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ABSTRACT

Mark-recapture experiments conducted during the summer of 1993 were used to estimate abundance of Arctic char *Salvelinus alpinus* near the Agulowak and Agulukpak rivers within the Wood River lake system, Alaska. Estimated abundance of char at the Agulowak River was 5,441 fish (95% CI 4,993 to 5,950). This is substantially less than the estimated historic average of over 11,700 fish. Abundance estimates at the Agulukpak River ranged between 4,011 and 7,118 char, which brackets the estimated historic average of over 6,300 fish.

Size composition at the Agulowak River was similar to that observed in 1976-1979, suggesting the mechanism causing the decline acted on all segments of the population. Size distribution of Arctic char at the Agulukpak River was slightly lower than those sampled in 1976-1978.

Based on these results the Department of Fish and Game, Division of Sport Fish recommends reducing the bag limit for Arctic char at the Agulowak River and limiting terminal tackle to single-hook artificial lures only.

KEY WORDS: Agulowak River, Agulukpak River, Arctic char, *Salvelinus alpinus*, Wood River lake system, mark-recapture experiment, size composition.

INTRODUCTION

Arctic char *Salvelinus alpinus* is an important gamefish to southwest Alaska's multimillion dollar sport fishing industry. Arctic char occur in most of the drainages of Bristol Bay but especially thrive in the Wood River system (Figure 1). The largest directed sport fishery for Arctic char in southwest Alaska occurs in the Wood River system at the mouths of the Agulowak and the Agulukpak rivers. Arctic char in the Wood River Lake system, particularly in the Agulowak and Agulukpak rivers, received considerable attention historically because of their predation on sockeye salmon smolt. Each spring Arctic char concentrate at the mouths of these rivers to feed on outmigrating salmon smolt. From the 1920s through 1940 the federal and state governments sponsored lethal predator control programs that paid bounties on Arctic char tails.

Predator control programs were terminated by 1941; however, a nonlethal program began in the mid 1970s. This program involved the temporary impounding of char from the mouths of the Agulowak and Agulukpak rivers to net pens during the smolt outmigration (Clark 1978). The program continued through 1980 with over 57,000 char sampled for length and, with additional studies, produced a number of population abundance estimates since 1954 (Tables 1 and 2).

Recent estimates of sport harvest of char from the Wood River drainage have averaged 1,563 (Table 3). Most Arctic char taken in the Wood River Lake system are caught at the Agulowak and Agulukpak rivers (Minard 1989). Recent harvest estimates of Arctic char for the Agulowak River are over twice as large as estimates from 1977-1981 (Mills 1979-1982). To what extent the increased sport harvest affected the abundance and size composition of Arctic char in the Agulowak and Agulukpak rivers was unknown, prompting the Division of Sport Fish to conduct a mark-recapture stock assessment project.

STUDY OBJECTIVES

The objectives of this study were to:

1. estimate the abundance of Arctic char ≥ 250 mm in length feeding near the mouths of the Agulowak and Agulukpak rivers from 1 June to 8 July 1993; and

2. estimate the length distribution and the condition factor of Arctic char ≥ 250 mm in length near the mouths of the Agulowak and Agulukpak rivers each week from 1 June to 8 July 1993.

METHODS

Population Abundance

Mark-recapture experiments were used to estimate the abundance of Arctic char ≥ 250 mm in length near the mouths of the Agulowak and Agulukpak rivers from 28 May to 8 July 1993. Char were captured with a 69 m by 11 m hand purse seine. Fishing was conducted during the twilight hours, with 8-20 seine sets

