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Status of Rainbow Trout in the Kanektok River, Togiak National Wildlife Refuge, Alaska, 2000

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Jim Larson

Abstract

The Kanektok River supports one of the largest sport fisheries for rainbow trout *Oncorhynchus mykiss* in southwest Alaska. To monitor stock status, rainbow trout within the wilderness area of Togiak National Wildlife Refuge between river km 28 and 60 were sampled during 18 - 27 July 2000. Two hundred twenty-five rainbow trout were captured and measured. The mean fork length was 397.9 mm (SD = 74.86) with a range of 230 mm to 594 mm. Strong recruitment of 300 to 350 mm fish was evident in the sample during 2000. Comparisons of results from 2000 to 1993 and 1985-87 during the same late July time period indicated that length distributions from 1985 and 1993 were significantly different ($p < 0.05$). Although rainbow trout > 600 mm made up a very small proportion of the 1985-1987 samples, the absence of large (> 600 mm) fish in the 1993 and 2000 samples suggests a shift in the population structure. Even with the apparent decrease in numbers of the largest fish, the population has sufficient mature fish to maintain the current fisheries.

Introduction

Rainbow trout *Oncorhynchus mykiss* populations in southwest Alaska are world famous and support many sport fisheries (ADFG 1990a). One of the more heavily fished populations in the region occurs in the Kanektok River (Wagner 1991). The earliest sampling of this population was conducted by the Alaska Department of Fish and Game (ADFG) in 1975 (Minard and Dunaway 1991). During the early 1980's sport fishing use-days on the Kanektok River increased dramatically and concern over the status of the rainbow trout population was expressed by local residents and sport fishing guides (Wagner 1991).

In response to this concern, the King Salmon Fish and Wildlife Office (Office) conducted a preliminary investigation of the population in 1983. Continued concern in 1984 prompted the Alaska Board of Fisheries (Board) to reduce the sport bag and possession limits for rainbow trout from 15 to 10 per day with no more than two fish greater than 20 inches. In 1985, the Board further reduced the rainbow trout limits from 10 to two fish per day with no size limit. Also in 1985, the Togiak National Wildlife Refuge (Refuge) placed a moratorium on issuing permits to sport fishing guides on the river within the Refuge. The moratorium limited the number of operators to only those who had operated on the river during and prior to 1984, and client numbers were limited to 1984 levels. Additionally in 1985, the Office began a three-year study to evaluate the status of the rainbow trout population. This study established a baseline for length structure against which future comparisons could be made and provided recommendations for a conservative approach to management (Wagner 1991).

Although guided sport fishing on the river within the Refuge had been limited through the late 1980's by the moratorium, unguided sport fishing appeared to be increasing (Mark Lisac, U. S. Fish and Wildlife Service, personal communication). In 1990 the Board maintained the bag and possession limits for rainbow trout, but added the restriction that only one fish greater than 20

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inches could be harvested and that only unbaited, single-hook, artificial lures could be used on the portion of the river within the wilderness area of the Refuge (ADFG 1990b). In 1991, the Refuge Public Use Management Plan (USFWS 1991) was adopted and applied to areas within the Refuge boundaries. The plan was implemented on the Kanektok River in 1994. The plan maintained the moratorium and attempted to disperse guided use throughout the season. The need to address future unguided use on the river was also noted.

Sport fishing regulations have become progressively more restrictive. Current regulations for rainbow trout allow only catch and release fishing from June 8 through October 31. A harvest of 2 fish per day, with only one fish greater than 20 inches, is allowed the remainder of the year. Sport anglers can only use unbaited, single hooks to fish for rainbow trout.

Although rainbow trout have historically been part of the subsistence harvest in the Kanektok River (USFWS 1990), little is known about the numbers of fish harvested. Rainbow trout are seldom targeted, but are captured incidentally in gill nets while local users are fishing for salmon, or while hook and line ice fishing for char (*Salvelinus* spp.) (Mark Lisac, U. S. Fish and Wildlife Service, personal communication).

