

THE CONTRIBUTION OF STOCKED TROUT TO THE
SPORT FISHERY OF THREE SMALL WISCONSIN LAKES

by

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ABSTRACT

To assess the effectiveness of stocking catchable-size trout in spring, creel surveys were conducted on lakes that were stocked with fin-clipped trout: Sunset Lake, Portage County, 26 ha, received 103 rainbow trout (Salmo gairdneri) per ha; Thomas Lake, Portage County, 13 ha, received 183 rainbow trout per ha; Lake Dorothy, Oneida County, 39 ha, received 77 rainbow trout and 51 brook trout (Salvelinus fontinalis) per ha. Experimental electrofishing was carried out on Lakes Sunset and Thomas to gain information on non-trout species. Estimated percentages of stocked trout harvested the first month of the angling season at Sunset Lake in 1975 and 1976, Thomas Lake in 1976 and rainbow and brook trout in Lake Dorothy in 1976 were 46, 72, 62, 22, and 64, respectively. The estimated total harvest of stocked rainbow trout for the 1975 season in Sunset Lake was 48%, and few trout appeared to survive to the second year in any lake. Fishing pressure was also concentrated in the first two weeks of the season, 67% in the first month of the total 7906 angler hours in the 9 month season in 1975 and 85% of a two month total of 5836 angler-hrs in 1976 at Sunset Lake. Estimated percentages of stocked weight returned for the first month of the season at Sunset Lake in 1975 and 1976, Thomas Lake in 1976 and rainbow and brook trout in Lake Dorothy in 1976 were 47, 76, 113, 31, and 80, respectively. Trout were the most abundant species in the harvest during May on all lakes

and also in June 1976 in Sunset Lake. The second most abundant species in the creel was white sucker in Sunset Lake and bluegill in Lakes Thomas and Dorothy. Mark/recapture population estimates from electrofishing of fish older than age one in Sunset Lake were 18 and 20 kg/ha of white sucker in 1975 and 1976 and 3.4, 3.7, and 27.6 kg/ha of yellow perch, largemouth bass, and cisco, respectively, in 1976.

In general, the return of stocked trout to the creel, both numbers and weight, at the study lakes was above average compared to other lakes.

Also, in general growth of trout in the study lakes was similar to that in other inland lakes in Wisconsin. However, growth rate was highest in Thomas Lake where non-bait food in trout was three times greater than in Sunset Lake, and as a result the weight of trout harvested exceeded the weight stocked (113%). In Sunset Lake 57% of the weight stocked was recovered during the 1975 - 76 season, but the following season 96% was recovered by the end of June.

Results of other studies indicate that 1) stocking larger trout yields higher returns than stocking smaller trout, 2) stocked brook trout provide higher returns than rainbow trout, but when stocked at subcatchable-size, brown trout yield the highest returns of the three species, 3) returns are higher for rainbow trout stocked in summer and brook and brown trout in spring than in other seasons, 4) comparisons of various strains of stocked trout have been inconclusive.

Warmwater species of fish support the sport fishery in Sunset Lake, and probably in the other lakes, from July through February. Growth of yellow perch, an apparently recent invader, in Sunset Lake was high in comparison to other waters. Growth of largemouth bass, bluegill, and

cisco, and food habits of stocked trout largemouth bass, bluegill, yellow perch, cisco, and white sucker were similar to those characteristics in other waters.

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INTRODUCTION

Objectives of this study were to determine the survival and contribution to the sport fishery of spring-stocked, catchable-size rainbow trout (Salmo gairdneri) in Lakes Sunset and Thomas, Portage County, and rainbow and brook trout (Salvelinus fontinalis) in Lake Dorothy, Oneida County, Wisconsin; describe growth and mortality of other species in Lakes Sunset and Thomas; describe food habits of trout and non-trout species in Sunset Lake and trout in Thomas Lake; estimate the standing stock of several non-trout species in Sunset Lake.

Lakes Sunset, Thomas, and Dorothy have been stocked with catchable-size trout to provide a trout fishery in addition to the existent warmwater fishery. The lakes lack inlets or outlets, but the trout can survive throughout the summer. Natural reproduction does not occur in the lakes.

This study was conducted from spring 1975 through spring 1977. Effort (fishing pressure) and harvest of various fish species were determined by creel surveys, and experimental electrofishing gear was used to gain information on non-trout species.

The trout season extended from the first weekend in May through March 1. The creel limit was 5 trout with a minimum length of 152 mm for the month of May and from October through March. The limit increased to 10 trout per angler from June through September 30.

Sunset Lake

Sunset Lake is a 26 ha hardwater lake with maximum and mean depths of 17 and 9 m, respectively. Total alkalinity ranged from 115 - 186 ppm and hardness from 136 - 222 ppm (Table 1). During summer stratification a thermocline generally developed between 5 - 8 m, which included a plus-heterograde oxygen curve (Appendix A). Eberly (1964) felt that most lakes with a plus-heterograde oxygen curve were mesotrophic. The fact that overturn (evident from uniform oxygen and temperature throughout the water column) occurred in fall in 1971, 1975, 1976, and spring 1973, but not in spring 1971, 1975, 1976 indicates that overturn generally occurred in fall but not in spring (Appendix A).

Table 1. Physical and chemical characteristics of the study lakes. Methods, according to Standard Methods 1965, in Appendix B.

	Sunset	Thomas	Dorothy
Area (ha)	26	13	39
Maximum Depth (m)	17	9	11
Mean depth (m)	9.2	5.1	-
Methyl Orange Alkalinity (ppm)	115 - 186 ^a	92 - 142 ^a	3 ^b
Total Hardness ^a (ppm)	136 - 222	128 - 198	-
Total Phosphate ^c (ppm)	.026	.055	-
Chlorophyll <u>a</u> ^d (mg/m ³)	1.37	5.15	-

a - range of 34 values at approximately monthly intervals from 1973 through 1976

b - Andrews and Threinen 1966

c - means of surface and bottom samples taken on November 11, 1975

d - means of surface collections on July 13, August 11, and September 8, 1976

Littoral substrate is mainly sand and gravel with sparse vegetation and small areas of rubble and silt (Fassbender and Nelson 1971).

Two permanent dwellings, 21 summer cottages, and an environmental education camp are located on the shore. Portage County maintains a swimming beach, picnic area, and a boat landing on the eastern shore.

In addition to stocked rainbow trout, other fish species present were largemouth bass (Micropterus salmoides), bluegill (Lepomis macrochirus), pumpkinseed (L. gibbosus), white sucker (Catostomus commersoni), yellow bullhead (Ictalurus natalis), cisco (Coregonus artedii), yellow perch (Perca flavescens) and minnows including spotfin shiner (Notropis spilopterus), common shiner (N. cornutus), bluntnose minnow (Pimephales notatus), and horneyhead chub (Nocomis biguttatus).

Walleye (Stizostedium vitreum), bluegill, largemouth bass, yellow perch, crappie (Pomoxis spp.), and bullhead have been stocked since 1933. Trout have been stocked since 1946. The lake was treated with rotenone in 1954 and toxaphene in 1965. Since 1974 catchable-size rainbow trout have been stocked in the spring only (Appendix C).

Thomas Lake

Thomas Lake is a 13 ha, hardwater lake with maximum and mean depths of 9 and 5 m, respectively. Alkalinity ranged from 92 - 142 ppm and hardness from 128 - 198 ppm (Table 1). During summer stratification, a thermocline developed at about 5 m (Fassbender and Nelson 1971). The lake probably is generally monomictic since overturn occurred only in fall in 1975 and 1976, though spring overturn occurred in 1973 (Appendix D).

The littoral substrate is sand and muck covered with dense aquatic vegetation, mostly Nitella sp., to a depth of 4 m. Nine permanent dwellings surround the lake including a farm on the southeast shore. Total phosphate levels during fall overturn and chlorophyll a levels during summer stratification were higher in Thomas Lake than Sunset Lake indicating higher fertility in Thomas Lake.

Fish present, in addition to stocked trout included largemouth bass, bluegill, pumpkinseed, white sucker, yellow perch, and yellow bullhead. Walleye, bullhead species, largemouth bass, smallmouth bass (M. dolomieu), and northern pike (Esox lucius) had been stocked since 1938. Rainbow trout have been stocked since 1957 after the lake was originally treated with rotenone. Catchable-size rainbow trout have been stocked each spring since 1958. Toxaphene was applied in 1961 (Appendix E).

Lake Dorothy

Lake Dorothy is a 39 ha, softwater lake with maximum depth of 11 m and 3 ppm total alkalinity (Table 1). Littoral substrate was about 65% sand, 15% rubble, 10% gravel, and 10% muck (Andrews and Threinen 1966). Twelve dwellings surround the lake and a public boat landing is located on the southern shore.

Fish species captured included bluegill, largemouth and smallmouth bass, pumpkinseed, yellow perch, white sucker, yellow bullhead, brown bullhead (I. nebulosus), and black crappie (Pomoxis nigromaculatus).

Trout are the only species legally stocked in the lake. Brook trout have been stocked since 1954 (Appendix F). Catchable-size brook

and rainbow trout have been stocked every spring since 1972 (Appendix F). The lake was never chemically treated to eradicate fish populations.

MATERIALS AND METHODS

Rainbow trout, stocked in all lakes, were 18 months old and were the fall spawning variety from Nevin Hatchery, Wisconsin. The brood stock had been developed in the Manchester National Fish Hatchery, Iowa. Brook trout stocked in Lake Dorothy were 16 months old and came from the Osceola Hatchery, Wisconsin. A pelvic fin was removed from the fish to facilitate identification. A sample of trout was anesthetized with MS 222, fish were weighed to the nearest gram, and total lengths were measured before the 1975 and 1976 releases. Individual fish were counted as they were released. Numbers, weights, and lengths of the 1977 stocking were obtained from hatchery records (Table 2).

Creel Survey

Creel surveys were conducted on, 1) Sunset Lake for the 1975 angling season, including the 1976 winter angling season, for the first 2 months (May and June) of the 1976 season, and for the opening weekend of the 1977 season, 2) Thomas Lake for the first month of the 1976 season and for the opening weekend of the 1977 season, 3) Lake Dorothy for the first month of the 1976 season. Stratified random sampling (Green 1972) was employed for the 1975 and 1976 seasons. Each of three categories of angling, shore, boat and ice fishing were stratified

Table 2. Number, weight and size of 18 month old rainbow trout from the Nevin Hatchery, Wisconsin stocked in Lakes Sunset, Thomas and Dorothy and brook trout from the Osceola Hatchery, Wisconsin stocked in Lake Dorothy. Standard deviations are given in parenthesis.

Lake	Trout Species	Number Stocked	Date of Release	Number per Hectare	Total kg.	Kg/Ha	Number in Sample ^a	Mean Length in Sample (mm)	Mean Weight in Sample (g)
Sunset	Rainbow	2710	April 30, 1975	105.9	322.49	12.65	111	232 (25.8)	119 (25.4)
	Rainbow	2687	April 8, 1976	105.0	357.37	13.70	110	231 (13.9)	133 (20.8)
	Rainbow ^b	2500	March 30, 1977	96.1	430.92	16.60		229	
Thomas	Rainbow	2250	April 8, 1976	173.0	254.25	19.56	95	229 (13.0)	113 (23.6)
	Rainbow ^b	2500	March 30, 1977	192.3	430.92	33.14		229	
Dorothy	Rainbow	3000	April 13, 1976	77.1	324.00	8.33	150	215 (16.4)	108 (25.4)
	Brook	2000	April 13, 1976	51.4	270.00	6.94	105	231 (25.0)	135 (41.3)

a - samples for Lakes Sunset and Thomas were obtained the day of release
 samples for Lake Dorothy were obtained the day before release

b - from hatchery records

into weekday day (0730 - 1530 hrs) and night (1530 - 2330 hrs) periods and weekend and holiday day and night periods. The half days for a stratum were randomly chosen with the restriction that a day and night period did not fall on the same day and all weekends and holidays and 3 weekdays per week were sampled to make up 40 hrs per week. Sampling effort was reduced to one weekend and one weekday per week from September 1975 through March 1976 and 2 weekdays and both weekend days from June 16 through July 4, 1976 on Sunset Lake to follow the decrease in fishing effort as the season progressed (Table 3). Twice as many night as day periods were sampled in Sunset and Thomas Lakes during May 1976 because I mistakenly thought the night period contained more variation than the day period in the number of trout harvested and the hours fished.

Table 3. Number of weekends and weekdays sampled per week and the ratio of day to night periods for Lakes Sunset, Thomas and Dorothy.

Lake	Dates	Number of days per week		Day to night ratio
		Weekend	Weekday	
Sunset	May 3 - Sept. 14, 1975	2	3	1:1
	Sept. 15, 1975 - March 1, 1976	1	1	1:1
	May 1 - May 31, 1976	2	3	1:2
	June 1 - June 15	2	3	1:1
	June 16 - July 4	2	2	1:1
	May 7, 8, 1977	2		a
Thomas	May 1 May 31, 1976	2	3	1:2
	May 7, 8, 1977	2		a
Dorothy	May 1 - May 28, 1976	2	3	1:1

a - survey from 0600 - 2200 hrs

Anglers were interviewed at the boat landings or parking lots on completion of fishing. Information collected in interviews was; number in party, length of trip, distance traveled, kind of bait, mode of fishing and number and species of fish caught and released (Appendix G). Lengths, weights, stomach and scale samples were taken when it was allowed. All shore anglers and some boat anglers not finished fishing were interviewed at the end of the day period. The survey clerk generally remained until everyone had finished fishing on all lakes. Anglers fished until 0300 hrs on Sunset and Thomas Lakes in 1976, while most anglers were finished fishing by 2200 hrs on Sunset Lake in 1975 and Lake Dorothy in 1976. Anglers who arrived late at night at Lakes Sunset and Thomas were given franked, addressed postcards and asked to record the time of completion of the trip and the number and species of fish caught and released. Cottage owners on Sunset and Thomas Lakes were interviewed when observed fishing.

All shore anglers and the number of boats could be seen at once and were counted from a vantage point on each lake. Shore angling effort was determined from the sum of the hourly instantaneous counts for each day and night period. Boat angling effort was estimated by determining the product of the sum of the boat counts and the number of anglers per boat from the interview data (Neuhold and Lu 1957). Harvest for each day or night period was estimated by determining the product of the catch per effort from the interviews and effort from the instantaneous counts (Neuhold and Lu 1957). I was told that anglers at Lake Dorothy used an access to the lake, other than the public boat landing, of which the clerk was unaware. I assumed catch per effort at both boat landings

was the same and multiplied catch per effort by the effort from the instantaneous counts to determine the harvest for individual periods.

Effort and harvest of trout from all 3 lakes and harvest of some non-trout species (e.g. white sucker caught at Sunset Lake May through June 1975 and 1976, and bluegill from Thomas Lake in 1976) were estimated by averaging the number of angler-hours or fish harvested for individual day or night periods and multiplying by the number of days in each segment of the fishing season. The fishing season was divided into segments as follows: opening weekend, the remaining days in May, June through the fourth of July weekend, the rest of July through November 24, and the ice fishing season from December 20 through March 1. Sunset Lake was not surveyed from November 25 through December 19, 1975 because ice was forming, and I did not consider anyone would be fishing. Estimates for categories (shore, boat, and ice anglers) and segments of the season were summed and confidence intervals determined according to Cochran (1963).

The first instantaneous day count and the last night count were weighted to document angling effort expended before arrival or after departure of the clerk. The day period was weighted through information from the interviews to include the hour the first angler arrived. The night period was weighted either from interviews or postcards to include the hour the last angler left. Carline (1972) found that unsuccessful anglers were less likely than successful anglers to send in information. If this were the case at Lakes Sunset and Thomas, the elevated catch per effort from the responding successful anglers would be offset, I assume, by the anglers that did not send in postcards but whose effort was included in the instantaneous count.

I considered any effort not included in the survey period as negligible.

I combined the number of non-trout species (i.e. white sucker harvested from July 1975 through February 1976, largemouth bass and bluegill from Sunset Lake, largemouth bass and pumpkinseed from Thomas Lake in 1976, and all non-trout species from Dorothy Lake) harvested from each lake because sample sizes were small. To estimate the harvest of each species, I multiplied the harvest of non-trout species by the percent each species comprised of the total harvest. The harvest of trout stocked the previous year was determined by the ratio of harvested carryover trout to current stock for observed and estimated numbers. I assumed no difference in catchability of carryover trout and the current year's stock. The weight of harvested fish was determined by expansion of sample mean weight or length-weight functional regressions.

A survey clerk was stationed at Lakes Sunset and Thomas for 16 hours each day of the 1977 opening weekend. Hourly counts were conducted from 0600 to 2200. Anglers fishing past 2200 on May 7 were given postcards. Carryover trout were measured and weighed, trout stocked in 1977 were measured, and the non-trout species were counted.

Population Estimates

A 230 volt DC electroshocker was used to capture largemouth bass, cisco, white sucker, and yellow perch in Sunset Lake at night. Captured fish were anesthetized with MS 222, measured, weighed, fin

clipped, scale samples were collected, and fish released.

During 1975, size of the white sucker and cisco populations were estimated in April and November, respectively, by Chapman's modification of the Petersen Formula (Ricker 1975):

$$N = \frac{(M + 1) (C + 1)}{(R + 1)} ,$$

where N is the population estimate; M is the number marked; C is the harvest of white sucker observed in the creel survey on opening day of the trout season or catch of cisco on the recapture electrofishing run, and R is the number of recaptures observed.

During 1976, white sucker, largemouth bass, and yellow perch population estimates were calculated from electrofishing data collected on April 20, 23, 25, 26, and 27 from Chapman's modification of the Schnabel Formula (Ricker 1975);

$$N = \frac{\sum (C M)}{R + 1} ,$$

where N is the population estimate; M is the number at large at time of capture that are marked; C is the catch for each day, and R is the number of recaptures observed. Confidence intervals for both formulae were obtained by considering R as a Poisson variable (Appendix II in Ricker 1975).

Growth

Trout and non-trout species captured by anglers and electrofishing were used for growth calculations. Data from angler caught trout were

augmented by data from electrofishing in October and November 1975 in Sunset Lake. In addition to scales from angler caught non-trout species, scales were obtained from fish captured by electrofishing during spring, summer, and fall 1975 and spring 1976 in Sunset Lake and spring 1976 in Thomas Lake.

Scales were taken from as many fish as practical and the lengths of fish from which scales were taken generally approximated the length frequency of captured yellow perch, largemouth bass, and bluegill (Appendix H1-3). Scales were taken from 7 or 8 cisco from each 10 mm length interval whenever possible (Appendix H4).

Scales from all centrarchids and yellow perch collected in 1975 were taken from approximately the third row above the lateral line on the left side of the fish directly below the anterior dorsal fin. Scales from cisco and yellow perch collected in 1976 were taken from the left side of the fish from the area below the lateral line at the tip of the depressed pectoral fin.

Small scales were mounted on glass microscope slides and larger scales were pressed on cellulose acetate (Smith, S.H. 1954). Scales were viewed on a Baush and Lomb microprojector at 27 to 83 power. From 1 to 3 scales were measured and a mean of the distance from the focus to each annulus along the anterior radius was calculated when more than one scale was used. All scales were read at least twice or until consecutive readings were obtained and confirmed by two experienced readers.

Back calculated lengths were determined from equations derived from functional regressions of fish length vs. scale radius (Ricker 1973). Weighted means of lengths at annulus formation were used to combine 1975 and 1976 samples from Sunset Lake

Lengths of cisco were not back calculated because the body scale relationship was of low predictive value ($r = .45$, Appendix I), in part because of the absence of fish smaller than 340 mm long in the sample (Appendix H4). Small fish may have been lacking because the sample was obtained during spawning time, and the smaller immature fish were not present inshore.

Food Habits

Stomachs of angler caught fish from Sunset Lake and trout from Thomas Lake were removed for determination of food habits. Stomachs from Sunset Lake fish were frozen in 1975. Stomachs from fish collected from Sunset and Thomas Lakes in 1976 were preserved in 10% formalin. Food items were identified in the laboratory. Volume was determined by water displacement in a graduated centrifuge tube.

RESULTS AND DISCUSSION

Fishing Pressure

Peak fishing pressure on Sunset Lake in 1975 and 1976 occurred on opening day and was followed by an exponential decline in effort (Figure 1). Sunset Lake received little pressure during the summer and fall of 1975 and the following winter. Sixty-seven percent of the total estimated fishing pressure at Sunset Lake in 1975 occurred during May, the first month of the season, and 79% occurred in the first 2 months of the season (Table 4). The winter fishery accounted for 5% of the total.

Fishing pressure was irregular on Thomas Lake in the first month of the 1976 season. Peak pressure occurred the second weekend and was followed by 3 smaller peaks in May (Figure 1).

On Dorothy Lake the pattern was similar to Sunset Lake, but the decline in effort was more irregular. Dorothy Lake received the lowest estimated opening weekend (27 hrs/ha) and first month pressure (71 hr/ha) of the three lakes (Table 4). Although Sunset Lake received the greatest opening weekend angling pressure, Thomas Lake probably received the highest angling pressure annually. Thomas Lake received an estimated 386 angling hrs/ha in the first month of the 1976 season, a value exceeding the estimated annual pressure (304 hrs/ha) on Sunset Lake in 1975.

Fishing pressure at Sunset Lake appeared to be constant annually but may not have been for Thomas Lake. Estimated pressure for Sunset Lake for May, and May and June in 1976 and for opening weekend in 1976 and 1977 were similar to the corresponding estimates in 1975. However, pressure for Thomas Lake for opening weekend was more than 2 times higher in 1977 than 1976.

