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STATE OF ALASKA
Keith H. Miller, Governor

ANNUAL REPORT OF PROGRESS, 1968 - 1969

FEDERAL AID IN FISH RESTORATION PROJECT F-9-1

SPORT FISH INVESTIGATIONS OF ALASKA

ALASKA DEPARTMENT OF FISH AND GAME
Wallace H. Noerenberg, Acting Commissioner

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INTRODUCTION

This report of progress involves the findings and work accomplished under the State of Alaska, Federal Aid in Fish Restoration, Project F-9-1, "Sport Fish Investigations of Alaska".

The work conducted during this reporting period constitutes effort on nine separate studies which are crucial in evaluating the sport fishing resources of the State. Recreational demands have necessitated broadening our knowledge of the fishery. All 20 jobs were of continuing nature enabling the Department to keep abreast of present and future impacts on certain fish species. Specifically, the work included work on inventory and cataloging of the sport fish and sport fish waters of the State, sport fishery creel census and access. Special emphasis was given to Dolly Varden, silver salmon, anadromous fish, grayling, salmon, sheefish, pike, and char. The information gathered has provided supporting documentation for better fish management and a basis for necessary future investigations.

The subject matter contained in these reports may be inconclusive. The findings and interpretation are subject to re-evaluation as the work progresses.

RESEARCH PROJECT SEGMENT

STATE: ALASKA

Project No: F-9-1

Job No: 16-B

Name: Sport Fish Investigations of Alaska.

Title: Investigations of the Tanana River and Tangle Lakes Grayling Fisheries: Migratory and Population Study.

Period Covered: July 1, 1968 to June 30, 1969.

ABSTRACT

Population estimates of Arctic grayling, Thymallus arcticus, were made for two sections of the Chena River with means of 452 and 657 grayling per mile calculated.

Efficiency of the A.C. boom shocker is discussed.

Creel census programs revealed 10,260 angler hours and 5,643 grayling harvested for the upper Chena; 14,114 angler hours and 11,633 grayling harvested at Badger Slough; 6,966 angler hours and 6,130 grayling harvested at Tangle Lakes; and 7,035 angler hours with a harvest of 7,048 grayling at the Salcha River.

Grayling fry were stocked in seven additional waters in 1968. Dissolved oxygen determinations and test netting revealed survival in oxygen concentrations down to 0.25 ppm. Yearling grayling were providing angling in several stocked waters.

Age and growth information was obtained from the upper and lower Chena River and the Tangle Lakes.

RECOMMENDATIONS

It is recommended that:

1. Grayling population estimation initiated in sections of the lower Chena in 1968 be repeated on an annual basis to follow population trends.

2. Techniques for population estimation developed in 1968 be applied to sections of the Badger Slough, Salcha River and Goodpaster River, and if feasible, to the Delta Clearwater River and Tangle Lakes system.

3. Periodic creel censuses be conducted on the Chena River, Badger Slough, Salcha River, and Tangle Lakes for comparison with 1968 creel census programs on these waters. Summer creel census of the Goodpaster River, Delta Clearwater River and spring creel

census of Shaw Creek, Mineral Lake outlet and other accessible grayling fisheries be conducted to further overall knowledge of Interior grayling utilization.

4. Concomitant to spring creel census efforts, locations for possible future grayling egg takes be sought.

5. Overwintering areas of grayling in the Chena River be located and the captured grayling be tagged to learn their intrastream movements.

6. Follow-up studies be conducted to further assess survival and growth of grayling experimentally introduced to various Interior waters. Additional grayling fry be stocked as suitable waters are located, and an experimental stock of grayling fry be introduced to Deadman Lake to assess survival in the presence of a pike population.

7. Additional life history data, especially age and growth information, be collected in conjunction with the above objectives.

OBJECTIVES

1. To develop techniques for estimation of the magnitude of the grayling populations in the Chena and Salcha Rivers, and determination of intrastream movements of grayling in these rivers.

2. To determine present angler utilization of the grayling in the Chena and Salcha Rivers and Tangle Lakes system.

3. To study the possible overwintering of grayling in the Chena River.

4. To continue evaluation of grayling stocking in lakes of various water quality and ecological characteristics.

5. Incidental to the above investigations, to collect additional grayling life history data whenever possible.

TECHNIQUES USED

Grayling for population and intrastream migration studies were captured by an A.C. boom shocker boat. This tool is essentially as described by Van Hulle (1968). During the season, several modifications were made to increase efficiency of this unit; the number of electrodes on the 16-foot cross boom was reduced from six to four to permit higher voltages in more conductive waters. The boom was converted to a single central boom extending 10 feet from the bow of a 20-foot river boat, with the cross boom hinged on either side of the central boom and held extended by shock cords. This permitted operation in more difficult areas where the cross boom could fold back if an obstruction was met.

All grayling over 145 mm in fork length were tagged with a numbered FD-67 internal anchor tag inserted in the dorsal musculature by means of an FD-67 tagging gun (Floy Tag Co.). Adipose fins were clipped from all tagged fish for tag-loss information and either the left pelvic (ventral) fin or adipose fin was clipped from all grayling smaller than 145 mm for future recognition.

Estimation of the grayling population in two sections of the lower Chena River was accomplished by a multiple tagging-and-recapture operation. The Schnabel method of population estimation was used as suggested by Mr. Sam Harbo, Biometrician, of the University of Alaska.

The Schnabel formula used is as follows:

X_i = number of marked animals captured in the i^{th} day.

Y_i = total number of fish captured on the i^{th} day.

M_i = total number of marked animals in the population on the i^{th} day (prior to that day's trapping).

$X = \sum_{i=1}^{n} X_i$ = the total number of recaptures through the n^{th} day.

