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Rainbow Trout Size in the Bristol Bay Sport Fish Management Area, 1956–2002

by

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and

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Alaska Department of Fish and Game Divisions of Sport Fish and Commercial Fisheries

Symbols and Abbreviations

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Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat. or long.
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	*e*
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	*E*
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$log_{2,}$ etc.
minute (angular)	'
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Figure **Page**

ABSTRACT

Rainbow trout (*Oncorhynchus mykiss*) length measurements were compiled from samples from the Bristol Bay Sport Fish Management Area (BBMA) and the Lower Kuskokwim Management Area (LKMA) from 1956 to 2002. Most fish were sampled with hook-and-line gear (64%), followed by seine (18%), weir trap (13%), gillnet (2%), and electroshocking (1%). Fish size differed by geographic location, season, and sampling gear. Sampling during the spring spawning event yielded the largest fish. Differences among gear types were not consistent across geographic locations. Even after controlling for site, season, and gear type, length distributions exhibited substantial variability among years. For this and other reasons, we recommend that rainbow trout management decisions in BBMA not be based on length information alone.

Key words: Rainbow trout, *Oncorhynchus mykiss*, length distribution, Bristol Bay, Lower Kuskokwim River, hook-and-line, seine, weir, gillnet, electroshock, management protocol.

INTRODUCTION

In February 1990, the Alaska Board of Fisheries adopted regulations implementing a comprehensive management plan for rainbow trout (*Oncorhynchus mykiss*) in Southwest Alaska (ADF&G 1990). The plan outlines the underlying principles by which rainbow trout stocks are managed and provides guidance for developing future regulations. Policy I of the plan states, in part, that native rainbow trout populations will be managed to maintain historic size distributions and age compositions. Such size and age baselines were not defined in the plan, and the need for such definitions is growing as resource agencies in the Bristol Bay area seek quantifiable management goals and protocols to assess them.

This report represents an initial attempt to define historic size distributions of rainbow trout in the Bristol Bay and Lower Kuskokwim areas. Rainbow trout length measurements sampled from the Bristol Bay Sport Fish Management Area (BBMA) and the Lower Kuskokwim Management Area (LKMA) from 1956 to 2002 are summarized and compared. Our original intent was to use this database to describe length distributions for healthy (lightly exploited) stocks, thereby defining benchmarks against which future samples of rainbow trout lengths could be compared. We hoped such comparisons could provide useful guidance on fishery management decisions.

In this report, we summarize and tabulate much of the rainbow trout data (1956–2002) from BBMA and LKMA. We also make a recommendation about BBMA management decisions based on length information, attempt to identify some of the pitfalls inherent in adopting a length-based management approach, and propose guidelines for future collection and use of rainbow trout length data.

METHODS

A master database of Bristol Bay rainbow trout length measurements was compiled from 3 sources: 1) files documented in Minard and Dunaway (1991) and Riffe (1994); 2) measurements collected from 1994 to the fall of 2002 and archived with the Alaska Department of Fish and Game Division of Sport Fish Research and Technical Services in Anchorage; and 3) additional data collected from the United States Fish and Wildlife Service within the management areas. The database contained 63,567 records from an area encompassed by BBMA and LKMA (Figure 1).

Records from the database were classified into 4 geographic regions: eastern, central, and western BBMA; and LKMA (Dunaway and Sonnichsen 2001) (Figure 1). Minard and Dunaway (1991) summarized data through 1989 and found that rainbow trout from the eastern region generally grew faster and attained a larger size than fish from the central and western regions. Riffe (1994) updated the summary through 1993.

Within regions, the data were categorized into the following drainages: Togiak and Negukthluk rivers for the western section; Wood River Lakes and the Nushagak River for the central region; Iliamna Lake, the Alagnak, Naknek, and King Salmon rivers for the eastern region; and the southern tributaries of the Kuskokwim River downstream of Aniak including the drainages flowing into eastern Kuskokwim Bay for LKMA (Figure 1). Most individual data sets originated from individual sites (rivers, creeks, and lakes) within these drainages, and some contained information about specific sublocations within these sites. See Table 1 for information about each data set.

The size of fish encountered can depend heavily on the time of year when sampling occurs. For this reason, database records were categorized into the following seasons: spring (March through May), summer (June and July), and fall (August through October). Less than 0.5% of fish were sampled in the months of November through February.

Gear types used for sampling included hook-and-line gear, beach seines, weir traps, gillnets, and electrofishing. Fish sampled by minnow traps and other methods (comprising less than 2% of the total) were not analyzed in this report.

We summarized length distributions following an approach modified from that of Gabelhouse (1984) who defined 5 length classes as percentages of the world-record size fish for each species. Gabelhouse (1984) used the world-record length listed by the International Game Fish Association in 1982 for steelhead/rainbow trout (43 in or 1,092 mm) as his starting point. We defined 6 classes, based on a more realistic maximum length (800 mm) for local resident fish. The smallest length class consisted of fish less than 250 mm, following the relative stock density (RSD) classes of Anderson and Neuman (1996). The length classes used in this report (and their approximate Gablehouse [1984] interpretations) were as follows: 1) <250 mm (stock), 2) 250–399 mm (stock to quality), 3) 400–499 mm (quality to preferred), 4) 500–649 mm (preferred to memorable), 5) 650–799 mm (memorable to trophy), and 6) >800 mm (trophy).

Gablehouse and RSD categories have traditionally been based on total length (TL). Most length measurements in the rainbow trout database were of fork length (FL). We converted FL to TL (mm) following Simpkins and Hubert (1996):

$$TL = 1.072\ FL\ . \tag{1}$$

For each data set, the proportion of rainbow trout in length class *j* was estimated as

$$\hat{p}_j = \frac{n_j}{n} \tag{2}$$

where

n_j = the number of rainbow trout sampled that were in length class *j*, and
n = the total number of rainbow trout sampled.

To improve readability of tables in this report, the estimated variances of length class proportions have not been tabulated with the point estimates. If needed, they can be obtained from

$$\hat{V}(\hat{p}_j) = \frac{\hat{p}_j\left(1-\hat{p}_j\right)}{n\ \ -1}\ . \tag{3}$$

We intended to use log-linear models to analyze the length class data and estimate the effects of region, season, gear-type, and year. However, all of our initial attempts to do so led to saturated or near-saturated models, where 3-way (or higher level) interactions were the rule rather than the exception. Because high-order interactions are so difficult to interpret, we concluded that there was little benefit to continued modeling of the length data. We therefore settled on a battery of 2-way χ^2 contingency tests (Conover 1980) to identify individual sources of association (the null hypothesis is that there is no association between categorical variables). Note that the results of such tests may be more valuable in a descriptive sense than in a probabilistic sense. For instance, we provide *P*-values for individual tests, but make no attempt to control for experiment-wise (overall) error rates.

To quantify inter-annual variability in rainbow trout lengths, we calculated the standard deviation of mean lengths as follows:

$$SD(\overline{TL}) = \frac{\sum_{y=1}^{n_Y}\left(\overline{TL}_y - \overline{\overline{TL}}\right)^2}{n_Y - 1} \tag{4}$$

where n_Y is the number of years with 30 or more sampled fish, $\overline{TL}_y$ is mean TL during year y, and $\overline{\overline{TL}}$ is the mean of $\overline{TL}_y$ across all years.

RESULTS

Sample sizes by site, season, and gear type are shown in Table 1. Most samples (79%) were collected from eastern BBMA, followed by western BBMA (12%), central BBMA (8%), and LKMA (1%). Approximately 33% of fish were sampled in spring, 26% in summer, and 41% in fall. Most fish were sampled with hook-and-line gear (64%), followed by seine (18%), weir trap (13%), gillnet (2%), and electroshocking (1%). The longest datasets come from Lower Talarik Creek (fall hook-and-line, 21 years of data with at least 30 fish sampled), Naknek River and tributaries (spring, summer, and fall hook-and-line, 13–14 years), and Kvichak River (spring seine, 10 years).

Size composition often differed by season of capture. Datasets originating from a specific site, year, and gear type in which at least 30 fish were captured during 2 or more seasons are listed in Tables 2–4. Most (62%) of those datasets showed a significant ($P < 0.05$) association between season and size composition. Generally, when length composition differed by season, fish captured during the spring spawning season were larger than those captured other times of the year. Differences between summer and fall were less consistent. For instance, in the Gechiak and Kanektok rivers, fish sampled during summer tended to be larger than those sampled in fall, whereas in Brooks River and Lower Talarik Creek, the opposite trend was normal. In other streams (e.g., Naknek and Negukthlik rivers), the effect of season differed by year (Tables 2–4).

Size composition usually differed by gear type. Datasets originating from a specific site, year, and season in which 2 or more gear types captured at least 30 fish each are listed in Table 5. Most (71%) of the datasets showed significant ($P < 0.05$) associations between gear type and size composition. There were few consistent patterns in these associations, i.e., the effects of gear type appeared to be site-, season-, and even year-specific (Table 5).

Hook-and-line samples originated from fish caught by sport anglers and by agency field staff. There were only 4 datasets originating from a specific site, year, and season in which at least 30 fish each were captured by sport anglers and by agency staff (Table 6). One of the 4 (Nonvianuk River, summer 1996) showed a significant difference in size composition between the 2 sources of data. Unfortunately, not all hook-and-line records in the database specified who captured the fish (27% missing).

To reduce unwanted variability, all subsequent comparisons were conducted after first controlling for season and gear type. Hook-and-line samples were not separated into sport-angler and agency-staff groups because there was no clear evidence that the groups were different, and because of the large fraction of missing data.

Length class proportions by site, gear, season, and year for all datasets with at least 2 years of data and sample sizes exceeding 30 each year are listed in Table 7. This table is sorted in such a way as to facilitate comparisons across years, within sites, seasons, and gear types. In approximately 78% of site-season-gear combinations (54 out of 69), size composition differed significantly ($P < 0.05$) among years. The 15 datasets in which length composition did not differ among years were short; none exceeded 3 years in length.

Length distributions, in the form of boxplots, are plotted over time in Figures 2–13 for stocks for which we have the most extensive historical information. These show little or no evidence of persistent declines in rainbow trout size. On the other hand, there were often large differences in sampled length distributions among years. For example, median length of hook-and-line sampled fish at Lower Talarik Creek fluctuated 50 to 100 mm or more between consecutive years during 1970–1971, 1986–1987, and 1999–2001 (Figure 10). Using the standard deviation of annual mean lengths (see Methods) as an index of such variability, the most variable datasets included Tazimina River (fall hook-and-line gear), Lower Talarik Creek (summer and fall weir trap, spring and summer hook-and-line), and the Naknek River (spring hook-and-line) (Table 8). The least variable data originated from the Arolik River (summer hook-and-line), the Gibralter River (fall hook-and-line), the Agulowak River (summer and fall hook-and-line), Gertrude Creek (fall hook-and-line), the Kanektok River (summer and fall hook-and-line), Gerchiak River (summer hook-and-line) and the Kvichak River (spring seine) (Table 8).

DISCUSSION

Much of the inter-annual variability in length distributions originates from the dynamic way that rainbow trout use their habitat. Many rainbow trout stocks in the region undertake seasonal movements in the spring for spawning, in the summer as fish move from spawning areas to feeding areas, and in the fall when fish move to additional feeding areas or overwintering areas (Russell 1976; Gwartney and Burger *Unpublished*; Jaenicke 1998b; Schwanke 2002; Meka et al. 2003). A fall movement of large rainbow trout into sites has been well documented at Lower Talarik Creek and the Naknek River (Russell 1977; Schwanke 2002). The timing of such movements can vary greatly depending on weather and water conditions. For example, in 1971 and 1975, cold temperatures and late ice break-ups delayed spawning at Lower Talarik Creek (Russell 1977).

In general, fish of similar size often group together because of common physical, nutritional, and reproductive demands. This leads to spatial/temporal heterogeneity in fish size. Such heterogeneity is dynamic because water levels, temperatures, turbidity, and food abundance are constantly changing. Conditions which lead to a particular aggregation of size groups inhabiting a specific area may not be reproduced at the same time each year.

Dynamic use of habitat has important implications for sampling. For example, the relative abundance of large fish sampled at a weir on Lower Talarik Creek was exceptionally high during the summers of 1971 and 1975 due to the spawning delay described above (Table 7). In general, any sampling design which is restricted in time and/or space is subject to fluctuations like these. Rarely can we sample extensively enough to provide an unbiased estimate of rainbow trout size for an entire site (usually an individual river or stream) over an entire season. Thus, it may not always be possible to design a research plan that produces repeatable results from one year to the next.

Lack of repeatability would severely hamper any attempt to use length information to trigger management decisions. “Historical size distributions” would have to be defined with rather wide bounds, which limits their utility as benchmarks for future reference. Furthermore, more than one year of data would be required before reliable evidence of a change could emerge. In short, exceedingly large and persistent deviations in sampled length distributions would be required to accurately detect any real change in rainbow trout size.

Finally, information on length composition alone can be misleading. Ultimately we are interested in the absolute abundance, rather than the relative abundance of large fish, and the two are not always concordant. For instance, after a particularly good year for recruitment of small fish into a population (indicating a healthy stock), the relative abundance of large fish may decline, possibly triggering unnecessary concern. The converse situation would be more serious. After several years of failed recruitment, the relative abundance of large fish would increase, mistakenly indicating stock health.

For these reasons, we discourage use of length information alone for guiding fishery management decisions. Sufficient knowledge of population trends can only come from having some knowledge of population abundance, even if such knowledge consists only of an abundance index. Only in the presence of abundance information can length distribution data provide useful guidance without serious risk.

RECOMMENDATIONS

- *Select a sampling design that is likely to be repeatable*. Sample the same time of year in the same place with the same gear, but sample extensively enough so that results will be relatively robust to annual differences in conditions.
- *Record all relevant details*. These might include specific location (latitude and longitude), time of day, and conditions (especially water level, temperature, and turbidity), and other details (type of terminal tackle, bait or not).
- *Consider trying to obtain a measure of effort*, and thus CPUE, to provide an index of abundance.
- *Be more concerned with sampling representatively and with repeatability, than with sample size*. Because of spatial and temporal heterogeneity in fish populations, samples will be autocorrelated in space and time, and thus the effective sample size will always be considerably less than the actual sample size.

