

STATE OF ALASKA

William A. Egan, Governor



Annual Report of Performance for

INVENTORY AND CATALOGING

*DISSEMINATION OF INFORMATION
COLLECTED ON DOLLY VARDEN*

*INVESTIGATIONS OF PUBLIC FISHING ACCESS
AND AQUATIC HABITAT REQUIREMENTS*

by

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RESEARCH PROJECT SEGMENT

State: ALASKA Name: Sport Fish Investigations of Alaska.

Project No.: F - 9 - 6

Study No.: G - I Study Title: INVENTORY AND CATALOGING.

Job No.: G - I - E Job Title: Inventory and Cataloging of the Sport Fish and Sport Fish Waters of the Bristol Bay Area.

Period Covered: July 1, 1973 to June 30, 1974.

ABSTRACT

King salmon, Oncorhynchus tshawytscha, escapements in the Naknek and Branch rivers were aerially estimated. The Naknek River subsistence and the Naknek/Kvichak commercial fishing areas produced catches of 627 and 867 king salmon, respectively.

Aerial and foot surveys were conducted to determine the numbers of spawning rainbow trout, Salmo gairdneri, in the Naknek, Brooks, and Copper rivers and Dream Creek (Gibraltar River system). An aerial survey flown on May 7 revealed an estimate of 130 rainbow trout spawners in the Naknek River. A foot survey conducted at Dream Creek on June 3 provided an estimate of 218 spawning rainbow trout. A survey conducted May 31-June 1 indicated 102 rainbow trout were spawning in Copper River.

Observations regarding timing of migrations for both mature and immature rainbow trout were made in the Copper and Gibraltar river drainages. Tag recoveries from both systems provided further information on rainbow trout movements within the Lake Iliamna area.

Length frequency by maturity and sex for rainbow trout is presented for both Copper and Gibraltar river systems. Age data is presented for 359 Copper River rainbow trout.

Creeel census data was collected from 219 anglers who fished 485 angler days on Copper River. Retain-release ratios, terminal gear preference, and length-age relationships were determined.

RECOMMENDATIONS

1. Naknek River Watershed:
 - a. Monitor the increasing sport fishing pressure, and regulate the sport fish harvest.
 - b. Continue to obtain aerial king salmon escapement estimates in Big, King Salmon, and Paul's creeks, and the Naknek River.
 - c. Enumerate rainbow trout spawning stocks in Brooks and Naknek rivers.
2. Kvichak River Watershed:
 - a. Determine migrational timing and distribution patterns for rainbow trout in Newhalen, Copper, and Gibraltar river drainages.
 - b. Determine the angler rainbow trout catch, catch release ratio, gear effectiveness, and effort for Newhalen River.
 - c. Determine sex composition, age, length, and weight for rainbow trout in Newhalen River.
 - d. Continue to obtain aerial king salmon escapement estimates in Alagnak (Branch) and Nonvianuk rivers.

OBJECTIVES

1. To determine environmental characteristics of existing or potential recreational fishing waters in the job area and obtain potential angler use and sport fish harvest estimates, with emphasis on the Gibraltar and Copper rivers in Lake Iliamna.
2. To enumerate king salmon spawning stocks in the Naknek River and its tributaries.
3. To assess all anadromous and freshwater fishery uses and determine their respective impacts upon area fish stocks.
4. To provide management recommendations for sport fishing resources in these waters and direction for future studies.

TECHNIQUES USED

Rainbow trout spawning ground surveys in Naknek River were aerially estimated from a Cessna 180. King salmon escapements were also aerially estimated in the Naknek River, its tributaries, and Branch River from a Cessna-180. Spawning ground counts were obtained by foot surveys at Dream Creek, Brooks River, and Copper River.

Rainbow trout were captured for sampling by hook and line. Whenever possible, fish retained by anglers were included in the sample. Rainbow trout captured were measured for length, using rigid portable measuring boards. Standard fork lengths were recorded to the nearest millimeter (mm).

Numbered FD-67 internal anchor tags (Floy Tag Company) were inserted into the dorsal body musculature in such a manner the anchor section of the tags lodged between consecutive pterygiophores. Tags used on fish were green (Gibralter River) and blue (Copper River).

Scales taken for age determinations were selected from the left dorsal margin between the lateral line and dorsal fin insertion. Scales were cleaned and mounted on numbered gum cards and impressions made in 0.002 inch thick cellulose acetate cards (2.5 in. x 5 in.). Scale impressions were analyzed for age, using an overhead microprojector.

All available data related to age samples are presented. Due to illegible, regenerate, and inverted scales, differences appear between the numbers of scale samples collected and scales read.

All rainbow trout scales collected at Copper River were analyzed for age determinations. Ages of sampled rainbow trout were determined by counting annular rings from selected scales.

For the purpose of this study and for ease in field differentiation, subjective criteria was used for maturity categories as follows:

Maturing - Developing kype (male); abdominal contour full and round; silvery coloration; generally 400 mm+ in length (used during the fall to describe fish that would spawn the following spring).

Pre-spawner (male) - Fully developed kype; discharge of milt from anal vent; spawning coloration (dark) with pronounced spotting; abdominal contour full and round.

Pre-spawner (female) - Ovipositor tinted and distended; discharge of loose ripe eggs; spawning coloration (dark) with pronounced spotting.

Post-spawner or "spent" (male) - Abdominal contour concave; discharge of water milt; anal vent tinted; wounds and lacerations; frayed ventral and caudal fins; dark coloration.

Post-spawner or "spent" (female) - Abdominal contour concave; ovipositor distended and tinted; discharge of water and few or no eggs; frayed caudal and ventral fins; dark coloration.

Non-spawner and Immature - Kype absent (male); induced distension of ovipositor not possible; bright silvery coloration; anal vent not discolored; no scale loss or scale regeneration; no fraying of caudal or ventral fins.

