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Jay S. Hammond, Governor

Annual Performance Report for

INVENTORY AND CATALOGING OF THE SPORT FISH AND SPORT FISH WATERS OF THE BRISTOL BAY AREA

by

Louis A. Gwartney

ALASKA DEPARTMENT OF FISH AND GAME

Ronald O. Skoog, Commissioner

DIVISION OF SPORT FISH

Richard Logan, Director

RESEARCH PROJECT SEGMENT

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ABSTRACT

Since the mid-1950's, the rainbow trout, Salmo gairdneri Richardson, of the Naknek River system in Bristol Bay have received more fishing pressure that those of any other system in the area. Within the past five years, however, research studying the affect of angling pressure and general condition of the stocks has been very limited. A comprehensive study was initiated in 1981 to define population parameters, movements and sport angling effort in the Naknek River drainage. This study is intended to continue for a minimum of 2 years.

During April and May, 1981, an estimate of 2,000 spawning Naknek River rainbow trout was made. Of these, 186 were tagged between April 16 and June 7. Sizes of tagged fish and subsequent recoveries are presented and discussed.

A creel census was initiated to estimate the numbers of rainbow trout caught and kept in the Naknek River between Lake Camp and Rapids Camp for the period June 8 through October 15, 1981. In addition to catch data, fish retained were measured, weighed, and scales taken for age analysis. Tagging continued through October 15. Results of these studies are summarized and discussed.

Spawning estimates for rainbow trout in index streams of the Bristol Bay area were made and presented, as are chinook salmon, Oncorhynchus tshawytscha (Walbaum), escapement estimates of the Naknek drainage.

KEY WORDS

Bristol Bay, Naknek River, rainbow trout, tagging, creel census, spawning surveys, chinook salmon, harvest, size frequencies, wild trout area.

BACKGROUND

The Bristol Bay area includes all waters draining into Bristol Bay from Cape Newenham to Port Heiden (Figure 1). The area contains some of the best recreational fishing within the State. Although effort is locally heavy on coho salmon, chinook salmon, Arctic grayling and Dolly Varden char, the rainbow trout of Bristol Bay have always demanded the attention of the Division of Sport Fish more than any other single species. Concerns by all individuals involved with rainbow trout have influenced the Board of Fisheries and the Federal government before statehood to adopt very restrictive angling methods and fishing seasons to insure the continual survival of these wild trout populations. With the increasing fishing effort, it is imperative that the managing agencies continue to update and expand their knowledge of this species.

Rainbow trout were studied extensively between 1971 and 1976 at Lower Talarik Creek, located on the north shore of Lake Iliamna (Figure 1), and a comprehensive report was completed in 1977 (Russell, 1977). Since this study was completed, rainbow trout spawning surveys and sporatic creel census studies have been conducted on selected streams in the Iliamna area.

Within the Bristol Bay area, the Naknek River has received more recreational angling effort than any other river system. According to Paddock, 1964, the establishment of two military recreational camps in the mid-1950's directed the first significant pressure on the Naknek River rainbows. Between 1957 and 1966, there was an apparent decline in the catch per unit of effort based on a voluntary creel census conducted by the military. These are the only data available for these years upon which to base effort and harvest estimates. The information was, however, thought to be less than accurate because data was based on voluntary reporting without statistical backing or continuity between years. Length measurements recorded were probably total lengths although standard fork or mid-eye to fork may have been used. Length data was recorded for only 9 of 16 years between 1956 and 1971. Redick, 1966, points out that if a reduction in numbers did occur, it was not born out in average size of rainbow trout available to, or harvested by, sport anglers. From 1956 through 1962, the average length of rainbows caught varied without apparent trend between 14.6 and 19.6 inches. Redick, 1966, also noted that a shift in angler interest toward other species had occurred. Increased pressure on chinook and sockeye salmon probably created the apparent drop in catch per unit of effort on rainbow trout, between the years 1957 and 1966.

In 1974 the two military recreation camps were permanently closed, reducing the effort on all species significantly. Since then, there has been a gradual increase in civilian angling pressure and relatively constant effort from the local King Salmon Air Force Base. Creel census studies were conducted by the Division of Sport Fish during brief periods of time

