour with peak fishing occurring from April 25 to May 8, 1989. An estimated total of 50 (SE = 19) steelhead were kept during the spring fishery period and 124 (SE = 49.7) steelhead were released

Table 2. Age classes of immigrant Karta River steelhead, March–June, 1989.

Age Class	Number of Steelhead	Number of Females	Number of Males	Percent of Total
2.2	22	10	12	2.8
2.2S1	7	4	3	0.9
2.2S1S1S1	1	1	0	0.1
2.3	14	11	3	1.8
2.3S1	5	4	1	0.6
3.1	2	0	2	0.3
3.1S1	1	1	0	0.1
3.2	156	81	75	19.8
3.2S1	128	88	40	16.1
3.2S1S1	36	32	4	4.5
3.2S1S1S1	10	9	1	1.3
3.3	145	110	35	18.5
3.3S1	46	36	10	5.8
3.3S1S1	3	2	1	0.4
4.1	5	0	5	0.6
4.2	50	28	22	6.3
4.2S1	61	40	21	7.7
4.2S1S1	17	14	3	2.1
4.2S1S1S1	1	1	0	0.1
4.2S1S1S1S1	1	1	0	0.1
4.3	43	26	17	5.5
4.3S1	26	16	10	3.1
4.3S1S1	6	5	1	0.8
5.2	3	2	1	0.4
5.2S1	2	2	0	0.3
5.3S1	1	1	0	0.1
Initial Spawners	440	268	172	55.6
Repeat Spawners	352	257	95	44.4
Total	792	525	267	100.0

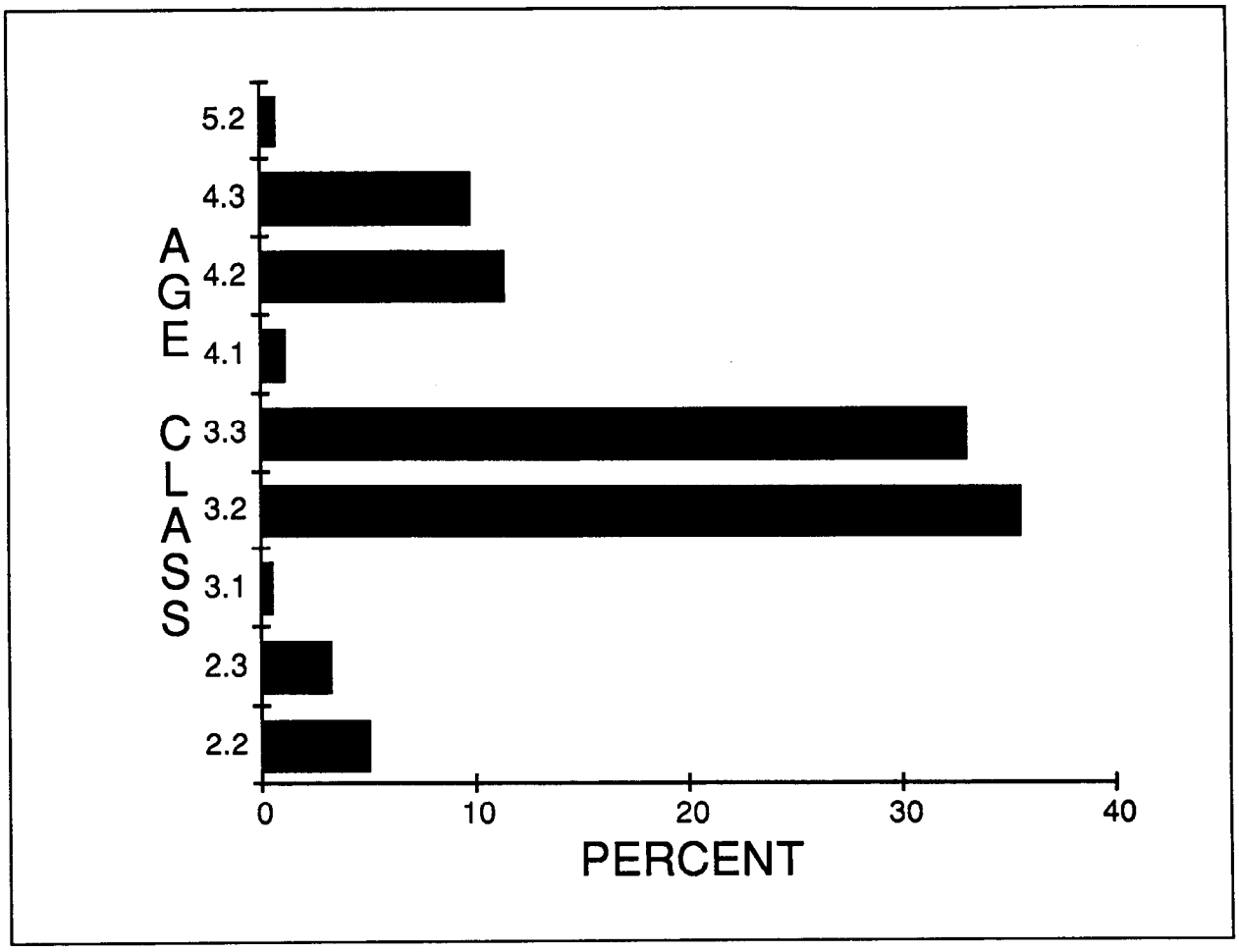


Figure 8. Age classes of initial steelhead spawners in the Karta River, 1989.

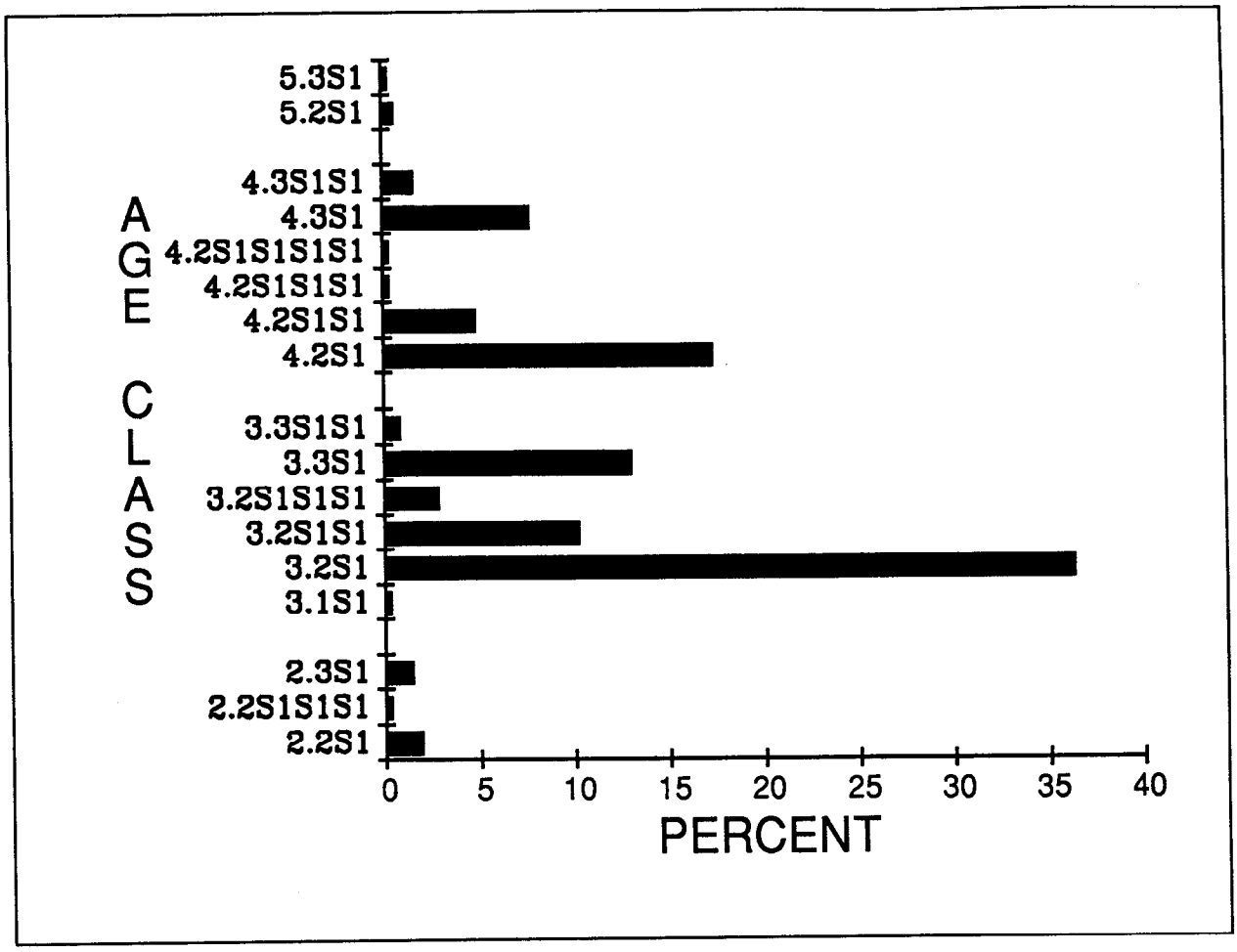
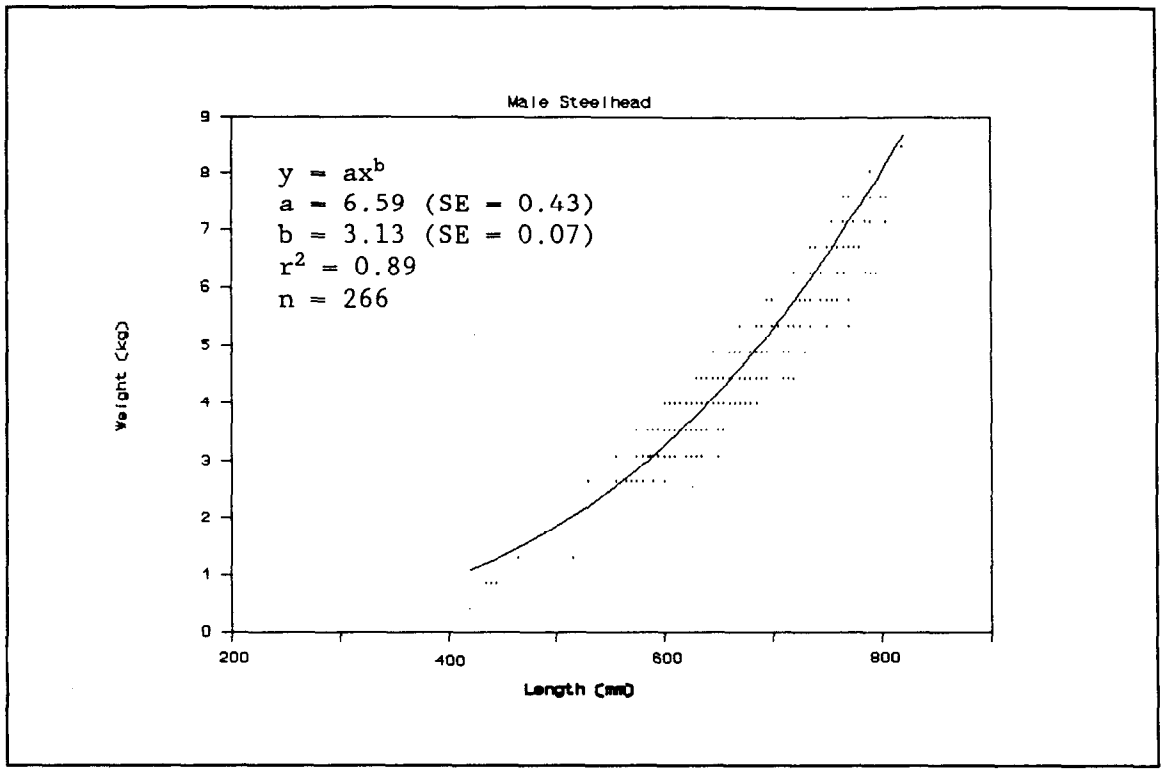