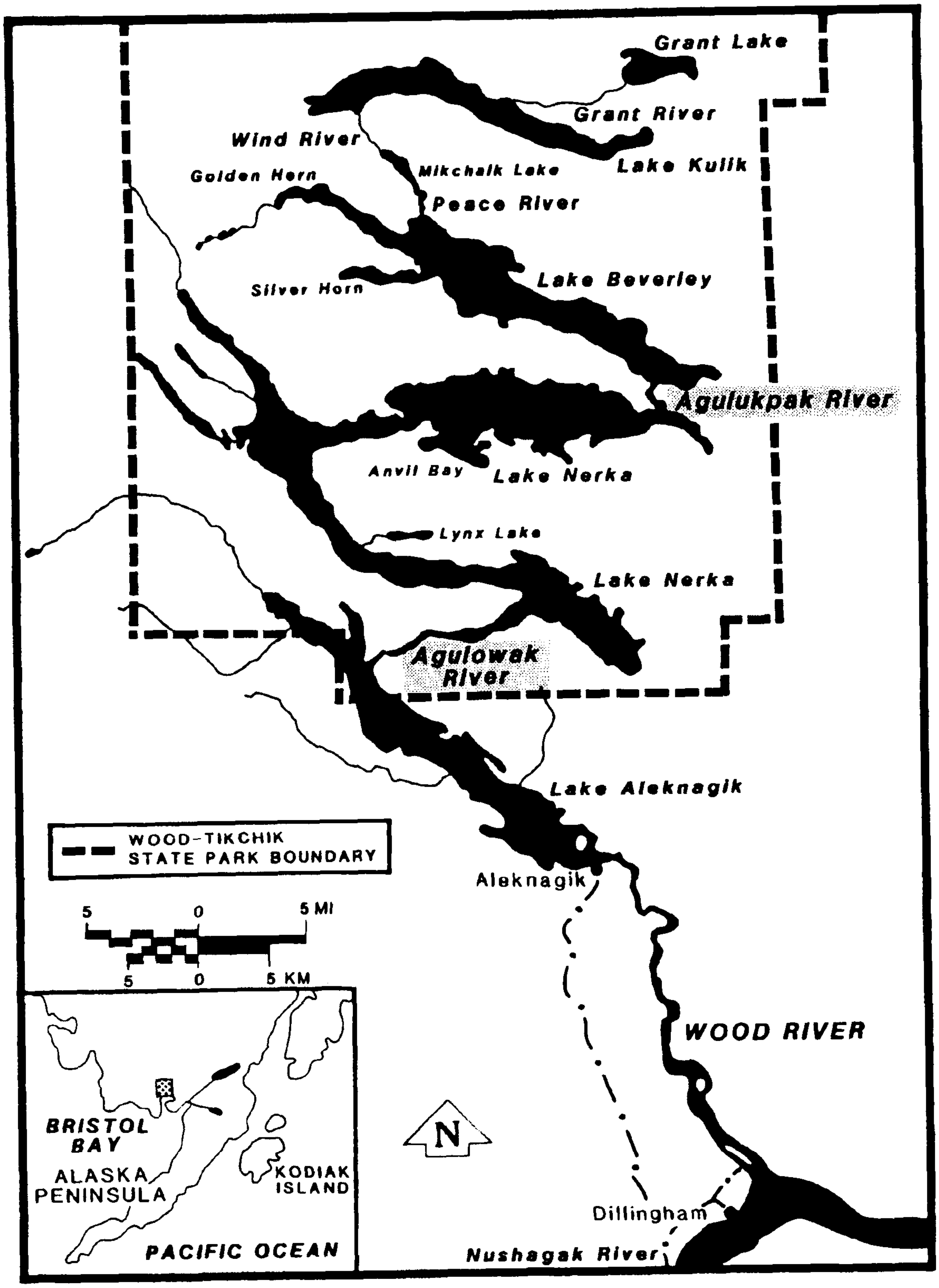


Figure 1. The Wood River Lake system.

Table 1. Historic estimates of abundance of Arctic char at the Agulowak River.

Year	Study Dates	Peak Estimate	95% Confidence Interval	Agency[a]	Estimator
1954	6/11 - 9/8	11,297	not available	FRI	Schnabel [b]
1971	6/17 - 7/18	13,400	11,400 - 15,600	FRI	Petersen [c]
1972	6/22 - 7/2	12,402	6,932 - 24,850	FRI	Petersen [d]
1975	6/11 - 7/18	13,490	10,967 - 17,520	ADF&G	Petersen [e]
1976	5/26 - 7/26	11,062	10,188 - 12,099	ADF&G	Schnabel [e]
1977	6/2 - 8/6	8,480	not available	ADF&G	R/C Ratio [f]
1978	6/1 - 8/10	11,822	not available	ADF&G	R/C Ratio [g]
1979	5/22 - 7/27	15,627	not available	ADF&G	Petersen [h]
1980	6/3 - 7/23	8,093	not available	ADF&G	Petersen [h]
Average all years		11,741			

[a] FRI = Fisheries Research Institute, University of Washington
ADF&G = Alaska Department of Fish and Game

[b] Thompson et al. (1971).

[c] Rogers et al. (1972).

[d] Rogers (1972).

[e] Meacham (1977a).

[f] Meacham (1977b).

[g] Clark (1978).

[h] Fried and Laner (1980).

Table 2. Historic estimates of abundance of Arctic char at the Agulukpak River.

Year	Study Dates	Peak Estimate	95% Confidence Interval	Agency[a]	Estimator
1972	6/19 - 7/25	7,262	5,847 - 9,628	FRI	Petersen[b]
1976	6/16 - 7/9	7,824	5,976 - 12,484	ADF&G	Petersen[c]
1977	6/16 - 7/10	5,836	not available	ADF&G	R/C Ratio[d]
1978	6/5 - 7/13	4,357	not available	ADF&G	R/C Ratio[e]
Average all years		6,320			

[a] FRI = Fisheries Research Institute, University of Washington
ADF&G = Alaska Department of Fish and Game

[b] Rogers (1972).

[c] Meacham (1977a).

[d] Meacham (1977b).

[e] Clark (1978).

Table 3. Estimated sport harvest of Arctic char in the Wood River drainage from 1977-1992.[a]

Year	Harvest Estimate
1977	435
1978	905
1979	685
1980	646
1981	529
1982	1,048
1983	2,108
1984	1,559
1985	882
1986	526
1987	2,335
1988	564
1989	2,348
1990	1,362
1991	1,724
1992	1,818
Average 1988-1992	1,563

[a] Mills (1979-1993).

made on any given evening. Arctic char were also captured at the Agulukpak River using hook and line gear to supplement low seine catches.

Capture and sampling of fish occurred at the Agulowak River from 28 May through 14 June (marking event) and from 28 June through 30 June (recapture event). Capture and sampling of fish occurred at the Agulukpak River from 17 June through 24 June (marking event) and from 6 July through 8 July (recapture event).

Fish ≥ 250 mm were marked with an individually numbered Floy T-Anchor tag and the adipose fin clipped to assess tag loss. Fork length (snout to fork-of-tail) was measured to the nearest millimeter on all fish prior to release. Tag number was recorded for all recaptured char and fork length measured prior to release. Recaptured char with a finclip but with no tag present were recorded as a tag loss and marked with a new tag. All captured char were released near the point of capture. All tagging and fork length data were recorded on a Sport Fish Division Revised Tagging Mark-Sense Form Version 1.0 (Heineman 1991).