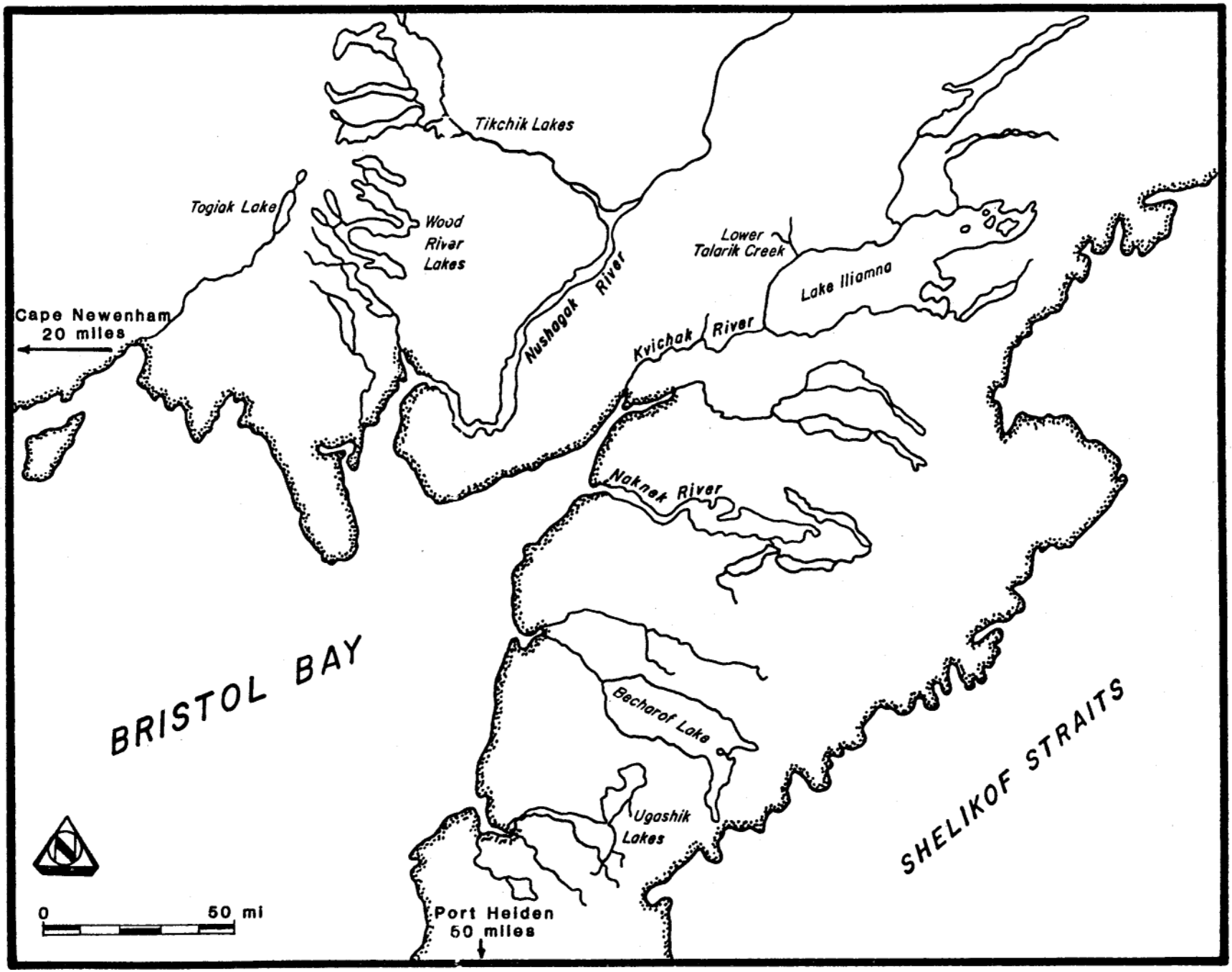

Figure 1. Bristol Bay study area.

in 1977, 1978 and 1980. Average sizes of rainbow trout retained by and available to the public have been recorded along with catch per unit of effort data. No apparent reductions in the rainbow trout population has occurred based on these fragmentary data.

Tagging of rainbow trout in the Naknek River was conducted on a small scale between the years 1966 and 1970. Two hundred four rainbows were tagged with 34 of these subsequently recovered. Table 1 is a summary of those recoveries. It appears there is some interchange between those rainbows in the lower Naknek river and those of both Brooks River and the Bay of Islands.

Aerial counts of spawning rainbow trout in the Naknek River have been made annually since 1972. These counts of large rainbows are to provide only "best estimates", and therefore likely reflect minimum numbers available to spawn and subsequently to the angling public. These counts are not considered definitive, since we know little of fish interchanges and are not able to see rainbows in deep or fast moving waters. Counts have varied from a low of 130 in 1973 to averages of 300-500 for the years since 1975.

With continuing pressures from recreational anglers, better data was needed to insure the maintenance of the rainbow trout population at a high level. Job objectives in the research project were changed and available monies directed to obtaining additional data from rainbow trout in the Naknek system. During 1981, a tagging program was initiated to study migrational movements, intermingling and growth rates of available rainbows. In the future, tagging with radio tags may better define movements and migrations within the system. A statistically designed creel census, developed by the Sport Fish biometrics staff was conducted between June 8 and October 15, 1981, to estimate total harvest of rainbow trout. In conjunction with the creel census, measurements and scales were collected from retained rainbows for an estimate of size and age composition of rainbows kept.

Table 2 presents common and scientific names of species mentioned in this report.

RECOMMENDATIONS

1. Direct available monies toward a continued study of rainbow trout within the Naknek River system.

2. Continue the enumeration of chinook salmon and rainbow trout in selected streams in the Naknek and Kvichak drainages in order to establish minimum spawning escapements.

3. Survey selected streams within the Bristol Bay area to determine the existence of, or the potential for recreational fisheries and information about the sport fishes present.

Table 1. Tag Recoveries, Naknek River Rainbow Trout, 1966-1977.