The types of gear used by Copper River sport fishermen were identified and success of anglers using different gear types compared. For purposes of this comparison, flies and lures were defined as follows:

Flies - Terminal tackle constructed by methods known as fly tying, including nymphs, dry, wet, and streamer flies.

Lures - Terminal tackle other than flies (including spoons, spinners, jigs, plugs, and artificial bait).

Expansion of actual creel census data into total "estimated angler harvest and use" was accomplished by following a ratio proportion formula:

Angler Use: $\frac{\text{Anglers checked}}{\text{Angler hrs. checked}} = \frac{\text{Anglers observed}}{\text{Unknown (total angler hrs.)}}$

Angler Harvest: $\frac{\text{Anglers checked}}{\text{Rainbow checked}} = \frac{\text{Anglers observed}}{\text{Unknown (total rainbow harvest)}}$

FINDINGS

King Salmon

Subsistence Catch:

The estimated Naknek River king salmon, Oncorhynchus tshawytscha, subsistence catch for 1973 was 627. Information was received from 114 subsistence fishing permits. Issuance of subsistence permits for this river more than doubled (111.1% increase) between 1970-1973 with the harvest increasing 169.1% during the same period.

Commercial Catch:

During 1973 the Naknek-Kvichak commercial king salmon catch was 867 (Table 1). This harvest was 90.6% less than the 15-year average of 9,565, and the smallest since 1959 (Table 2). Two 12-hour fishing periods were allowed in the district during the emergency order period and was the least amount of commercial fishing time allowed in this district since statehood. The reduced commercial fishing time contributed to the low king salmon harvest since king salmon are harvested incidental to red salmon, O. nerka, fishing. As indicated in Table 1, the king salmon were harvested both before and following the emergency order period, June 23 to July 17.

Escapements:

The 1971-73 Naknek River aerial king salmon escapement estimates are presented in Table 3. The 1973 king salmon escapement into King Salmon Creek, a Naknek River tributary, was considered by the observer to be larger than reported due to the high and turbid water that contributed to poor counting conditions. The aerial king salmon escapements from 1971-1973 are comparable, though individual stream fluctuations are noted (Table 4).

TABLE 1. Naknek-Kvichak Commercial King Salmon Catch by Day from June 19 - August 2, 1973.

<u>Date</u>	<u>King Salmon Catch</u>	<u>Date</u>	<u>King Salmon Catch</u>
6/19	216	7/13	-
6/20	64	7/14	-
6/21	190	7/15	-
6/22	19	7/16	-
6/23	7	7/17	33
6/24	-	7/18	106
6/25	-	7/19	67
6/26	-	7/20	17
6/27	-	7/21	10
6/28	26	7/22	3
6/29	-	7/23	18
6/30	-	7/24	16
7/ 1	-	7/25	4
7/ 2	28	7/26	27
7/ 3	-	7/27	3
7/ 4	-	7/28	5
7/ 5	-	7/29	-
7/ 6	-	7/30	-
7/ 7	-	7/31	7
7/ 8	-	8/ 1	-
7/ 9	-	8/ 2	<u>1</u>
7/10	-		
7/11	-		
7/12	-		
		Total	867

TABLE 2. Summary of the Naknek-Kvichak District Commercial Catches of King Salmon, 1959-1973.

<u>Year</u>	<u>King Salmon Catch</u>	<u>Year</u>	<u>King Salmon Catch</u>
1959	15,298	1967	3,705
1960	17,778	1968	6,398
1961	10,206	1969	19,016
1962	8,816	1970	18,488
1963	4,713	1971	10,254
1964	12,267	1972	2,126
1965	8,045	1973	<u>867</u>
1966	5,497	15-year average	9,565

TABLE 3. Aerial King Salmon Surveyed Escapement Estimates for Naknek River, Paul's, King Salmon and Big Creeks, 1971-1973.

Surveyed River/Creek	Survey Date	Estimated King Salmon			Survey Comments
		1971	1972	1973	
Paul's Creek	7/28	52			Peak spawning
Paul's Creek	7/28		156		Prior to peak
Paul's Creek				0	Turbid water
King Salmon Creek	7/28	704			Peak spawning
King Salmon Creek			1,224		Peak spawning
King Salmon Creek	8/ 1			115	After peak and turbid water
Big Creek	8/13	490			After peak and turbid water
Big Creek	8/18		1,060		After peak
Big Creek	8/17			1,106	Peak spawning
Naknek River	8/26	1,620			Peak spawning
Naknek River	8/23		351		After peak
Naknek River	8/19			<u>1,315</u>	Peak spawning
Totals		2,866	2,791	2,536	

Alagnak (Branch River) Watershed:

Escapement:

King salmon escapements into the Alagnak River system have been aerially estimated since 1968. The aerial survey conducted on August 16 indicated an estimate of 824, and a range estimate of 825-1,250 king salmon. The survey was flown during the peak spawning period. The 1973 survey provided the lowest king salmon estimate of the six years surveyed (Table 4).

TABLE 4. Aerial King Salmon Escapement Estimates for Alagnak (Branch) River, 1968-1973.

<u>Year</u>	<u>Estimated Escapement</u>	<u>Year</u>	<u>Estimated Escapement</u>
1968	7,000-10,000	1971	1,400-1,500
1969	5,000- 7,000	1972	2,200-2,500
1970	4,600- 5,300	1973	825-1,250

Rainbow Trout

Copper River:

Rainbow trout investigations were conducted on Copper River during 1973 for the second consecutive year. Angler use and life history data were collected to further the Department's knowledge of these fish in relationship to the Trophy Fish Area.