We used the Chapman modified Petersen two-sample mark-recapture model (Seber 1982, page 59) to estimate abundance. Assumptions of the Petersen estimator are:

1. the population is closed, with no additions (recruitment or immigration) or losses (mortality or emigration) between sampling events;

2. marking does not affect capture probability during the recapture event;

3. all Arctic char ≥ 250 mm in length have an equal probability of capture during the marking event or the recapture event; or marked fish mix completely with unmarked fish prior to the recapture event;

4. marks (tags) are not lost between sampling events; and

5. all marked fish captured during the recapture event are correctly identified and recorded.

The first assumption addresses the notion of closure. Though the two rivers were not closed to migration, and mortality or removal was possible, the assumption of closure was met by simply limiting the duration of the study period. It was also assumed that growth related recruitment did not occur.

If char emigrate but no immigration occurs between sampling events, we assume marked and unmarked individuals left at the same rate. No correction is necessary and the estimate is of abundance during the first event. If char immigrate but no emigration occurs between sampling events, no correction is needed but the population estimate is for the second sampling event (Bernard and Hansen 1992). If both immigration and emigration occur between sampling events, no correction is possible and the population estimate is biased high.

To determine if migration was a problem, we tested the null hypothesis that the probability of capture during the recapture event (i.e., recapture rate) was equal among all time periods of the marking event. Time periods were composed of 2-3 sequential capture dates. The alternative hypothesis was that the probability of capture during the recapture event was different for at least one time period of the marking event.

While both harvest and hook-and-release mortality may have occurred at both rivers, we assumed this mortality would equally affect marked and unmarked individuals. Additionally, the fish captured during the study were handled with utmost care to avoid injury or stress related mortality.

The second assumption, addressing whether capture and handling during the marking event affects the probability of capture during the recapture event, could not be tested directly. However, results of tests examining violation of the third assumption provided indirect evidence of whether the second assumption was violated. Careful handling of the fish and fishing throughout the study area should have minimized problems of violating this assumption.

The third assumption addresses the issue that all fish have an equal probability of capture during the study period. To determine if the probability of capture differed due to size (i.e., size selective bias of the capture gear), Kolmogorov-Smirnov (KS) tests were applied to length data collected from the marking and recapture events at each river. In one KS test, the null hypothesis was that the cumulative length distribution of all fish released during the marking event was equal to the cumulative length distribution of all fish captured during the recapture event. A second test evaluated the null hypothesis that the cumulative length distribution of all fish released during the marking event was equal to the length distribution of fish recaptured during the recapture event.

The fourth and fifth assumptions, dealing with lost tags and identification of marked fish, were addressed by employing a secondary mark: an adipose finclip. Each fish that was captured was carefully inspected for a tag and finclip. This process ensured that fish which lost tags were identified, and that all fish were adequately inspected to ensure their capture histories were accurately recorded.

Biological Sampling

To attain the desired precision for estimating the length distributions, a minimum of 130 char were sampled (Thompson 1987) from each river during each event. All captured char were measured for fork length and the first 26 unmarked char sampled each evening were weighed to the nearest 10 g. All length and weight data were recorded on a Sport Fish Division Revised Tagging Mark-Sense Form Version 1.0 (Heineman 1991).

Mean length, weight, and their associated variances were calculated using normal procedures. The relationship of the natural log of weight as a function of the natural log of length (condition) was estimated using standard regression procedures (Draper and Smith 1981). Analysis of covariance was used to test whether the regression slope (i.e., estimates of the condition index) and the intercept estimates differed among weeks at each river.

Although Arctic char at the Agulowak and Agulukpak rivers were measured in previous studies (Baker 1988, Clark 1978, Fried and Laner 1980, Meacham 1977a and 1977b), none of these studies determined if changes in size composition occurred among years. Since effort, capture methodology, and time of capture were similar among these studies, we tested whether changes in size composition occurred in these two populations among years. Length data were collected from Arctic char at the Agulukpak River during the summers of 1976-1978 and at the Agulowak River during the summers of 1976-1979. The length distribution data were combined into 10 mm length categories. An Anderson-Darling K-sample test (Scholz and Stephens 1987) was used to test the hypothesis that the cumulative length distribution of char at each river is equal among years. If differences existed, a KS test was performed on each pairwise comparison to determine which years were different.

RESULTS

Abundance Estimates

Agulowak River:

During the marking event 1,545 unique live Arctic char ≥ 250 mm were captured and released (Table 4). Tag loss during the marking event was 3%. During the recapture event 919 unique char were captured. Of these fish 260 were recaptures from the marking event: 228 with tags and 32 (12%) that lost their tags. We assumed tag loss occurred between events on char originally captured during the marking event.

The cumulative length distribution of char captured and released during the marking event was significantly greater (n_1 = 1,543; n_2 = 919; D = 0.0063; P = 0.02) than that of char captured during the recapture event (Figure 2). The cumulative length distribution of char recaptured during the recapture event was significantly greater (n_1 = 1,543; n_2 = 260; D = 0.1354; P < 0.001) than that of char captured and released during the marking event. These results indicate size selective sampling, but generally when size selective gear bias occurs the cumulative length distributions cross each other. We concluded that large sample sizes and growth of recaptured fish caused these results and that the probability of capture was not affected by size selective sampling.