- *Study a few rainbow trout stocks in depth, rather than collecting length information on many.* Better information on rainbow trout movements and population dynamics will go further toward advancing our understanding and improving our management.
- *When feasible, examine a specific component of a stock, such as the spawning population.* Sexually mature fish are identifiable during the spring and the examination of these larger mature fish can reduce the variability in length composition providing a better historical comparison.
- *Do not base management decisions solely on length data*. Sampled length distributions often have low repeatability and can be misleading.

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TABLES

Table 1.–Rainbow trout length data sets from eastern, central, and western regions of the Bristol Bay Management Area (BBMA) and the Lower Kuskokwim Management area catalogued for this report.

Region	Site	Method	No. of years	Years	Avg *n*	Additional references[a]
Central BBMA						
	Agulowak River	Hook/Line	11	1964–1998	212	Minard 1989, Dunaway 1993
	Agulukpak River	Hook/Line	10	1964–1996	162	Minard 1989, Dunaway 1993, Rogan and Jaenicke 1997
	Chilchitna River	Hook/Line	1	1977	6	
	Chilikadrotna River	Hook/Line	2	1977–1978	25	
	Grant River	Hook/Line	1	1969	3	
	Ice Creek	Hook/Line	1	1970	1	
	Igushik River	Hook/Line	2	1964–1968	4	
	Kashaiak Creek	Hook/Line	1	1997	19	
	King Salmon River (Nushagak R)	Hook/Line	3	1980–1989	12	
	Koktuli River	Hook/Line	1	1977	60	Russell *Unpublished*
	Lake Nerka	Hook/Line	1	1964	2	
	Little Togiak Creek	Hook/Line	2	1964–1970	7	
	Lynx Creek	Hook/Line	1	1970	2	
	Muklung River	Hook/Line	1	2000	4	
	Mulchatna River	Hook/Line	7	1976–1991	43	
	Nushagak River System (other)	Gill Net	1	1965	1	
		Hook/Line	5	1964–1998	59	Schwanke *Unpublished*
	Osviak River	Hook/Line	2	1996–1997	9	
	Peace River	Hook/Line	1	1969	5	
	Rainbow Basin	Hook/Line	2	1969–1974	4	
	Stuyahok River	Hook/Line	2	1963–1977	26	
	Tikchik Narrows	Hook/Line	1	1967	6	
	Tikchik-Nuyakuk Lake System	Hook/Line	4	1967–1990	15	
	Unknown Wood River	Hook/Line	1	1969	4	
	Wind River	Hook/Line	3	1964–1970	5	
Eastern BBMA						
	Alagnak River	Gill Net	1	1998	5	
		Hook/Line	11	1965–1998	76	Magee et al. *Unpublished*, Jaenicke 1998a
	Alexey Creek	Hook/Line	1	1974	6	
	American Creek	Hook/Line	2	1984–1989	73	Gwartney *Unpublished*
	Belinda Creek	Hook/Line	2	1967–1976	42	
	Big Creek (Naknek R)	Hook/Line	6	1964–1988	13	

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Table 1.–Part 2 of 5.

Region	Site	Method	No. of years	Years	Avg *n*	Additional references[a]
Eastern BBMA						
	Brooks Lake	Hook/Line	5	1960–1985	14	
	Brooks River	Hook/Line	9	1964–1996	137	Gwartney *Unpublished*
	Char Lake	Gill Net	2	1964–1972	3	
		Hook/Line	1	1970	4	
	Chekok Creek	Electroshocking	1	1976	6	
		Hook/Line	2	1970–1976	48	
	Chekok Point	Gill Net	1	1974	1	
	Contact Creek	Hook/Line	1	1991	26	
	Copper River	Gill Net	3	1964–1973	6	
		Electroshocking	1	1972	1	
		Hook/Line	10	1964–1990	171	ADF&G Dillingham field logs
	Dream Creek	Hook/Line	4	1973–1977	61	
	Gertrude Creek	Hook/Line	7	1970–1992	81	
	Gibralter Lake	Hook/Line	2	1963–1989	3	
	Gibralter River	Hook/Line	5	1967–1973	59	
	Idavain Creek	Hook/Line	3	1983–1985	66	Gwartney *Unpublished*
	Iliamna River	Hook/Line	5	1969–1997	27	Jaenicke 1999
	Intricate Bay	Gill Net	2	1972–1973	3	
		Hook/Line	2	1970–1971	9	
	Kakhonak Bay	Gill Net	1	1973	1	
	Kakhonak Lake	Gill Net	1	1956	70	
		Hook/Line	1	1956	2	
	Kakhonak River	Hook/Line	1	1976	34	
	King Salmon Creek (Naknek R)	Hook/Line	5	1964–1969	8	
	King Salmon River (Becharof)	Weir Trap	3	1997–1999	283	
		Hook/Line	3	1997–1999	691	
	King Salmon River (Egegik)	Hook/Line	1	1991	34	
	Kukaklek Lake	Hook/Line	1	1997	3	
	Kulik River	Hook/Line	4	1964–1989	37	
	Kvichak River	Gill Net	2	1964–1967	23	
		Seine	10	1987–1997	862	Minard et al. 1992, Fleischman *Unpublished*, Dunaway *Unpublished*b
		Hook/Line	13	1964–1997	175	Dye *Unpublished*

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Table 1.–Part 3 of 5.

Region	Site	Method	No. of years	Years	Avg *n*	Additional references[a]
Eastern BBMA						
	Lake Grosvenor/Lake Coleville	Hook/Line	1	1984	10	
	Lower Talarik Creek	Gill Net	5	1963–1974	7	
		Electroshocking	3	1972–1975	104	
		Seine	6	1964–1997	214	
		Weir Trap	6	1970–1975	1174	Russell 1977
		Hook/Line	27	1963–2002	232	Russell 1977, Collins *Unpublished*
	Margot Creek	Hook/Line	2	1983–1984	2	
	Middle Talarik Creek	Electroshocking	1	1971	11	
	Mink Creek	Hook/Line	3	1990–1992	81	
	Moraine Creek	Electroshocking	1	1976	10	
		Hook/Line	5	1964–1995	54	ADF&G Dillingham field logs
	Mossy Creek	Hook/Line	3	1990–1992	41	
	Naknek Lake (Bay of Islands)	Hook/Line	9	1968–2000	24	
	Naknek Lake (Other)	Gill Net	2	1965–1967	4	Minard *Unpublished*
		Hook/Line	4	1968–1999	20	
	Naknek River and tributaries	Gill Net	4	1963–2001	286	Schwanke 2002
		Seine	4	1966–2001	250	Schwanke 2002
		Hook/Line	26	1964–2001	295	Dunaway *Unpublished*a, Dunaway and Sonnichsen *Unpublished*, Fair *Unpublished*, Gwartney *Unpublished*, Jaenicke and Dunaway *Unpublished*
	Nanuktuk Creek	Electroshocking	1	1976	6	
	Newhalen River	Gill Net	1	1974	5	
		Hook/Line	5	1964–1976	68	
	Nick G Creek	Gill Net	1	1972	1	
		Hook/Line	2	1969–1973	8	
	Nonvianuk River	Hook/Line	7	1964–1997	67	Jaenicke 1998b
	Number 5 Creek	Hook/Line	2	1990–1991	2	
	Otter Creek	Hook/Line	1	1991	8	
	Roadhouse Creek	Hook/Line	1	1971	3	
	Tazimina River	Seine	1	1988	18	
		Hook/Line	5	1974–1989	98	Brookover 1990
	Tomkok Creek	Hook/Line	1	1970	1	
	Tommy Creek	Hook/Line	2	1969–1970	1	

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Table 1.–Part 4 of 5.

Region	Site	Method	No. of years	Years	Avg *n*	Additional references[a]
Eastern BBMA						
	Upper Talarik Creek	Electroshocking	1	1976	9	
		Hook/Line	2	1974–1976	7	
	Whale Mt Creek	Hook/Line	3	1990–1992	128	
Kuskokwim						
	Aniak River	Gill Net	2	1975–1976	14	
		Hook/Line	7	1974–1996	54	Alt 1977, Alt 1986, Dunaway *Unpublished*a
	Kasigluk River	Hook/Line	1	1975	7	
	Kisaralik Lake	Hook/Line	1	1976	8	
	Kisaralik River	Gill Net	1	1975	2	
		Hook/Line	3	1975–1986	7	
	Kwethluk River	Gill Net	3	1975–1991	4	
		Weir Trap	1	1992	1	
		Hook/Line	6	1975–1992	51	Alt 1977, Alt 1986
Western BBMA						
	Arolik Lake	Hook/Line	1	1976	20	
	Arolik River	Hook/Line	7	1991–1997	243	Lisac and MacDonald 1995, MacDonald 1997
	Gechiak River	Hook/Line	6	1993–1997	204	Lisac and MacDonald 1996, MacDonald 1997, MacDonald and Lisac 1998
	Goodnews River	Gill Net	1	1975	5	
		Hook/Line	3	1975–1993	187	Alt 1977, Alt 1986, Faustini 1996
	Goodnews River Middle Fork	Hook/Line	2	1985–1988	48	
	Goodnews River South Fork	Hook/Line	1	1988	30	
	Kanektok River	Hook/Line	9	1975–1997	229	Adams 1996
	Kemuk River	Hook/Line	1	1995	5	
	Kukaktlik River	Hook/Line	1	1985	30	
	Negukthlik River	Hook/Line	3	1986–1990	190	Lisac 1996
	Ongivinuck River	Hook/Line	4	1988–1997	6	
	Pungokepuk Creek	Hook/Line	7	1963–1997	102	Lisac and MacDonald 1996, MacDonald 1997, MacDonald and Lisac 1998
	Pungokepuk Lake	Hook/Line	1	1988	23	
	Togiak River System	Hook/Line	5	1973–1987	5	
	Ungalikthluk River	Hook/Line	1	1977	7	

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Table 1.–Part 5 of 5.

[a] References in addition to Minard and Dunway (1991) and Riffe (1994). Unpublished documents are as follows:

Collins, C. N. Unpublished. Memo summarizing Lower Talarik Creek Rainbow Trout Project Fall 2002. Alaska Department of Fish and Game, Division of Sport Fish. Dated November 24, 2003, Dillingham.

Dunaway, D. O. Unpublished a. Memo summarizing Aniak River Rainbow Trout Work and Analysis, 1993. Alaska Department of Fish and Game, Division of Sport Fish. Dated January, 27 1994, Dillingham.

Dunaway, D. O. Unpublished b. Memo summarizing Igiugig Rainbow Trout Spring 1997. Alaska Department of Fish and Game, Division of Sport Fish. Dated April 17, 1997, Dillingham.

Dunaway, D. O and S. Sonnichsen. Unpublished. Memo summarizing Naknek River Rainbow Trout Projects 1993. Alaska Department of Fish and Game, Division of Sport Fish. Dated January 28, 1994, Dillingham.

Dye, J, E. Unpublished. Memo summarizing Kvichak Fall Rainbow Trout Project, 1997. Alaska Department of Fish and Game, Division of Sport Fish. Dated October 20, 1997, Dillingham.

Fair, L. Unpublished. Memo summarizing Naknek River Rainbow Trout Projects, 1995. Alaska Department of Fish and Game, Division of Sport Fish. Dated December 14, 1995, Dillingham.

Fleischman, S. J. Unpublished. Memo summarizing Igiugig Rainbow Trout 1996 Analysis. Alaska Department of Fish and Game, Division of Sport Fish. Dated October 31, 1996, Anchorage.

Gwartney, L. A. *Unpublished*. Naknek drainage rainbow trout study in the Katmai National Park and Preserve. Final Report to National Park Service, 1985. Alaska Department of Fish and Game, Anchorage, Alaska.

Jaenicke, M. J. and D. O. Dunaway. Unpublished. Memo summarizing Naknek Rainbow Trout Recent Data. Alaska Department of Fish and Game, Division of Sport Fish. Dated October 13, 1998, Dillingham.

Magee, J. P., R. P. Eakle, and G. Dunmire. Unpublished. Summary of Branch-Alagnak River Float Survey Rainbow Trout Sampling August 7-11, 1989. Alaska Department of Fish and Game, Division of Sport Fish. Dated August 1989, Dillingham.

Minard, R. E. Unpublished. Memo summarizing Bay of Islands Project, 1994. Alaska Department of Fish and Game, Division of Sport Fish. Dated November 26, 1995, Dillingham.

Russell, R. Unpublished. Summary of Koktuli River Float Surveys, 1977. Alaska Department of Fish and Game, Division of Sport Fish. Dated July and September, 1977, Dillingham.

Schwanke, C. J. Unpublished. Memo summarizing the Upper Nushagak River Rainbow Trout Project, 1998. Alaska Department of Fish and Game, Division of Sport Fish. Dated December 3, 1998, Dillingham

Table 2.–Length class composition by site, gear type, year, and season for years in which $n > 30$ samples were obtained in more than one season, central region BBMA.

Site	Gear type	Year	*P* value[a]	Season[b]	*n*	Length Class Percentages[c] 1	2	3	4	5	6
Agulowak River	Hook/Line	1988	0.058	Summer	147	2	55	43	0	0	0
				Fall	86	3	51	41	5	0	0
		1989	0.069	Summer	46	0	28	52	20	0	0
				Fall	105	4	31	58	7	0	0
		1990	0.641	Summer	166	1	63	34	2	0	0
				Fall	84	1	56	38	5	0	0
		1991	0.583	Summer	31	0	35	42	23	0	0
				Fall	99	2	42	41	14	0	0
Agulukpak River	Hook/Line	1986	0.330	Summer	40	0	38	43	20	0	0
				Fall	132	2	24	46	28	0	0
		1988	0.838	Summer	67	9	21	49	21	0	0
				Fall	78	6	18	51	23	1	0

[a] χ^2 test of association between length class and season.

[b] Season: Spring = March–May, Summer = June–July, Fall = August–October

[c] Length class 1 = total length (TL) < 250mm, 2 = 250 < TL < 400, 3 = 400 < TL < 500, 4 = 500 < TL < 650, 5 = 650 < TL < 800, 6 = TL > 80.

Table 3.–Length class composition by site, gear type, year, and season for years in which $n > 30$ samples were obtained in more than one season, eastern BBMA.

