

Fishery Data Series No. 97-38

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Lael M. Rogan

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Lael M. Rogan
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Michael J. Jaenicke
Division of Sport Fish, Dillingham

Alaska Department of Fish and Game
Division of Sport Fish, Research and Technical Services
333 Raspberry Road, Anchorage, Alaska, 99518-1599

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*Lael M. Rogan and Michael J. Jaenicke,
Alaska Department of Fish and Game, Division of Sport Fish,
P.O. Box 230, Dillingham, AK 99737-0605, USA*

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ABSTRACT

A creel survey conducted at the Agulupak River during the summer of 1996 indicated that no significant changes had occurred in angler demographics or biological composition of the rainbow trout population since the mid-1980s. The typical angler on the Agulupak River is male (86%), guided (85%), nonresident (85%), and fishes from a boat (82%). The fishery sustained an estimated 6,301 angler-hours of effort (SE = 103) from 23 June through 22 September 1996, during which anglers caught an estimated 5,320 rainbow trout (SE = 113). Continued monitoring of the fishery is recommended to ensure that the rainbow trout population remains healthy in the Agulupak River.

Key words: Rainbow trout, *Oncorhynchus mykiss*, creel census, angler demographics, biological composition, Agulupak River, Southwest Alaska.

INTRODUCTION

Rainbow trout *Oncorhynchus mykiss* are an important sport fish species in southwest Alaska. The Agulupak River, which flows approximately 2.5 km (1.5 miles) from the outlet of Lake Beverly down to Lake Nerka within Wood/Tikchik State Park (Figure 1), provides an excellent location and opportunity for rainbow trout anglers. It also supports major sport fisheries for Arctic char *Salvelinus alpinus*, Dolly Varden *Salvelinus malma*, and Arctic grayling *Thymallus arcticus*. The Agulupak River rainbow trout fishery is managed as a special management area and is one of six fly-fishing-only catch-and-release waters in Southwest Alaska (Minard and Dunaway 1995). Thus, all rainbow trout caught in the Agulupak River fishery must be released immediately. The management objective for this fishery is to maintain historical size and age composition, and a diversity of angling opportunity.

Since statehood, the Department of Fish and Game has conducted studies of rainbow trout of the Wood River Lake system to document stock status and improve management. Rainbow trout in the Agulupak River were tagged with numbered Floy anchor tags during creel surveys from 1986-1988 (Minard 1989), and in 1992 (Dunaway 1993a). Estimated sport fishing effort on the entire Wood River Lake system ranged from 1,701 to 5,040 angler days from 1977 to 1988 (Mills 1978-1989), and then increased to a new level of effort ranging from 6,482 to 12,144 angler-days beginning in 1989 (Mills 1990-1994, Howe et al. 1995, 1996) (Table 1). Effort averaged over 9,000 angler days per year during 1991-1995 (Table 1). The primary rainbow trout fisheries in the Wood River Lake system occur in the Agulowak and Agulupak rivers (Minard 1989). Effort on the Agulupak River, estimated from creel survey data, was 1,825 angler-hours in 1986, 4,265 in 1987, and 3,685 in 1988 (Minard 1989). Seasonally, sport fishing effort generally builds in late June, is maintained at a substantial level through August, and increases further during September before subsiding in late September or early October (Minard 1989).

Objectives of this study on the 1996 Agulupak rainbow trout fishery were to estimate recreational fishing effort in angler-days and angler-hours, the number of rainbow trout caught (defined as fish caught, landed, and released; fish that were hooked but that broke the line or became unhooked during the course of reeling in the fish were not included), the distribution of catch success of rainbow trout among anglers (angler-days), and to estimate the proportion of

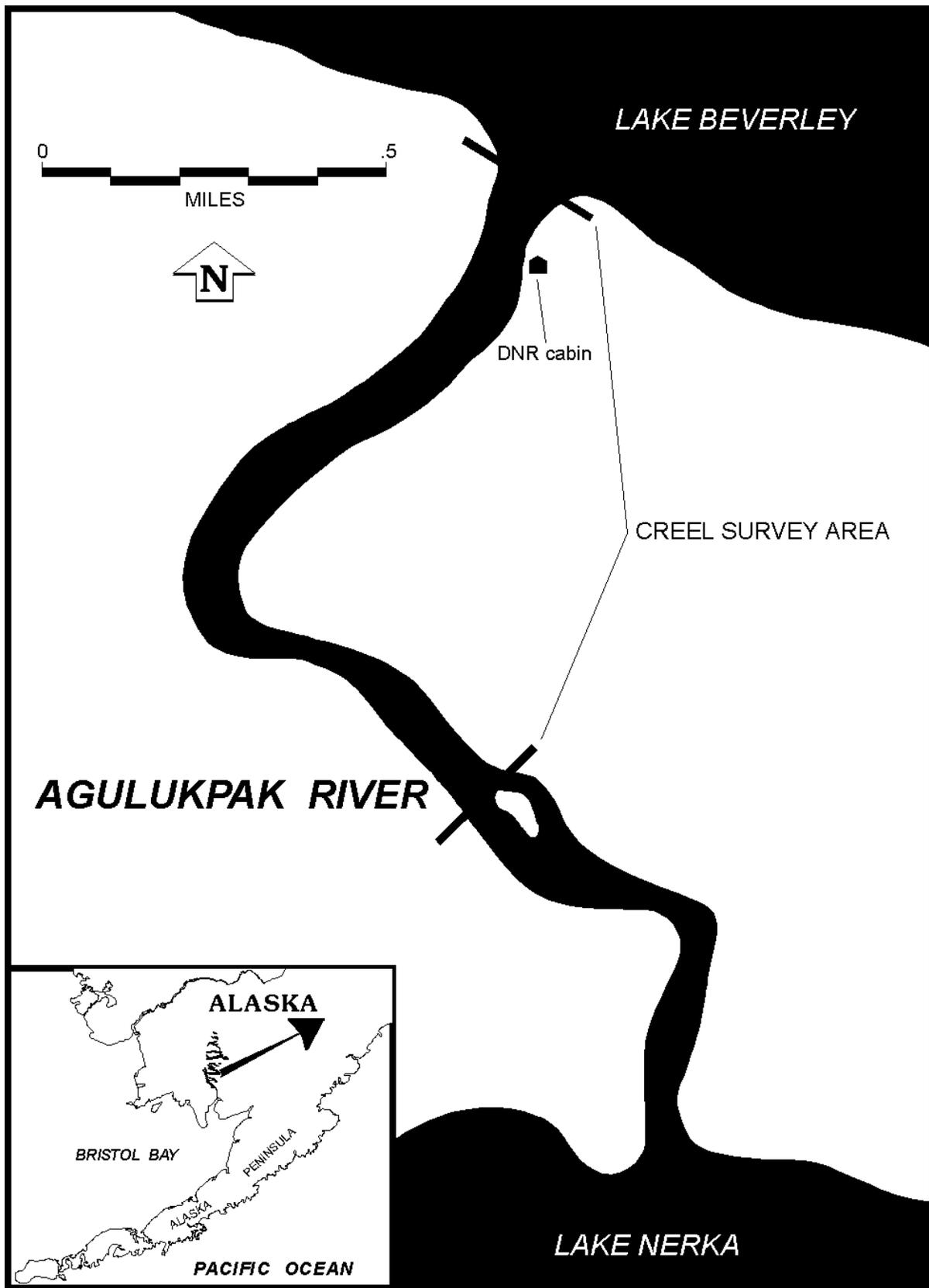


Figure 1.-Agulukpak River study site.

