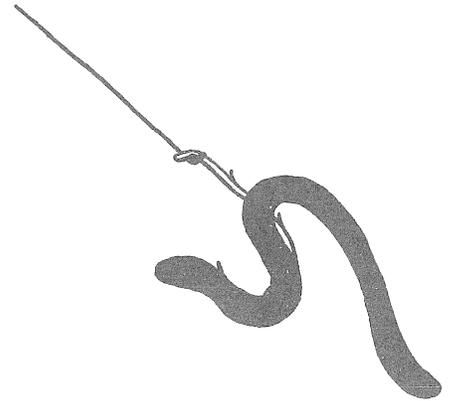
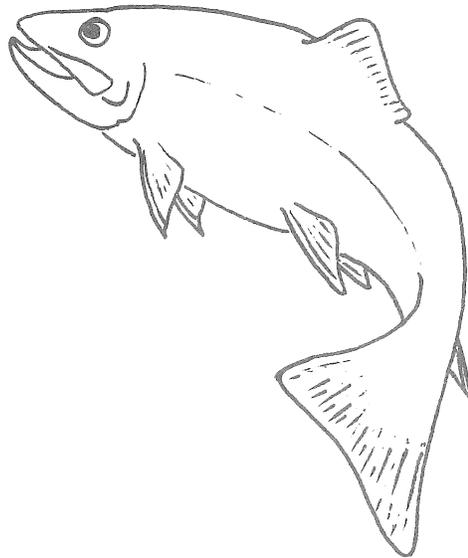
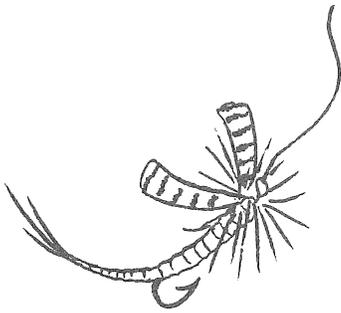


Miscellaneous Research Report No. 10
(Fisheries)

EVALUATION OF FLY-FISHING-ONLY AT LAWRENCE CREEK
(A Three-Year Progress Report)

by
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Wisconsin Conservation Department
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Abstract

Slightly fewer anglers utilizing the zone (CD) restricted to fly-fishing creel a slightly greater number of brook trout while fishing fewer hours than those anglers who fished in the any-lure zone (AB). The flies-only zone normally contained more legal-sized trout before and after the fishing season. Angling exploitation was low but similar in both zones. It never exceeded 12 percent of the preseason population.

Harvests were not determined by the methods of fishing but by interaction of the prevailing size limit of 8 inches, the amount of angling pressure and densities of trout. The bag limit of 5 had little direct influence upon catches.

No differences in standing crops, survival rates, reproductive capabilities, or growth of trout in the two fishing zones could be directly related to differences in fishing methods. If any benefits or detriments did accrue they were masked by natural mortality. Bait-fishermen caught and released 40 percent of the preseason stocks without increasing total mortality.

Standing crops of older age-groups increased over the 3-year period, but the increases occurred in both zones. Light exploitation in both zones plus above average overwinter survivals were responsible for the increases.

Fly-fishermen were definitely attracted to Lawrence Creek by the flies-only regulation, and they had better fishing success than anglers had in the any-lure zone.

Seasonal patterns of angling pressure were similar in both zones but daily patterns were not. Fishing pressure in AB was heavy in the morning and very light after 5 p.m. Fishing pressure in CD was heavy in the afternoon and evening.

Although exploitation was low in both zones, the slightly higher proficiency of fly-fishermen indicates that application of a flies-only rule will not be sufficient to prevent overharvest of brook trout if angling pressure is heavy or density of trout is low.

In the management of our wild brook trout fisheries the most effective regulation over a wide range of angling pressure and trout density is the size limit. If this regulation is wisely applied there is little biological need at present for either bag limits or restrictions on commonly accepted methods of angling.

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INTRODUCTION

Since its inception in 1955 a basic objective of the research project at Lawrence Creek has been evaluation of angling regulations imposed upon a wild brook trout fishery. A summary of the first 6 years of research, during which three sets of regulations were tested, has been published (Hunt, Brynildson and McFadden, 1962). Testing of a fourth set of regulations began in 1961. This is a progress report of our findings after 3 years of evaluation. A Technical Bulletin will be published when the study is completed.

During the 1961-63 trout fishing seasons the following regulations were in effect:

1. Minimum size limit of 8 inches.
2. Daily bag limit of 5 trout.
3. Fly-fishing as the only legal method allowed in sections C and D, the lower half of the stream.
4. Provisions for issuing free permits daily for each fishing trip, registration of all trout creeled, and special fishing hours of 6 a.m.-10 p.m. were continued as in previous seasons.

Effects of both the bag limit and size limit will be briefly discussed. However, most of this report will deal with the fly-fishing-only regulation since it is the regulation of major interest. In recent years there has been increasing discussion within conservation agencies and among trout fishermen concerning the merit of the flies-only-regulation, and, even though dozens of trout streams have been set aside for fly-fishing-only, scientific evaluation of the practice is inadequate.