Figure 9. Age classes of repeat steelhead spawners in the Karta River, 1989.

Table 3. Age, weight, and length of immigrant steelhead that were aged, and for which there were paired lengths and weights, Karta River, 1989.

	Males					Females				
		Mean Length		Mean Weight			Mean Length		Mean Weight	
Age Class	n	(mm)	SE	(kg)	SE	n	(mm)	SE	(kg)	SE
2.2	12	595.4	9.66	3.2	0.20	10	603.5	9.86	3.3	0.14
2.3	3	745.0	22.91	5.9	0.78	11	688.2	4.92	4.8	0.19
3.1	2	432.5	12.50	0.7	0.22	-	-	-	-	-
3.2	74	609.6	3.62	3.5	0.06	80	608.1	3.25	3.5	0.06
3.3	35	716.9	9.20	5.6	0.22	109	713.8	2.94	5.4	0.07
4.1	5	445.0	5.24	1.0	0.09	-	-	-	-	-
4.2	22	630.5	7.38	4.1	0.14	28	616.6	6.17	3.7	0.09
4.3	17	744.7	9.66	5.9	0.23	26	711.9	5.51	5.5	0.15
5.2	1	620.0	-	3.6	-	2	602.5	22.50	3.2	0.45
2.2S1	3	645.0	10.41	4.1	-	4	691.3	18.53	5.3	0.38
2.2S1S1S1	-	-	-	-	-	1	740.0	-	5.9	-
2.3S1	1	730.0	-	5.9	-	4	736.3	4.27	5.4	0.41
3.1S1	-	-	-	-	-	1	665.0	-	4.1	-
3.2S1	40	658.1	7.36	4.3	0.14	88	687.1	3.63	4.9	0.08
3.2S1S1	4	743.8	22.21	6.2	0.50	31	718.7	5.94	5.4	0.18
3.2S1S1S1	1	790.0	-	7.2	-	9	755.0	12.08	6.1	0.23
3.3S1	10	737.5	7.93	6.2	0.22	36	726.4	4.57	5.6	0.10
3.3S1S1	1	755.0	-	6.8	-	2	742.5	27.50	5.9	-
4.2S1	21	661.4	6.94	4.5	0.13	40	686.9	5.77	4.9	0.13
4.2S1S1	3	723.3	17.64	5.0	0.26	14	708.9	9.82	5.5	0.24
4.2S1S1S1	-	-	-	-	-	1	730.0	-	6.3	-
4.2S1S1S1S1	-	-	-	-	-	1	760.0	-	5.4	-
4.3S1	10	750.5	9.50	6.3	0.31	16	737.8	7.42	5.8	0.17
4.3S1S1	1	745.0	-	6.3	-	5	776.0	21.00	7.2	0.57
5.2S1	-	-	-	-	-	2	700.0	20.00	5.4	-
5.3S1	-	-	-	-	-	1	695.0	-	5.0	-
Initial Spawners	171	642.2	5.97	4.1	0.11	266	665.6	3.62	4.5	0.07
Repeat Spawners	95	686.3	5.62	4.9	0.12	256	706.9	2.51	5.3	0.06
Total	266	657.9	4.51	4.4	0.09	522	685.8	2.39	4.9	0.05



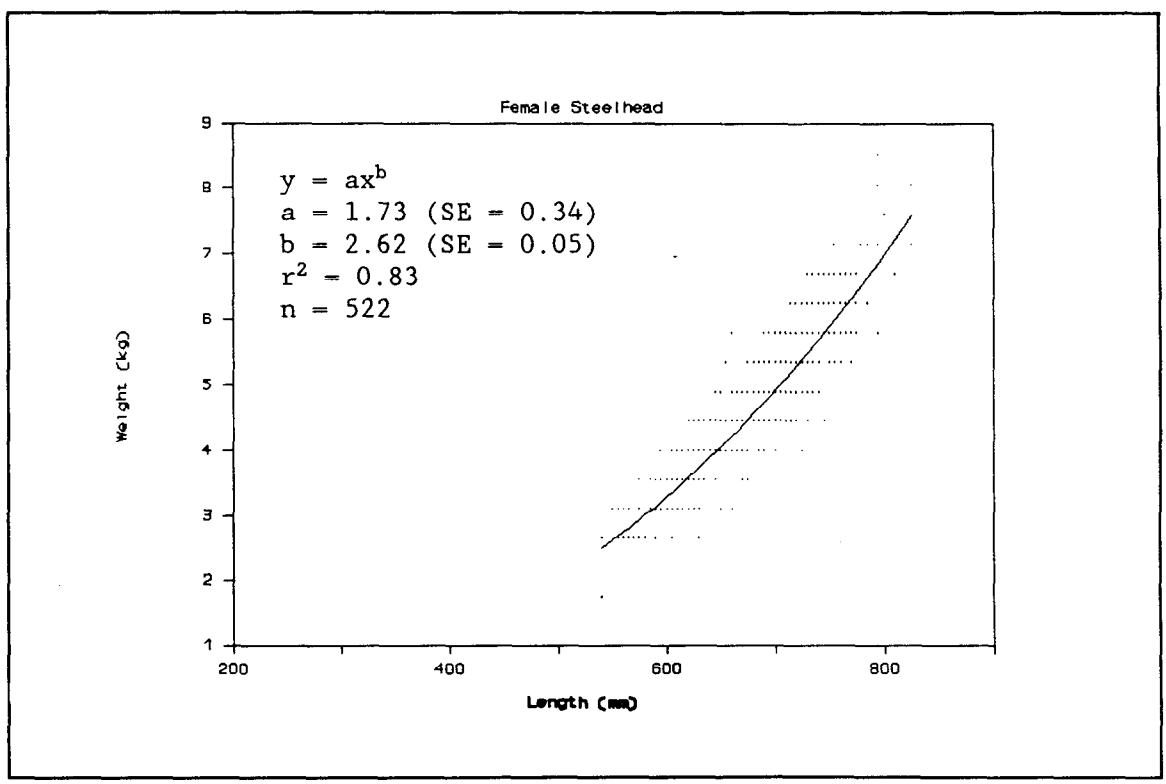


Figure 10. Weight versus length relationship for male and female steelhead sampled at the Karta River during 1989.

Table 4. Estimates of sport fishing effort, harvest, and release, Karta River, March 14 through June 5, 1989.

	Effort, catch, and harvest estimates	95% Confidence Interval
Angler-Hours of effort	1,568	1,158 - 1,978
Steelhead Kept	50	12 - 88
Steelhead Released	124	25 - 223
Rainbow Kept	0	0 - 0
Rainbow Released	9	4 - 15
Dolly Varden Kept	0	0 - 0
Dolly Varden Released	6	1 - 17

(Table 4), yielding a kept-to-released ratio of approximately 1:2.5 over the season.

Approximately 34% of the anglers interviewed use bait (salmon eggs) as terminal gear, and the remaining anglers used flies (23%), spinners (21.5%), or artificials (21.5%).

Recreational Use

A total of 40 on-site recreational user survey interviews were completed. Twenty-five percent of those interviewed were residents of Alaska (Ketchikan 15%, Anchorage 7.5%, and Hollis 2.5%), 70% were non-residents (Washington 30%, California 17.5%, Utah 10%, Oregon 7.5%, New Mexico and Colorado 2.5% each), and 5% refused to declare their residency (Appendix A1). All of the recreational anglers visited the Karta River less than five times between March and June 1989, and 58% of these visitors had from four to six individuals in their group. Eighty-five percent of the users visiting this area spent two days or less of actual fishing time on the Karta River.

Recreational users of this system indicated that over 75% of them saw fewer than nine people during their visit. The majority of respondents (75%) observed about what they felt was a reasonable number of other individuals (less than 10) using this area concurrently. Responses to perception of angling pressure were in general agreement, as over 57% of those contacted felt that the Karta River was receiving about the right amount of pressure.