Table 1.-Estimated sport fishing effort (angler-days), and harvest and catch of rainbow trout on the Wood River Lake system during 1977-1995.

Year	Effort	Harvest	Catch ^a
1977	3,549	252	
1978	2,843	217	
1979	1,745	409	
1980	3,884	258	
1981	1,701	475	
1982	3,139	461	
1983	5,040	944	
1984	3,497	1,060	
1985	2,460	304	
1986	3,012	262	
1987	2,325	595	
1988	4,457	601	
1989	10,272	478	
1990	7,618	593	8,631
1991	10,853	215	8,879
1992	6,647	547	5,897
1993	6,482	306	8,283
1994	12,144	383	8,677
1995	9,022	209	7,260
1991-1995:			
Average	9,030	332	7,799
1986-1995			
Average	7,283	419	

Source: Mills 1979-1994; Howe et al. 1995, 1996.

^a Catch not estimated prior to 1990.

angler-days by angler type (shore/boat, guided/unguided, residency, and adult/youth). In addition we estimated the length and age composition of sport-caught rainbow trout in the fishery.

METHODS

STUDY DESIGN

The Alaska Department of Natural Resources, State Parks Division field crew conducted the survey from 23 June through 22 September 1996. Sampling was conducted along the upper 1.7 km (1 mile) section of the river (Figure 1), where the majority of the fishing effort occurs and where the majority of the anglers enter and exit the fishery. Anglers who had completed fishing for the day were interviewed and biological data were collected from caught rainbow trout.

To collect biological information, field technicians requested to stay with a group of anglers for several hours at a time, and sample all the fish they caught. The ideal situation was for the technician to join a group of anglers on a boat, because this provided a useful platform for sampling throughout the study area. Additionally, several rainbow trout could be kept alive in a large water-filled plastic tote during sampling, which was especially helpful if a group of anglers was catching fish rapidly. Sampling of fish captured by anglers wading into the river was rarely undertaken because of the inherent difficulty in measuring and taking scale samples from captured fish while the technician was standing out in the swift current or the slippery streambed of the upper Agulukpak River. As a secondary source of biological information, field technicians conducted test fisheries with hook-and-line gear to capture and sample rainbow trout when samples from sport anglers were unavailable.

Originally, the study was to be a census of the fishery from 23 June through 22 September, however 11 days of sampling were missed due to weather-related and other circumstances and not all participating anglers could be interviewed (18% missed). Consequently the data were treated as coming from a stratified, two-stage direct expansion creel survey. Stratification was by week, days were the first-stage sampling units, and anglers were the second-stage sampling units.

DATA COLLECTION

Only anglers who had completed fishing for the day were interviewed. The number of rainbow trout caught and time fished (to the nearest half hour) were recorded, as well as angler residency, gender, whether the angler fished from a boat or from shore, and whether the angler employed the services of a guide. The number of anglers not interviewed each day was also recorded.

Rainbow trout caught by sport anglers were measured for fork length to the nearest millimeter, and examined for the presence of tags, fin clips, and tag scars. In addition, a scale smear of six to 12 scales was taken from the preferred area (Alvord 1954, Maher and Larkin 1955) for aging purposes. The smear technique minimized errors of estimating age caused by regenerated scales. Scales were placed inside coin envelopes upon which the corresponding length, tag number (if a tag was present), and other data were recorded for that particular fish. Upon completion of the sampling procedures, all rainbow trout were released unharmed.

After the field season, the scale smears were sorted under a microscope and the three or four best scales mounted on adhesive-coated cards. The mounted scales were pressed against acetate cards in a heated hydraulic press and the resulting scale impressions displayed on a microfiche projector for age determination (Jearld 1983). Utilizing the procedure described by Coggins (1994) for aging rainbow trout scale samples, the scale impressions were read three separate times, and only those readings which had at least two out of the three age determinations matching were considered as a known age. The occurrence of aging error; i.e., no modal ages, regenerated scales, inverted scales, missing scales, was recorded.

DATA ANALYSIS

Effort, Catch, and Harvest

The creel survey was originally designed to be a census; i.e., we intended to interview all anglers every day. However 11 sampling days were missed due to weather-related transportation problems and other factors. If missed sampling were a random process, we could treat the data

as a sample survey. However missed days were not random: a disproportionate number (5 of 11) were Saturdays, due to crew change schedules. Therefore we first stratified the data by day of the week to assess whether the nonrandom pattern of missing days would cause biased estimates. Estimates from the day-of-the-week stratification differed very little (3%-4%) from unstratified estimates or those generated from stratifying by week. We concluded that the non-random sampling schedule caused negligible bias, and chose weekly stratification to document changes in catch and effort through time. Weekly strata were defined to start on Monday and end on Sunday, except that the first stratum was defined to be 8 days long (Sunday, 23 June through Sunday, 30 June).

The number of rainbow trout caught during sampled day i of stratum (week) h was estimated as:

$$\hat{N}_{hi} = M_{hi} \bar{N}_{hi}, \quad (1)$$

where M_{hi} is the total number of interviewed and noninterviewed anglers during day i of week h , and \bar{N}_{hi} is the mean catch per angler for day i :

$$\bar{N}_{hi} = \frac{\sum_{j=1}^{m_{hi}} N_{hij}}{m_{hi}}, \quad (2)$$

where N_{hij} is the number of rainbow trout caught by angler j , and m_{hi} is the number of anglers interviewed during sampled day i .

Estimated catch during stratum h (\hat{N}_h) was calculated as:

$$\hat{N}_h = D_h \bar{N}_h, \quad (3)$$

where D_h is the number of days in the stratum (equaling 8 for stratum one and 7 for all other strata), and \bar{N}_h is the estimated mean daily catch during stratum h :

$$\bar{N}_h = \frac{\sum_{i=1}^{d_h} \hat{N}_{hi}}{d_h}, \quad (4)$$

where d_h is the number of sampled days in stratum h .

