1.4, 33.8, 30.0, 39.0, 46.0, 47.3

FINAL REPORT

RESEARCH AND SURVEYS

FEDERAL AID PROJECT NO. F-41-R

FACTORS INFLUENCING FISH POPULATIONS IN OKLAHOMA WATERS

JOB NO. 13

DEVELOPMENT OF A WHITE CRAPPIE FISHERY IN A STAGE-FILL IMPOUNDMENT IN OKLAHOMA

JULY 1, 1986 to JUNE 30, 1991

FINAL REPORT

STATE: OKLAHOMA PROJECT NUMBER: F-41-R

PROJECT TITLE: Factors Influencing Fish Populations in Oklahoma Waters

STUDY TITLE: Development of a White Crappie Fishery in a Stage-fill Impoundment in Oklahoma

PERIOD COVERED: July 1, 1986 to June 30, 1991

OBJECTIVE NUMBER: 13 JOB NUMBER: 13

ABSTRACT

We examined the development of the white crappie (*Pomoxis annularis*) fishery in Skiatook Lake, Oklahoma, during and after the five-year stage-fill of the impoundment to assess factors influencing its characteristics and dynamics. The study included monitoring of harvests, exploitation rates, population abundances, age and size structures, and growth rates, and a mathematical model incorporating these parameters was constructed to evaluate the utility of implementing restrictive harvest regulations to maintain or enhance the quality of the fishery. Skiatook Lake is located in close proximity to metropolitan Tulsa and received intense angling pressure. The fishery was characterized by high rates of exploitation and natural mortality, a total annual mortality rate that varied as a function of fishing mortality, declining abundances, changes in size distribution that were caused by size-selective fishing mortality, and evidence of growing angler dissatisfaction with the sizes of fish available for harvest. It therefore resembled overexploited populations elsewhere which have benefited from restrictive harvest regulations. Unfortunately, the anticipated benefits of the stage-fill did not materialize and the Skiatook Lake white crappie population suffers high natural mortality and poor growth rates. Therefore, success of such regulations

is unlikely. Because fish production is lost to death by natural mortality at a greater rate than it is replaced by growth in this population, restrictive harvest regulations aimed at deferring angling mortality are unlikely to increase annual yields at Skiatook Lake. Nevertheless, improvement of the quality of the fishery (e.g., average size of harvested fish) may be gained at the expense of relatively small losses in quantity (total annual yield) through implementation of mildly restrictive regulations.

REPORT CONTENT

I. Objective:

To describe the development of a white crappie (*Pomoxis annularis*) fishery in a stage-fill impoundment in Oklahoma.

II. Introduction:

Crappie (*Pomoxis* spp.) angling is typically good in new reservoirs for several years following impoundment (Thompson et al. 1951). However, average size of harvested crappie and their contribution to angler harvest decline in most reservoirs as they age (Thompson et al. 1951; Rutledge and Barron 1972). Conventional wisdom suggests that such populations are stunted because of reduced reservoir productivity and that enhanced exploitation would permit higher growth rates and greater yields (Ming 1971). However, excessive angler exploitation of quality-sized crappie (>200 mm total length) also could decrease average size (Colvin 1983) and result in apparently stunted populations. Populations consisting of mostly sub-harvestable sized crappie in nearly all of the larger reservoirs in Missouri were attributed to high angler exploitation of larger crappie (Colvin 1982). Accordingly, minimum length limits and reduced daily creel limits have been introduced in several states on some waters with high angling pressure to regulate harvest of crappie. Length limits improved the quality of crappie angling in reservoirs in Missouri (Colvin 1990) and Texas (Webb et al. 1990) but other studies (Reed and Davies, in press; Larson et al., in press) suggested natural mortality of crappie is high and deferred exploitation would have negligible or deleterious effects on future yields.

We examined the development of the white crappie (*P. annularis*) fishery in Skiatook Lake, Oklahoma, during and after the five-year stage-fill of the impoundment to assess factors influencing its characteristics and dynamics. The impoundment was filled in stages to annually inundate terrestrial vegetation and thereby create conditions resembling a newly-impounded reservoir each year. This was expected to extend the period of excel-

lent growth, survival, and reproduction typical of new reservoirs. Skiatook Lake is located in close proximity to metropolitan Tulsa and was expected to receive intense angling pressure. We hypothesized that deterioration of the fishery during the fill period would suggest that factors other than a decline in reservoir productivity (e.g., overexploitation) were responsible. The study included periodic monitoring of harvests, exploitation rates, population abundances, age and size structures, and growth rates. Examination of these factors offers insight facilitating enhanced management of this species, particularly with respect to the utility of restrictive harvest regulations for maintenance of a high quality fishery.

III. Methods:

Skiatook Lake is an impoundment of Hominy Creek located about 32 km northwest of Tulsa, Oklahoma, in Osage County. The reservoir is managed by the U.S. Army Corps of Engineers for flood control and recreation. Skiatook Lake was filled in stages from October 1984 to July 1989 in an attempt to extend the initial period of high productivity of the reservoir. At normal pool, the lake surface area is 4,265 hectares with 257 km of shoreline. The maximum depth is 31 m and the mean depth is 10.4 m. The reservoir is relatively deep and clear by Oklahoma standards and resembles other northeastern Oklahoma reservoirs with steep, wooded, and rocky shorelines.

Monthly samples of white crappie were collected from September 1986 to November 1990 with trap and barrel nets set overnight throughout Skiatook Lake to monitor relative abundances and size structures of the population. Comparisons of these parameters over time allowed documentation of population trends and dynamics. Trap net sets were limited to gradually sloping areas with sparse bottom cover (as advised by Jeff Boxrucker, Oklahoma Department of Wildlife Conservation, personal communication). A Lowrance X-16 recording sonar unit was used to locate suitable sampling sites. Barrel nets were set on a variety of slopes, but generally also in areas with sparse bottom cover. Sampling sites could not be standardized due to rising water levels during the stage-filling of the lake. Net-

ting was directed at maximizing white crappie catch rates, and unproductive sets were moved in an effort to find concentrations of white crappie.

Individuals collected in each net were counted, and total lengths of each were measured. Samples were pooled by seasonal quarter (e.g., March to May constituted the spring quarter) to reduce variability that resulted from environmental fluctuations. Monthly effort varied in an attempt to collect 200 individuals per month and 600 individuals per quarter. Relative abundances were expressed as catch-per-unit-effort (CPUE) rates (number per net-night) of all white crappie and white crappie $\geq$200 mm TL. Length-frequency distributions (expressed as length-interval specific catch-per-unit-effort rates) were constructed for each quarter to examine shifts in population size structures.

Whole otoliths were examined to ascertain ages of white crappie sampled during autumn quarters of 1986 to 1990. Otoliths are more reliable than scales for age and growth determination of crappie in Oklahoma (Boxrucker 1986) and autumn samples best represent the actual age/size structure of crappie populations (Boxrucker and Ploskey 1988). Total length and weight of each fish were recorded in the laboratory. Otoliths were removed and stored dry in coin envelopes. Otoliths were placed in a black dish, immersed in water, and examined under a dissecting microscope using reflected light (Maceina and Betsill 1987). Otolith radius was measured from the kernel to the anterior tip with an ocular micrometer; distances to annuli were measured along the same axis (Schramm and Doerzbacher 1982). Total lengths at annuli were back-calculated using the Whitney and Carlander modification of the Lee method (Whitney and Carlander 1956; Carlander 1981; Carlander 1983). Actual total lengths at capture and back-calculated total lengths at age of fish collected in autumn quarters of 1986 through 1990 were compared among years.

At least 1,000 white crappie were tagged with anchor tags and released annually in 1987, 1988, 1989, and 1990 to estimate exploitation rates. Crappie were captured with trap and barrel nets throughout the reservoir during February and March when water temperatures were $<$15 C to permit handling of the fish without high mortality (Knapp 1985). Total

length and weight of each tagged fish was measured. A numbered anchor tag was attached to each fish prior to release. Only crappie ≥200 mm TL were tagged.

Anglers returning tags were rewarded with a "OSU Crappie Buster" cap. Signs explaining the program and providing information on tag return procedures were posted at all boat ramps on the lake, other access areas, local bait shops, and convenience stores. Newspaper and television coverage also advertised the project. Proprietors of local bait shops collected tags and information. Anglers could also send tags directly to Oklahoma State University.

Estimates of total annual mortality rates (A), annual survival rates (S), instantaneous annual mortality mortality rates (Z), and annual angler exploitation rates (u) were calculated for white crappie in Skiatook Lake using Ricker's (1975) method when marking is done at the start of fishing in two consecutive years. Analyses incorporated experimentally derived tag loss (4.0%), tagging mortality (4.8%), and tag-return failure (33%) rate estimates (Stubbs 1990).

An access-point creel survey was conducted at all open boat ramps on Skiatook Lake from September 1986 through November 1990. Anglers returning from fishing were interviewed during randomly selected 8-hour periods (midnight to 8 AM, 8 AM to 4 PM, or 4 PM to midnight) during the summer, autumn, and spring quarters. During the winter quarter, all creel periods extended from 10 AM until one hour after sunset; night fishing was nonexistent during winter at Skiatook Lake. Twenty-five creel periods were scheduled for each quarter from September 1986 through May 1988; thereafter, 32 creel periods were completed during each quarter. Creel effort was stratified by day-type (weekends vs. weekdays); 60% of creel periods occurred on weekends, 40% were on weekdays. Because creel periods were selected randomly and included both day and night periods, estimates of pressure, harvest, and catch were calculated through direct expansion of creel data after segregation by day-type (Van Den Avyle 1986).

The effects of various combinations of potential length (8 to 12 inches) and daily creel limits (5 to 37) on the Skiatook Lake crappie fishery were estimated using a tabular Ricker (1975) equilibrium-yield model programmed in Lotus 1-2-3. The model incorporated growth rates calculated from autumn 1989 samples (which were similar to 1990 values) and assumed that growth was constant during spring, summer, and autumn and negligible during winter. Examination of monthly length-frequency distributions validated this assumption. Mean annual exploitation and natural mortality rate estimates from our tagging study were used. Natural mortality was assumed to occur at a constant rate throughout the year, but angling mortality was segregated according to seasonal trends observed in the creel survey as follows: winter, 5.1%; spring, 24.2%; summer, 44.8%; and autumn, 25.8%. Recruitment to the harvestable fishery (i.e., exposure to angling mortality) was empirically determined to occur between 7 and 9 inches (178-229 mm TL); an exponentially increasing probability of harvest within this range provided the best fit to observed creel length frequencies. The effects of changes in daily creel limit on reduction of angling mortality were calculated by comparing aggregate actual harvests to those reduced artificially to conform to the putative daily limit.

IV. Results:

Trap-net catch-per-unit-effort rates of white crappie varied seasonally within and among years (Figure 1). In general, CPUE rates indicated that relative abundances of white crappie in Skiatook Lake decreased during much of the study before recovering somewhat in 1990. Relative abundances of all white crappie in aggregate progressively declined during sequential autumn, winter, and summer quarters prior to 1990, as did harvestable-sized (>200 mm TL) white crappie during autumn and summer quarters. Conversely, spring relative abundances of both size groupings were higher in 1989 and 1990 than in 1987 and 1988, but field personnel attributed these differences to weather conditions and water level fluctuations. The improvement in white crappie CPUE rates in 1990 may signal stabilization of the abundance of this population.

Barrel-net catch-per-unit-effort rates were less variable among years than trap-net rates and showed no distinct trends (Figure 2). It seems likely that these nets become saturated and therefore offer little information on relative abundances.

Length-frequency distributions of white crappie collected in trap nets (Figures 3 to 6) and barrel nets (Figures 7 to 10) suggested that the size structure of the population shifted progressively toward smaller fish before stabilizing during the last year of the study. For example, white crappie $\geq$300 mm TL ("memorable" sized; Gabelhouse 1984) became rare, comprising 3.9%, 0.6%, 0.6%, 0.5%, and 0.4% of the autumn trap net catches from 1986 through 1990, respectively. Over the same period, white crappie >250 mm TL comprised 7.9%, 10.8%, 5.0%, 4.9%, and 5.9% of autumn trap net catches. Barrel net catches were similarly distributed. The presence of appreciable numbers of young-of-year in autumn 1990 trap net catches (Figure 3) suggested improved recruitment.

Mean lengths-at-capture of aged white crappie collected during sequential autumn quarters progressively declined throughout the study prior to showing some evidence of stabilizing in 1990 (Table 1, Figure 11). Similarly, mean back-calculated lengths-at-age also declined in a regular progression (Table 1, Figure 12). Back-calculated lengths-at-age of individual cohorts of white crappie collected during sequential autumn quarters also showed progressive declines (Table 1). For example, estimated lengths at age I of the 1985 year class sampled in 1986, 1987, and 1988 were 123 mm, 119 mm, and 118 mm, respectively. Lengths of this cohort at age II were 193 mm and 186 mm in 1987 and 1988. Similarly, estimated lengths at age I of the 1986 year class sampled in 1987, 1988, 1989, and 1990 were 125 mm, 116 mm, 99 mm, and 100 mm, respectively. Lengths of this cohort at age II were 170 mm, 155 mm, and 148 mm in 1988, 1989, and 1990. These progressive decreases in estimated lengths at age of cohorts infer enhanced mortality rates of faster growing individuals within each cohort. High mortality rates of fast growing white crappie probably resulted from rapid cropping of individuals soon after they attained a size acceptable to anglers (as opposed to resulting from natural mortality). This hypothesis is corroborated by

age structures of the population (Figures 13-17). Older fish progressively composed a greater proportion of the population from one year to the next. The proportions of autumn samples consisting of age-III and age-IV fish were 1.8%, 0.2%, 3.2%, 10.2%, and 23.1% from 1986 through 1990. However, lengths of a majority of these overlapped with those of younger fish. Therefore, size (via angler selection) appeared to mediate mortality more effectively than age.

Nevertheless, actual (i.e., non-confounded) growth rates of white crappie in Skiatook Lake also decreased as evidenced by decreases in lengths-at-capture and back-calculated lengths-at-age of age-0 and age-I individuals collected in autumn quarters (Figures 11 and 12). Because these fish were collected before they were recruited to the fishery (i.e., they were too small to harvest), their decreased growth rates cannot be attributed to confounding by angler selection.

Natural mortality rate estimates (v) of white crappie in Skiatook Lake derived from tagging data were constant from 1987 through 1989 (38.3% to 39.1%; Table 2), but exploitation (u) varied (41.0% to 52.8%; Table 2). Therefore, total annual mortality (A) varied as a function of exploitation. Relatively low exploitation in 1988 and 1990 probably resulted from fluctuating lake levels and high turbidity during spring which decreased angler success rates. Total annual mortality was consistently high ($\geq$80%) resulting in low carryover of harvestable-sized fish from year to year.

The creel survey indicated that popularity of angling at Skiatook Lake increased throughout the study. Quarterly comparisons of angler effort showed consistent increases among corresponding quarters (Figure 18) except in summer 1989 (when access-road construction apparently reduced recreational use of the reservoir) and autumn 1990. Annual total effort estimates (autumn through summer) were 196787, 304448, 286725, and 459943 angler hours during the four years of the study (Table 3). Effort directed specifically at crappie constituted 44.9%, 46.3%, 48.4%, and 38.8% of this effort during each year (Table 4). The decrease in relative pressure during the final year was compensated by increases in

effort directed at bass (Table 5) and other species (primarily catfish and hybrid striped bass; Table 6), but effort directed at crappie actually increased in absolute terms during the final year (Table 4). Accordingly, it is unclear whether the decrease in relative pressure for crappie can be considered indicative of growing angler dissatisfaction.

In general, quarterly white crappie catches and harvests progressively increased or were stable over much of the study (Figure 19), except during the springs of 1988 and 1990 when fluctuating lake levels and high turbidities deleteriously affected angler success. However, most crappie catch statistics (especially harvest-per-unit-effort; Tables 7-10) declined appreciably in summer and autumn of 1990, despite a record-high crappie catch in summer 1990 (Figure 19). During all quarters except winter, anglers kept a substantially lower proportion of their crappie catch in the last year of the study than previously (Figure 20) suggesting angler dissatisfaction with the size distribution of available crappie. Mean lengths of creeled white crappie changed little during the study, but relative proportions of large fish declined and modes tended to shift downward slightly (Figures 21-24). The largest shifts in creeled white crappie size distributions occurred during the first few years of the study and stabilized thereafter.

Most crappie anglers (59.8%) failed to harvest any crappie during a typical day of fishing at Skiatook Lake and very few anglers (4.8%) harvested more than 15 crappie per day (Figure 25). Accordingly, the daily creel limit (currently 37 crappie) would need to be curtailed appreciably to elicit tangible reductions in angling mortality (Figure 25). Daily creel limits of 15 and 10 fish per day would be required to reduce angling mortality by 10% and 20%, respectively (Figure 25). However, output from the Ricker equilibrium-yield model (Tables 11-15) indicated that such decreases in angling mortality would not increase total annual yield (in kg) of this crappie fishery. Length limits also would not result in enhanced total yields. Rather, institution of any more-restrictive limit would decrease annual yields. This outcome is a function of low growth rates combined with high natural mortality rates at Skiatook Lake; i.e., potential yield would be lost by leaving fish in the population

because the crappie are dying more rapidly than they are growing. Because the possibility existed that the natural mortality rate was overestimated (if the fishing mortality rate was underestimated, e.g., because of a higher tag-return failure rate than we calculated), we ran the model with alternative combinations of natural and fishing mortality rates. Even at the extremes we considered possible (60.0% fishing mortality and 26.3% natural mortality), the same relationship existed (albeit not as dramatically): yields declined progressively as regulations were made more stringent.

Yields of crappie of certain sizes could, however, be increased through regulation of the fishery. For example, yield of fish >10" could be increased three-fold with a 10" length limit from 3,222 kg to 10,001 kg (Table 13), but with a corresponding diminution of total yield from 14,311 kg to 10,001 kg (Table 11). A 9" limit would reduce total yield by 13.6% (from 14,311 kg to 12,371 kg) but would increase the proportion of fish >9" in the yield from 51.1% to 100% (Table 15). Because many anglers at Skiatook Lake currently release fish <9" voluntarily, a 9" limit would increase yield of crappie larger than the minimum size acceptable to most anglers.

V. Discussion:

The white crappie population in Skiatook Lake in many ways resembled overexploited populations elsewhere which have benefited from restrictive harvest regulations. The fishery was characterized by high rates of exploitation, a total annual mortality rate that varied as a function of fishing mortality, declining abundances, changes in size distribution that were caused by size-selective fishing mortality, and evidence of growing angler dissatisfaction with the sizes of fish available for harvest. These conditions are symptomatic of crappie fisheries in Missouri (Colvin 1990), Kansas (Don Gabelhouse, Jr., Kansas Department of Wildlife and Parks, personal communication), Oklahoma (Jeff Boxrucker, personal communication), Kentucky (Benjy Kinman, Kentucky Department of Fish and Wildlife Resources, personal communication), Mississippi (Keith Meals, Mississippi Department of Wildlife Conservation, personal communication), and Texas (Webb et al. 1990) where

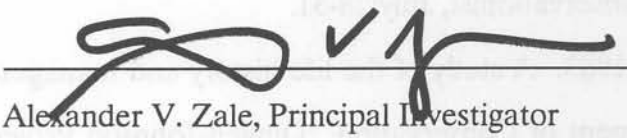
restrictive harvest regulations have been used successfully or appear to have promise. Typically, these regulations entail 10" minimum size limits and daily creel limits of less than 25 fish.

Unfortunately, the anticipated benefits of the stage-fill failed to materialize at Skiatook Lake and the white crappie population suffers poor growth rates which make the success of similar regulations unlikely. The impoundment was successfully filled in stages to annually inundate terrestrial vegetation and thereby create conditions resembling a newly-impounded reservoir each year. This was expected to extend the period of excellent growth, survival, and reproduction typical of new reservoirs. However, the precipitous early decline in growth rates and their subsequent stagnation, despite high annual mortality, suggest that the stage-fill procedure failed to extend the new-lake fish production "boom" at Skiatook Lake. Angler selection for fast-growing fish was partly responsible for the apparent reduction in growth rates, but similar declines in growth of sub-harvestable sized individuals could not be attributed to this factor. Declining nutrient levels, inter- and intraspecific competition, and forage deficiencies may be possible explanations, but additional research will be required to elucidate this phenomenon. By 1989, growth rates at Skiatook Lake had declined to levels precluding harvest of most white crappie younger than age IV or V if a 10" minimum length limit were imposed. High natural mortality rates render these fish too rare to sustain a productive fishery.

Whereas a 10" length limit may not be feasible at Skiatook Lake, a 9" limit may be useful in improving the fishery. Almost half of the crappie now being harvested are less than 9" in length, but many anglers consider these fish too small and release them voluntarily. Overall reduction of the fishery's yield would be relatively small (<15%) and the regulation would help diminish negative effects caused by sporadic poor recruitment. Missouri reports promising preliminary results using 9" length limits to control harvest of crappie populations with slow growth rates and thereby improve the quality of these fisheries (Michael Colvin, Missouri Department of Conservation, personal communication).

VI. Conclusions and Recommendations:

Angling pressure on Skiatook Lake has progressively increased and is likely to remain high. The crappie population suffers high rates of angling and natural mortality but also exhibits poor growth rates, despite the stage-filling of the reservoir. Because fish production is lost to death by natural mortality at a greater rate than it is replaced by growth in this population, restrictive harvest regulations aimed at deferring angling mortality are unlikely to prove as successful in Skiatook Lake as elsewhere. Nevertheless, improvements in the quality of the fishery (i.e., average size of harvested fish) may be gained at the expense of relatively small losses in quantity (i.e., total annual yield). Accordingly, we recommend consideration of implementation of a 9" length limit on crappie at Skiatook Lake, especially if this regulation proves successful in Missouri fisheries characterized by similarly slow growth rates.

VII. Prepared by: 

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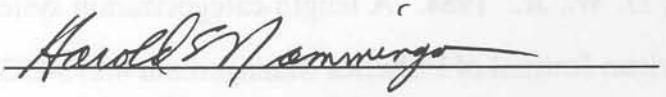
VIII. Date: 31 December 1991

IX. Approved by: 

Dr. Harold Namminga, D-J Coordinator

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Table 1. Mean total lengths at capture and back-calculated total lengths at age (mm) of white crappie collected in the autumns of 1986-1990. Ranges are presented below point estimates.

Year class	N	Length at capture	Back-calculated total length at annulus ± SD			
			1	2	3	4
Autumn 1986						
1985	119	187 ± 35 129-271	123 ± 22 76-187			
1984	7	303 ± 32 254-339	149 ± 49 81-215	235 ± 54 153-303		
1983	4	305 ± 17 281-327	89 ± 5 82-92	178 ± 30 139-207	246 ± 33 198-273	
1982	1	331	78	144	244	298
Weighted mean			123 ± 25 76-215	208 ± 54 139-303	246 ± 28 198-273	298
N			131	12	5	1
Autumn 1987						
1986	149	164 ± 25 121-258	125 ± 18 86-185			
1985	130	237 ± 27 163-317	119 ± 18 85-188	193 ± 27 138-292		
1984	1	218	111	145	190	
Weighted mean			122 ± 18 85-188	192 ± 28 129-292	190	
N			280	131	1	
Autumn 1988						
1987	62	146 ± 18 108-234	101 ± 14 70-131			
1986	111	215 ± 24 150-298	116 ± 17 84-173	170 ± 21 135-249		
1985	25	282 ± 30 200-333	118 ± 16 88-148	186 ± 23 143-251	246 ± 33 180-308	
Weighted mean			111 ± 17 70-173	173 ± 22 135-251	246 ± 33 180-308	
N			198	136	25	

Table 1. Continued.