Site	Gear type	Year	*P* value[a]	Season[b]	*n*	Length Class Percentages[c] 1	2	3	4	5	6
Alagnak R.	Hook/Line	1996	0.309	Summer	198	26	52	10	10	3	0
				Fall	125	17	62	12	8	2	0
		1997	0.591	Summer	195	4	27	33	31	5	0
				Fall	40	3	33	30	35	0	0
Brooks R.	Hook/Line	1983	0.000	Summer	208	0	10	56	33	1	0
				Fall	341	0	14	37	48	1	0
		1984	0.052	Spring	96	0	8	55	34	1	1
				Summer	191	2	10	38	49	2	0
		1989	0.000	Summer	77	9	40	21	30	0	0
				Fall	114	1	13	13	69	4	0
Copper R.	Hook/Line	1972	0.000	Spring	33	33	0	12	45	9	0
				Summer	278	10	17	42	29	1	0
				Fall	342	2	10	37	49	1	0
		1973	0.9283	Summer	281	17	32	26	24	1	0
				Fall	161	17	34	28	20	1	0
Gertrude Creek	Hook/Line	1988	0.9169	Summer	51	0	10	43	47	0	0
				Fall	31	0	10	39	52	0	0
		1990	0.1359	Spring	35	0	26	43	29	3	0
				Summer	80	1	9	40	50	0	0
				Fall	75	1	23	32	41	3	0
		1991	0.3948	Spring	54	0	26	41	31	2	0
				Summer	74	3	36	31	30	0	0
				Fall	77	0	34	34	32	0	0
Gibralter R.	Hook/Line	1973	0.8319	Summer	54	2	26	41	30	2	0
				Fall	73	1	18	42	36	3	0
King Salmon R. (Becharof)	Hook/Line	1997	0.0001	Spring	158	0	2	30	68	1	0
				Summer	438	1	15	52	32	0	0
				Fall	256	0	21	40	39	0	0
		1998	0.0001	Spring	58	0	5	29	64	2	0
				Summer	327	1	28	45	26	0	0
				Fall	166	0	24	45	31	0	0
		1999	0.6207	Summer	398	1	18	38	44	0	0
				Fall	255	1	21	39	39	0	0
Kvichak R.	Hook/Line	1964	0.2947	Summer	95	0	20	23	35	21	1
				Fall	145	2	31	19	28	19	1
		1975	0.0004	Summer	52	0	17	21	38	23	0
				Fall	62	0	44	32	19	5	0
Lower Talarik Creek	Seine	1987	0.0001	Spring	276	0	11	50	36	3	0
				Fall	110	8	39	15	21	16	1
	Hook/Line	1964	0.0001	Spring	50	22	30	32	16	0	0
				Fall	140	11	41	4	23	21	0
		1968	0.0001	Summer	41	0	83	12	5	0	0
				Fall	467	9	31	9	22	28	1
		1970	0.0001	Spring	68	0	25	35	37	3	0
				Summer	220	10	70	13	6	1	0

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Table 3.–Part 2 of 3.

Site	Gear type	Year	*P* value[a]	Season[b]	*n*	Length Class Percentages[c]					
						1	2	3	4	5	6
Lower Talarik				Fall	275	3	16	6	25	45	4
Creek (cont.)		1971	0.001	Summer	148	1	39	36	11	13	1
				Fall	282	4	50	21	15	10	0
		1975	0.0123	Summer	42	0	57	21	12	10	0
			0.0123	Fall	48	10	40	6	15	25	4
		1986	0.0001	Spring	127	0	10	31	37	20	1
				Summer	51	22	75	4	0	0	0
				Fall	368	10	51	13	17	9	1
		1987	0.0001	Spring	160	0	35	28	34	4	0
				Summer	98	15	78	6	1	0	0
				Fall	112	3	41	15	22	19	0
		1997	0.0001	Spring	114	0	11	13	38	32	6
				Fall	199	0	28	10	41	21	1
Mink Creek	Hook/Line	1991	0.0016	Summer	55	27	36	22	15	0	0
				Fall	111	56	23	7	14	0	0
Naknek R.	Hook/Line	1966	0.0001	Spring	37	0	43	16	8	27	5
and tributaries				Summer	146	3	57	18	9	12	1
				Fall	33	55	12	9	9	9	6
		1968	0.0001	Spring	92	0	45	16	5	29	4
				Summer	46	13	22	20	22	13	11
		1969	0.0001	Spring	96	0	19	31	8	33	8
				Summer	67	0	39	36	21	4	0
		1981	0.0001	Spring	186	0	3	8	17	72	1
				Summer	155	0	30	35	27	7	0
				Fall	301	0	35	36	19	10	1
		1982	0.0001	Spring	131	0	2	2	17	77	2
				Summer	211	2	39	36	13	7	3
				Fall	214	0	18	34	33	14	2
		1983	0.0001	Spring	271	0	4	3	32	60	1
				Summer	50	0	52	26	20	2	0
				Fall	211	0	54	23	15	8	0
		1984	0.0001	Spring	323	0	4	5	33	55	2
				Fall	262	3	27	31	26	11	1
		1987	0.2274	Summer	43	0	14	40	42	5	0
				Fall	53	0	19	55	23	4	0
		1988	0.0001	Spring	125	0	4	4	31	60	1
				Summer	69	4	59	13	22	1	0
				Fall	99	3	58	22	13	4	0
		1989	0.0001	Spring	75	0	16	5	5	69	4
				Summer	199	2	50	33	10	6	0
				Fall	269	1	46	29	16	6	1
		1993	0.0001	Spring	615	0	11	14	28	46	1
				Fall	202	11	49	25	14	1	0
		1995	0.0074	Summer	55	2	55	24	18	2	0
				Fall	352	0	32	34	23	11	0
		1999	0.0001	Spring	552	0	1	16	32	46	5
				Summer	64	0	6	36	39	17	2
				Fall	298	1	20	29	24	24	1

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Table 3.–Part 3 of 3.

						Length Class Percentages[c]					
Site	Gear type	Year	*P* value[a]	Season[b]	*n*	1	2	3	4	5	6
Newhalen R.	Hook/Line	1974	0.3579	Summer	133	10	25	20	40	6	0
				Fall	193	8	33	23	31	6	0
Nonvianuk R.	Hook/Line	1996	0.0001	Summer	252	10	73	11	6	0	0
				Fall	45	53	42	2	2	0	0
Tazimina R.	Hook/Line	1988	0.6578	Summer	77	8	31	30	26	5	0
				Fall	144	11	35	22	28	3	0
Whale Mt. Creek	Hook/Line	1991	0.0002	Spring	94	0	5	28	64	3	0
				Summer	87	0	21	43	37	0	0
				Fall	67	0	18	45	37	0	0

[a] χ^2 test of association between length class and season.

[b] Season: Spring = March–May, Summer = June–July, Fall = August–October

[c] Length class 1 = total length (TL) < 250mm, 2 = 250 < TL < 400, 3 = 400 < TL < 500, 4 = 500 < TL < 650, 5 = 650 < TL < 800, 6 = TL > 80.

Table 4.–Length class composition by site, gear type, year, and season for years in which $n > 30$ samples were obtained in more than one season, western BBMA, and Kuskokwim regions.

Site	Gear type	Year	*P* value[a]	Season[b]	*n*	Length Class Percentages[c] 1	2	3	4	5	6
Kuskokwim											
Aniak River	Hook/Line	1993	0.715	Summer	31	0	32	35	32	0	0
				Fall	168	1	43	32	23	1	0
Western											
Arolik River	Hook/Line	1994	0.028	Summer	464	0	7	31	61	1	0
				Fall	63	0	11	44	41	3	0
Gechiak R.	Hook/Line	1994	0.375	Summer	89	1	39	48	11	0	0
				Fall	87	0	51	39	10	0	0
		1995	0.000	Summer	136	3	38	41	18	0	0
				Fall	117	2	72	21	6	0	0
		1996	0.000	Spring	42	0	19	33	40	7	0
				Summer	195	6	68	19	7	0	0
		1997	0.007	Spring	84	1	42	42	14	1	0
				Summer	283	2	53	33	12	0	0
				Fall	173	3	62	30	5	0	0
Goodnews R.	Hook/Line	1988	0.459	Summer	103	1	41	29	29	0	0
				Fall	71	1	30	31	38	0	0
		1993	0.014	Summer	167	1	16	37	46	1	0
				Fall	173	0	30	35	35	0	0
Kanektok R.	Hook/Line	1985	0.017	Summer	58	0	9	50	38	3	0
				Fall	190	0	20	46	34	0	0
		1986	0.128	Spring	91	0	8	60	32	0	0
				Summer	346	0	16	48	36	1	0
				Fall	103	0	18	47	33	2	0
		1987	0.095	Summer	262	7	17	48	27	0	0
				Fall	124	10	27	45	19	0	0
		1993	0.000	Summer	498	1	11	47	41	0	0
				Fall	285	1	28	35	35	0	0
Negukthlik R.	Hook/Line	1989	0.000	Summer	116	0	22	36	28	14	0
				Fall	145	11	35	21	21	11	0
		1990	0.002	Spring	59	2	32	34	31	2	0
				Summer	164	5	48	18	19	10	0
				Fall	50	2	32	14	34	18	0
Pungokepuk Creek	Hook/Line	1993	0.015	Spring	50	2	12	34	26	26	0
				Summer	81	0	7	46	40	7	0
		1994	0.132	Spring	31	0	13	32	39	16	0
				Summer	56	2	29	36	30	4	0
		1995	0.000	Spring	30	0	0	7	40	50	3
				Summer	71	3	24	32	38	3	0
				Fall	125	2	30	34	34	0	0
		1996	0.000	Spring	47	0	17	21	43	15	4
				Summer	55	5	13	58	22	2	0
		1997	0.079	Spring	50	14	10	24	42	10	0
				Summer	30	13	13	43	30	0	0
				Fall	60	2	12	37	47	3	0

[a] χ^2 test of association between length class and season.

[b] Season: Spring = March–May, Summer = June–July, Fall = August–October

[c] See Methods section for length class definitions.

Table 5.–Length class composition by site, season, year, and gear type for years in which $n > 30$ samples were obtained by more than one gear type, eastern BBMA.

Site	Season[a]	Year	*P* value[b]	Gear type	*n*	Length Class Percentages[c]					
						1	2	3	4	5	6
King Salmon R. (Becharof)	Spring	1997	0.053	Weir Trap	234	0	7	38	55	0	0
				Hook/Line	158	0	2	30	68	1	0
		1998	0.554	Weir Trap	99	0	7	33	60	0	0
				Hook/Line	58	0	5	29	64	2	0
	Summer	1997	0.323	Weir Trap	107	0	22	40	37	0	0
				Hook/Line	438	1	15	52	32	0	0
		1998	0.009	Weir Trap	94	1	12	55	32	0	0
				Hook/Line	327	1	28	45	26	0	0
		1999	0.003	Weir Trap	109	0	7	28	64	0	0
				Hook/Line	398	1	18	38	44	0	0
	Fall	1997	0.787	Weir Trap	70	1	16	44	39	0	0
				Hook/Line	256	0	21	40	39	0	0
		1998	0.034	Weir Trap	82	0	13	38	49	0	0
				Hook/Line	166	0	24	45	31	0	0
		1999	0.574	Weir Trap	51	0	27	41	31	0	0
				Hook/Line	255	1	21	39	39	0	0
Kvichak R.	Fall	1964	0.262	Gill Net	39	0	26	23	41	8	3
				Hook/Line	145	2	31	19	28	19	1
Lower Talarik Creek	Spring	1987	0.000	Seine	276	0	11	50	36	3	0
				Hook/Line	160	0	35	28	34	4	0
		1997	0.000	Seine	575	0	7	37	37	18	1
				Hook/Line	114	0	11	13	38	32	6
	Summer	1971	0.000	Weir Trap	67	15	19	12	10	34	9
				Hook/Line	148	1	39	36	11	13	1
		1972	0.000	Electroshocking	138	1	20	15	37	27	1
				Weir Trap	205	37	52	6	4	1	0
				Hook/Line	92	0	17	50	15	16	1
		1975	0.000	Electroshocking	42	98	2	0	0	0	0
				Weir Trap	330	5	18	6	21	48	2
				Hook/Line	42	0	57	21	12	10	0
	Fall	1964	0.001	Seine	41	7	34	2	17	37	2
				Hook/Line	140	11	41	4	23	21	0
		1973	0.001	Weir Trap	967	14	35	2	26	22	0
				Hook/Line	61	3	16	2	39	38	2
		1974	0.000	Electroshocking	69	91	9	0	0	0	0
				Weir Trap	602	21	32	1	19	26	0
				Hook/Line	59	0	10	8	22	56	3
		1975	0.000	Electroshocking	64	94	6	0	0	0	0
				Weir Trap	306	40	51	4	2	4	0
				Hook/Line	48	10	40	6	15	25	4
		1987	0.000	Seine	110	8	39	15	21	16	1
				Hook/Line	112	3	41	15	22	19	0
Naknek River and tributaries	Spring	2000	0.000	Gill Net	613	0	6	11	20	58	6
				Seine	445	3	22	13	16	42	4
				Hook/Line	825	0	10	28	31	29	2
		2001	0.000	Gill Net	489	0	1	4	16	67	12
				Seine	542	0	22	12	14	43	7

[a] Season: Spring = March–May, Summer = June–July, Fall = August–October
[b] χ^2 test of association between length class and gear type.
[c] See Methods section for length class definitions.

Table 6.–Length class composition of hook and line samples by site, season, year, and data source for years in which *n* > 30 samples were obtained by both agency staff and sport anglers, eastern BBMA.

							Length Class Percentages[c]					
Site	Season[a]	Year	*P* value[b]	Gear type	Source	*n*	1	2	3	4	5	6
Alagnak River	Summer	1997	0.110	Hook/Line	Sport	49	0	18	33	41	8	0
				Hook/Line	Staff	146	5	30	34	27	4	0
Lower Talarik Creek	Fall	1999	0.363	Hook/Line	Sport	163	0	15	13	44	28	1
				Hook/Line	Staff	46	0	15	26	33	26	0
Moraine Creek	Fall	1995	0.600	Hook/Line	Sport	104	0	5	25	60	11	0
				Hook/Line	Staff	81	0	4	17	67	12	0
Nonvianuk River	Summer	1996	0.000	Hook/Line	Sport	34	0	62	15	24	0	0
				Hook/Line	Staff	218	12	75	10	4	0	0

[a] Season: Spring = March–May, Summer = June–July, Fall = August–October

[b] χ^2 test of association between length class and data source.