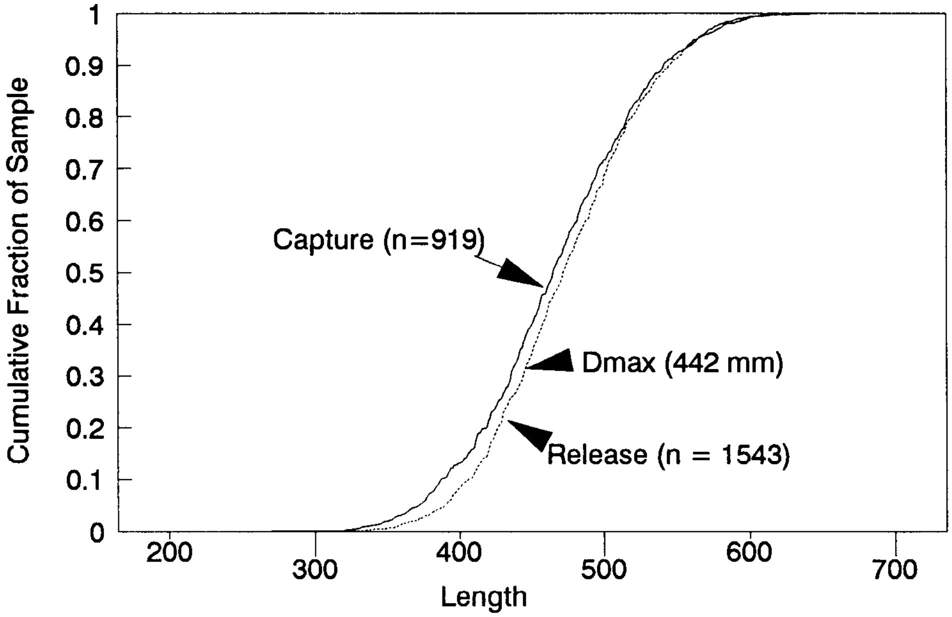
There was no significant difference (χ^2 = 2.95, df = 3, P = 0.40) in recapture rate among four periods of the marking event (Table 5). Although there was a borderline significant difference (χ^2 = 15.34, df = 8, P = 0.05) in recapture rate among capture dates, there was no consistent pattern or trend. Based on these results, an unstratified Chapman modified Petersen model was used to estimate abundance of Arctic char at the Agulowak River. The estimated abundance was 5,441 (SE = 259) char (Table 6).

Agulukpak River:

During the marking event 1,020 unique char ≥ 250 mm were captured and released with tags (Table 4). Five fish of 126 recaptures (4%) lost their tag during the marking event. During the recapture event 250 unique char were captured. Of these fish, one fish (3%) lost its tag and 34 additional fish were recaptured with tags for a total of 35 recaptures.

Table 4. Summary of capture data of Arctic char during two sampling events at the Agulowak and Agulukpak rivers in 1993.

Event	Total Records	Duplicate Tag Nos	Unique Captures	Lost Tags Number	Lost Tags Percent	Unique Recaps
Agulowak River						
Marking Event 5/28 - 6/14	1,869	324	1,545	9	3	
Recapture Event 6/28 - 6/30	935	16	919	32	12	228
Agulukpak River						
Marking Event 6/17 - 6/24	1,146	126	1,020	5	4	
Recapture Event 7/06 - 7/08	254	4	250	1	3	34



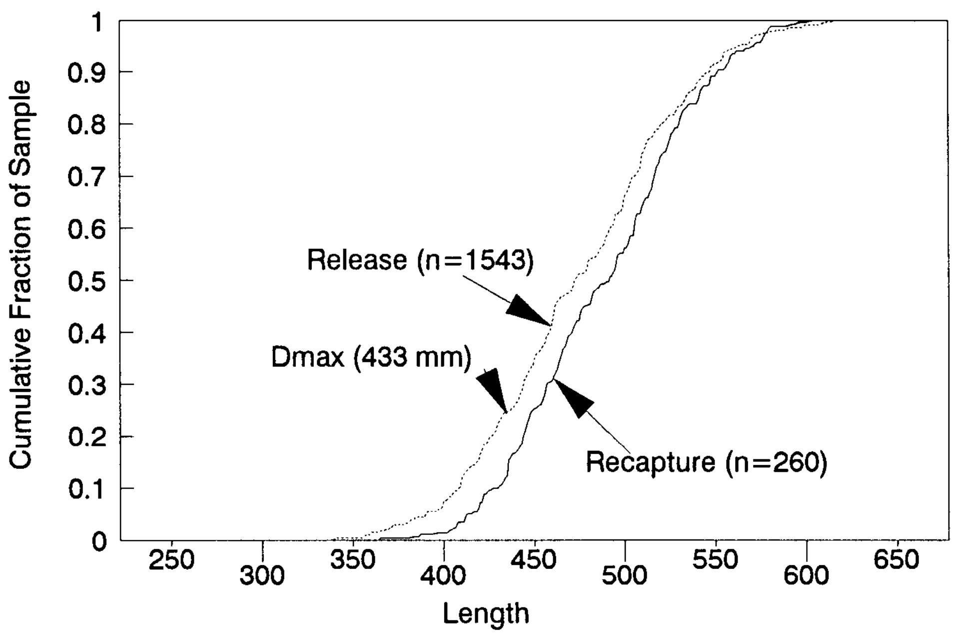


Figure 2. Length distributions of Arctic char at the Agulowak River in 1993.

Table 5. Number of Arctic char recaptured and not recaptured during the recapture event by period of the marking event at the Agulowak and Agulukpak rivers during 1993.

Marking Period	Recaptured[a]	Not Recaptured	Total	Recapture Rate
Agulowak River				
28 May - 2 June	27	151	178	0.152
3 June - 4 June	57	372	429	0.133
7 June - 9 June	68	424	492	0.138
11 June - 14 June	76	370	446	0.170
Agulukpak River				
17 June - 19 June	7	179	186	0.038
20 June - 22 June	8	501	509	0.016
23 June - 24 June	19	306	325	0.058

[a] Recapture event occurred from 28-30 June at the Agulowak River and 6-8 July at the Agulukpak River.