Two of the better biological evaluations that have been done were conducted in Michigan. In 1954, Shetter, Whalls, and Corbett reported the results of a 3-year experiment on the North Branch AuSable River. Part of their study area was restricted to fly fishing under a 10-inch minimum size limit. In the remainder there was an any-lure regulation and a 7-inch minimum size limit. Both brook and brown trout were present. During the testing period the flies-only zone was used more than the normal water. In both zones the percentage of successful anglers increased over the 3-year period, but the percentages were always considerably lower in the flies-only zone (10-32 percent range versus 43-51 percent range), probably because of the higher size limit there. The number of trout creeled increased each year in both zones. Most of the legal-sized brook trout were cropped under either the 7-inch or 10-inch limit. Most of the legal-sized brown trout were not cropped. Fall electrofishing indicated an increase in trout density in the flies-only zone of up to 250 percent over densities prior to testing. The increase, mainly in fingerling brook trout, was attributed to survival of a higher proportion of adult brook trout to a size which allowed them to spawn at least once. (Note: Increased survival may have resulted from increasing the size limit from 7- to 10-inches, rather than restricting the anglers to use of flies). The investigators did not determine if the any-lure zone also had an increase in trout densities.

The second evaluation in Michigan was reported in 1962 by Shetter and Alexander who conducted a 10-year study (1949-59) of the brook trout fishery in Hunt Creek. During the first 5 years angling regulations were similar in both fishing zones and included a 7-inch size limit, bag limit of 5, and no restrictions on commonly accepted methods of fishing. Fishing was by permit only throughout the 10-year period. During the last 5 years one zone was restricted to fly-fishing. This was the only change made.

In the restricted zone following the change to flies-only, angling pressure decreased sharply, catch per hour increased considerably, and total catch increased slightly. In the any-lure zone during the same period, angling pressure increased sharply, catch per hour increased slightly, and total catch increased greatly. Many anglers chose to change their fishing zone rather than their method of fishing. Numbers of small trout released changed little in either zone between experimental periods. Fall stocks of legal-sized trout increased in both zones. The main effect of the flies-only rule was a greater catch per hour for the fewer anglers who fished the restricted zone. The flies-only rule did not increase survival of sublegal brook trout.

In a Wisconsin study initiated in 1955, a 5.5-mile stretch of the Peshtigo River, Marinette County, was established as flies-only water. A minimum size limit of 12 inches and a bag limit of 5 were also adopted. It was not possible to determine changes in the trout population by electrofishing because the stream was too wide and deep to collect trout effectively. The only source of information to evaluate the regulations was a partial creel census of anglers using the area. Based on a 4-year collection of these creel census records, Burdick and Brynildson (1960) concluded that trout fishing had not improved, there was no evidence that natural reproduction had improved, fishing had been largely sustained by the stocking of legal-sized rainbow trout, and the rate of catch was very low. They recommended that fly-fishing-only be tested on a smaller trout stream with better natural reproduction and where evaluation could be more thoroughly done.

Lawrence Creek met these requirements as well as providing the opportunity to compare the effects of fly-fishing-only with the effects of size limit and bag limit restrictions, determined previously. However, evaluation of the flies-only rule was complicated by the fact that a new size limit was concurrently applied. Whenever two or more regulations are changed at the same time it is difficult to determine which regulations influenced subsequent changes in the fishery. Emphasis in the presentation that follows will be placed on comparisons within years of angling and trout population statistics, between the two fishing zones, AB (the any-lure zone) and CD (the flies-only zone). Consistent zonal trends over the 3-year period will also be pointed out. Comparisons between zones will highlight those changes due to difference in fishing methods. Consistent trends in both zones will generally indicate responses to some factor other than the presence or absence of a fly-fishing-only regulation. Where possible, comparisons and trends will be reported on a "per acre" basis because there is more stream to fish in AB (6.3 surface acres) than in CD (5.3 surface acres).

Review of 1961-63 Creel Census at Lawrence Creek

In two of three seasons angling trips per acre were higher on AB than on CD. Angler hours per acre were higher on AB all three seasons. The number of trout creeled per acre was similar in both zones during 1962 and higher for CD during 1961 and 1963. The 1963 harvest in both zones was the highest, but angling effort was also highest. Trips, hours, and catch tended to increase each year (Fig. 1). Trout creeled on CD were slightly larger all three seasons. Angler harvest in pounds per acre reflected this fact. Catch per hour of legal-sized trout was higher on CD two of three seasons while the number of trout released per hour was higher on AB all three seasons. CD always held more legal and sublegal trout per acre at the beginning of each fishing season.

Angler exploitation, one of the most important fishery statistics, was slightly higher on CD in 1961, slightly lower on CD in 1962, and similar in both zones in 1963. Harvest, expressed as a percentage of the preseason stock cropped, never exceeded 12 percent in either zone. Percentage of successful angling trips was higher on CD in 1961 and 1963 and similar to that in AB during 1962. All three years the preseason standing crop of trout, in both numbers and pounds, was higher in CD. Minimum production, expressed as residual biomass (surviving age I+ in September) plus angler harvest, was higher on CD all three seasons. Number of trout creeled plus the number of legal trout remaining at the end of the season was consistently higher for CD and the difference increased each year.

In both zones and in all 3 fishing seasons there was never a shortage of legal-sized trout. With one exception (AB in 1962) there were more legal trout per acre remaining than were harvested. The harvest increased from 30 to 48 to 55 trout per acre on AB during the 3 fishing seasons. In CD the harvest went from 49 to 46 to 77 trout per acre during the same period. During the first half of the season harvest usually exceeded recruitment, while recruitment exceeded harvest during the second half. In both zones seasonal catches could have been doubled if enough anglers had fished during the closing weeks of the season (Fig. 2).