[c] Length class 1 = total length (TL) < 250mm, 2 = 250 < TL < 400, 3 = 400 < TL < 500, 4 = 500 < TL < 650, 5 = 650 < TL < 800, 6 = TL > 80.

Table 7.–Length class composition by site, season, gear type, and year, for years in which $n > 30$ samples were obtained.

Site	Season[a]	Gear type	*P* value[b]	Year	*n*	Length Class Percentages[c] 1	2	3	4	5	6
<u>Central Region</u>											
Agulowak River	Summer	Hook/Line	0.0001	1988	147	2	55	43	0	0	0
				1989	46	0	28	52	20	0	0
				1990	166	1	63	34	2	0	0
				1991	31	0	35	42	23	0	0
	Fall	Hook/Line	0.0001	1988	86	3	51	41	5	0	0
				1989	105	4	31	58	7	0	0
				1990	84	1	56	38	5	0	0
				1991	99	2	42	41	14	0	0
				1992	1427	1	41	49	9	0	0
				1998	52	0	25	52	23	0	0
Agulukpak River	Summer	Hook/Line	0.1974	1986	40	0	38	43	20	0	0
				1988	67	9	21	49	21	0	0
	Fall	Hook/Line	0.0001	1966	52	0	17	63	19	0	0
				1970	64	11	55	20	14	0	0
				1986	132	2	24	46	28	0	0
				1987	184	5	15	45	34	0	1
				1988	78	6	18	51	23	1	0
				1992	754	1	23	45	31	0	0
				1996	206	1	31	36	32	0	0
Mulchatna River	Summer	Hook/Line	0.0069	1989	30	0	50	47	3	0	0
				1990	180	3	46	40	11	0	0
<u>Eastern Region</u>											
Alagnak River	Summer	Hook/Line	0.0001	1996	198	26	52	10	10	3	0
				1997	195	4	27	33	31	5	0
	Fall	Hook/Line	0.0001	1989	142	30	45	15	10	0	0
				1995	32	25	53	13	9	0	0
				1996	125	17	62	12	8	2	0
				1997	40	3	33	30	35	0	0
Brooks River	Summer	Hook/Line	0.0001	1982	53	0	53	30	17	0	0
				1983	208	0	10	56	33	1	0
				1984	191	2	10	38	49	2	0
				1989	77	9	40	21	30	0	0
				1996	101	2	44	40	15	0	0
	Fall	Hook/Line	0.0001	1983	341	0	14	37	48	1	0
				1989	114	1	13	13	69	4	0
Copper River	Summer	Hook/Line	0.0001	1972	278	10	17	42	29	1	0
				1973	281	17	32	26	24	1	0
				1989	98	2	41	46	11	0	0
	Fall	Hook/Line	0.0001	1969	99	9	28	51	11	1	0
				1970	41	0	5	54	41	0	0
				1972	342	2	10	37	49	1	0
				1973	161	17	34	28	20	1	0
				1990	275	3	33	28	32	4	0

-continued-

Table 7.–Part 2 of 6.

Site	Season[a]	Gear type	*P* value[b]	Year	*n*	Length Class Percentages[c] 1	2	3	4	5	6
Gertrude Creek	Spring	Hook/Line	0.7967	1990	35	0	26	43	29	3	0
				1991	54	0	26	41	31	2	0
	Summer	Hook/Line	0.0001	1988	51	0	10	43	47	0	0
				1990	80	1	9	40	50	0	0
				1991	74	3	36	31	30	0	0
	Fall	Hook/Line	0.031	1983	32	0	22	34	44	0	0
				1988	31	0	10	39	52	0	0
				1990	75	1	23	32	41	3	0
				1991	77	0	34	34	32	0	0
Gibralter River	Fall	Hook/Line	0.0705	1969	30	0	13	33	43	10	0
				1970	31	0	6	32	61	0	0
				1971	80	0	15	38	46	1	0
				1973	73	1	18	42	36	3	0
Iliamna River	Fall	Hook/Line	0.1424	1996	41	0	27	41	32	0	0
				1997	53	0	8	38	43	11	0
King Salmon River (Becharof)	Spring	Weir Trap	0.4805	1997	234	0	7	38	55	0	0
				1998	99	0	7	33	60	0	0
		Hook/Line	0.3752	1997	158	0	2	30	68	1	0
				1998	58	0	5	29	64	2	0
	Summer	Weir Trap	0.0001	1997	107	0	22	40	37	0	0
				1998	94	1	12	55	32	0	0
				1999	109	0	7	28	64	0	0
		Hook/Line	0.0001	1997	438	1	15	52	32	0	0
				1998	327	1	28	45	26	0	0
				1999	398	1	18	38	44	0	0
	Fall	Weir Trap	0.1088	1997	70	1	16	44	39	0	0
				1998	82	0	13	38	49	0	0
				1999	51	0	27	41	31	0	0
		Hook/Line	0.0149	1997	256	0	21	40	39	0	0
				1998	166	0	24	45	31	0	0
				1999	255	1	21	39	39	0	0
Kvichak River	Spring	Seine	0.0001	1987	102	0	2	52	41	5	0
				1988	541	0	0	20	72	7	0
				1989	733	0	1	13	58	27	0
				1990	1291	4	18	26	31	19	1
				1991	1273	0	11	38	34	16	1
				1993	871	0	6	37	42	15	1
				1994	866	0	9	31	47	12	0
				1995	894	0	7	30	51	12	0
				1996	901	0	5	31	45	19	1
				1997	1144	0	5	38	36	20	1
	Summer	Hook/Line	0.0001	1964	95	0	20	23	35	21	1
				1969	263	0	41	32	19	8	0
				1971	32	0	28	22	41	6	3
				1975	52	0	17	21	38	23	0

-continued-

Table 7.–Part 3 of 6.

Site	Season[a]	Gear type	*P* value[b]	Year	*n*	Length Class Percentages[c] 1	2	3	4	5	6
Kvichak River (cont.)	Fall	Hook/Line	0.0001	1964	145	2	31	19	28	19	1
				1968	57	0	56	23	19	2	0
				1975	62	0	44	32	19	5	0
				1990	414	2	43	24	21	10	0
				1991	530	0	36	27	26	10	1
				1997	418	0	19	33	31	17	1
Lower Talarik Creek	Spring	Seine	0.0001	1987	276	0	11	50	36	3	0
				1988	248	0	1	17	71	10	0
				1997	575	0	7	37	37	18	1
		Weir Trap	0.0001	1971	121	12	11	8	20	48	2
				1973	1,249	0	4	15	52	28	1
				1974	775	2	8	3	52	35	0
				1975	79	6	6	3	37	46	3
		Hook/Line	0.0001	1964	50	22	30	32	16	0	0
				1970	68	0	25	35	37	3	0
			0.0001	1986	127	0	10	31	37	20	1
				1987	160	0	35	28	34	4	0
				1997	114	0	11	13	38	32	6
	Summer	Electroshock	0.0001	1972	138	1	20	15	37	27	1
				1975	42	98	2	0	0	0	0
		Weir Trap	0.0001	1971	67	15	19	12	10	34	9
				1972	205	37	52	6	4	1	0
				1973	605	12	44	14	19	12	0
				1974	301	16	9	3	41	29	1
				1975	330	5	18	6	21	48	2
		Hook/Line	0.0001	1968	41	0	83	12	5	0	0
				1970	220	10	70	13	6	1	0
				1971	148	1	39	36	11	13	1
				1972	92	0	17	50	15	16	1
				1975	42	0	57	21	12	10	0
				1986	51	22	75	4	0	0	0
				1987	98	15	78	6	1	0	0
	Fall	Electroshock	1	1974	69	91	9	0	0	0	0
				1975	64	94	6	0	0	0	0
		Seine	0.1405	1964	41	7	34	2	17	37	2
				1987	110	8	39	15	21	16	1
		Weir Trap	0.0001	1972	1424	33	44	10	9	3	0
				1973	967	14	35	2	26	22	0
				1974	602	21	32	1	19	26	0
				1975	306	40	51	4	2	4	0
		Hook/Line	0.0001	1964	140	11	41	4	23	21	0
				1968	467	9	31	9	22	28	1
				1969	217	1	23	5	22	48	1
				1970	275	3	16	6	25	45	4
				1971	282	4	50	21	15	10	0
				1973	61	3	16	2	39	38	2
				1974	59	0	10	8	22	56	3

-continued-

Table 7.–Part 4 of 6.

Site	Season[a]	Gear type	*P* value[b]	Year	*n*	Length Class Percentages[c] 1	2	3	4	5	6
Lower Talarik Creek	Fall	Hook/Line	0.0001	1975	48	10	40	6	15	25	4
(continued)				1986	368	10	51	13	17	9	1
				1987	112	3	41	15	22	19	0
				1990	320	2	35	10	19	31	3
				1991	500	0	37	19	24	19	1
				1994	147	1	32	6	24	34	3
				1995	253	1	30	11	21	33	4
				1996	307	0	19	12	42	26	2
				1997	199	0	28	10	41	21	1
				1998	255	0	14	8	41	35	2
				1999	209	0	15	16	42	27	0
				2000	275	2	42	13	24	18	0
				2001	132	0	23	8	50	20	0
				2002	159	0	21	9	54	16	0
Naknek Lake	Summer	Hook/Line	0.0001	1984	43	0	0	2	23	60	14
(Bay of Islands)				2000	95	0	0	0	20	76	4
Naknek River	Spring	Gill Net	0.0001	2000	613	0	6	11	20	58	6
and tributaries				2001	489	0	1	4	16	67	12
		Seine	0.004	2000	445	3	22	13	16	42	4
				2001	542	0	22	12	14	43	7
		Hook/Line	0.0001	1966	37	0	43	16	8	27	5
				1968	92	0	45	16	5	29	4
				1969	96	0	19	31	8	33	8
				1971	61	0	51	18	8	20	3
				1981	186	0	3	8	17	72	1
				1982	131	0	2	2	17	77	2
				1983	271	0	4	3	32	60	1
				1984	323	0	4	5	33	55	2
				1985	277	0	0	1	29	69	1
				1988	125	0	4	4	31	60	1
				1989	75	0	16	5	5	69	4
				1993	615	0	11	14	28	46	1
				1999	552	0	1	16	32	46	5
				2000	825	0	10	28	31	29	2
	Summer	Hook/Line	0.0001	1966	146	3	57	18	9	12	1
				1967	73	7	30	22	14	25	3
				1968	46	13	22	20	22	13	11
				1969	67	0	39	36	21	4	0
				1970	51	0	29	37	25	6	2
				1981	155	0	30	35	27	7	0
				1982	211	2	39	36	13	7	3
				1983	50	0	52	26	20	2	0
				1987	43	0	14	40	42	5	0
				1988	69	4	59	13	22	1	0
				1989	199	2	50	33	10	6	0
				1995	55	2	55	24	18	2	0
				1999	64	0	6	36	39	17	2

-continued-

Table 7.–Part 5 of 6.

Site	Season[a]	Gear type	*P* value[b]	Year	*n*	Length Class Percentages[c]					
						1	2	3	4	5	6
	Fall	Hook/Line	0.0001	1966	33	55	12	9	9	9	6
				1977	69	0	32	30	23	14	0
				1981	301	0	35	36	19	10	1
				1982	214	0	18	34	33	14	2
				1983	211	0	54	23	15	8	0
				1984	262	3	27	31	26	11	1
				1987	53	0	19	55	23	4	0
				1988	99	3	58	22	13	4	0
				1989	269	1	46	29	16	6	1
				1991	157	0	57	26	16	1	0
				1993	202	11	49	25	14	1	0
				1995	352	0	32	34	23	11	0
				1999	298	1	20	29	24	24	1
Nonvianuk River	Summer	Hook/Line	0.0001	1974	44	0	73	20	7	0	0
				1990	106	1	60	23	16	0	0
				1996	252	10	73	11	6	0	0
Tazimina River	Fall	Hook/Line	0.0001	1974	66	45	53	2	0	0	0
				1987	104	3	26	13	39	18	0
				1988	144	11	35	22	28	3	0
				1989	45	0	9	9	69	13	0
Whale Mt Creek	Summer	Hook/Line	0.0269	1991	87	0	21	43	37	0	0
				1992	104	0	8	29	63	1	0
<u>Kuskokwim Region</u>											
Aniak River	Summer	Hook/Line	0.1339	1985	49	0	10	59	31	0	0
				1993	31	0	32	35	32	0	0
				1996	37	0	27	49	24	0	0
Kwethluk River	Fall	Hook/Line	0.0868	1985	157	1	35	48	17	0	0
				1989	103	0	28	61	11	0	0
<u>Western Region</u>											
Arolik River	Summer	Hook/Line	0.0039	1992	227	0	11	41	46	2	0
				1993	163	0	6	31	61	3	0
				1994	464	0	7	31	61	1	0
				1995	259	0	14	36	49	2	0
				1996	306	0	9	33	57	1	0
				1997	95	0	16	37	47	0	0
	Fall	Hook/Line	0.2454	1991	82	0	29	32	39	0	0
				1994	63	0	11	44	41	3	0
Gechiak River	Spring	Hook/Line	0.0107	1996	42	0	19	33	40	7	0
				1997	84	1	42	42	14	1	0
	Summer	Hook/Line	0.0001	1994	89	1	39	48	11	0	0
				1995	136	3	38	41	18	0	0
				1996	195	6	68	19	7	0	0
				1997	283	2	53	33	12	0	0
	Fall	Hook/Line	0.0136	1994	87	0	51	39	10	0	0
				1995	117	2	72	21	6	0	0
				1997	173	3	62	30	5	0	0

-continued-

Table 7.–Part 6 of 6.