Over 73% of the recreational users interviewed on-site during this study supported improvements in this area's recreational facilities. The improvements supported included additions to existing cabins and trails (52.9%), increased access sites (5.9%), improved camping sites (2.9%), improved cabins and availability (5.9%), and construction of boat launches (5.9%). Approximately 26% favor no improvements. Over half of the recreational users favored changes in fishing regulations. The changes supported ranged from catch and release (17.9%) to punchcard and seasonal limit (12.8%), to catch and release with barbless hooks (10.3%), and to various combinations of the above (13%). Forty-six percent of the interview responses indicated support for no change in existing regulations. The majority of respondents (87%) favored enhancement of native steelhead stocks. Access information gathered from this survey indicated that 92% entered this area via float plane, with nearly 60% accessing the river from saltwater. The validity of this information appears to be quite good, based on the low repeat interview rates. Eighty-nine percent of the respondents were not surveyed more than once, indicating that a broad range of individuals responded to this survey.

Forty-two of the 200 mail-in recreational user surveys distributed in person or at USFS cabins on the Karta River were returned (21%). Information obtained from the survey questions were similar in content to on-site recreational use interviews. The majority of respondents were non-residents (70%) who were visiting the area primarily to fish (86%) without the aid of a freshwater guide (100%). Most respondents (66%) indicated that they felt that the river habitat was not being impacted. The remaining respondents (34%) felt that the area was being impacted by discarded trash and fishing line, and that limitations on commercial guide operations, new sport fishing regulations, access site changes, otter control, elimination of gill netting in the river mouth, and work to address trash problems should be implemented.

The mail-in survey also showed that most party sizes were under four; fewer than 10 people should be encountered on a visit; if new fishing regulations were imposed, catch and release, no bait, barbless hooks, and a punchcard with seasonal limit were supportable; increases in cabin facilities were needed, including access improvements; boating should be limited; most users will return for another trip to this or other systems on PWI; float planes were the primary access method, and a slightly higher percentage entered the area from saltwater rather than landing on Karta or Salmon Lakes. Other areas considered to be at least a slight problem included obstructions in the river, vandalism, poorly maintained trails, too many people seen on the river, bites from insects, airplanes flying overhead, lack of information on the area, people fishing, too few toilets and too much human waste, nuisance wildlife, lack of dry wood, and lack of signs explaining cabin use, especially to people who did not have the cabin reserved.

In-River Distribution

A total of 91 radio tagged steelhead (36 males, 55 females) were released upstream of the Karta River weir during the period from March 24 through June 6, 1989. Approximately 85% of the radio tagged fish were accurately tracked, and 11% were found in otter dens or at otter kill sites. Sport fishermen harvested two percent of the tagged fish, one percent of the tags malfunctioned, and one percent of the tags were never located following release. Aerial and foot surveys located 87% of the tagged fish in the mainstem Karta River, 4% in the river between Little Salmon (Karta) Lake and Salmon Lake, 5% in Senator Wirth Creek, 1.3% in McGilvery Creek, and 2.6% in Andersen Creek (Figure 11 and Appendix B4). Female steelhead spent on the average 35.5 days in the river (range = 17-77, SE 2.03) while male steelhead spent on the average 45.5 days (range = 13-76, SE 2.39). The number of days in-river for both sexes decreased as the end of the spawning season (June) approached (Figures 12 and 13).

Additional analysis of the radio telemetry data attempted to correlate steelhead age with distance traveled upstream, age with time of return, and date of arrival in the Karta River with distance traveled up-river. There was very little correlation between any of these variables within the Karta River steelhead population.

DISCUSSION

The Karta River system represents one of 85 documented systems that produce steelhead on PWI. This stream is also one of only 12 streams on PWI which contain both fall and spring run steelhead populations, and is classified as an excellent producer, especially during the spring run segment. The importance and popularity of this stream is well documented, as indicated by the number of U.S. Forest Service recreation cabins located in this drainage, and the difficulty of reserving these cabins during the spring steelhead angling period (April-May). Local public information on this stream indicated that the population size exceeded 500 fish annually. Verification of this estimate did not occur until the early 1980's, when Jones (1983) produced a conservative escapement estimate of 1,022, based upon the number of upstream and downstream migrating fish noted at the escapement weir he operated in this system.

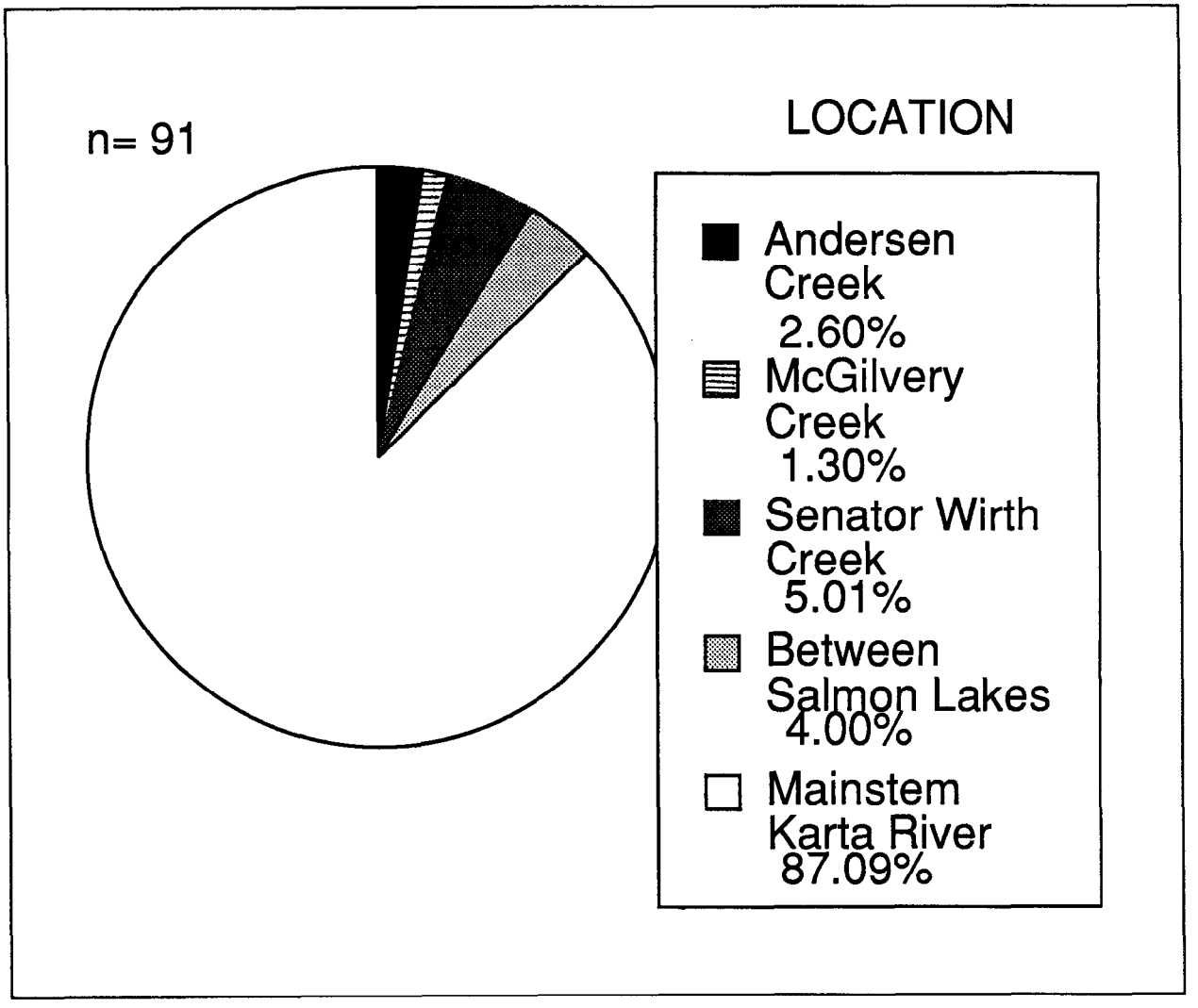


Figure 11. Karta River steelhead in-river distribution from radio telemetry, March through June, 1989.

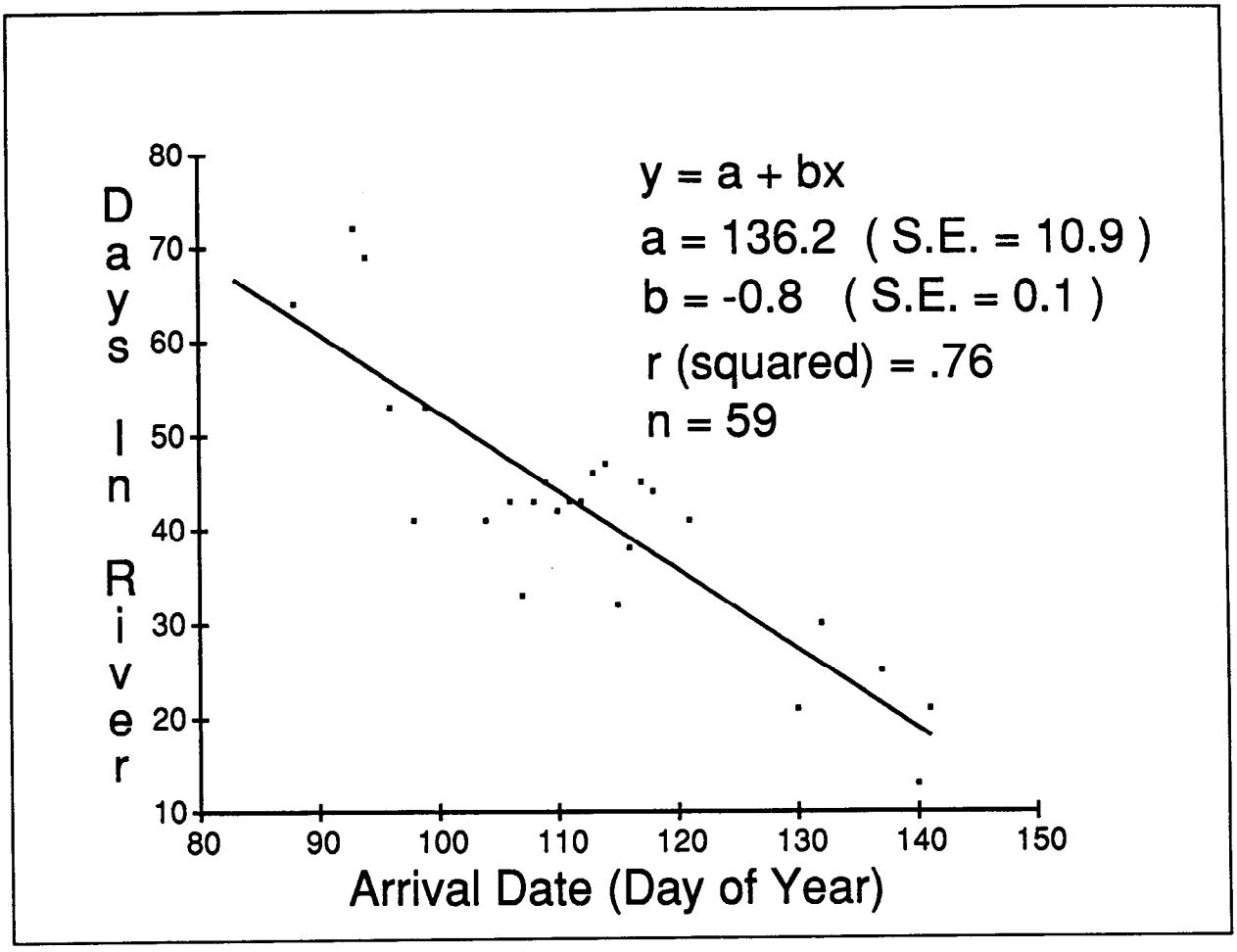


Figure 12. Karta River male steelhead mean days in river versus arrival date (Day of year), 1989.