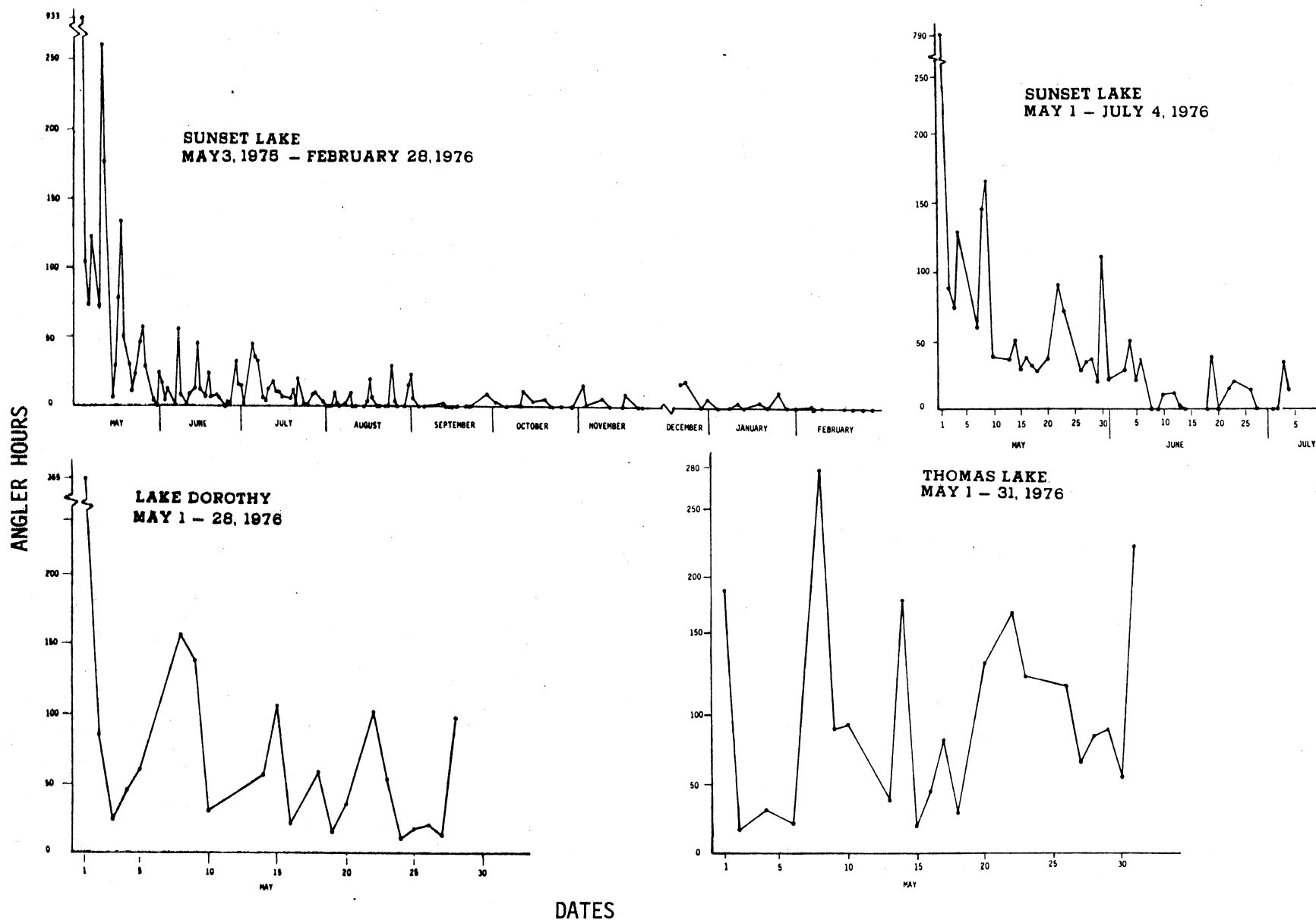


Figure 1. Number of angler hours per survey period determined from the instantaneous counts at Lakes Sunset in 1975 and 1976, Thomas in 1976, and Dorothy in 1976.

Table 4. Estimated fishing pressure (angler hours) at Lakes Sunset, Thomas and Dorothy from Appendices J. $\pm 95\%$ confidence intervals in parenthesis.

	Sunset Lake			Thomas Lake		Lake Dorothy
	1975	1976	1977	1976	1977	1976
Opening weekend Total	2078	1733	1840	418	833	1037
per ha	80	67	71	32	64	27
Remaining days in May Total	3253 (874)	3224 (593)		4653 (999)		1727 (434)
May Total	5331	4957		5017		2764
per ha	205	191		386		71
June Total	955 (227)	879 (414)				
May - June Total	6287	5836				
per ha	242	224				
July - November Total	1211 (290)					
December - February Total	409 (357)					
Grand Total per ha	7906 304					

Shore anglers generally fished earlier in the season than boat anglers at Sunset Lake, but not at Lakes Thomas and Dorothy. Shore anglers (3518 hrs) expended more effort than boat anglers (1812 hrs) during May 1975 at Sunset Lake and shore angling effort (2450 hrs) was similar to boat angling effort (2500 hrs) in 1976 (Appendix J1 and J2). Boat anglers expended more effort than shore anglers in June in both years at Sunset Lake. Few anglers fished from shore at Thomas Lake (Appendix J3) because the wooded shore made angling difficult there. More boat (1611 hrs) than shore (1152 hrs) angling effort was expended at Lake Dorothy during May 1976 (Appendix J4).

The fishing pressure of 304 hrs/ha estimated for Sunset Lake during the 1975 - 1976 season fell about in the middle of the range of 27 other trout-stocked lakes in various states and Canada (Table 5). Eleven lakes received higher and 16 lakes received lower seasonal fishing pressure than Sunset Lake.

Harvest of Trout

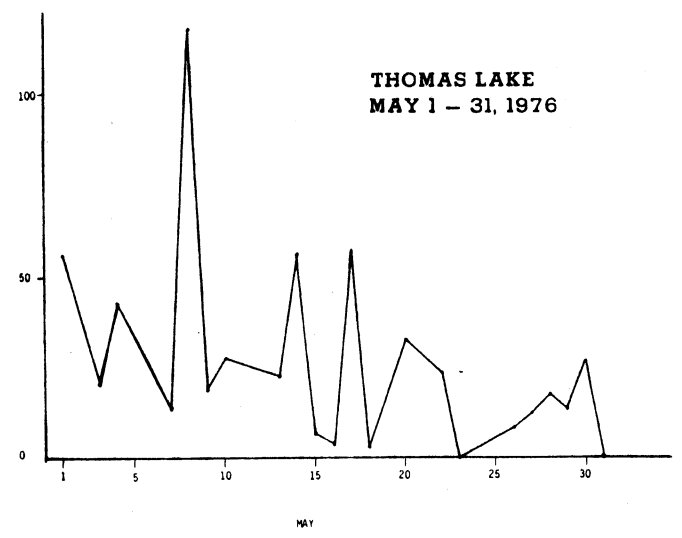
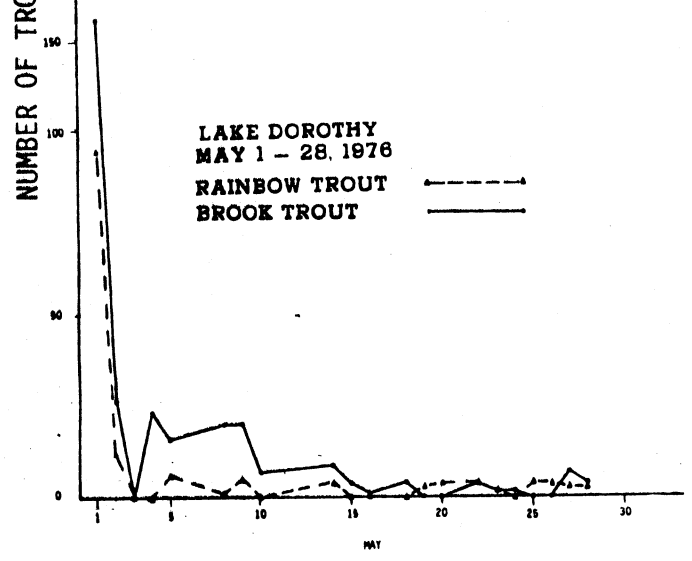
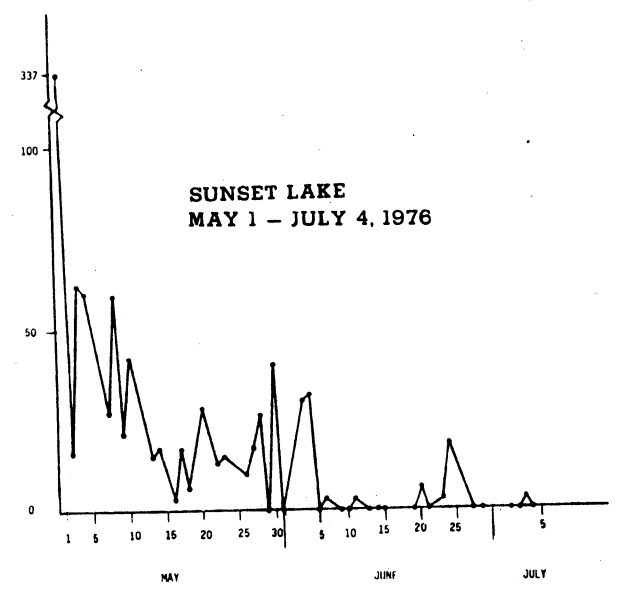
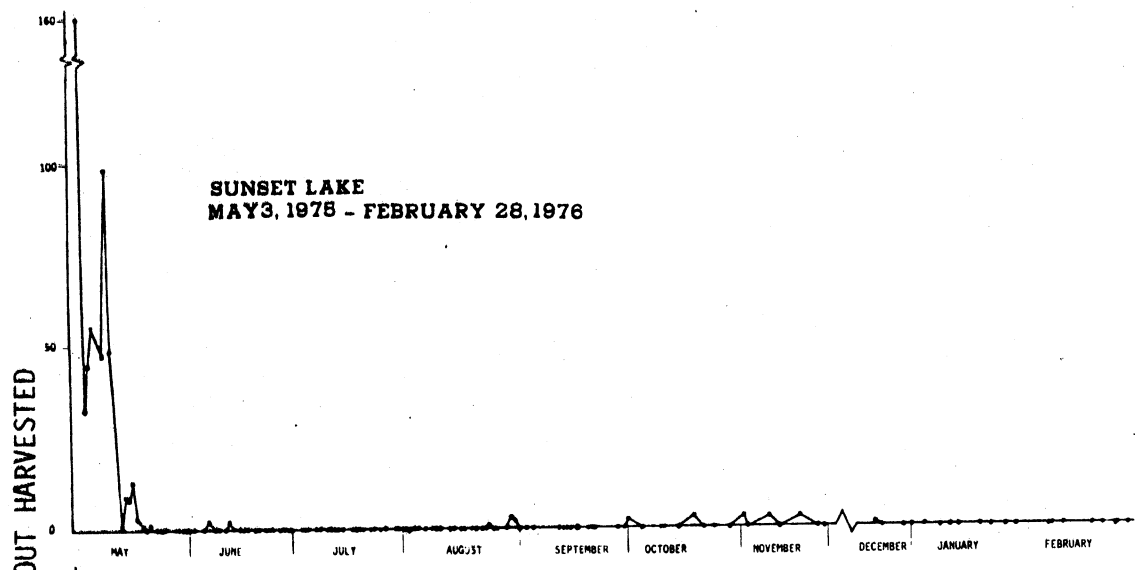
In both Sunset and Dorothy Lakes the pattern of harvest was similar to that for angling pressure, high harvest in the first few days of the season followed by rapid decline with low irregular catches (Figure 2). Virtually no trout were observed harvested during July and August from Sunset Lake in 1975, few trout were harvested during fall, and only one trout was observed harvested through the ice. Similar harvest patterns have been reported by others for lake stockings of catchable-size rainbow trout (Brynildson et al. 1970, Weidlein 1971, Soldwedel and Pyle 1969, Rawstron 1972, 1973, Smith 1968, Klein 1972, unpublished data of the Michigan Department of Natural Resources compiled by C. M. Taube,

Table 5. Area, number of angler hours, number of months in the season and angler hours per hectare for various trout-stocked lakes. Pressure is determined from one season unless otherwise noted.

Lake	Area (ha)	Angler Hours	Number of Months in Season	Hrs/Ha	Reference
<u>Wisconsin</u>					
Sunset	26	7914	9	304	Present study
Riley	7	132	6	19	Brynildson 1958
Turk	4	391	6	98	Brynildson 1958
Cather	4	264	6	66	Brynildson 1958
Devil's	151	41837	9	277	Brynildson et al. 1970 mean of 2 years
Weber	16			65	Burdick and Cooper 1956 mean of 6 years
<u>Michigan</u>					
Moccasin	2	1789	5	894	Galbraith 1959a, b, 1963 mean of 9 years
Airport	3	750	5	250	Galbraith 1959a,b,1963 mean of 5 years
Airport	3	1246	6	415	Galbraith 1959a,b,1963 mean of 4 years
Swanzy	8	2143	5	268	Galbraith 1959a,b,1963 mean of 4 years
East Fish	7	1639	5	252	Alexander and Shetter 1969 mean of 2 years
Corey	255	88000	12	345	Unpublished data of the Mich. DNR compiled by C. M. Taube
<u>Massachusetts</u>					
Quabbin Reservoir	10125	230090	8	23	McCaig et al. 1960
<u>Connecticut</u>					
Uncas	28	8767	6	313	Wadman 1961 mean of 2 years
Dodge	13	5187	6	399	Wadman 1961 mean of 2 years
Norwich	11	4118	6	374	Wadman 1961 mean of 2 years

Table 5. con't

Lake	Area (ha)	Angler Hours	Number of Months in Season	Hrs/Ha	Reference
<u>New Brunswick</u>					
Gibson	24	487	6	20	Smith 1955 mean of 7 years
Crecy	20	1200	6	60	Smith 1955 , 1968 mean of 11 years
<u>Utah</u>					
Fish	1012	150000	6	148	Bangerter 1973
<u>Idaho</u>					
Stanley	73	8600		118	Bjornn 1960
Redfish	607	19000		31	Bjornn 1960
Alturas	486	13900		29	Bjornn 1960
<u>Colorado</u>					
Parvin	25	21787	5	871	Klein 1972
West	8	42583	12	5323	Klein 1976
Bowdy	47	104264	12	2218	Klein 1976
<u>Oregon</u>					
South Twin	53	25549	2	482	Holloway 1947
<u>California</u>					
Lower Sardine	19	7632		402	Boles and Borgeson 1966 mean of 4 years
Beardsley Reservoir	291	29971	6	103	Treanor and Nicola 1971 mean of 6 years
Castle	19	3479	6	183	Wales and German 1956, Wales and Borgeson 1961 mean of 12 years



DATES

Figure 2. Number of trout harvested per survey period determined by the product of catch per effort from interviews and effort from instantaneous counts at Lakes Sunset in 1975 and 1976, Thomas in 1976 and Dorothy in 1976.

Stocek and MacCrimmon 1965, Keating 1960, Miller and Thomas 1956) and brook trout (Shetter 1947, Alexander and Shetter 1969, Galbraith 1959a,b), but brown trout (Salmo trutta) have provided a more sustained fishery in one lake (Brynildson et al. 1970). An estimated 46 and 73% of stocked rainbow trout were harvested from Sunset Lake in 1975 and 1976, respectively, by the end of May (Table 6). On Dorothy Lake, 22 and 64% of stocked rainbow and brook trout, respectively, were harvested by the end of May. The May 1975 harvest from Sunset Lake accounted for 95% of the total year's harvest.

At Thomas Lake in 1976, harvest of trout, like fishing pressure did not follow the pattern of Lakes Sunset and Dorothy. Harvest peaked during the second weekend of the season and declined more gradually and irregularly than the other lakes (Figure 2). An estimated 62% (1400 trout) were harvested in the first month of the season (Table 6). Harvest on opening weekend 1977 increased 3 fold from the previous year, whereas effort increased 2 fold (Table 6). I do not know if harvest and effort patterns characteristically differ from the other lakes or if 1976 was atypical of other years at Thomas Lake. Although effort and harvest were lower than Sunset Lake on opening weekend in 1976, effort and harvest on opening weekend in 1977 were similar to Sunset Lake in 1976 and 1975, respectively (Tables 4, 6).

Most trout caught after May on Sunset Lake in 1976 and during May 1976 on Thomas Lake were observed taken by anglers with gasoline lanterns still fishing at night (Appendix J2, J3). A high percentage of the stocked rainbow trout were taken at night, also, on Lakes Devil's (Brynildson et al. 1970) and Nebish (Brynildson and Kempinger 1973),

Table 6. Estimated number (from Appendix J) and weight (kg) (from Appendix O) of stocked trout **recovered from** Lakes Sunset, Thomas and Dorothy. 95% confidence intervals are given in parenthesis and % denotes percent of quantity stocked.

	<u>Sunset Lake</u>			<u>Thomas Lake</u>		<u>Lake Dorothy</u>	
	1975	1976	1977	1976	1977	Rainbow Trout	Brook Trout
Opening Weekend							
Number	396	726	1084	112	361	522	928
%	14.6	27.0	43.5	5.0	14.4	17.4	46.4
Remaining Days in May							
Number	846	1241		1288		134	356
	(368)	(327)		(418)		(63)	(153)
May Total							
Number	1242	1967		1400		657	1284
%	45.8	73.2		62.2		21.9	64.2
Weight	151.6	271.1		287.0		99.6	217.4
%	47.0	75.9		112.9		30.7	80.5
June							
Number	8	370					
	(13)	(330)					
May and June Total							
Number	1250	2337					
%	46.1	87.0					
Weight	152.7	343.2					
%	47.4	96.0					
July through November							
Number	56						
	(44)						
December through February							
Number	5						
	(13)						
May through February Total							
Number	1311						
%	48.4						
Weight	169.0						
%	52.4						
May 1976							
Number	28						
May, 1975 through May, 1976							
Number	1339						
%	49.4						
Weight	182.6						
%	56.6						

Wisconsin, but co-stocked brown trout were caught primarily during daylight.

Harvest of trout differed between years at Sunset Lake. Almost twice as many trout were harvested during May and June in 1976 than 1975 (Table 6). Difference between the years was greatest during June when an estimated 8 trout were harvested in 1975 and 370 in 1976. Butler and Borgeson (1965) found that harvests did not appreciably change when environmental and stocking conditions were constant. Effort and number of trout stocked were similar between years in Sunset Lake, but variation in the type of fishery (day vs. night) and release date in relation to opening day might have caused the difference in harvests. Effort and trout harvest were greater at night than during the day in 1976, whereas the opposite was true in 1975. Opening weekend harvest was highest in 1977 when trout were released 4 weeks before the season, intermediate in 1976 when trout were stocked 2 weeks before the season, and lowest in 1975 when trout were stocked 3 days before the season.

More brook trout (64%) than rainbow trout (22%) were taken during the first month of the season at Lake Dorothy (Table 6). More brook trout were harvested in the first month of the season from Lake Crecy, New Brunswick (Smith 1968) and East Fish Lake, Michigan (Alexander and Shetter 1969), but a higher percentage of the stocked rainbow trout were eventually harvested than the brook trout. In contrast, more rainbow trout than brook trout were harvested the first nine days of the season at Larson Lake, Wisconsin (preliminary data and subject to revision by L. Andrews, Department of Natural Resources, Woodruff, Wisconsin).

Boat anglers were more successful harvesting trout than shore anglers early in the season on all the lakes. Catch (harvest) per effort of boat anglers was consistently higher than shore anglers at Lakes Sunset and Dorothy during May (Table 7). No trout were caught from shore

Table 7. Catch of stocked trout per effort of shore and boat anglers at Lakes Sunset and Dorothy during May.

Lake	Number of trout harvested per angler hour	
	Shore anglers	Boat anglers
Sunset 1975	.206	.285
1976	.279	.514
Dorothy		
Rainbow trout	.137	.309
Brook trout	.429	.489

at Thomas Lake during May and during June 1975 and 1976 at Sunset Lake (Appendix J1, J2, J3). In contrast, during the July - November segment of the season at Sunset Lake in 1975, catch per effort was higher for shore anglers (.100) than boat anglers (.040), though sample sizes were small.

Returns of rainbow trout at Lakes Sunset and Thomas and brook trout at Lake Dorothy were above average, and rainbow trout at Lake Dorothy below average in relation to other trout-stocked lakes in various states and Canada. Of 52 lakes in which first year or less than first year returns were reported, 32 had a lower percent of trout returned than the 49% recorded at Sunset Lake in 1975 and 7 had a higher percent return than the 86% at Sunset Lake in 1976 (Table 8). The percent

Table 8. Returns of catchable-size rainbow trout (brook trout denoted by a) for the first year, or less if specified in the comments, after release.