Table 6. Number of Arctic char captured during the marking (M) and recapture (C) events, number of marked char recaptured (R) during the recapture event, and relevant statistics of the estimated abundance of Arctic char at the mouths of the Agulowak and Agulukpak rivers during 1993 estimated with an unstratified Petersen model.

Statistic	Agulowak River	Agulukpak River
M	1,543	1,030
C	919	250
R	260	35
N	5,441	7,118 [a]
Var(N)	67,292	1,131,794
SE(N)	259	1,064
95% Confidence Interval	4,993 - 5,950	5,032 - 9,203
95% Relative Precision	9%	29%

[a] This estimate was modified to a range of 4,011-7,118 fish after additional testing and analyses.

Since fish were caught using both hook and line gear and the hand purse seine, a KS test was used to determine if the cumulative length distribution was different between the gear types. If no difference was detected then the data could be combined. There was no significant difference (n_1 = 1,067; n_2 = 195; D = 0.0777; P = 0.26) in the cumulative length distribution between gear types (Figure 3), so we combined the data. The cumulative length distribution of char captured and released during the marking event was not significantly different (n_1 = 1,015; n_2 = 248; D = 0.0603; P = 0.44) from that of all char captured during the recapture event (Figure 4). The cumulative length distribution of char recaptured during the recapture event was also not significantly different (n_1 = 1,015; n_2 = 34; D = 0.1642; P = 0.32) than that of all char captured and released during the marking event. We concluded there was no size selective sampling at the Agulukpak River.

Based on the results of the KS tests an unstratified Chapman modified Petersen model was used to estimate abundance. Abundance was estimated at 7,118 (SE = 1,064) char (Table 6).

However, at the Agulukpak River there was a significant difference (χ^2 = 11.38, df = 2, P = 0.003) in recapture rate, primarily due to the low recapture rate of char marked during the middle period of the marking event (Table 5). Further analysis indicated the recapture rate was not different (χ^2 = 3.10, df = 1, P = 0.08) between the first two marking periods and that char captured during the first two marking periods had a significantly lower (χ^2 = 9.35, df = 1, P = 0.002) recapture rate than those captured during the last marking period.

We concluded from these results and discussion with the field crew (Lew Coggins, School of Fisheries and Ocean Sciences, University of Alaska-Southeast, Juneau, personal communication), that both immigration and emigration occurred between sampling events at the Agulukpak River. This makes the Petersen estimate biased high (overestimate abundance) with an unknown degree of bias. We decided to estimate abundance with mark-recapture data collected only during the marking event using program CAPTURE (Otis et. al. 1978). This program fits different closed population models to mark-recapture data and, through a series of likelihood ratio tests, determines which model best fits the data. The models differ by relaxing in various ways the assumption that each individual has an equal probability of capture. The model that best fit the Arctic char data from the Agulukpak River allowed the probability of capture to differ over time (Chao 1989) and gave an abundance estimate of 4,011 (SE = 346) char.

<u>Biological Sampling</u>

Length and weight data of each river were divided into three groups (Table 7). These groups corresponded to the first half and the second half of the marking event, and the recapture event. Analysis of covariance detected no significant difference in the condition indices (i.e., estimated slope of natural log of body weight as a linear function of natural log of fork length) among the three groups at either the Agulowak (F = 0.80; df = 2, 330; P = 0.45) or the Agulukpak (F = 0.66; df = 2, 286; P = 0.52) rivers. Therefore, we combined the data of each river and tested the null hypothesis that condition was equal between the two rivers. Condition index at the Agulukpak River [K = 2.92;