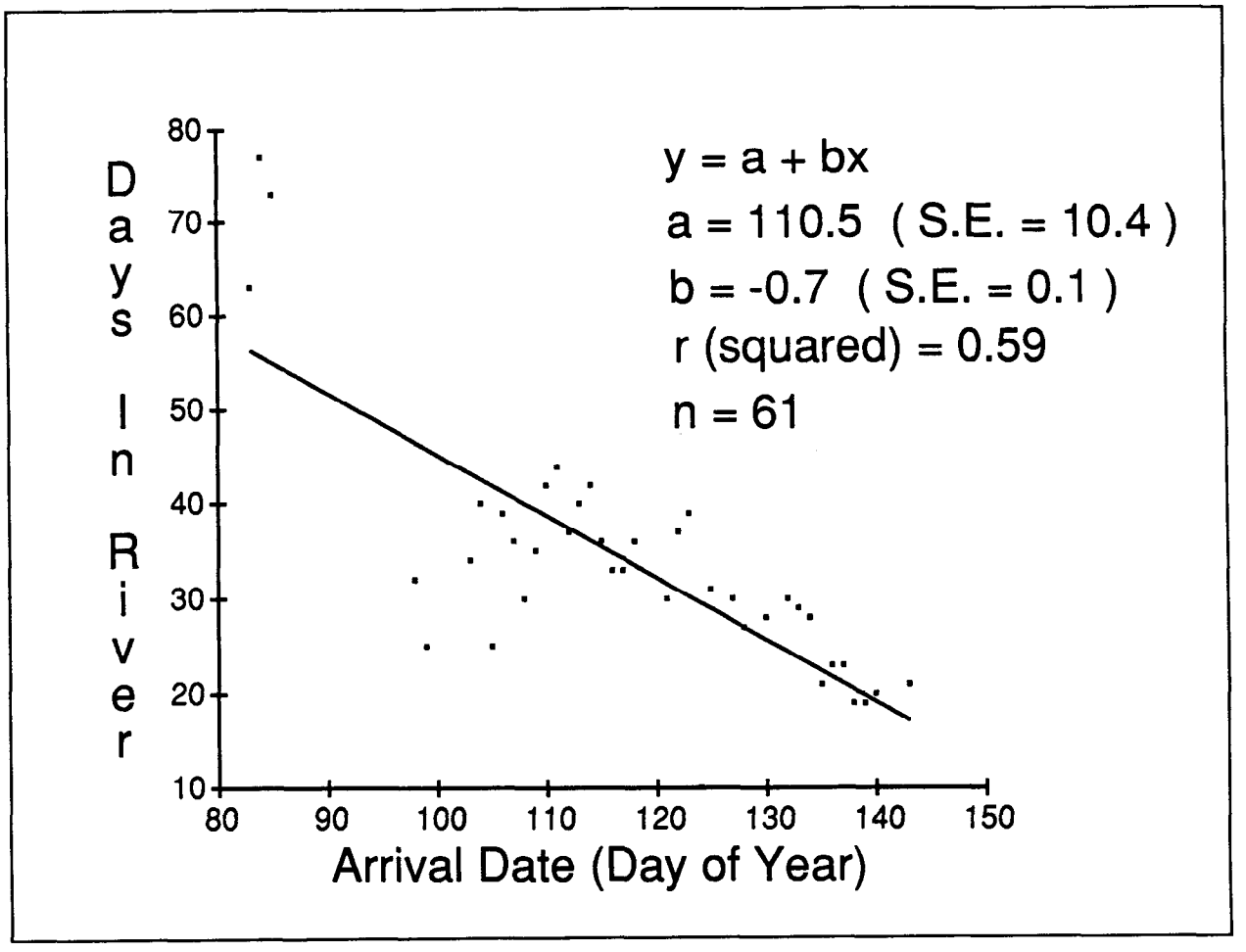


Figure 13. Karta River female steelhead mean days in river versus arrival date (Day of year), 1989.

Our study verified that the population of steelhead in this system easily exceeds 1,000 annually, with 1,220 upstream and 842 downstream migrating fish counted. We also noted a high ratio of females in this population (2.2 to 1), reflecting a higher survival rate of this sex. Approximately 66% of the escapement for both males and females occurred between April 13 and May 5, with the peak escapement counted on April 28. This information corroborates the general public perception that, in Southeast Alaska, the peak escapement time for spring-run steelhead spans mid-April to mid-May. Physical data collected at the weir did not reveal any significant trends in upstream or downstream migration of steelhead with water temperature and/or water level. Migration activity did increase once water temperatures exceeded 4.4°C (40°F) and water level exceeded 38.1 cm at the weir as a result of snow melt and spring rainfall.

The steelhead population present in the Karta River is dominated by fish that spend three to four years in freshwater before smolting, and two to three years in saltwater before returning as adults to spawn. This age structure is very similar to that noted by Jones (1983), except that one-ocean jacks appeared to a minor degree in our study. The predominance of extensive freshwater rearing and two to three years of saltwater growth is typical of many systems in Southeast Alaska. AWL data gathered on the Klawock River (Freeman and Hoffman, 1989), Ward Creek (Hubartt, 1989), and the Thorne River (Freeman and Hoffman, 1989) showed similar age structures with one exception. Scale samples from the Klawock River showed a high frequency of one year of freshwater residency, coupled with two or three years of saltwater growth. The Klawock system is heavily influenced by hatchery produced steelhead smolts that are produced in one year of intensive freshwater rearing.

Steelhead length and weights were strongly correlated to sex, with females more dominant in both length and weight categories. In high use areas such as Karta River, conservative management strategies such as catch and release regulations, size restrictions, or small seasonal bag limits may be appropriate to ensure continuation of a quality sport fishery.

In-river distributions described during the radio telemetry portion of this project were surprising. The major tributaries to the Karta River system (Andersen Creek, McGilvery Creek, Flagstaff Creek, etc.) were believed to represent the preferred steelhead habitat. This study identified the mainstem river as the prime area for steelhead. The use of Senator Wirth Creek (a tributary to Karta Lake) by steelhead was undocumented before this study. Future resource management decisions will need to emphasize the importance of the mainstem Karta River and associated lakes (Salmon and Karta) over tributaries such as Flagstaff, Andersen and McGilvery Creeks.

The spring steelhead fishery in the Karta River during 1989 was not typical for this stream. Severe cold weather during January through the third week of March limited angler access due to ice cover and above normal snow levels (30.5 to 121.9 cm). This weather resulted in abnormally low water levels and cold water temperatures which impacted this fishery well into April. Steelhead angler effort and catch rates improved dramatically beginning in mid-April, and continued to improve as fish concentrations (upstream migration) increased to peak levels during late April and early May. Effort, especially from non-residents, peaked at this time.

The estimated 1989 steelhead harvest of 50 fish (SE = 19) derived from the on-site creel survey is considerably below the seven year (1982 - 1988) average of

estimates (280 fish) derived by the annual statewide harvest postal survey (Table 1). The difference between those figures and the on-site estimate may be a result of the different periods of time covered by each estimate. The on-site creel survey covered only the spring run segment (March-June) while the Statewide Harvest Survey covers the entire steelhead season (fall and spring) which runs from October through June. Information gathered by Jones (1983) during his on-site creel program estimated a steelhead harvest of 119 from the April-May segment of the spring run. His estimate was much closer to ours, and tends to reaffirm the accuracy of our estimate.

Anglers utilizing the Karta River represented a wide spectrum of gear type enthusiasts who expended an average of 9.1 hours to catch a steelhead. Fishing with bait was the most common gear type, and retention of fish for personal use was most likely amongst this type of angler. The ratio of kept verses released fish by all anglers was approximately 1:2.5. This is slightly lower than that noted by Jones (1983), who identified a 1:2.38 kept to released fish ratio. Steelhead fishermen utilizing the Karta River generally represent recreational (hook and release) users of this resource rather than "catch and kill" anglers, when compared to Klawock and Thorne River users whose kept-to-released fish ratio approached 1:1 (Freeman and Hoffman 1988, 1989).

The recreational user of the Karta River drainage was favorably impressed with the current situation on this river. Even though the majority of individuals were non-residents, most users had a pleasant experience on their trip. The pleasant experience was defined as catching a reasonable number of fish; not seeing too many other anglers; enjoying good weather, scenery, and wildlife; plus, just coming to a scenic part of Alaska. However, many users of this area had definite ideas on how their experience could be improved. Many individuals were concerned with litter accumulations, favored some type of restrictive fishing regulation(s), and would support enhancement and facility improvements. Most planned on returning to this area in the future. The opinions of the users of the Karta River area were similar to those of Thorne River recreational users (Freeman and Hoffman 1989). The degree of satisfaction reflected in recreational surveys conducted in both areas indicates that present management is meeting the needs of most recreational users. Nevertheless, managers should act on at least some of the opinions expressed to improve the experience of recreational users.