Variance of \hat{N}_h was estimated as:

$$V(\hat{N}_h) = (1 - f_{1h}) D_h^2 \frac{S_{1h}^2}{d_h} + f_{1h}^{-1} \sum_{i=1}^{d_h} \left[M_{hi}^2 (1 - f_{2hi}) \frac{s_{2hi}^2}{m_{hi}} \right], \quad (5)$$

where:

$$S_{1h}^2 = \frac{\sum_{i=1}^{d_h} (\hat{N}_{hi} - \hat{N}_h)^2}{d_h - 1}, \quad (6)$$

$$s_{2hi}^2 = \frac{\sum_{j=1}^{m_{hi}} (N_{hij} - \hat{N}_{hi})^2}{m_{hi} - 1}, \quad (7)$$

and where $f_{1h} = d_h/D_h$ and $f_{2hi} = m_{hi}/M_{hi}$. Catch of rainbow trout for the entire survey and its variance were estimated by summing across all strata:

$$\hat{N} = \sum_h \hat{N}_h, \quad (8)$$

$$V(\hat{N}) = \sum_h V(\hat{N}_h). \quad (9)$$

We also summed estimates over 2-4 week intervals for comparison with the results of past surveys. Estimates of fishing effort and its estimated variance were calculated with equations 1-9 above by substituting angler-hours for catch. Number of angler days (\hat{M}_h and \hat{M}) were estimated by substituting M_{hi} for \hat{N}_{hi} in equations 3-6 and 8-9 above, and omitting the second term of the variance in equation 5.

Catch Per Unit Effort

Catch per unit effort (CPUE) of anglers participating in the 1996 Agulupak River rainbow trout fishery was estimated as follows. First, CPUE was calculated for each completed-trip angler:

$$CPUE_{hij} = \frac{C_{hij}}{e_{hij}}, \quad (10)$$

where C_{hij} and e_{hij} are the catch and effort (angler-hours) of angler j , during sampled day i of stratum h .

Mean CPUE and its variance were then calculated as follows:

$$\overline{CPUE}_h = \frac{\sum_{i=1}^{d_h} \sum_{j=1}^{m_{hi}} CPUE_{hij}}{m_h}, \quad (11)$$

$$V[\overline{CPUE}_h] = \frac{1 - \frac{m_h}{\hat{M}_h}}{m_h} \frac{\sum_{i=1}^{d_h} \sum_{j=1}^{m_{hi}} (CPUE_{hij} - \overline{CPUE}_h)^2}{(m_h - 1)}, \quad (12)$$

where m_h is the total number of completed-trip anglers interviewed during stratum h and \hat{M}_h is the estimated total number of anglers during stratum h (see equation 3 above).

Angler Success

The distribution of catch success of rainbow trout was estimated as a series of binomial proportions (Cochran 1977):

$$\hat{p}_i = \frac{m_i}{m}, \quad (13)$$

where:

m_i = number of anglers who caught zero rainbow trout for $i = 0$, 1 or more rainbow trout for $i = 1$, etc., and

m = total number of anglers interviewed (646).

The variance of these proportions was estimated as:

$$V(\hat{p}_i) = \left(1 - \frac{m}{\hat{M}}\right) \frac{\hat{p}_i(1 - \hat{p}_i)}{m - 1}, \quad (14)$$

where \hat{M} is the estimated number of angler-days (878). The proportion of angler-days by angler type and their associated variances were estimated similarly using equations 13 and 14

RESULTS

EFFORT, CATCH, AND HARVEST

A total of 647 anglers were interviewed during the survey (Appendix A1). An estimated 878 angler-days (SE = 14) and 6,301 angler-hours of effort (SE = 103) were expended during the survey from 23 June through 22 September (Table 2). An estimated 5,320 (SE = 113) rainbow trout were caught and 5 (SE < 1) were harvested illegally within the Agulukupak River rainbow trout catch-and-release area. The greatest catch occurred during the last week of the survey (Table 2).

Most anglers were guided (85%, SE = 0.7%) and non-Alaskan residents of the United States (85%, SE = 0.7%; Table 3). The majority of anglers fished from boats (82%, SE = 0.8%).

More than 88% (SE = 0.4%) of anglers caught one or more rainbow trout by the completion of their fishing day (Figure 2). Almost 53% (SE = 0.8%) caught five or more rainbow trout and 26% (SE = 0.7%) caught 10 or more rainbow trout during their fishing day.

BIOLOGICAL COMPOSITION

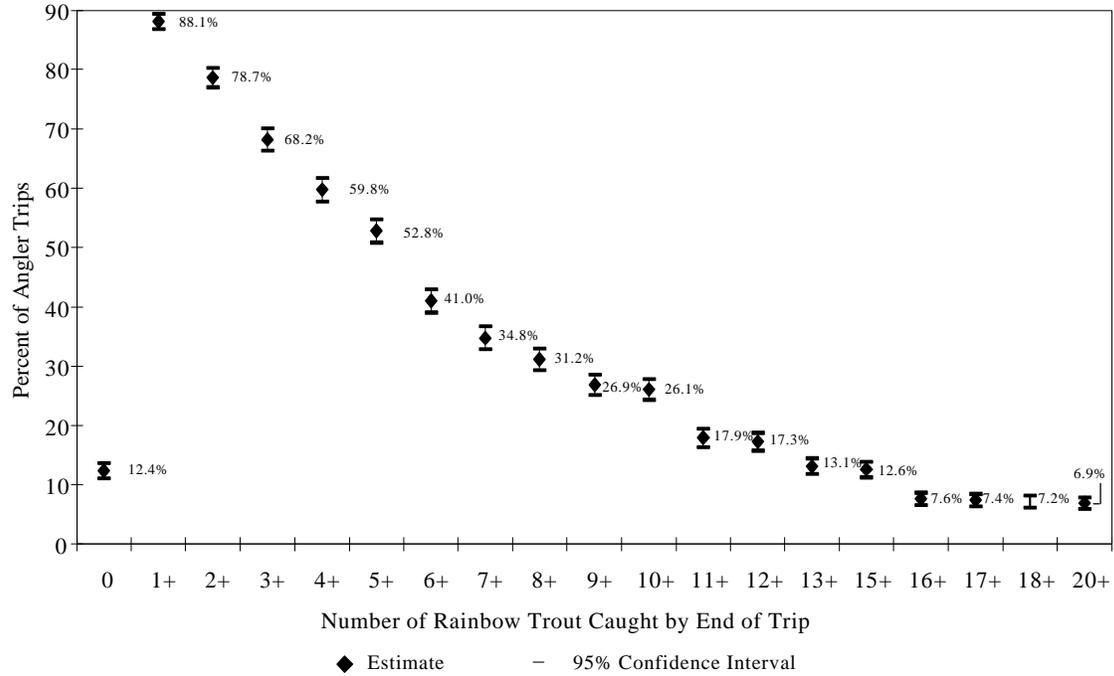
Lengths of rainbow trout captured by sport anglers ($n = 106$) were not significantly different from rainbow trout captured in test fishing ($n = 114$) (K-S test, $D = 0.08$, $P = 0.83$); therefore, samples were combined. Sampled rainbow trout ($n = 220$) averaged 417 mm (SE = 5) in length (Table 4, Figure 3). Length distribution did not change between the first and second half of the sample (K-S test, $D = 0.055$, $n_1 = 110$, $n_2 = 110$, $P = 0.49$). Scale samples were collected from all rainbow trout sampled, and age estimates were made from 126 of these (Table 4). Approximately 34% of the fish were age 6, 21% were age 5, followed by age 7 (15%) and age 4 (11%) (Figure 4). The largest rainbow trout sampled and aged was 10 years old and 550 mm (21 in) in length; the largest rainbow trout sampled was 560 mm (22 in); age was unknown for this fish.