Year class	N	Length at capture	Back-calculated total length at annulus ± SD 1	2	3	4
Autumn 1989						
1988	38	146 ± 11 122-187	110 ± 10 93-138			
1987	103	195 ± 24 149-264	100 ± 13 71-134	162 ± 18 125-201		
1986	33	224 ± 36 159-295	99 ± 15 74-130	155 ± 21 114-216	207 ± 33 139-261	
1985	1	319	136	193	250	308
Weighted mean			102 ± 14 71-138	160 ± 19 114-216	208 ± 33 139-261	308
N			175	137	34	1
Autumn 1990						
1989	31	154 ± 17 123-221	95 ± 9 81-125			
1988	70	196 ± 28 144-257	104 ± 13 67-126	149 ± 15 117-182		
1987	69	216 ± 35 152-290	99 ± 13 74-133	156 ± 16 120-191	200 ± 32 148-257	
1986	11	226 ± 40 175-313	100 ± 15 80-129	148 ± 23 121-190	194 ± 35 153-250	229 ± 44 167-295
Weighted mean			100 ± 13 67-133	152 ± 17 117-191	200 ± 33 148-257	229 ± 44 167-295
N			181	150	80	11

Table 2. Instantaneous mortality (Z), annual mortality (A), annual survival (S), exploitation (u), and natural mortality (v) rates of white crappie >200 mm TL, Skiatook Lake, Oklahoma, 1987-1990, derived from tag return data.

Year	Z	A (%)	S (%)	u (%)	v (%)
1987	2.10	87.7	12.3	49.4	38.3
1988	1.61	80.0	20.0	41.0	39.1
1989	2.43	91.2	8.8	52.8	38.4
1990	--	--	--	42.2	--

Table 3. Estimated quarterly catches by all anglers at Skiatook Lake, Oklahoma, September 1986 through November 1990.

	Autumn 1986	Winter 1986-87	Spring 1987	Summer 1987
Effort (hours)	22748	7030	82791	84218
All species, total	29946	4390	142626	128236
harvested	8034	1919	36462	27404
released	21913	2471	106165	100832
Both crappies, total	15026	4220	68633	53220
harvested	6352	1887	30856	23711
released	8673	2333	37776	29510
White crappie, harvested	6352	1887	30755	23405
Black crappie, harvested	0	0	101	306
Largemouth bass, total	11429	119	50011	46707
harvested	502	4	1215	391
released	10927	115	48796	46317
Sunfishes, total	2092	36	19938	24428
harvested	276	28	3288	2411
released	1816	8	16649	22017
Catfishes, total	1368	15	3575	3786
harvested	872	0	1001	891
released	496	15	2574	2894
Channel catfish, harvested	536	0	85	317
Yellow bullhead, harvested	140	0	135	113
Black bullhead, harvested	196	0	731	397
Flathead catfish, harvested	0	0	25	42
Blue catfish, harvested	0	0	25	22
Hybrid stripers, total	0	0	214	0
harvested	0	0	101	0
released	0	0	113	0
Freshwater drum, total	31	0	126	48
harvested	31	0	0	0
released	0	0	126	48
Carp, total	0	0	130	0
harvested	0	0	0	0
released	0	0	130	0
Walleye, total	0	0	0	48
harvested	0	0	0	0
released	0	0	0	48
Gar, released	0	0	0	0

Table 3. Continued.

	Autumn 1987	Winter 1987-88	Spring 1988	Summer 1988
Effort (hours)	63950	9982	91784	138732
All species, total	82808	3265	54970	207417
harvested	23787	857	14857	56114
released	59022	2407	40112	151303
Both crappies, total	47412	2861	25656	117344
harvested	21857	813	12526	48229
released	25357	2048	13129	69114
White crappie, harvested	21386	752	12351	43062
Black crappie, harvested	471	61	176	5167
Largemouth bass, total	19441	215	22004	52087
harvested	579	16	1300	900
released	18864	199	20703	51186
Sunfishes, total	14636	108	6344	31542
harvested	422	6	778	4901
released	14215	102	5567	26641
Catfishes, total	1292	0	902	6126
harvested	704	0	221	1950
released	587	0	681	4176
Channel catfish, harvested	280	0	173	1874
Yellow bullhead, harvested	54	0	0	0
Black bullhead, harvested	197	0	16	57
Flathead catfish, harvested	122	0	0	19
Blue catfish, harvested	51	0	32	0
Hybrid stripers, total	159	81	0	170
harvested	159	22	0	113
released	0	59	0	57
Freshwater drum, total	0	0	64	19
harvested	0	0	32	19
released	0	0	32	0
Carp, total	68	0	0	19
harvested	68	0	0	0
released	0	0	0	19
Walleye, total	0	0	0	92
harvested	0	0	0	0
released	0	0	0	92
Gar, released	0	0	0	19

Table 3. Continued.

	Autumn 1988	Winter 1988-89	Spring 1989	Summer 1989
Effort (hours)	74967	13945	108494	89319
All species, total	102029	13866	101740	136890
harvested	28555	6033	35863	46306
released	73475	7834	65877	90584
Both crappies, total	55820	13015	60673	104296
harvested	25957	5872	33050	42611
released	29864	7143	27623	61685
White crappie, harvested	24815	3940	27493	38392
Black crappie, harvested	1142	1932	5556	4220
Largemouth bass, total	26388	479	28497	18555
harvested	922	10	1241	803
released	25466	469	27256	17751
Sunfishes, total	15044	242	8739	10244
harvested	517	53	890	1046
released	14527	188	7849	9198
Catfishes, total	4457	10	3488	2851
harvested	978	10	545	1596
released	3479	0	2941	1255
Channel catfish, harvested	506	10	188	1418
Yellow bullhead, harvested	0	0	0	0
Black bullhead, harvested	472	0	357	53
Flathead catfish, harvested	0	0	0	0
Blue catfish, harvested	0	0	0	125
Hybrid stripers, total	302	122	325	659
harvested	182	88	136	232
released	120	34	188	427
Freshwater drum, total	0	0	0	249
harvested	0	0	0	18
released	0	0	0	232
Carp, total	18	0	20	0
harvested	0	0	0	0
released	18	0	20	0
Walleye, total	0	0	0	0
harvested	0	0	0	0
released	0	0	0	0
Gar, released	0	0	0	36

Table 3. Continued.

	Autumn 1989	Winter 1989-90	Spring 1990	Summer 1990	Autumn 1990
Effort (hours)	95489	16664	133486	214304	70056
All species, total	105635	17086	48780	216362	59961
harvested	36882	9070	9852	44884	18250
released	68752	8016	38929	171478	41710
Both crappies, total	81163	16338	23354	145556	37646
harvested	33972	8988	6257	33704	13116
released	47191	7349	17097	111852	24531
White crappie, harvested	32482	8676	5204	32477	12925
Black crappie, harvested	1491	313	1054	1225	191
Largemouth bass, total	17735	435	15356	44723	16384
harvested	1884	64	1301	5775	1882
released	15850	371	14055	38948	14502
Sunfishes, total	5382	243	7808	19260	1802
harvested	377	0	879	2820	27
released	5006	243	6930	16439	1774
Catfishes, total	1045	17	574	4667	1450
harvested	371	0	242	1698	766
released	674	17	332	2968	684
Channel catfish, harvested	340	0	242	1343	766
Yellow bullhead, harvested	31	0	0	30	0
Black bullhead, harvested	0	0	0	0	0
Flathead catfish, harvested	0	0	0	266	0
Blue catfish, harvested	0	0	0	59	0
Hybrid stripers, total	308	52	1567	1684	2650
harvested	277	17	1173	856	2431
released	31	35	394	827	219
Freshwater drum, total	0	0	91	473	0
harvested	0	0	0	30	0
released	0	0	91	443	0
Carp, total	0	0	30	0	0
harvested	0	0	0	0	0
released	0	0	30	0	0
Walleye, total	0	0	0	0	27
harvested	0	0	0	0	27
released	0	0	0	0	0
Gar, released	0	0	0	0	0

Table 4. Estimated quarterly catches by crappie anglers at Skiatook Lake, Oklahoma, September 1986 through November 1990.

	Autumn 1986	Winter 1986-87	Spring 1987	Summer 1987
Effort (hours)	9323	4336	42168	32612
All species, total	19284	4369	96500	74608
harvested	7263	1914	29193	22040
released	12021	2455	67307	52567
Both crappies, total	15009	4216	61028	44521
harvested	6352	1887	26180	19567
released	8657	2329	34848	25333
White crappie, harvested	6352	1887	26180	19259
Black crappie, harvested	0	0	0	598
Largemouth bass, total	3120	102	22154	12404
harvested	114	0	174	95
released	3006	102	21980	12355
Sunfishes, total	114	36	10451	14697
harvested	65	28	1935	1793
released	49	8	8516	12904
Catfishes, total	1041	15	2736	2512
harvested	732	0	993	675
released	309	15	1833	1837
Channel catfish, harvested	536	0	85	206
Yellow bullhead, harvested	0	0	110	113
Black bullhead, harvested	196	0	709	311
Flathead catfish, harvested	0	0	0	21
Blue catfish, harvested	0	0	0	22
Hybrid stripers, total	0	0	0	0
harvested	0	0	0	0
released	0	0	0	0
Freshwater drum, total	0	0	0	48
harvested	0	0	0	0
released	0	0	0	48
Carp, total	0	0	130	0
harvested	0	0	0	0
released	0	0	130	0
Walleye, total	0	0	0	48
harvested	0	0	0	0
released	0	0	0	48
Gar, released	0	0	0	0

Table 4. Continued.

	Autumn 1987	Winter 1987-88	Spring 1988	Summer 1988
Effort (hours)	26514	5991	41347	67035
All species, total	61082	2955	32669	138385
harvested	22941	830	11605	47590
released	38140	2126	21066	90795
Both crappies, total	46506	2833	22414	108381
harvested	21718	813	10937	43335
released	24789	2020	11476	65044
White crappie, harvested	21247	752	10761	38630
Black crappie, harvested	471	61	176	4706
Largemouth bass, total	3157	66	5083	9391
harvested	20	16	146	186
released	3137	50	4937	9205
Sunfishes, total	10278	11	4697	16466
harvested	382	0	378	2549
released	9896	11	4319	13917
Catfishes, total	1025	0	428	4110
harvested	704	0	128	1499
released	320	0	300	2612
Channel catfish, harvested	280	0	96	1423
Yellow bullhead, harvested	54	0	0	0
Black bullhead, harvested	197	0	16	57
Flathead catfish, harvested	122	0	0	19
Blue catfish, harvested	51	0	16	0
Hybrid stripers, total	51	43	0	19
harvested	51	0	0	19
released	0	43	0	0
Freshwater drum, total	0	0	48	0
harvested	0	0	16	0
released	0	0	32	0
Carp, total	68	0	0	19
harvested	68	0	0	0
released	0	0	0	19
Walleye, total	0	0	0	0
harvested	0	0	0	0
released	0	0	0	0
Gar, released	0	0	0	0

Table 4. Continued.

	Autumn 1988	Winter 1988-89	Spring 1989	Summer 1989
Effort (hours)	37108	10894	47536	43258
All species, total	80865	13619	71628	110456
harvested	26756	5945	34089	41627
released	54109	7674	37540	68829
Both crappies, total	54983	12995	56669	98003
harvested	25469	5872	32510	39899
released	29514	7123	24159	58105
White crappie, harvested	24393	3940	27012	35678
Black crappie, harvested	1076	1932	5498	4220
Largemouth bass, total	8274	338	6099	3547
harvested	264	10	260	36
released	8009	328	5839	3511
Sunfishes, total	14139	241	5619	7217
harvested	499	53	851	992
released	13641	188	4768	6224
Catfishes, total	3259	10	3201	1422
harvested	433	10	428	684
released	2826	0	2773	739
Channel catfish, harvested	415	10	71	612
Yellow bullhead, harvested	0	0	0	0
Black bullhead, harvested	18	0	357	0
Flathead catfish, harvested	0	0	0	0
Blue catfish, harvested	0	0	0	71
Hybrid stripers, total	193	34	39	0
harvested	91	0	39	0
released	102	34	0	0
Freshwater drum, total	0	0	0	232
harvested	0	0	0	18
released	0	0	0	214
Carp, total	18	0	0	0
harvested	0	0	0	0
released	18	0	0	0
Walleye, total	0	0	0	0
harvested	0	0	0	0
released	0	0	0	0
Gar, released	0	0	0	0

Table 4. Continued.

	Autumn 1989	Winter 1989-90	Spring 1990	Summer 1990	Autumn 1990
Effort (hours)	51875	12207	43446	71178	27115
All species, total	90454	16842	25551	155940	38334
harvested	34087	9070	5719	34368	13745
released	56367	7773	19832	121572	24589
Both crappies, total	80410	16199	18776	141628	35491
harvested	33470	8988	5082	32788	13007
released	46940	7210	13694	108839	22484
White crappie, harvested	32011	8676	4448	31621	12817
Black crappie, harvested	1460	313	634	1166	191
Largemouth bass, total	5685	366	1662	3913	1502
harvested	94	64	30	325	218
released	5591	302	1632	3589	1285
Sunfishes, total	3226	243	4812	8966	575
harvested	31	0	454	782	27
released	3195	243	4358	8182	547
Catfishes, total	1014	17	272	959	273
harvested	371	0	121	414	136
released	643	17	150	546	136
Channel catfish, harvested	340	0	121	384	136
Yellow bullhead, harvested	31	0	0	30	0
Black bullhead, harvested	0	0	0	0	0
Flathead catfish, harvested	0	0	0	0	0
Blue catfish, harvested	0	0	0	0	0
Hybrid stripers, total	120	17	30	59	493
harvested	120	17	30	59	356
released	0	0	0	0	137
Freshwater drum, total	0	0	0	414	0
harvested	0	0	0	0	0
released	0	0	0	414	0
Carp, total	0	0	0	0	0
harvested	0	0	0	0	0
released	0	0	0	0	0
Walleye, total	0	0	0	0	0
harvested	0	0	0	0	0
released	0	0	0	0	0
Gar, released	0	0	0	0	0

Table 5. Estimated quarterly catches by bass anglers at Skiatook Lake, Oklahoma, September 1986 through November 1990.

	Autumn 1986	Winter 1986-87	Spring 1987	Summer 1987
Effort (hours)	11762	2652	30547	41509
All species, total	10209	21	35432	43704
harvested	599	4	3893	2478
released	9610	17	31539	41227
Both crappies, total	16	4	4583	4917
harvested	0	0	2754	2039
released	16	4	2099	2877
White crappie, harvested	0	0	2654	1997
Black crappie, harvested	0	0	101	42
Largemouth bass, total	8309	17	24670	32407
harvested	388	4	969	275
released	7921	12	23701	32132
Sunfishes, total	1884	0	5610	6148
harvested	211	0	122	121
released	1673	0	5487	6026
Catfishes, total	0	0	236	232
harvested	0	0	47	42
released	0	0	189	190
Channel catfish, harvested	0	0	0	21
Yellow bullhead, harvested	0	0	0	0
Black bullhead, harvested	0	0	22	0
Flathead catfish, harvested	0	0	0	21
Blue catfish, harvested	0	0	25	0
Hybrid stripers, total	0	0	63	0
harvested	0	0	0	0
released	0	0	63	0
Freshwater drum, total	0	0	0	0
harvested	0	0	0	0
released	0	0	0	0
Carp, total	0	0	0	0
harvested	0	0	0	0
released	0	0	0	0
Walleye, total	0	0	0	0
harvested	0	0	0	0
released	0	0	0	0
Gar, released	0	0	0	0

Table 5. Continued.

	Autumn 1987	Winter 1987-88	Spring 1988	Summer 1988
Effort (hours)	29787	2403	39764	56833
All species, total	18462	137	19126	54500
harvested	548	0	2256	4472
released	17914	137	16870	50028
Both crappies, total	173	0	2416	4774
harvested	40	0	1083	2460
released	133	0	1334	2313
White crappie, harvested	40	0	1083	2368
Black crappie, harvested	0	0	0	92
Largemouth bass, total	15734	137	16087	40148
harvested	400	0	1059	713
released	15335	137	15028	39433
Sunfishes, total	2424	0	576	9203
harvested	0	0	66	1222
released	2424	0	510	7980
Catfishes, total	20	0	32	208
harvested	0	0	32	57
released	20	0	0	151
Channel catfish, harvested	0	0	16	57
Yellow bullhead, harvested	0	0	0	0
Black bullhead, harvested	0	0	0	0
Flathead catfish, harvested	0	0	0	0
Blue catfish, harvested	0	0	16	0
Hybrid stripers, total	108	0	0	57
harvested	108	0	0	19
released	0	0	0	38
Freshwater drum, total	0	0	16	0
harvested	0	0	16	0
released	0	0	0	0
Carp, total	0	0	0	0
harvested	0	0	0	0
released	0	0	0	0
Walleye, total	0	0	0	92
harvested	0	0	0	0
released	0	0	0	92
Gar, released	0	0	0	19

Table 5. Continued.

	Autumn 1988	Winter 1988-89	Spring 1989	Summer 1989
Effort (hours)	33988	2413	53502	36852
All species, total	19257	159	26237	18932
harvested	1163	0	1501	2055
released	18095	159	24736	16878
Both crappies, total	801	19	2697	2572
harvested	488	0	441	1233
released	314	19	2254	1338
White crappie, harvested	421	0	383	1233
Black crappie, harvested	66	0	58	0
Largemouth bass, total	17788	140	21597	14117
harvested	657	0	942	714
released	17130	140	20654	13402
Sunfishes, total	651	0	1774	1692
harvested	18	0	20	0
released	633	0	1754	1692
Catfishes, total	0	0	0	374
harvested	0	0	0	107
released	0	0	0	267
Channel catfish, harvested	0	0	0	71
Yellow bullhead, harvested	0	0	0	0
Black bullhead, harvested	0	0	0	18
Flathead catfish, harvested	0	0	0	0
Blue catfish, harvested	0	0	0	18
Hybrid stripers, total	18	0	169	178
harvested	0	0	98	0
released	18	0	71	178
Freshwater drum, total	0	0	0	0
harvested	0	0	0	0
released	0	0	0	0
Carp, total	0	0	0	0
harvested	0	0	0	0
released	0	0	0	0
Walleye, total	0	0	0	0
harvested	0	0	0	0
released	0	0	0	0
Gar, released	0	0	0	0

Table 5. Continued.

	Autumn 1989	Winter 1989-90	Spring 1990	Summer 1990	Autumn 1990
Effort (hours)	40906	4214	74823	105634	35507
All species, total	14615	208	17640	43290	16947
harvested	2293	0	1543	6012	2207
released	12322	208	16097	37278	14740
Both crappies, total	283	139	3189	1609	1745
harvested	31	0	272	650	109
released	251	139	2918	959	1636
White crappie, harvested	0	0	241	650	109
Black crappie, harvested	31	0	30	0	0
Largemouth bass, total	12018	69	12968	38770	13513
harvested	1790	0	1090	5362	1445
released	10229	69	11878	33409	12068
Sunfishes, total	2156	0	1331	2791	953
harvested	346	0	61	0	0
released	1811	0	1270	2791	953
Catfishes, total	31	0	121	118	0
harvested	0	0	91	0	0
released	31	0	30	118	0
Channel catfish, harvested	0	0	91	0	0
Yellow bullhead, harvested	0	0	0	0	0
Black bullhead, harvested	0	0	0	0	0
Flathead catfish, harvested	0	0	0	0	0
Blue catfish, harvested	0	0	0	0	0
Hybrid stripers, total	126	0	30	0	735
harvested	126	0	30	0	653
released	0	0	0	0	82
Freshwater drum, total	0	0	0	0	0
harvested	0	0	0	0	0
released	0	0	0	0	0
Carp, total	0	0	0	0	0
harvested	0	0	0	0	0
released	0	0	0	0	0
Walleye, total	0	0	0	0	0
harvested	0	0	0	0	0
released	0	0	0	0	0
Gar, released	0	0	0	0	0

Table 6. Estimated quarterly catches by anglers not fishing expressly for crappie or bass at Skiatook Lake, Oklahoma, September 1986 through November 1990.

	Autumn 1986	Winter 1986-87	Spring 1987	Summer 1987
Effort (hours)	1664	42	10077	10097
All species, total	453	0	10694	9923
harvested	172	0	3376	2885
released	282	0	7318	7038
Both crappies, total	0	0	2751	3448
harvested	0	0	1921	2148
released	0	0	830	1300
White crappie, harvested	0	0	1921	2148
Black crappie, harvested	0	0	0	0
Largemouth bass, total	0	0	3186	1851
harvested	0	0	72	66
released	0	0	3114	1785
Sunfishes, total	94	0	3877	3583
harvested	0	0	1231	496
released	94	0	2646	3087
Catfishes, total	328	0	603	1041
harvested	140	0	50	174
released	187	0	552	867
Channel catfish, harvested	0	0	0	90
Yellow bullhead, harvested	140	0	25	0
Black bullhead, harvested	0	0	0	84
Flathead catfish, harvested	0	0	25	0
Blue catfish, harvested	0	0	0	0
Hybrid stripers, total	0	0	151	0
harvested	0	0	101	0
released	0	0	50	0
Freshwater drum, total	31	0	126	0
harvested	31	0	0	0
released	0	0	126	0
Carp, total	0	0	0	0
harvested	0	0	0	0
released	0	0	0	0
Walleye, total	0	0	0	0
harvested	0	0	0	0
released	0	0	0	0
Gar, released	0	0	0	0

Table 6. Continued.

	Autumn 1987	Winter 1987-88	Spring 1988	Summer 1988
Effort (hours)	7649	1588	10671	14863
All species, total	3265	175	3174	14533
harvested	298	28	997	4051
released	2967	147	2177	10481
Both crappies, total	534	28	827	4188
harvested	99	0	507	2432
released	435	28	320	1756
White crappie, harvested	99	0	507	2063
Black crappie, harvested	0	0	0	369
Largemouth bass, total	551	11	835	2548
harvested	159	0	96	0
released	392	11	739	2548
Sunfishes, total	1933	97	1071	5873
harvested	40	6	334	1129
released	1893	91	737	4744
Catfishes, total	247	0	442	1808
harvested	0	0	61	394
released	247	0	381	1413
Channel catfish, harvested	0	0	61	394
Yellow bullhead, harvested	0	0	0	0
Black bullhead, harvested	0	0	0	0
Flathead catfish, harvested	0	0	0	0
Blue catfish, harvested	0	0	0	0
Hybrid stripers, total	0	38	0	94
harvested	0	22	0	76
released	0	16	0	19
Freshwater drum, total	0	0	0	19
harvested	0	0	0	19
released	0	0	0	0
Carp, total	0	0	0	0
harvested	0	0	0	0
released	0	0	0	0
Walleye, total	0	0	0	0
harvested	0	0	0	0
released	0	0	0	0
Gar, released	0	0	0	0

Table 6. Continued.