Site	Season[a]	Gear type	*P* value[b]	Year	*n*	Length Class Percentages[c] 1	2	3	4	5	6
Goodnews River	Summer	Hook/Line	0.0011	1975	48	0	17	35	48	0	0
				1988	103	1	41	29	29	0	0
				1993	167	1	16	37	46	1	0
	Fall	Hook/Line	0.953	1988	71	1	30	31	38	0	0
				1993	173	0	30	35	35	0	0
Goodnews River	Fall	Hook/Line	0.0567	1985	61	0	5	26	69	0	0
Middle Fork				1988	35	3	23	20	54	0	0
Kanektok River	Summer	Hook/Line	0.0001	1975	31	0	10	29	61	0	0
				1985	58	0	9	50	38	3	0
				1986	346	0	16	48	36	1	0
				1987	262	7	17	48	27	0	0
				1988	34	0	18	59	24	0	0
				1993	498	1	11	47	41	0	0
	Fall	Hook/Line	0.0001	1985	190	0	20	46	34	0	0
				1986	103	0	18	47	33	2	0
				1987	124	10	27	45	19	0	0
				1993	285	1	28	35	35	0	0
Negukthlik River	Summer	Hook/Line	0.0001	1989	116	0	22	36	28	14	0
				1990	164	5	48	18	19	10	0
	Fall	Hook/Line	0.0664	1989	145	11	35	21	21	11	0
				1990	50	2	32	14	34	18	0
Pungokepuk Creek	Spring	Hook/Line	0.0006	1993	50	2	12	34	26	26	0
				1994	31	0	13	32	39	16	0
				1995	30	0	0	7	40	50	3
				1996	47	0	17	21	43	15	4
				1997	50	14	10	24	42	10	0
	Summer	Hook/Line	0.0035	1993	81	0	7	46	40	7	0
				1994	56	2	29	36	30	4	0
				1995	71	3	24	32	38	3	0
				1996	55	5	13	58	22	2	0
				1997	30	13	13	43	30	0	0
	Fall	Hook/Line	0.0001	1995	125	2	30	34	34	0	0
				1997	60	2	12	37	47	3	0

[a] Season: Spring = March–May, Summer = June–July, Fall = August–October

[b] χ^2 test of association between length class and data source.

[c] Length class 1 = total length (TL) < 250mm, 2 = 250 < TL < 400, 3 = 400 < TL < 500, 4 = 500 < TL < 650, 5 = 650 < TL < 800, 6 = TL > 80.

Table 8.–Standard deviation of mean annual rainbow trout length by site, season, and gear type, for datasets in which n > 30 samples were obtained for 4 or more years.

Region	Site	Season[a]	Gear type	Years	SD(Mean)
Central	Agulowak River	Summer	Hook/Line	4	25
	Agulowak River	Fall	Hook/Line	6	20
	Agulukpak River	Fall	Hook/Line	7	33
Eastern	Alagnak River	Fall	Hook/Line	4	58
	Brooks River	Summer	Hook/Line	5	41
	Copper River	Fall	Hook/Line	5	40
	Gertrude Creek	Fall	Hook/Line	4	21
	Gibralter River	Fall	Hook/Line	4	16
	Kvichak River	Spring	Seine	10	26
	Kvichak River	Summer	Hook/Line	4	41
	Kvichak River	Fall	Hook/Line	6	40
	Lower Talarik Creek	Spring	Weir Trap	4	22
	Lower Talarik Creek	Spring	Hook/Line	5	87
	Lower Talarik Creek	Summer	Weir Trap	5	114
	Lower Talarik Creek	Summer	Hook/Line	7	72
	Lower Talarik Creek	Fall	Weir Trap	4	101
	Lower Talarik Creek	Fall	Hook/Line	21	58
	Naknek River and tributaries	Spring	Hook/Line	14	71
	Naknek River and tributaries	Summer	Hook/Line	13	45
	Naknek River and tributaries	Fall	Hook/Line	13	51
	Tazimina River	Fall	Hook/Line	4	128
Western	Arolik River	Summer	Hook/Line	6	11
	Gechiak River	Summer	Hook/Line	4	24
	Kanektok River	Summer	Hook/Line	6	25
	Kanektok River	Fall	Hook/Line	4	23
	Pungokepuk Creek	Spring	Hook/Line	5	65
	Pungokepuk Creek	Summer	Hook/Line	5	30

[a] Season: Spring = March–May, Summer = June–July, Fall = August–October

FIGURES

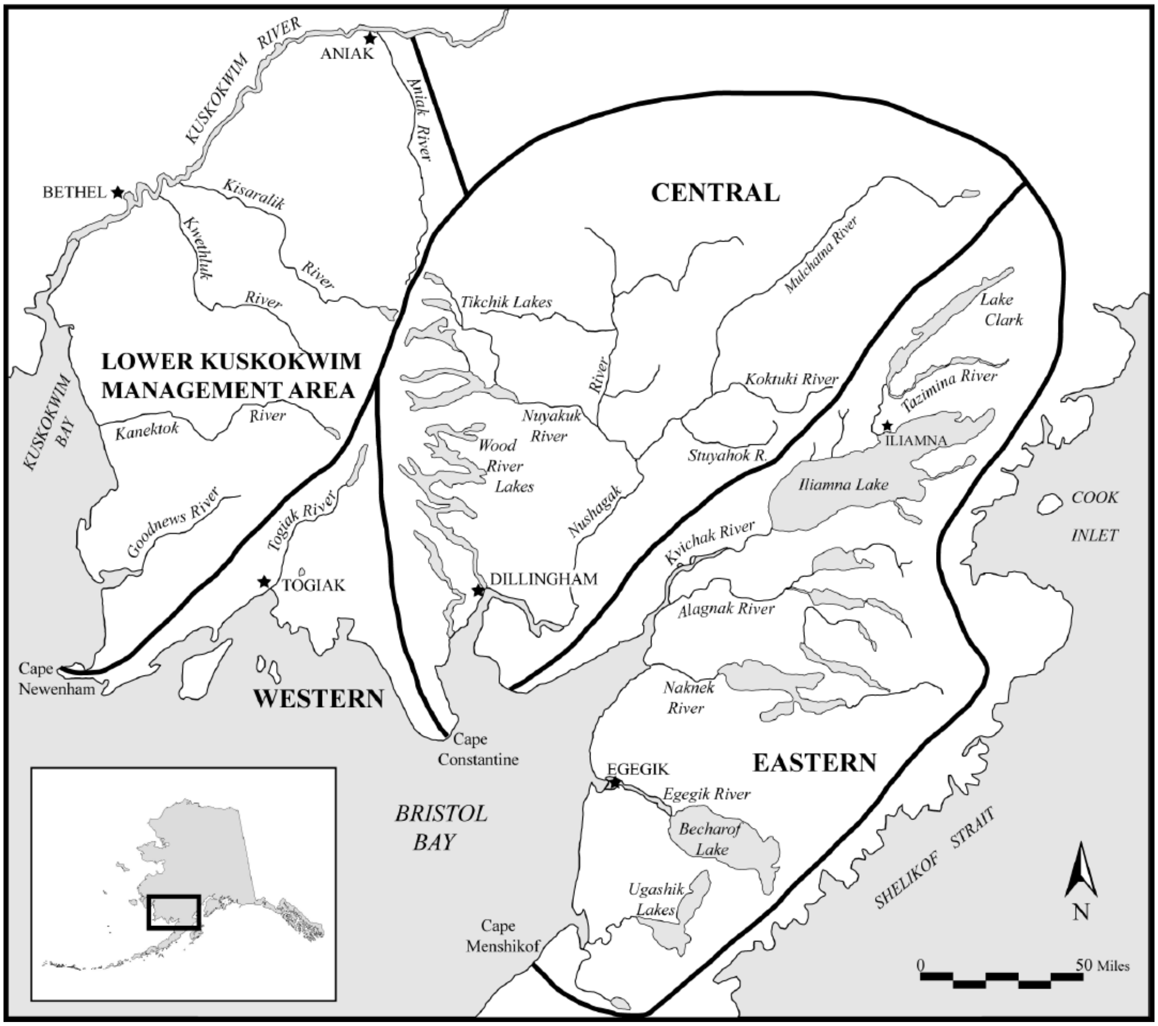

Figure 1.-The eastern, central, and western regions of the Bristol Bay Management Area and the Lower Kuskokwim Management Area.

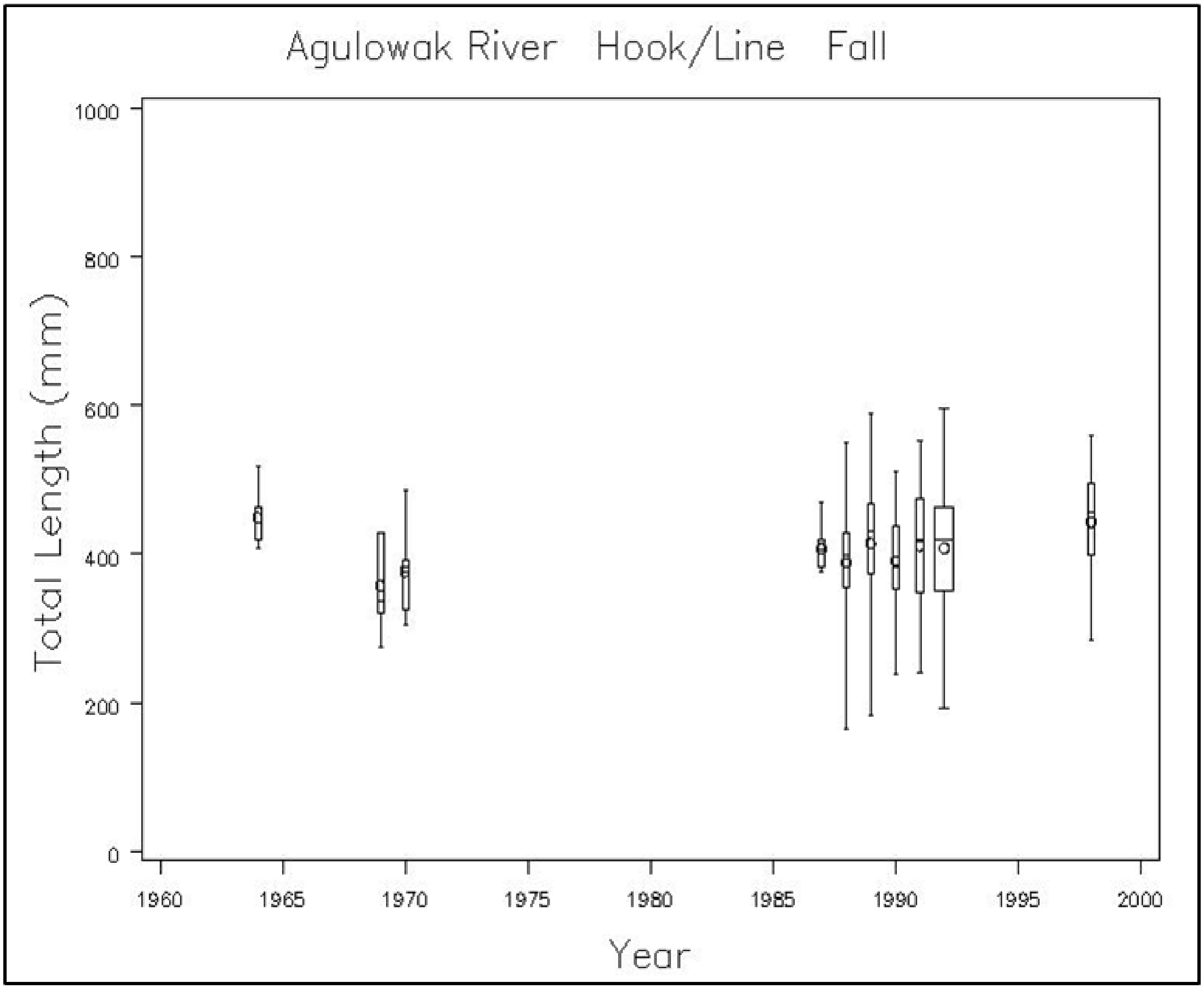

Figure 2.–Yearly length distribution boxplots for the Agulowak River during fall with hook-and-line gear. Horizontal lines of box represent the 25th, 50th (median), and 75th percentiles of rainbow trout total length (mm). Whiskers extend to length minima and maxima. Circles are means. Box widths are proportional to sample size.

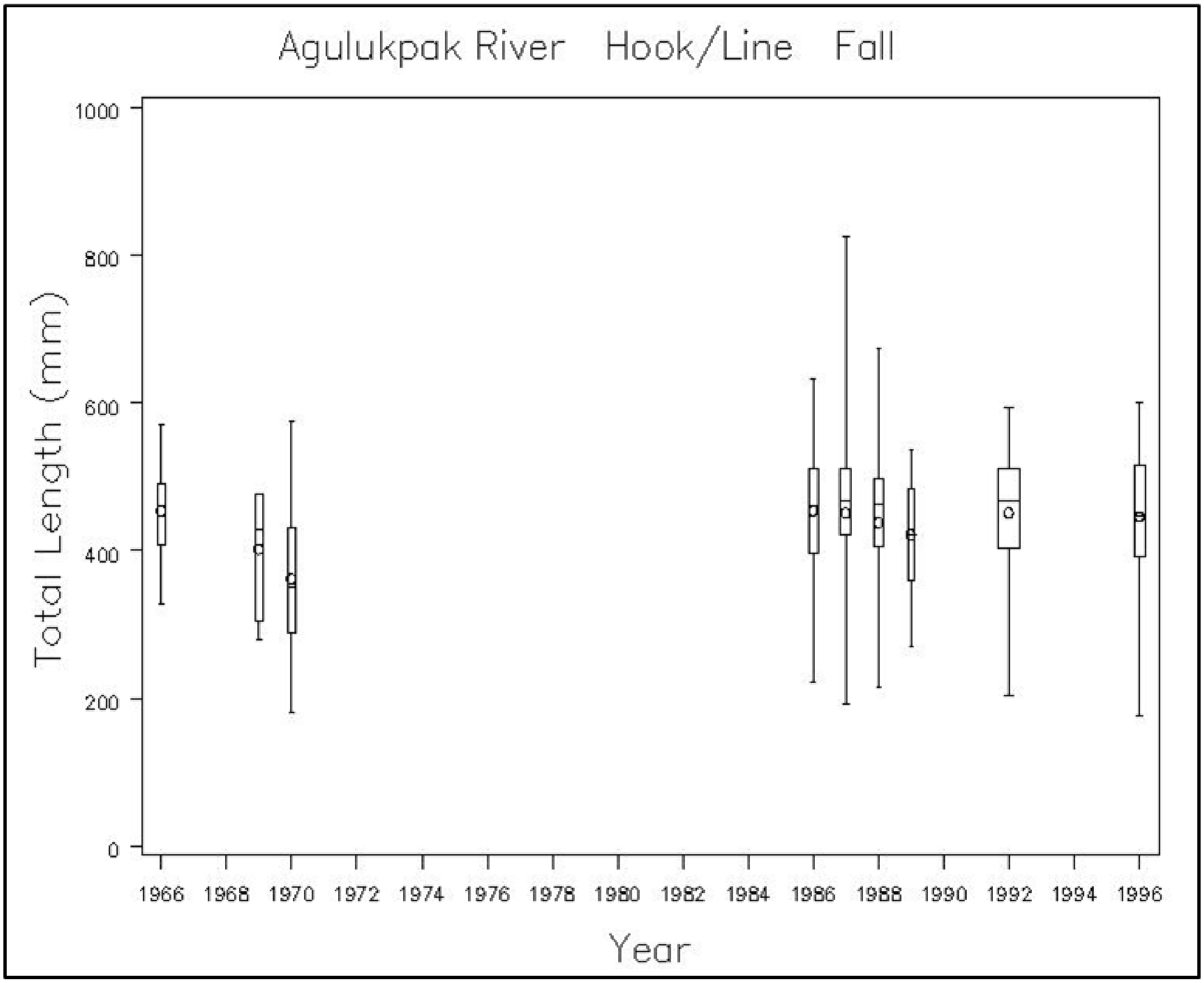

Figure 3.–Yearly length distribution boxplots for the Agulukpak River during fall with hook-and-line gear. Horizontal lines of box represent the 25th, 50th (median), and 75th percentiles of rainbow trout total length (mm). Whiskers extend to length minima and maxima. Circles are means. Box widths are proportional to sample size.