Table 2.-Estimates of catch of rainbow trout and angler effort, by week, for the Agulukpak River fishery, 1996.

Week	Days Sampled	Catch		Angler-hours		Angler-days		CPUE	
		Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE
23-30 June	7	235	27	448	9	66	1	0.64	0.06
1-7 July	7	202	17	409	6	55	0	0.48	0.04
8-14 July	6	304	37	466	24	67	2	0.61	0.03
15-21 July	5	191	29	545	51	70	6	0.46	0.03
22-28 July	6	517	29	591	22	81	3	0.83	0.04
29 July-4 Aug	6	544	34	577	35	71	4	0.99	0.06
5-11 Aug	6	421	35	356	33	54	5	1.24	0.07
12-18 Aug	7	477	6	445	0	62	0	1.05	0.01
19-25 Aug	6	473	48	411	25	58	4	1.07	0.06
26 Aug-1 Sept	5	316	48	473	56	62	8	0.69	0.10
2-8 Sept	6	267	25	599	25	79	4	0.46	0.04
9-15 Sept	7	241	18	509	8	71	0	0.55	0.05
16-22 Sept	7	1,132	29	472	6	83	0	2.37	0.05
Total	81	5,320	113	6,301	103	878	14	0.96	0.01

Table 3.-Number and percent of angler-trips, by angler characteristic, during the Agulukpak River rainbow trout sport fishery, 23 June through 23 September 1996.

Characteristic	Angler-trips	Percent	SE
<u>ANGLER TYPE</u>			
Guided	551	85	0.7
Unguided	96	15	0.7
<u>RESIDENCY</u>			
<u>Alaska Residents</u>			
Local Alaskan Residents	6	1	0.2
Nonlocal Alaskan Residents	55	9	0.6
<u>Non-Alaskan Residents</u>			
U.S. Residents	551	85	0.7
Non-U.S. Residents	31	5	0.4
<u>SEX</u>			
Male	557	86	0.7
Female	88	14	0.7
<u>YOUTH/ADULT</u>			
Youth	10	2	0.3
Adult	634	98	0.3
<u>BOAT/ShORE</u>			
Fished from boat	530	82	0.8
Fished from shore	117	18	0.8
TOTAL ANGLER TRIPS	647		



Note: There were no anglers catching 14 fish and no anglers catching 19 fish.

Figure 2.-Angler success for rainbow trout captured on the Agulupak River in 1996.

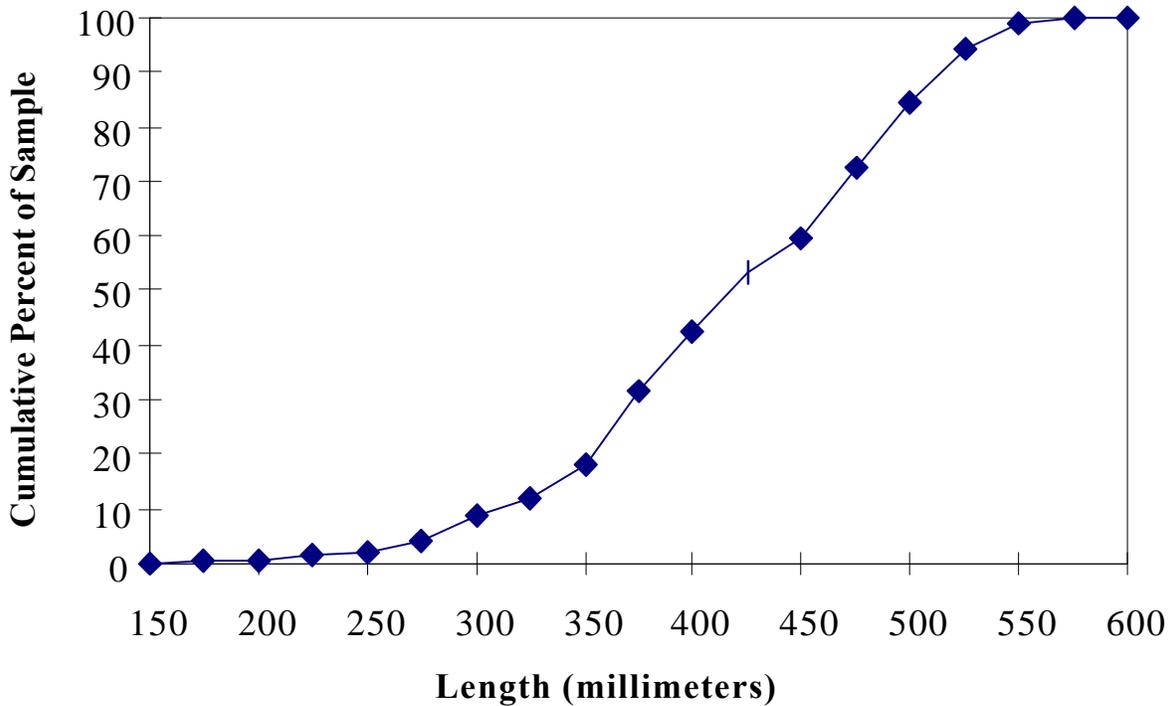


Figure 3.-Length frequency distribution of rainbow trout (n = 220) captured in the Agulupak River in 1996.

Table 4.-Mean lengths of rainbow trout captured with hook-and-line gear (by sport anglers and in test fishing), by age group, Agulukpak River, 6 July to 23 September 1996.

	Estimated Age										Aged Total	Unknown Age	Grand Total
	1	2	3	4	5	6	7	8	9	10			
n	1	3	9	14	27	43	19	8	1	1	126	94	220
Percent (of aged)	0.8	2.4	7.1	11.1	21.4	34.1	15.1	6.3	0.8	0.8	100.0	---	
Standard Error	0.79	1.36	2.30	2.81	3.67	4.24	3.20	2.18	0.79	0.79	0.00	---	
Mean Length	165	257	289	324	365	404	445	489	550	550	387	457	417
Standard Error	---	23	6	12	7	6	11	10	---	---	6	7	5

Rainbow trout with scales that could be aged were smaller on average (mean length = 387 mm, SE = 6, n = 126) than trout whose scales could not be aged (mean length = 457 mm, SE = 7, n = 94; Table 4, Figure 5); a K-S test detected a significant difference ($D = 0.49$, $n_1 = 126$, $n_2 = 94$, $P = 0.001$) in the length distribution between the aged versus unknown age fish. Approximately 93% of the unageable fish had regenerated scales (n = 87), the remainder being inverted (n = 5), lacking a modal age (n = 1), or lacking scale samples (n = 1). Thus, the estimates of age composition may be biased low to an unknown extent.