In 1992, the Federal Subsistence Board recognized rainbow trout as a valid subsistence species in the non-navigable waters of the Kanektok River within the Refuge. In 1999, the interpretation of waters open to subsistence fishing under Federal regulations was expanded to include all waters within the Federal conservation unit. Therefore, the entire Kanektok River watershed is covered under Federal subsistence regulations. Under Federal subsistence regulations, rural residents with a positive customary and traditional use determination for this area do not have any harvest limits for rainbow trout.

As part of a long term monitoring program identified in the Refuge Fishery Management Plan (USFWS 1990) and to provide information for the Refuge's Public Use Management Plan (USFWS 1991), the Office initiated the third in a series of investigations concerning the status of rainbow trout in the Kanektok River in 2000. The study was modified from past sampling events to simplify rainbow trout collection and historical comparison. The last two weeks in July were selected based on catch rates from past studies (Wagner 1991 and Adams 1996) which indicated that if water conditions are good, a large sample can be collected in a short time. The primary objectives were to: (1) describe the length compositions of rainbow trout within the study area; and (2) compare the current length frequency distribution to the historical data.

Study Area

The Kanektok River originates at Kagati Lake within Togiak National Wildlife Refuge and flows west approximately 150 km before entering Kuskokwim Bay at Quinhagak (Figure 1). The drainage is approximately 2,357 km^2 with the upper 117 km of the river occurring within Refuge Wilderness (USFWS 1986). The river is extremely braided with many unstable, newly cut channels and has a predominantly gravel bottom for most of its course. The velocity of the river is swift, averaging 1.4-1.7 m/sec. Most of the riparian area has thick stands of willow (*Salix* spp.) and alder (*Alnus* spp.) with scattered stands of cottonwood (*Populus* spp.). Major tributaries of the river are Takshilik, Nukluk, Klak, Kanuklik and Paiyun creeks.

The study area in 2000 was restricted to the same 32-km section of the mainstem river sampled during 1985-1987 and 1993. The area extended from river km 28 (the lower boundary of the wilderness area) upstream to river km 60. In 1985 the study area was chosen because it included