	Autumn 1988	Winter 1988-89	Spring 1989	Summer 1989
Effort (hours)	3870	638	7456	9209
All species, total	1906	88	3874	7502
harvested	635	88	273	2624
released	1271	0	3601	4877
Both crappies, total	36	0	1307	3722
harvested	0	0	98	1480
released	36	0	1209	2242
White crappie, harvested	0	0	98	1480
Black crappie, harvested	0	0	0	0
Largemouth bass, total	327	0	800	890
harvested	0	0	39	53
released	327	0	761	837
Sunfishes, total	254	0	1346	1336
harvested	0	0	20	53
released	254	0	1326	1282
Catfishes, total	1198	0	285	1055
harvested	544	0	117	805
released	654	0	169	249
Channel catfish, harvested	91	0	117	734
Yellow bullhead, harvested	0	0	0	0
Black bullhead, harvested	454	0	0	36
Flathead catfish, harvested	0	0	0	0
Blue catfish, harvested	0	0	0	36
Hybrid stripers, total	91	88	117	481
harvested	91	88	0	232
released	0	0	117	249
Freshwater drum, total	0	0	0	18
harvested	0	0	0	0
released	0	0	0	18
Carp, total	0	0	20	0
harvested	0	0	0	0
released	0	0	20	0
Walleye, total	0	0	0	0
harvested	0	0	0	0
released	0	0	0	0
Gar, released	0	0	0	0

Table 6. Continued.

	Autumn 1989	Winter 1989-90	Spring 1990	Summer 1990	Autumn 1990
Effort (hours)	2708	243	15216	37491	7433
All species, total	565	35	5589	17132	4680
harvested	503	0	2591	4504	2298
released	63	35	2999	12628	2382
Both crappies, total	471	0	1389	2318	411
harvested	471	0	904	266	0
released	0	0	485	2052	411
White crappie, harvested	471	0	514	207	0
Black crappie, harvested	0	0	390	59	0
Largemouth bass, total	31	0	726	2038	1369
harvested	0	0	181	89	219
released	31	0	545	1949	1150
Sunfishes, total	0	0	1665	7503	274
harvested	0	0	364	2038	0
released	0	0	1302	5465	274
Catfishes, total	0	0	182	3589	1178
harvested	0	0	30	1284	630
released	0	0	152	2304	548
Channel catfish, harvested	0	0	30	959	630
Yellow bullhead, harvested	0	0	0	0	0
Black bullhead, harvested	0	0	0	0	0
Flathead catfish, harvested	0	0	0	266	0
Blue catfish, harvested	0	0	0	59	0
Hybrid stripers, total	63	35	1507	1624	1422
harvested	31	0	1113	797	1422
released	31	35	394	827	0
Freshwater drum, total	0	0	91	59	0
harvested	0	0	0	30	0
released	0	0	91	30	0
Carp, total	0	0	30	0	0
harvested	0	0	0	0	0
released	0	0	30	0	0
Walleye, total	0	0	0	0	27
harvested	0	0	0	0	27
released	0	0	0	0	0
Gar, released	0	0	0	0	0

Table 7. Estimated catch-per-angler-hour of all anglers at Skiatook Lake, Oklahoma, September 1986 through November 1990.

	Autumn 1986	Winter 1986-87	Spring 1987	Summer 1987
All species, total	1.316	0.624	1.723	1.523
harvested	0.353	0.273	0.440	0.325
released	0.963	0.351	1.282	1.197
Both crappies, total	0.660	0.600	0.829	0.632
harvested	0.279	0.268	0.373	0.282
released	0.381	0.332	0.456	0.350
White crappie, harvested	0.279	0.268	0.371	0.278
Black crappie, harvested	0	0	0.001	0.004
Largemouth bass, total	0.502	0.017	0.604	0.554
harvested	0.022	<0.001	0.015	0.005
released	0.480	0.016	0.589	0.550
Sunfishes, total	0.092	0.005	0.241	0.290
harvested	0.012	0.004	0.040	0.029
released	0.080	0.001	0.201	0.261
Catfishes, total	0.060	0.002	0.043	0.045
harvested	0.038	0	0.012	0.010
released	0.022	0.002	0.031	0.034
Channel catfish, harvested	0.024	0	0.001	0.004
Yellow bullhead, harvested	0.006	0	0.002	0.001
Black bullhead, harvested	0.009	0	0.009	0.005
Flathead catfish, harvested	0	0	<0.001	<0.001
Blue catfish, harvested	0	0	<0.001	<0.001
Hybrid stripers, total	0	0	0.002	0
harvested	0	0	0.001	0
released	0	0	0.001	0
Freshwater drum, total	0.001	0	0.002	<0.001
harvested	0.001	0	0	0
released	0	0	0.002	<0.001
Carp, total	0	0	0.002	0
harvested	0	0	0	0
released	0	0	0.002	0
Walleye, total	0	0	0	<0.001
harvested	0	0	0	0
released	0	0	0	<0.001
Gar, released	0	0	0	0

Table 7. Continued.

	Autumn 1987	Winter 1987-88	Spring 1988	Summer 1988
All species, total	1.295	0.327	0.599	1.495
harvested	0.372	0.086	0.162	0.404
released	0.923	0.241	0.437	1.091
Both crappies, total	0.738	0.287	0.280	0.846
harvested	0.342	0.081	0.136	0.348
released	0.396	0.205	0.143	0.498
White crappie, harvested	0.334	0.075	0.134	0.310
Black crappie, harvested	0.007	0.006	0.002	0.037
Largemouth bass, total	0.304	0.022	0.240	0.375
harvested	0.009	0.002	0.014	0.006
released	0.295	0.020	0.226	0.369
Sunfishes, total	0.229	0.011	0.069	0.227
harvested	0.006	0.001	0.008	0.035
released	0.222	0.010	0.061	0.192
Catfishes, total	0.020	0	0.010	0.044
harvested	0.011	0	0.002	0.014
released	0.009	0	0.007	0.030
Channel catfish, harvested	0.004	0	0.002	0.014
Yellow bullhead, harvested	0.001	0	0	0
Black bullhead, harvested	0.003	0	<0.001	<0.001
Flathead catfish, harvested	0.002	0	0	<0.001
Blue catfish, harvested	0.001	0	<0.001	0
Hybrid stripers, total	0.002	0.008	0	0.001
harvested	0.002	0.002	0	0.001
released	0	0.006	0	<0.001
Freshwater drum, total	0	0	0.001	<0.001
harvested	0	0	<0.001	<0.001
released	0	0	<0.001	0
Carp, total	0.001	0	0	<0.001
harvested	0.001	0	0	0
released	0	0	0	<0.001
Walleye, total	0	0	0	0.001
harvested	0	0	0	0
released	0	0	0	0.001
Gar, released	0	0	0	<0.001

Table 7. Continued.

	Autumn 1988	Winter 1988-89	Spring 1989	Summer 1989
All species, total	1.361	0.994	0.938	1.532
harvested	0.381	0.433	0.330	0.518
released	0.980	0.562	0.607	1.014
Both crappies, total	0.744	0.933	0.559	1.167
harvested	0.346	0.421	0.305	0.477
released	0.398	0.512	0.255	0.690
White crappie, harvested	0.331	0.282	0.253	0.429
Black crappie, harvested	0.015	0.138	0.051	0.047
Largemouth bass, total	0.352	0.034	0.263	0.207
harvested	0.012	0.001	0.011	0.008
released	0.340	0.034	0.251	0.198
Sunfishes, total	0.201	0.017	0.080	0.114
harvested	0.007	0.004	0.008	0.011
released	0.194	0.013	0.072	0.102
Catfishes, total	0.059	0.001	0.032	0.031
harvested	0.013	0.001	0.005	0.017
released	0.046	0	0.027	0.014
Channel catfish, harvested	0.007	0.001	0.002	0.015
Yellow bullhead, harvested	0	0	0	0
Black bullhead, harvested	0.006	0	0.003	<0.001
Flathead catfish, harvested	0	0	0	0
Blue catfish, harvested	0	0	0	0.001
Hybrid stripers, total	0.004	0.009	0.003	0.007
harvested	0.002	0.006	0.001	0.002
released	0.002	0.002	0.002	0.004
Freshwater drum, total	0	0	0	0.002
harvested	0	0	0	<0.001
released	0	0	0	0.002
Carp, total	<0.001	0	<0.001	0
harvested	0	0	0	0
released	<0.001	0	<0.001	0
Walleye, total	0	0	0	0
harvested	0	0	0	0
released	0	0	0	0
Gar, released	0	0	0	<0.001

Table 7. Continued.

	Autumn 1989	Winter 1989-90	Spring 1990	Summer 1990	Autumn 1990
All species, total	1.106	1.025	0.365	1.009	0.855
harvested	0.386	0.544	0.073	0.209	0.260
released	0.719	0.481	0.291	0.800	0.595
Both crappies, total	0.849	0.980	0.174	0.679	0.537
harvested	0.355	0.539	0.046	0.157	0.187
released	0.494	0.441	0.128	0.521	0.350
White crappie, harvested	0.340	0.520	0.038	0.151	0.184
Black crappie, harvested	0.015	0.018	0.007	0.005	0.002
Largemouth bass, total	0.185	0.026	0.115	0.208	0.233
harvested	0.019	0.003	0.009	0.026	0.026
released	0.165	0.022	0.105	0.181	0.207
Sunfishes, total	0.056	0.014	0.058	0.089	0.025
harvested	0.003	0	0.006	0.013	<0.001
released	0.052	0.014	0.051	0.076	0.025
Catfishes, total	0.010	0.001	0.004	0.021	0.020
harvested	0.003	0	0.001	0.007	0.010
released	0.007	0.001	0.002	0.013	0.009
Channel catfish, harvested	0.003	0	0.001	0.006	0.010
Yellow bullhead, harvested	<0.001	0	0	<0.001	0
Black bullhead, harvested	0	0	0	0	0
Flathead catfish, harvested	0	0	0	0.001	0
Blue catfish, harvested	0	0	0	<0.001	0
Hybrid stripers, total	0.003	0.003	0.011	0.007	0.037
harvested	0.002	0.001	0.008	0.003	0.034
released	<0.001	0.002	0.002	0.003	0.003
Freshwater drum, total	0	0	<0.001	0.002	0
harvested	0	0	0	<0.001	0
released	0	0	<0.001	0.002	0
Carp, total	0	0	<0.001	0	0
harvested	0	0	0	0	0
released	0	0	<0.001	0	0
Walleye, total	0	0	0	0	<0.001
harvested	0	0	0	0	<0.001
released	0	0	0	0	0
Gar, released	0	0	0	0	0

Table 8. Estimated catch-per-angler-hour of crappie anglers at Skiatook Lake, Oklahoma, September 1986 through November 1990.

	Autumn 1986	Winter 1986-87	Spring 1987	Summer 1987
All species, total	2.068	1.008	2.288	2.288
harvested	0.779	0.441	0.692	0.676
released	1.289	0.566	1.596	1.612
Both crappies, total	1.610	0.972	1.447	1.365
harvested	0.681	0.435	0.621	0.600
released	0.929	0.537	0.826	0.777
White crappie, harvested	0.681	0.435	0.621	0.590
Black crappie, harvested	0	0	0	0.018
Largemouth bass, total	0.335	0.024	0.525	0.380
harvested	0.012	0	0.004	0.003
released	0.322	0.024	0.521	0.379
Sunfishes, total	0.012	0.008	0.248	0.451
harvested	0.007	0.006	0.046	0.055
released	0.005	0.002	0.202	0.396
Catfishes, total	0.112	0.003	0.065	0.077
harvested	0.078	0	0.024	0.021
released	0.033	0.003	0.043	0.056
Channel catfish, harvested	0.057	0	0.002	0.006
Yellow bullhead, harvested	0	0	0.003	0.003
Black bullhead, harvested	0.021	0	0.017	0.010
Flathead catfish, harvested	0	0	0	0.001
Blue catfish, harvested	0	0	0	0.001
Hybrid stripers, total	0	0	0	0
harvested	0	0	0	0
released	0	0	0	0
Freshwater drum, total	0	0	0	0.001
harvested	0	0	0	0
released	0	0	0	0.001
Carp, total	0	0	0.003	0
harvested	0	0	0	0
released	0	0	0.003	0
Walleye, total	0	0	0	0.001
harvested	0	0	0	0
released	0	0	0	0.001
Gar, released	0	0	0	0

Table 8. Continued.

	Autumn 1987	Winter 1987-88	Spring 1988	Summer 1988
All species, total	2.304	0.493	0.790	2.064
harvested	0.865	0.138	0.281	0.710
released	1.438	0.355	0.509	1.354
Both crappies, total	1.754	0.473	0.542	1.617
harvested	0.819	0.136	0.264	0.646
released	0.935	0.337	0.278	0.970
White crappie, harvested	0.801	0.126	0.260	0.576
Black crappie, harvested	0.018	0.010	0.004	0.070
Largemouth bass, total	0.119	0.011	0.123	0.140
harvested	0.001	0.003	0.004	0.003
released	0.118	0.008	0.119	0.137
Sunfishes, total	0.388	0.002	0.114	0.246
harvested	0.014	0	0.009	0.038
released	0.373	0.002	0.104	0.208
Catfishes, total	0.039	0	0.010	0.061
harvested	0.026	0	0.003	0.022
released	0.012	0	0.007	0.039
Channel catfish, harvested	0.010	0	0.002	0.021
Yellow bullhead, harvested	0.002	0	0	0
Black bullhead, harvested	0.007	0	<0.001	0.001
Flathead catfish, harvested	0.005	0	0	<0.001
Blue catfish, harvested	0.002	0	<0.001	0
Hybrid stripers, total	0.002	0.007	0	<0.001
harvested	0.002	0	0	<0.001
released	0	0.007	0	0
Freshwater drum, total	0	0	0.001	0
harvested	0	0	<0.001	0
released	0	0	0.001	0
Carp, total	0.002	0	0	<0.001
harvested	0.002	0	0	0
released	0	0	0	<0.001
Walleye, total	0	0	0	0
harvested	0	0	0	0
released	0	0	0	0
Gar, released	0	0	0	0

Table 8. Continued.

	Autumn 1988	Winter 1988-89	Spring 1989	Summer 1989
All species, total	2.179	1.250	1.507	2.553
harvested	0.721	0.546	0.717	0.962
released	1.458	0.704	0.790	1.591
Both crappies, total	1.482	1.193	1.192	2.265
harvested	0.686	0.539	0.684	0.922
released	0.795	0.654	0.508	1.690
White crappie, harvested	0.657	0.362	0.568	1.343
Black crappie, harvested	0.029	0.177	0.116	0.097
Largemouth bass, total	0.223	0.031	0.128	0.081
harvested	0.007	0.001	0.005	<0.001
released	0.216	0.030	0.123	0.081
Sunfishes, total	0.381	0.022	0.118	0.166
harvested	0.013	0.005	0.018	0.022
released	0.368	0.017	0.100	0.143
Catfishes, total	0.088	0.001	0.067	0.032
harvested	0.012	0.001	0.009	0.015
released	0.076	0	0.058	0.017
Channel catfish, harvested	0.011	0.001	0.001	0.014
Yellow bullhead, harvested	0	0	0	0
Black bullhead, harvested	<0.001	0	0.008	0
Flathead catfish, harvested	0	0	0	0
Blue catfish, harvested	0	0	0	0.001
Hybrid stripers, total	0.005	0.003	0.001	0
harvested	0.002	0	0.001	0
released	0.003	0.003	0	0
Freshwater drum, total	0	0	0	0.005
harvested	0	0	0	<0.001
released	0	0	0	0.004
Carp, total	<0.001	0	0	0
harvested	0	0	0	0
released	<0.001	0	0	0
Walleye, total	0	0	0	0
harvested	0	0	0	0
released	0	0	0	0
Gar, released	0	0	0	<0.001

Table 8. Continued.

	Autumn 1989	Winter 1989-90	Spring 1990	Summer 1990	Autumn 1990
All species, total	1.743	1.379	0.588	2.190	1.413
harvested	0.657	0.743	0.131	0.482	0.506
released	1.086	0.636	0.456	1.707	0.906
Both crappies, total	1.550	1.327	0.432	1.989	1.308
harvested	0.645	0.736	0.116	0.460	0.479
released	0.904	0.590	0.315	1.529	0.829
White crappie, harvested	0.617	0.710	0.102	0.444	0.472
Black crappie, harvested	0.028	0.025	0.014	0.016	0.007
Largemouth bass, total	0.109	0.029	0.038	0.054	0.055
harvested	0.001	0.005	<0.001	0.004	0.008
released	0.107	0.024	0.037	0.050	0.047
Sunfishes, total	0.062	0.019	0.110	0.125	0.021
harvested	<0.001	0	0.010	0.010	<0.001
released	0.061	0.019	0.100	0.114	0.020
Catfishes, total	0.019	0.001	0.006	0.013	0.010
harvested	0.007	0	0.002	0.005	0.005
released	0.012	0.001	0.003	0.007	0.005
Channel catfish, harvested	0.006	0	0.002	0.005	0.005
Yellow bullhead, harvested	<0.001	0	0	<0.001	0
Black bullhead, harvested	0	0	0	0	0
Flathead catfish, harvested	0	0	0	0	0
Blue catfish, harvested	0	0	0	0	0
Hybrid stripers, total	0.002	0.001	<0.001	<0.001	0.018
harvested	0.002	0.001	<0.001	<0.001	0.013
released	0	0	0	0	0.005
Freshwater drum, total	0	0	0	0.005	0
harvested	0	0	0	0	0
released	0	0	0	0.005	0
Carp, total	0	0	0	0	0
harvested	0	0	0	0	0
released	0	0	0	0	0
Walleye, total	0	0	0	0	0
harvested	0	0	0	0	0
released	0	0	0	0	0
Gar, released	0	0	0	0	0

Table 9. Estimated catch-per-angler-hour of bass anglers at Skiatook Lake, Oklahoma, September 1986 through November 1990.

	Autumn 1986	Winter 1986-87	Spring 1987	Summer 1987
All species, total	0.868	0.008	1.160	1.053
harvested	0.051	0.002	0.127	0.060
released	0.817	0.006	1.032	0.993
Both crappies, total	0.001	0.002	0.159	0.118
harvested	0	0	0.090	0.049
released	0.001	0.002	0.069	0.069
White crappie, harvested	0	0	0.087	0.048
Black crappie, harvested	0	0	0.003	0.001
Largemouth bass, total	0.706	0.006	0.808	0.781
harvested	0.033	0.002	0.032	0.007
released	0.673	0.004	0.776	0.774
Sunfishes, total	0.160	0	0.184	0.148
harvested	0.018	0	0.004	0.003
released	0.142	0	0.180	0.145
Catfishes, total	0	0	0.008	0.006
harvested	0	0	0.002	0.001
released	0	0	0.006	0.004
Channel catfish, harvested	0	0	0	<0.001
Yellow bullhead, harvested	0	0	0	0
Black bullhead, harvested	0	0	<0.001	0
Flathead catfish, harvested	0	0	0	<0.001
Blue catfish, harvested	0	0	<0.001	0
Hybrid stripers, total	0	0	0.002	0
harvested	0	0	0	0
released	0	0	0.002	0
Freshwater drum, total	0	0	0	0
harvested	0	0	0	0
released	0	0	0	0
Carp, total	0	0	0	0
harvested	0	0	0	0
released	0	0	0	0
Walleye, total	0	0	0	0
harvested	0	0	0	0
released	0	0	0	0
Gar, released	0	0	0	0

Table 9. Continued.

	Autumn 1987	Winter 1987-88	Spring 1988	Summer 1988
All species, total	0.620	0.057	0.481	0.959
harvested	0.018	0	0.057	0.079
released	0.601	0.057	0.424	0.880
Both crappies, total	0.006	0	0.061	0.084
harvested	0.001	0	0.027	0.043
released	0.004	0	0.034	0.041
White crappie, harvested	0.001	0	0.027	0.042
Black crappie, harvested	0	0	0	0.002
Largemouth bass, total	0.528	0.057	0.404	0.706
harvested	0.013	0	0.027	0.012
released	0.515	0.057	0.378	0.694
Sunfishes, total	0.081	0	0.014	0.162
harvested	0	0	0.002	0.022
released	0.081	0	0.013	0.140
Catfishes, total	0.001	0	0.001	0.004
harvested	0	0	0.001	0.001
released	0.001	0	0	0.003
Channel catfish, harvested	0	0	<0.001	0.001
Yellow bullhead, harvested	0	0	0	0
Black bullhead, harvested	0	0	0	0
Flathead catfish, harvested	0	0	0	0
Blue catfish, harvested	0	0	<0.001	0
Hybrid stripers, total	0.004	0	0	0.001
harvested	0.004	0	0	<0.001
released	0	0	0	0.001
Freshwater drum, total	0	0	<0.001	0
harvested	0	0	<0.001	0
released	0	0	0	0
Carp, total	0	0	0	0
harvested	0	0	0	0
released	0	0	0	0
Walleye, total	0	0	0	0.002
harvested	0	0	0	0
released	0	0	0	0.002
Gar, released	0	0	0	<0.001

Table 9. Continued.

	Autumn 1988	Winter 1988-89	Spring 1989	Summer 1989
All species, total	0.566	0.066	0.490	0.513
harvested	0.034	0	0.028	0.055
released	0.532	0.066	0.462	0.457
Both crappies, total	0.024	0.008	0.050	0.069
harvested	0.014	0	0.008	0.033
released	0.009	0.008	0.042	0.036
White crappie, harvested	0.012	0	0.007	0.033
Black crappie, harvested	0.002	0	0.001	0
Largemouth bass, total	0.523	0.058	0.404	0.383
harvested	0.019	0	0.018	0.019
released	0.504	0.058	0.386	0.363
Sunfishes, total	0.019	0	0.033	0.045
harvested	<0.001	0	0	0
released	0.019	0	0.033	0.045
Catfishes, total	0	0	0	0.010
harvested	0	0	0	0.002
released	0	0	0	0.007
Channel catfish, harvested	0	0	0	0.001
Yellow bullhead, harvested	0	0	0	0
Black bullhead, harvested	0	0	0	<0.001
Flathead catfish, harvested	0	0	0	0
Blue catfish, harvested	0	0	0	<0.001
Hybrid stripers, total	<0.001	0	0.003	0.004
harvested	0	0	0.002	0
released	<0.001	0	0.001	0.004
Freshwater drum, total	0	0	0	0
harvested	0	0	0	0
released	0	0	0	0
Carp, total	0	0	0	0
harvested	0	0	0	0
released	0	0	0	0
Walleye, total	0	0	0	0
harvested	0	0	0	0
released	0	0	0	0
Gar, released	0	0	0	0

Table 9. Continued.

	Autumn 1989	Winter 1989-90	Spring 1990	Summer 1990	Autumn 1990
All species, total	0.357	0.049	0.235	0.409	0.477
harvested	0.056	0	0.020	0.056	0.062
released	0.301	0.049	0.215	0.352	0.415
Both crappies, total	0.006	0.032	0.042	0.015	0.049
harvested	<0.001	0	0.003	0.006	0.003
released	0.006	0.032	0.038	0.009	0.046
White crappie, harvested	0	0	0.003	0.006	0.003
Black crappie, harvested	<0.001	0	<0.001	0	0
Largemouth bass, total	0.293	0.016	0.173	0.367	0.380
harvested	0.043	0	0.014	0.050	0.040
released	0.250	0.016	0.158	0.316	0.339
Sunfishes, total	0.052	0	0.017	0.026	0.026
harvested	0.008	0	<0.001	0	0
released	0.044	0	0.016	0.026	0.026
Catfishes, total	<0.001	0	0.001	0.001	0
harvested	0	0	0.001	0	0
released	<0.001	0	<0.001	0.001	0
Channel catfish, harvested	0	0	0.001	0	0
Yellow bullhead, harvested	0	0	0	0	0
Black bullhead, harvested	0	0	0	0	0
Flathead catfish, harvested	0	0	0	0	0
Blue catfish, harvested	0	0	0	0	0
Hybrid stripers, total	0.003	0	<0.001	0	0.020
harvested	0.003	0	<0.001	0	0.018
released	0	0	0	0	0.002
Freshwater drum, total	0	0	0	0	0
harvested	0	0	0	0	0
released	0	0	0	0	0
Carp, total	0	0	0	0	0
harvested	0	0	0	0	0
released	0	0	0	0	0
Walleye, total	0	0	0	0	0
harvested	0	0	0	0	0
released	0	0	0	0	0
Gar, released	0	0	0	0	0

Table 10. Estimated catch-per-angler-hour of anglers not fishing expressly for crappie or bass at Skiatook Lake, Oklahoma, September 1986 through November 1990.