$\lambda = \sum_{i=1}^{n} (Y_i M_i)$

then, N = estimate of population = $\frac{\lambda}{X + 1}$

The Chena River was divided into study sections as depicted in Figure 1 by Van Hulle (1968).

Estimates of angler usage of the Badger Slough and Chena Hot Springs Road area of the Chena River as well as the Tangle Lakes complex were made utilizing a randomized periodic angler count system. Counts were stratified to provide greater sampling during high-use periods, thus reducing variability. This method was also suggested and outlined by Mr. Sam Harbo. A creel census of the Salcha River was conducted utilizing counts of bank anglers and river boats and/or boat trailers. Only returns of completed anglers on all of the above creel censuses were used in computing catch statistics.

On the Chena Hot Springs Road creel census, a biologist and vehicle, together with a house trailer-check station, were provided through the cooperation of the Fish and Wildlife Service, River Basin Studies.

Dissolved oxygen determinations were made with a Hach OX 2-P drop titration kit. Gill nets used to sample grayling-stocked lakes were of monofilament construction, 125 by 6 feet with five graduated mesh sizes ranging from 1/2 inch to 2 1/2 inches square measure.

Aging of grayling scales was accomplished with a Bausch & Lomb microprojector.

Scales of fish larger than 100 mm were impressed on cellulose acetate with an Ann Arbor Roller Press prior to reading. Scales of fish smaller than 100 mm were mounted on glass slides.

FINDINGS

Population Estimation

All efforts to estimate grayling populations were confined to the Chena River to develop and test techniques and refine equipment. Two sections of the lower Chena River were selected for intensive study: the

approximately three-mile-long section from the confluence with the Little Chena River to the confluence with Badger Slough (Area 6) and the approximately five miles of river flowing through Fairbanks from the Wendell Street Bridge to the University Avenue Bridge (Area 2). These sampling areas were chosen to represent the lower river both above and below major sources of domestic and industrial pollution. Neither section is subject to heavy angler use. These sections will be used in future assessment of grayling population trends in the lower river.

Sampling by shocker boat was conducted on much of 95 miles of river downstream from the 37.7 mile bridge on the Chena Hot Springs Road; however, no population estimates were made on areas other than the above-listed test sections as the cost-benefit ratio does not justify such extensive sampling at present.

Utilizing a standard Schnabel formula, a summer population of 1,357 grayling (90 percent confidence range 1,096 to 1,828) or a mean of 452 per mile was calculated for Section 6. In Section 2, a total of 3,286 grayling (90 percent confidence range 1,887 to 5,804) or a mean of 657 per mile was calculated as summer residents.

Only yearling and older grayling were included in the estimates as young-of-the-year grayling did not begin to appear in these sections of river until mid-August.

Intrastream Movements

Chena River:

Validity of the Schnabel estimate depends on a static population or one in which ingress approximates egress. Summer intrastream grayling movements were estimated from tagging and recapture in the test sections and in other areas of the river. Angler recaptures were also used to assess intrastream movements.

Of the 1,743 grayling captured with the boom shocker in 1968, 1,057 were tagged with internal anchor tags. Recaptures of these tagged grayling totaled 136. Ninety-eight (72.1 percent) of these grayling were recaptured in the section of river where tagged. Eleven (8.1 percent) exhibited an upstream movement and 27 (19.8 percent) moved downstream. The greater downstream movement may partly reflect our practice of releasing fish at the lower end of the tagging section. All recaptures not made in the section where tagged were from adjacent areas. No grayling moved more than a few miles from the point of tagging. Twenty-four grayling were recaptured twice, three grayling three times, and one was recaptured four times. One tag loss was recorded from 1968 tagged grayling.

Evidence of a fairly static summer population was also obtained from recapture of grayling tagged in 1967. Of the 303 grayling tagged in 1967, 11 were reported captured by anglers in 1967. Out of 292 possible grayling remaining, 32 (10.9 percent) were recaptured in 1968. Two tag losses (6.25 percent) of the 32 recaptures were noted: one tag was unreadable and one recapture area was not recorded by the angler.

Of the remaining 28 grayling, 17 (61 percent) were recaptured in the same section as tagged, six (21 percent) showed upstream movement, and five (18 percent) moved downstream.

Chatanika River:

A weir was constructed on the Chatanika River downstream from the Elliott Highway bridge in August, 1968. The weir was designed principally to provide information on sheefish, Stenodus leucichthys, as described by Alt (1969); however, grayling migrations were also monitored by the weir. The recorded pattern of fall grayling movement in most streams is one of downstream migration (Reed, 1961).

From August 10 to 31, 90 grayling were passed through the upstream trap and approximately 250 were checked through going downstream.

In September, chiefly in the three-day period of September 27 to 29, 873 grayling were checked through the upstream trap. This migration coincided with a large upstream spawning migration of whitefish. The grayling probably followed whitefish spawners to prey on eggs. Freeze-up necessitated the dismantling of the weir before the return downstream of either the whitefish or the grayling.

Boom Shocker Efficiency:

Efficiency of the boom shocker was improved considerably since 1967, both through modification and through increased experience in operation. During 1967 a mean of 32.3 fish per hour, including 11.7 grayling, were captured with the boom shocker in the Chena River (Van Hulle, 1968). In 1968 the boom shocker was operated in the Chena River for a total of 42.3 hours, with a mean capture of 41.2 grayling per hour.

The latest modification of the boom shocker unit with flexible boom raised the mean efficiency to 56.7 grayling per hour. For comparison, the capture rate of the grayling project crew using hook and line in several Tanana drainage streams in 1960 was 4.1 grayling per man hour (Reed, 1961).