The statistics for this verbal summary are presented in Table 1 in the order in which they were discussed:

Creel Census Statistics and Legal Stock, 1961-63 Seasons
Table 1

Item Discussed	Zone AB			Zone CD		
	1961	1962	1963	1961	1962	1963
Angling trips per acre	49	80	77	54	76	75
Angling hours per acre	111	201	208	110	174	194
Trout creeled per acre	30	48	55	49	46	77
Av. length (inches) of trout creeled	8.6	8.7	8.6	8.8	8.9	8.7
Angler harvest in pounds per acre	7	11	12	12	12	18
Catch of legal trout per hour	0.27	0.26	0.27	0.35	0.25	0.40
Catch of trout released per hour	1.61	2.33	1.02	1.60	1.91	1.20
Legal trout per acre-preseason stock	13	45	48	57	89	137
Sublegal trout per acre-preseason stock	345	681	523	361	906	549
Percent of preseason stock cropped	8	7	11	12	5	11
Percent of successful angling trips	26	29	31	39	28	41
Preseason standing crop-no. per acre	358	726	571	418	995	686
Preseason standing crop-lbs. per acre	21	50	43	34	80	76
Minimum summer production-lbs. per acre	50	57	48	52	72	67
Trout creeled plus Sept. legals-no. per acre	109	78	111	122	110	166
No. of legal trout per acre-preseason stock	13	45	48	57	89	137
No. of legal trout per acre-midseason stock	19	18	50	50	41	91
No. of legal trout per acre-postseason stock	79	30	56	74	64	89
No. of legal trout per acre creeled	30	48	55	49	46	77

REVIEW OF 1961-63 TROUT POPULATION STRUCTURE

Some of the differences and similarities in stocks of trout within the two fishing zones have been mentioned in the preceding section concerning the creel census. For example, CD held more legal and sublegal trout per acre at the beginning of each fishing season. Among the trout present, however, the ratio of legal to sublegal trout was generally similar from season to season in the two zones. For the 3-year period the average preseason ration was the same in both zones -- 4.8 sublegal trout per legal trout (Table 2).

Table 2
Numbers of Legal and Sublegal Trout in Each Zone at Beginning of Season

		1961	1962	1963
Number of legal trout	) AB	80	284	300
	) CD	298	468	719
Number of sublegal trout	) AB	2,170	4,278	3,284
	) CD	1,896	4,758	2,881
Number of legal trout per acre	) AB	13	45	48
	) CD	57	89	137
Number of sublegal trout per acre	) AB	346	681	523
	) CD	361	906	549
Ratio of legal to sublegal trout	) AB	1:4	1:8	1:4
	) CD	1:4	1:9	1:3

Standing Crops. Within each zone the highest preseason standing crop occurred in 1962 when the age I stock (1961 year class) was exceptionally strong. In both zones the numbers of age II and age III+ trout increased each year in both preseason and post-season stocks. But, because the increases occurred in both fishing zones there was no correlation with fishing methods (Tables 3 and 4). The two factors most responsible for these concurrent increases of older trout in both zones were: (1) generally light angling exploitations all 3 fishing seasons, and (2) above-average overwinter survival during 1961-62 and 1962-63 (8 percent above average both winters).

Table 3
Preseason Standing Crop of Brook Trout--by Number, Age, Year, and Zone

	Zone AB			Zone CD		
	1961	1962	1963	1961	1962	1963
Age I	2,026	4,073	2,657	1,576	4,494	1,987
Age II	220	467	893	607	646	1,516
Age III+	4	22	34	9	86	97

Table 4
Postseason Standing Crop of Brook Trout--By Number, Age, Year, and Zone

	Zone AB			Zone CD		
	1961	1962	1963	1961	1962	1963
Age I	1,421	2,186	1,256	939	2,337	1,132
Age II	93	97	278	168	106	472
Age III+	2	5	11	1	17	26

Survival. Rates of survival through the summer periods (April-September) were consistently higher in AB than in CD. The average for 3 summers was 55 percent in AB and 48 percent in CD. Average angling mortality was 9 percent in both zones. Therefore, natural mortality was higher in CD than in AB by 7 percent (Table 5). These natural mortality statistics are especially noteworthy because they include an unknown amount of hooking mortality of sublegal trout. Over the 3-summer period approximately 40 percent of the sublegal trout in each zone were hooked and released. The highest hooking rates were 44 percent in AB in 1962 and 43 percent in CD in 1961.

One of the basic arguments concerning fly-fishing versus bait-fishing involves the loss of sublegal trout returned to the water. Hooking mortality of released trout has been shown to be considerably higher for bait-caught than for fly-caught trout (42 percent versus 3 percent, Shetter and Allison, 1955), but this source of mortality must be considered along with all other sources. In Lawrence Creek such differential hooking mortality did not noticeably alter the total amount of natural mortality within zones during the summers of 1961-63. Undoubtedly a higher percentage of small trout did die after being released by bait fishermen in AB, but this loss was absorbed and masked by deaths due to other causes. Hooking mortality was compensated for as a part of natural mortality that would have occurred anyway. Apparently the percentage of trout hooked and released by bait-fishermen must greatly exceed 40 percent of the population before the resultant mortality impairs the fishery. Such mortality did not result from applying 100-200 angler hours per acre to trout densities of 350-700 per acre. Natural mortality of trout in CD has generally been greater than in AB and it continued to be so during the 3-year period of restriction on the methods of fishing.

Under the prevailing angling pressure at Lawrence Creek the fly fishing restriction did not save a higher percentage of released trout for future harvest. It may have prolonged the lives of some for a short period during which they could have provided sport for other anglers.