Spring Spawning Activities:

The Copper River study commenced on May 18. On May 20, the water was high and murky from the spring freshet. On May 21 spawning rainbow trout were observed in section five (Figure 1) and one female rainbow trout captured was in pre-spawning condition. Observations indicated the fish were entering the system during the spring freshet.

Copper River was foot surveyed between May 31 and June 1 to visually determine the number of spawning rainbow trout. The observed spawning population of rainbow trout was 102 (Table 5) and estimated to be between 175 and 250 fish in total.

The 1973 observed rainbow trout spawning population of 102 was 83.8% less than the 1972 population of 630 (Table 5). Continued spawning surveys after June 1 indicated the May 31 through June 1 survey was near the spawning peak. The rainbow trout spawning peak was approximately one week earlier in 1973 than 1972. (Table 5).

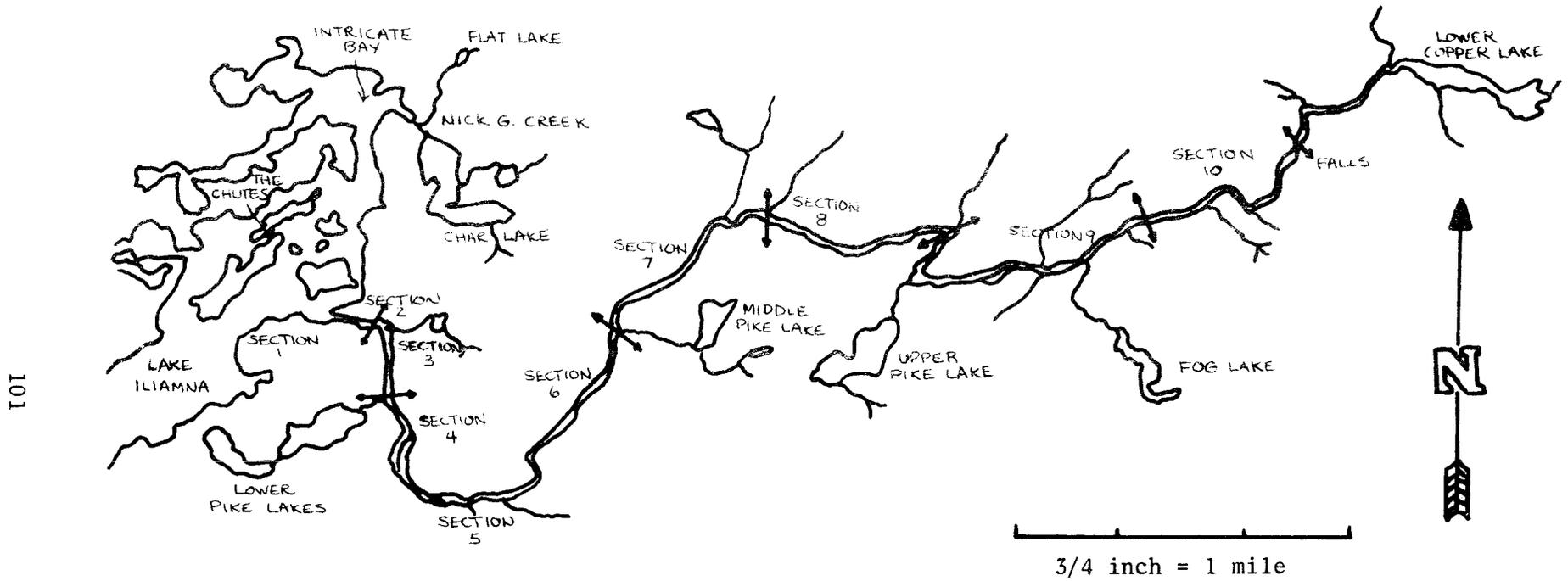


Figure 1. Rainbow Trout Sampling Areas, Copper River, 1972-73.

TABLE 5. Rainbow Trout Spawning Distribution by Section, Copper River, 1972*-1973**.

Section	Copper River				Total	
	East Side		West Side		1972	1973
	1972	1973	1972	1973		
1	-	-	-	-	-	-
2	0	-	0	-	0	-
3	0	0	0	0	0	0
4	0	3	10	1	10	4
5	141	13	54	22	195	35
6	111	15	46	15	157	30
7	33	0	16	1	49	1
8	7	3	34	14	41	17
9	40	2	70***	11	110	13
10	<u>40</u>	<u>2</u>	<u>28****</u>	<u>0</u>	<u>68</u>	<u>2</u>
Total	372	38	258	64	630	102

* Survey was conducted from June 5-7, 1972.

** Survey was conducted from May 31-June 1, 1973.

*** Includes 14 rainbow trout observed in a tributary stream.

**** Includes 1 rainbow trout observed in a tributary stream.

One hundred nineteen mature rainbow trout were sampled from the angler creel and from Department hook and line sampling during the season. The length frequency for this sample by sex is shown in Table 6.

TABLE 6, Spawning Rainbow Trout* Length Frequency by Sex, Copper River, 1972**-1973***.

Length	Sex by Spawner				Total	
	Males		Females		1972	1973
	1972	1973	1972	1973		
275 - 299	-	-	-	1	-	1
300 - 324	-	-	-	-	-	-
325 - 349	-	2	-	-	-	2
350 - 374	1	-	-	1	1	1
375 - 399	-	3	1	1	1	4
400 - 424	2	1	3	9	5	10
425 - 449	8	9	25	10	33	19
450 - 474	12	9	33	11	45	20
475 - 499	12	16	30	9	42	25
500 - 524	19	11	21	8	40	19
525 - 549	15	11	8	2	23	13
550 - 574	9	4	9	-	18	4
575 - 599	5	1	5	-	10	1
600 - 624	5	-	2	-	7	-
625 - 649	-	-	-	-	-	-
650 - 674	1	-	-	-	1	-
Total	89	67	137	52	226	119
Length Range (mm)	373-652	334-584	391-616	291-549	373-652	291-584
Mean Length (mm)	512	485	485	456	496	472

* Includes prespawners, spawners, and post spawners sampled by Department personnel during tagging program and from the sportsmen's creel.