Immobilization of grayling with the boom shocker was marginal until a voltage of 200+ was achieved. Amperage was less important, with amperages from 2 to 10 allowing efficient capture of fish in various waters. In addition to grayling, other fish captured by the boom shocker in 1968 included slimy sculpin, Cottus cognatus, round whitefish, Prosopium cylindraceum, least cisco, Coregonus sardinella, burbot, Lota lota, brook lamprey, Lampetra lamottei, northern sucker, Catostomus catostomus, broad whitefish, Coregonus nasus, humpback whitefish, C. lavaretus, sheefish, northern pike, Esox lucius, chum salmon, Oncorhynchus keta, and silver salmon, O. kisutch.

Seven grayling were killed during the 1968 shocking and tagging operations. These mortalities were due to improper tagging or handling; none were attributable to immobilization by electrofishing. To test lethal effects of the boom shocker, a two-pound whitefish was subjected to repeated exposure to a field of 250 volts and 3 amps for a total of approximately 90 seconds. The fish could not be revived, and autopsy revealed internal hemorrhages caused by repeated muscle tetany.

Angler Utilization

Chena River:

Two principal areas of the Chena River system were selected for intensive creel census because of high angler utilization. These were the Badger Slough, a small tributary of the lower Chena which is readily accessible to anglers for approximately 10 miles, and the section of the main Chena River and North Fork that parallels the Chena Hot Springs Road for approximately 27 miles. A check station was located at Mile 26.5 Chena Hot Springs Road, at which point the upper river becomes readily accessible to the roadside angler.

A program of randomly selected angler counts was developed to measure total hours of angler utilization. Each day was divided into nine two-hour periods from 4:00 a.m. to 10:00 p.m. Sampling was stratified to provide a more intensive census on weekends and holidays and for periods after 10:00 a.m. when angling pressure was greatest. Only interviews of anglers who had completed fishing were used to compute grayling catch and hours per trip. Of the calculated 2,714 anglers utilizing this portion of the Chena River, 904 were interviewed or filled out questionnaires upon completion of fishing. Table 1 presents creel census data from the Chena Hot Springs fishery.

TABLE 1 - Creel Census Results on Chena Hot Spring Road, May 1 to September 2, 1968.

Period	Angler Hours		
May 1 - 19	662	No. of Angler Trips	2,714
June 1 - 28	2,433	Mean Hours/Angler Trip	3.78
June 29 - August 2	4,984	Total Grayling Catch	5,643
August 3 - September 2	2,181	Grayling/Angler Hour	0.55
		Angler Composition:	
Total Angler Hours	10,269	Local Non-Military	64.1%
		Local Military	21.8%
		Tourist	14.1%

Included on the creel census form used in the Chena Hot Springs Road area was the question "Did you have a successful trip?" Table 2 lists the response to this question.

TABLE 2 - Angler Response to Question "Did you have a successful trip?" Chena Hot Springs Road Area, 1968.

	Yes (%)	No (%)
Total anglers responding - 575		
No Fish/Angler	159 (73.2)	57 (26.8)
Less than 1 Fish/Angler	102 (87.9)	14 (12.1)
1+ - 2 Fish/Angler	62 (91.2)	6 (8.8)
2+ - 3 Fish/Angler	41 (95.3)	2 (4.7)
3+ - 4 Fish/Angler	45 (97.8)	1 (2.2)
4+ Fish/Angler	86 (100)	0 (0.0)
Total	495 (86.1)	80 (13.9)

The high percentage (86.1 percent overall) of satisfied respondent anglers was surprising, especially since 86.2 percent of the total anglers were local residents, and the road beyond the check station is gravel and in rather poor condition. It is apparent from this that a majority of anglers here consider the fishing as only a minor part of the outing.

A flood control dam has been proposed for the Chena River. The probable location for this dam would flood the river from approximately the location of the creel check station (Mile 26.5) to the first bridge (Mile 37.7). To assess the minimum loss of river fishing that would result if the dam was constructed, note was taken of the area where each angler fished. An estimated 5,038 angler hours (49.1 percent of the total angling effort) was expended in the area preceding the first bridge.

Table 3 presents data from the 1968 Badger Slough creel census. The Badger Slough has one of the earliest grayling fisheries to commence in the Fairbanks area each spring, and the angler success rate early in the season is one of the highest in the area, averaging 1.27 grayling per angler hour in April, 1968. Both catch rate and angler utilization diminish as the season progresses and very little use of the fishery was noted after mid-July.

TABLE 3 - Creel Census Results on Badger Slough, April 17 to July 15, 1968.

Period	Angler Hours		
April 17 - 30	3,142	No. of Angler Trips	7,574
May 1 - 31	5,828	Mean Hours/Angler Trip	1.86
June 1 - 28	4,050	Total Grayling Catch	11,633
June 29 - July 15	1,094	Grayling/Angler Hour	0.82
		Angler Composition:	
Total Angler Hours	14,114	Local Military	57.5%
		Local Non-Military	37.8%
		Tourist	4.6%

It is doubtful if any appreciable grayling spawning activity takes place in Badger Slough. The high angler utilization failed to reveal the presence of significant numbers of mature fish during the spawning season. The average length of angler-caught grayling was approximately 200 mm.

The proximity of Badger Slough to Fort Wainwright and Eielson Air Force Base makes it popular with military personnel, as evidenced by the 57.5 percent of total fishermen being military.

The combined angler utilization of the Chena Hot Springs Road area and Badger Slough in 1968 is calculated at 24,374 angler hours. Considerable fishing also takes place at other locations on the river, and the usage noted at Badger Slough and Chena Hot Springs Road is probably not more than half of the total yearly angling effort for the entire Chena River system.

The computed variances of estimated man hours of angling were different for each area and time period due to unequal sampling of the various strata; however, the overall variance was not more than 25 percent at the 90 percent confidence interval.