Lake	Area (ha)	Stocked		Percent Return		Reference and Comments
		Number/ha	kg/ha	Number	Weight	
<u>Wisconsin</u>						
Sunset 1975	26	106	12.6	49	52	Present study
Sunset 1976	26	106	13.7	87	96	Present study, survey for first 2 months of the season
Thomas	13	173	19.6	62	113	Present study, survey for first month of the season
Dorothy	39	77	8.3	22	31	Present study, survey for first month of the season
Dorothy ^a	39	51	6.9	64	80	Present study, survey for first month of the season
Riley	7	86	4.2	16	28	Brynildson 1958, means of 2 stockings in 2 years
Turk	4	284	20.2	47	56	Brynildson 1958, means of 3 stockings in 2 years
Cather	4	179	10.8	46	68	Brynildson 1958, means of 3 stockings in 2 years
Palette	68	126	11.0	38	35	Brynildson 1962, mean of 2 stockings in 2 years
Hoose	30	121	13.2	10	11	Brynildson 1962, first 2 months of season surveyed
Rock	45	73		5		Brynildson 1962, mean of spring and fall stockings, first 2 months of the season surveyed
Fish	102	20	5.2	20	10	Brynildson 1961, mean of spring and fall stockings, first 2 months of the season surveyed
Sand ^a	9	222	30	46	37	Theumler per. comm. first 2 months of the season surveyed
Montgomery ^a	9	222		72		Theumler per. comm. first 2 months of the season surveyed
Larson	4	250		72		Andrews per. comm. first 9 days of the season surveyed
Larson ^a	4	250		66		Andrews per. comm. first 9 days of the season surveyed
<u>Michigan</u>						
East Fish	7	41		66		Shetter 1947, Alexander and Shetter 1969, mean of 7 years
East Fish ^a	7	41		46		Shetter 1947, Alexander and Shetter 1969, mean 7 years
South Twin	53	50		64		Shetter and Hazard 1941
Moccasin ^a	3	300	22	45		Galbraith 1959a, mean of 2 years
Airport ^a	3	125	9.8	55		Galbraith 1959b, mean of 3 years
Corey	255	11		35		Unpublished data of Mich. DNR, compiled by C.M. Taube, mean of spring and winter stockings over 7 years

Table 8. CONTINUED

Lake	Area (ha)	Stocked Number/ha	kg/ha	Percent Return Number Weight		Reference and Comments
<u>Massachusetts</u>						
Quabbin Reservoir	10125	.2	.08	50	39	Hambly 1972, mean of 4 stockings in 1 year
<u>Maine</u>						
Higgins	10	20	23	29	27	Mullan 1959
Tyler ^a	2	288		39		Foye 1956, mean of 3 years, first 2 months of season surveyed
Figure ^a Eight	4	259		64		Foye 1956, mean of 3 years, first 2 months of season surveyed
Emery ^a	1	327		16		Foye 1956, mean of 3 years, first 2 months of season surveyed
Chamberlain ^a	1	199		29		Foye 1956, mean of 3 years, first 2 months of season surveyed
<u>Connecticut</u>						
Uncas	28	11		68		Wadman 1961, mean of 2 years
Dodge	13	77		74		Wadman 1961, mean of 2 years
Dodge ^a	13	23		30		Wadman 1961
Norwich	11	82		58		Wadman 1961, mean of 2 years
Norwich ^a	11	45		89		Wadman 1961, mean
<u>New Jersey</u>						
Spruce Run Reservoir	522	2		36		Soldwedel and Pyle 1969 mean of 5 stockings in 2 years
<u>New Brunswick</u>						
Gibson ^a	25	38		11		Smith 1955, mean of 7 years
Crecy	20	73		75		Smith 1968, mean of 2 years
Crecy ^a	20	34		12		Smith 1955, 1968, mean of 6 stockings in 3 years
<u>Kentucky</u>						
Cumberland	20335	3		.2		Axon 1974, mean of 5 years
<u>Missouri</u>						
Taneycomo	700	3		22		Fry and Hanson 1968

Table 8. CONTINUED

Lake	Area (ha)	Stocked		Percent Return		Reference and Comments
		Number/ha	kg/ha	Number	Weight	
<u>California</u>						
Pillsbury	941	16		26		Kabel 1960
Lower Sardine	19	386		45		Boles and Borgeson 1966, mean of 3 stockings in 2 years
Berryessa	8094	.05		27		Rawstron 1972, 1973, mean of 7 stockings in 3 years
Merle Collins	401	.2		42		Rawstron 1973, mean of 3 stockings
Pine Flat	2428	.2		38		Rawstron 1973, mean of 3 stockings
Isabella	4856	.1		26		Rawstron 1973, mean of 3 stockings
Conn Valley	324	62		.4		Curtis 1951
June	125	504		49		Curtis 1951, Butler and Borgeson 1965, mean of 5 years
Convict	68	22		73		Butler and Borgeson 1965, mean of 3 stockings in 2 years
Green Valley	5	280		98		Butler and Borgeson 1965
Gregory	39	72		99		Butler and Borgeson 1965
Huntington	583	21		79		Butler and Borgeson 1965
Arrowhead	316	9		43		Butler and Borgeson 1965
South	72	35		74		Butler and Borgeson 1965
Gull	28	2786		13		Curtis 1951
<u>Oregon</u>						
South Twin	53	490		32		Holloway 1947
<u>Colorado</u>						
Eggleston	32	41		2		Barrows 1962, mean of 8 stockings in 2 years
Island	55	16		3		Barrows 1962, mean of 5 stockings in 2 years
Parvin	25	20		71		Klein 1953, 1972, mean of 6 stockings in 2 years

Table 8. CONTINUED

Lake	Area (ha)	Stocked Number/ha	kg/ha	Percent Return Number Weight	Reference and Comments
<u>Minnesota</u>					
Algren	.8	607		86	Kelley 1953
Holes	.4	562		57	Kelley 1953
Melrose Deep	.8	562		86	Kelley 1953
Trabetusky	.4	562		99	Kelley 1953
<u>Alberta</u>					
Chickako	20	1438		7 36	Miller and Thomas 1956
<u>Idaho</u>					
Stanley	73	137		95	Bjornn 1960
Redfish	607	39		100	Bjornn 1960
Alturas	486	31		88	Bjornn 1960
Kelso	28	4		38	Jeppson 1960, mean of 7 stockings in one year
Spirit	566	.2		16	Jeppson 1960, mean of 7 stockings in one year
<u>Arkansas</u>					
Bull Shoals Reservoir	18400	.2		15	Baker and Mathis 1967
<u>Utah</u>					
Fish	1012	33	6	44 51	Bangerter 1973, mean of 9 plants in 3 years

return of only 13 lakes was below the 22% returned at Lake Dorothy. Of 14 lakes stocked with brook trout, 11 had a lower return than the 64% at Lake Dorothy.

The ranking of Lakes Sunset, Thomas, and Dorothy in relation to the weight of trout returned in other lakes was similar to the number returned. The ratio of weight harvested to weight stocked for rainbow trout was above average at Lakes Sunset and Thomas and for brook trout at Lake Dorothy and was below average for rainbow trout at Lake Dorothy. Weight returned at Thomas Lake, 113% of weight stocked (in the first month of the season) was highest of 10 lakes in which first year returns were reported, and Sunset Lake rainbow trout in 1975 returned more weight (52% of weight stocked) than 8 of the 10 lakes (Table 8). Rainbow trout in 6 of the 10 lakes returned more weight than at Lake Dorothy (31% of weight stocked). Brook trout at Lake Dorothy returned more weight than both of the other lakes stocked with brook trout in which weight return was reported.

Trout Harvest Influenced by Size, Species, Strain, and Season: Other Studies

Returns of stocked trout may be affected by size of trout released, species, strain, and the season of stocking. In many studies stocking larger trout usually yielded higher returns than smaller trout. Thirty percent of the catchable-size stocked trout and 13% of the subcatchable-size (all trout less than legal size) were harvested from 339 separate stockings that I found (Table 9). In addition, Shetter et al. (1964) reported that catchable-size trout returned the highest percent (45), subcatchable-size (76 - 175 mm) were intermediate (15%), and fingerling (fry - 76 mm) returned the lowest percent (11) in various lakes in the United States. Also, Needham (1959) reported the mean

Table 9. Eventual and first year harvest, expressed as percent of numbers stocked, of catchable and subcatchable^a-size trout stocked during various seasons. Number of separate stockings (from Appendix L) in parenthesis.

Species of trout	Season of release				Mean
	Spring	Summer	Fall	Winter	
Catchable-size					
Eventual harvest					
Rainbow	30 (58)	51 (34)	15 (26)	42 (10)	32 (128)
Brook	80 (3)	41 (6)	39 (24)		44 (33)
Brown	37 (14)	10 (5)	5 (1)		15 (22)
Mean	30 (75)	39 (47)	15 (51)	42 (10)	30 (183)
First year harvest					
Rainbow	30 (88)	35 (23)	30 (31)	28 (6)	31 (148)
Brook	72 (7)	25 (6)	48 (18)		35 (31)
Brown	38 (21)				38 (21)
Mean	31 (116)	34 (29)	30 (49)	28 (6)	
Subcatchable-size					
Eventual harvest					
Rainbow	9 (26)	15 (47)	5 (30)		12 (103)
Brook	35 (4)	2 (3)	18 (42)		18 (49)
Brown	56 (2)	4 (2)			28 (4)
Mean	11 (32)	15 (52)	11 (72)	13	13 (156)

^a - all trout smaller than legal size

return for 38 experiments of stocked legal size trout (34%) was higher than the mean return of 32 cases in which fingerling trout were stocked (7%). Larger catchable-size trout provided greater returns to the creel than smaller fish (Solwedel and Pyle 1969, Geldern and Kabel 1960, Smith 1968, Weidlein 1971).

Catchable ($z = 50.08$, $p = .01$, $n_1 = 1741682$, $n_2 = 39467$; Fisher 1973) and subcatchable-size ($z = 83.13$, $p = .01$, $n_1 = 1751693$, $n_2 = 2048617$) brook trout provided significantly higher returns than rainbow trout (Table 9). Legal-size stocked brook trout provided highest eventual returns and brown trout highest ($z = 7.68$, $p = .01$, $n_1 = 37585$, $n_2 = 66684$; brown trout vs. brook trout) first year returns. Brown trout provided the highest returns of trout stocked at subcatchable-size. Also, Shetter et al. (1964) reported that from 179 experiments, the recovery of fingerling rainbow trout (10%) was lower than brook and brown trout (both 12%), and recovery of sublegal size trout was the same for the 3 species (15%). However, recoveries of legal size rainbow trout (50%) were higher than brook (45%) and brown ((40%) trout.

Highest recovery of stocked rainbow trout occurred when they were stocked in summer (Table 9). Returns of brook and brown trout were highest when stocked in spring.

In several studies survival and harvest of several strains of rainbow trout were different, but I discerned no evident general trends. Cordone and Nicola (1970) found a wild strain was harvested at a higher rate than domestic strains in a California reservoir. Yet Ayles (1973) reported rainbow trout from domestic strains had higher survival rates than wild strains in Canadian prairie potholes. Different harvest rates were found among domestic strains by Weidlein (1971), but none was found by Solwedel and Pyle (1969) among two other domestic strains. Rawstron (1972, 1973) found no difference in annual harvest rates of domestic strains, but the Coleman Kamloops strain survived longer and therefore, was able to sustain the fishery for a longer time.

Wild strains of brook trout had survival rates either higher than or equal to domestic strains, but no difference in harvest rates were reported. Flick and Webster (1964) found over-summer survival was higher in wild strains than domestic strains even though over-winter survival rates were the same for both strains. Flick and Webster (1976) found wild and hybrid strains consistently exhibited greater longevity than domestic strains. In contrast, Eipper (1964) found that wild and domestic strains did not differ appreciably in annual survival. Greene (1952) found that as many or more of a wild strain were harvested the second year as the first year after stocking, whereas the bulk of the domestic strain was caught the first year after stocking; however he found no difference in eventual harvest between the strains.

Plosila (1977) reported that the strain of lake trout (Salvelinus namaycush) was more important than the size of the fish or season of stocking in determining survival.

Characteristics of Anglers

A few angling parties harvested many of the trout in all three lakes. During the 1975 season at Sunset Lake, 3.5% of the parties fishing for trout harvested 31% of the trout (Table 10). At Thomas Lake 12% of the parties fishing for trout harvested 49% and at Lake Dorothy 12% caught 51% of the total trout harvest. Less than 12% of the parties fishing for trout caught creel limits and more than 44% harvested no trout at all.

Trout were the main attraction at Lakes Sunset and Dorothy. Ninety-five percent of the parties interviewed at Sunset Lake during the 1975-76 season said they were fishing for trout even though the trout fishery was essentially a two-month fishery. Over 89% of the parties that came to fish at Lake

Table 10. Number of parties interviewed, number (and percent) of parties with finished trips fishing for trout and other fish, and with creel limits, number of trout harvested by those parties with limits and the number of parties catching no trout on Lakes Sunset, Thomas and Dorothy.

Lake	Date	Total Number of Parties Interviewed	Number (%) of Parties with Finished Trips Fishing for:		Number (%) of Parties with Creel Limits	Number (%) of Trout Harvested by Those Parties with Limits	Number (%) of Parties Catching No Trout
			Trout	Other			
Sunset	May 3, 1975- Feb. 28, 1976	483	460 (95.2)	17 (3.5)	14 (3.5)	155 (30.6)	333 (72.4)
	May 1, - July 4, 1976	400	377 (94.2)	11 (2.7)	30 (7.9)	350 (38.7)	214 (56.8)
Thomas	May 1 - 31, 1976	310	152(49.0)	147(47.4)	18(11.8)	190(48.8)	67(44.1)
Dorothy	May 1 - 28, 1976	197	176(89.3)	21(10.7)	21(11.9)	230(51.4)	87(49.1)

Dorothy, came to fish for trout. But at Thomas Lake 47% of the anglers were interested in warmwater fish, even in the first month of the season.

The majority of the anglers fishing the lakes traveled 20 miles or less (Appendix M). Most used earthworms for bait. Corn was used frequently as bait in Sunset Lake, infrequently at Thomas Lake and not at Lake Dorothy.

Contribution of Trout to the Sport Fishery

Trout were the most abundant fish in the harvest in May 1976 in all lakes, and white sucker in Sunset Lake and bluegill in Lakes Thomas and Dorothy were the next most abundant species in the harvest (Table 11). Trout made up 31 (number) and 29% (weight) of the total 1975-76 harvest at Sunset Lake. Though trout made up the greatest number of fish removed during May 1975 in Sunset Lake, white sucker made up the greatest biomass. Warmwater species dominated the harvest at Sunset Lake in both number and weight the rest of the 1975-76 season.

Total weight removed in spring was similar among years in Sunset Lake. Weight harvested of all species in May, and May and June 1975 was similar to corresponding periods in 1976 (Table 11). The composition of the harvest changed, however, as non-trout species were more abundant in the 1975 harvest than the 1976 harvest.

Population Estimates

The standing stock of largemouth bass and spawning populations of white sucker, cisco, and yellow perch in Sunset Lake was estimated to be 52 kg/ha (Table 12). White sucker was the most abundant species. Cisco, almost unexploited in the lake, made up the greatest

Table 11. Estimated number and weight (kg) of fish harvested from Lakes Sunset, Thomas, and Dorothy. Estimated numbers obtained from Appendices K and M, and estimated weight from Appendix O. Percent of monthly harvest is given in parenthesis.

	Sunset		Lake		Thomas		Dorothy
	1975 Number	Weight	1976 ^d Number	Weight	Number	Weight	Number
May							
Rainbow trout ^a	1242 (35)	152 (31)	1967 (78)	271 (67)	1400 (55)	287 (57)	657 (29)
Rainbow trout	28 (.8)	11 (2)	28 (1)	14 (3)	12 (.5)	11 (2)	13 (.6)
Brook trout ^a							1284 (56)
Brook trout ^b							3 (.1)
White Sucker	1060 (30)	207 (43)	326 (13)	87 (22)			
Yellow Perch	398 (11)	28 (6)	83 (3)	11 (3)			5 (.2)
Bluegill	394 (11)	33 (7)	47 (2)	8 (2)	875 (34)	115 (23)	153 (7)
Largemouth bass	398 (11)	53 (11)	61 (2)	11 (2)	124 (5)	76 (15)	24 (1)
Pumpkinseed	13 (.3)	.8 ^c (.2)			147 (6)	10 (2)	
Black crappie							95 (4)
Smallmouth bass							46 (2)
Total	3533	485	2512	402	2558	499	2280
kg/ha		19		15		38	
June							
Rainbow trout ^a	8 (3)	1 (2)	370 (58)	72 (54)			
White sucker	15 (5)	3 (7)	70 (13)	21 (19)			
Yellow Perch	10 (3)	.7 (2)	11 (2)	1 (.9)			
Bluegill	60 (21)	6 (15)	31 (6)	5 (4)			
Largemouth bass	194 (68)	29 (71)	65 (12)	12 (11)			
Pumpkinseed			3 (.5)	.3 ^e (.2)			
Total	287	41	550	112			
kg/ha		2		4			
May and June Total	3820	526	3062	514			
kg/ha		20		20			
July - February							
Rainbow trout ^a	66 (18)	16 (27)					
White sucker	37 (10)	10 (17)					
Yellow perch	96 (26)	11 (18)					
Bluegill	84 (23)	8 (13)					
Largemouth bass	70 (19)	14 (23)					
Pumpkinseed	13 (4)	.8 (1)					
Total	366	60					
May - February total	4186	586					
kg/ha		22					

a - current year's stocking

b - from previous year's stocking

c - weight based on 4 fish taken in May 1975

d - 1 observed bullhead and 2 cisco not included

e - weight based on 1 fish taken in June

Table 12. Estimated standing stock of four species of fish in Sunset Lake (26 ha) from Appendix P.

Species	Kind of Estimate	Date of Estimate	Number	95% Confidence Interval	Mean Weight (kg)	Total Weight (kg)
White Sucker	Petersen	May, 1975	2150	1117 - 2150	.218	469
Cisco	Petersen	Nov. 1975	1281	770 - 2270	.535	685
White Sucker	Schnabel	April, 1976	2057	1679 - 2585	.251	516
Yellow Perch (> 125 mm)	Schnabel	April, 1976	956	825 - 1122	.091	87
Largemouth Bass (> 150 mm)	Schnabel	April, 1976	234	152 - 383	.297	69

biomass. The population estimate was made for yellow perch greater than 125 mm and largemouth bass greater than 150 mm since electrofishing was not as efficient in capturing smaller fish as larger fish.

Population estimates should be considered minimal because of possible gear selectivity, capture during spawning, and bias from use of one kind of gear for both mark and recapture. The estimates for yellow perch, white sucker, and cisco were made at spawning times, and the continual recapture of males on spawning grounds would cause underestimation of population size. Chadwick (1976) found the population estimate for yellow perch was underestimated by 8.5 times because males, presumably on spawning grounds, continually reentered trap nets. Since electrofishing was used to obtain both mark and recapture data to estimate population size of cisco, white sucker in 1976, and yellow perch, the estimates may be biased. Schneider (1971) found estimates using both mark and recapture data obtained by electrofishing were less than estimates made with trap nets or both types of gear. However, the estimate of white sucker population size was determined in 1975 using electrofishing gear for marking, and angling for recapture, and the estimated number and weight were similar to the 1976 estimate, an indication that the sucker estimate may not have been biased.

Growth of Trout

Growth conditions were best for rainbow trout in Thomas Lake and worst in Sunset Lake. From the mid-April 1976 release to the end of May, trout from Thomas Lake exhibited the highest growth rate and trout from Sunset Lake the lowest of the three lakes (Table 13). Also, carryover trout from Thomas

Table 13. Length, weight and monthly growth rate (G)^a of trout stocked in Lakes Sunset, Thomas and Dorothy based on stocking sample, electrofishing^b and angling. Standard deviations are in parenthesis.

Lake	Date	Mark	Number in sample	Mean length mm	Mean weight g	G
Sunset	April 30 ^C , 1975	R V	111	232 (25.8)	119 (25.4)	.008
	May	R V	144	235 (19.4)	120	
	June	R V	2	249	145	
	August	R V	5	274 (25.1)	194	.189
	October	R V	8	305 (25.5)	290 (59.2)	.146
	November	R V	12	308 (20.5)	297 (66.0)	.201
	May, 1976	R V	9	366 (26.7)	488	.024
	May, 1975	N M	7	323 (15.9)	325	.083
	May, 1975	N M	1 ^d	537	2500	
	April 8 ^C , 1976	L V	110	231 (13.9)	133 (20.8)	.051
	May	L V	438	245 (14.1)	140 (23.0)	
	June	L V	35	271 (12.4)	195 (27.0)	
	March 30 ^C 1977	N M		229		.334
	May 7, 8	N M	440	253 (20.0)		
Thomas	April 8 ^C , 1976	L V	110	229 (13.0)	113 (23.6)	.596
	May	L V	249	266 (17.0)	205 (47.0)	
	May	N M	4	432 (24.1)	894 (147.7)	
	March 30 ^C , 1977	N M		229		.361
	May 7, 8	N M	121	289 (18.3)		
	May 7, 8	L V	2	417 (10.6)	590 (127.0)	
Dorothy Rainbow trout						
	April 13 ^C , 1976	R V	150	215 (16.4)	108 (25.4)	.361
	May	R V	139	240 (13.2)	155 (33.2)	
	May	N M	5	247 (14.1)	167 (33.5)	
Brook trout						
	April 13 ^C , 1976	R V	105	231 (25.0)	135 (41.3)	.213
	May	R V	310	247 (14.1)	167 (33.5)	
	May	N M	1	379		

a - $G = (\ln \bar{w}_{\text{time 2}} - \ln \bar{w}_{\text{time 1}}) / \text{months}$

b - from October and November sample on Sunset Lake only

c - stocking

d - presumably from 1973 release

N M - not marked (assumed to be from previous year's release if found in 1975 or 1976)

R V - right ventral fin clip

L V - left ventral fin clip

Lake were longer than trout from Sunset Lake caught in May. Also, although trout stocked in Lakes Thomas and Sunset in 1977 were about the same size (Table 11), the trout harvested from Thomas Lake on opening weekend were larger (289 mm) than the trout harvested from Sunset Lake (253 mm).

Rainbow trout grew faster than brook trout in Lake Dorothy. Rainbow trout were stocked at a smaller size, and higher growth rate would be expected. Growth appeared to even out over the year as carryover fish of both species were similar in length, though sample sizes were small.

Trout growth in the three lakes was similar to other inland Wisconsin lakes. Some 18-month old rainbow trout released into Devil's Lake, Sauk County in spring reached 483 mm by the following spring (Brynildson et al. 1970). Fall hatched rainbow trout, stocked at 81 - 99 mm long, were 249 - 307 mm long by the next April and 386 - 452 mm long by the following March and April at Nebish Lake, Vilas County (Brynildson and Kempinger 1973). Winter-hatched rainbow trout grew from 187 mm long from spring release to 330 mm by the following spring in Riley Lake, Chippewa County (Brynildson 1958). Rainbow trout whose mean lengths ranged from 30 to 90 mm were planted into Weber Lake,

Vilas County from May through October for 5 years (Burdick and Cooper 1956). In May of the first full growing season, the mean lengths of the trout stocked from May through October ranged from 178 to 264 mm. The second May, the means ranged from 345 to 439 mm. The authors found neither survival nor time of release to be related to growth.

