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SIZE AND CONDITION OF TROUT AND SALMON FROM THE WISCONSIN WATERS OF LAKE MICHIGAN, 1969-84

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ABSTRACT

Most trout and salmon creeled in the Wisconsin waters of Lake Michigan did not decline in either weight or condition from 1969 through 1984, contradicting the widely held opinion that declining alewife abundance has led to decreasing size and condition of salmonid predators. Only chinook salmon (Onchorhyncus tshawytscha) declined in condition and trophy size (95th percentile weight) in the southern basin of Lake Michigan, beginning in 1975, confirming a possible forage limitation on their growth. Coho salmon (O. kisutch) improved in mean weight during spring in the southern basin, but were unchanged in their trophy weight and condition. Lake trout (Salvelinus namaycush) improved in their mean and trophy weights, but declined in their condition to levels similar to those in 1937 and 1938. Brown trout (Salmo trutta) mean weight and condition improved in some seasons and lake zones but trophy weight was stable. Rainbow trout (S. gairdneri) improved in mean and trophy weights and condition. Brook trout (Salvelinus fontinalis) declined in condition but were unchanged in their mean and trophy weight. I recommend that 1) stocking of chinook salmon be reduced by at least 10% and 2) size and condition of other salmonids be monitored for future change.

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INTRODUCTION

This study was undertaken to test the hypothesis that salmonid size and condition has declined in Lake Michigan and to find information that supports the further hypothesis that forage is limiting salmonid growth. Trout and salmon have been stocked in Lake Michigan in increasing numbers since the mid-60s and alewives (Alosa pseudoharengus), their primary forage, have declined lakewide to the point where some experts are cautioning against any increases in stocking (Stewart et al. 1981). These experts generally contend that salmonid predation reduced alewife abundance and, consequently, that 1) reductions in alewife abundance will allow competitors to increase in abundance; 2) growth rates and condition of forage fishes will improve as those of salmonid predators decline; and 3) diversity of diets will increase for salmonid predators. Other researchers maintain that the reductions in alewife populations resulted from a series of severe winters from 1976 through 1983 and that the evolving forage base will favor less pelagic salmonids, such as lake trout (Salvelinus namaycush)(Eck and Brown 1985).

In conjunction with these predictions by the experts, the public has begun to voice its own opinion, specifically, that the size of trout and salmon in anglers' catches has declined in recent years. Thus, there is widespread opinion that forage in Lake Michigan is insufficient to support even present levels of stocking and that salmonid growth has declined as a result. State resource agencies have responded to the controversy in recent years by either reducing or stabilizing their stocking.

METHODS

The Wisconsin Department of Natural Resources (WDNR) initiated the Lake Michigan creel survey in 1969 to assess the rapidly expanding sport fishery. The overall survey design is based on a stratified random site visitation schedule, angler interviews, and instantaneous counts of angler effort. The lakeshore is divided into geographical zones encompassing many individual sites. As the fishery grew, the number of sites surveyed and the number of clerks used to conduct the survey were increased. During the survey, trout and salmon creeled by interviewed anglers were routinely weighed and measured. Data were keyed and stored on a computer file and analyses were conducted using the SAS computer program. Data used in my analyses included only those records for which both length (inches) and weight (lbs) were recorded. The overall creel survey file consisted of 293,543 records, of which 71,545 were valid length-weight measurements.

Data were categorized by species, geographical zone, season, and year (Appendix Tables 1, 2). Six species of salmonids have been stocked by WDNR continuously from 1969 to the present and compose the bulk of the data: brook trout (Salvelinus fontinalis), brown trout (Salmo trutta), chinook salmon (Onchorhyncus tshawytscha), coho salmon (O. kisutch), lake trout (Salvelinus namaycush), and rainbow trout (Salmo gairdneri). Sites surveyed were divided into three major geographical zones: 1) Green Bay; 2) the northern lake basin, from the tip of Door County through Manitowoc County; and 3) the southern lake basin, from Sheboygan County south (Fig. 1). Dates surveyed were divided into three seasons: 1) spring (March through May), 2) summer (June through August), and 3) autumn (September through November).