	Autumn 1986	Winter 1986-87	Spring 1987	Summer 1987
All species, total	0.272	0	1.061	0.983
harvested	0.103	0	0.335	0.286
released	0.169	0	0.726	0.697
Both crappies, total	0	0	0.273	0.341
harvested	0	0	0.191	0.213
released	0	0	0.082	0.129
White crappie, harvested	0	0	0.191	0.213
Black crappie, harvested	0	0	0	0
Largemouth bass, total	0	0	0.316	0.183
harvested	0	0	0.007	0.006
released	0	0	0.309	0.177
Sunfishes, total	0.056	0	0.385	0.355
harvested	0	0	0.122	0.049
released	0.056	0	0.262	0.306
Catfishes, total	0.197	0	0.060	0.103
harvested	0.084	0	0.005	0.017
released	0.112	0	0.055	0.086
Channel catfish, harvested	0	0	0	0.009
Yellow bullhead, harvested	0.084	0	0.002	0
Black bullhead, harvested	0	0	0	0.008
Flathead catfish, harvested	0	0	0.002	0
Blue catfish, harvested	0	0	0	0
Hybrid stripers, total	0	0	0.015	0
harvested	0	0	0.010	0
released	0	0	0.005	0
Freshwater drum, total	0.019	0	0.012	0
harvested	0.019	0	0	0
released	0	0	0.012	0
Carp, total	0	0	0	0
harvested	0	0	0	0
released	0	0	0	0
Walleye, total	0	0	0	0
harvested	0	0	0	0
released	0	0	0	0
Gar, released	0	0	0	0

Table 10. Continued.

	Autumn 1987	Winter 1987-88	Spring 1988	Summer 1988
All species, total	0.427	0.110	0.297	0.978
harvested	0.039	0.018	0.093	0.272
released	0.388	0.092	0.204	0.705
Both crappies, total	0.070	0.018	0.077	0.282
harvested	0.013	0	0.048	0.164
released	0.057	0.018	0.030	0.118
White crappie, harvested	0.013	0	0.048	0.139
Black crappie, harvested	0	0	0	0.025
Largemouth bass, total	0.072	0.007	0.078	0.171
harvested	0.021	0	0.009	0
released	0.051	0.007	0.069	0.171
Sunfishes, total	0.253	0.061	0.100	0.395
harvested	0.005	0.004	0.031	0.076
released	0.247	0.057	0.069	0.319
Catfishes, total	0.032	0	0.041	0.122
harvested	0	0	0.006	0.026
released	0.032	0	0.036	0.095
Channel catfish, harvested	0	0	0.006	0.026
Yellow bullhead, harvested	0	0	0	0
Black bullhead, harvested	0	0	0	0
Flathead catfish, harvested	0	0	0	0
Blue catfish, harvested	0	0	0	0
Hybrid stripers, total	0	0.024	0	0.006
harvested	0	0.014	0	0.005
released	0	0.010	0	0.001
Freshwater drum, total	0	0	0	0.001
harvested	0	0	0	0.001
released	0	0	0	0
Carp, total	0	0	0	0
harvested	0	0	0	0
released	0	0	0	0
Walleye, total	0	0	0	0
harvested	0	0	0	0
released	0	0	0	0
Gar, released	0	0	0	0

Table 10. Continued.

	Autumn 1988	Winter 1988-89	Spring 1989	Summer 1989
All species, total	0.492	0.138	0.520	0.814
harvested	0.164	0.138	0.037	0.284
released	0.328	0	0.483	0.529
Both crappies, total	0.009	0	0.175	0.404
harvested	0	0	0.013	0.160
released	0.009	0	0.162	0.243
White crappie, harvested	0	0	0.013	0.160
Black crappie, harvested	0	0	0	0
Largemouth bass, total	0.084	0	0.107	0.096
harvested	0	0	0.005	0.005
released	0.084	0	0.102	0.090
Sunfishes, total	0.066	0	0.180	0.145
harvested	0	0	0.003	0.005
released	0.066	0	0.178	0.139
Catfishes, total	0.310	0	0.038	0.114
harvested	0.140	0	0.016	0.087
released	0.169	0	0.023	0.027
Channel catfish, harvested	0.024	0	0.016	0.079
Yellow bullhead, harvested	0	0	0	0
Black bullhead, harvested	0.117	0	0	0.003
Flathead catfish, harvested	0	0	0	0
Blue catfish, harvested	0	0	0	0.003
Hybrid stripers, total	0.024	0.138	0.016	0.052
harvested	0.024	0.138	0	0.025
released	0	0	0.016	0.027
Freshwater drum, total	0	0	0	0.001
harvested	0	0	0	0
released	0	0	0	0.001
Carp, total	0	0	0.003	0
harvested	0	0	0	0
released	0	0	0.003	0
Walleye, total	0	0	0	0
harvested	0	0	0	0
released	0	0	0	0
Gar, released	0	0	0	0

Table 10. Continued.

	Autumn 1989	Winter 1989-90	Spring 1990	Summer 1990	Autumn 1990
All species, total	0.208	0.144	0.367	0.456	0.629
harvested	0.185	0	0.170	0.120	0.309
released	0.023	0.144	0.197	0.336	0.320
Both crappies, total	0.173	0	0.091	0.061	0.055
harvested	0.173	0	0.059	0.007	0
released	0	0	0.031	0.054	0.055
White crappie, harvested	0.173	0	0.033	0.005	0
Black crappie, harvested	0	0	0.025	0.001	0
Largemouth bass, total	0.011	0	0.047	0.054	0.184
harvested	0	0	0.011	0.002	0.029
released	0.011	0	0.035	0.051	0.154
Sunfishes, total	0	0	0.109	0.200	0.036
harvested	0	0	0.023	0.054	0
released	0	0	0.085	0.145	0.036
Catfishes, total	0	0	0.011	0.095	0.158
harvested	0	0	0.001	0.034	0.084
released	0	0	0.009	0.061	0.073
Channel catfish, harvested	0	0	0.001	0.025	0.084
Yellow bullhead, harvested	0	0	0	0	0
Black bullhead, harvested	0	0	0	0	0
Flathead catfish, harvested	0	0	0	0.007	0
Blue catfish, harvested	0	0	0	0.001	0
Hybrid stripers, total	0.023	0.144	0.099	0.043	0.191
harvested	0.011	0	0.073	0.021	0.191
released	0.011	0.144	0.025	0.022	0
Freshwater drum, total	0	0	0.005	0.001	0
harvested	0	0	0	<0.001	0
released	0	0	0.005	<0.001	0
Carp, total	0	0	0.001	0	0
harvested	0	0	0	0	0
released	0	0	0.001	0	0
Walleye, total	0	0	0	0	0.003
harvested	0	0	0	0	0.003
released	0	0	0	0	0
Gar, released	0	0	0	0	0

Table 11. Predicted total annual yields, yield-per-unit-effort rates, and total annual catches under various combinations of length and daily creel limits generated by the Ricker equilibrium-yield model of the white crappie population of Skiatook Lake, Oklahoma.

Length limit	Daily creel limit						
	37	30	25	20	15	10	5
Total Annual Yield (kg)							
--	14311	14278	14217	14119	13924	13395	11715
8"	13975	13942	13883	13786	13595	13077	11429
9"	12371	12338	12279	12184	11997	11495	9948
10"	10001	9974	9923	9842	9682	9256	7952
11"	7166	7145	7108	7047	6927	6609	5643
12"	5106	5090	5059	5011	4916	4665	3929
Total Annual Yield (N)							
--	85280	84908	84234	83160	81085	75781	61306
8"	77316	76993	76406	75469	73654	68988	56087
9"	53881	53654	53241	52583	51309	48041	39039
10"	32923	32789	32544	32154	31398	29446	24010
11"	17424	17354	17228	17026	16633	15617	12768
12"	9639	9598	9524	9406	9178	8592	6975
Yield-per-unit-effort (kg/h)							
--	0.0461	0.0460	0.0458	0.0455	0.0449	0.0432	0.0377
8"	0.0450	0.0449	0.0447	0.0444	0.0438	0.0421	0.0368
9"	0.0399	0.0398	0.0396	0.0393	0.0386	0.0370	0.0320
10"	0.0322	0.0321	0.0320	0.0317	0.0312	0.0298	0.0256
11"	0.0231	0.0230	0.0229	0.0227	0.0223	0.0213	0.0182
12"	0.0164	0.0164	0.0163	0.0161	0.0158	0.0150	0.0126
Yield-per-unit-effort (N/h)							
--	0.2750	0.2738	0.2717	0.2682	0.2615	0.2444	0.1977
8"	0.2494	0.2483	0.2464	0.2434	0.2375	0.2225	0.1809
9"	0.1738	0.1730	0.1717	0.1696	0.1655	0.1549	0.1259
10"	0.1062	0.1057	0.1049	0.1037	0.1012	0.0949	0.0774
11"	0.0562	0.0559	0.0555	0.0549	0.0536	0.0503	0.0411
12"	0.0310	0.0309	0.0307	0.0303	0.0296	0.0277	0.0225
Total annual catch (kg)							
--	38185	38292	38487	38800	39413	41033	45849
8"	39657	39758	39943	40238	40819	42356	46949
9"	46024	46108	46259	46502	46979	48242	52014
10"	52705	52771	52890	53082	53458	54450	57380
11"	59436	59483	59567	59701	59965	60658	62685
12"	64428	64459	64515	64605	64782	65242	66574
Total annual catch (N)							
--	414186	414662	415524	416897	419550	426329	444818
8"	423786	424205	424966	426180	428529	434562	451186
9"	455834	456108	456605	457400	458942	462921	474007
10"	481034	481206	481519	482017	482985	485481	492426
11"	500328	500420	500589	500857	501379	502724	506470
12"	511083	511132	511221	511363	511638	512348	514318

Table 12. Predicted catch-per-unit-effort rates, mean weights and lengths of harvested crappie, and total biomasses and abundances of white crappie >6" under various combinations of length and daily creel limits generated by the Ricker equilibrium-yield model of the white crappie population of Skiatook Lake, Oklahoma.

Length limit	Daily creel limit						
	37	30	25	20	15	10	5
Catch-per-unit-effort (kg/h)							
--	0.1231	0.1235	0.1241	0.1251	0.1271	0.1323	0.1478
8"	0.1279	0.1282	0.1288	0.1298	0.1316	0.1366	0.1514
9"	0.1484	0.1487	0.1492	0.1500	0.1515	0.1556	0.1677
10"	0.1700	0.1702	0.1706	0.1712	0.1724	0.1756	0.1850
11"	0.1917	0.1918	0.1921	0.1925	0.1934	0.1956	0.2022
12"	0.2078	0.2079	0.2081	0.2084	0.2089	0.2104	0.2147
Catch-per-unit-effort (N/h)							
--	1.3360	1.3376	1.3404	1.3448	1.3533	1.3752	1.4348
8"	1.3670	1.3648	1.3708	1.3747	1.3823	1.4018	1.4554
9"	1.4704	1.4713	1.4729	1.4754	1.4804	1.4932	1.5290
10"	1.5517	1.5522	1.5532	1.5548	1.5580	1.5660	1.5884
11"	1.6139	1.6142	1.6148	1.6156	1.6173	1.6216	1.6337
12"	1.6486	1.6488	1.6491	1.6495	1.6504	1.6527	1.6590
Mean weight of harvested white crappie (g)							
--	167.8	168.2	168.8	169.8	171.7	176.8	191.1
8"	180.8	181.1	181.7	182.7	184.6	189.6	203.8
9"	229.6	230.0	230.6	231.7	233.8	239.3	254.8
10"	303.8	304.2	304.9	306.1	308.4	314.3	331.2
11"	411.3	411.7	412.6	413.9	416.5	423.2	441.9
12"	529.8	530.3	531.2	532.7	535.6	543.0	563.3
Mean length (mm) of harvested white crappie							
--	230.5	230.7	230.9	231.3	232.1	234.1	239.5
8"	235.6	235.8	236.0	236.4	237.1	239.0	244.1
9"	252.8	253.0	253.2	253.5	254.2	255.9	260.7
10"	274.6	274.7	274.9	275.2	275.8	277.4	281.7
11"	300.2	300.3	300.5	300.8	301.3	302.8	306.6
12"	323.5	323.6	323.7	324.0	324.5	325.8	329.4
Total biomass (kg) of white crappie >6" present January 1							
--	45306	45406	45587	45879	46450	47964	52483
8"	46755	46848	47018	47291	47828	49255	53548
9"	52100	52184	52338	52583	53064	54325	58026
10"	58899	58961	59072	59252	59603	60534	63298
11"	66087	66123	66190	66299	66512	67081	68802
12"	69713	69745	69803	69896	70077	70547	71879
Total abundance of white crappie >6" present January 1							
--	641036	641468	642253	643505	645926	652137	669198
8"	651399	651764	652427	653488	655550	660890	675849
9"	675352	675648	676185	677039	678685	682881	694260
10"	703102	703257	703538	703988	704864	707137	713537
11"	723104	723172	723297	723498	723891	724923	727910
12"	730279	730332	730427	730580	730874	731624	733652

Table 13. Predicted total biomasses, abundances, yields, and yield-per-unit-effort rates of white crappie >10" under various combinations of length and daily creel limits generated by the Ricker equilibrium-yield model of the white crappie population of Skiatook Lake, Oklahoma.

Length limit	Daily creel limit						
	37	30	25	20	15	10	5
Total biomass (kg) of white crappie >10" present January 1							
--	1971	2012	2087	2210	2461	3176	5694
8"	2124	2167	2245	2373	2632	3369	5929
9"	3337	3389	3486	3641	3953	4809	7573
10"	6119	6180	6292	6471	6823	7754	10517
11"	13306	13343	13410	13518	13731	14300	16021
12"	16932	16964	17022	17115	17297	17766	19098
Total abundance of white crappie >10" present January 1							
--	5486	5594	5794	6119	6777	8628	14867
8"	5912	6024	6231	6569	7249	9152	15482
9"	9287	9424	9675	10081	10886	13063	19774
10"	17028	17183	17465	17915	18791	21064	27464
11"	37030	37099	37224	37425	37818	38849	41837
12"	44205	44258	44354	44507	44801	45551	47579
Total annual yield (kg) of white crappie >10"							
--	3222	3247	3292	3362	3492	3791	4304
8"	3472	3496	3540	3609	3735	4021	4482
9"	5454	5470	5497	5538	5609	5740	5725
10"	10001	9974	9923	9842	9682	9256	7952
11"	7166	7145	7108	7047	6927	6609	5643
12"	5106	5090	5059	5011	4916	4665	3929
Total annual yield (N) of white crappie >10"							
--	10606	10674	10796	10983	11324	12062	12998
8"	11430	11495	11611	11790	12113	12794	13535
9"	17955	17983	18029	18094	18190	18262	17287
10"	32923	32789	32544	32154	31398	29446	24010
11"	17424	17354	17228	17026	16633	15617	12768
12"	9639	9598	9524	9406	9178	8592	6975
Yield-per-unit-effort (kg/h) of white crappie >10"							
--	0.0103	0.0104	0.0106	0.0108	0.0112	0.0122	0.0138
8"	0.0112	0.0112	0.0114	0.0116	0.0120	0.0129	0.0144
9"	0.0175	0.0176	0.0177	0.0178	0.0180	0.0185	0.0184
10"	0.0322	0.0321	0.0320	0.0317	0.0312	0.0298	0.0256
11"	0.0231	0.0230	0.0229	0.0227	0.0223	0.0213	0.0182
12"	0.0164	0.0164	0.0163	0.0161	0.0158	0.0150	0.0126
Yield-per-unit-effort (N/h) of white crappie >10"							
--	0.0342	0.0344	0.0348	0.0354	0.0365	0.0389	0.0419
8"	0.0368	0.0370	0.0374	0.0380	0.0390	0.0412	0.0436
9"	0.0579	0.0580	0.0581	0.0583	0.0586	0.0589	0.0557
10"	0.1062	0.1057	0.1049	0.1037	0.1012	0.0949	0.0774
11"	0.0562	0.0559	0.0555	0.0549	0.0536	0.0503	0.0411
12"	0.0310	0.0309	0.0307	0.0303	0.0296	0.0277	0.0225

Table 14. Predicted yields and yield-per-unit-effort rates of white crappie >9" under various combinations of length and daily creel limits generated by the Ricker equilibrium-yield model of the white crappie population of Skiatook Lake, Oklahoma.

Length limit	Daily creel limit						
	37	30	25	20	15	10	5
Total annual yield (kg) of white crappie >9"							
--	7307	7324	7353	7396	7468	7592	7479
8"	7875	7887	7908	7939	7988	8053	7788
9"	12370	12338	12279	12184	11996	11494	9948
10"	10001	9974	9923	9842	9682	9256	7952
11"	7166	7145	7108	7047	6927	6609	5643
12"	5106	5090	5059	5011	4916	4665	3929
Total annual yield (N) of white crappie >9"							
--	31828	31849	31881	31918	31942	31730	29352
8"	34299	34297	34289	34263	34166	33655	30565
9"	53881	53654	53241	52583	51309	48041	39039
10"	32923	32789	32544	32154	31398	29446	24010
11"	17424	17354	17228	17026	16633	15617	12768
12"	9639	9598	9524	9406	9178	8592	6975
Yield-per-unit-effort (kg/h) of white crappie >9"							
--	0.0235	0.0236	0.0237	0.0238	0.0240	0.0244	0.0241
8"	0.0254	0.0254	0.0255	0.0256	0.0257	0.0259	0.0251
9"	0.0399	0.0398	0.0396	0.0393	0.0386	0.0370	0.0320
10"	0.0322	0.0321	0.0320	0.0317	0.0312	0.0298	0.0256
11"	0.0231	0.0230	0.0229	0.0227	0.0223	0.0213	0.0182
12"	0.0164	0.0164	0.0163	0.0161	0.0158	0.0150	0.0126
Yield-per-unit-effort (N/h) of white crappie >9"							
--	0.1026	0.1027	0.1028	0.1029	0.1030	0.1023	0.0946
8"	0.1106	0.1106	0.1106	0.1105	0.1102	0.1085	0.0985
9"	0.1738	0.1730	0.1717	0.1696	0.1655	0.1549	0.1259
10"	0.1062	0.1057	0.1049	0.1037	0.1012	0.0949	0.0774
11"	0.0562	0.0559	0.0555	0.0549	0.0536	0.0503	0.0411
12"	0.0310	0.0309	0.0307	0.0303	0.0296	0.0277	0.0225

Table 15. Predicted length-specific yields and yield-per-unit-effort rates of white crappie under various length limits generated by the Ricker equilibrium-yield model of the white crappie population of Skiatook Lake, Oklahoma. A 37-fish daily creel limit was used throughout.

Length limit	Length interval	Yield			
		kg	kg/h	N	N/h
None	<8"	1343	0.0043	13533	0.0436
	8-9"	5661	0.0182	39918	0.1287
	9-10"	4086	0.0131	21222	0.0684
	10-11"	2160	0.0069	8025	0.0258
	11-12"	727	0.0023	1949	0.0062
	12-13"	252	0.0008	512	0.0016
	>13"	83	0.0002	120	0.0003
8"	8-9"	6100	0.0196	43017	0.1387
	9-10"	4403	0.0142	22869	0.0737
	10-11"	2328	0.0075	8648	0.0278
	11-12"	783	0.0025	2101	0.0067
	12-13"	271	0.0008	551	0.0017
	>13"	89	0.0002	130	0.0004
9"	9-10"	6916	0.0223	35926	0.1158
	10-11"	3657	0.0117	13586	0.0438
	11-12"	1230	0.0039	3300	0.0106
	12-13"	426	0.0013	866	0.0027
	>13"	140	0.0004	204	0.0006
10"	10-11"	6706	0.0216	24910	0.0803
	11-12"	2256	0.0072	6051	0.0195
	12-13"	782	0.0025	1588	0.0051
	>13"	257	0.0008	374	0.0012
11"	11-12"	4906	0.0158	13159	0.0424
	12-13"	1670	0.0054	3453	0.0111
	>13"	560	0.0018	812	0.0026
12"	12-13"	3842	0.0123	7803	0.0251
	>13"	1265	0.0040	1836	0.0059

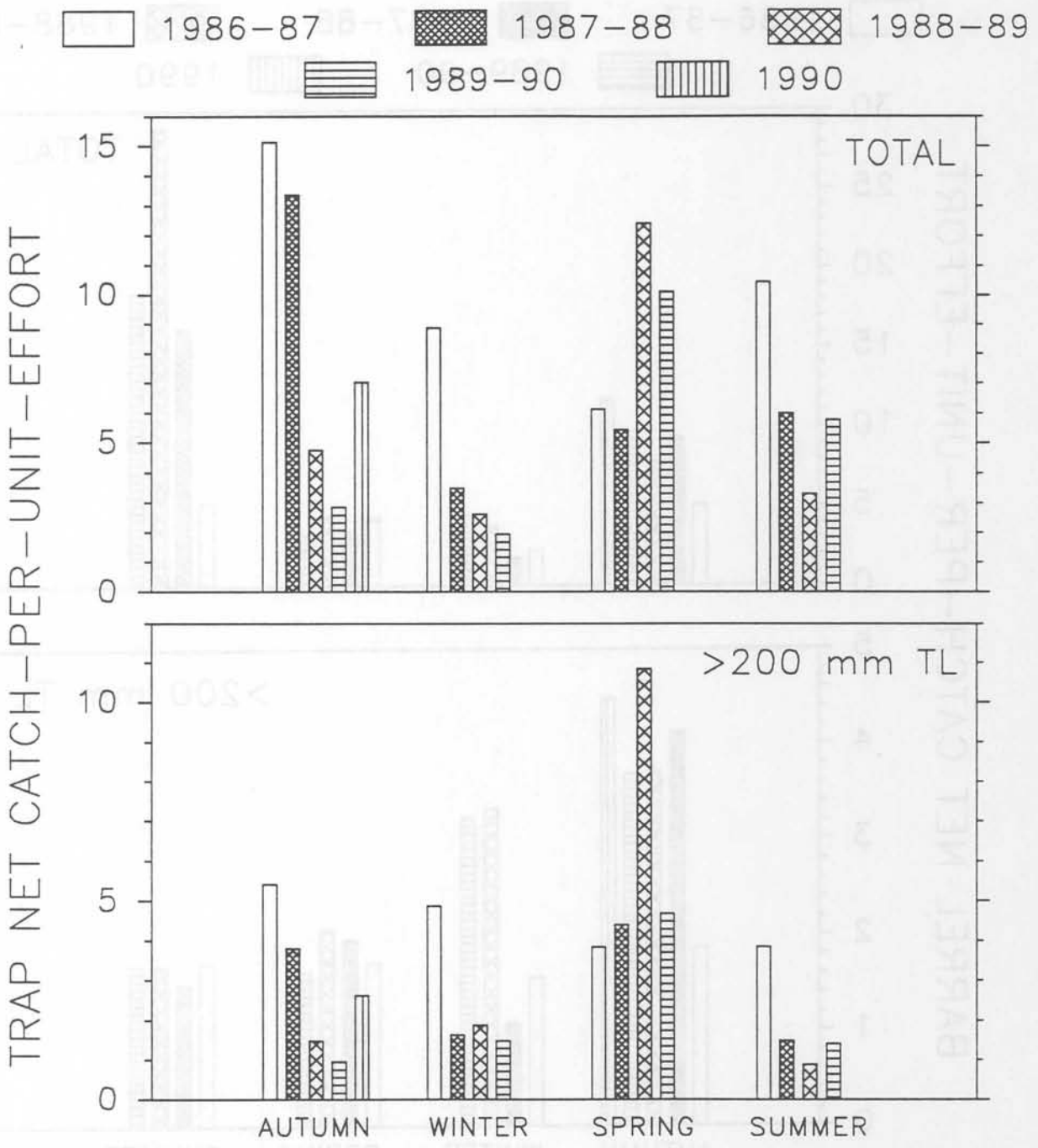

Figure 1. Quarterly trap net catch-per-unit-effort rates, autumn 1986 to autumn 1990, Skiatook Lake, Oklahoma.