Tagged			Recovered		
Date	Location	Fork Length(mm)	Date	Location	Fork Length(mm)
6/29/66	Naknek Lake Outlet	546	7/18/66	Lake Camp Dock	-
3/1/68	Just below Lake Camp	337	June 68	1 mile into Naknek Lake	-
5/13/69	Lower rapids	368	7/12/69	Flats, F&G Cabin	402
3/20/68	Lake Camp	292	9/7/69	Production Point	-
3/21/68	Mid rapids area	394	6/14/68	Lake Camp	-
3/21/68	Mid rapids area	355	8/8/68	Brooks River	-
4/5/68	Below rapids	629	8/11/68	Bay of Islands	-
4/5/68	Below rapids	724	5/14/68	Foot of rapids	-
4/5/68	Below rapids	724	9/1/70	Brooks River	-
5/14/68	Tower point	698	5/13/69	Tower point	-
3/29/68	Flats above cable	445	6/27/68	Below King Salmon Cr.	-
5/20/68	Lake Camp	584	9/30/69	Lake Camp	698
6/20/68	Tower point	267	June 68	Lake Camp	-
5/26/68	Tower point	308	6/8/68	Lake Camp	-
4/10/69	Production Point	419	8/26/69	Trefon's cabin	533
4/10/69	Production Point	425	9/21/70	Lake Camp	705
5/13/69	Rapids	685	10/16/71	Lake Camp	720
5/13/69	Rapids	305	6/23/69	Lake Camp	-
5/13/69	Rapids	387	1969	Above rapids	-
5/13/69	Above Production Point	464	7/21/71	Lake Camp	609
5/13/69	Snag point	368	6/19/69	Lake Camp	-
5/13/69	Snag point	362	6/8/69	1 mile below Lake Camp	489
5/13/69	Snag point	381	9/18/69	Lake Camp	431
5/13/69	Snag point	387	8/7/69	Lake Camp	-
5/13/69	Tower point	420	8/14/71	Above rapids	596
5/13/69	Tower point	384	5/14/71	-	-
6/20/69	Flats above smolt cable	395	9/18/69	Trefon's cabin	482
6/20/69	Flats above smolt cable	390	6/22/69	Below smolt cable	-
6/20/69	Flats above smolt cable	320	7/15/70	At smolt cable	441
6/20/69	Lake Camp	420	6/13/76	Lake Camp	700
6/20/69	Above Lake Camp	450	7/31/70	Lake Camp	-
7/14/70	Bay-of-Islands	765	6/24/71	Near Lake Camp	-
7/14/70	Bay-of-Islands	587	4/24/73	Naknek River ½ mile below F&G camp	-
10/21/69	Lake Camp	609	11/5/72	Lake Camp	685
3/1/68	Lake Camp	337	June 68	Production Point	305

Table 2. List of Common and Scientific Names.

Common Name	Scientific Name and Author
Chinook salmon	Oncorhynchus tshawytscha (Walbaum)
Coho salmon	Oncorhynchus kisutch (Walbaum)
Sockeye salmon	Oncorhynchus nerka (Walbaum)
Rainbow trout	Salmo gairdneri Richardson
Dolly Varden	Salvelinus malma (Walbaum)
Arctic grayling	Thymallus arcticus (Pallas)

OBJECTIVES

1. To determine the distribution and utilization of sport fish species within the waters of the job area, with emphasis on the Tikchik and Upper Nushagak systems.

2. To determine the magnitude of rainbow trout spawning stocks in Lower Talarik Creek, Dream Creek, Copper River, Naknek River, Brooks River and other streams as time permits.

3. To determine the magnitude of chinook salmon spawning stocks utilizing the Naknek River drainage.

4. To estimate the population of Arctic grayling at Lower Ugashik Lake outlet and Ugashik Lake Narrows.

5. To provide recommendations and identify future research needs relative to the management of area sport fish resources.

TECHNIQUES USED

The 1981 Naknek River rainbow trout creel census was identical in design to the 1978 census (Gwartney, 1979). It was designed to estimate the number of rainbow trout caught and kept from the Naknek River between Trefon's cabin and Rapid Camp between June 8 and October 15 (Figure 2). In addition, data were collected to estimate angler effort and size of rainbow trout retained. This census required the full time effort of one person working 4 to 8 hours a day, 5 or 6 days a week.

To eliminate bias created because more fishing effort was expended during afternoons and weekends, census periods were randomly assigned to the days between June 8 and October 15. Three daily time periods were selected to sample. These were: 1) 8 a.m - 12 noon, 2) 12 noon - 4 p.m., 3) 4 p.m. - 9 p.m. (until September 9) then 8 p.m.

During each random time period, one count of anglers was made by boat between Trefon's cabin and Rapids Camp. Before and after each count, an attempt was made to contact each fisherman returning to Lake Camp, following his day's fishing. Each fisherman contacted was interviewed and his fish measured and weighed. Scales were taken for age analysis.

All data collected from the census were sent to Anchorage for analysis and compilation by the Division biometrician and his staff. Copies of the creel census schedule are available both in King Salmon and Anchorage Division of Sport Fish offices.