Estimates of weight were calculated in three different ways for all combinations of species, zones, seasons, and years: 1) mean weight; 2) the weight at the 95th percentile of the weight distribution (trophy weight); and 3) the weight predicted for a standard length fish from the length-weight regression model (condition). Standard length of each species was the overall mean: 13-inch brook trout, 20-inch brown trout, 30-inch chinook salmon, 22-inch coho salmon, 22-inch rainbow trout, and 25-inch lake trout. Length-weight regression models were derived following calculation of mean weight at half-inch length increments. Each weight variable was used as a dependent variable and the specific hypothesis being tested was that the dependent variable did not show a negative linear relationship with year. An overall analysis of covariance (ANCOVA) was carried out for each species using year as a covariate, and zone and season as class variables. Since significant zone by season interactions were found in most species, separate regressions of mean, trophy, and standard weight on year were run for each zone and season and over all zones and seasons. Any weight statistics based on fewer than 20 fish were excluded from the analyses. The linear trend tests were not sensitive to nonlinear patterns of weight change, so plots of weight versus year were used to identify more complex trends.

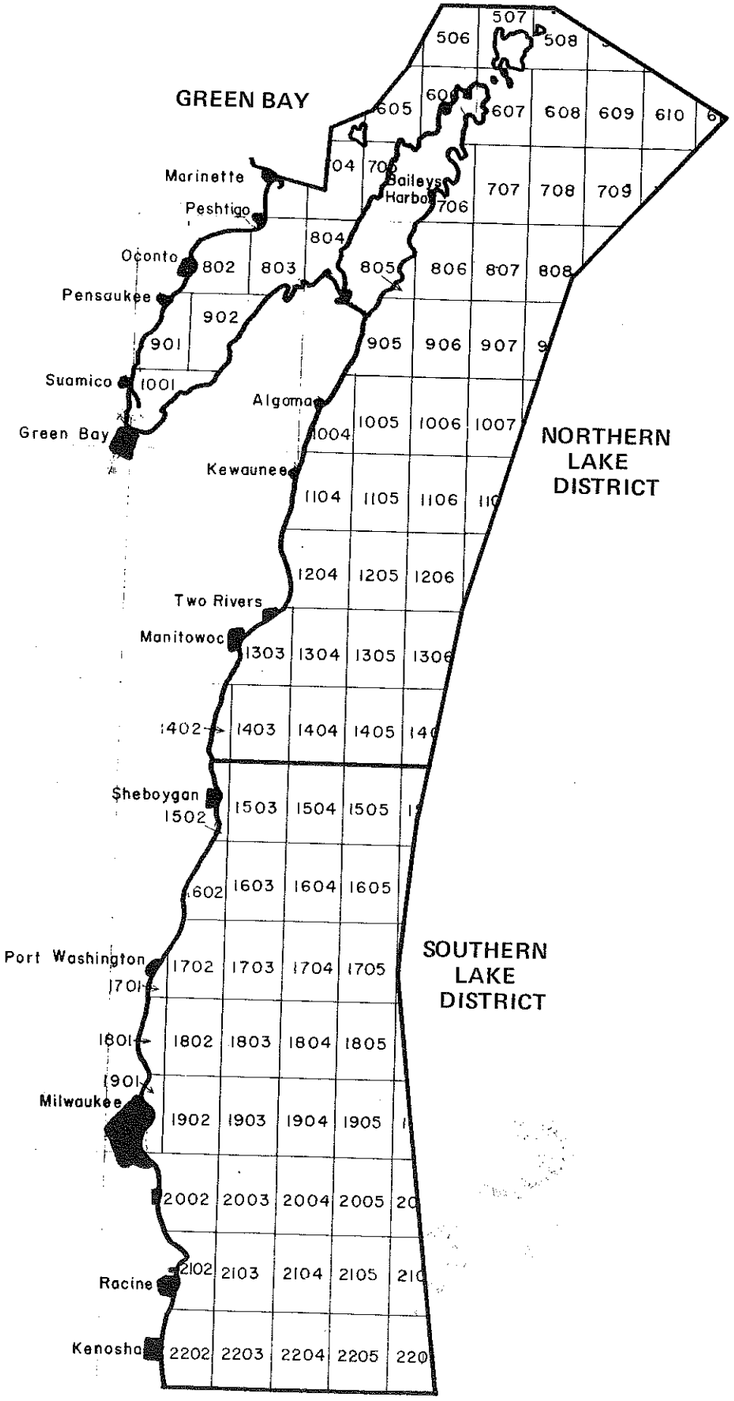

FIGURE 1. The Wisconsin waters of Lake Michigan, showing principal basins used in the analysis of salmonid weight.