Tangle Lakes:

The Tangle Lakes are a river-lake complex at Mile 22, Denali Highway. Several camping areas are located here and the area is a popular stop-over for people traveling to McKinley Park, as well as for people who come to angle for grayling and lake trout, Salvelinus namaycush.

A creel census station was operated at the Tangle Lakes from June 22 through September 2. Results of this creel census are presented in Table 4.

TABLE 4 - Summary of Tangle Lakes Creel Census, 1968.

Period	Angler Hours Weekdays	Hours Weekends and Holidays
June 22 - July 12	583	1,303
July 13 - September 2	2,607	2,473
Total	3,190	3,776

Total Angler Hours,	6,966
Total Angler Trips,	1,924
Man Hours/Angler Trip,	3.62
Total Grayling Catch,	6,130
Grayling Catch/Man Hour,	0.88
Total Lake Trout Catch,	348
Lake Trout/Man Hour,	0.05

Catch per man hour, total catch, and angler composition were computed from 1,098 completed angler interviews. Man hours of fishing from July 13 to September 2 was based on randomized hourly angler counts, stratified to provide increased sampling during higher use periods. Man hours of fishing prior to July 13 was based on angler counts, not totally randomized, and angler interviews.

On July 23 the section of the Tangle River adjacent to the campground area was closed for the remainder of the season for construction of new boat launching facilities on Long Tangle Lake and enlargement of picnic and camping facilities. The area closed was popular with anglers and accounted for 27.3 percent of the boat anglers and 45.6 percent of the bank anglers, or 39.9 percent of the total fishing effort prior to its closure.

Table 5 summarizes angler composition and success at the Tangle Lakes in 1968.

The high percentage of tourists (25.9 percent) using this fishery is undoubtedly due to its location on the main access route to McKinley Park.

It is apparent that boat anglers had some advantage in catching grayling and a great advantage in catching lake trout. Although not shown in the table, boat anglers also caught larger fish on an average than bank anglers. Despite the excellent fishing experienced by most anglers, 27 percent of the total anglers took no fish. This is due in part to the

preference of some anglers for concentrating on lake trout, with their low capture rate, and to a relatively large number of anglers who were unfamiliar with the area or with grayling fishing techniques.

TABLE 5 - Angler Composition and Success, Tangle Lakes, 1968.

Resident Non-Military	44.8%
Resident - Military	29.3%
Tourist	25.9%
Boat Anglers	56.6%
Bank Anglers	43.4%
Grayling/Boat Angler	3.42
Lake Trout/Boat Angler	0.25
Boat Anglers Catching No Fish	24.6%
Grayling/Bank Angler	2.88
Lake Trout/Bank Angler	0.09
Bank Anglers Catching No Fish	30.1%

The question "Did you have a successful trip?" was asked Tangle Lakes anglers as it was Chena River anglers. Results of this questionnaire are listed in Table 6.

TABLE 6 - Angler Response to Question "Did you have a successful trip?" Tangle Lakes, 1968.

	Yes (%)	No (%)
Total anglers responding - 329		
No Fish/Angler	11 (40.7)	16 (59.3)
Less Than 1 Fish/Angler	32 (86.5)	5 (13.5)
1+ - 2 Fish/Angler	27 (90.0)	3 (10.0)
2+ - 3 Fish/Angler	39 (92.9)	3 (7.1)
3+ - 4 Fish/Angler	32 (100)	0 (0)
4+ Fish/Angler	156 (96.9)	5 (3.1)
Total	297 (90.3)	32 (9.7)

While fishing success was considered to be slightly more important in the overall trip to Tangle Lake anglers than to Chena Hot Springs Road anglers, it is evident that most anglers at Tangle Lakes are also satisfied with a limited number of grayling in the creel.

Salcha River:

The Salcha River, 40 miles south of Fairbanks, is an important tributary of the Tanana River. The Salcha is crossed near its confluence with the Tanana by the Richardson Highway. No other roads cross the river and summer access to the upper river is solely by riverboat or airplane.

A creel census program was conducted at the Salcha River from May 5 to August 18, 1968. A summary of this census is presented in Table 7. Census forms from 175 boat anglers and 32 bank anglers who had completed fishing were used in computing hours per angler and grayling per hour. Counts were made of bank anglers, boats and boat trailers parked at the only boat launching facility on the river to compute angler hours. A mean of 3.64 anglers per boat was established and used in computing angler hours and total anglers.

TABLE 7 - Salcha River Creel Census, May 5 to August 18, 1968.

Total Anglers	2,013
Angler Hours	7,035
Total Grayling	7,048
Grayling/Angler Hour	1.00
Number Boat Anglers	1,358
Boat Angler Hours	5,909
Total Grayling	6,395
Grayling/Angler Hour	1.04
Number Bank Anglers	655
Bank Angler Hours	1,126
Total Grayling	653
Grayling/Angler Hour	0.58

Boat fishermen, many who reported fishing 30 to 120 miles upstream, were far more successful than bank anglers. Many boat fishermen spent several days at a time upriver at their cabins or camping and fished only periodically. After August 18, nearly all river boating was connected with moose hunting, although some angling undoubtedly still occurred.

Several salmon anglers were noted, but no salmon were observed caught despite an excellent salmon run in the Salcha as reported by the Division of Commercial Fisheries. The low number of salmon taken near the bridge may be due in part to the newly constructed highway bridge altering a pool formerly used by migrating salmon.

The 1963 and 1964 creel census results on the Salcha River are presented in Table 8 for comparison with 1968 findings. Due to the relatively short time the 1963 and 1964 creel censuses were in effect, total grayling catches were not comparable; however, a comparison of catch per angler hour between 1968 and 1963-64 shows that fishing success for grayling has not diminished and even appears considerably greater in 1968.