All rainbow trout were captured by hook and line. Sampling consisted of measurements of fork and total lengths of each fish to the nearest millimeter, sexing the fish and tagging the trout if it was over 275 mm in total length. Numbered FD-67 internal anchor tags (Floy Tag Company) were inserted into the dorsal body musculature in such a manner that the anchor

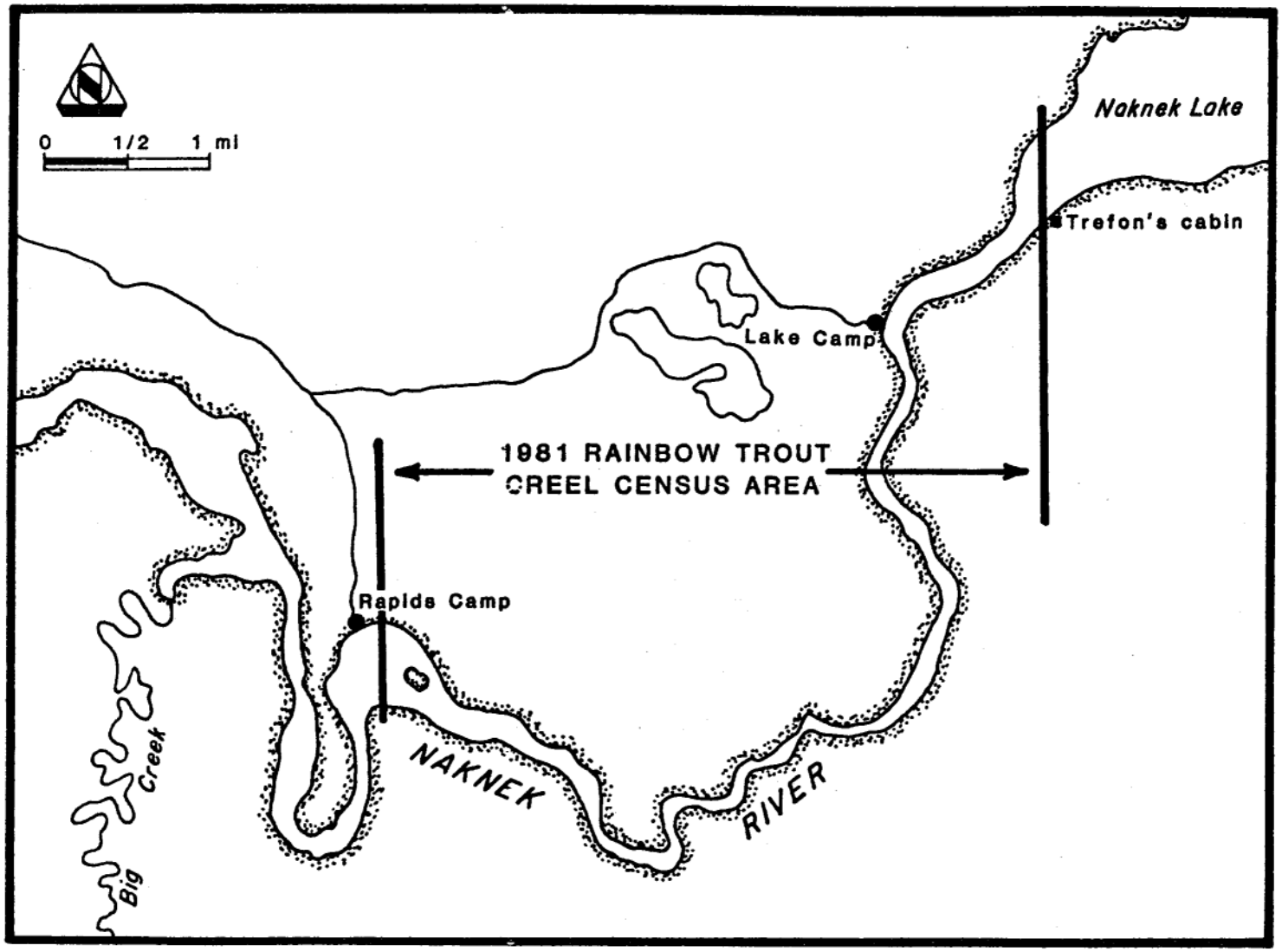

Figure 2. Naknek River showing area covered during 1981 Rainbow Trout creel census.

section of the tag lodged between consecutive pterygiophores. Similar to the creel census data, all tagging information was recorded on standard forms and analyzed by the Division biometric staff. Chinook salmon and rainbow trout in the Naknek River were aerially estimated.

FINDINGS

Results

Naknek River Rainbow Trout Tagging and Spawning Surveys:

On April 9, 1981, the author flew down the Naknek River, and observed at least 500 large rainbows distributed between Trefon's cabin and the lower boundary of the spring closure. Spawning was obvious, especially in the lower stretches of the river. Figure 3 shows the distribution on April 9. On April 16, the author flew the Naknek River again and saw approximately 250 fish in the river just upstream from the closure boundary, plus at least 200 more up-stream from this concentration.

Tagging began on April 16 in the area between the old cable crossing and the Fish and Game cabin (Figure 3). Between April 16 and June 7, 189 rainbow trout were tagged, of which 167 were spawners over 23 inches in total length.