RESULTS

The number of each species of fish measured corresponded roughly with their importance in the sport harvest: 21,138 coho salmon, 19,960 chinook salmon, 11,315 lake trout, 9,552 brown trout, 8,799 rainbow trout, and 781 brook trout were included. Each species is treated in turn according to the strength of the corresponding data set. Sample sizes and weight estimates for the individual species are presented in the Appendix by year, geographic zone, and season.

Coho Salmon

Coho salmon samples from the southern basin were adequate in all seasons and from the northern basin in summer and autumn. Samples from the northern basin in spring and from Green Bay were generally too small to permit making inferences about weight of coho salmon. Most coho salmon stocked by Wisconsin are released in the southern basin where they mix with those planted by other states. Subsequently, they migrate from the southern lake basin in spring to the northern lake basin in summer, before returning to their respective spawning locations in the southern lake basin in autumn (Patriarche 1980).

Overall, mean weight of coho salmon varied through the years with no significant trend (Fig. 2), but increased significantly in the southern basin in spring (P=0.0055). Thus, the early growth of this single-aged species improved over the years, while its subsequent growth remained stable. Mean weight of coho salmon increased overall from nearly 3 lbs in spring to about 6 lbs in autumn (Table 1).

TABLE 1. Mean, trophy, and standard weight of coho salmon from Lake Michigan, 1969-84.

Lake Zone	Season	Weight Parameter (±1 s.e.) Mean	Trophy	Standard
Green Bay	Spring	-	-	-
	Summer	-	-	-
	Autumn	-	-	-
North Basin	Spring	-	-	-
	Summer	5.0±1.2	8.3±1.7	4.2±0.3
	Autumn	6.6±1.2	10.9±1.2	4.4±0.4
South Basin	Spring	2.9±0.5	4.3±1.1	3.5±0.4
	Summer	4.9±0.8	7.9±1.1	4.2±0.3
	Autumn	5.8±1.2	9.5±1.1	4.3±0.6
OVERALL		4.8±0.8	8.7±1.3	4.1±0.2

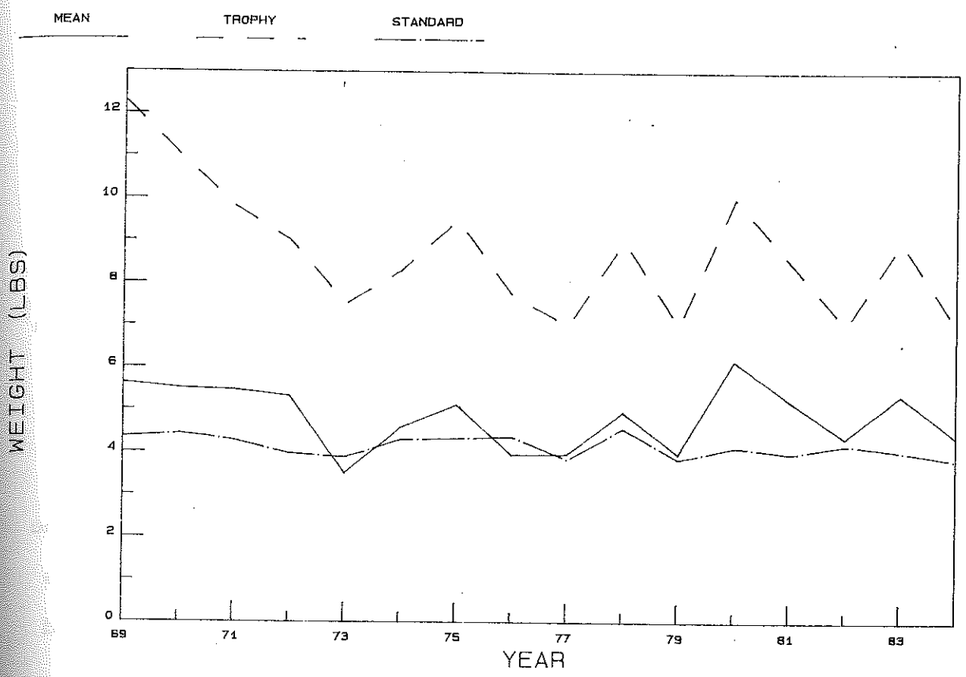

FIGURE 2. Mean, trophy, and standard weight of coho salmon caught in the Wisconsin waters of Lake Michigan, 1969-84.