** Samples were collected from May 15-October 9, 1972.

*** Samples were collected from May 21-September 25, 1973.

The total sample during 1973 was less than the 1972 sample. Both male and female mean lengths were smaller in 1973. The mean length for the 1973 males was 485 mm, or 27 mm less than the 1972 sample (512 mm). The female mean length for 1973 was 456 mm, or 29 mm less than the 1972 sample (485 mm). The total 1973 sample mean length was 472 mm, or 24 mm less than the 1972 sample. The length range for mature fish in 1973 was 291-584 mm. The male-to-female sex ratio was 67:52 (1:0.8).

The 1973 Copper River age frequency by sex for spawning rainbow trout is presented in Table 7.

TABLE 7. Spawning Rainbow Trout Age Frequency by Sex, Copper River, May 21-September 25, 1973*.

Age Class	Male		Female		Totals	
	No.	%	No.	%	No.	%
VII	3	7.0	1	2.5	4	4.8
VIII	8	18.6	14	35.0	22	26.5
IX	25	58.1	25	62.5	50	60.2
X	7	16.3	-	---	7	8.4
Totals	43	100.0	40	100.0	83	99.9

* Includes pre-spawners, spawners, and post spawners sampled by Department personnel during tagging program and from sportsmen's creel.

Of the 119 mature fish sampled, 83 (69.6%) had legible scales for age determinations. Ninety-three percent of the mature male fish were between ages VIII and X and ranged from age VII-X. Ninety-five percent of the mature female fish were ages VIII-IX and ranged from age VII-IX. There were no age X female rainbow trout.

Migration Patterns:

Immature rainbow trout were observed in lower section 3 on May 30 (Figure 1). These fish were also observed in 1972 entering Copper River during the same time period (Siedelman, et al., 1973). These fish were excluded from the spawning population estimate.

All migrational patterns observed during 1972 (Siedelman, et al., 1973) were also observed during 1973 with slight alterations in timing. Rainbow trout fry were first observed in section 7 on August 16, indicating an incubation and emergence period of approximately 77 days from the spawning peak to the first rainbow trout fry observation.

The fall run of rainbow trout appeared in the lower river area during the first week of September. Many of these silvery, robust rainbow trout will spawn during the spring of 1974. This year's influx of fall-run fish (approximately 50) was less than the 1972 immigration of 125-200 rainbow trout.

Age-length Relationship:

The total number of Copper River rainbow trout sampled by the Department hook and line collection and the sportsmen catch was 437. The length frequency by

sampling method is shown in Table 8. These fish ranged from 119-666 mm with a mean length of 365 mm.

TABLE 8, Rainbow Trout Length Frequency by Capture Method, Copper River, May 21-September 30, 1973.

Length (mm)	Capture Method		Total
	Hook & Line (Dept.)* (May 21 - Sept. 30)	Hook & Line (Sportsmen) (June 12 - Sept. 23)	
100 - 124	1	-	1
125 - 149	1	-	1
150 - 174	6	-	6
175 - 199	13	-	13
200 - 224	31	2	33
225 - 249	42	2	44
250 - 274	28	4	32
275 - 299	20	3	23
300 - 324	23	2	25
325 - 349	14	4	18
350 - 374	15	4	19
375 - 399	26	8	34
400 - 424	28	5	33
425 - 449	30	6	36
450 - 474	17	8	25
475 - 499	24	9	33
500 - 524	18	7	25
525 - 549	13	4	17
550 - 574	6	3	9
575 - 599	2	3	5
600 - 624	1	2	3
625 - 649	-	1	1
650 - 674	-	1	1
Total	359	78	437
Length Range (mm)	119-602	200-666	119-666
Avg. Length (mm)	351	433	365

* Includes 9 stream dead.

The age-length relationships of 359 rainbow trout selected from the 437 fish samples collected are shown in Table 9. Ages for this sample ranged from III-X and lengths from 119-666 mm. The mean length of fish aged is 354 mm. Ages VI-IX accounted for 87.2% of the total fish aged (Table 8).

Tag Recoveries:

One hundred ninety-six rainbow trout were tagged in Copper River during 1973 and, of these, 27 (13.8%) recovered prior to fall freeze-up. Four were recovered outside the river, three at Nick G. Creek and one at Chekok (Figure 2). Twenty-three recoveries were collected in Copper River, indicating inter-stream migration: upstream (6), downstream (8), or within the same area (9).

Seventeen tags from the 1972 tagging of 367 Copper River rainbow trout were recovered during 1973. To date, 45 (12.3%) of the 367 rainbow trout tagged in 1972 were recovered.

All fish recovered within the river after September 10 had migrated downstream from their tagging location. This late migrational pattern indicates the fish are moving lakeward prior to the late fall ice period. This late migration pattern was also noted during 1972 (Siedelman, et al., 1973).

Some rainbow trout noted as prespawner when tagged were later recovered "spent" within the river, indicating some fish remain in the river after spawning. This pattern was also noted during 1972 (Siedelman, et al., 1973).

Creel Census:

Copper River creel census activities were conducted from June 12, 1973, the opening day of fishing season, until September 30, 1973. The rainbow trout sport catch ratios, release ratios, and gear preference were determined. Retained fish were sampled for length, sex, and maturity.

A total of 219 anglers fished Copper River an observed 485 angler days. Of the 485 angler days observed, 454 (93.6%) were checked by Department personnel. A total of 1,030 rainbow trout were caught, of which 167 were retained for a retain-release ratio of 1:6. Rainbow trout catch per hour for the 1973, 111 day, creel census period was 0.49. The monthly creel census totals are presented in Table 10.