Figure 4 presents a length frequency of 161 tagged rainbow trout spawners, by sex, between April 16 and May 14. On May 12, the Naknek River started rising and rainbows began to move upstream. By May 15, very few large rainbows were left in the tagging area.

Tagging continued after June 7 throughout the Naknek River (Table 3). Bill Adint, assigned to creel census, concentrated his efforts near Lake Camp while I tagged in the river, mainly above Rapids Camp.

Between April 16 and October 15, 1981, 335 rainbows were tagged in the Naknek drainage. Twelve were tagged at Brooks Camp and the remaining 323 were tagged from Rapids Camp upstream to Lake Camp. By October 15, twelve recoveries were made in 1981.

Table 4 lists the tagging locations and subsequent recoveries of these fish. Six of the 12 were recaptured near their respective tagging sights. Two were caught in the Bay of Islands, located at the head of Naknek Lake and the other four were taken within the Naknek River. All tag recoveries were from fish tagged prior to June 17, 1981 and all were fish over 500 mm in total length. No recoveries were made at Brooks Camp. No estimate of tag loss or growth rates have been made due to the limited data.

Naknek River Rainbow Trout Creel Census:

Estimates of angler hours, angler days, total catch and total rainbow trout retained by anglers are presented in Table 5 for two 1981 calendar periods. Of the 303 persons interviewed between June 8 and October 15, 48% were

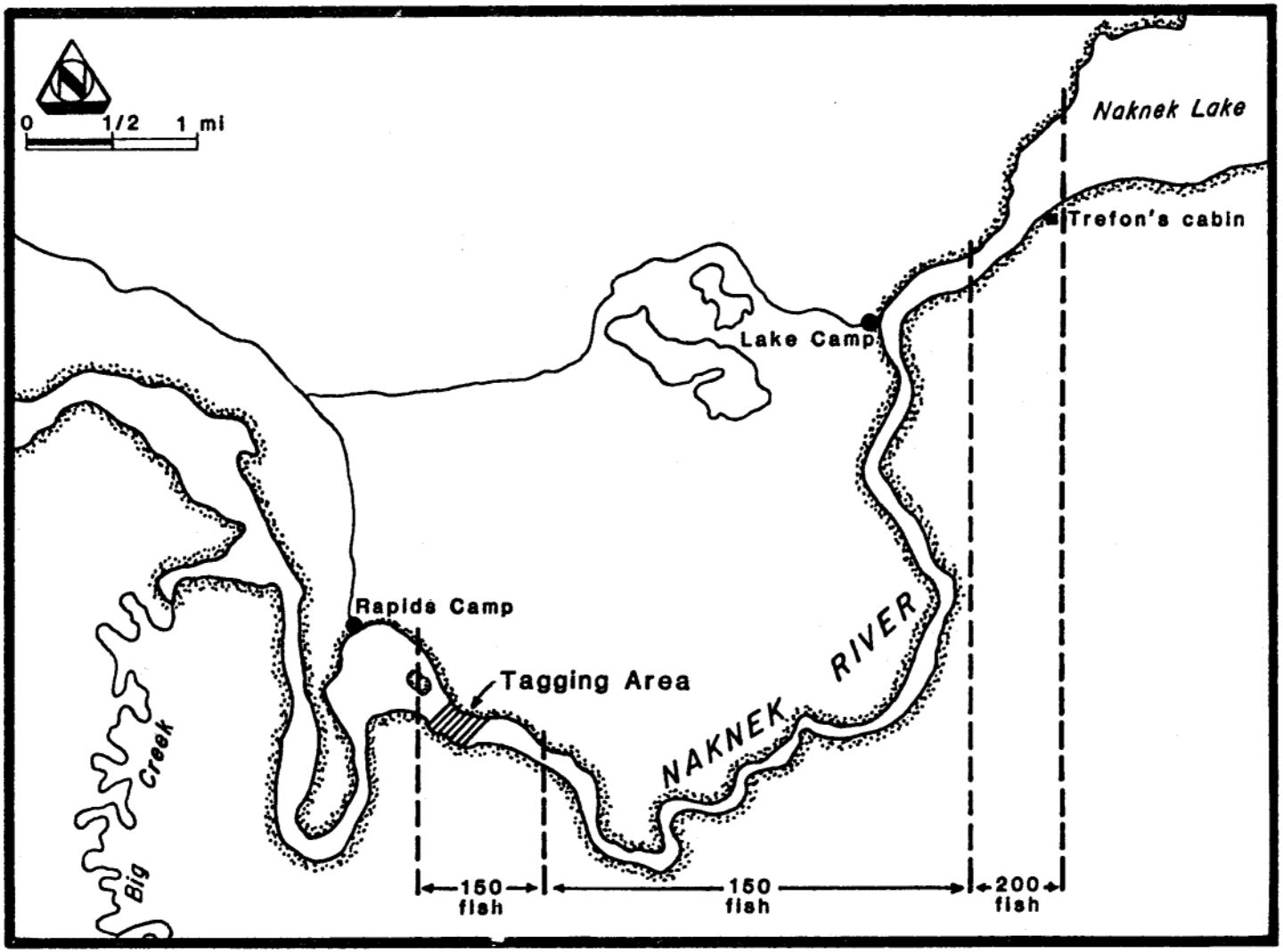

Figure 3. Upper Naknek River showing Rainbow Trout distribution as observed April 9, 1981 and the area where Rainbow Trout were tagged on April 16 through June 7, 1981.