Trophy weight of coho salmon, unlike mean weight, declined significantly overall through the years (P=0.0152; Fig. 2). The most dramatic decline occurred from 1969 through 1973 and was followed by an oscillating pattern of trophy weight through 1984. Trophy weight also declined in the northern basin in autumn (P=0.0158), but is of doubtful meaning because Wisconsin shifted away from stocking coho in the northern basin in the late 70s. Consequently, coho caught in the northern basin in autumn beginning in the late 70s were less likely to be adults than in previous years, reducing the estimates of trophy weight. Trophy weight increased overall from over 4 lbs in spring to about 10 lbs in autumn (Table 1).

Overall, condition of coho was unchanged through the years (Fig. 2), but declined in the northern basin in autumn (P=0.0584). However, this result is also of doubtful meaning because, as with trophy weight, samples from the northern basin in autumn were biased by a change in stocking policy in the mid-70s. Condition of coho was similar among lake zones and seasons (Table 1); a 22-inch coho salmon weighed about 4 lbs overall.

Chinook Salmon

Chinook salmon samples were adequate from the northern basin in summer and autumn and from the southern basin in all three seasons. However, even in these zones and seasons, samples were generally inadequate in 1969 and 1970, and in some cases, in 1971 and 1972. Similarly, samples were generally inadequate from Green Bay and in the spring from the northern basin. Wisconsin began stocking chinook salmon in 1969, starting with 66,000 and increasing to nearly 1 million by 1975, 2 million by 1978, and 3 million by 1984. Thus, 1972 was the first year in which a fully recruited population was available to the sport fishery. The lack of adequate samples from Green Bay is less easily explained, since many chinook are stocked in Green Bay. However, the warmer waters of Green Bay probably limit the number of fish present there through the season or restrict their presence to very deep, less accessible waters.

Overall, mean weight of chinook salmon increased through the years (P=0.0003; Fig. 3). The unusual pattern illustrated was accounted for by conflicting trends in the spring, summer, and autumn, as mean weight 1) increased steadily over the years during spring in the southern basin (P=0.0619) and summer in the northern (P=0.0002) and southern (P=0.0001) basins, and 2) increased dramatically from pre-1975 levels to post-1974 levels during autumn in the northern basin (P=0.0806). Mean weight probably increased prior to 1975 as year classes were recruited to the fishery and as stocking increased. Beginning in 1975, mean weight in most zones and seasons probably increased in conjunction with stocking rates, declining only in the northern basin in autumn by 0.4 lbs per year (P=0.0617). Chinooks caught in autumn were typically largest, averaging about 16 lbs from the northern basin and 12 lbs from the southern basin (Table 2).

TABLE 2. Mean, trophy, and standard weight of chinook salmon from Lake Michigan, 1969-84.

Lake Zone	Season	Weight Parameter (±1 s.e.) Mean	Trophy	Standard
Green Bay	Spring	-	-	-
	Summer	13.9±0.2	22.5±0.8	11.1±1.0
	Autumn	16.0±1.0	23.6±2.1	10.5±0.4
North Basin	Spring	-	-	-
	Summer	9.8±2.2	23.6±2.1	10.7±0.7
	Autumn	15.7±4.5	25.2±3.8	10.2±1.6
South Basin	Spring	10.8±3.1	19.9±2.6	11.0±1.4
	Summer	8.8±1.6	21.4±2.4	10.8±1.1
	Autumn	12.3±4.4	21.4±4.6	10.3±1.1
OVERALL		10.4±2.3	22.8±2.8	10.3±1.0