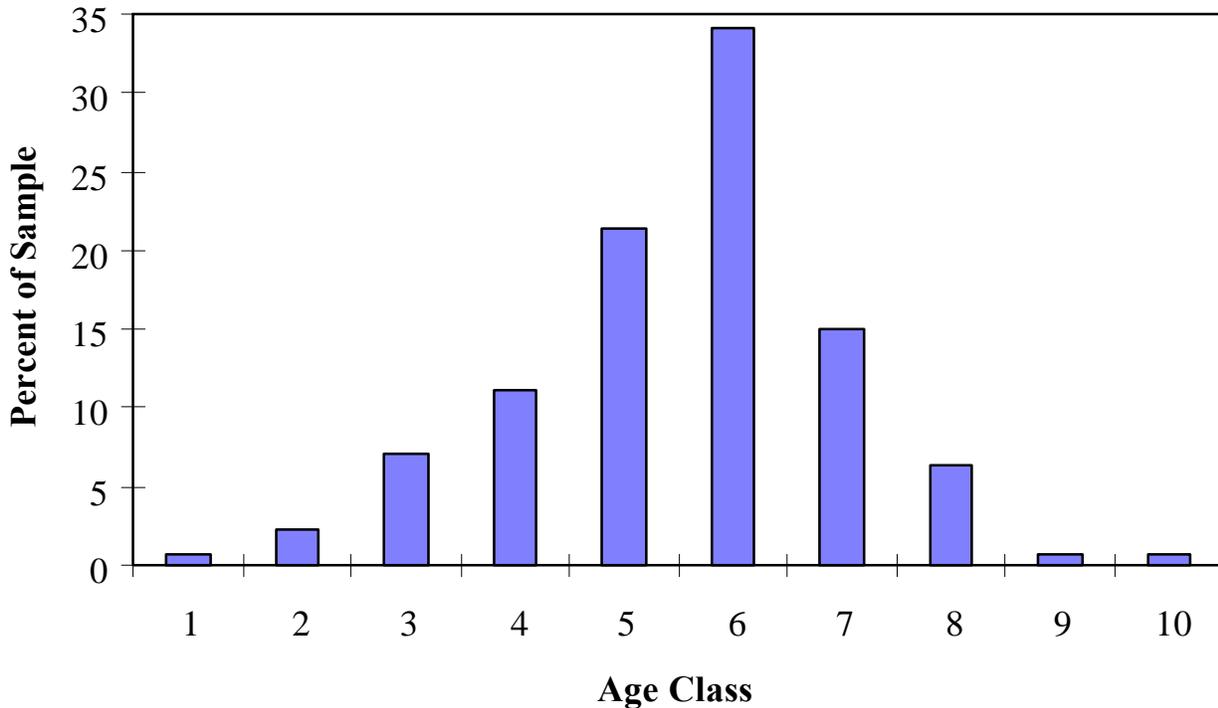


Figure 4.-Modal age distribution for rainbow trout (n = 126) captured in the Agulukpak River in 1996.

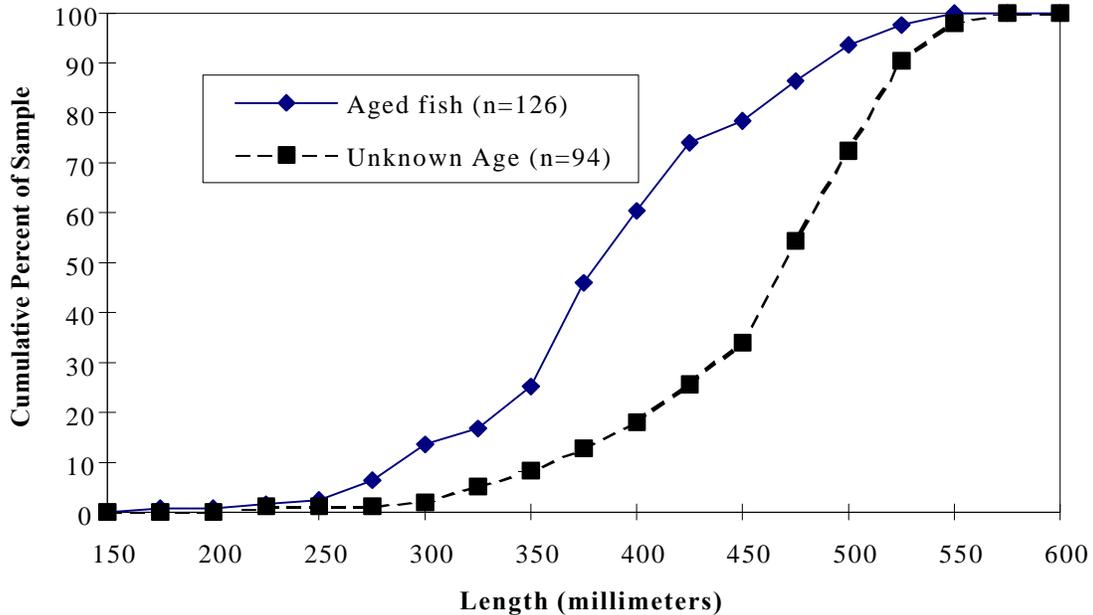


Figure 5.-Comparison of cumulative length distributions of known (n = 126) versus unknown age (n = 94) rainbow trout captured in the Agulupak River in 1996.

Four rainbow trout captured during the 1996 creel survey had been tagged with Floy T-Anchor tags previously at the Agulupak River, one in 1988 and three in 1992 (Appendix B1). None of the scale samples from the four recaptured rainbow trout in 1996 were ageable due to scale regeneration; and only one of the four trout had an estimated age at date of initial tagging—specifically, the fish with tag number 104520 had an estimated age of 3 years in 1988 and thus the estimated age in 1996 should be 11 years old.

DISCUSSION

Comparison of the results from this year’s survey with previous creel surveys on the Agulupak River (1986-1988, 1992) provide an indication of the growth of this fishery. Both effort and catch have increased since 1987 and 1988 (Table 5), the two previous surveys with sampling periods similar to this year’s (mid-June to mid-September). In 1987 effort was 4,265 angler hours and catch was 3,692 fish; 1988 had 3,685 angler hours and a catch of 2,884 fish; 1996 had 6,301 angler hours and 5,320 fish caught. Like many sport fisheries around Alaska and the rest of the United States, fly fishing is becoming increasingly popular and anglers are flocking to areas which are “undiscovered.” The Agulupak River is gaining notoriety for its superb fly-fishing opportunities which may partially explain this rise in use.

Angler demographics for 1996 were compared to previous studies as well. There have been no dramatic shifts in the characteristics of anglers fishing the Agulupak River since 1986. The proportions of demographic characteristics illustrated in this survey were remarkably similar to those from previous years (Dunaway 1993a and 1993b; Minard 1989), which were predominately guided adults from out-of-state, fishing from a boat.

Table 5.-Estimates of effort, and catch and CPUE (fish/hour) of rainbow trout, from the Agulukpak River sport fishery, 1986-1996.