Table 8 presents the length frequency of 78 rainbow trout sampled from the angler creel. The angler retained fish ranged from 119-666 mm with a mean length of 365 mm.

The length frequency by age for 64 (82.1%) of the 78 rainbow trout recruited to the angler creel from Copper River is presented in Table 11. Ages ranged from IV-X, with 87.6% age VII and older.

Flies and Jures were the only terminal gear used on Copper River. The use of bait is allowed only from November 1 until the second Tuesday in June. Com-

TABLE 9. Rainbow Trout Length/Age Frequency as Determined from Hook and Line Samples, Copper River, May 21-September 30, 1973.

Length (mm)	Age Group								Total
	III	IV	V	VI	VII	VIII	IX	X	
100 - 124	1	-	-	-	-	-	-	-	1
125 - 149	1	-	-	-	-	-	-	-	1
150 - 174	1	5	-	-	-	-	-	-	6
175 - 199	-	10	-	-	-	-	-	-	10
200 - 224	-	17	13	-	-	-	-	-	30
225 - 249	-	2	34	3	-	-	-	-	39
250 - 274	-	-	8	20	-	-	-	-	28
275 - 299	-	-	-	17	6	-	-	-	23
300 - 324	-	-	-	7	15	-	-	-	22
325 - 349	-	-	-	4	13	1	-	-	18
350 - 374	-	-	-	-	10	8	-	-	18
375 - 399	-	-	-	-	6	22	-	-	28
400 - 424	-	-	-	-	3	21	2	-	26
425 - 449	-	-	-	-	-	19	7	-	26
450 - 474	-	-	-	-	-	5	13	-	18
475 - 499	-	-	-	-	-	5	17	-	22
500 - 524	-	-	-	-	-	-	19	-	19
525 - 549	-	-	-	-	-	-	9	5	14
550 - 574	-	-	-	-	-	-	2	2	4
575 - 599	-	-	-	-	-	-	1	1	2
600 - 624	-	-	-	-	-	-	3	-	3
625 - 649	-	-	-	-	-	-	-	-	-
650 - 674	-	-	-	-	-	-	-	1	1
Total	3	34	55	51	53	81	73	9	359
Length Range (mm)	119-173	150-235	200-268	229-335	281-420	338-493	419-618	528-666	119-666
Mean Length	146	200	235	280	338	412	496	562	354
Growth Increment (mm)		54	35	45	58	74	84	66	
%	0.8	9.5	15.3	14.2	14.8	22.6	20.3	2.5	100.0

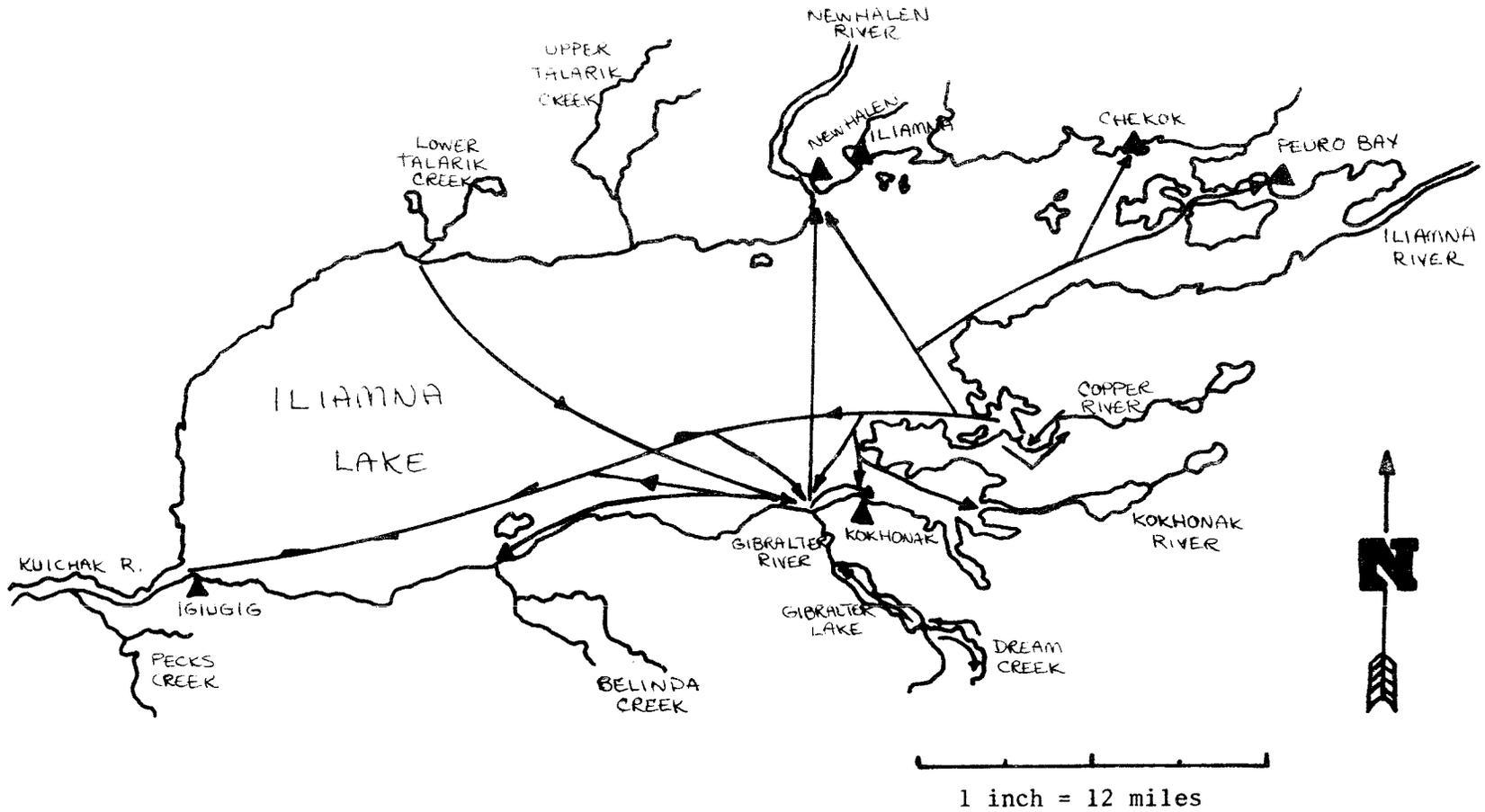


Figure 2. Copper and Gibraltar Rainbow Trout Migratory Patterns in Lake Iliamna from Tag Recovery Information 1971-73.