Table 5
Percentage Mortality and Survival of Brook Trout--By Age, Year, and Zone

	Zone AB			Zone CD		
	1961	1962	1963	1961	1962	1963
Age I						
Angling Mortality	3	1	1	2	1	2
Natural Mortality	27	45	45	37	47	43
Survival	70	54	54	61	52	57
Age II						
Angling Mortality	54	51	37	35	25	23
Natural Mortality	4	28	29	37	59	29
Survival	42	21	34	28	16	31

Reproduction. Reproductive potential of spawning stocks in the two zones largely reflected fluctuations in summer and winter survival rates and the rates of angling exploitation. Numbers of spawners were not influenced by the

difference in fishing methods in the two zones. Fishing methods could have altered spawning stocks if various age-groups were more vulnerable to one method of fishing than another, or if survival of hooked sublegal trout were higher due to one method of fishing. Our creel census data and trout population data for 1961-63 indicate no such interactions between fishing methods and numbers of potential spawners. Exploitation was similar in both zones and fly fishing did not increase survival of sublegal trout.

Growth. Growth rates showed no consistent trends within zones or consistent trends between zones during the 3-year period. Neither was there any fixed pattern of differences within zones for the 1961-63 period as compared to the previous 3-year period. Mean lengths of age-groups varied from year to year and zone to zone. For example, in 1961 and 1963 age I brook trout in AB were larger than in CD while CD had larger age II brook trout in 1961 and 1962. None of the angling regulations appeared to influence growth (Table 6).

Table 6
Average Lengths of Age-Groups of Brook Trout in September-By Year and Zone

	Zone AB			Zone CD		
	1961	1962	1963	1961	1962	1963
Age 0	4.0	3.9	4.0	3.9	3.7	4.1
Age I	7.5	6.9	7.0	7.4	6.9	6.9
Age II	9.1	8.4	8.6	9.2	8.7	8.3

	1958			1959			1960		
	1958	1959	1960	1958	1959	1960	1958	1959	1960
Age 0	3.6	3.7	3.9	--	3.8	3.8			
Age I	6.7	7.1	7.1	7.0	6.8	7.2			
Age II	8.3	8.5	8.7	9.5	7.7	9.3			

EFFECTS OF SIZE AND BAG LIMITS: 1961-63 FISHING SEASONS

Size Limit. When our findings compiled during 1961-63 were compared with those gathered when testing only size limits and bag limits during the 1955-60 seasons, it was evident that the regulation of greatest influence on the trout populations and fishing success during the latest testing period was the 8-inch minimum size limit, not the presence or absence of the flies-only rule, nor the restriction of the daily bag to 5 trout. Yield in numbers of trout per acre and pounds of trout per acre, percentage exploitation of the preseason stocks, rate of catch per hour, and percentage of successful angling trips during 1961-63 were all intermediate to comparable values derived from testing 6-inch and 9-inch size limits (Table 7). For example, 32 percent of the preseason stock was cropped when a 6-inch limit was tested, only 4 percent was cropped when a 9-inch limit was tested, and 9 percent was cropped when an 8-inch limit

was tested. Catch per hour was 0.69 under a 6-inch limit, 0.31 under an 8-inch limit, and 0.12 under a 9-inch limit.

Table 7
Catch Statistics under Three Size Limits

<u>Item Compared</u>	<u>6-inch limit</u>	<u>8-inch limit</u>	<u>9-inch limit</u>
Yield (no. per acre)	342	50	26
Yield (lbs. per acre)	62	12	8
Catch per hour	0.69	0.31	0.12
Percent successful trips	47	31	16
Percent harvest			
Age I	24	2	1
Age II	72	35	14
Age III	42	52	32
Age I-III Average	32	9	4

Bag Limit. The daily bag limit of 5 trout, like the size limit, applied to both fishing zones. However, the bag limit had little direct influence upon the harvest in either zone. In the flies-only zone limit catches were made on only 6 percent of the total trips over 3 seasons. The 3-season average was only 4 percent in the any-lure zone (Table 8).

If there had been no bag limit, only an 8-inch size limit, and if angling pressure remained unchanged probably seasonal harvests would have been only slightly higher. However, angling pressure might have increased had the bag limit been removed just as we suspect angling pressure was reduced by the presence of a bag limit of 5. Some anglers may have chosen to fish streams other than Lawrence Creek because of the smaller bag limit. Thus, reduction or liberalization of bag limits may indirectly alter the harvest through changes in fishing pressure even though bag limits are ineffective in altering catches of those who do fish.

Table 8
Limit Catches of 5 Trout Expressed as Percent of Total Trips per Zone

<u>Zone</u>	<u>1961</u>	<u>1962</u>	<u>1963</u>	<u>1961-63 Avg.</u>
AB	4	4	5	4
CD	5	4	9	6

EFFECTS OF FLIES-ONLY REGULATION ON ANGLER CHARACTERISTICS

While the flies-only regulation did not materially influence the trout population, its application did reveal several angler characteristics having potential management value. Approximately 89 percent of the fly-fishermen who came to Lawrence Creek during the 1961-63 seasons chose to fish in the zone

reserved for that method of fishing. Apparently fly-fishermen will react positively to a flies-only regulation and concentrate on stretches of streams restricted for their use. Certainly fly-fishermen were attracted to Lawrence Creek in response to the flies-only restriction. More fly-fishermen were registered during 1962 than in any previous year, despite the fact that total fishing trips in 1962 were only half those of the peak registration of 1955. During the 1955-60 fishing seasons fly-fishermen accounted for only 16-28 percent of the total trips and 9-22 percent of the total catch. During the following 3 seasons they accounted for 49-55 percent of the total trips and 47-66 percent of the total catch (Table 9).