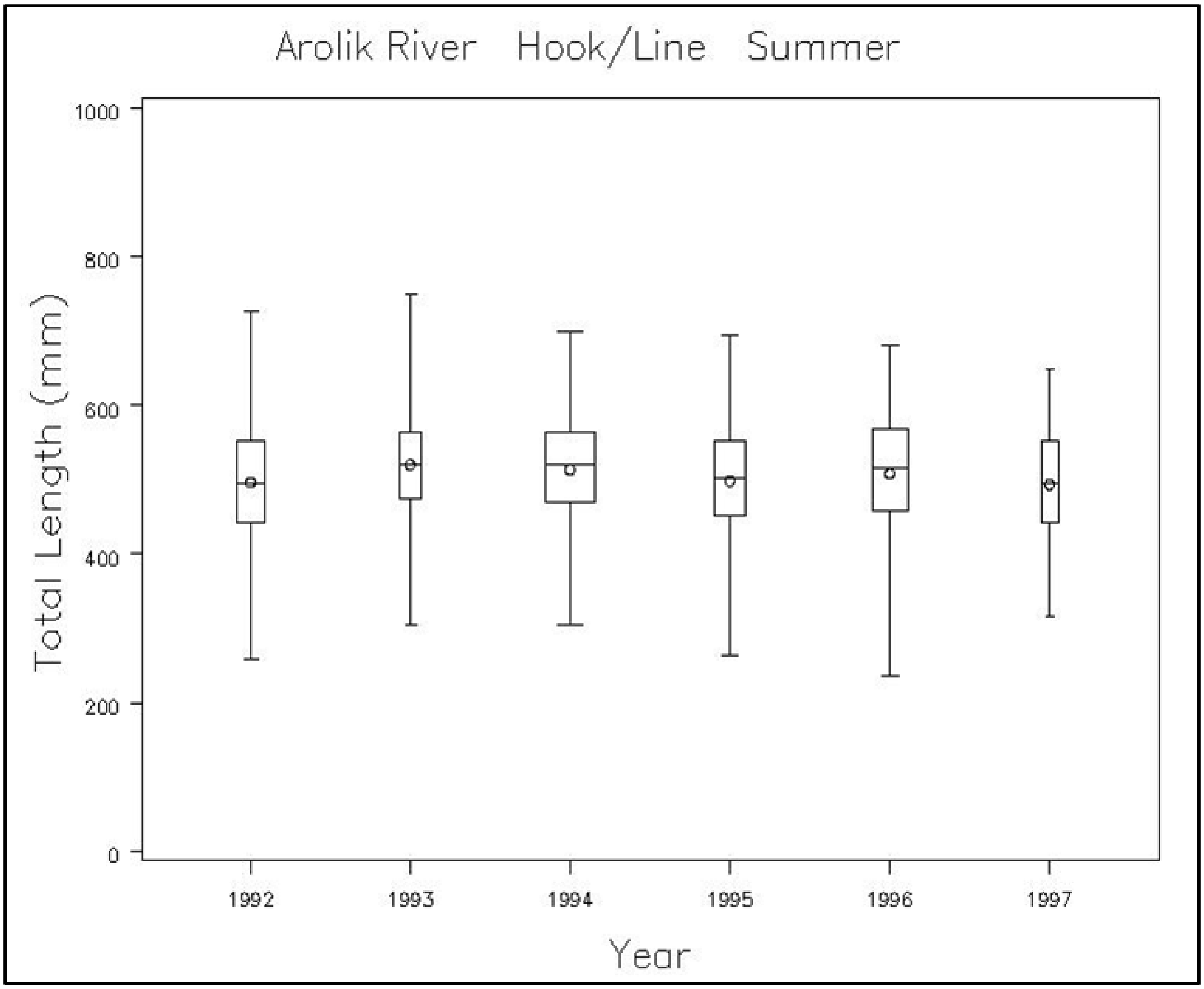

Figure 4.–Yearly length distribution boxplots for the Arolik River during summer with hook-and-line gear. Horizontal lines of box represent the 25th, 50th (median), and 75th percentiles of rainbow trout total length (mm). Whiskers extend to length minima and maxima. Circles are means. Box widths are proportional to sample size.

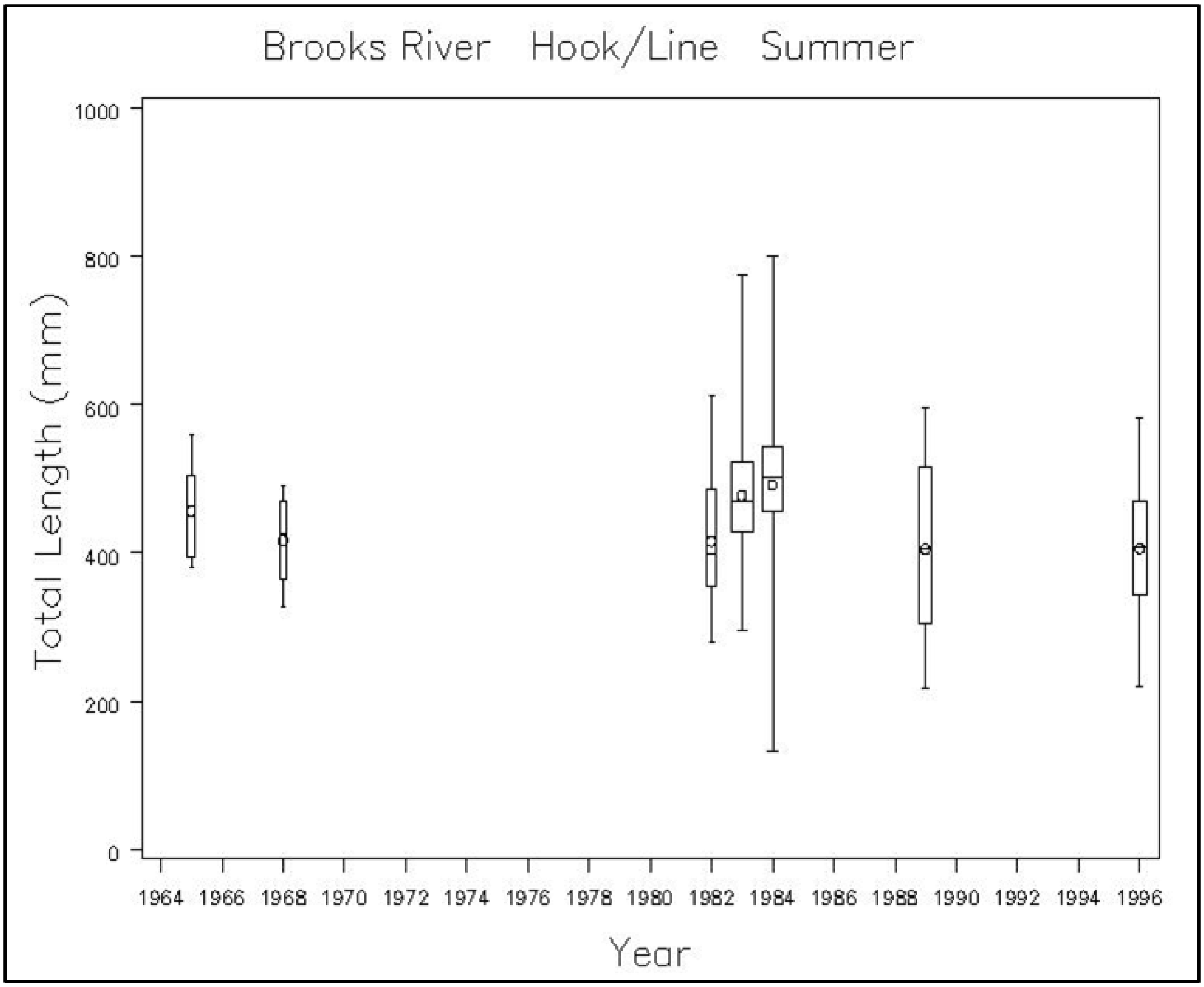

Figure 5.–Yearly length distribution boxplots for the Brooks River during summer with hook-and-line gear. Horizontal lines of box represent the 25th, 50th (median), and 75th percentiles of rainbow trout total length (mm). Whiskers extend to length minima and maxima. Circles are means. Box widths are proportional to sample size.

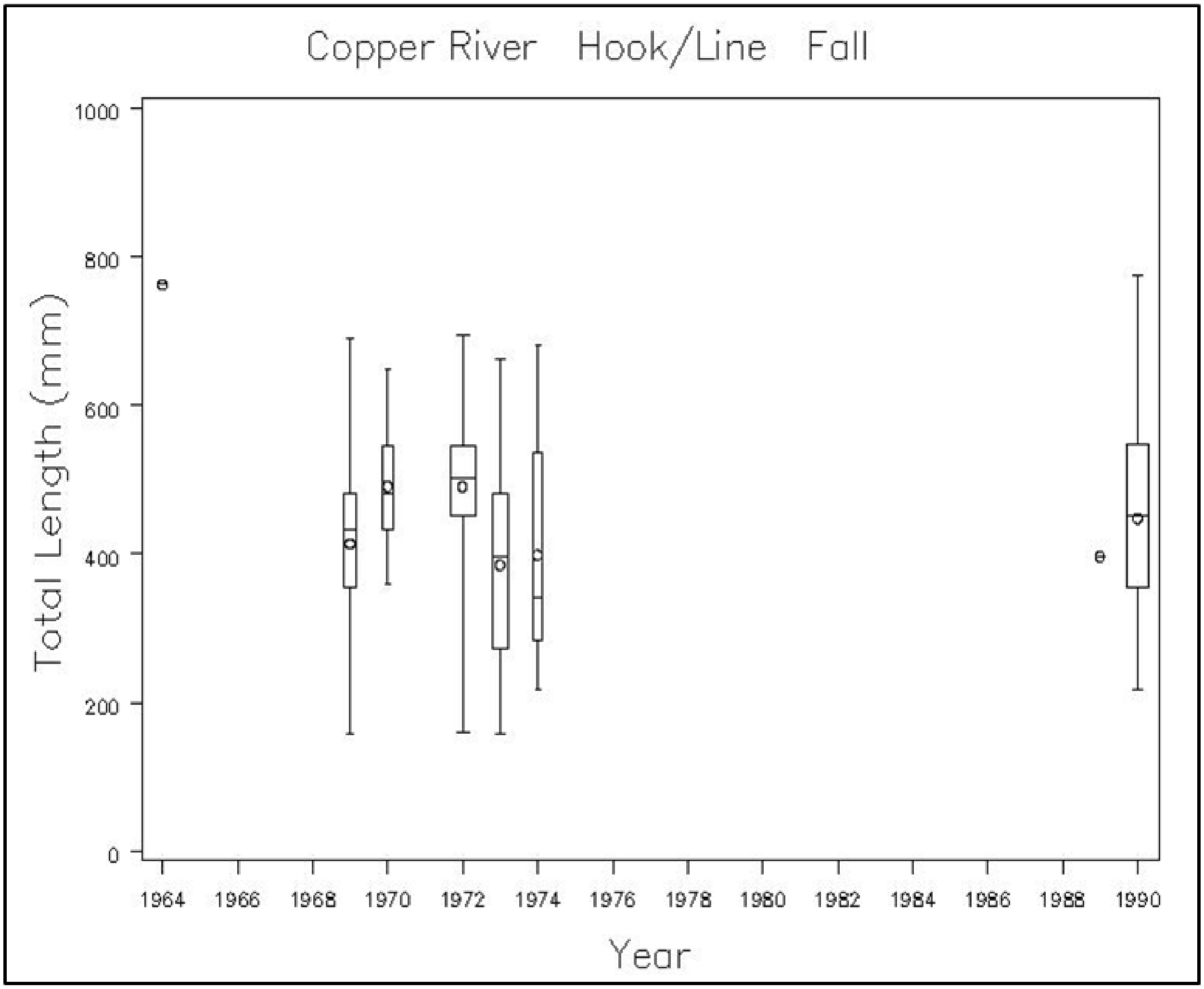

Figure 6.–Yearly length distribution boxplots for the Copper River during fall with hook-and-line gear. Horizontal lines of box represent the 25th, 50th (median), and 75th percentiles of rainbow trout total length (mm). Whiskers extend to length minima and maxima. Circles are means. Box widths are proportional to sample size.