Growth of Other Fish

In Sunset Lake, growth was determined for 73 yellow perch in 1975 and 80 yellow perch in 1976 (Appendix I). Growth histories were calculated for three year classes (1972 - 74) in 1975 and four year classes in 1976 (1972 - 75) (Appendix Q1). Mean lengths at annuli I - IV were 93, 166, 202, and 205 mm (Table 14).

Yellow perch were evidently a recent addition to Sunset Lake. No fish older than age III were found in 1975 and none older than IV in 1976. Seining by personnel of the Wisconsin Department of Natural Resources during May 1970 yielded no yellow perch (Folz 1971), and electrofishing in September 1974 yielded a perch 81 and 140 mm long (Zimmerman 1975). The fish were probably stocked illegally in 1971 or 1972.

Growth conditions for yellow perch were better in Sunset Lake than other lakes. Yellow perch in Sunset Lake were larger at successive ages than populations in most Wisconsin, Michigan and Ontario lakes and similar to those in Lake Winnebago, a shallow, eutrophic Wisconsin lake (Table 14).

Lengths at various annuli were calculated for 234 largemouth bass captured in Sunset Lake in 1975, 114 largemouth bass in 1976 and for 95 largemouth bass from Thomas Lake in 1976 (Appendix I). Growth histories were calculated for seven year classes (1968 - 74) in 1975 and nine year

Table 14. Mean total length (mm) at each annulus for yellow perch from Sunset Lake, Wisconsin and other populations.

Lake	I	II	III	IV	V	VI	VII	VIII	IX	X	Reference
Sunset Wisconsin	93	166	202	215							Present study, weighted means of back calculated length at annulus formation, sexes combined
n	149	135	112	47							
SD	8.0	3.4	3.3								
Red Deer Ontario	59	96	119	146	175	178					Chadwick 1976, weighted back calculated length at annulus formation, both sexes combined from his Table 3.
Mill Michigan	76	119	150	170	196	226	241	211			Schneider 1971, mean lengths of age groups.
Winnebago Wisconsin	103	148	185	224	253	274	292	309	328	327	Weber 1974, means of back calculated lengths of both sexes combined from his Tables 3 and 4.
Wisconsin Drainage Lakes	68	109	140	180	201	236					Snow 1969, means of 7 lakes.
Wisconsin Seepage Lakes	66	99	127	150	168	183					Snow 1969, means of 3 lakes
Spring Wisconsin	104	127	175	236	251	269					Snow 1976, mean length at age
Nebish Wisconsin	86	122	147	173	213	244					Kempinger 1976, mean length at spawning
Michigan Lakes	79	117	155	178	203	229		251	272	287	Laarman 1963, statewide means

classes (1967 - 75) in 1976 from Sunset Lake and twelve year classes (1964 - 75) of largemouth bass from Thomas Lake (Appendix Q2). Mean lengths of largemouth bass from Sunset Lake at annuli I - IX were 82, 133, 216, 285, 353, 417, 436, 489, and 496 mm, and of largemouth bass from Thomas Lake at annuli I - XII were 69, 129, 192, 253, 310, 367, 408, 446, 458, 470, 487, and 504 mm (Table 15).

Length at annulus formation was calculated for 163 bluegill collected in 1975 and 47 bluegill collected in 1976 from Sunset Lake and 101 bluegill collected from Thomas Lake in 1976 (Appendix I). Growth histories were calculated for five year classes (1970 - 74) in 1975 and six year classes (1970 - 75) in 1976 for fish from Sunset Lake and six year classes (1969 - 74) for fish from Thomas Lake (Appendix Q3). Mean lengths of bluegill from Sunset Lake at annuli I - VI were 43, 79, 130, 159, 182, and 219 mm, and of bluegill from Thomas Lake at annuli I - VII were 42, 62, 95, 137, 174, 203, and 224 mm (Table 16).

Largemouth bass and bluegill grew faster in Sunset Lake than Thomas Lake, but the differences were small (Tables 15 and 16). Growth of largemouth bass and bluegill from Lakes Sunset and Thomas appeared average for Wisconsin and Michigan populations.

Six year classes (1967 - 72) (Appendix Q4) were found for cisco captured in November 1975 at Sunset Lake. Mean lengths at annuli III - VIII were 353, 352, 370, 387, 390, and 405 mm. Growth of cisco at Sunset Lake were about average when compared to other populations in inland lakes (Table 17). Cisco from Lakes Trout, Muskellunge, and Silver in Wisconsin and Nipissing, Ontario were smaller, but cisco from Clear Lake, Wisconsin and various Michigan lakes were about the same length at successive ages as cisco from Sunset Lake.

Table 15. Mean total length (mm) at each annulus for largemouth bass from Lakes Sunset and Thomas and other populations

Lake	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Reference
Sunset													
Wisconsin	82	133	216	285	353	417	436	489	495				Present study, weighted means back calculated length at annulus formation sexes combined.
n	277	228	212	65	9	5	4	2	2				
SD	15.7	23.2	20.0	13.5	57.5	54.7	45.0	-	-				
Thomas													
Wisconsin	69	129	192	253	310	367	408	446	458	470	487	504	Present study, weighted means back calculated length at annulus formation sexes combined.
n	92	72	66	53	38	27	18	15	10	8	7	6	
SD	6.4	13.2	17.4	26.2	35.6		34.1	39.7	38.5	31.1	12.2	4.9	
Brown's	91	170	229	272	305	345	411	452	467	477	498	521	Mraz and Threinan 1955, weighted mean back calculated lengths.
Spring													
Wisconsin	124	244	345				437	470	495	538			Snow 1976, mean length at age.
Wisconsin													
Drainage													
Lakes	79	160	231	315	333	373	424						Snow 1969, means of 7 lakes.
Wisconsin													
Seepage													
Lakes	74	157	234	295	295	381	419						Snow 1969, means of 5 lakes.
Mill													
Michigan	89	160	213	256	295	340	389	432	472	477	513		Schneider 1971, mean length at age.
Michigan													
Lakes	91	155	218	269	310	345	383	424	450	477	503	498	Laarman 1963, statewide means.

Table 16. Mean total length (mm) at each annulus for bluegill from Lakes Sunset and Thomas and other populations.

Lake	I	II	III	IV	V	VI	VII	VIII	IX	Reference
Sunset										
Wisconsin	43	79	130	159	182	219				Present study, weighted means of back calculated lengths at annulus formation sexes combined.
n		127	121	109	30	1				
SD	.8	7.6	8.5	6.2	3.7	-				
Thomas										
Wisconsin	42	62	95	137	174	203	224			Present study, weighted means of back calculated lengths at annulus formation sexes combined.
n	99	99	97	85	55	25	3			
SD	2.0	5.1	4.2	2.6	3.4	.3	-			
Spring										
Wisconsin		114	178	226	241	261	261			Snow 1976, mean lengths at age.
Wisconsin										
Drainage										
Lakes	38	79	109	142	165	183	201	203	211	Snow 1969, means of 8 lakes.
Wisconsin										
Seepage										
Lakes	36	69	86	109	112	127	147	155	168	Snow 1969, means of 4 lakes.
Mill										
Michigan	43	63	91	117	140	163	178	185	203	Schneider 1971, mean lengths at age.
Michigan										
Lakes	58	86	112	140	163	178	190	201	218	Laarman 1963, statewide means.

Table 17. Mean total length (mm) at each annulus for cisco from Sunset Lake and other populations.

Lake	I	II	III	IV	V	VI	VII	VIII	IX	Reference
Sunset Wisconsin			353	352	370	387	390	405		Present study, actual lengths at capture in November.
n			3	9	12	17	2	1		
SD			13.7	15.2	11.0	11.0	14.1	-		
Trout Wisconsin	96	139	162	175	187	199	212	224		Hile 1936, mean of back calculated lengths, S.L. converted to T.L. by multiplying by 1.185 (Carlander 1969).
Muskellunge Wisconsin	114	169	191	206						Hile 1936, means of back calculated lengths, S.L. converted to T.L. by multiplying by 1.185 (Carlander 1969).
Silver Wisconsin	95	153	184	200	214	224	232			Hile 1936, means of back calculated lengths, S.L. converted to T.L. by multiplying by 1.185 (Carlander 1969).
Clear Wisconsin	130	234	305	342	367	384	400	412	423	Hile 1936, means of back calculated lengths, S.L. converted to T.L. by multiplying by 1.185 (Carlander 1969).
Birch Michigan	127	254	328	372	404					Clady 1967, means of means of age groups from Fig. 1.
Michigan Lakes	213	246	269	295	325	353	353	396	399	Laarman 1963, statewide means.
Nipissing Ontario	203	226	242	255	262	268	295	325	359	Fry 1937, weighted means of mean length at age, sexes combined from his Table 15, S.L. converted to T.L. by multiplying by 1.185 (Carlander 1969).

Mortality of Trout

Few trout stocked at catchable-size survived to the next season. Trout released in 1974 and 1975 at Sunset Lake were not observed in the creel after the second weekend of the following season. A total of 28 carryover trout were estimated harvested during May of both years and no carryover trout were observed on opening weekend of 1977. One trout, presumably from the 1973 stocking was observed caught at Sunset Lake in 1975.

At Thomas Lake, four carryover trout were observed in the first month of the 1976 season and two on opening weekend of the 1977 season. At Lake Dorothy, five carryover rainbow trout and one carryover brook trout were checked during the first month of the 1976 season. Similar carryover has been reported for rainbow trout (Alexander 1975, Barrows 1962, Axon 1974, Brynildson 1961 and 1962, Bridges and Hambly 1971), brook trout (Galbraith 1959a, b, Alexander and Shetter 1969, Smith, M.W. 1954, 1968, T. Theumler, personal communication, Department of Natural Resources, Wausaukee, Wisconsin), and brown trout (Bridges and Hambly 1971). In contrast, two lakes that had few or no non-trout species had higher trout survival. Boles and Borgeson (1966) reported catchable-size stocked brown trout were harvested 7 years after release and Wales and German (1956) reported fingerling stocked brook trout were harvested up to 7 years after release.

Predation may be an important cause of natural mortality of stocked trout. Largemouth bass ate trout at Thomas Lake. Seventeen largemouth bass, range 360 to 512 mm long, were captured by electrofishing on April 29, 1976, 21 days after stocking; two of the bass (460 and 422 mm long) had eaten a trout (264 and 220 mm long, respectively). No evidence of predation of bass on trout was observed in Sunset Lake even though similar size bass were found there.

Predation of bass on trout has also been documented by Stoeck and MacCrimmon (1960), Axon (1974) and Keith and Barkley (1970). Predation by domestic moscovy ducks (Cairina moschata), great blue heron (Ardea herodias), kingfisher (Megaceryle alcyon) (Eipper 1964), mergansers (Johnson and Hasler 1956), cormorant (Phalacrocorax auritus) (Myers and Peterka 1976), older trout (Smith 1968, Wales and German 1956) and yellow perch and smallmouth bass (Avery 1975) has been thought to adversely affect fingerling trout populations. Eel (Anguilla rostrata) (Smith 1956), green heron (Butorides virescens), american merganser (Mergus merganser), hooded merganser (Lophodytes cucullatus), goldeneye (Bucephala clangula), kingfisher, loon (Gavia immer), coot (Fulica americana), pied-billed grebe (Podilymbus podiceps), water snake (Natrix sipedon), raccoon (Procyon lotor), otter (Lutra canadensis), mink (Mustella vison), osprey (Pandion haliaetus) (Alexander and Shetter 1969, Alexander 1976), and chain pickerel (Esox niger) (Keith and Barkley 1970) were considered to be important causes of natural mortality on catchable-size trout populations. I observed loon, goldeneye, coot, kingfisher, and sign of raccoon at Sunset Lake, but saw no indication of their predation on trout.

Undetected fishing mortality may be considered natural mortality, and Butler and Borgeson (1965) found it caused underestimation of harvest in proportion to fishing pressure. They found underestimates of angling pressure were caused by missing anglers during instantaneous counts. Counts were likely to be in error on the three study lakes when many anglers were present, such as on opening day. Also poachers, and anglers keeping illegal limits would cause underestimation of harvest, but not necessarily in relation to fishing pressure. Wardens received word of illegal limits at Thomas Lake in 1976, but no illegal limits were seen in the study. Since trout were stocked in Sunset Lake in 1975 just before the opening day, little preseason harvest could have occurred. Trout were stocked 2 weeks before the

beginning of the 1976 season in Lakes Sunset and Thomas, and I was notified of preseason harvest of trout at Sunset Lake. Also, Butler and Borgeson (1965) found that expert legal anglers who caught limits quickly and left were less likely to be interviewed than most anglers when pressure was high, and the expert anglers on the three study lakes would have been missed at times of high pressure, such as opening day.

Mortality of Other Fish

The total annual mortality rate (A) for bluegill, ages V through VII in Thomas Lake, estimated from catch curves, was 78% (Figure 3). This estimate is similar to other published rates. Schneider (1971) reviewed 5 studies that reported annual mortality rates from 56 to 82% for exploited populations from ages II through VIII. Also, I estimated total annual mortality from a catch curve from the "typical" unexploited year class at Mill Lake, Michigan (Schneider 1971) to be 48% for ages II through VIII. Chang (1971) reported annual mortality of 80% for ages II through VI from a lightly exploited bluegill population in a Missouri farm pond. I calculated 77% annual mortality for bluegill from population estimates of age groups II through VII from Spring Lake, Wisconsin (Snow 1976).

Total annual mortality of largemouth bass in Thomas Lake, estimated from a catch curve, was 24% for ages III through IX (Figure 3). I used the mean of frequencies for ages VI, IX and XII because I caught no fish from ages VII, VIII, X, and XI (Appendix R). This estimate is low for exploited populations and probably is not accurate. I calculated 59% mortality for largemouth bass from populations estimates of age groups II through IX from Spring

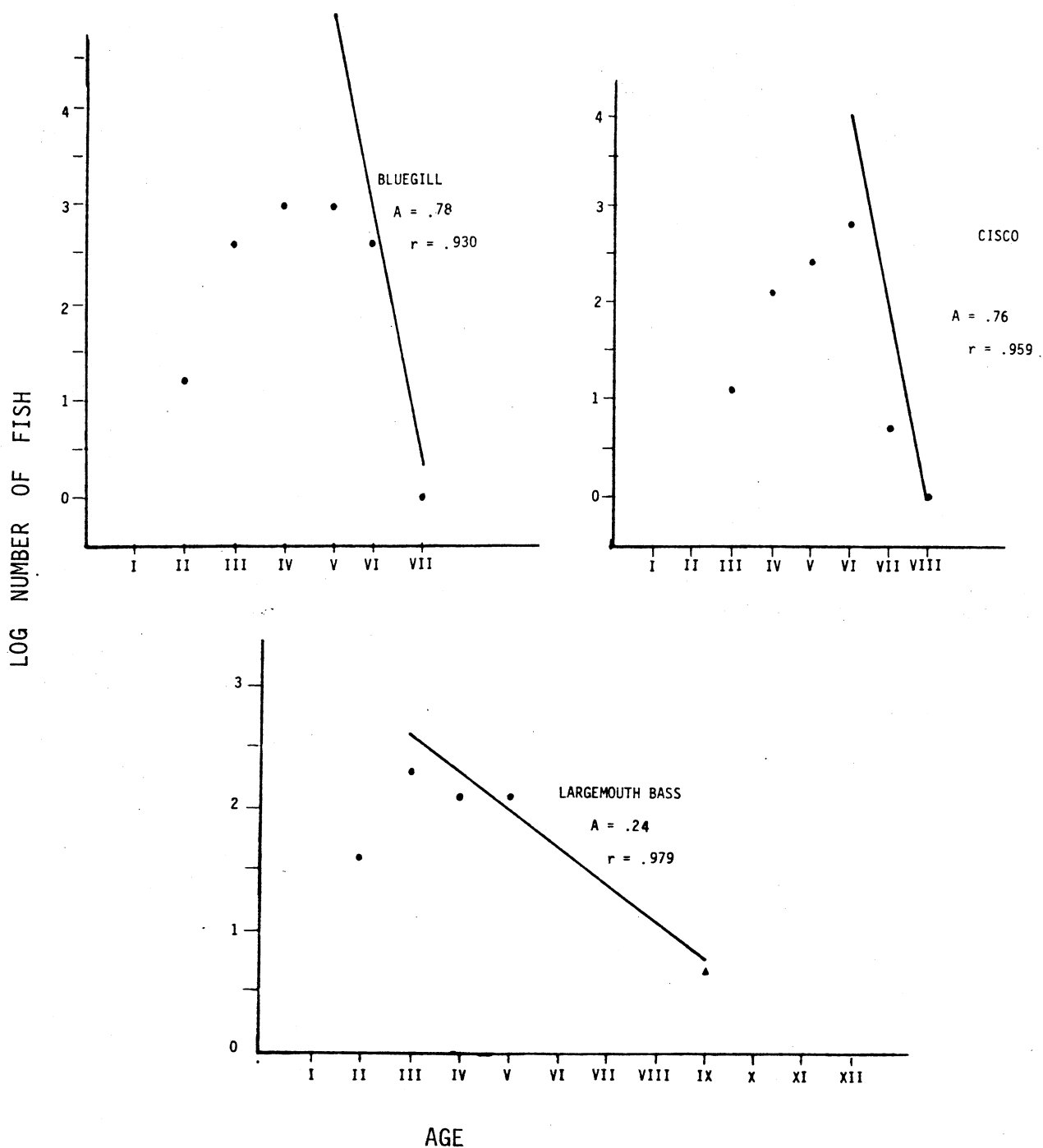


Figure 3. Catch curves from electrofishing data for bluegill and largemouth bass from Thomas Lake in 1976 and cisco from Sunset Lake in 1975. A is total annual mortality rate. Lines placed by method of least squares (Appendix R). Mean of largemouth bass ages VI, IX, and XII denoted by ▲.

Lake, Wisconsin (Snow 1976) and 48% for the "typical" unexploited year class of ages IV through XI at Mill Lake, Michigan (Schneider 1971). I also calculated an annual mortality rate of 53% from a catch curve for largemouth bass in Brown's Lake, Wisconsin (Mraz and Threinen 1955). The estimate was based on data from angling and seining for ages IV through XI. However, the authors computed total mortality from the age frequency distribution to be 24%. I cannot explain the discrepancy. Annual mortality of smallmouth bass typically exceeds 50% (Coble 1975).

Mortality of cisco in Sunset Lake was estimated to be 76% for ages VI through VIII (Figure 3). I also estimated annual mortality rates of cisco from data of Hile (1936) to be 46% in trout Lake for ages IV through XII, 90% in Silver Lake for ages V through VII, and 36% in Clear Lake for ages III through XI. My estimate for cisco from Square Lake, Alberta (Miller 1949) was 73% for ages IV through IX. The author suggested 71% at age IV was the mortality rate that best described the actual one.

Mortality of yellow perch, bluegill and largemouth bass from Sunset Lake was not estimated because of the dearth of older fish in my samples.

Food Habits of Trout

Corn, aquatic insects, and zooplankton, in that order comprised the greatest volume of food of rainbow trout in Sunset Lake (Table 18). Those three items made up 74% of the total volume of 66 rainbow trout 148 to 344 mm long captured by anglers from May 3, 1975 through July 4, 1976.

Table 18. Food of 66 rainbow trout 148 - 344 mm long captured by anglers from Sunset Lake from May 3, 1975 to July 4, 1976.

Items	Number of individual food items found	Number of stomachs containing item	% occurrence in stomachs with food	% of total food volume (158.8 ml)
Empty		1		
Aquatic Insects				
Coleoptera	37	8	12.3	.6
Cerculionidae	44	7	10.8	1.3
Haliplidae	2	1	1.5	tr
Gyrinidae	23	3	4.6	1.2
Ephemeroptera larvae	9	8	12.3	1.2
Diptera larvae	88	20	30.7	.4
pupae	14	17	26.1	.1
Odonata				
Anisoptera	1	1	1.5	.1
Megaloptera				
Sialidae	28	2	3.1	1.1
Hemiptera				
Corixidae	106	10	15.4	2.1
Hebridae	4	1	1.5	tr
Unidentified insect parts		23	35.4	8.2
Terrestrial Invertebrates	28	13	20.0	5.6
Hymenoptera	7	3	4.6	.06
Arachnida	35	5	7.7	.4
Diptera (adult)	40	11	16.9	.2
Crustacea				
Decapoda	4	3	4.6	.06
Cladocera and Copepoda		25	13.8	8.7
Other				
Turbellaria	3	2	3.1	tr
Gastropoda	2	1	1.5	.06
Vegetation		24	36.9	6.3
Cigarette filters	8	6	9.2	5.1
Stones	2	2	3.1	.1
Rubber	3	3	4.5	.4
Fish	3	3	4.5	2.5
Bait				
Eggs	1	1	1.5	.4
Worms	8	6	9.2	3.8
Corn	426	37	56.9	48.5

tr - trace, less than .1 ml

Corn was used as bait. Aquatic insects (32%), crustacean zooplankton (17%), plant material (12%), and terrestrial invertebrates (12%) made up 73% of the total volume when corn was eliminated from the analysis. Diptera was the most frequently eaten insect. Trout, whose lengths were 305, 276, and 344 mm long and were taken in the fall contained bluegill and other unidentified fish. Food eaten was similar to the items reported for other lake populations (Wadman 1961, Brynildson and Kempinger 1973, Brynildson 1958, Burdick and Cooper 1956, Leonard and Leonard 1955, and Swift 1970). However, unlike Brynildson and Kempinger (1973), I found cladocerans less than 1 mm long and copepods in the trout stomachs.

During May, aquatic insects made up 14, 4, and 84% of the total food volume of sampled trout stocked in the current season in Sunset Lake in 1975, 1976 and Thomas Lake, respectively (Table 19). The high frequency of occurrence and percent of total food volume of Diptera made it the most important food in Thomas Lake. Fifty-six and 70% of stomachs taken from trout in Lakes Sunset in 1976 and Thomas in 1976, respectively, contained crustacean zooplankton, but none were found in stomachs of trout taken from Sunset in 1975. The fact that fishing started 3 days after both ice-out and stocking in 1975 may have had an effect on availability of zooplankton.