Table 9
Percentages of Trips and Catch Accounted for by Bait-Fishermen and Fly-Fishermen During the 1955-63 Fishing Seasons

	Fishing Season								
	1955	1956	1957	1958	1959	1960	1961	1962	1963
Percent of trips									
Bait-fishermen	61	71	65	53	53	52	38	40	39
Fly-fishermen	25	16	19	24	21	28	55	49	49
Percent of catch									
Bait-fishermen	68	77	74	62	60	45	28	49	36
Fly-fishermen	22	14	16	19	14	14	66	47	57

Distribution of angling pressure was also influenced by the regulation change. Prior to 1961 stream section C had always been the most intensively fished section. When section C became part of the flies-only zone, section B became the most intensively used section. However, the increase in fly-fishermen on section C after 1960 did not offset the loss of bait-fishermen and spin-fishermen who were prevented from fishing there.

Fishing pressure during the first week of the 1961-63 seasons was considerably higher in the any-lure zone, but thereafter weekly fluctuations in angling effort were similar in both zones. There was no midseason increase of fishing pressure in CD in response to natural hatches of aquatic insects (Fig. 3).

While seasonal angling pressure followed the same pattern in both zones, daily patterns of angling activity did not. Throughout a season peak fishing pressure in AB usually occurred in the morning and fell to low levels after 5 p. m. In CD peak fishing pressure usually occurred in the afternoon and early evening (Fig. 4).

Finally, it is important to recall that under the existing size and bag limits and the effects they had on fishing pressure, fly-fishermen were as proficient at harvesting wild brook trout as were fishermen in the any-lure zone. Consequently, application of a flies-only regulation on waters adaptable to fly fishing would not in itself reduce the threat of overharvesting brook trout stocks. Conversely, a flies-only regulation cannot be opposed in the belief that fly-fishing is so inefficient that a trout resource would not be properly utilized. Catches of fly-fishermen as well as catches of bait-fishermen must be controlled by some other regulation or combination of

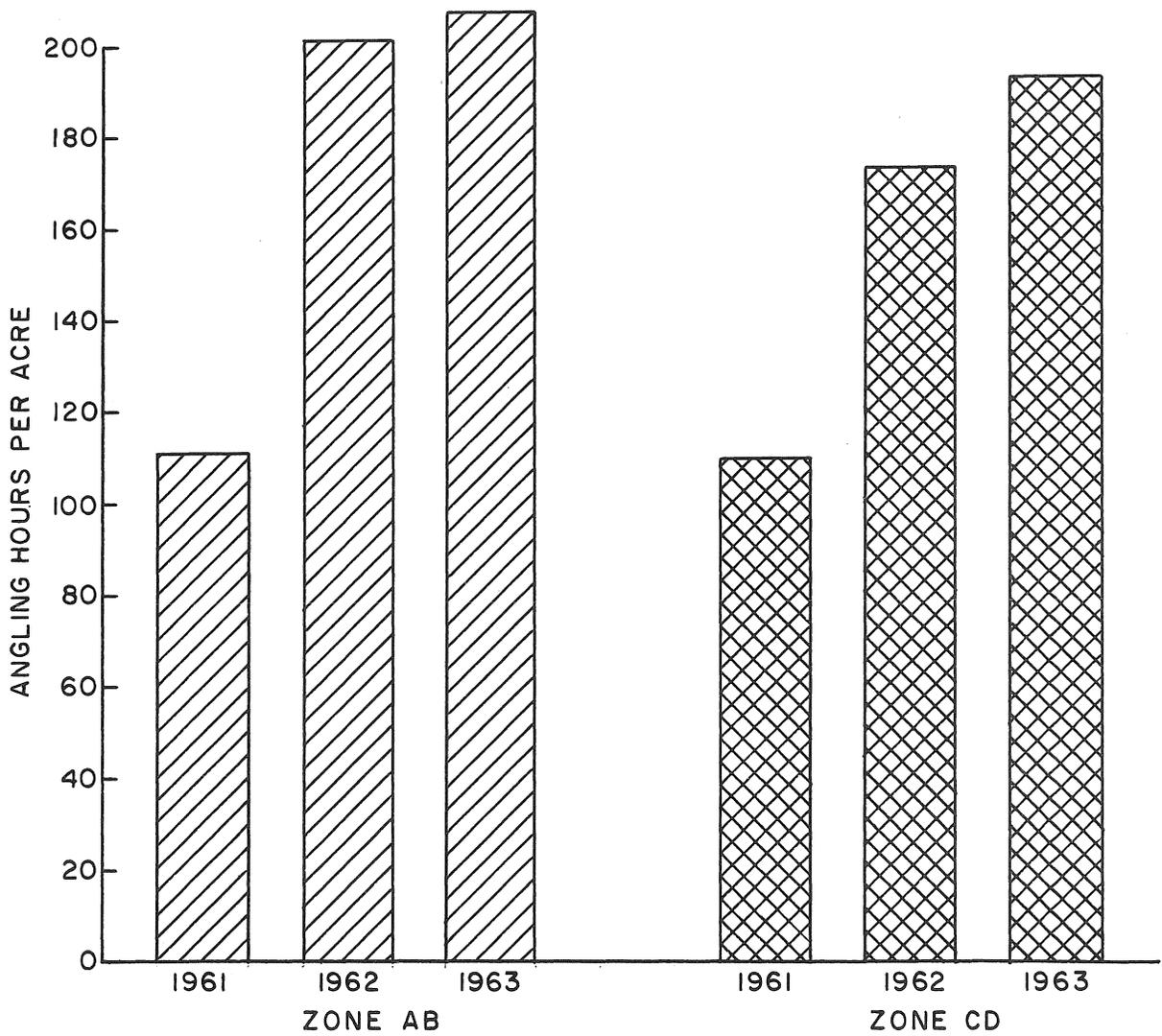
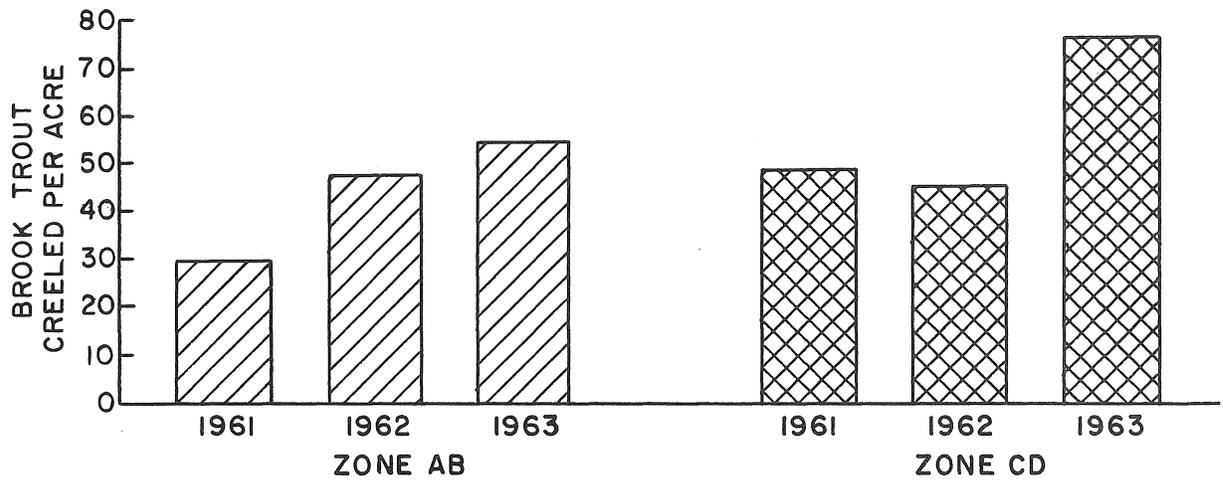
regulations, which is effective over a wide range of angling pressure and trout density.