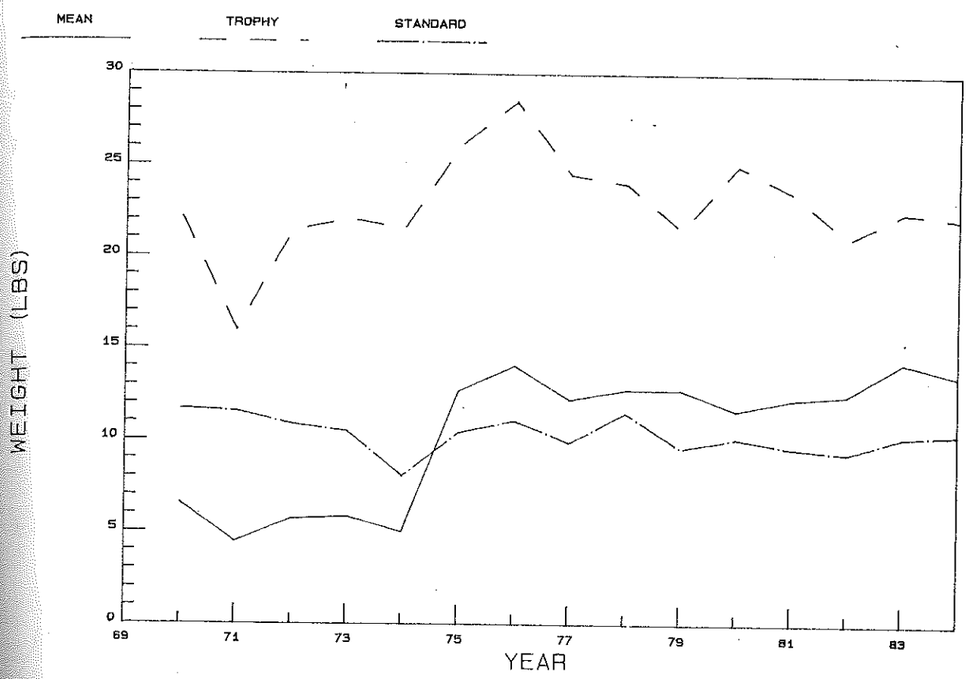

FIGURE 3. Mean, trophy, and standard weight of chinook salmon caught in the Wisconsin waters of Lake Michigan, 1969-84.

Trophy weight of chinook salmon peaked in 1976, then declined through 1984 by 0.6 lbs per year (P=0.0125; Fig. 3). The same pattern was repeated in the northern basin in summer (P=0.0458) and in the southern basin in summer (P=0.0266) and autumn (P=0.0066). Thus, trophy weight of chinook salmon declined after 1976, though not in the same zone or season as mean weight. Trophy weight was greatest in autumn, averaging about 25 lbs in the northern basin and 21 lbs in the southern basin (Table 2).

Condition of chinook salmon exhibited no overall trend through the years (Fig. 3) but declined by 0.2-0.4 lbs per year in the southern basin in spring (P=0.0704), summer (P=0.0004), and autumn (P=0.0685). In contrast, condition of chinooks in the northern basin was relatively stable over the years. Thus, declining condition of 30-inch chinook salmon in the southern basin may have led to their reduced trophy weight there. Other weight changes detected were apparently not related to changing condition, but rather to some other factor such as stocking rate, exploitation rate, migration rate, or habitat shifts. Condition declined seasonally from 11 lbs in spring to 10 lbs in autumn (Table 2).

Lake Trout

Lake trout samples were adequate in the northern and southern basins, and generally inadequate from Green Bay. Lake trout are not stocked in Green Bay due to high incidental mortality in the large-mesh gill net fishery. Stocking of lake trout yearlings in Wisconsin waters was begun in 1965 with 205,000 fish, increased to more than 1 million by 1967, and has been relatively stable at about 1 million since then.

Overall, mean weight of lake trout increased (P=0.0001; Fig. 4), specifically in the northern basin in summer (P=0.0001) and autumn (P=0.0416), and in the southern basin in spring (P=0.0865) and summer (P=0.0002). These increases in mean weight probably reflect the gradual maturation of the lake trout population recruited to the sport fishery over the years (lake trout are known to live in excess of 20 years). Mean weight was greater in spring and autumn than in summer, averaging more than 6 lbs overall (Table 3).

TABLE 3. Mean, trophy, and standard weight of lake trout from Lake Michigan, 1969-84.