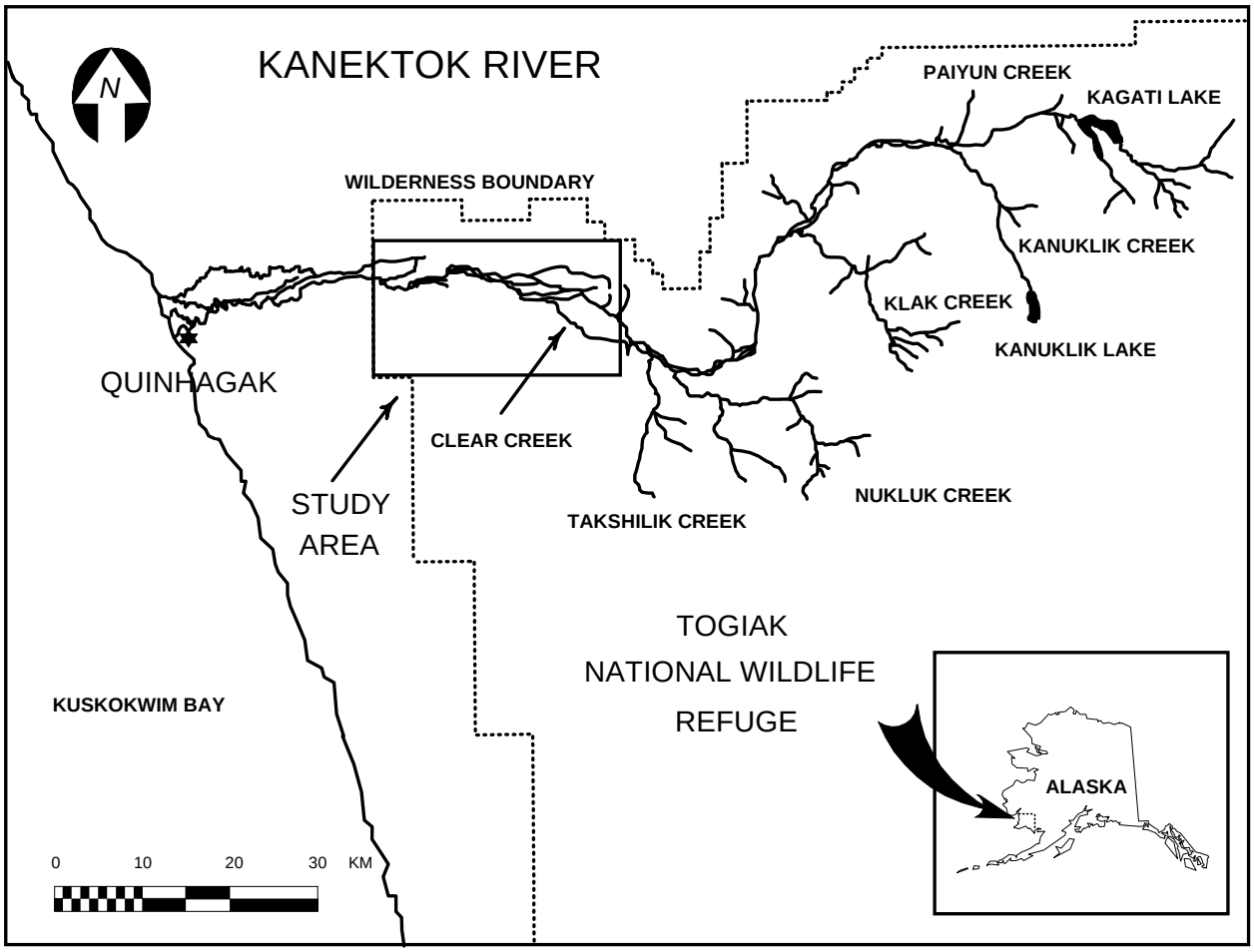

Figure 1. Study area for rainbow projects on the Kanektok River, 1985 through 2000.

suitable habitat for rainbow trout, and it was within the wilderness area of the Refuge (Wagner 1991). The lower reach of the study area (km 28-37) is highly braided with no obvious main channel, the middle reach (km 38-47) is also braided but usually contains a main channel, and the upper reach (km 48-60) is less braided, often bordered by bluffs. The lower five km of Clear Creek was the only tributary within the study area that was sampled.

Methods

In a cooperative effort between the Office, Refuge and the Native Village of Kwinhagak, the rainbow trout population on the Kanektok River was sampled from 18 - 27 July 2000. A six-person crew used a variety of single hook artificial lures, including flies, jigs, and spinners, to capture rainbow trout. The fork length of all captured fish was measured to the nearest mm.

The length frequency distribution from this sample was compared to 1985 -1987 (Wagner 1991) and 1993 (Adams 1996) historic data. To minimize the effects of growth, length frequency analysis among the years was restricted to fish captured between river kilometers 28 and 60 during a sampling period common to all years (11 - 31 July). Only fish caught using single hook artificial lures were used in the comparison. Cumulative length frequency distributions for

rainbow trout >199 mm (all fish) and >399 mm among all years were compared with Kolmogorov-Smirnov two sample tests (∀ = 0.05) (SYSTAT for Windows 1992).

Results

From 18 - 27 July 2000, 225 rainbow trout were captured and measured. The mean fork length was 397.9 mm (SD = 74.86) with a range of 230 mm to 594 mm. Cumulative length frequency comparisons showed the distribution of rainbow trout lengths sampled in 2000 were significantly different from the 1985 and 1993 samples (Table 1, Figure 2). Of the ten comparisons possible between years, five were significantly different. When the cumulative length frequency distributions for rainbow trout greater than 399 mm were compared, only two comparisons were significantly different (Table 1, Figure 3). The median lengths ranged from 408 to 452 mm (Figure 2).

Because the sample sizes were small, the 1985, 1986, and 1987 length samples were combined in a single bar graph and visually compared to 1993 and 2000 data (Figure 4). Two points are apparent. In 2000, the proportion of small fish was greater than the samples from the 1980's and 1993. Conversely, fish were observed in the 601-650 mm range from the1980's sample but not in the 1993 or 2000 samples.