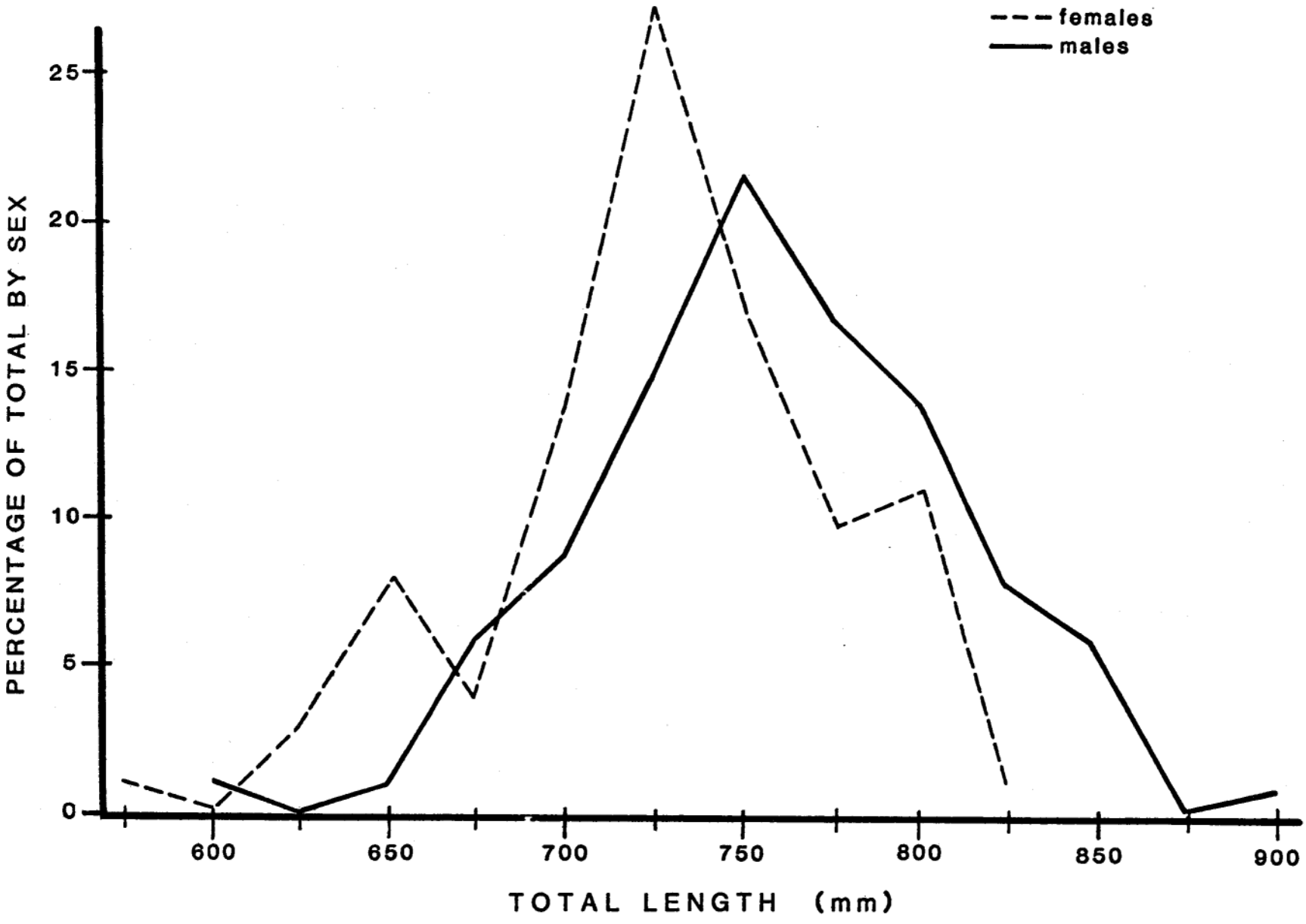

Figure 4. A length frequency of spawning Rainbow Trout tagged in the Naknek River, 1981.

Table 3. Numbers and Mean Sizes of Rainbow Trout Tagged in the Naknek River Between June 8 and October 15, 1981, for Two Time Periods and Two Fates of Fish.

Dates	Numbers	Mean Total Lengths	Mean Fork Lengths
		Released Uninjured	
June 8 - August 11	68	497 mm	461 mm
August 12 - October 15	64	493 mm	469 mm
		Released Injured	
June 8 - August 11	9	376 mm	354 mm
August 12 - October 15	5	371 mm	321 mm

Table 4. Tag Recoveries for Naknek River Rainbow Trout, 1981.