Year	Sampling Period	Angler-Hours	SE	Catch	SE	CPUE	SE
1986 ^a	6/29 - 8/22	1,826	208.8	1,322	151	0.72	0.004
1987 ^a	6/17 - 7/11	665	57.5	167	25	0.25	0.03
	7/12 - 8/28	2,303	0	1,596	0	0.69	0.04
	8/29 - 9/16	1,297	0	1,929	0	1.49	0.08
Total	6/17 - 9/16	4,265	58	3,692	25		
1988 ^a	6/14 - 7/8	475	17.94	140	6	0.29	0.04
	7/9 - 8/2	1,183	27.29	927	26	0.79	0.06
	8/3 - 8/27	997	2.82	1,262	3	1.30	0.09
	8/28 - 9/16	1030	32.06	555	40	0.56	0.06
Total	6/14 - 9/16	3,685	45.86	2,884	48		
1992 ^b	8/1 - 9/22	2,759	53.6	1,862	72	0.68	
1996	6/23 - 7/7	857	11	437	32	0.57	0.04
	7/8 - 8/4	2,178	70	1,557	65	0.73	0.02
	8/5 - 9/1	1,685	70	1,686	76	1.03	0.03
	9/2 - 9/22	1,580	27	1,640	42	1.32	0.05
Total		6,301	103.0	5,320	113	0.96	0.01

^a Source: Minard 1989

^b Source: Dunaway 1993a

Age and length data for rainbow trout from the Agulukpak River in 1987 and 1992 were available for comparison with the 1996 data. To make a valid comparison between years, some data truncation was necessary. The age/length data for rainbow trout with the smallest window of sampling time was during 1987, when the 184 fish were sampled during 17 September to 20 September 1987. The short sampling duration of the 1987 data influenced what data could be used from the 1992 and 1996 rainbow trout age/length data.

The 1992 age/length data represent information from a mark-recapture project that occurred at the Agulukpak River during which two sampling events occurred (Dunaway 1993b). During the first sampling period (Period A: 18 September to 23 September), a total of 380 fish were captured. Length data are only available from Period A for 365 of the 380 fish (364 new/untagged fish and one fish tagged in a previous year), as 14 fish were recaptured/tagged fish from earlier in this sampling event, and one new/untagged fish did not have a length recorded. During the second sampling period (Period B: 27 September to 1 October), a total of 379 fish were captured. Length data are available from Period B for 329 new/untagged fish, as the remaining 50 fish were recaptured/tagged fish from either Period A or B. A K-S test detected no significant difference ($D = 0.08$, $n_1 = 365$, $n_2 = 329$, $P = 0.20$) between the length distributions between Period A and B. We decided to only use the data from period A (18 September to 23 September) as the sample size ($n = 365$) was more than adequate for the 1992 data and the sampling time also matched the 1987 age/length data.

The 1996 age/length data represented 220 fish sampled from 6 July to 23 September, with 86 fish being sampled during 6 July to 26 August, and 134 fish being sampled during 13 September to 23 September (Appendix A1). The latter group of the 1996 sampled fish (n = 134, 13 September to 23 September) was selected to be compared with the 1987 and truncated 1992 age/length data, based on the concern that the rainbow trout population structure in July and August may not be representative of the population during mid- to late-September in the Agulukpak River.

Thus, the rainbow trout age/length data collected from the Agulukpak River from the following years and time periods were compared: 1987 - 9/17 to 9/20 (n = 184), 1992 - 9/18 to 9/23 (n = 365), and 1996 - 9/13 to 9/23 (n = 134) (Appendix C1). The cumulative length distributions (Figure 6) did not differ among these data sets (Anderson Darling test: $T_{akn} = 1.47$, $P = 0.84$). Estimated age distributions differed somewhat among years 1987, 1992, and 1996 (Figure 7). The predominant modal age for 1987 (n = 107) and 1992 (n = 269) was 5 years, but age 6 was more prevalent among the 1996 samples (n = 87).

Based on the results of this survey and analysis of biological sampling, we conclude that the rainbow trout stock in the Agulukpak River is healthy, stable and at historical levels. Due to the increasing fishing effort at the Agulukpak River, we recommend that this fishery be monitored regularly for any changes which might occur in the future.

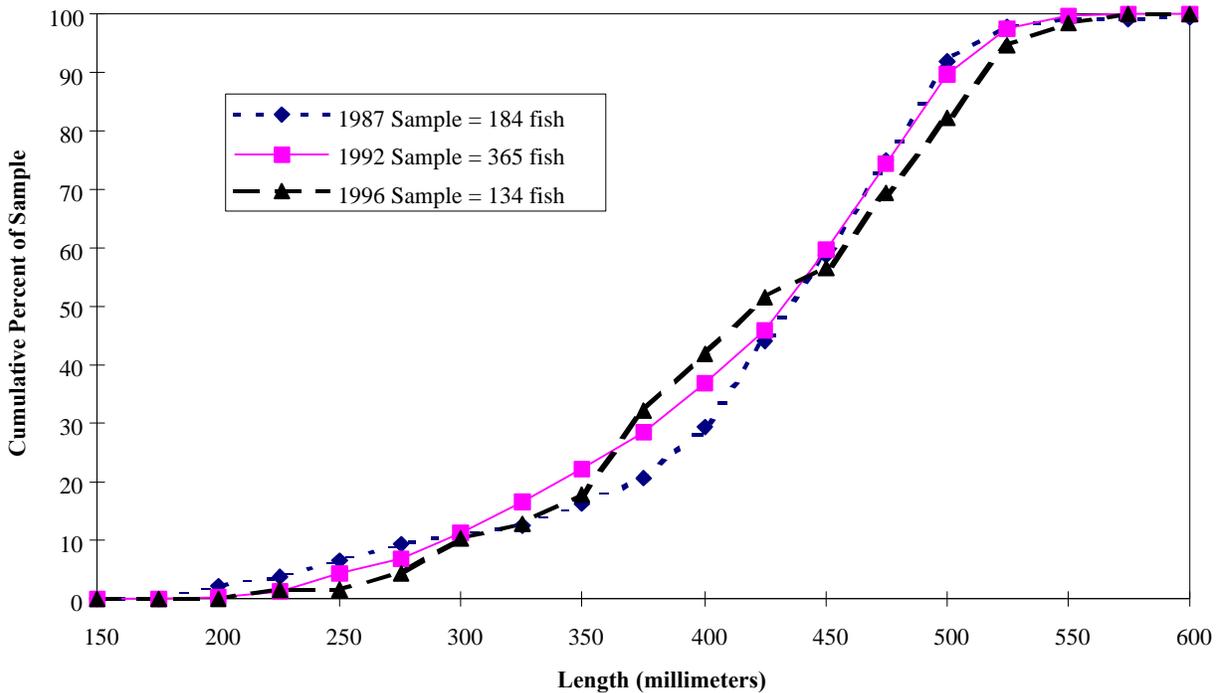


Figure 6.-Comparison of length frequency distributions of rainbow trout captured in the Agulukpak River in 1987, 1992, and 1996.