Overwintering - Chena River

Large numbers of grayling were captured through the ice at Mile 25 on the Chena River in March and April, 1967 (Van Hulle, 1968). On March 1, 1968, four sexually mature grayling were captured at the same location, again verifying the presence of grayling here at least two months prior to spring break-up.

TABLE 8 - Salcha River Creel Censuses, 1963 and 1964.

Period	Total Anglers	Angler Hours	Total Grayling	Total Salmon	Fish/ Angler Hour
7/13 - 8/4/63	275	---	1,294	89	0.67*
7/21 - 8/16/64	409	1,816	1,175	--	0.64

*Includes salmon.

Efforts to capture grayling farther up river at Mile 62 and Mile 95 during the winter of 1968-69 were unsuccessful. Thick ice cover and low water flow combined to make impossible the setting of 2 foot deep gill nets. No angling efforts were expended here.

Immediately prior to freeze-up in 1968, a gill net was set across the Chena River at its confluence with the Tanana River. No grayling were captured in a 24-hour period; thus, no outmigration at that time could be demonstrated.

GRAYLING INTRODUCTIONS

During 1967 nine waters were stocked with grayling fry to test survival and growth under various dissolved oxygen conditions (Roguski and Spetz, 1968). Results of test netting these waters, together with the lowest D.O. recorded in each water subsequent to stocking, are presented in Table 9. No further survival under conditions of no measurable D.O. was noted as in 1966 (Roguski, 1967). Netting was often limited to a 15- or 30-minute period to avoid decimating large numbers of grayling observed in the lakes. During 1968 considerable angler utilization of the yearling grayling was noted on Otto's, Big and Left O.P. Lakes and 31-Mile Pit.

In 31-Mile Pit, grayling overwintered only in a small pond which was connected to the main pond during periods of high water. No dissolved oxygen determinations were made on the small pond in 1968. In 1969 the small pond was found to retain a small concentration of dissolved oxygen somewhat longer, but both ponds were depleted by early March (Table 10). Table 10 lists D.O. determinations made on the seven waters stocked with grayling fry during 1968 as well as 1967 stocked waters. The excellent survival of grayling in Otto's Lake prompted a secondary stocking of fry in 1968 to test their survival with an established population already present. Initial observed predation was high, but a resort owner on the lake reported the presence of "many small grayling" in late summer, along with the yearling grayling. The severe winter of 1968-69 caused a total D.O. depletion of Otto's Lake by late March, and loss of both year classes is probable.

Big and Left O.P. Lakes exhibited good D.O. levels despite the extremely cold winter of 1968-69; the probable reason for this was their exposure to winds that left much of the surface free of snow, allowing the ice to transmit enough light for photo-synthetic oxygenation.

TABLE 9 - Results of Netting Waters Stocked with Grayling in 1967.

Lake	Lowest Measured D.O. (ppm)	Date	Grayling Captured*	Size Range (mm)	Mean Length (mm)	Date Captured
Big Lake	4.0	3/6/68	A) 8	170 - 195	184	6/25/68
Craig #1	1.0	4/21/68	A) 9	135 - 170	150	6/19/68
Craig #2	0.25	4/21/68	A) 4	85 - 95	90	6/19/68
Left O.P. Lake	1.5	3/6/68	B) 9	180 - 190	188	6/25/68
Miller's Pond	0.0	4/9/68	C) 0			
Otto's Lake	0.5	2/21/68	C) 43	135 - 200	181	6/11/68
Sergeants Pond	3.0	3/12/68	C) 7	174 - 184	179	6/7/68
31-Mile Pit	0.5	3/12/68	D) 17	145 - 147	146	6/7/68
Dot Lake	0.0	3/19/68	C) 0			

*A) 25' 1/2" Mesh, 25' 1" Mesh Gill Net - 30 min.
B) 25' 1/2" Mesh, 25' 1" Mesh Gill Net - 15 min.
C) One 125' Graduated Mesh Gill Net - 24 hrs.
D) One 125' Graduated Mesh Gill Net - 21 hrs.

TABLE 10 - Dissolved Oxygen of Grayling Stocked Waters, 1968-69.

Name	Date	Sample Depth	Snow Depth	Ice Depth	D.O. (ppm)
ARR Pit #3**	1/27/69	3'	20"	19"	1.0
		5'			
ARR Pit #4**	1/27/69	3'	14"	28"	0.8
		8'			0.0
Bailey Pond **	2/6/69	3'	15"	22"	8.5
		5'			8.0
		10'			8.0
Big Lake*	3/6/69	3'	Drifted	36"	2.5
		8'	Patches		1.5
Craig #1	4/21/68	5'	3"	28"	1.0
		10'			0.25
	1/23/69	5'	11"	25"	5.0
		10'			5.0
		20'			4.5
	2/7/69	5'	11"	25"	4.0
		10'			3.0
		15'			0.5
Craig #2*	4/21/68	3'	3"	31"	0.25
		6'			0.25
	1/23/69	5'	11"		2.5
		10'			2.5
		20'			1.5
	3/7/69	5'	13"	25"	1.0
		10'			0.5
		15'			0.4
East 19 Mi. Pit**	2/11/69	3'	19"	19"	3.25
Engineer Hill Lake**	4/12/68	Sur.	6"	26"	5.0
		7'			0.4
		10'			0.4
	1/30/69	5'	11"	21"	5.5
		10'			2.0
Left O.P. Lake*	4/7/68	Sur.	Trace	16"	3.0
		7'			5.0
		14'			1.0
	3/6/69	5'	Trace	43"	2.0
Miller's Pond*	4/9/68	Sur.	13"		0.0
		9'	27"		0.0
Otto's Lake ***		2'	0	22"	5.0
		4'			5.0
	2/11/69	6'	7"	45"	0.7
	3/20/69	4'	Drifted	52"	0.0
		6'	Patches		0.0

TABLE 10 (Cont.) - Dissolved Oxygen of Grayling Stocked Waters, 1968-69.