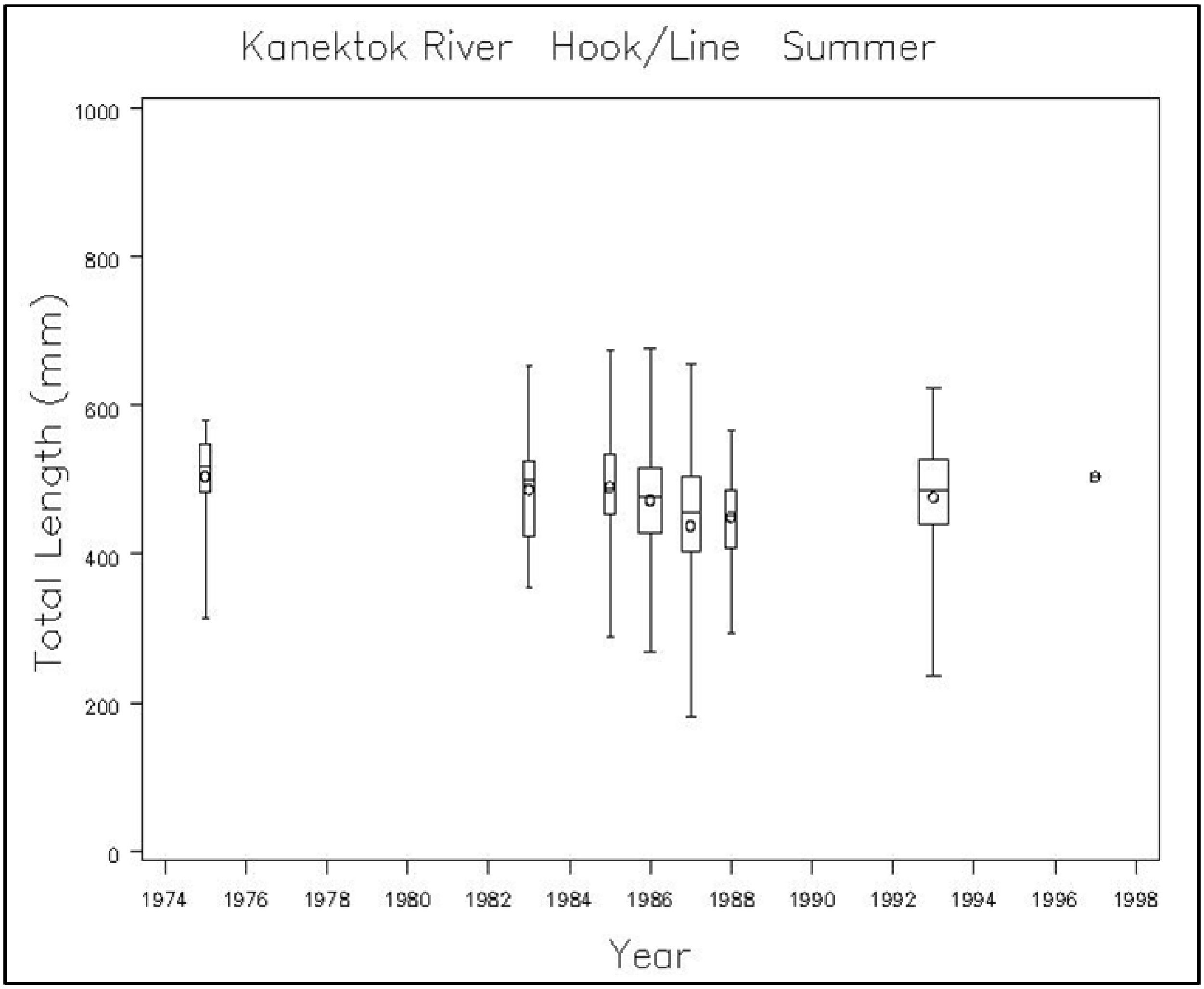

Figure 7.–Yearly length distribution boxplots for the Kanektok River during summer with hook-and-line gear. Horizontal lines of box represent the 25th, 50th (median), and 75th percentiles of rainbow trout total length (mm). Whiskers extend to length minima and maxima. Circles are means. Box widths are proportional to sample size.

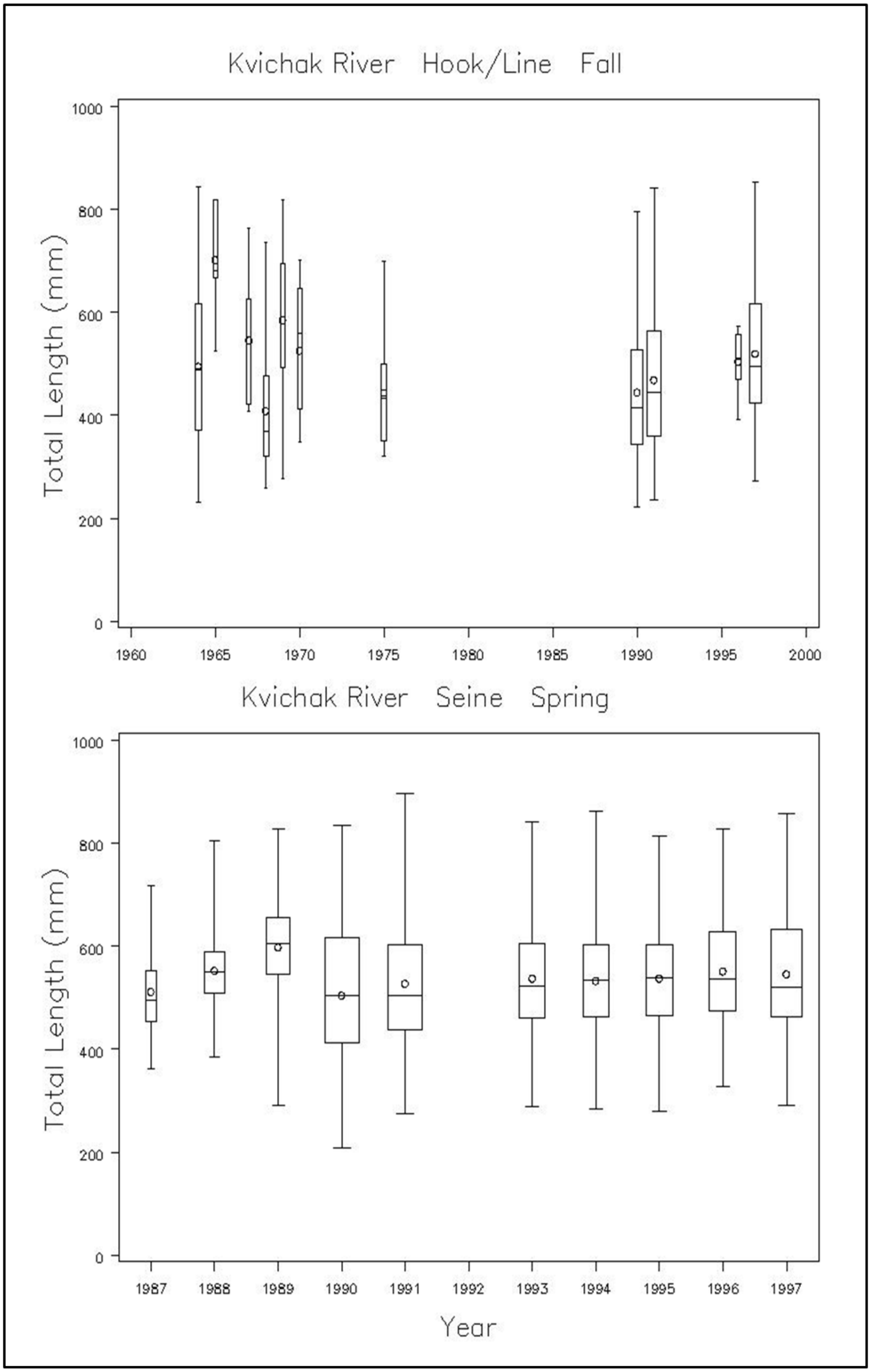

Figure 8.–Yearly length distribution boxplots for the Kvichak River during fall with hook-and-line gear (top) and during spring with seine gear (bottom). Horizontal lines of box represent the 25th, 50th (median), and 75th percentiles of rainbow trout total length (mm). Whiskers extend to length minima and maxima. Circles are means. Box widths are proportional to sample size.

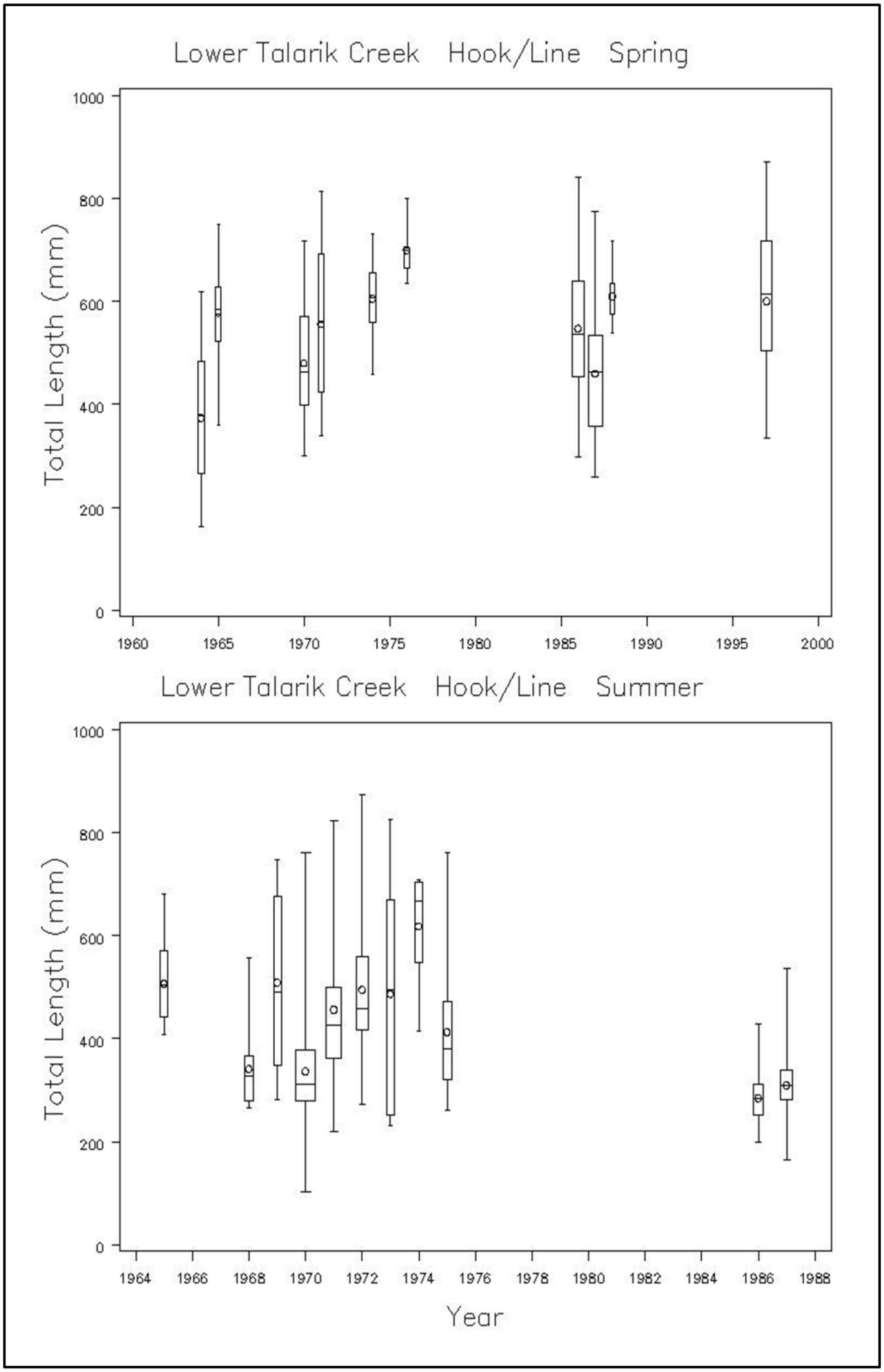

Figure 9.–Yearly length distribution boxplots for Lower Talarik Creek during spring (top) and summer (bottom) with hook-and-line gear. Horizontal lines of box represent the 25th, 50th (median), and 75th percentiles of rainbow trout total length (mm). Whiskers extend to length minima and maxima. Circles are means. Box widths are proportional to sample size.

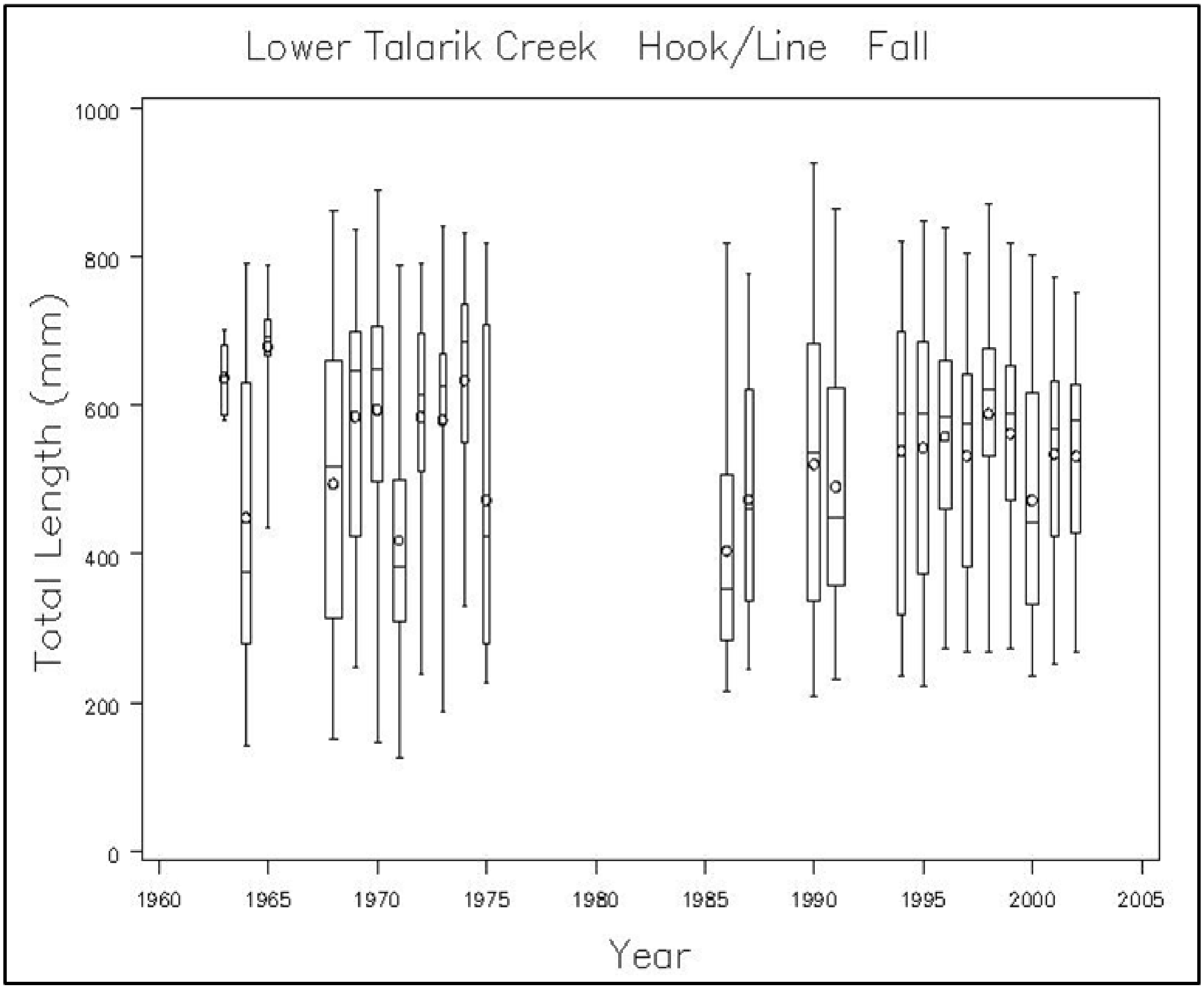

Figure 10.–Yearly length distribution boxplots for Lower Talarik Creek during fall with hook-and-line gear. Horizontal lines of box represent the 25th, 50th (median), and 75th percentiles of rainbow trout total length (mm). Whiskers extend to length minima and maxima. Circles are means. Box widths are proportional to sample size.