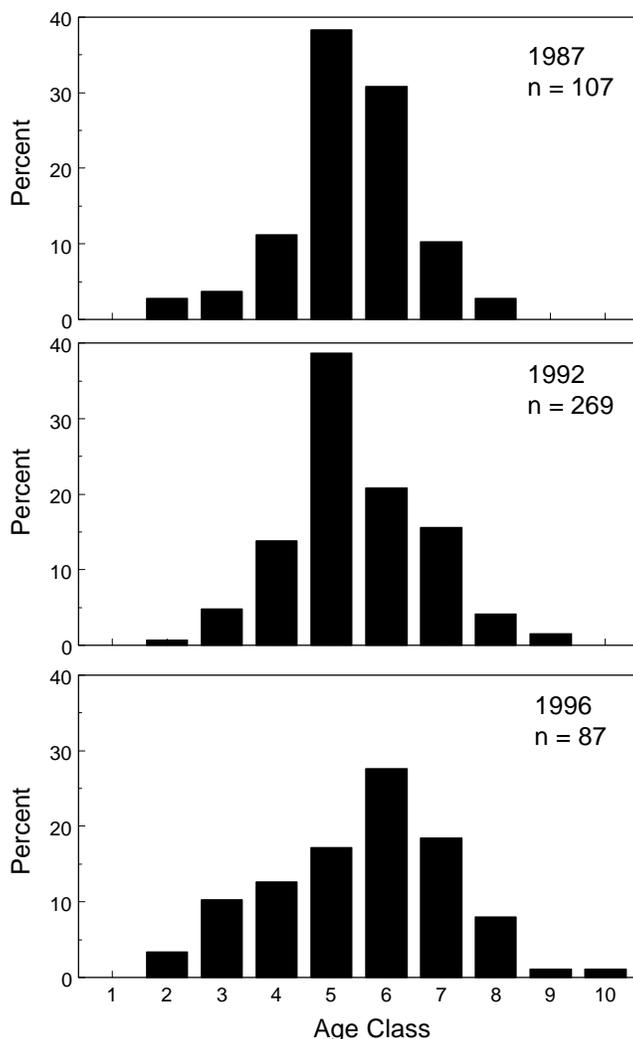


Figure 7.-Age comparison of rainbow trout captured in the Agulupak River in 1987, 1992, and 1996

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LITERATURE CITED

- Alvord, W. 1954. Validity of age determinations from scales of brown trout, rainbow trout, and brook trout. *Transactions of the American Fisheries Society* 83:91-103.
- Cochran, W. G. 1977. *Sampling techniques*, third edition. John Wiley and Sons, New York.
- Coggins, L. G., Jr. 1994. Precision of ages estimated from scales for rainbow trout in Bristol Bay, Alaska. Alaska Department of Fish and Game, Fishery Data Series No. 94-26, Anchorage.
- Dunaway, D. O. 1993a. Unpublished. Memorandum to Dan Hourihan, Wood-Tikchik State Park. Fall creel survey and population estimates. Division of Sport Fish File 600-6.1-2-2: Agulowak and Agulukpak Rainbow Trout Study 1992. Located at: ADF&G, P.O. Box 230, Dillingham, AK 99576-0230.
- Dunaway, D. O. 1993b. Status of rainbow trout stocks in the Agulowak and Agulukpak rivers of Alaska during 1992. Alaska Department of Fish and Game, Fishery Data Series No. 93-41, Anchorage.
- Howe, A. L., G. Fidler, A. E. Bingham, and M. J. Mills. 1996. Harvest, catch, and participation in Alaska sport fisheries during 1995. Alaska Department of Fish and Game, Fishery Data Series No. 96-32, Anchorage.
- Howe, A. L., G. Fidler, and M. J. Mills. 1995. Harvest, catch, and participation in Alaska sport fisheries during 1994. Alaska Department of Fish and Game, Fishery Data Series No. 95-24, Anchorage.
- Jearld, A. Jr. 1983. Age determination. Pages 301-324, in L. A. Nielsen, editors. *Fisheries techniques*. The American Fisheries Society, Bethesda, Maryland.
- Maher, F. P., and P. A. Larkin. 1955. Life history of the steelhead trout of the Chilliwack River, British Columbia. *Transactions of the American Fisheries Society* 84:27-38.
- Mills, M. J. 1979. Alaska statewide sport fish harvest studies (1977). Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1978-1979, Project F-9-11, 20 (SW-1-A), Juneau.
- Mills, M. J. 1980. Alaska statewide sport fish harvest studies (1978). Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1979-1980, Project F-9-12, 21 (SW-1-A), Juneau.
- Mills, M. J. 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-1-A), Juneau.
- Mills, M. J. 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-1-A), Juneau.
- Mills, M. J. 1982. Alaska statewide sport fish harvest studies (1981). Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1981-1982, Project F-9-14, 23 (SW-1-A), Juneau.
- Mills, M. J. 1983. Alaska statewide sport fish harvest studies (1982). Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1982-1983, Project F-9-15, 24 (SW-1-A), Juneau.
- Mills, M. J. 1984. Alaska statewide sport fish harvest studies (1983). Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1983-1984, Project F-9-16, 25 (SW-1-A), Juneau.
- Mills, M. J. 1985. Alaska statewide sport fish harvest studies (1984). Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1984-1985, Project F-9-17, 26 (SW-1-A), Juneau.
- Mills, M. J. 1986. Alaska statewide sport fish harvest studies (1985). Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1985-1986, Project F-10-1, 27 (RT-2), Juneau.
- Mills, M. J. 1987. Alaska statewide sport fisheries harvest report 1986. Alaska Department of Fish and Game, Fishery Data Series No. 2, Juneau.
- Mills, M. J. 1988. Alaska statewide sport fisheries harvest report 1987. Alaska Department of Fish and Game, Fishery Data Series No. 52, Juneau.
- Mills, M. J. 1989. Alaska statewide sport fisheries harvest report 1988. Alaska Department of Fish and Game, Fishery Data Series No. 122, Juneau.

LITERATURE CITED (Continued)

- Mills, M. J. 1990. Harvest and participation in Alaska sport fisheries during 1989. Alaska Department of Fish and Game, Fishery Data Series No. 90-44, Anchorage.
- Mills, M. J. 1991. Harvest, catch, and participation in Alaska sport fisheries during 1990. Alaska Department of Fish and Game, Fishery Data Series No. 91-58, Anchorage.
- Mills, M. J. 1992. Harvest, catch, and participation in Alaska sport fisheries during 1991. Alaska Department of Fish and Game, Fishery Data Series No. 92-40, Anchorage.
- Mills, M. J. 1993. Harvest, catch, and participation in Alaska sport fisheries during 1992. Alaska Department of Fish and Game, Fishery Data Series No. 93-42, Anchorage.
- Mills, M. J. 1994. Harvest, catch, and participation in Alaska sport fisheries during 1993. Alaska Department of Fish and Game, Fishery Data Series No. 94-28, Anchorage.
- Minard, R. E. 1989. Effort, catch, and harvest statistics for the sport fisheries on the Agulupak and Agulowak rivers, Wood River Lake system, Alaska, 1986-1988. Alaska Department of Fish and Game, Fishery Data Series No. 90, Juneau.
- Minard, R. E. and D. O. Dunaway. 1995. 1994 Area management report for the recreational fisheries of the Southwest Alaska Sport Fish Management Area. Alaska Department of Fish and Game, Fishery Management Report No. 95-2, Anchorage.