Table1. Kolmogorov-Smirnov two sample maximum difference and p value (in parenthesis) for rainbow trout > 199 mm and > 399 mm captured between 11 - 31 July 1985, 1986, 1987, 1993, and 2000 on the Kanektok River between river kilometer 28 and 60.

	YEAR			
YEAR	1985	1986	1987	1993
	>199mm			
1986	0.280 (0.083)			
1987	0.369 (0.003)[a]	0.280 (0.713)		
1993	0.161 (0.327)	0.264 (0.026)[a]	0.260 (0.005)[a]	
2000	0.420 (>0.001)[a]	0.232 (0.071)	0.127 (0.474)	0.283 (<0.001)[a]
	>399mm			
1986	0.208 (0.512)			
1987	0.151 (0.811)	0.101 (0.997)		
1993	0.316 (0.334)	0.316 (0.023)[a]	0.242 (0.084)	
2000	0.183 (0.324)	0.183 (0.458)	0.106 (0.922)	0.191 (0.008)[a]

[a] Significantly different (∀ = 0.05)

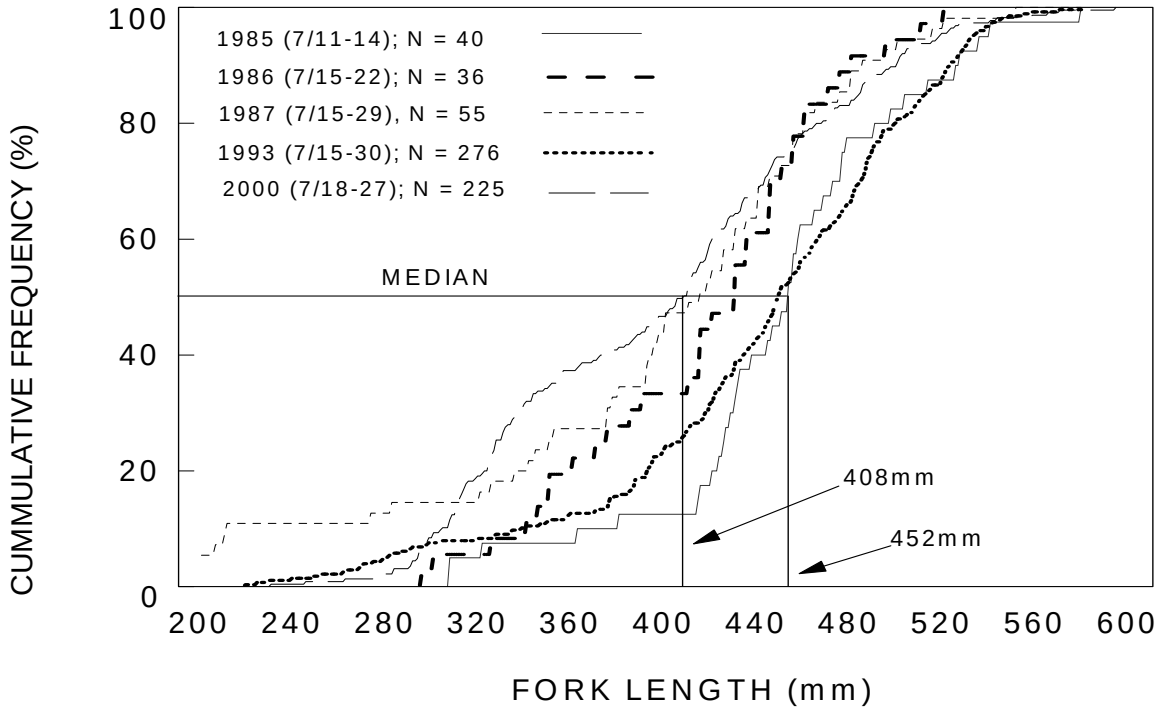

Figure 2. Cumulative length frequency distribution of rainbow trout greater than 199 mm sampled on the Kanektok River between river kilometers 32 and 60 from 11 – 31 July 1985, 1986, 1987, 1993, and 2000