Name	m, Date	Sample Depth	Snow Depth	Ice Depth	D.O. (ppm)
Sergeants Pond*	4/9/68	Sur.	6"	29"	4.0
		7'			1.0
Summer Shade Pond**	2/11/69	3'	9"	27"	1.75
31-Mile Pit*	1/24/69				
Large Pond		3'	19"	15"	0.0
		5'			0.0
Small Pond		3'	19"	15"	0.8
		5'			0.8
	3/6/69	3'	7"	24"	0.0

*Stocked in 1967.
**Stocked in 1968.
***Stocked in 1967 and 1968.

Age and Growth

During 1968, age and growth data was collected in three areas, the lower Chena and upper Chena Rivers and the Tangle Lakes.

Chena River:

Length frequency of 1,743 grayling captured in the lower Chena River from June 17 to August 14 by shocker boat is depicted in Figure 1. Young-of-the-year grayling did not appear in this portion of the river until nearly the end of the sampling period. Although no grayling larger than 360 mm were captured with the shocker boat, this tool was efficient in capturing suckers, whitefish, pike, salmon, and sheefish larger than grayling. Thus, it is highly probable that few grayling larger than the maximum size taken by shocker boat are present in the lower river during midsummer.

In contrast to this, Figure 2 shows the length frequency of 232 grayling taken by anglers from the upper Chena River. This length distribution may be biased by inconsistency in sampling; a tendency to measure more of the larger fish being probable. However, the maximum length of these fish is approximately 46 mm greater than that of grayling from the lower river. Many of the largest measured grayling were captured in the headwater tributaries of the North Fork, substantiating the tendency of larger fish to summer in the upper reaches of the river.

Table 11 presents age and growth data from 117 grayling selected to represent approximately equally the length range of all Chena River grayling sampled in 1968. Aging by scale reading was quite reliable up to age class IV+ but begins to lose validity after that. No fish older than age class VII+ were recorded, although misinterpretation of annuli may exist.

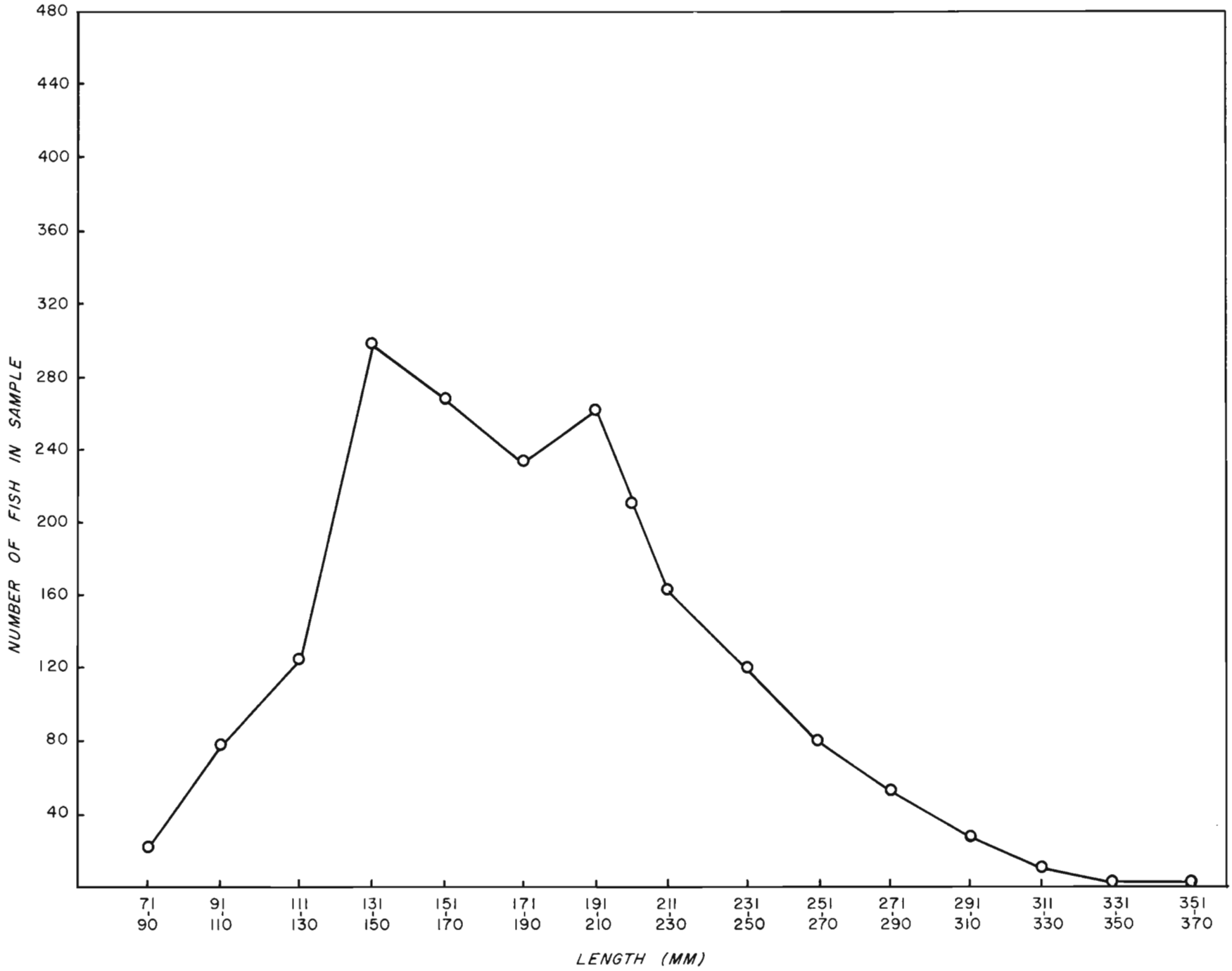

FIGURE 1. LENGTH FREQUENCY OF 1,743 GRAYLING CAPTURED IN THE CHENA RIVER BY SHOCKER BOAT, 1968.