Food volume in the stomachs of trout from Thomas Lake was about 3 times greater than trout from Sunset Lake if corn were eliminated from the May analysis (Table 19). The greater stomach volume in Thomas Lake trout than Sunset Lake trout is probably related to the faster growth of Thomas Lake trout.

Table 19. Food of rainbow trout 148 - 291 mm long captured in May by anglers from Sunset Lake, 1975 and 1976 and Thomas Lake 1976.

	Sunset 1975		Sunset 1976		Thomas Lake 1976	
	Percent Occurrence in Stomachs with Food	Percent of Total Food Volume (26.3 ml)	Percent Occurrence in Stomachs with Food	Percent of Total Food Volume (65.3 ml)	Percent Occurrence in Stomachs with Food	Percent of Total Food Volume (59.8 ml)
Number of Fish Examined	15		26		30	
Item						
Empty	1					
Aquatic Insects						
Coleoptera	42.8	.7				
Circulionidae	21.4	tr				
Hemiptera						
Corixidae	7.1	.4				
Gerridae	7.4	tr			13.3	.2
Diptera						
larvae and pupae	.7	tr	38.5	.3		
adult	.7	tr	15.4	tr	87	76.2 ^a
Ephemeroptera	14.3	.4	3.8	.5		
Megaloptera						
Sialis			3.8	2.3		
Odonata						
Anisoptera			3.8	.3		
Zygoptera					3.3	tr
Unidentified Parts	.5	13.3	23.1	.8	50.0	7.4
Crustacea						
Decapoda	.7	3.6	3.8	.3		
Cladocera and Copepoda			57.7	10.9	70.0	13.0
Gastropoda					3.3	tr
Nematoda					3.3	tr
Oligochaeta			15.4	2.1		
Arachnida	.7	tr				
Plant	35.7	13.7	30.8	3.1	13.3	.8
Other						
Corn	64.3	61.6	84.6	75.5	4.0	2.8
Cigarette Filters	.7	4.6	3.8	2.8		
Rubber Band	.7	1.3	3.8	.6		

tr - trace, less than .1 ml

a - 24% Chaoborus larvae

50% Chironomidae larvae

26% Chironomidae pupae

Food Habits of Other Fish

Earthworms, aquatic insects, and fish, in descending order of volume made up 83% of the total volume of 16 stomachs of yellow perch 120 to 241 mm long taken in Sunset Lake from May 9, 1975 through May 1, 1976 (Table 20). If bait were eliminated, aquatic insects, fish, and crayfish in order of descending volume, made up 97% of the total. Frequency of occurrence had little meaning because of the small sample size, as no item was eaten by more than 2 perch. Other studies have reported that yellow perch ate zooplankton, insects, and fish depending on the size of the perch, season, and availability of food (Clady 1974, Echo 1954, Gunderson et al. 1976, Schneider 1971, Galbraith 1967).

Zooplankton was almost the only discernible food found in the stomachs of 27 cisco 300 to 399 mm long captured in November 1975, and May and June 1976 (Table 21). I had difficulty identifying the stomach contents because the fish were frozen and thawed a number of times for another study (Cleveland, in preparation). Engel (1976) found that cisco in Pallette Lake, Wisconsin ate zooplankton throughout the year with no evidence of size selective feeding except that rotifers were avoided.

Crayfish was the most important food in 62 stomachs from largemouth bass 188 to 425 mm long captured from May 9, 1976 through June 19, 1976 in Sunset Lake (Table 22). None of the ingested fish could be identified to species because of decomposition. Little overlap of food habits of largemouth bass and trout in Sunset Lake was found, in contrast to reports by Stoeck and MacCrimmon (1965) and Brynildson (1958) though competition was not implied. Stoeck and MacCrimmon found that aquatic insects were eaten by both largemouth bass and the stocked

Table 20. Food of 16 yellow perch 120 - 241 mm long captured by anglers from Sunset Lake from May 9, 1975 through May 1, 1976.

Item	Number of individual food items found	Number of stomachs containing item	% occurrence in stomachs with food	% of total food volume (7.8 ml)
Empty		5		
Aquatic insects				
Ephemeroptera				
Ephemeridae	10	2	18	23
Diptera				
larvae	2	1	9	tr
pupae	4	1	9	2.5
Unidentified insect parts	2	2	18	2.6
Crustacea				
Decapoda	1	1	9	12.8
Cladocera and Copepoda		2	18	1.3
Other				
Turbellaria		1	9	tr
Fish (Bluegill)	3	2	18	16.7
Bait				
Earth worms	3	3	27	37
Corn	2	1	9	3.8

tr - trace, less than .1 ml

Table 21. Food of 27 cisco. 300 - 390 mm long captured by electrofishing and anglers from Sunset Lake in November 1975 and May and June 1976.

Item	Number of individual food items	Number of stomachs containing item	% occurrence in stomachs with food	% of total food volume (.5 ml)
Empty		12		
Aquatic insects				
Diptera				
Chaoboridae	1	1	6.6	tr
Crustacea				
Cladocera and Copepoda		9	60	99.9
Other				
Diptera (adults)	1	1	6.6	tr
Fish scale (Cyprinid)	1	1	6.6	tr
Plant	3	3	20	tr

tr - trace, less than .1 ml

Table 22. Food of 62 largemouth bass 188 - 425 mm long captured by anglers from Sunset Lake from May 9, 1975 through June 19, 1976.

Item	Number of individual food items found	Number of stomachs containing item	% occurrence in stomachs with food	% of total food volume (129.5 ml)
Empty		4		
Aquatic insects				
Odonata				
Zygoptera nymphs		7	11.3	.3
Ephemeroptera		3	5.2	.2
Diptera pupae		1	1.7	tr
Hemiptera Corixidae		3	5.2	tr
Crustacea				
Decapoda		37	63.8	73.4
Terrestrial insects				
Odonata				
Zygoptera adult		3	4.8	1.0
Anisoptera adult		4	6.4	4.1
Diptera adult		2	3.4	1.0
Fish (unidentified)		10	17.2	10.2
Other				
Plant		6	10.3	.8
Bait (earthworms)	20	11	19	8.7
Stones		3	5.2	.1

tr - trace, less than .1 ml

trout. Brynildson found that largemouth bass of ages II through IV ate Diptera and Odonata as did rainbow trout in Cather Lake, Wisconsin.

Detritus (39%), earthworms (37%), and Diptera (8%) made up most of the food volume of 26 white sucker from 276 to 395 mm long captured from May 1, 1975 through June 29, 1976 in Sunset Lake (Table 23).

Carlander's (1969) compilation of feeding habits of white sucker indicated that young fed predominantly on entomostraca, insects, rotifers, and algae, and adults fed on chironomids, entomostraca, amphipods, fingernail clams, snails, and detritus.

Aquatic and terrestrial insects, combined, made up 89% of the total food volume of 36 bluegill 86 to 210 mm long captured from May 1 through August 29, 1975 (Table 24). Keast and Webb (1966) reported that aquatic insects were important to bluegill in Lake Opinicon, Ontario, but the dominant food usually was that which was most abundant at the time. Daphnia and midge larvae were the dominant food of bluegill in Wyland Lake, Indiana (Gerking 1962). Schneider (1971) found that insects predominated in bluegill 30 to 216 mm long in Mill Lake, Michigan.

Table 23. Food of 16 white sucker 276 - 395 mm long captured by anglers from Sunset Lake from May 1, 1975 through June 29, 1976.

Item	Number of individual food items found	Number of stomachs containing item	% occurrence in stomachs with food	% of total food volume (8.4 ml)
Empty		4		
Aquatic insects				
Trichoptera larvae	2	2	16.7	tr
Ephemeroptera nymph		1	8.3	tr
Diptera larvae	24	5	41.7	7.7
pupae	7	2	16.7	tr
Crustacea				
Cladocera and Cpoepoda		1	8.3	tr
Other				
Gammaridae	2	1	8.3	tr
Gastropoda	6	3	25	tr
Unidentified detritus		4	33.3	39.2
Stones	2	2	16.7	9.5
Bait				
Earthworms	13	9	75	37.4
Corn	9	1	8.3	4.7

tr - trace, less than .1 ml

Table 24. Food of 36 bluegill 86 - 210 mm long captured by anglers from Sunset Lake from May 1 through August 29, 1975.

Item	Number of individual food items found	Number of stomachs containing item	% occurrence in stomachs with food	% of total food volume (32.9 ml)
Aquatic insects				
Hemiptera				
Corixidae	18	6	16.7	1.5
Coleoptera	23	9	25	4.5
Ephemeroptera	10	5	13.9	.3
Trichoptera		23	63.9	1.5
Odonata				
Zygoptera nymphs		3	8.3	1.2
Anisoptera nymphs		4	11.1	1.0
Diptera				
larvae	19	4	11.1	1.2
pupae	38	9	25	.3
Unidentified parts		26	72.2	61.4
Terrestrial insects	119	16	44.4	12.1
Zygoptera adults		4	11.1	1.0
Anisoptera adult		2	5.5	.3
Diptera adult	33	10	27.8	2.9
Crustaceans				
Cladocera and Copepoda	270	2	5.6	.3
Other				
Gammaridae	14	3	8.3	tr
Gastropoda	4	2	5.6	tr
Nematoda	40	7	19.4	tr
Plant		7	19.4	.9
Bait				
Earthworms	8	8	22.2	10.1

tr - trace, less than .1 ml

CONCLUSIONS

The spring stocking of catchable-size trout in the study lakes provided a short term, popular, sport fishery, especially in Lakes Sunset and Dorothy. Frequently half or more of the stocked fish were caught in the first month of the fishing season (separate estimates were 46, 73, 62, 22, and 64%; Table 6) and few stocked trout were caught thereafter. The great majority of anglers interviewed at Lakes Sunset and Dorothy were fishing for trout - at Sunset Lake 95% of anglers interviewed over the 9 month season (Table 10), even though the trout fishery persisted for less than two months (Figure 2). At Thomas Lake, however, about half the anglers were fishing for warmwater species, even in the first month of the season (Table 10).

Largely because the trout were harvested rapidly, relatively little of the productive capacity of the lakes was channelled into production of trout flesh (separate estimates of percentage weight returned of that stocked were 57, 96, 113, 31, and 80; Table 6). Therefore, the trout fishery was essentially a put-and-take fishery, and the stocking of trout provided a coldwater fishery in addition to the existing warmwater fishery at little expense to the warmwater fishery.

If it were considered desirable to prolong the trout fishery, the same strains of trout could be stocked at intervals or different strains or species could be stocked. Whatever alternatives were used, the degree to which lake productivity was channelled into trout production would be determined by growth and survival rates of trout, fishing intensity, and vulnerability of trout to angling.

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Temperature (C) and oxygen (ppm) regimes in Sunset Lake from September 1971 through May 1977. Data for 1971 and 1972 unpublished from L. Lange manuscript, College of Natural Resources, UWSP. Data for 1973 through 1977 from Environmental Task Force, UWSP.

Date	C			ppm		
	Surface	8 m	16m	Surface	8 m	16 m
September 18, 1971	20.	13	6	9.1	12	.25
October 13	15	14	7	9.1	9.0	.5
November 10	9.	9	9	8.7	8.6	7.4
December 21	1	2	3	11.4	10.4	9.8
January 18 1972	.3	3	3	11.7	9.4	4.5
February 24	.5	3	4	10.5	8.5	1.0
March 28		3	4	10.5	7.8	1.0
May 4	10	4	4	10.2	7.5	1.1
May 24	22	5	4	9.8	15.0	1.3
June 21	20	10	5	8.9	16.6	.5
July 2	22	13	5	8.7	15.8	.22
July 31	22	17	5	8.3	18.2	0.00
August 17	24	15	5	8.3	17.1	.2
August 29	21	16	5	9.2	17.3	.4
January 11, 1973	2	-	3	8.9	-	6.5
April 5	4	-	4	9.2	-	8.9
June 11	23	-	6	8.3	-	.1
July 18	24	17	6	8.1	13.2	0.0
August 31	24	15	6	7.9	13.3	0.0
March 24, 1974	1	3	4	9.9	8.6	.3
May 28	15	11	5	10.2	13	.3
June 26	23	9	6	9.4	14.0	0.0
September 17	16	16	8	9.0	9.0	0.0
January 8, 1975	1	3	3	10.0	8.5	8.3
February 17	3	4	4	7.4	6.5	5.4
April 2	2	4	4	7.5	5.0	3.3
May 13	16	6	5	11.8	6.5	.15
June 24	24	13	8	8.6	10.4	0.0
July 21	26	12	12	8.5	11.3	0.0
August 18	25	15	8	8.6	12.9	1.8
September 30	15	13	6	8.3	9.4	1.1
November 11	9	9	9	8.8	8.5	8.3

Appendix A. CONTINUED

Date	C			<u>ppm</u>		
	Surface	8 m	16 m	Surface	8 m	16 m
January 14, 1976	1	4	4	12.7	8.2	7.4
February 10	0	2	4	9.3	7.6	2.3
March 9	0	4	4	9.2	5.2	.6
April 20	12	6	6	10.9	7.8	.03
June 15	22	11	7	8.8	11.2	.5
July 12	-	12	11	8.1	5.6	.5
August 10	24	16	10	8.7	12.0	.7
September 7	22	9	-	-	-	-
October 12	14	14	13	9.2	9.0	0.0
November 17	4	4	4	9.8	9.9	8.4
December 13	2	2	3	12.2	10.5	5.8
January 10, 1977	1	2	3	11.2	9.1	7.7
February 7,8	0	1	2	10.3	8.6	6.4
March 8	2	4	4	9.9	9.0	2.6
April 19	14	8	8	10.7	13.1	.6
May 24	24	7	6	8.2	14.1	0.0

Appendix B

List of tests and procedures used for unpublished analysis of water from Lakes Sunset and Thomas by the Environmental Task Force, UWSP, and L. Lange manuscript, College of Natural Resources, UWSP.

Test	Method
Dissolved Oxygen	Sect. 218 B Azide Modification Method
Alkalinity	Sect. 102.4 B Mixed Bromcresolgreen-methyl Red Indicator Method
Total Hardness	Sect. 122 B EDTA Titrimetric Method
Total Phosphate	Sect. 223 C Persulfate Digestion Method
Chlorophyll <u>a</u>	Sect. 602 A Trichromatic Method

History of fish stocking and chemical treatments of Sunset Lake from 1946 through 1977.

Date	Species	Stage of Development	Number
1946	Rainbow Trout	Fingerling	27000
		Yearling	3000
1948	Rainbow Trout	Fingerling	5000
		Adult	1000
1949	Rainbow Trout	Yearling	2400
	Brown Trout	Fingerling	18900
1950 ^a	Rainbow Trout	Adult	1000
1951	Rainbow Trout	Yearling	2850
	King Salmon ^b	Fingerling	810
		Yearling	424
1952	Rainbow Trout	Fingerling	54400
		Yearling	2090
		Adult	1000
1953, Fall	Rainbow Trout	Fingerling	2850
1954, September	Chemical Treatment with Rotenone		
1954	Rainbow Trout	Yearling	2215
	Brook Trout	Fingerling	11800
		Adult	200
1955	Rainbow Trout	Fingerling	6700
		Yearling	5325
	Brook Trout	Fingerling	5000
		Yearling	3000
		Adult	3000
1956, September October	Rainbow Trout	Fingerling	1600
		Adult	2712
1957, May september	Rainbow Trout	Adult	1600
			3500
1958, June April March	Largemouth Bass	Fingerling	5000
	Rainbow Trout	Fingerling	109153
		Adult	3200
1959, Spring Fall Fall	Rainbow Trout	Fingerling	3500
		Yearling	3500
	Brown Trout		29393
1960, Spring Fall	Rainbow Trout	Yearling	1550
			6000
1961, Spring Fall Fall	Rainbow Trout	Adult	1500
			4500
	Cisco ^c	Adult	485
1962, Spring Fall	Rainbow Trout	Adult	1500
			5000
1963	Rainbow Trout	Adult	5000
1964	Rainbow Trout	Adult	5000

Appendix C. CONTINUED

Date	Species	Stage of Development	Number
1965, July	Chemical Treatment with Toxaphene		
1965, Fall	Rainbow Trout	Adult	5000
1966, Spring	Brook Trout	Yearling	4150
June	Rainbow Trout	Fingerling	5000
September		Fingerling	5000
1967, October	Rainbow Trout	Fingerling	5000
Fall	Largemouth Bass	Fingerling	5000
1968	Rainbow Trout	Yearling	5000
	Brown Trout	Yearling	190
1969	Rainbow Trout	Adult	5000
1970, Spring	Rainbow Trout	Adult	5000
1971, Spring	Rainbow Trout	Adult	2500
Fall			2500
1972, Spring	Rainbow Trout	Adult	2500
Fall			2500
1973, Spring	Rainbow Trout	Adult	2500
Fall			2500
	Brown Trout	Brood Stock	30
1974, Spring	Rainbow Trout	Adult	2500
1975, April	Rainbow Trout ^d	Adult	2710
1976, April	Rainbow Trout ^e	Adult	2685
1977, April	Rainbow Trout	Adult	2500

a - Rainbow Trout from 1950 to 1977 were the fall spawning variety from Nevin Hatchery, Wisconsin brood stock

b - Oncorhynchus tshawytscha

c - cisco were obtained from Pallette Lake, Vilas County, Wisconsin

d - Right ventral fin clip

e - Left ventral fin clip

Appendix D

Temperature (C) and oxygen (ppm) regimes in Thomas Lake from February 1973 through May 1977. Data from Environmental Task Force Laboratory, UWSP.

Date	<u>C</u>		<u>ppm</u>	
	Surface	8.5 m	Surface	8.5 m
February 20, 1973	2	4	10.7	2.3
April 12	4	4	12.3	12.2
June 11	25	11	7.9	.6
March 24, 1974	2	4	9.1	.6
May 28	12	8.1	13.1	.3
July 22	23	9	8.9	0.0
September 17	17	15	8.4	3.0
February 17, 1975	-	-	7.6	3.3
April 2, 1975	1	4	5.7	.1
May 13	16	7	11.1	1.2
June 24	25	9	10.1	2.2
July 21	27	8	8.6	-
August 18	-	10	8.5	0.0
September 30	-	-	8.8	0.0
November 11	8	8	8.2	8.2
January 14, 1976	-	-	10.5	4.7
February 10	0	4	10.5	1.2
March 9	11	1	9.3	.4
April 20	12	7	11.1	6.4
June 15	24	18	8.4	6.4
July 12	23	9	8.9	1.4
August 10	24	15	8.5	1.2
September 7	22	21	8.3	6.1
October 11	13	13	6.3	6.0
December 13	2	4	12.0	9.3
January 10, 1977	0	3	9.8	9.1
February 7	1	4	8.0	5.6
March 8	1	4	8.2	3.6
April 19	16	10	12.1	11.0
May 24	22	10	7.3	.1

History of fish stocking and chemical treatments of Thomas Lake from 1957 through 1977.

Date	Species	Stage of Development	Number
1957, May	Chemical Treatment with Rotenone		
1957	Rainbow Trout ^a	Fingerling	2250
	Bluegill	Fingerling	50000
	Largemouth Bass	Fingerling	10032
1958	Rainbow Trout	Legal	2192
	Bluegill	Adult	1090
	Largemouth Bass	Fingerling	22000
1959	Rainbow Trout	Adult	1000
	Largemouth Bass	Fingerling	4500
1960	Rainbow Trout	Legal	1000
	Largemouth Bass	Adult	310
1961, June	Chemical Treatment with Toxaphene		
1962	Rainbow Trout	Legal	4500
	Largemouth Bass	Fingerling	15000
		Adult	180
	Smallmouth Bass	Fingerling	5000
	Bluegill	Fingerling and Adult	4921
1963	Rainbow Trout	Legal	3500
	Bluegill	Fingerling	1460
1964	Rainbow Trout	Legal	4770
1965	Rainbow Trout	Legal	3000
1966	Rainbow Trout	Legal	3000
1967	Rainbow Trout	Legal	3000
1968	Rainbow Trout	Legal	3000
1969	Rainbow Trout	Legal	2500
1970	Rainbow Trout	Legal	2500
1971	Rainbow Trout	Legal	2500
1972, May	Rainbow Trout	Legal	2500
1973, April	Rainbow Trout	Legal	2500
1974, April	Rainbow Trout	Legal	2500
1975, April	Rainbow Trout	Legal	2500
1976, April ^b	Rainbow Trout	Legal	2280
1977, March	Rainbow Trout	Legal	2500

a - Rainbow trout were the fall spawning variety from Nevin Hatchery, Wisconsin brood stock.

b - Left ventral fin clip

Stocking history of Lake Dorothy from 1954 through 1976.

Date	Species	Stage of Development	Number
1954	Brook Trout	Fingerling	37080
1955	Brook Trout	Fingerling	20000
1956	Brook Trout	Fingerling	14000
1957	Brook Trout	Fingerling	9000
1958	Brook Trout	Legal	5000
1959	Brook Trout	Fingerling	12170
1961	Brook Trout Rainbow Trout ^a	Fingerling Legal	10000 4000
1962	Brook Trout	Fingerling	6000
1963	Brook trout Rainbow Trout	Legal Legal	5000 5000
1964	Brook Trout Rainbow Trout	Legal Legal	5000 5000
1965	Brook Trout Rainbow	Fingerling Legal Legal	3000 2500 5000
1966	Brook Trout Rainbow Trout	Legal Legal	2500 2500
1967	Brook Trout Rainbow Trout	Legal Legal	2500 4000
1968	Brook Trout Rainbow Trout	Legal Legal	2500 4000
1969, March	Brook Trout	Legal	2000
1970, April	Brook Trout	Legal	2000
1971, April	Brook Trout	Legal	2000
1972, May April	Brook Trout Rainbow Trout	Legal Legal	2000 2000
1973, April March	Brook Trout Rainbow Trout	Legal Legal	2000 2000
1974, April May	Brook Trout Rainbow Trout	Legal Legal	2000 2000
1975, April April	Brook Trout Rainbow Trout	Legal Legal	2000 2000
1976, April April	Brook Trout ^{bc} Rainbow Trout ^c	Legal Legal	2000 3000

a - Rainbow trout were the fall spawning variety from Nevin Hatchery, Wisconsin brood stock.

b - from the Osceola Hatchery, Wisconsin brood stock

c - Right ventral fin clip

Creel Survey Report _____
Sunset Lake

78.