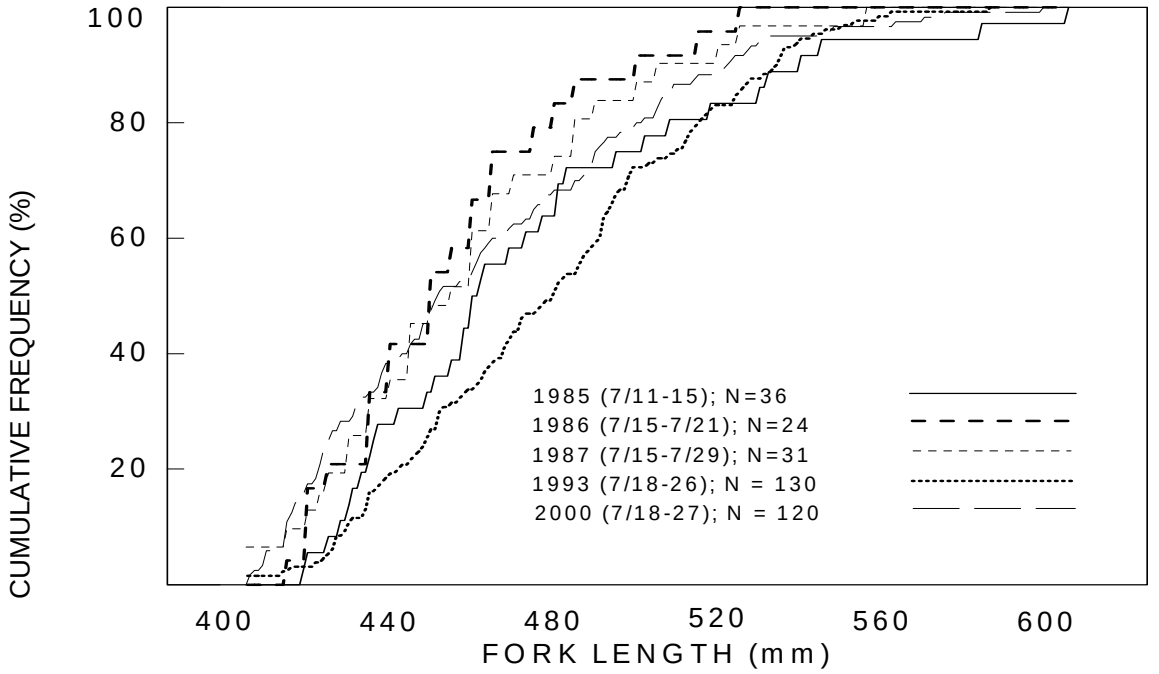

Figure 3. Cumulative length frequency distribution of rainbow trout greater than 399 mm sampled on the Kanektok River between river kilometers 32 and 60 from 11 – 31 July 1985, 1986, 1987, 1993, and 2000.