CONCLUSION

It is now clear from the experimental evidence gathered at Lawrence Creek during the past 8 years that the best and most reliable single regulation for managing wild brook trout in Wisconsin is the size limit. If size limits are wisely applied there is little biological need at present for either bag limits or restrictions on the commonly accepted methods of fishing.

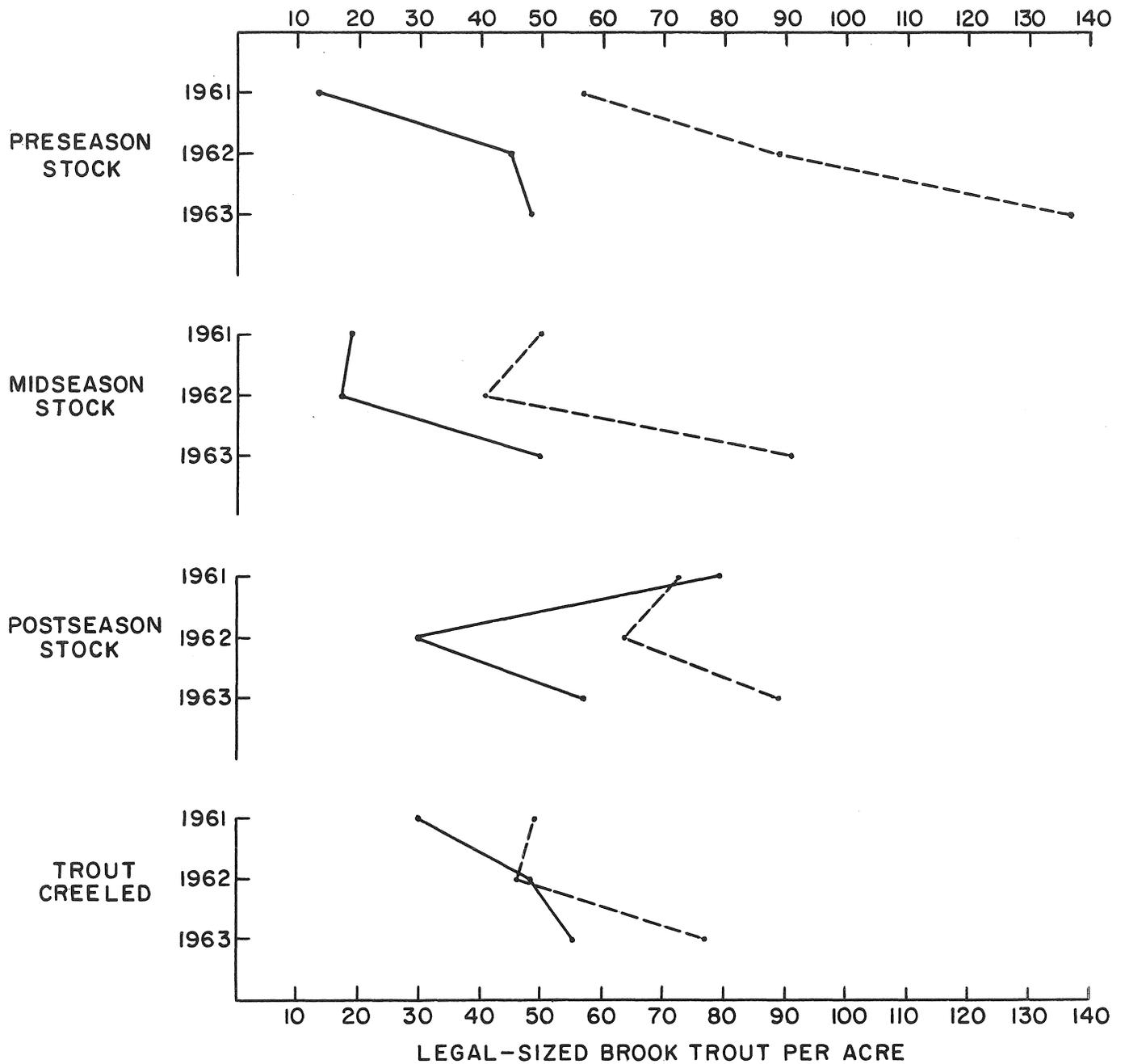
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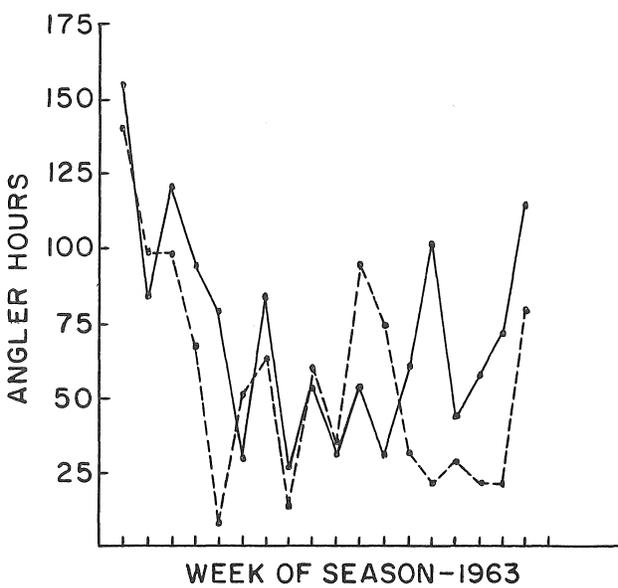
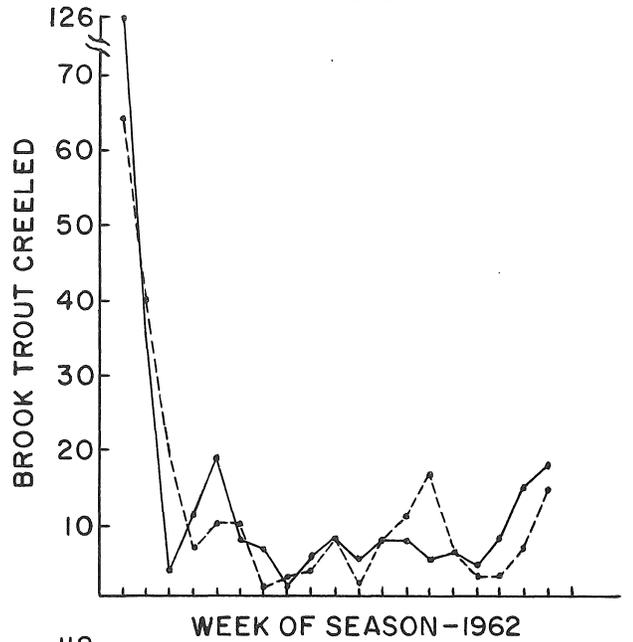
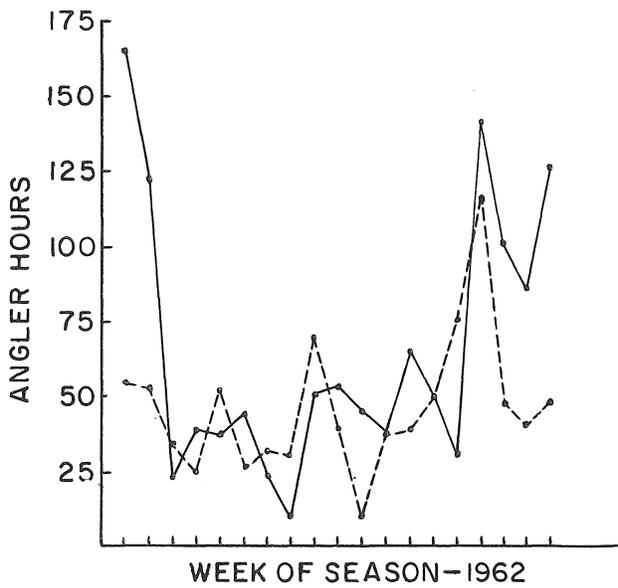
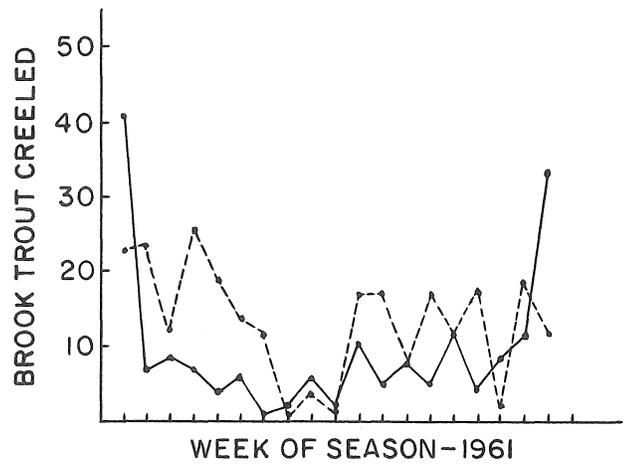
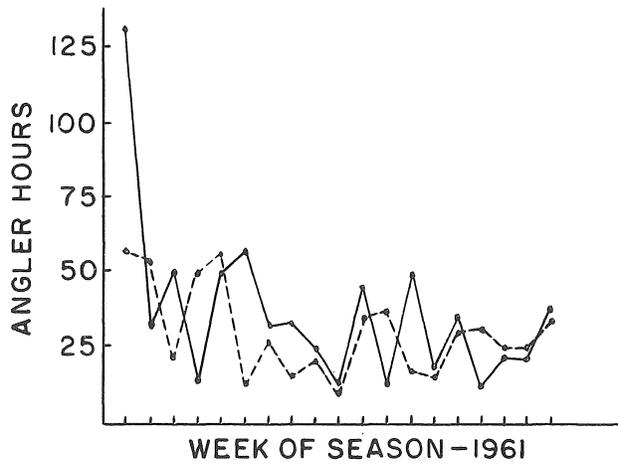
ANGLING HOURS PER ACRE AND BROOK TROUT CREELED PER ACRE IN ZONE AB AND ZONE CD DURING THE 1961-63 FISHING SEASONS.