ACKNOWLEDGEMENTS

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LITERATURE CITED

Cochran, W.G. 1977. Sampling techniques. John Wiley and Sons, New York, NY, U.S.A.

Eiler, J.H. 1989. Use of radio telemetry for studying fish in large turbid rivers. Proceedings of the Tenth International Symposium on Biotelemetry. *In press*.

Freeman, G. and Hoffman, S. 1989. Steelhead *Oncorhynchus mykiss* creel census on the Klawock River, Southeast Alaska, 1987–1988. Alaska Department of Fish and Game. Fishery Data Series No. 118 Juneau. 17 pages.

Freeman, G. and Hoffman, S. 1990. Steelhead *Oncorhynchus mykiss* creel census and recreation survey on the Thorne River, Southeast Alaska, 1988–1989. Alaska Department of Fish and Game. *In press*.

Goodman, L.A. 1960. On the exact variance of products. Journal of the American Statistical Association 55:708–713.

Hubartt, D., 1989. Ward Creek Steelhead Creel Survey, Ketchikan, Alaska, 1988. Alaska Department of Fish and Game. Fishery Data Series No. 119 Juneau. 23 pages.

Jessen, R.J. 1978. Statistical survey techniques. John Wiley and Sons, New York, New York, U.S.A.

Jones, D.E. 1983. A study of cutthroat–steelhead in Alaska. Alaska Department of Fish and Game. Anadromous Fish Studies, Completion Report, 1983. Project AFS–42, 25 (AFS–42–11) 73–87.

Lehmann, E.L. 1975. Nonparametrics. Statistical methods based on ranks. Holden–Day, Incorporated. San Francisco, U.S.A.

Narver, R.A. and Withler, F.C. 1977. Age and size of steelhead trout, *Salmo gairdneri*, in anglers catches from Vancouver Island, British Columbia streams. Fisheries Research Board of Canada. Circular 91: 1–26.

Mills. M. J. 1979. Alaska statewide sport fish harvest studies. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1978.1979, Project F–9–11, 20 (SW–I–A). 112 pp.

_____. 1980. Alaska statewide sport fish harvest studies. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1979–1980, Project F–9–12, 21 (SW–I–A). 65 pp.

_____. 1981a. Alaska statewide sport fish harvest studies (1979). Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1980–1981, Project F–9–13, 22 (SW–I–A). 77 pp.

_____. 1981b. Alaska statewide sport fish harvest studies (1980). Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1980–1981. Project F–9–13, 22 (SW–I–A). 107 pp.

_____. 1982. Alaska statewide sport fish harvest studies (1981). Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1981-1982, Project F-9-14, 23 (SW-I-A). 115 pp.

_____. 1983. Alaska statewide sport fish harvest studies (1982). Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1982-1983, Project F-9-15, 24 (SW-I-A). 119 pp.

_____. 1984. Alaska statewide sport fish harvest studies (1983). Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1983-1984, Project F-9-16, 25 (SW-I-A). 123 pp.

_____. 1985. Alaska statewide sport fish harvest studies (1984). Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1984-1985, Project F-9-17, 26 (SW-I-A). 137 pp.

_____. 1987. Alaska statewide sport fisheries harvest report. Alaska Department of Fish and Game, Fishery Data Series No 2. 140 pp.

_____. 1988. Alaska statewide sport fisheries harvest report. Alaska Department of Fish and Game, Fishery Data Series No. 52. 142 pp.

Neuhold, J.M., and K.H. Lu. 1957. Creel census method. Utah State Department of Fish and Game Publication 8, Salt Lake City, Utah, U.S.A. 36 pp.

Von Geldern, C.E., Jr., and P.K. Tomlinson. 1973 On the analysis of angler catch rate data from warmwater reservoirs. California Fish and Game 59:281-292.

APPENDIX A

Appendix A1. Summary of Karta River in-person recreational survey from March-June, 1989. Total number of respondents = 40. Number in parenthesis represents total number of individuals who indicated this was their answer.

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1. WHAT COMMUNITY ARE YOU FROM?

A. Thorne Bay B. Klawock C. Craig
D. Coffman Cove E. Ketchikan (6) F. Other (34)
Specify: WA (12), CA (7), UT (4), OR (3), NM (1), CO (1), Anchorage, AK (3), Hollis, AK (1), Unspecified (2).

2. HOW MANY TIMES DURING THE STEELHEAD SEASON HAVE YOU VISITED THE KARTA RIVER?

A. 0-5 (39) B. 5-20 C. 20-40 D. 40-75 E. Over 75

3. HOW MANY PEOPLE ARE IN YOUR PARTY?

A. 1 B. 2-3 (16) C. 4-6 (23) D. 8-10 (1)
E. More Than 10

4. HOW MUCH TIME DID YOU SPEND ON THE RIVER DURING THIS VISIT?

A. 1 Hour (1) B. 2 Hours (5) C. 3 Hours (1)
D. 4-6 Hours (11) E. 8-10 Hours (5) F. Other (17)
Over 10 Hours (1), 20 Hours (2), 22 Hours (2),
24 Hours (2), 25 Hours (1), 28 Hours (1),
30 Hours (1), 20-40 Hours (1), 40 Hours (1),
3.5 Days (1), 4 Days (1), 6 Days (2), 7 Days (1)

5. HOW MANY PEOPLE DID YOU SEE DURING THIS VISIT?

A. None (6) B. 1-3 (8) C. 4-6 (7) D. 7-9 (10)
E. 10-15 (5) F. 16-25 (4) G. Other _____

6. WHAT IS AN ACCEPTABLE AMOUNT OF PEOPLE TO SEE WITHOUT FEELING CROWDED?

A. 0 (3) B. 1 C. 2 (3) D. 3-4 (14)
E. 5-6 (9) F. 7-10 (9) G. Other 10-15 (1)

7. HOW DO YOU PERCEIVE THE FISHING PRESSURE ON THIS RIVER?

A. Too much pressure (7) B. Right Amount of pressure (23)
C. Can handle more users (4) D. Didn't notice (6).

-(Continued)-

8. WOULD YOU SUPPORT IMPROVED RECREATION FACILITIES ON THE RIVER?

A. Boat launch (2)
B. Improve existing (17)
C. Increase access sites (2)
D. Camping facilities (1)
E. Improved cabins/availability (1) F. None (9).

9. WOULD YOU SUPPORT STEELHEAD FISHING REGULATIONS INCLUDING:

A. Catch and Release Only (7).
B. No Bait.
C. Barbless Hooks.
D. Punchcard With Seasonal Limit (5).
E. No Change To Existing Regulations (18).
F. Other
A+C+D (2), D+E (1), A+C (4),
A+C+E (1), A+B+C+D (1).

10. DO YOU SUPPORT STEELHEAD ENHANCEMENT? (NATIVE STOCKS)

A. Yes (34) B. No (5)

11. HAVE YOU BEEN SURVEYED PRIOR TO THIS INTERVIEW?

A. Yes (4) B. No (34)

12. HOW DID YOU ACCESS THE KARTA RIVER?

A. Boat (3) B. Float plane (34).

13. WHERE WERE YOU DROPPED OFF ON THE KARTA RIVER?

A. Saltwater (20) B. Karta Lake (14) C. Salmon Lake.

Appendix A2. Summary of the Karta River mail-in recreational survey from March-June, 1989. Total number of respondents = 42. Number in parenthesis represents total number of individuals who indicated this was their answer.

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1. WHAT WAS YOUR REASON FOR VISITING THE KARTA RIVER?

   A. Camp (5) B. Fish (30) C. Boat
   D. Picnic E. Other (specify) (3) USFS Crew

2. ARE YOU A RESIDENT OF ALASKA?

   A. Yes (10) B. No (23) Where? CA (6) WA (10)
   UT (3) FL (1) NM (1)
   Unknown (2).

3. IF YOU ARE A RESIDENT, WHAT TOWN ARE YOU FROM?

   A. Thorne Bay (1) B. Klawock C. Craig
   D. Coffman Cove E. Ketchikan (9) F. Other

4. HOW MANY TIMES PER YEAR DO YOU VISIT THE KARTA RIVER?

   A. 1-5 (28) B. 6-10 C. 11-20 D. 21-30 (1)
   E. 31-50 F. Over 50

5. ON YOUR VISITS TO THE KARTA RIVER, WERE YOU PROFESSIONALLY GUIDED?

   A. Yes B. No (23) If Yes, By Whom _____

6. DO YOU FEEL THE RIVER ENVIRONMENT IS BEING DAMAGED BY RECREATIONAL USE?

   A. Yes (11) B. No (22) If Yes, by what type of environmental damage? Trash and discarded fishing line?

7. DO YOU FEEL MORE CONTROLS ARE NEEDED TO PREVENT THE RIVER ENVIRONMENT FROM BEING DAMAGED BY RECREATIONAL USE?

   A. Yes (7) B. No (18)

8. WHAT TYPE OF CONTROLS SHOULD BE INITIATED?

   A. Limit Commercial Outfitter Guides (16).
   B. Impose New Fishing Regulations (4).
   C. Limit The Number Of Access Sites (4).
   D. Restrict Camping In Access Sites.
   E. Other: No Controls (3), Trap Otters (3), Put Up Litter Removal Signs (4), Implement Clean-up Deposit On Cabins (2), Stop Gill Netting At River Mouth (1).

-(Continued)-

9. HOW MANY PEOPLE WERE IN YOUR PARTY VISITING THE RIVER?

A. 0 B. 1 C. 2 (4) D. 3-4 (9) E. 5-6
F. Other. 7 (2).

10. WHAT IS AN ACCEPTABLE NUMBER OF PEOPLE TO SEE WITHOUT FEELING CROWDED?

A. 0 (6) B. 1 C. 2 D. 3-4 (14) E. 5-6 (8)
F. 7-10 (5) G. Other.

11. WOULD YOU SUPPORT FISHING REGULATIONS INCLUDING:

A. Catch and Release Only (7) B. No Bait (4).
C. Barbless Hooks (14).
D. Punchcard With Seasonal Limit (11).
E. No Change To Existing Regulations (14).