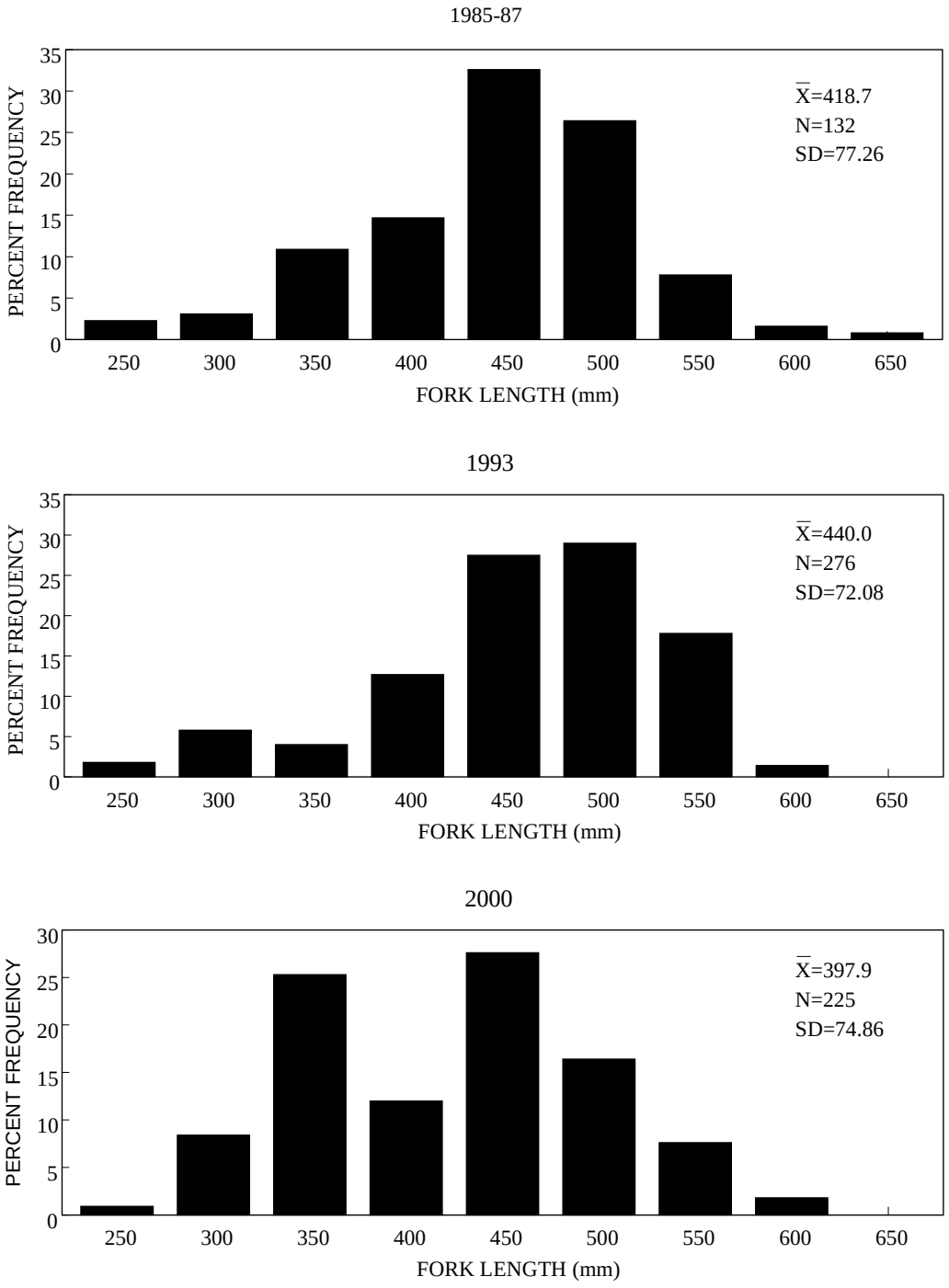

Figure 4. Length frequencies of rainbow trout greater than 199 mm captured by hook and line between 11 July and 31 July 1985 to1987 combined, 1993, and 2000 in the Kanektok River. The X-axis labels indicate the upper value of the 50mm bar.

DISCUSSION

The Refuge Comprehensive Conservation Plan (USFWS 1986) and Fishery Management Plan (USFWS 1990) directs that fish and wildlife populations on the Refuge be conserved in their natural diversity. The ADFG's Southwest Alaska Rainbow Trout Management Plan (ADFG 1990a) states that rainbow trout populations will be managed to maintain historic size and age structures. These two plans guide a management approach that provides for optimal fishing opportunity while conserving the historic size and age compositions of the population. Although stating these goals is relatively straightforward, actually translating them into biological measures is difficult owing to the natural variations in the population, the difficulty in aging rainbow trout, and sampling variability.

The significant differences in length frequency distributions between the 2000 sample and other years were mostly due to the capture of a large proportion of rainbow trout measuring 300 to 350 mm. Based on the length at age data from 1993 (Adams 1996), these fish would predominately be 3 or 4 years old and would indicate strong survival and recruitment from the 1996 and 1997 brood years. Presumably, environmental conditions favored reproductive success or juvenile survival. The influx of smaller fish would reduce the mean length. Conversely, reproductive failures would cause the mean length or length frequency distribution to be shifted toward larger fish.