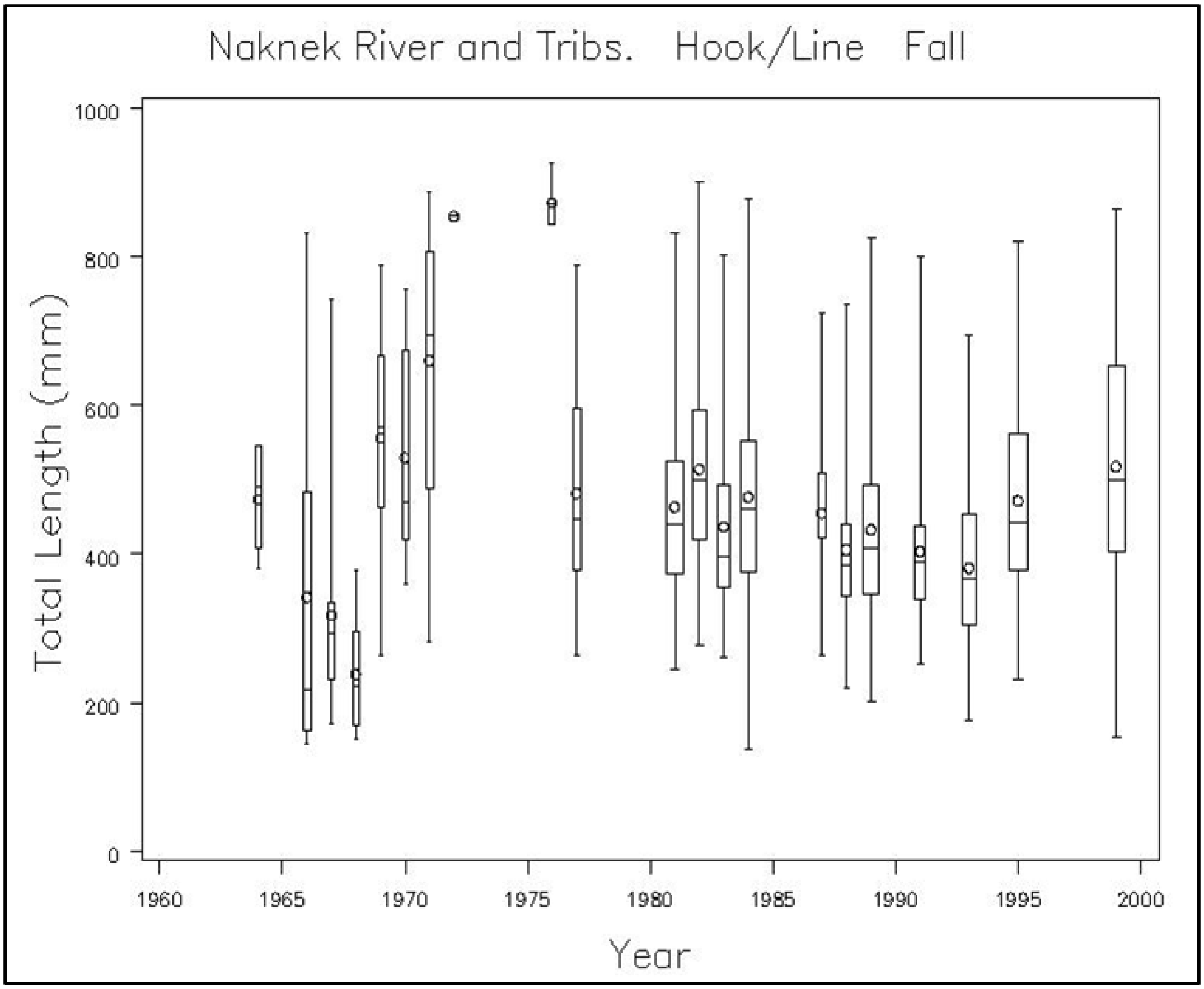

Figure 11.–Yearly length distribution boxplots for the Naknek River and tributaries during fall with hook-and-line gear. Horizontal lines of box represent the 25th, 50th (median), and 75th percentiles of rainbow trout total length (mm). Whiskers extend to length minima and maxima. Circles are means. Box widths are proportional to sample size.

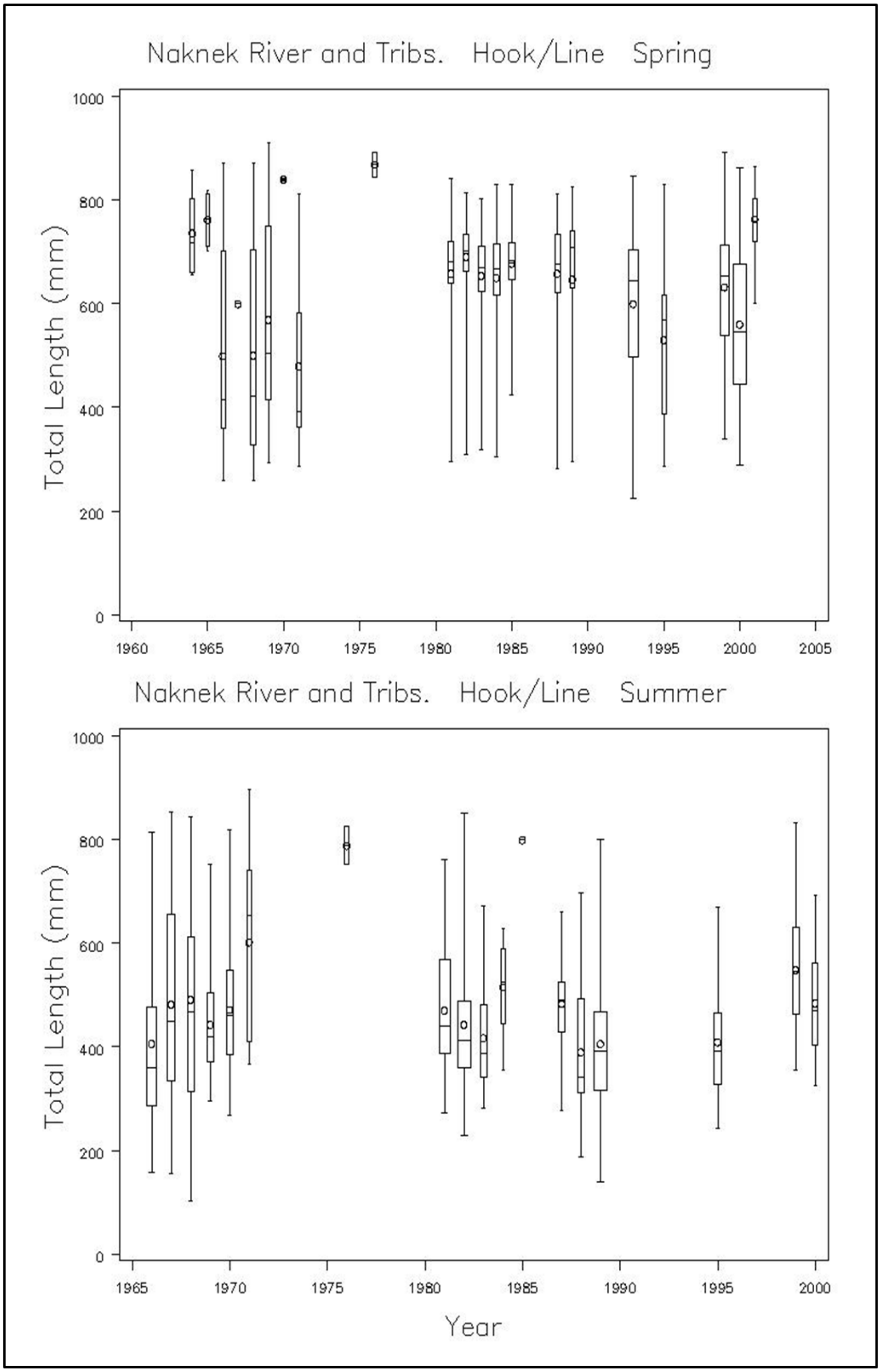

Figure 12.–Yearly length distribution boxplots for the Naknek River and tributaries during spring (top) and summer (bottom) with hook-and-line gear. Horizontal lines of box represent the 25th, 50th (median), and 75th percentiles of rainbow trout total length (mm). Whiskers extend to length minima and maxima. Circles are means. Box widths are proportional to sample size.

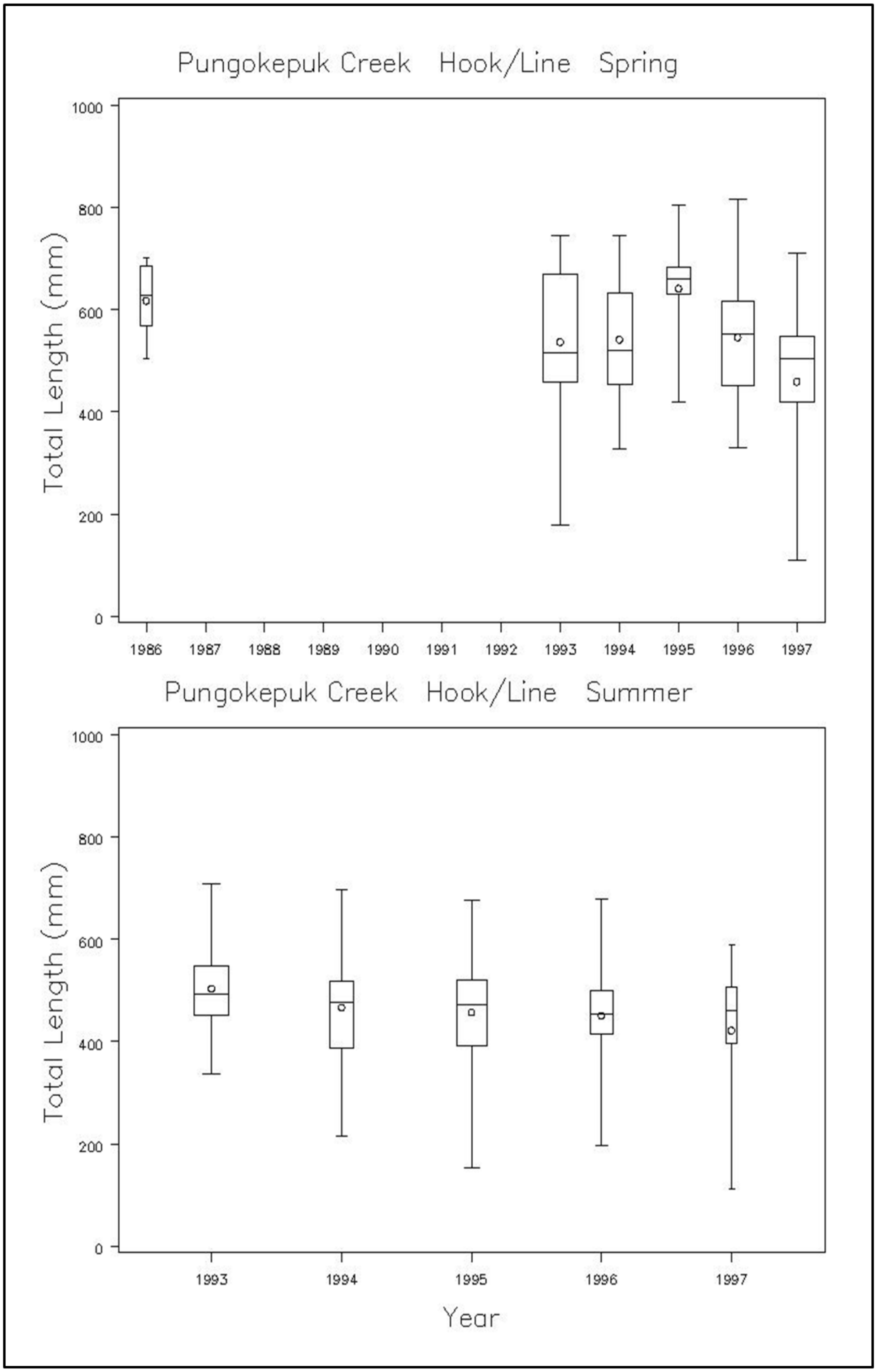

Figure 13.–Yearly length distribution boxplots for Pugokepuk Creek during spring (top) and summer (bottom) with hook-and-line gear. Horizontal lines of box represent the 25th, 50th (median), and 75th percentiles of rainbow trout total length (mm). Whiskers extend to length minima and maxima. Circles are means. Box widths are proportional to sample size.