Date ____ / ____ / ____ Water Temp. ____ No. in party ____

Start _____ Finish _____ Total ____

Distance Traveled _____

Bait: Artificial __, Worms __, Minnows __, Corn __, Corn __, Mayflies __, other __

Fished from: Boat (__ P, __ N) Shore __, Waders __

Area fished I __ II __ III __ IV __

Species sought RBT _____, WHS _____, YEP _____ BLG _____ other _____

Species	Lt.	Wt.	Mark	Stomach Collected	Scales Collected	Released
----	----	-----	---	-	-	-
----	----	-----	---	-	-	-
----	----	-----	---	-	-	-
----	----	-----	---	-	-	-
----	----	-----	---	-	-	-
----	----	-----	---	-	-	-
----	----	-----	---	-	-	-
----	----	-----	---	-	-	-
----	----	-----	---	-	-	-
----	----	-----	---	-	-	-
----	----	-----	---	-	-	-
----	----	-----	---	-	-	-
----	----	-----	---	-	-	-
----	----	-----	---	-	-	-
----	----	-----	---	-	-	-
----	----	-----	---	-	-	-

RV = 1, LV = 2, No Clip = 0, P = Power, N = No Power

Appendix H1

Number of yellow perch captured in each length interval by electrofishing and angling and the number of fish from which scales were obtained from Sunset Lake in 1975 and 1976.

Length (mm)	1975		1976	
	Number captured	Number from which scales were obtained	Number captured	Number from which scales were obtained
60 - 69			1	1
70 - 79	2			
88 - 89	24			
90 - 99	45	2		
100 - 109	24	3	2	1
110 - 119	17	3	2	1
120 - 129	7	1		
130 - 139	5	3		
140 - 149	3	1		
150 - 159	4	3	1	
160 - 169	2	1	3	2
170 - 179	9	5	5	4
180 - 189	17	3	11	8
190 - 199	54	6	22	22
200 - 209	125	17	27	16
210 - 219	129	18	19	4
220 - 229	30	7	11	5
230 - 239	5	5	3	2
240 - 249	2	2	2	
250 - 259	1		1	
260 - 269			3	
270 - 279				
280 - 289	1		1	
290 - 299			1	

Number of largemouth bass captured in each length interval by electrofishing and angling and the number of fish from which scales were obtained from Sunset Lake in 1975 and 1976, and Thomas Lake in 1976.

Length (mm)	Sunset Lake				Thomas Lake	
	1975 Number captured	1975 Number from which scales were obtained	1976 Number captured	1976 Number from which scales were obtained	1976 Number captured	1976 Number from which scales were obtained
70 - 79			1			
80 - 89			4			
90 - 99			19	5		
100 - 109	7	2	10	3		
110 - 119	11	2	15	6		
120 - 129	10	2	17	4		
130 - 139	6	3	12	6		
140 - 149	3	2	14	5	11	2
150 - 159			6	5	8	4
160 - 169	1		2	1	9	2
170 - 179			2	1	5	3
180 - 189	4	3	2		3	1
190 - 199	19	15	3	2	4	2
200 - 209	24	24	6	3	4	
210 - 219	39	38	10	2	1	1
220 - 229	23	20	5	3		
230 - 239	14	12	2		2	2
240 - 249	13	12	2	1	4	3
250 - 259	9	9	3	2	5	3
260 - 269	7	6	8	7	4	3
280 - 289	2	2	23	15	2	1
290 - 299	1	1	21	20	6	4
300 - 309			8	7	5	3
310 - 319	1	1	3	1	4	3
320 - 329			1			
330 - 339	2	1			1	1
340 - 349					2	2
350 - 359					2	
360 - 369	2	1			3	3
370 - 379	1	1			3	3
380 - 389	1	1	1	1	2	1
390 - 399			1	1	1	
400 - 409					1	
410 - 419	1	1			1	1

Appendix H2 CONTIUED

Length (mm)	Sunset Lake				Thomas Lake	
	1975 Number captured	Number from which scales were obtained	1976 Number captured	Number from which scales were obtained	1976 Number captured	Number from which scales were obtained
420 - 429					1	1
430 - 439					2	2
440 - 449					1	1
450 - 459	1	1				
460 - 469					2	2
470 - 479					3	3
480 - 489					2	2
490 - 499					1	1
500 - 509					3	3
510 - 519	1	1			2	2
520 - 529					2	2
530 - 539			1	1		
540 - 549						
570 - 579			1	1		

Appendix H3

Number of bluegill captured in each length interval by electrofishing and angling and the number of fish from which scales were obtained from Sunset Lake in 1975 and 1976, and Thomas Lake in 1976

Length (mm)	Sunset Lake				Thomas Lake	
	1975 Number captured	1975 Number from which scales were obtained	1976 Number captured	1976 Number from which scales were obtained	1976 Number captured	1976 Number from which scales were obtained
60 - 69	2	1			6	1
70 - 79	2	1			17	
80 - 89	3	3			41	4
90 - 99	2	2			33	4
100 - 109	1	1	1	1	12	3
110 - 119	1	1	1	1	13	3
120 - 129	2	2			29	4
130 - 139	4	4	4	4	40	9
140 - 149	11	7	3	2	49	12
150 - 159	18	15	4	2	23	6
169 - 169	37	33	2	1	28	9
170 - 179	27	23	3	2	19	7
180 - 189	13	13	7	3	23	10
190 - 199	4	4	14	14	17	4
200 - 209		2	2	2	17	6
210 - 219	1	1	1	1	17	9
220 - 229					10	6
230 - 239					1	1
240 - 249						
250 - 259					1	1

Appendix H4

Number of cisco captured in each length interval by electrofishing and the number of fish from which scales were obtained from Sunset Lake in November 1975.

Length (mm)	Number captured	Number from which scales were obtained
340 - 349	3	2
350 - 359	14	7
360 - 369	31	8
370 - 379	72	7
380 - 389	64	7
390 - 399	19	8
400 - 409	4	3

Appendix I

Species, year collected, scale radius (X) vs. fish length (Y) functional regression (Ricker 1973), number in sample collected by anglers and electrofishing from Sunset and Thomas Lakes, regression correlation coefficient (r), and scale magnification.

Species	Year collected	Scale radius vs. fish length regression	Number in sample	r	Scale magnification
Sunset Lake					
Bluegill	1975	$y = .5991 x + 24.933$	163	.968	80
	1976	$y = 1.536 x + 27.080$	47	.9690	43
Yellow Perch	1975	$y = 1.097 x + 20.593$	73	.8643	80
	1976	$y = 1.877 x + 44.286$	80	.9480	43
Largemouth Bass	1975	$y = 2.347 x + 38.756$	234	.9695	27
	1976	$y = 1.733 x + 40.721$	114	.9752	43
Cisco	1975	$y = .703 x + 203.424$	46	.4544	80
Thomas Lake					
Bluegill	1976	$y = 1.396 x + 35.557$	101	.9351	43
Largemouth Bass	1976	$y = 2.048 x + 36.111$	95	.9853	43

Number of survey periods for each strata from May 3, 1975 through February 28, 1976, mean number of observed angler hours per survey period, standard deviation, total possible number of sample periods, estimated effort, and 95% confidence intervals at Sunset Lake.

Strata	Number of survey periods	Mean number of hours observed per survey period	SD	Number of total possible periods	Estimated effort (angler hours)	95% Confidence interval (+)
May 3, 4, 1975; opening weekend						
Shore						
Day	1	588	-	2	1176	-
Night	1	78	-	2	156	-
Boat						
Day	1	345.0	-	2	690	-
Night	1	27.8	-	2	55.6	-
Total					2077.6	
May 5 - June 1, 1975						
Shore						
Weekday	4	21.7	22.8	19	413.2	614
Day	7	34.4	31.3	19	654.1	438
Night						
Weekend	4	108.5	70.6	9	976.5	754
Day	5	15.8	18.2	9	142.2	136
Night						
Boat						
Weekday	4	10	17.4	19	190.0	468
Day	7	17.7	11.4	19	336.3	159
Night						
Weekend	4	46.0	33.5	9	413.9	357
Day	5	14.0	16.8	9	126.4	125
Night						
Total					3252.6	874
June 2 - July 6, 1975						
Shore						
Weekday	11	4.9	5.0	24	118.0	60
Day	3	5.7	2.3	24	136.8	129
Night						
Weekend	4	1.0	1.2	11	11.0	16
Day	7	3.3	2.6	11	36.3	16
Night						
Boat						
Weekday	11	1.4	4.2	24	33.6	50
Day	3	4.8	4.3	24	115.2	240
Night						
Weekend	4	15.4	12.6	11	169.4	176
Day	7	30.4	20.0	11	334.4	123
Night						
Total					954.7	227
July 7 - November 24, 1975						
Shore						
Weekday	20	.9	2.2	150	90	94
Day	15	1.1	2.2	150	110	97
Night						
Weekend	14	1.9	3.6	41	77.9	70
Day	16	2.8	3.6	41	114.8	62
Night						
Boat						
Weekday	20	.9	2.0	150	90	83
Day	15	2.4	4.4	150	240	191
Night						
Weekend	14	3.6	5.7	41	147.6	110
Day	16	3.3	6.7	41	241.3	115
Night						
Total					1210.6	290
December 20, 1975 - February 23, 1976						
Ice Fishing						
Weekday	4	0	-	45	0	-
Day	6	4.7	7.5	45	216.2	338.9
Night						
Weekend	5	.8	1.5	25	20.8	52
Day	5	6.1	7.5	25	171.6	270
Night						
Total					408.6	347

Appendix J2

Number of survey periods for each strata from May 1 through July 4, 1976, mean number of observed angler hours per survey period, standard deviation, total possible number of sample periods, estimated effort and, 95% confidence intervals at Sunset Lake.

Strata	Number of survey periods	Mean number of hours observed per survey period	SD	Number of total possible periods	Estimated effort (angler hours)	95% Confidence interval (+)
May 1, 2, 1976; opening weekend						
Shore						
Day	1	303	-	2	606	-
Night	1	55	-	2	110	-
Boat						
Day	1	487.2	-	2	974.4	-
Night	1	21.3	-	2	42.7	-
Total					1733.1	
May 3 - 31, 1976						
Shore						
Weekday						
Day	3	30.0	8.7	20	600.0	399
Night	9	24.2	29.9	20	484.0	341
Weekend						
Day	4	32.7	35.0	9	294.3	373
Night	5	39.6	29.2	9	356.4	217
Boat						
Weekday						
Day	3	11.6	8.5	20	232.0	390
Night	9	27.0	6.2	20	540.0	70
Weekend						
Day	4	29.7	37.0	9	267.3	395
Night	5	50.0	31.5	9	450.0	235
Total					3224.0	593
June 1 - July 4, 1976						
Shore						
Weekday						
Day	5	.6	1.3	24	14.4	35
Night	6	3.3	4.4	24	79.9	95
Weekend						
Day	5	.6	1.3	10	6	12
Night	5	5	2.3	10	50	21
Boat						
Weekday						
Day	5	0	-	24	0	-
Night	6	18.8	19.1	24	451.2	417
Weekend						
Day	5	8.3	7.7	10	82.8	67
Night	5	19.5	14.3	10	195.0	126
Total					879.3	414

Appendix J3

Number of survey periods for each strata from May 1 through May 31, 1976, mean number of observed angler hours per survey period, standard deviation, total possible number of sample periods, estimated effort, and 95 % confidence intervals at Thomas Lake.

Strata	Number of survey periods	Mean number of hours observed per survey period	SD	Number of total possible periods	Estimated effort (angler hours)	95% Confidence interval (+)
May 1, 2, 1976; opening weekend						
Shore						
Day	1	1	-	2	.2	-
Night	1	0	-	2	0	-
Boat						
Day	1	189.9	-	2	379.8	-
Night	1	18	-	2	36	-
Total					417.8	-
May 3 - 31, 1976						
Shore						
Weekday						
Day	3	0	-	20	0	-
Night	9	4.8	5.2	20	96	59
Weekend						
Day	4	5.0	3.6	9	45	38
Night	5	3.6	3.0	9	32.4	22
Boat						
Weekday						
Day	3	29.6	10.0	20	592.8	456
Night	9	88.3	48.0	20	1766.6	547
Weekend						
Day	4	104.2	75.5	9	938.1	806
Night	5	131.4	106.2	9	1182.6	791
Total					4653.5	999

Appendix J4

Number of survey periods for each strata from May 1 through May 28, 1976, mean number of observed angler hours per survey period, standard deviation, total possible number of sample periods, estimated effort, and 95% confidence intervals at Lake Dorothy.

Strata	Number of survey periods	Mean number of hours observed per survey period	SD	Number of total possible periods	Estimated effort (angler hours)	95% Confidence interval (+)
May 1, 2, 1976; opening weekend						
Shore						
Day	1	170.2	-	2	491.0	-
Night	1	57.7	-	2	78	-
Boat						
Day	1	205.9	-	2	411.8	-
Night	1	28	-	2	56	-
Total					1036.8	-
May 3 - 28, 1976						
Shore						
Weekday						
Day	8	8.4	5.4	20	168	70
Night	5	8.9	6.4	20	178	138
Weekend						
Day	2	17	5.7	6	102	248
Night	4	225	24.2	6	135	133
Boat						
Weekday						
Day	8	21.4	13.7	20	428.0	177
Night	5	9.4	8.6	20	188.0	138
Weekend						
Day	2	49.8	31.5	6	298.9	1386
Night	4	38.2	19.2	6	229.2	106
Total					1726.9	434

Appendix K1

Number of survey periods for each strata from May 3, 1975 through February 28, 1976, mean number of rainbow trout observed harvested per survey period, standard deviation, total possible number of sample periods, estimated harvest, and 95% confidence interval at Sunset Lake.

Strata	Number of survey periods	Mean number of trout observed harvested per survey period	SD	Number of total possible periods	Estimated harvest	95% Confidence interval ($\pm$)
May 3, 4, 1975; opening weekend						
Shore						
Day	1	30	-	2	60	-
Night	1	19	-	2	38	-
Boat						
Day	1	135	-	2	270	-
Night	1	14	-	2	28	-
Total					396	
May 5 - June 1, 1975						
Shore						
Weekday						
Day	4	1.7	2.9	19	32	77
Night	2	16.4	17.9	19	312	250
Weekend						
Day	4	31	33.3	9	279	355
Night	5	.6	1.3	9	5	10
Boat						
Weekday						
Day	4	.7	1.1	19	13	31
Night	7	6.4	9.5	19	122	128
Weekend						
Day	4	9.2	11.3	9	83	120
Night	5	0	-	9	0	-
Total					846	368
June 2 - July 6, 1975						
Boat						
Weekday						
Day	11	0	-	24	0	-
Night	3	0	-	24	0	-
Weekend						
Day	4	.5	1	11	5	14
Night	7	.3	.8	11	3	6
Total					8	13
July 7 - November 24, 1975						
Shore						
Weekday						
Day	20	0	-	100	0	-
Night	19	.1	.5	100	10	20
Weekend						
Day	14	.2	.8	41	8	15
Night	16	.3	1.2	41	12	21
Boat						
Weekday						
Day	20	.1	.4	100	10	19
Night	19	0	-	100	0	-
Weekend						
Day	14	0	-	41	0	-
Night	16	.4	.9	41	16	15
Total					56	44
December 20, 1975 - February 28, 1976						
Ice Fishing						
Weekday						
Day	4	0	-	46	0	-
Night	6	0	-	46	0	-
Weekend						
Day	5	0	-	26	0	-
Night	5	.2	.4	26	5	-
Total					5	13

Appendix K2

Number of survey periods for each strata from May 1 through July 4, 1976, mean number of rainbow trout observed harvested per survey period, standard deviation, total possible number of sample periods, estimated harvest, and 95% confidence interval at Sunset Lake.

Strata	Number of survey periods	Mean number of trout observed harvested per survey period	SD	Number of total possible periods	Estimated harvest	95% Confidence interval ($\pm$)
May 1, 2, 1976; opening weekend						
Shore						
Day	1	129	-	2	258	-
Night	1	8	-	2	16	-
Boat						
Day	1	218	-	2	436	-
Night	1	8	-	2	16	-
Total					726	
May 3 - 31, 1976						
Shore						
Weekday						
Day	3	6.3	4.5	20	126	206
Night	9	9.0	13.0	20	180	148
Weekend						
Day	4	4.5	7.1	9	40	76
Night	5	6.8	10.4	9	61	78
Boat						
Weekday						
Day	3	9.7	8.5	20	194	390
Night	9	21.8	12.0	20	436	137
Weekend						
Day	4	1.7	2.9	9	15	30
Night	5	21.0	20.2	9	189	151
Total					1241	327
June 1 - July 4, 1976						
Boat						
Weekday						
Day	5	0	-	24	-	-
Night	6	14.5	15.1	24	348	329
Weekend						
Day	5	0	-	10	-	-
Night	5	2.2	2.5	10	22	22
Total					370	330

Appendix K3

Number of survey peroids for each strata from May 1 through May 31, 1976, mean number of harvested trout observed per survey period, standard deviation, total possible number of sample periods, estimated harvest, and 95% confidence interval at Thomas Lake.

Strata ^a	Number of survey periods	Mean number of trout observed harvested per survey period	SD	Number of total possible periods	Estimated harvest	95% Confidence interval (±)
May 1, 2, 1976						
Boat						
Day	1	56	-	2	112	-
Night	1	0	-	2	-	-
Total					112	
May 3 - 31, 1976						
Boat						
Weekday						
Day	3	13.7	9.5	20	274	435
Night	9	30.9	17.8	20	618	203
Weekend						
Day	4	9.3	8.8	9	79	94
Night	5	35.2	47.6	9	317	355
Total					1288	

a - no trout were caught from shore

Appendix K4

Number of survey periods for each strata from May 1 through May 28, 1976, mean number of rainbow trout observed per survey period, standard deviation, total possible number of sample periods, estimated harvest, and 95% confidence interval at Lake Dorothy.

Strata	Number of survey periods	Mean number of rainbow trout observed per survey period	SD	Number of total possible periods	Estimated harvest	95% Confidence interval ($\pm$)
May 1, 2, 1976; opening weekend						
Shore						
Day	1	70	-	2	140	-
Night	1	4	-	2	8	-
Boat						
Day	1	178	-	2	356	-
Night	1	9	-	2	18	-
Total					522	
May 3 - 28, 1976						
Shore						
Weekday						
Day	8	0	-	20	0	-
Night	5	0	-	20	0	-
Weekend						
Day	2	.5	.71	6	3	31
Night	4	1.2	1.5	6	7	8
Boat						
Weekday						
Day	8	3.9	3.8	20	78	49
Night	5	1.8	2.5	20	36	53
Weekend						
Day	2	.5	.71	6	3	31
Night	4	1.2	1.5	6	7	8
Total					134	63

Appendix K5

Number of survey periods for each strata from May 1 through May 28, 1976, mean number of brook trout observed per survey period, standard deviation, total possible number of sample periods, estimated harvest, and 95% confidence interval at Lake Dorothy.

Strata	Number of survey periods	Mean number of brook trout observed per survey period	SD	Number of total possible periods	Estimated harvest	95% Confidence interval ($\pm$)
May 1, 2, 1976; opening weekend						
Shore						
Day	1	214	-	2	428	-
Night	1	8	-	2	16	-
Boat						
Day	1	222	-	2	444	-
Night	1	20	-	2	40	-
Total					928	
May 3 - 28, 1976						
Shore						
Weekday						
Day	8	1.5	2.8	20	30	48
Night	5	0	-	20	0	-
Weekend						
Day	2	2	1.4	6	12	62
Night	4	1.5	3	6	9	16
Boat						
Weekday						
Day	8	8.9	10.7	20	178	139
Night	5	3	4.1	20	60	89
Weekend						
Day	2	3	2.8	6	18	124
Night	4	8.2	7.5	6	49	42
Total					356	

Appendix L1

Number and weight (kg) stocked and returned of rainbow, brook (k), and brown (n) trout stocked at subcatchable-size (all those smaller than legal size) during spring (sp), summer (su), and fall (f) in various lakes in the United States and Canada.