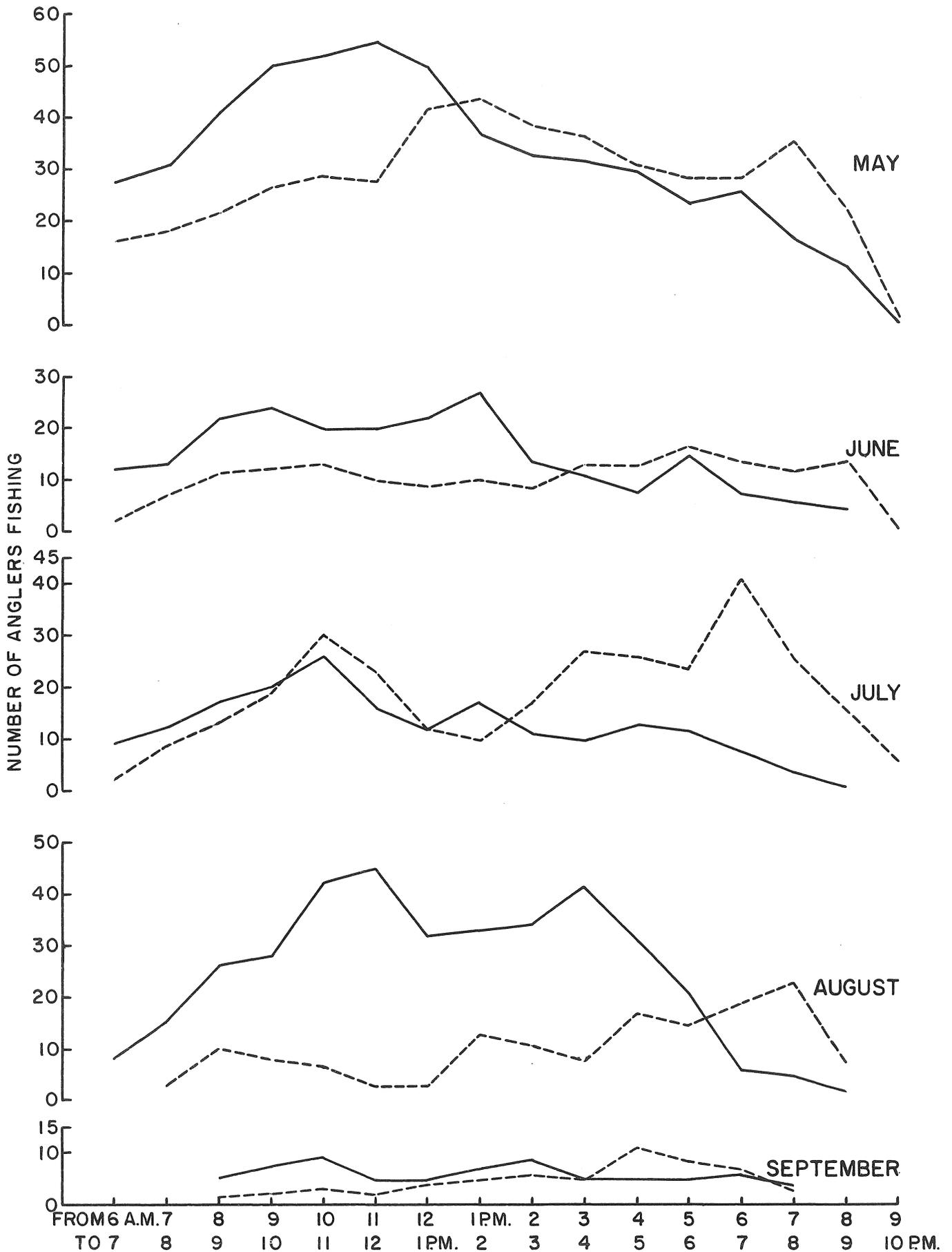
FIGURE I.



LEGAL-SIZED BROOK TROUT PER ACRE COMPRISING THE PRESEASON, MIDSEASON, AND POSTSEASON STOCKS IN AB (SOLID LINE) AND IN CD (BROKEN LINE), AND THE NUMBER OF BROOK TROUT CREELED PER ACRE IN AB AND CD DURING THE 1961-63 FISHING SEASONS.

FIGURE 2.





HOURLY DISTRIBUTION OF ANGLING EFFORT IN AB (SOLID LINE) AND IN CD (BROKEN LINE) DURING EACH MONTH OF THE 1963 TROUT FISHING SEASON AT LAWRENCE CREEK

FIGURE 4