12. DURING YOUR VISIT TO THE KARTA RIVER, DID YOU CAMP ON NATIONAL FOREST LANDS?

A. Yes B. No (33) If Yes, Did You Stay In Tents or a Camper/Van_____? Where Did You Camp? _____

13. IF YOU WERE A VISITING RECREATIONIST, DID YOU RESIDE IN A NEIGHBORING COMMUNITY?

A. Yes B. No (33) If Yes, Where _____

14. WOULD YOU LIKE TO SEE INCREASED CAMPING OR CABIN OPPORTUNITIES ON THE KARTA RIVER?

A. Yes B. No (33) If Yes, Where _____

15. LISTED BELOW ARE SEVERAL FACTORS WHICH COULD INFLUENCE YOUR RIVER EXPERIENCE. PLEASE IDENTIFY THE ITEMS THAT ARE IMPORTANT TO YOU.

A. Fishing Success (29) B. Weather (4)
C. River Water Levels (12) D.Sufficient Camping Space
E. Boat Landings (3) F. Sufficient Parking
G. Contact With Other People (22) H. Reservation Desired Week (3)

16. COULD YOUR RECREATIONAL EXPERIENCE HAVE BEEN IMPROVED? (Circle all items that would have helped).

A. Fishing Access (25) B. Increased Camping Space
C. Increased Parking Space D. Boat Landings In The River
E. More Contact With Others F. Less Contact (14)
G. Improve Existing Trails (9) H. Create More Trails I. No (5)

-(Continued)-

17. SHOULD BOATING USE ON THE RIVER BE REGULATED?

A. Yes (21) B. No (5) If Yes, How? No Boats (15)

18. SHOULD COMMERCIAL DRIFT BOATS BE ALLOWED ON THE RIVER?

A. Yes B. No (29) If Yes, where? _____

19. SHOULD JET BOATS BE ALLOWED ON THE RIVER?

A. Yes B. No (29)

20. SHOULD BOATING USE BE REGULATED?

A. Yes (22) B. No If Yes, how? No boats (8), outboard motor restriction of 6 hp or less.

21. DO YOU EXPECT TO VISIT THE KARTA RIVER AGAIN?

A. Yes (22) B. No C. Maybe (11).

22. HAVE YOU USED OTHER RIVERS ON PRINCE OF WALES ISLAND?

A. Yes (15) B. No (18) If Yes, Please Specify. Staney Creek, Harris River, Kegan Creek, Thorne River, Klawock River, and Maybeso Creek.

23. ARE YOU RETIRED?

A. Yes (1) B. No (3).

24. HAVE YOU SENT IN AN INTERVIEW FORM PRIOR TO ANSWERING THIS QUESTIONNAIRE?

A. Yes (3)* B. No (30) * Surveyed On Thorne River.

25. HOW DID YOU ACCESS THE KARTA RIVER?

A. Boat (6) B. Float plane (27).

26. WHERE WERE YOU DROPPED OFF ON THE KARTA RIVER?

A. Saltwater (19) B. Karta Lake (14) C. Salmon Lake.

-(Continued)-

INFORMATION ABOUT PROBLEMS YOU MAY HAVE EXPERIENCED DURING YOUR RIVER TRIP WOULD BE HELPFUL TO RESOURCE MANAGERS. TO WHAT EXTENT DID YOU FIND EACH OF THE FOLLOWING TO BE A PROBLEM DURING YOUR TRIP? (CIRCLE THE NUMBER THAT BEST DESCRIBES HOW SERIOUS YOU FOUND EACH TO BE.)

1. - Not a problem
2. - Slight problem
3. - Moderate problem
4. - Serious problem
5. - Very serious problem

1.	Too few garbage cans.....	1(32).	5(1).			
2.	Erosion of stream banks.....	1(26).	2(6).	3(1).		
3.	Litter in river.....	1(8).	2(14).	3(6).	4(5).	
4.	Litter on banks.....	1(1).	2(21).	3(6).	4(4).	5(1).
5.	Obstructions in river.....	1(23).	2(6).	5(4).		
6.	Vandalism.....	1(18).	2(16).			
7.	Water pollution.....	1(28).	2(5).			
8.	Off-road vehicles in area....	1(33).				
9.	People being inconsiderate...	1(30).	2(3).			
10.	Poorly maintained trails.....	1(13).	2(5).	3(15).		
11.	Too few developed trails.....	1(32).	2(1).			
12.	Too many people on river.....	1(14).	2(4).	3(6).	4(4).	5(5).
13.	Insect bites.....	1(25).	2(8).			
14.	Motorized boats on river.....	1(33).				
15.	Airplanes flying overhead....	1(28).	2(5).			
16.	Too few rules.....	1(33).				
17.	Too many rules.....	1(30).	2(3).			
18.	Trees and branches over the river.....	1(26).	2(7).			
19.	People playing loud radios...	1(33).				

-(Continued)-

20. Insufficient information concerning the area.....	1(30).	3(3).			
21. Too few commercial operations.	1(33).				
22. Poor toilet facilities at drop-off and pick-up areas...	1(33).				
23. Too few toilets along river between drop-off and pick-up areas.....	1(29).	3(4).			
24. Not enough law enforcement...	1(30).	2(3).			
25. Too much law enforcement.....	1(33).				
26. People fishing.....	1(19).	2(4).	3(6).	4(4).	
27. Roads within sight of river..	1(33).				
28. Too many signs along the river.....	1(33).				
29. People being rowdy.....	1(33).				
30. Someone in your group is injured.....	1(33).				
31. Human body waste.....	1(25).	3(7).	4(1).		
32. Damage to or loss of your personal property.....	1(33).				
33. Navigation problems due to low water levels.....	1(33).				
34. Navigation problems due to high water levels.....	1(31).				
35. Nuisance wildlife.....	1(29).	4(3).			
36. Poor quality campsites.....	1(33).				
37. Campsites occupied by others.	1(32).				
38. Campsites not clearly marked.	1(32).				
39. Other.....	Not enough dry wood and a need exists for information signs explaining cabin use rules especially for people not staying in the USFS cabins.				

APPENDIX B

Appendix B1. Age, weight, and length (mid-eye to fork of tail) of Karta River initial steelhead spawners by sex, 1989.

Age 2.2 (n = 22)

Male		Female	
Length(mm)	Weight(kg)	Length(mm)	Weight(kg)
635	3.2	620	3.2
575	2.7	625	3.2
605	3.2	635	4.1
580	3.2	645	4.1
515	1.4	575	3.2
565	2.7	620	3.2
620	3.6	585	3.2
625	4.1	555	3.2
610	3.6	610	3.6
585	3.2	565	2.7
620	3.6		
610	3.6		
Range (515-635)	(1.4-4.1)	(555-645)	(2.7-4.1)

Age 2.3 (n = 14)

Male		Female	
Length(mm)	Weight(kg)	Length(mm)	Weight(kg)
730	5.9	655	5.4
790	7.3	700	5.9
715	4.5	705	4.5
		670	4.5
		695	5.5
		700	5.5
		670	4.1
		685	4.1
		700	4.1
		700	4.5
		690	5.0
Range (715-790)	(4.5-7.3)	(655-705)	(4.1-5.9)

-(Continued)-

Age 3.1 (n = 2)

Male		Female	
Length(mm)	Weight(kg)	Length(mm)	Weight(kg)
420	0.5		
445	0.9		
Range (420–445)	(0.5–0.9)		

Age 3.2 (n = 156)

Male		Female	
Length(mm)	Weight(kg)	Length(mm)	Weight(kg)
610		610	3.2
585	3.2	610	4.1
585	3.6	595	3.6
600	3.2	620	3.6
600	3.6	590	3.6
575	3.2	665	4.1
600	3.6	645	4.1
600	3.2	625	3.6
615	3.6	620	3.6
625	3.2	610	3.2
590	3.2	610	4.1
630	3.6	645	3.6
625	3.6	575	3.2
600	3.2	585	3.6
635	4.1	650	4.1
620	3.6	575	3.2
630	4.5	595	3.6
640	3.6	605	4.1
600	4.1	540	2.7
600	2.7	570	2.7
595	3.6	600	3.2
580	3.2	620	3.2
570	2.7	660	4.1
620	3.6	585	3.2

-(Continued)-

Age 3.2

Male		Female	
Length(mm)	Weight(kg)	Length(mm)	Weight(kg)
580	3.2	610	3.2
590	3.2	620	3.6
635	4.1	575	2.7
490	1.8	630	4.1
605	4.1	615	3.2
590	3.6	615	3.2
630	3.6	635	3.6
625	3.2	610	3.6
645	4.1	630	4.5
610	3.2	540	1.8
650	3.6	590	3.6
675	4.5	565	2.7
610	3.2	605	3.2
580	2.7	615	3.6
600	3.2	630	3.2
640	3.6	590	2.7
585	3.2	610	3.6
555	3.2	595	3.6
615	3.6	555	2.7
600	3.6	575	3.6
588	3.2	565	3.2
635	4.1	645	3.6
615	3.6	605	3.2
615	3.6	630	3.6
595	3.2	605	3.2
650	3.2	595	3.2
645	4.1	595	3.6
685	4.5	630	4.1
575	3.6	610	4.1
640	4.1	605	
590	3.2	605	3.6
590	3.2	605	3.6
630	4.1	595	3.2
630	3.6	610	4.1
640	4.1	600	3.6
610	3.6	665	4.5
590	3.6	560	2.7
625	3.2	615	3.6
590	2.7	675	3.6

-(Continued)-

Age 3.2

Male		Female	
Length(mm)	Weight(kg)	Length(mm)	Weight(kg)
530	2.7	595	3.6
610	4.1	550	3.2
585	3.2	650	4.1
615	4.1	605	3.6
615	3.6	590	3.6
605	3.2	620	3.6
650	4.1	590	3.6
600	3.2	595	4.1
655	4.1	665	4.5
595	3.2	645	5.0
680	4.5	585	3.2
600	3.2	630	4.5
		610	4.1
		630	2.7
		635	3.6
		575	3.2
		605	2.7
		650	4.1
Range (490–685)	(1.8–4.5)	(540–675)	(1.8–5.0)

–(Continued)–

Age 3.3 (n = 145)