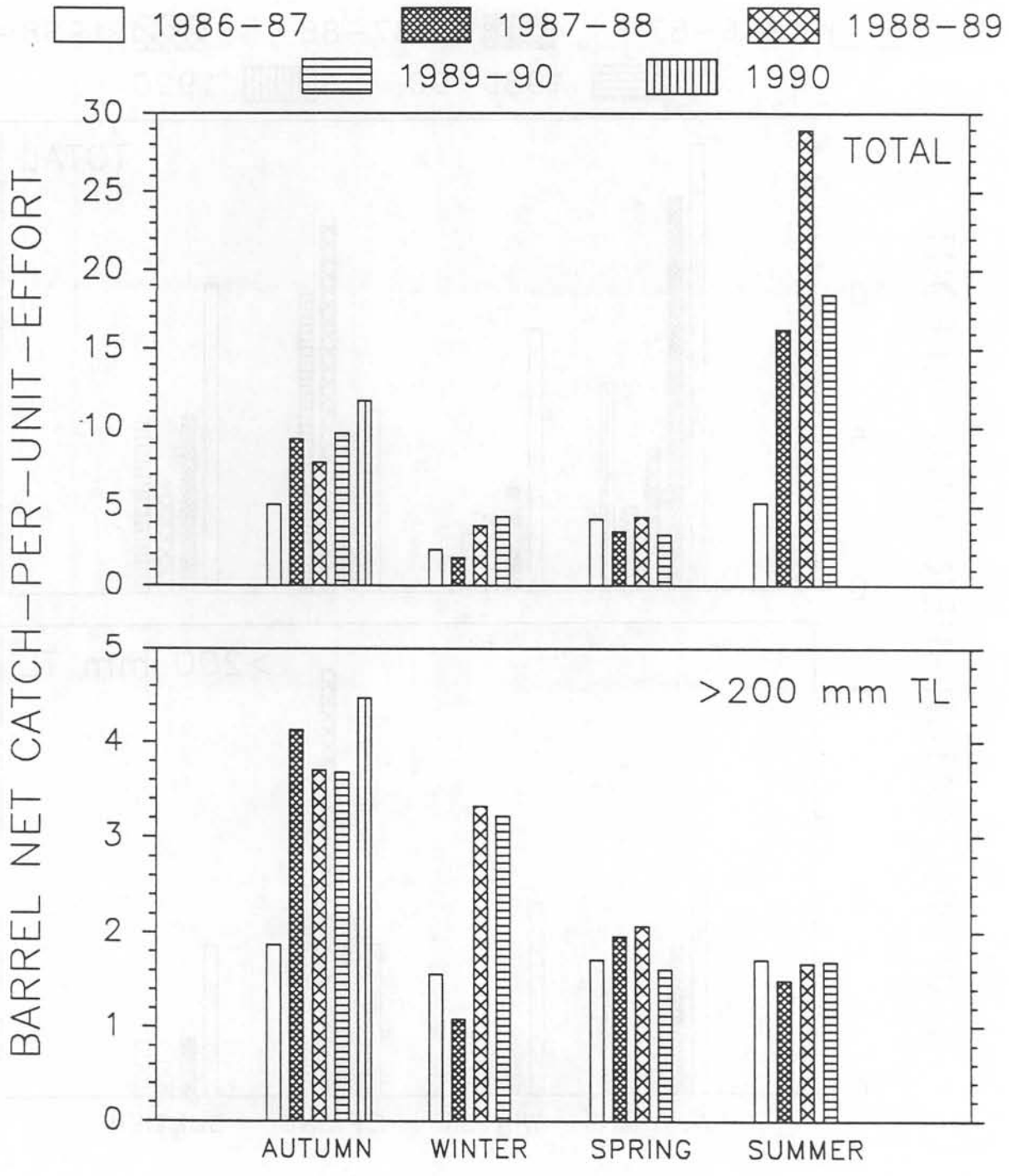

Figure 2. Quarterly barrel net catch-per-unit-effort rates, *autumn 1986 to autumn 1990*, Skiatook Lake, Oklahoma.

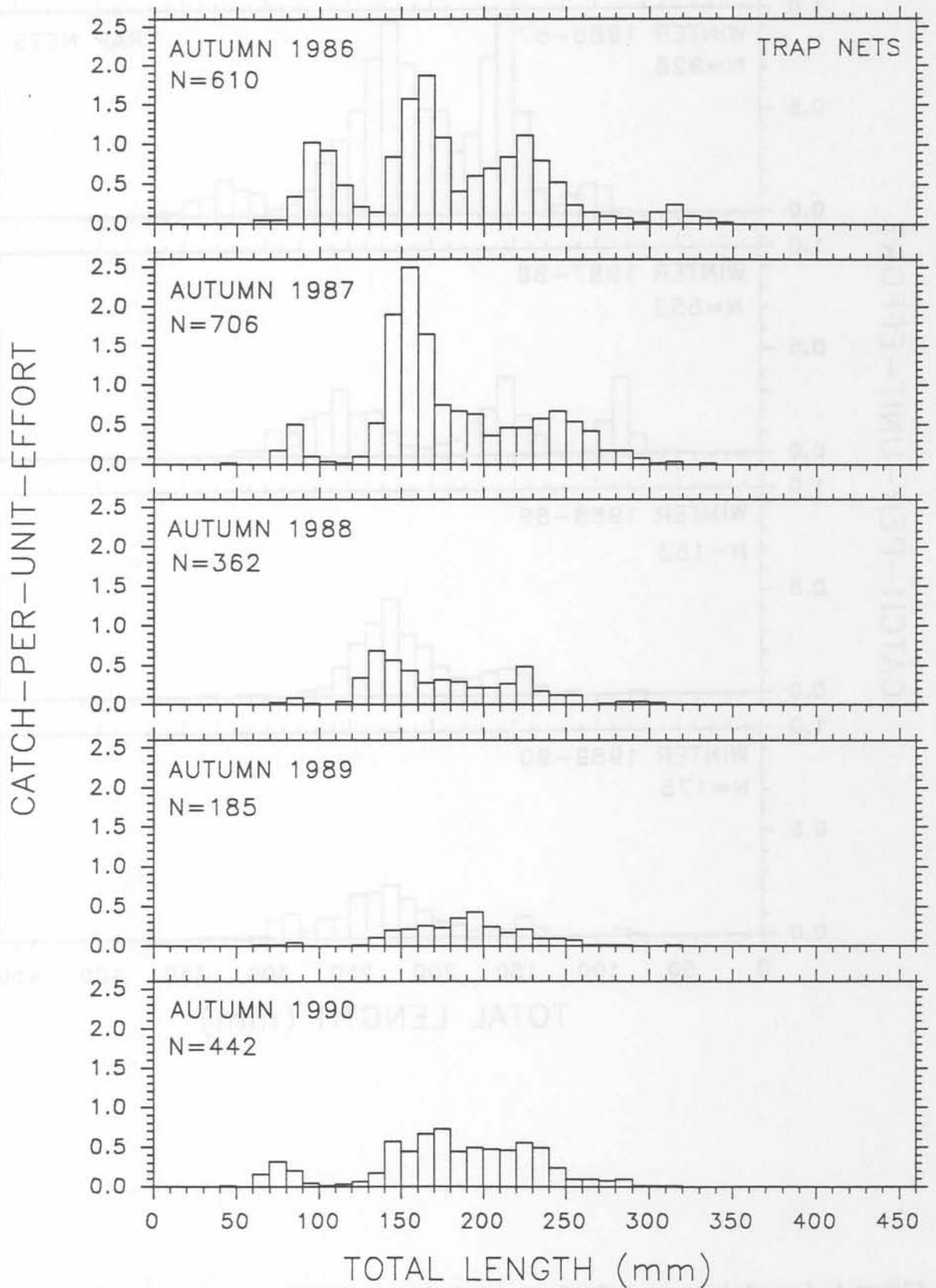

Figure 3. Length-frequency distributions of white crappie captured in trap nets expressed as length-interval specific catch-per-unit-effort rates, autumn 1986 to autumn 1990, Skiatook Lake, Oklahoma.

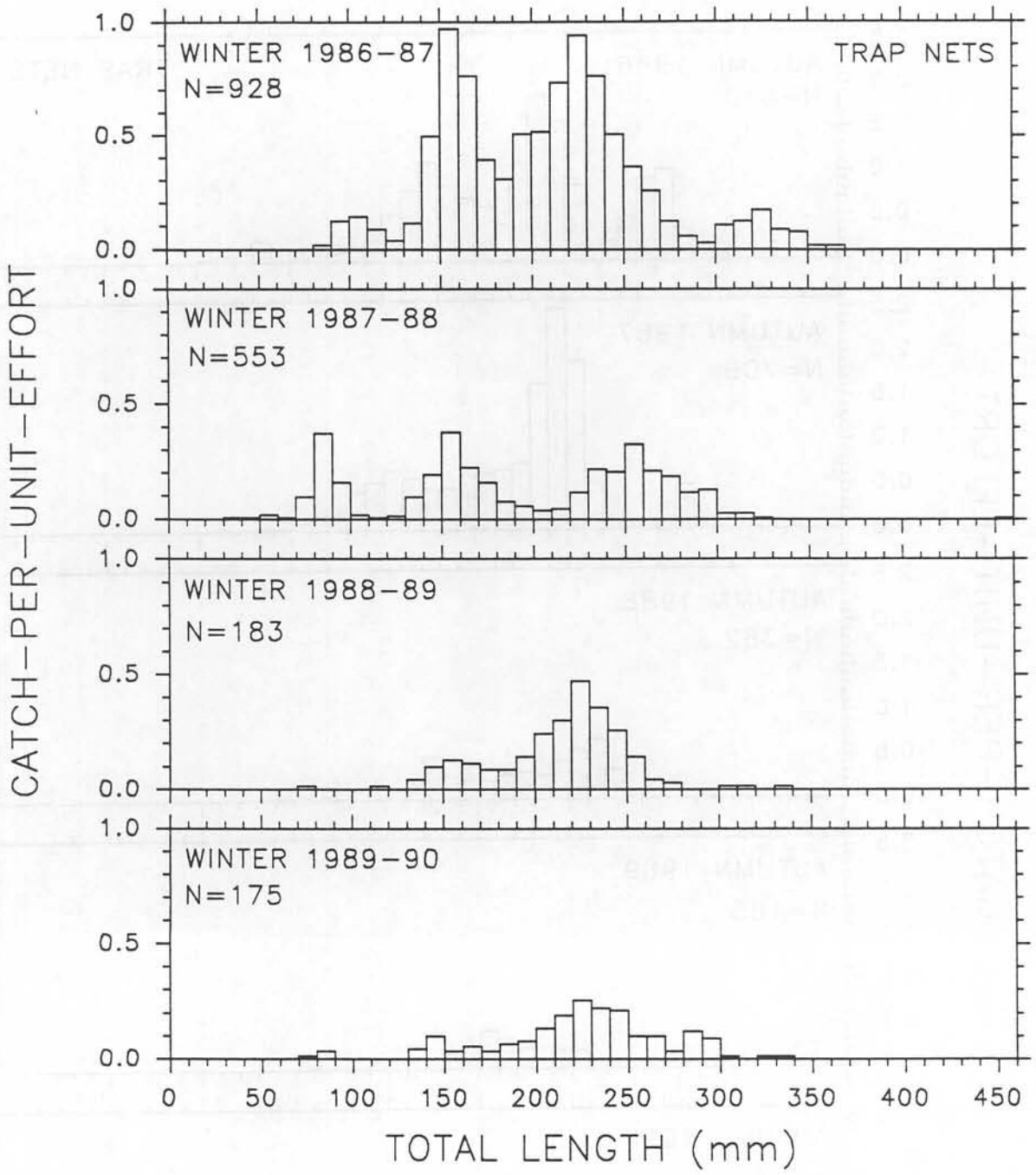

Figure 4. Length-frequency distributions of white crappie captured in trap nets expressed as length-interval specific catch-per-unit-effort rates, winter *1986-87 to winter 1989-90*, Skiatook Lake, Oklahoma.

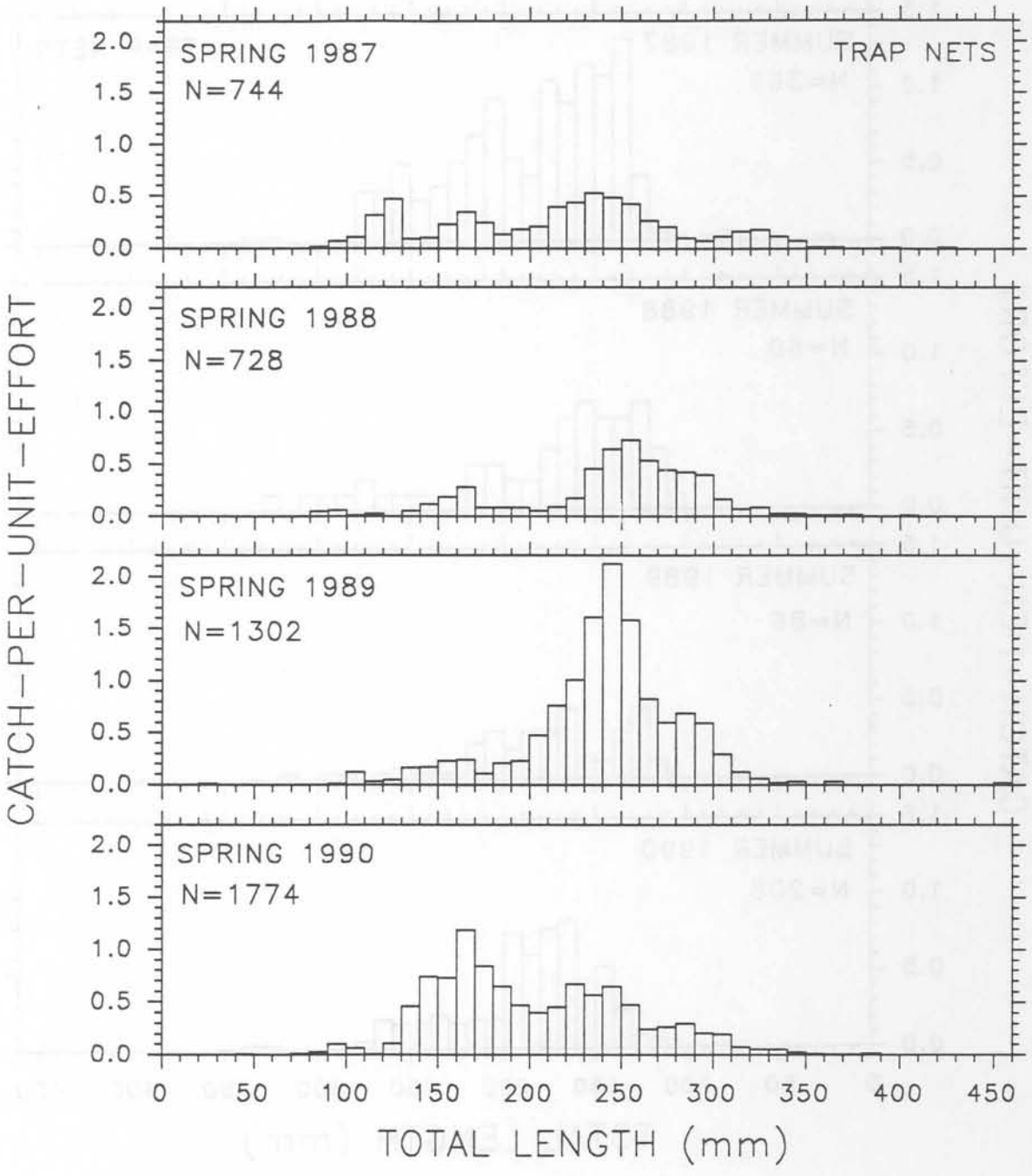

Figure 5. Length-frequency distributions of white crappie captured in trap nets expressed as length-interval specific catch-per-unit-effort rates, spring 1987 to spring 1990, Skiatook Lake, Oklahoma.

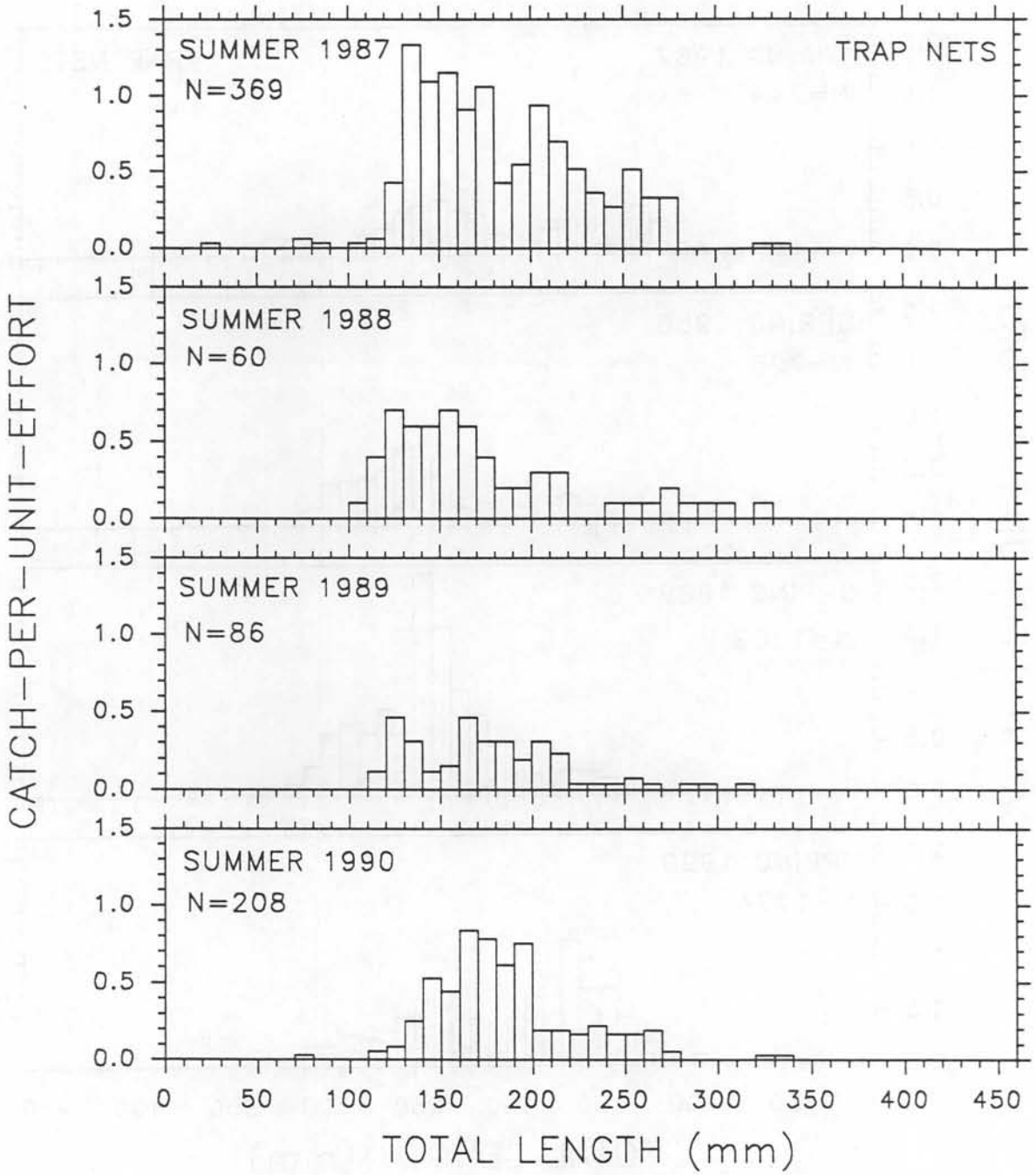

Figure 6. Length-frequency distributions of white crappie captured in trap nets expressed as length-interval specific catch-per-unit-effort rates, summer 1987 to summer 1990, Skiatook Lake, Oklahoma.

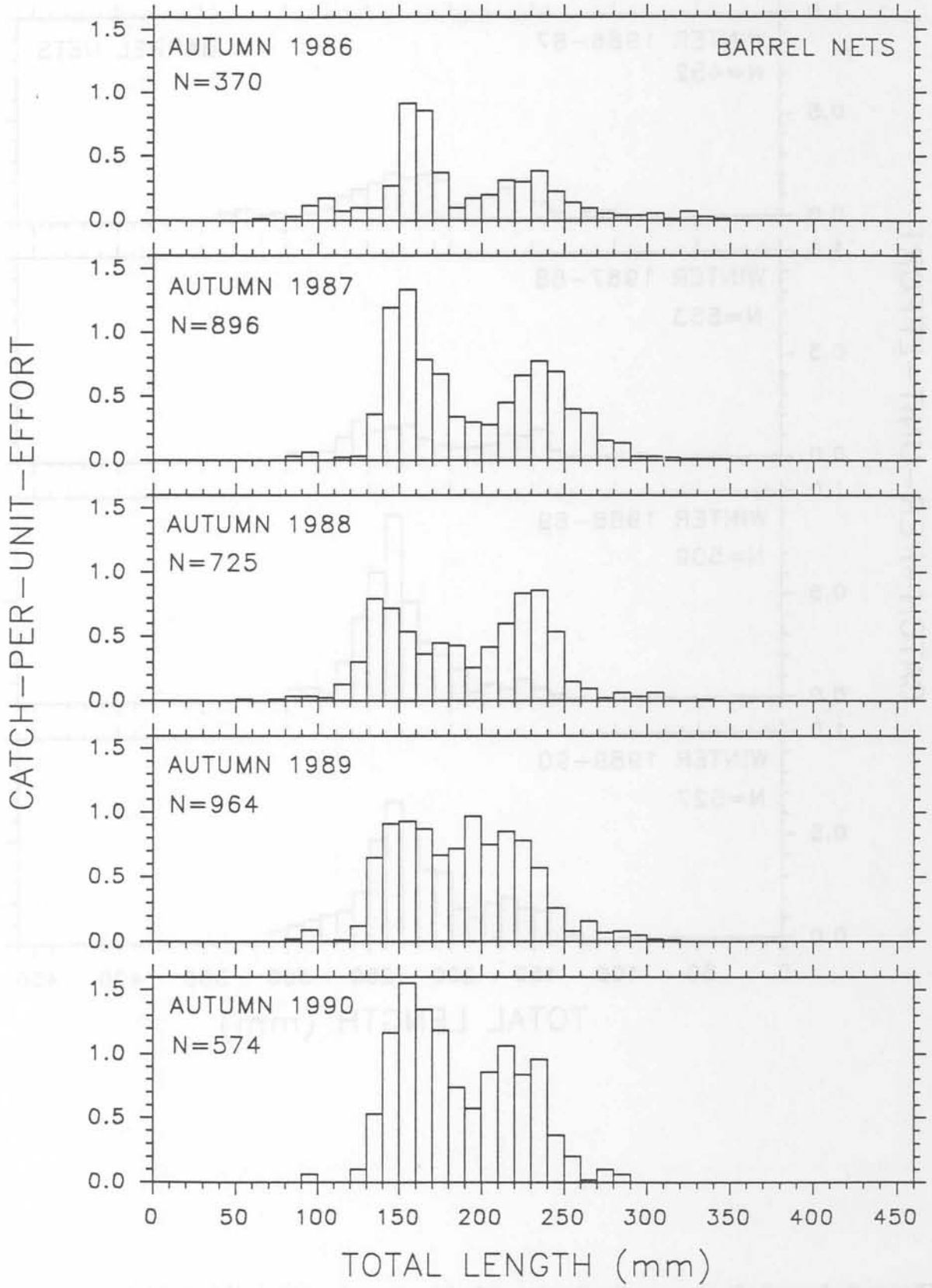

Figure 7. Length-frequency distributions of white crappie captured in barrel nets expressed as length-interval specific catch-per-unit-effort rates, autumn 1986 to autumn 1990, Skiatook Lake, Oklahoma.