TABLE 10. Creel Census Totals by Month, Copper River, June 12-September 30, 1973.

	Months				Total
	June	July	August	September	
Total angler days observed	140	180	34	131	485
Total angler days checked	136	167	27	124	454
% angler days checked	97.1	92.8	79.4	94.7	93.6
Angler hours expended (actual)	618.0	776.0	95.5	482.0	1,971.5
Angler hours expended (expanded)	636.0	836.0	120.0	509.0	2,106.0
No. rainbow trout caught (actual)	258	450	82	167	957
No. rainbow trout caught (expanded)	266	485	103	176	1,030
Rainbow trout catch/hr.*	0.42	0.58	0.86	0.35	0.49
Rainbow trout retained (actual)	49	52	13	43	157
Rainbow trout retained (expanded)	50	56	16	45	167
Rainbow trout retained/caught	1/5	1/9	1/6	1/4	1/6

* Computed using expanded figures.

TABLE 11. Logler Caught Rainbow Trout by Length Frequency, Copper River, June 12-September 30, 1973.

Length (mm)	Age Group							Total
	IV	V	VI	VII	VIII	IX	X	
200 - 224	1	1	-	-	-	-	-	2
225 - 249	-	1	1	-	-	-	-	2
250 - 274	-	1	2	-	-	-	-	3
275 - 299	-	-	1	2	-	-	-	3
300 - 324	-	-	-	2	-	-	-	2
325 - 349	-	-	-	4	-	-	-	4
350 - 374	-	-	-	2	1	-	-	3
375 - 399	-	-	-	1	6	-	-	7
400 - 424	-	-	-	1	4	-	-	5
425 - 449	-	-	-	-	3	1	-	4
450 - 474	-	-	-	-	1	6	-	7
475 - 499	-	-	-	-	2	4	-	6
500 - 524	-	-	-	-	-	7	-	7
525 - 549	-	-	-	-	-	3	1	4
550 - 574	-	-	-	-	-	1	-	1
575 - 599	-	-	-	-	-	-	1	1
600 - 624	-	-	-	-	-	2	-	2
625 - 649	-	-	-	-	-	-	-	-
650 - 674	-	-	-	-	-	-	1	1
Total	1	3	4	12	17	24	3	64
Length Range (mm)	216	200-256	246-295	282-420	369-479	426-618	530-666	216-666
Mean Length	216	234	265	339	418	503	593	422
Growth Increment (mm)	18	31	74	79	85	90		
%	1.6	4.7	6.3	18.8	26.6	37.5	4.7	100.2

parative effectiveness of terminal gear used by anglers to catch rainbow trout in the river is presented in Table 12. All totals used are actual and obtained from anglers through Department conducted interviews.

Lure fishermen spent 995 hours fishing for rainbow trout in the river and fly fishermen 697 hours. Fly fishermen caught 0.66 fish/hour, and lure fishermen caught 0.35. Lure fishermen retained three times as many fish/hour as did fishermen (Table 12).

Naknek River:

An aerial survey was flown on May 7 to determine distribution and numbers of spawning rainbow trout in the Naknek River. One hundred thirty spawning rainbow trout were observed. The water was lower than during past seasons, forcing the fish from their more preferred spawning areas (Redick, 1967) into adjacent deeper shoals and rapid areas.

Brooks River (Naknek River System):

Brooks River, an interconnecting river draining Brooks Lake and flowing into Naknek Lake, was foot surveyed to estimate the river's rainbow trout spawning population. The survey conducted on June 4 was the first attempt by the Department to assess this river's rainbow trout spawning population. The river is approximately one mile in length and divided by a falls approximately 800 yards upstream. One hundred fifteen rainbow trout were observed spawning in the river. The major spawning areas are above the falls where approximately 90 fish were observed. Some redds were unoccupied, indicating the survey was conducted after the spawning peak.

Gibraltar River System:

Rainbow trout spawning ground surveys and sampling were conducted during 1973 in the Gibraltar River drainage. Life history data was collected to further the Department's knowledge of these fish in relationship to the Trophy Fish area.

Spring Spawning Activities

Three surveys (May 25, June 3, and June 11) were conducted on Dream Creek, a tributary of Gibraltar Lake, to estimate the rainbow trout spawning population and distribution.

The survey on May 25 indicated rainbow trout were moving into, and spawning in, Dream Creek. One hundred twelve fish were observed throughout this creek. The major spawning area is within the first 1.5 mile of braided stream area. Some spawners were observed in the upper creek area. No spawning rainbow trout were observed in Southeast Creek, an adjacent tributary to Gibraltar Lake, during this survey.

TABLE 12. Comparative Effectiveness of Terminal Gear Used by Anglers, Copper River, June 12-September 30, 1973.