Male		Female	
Length(mm)	Weight(kg)	Length(mm)	Weight(kg)
750	5.9	735	5.9
760	6.4	710	4.5
690	5.0	705	5.9
590	3.6	670	4.5
685	4.5	720	5.9
585	3.2	670	3.6
695	4.5	725	5.0
720	4.5	715	6.4
745	6.4	675	5.0
790	7.7	710	5.0
790	8.2	690	4.5
715	5.5	620	3.6
660	4.5	795	7.3
620	3.6	705	4.5
760	6.8	715	5.5
665	5.0	680	5.5
700	5.9	675	4.5
765	7.7	690	5.0
820	8.6	690	4.5
735	5.5	700	5.0
685	5.0	720	5.9
745	5.9	745	6.4
675	4.5	715	5.0
675	4.5	745	5.9
675	4.1	720	6.4
685	5.0	720	5.5
725	5.9	685	5.0
780	6.8	675	5.5
730	5.9	710	5.5
760	5.9	710	5.5
760	6.8	735	5.0
725	5.9	720	5.5
765	6.4	690	4.5
755	5.9	695	5.5
710	5.0	710	5.5
		715	5.5
		705	5.5
		715	5.5
		705	5.0
		735	5.5

-(Continued)-

Age 3.3

Male		Female	
Length(mm)	Weight(kg)	Length(mm)	Weight(kg)
		695	5.0
		755	5.9
		765	6.4
		730	5.9
		770	5.5
		795	7.3
		725	5.5
		720	5.9
		705	4.5
		735	6.8
		720	5.9
		735	5.9
		660	5.0
		695	4.5
		780	7.3
		695	4.5
		735	5.9
		675	4.1
		735	5.9
		745	6.8
		725	5.5
		675	4.1
		725	5.0
		740	5.9
		730	6.8
		700	5.0
		710	5.5
		695	4.5
		700	5.0
		670	4.5
		785	7.3
		725	5.9
		760	6.4
		670	4.5
		690	5.0
		695	5.0
		765	6.4
		740	5.5
		740	5.5
		725	

-(Continued)-

Age 3.3

Male		Female	
Length(mm)	Weight(kg)	Length(mm)	Weight(kg)
		690	4.5
		720	5.5
		725	5.9
		705	4.5
		705	5.9
		725	5.9
		685	5.0
		720	5.9
		750	5.9
		760	6.4
		725	5.9
		740	5.0
		705	5.0
		730	5.5
		725	6.4
		725	5.5
		675	4.5
		690	5.0
		695	5.5
		745	5.9
		690	5.9
		705	5.0
		730	5.9
		705	5.5
		655	4.5
		750	6.4
		670	5.0
		730	6.8
		700	4.5
		650	4.1
Range (585-820)	(3.2-8.6)	(620-795)	(3.6-7.3)

-(Continued)-

Age 4.1 (n = 5)

Male		Female	
Length(mm)	Weight(kg)	Length(mm)	Weight(kg)
440	0.9		
435	0.9		
440	0.9		
465	1.4		
445	0.9		
Range (435–465)	(0.9–1.4)		

-(Continued)-

Age 4.2 (n = 50)

Male		Female	
Length(mm)	Weight(kg)	Length(mm)	Weight(kg)
650	4.1	595	3.6
530	2.7	600	3.2
650	4.5	615	3.6
670	5.5	625	4.5
670	5.0	640	4.1
650	4.1	615	4.1
630	3.2	555	2.7
600	3.6	645	4.1
620	3.6	625	3.6
600	4.1	630	4.1
645	4.1	630	4.1
645	4.1	645	4.5
635	4.1	595	3.2
630	4.1	610	3.6
625	4.1	630	4.1
610	4.1	615	3.6
645	4.1	610	3.6
555	2.7	595	3.2
660	5.0	730	4.5
650	4.5	620	3.2
645	5.0	590	3.2
655	5.0	650	4.1
		560	3.2
		585	3.6
		630	3.6
		635	3.6
		590	3.2
		600	3.2
Range (530–670)	(2.7–5.5)	(555–730)	(2.7–4.5)

–(Continued)–

Age 4.3 (n = 43)

Male		Female	
Length(mm)	Weight(kg)	Length(mm)	Weight(kg)
725	5.5	670	4.5
770	5.9	720	5.9
755	7.3	710	5.9
765	6.8	720	6.4
650	4.1	735	5.9
715	5.0	670	4.5
710	4.5	715	5.9
770	7.7	730	5.9
750	5.9	700	5.0
725	5.9	705	5.0
805	7.3	675	4.5
755	5.9	690	4.1
785	6.4	720	5.5
790	6.4	720	5.5
685	5.5	740	6.8
770	5.5	625	4.1
735	6.4	705	5.5
		695	5.0
		725	5.9
		745	5.9
		725	5.9
		745	6.8
		735	6.4
		735	5.5
		715	5.5
		740	6.4
Range (650–805)	(4.1–7.7)	(625–745)	(4.1–6.8)

–(Continued)–

Age 5.2 (n = 3)

	Male		Female	
	Length(mm)	Weight(kg)	Length(mm)	Weight(kg)
	620	3.6	580	2.7
			625	3.6
Range	-	-	(580–625)	(2.7–3.6)

Appendix B2. Age, weight, and length (mid-eye to fork of tail) of Karta River repeat steelhead spawners by sex, 1989.

Age 2.2S1 (n = 7)

Male		Female	
Length(mm)	Weight(kg)	Length(mm)	Weight(kg)
630	4.1	645	4.5
665	4.1	680	5.0
640	4.1	710	5.5
		730	6.4
Range (630–665)	–	(645–730)	(5.0–6.4)

Age 2.2S1S1S1 (n = 1)

Male		Female	
Length(mm)	Weight(kg)	Length(mm)	Weight(kg)
–	–	740	5.9

Age 2.3S1 (n = 5)

Male		Female	
Length(mm)	Weight(kg)	Length(mm)	Weight(kg)
730	5.9	745	4.5
		740	6.4
		735	5.9
		725	5.0
Range –	–	(725–745)	(4.5–6.4)

Age 3.1S1 (n = 1)

Male		Female	
Length(mm)	Weight(kg)	Length(mm)	Weight(kg)
–	–	665	4.1

–(Continued)–

Age 3.2S1 (n = 128)

Male		Female	
Length(mm)	Weight(kg)	Length(mm)	Weight(kg)
585	3.6	645	4.1
705	5.5	720	4.5
710	4.5	705	5.9
625	3.6	665	4.5
675	4.1	705	5.5
615	3.6	665	5.0
660	4.1	665	4.1
660	4.1	715	6.4
675	4.5	635	3.6
635	3.6	690	5.0
610	3.6	635	4.5
620	3.2	690	5.0
615	4.1	685	4.5
680	4.1	710	5.5
655	4.1	705	5.5
650	3.6	725	5.0
690	4.5	750	5.5
605	3.6	750	6.8
625	3.2	680	5.5
670	4.5	730	5.5
685	5.0	645	4.1
655	3.6	695	4.5
670	4.1	695	5.0
615	3.6	670	4.5
600	3.6	650	5.0
640	4.5	730	5.9
665	4.1	690	4.5
620	3.2	640	4.1
800	7.7	690	5.5
670	5.5	685	4.5
685	4.5	675	5.0
695	5.0	660	4.5
690	5.5	690	5.0
655	4.1	700	5.5
630	4.1	715	5.9
670	4.5	660	4.1
590	3.2	645	3.6
705	5.5	680	5.0
625	4.1	720	5.9
795	6.4	695	5.5
		755	5.9

-(Continued)-

Age 3.2S1

Male		Female	
Length(mm)	Weight(kg)	Length(mm)	Weight(kg)
		735	5.5
		700	5.5
		685	5.0
		730	5.5
		660	4.1
		695	5.0
		750	5.5
		695	5.0
		635	3.6
		695	5.9
		640	4.1
		690	5.0
		645	4.5
		620	3.6
		660	4.5
		710	5.5
		680	5.5
		660	4.1
		735	5.5
		620	4.1
		680	4.5
		700	5.5
		675	5.0
		745	6.4
		655	4.5
		665	4.1
		650	4.5
		680	4.5
		720	5.9
		755	7.3
		685	5.5
		630	3.6
		745	5.9
		700	5.0
		655	4.5
		735	5.9
		660	5.9
		710	5.9
		710	5.0
		700	5.0

-(Continued)-

Age 3.2S1

	Male		Female	
	Length(mm)	Weight(kg)	Length(mm)	Weight(kg)
			705	5.5
			670	4.5
			670	4.5
			655	4.1
			705	5.5
			625	4.1
			685	4.1
Range	(590-800)	(3.2-7.7)	(620-755)	(3.6-7.3)

-(Continued)-

Age 3.2S1S1 (n = 36)

Male		Female	
Length(mm)	Weight(kg)	Length(mm)	Weight(kg)
685	5.0	750	5.9
735	5.9	685	5.5
770	6.8	715	4.5
785	7.3	650	3.2
		795	8.2
		715	5.5
		700	5.5
		725	6.4
		775	6.8
		670	4.1
		715	5.0
		750	6.4
		670	4.5
		755	6.8
		745	6.4
		700	5.0
		705	5.0
		675	4.5
		695	4.5
		690	4.1
		725	5.9
		705	4.5
		715	5.9
		750	5.9
		700	5.5
		720	5.9
		745	5.9
		715	5.0
		715	5.5
		750	5.9
		730	
		760	5.9
Range (685–785)	(5.0–7.3)	(690–795)	(3.2–8.2)

–(Continued)–

Age 3.2S1S1S1 (n = 10)

Male		Female	
Length(mm)	Weight(kg)	Length(mm)	Weight(kg)
790	7.3	740	6.4
		760	6.8
		740	5.5
		825	7.3
		795	5.9
		745	6.8
		760	5.9
		725	5.5
		705	5.5
Range -	-	(705–825)	(5.5–7.3)

Age 3.3S1 (n = 46)

Male		Female	
Length(mm)	Weight(kg)	Length(mm)	Weight(kg)
730	5.9	685	4.5
730	5.9	750	6.8
775	7.3	730	5.9
775	6.8	720	5.5
695	5.0	720	5.9
720	6.4	725	5.0
725	5.5	755	5.5
725	5.9	685	5.5
750	6.8	715	5.0
750	6.8	760	5.9
		785	6.4
		760	6.4
		715	6.4
		725	5.9
		705	5.5
		685	4.5