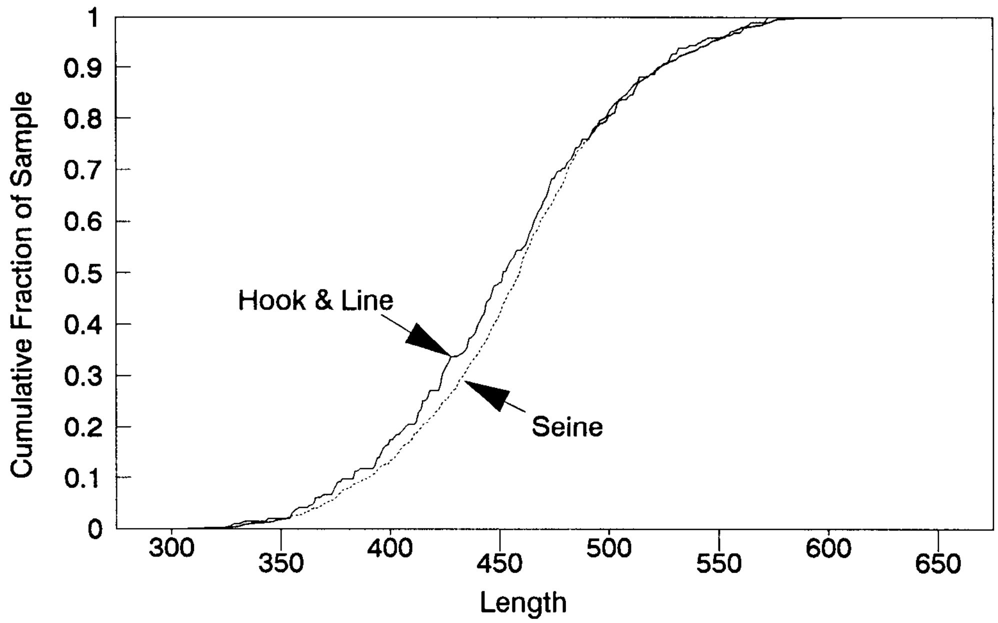
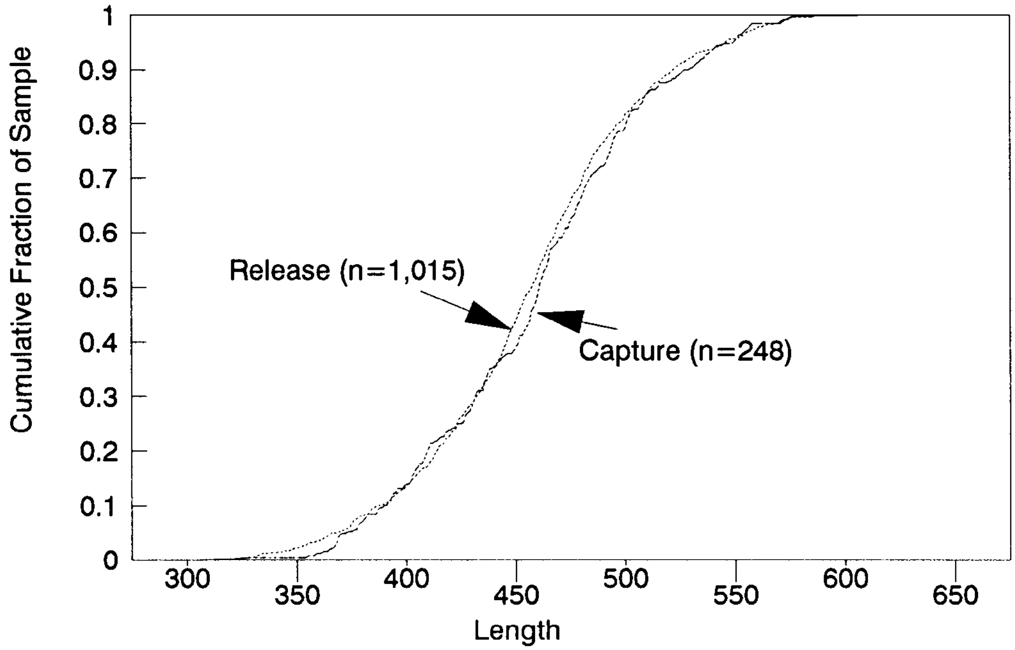


Figure 3. Length distributions of Arctic char captured with hook and line and purse seine at the Agulukpak River in 1993.



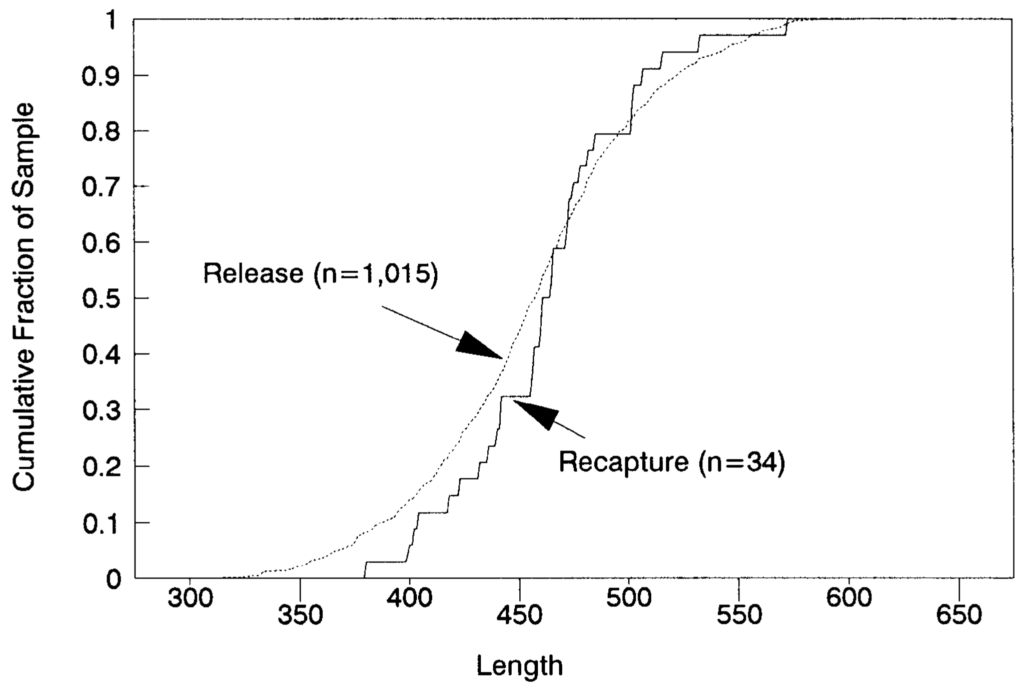


Figure 4. Length distributions of Arctic char at the Agulukpak River in 1993.

Table 7. Estimate of condition index (K) and associated standard error for Arctic char at the mouths of the Agulowak and Agulukpak rivers during 1993.

Time Period	n	K	SE(K)
Agulowak River			
28 May - 4 June	130	2.60	0.13
7 June - 14 June	128	2.79	0.18
28 June - 30 June	78	2.87	0.14
Total	336	2.69	0.09
Agulukpak River			
17 June - 20 June	104	3.03	0.13
22 June - 24 June	104	2.82	0.11
6 July - 8 July	84	2.87	0.17
Total	292	2.92	0.08

SE(K) = 0.08] was nearly significantly greater (F = 3.61; df = 1, 624; P = 0.06) than that at the Agulowak River [K = 2.69; SE(K) = 0.09].