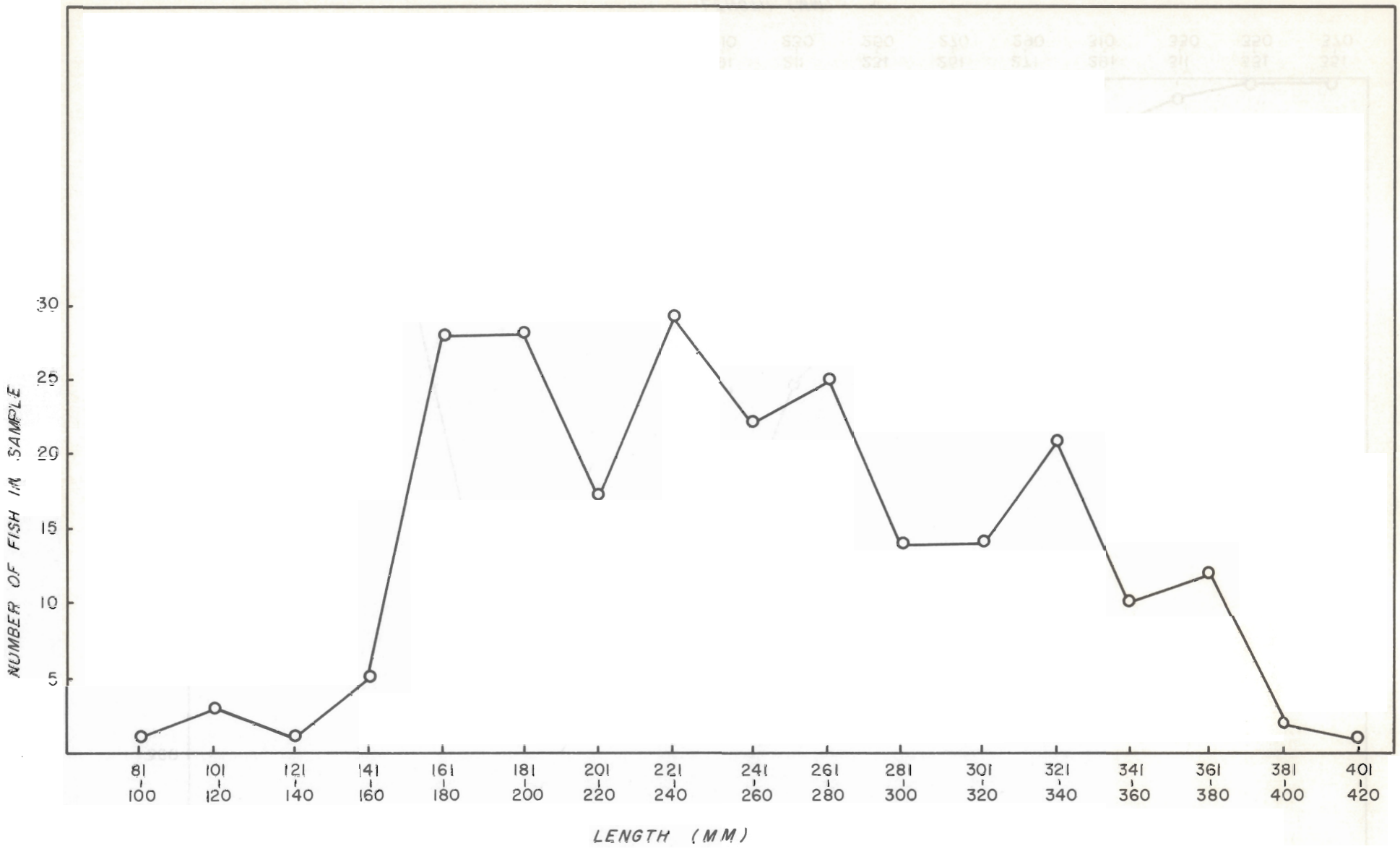

FIGURE 2. LENGTH FREQUENCY OF 232 CHENA HOT SPRINGS ROAD ANGLER-CAUGHT GRAYLING, 1968.

TABLE 11 - Age and Growth of Chena River Grayling Collected From June 17 to August 14, 1968.

Age	Length Range (mm)	Mean Fork Length (mm)	No. in Sample
0+	68 - 79	73.4	10
I+	83 - 130	103.4	24
II+	108 - 178	149.9	28
III+	170 - 255	213.5	29
IV+	202 - 295	254.8	15
V+	282 - 295	289.0	3
VI+	296 - 315	303.7	6
VII+	357 - 387	372.0	2
Total			117

Tangle Lakes:

A total of 279 angler-caught grayling was sampled to demonstrate the length frequency of Tangle Lakes grayling in Figure 3. The maximum length of this sample closely resembles that of the upper Chena River grayling; however, a pronounced mode of 250 mm for Tangle Lakes grayling was not evident in the upper Chena River grayling. Average size of Tangle Lakes fish was somewhat greater than upper Chena River grayling and considerably greater than lower Chena River grayling.

Table 12 depicts the age and growth in length of 133 Tangle Lakes grayling selected to represent (nearly equally) the various size classes. Few fish in the I+ and VII+ age classes enter this fishery. As with the Chena River, no fish older than VII+ were detected, but difficulty in properly assessing age of older fish exists. The first annulus of the sampled fish was frequently obscure, especially in older fish, thus adding to difficulty of assigning age classes.