The high variation between years reduces the effectiveness of using mean lengths and length frequency distributions to evaluate rainbow trout populations. Even successive year sampling from 1985 to 1987 showed variations between years, and pooling these data to compensate for low sample sizes is questionable. Although standard sample timing and protocols can reduce the sample variation, environmental variation probably influences seasonal growth and recruitment, which in turn can cause large variations in fish lengths. In Arctic environments, high reproductive success or failure rates are common which further complicates setting population benchmarks.

It is not known if the age composition has remained similar to the historic composition since scales are an unreliable method to age rainbow trout in the Kanektok River (Wagner 1991), and collecting otoliths for aging fish is not practical in these small populations. Although length frequency distributions exhibit considerable annual variation, the absence of rainbow trout greater than 600 mm compared to the mid 1980's samples was first noted in 1993 (Adams 1996) and continues to be a concern. Even though the length samples for this report were limited to July, Wagner (1991) results showed that about 1 percent of the fish sampled during 1985, 1986 and 1987 should exceed 600 mm regardless of whether the sample was drawn from the entire sample season or only the July period. At that rate, two rainbow trout greater than 600 mm would be expected in the 2000 sample. At such a low expected rate, the lack of large fish can be explained by sample variation, so it is uncertain whether the goal of maintaining historical length composition is being met or whether there truly has been a diminution of size structure. Additional sampling will support or refute the contention that size structure has remained unchanged.

It appears that the current catch and release regulation should conserve the rainbow trout population. According to Wagner (1991) and Alt (1975), rainbow trout in the Kanektok River mature at about 450 mm. Based on a 450 mm threshold, approximately 45% to 50% of the sampled fish in 2000 were mature, which should be adequate to maintain the population.

Although data among the years were standardized to limit variability, sampling bias may have affected the analysis outcomes. Hook and line sampling has been the accepted method for evaluating most rainbow trout populations in southwest Alaska, but the variability associated with this method may not provide a clear representation of population structure. Variability in the sampler's angling experience and gear selection and a fish's previous experience with the gear may all affect the number of fish captured as well as the length composition of the sample. However, Hetrick and Bromaghin (2006) found that hook and line sampling for rainbow trout could provide an unbiased sample. In that study, a rainbow trout population with a known length frequency distribution was sampled using the same fishing gear described in this report. The hook and line sample distribution was not significantly different from the known population and was not biased toward large or small rainbow trout. Therefore, hook and line sampling may provide an unbiased assessment of the population.

While the data are not conclusive, the absence of fish greater than 600 mm in 1993 and 2000 suggest the historic length and age composition of rainbow trout in the study area may be changing. Since subsistence harvest appears to be minimal, and sport fishing is limited to catch and release, hooking and handling mortality may be the predominant factor affecting population change. However, the proportion of mature fish and recruitment of immature fish suggest the population can support the existing fisheries. The large variation in length distribution between years highlights the need to continue regular sampling. Ideally, a population estimate would be included in future assessments.

Given the difficulty in conducting rainbow trout population estimates, it is recommended that the management goal be based on two measures. The first measure would be the proportion of rainbow trout exceeding a threshold length. Based on the samples collected so far, 430 mm represents the approximate mid point of the cumulative length distributions. If the distribution consistently falls below this point, increased sampling efforts and changes to the regulations may be warranted. Second, the rainbow trout catch rates could be used to monitor relative abundance through a directed creel census or by monitoring sport fishing guides. Wagner (1991) conducted a detailed creel survey and found guided float anglers had the highest catch rate for rainbow trout. Working with a few guided float trip operators could yield an inexpensive method to acquire quality catch data.

The lack of age data also limits a thorough understanding of rainbow trout population dynamics. Using length frequency distributions and catch data will only provide limited indicators of population health. Wagner (1991) and Irving and Faustini (1994) showed that scales underestimate the true age of rainbow trout and that otoliths seem to provide good estimates of rainbow trout age. However, collecting enough rainbow trout to estimate age composition using otoliths was not realistic or acceptable to managers. Mills and Chalanchuk (2004) compared age estimates from otoliths and fin rays in lake whitefish *Coregonis clupeaformis* that live beyond 25 years and found fin ray age estimates were comparable to ages determined from otoliths. Given the success of their work with fin rays, additional research on non-lethal age sampling of rainbow trout should be undertaken.

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