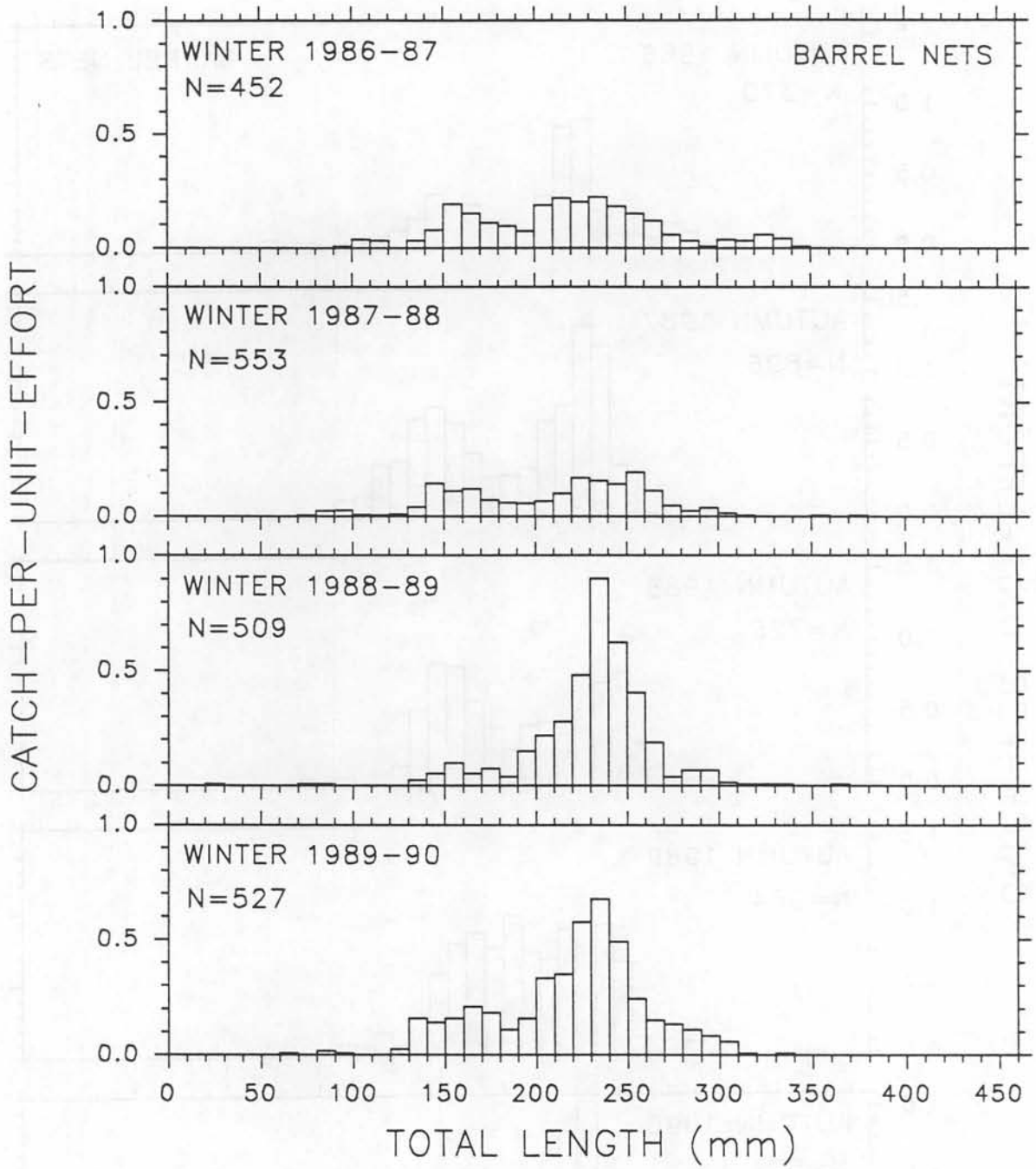

Figure 8. Length-frequency distributions of white crappie captured in barrel nets expressed as length-interval specific catch-per-unit-effort rates, winter 1986-87 to winter 1989-90, Skiatook Lake, Oklahoma.

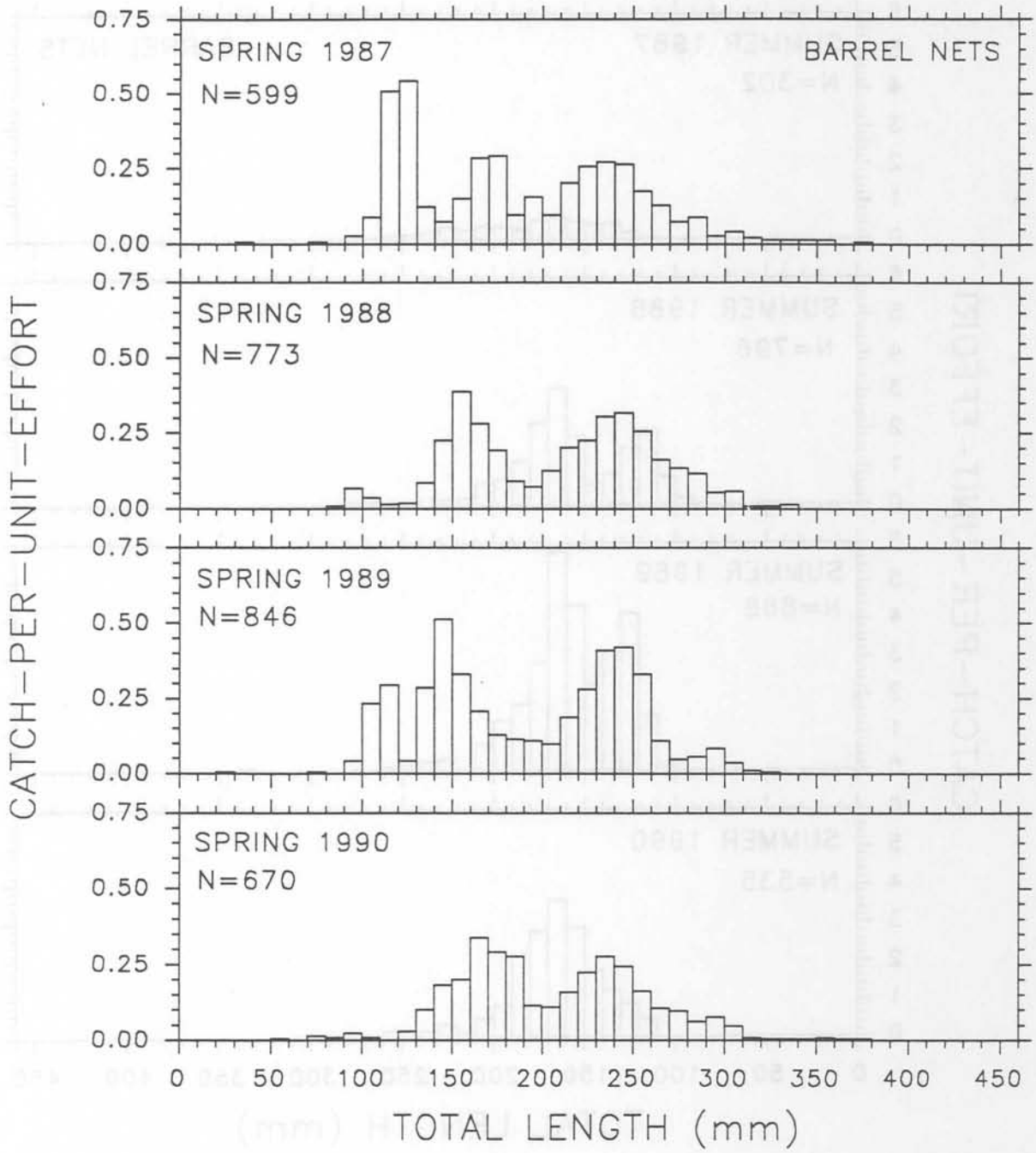

Figure 9. Length-frequency distributions of white crappie captured in barrel nets expressed as length-interval specific catch-per-unit-effort rates, spring 1987 to spring 1990, Skiatook Lake, Oklahoma.

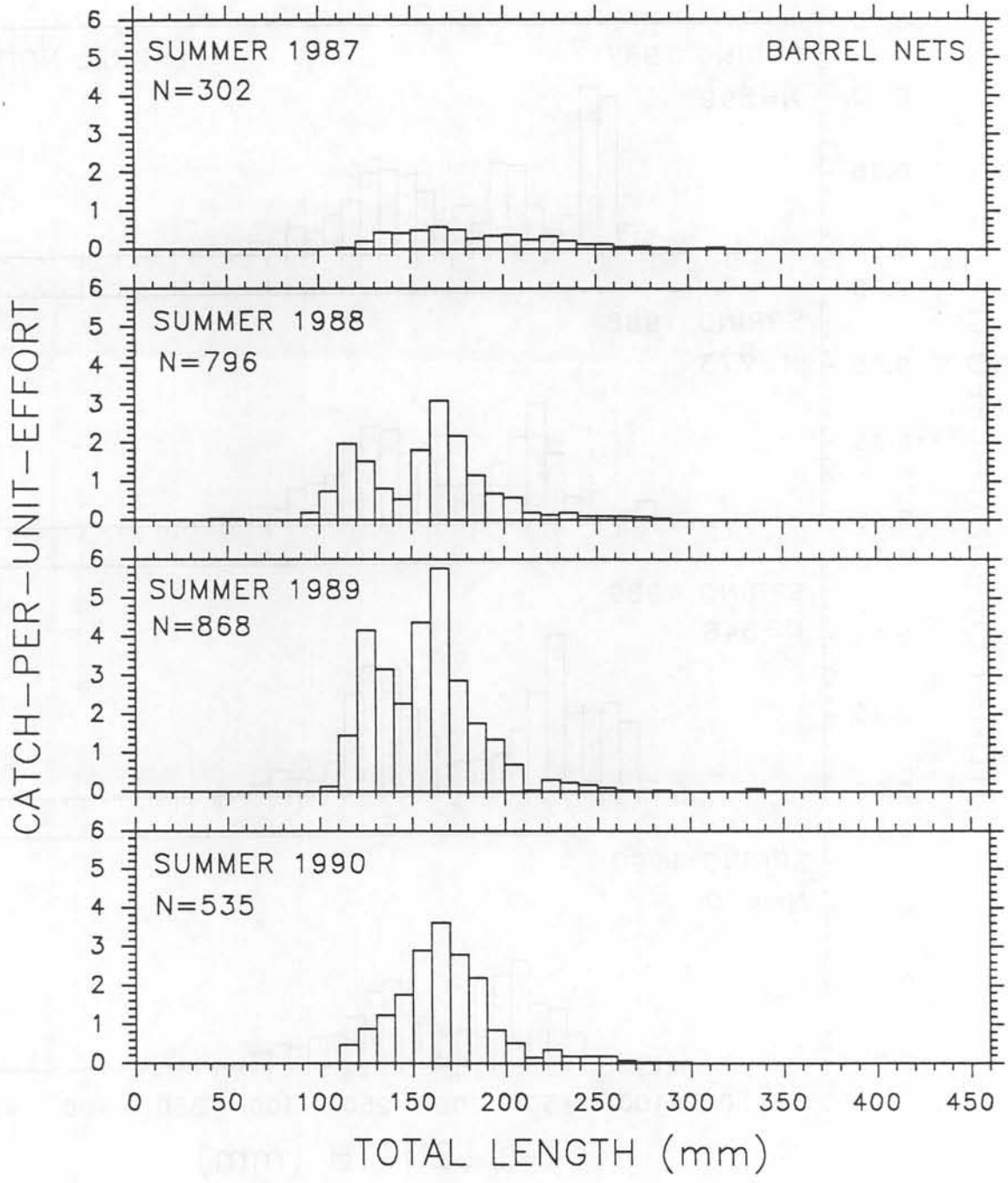

Figure 10. Length-frequency distributions of white crappie captured in barrel nets expressed as length-interval specific catch-per-unit-effort rates, summer 1987 to summer 1990, Skiatook Lake, Oklahoma.

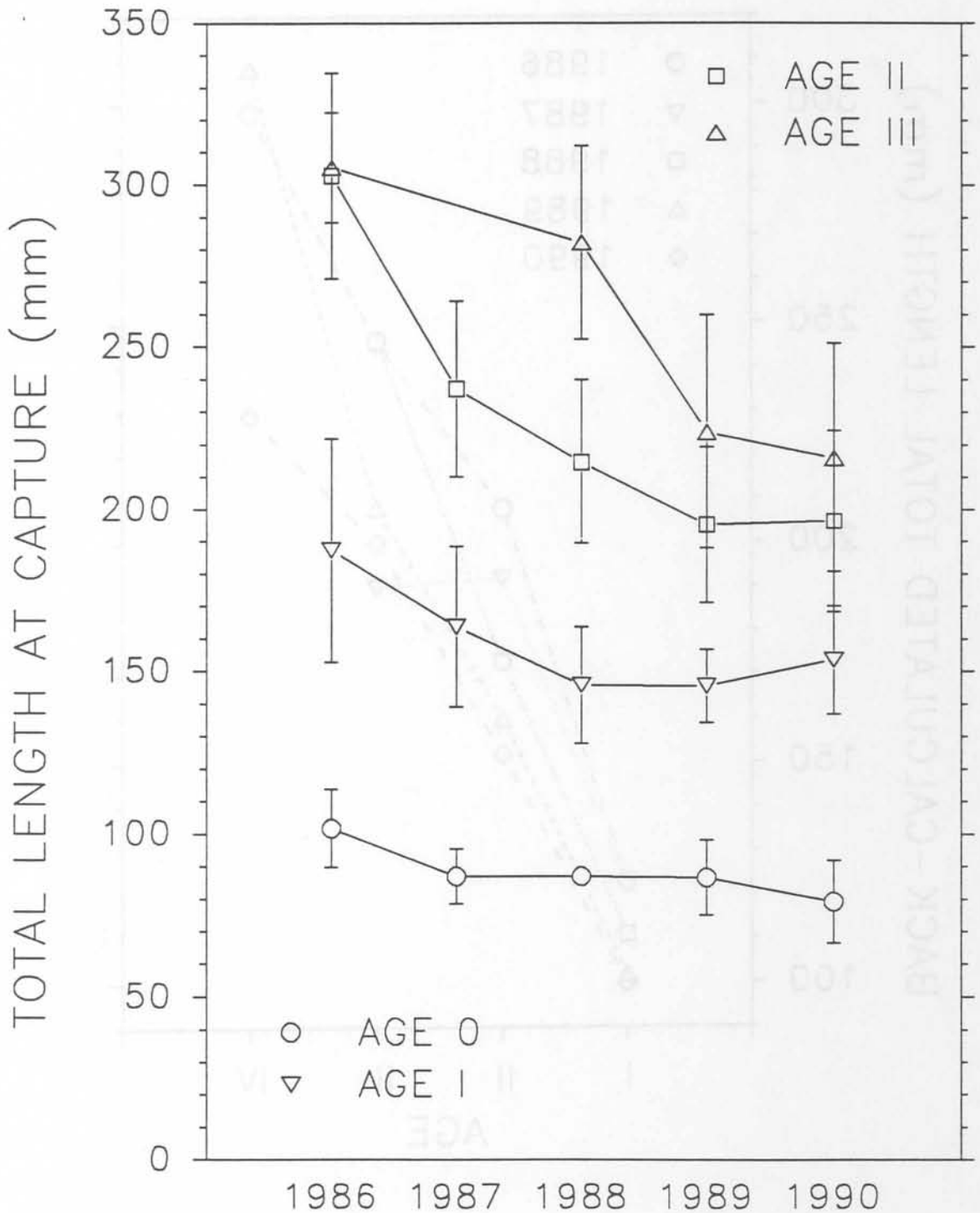

Figure 11. Mean total lengths at capture, by age, of white crappie collected in the autumns of 1986-1990, Skiatook Lake, Oklahoma.

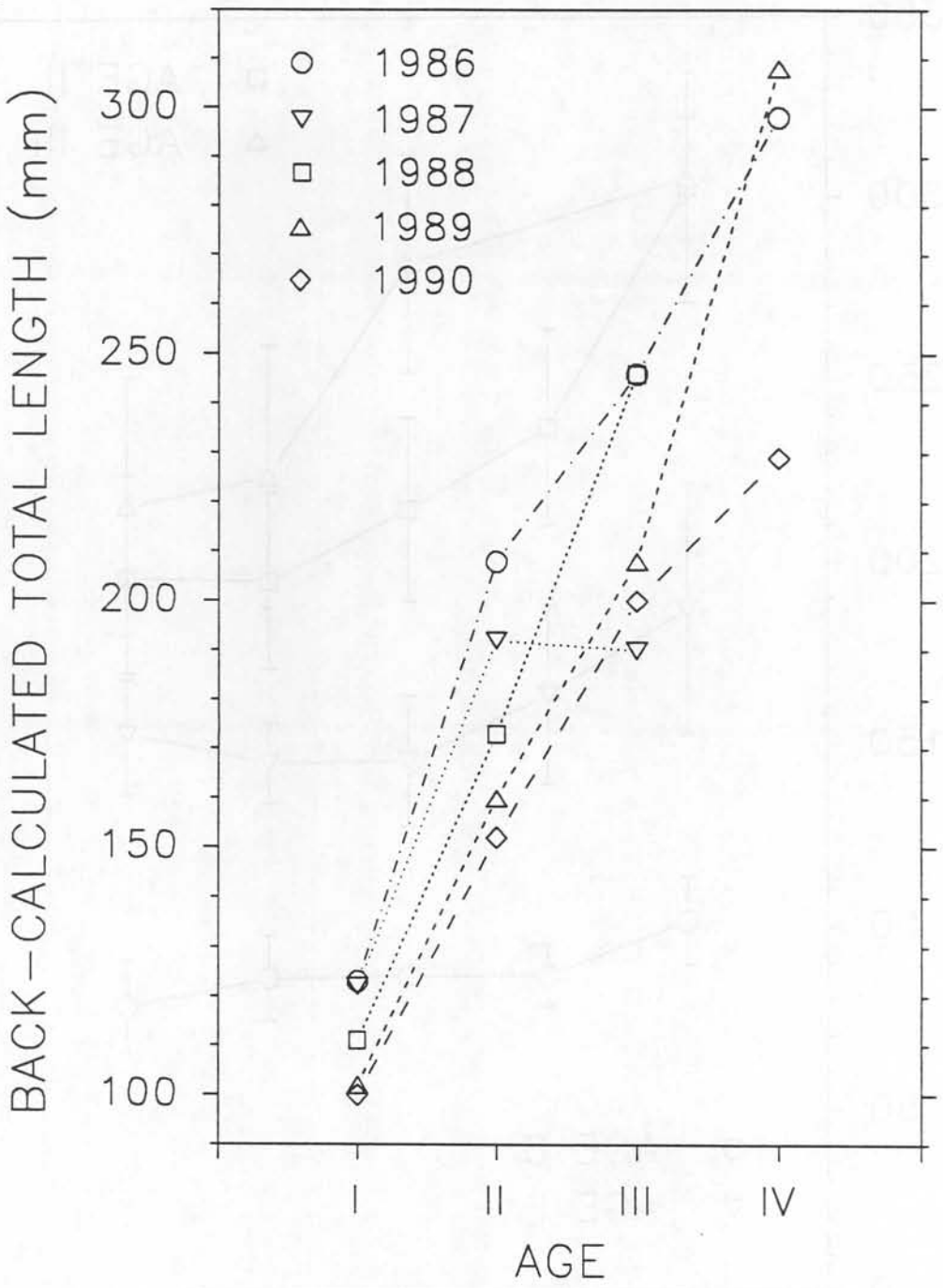

Figure 12. Mean back-calculated total lengths at age of white crappie collected in the autumns of 1986-1990, Skiatook Lake, Oklahoma.

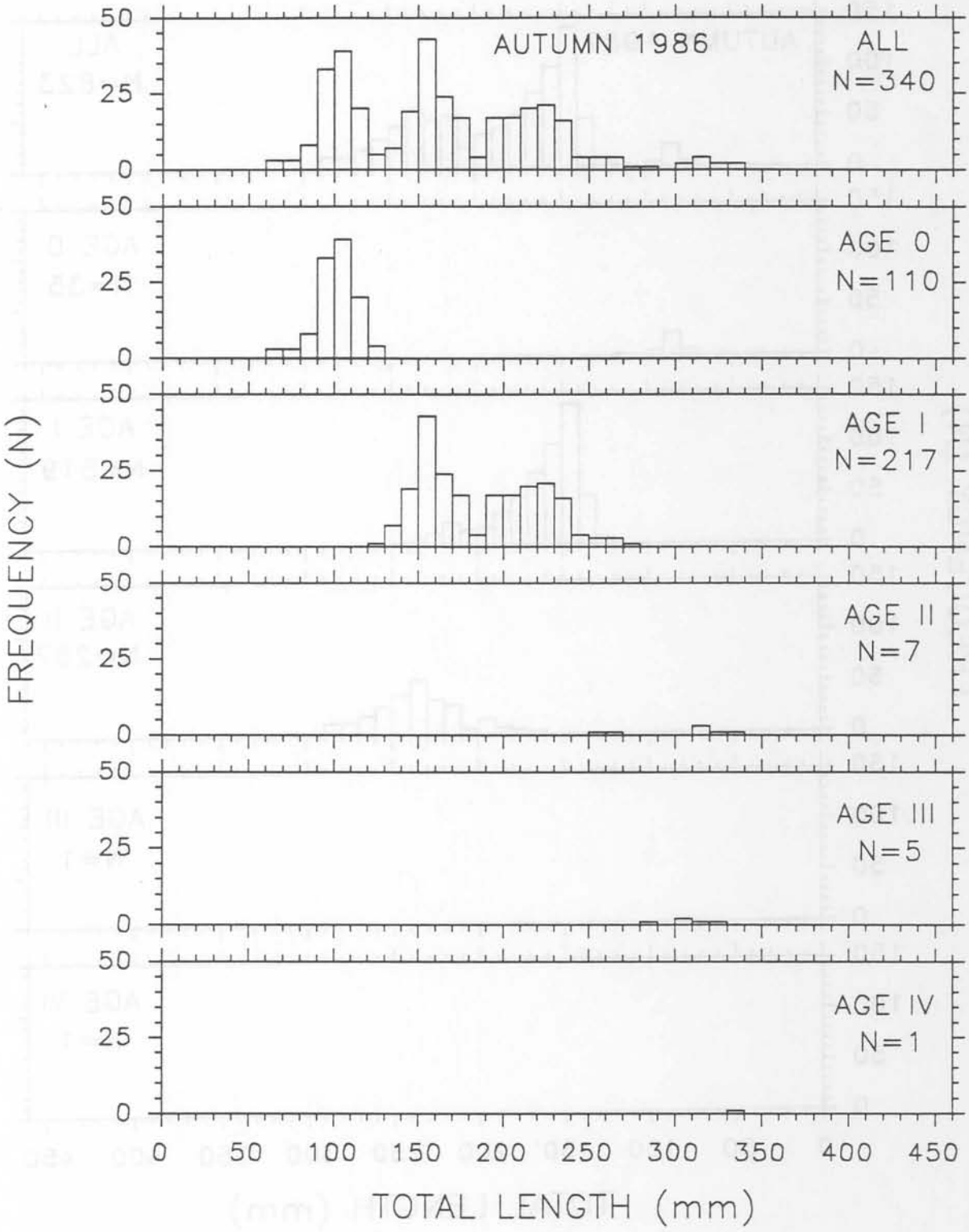

Figure 13. Age-specific length-frequency distributions of white crappie collected with trap and barrel nets, autumn quarter 1986, Skiatook Lake, Oklahoma. Ages were determined from examination of otoliths.