Tagging Information		Recovery Information	
Date	Location	Date	Location
4/20/81	3/4 mile upstream from Rapids Camp	5/2/81	3/4 mile upstream from Rapids Camp
4/22/81	3/4 mile upstream from Rapids Camp	7/4/81	Bay of Islands
4/22/81	3/4 mile upstream from Rapids Camp	10/3/81	Lake Camp
4/28/81	3/4 mile upstream from Rapids Camp	4/29/81	3/4 mile upstream from Rapids Camp
5/2/81	3/4 mile upstream from Rapids Camp	5/8/81	3/4 mile upstream from Rapids Camp
5/8/81	3/4 mile upstream from Rapids Camp	6/17/81	3/4 mile upstream from Rapids Camp
5/8/81	3/4 mile upstream from Rapids Camp	5/13/81	3/4 mile upstream from Rapids Camp
5/8/81	3/4 mile upstream from Rapids Camp	6/11/81	3/4 mile upstream from Rapids Camp
5/14/81	3/4 mile upstream from Rapids Camp	8/8/81	Bay of Islands
6/11/81	3/4 mile upstream from Rapids Camp	7/26/81	1/2 mile below Rapids Camp
6/11/81	3/4 mile upstream from Rapids Camp	7/20/81	Lake Camp
6/17/81	3/4 mile upstream from Rapids Camp	7/26/81	1/2 mile below Rapids Camp

Table 5. Naknek River Rainbow Trout Creel Census Summary, June 8 - October 15, 1981.

	June 8 - August 11			August 12 - October 15			Grand Totals
	Week-Ends	Week-Days	Period Totals	Week-Ends	Week-Days	Period Totals	
Total Angler-hours	1142	2982	4124	1492	1533	3025	7149
Total Angler-days	394	833	1227	354	370	724	1951
Hours/Angler-day	2.90	3.58	3.36	4.22	4.14	4.18	3.66
Catch/hour	0.79	1.29	1.15	1.15	1.70	1.43	1.27
Total Catch	902	3846	4748	1716	2606	4322	9070
Kept/hour	0.22	0.36	0.32	0.33	0.24	0.28	0.31
Total Harvest	251	1073	1324	492	368	860	2184

residents. Eighty-nine percent were civilians; the rest were military personnel. Eighty-six percent of those interviewed used lures and 14% were fly fishermen. Anglers released 76% of the rainbows caught and retained an average of 1.1 trout per angler-day.

Length, Weight and Age Data for Naknek River Rainbow Trout:

The average fork and total lengths of Naknek River rainbow trout kept by anglers between June 8 and October 15, 1981 were as follows:

Time Periods	Sample Size	Mean Fork Length (mm)	SD (mm)	Sample Size	Mean Total Length (mm)	SD (mm)
June 8-Aug. 11	101	436	97	104	463	101
Aug. 12-Oct. 15	218	420	109	218	433	113

Two regressions were developed from the data. The first is a relationship between fork and total lengths over the range of data from 228 mm to 840 mm of fork length. The regression equation is:

Total length = 4.18578 + 1.04697 (fork length)

The r value is 0.99944. The second equation predicts weight in grams based on total length measurements in millimeters.

This regression for weights of fish between 240 mm and 890 mm in total length is:

log(weight) = (-4.75475) + (2.90613) log (Length) or:
w = (0.0000176) L 2.90613

The r value is 0.94430. Tables 6 and 7 present predicted total lengths from fork lengths at 25 mm intervals from 225 mm to 850 mm, and predicted weights for each of the 25 mm groupings of fish.

From scales collected from rainbows retained by anglers, the ages of 158 fish were determined. Corresponding mean and total lengths and standard deviations are presented in Table 8.

Rainbow Trout Spawning Surveys in Other Bristol Bay Streams:

On April 27, 1981, I flew an aerial survey in a Cessna 180 to assess spawning activity in the other index streams in the Naknek and Kvichak drainages. The weather was clear and calm and survey conditions were excellent. Table 9 presents the results of this survey along with results of similar surveys for the past 9 years.

Chinook Salmon Spawning Estimates for the Naknek Systems:

The 1981 chinook salmon escapement estimates were made by Richard Russell and Donald Bill, Commercial Fish Biologists in King Salmon. Table 10 presents the results of their surveys for 1981 and results of similar surveys since 1974.

Table 6. 1981 Naknek Rainbow Study Showing Predicted Total Lengths at 25 Millimeter Intervals of Fork Lengths.

Fork Length (mm)	Predicted Total Length(mm)	Fork Length (mm)	Predicted Total Length(mm)
225	240	570	606
250	266	600	632
275	292	625	659
300	318	650	685
325	344	675	711
350	371	700	737
375	397	725	763
400	423	750	789
425	449	775	816
450	475	800	842
475	501	825	868
500	528	850	894
525	554		
550	580		

Actual Fork Length Minimum = 228 mm Maximum = 840 mm
Regression Equation: TL = 4.18578 + 1.04697 (FL)
Correlation r = 0.9944

Table 7. 1981 Naknek Rainbow Trout Study Predicting Weights at Every 25 Millimeter Interval of Total Length.