When comparing the cumulative length distribution of each river with data collected in previous studies, the sample size at the Agulowak River exceeded the maximum limits of the software to conduct the Anderson-Darling tests. It was assumed that with 19,691 observations there would be a significant difference among years and we conducted the pairwise comparisons between years. The length distributions fell into three groups: 1978, 1979 < 1993 < 1976, 1977 (Table 8). The cumulative length distributions appear to show no major difference among years (Figure 5A).

The length distribution of char at the Agulukpak River was significantly different (T_{akn} = 44.64, P < 0.001) among years. Based on the test results (Table 8) and a plot of the distributions (Figure 5B), the major conclusion is that char sampled in 1993 were smaller than those sampled in 1976-1978.

DISCUSSION

The abundance estimates from the Chapman modified Petersen model are biased if both immigration and emigration to these rivers occurred during the mark-recapture experiments. From observations made by the field crew (Lew Coggins, School of Fisheries and Ocean Sciences, University of Alaska-Southeast, Juneau, personal communication), it is likely immigration occurred at the Agulowak River during the marking event and perhaps between events. However, it is doubtful that emigration occurred to any great degree because:

(a) The recapture rate of char marked the first day of the marking event (19%) was high relative to the overall recapture rate (15%).

(b) Daily catches during the recapture event were as high as those during the latter portion of the marking event. Assuming equal effort was expended during these times, which is likely because the crew was familiar with the gear and the area, this implies the number of char did not decline between events. However, note that emigration could occur and abundance decline, but not to the point where it reduced catches.

(c) If both immigration and emigration occurred, we would expect that char present and captured early during the marking event would emigrate sooner or at a greater rate, and thus have a different recapture rate, than char marked towards the end of the marking event (some of which, presumably, immigrated to the Agulowak River during the marking event).

Although these arguments are weak, we concluded immigration occurred but emigration was minimal at worst. In this case the population estimate of 5,441 is unbiased but reflects the abundance during the second event. This is the lowest estimate of abundance of Arctic char at the Agulowak River (Table 1).

Both immigration and emigration likely occurred at the Agulukpak River. It is likely immigration occurred based on discussion with the field crew and

Table 8. Results of pairwise Kolmogorov-Smirnov tests comparing the cumulative length distribution of Arctic char between years at the Agulowak and Agulukpak rivers.

		Year Tested Against[a]			
Year	n[b]	1977	1978	1979[c]	1993
Agulowak					
1976	2,608	NSD	78 << 76	79 << 76	93 < 76
1977	5,710		78 << 77	79 << 77	93 << 77
1978	7,061			NSD	78 << 93
1979	1,510				79 < 93
1993	2,802				
Agulukpak					
1976	2,816	NSD	NSD		93 << 76
1977	2,429		78 < 77		93 << 77
1978	1,890				93 << 78
1993	1,197				

[a] NSD = No significant difference at $P > 0.01$; Year X < Year Y = Length distribution of Year X significantly smaller than that of Year Y at $0.01 \geq P > 0.001$; Year X << Year Y = Length distribution of Year X significantly smaller than that of Year Y at $P \leq 0.001$.

[b] Number of char sampled for length.

[c] Only the Agulowak River was sampled in 1979.