Lake County/Province	Area (ha) Max. Depth (m)	Stocked		Return		Season and year of stocking	Reference
		Number	Weight	Number	Weight		
<u>Wisconsin</u>							
Weber	16	6000	11.8	19	26.3	sp. 1947	Burdick and Cooper 1956
Vilas	14	4000	5.0	68	30.4	su. 1947	
		4000	30.8	236	210.0	f. 1947	
		8000	61.7	467	200.9	f. 1948	
		10000	5.0	36	15.4	sp. 1949	
		10000	67.1	1826	309.3	f. 1950	
Nebish	38	4500	35.4	865	566.5	su. 1967	Brynildson and Kempinger 1973
Vilas	14	4500n	34.5	348	212.3	su. 1967	
		4500	-	1	1.1	su. 1973	
		4500n	-	0	0	su. 1973	
<u>Alberta</u>							
Chickako	20	5300	6.8	1220	1587.6	sp. 1953	Miller and Thomas 1956
	17	12720	8.1	50	-	sp. 1955	
<u>California</u>							
Beardsley Reservoir	291	20000	47.3	1036	267.0	f. 1961	Cordone and Nicola 1970
Toulumne	41	20000	59.1	943	210.7	f. 1961	
		15000	121.5	1467	362.6	sp. 1962	
		10000	27.0	407	51.3	su. 1962	
		10000	18.9	207	41.2	f. 1962	
		10000	33.3	43	5.2	f. 1962	
		10000	76.6	40	3.8	f. 1962	
		10000	189.0	1821	398.3	sp. 1963	
		10000	283.5	2474	543.7	sp. 1963	
		10000	94.5	218	43.7	sp. 1963	
		10000	47.3	2176	478.3	su. 1963	
		10000	113.4	1014	237.7	su. 1963	
		10000	14.1	1084	257.7	su. 1963	
		20000	55.1	1377	323.0	su. 1963	
		10000	128.9	2341	486.3	sp. 1964	
		10000	101.2	619	61.0	sp. 1964	
		10000	5.5	183	40.0	su. 1964	
		5000	15.7	377	42.9	su. 1964	
		5000	31.5	187	26.1	su. 1964	
		5000	50.6	295	46.0	su. 1964	
		10000	15.3	160	33.4	su. 1964	
		5000	8.1	124	23.0	su. 1964	
		10000	7.4	247	59.3	f. 1964	
		5000	44.3	833	163.4	sp. 1965	
		5000	50.6	881	176.5	sp. 1965	
		10000	9.4	620	98.5	sp. 1965	
		3000	56.7	598	120.8	su. 1965	
		10000	17.7	973	163.7	su. 1965	
		10000	45.7	1554	257.1	su. 1965	
		10000	61.6	1900	313.6	su. 1965	
		10000	113.4	1710	269.3	su. 1965	
		10000	10.5	136	21.4	su. 1965	
		16200	328.0	5307	1022.8	sp. 1965	
		10000	20.2	671	107.9	su. 1966	
		10000	56.7	635	120.9	su. 1966	
		10000	72.7	541	99.9	su. 1966	
		10000	24.6	123	18.5	su. 1966	
		10000	56.7	674	131.5	su. 1966	
		5000	177.2	1469	407.5	sp. 1967	
		5000	37.3	413	107.3	sp. 1967	
		5000	37.3	483	141.2	sp. 1967	
		10000	37.3	102	15.3	su. 1967	
		10000	25.1	63	14.7	su. 1967	
		10000	83.4	38	4.9	f. 1967	
		10000	74.6	26	3.7	f. 1967	
Tahoe	50000	14686		30		sp. 1961	Cordone and Frantz 1968
	501	13517		14		sp. 1961	

Lake County/Province	Area (ha) Max. Depth (m)	Stocked		Return		Season and year of stocking	Reference
		Number	Weight	Number	Weight		
		26766		0		f. 1961	
		26743		0		f. 1961	
		26665		0		f. 1961	
		71570		72		su. 1962	
		34272		34		su. 1962	
		48009		14		su. 1962	
		25769		1005		su. 1962	
		98368		2951		su. 1963	
Conn Valley Reservoir Napa	324 24	100000		3300		sp. 1946	Curtis 1951
Castle Siskiyou	19 37	20000 ^k 20000 ^k	113.4 45.4	6923 7277	403.3 418.7	f. 1947 f. 1948	Wales and German 1956
		2500	3.8	525		f. 1952	Wales and Borgeson 1961
		2500	3.5	295		f. 1952	
		3000	10.0	79		f. 1953	
		3000	10.2	109		f. 1953	
		5000	10.9	1276		f. 1954	
		5000	7.9	221		f. 1954	
		5470	9.7	995		f. 1955	
Gull Mono	28 20	20000	189.0	530		su. 1941	Curtis 1951
Alamador Plumas	1133 37	100000 73800	221.5 317.0	384 42		su. 1946 su. 1947	Curtis 1951
<u>Colorado</u>							
West Larimer	8	3000 3000 ⁿ 5110 ⁿ		2040 2040 2504		sp. 1972 sp. 1972 sp. 1973	Curtis 1951
Eggleston Grand Mesa	32	4000 4050 4000 4000 4000		92 74 53 69 43		su. 1953 su. 1954 su. 1955 su. 1956 su. 1957	Barrows 1962
Island Grand Mesa	55	4050 4000 4000 4050 4050		148 64 75 91 41		su. 1953 su. 1954 su. 1955 su. 1956 su. 1957	Barrows 1962
<u>Idaho</u>							
Soldier's Meadow Reservoir		9780		1244		f. 1957	Keating 1960
<u>Connecticut</u>							
Dodge New London	13 15	3000 3500		1207 636		sp. 1958 f. 1959	Wadman 1961
Uncas New London	28 12	4000 ^k		110		f. 1958	Wadman 1961
Norwich New London	11 12	3000		261		f. 1958	Wadman 1961

Appendix L1. CONTIUED

Lake County/Province	Area (ha) Max. Depth (m)	Stocked		Return		Season and year of stocking	Reference		
		Number	Weight	Number	Weight				
<u>Massachusetts</u>									
Hathaway Barnstable	8	1350	10.2	65	34.5	sp. 1953	Mullan 1959		
	17	1000	.2	0	0	sp. 1954			
		500k	.9	153	18.7	sp. 1954			
		500k	.1	127	19.9	su. 1954			
		300k	2.8	57	10.0	f. 1954			
		700	21.3	257	80.1	f. 1954			
		1500	.3	0	0	sp. 1955			
		1000	16.8	77	10.6	f. 1955			
Higgins	10	3000k	35.8	769	183.3	sp. 1951	Mullan 1959		
	20	500k	19.5	124	31.4	sp. 1951			
		2300	53.1	1137	2020	sp. 1955			
<u>Michigan</u>									
Swanzy Marquette	8	3000k	16.3	322	65.0	f. 1952	Galbraith 1959a		
	14	3000k	19.7	10	3.4	f. 1953			
		2971k	39.0	520	76.3	f. 1954			
		5100k	169.0	1405	105.0	f. 1955			
		5100k	190.0	1674	101.0	f. 1956			
		5100k	159.0	941	60.0	f. 1957			
		6120k	102.0	447	38.3	sp. 1958	Galbraith 1963		
		2940k	28.0	50	17.0	sp. 1959			
		2940k	39.0	814	77.2	sp. 1960			
Airport Marquette		3	2000k	12.7	268	32.3		f. 1951	Galbraith 1959a
	9	750k	34.0	360	32.6	f. 1952			
		750k	27.2	220	21.0	f. 1954			
		2010k	36.5	693	57.7	sp. 1958			
		985k	9.3	93	11.3	sp. 1960			
Moccasin Marquette	3	750k	40.8	444	48.9	f. 1952	Galbraith 1959a		
	8	3150k	59.9	1087	94.0	f. 1955		Galbraith 1959b	
		3150k	45.8	716	60.0	f. 1956			
		3150k	30.4	580	49.0	f. 1957			
		3150k	57.2	180	41.3	sp. 1958			
		3150k	32.8	958	98.1	sp. 1959			
		3150k	44.0	471	31.2	sp. 1960			
<u>Utah</u>									
Fish	1012	172675		54011		su. 1969	Bangerter 1973		
		27325		3114		su. 1968			
		100000		26013		su. 1969			
		100000		21753		su. 1969			
		100000		39016		su. 1970			
		100000		12103		su. 1970			

Appendix L2

Number and weight (kg) stocked and returned of rainbow, brook (k), and brown (n) trout stocked at catchable-size during spring (sp), summer (su), fall (f), winter (w), and fishing pressure (angler hours) for the year of stocking in various lakes in the United States and Canada.

Lake County/Province	Area (ha) Max. Depth (m)	Stocked		Return			Fishing pressure per season	Season and year of stocking	Reference
		Number	Weight	Number (first year)	Number (Eventual)	Weight (Eventual)			
<u>Wisconsin</u>									
Sunset Portage	26 17	2710	322.5	1316	1344	182.6	7914	sp. 1975	Present study
Turk Chippewa	4	880	52.8	409		44.6c	391	sp. 1951	Brynildson 1958
	6	352	70.7	247		44.1c	391	sp. 1951	
		2180	118.8	543		49.3c		sp. 1952	
Cather Chippewa	4	840	50.3	486		65.9c	264	sp. 1951	Brynildson 1958
	11	50	10.0	35		9.9c	264	sp. 1951	
		1260	69.2	144		11.7		sp. 1952	
Riley Chippewa	7	600	35.9	162	214	51.5	132	sp. 1951	Brynildson 1958
	20	600	33.0	34		5.4c		sp. 1952	
Palette Vilas	66	8550	795.2	2998	3001	271.1		w. 1960	Brynildson 1961
	20	8550	701.1	3501	3503	2521		sp. 1960	
<u>Alberta</u>									
Chickako	20 17	2852	164.0	210	780	628.1		sp. 1954	Miller and Thomas 1956
<u>Arkansas</u>									
Bull Shoals Reservoir Baxter	18400	1000		170				sp. 1961	Baker and Mathis 1967
	62	1000		139				sp. 1962	
		1000		182				sp. 1963	
		500		40				sp. 1964	
<u>California</u>									
Shasta		53080		14703	19003			sp. 1968	Weidlein 1971
		45144		12189	15845			sp. 1968	
		20000		700	860			sp. 1968	
		20000		5380	7160			sp. 1958	
		20000		4846	6540			sp. 1968	
		20000 ⁿ		3780	5480			sp. 1968	
		279296		111439	18142			w. 1968	
		51153			15499			sp. 1969	
		47356			12313			sp. 1969	
		300			65			sp. 1969	
		298			12			sp. 1969	
		19998			4560			sp. 1969	
		19740			7639			sp. 1969	
		3400			7820			f. 1969	
		10002 ⁿ			130			su. 1969	
		10002 ⁿ			130			su. 1969	
		15000 ⁿ			780			f. 1969	
		400			52			sp. 1970	
Conn Valley Reservoir Napa	324 34	20100	139.7	72				sp. 1948	Curtis 1957
Convict Mono	68	2000	15.9	972				su. 1957	Butler and Borgeson 1965
		1200		1020				su. 1958	
		1200		1180				su. 1968	
Green Valley Lake	5	1400		1372				su. 1957	Butler and Borgeson 1965

Lake County/Province	Area (ha) Max. Depth (m)	Stocked		Return			Fishing pressure per season	Season and year of stocking	Reference
		Number	Weight	Number (first year)	Number (Eventual)	Weight (Eventual)			
Gregory	39	2800		2776				su. 1957	Butler and Borgeson 1965
Huntington	583	2730 2730 2880 3800		2402 2512 2131 2584				su. 1958 su. 1958 su. 1958 su. 1958	Butler and Borgeson 1965
June Mono	125 43	70000 70000 70000 100000 5012	763.3 1526.5 1526.5 3360.0 454.7	26000 29000 37000 56000 5012				sp. 1939 su. 1940 sp. 1941 sp. 1942 sp. 1957	Curtis 1951 Butler and Borgeson 1965
Arrowhead	316	3000		1290				sp. 1957	Butler and Borgeson 1965
Lower Sardine	19 23	3000n 5000n 815n 1315n 2227n 1173n 1998n 2006n 2002n 2013	515.4	264 2530 456 437 1314 459 861 441 256 1477	1626 3630 660 602 1693 662 1261 744 474 1517		5020 7732 7732 7227 7227 7227	sp. 1954 su. 1955 sp. 1957 sp. 1957 sp. 1958 sp. 1958 sp. 1959 sp. 1959 sp. 1959 sp. 1959	Boles and Borgeson 1966
Pillsbury Lake	941	15050	1365.3	3898	26			sp. 1957	Kabel 1960
Berryessa Napa	8094	416 419 399 398 395 399 398 398	45.3 45.6	58 59 157 124 144 111 124 97	70 77 170 135 170 117 141 130	38.5 82.3		sp. 1968 sp. 1968 sp. 1969 sp. 1969 sp. 1969 sp. 1970 sp. 1970 sp. 1970	Rawstron 1972 Rawstron 1972
Merle Collins Reservoir	401 47	99 99 100	19.8 14.7 17.3	44 41 40	44 42 42	10.7 14.2 18.0		sp. 1970 sp. 1970 sp. 1970	Rawstron 1973
Pine Flat	2428	397 398 391 398	68.0 68.0 68.0 98.9	142 134 126 198	143 138 134 204	36.9 44.8 44.3 89.4		sp. 1969 sp. 1969 sp. 1969 sp. 1970	Rawstron 1973
Isabella	4856	398 399 397		141 79 92	141 79 93			sp. 1969 sp. 1969 sp. 1969	Rawstron 1973
Tahoe	5000 501	4000 90073 13374 1554 14524 27230 91967 12345 2043 4974 3058 4742 15755 5190 5254 6208 1252			840 21257 749 463 2295 953 2391 99 161 1124 144 1356 8067			su. 1960 f. 1960 sp. 1961 sp. 1961 su. 1961 su. 1961 f. 1961 sp. 1962 su. 1962 su. 1962 su. 1962 su. 1962 su. 1962 su. 1963 su. 1964 su. 1964 su. 1964 su. 1964	Cordone and Frantz 1968 Nicola and Cordone 1974
Castle Siskiyou	19 37	20000k 2500 2500 4813 5000	682.0 145.4 86.6 426.6 515.4	5800 2130	9600 2028 1808 4008 3630	443.6 117.9 62.6		su. 1947 su. 1952 su. 1952 su. 1955 su. 1955	Males and German 1956 Males and Borgeson 1961

Lake County/Province	Area (ha) Max. Depth (m)	Stocked		Return			Fishing pressure per season	Season and year of stocking	Reference
		Number	Weight	Number (first year)	Number (Eventual)	Weight (Eventual)			
Gull Mono	28 20	78000	1842.7	10000	27000			f. 1940	Curtis 1951
South Mono	72	2500	226.8	1850				f. 1957	Butler and Borgeson 1965
Colorado									
Eggleston Grand Mesa	32	1840		36				sp. 1956	Barrows 1962
		800		26	26			su. 1956	
		400		7	7			f. 1956	
		270		25	25			su. 1957	
		76		2	2			su. 1957	
		5500		101	101			su. 1957	
		500		0	0			su. 1957	
		1125		3	3			f. 1957	
Island Grand Mesa	55	2208		74				su. 1956	Barrows 1962
		800		28	28			su. 1956	
		400		9	9			f. 1956	
		450		11	11			su. 1957	
		450		6	6			su. 1957	
Parvin Larimer	25 10	479		384	406			sp. 1950	Klein 1953
		491		390	444			su. 1950	
		500		220	402			su. 1950	
		498		334	408			w. 1950	Klein 1972
		500		367	388			w. 1950	
		497		408			21787	sp.	
Connecticut									
Uncas New London	28 12	400		307	308		11500	sp. 1958	Wadman 1961
		800n		742	768		11506	sp. 1958	
		200		103			6028	sp. 1959	
		600n		279			6028	sp. 1959	
Dodge New London	13 15	800		650	666		6542	sp. 1958	Wadman 1961
		500k		480	483		6542	sp. 1958	
		200		91			3832	sp. 1959	
		300k		89			3832	sp. 1959	
Norwich New London	11 12	500		253	276		5383	sp. 1958	Wadman 1961
		300k		300	300		5383	sp. 1958	
		400		266			2853	sp. 1959	
		200k		146			2853	sp. 1959	
Idaho									
Kelso	28 15	100		58	58			sp. 1958	Jeppson 1960
		100		68	68			sp. 1958	
		100		34	34			su. 1958	
		100		39	39			su. 1958	
		100		21	21			su. 1958	
		100		30	30			su. 1958	
		100		14	23			f. 1958	
Spirit	566 24	100		35	38			sp. 1958	Jeppson 1960
		100		39	45			sp. 1958	
		100		15	15			si. 1958	
		100		10	22			su. 1958	
		100		5	5			su. 1958	
		100		3	11			f. 1958	
		100		3	15			f. 1958	
Soldiers Meadow Reservoir		4920		2365				sp. 1958	Keating 1960
		7340		3134				sp. 1959	
Waha		8280		7531				sp. 1959	Keating 1960
Alturas	486	15250		13420			13900	sp. 1959	Keating 1960
Stanley	73	19000		3500			8000	1959d	Bjornn 1960

Lake County/Province	Area (ha) Max. Depth (m)	Stocked		Return			Fishing pressure per season	Season and year of stocking	Reference
		Number	Weight	Number (first year)	Number (Eventual)	Weight (Eventual)			
Redfish	607	23600		23600			19000	1953d	Bjornn 1960
<u>Kentucky</u>									
Cumberland	20335 27	25000 104583 52230 35722 100309		235 73 418 61 8	240 73 429 61 8			f. 1968 f. 1969 sp. 1971 sp. 1972 sp. 1973	Axon 1974
<u>Massachusetts</u>									
Quabbin Reservoir	10125 46	1000 1000k 1000n 1000n 1000n 5000 5105n 5000 5000n 5000 5000n 20000n 8000 24000n 5000 590 5000n 28200n 20000n 212 150 20000 3150 3000 14100	101 24 615 <						

Lake County/Province	Area (ha) Max. Depth (m)	Stocked Number Weight	Return Number (first year)	Number (Eventual)	Weight (Eventual)	Fishing pressure per season	Season and year of stocking	Reference
Minnesota								
Dodd Sherburne	.5	337n 34.0 479n 399.9	202 214				sp. 1951 sp. 1953	Kelley 1953
Milrose Sherburne	1	974n 81.0	352				sp. 1953	Kelley 1953
Algren Sherburne	.8	486 73.0	418				sp. 1953	Kelley 1953
Holes Sherburne	.4	225 34.0	225				sp. 1953	Kelley 1953
Thielman Sherburne	.5	479n 39.9	225				sp. 1953	Kelley 1953
Transformer Sherburne	.5	479n 39.9	171				sp. 1953	Kelley 1953
Melrose Deep Sherburne	.8	450 68.0	387				sp. 1953	Kelley 1953
Trabetusky Sherburne	.4	225 34.0	223				sp. 1953	Kelley 1953
Missouri								
TaneyCOMO Taney	700	1859	403	426			sp. 1950	Fry and Hanson 1960
New Brunswick								
Crecy Charlotte	20 4	665k 197.7 812k 67.6 659k 77.0 675k 79.9 675k 32.5 675k 52.2 675k 58.0 675k 85.3 675k 85.3 675k 239.6 675k 239.6 675k 209.6 675k 209.6 675k 329.9 675k 201.1	197.7 67.6 77.0 79.9 32.5 52.2 58.0 85.3 85.3 239.6 239.6 209.6 209.6 329.9 201.1	6 82 111 26 12 92 306 244 552 597 579 377 536 1232 942	2.0 19.6 30.8 9.6 4.6 62.6 57.4 48.0 109.0 252.9 252.9 1576 1576 2115 3587		f. 1944 f. 1945 f. 1946 f. 1947 f. 1948 f. 1949 f. 1950 f. 1951 f. 1951 f. 1952 f. 1952 f. 1953 f. 1953 f. 1959 f. 1960	Smith, M.W. 1954. 1955 <

Appendix L2. CONTINUED

Lake County/Province	Area (ha) Max. Depth (m)	Stocked		Return			Fishing pressure per season	Season and year of stocking	Reference
		Number	Weight	Number (first year)	Number (Eventual)	Weight (Eventual)			
<u>Utah</u>									
Fish	1012	40000	6052.0	20560	30952	6402.7		sp. 1968	Bangerter 1973
	36	35000	5676.0	17654	30671	6373.0		su. 1963	
		25000	4149.0	7375	16824	3686.0		su. 1963	
		40000	7260.0	25556	31692	7397.1		sp. 1969	
		35000	7286.0	19138	27161	6956.0		su. 1969	
		25000	4149.0	7375	16824	3686.0		su. 1969	
		40000	6548.0	20728	32580	7189.9		sp. 1970	
		35000	6377.0	12775	28015	6345.0		su. 1970	
		25000	4355.0	2605	13657	3134		su. 1970	

c - weight of first year's harvest

d - no season of stocking given

Appendix M

Percent of parties traveling various distances (miles) to the lakes.

Lake	Percent of parties traveling distance				
	0 - 20	21 - 50	51 - 100	101 - 200	>201
Sunset 1975	79.1	11.0	6.4	3.1	.4
Sunset 1976	75.1	14.3	6.5	4	.5
Thomas 1976	88.3	9.7	2.0		
Dorothy 1976	61.0	13.4	12.2	7.0	6.4

Percent of parties using various baits. Totals are not 100% because some parties used more than one kind of bait.

Lake	Percent parties using baits					
	Worms	Corn	Artificial	Minnows	Mayflies	Other
Sunset 1975	50.9	20.7	18.8	5.9	1.5	2.3
Sunset 1976	57.3	42.5	21.6	4.8	5	5
Thomas 1976	84.5	7.4	26.8	5.5	4.8	3.2
Dorothy 1976	86.3		13.1	9.1		

Appendix M1

Number of survey periods for each strata from May 3 through July 6, 1975, mean number of white sucker observed harvested per survey period, standard deviation, total possible number of sample periods, estimated harvest, and 95% confidence interval at Sunset Lake.

Strata	Number of survey periods	Mean number of white sucker observed harvested per survey period	SD	Number of total possible periods	Estimated harvest	95% Confidence interval (+)
May 3,4, 1975: opening weekend						
Shore						
Day	1	173	-	2	110	-
Night	1	20	-	2	16	-
Boat						
Day	1	55	-	2	346	-
Night	1	8	-	2	40	-
Total					512	
May 5,- June 1, 1975						
Shore						
Weekday						
Day	4	.7	1.0	19	14	26
Night	7	12.4	24.7	19	236	345
Weekend						
Day	4	12.7	8.8	9	115	94
Night	5	.2	.4	9	2	3
Boat						
Weekday						
Day	4	7.2	14.5	19	138	389
Night	7	1	1.7	19	19	23
Weekend						
Day	4	2.5	3.3	9	22	35
Night	5	.2	.4	9	2	3
Total					548	429
June 2 - July 6, 1975						
Shore						
Weekday						
Day	11	0	-	24	0	-
Night	3	0	-	24	0	-
Weekend						
Day	4	0	-	11	0	-
Night	7	.1	.4	11	1	4
Boat						
Weekday						
Day	11	.2	.6	24	5	12
Night	3	0	-	24	0	-
Weekend						
Day	4	0	-	11	0	-
Night	7	.8	1.9	11	9	13
Total					15	18

Appendix N2

Number of survey periods for each strata from May 3, 1975 - February 28, 1976, mean number of bluegill, yellow perch, largemouth bass, pumpkinseed and white sucker (after July) observed harvested per survey period, standard deviation, total possible number of sample periods, estimated harvest and 95% confidence interval at Sunset Lake.