TABLE 12 - Age and Growth of Tangle Lakes Grayling, 1968.

Age	Length Range (mm)	Mean Fork Length (mm)	No. in Sample
I+	114 - 146	127.0	3
II+	175 - 229	200.0	41
III+	210 - 310	256.1	37
IV+	256 - 339	305.1	26
V+	335 - 371	346.8	10
VI+	345 - 400	368.0	11
VII+	374 - 406	391.6	5
Total			133

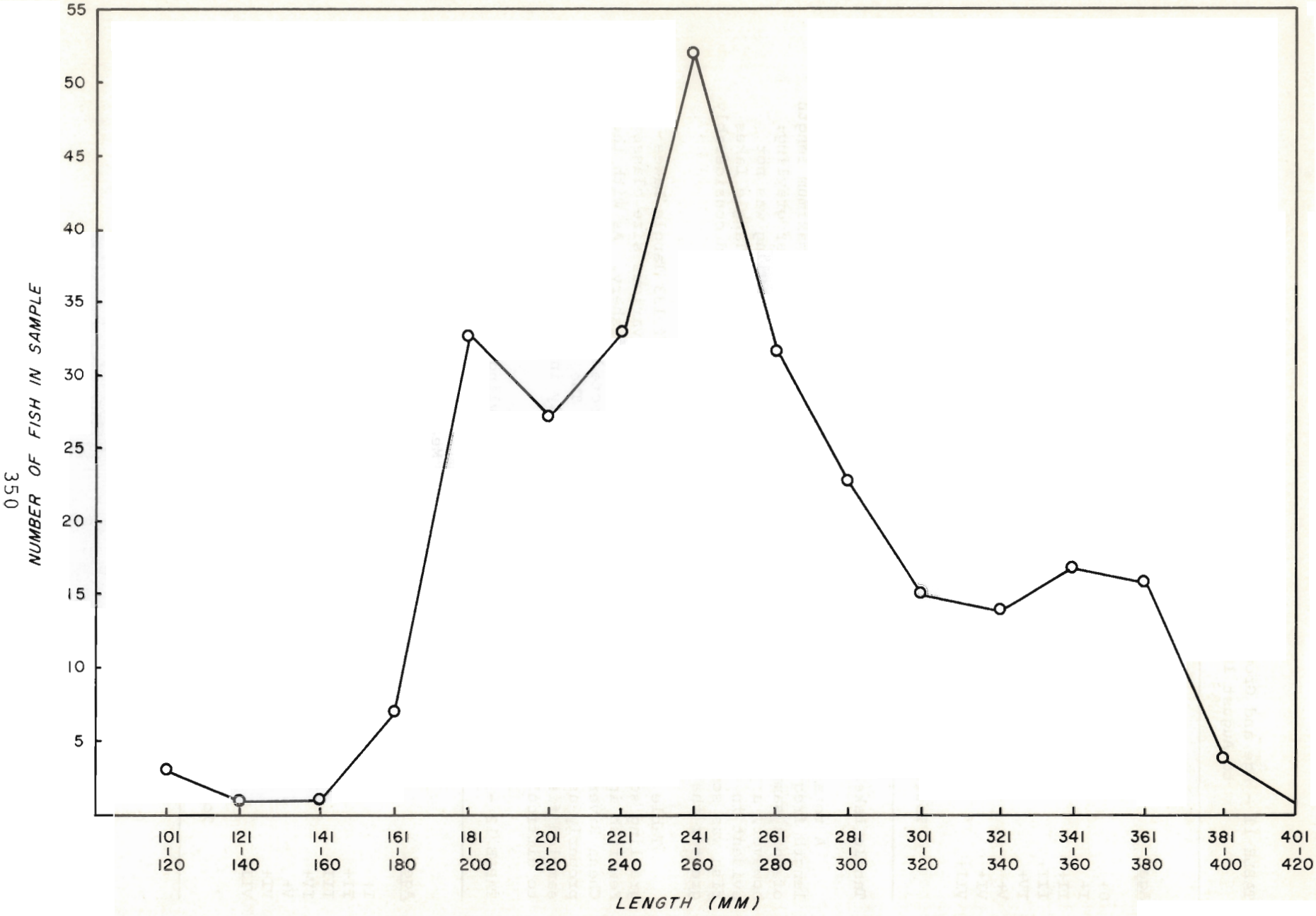

FIGURE 3. LENGTH FREQUENCY OF 279 ANGLER-CAUGHT GRAYLING IN TANGLE LAKES, 1968.

LITERATURE CITED

Alt, Kenneth T. 1969. Sheefish and Pike Investigations of the Upper Yukon and Kuskokwim Drainages with emphasis on Minto Flats Drainages. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress, 1968-1969, Project F-9-1, 10:353-368.

Reed, Roger J. 1961. Investigation of the Tanana River Grayling Fisheries: Migration Study. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress, 1960-1961, Project F-5-R-2, 2:195-214.

_____. 1961. Investigation of the Tanana River Grayling Fisheries: Creel Census - Chatanika and Delta Clearwater. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress, 1960-1961, Project F-5-R-2, 2:215-224.

Van Hulle, Frank. 1968. Investigation of the Fish Populations in the Chena River. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress, 1967-1968, Project F-5-R-9, 9:287-304.

Roguski, Eugene A. 1967. Inventory and Cataloging of the Sport Fish and Sport Fish Waters in the Interior of Alaska. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress, 1966-1967, Project F-5-R-8, 8:231-246.

Roguski, Eugene A. and Carl E. Spetz. 1968. Inventory and Cataloging of the Sport Fish and Sport Fish Waters in the Interior of Alaska. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress, 1967-1968, Project F-5-R-9, 9:265-285.

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Sheefish are becoming an increasingly important sport fish in Alaska.