APPENDIX A.

Appendix A1.-Sampling effort at the Agulupak River during the 1996 creel survey.

Date	Anglers Interviewed	Hours Fished	Catch	Anglers Missed	Samples Collected	Cumulative Samples
6/23	4	33.0	25	4	0	0
6/24	10	57.0	52	0	0	0
6/25	8	32.0	25	2	0	0
6/26	5	40.9	13	2	0	0
6/27	6	45.8	34	2	0	0
6/28	4	32.0	1	4	0	0
6/29 ^a				4	0	0
6/30	3	24.0	3	4	0	0
7/1	10	82.0	46	0	0	0
7/2	8	64.0	42	4	0	0
7/3	4	32.3	12	5	0	0
7/4	7	51.5	17	4	0	0
7/5	3	17.5	4	0	0	0
7/6	1	6.0	1	4	1	1
7/7	1	6.0	6	4	0	1
7/08 ^b	1	6.0	5		0	1
7/9	7	52.0	28	2	1	2
7/10	11	69.2	16	0	1	3
7/11	10	82.0	44	0	0	3
7/12	6	34.0	25	2	1	4
7/13	3	16.0	14	4	3	7
7/14	8	64.0	65	4	1	8
7/15	11	87.0	37	0	0	8
7/16	2	16.0	1	2	0	8
7/17 ^b	8	66.0	47		0	8
7/18	12	50.0	21	2	0	8
7/19	11	79.0	47	0	2	10
7/20	8	68.5	24	2	2	12
7/21 ^c						12
7/22	7	54.0	48	0	0	12
7/23	11	87.0	64	0	0	12
7/24	10	88.0	90	2	0	12
7/25	15	112.5	82	0	0	12
7/26	11	68.0	58	0	0	12
7/27 ^a					2	14
7/28	12	82.0	86	1	0	14
7/29	6	49.5	41	4	0	14
7/30	15	120.0	116	0	0	14
7/31	5	39.0	56	3	0	14

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Appendix A1.-Page 2 of 3.

Date	Anglers Interviewed	Hours Fished	Catch	Anglers Missed	Samples Collected	Cumulative Samples
8/1	10	80.0	31	5	0	14
8/2	5	40.0	83	0	0	14
8/03 ^c						14
8/4	6	52.0	48	2	0	14
8/5	4	32.0	15	0	0	14
8/06 ^c						14
8/7	4	23.0	65	0	0	14
8/8	14	98.5	96	0	0	14
8/9	8	40.0	26	4	5	19
8/10	3	24.0	60	0	0	19
8/11	10	73.0	90	0	0	19
8/12	11	58.0	40	0	1	20
8/13	8	64.0	97	0	12	32
8/14	11	88.0	84	0	2	34
8/15	10	78.0	95	0	3	37
8/16	5	40.0	50	2	15	52
8/17	7	48.5	19	0	0	52
8/18	8	52.0	72	0	0	52
8/19	8	64.0	68	0	12	64
8/20	8	64.0	69	0	0	64
8/21	11	82.5	153	0	10	74
8/22	5	30.0	36	0	0	74
8/23	4	32.0	39	0	0	74
8/24 ^c						74
8/25	14	80.0	45	0	0	74
8/26	4	32.0	19	0	12	86
8/27	2	16.0	9	6	0	86
8/28 ^c						86
8/29	14	103.0	59	2	0	86
8/30	6	47.0	29	0	0	86
8/31 ^c						86

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Appendix A1.-Page 3 of 3.

Date	Anglers Interviewed	Hours Fished	Catch	Anglers Missed	Samples Collected	Cumulative Samples
9/1	10	80.0	79	0	0	86
9/2	8	64.0	25	3	0	86
9/3	13	96.0	29	4	0	86
9/4	3	24.0	17	8	0	86
9/5	12	76.0	31	0	0	86
9/06 ^a				2		86
9/7	7	56.0	22	0	0	86
9/8	8	64.0	33	2	0	86
9/9	10	80.0	20	7	0	86
9/10	10	80.0	34	4	0	86
9/11	5	40.0	31	4	0	86
9/12	4	32.0	19	3	0	86
9/13	7	49.0	10	0	8	94
9/14	8	39.5	27	7	7	101
9/15	2	10.0	10	0	5	106
9/16	14	69.0	129	0	0	106
9/17	9	51.0	107	0	4	110
9/18	14	87.0	243	0	13	123
9/19	19	127.0	244	0	32	155
9/20	12	68.0	162	4	9	164
9/21	6	31.0	107	2	7	171
9/22	1	2.0	10	2	24	195
9/23 ^d					25	220

^a No interviews conducted; number of missed anglers obtained from other sources.

^b Data were not used because corresponding counts of anglers were not available.

^c No sampling conducted on this day.

^d Test fishing only; no interviews conducted.

APPENDIX B.

Appendix B1.-Tag recovery information of rainbow trout captured at the Agulukpak River in 1996 which had previously been tagged with Floy T-Anchor tags.

Tag Number (Tag Color)	Initial Tagging Information				Recapture Information			
	Date (Location)	Length (mm)	Wt (g)	Est. Age	Date	Length (mm)	Wt (g)	Est Age
104520 (dark green)	9/14/88 (Agulukpak R.)	237	150	3	9/23/96	510	NA	Scale regenerated; estimated age 11 years old based on age at tagging in 1988
154104 (dark green)	9/28/92 (Agulukpak R.)	280	NA	NA	8/21/96	530	NA	Scale regenerated
154293 (dark green)	10/1/92 (Agulukpak R.)	450	NA	NA	9/23/96	500	NA	Scale regenerated
258653 (dark green)	9/19/92 (Agulukpak R.)	370	NA	NA	8/19/96	490	NA	Scale regenerated

APPENDIX C.

Appendix C1.-Computer files and software used to produce this report.

Data files:

T1280IAX.DTA	Agulukpak River creel census angler interview data from 1996
T1280BA6.DTA	Agulukpak River creel census rainbow trout AWL data from 1996
T1280CA6.DTA	Agulukpak River creel census angler count data from 1996
T1280BA7.DTA	Agulukpak River rainbow trout AWL data from 1987 (collected 9-17-87 to 9-20-87)
T128ABA2.DTA	Agulukpak River rainbow trout AWL data from 1992 (collected 9-18-92 to 10-1-92)

Analysis programs:

KS2M.EXE	A program developed by ADF&G Sport Fish Division, Research and Technical Services staff for conducting Kolmogorov-Smirnov two sample tests.
BBXP.EXE	A series of programs that uses biological files to produce tables of mean length and weight by sex and age group. The program also produces a data set which may be used in Excel™ to create graphs.