<u>Angler Catch and Effort</u>	<u>Terminal Gear</u>			<u>Total</u>
	<u>Flies</u>	<u>Lures</u>	<u>Other*</u>	
Total angler hours	697	995	235	1,927
Total rainbow trout caught	463	353	98	914
Rainbow trout catch/hour	0.66	0.35	0.42	0.47
Total rainbow trout retained	28	117	18	163
Rainbow trout retained/hour	0.04	0.12	0.08	0.08

* Anglers using both flies and lures during a single day.

On June 8, Dream Creek was again surveyed from the mouth to the upstream end of the braided area (approximately 1.5 miles). Two hundred eighteen spawners were observed. This survey was conducted near the spawning peak.

The final spawning ground survey was conducted on June 11. Rainbow trout were still spawning, but most redds were unoccupied. Fish were observed moving downstream into the lower creek area and would evidently continue their migration into Gibraltar Lake.

A survey of Gibraltar River from July 23-27 indicated that spawning may also take place in Gibraltar River. Three spent rainbow trout carcasses were found on river bars and sampling yielded additional spent fish.

Sex and length frequency for 58 rainbow trout spawners collected in the Gibraltar River drainage is presented in Table 13. Mean length for 28 males and 30 female fish were 507 and 531 mm respectively. Male length ranged from 301-615 mm, and females ranged from 372-629 mm. The mean length for both mature male and female fish was 519 mm.

Age frequency by sex for rainbow trout spawning in Gibraltar River is presented in Table 14. Of the 58 mature fish sampled, 38 (65.5%) had legible scales for age determinations. More female rainbow trout scale samples were regenerate (64.3%) than male samples. Age samples for males ranged from VI-X and females from VII-IX. The majority (84.2%) of this river's spawning population was aged VIII-X. There appears to be more age X and XI spawning rainbow trout in Gibraltar River (29.0%) than in the Copper River (8.3%) spawning population. This may indicate that the Gibraltar River fish have not been exploited to the extent that the Copper River rainbow trout population has been exploited.

Migration and Timing

Dream Creek

No immature rainbow trout were noted in Dream Creek during the May 25 and June 8 surveys. Sampling during July 11-14 indicated that spawning, post spawning and immature fish were present in the creek.

Immature fish sampled during this survey ranged in length from 237-593 mm with a mean of 435 mm.

A survey conducted in Dream Creek on July 24 indicated the major groups of spent and large immature rainbow trout had apparently migrated downstream into Gibraltar Lake. These larger fish were replaced by numerous small rainbow trout from fingerling size to approximately 250 mm. Two spent rainbow trout were captured. Seventeen immature fish ranging from 132-362 mm, with a mean length of 248 mm, were collected. No sockeye salmon were in the stream, but were observed schooled off the stream mouth in Gibraltar Lake.

Dream Creek was surveyed on August 29 and again on September 22. On August 29 rainbow trout were observed interspersed with spawning sockeye salmon

TABLE 13. Rainbow Trout Length Frequency by Maturity, Gibraltar River Drainage, 1973.

Length (mm)	Male	Female	Immature & Developing	Unknown	Total
125-149	-	-	2	-	2
150-174	-	-	1	-	1
175-199	-	-	4	-	4
200-224	-	-	3	-	3
225-249	-	-	1	-	1
250-274	-	-	6	-	6
275-299	-	-	5	-	5
300-324	1	-	5	-	6
325-349	-	-	10	-	10
350-374	-	1	18	-	19
375-399	1	-	19	1	21
400-424	2	-	15	7	24
425-449	2	1	12	12	27
450-474	2	4	12	9	27
475-499	2	5	6	5	18
500-524	6	5	5	-	16
525-549	4	7	2	1	14
550-574	4	4	-	-	8
575-599	1	2	3	-	6
600-624	3	-	-	3	6
625-649	-	1	-	-	1
650-674	-	-	-	-	-
675-699	-	-	1	-	1
Total	28	30	130	38	226
Length range (mm)	301-615	372-629	132-690	377-615	132-690
Mean length (mm)	507	531	386	460	341

* Includes spawners and post spawners sampled by Department personnel during tagging program.

TABLE 14. Spawning Rainbow Trout Age Frequency by Sex, Gibraltar River, June 11-September 25, 1973*.

Age Class	Male		Female		Totals	
	No.	%	No.	%	No.	%
VI	1	4.3			1	2.6
VII	1	4.3	2	13.3	3	7.9
VIII	7	30.4	6	40.0	13	34.2
IX	8	34.8	2	13.3	10	26.3
X	6	26.1	3	20.0	9	23.7
XI	-	-	2	13.3	2	5.3
Totals	23	99.9	15	99.9	38	100.0

* Includes spawners and post spawners sampled by Department personnel during tagging program.

throughout the lower creek area, and numerous juvenile rainbow trout were observed in the creek area.

The survey conducted on September 22 indicated the juvenile rainbow trout had migrated from the stream. The sockeye salmon spawning was nearly complete and the numbers of rainbow trout remaining in the stream were fewer than observed during previous surveys. The remaining fish appeared to migrate downstream to Gibraltar Lake prior to freeze-up.

Southeast Creek:

During the June 11-14 survey, one immature rainbow trout was captured from Southeast Creek, although this stream was turbid from the spring run-off.

Twenty-three rainbow trout were sampled from Southeast Creek on July 24. The mean length for these fish was 458 mm. Nine were post spawners, 10 immature, and four undetermined. The fish were found throughout the lower one-half mile of the stream. The rainbow trout appeared to be entering with sockeye salmon presumably to feed on the eggs of spawning salmon.

Southeast Creek was surveyed on August 30 and September 22. A total of 28 rainbow trout were sampled in the lower mile of stream on August 30. Salmon spawning was nearly completed at this time. No juvenile rainbow trout were observed. The mean length of the rainbow trout sampled was 450 mm, and ranged in length from 388-578 mm. On September 22, the same area of stream was surveyed. No rainbow trout were caught and only two were observed. Viewing conditions were excellent. The rainbow trout had migrated downstream to Gibraltar Lake and sockeye salmon spawning was completed.