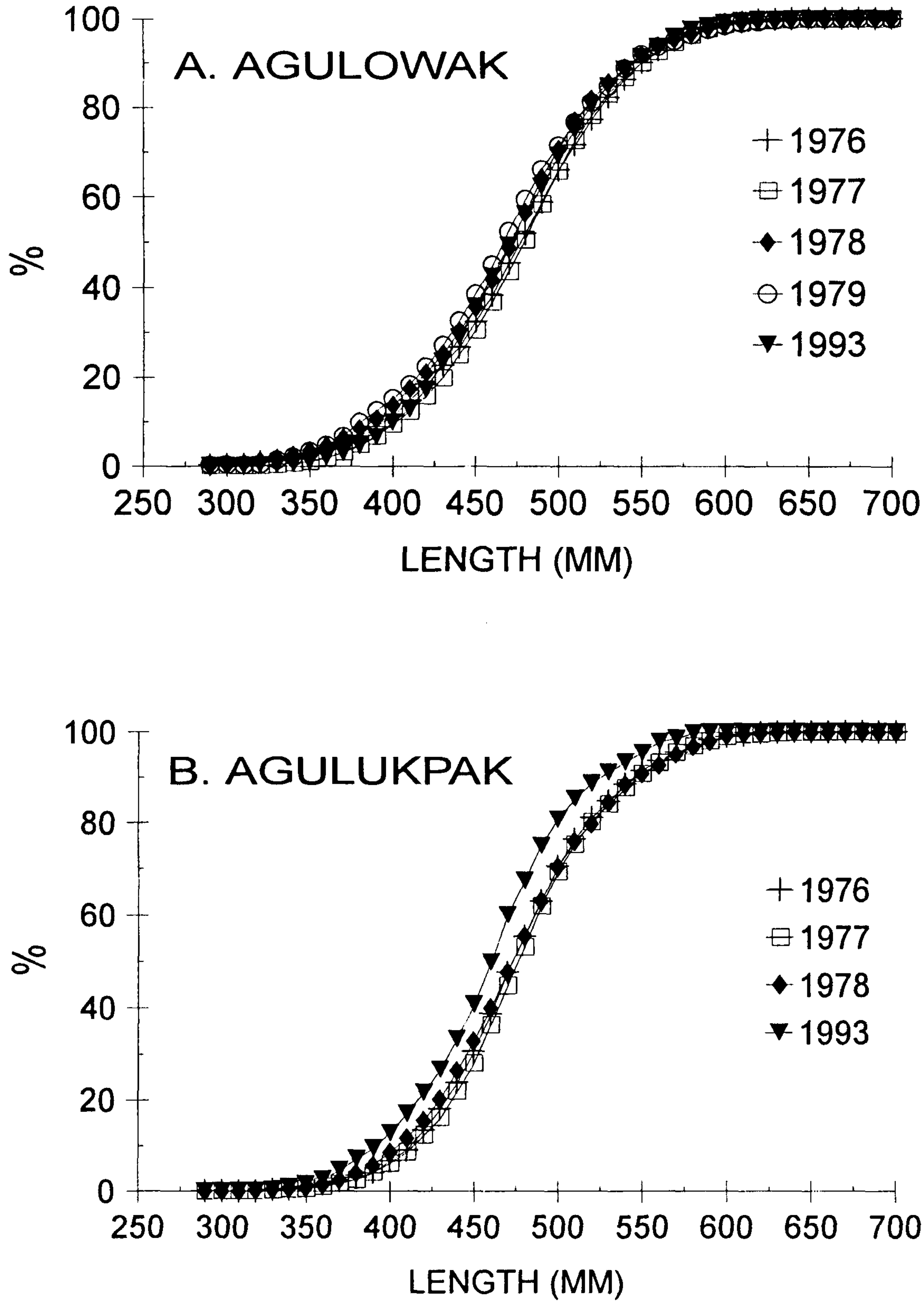


Figure 5. Length distributions of Arctic char sampled at the Agulowak River 1976-1979 and 1993, and the Agulukpak River 1976-1978 and 1993.

because all of the abundance estimates from CAPTURE, based solely on data from the marking event, were at least 3,000 char lower than the Petersen estimate using all of the data. It also appeared that emigration occurred because recapture rates differed among char marked "early" vs. "late" of the marking event. It is possible that char captured early during the marking event were emigrating at a greater rate or began emigrating earlier than those captured later in the marking event. Daily catches were also lower during the recapture event than during the latter portion of the marking event, but the field crew spent much time sorting adult sockeye salmon from the seine net during the recapture event. The crew believed the large numbers of adult sockeye salmon perhaps caused Arctic char to leave the area. Because it seems both immigration and emigration occurred, the Petersen estimate of 7,118 is biased high with an unknown degree of bias. The population estimate of 4,011 from CAPTURE is of limited value. The estimate is valid only for the 8-day period of the marking event (17-24 June), and if immigration actually occurred this estimate is biased low with an unknown degree of bias. Although bias makes both estimates at the Agulukpak River unsatisfactory, the population was likely between 4,000-7,000 char. This range of values is in line with previous estimates.

Results of the condition factor analysis were a bit surprising. Initially it was thought that the condition index would increase over time as the char gained weight while eating sockeye smolt. In retrospect, char likely also increase in length, so that although char grow and improve their "condition," the relationship between natural log length and natural log weight did not change significantly (at least statistically). It is also possible that these results provide another indication that immigration occurred during the mark-recapture experiments.

The cumulative length distribution of Arctic char in 1993 at the Agulowak River is within those distributions seen historically, but char at the Agulukpak River are smaller on average than those in the late 1970s. There are several possible explanations for these results, especially at the Agulukpak River. It is possible that large char were overexploited or more susceptible to hook and line mortality, or perhaps a large cohort of younger, smaller fish is dominating the population and causing the size distribution to shift.

Given these results, it appears that the population of Arctic char feeding at the Agulukpak River is stable relative to historic levels. The minor shift in size composition is not alarming at this point. Regulations governing this fishery appear to provide adequate protection and no changes are recommended.

Abundance of Arctic char feeding at the Agulowak River has dropped by half of that previously reported. The fact that size composition has not changed from the historic levels suggests the decline has been across all segments of the population. Sport harvest of Arctic char in the Wood River lakes system averaged 1,500 fish annually since 1988 and was as high as 2,348 fish in 1988 (Mills 1989). The vast majority of this harvest comes from the Agulowak River (Minard 1989). Given an abundance of 5,441 char at the Agulowak and a likely average harvest of 1,350 char per year, it is conceivable that exploitation on this stock exceeds 20% annually. In addition to a relatively high level of exploitation, there is a very high degree of catch and release fishing directed toward Arctic char in the Agulowak River. Catch and release mortality could also be contributing to the decline.

During September 1993, we conducted mark-recapture experiments on prespawning populations of Arctic char at Ice, Youth, and Sunshine creeks. These creeks are major spawning areas for Arctic char (McBride 1979) and, like the Agulowak River, all three creeks flow into Lake Aleknagik. We attempted to estimate abundance of Arctic char at these three creeks to determine if the decline in abundance at the Agulowak River was caused by a decline in the spawning component of the Arctic char population in Lake Aleknagik, or by a decline in Arctic char throughout the rest of the lake. Unfortunately, poor weather and high water did not allow us to capture and mark sufficient numbers of fish to get an abundance estimate at any of the creeks.

Given the apparent decline of Arctic char at the Agulowak River, the Division of Sport Fish proposed that the Alaska Board of Fisheries take action to allow this stock to recover. Regulatory changes that reduce harvest and the potential effects of catch-and-release mortality were recommended. Specifically, bag and possession limits should be reduced from ten fish to two fish per day, and terminal tackle limited to single hook artificial lures, to reverse the apparent decline in char abundance. Periodic monitoring of the Arctic char populations of both the Agulowak and Agulukpak rivers should be planned to evaluate the effect of these regulation changes.

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