Total Length (mm)	Predicted Weight (gm)
240	145
250	164
275	216
300	278
325	351
350	435
375	537
400	641
425	765
450	903
475	1057
500	1227
525	1414
550	1618
575	1842
600	2084
625	2347
650	2630
675	2935
700	3262
725	3612
750	3986
775	4385
800	4808
825	5258
850	5735
875	6239
890	6555

Actual Total Length Minimum = 240 mm Maximum = 890 mm
Regression equation: log(weight) = (-4.75475)log(length) or
W = (0.0000176) L 2.90613
Correlation: r = 0.94430

Table 8. Mean Length and Standard Deviations by Age Group for Rainbow Trout From the Naknek River, 1981.

Age	Sample Size	Mean Fork Length (mm)	SD (mm)	Mean Total Length (mm)	SD (mm)
2	2	284	--	304	-
3	20	330	39	350	39
4	56	410	36	434	37
5	47	494	58	520	59
6	15	579	54	606	58
7	13	652	55	684	54
8	3	704	--	741	--
9	2	728	--	768	--

Table 9. A Summary of Rainbow Trout Spawning Surveys Made on Streams in the Naknek and Kvichak Drainages, 1972-1981.

Year	Copper River	Brooks River	Lower Talarik	Dream Creek
1972	630	***	600	***
1973	102	150	1,000	218
1974	91	169	1,100	43
1975	85	88	1,100	46
1976	*	100	1,100	200-250
1977	400-500	125-175	800	138
1978	250-350	125-150	1,000-1,200**	175-225
1979	200-250**	250-300	1,900-2,100**	*
1980	***	200	1,250-1,300**	***
1981	650-750	100-200***	1,200-1,300**	125-150

* No count possible due to turbid waters.

** Aerial survey.

*** No peak count made.

Table 10. Chinook Salmon Escapement Estimates, Naknek River System, 1974-1981.*

Year	King Salmon Creek	Big Creek	Mainstream Naknek River	Estimated Total (Mid-Point)
1974	600-800	1,200-1,300	400-500	2,400
1975	350-400	800-850	2,250-2,750	3,700
1976	350-450	1,300-1,500	7,000-7,500	9,025
1977	2,200-2,500	2,600-2,800	5,500-6,000	10,800
1978	250-350	4,600-5,000	3,000-5,000	9,075
1979	1,500-2,000	3,300-4,000	1,500-2,000	7,150
1980	No Count**	No Count**	No Count**	--
1981	1,400-1,600	3,950	3,470	8,920

* Aerial surveys.

** High water.

DISCUSSION

Based on the aerial surveys of April 9 and April 16, and almost daily observations from April 16 through May 15, the Naknek River spawning population is probably at least 2,000 rainbow trout. This is 1,500 fish higher than any previous estimate (Gwartney, 1978). Previous estimates were based solely on aerial counts made once or twice during the spring. Further evidence of a larger spawning population is evident when tagging data is examined. While 189 rainbows were tagged prior to June 8 just upstream from Rapids Camp (Figure 3), only four trout previously tagged were recaptured during this period. The length frequency of spawning rainbow trout suggest a healthy population with fish ranging from 550 mm (total length) to 890 mm (total length). The average total length for 178 spawners was 697 mm.

Considering the winters and springs of 1980 and 1981 were similar, it is assumed that the rainbow sport harvest would also be similar. Based on a census conducted by Richard Russell in 1980, the numbers of rainbows retained during the period from January 5 to April 10 was approximately 900 (Gwartney, 1981). Coupled with this year's estimate of 2,184 between June 8 and October 15, this year's total harvest would exceed 3,000 trout and surpass the previous high in 1957 by 400 fish. The 1978 estimate for the period August 12 to October 1 was significantly lower than the 1981 estimate (284 vs 860 kept). While the numbers of anglers were similar in the 2 years, the number kept per hour was up in 1981 to 1.27 compared to 0.45 in 1978. Along with the increased catch rates in 1981, the average size of fish retained dropped slightly from the 1978 sample. This is not necessarily a sign of overfishing but rather the result of more smaller fish being available in 1981 as compared to 1978. The average size of rainbows retained in 1978 was 484 mm in total length compared to 463 in 1981 (Gwartney, 1979). For further comparison, a 12-day creel census in 1977 (September 30-October 15) resulted in an average size rainbow of 469 mm (Gwartney, 1978). Redick in 1966, reported that rainbow trout, based on military catch records varied from 371 mm to 498 mm between 1957 and 1966. Based on all available data, there is no evidence that the average size of rainbow trout is affected by present angling pressure. This variation in average sizes could probably be better explained by the appearance of strong or weak age classes entering the fishery.

The lack of tag recoveries from rainbows tagged after June 8 also suggest a large population. While an estimated 9,070 rainbows were caught, only three tags were reported from 146 releases.

Based on age analysis, the average fish retained was between 4 and 5 years old. The average spawner was around 7 years in age.

Of particular interest outside the Naknek River system is the estimate of rainbow trout spawning in the Copper River. This year's estimate of 650-750 fish is the highest in the past 10 years. The Lower Talarik Creek and Brooks River counts were similar to most previous years' data.

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Prepared by:

Louis A. Gwartney
Fishery Biologist

Approved by:

E. Richard Logan, Director
Division of Sport Fish

Mark C. Warner, Ph.D.
Sport Fish Research Chief