-(Continued)-

Age 3.3S1

Male		Female	
Length(mm)	Weight(kg)	Length(mm)	Weight(kg)
		775	6.8
		735	5.9
		730	5.0
		720	5.9
		670	4.1
		700	5.0
		745	5.9
		775	5.9
		760	5.9
		725	5.5
		745	6.4
		740	6.4
		720	5.0
		690	5.0
		725	5.5
		720	5.5
		715	5.0
		710	5.9
		700	5.9
		730	5.5
Range (695–775)	(5.0–7.3)	(670–785)	(4.1–6.8)

Age 3.3S1S1 (n = 3)

Male		Female	
Length(mm)	Weight(kg)	Length(mm)	Weight(kg)
755	6.8	770	5.9
		715	5.9
Range –	–	(715–770)	–

–(Continued)–

Age 4.2S1 (n = 61)

Male		Female	
Length(mm)	Weight(kg)	Length(mm)	Weight(kg)
635	3.6	745	5.9
645	4.5	715	5.9
735	5.5	645	4.1
715	4.5	640	4.1
625	4.1	710	5.5
680	5.0	735	6.4
655	4.1	685	4.1
695	5.9	665	4.5
620	4.1	710	5.5
665	5.0	690	4.5
700	5.5	675	5.5
640	4.5	700	5.5
635	4.5	685	5.5
650	3.6	705	5.9
660	4.5	755	6.4
645	4.5	620	4.5
620	4.1	650	4.1
685	4.1	705	4.5
635	4.1	610	3.2
680	5.0	710	5.9
670	4.5	665	5.0
		670	4.5
		695	5.0
		645	3.6
		665	4.5
		660	4.1
		665	4.5
		705	5.5
		720	5.9
		670	4.5
		725	5.0
		665	4.5
		665	4.5
		670	4.5
		620	4.1
		725	5.9
		695	5.0
		725	5.0
		760	6.8
		710	5.9
Range (620–735)		(610–760)	
	(3.6–5.9)		(3.6–6.8)

-(Continued)-

Age 4.2S1S1 (n = 17)

Male		Female	
Length(mm)	Weight(kg)	Length(mm)	Weight(kg)
750	5.5	720	6.4
730	5.0	705	5.0
690	4.5	730	5.9
		740	5.9
		700	5.5
		660	3.2
		765	6.8
		725	6.4
		695	5.5
		700	5.5
		715	5.9
		640	4.5
		665	5.0
		765	5.9
Range (690-750)	(4.5-5.5)	(640-765)	(3.2-6.8)

Age 4.2S1S1S1 (n = 1)

Male		Female	
Length(mm)	Weight(kg)	Length(mm)	Weight(kg)
-	-	730	6.4

-(Continued)-

Age 4.2S1S1S1S1 (n = 1)

Male		Female	
Length(mm)	Weight(kg)	Length(mm)	Weight(kg)
–	–	760	5.5

Age 4.3S1 (n = 26)

Male		Female	
Length(mm)	Weight(kg)	Length(mm)	Weight(kg)
805	7.7	735	5.9
710	4.5	720	5.0
720	5.5	710	4.5
735	6.8	725	5.9
740	6.8	810	6.8
745	6.4	775	6.4
730	5.9	725	5.5
765	7.3	770	6.8
785	7.3	720	5.9
770	5.5	710	5.0
		750	6.4
		720	5.9
		740	5.5
		695	5.5
		735	6.4
		765	6.8
Range (710–805)	(4.5–7.7)	(695–810)	(4.5–6.8)

–(Continued)

Age 4.3S1S1 (n = 6)

	Male		Female	
	Length(mm)	Weight(kg)	Length(mm)	Weight(kg)
	745	6.4	800	7.7
			825	8.2
			705	5.9
			795	8.6
			755	5.9
Range	–	–	(705–825)	(5.9–8.6)

Age 5.2S1 (n = 2)

	Male		Female	
	Length(mm)	Weight(kg)	Length(mm)	Weight(kg)
	–	–	680	5.5
			720	5.5
Range	–	–	(680–720)	–

Age 5.3S1 (n = 1)

Male		Female	
Length(mm)	Weight(kg)	Length(mm)	Weight(kg)
–	–	695	5.0

Appendix B3. Effort, catch, and harvest statistics for the Karta River steelhead fishery by seasonal period from March 14 through June 4, 1989.

	Seasonal Period						
	3/14 to 3/27	3/28 to 4/10	4/11 to 4/24	4/25 to 5/08	5/09 to 5/22	5/23 to 6/05	Total
Number of Count Samples	14	20	20	20	20	20	114
Mean Number of Anglers Counted	3	3	5	3	1	1	17
Number of Interviews	7	10	10	10	10	10	57
Number of Possible Samples	112	112	126	140	140	140	770
Number of Anglers Interviewed	2	16	18	15	3	2	56
Angler-Hours of Effort	314	252	441	355	70	136	1568
Variance of Angler-Hours	18,651	4,439	7,124	8,020	1,039	2,810	42,083
Steelhead Kept	0	6	31	13	0	0	50
Variance of Steelhead Kept	0	65	114	182	0	0	360
Steelhead Released	0	25	41	59	0	0	124
Variance of Steelhead Released	0	1,035	388	1,045	0	0	2,468

Appendix B4. Karta River spawning steelhead radio telemetry tracking data, March through June, 1989.

Tag No.	Sex	Age	Length (mm)	Weight (kg)	Distance Upstream (km)	In-River Area[a]
1	F	3.2S1S1S1	750	5.9	1.1	1
2	F	3.3	735	5.9	0.7	1
3	F	N.A.	N.A.	N.A.	1.8	1
4	F	4.2	635	3.6	.5	1
5	F	4.3S1	695	5.5	2.3	1
6	F	N.A.	680	5.0	7.3	3
7	F	3.2S1	700	5.0	5.6	2
8	F	3.3	725	5.0	2.2	1
9	F	4.2S1	755	6.4	1.9	1
10	F	3.2	610	3.2	1.9	1
11	F	3.2S1	630	3.6	12.1	5
12	F	3.2S1S1S1	760	6.8	2.2	1
13	F	3.3	675	5.0	0.5	1
14	F	4.2S1	650	4.1	1.8	1
15	F	4.2	595	3.2	1.0	1
16	F	3.3	795	3.3	1.9	1
17	F	3.3	680	5.0	4.8	2
18	F	3.2S1	680	4.6	2.8	1
19	F	4.2	615	3.6	1.9	1
20	F	N.A.	775	6.8	1.8	1
21	F	3.2S1S1S1	745	6.8	0.8	1
22	F	N.A.	680	4.6	1.9	1
23	F	N.A.	690	4.6	13.7	4
24	F	3.2	585	3.2	11.3	5
25	F	3.2S1S1	700	5.5	1.8	1
26	F	N.A.	725	5.0	1.8	1
27	F	3.2	595	3.2	1.9	1
28	F	3.2	610	4.1	0.8	1
29	F	4.2S1	695	4.9	7.3	3
30	F	N.A.	680	4.6	1.1	1
31	F	3.3	730	5.5	0.8	1
32	F	3.3	725	5.9	0.8	1
33	F	N.A.	N.A.	N.A.	1.9	1
34	F	3.3S1	720	5.5	5.2	2
35	F	4.2	600	3.1	1.1	1
36	F	3.3	675	4.6	1.9	1
37	F	3.3	745	5.9	1.9	1
38	F	3.2S1S1S1	725	5.5	2.2	1
39	F	2.3	700	4.1	1.3	1
40	F	3.3	690	5.9	1.0	1

-(Continued)-

Appendix B4. (page 2 of 3)

Tag No.	Sex	Age	Length (mm)	Weight (kg)	Distance Upstream (km)	In-River Area[a]
41	F	3.3S1	730	5.9	1.3	1
42	F	3.3	730	5.9	7.3	3
43	F	3.3	655	4.6	2.3	1
44	F	3.2	665	4.6	1.3	1
45	F	3.2S1	720	4.6	1.3	1
Mean			690	5.0	2.9	
Standard Error			8.1	0.2	0.5	

-(Continued)-

Tag No.	Sex	Age	Length (mm)	Weight (kg)	Distance Upstream (km)	In-River Area[a]
1	M	3.2	575	3.2	1.8	1
2	M	4.2	655	4.6	1.9	1
3	M	4.2	645	5.0	1.1	1
4	M	4.3	755	7.3	2.2	1
5	M	4.2S1	625	4.1	0.8	1
6	M	N.A.	770	6.4	1.3	1
7	M	4.3S1	695	5.5	5.6	2
8	M	N.A.	N.A.	N.A.	1.9	1
9	M	N.A.	N.A.	N.A.	2.2	1
10	M	4.2S1	700	5.5	1.8	1
11	M	N.A.	640	4.6	1.9	1
12	M	3.2	590	3.6	1.8	1
13	M	N.A.	625	4.1	1.8	1
14	M	4.3	785	6.4	0.8	1
15	M	N.A.	615	3.6	2.1	1
16	M	3.3	665	5.0	0.7	1
17	M	4.2	670	5.0	0.8	1
18	M	3.3	765	7.7	11.2	5
19	M	N.A.	700	5.0	0.8	1
20	M	3.3	685	5.0	2.2	1
21	M	N.A.	N.A.	N.A.	1.9	1
22	M	3.2	635	4.1	1.9	1
23	M	N.A.	705	4.6	1.0	1
24	M	N.A.	695	4.6	1.9	1
25	M	3.2	630	4.1	1.9	1
26	M	4.3S1	710	4.6	1.3	1
27	M	3.2S1	710	4.6	1.3	1
28	M	3.2	680	4.6	1.0	1
29	M	3.2S1	705	5.5	2.8	1
30	M	2.2	610	3.6	2.2	1
Mean			676	4.9	2.1	
Standard Error			10.6	0.2	0.4	

[a] In-River Area Codes: 1 = Mainstem Karta River
2 = Between Karta and Salmon Lakes
3 = Senator Wirth Creek
4 = McGilvery Creek
5 = Anderson Creek