Strata	Number of survey periods	Mean number of fish observed harvested per survey period	SD	Number of total possible periods	Estimated harvest	95% Confidence interval ($\pm$)
May 3,4, 1975: opening weekend						
Shore						
Day	1	40	-	2	80	-
Night	1	2	-	2	4	-
Boat						
Day	1	28	-	2	56	-
Night	1	4	-	2	2	-
Total					142	
May 5- June 1,1975						
Shore						
Weekday						
Day	4	9.5	9.9	19	180	265
Night	7	3.4	3.1	19	65	43
Weekend						
Day	4	21.7	20.4	9	195	218
Night	5	3.8	5.5	9	34	41
Boat						
Weekday						
Day	4	8	10.9	19	152	292
Night	7	12.1	20.1	19	230	282
Weekend						
Day	4	9.5	14.4	9	85	154
Night	5	13.2	17.7	9	119	132
Total					1060	417
June 2 - July 6, 1975						
Shore						
Weekday						
Day	11	.2	.6	24	4	7
Night	3	3.7	4.0	24	89	225
Weekend						
Day	4	0	-	11	0	-
Night	7	.1	.4	11	2	2
Boat						
Weekday						
Day	11	.3	.9	24	7	11
Night	3	0	-	24	0	-
Weekend						
Day	4	6.7	9.9	11	74	138
Night	7	8.3	12.3	11	92	76
Total					267	184
July 7 - November 24, 1975						
Shore						
Weekday						
Day	20	0	-	100	0	-
Night	19	.2	.9	100	21	40
Weekend						
Day	14	0	-	41	0	-
Night	16	.1	.5	41	4	8
Boat						
Weekday						
Day	20	.2	.9	100	20	37
Night	19	.5	2.1	100	50	90
Weekend						
Day	14	1.4	2.6	41	57	51
Night	16	2.2	3.2	41	90	55
Total					242	122
December 20, 1975 - February 28, 1976						
Ice Fishing						
Weekday						
Day	4	0	-	46	0	-
Night	6	.8	2.0	46	37	92
Weekend						
Day	5	0	-	26	0	-
Night	5	1	2.4	26	26	71
Total					63	101

Appendix N3

Number of survey periods for each strata from May 1 - July 4, 1976, mean number of white sucker observed harvested per survey period, standard deviation, total possible number of sample periods, estimated harvest, and 95% confidence interval at Sunset Lake.

Strata	Number of survey periods	Mean number of white sucker observed harvested per survey period	SD	Number of total possible periods	Estimated harvest	95% Confidence interval (+)
May 1, 2, 1976: opening weekend						
Shore						
Day	1	37	-	2	74	-
Night	1	2	-	2	4	-
Boat						
Day	1	7	-	2	14	-
Night	1	1	-	2	2	-
Total					94	
May 3 -31, 1976						
Shore						
Weekday						
Day	3	.3	.6	20	6	26
Night	9	.9	2.0	20	18	22
Weekend						
Day	4	2.2	3.3	9	20	35
Night	5	3.4	6.5	9	31	49
Boat						
Weekday						
Day	3	1.7	1.5	20	34	70
Night	9	1.8	2.4	20	36	27
Weekend						
Day	4	.5	.6	9	4	6
Night	5	9.2	9.0	9	83	67
Total					232	84
June 1 - July 4, 1976						
Boat						
Weekday						
Day	5	0	-	24	0	-
Night	6	2.2	3.2	24	53	71
Weekend						
Day	5	0	-	10	0	-
Night	5	1.8	-	10	18	22
Total					71	70

Appendix N4

Number of survey periods for each strata from May 1 - July 4, 1976, mean number of yellow perch, largemouth bass, bluegill, and pumpkinseed observed harvested per survey period, standard deviation, total possible number of sample periods, estimated harvest, and 95% confidence interval at Sunset Lake.

Strata	Number of survey periods	Mean number of fish observed harvested per survey period	SD	Number of total possible periods	Estimated Harvest	95% Confidence interval (+)
May 1, 2, 1976: opening weekend						
Shore						
Day	1	4	-	2	8	-
Night	1	0	-	2	0	-
Boat						
Day	1	12	-	2	24	-
Night	1	1	-	2	2	-
Total					34	
May 3 - 31, 1976.						
Shore						
Weekday						
Day	3	0	-	20	0	-
Night	9	.4	1.0	20	8	12
Weekend						
Day	4	1.5	3	9	13	32
Night	5	1.2	1.3	9	11	10
Boat						
Weekday						
Day	3	0	-	20	0	-
Night	9	1.6	3.7	20	32	42
Weekend						
Day	4	4.7	2.6	9	42	29
Night	5	6.6	3.6	9	59	27
Total					165	53
June 1 - July 4, 1976						
Shore						
Weekday						
Day	5	0	-	24	0	-
Night	6	1.2	2.8	24	29	62
Weekend						
Day	5	0	-	10	0	-
Night	5	.2	.4	10	2	4
Boat						
Weekday						
Day	5	0	-	24	0	-
Night	6	2.7	2.9	24	65	64
Weekend						
Day	5	.8	1.3	10	8	11
Night	5	1.6	2.3	10	16	20
Total					120	79

Appendix N5

Number of survey periods for each strata from May 1 through May 31, 1976, mean number of bluegill observed harvested per survey period, standard deviation, total possible number of sample periods, estimated effort, and 95% confidence interval at Thomas Lake.

Strata	Number of survey periods	Mean number of bluegills observed harvested per survey period	SD	Total number of possible periods	Estimated Harvest	95% Confidence interval (+)
May 1, 2, 1976: opening weekend						
Shore						
Day	1	0	-	2	0	-
Night	1	0	-	2	0	-
Boat						
Day	1	4	-	2	0	-
Night	1	0	-	2	0	-
Total					8	
May 3 - 31, 1976						
Shore						
Weekday						
Day	3	0	-	20	-	-
Night	9	1.3	2.3	20	46	26
Weekend						
Day	4	.25	1.5	9	2	5
Night	5	1	1.4	9	9	10
Boat						
Weekday						
Day	3	2.7	2.3	20	53	106
Night	9	17.7	17.9	20	353	204
Weekend						
Day	4	17.5	16.0	9	157	171
Night	5	27.4	28.5	9	247	212
Total					867	279

Appendix N6

Number of survey periods for each strata from May 1 - May 31, 1976, mean number of largemouth bass, pumpkinseed and bullhead observed harvested per survey period, standard deviation, total possible number of sample periods, estimated harvest, and 95% confidence interval at Thomas Lake.

Strata	Number of survey periods	Mean number of fish observed harvested per survey period	SD	Total number of possible periods	Estimated Harvest	95% Confidence interval (+)
May 1, 2, 1976: opening weekend						
Shore						
Day	1	0	-	2	0	-
Night	1	0	-	2	0	-
Boat						
Day	1	1	-	2	2	-
Night	1	0	-	2	0	-
Total					2	
May 3 - 31, 1976.						
Shore						
Weekday						
Day	3	0	-	20	0	-
Night	9	1	2	20	20	53
Weekend						
Day	4	0	-	9	0	-
Night	5	1.2	2.7	9	11	20
Boat						
Weekday						
Day	3	4.7	8.1	20	93	370
Night	9	3.7	2.4	20	73	27
Weekend						
Day	4	4.0	6.7	9	36	72
Night	5	4.6	4.9	9	41	37
Total					274	189

Appendix N7

Number of survey periods for each strata from May 1 - May 28, 1976, mean number of non-trout species observed per survey period, standard deviation, total possible number of sample periods, estimated harvest, and 95% confidence interval at Lake Dorothy.

Strata	Number of survey periods	Mean number of fish observed per survey period	SD	Total number of possible periods	Estimated harvest	95% Confidence interval (+)
May 3 - 28, 1976						
Shore						
Weekday						
Day	8	2.7	5.1	20	54	66
Night	5	4.2	4.3	20	84	92
Weekend						
Day	2	5.5	7.8	6	33	342
Night	4	0	-	6	0	-
Boat						
Weekday						
Day	8	4.4	12.0	20	88	155
Night	5	.8	1.8	20	16	38
Weekend						
Day	2	6	4.2	6	36	187
Night	4	1	2	6	6	16
Total					317	195

Appendix N8

Percent distribution of non-trout species in observed harvest from Lakes Sunset, Thomas, and Dorothy.

Species	Opening weekend	Remaining days in May	June	July through November	December through February
Sunset Lake 1975					
White sucker				15.3	
Bluegill		37.2	22.8	34.7	
Largemouth bass	3.0	37.2	73.3	29.2	
Pumpkinseed		1.1		5.5	
Yellow perch	97.0	24.5	3.8	15.3	100
Sunset Lake 1976					
Bluegill	18.2	24.7	26.2		
Largemouth bass	91.0	35.3	54.8		
Pumpkinseed		4.7	2.4		
Yellow perch	72.7	35.3	9.5		
Bullhead			2.4		
Cisco			4.8		
Thomas Lake 1976					
Largemouth bass	100.0	45.0			
Pumpkinseed		53.7			
Bullhead		1.3			
Lake Dorothy 1976 ^a					
Bluegill		48.3			
Largemouth bass		7.6			
Smallmouth bass		14.4			
Black crappie		30.0			
Yellow perch		1.7			

a - only trout were observed caught on opening day

Appendix 01

Weight of rainbow trout harvested from Sunset Lake in 1975 and 1976 calculated from sample means or length vs. weight functional regressions.

Date	Number in length sample	Mean length in mm (SD)	Number in weight sample	Mean weight in g (SD)	Estimated number removed	Estimated weight removed kg
May 3, 4, 1975	127	234 (20.3)	a	120	396	47.5
May	17	236 (24.5)	a	123	846	104.1
June	2	249 (5.7)	a	145	8	1.2
July - November	18	295 (26.2)	a	243	56	13.6
December - February	1	312	a	287	5	1.4
Carryover	7	323 (15.8)	b	325	27	8.8
	1	537	1	2500	1	2.5
May 1, 2, 1976	101	239 (12.2)	100	129 (18.1)	726	93.6
May	337	246 (14.3)	331	143 (23.3)	1241	177.5
June	35	271 (12.4)	35	195 (27.0)	370	72.1
Carryover	9	366	c	488	28	13.6

a - $\log W = 3.0385 (\log L) - 5.1199$ (May - December sample)

n = 134 r = .971

b - $\log W = 5.9688 (\log L) - 12.4612$ (May sample)

n = .5 r = .918

c - $\log W = 2.4778 (\log L) - 3.6642$ (May sample)

n = 4 r = .997

Appendix 02

Weight of bluegill harvested from Sunset Lake in 1975 and 1976 calculated from sample means.

Date	Number in length sample	Mean length in mm (SD)	Number in weight sample	Mean weight in g (SD)	Estimated number removed	Estimated weight removed kg
May 1975	67	165 (11.0)	67	85 (17.9)	394	33.5
June	10	173 (12.5)	10	105 (26.5)	60	6.3
July - November	23	170 (15.4)	23	95 (28.1)	84	8.0
May 1, 2, 1976	3	199 (11.0)	3 ^a	162 (30.9)	6	1.0
May				162	41	6.6
June				162	31	5.0

^a - sample from May - June

Appendix D3

Weight of white sucker harvested from Sunset Lake in 1975 and 1976 calculated from sample means or length vs weight functional regressions.

Date	Number in length sample	Mean length in mm (SD)	Number in weight sample	Mean weight in g (SD)	Estimated number removed	Estimated weight removed kg
May 3, 4, 1975	120	293 (15.8)	a	192	512	98.3
May	17	297 (17.9)	a	199	548	109.0
June	7	298 (41.9)	a	201	15	3.0
July - November	11	327 (36.6)	a	259	37	9.6
May 1, 2, 1976	3	305 (25.7)	b	265	94	24.9
May	13	306 (13.0)	b	269	232	62.4
June	11	315 (6.6)	b	301	71	21.7

a - $\log W = 2.7066 (\log L) - 4.3927$ (May - November sample)

n = 32 r = .9469

b - $\log W = 3.8943 (\log L) - 7.2511$ (May - June sample)

n = 26 r = .6510

Appendix 04

Weight of largemouth bass harvested from Sunset Lake in 1975 and 1976 calculated from sample means or length vs weight functional regressions.

Date	Number in length sample	Mean length in mm (SD)	Number in weight sample	Mean weight in g (SD)	Estimated number removed	Estimated weight removed kg
May 3, 4, 1975	1	225	a	138	4	.5
May	75	219 (29.1)	75	135 (72.3)	394	53.2
June	46	223 (23.9)	46	152 (56.8)	194	29.5
July - November	14	236 (32.5)	14	199 (76.5)	70	13.9
May 1, 2, 1976	16	223 (66.3)	16	187 ^b (143.1)	3	.6
May				187 ^b	58	10.8
June				187 ^b	65	12.2

a - $\log W = 3.2880 (\log L) - 5.5927$ (May sample)

n = 75 r = .9722

b - sample from June 6 - June 22, 1976

Appendix 05

Weight of yellow perch harvested from Sunset Lake in 1975 and 1976 calculated from sample means or length vs weight functional regressions.

Date	Number in length sample	Mean length in mm (SD)	Number in weight sample	Mean weight in g (SD)	Estimated number removed	Estimated weight removed kg
May 3, 4, 1975	34	203 (18.4)	a	75	138	10.3
May	26	196 (13.7)	26	70 (16.2)	260	18.2
June	1	192	1	70	10	.7
July - November	9	227 (13.1)	9	122 (21.7)	37	4.5
December	11	214 (10.5)	11	103 (19.8)	64	6.6
May 1, 2, 1976	3	219 (24.0)	3	113 (42.4)	25	4.1
May	8	224 (8.0)	8	115 (13.9)	58	6.7
June	b	223 (12.9)	b	114 (22.3)	11	1.2

a - $\log W = 2.9277 (\log L) - 4.8829$ (May sample)

n = 32 r = .88064

b - entire May sample

Appendix 06

Weight of fish harvested from Thomas Lake in 1976 calculated from sample mean weights.

Species	Number in length sample	Mean length in mm (SD)	Number in weight sample	Mean weight in g (SD)	Estimated number removed	Estimated weight removed kg
Bluegill	92	175 (28.7)	92	132 (68.9)	875	115.5
Largemouth Bass	20	317 (100.9)	20	616 (697.5)	124	76.3
Pumpkinseed	10	136 (26.3)	10	70 (51.3)	147	10.3
Rainbow Trout	249	266 (17.0)	239	205 (47.0)	1400	287.0
Carryover	4	432	4	894	12	10.7

Appendix 07

Weight of trout harvested from Lake Dorothy in 1976 calculated from sample mean weights.

Species Date	Number in length sample	Mean length in mm (SD)	Number in weight sample	Mean weight in g (SD)	Estimated number removed	Estimated weight removed kg
Rainbow Trout						
May 1, 2, 1976	99	241 (13.74)	46	149 (25.55)	522	77.8
May 3 -28	40	240	38	163	134	21.8
Brook Trout						
May 1, 2, 1976	187	249 (13.36)	100	172 (33.90)	928	159.6
May 3 - 28	123	243 (14.49)	106	162 (32.58)	356	57.7

Appendix P

Population estimates of white sucker, cisco, largemouth bass and yellow perch at Sunset Lake.

Chapman's modification of the Petersen Formula (Ricker 1975): $(C + 1)(M + 1)/(R + 1) = N$

N = population estimate; M = number marked; C = number of white sucker observed in the creel survey on opening day of trout season or the catch of cisco on the recapture electrofishing run; R = number of recapture observed.

Species	M	Date in 1975	C	C	Number M	R	N	+95% Confidence Interval
White sucker		April 30,	May 3,	171	99	7	2150	1117 - 4526
Cisco		November 17	November 24	30				
		November 19		152	97	13	1281	770 - 2270

Chapman's modification of the Schnabel Formula (Ricker 1975): $\sum (C M) / (R + 1) = N$

N = population estimate; M = number at large at time of capture that are marked; C = catch for each day; R = number of recaptures observed.

Species	Date in April 1976	C	M	R	N	+95% Confidence Interval
White sucker	20	157	0	0		
	23	167	1357	18	1380	
	25	115	324	19	1670	
	26	101	439	20	1859	
	27	128	540	28	2057	1679 - 2585
Largemouth bass (> 150 mm T.L.)	20	25	0	0		
	23	20	25	1	500	
	25	15	45	3	294	
	26	18	60	4	250	
	27	31	78	11	234	152 - 383
Yellow perch (> 125 mm T.L.)	20	84	0	0		
	23	143	84	22	522	
	25	147	227	33	810	
	26	114	374	45	871	
	27	139	488	62	956	825 - 1122

Appendix Q1

Back calculated lengths at annulus formation for year classes of yellow perch captured in Sunset Lake in 1975 and 1976.

Year class	Number of fish	Mean length at capture (mm)	Length at each annulus (mm)			
			1	2	3	4
1975						
1972	53	207	87	168	205	
1973	11	179	79	165		
1975	5	123	87			
1976						
1972	47	213	101	165	198	215
1973	12	201	97	169	201	
1974	12	156	87	156		
1975	9	106	106			
Weighted mean			93	166	202	215
Number			149	135	112	47
SD			8.0	3.4	3.3	-

Appendix Q2

Back calculated lengths at annulus formation for year classes of largemouth bass collected in 1975 and 1976 from Sunset Lake and in 1976 from Thomas Lake.

Year class	Number of Fish	Mean length at capture (mm)	Length at each annulus (mm)											
			1	2	3	4	5	6	7	8	9	10	11	12
Sunset Lake 1975														
1968	2	476	61	94	173	252	307	357	397					
1969	1	425	83	142	203	297	402	452						
1970	3	337	71	111	178	260	307							
1971	2	325	69	156	240	331								
1972	137	224	78	131	218									
1973	5	206	85	170										
1974	13	137	87											
Sunset Lake 1976														
1967	2	552	116	225	329	292	434	459	475	489	496			
1971	1	380	60	186	295	340	371							
1972	54	290	67	111	199	284								
1973	10	267	81	170	268									
1973	10	267	81	170	268									
1974	11	213	84	200										
1975	36	127	119											
Weighted mean			82	133	216	285	353	417	436	489	496			
Number		277	228	212	65	9	5	4	2	2				
SD		15.7	23.2	20.0	13.5	57.5	54.7	45	-	-				
Thomas Lake 1976														
1964	6	508	75	120	167	211	277	334	375	419	449	476	489	504
1965	1	480	63	93	141	173	233	274	323	362	407	442	476	
1966	1	487	73	149	237	306	339	376	415	438	454	464		
1967	2	469	84	141	234	300	348	392	442	488	511			
1968	5	453	88	158	214	275	362	419	454	480				
1969	3	414	78	136	202	278	358	372	401					
1970	9	370	71	122	183	257	321	363						
1971	11	307	64	112	175	233	281							
1972	15	261	67	133	200	266								
1973	13	188	67	128	196									
1974	6	148	73	146										
1975	20	58	64											
Weighted mean			69	129	192	253	310	367	408	446	458	470	487	504
Number			92	72	66	53	38	27	18	15	10	8	7	6
SD			6.4	13.2	17.4	26.2	35.6	34.1	39.7	38.5	31.1	4.9	4.9	-

Appendix Q3

Back calculated lengths at annulus formation for year classes of bluegill collected in 1975 and 1976 from Sunset Lake and in 1976 from Thomas Lake.

Year class	Number of fish	Mean length at capture (mm)	Length at each annulus (mm)						
			1	2	3	4	5	6	7
Sunset Lake 1975									
1970	6	168	40	72	117	142	175		
1971	78	169	43	79	130	163			
1972	6	155	41	93	147				
1973	5	131	44	103					
1974	8	91	44						
Sunset Lake 1976									
1970	1	210	40	95	127	155	191	219	
1971	23	189	40	69	123	152	183		
1972	1	135	43	94	141	161			
1973	6	140	43	84	158				
1974	1	103	40	80					
1975	10	44	44						
Weighted mean			43	79	130	159	182	219	
Number			135	127	121	109	30	1	
SD			.8	7.6	8.5	6.2	3.7		
Thomas Lake 1976									
1969	3	237	39	55	88	145	181	202	224
1970	22	210	39	55	88	133	170	203	
1971	30	173	42	62	95	138	176		
1972	30	140	42	66	99	137			
1973	12	96	44	67	96				
1974	2	77	50	79					
Weighted mean			42	62	95	137	174	203	224
Number			99	99	97	85	55	25	3
SD			2.0	5.1	4.2	2.6	3.4	.3	-

Appendix Q4

Lengths at capture for age groups of cisco captured by electrofishing in November 1975 from Sunset Lake. n is sample size, s is sample standard deviation.

Age	Mean length (mm)	n	s	Range
III	353	3	13.7	341 - 368
IV	352	9	15.2	315 - 365
V	370	12	11.0	354 - 386
VI	387	17	11.0	364 - 400
VII	390	2	14.1	380 - 400
VIII	405	1	-	

Appendix R

Number of largemouth bass and bluegill from Thomas Lake and cisco from Sunset Lake captured by electrofishing and the regression formulae for the catch curves shown in Figure 3.

Age class	Largemouth bass	Number Bluegill	Cisco
II	5	2	
III	10	13	
IV	8	21	3
V	8	21	8
VI	2	13	11
VII		1	17
VIII			2
IX	1		1
X			
XI			
XII	3		

Largemouth bass $Y = 2.681 - .275 X$ for ages III - IX

where X is age class and Y is ln abundance of the age class

Bluegill $Y = 4.914 - 1.522X$ for ages V - VII

Cisco $Y = 4.009 - 1.417 X$ for ages VI - VIII