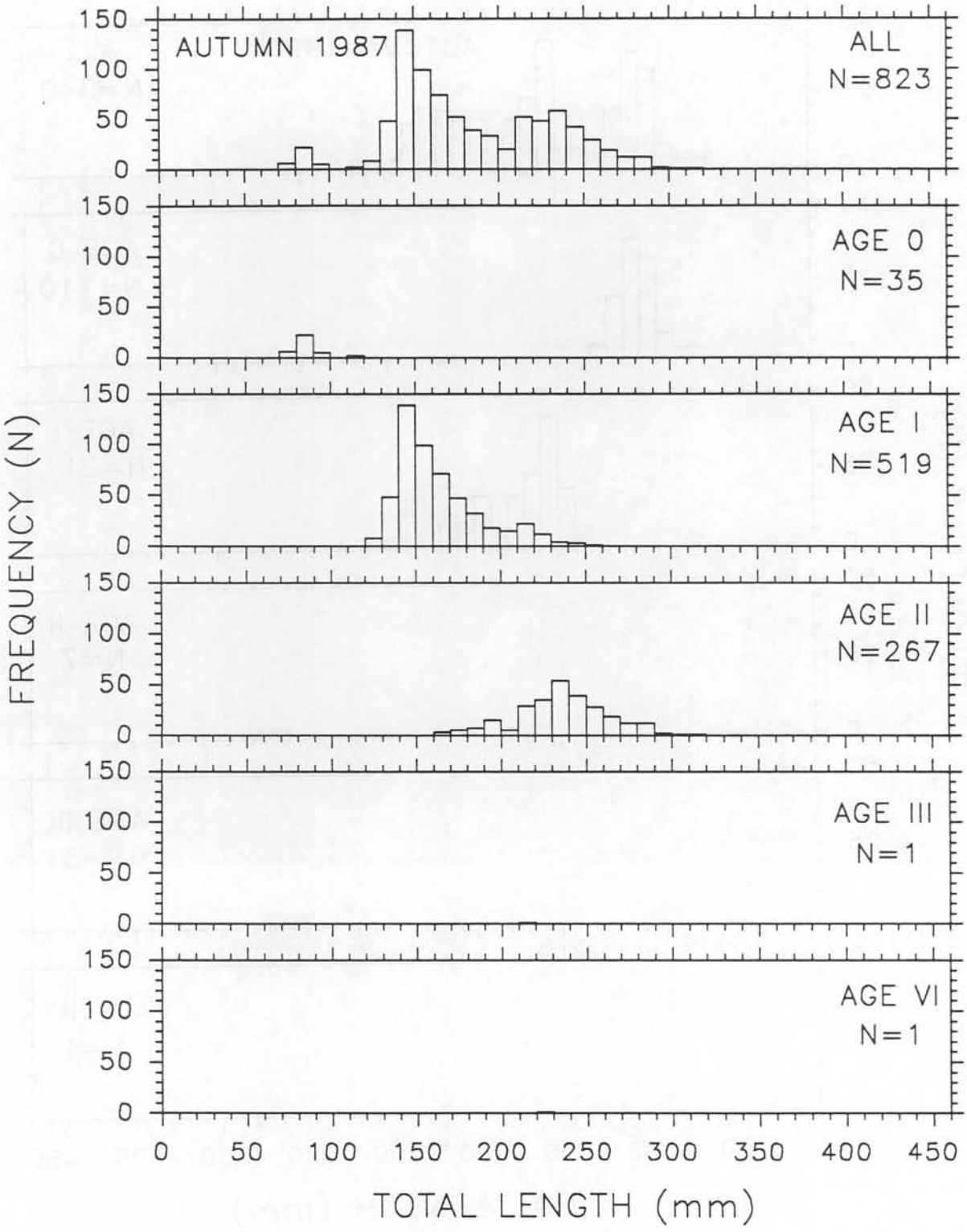

Figure 14. Age-specific length-frequency distributions of white crappie collected with trap and barrel nets, autumn quarter 1987, Skiatook Lake, Oklahoma. Ages were determined from examination of otoliths.

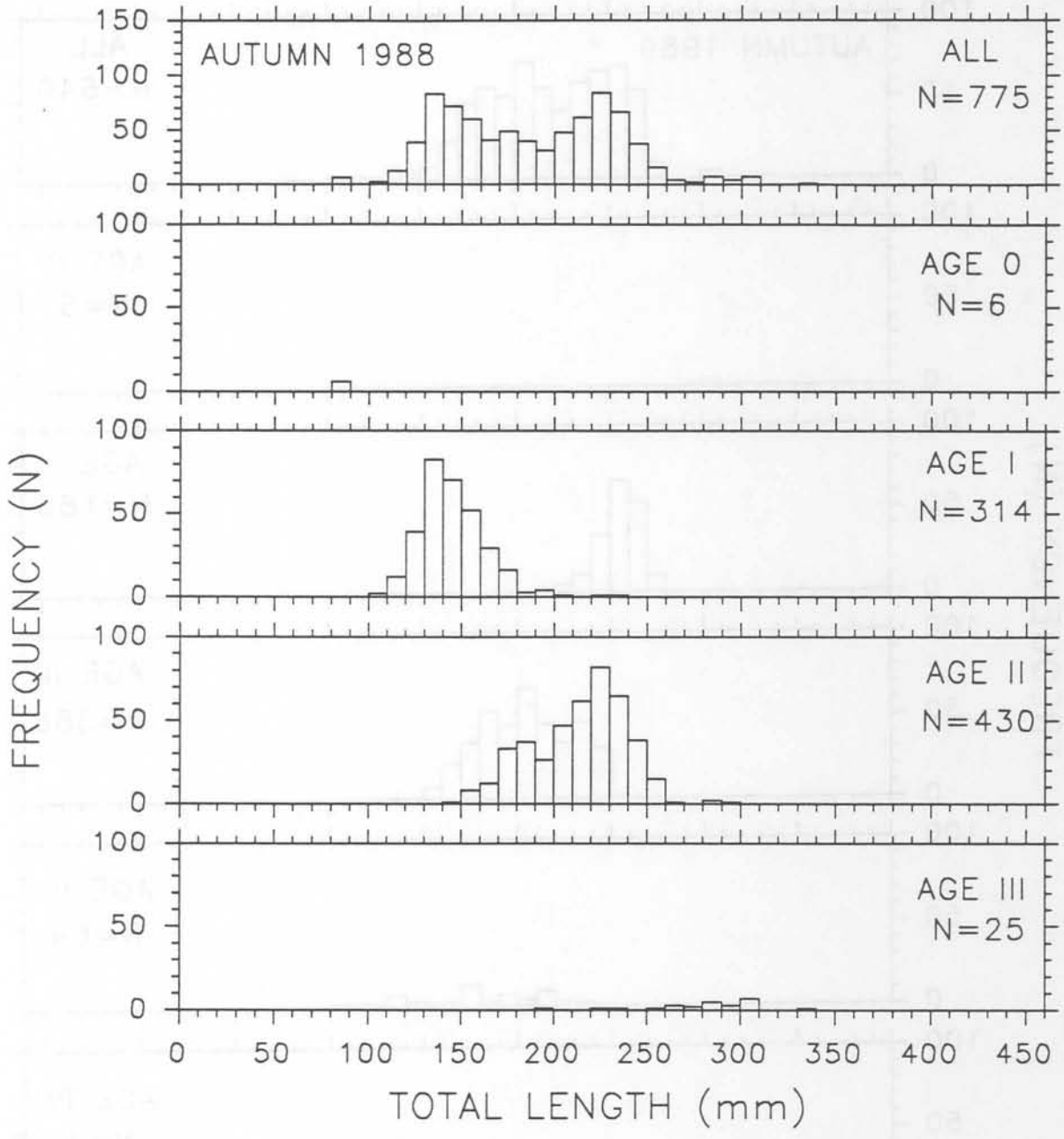

Figure 15. Age-specific length-frequency distributions of white crappie collected with trap and barrel nets, autumn quarter 1988, Skiatook Lake, Oklahoma. Ages were determined from examination of otoliths.

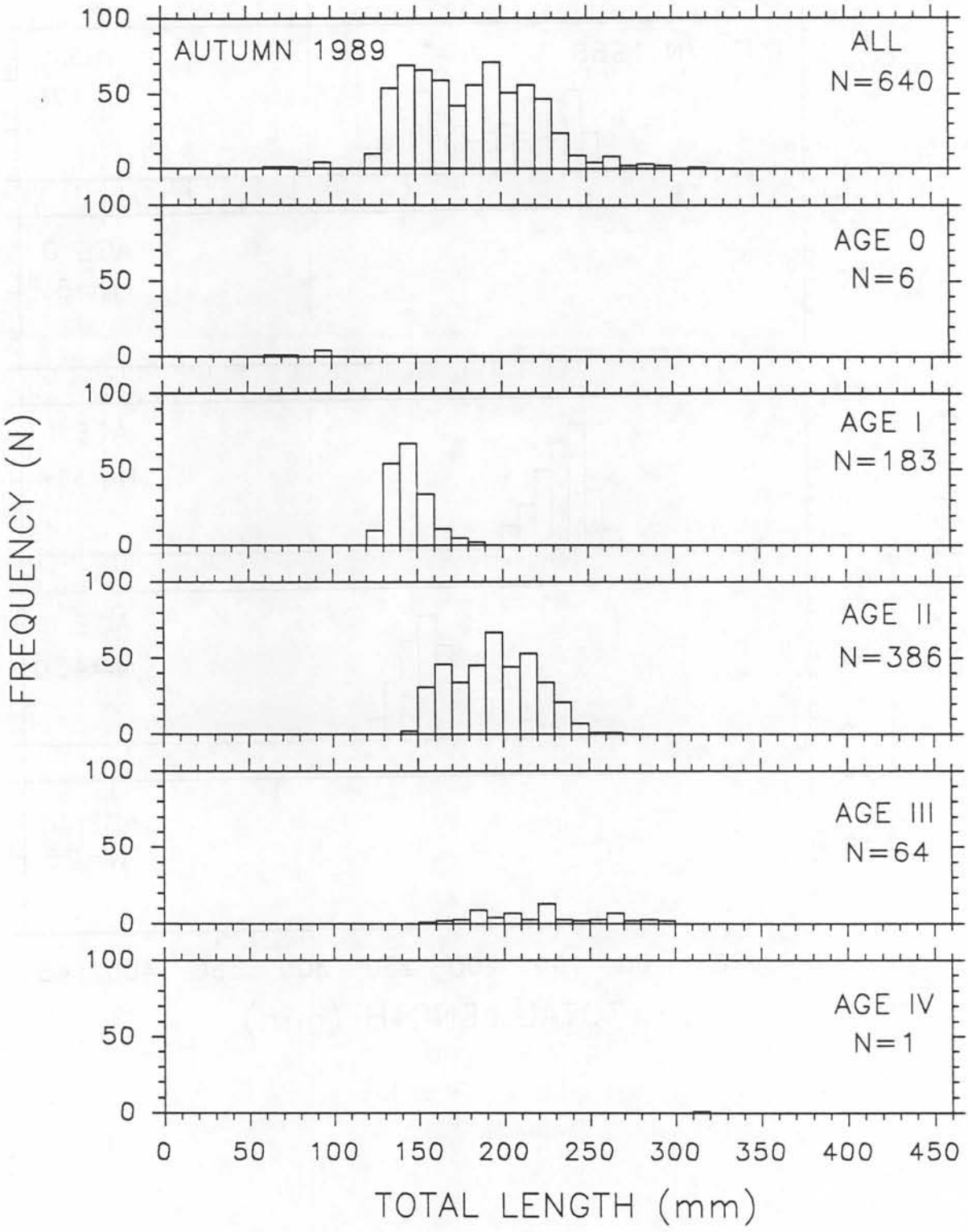

Figure 16. Age-specific length-frequency distributions of white crappie collected with trap and barrel nets, autumn quarter 1989, Skiatook Lake, Oklahoma. Ages were determined from examination of otoliths.

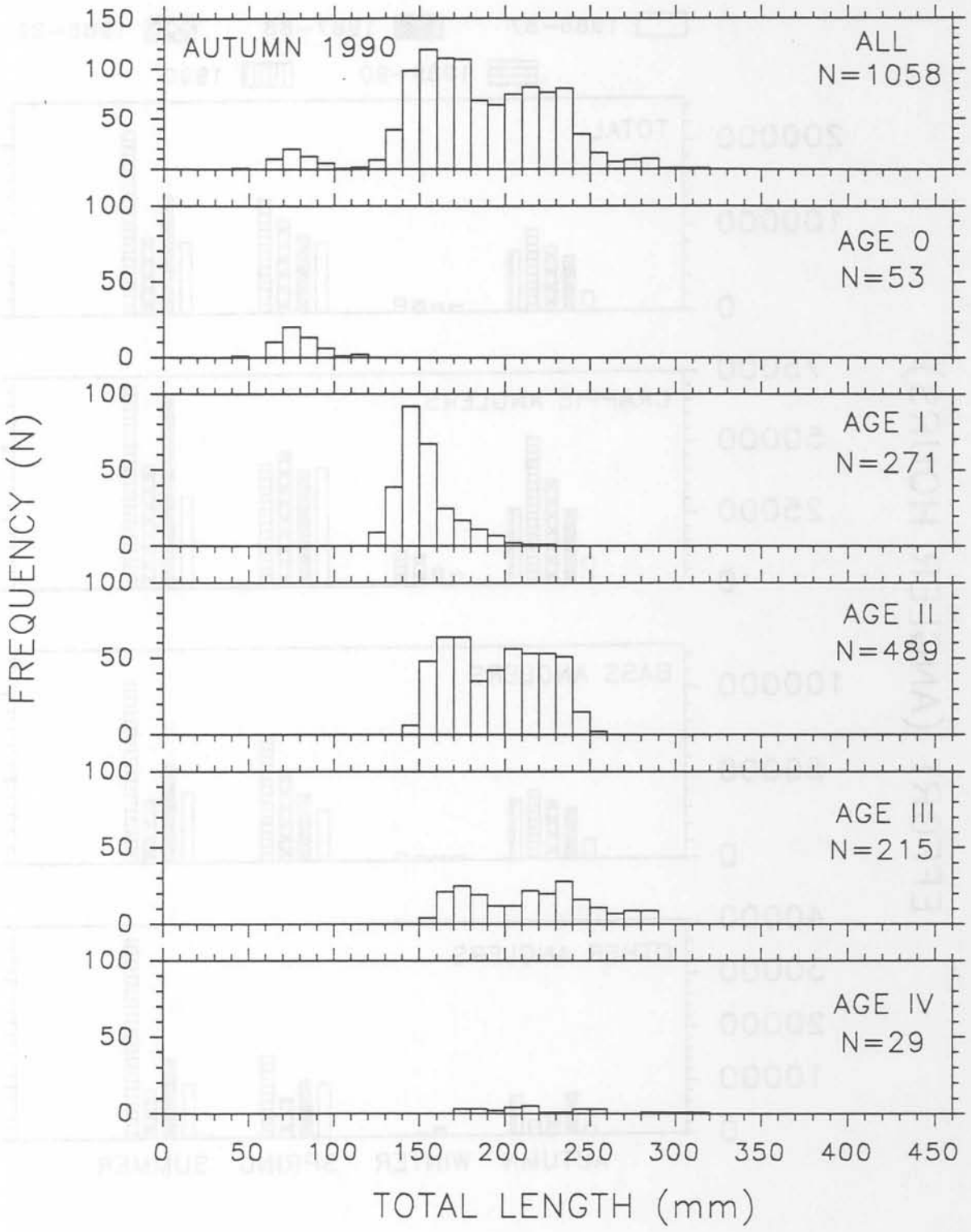

Figure 17. Age-specific length-frequency distributions of white crappie collected with trap and barrel nets, autumn quarter 1990, Skiatook Lake, Oklahoma. Ages were determined from examination of otoliths.

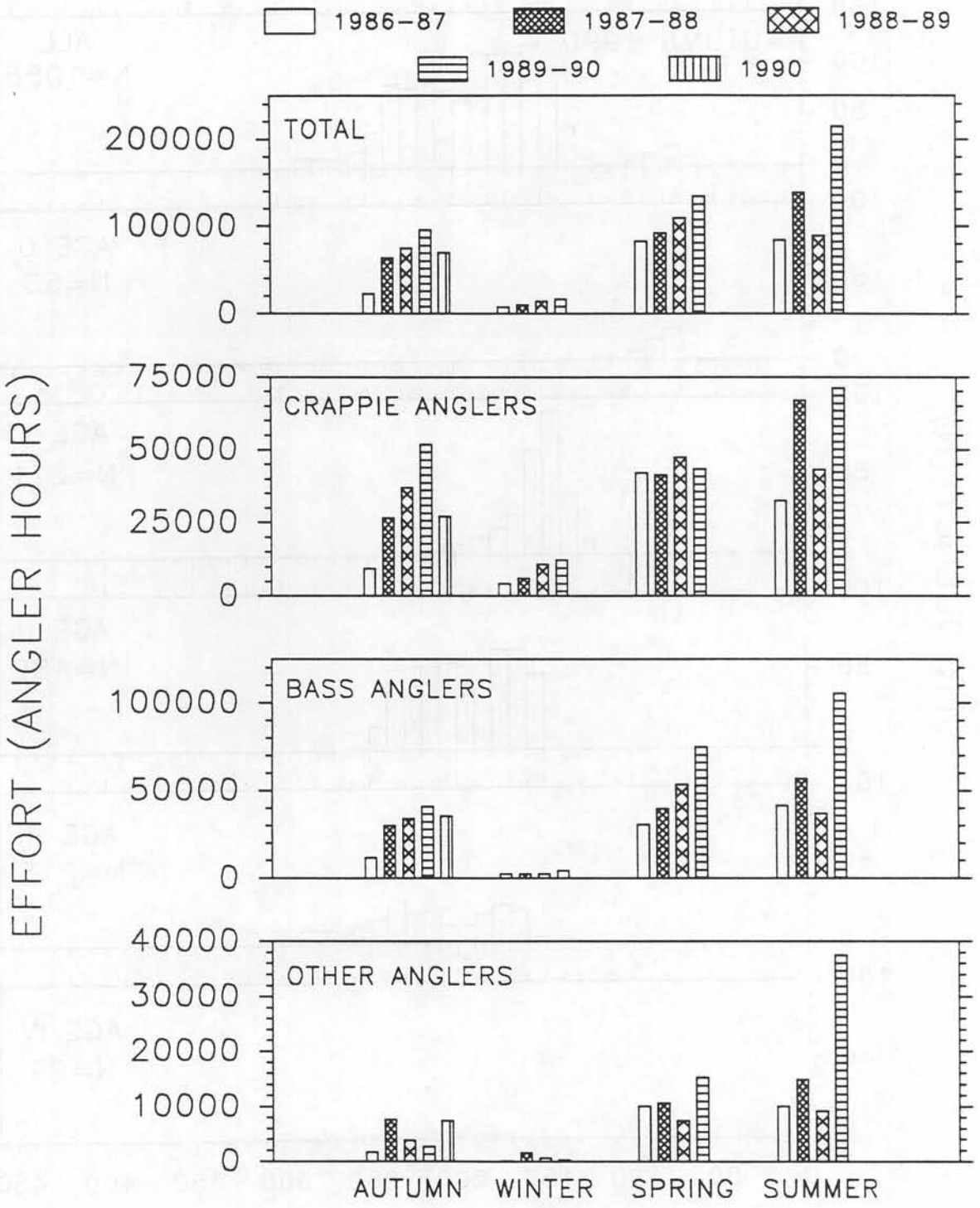

Figure 18. Quarterly angling effort estimates, autumn 1986 to autumn 1990, Skiatook Lake, Oklahoma.

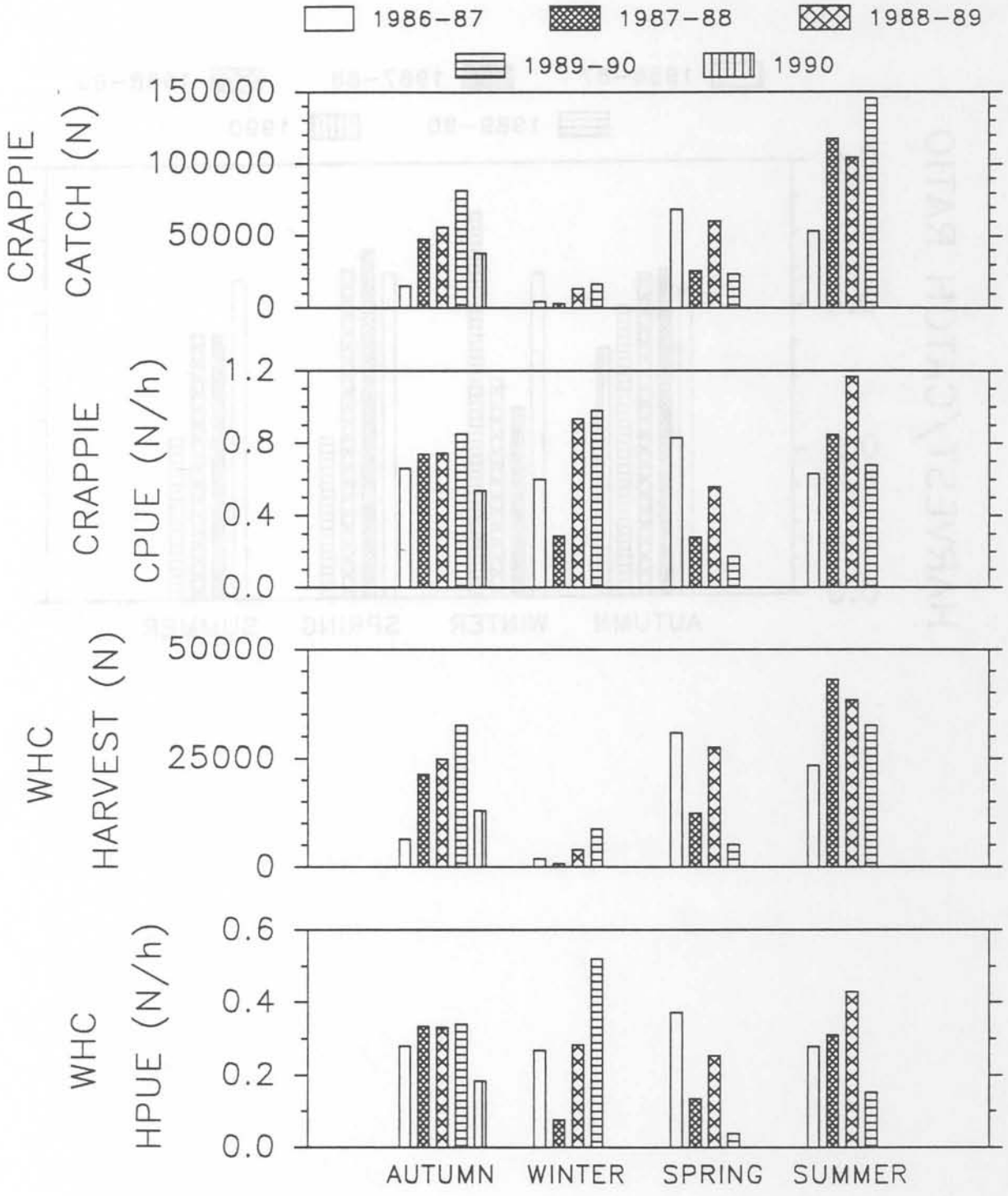

Figure 19. Quarterly white crappie catch and harvest estimates and rates, autumn 1986 to autumn 1990, Skiatook Lake, Oklahoma.