Gibraltar River:

From July 25 through July 27, Gibraltar River was surveyed. Thirty-one rainbow trout were sampled ranging in length from 185-607 mm and averaging 407 mm. Lake fish (dark back and silver sides) were found throughout the river area. The lower river area appeared to have more rainbow trout than the upriver area.

Arctic grayling, Thymallus arcticus, were collected for the first time in Gibraltar River, during this survey. There appears to be a very limited population of these fish in this drainage.

Gibraltar River was floated September 22 through September 25. A total of 44 rainbow trout were caught. They ranged in length from 190-690 mm, with a mean of 440 mm. The heaviest concentration of rainbow trout appeared to be in the lower two to three miles of river. Several large lake-run rainbow trout were observed in the lower quarter mile of river.

Age-Length Relationship

Age-length relationships of 193 rainbow trout selected from the 226 samples

collected are shown in Table 15. Ages ranged from III-XI and lengths from 132-690 mm. The mean length for fish aged was 421 mm. Ages VII and VIII accounted for 67.9% of the total fish aged.

The growth increment from ages III-X for both Copper and Gibraltar rivers' rainbow trout populations are comparable (Tables 9 and 15). These comparable growth patterns could be expected due to observed similarities between both drainages.

Tag Recoveries

Tags were affixed to 179 rainbow trout in the Gibraltar River drainage during 1973. Of these, 16 (8.9%) were recovered within the drainage. No recoveries have been reported from outside the drainage.

Three 1971 tags were recovered in Gibraltar River, two from fish previously tagged in Gibraltar River and one from a fish tagged at the outlet of Lower Palamak Creek (Figure 2).

Tag recoveries indicate some fish migrate from Dream Creek into Southeast Creek. Two fish tagged in Dream Creek were recovered in Gibraltar River, and three other fish were caught at the outlet of Gibraltar Lake, or head of Gibraltar River.

DISCUSSION

The 1973 Copper River rainbow trout spawning population of 102 was substantially below the 630 observed in 1972. Evaluating this reduction from two years' data is impossible but the population's migratory patterns may provide an index of abundance. Based on the low return of fall immigrants (125-200) observed in the lower river area (sections 3, 4, and 5) during 1972, it was felt that the 1973 spawning population would be low.

The 1973 immigration of the fall fish in the lower river area was estimated at 50 rainbow trout. If this relationship between the number of fall fish and spring spawners exists, the 1974 spring spawning population will be less than the 1973 return.

Sport fishing on these low stocks could be detrimental to the age classes represented in the spawning population, since all spawning fish do not drop out of the stream (fishery) into Lake Iliamna. The 1974 Copper River spawning population should be monitored closely to determine (1) the number of spring spawners, (2) the number of spring immigrant immature fish, and (3) if a sport fishery should be allowed in the stream.

Visual observations of a reduced rainbow trout population in Copper River is further substantiated by tag recoveries and angler use.

The percentage of tag recoveries during 1973 (11.2%) was higher than the percentage of tags recovered during 1972 (5.7%), indicating a smaller resident population in 1972.

TABLE 15. Rainbow Trout Length-Age Frequency as Determined from Hook and Line Samples, Gibraltar River, June 11-September 25, 1973.

Length (mm)	III	IV	V	VI	VII	VIII	IX	X	XI	Totals
125-149	1	-	-	-	-	-	-	-	-	1
150-174	-	1	-	-	-	-	-	-	-	1
175-199	-	4	-	-	-	-	-	-	-	4
200-224	-	-	3	-	-	-	-	-	-	3
225-249	-	-	1	-	-	-	-	-	-	1
250-274	-	-	4	2	-	-	-	-	-	6
275-299	-	-	1	3	1	-	-	-	-	5
300-324	-	-	-	4	2	-	-	-	-	6
325-349	-	-	-	1	8	-	-	-	-	9
350-374	-	-	-	-	19	-	-	-	-	19
375-399	-	-	-	-	15	4	-	-	-	19
400-424	-	-	-	-	6	16	-	-	-	22
425-449	-	-	-	-	2	22	-	-	-	24
450-474	-	-	-	-	-	22	-	-	-	22
475-499	-	-	-	-	-	14	3	-	-	17
500-524	-	-	-	-	-	-	8	-	-	8
525-549	-	-	-	-	-	-	7	3	-	10
550-574	-	-	-	-	-	-	-	4	2	6
575-599	-	-	-	-	-	-	-	4	1	5
600-624	-	-	-	-	-	-	-	4	-	4
625-649	-	-	-	-	-	-	-	-	-	-
650-674	-	-	-	-	-	-	-	-	-	-
675-699	-	-	-	-	-	-	-	1	-	1
Totals	1	5	9	10	53	78	18	16	3	193
Mean Length	132	186	245	303	372	446	517	582	571	421
Length Range	132	163-195	200-279	267-393	290-447	392-497	485-549	531-690	554-586	132-690
Growth Increment	54	59	58	69	74	71	65	-11		
%	0.5	2.6	4.7	5.2	27.5	40.4	9.3	8.3	1.6	100.1

Related to the reduced number of anglers, catch per hour, and increased percentage of tag recoveries, the fish population within the stream appeared to have been exploited in 1973 to a greater extent by anglers than the 1972 population. This is based on the assumption that the catchability of tagged fish remained the same.

Copper River observed angler pressure dropped from 833 in 1972 to 485 in 1973. Probable reason for this decrease was the availability of fish in the river.

The catch/hour for 1973 was 0.49 which was a reduction of 0.43 (53.3%) fish/hour. If the population is less in 1974 than during 1973, this downward trend in angling pressure and catch/hour will continue.

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