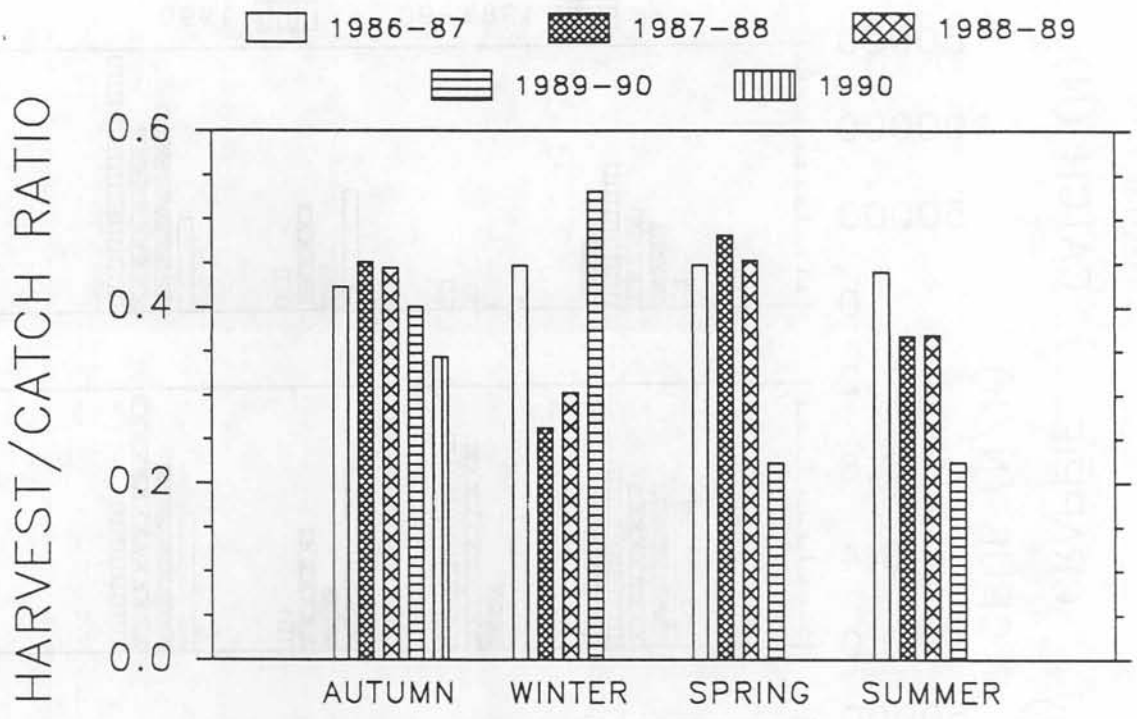

Figure 20. Quarterly ratios of white crappie harvest to catch estimates, autumn 1986 to autumn 1990, Skiatook Lake, Oklahoma.

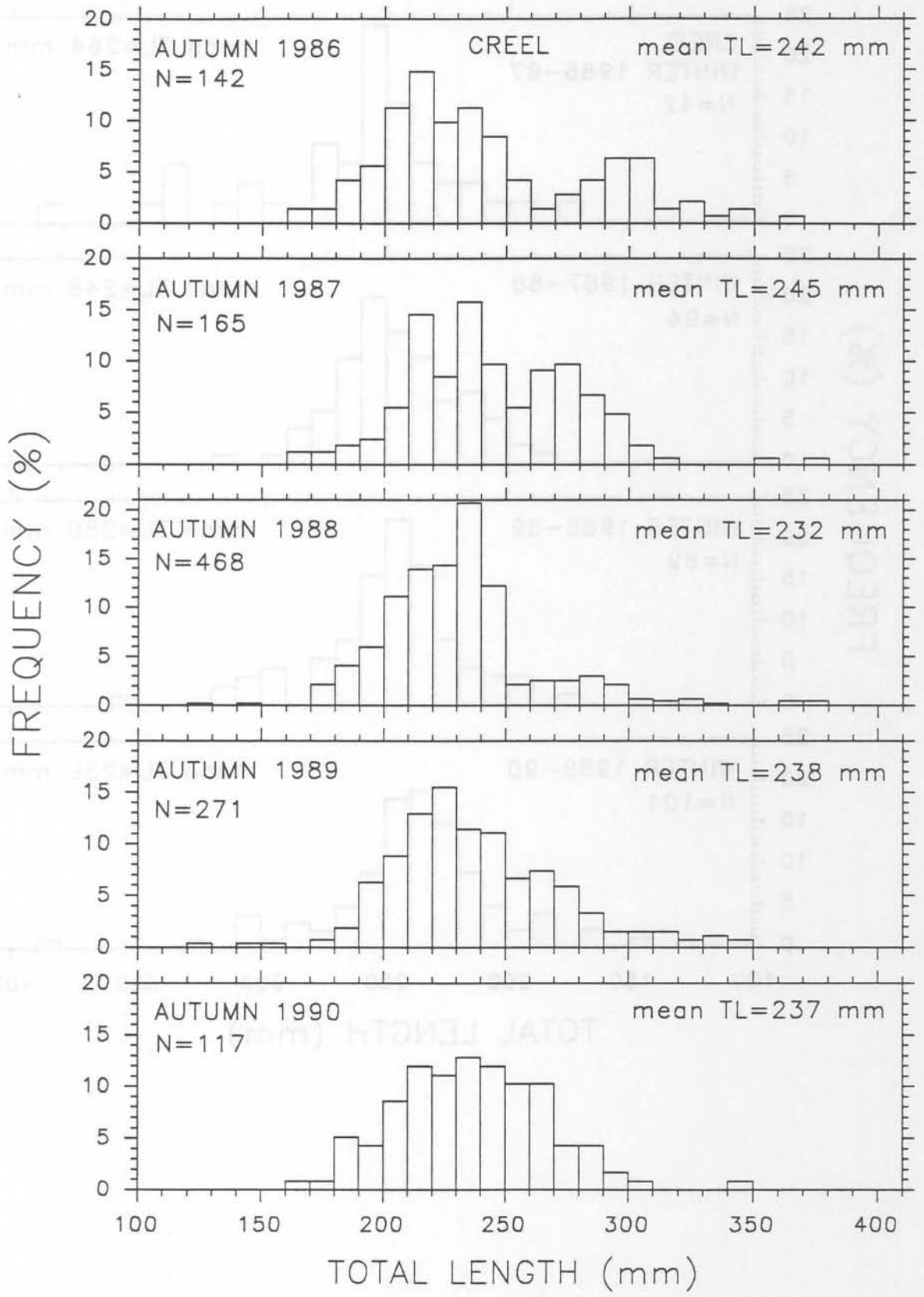

Figure 21. Length-frequency distributions of white crappie harvested by anglers, autumn 1986 to autumn 1990, Skiatook Lake, Oklahoma.

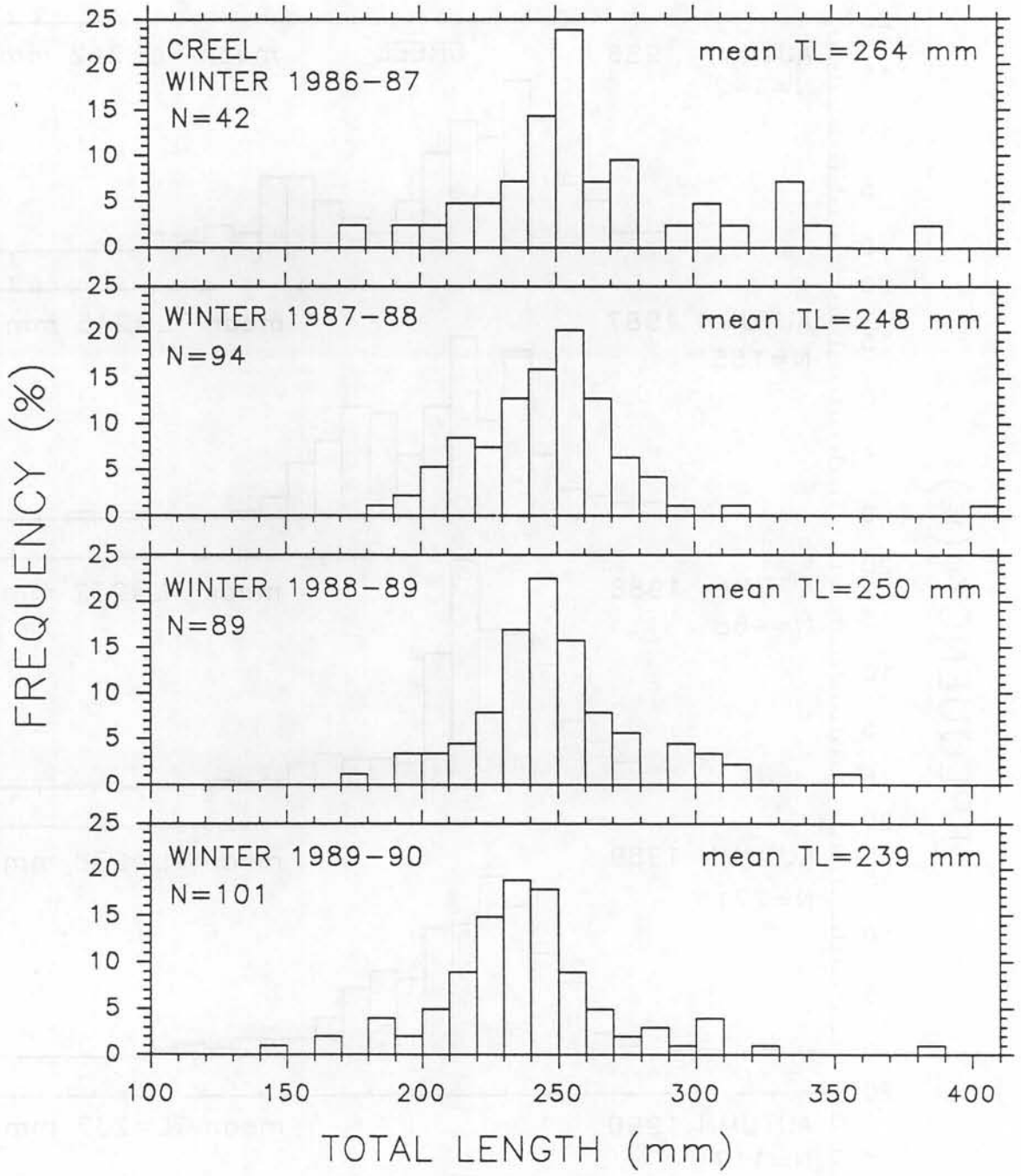

Figure 22. Length-frequency distributions of white crappie harvested by anglers, winter 1986-87 to winter 1989-90, Skiatook Lake, Oklahoma.

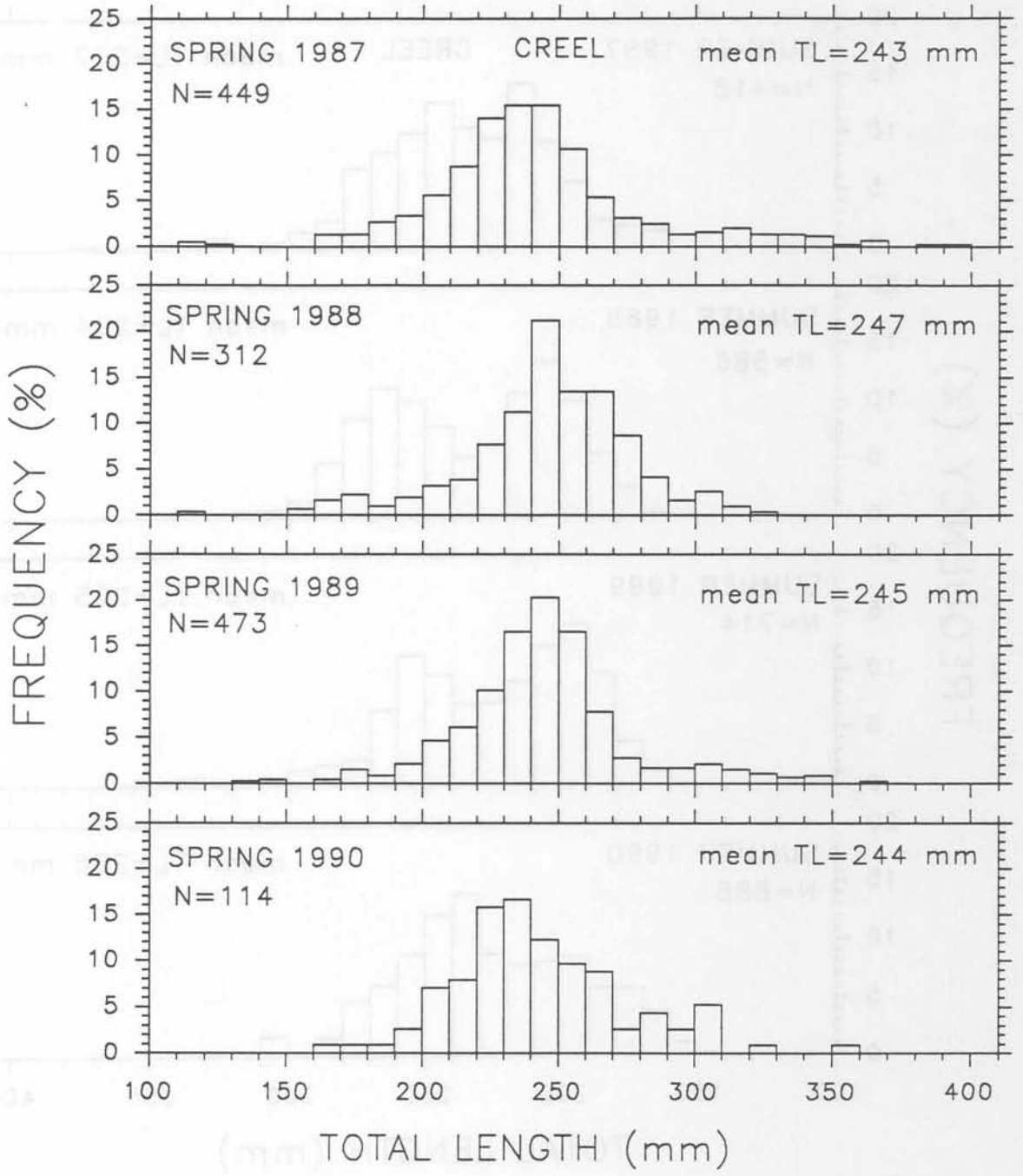

Figure 23. Length-frequency distributions of white crappie harvested by anglers, spring 1987 to spring 1990, Skiatook Lake, Oklahoma.

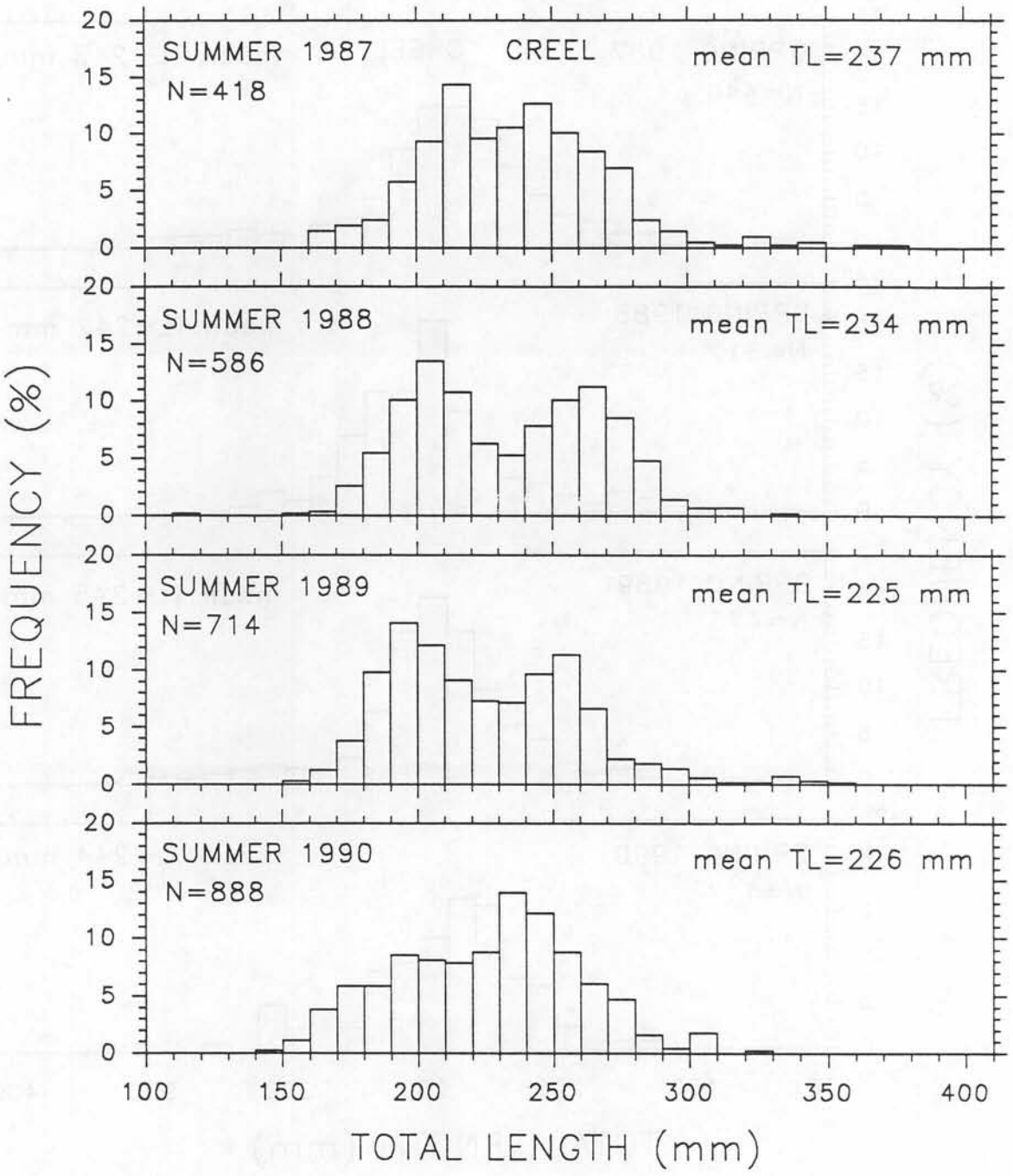

Figure 24. Length-frequency distributions of white crappie harvested by anglers, summer 1987 to summer 1990, Skiatook Lake, Oklahoma.

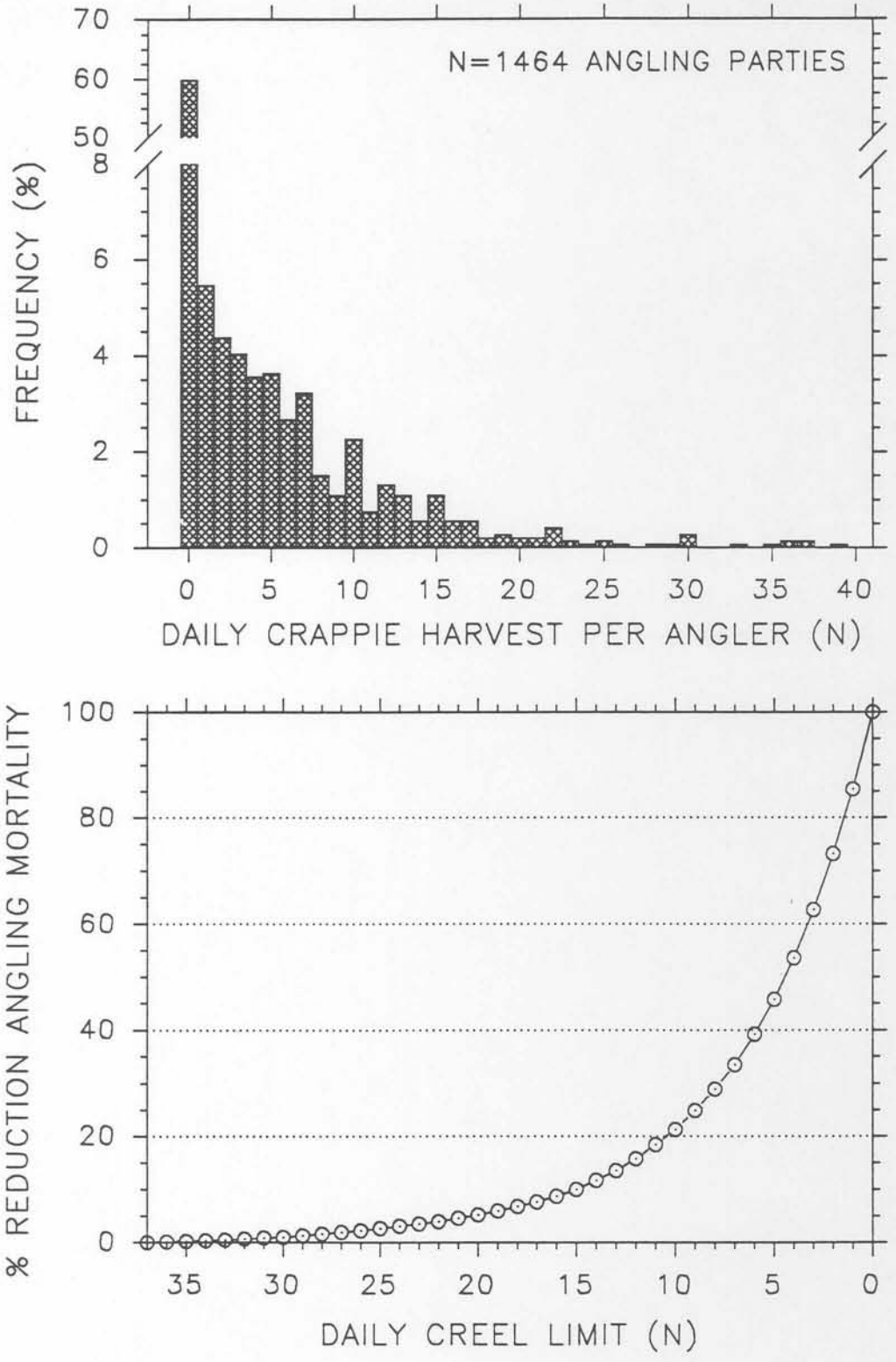

Figure 25. Frequency distribution of numbers of white crappie harvested per crappie angler per day, September 1986 to November 1990, Skiatook Lake, Oklahoma, and estimated potential reductions in angling mortality of white crappie at Skiatook Lake resulting from implementation of restrictive daily creel limits.