Lake Zone	Season	Weight Parameter (±1 s.e.) Mean	Trophy	Standard
Green Bay	Spring	-	-	-
	Summer	-	-	-
	Autumn	-	-	-
North Basin	Spring	7.3±0.8	12.9±0.5	5.7±0.2
	Summer	6.2±0.5	11.3±0.9	5.8±0.3
	Autumn	6.5±0.5	11.6±1.6	5.6±0.3
South Basin	Spring	7.0±1.7	13.7±4.0	5.9±0.2
	Summer	6.2±0.4	11.2±0.8	5.8±0.2
	Autumn	7.0±0.9	11.1±2.0	5.7±0.6
OVERALL		6.3±0.5	11.1±0.8	5.8±0.2

Trophy weight of lake trout also increased overall (P=0.0001; Fig. 4), specifically in the northern basin in spring (P=0.0047), summer (P=0.0001), and autumn (P=0.0057), and in the southern basin in summer (P=0.0423). Again, as with mean weight, these increases in trophy weight probably reflected an overall maturation of the lake trout population. Trophy weight was greatest in spring, averaging about 13 lbs in the northern basin and 14 lbs in the southern basin (Table 3).

Condition of lake trout, in contrast to average and trophy weights, declined overall by 0.02 lbs per year (P=0.0623; Fig. 4), though not in any season or zone. This trend in condition is not convincing, however, given the level of

significance and the modest rate of decline. Condition of 25-inch lake trout was similar among lake basins and seasons, averaging nearly 6 lbs overall (Table 3).

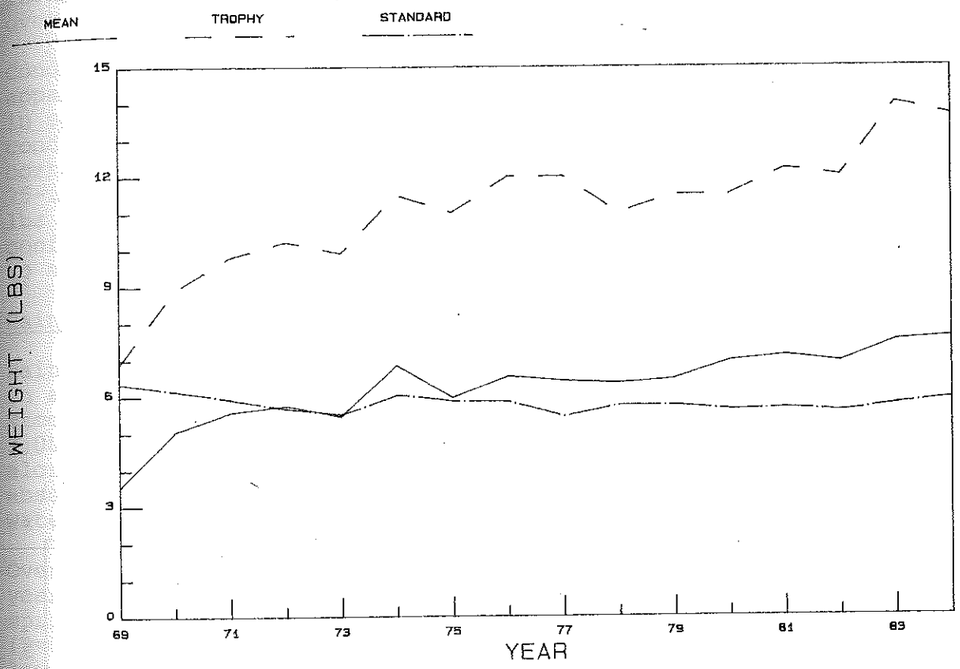

FIGURE 4. Mean, trophy, and standard weight of lake trout caught in the Wisconsin waters of Lake Michigan, 1969-84.

Brown Trout

Brown trout samples were adequate from the lake zones in all seasons and in Green Bay in recent years. Brown trout are stocked in large numbers throughout Wisconsin's waters of Lake Michigan and prefer the warmer inshore waters of the lake zones and Green Bay. Stocking began in 1966 with 43,000 and now exceeds 1 million fish per year.

Mean weight of brown trout exhibited no overall trend through the years (Fig. 5) but increased in the southern basin in spring (P=0.0763) and summer (P=0.0807). Generally, brown trout were larger in Green Bay than in the lake and larger in the northern basin than in the southern basin (Table 4). Mean weight increased greatest from spring to summer, averaging nearly 5 lbs overall.

TABLE 4. Mean, trophy, and standard weight of brown trout from Lake Michigan, 1969-84.

Lake Zone	Season	Weight Parameter (±1 s.e.) Mean	Trophy	Standard
Green Bay	Spring	3.8±0.6	7.8±1.8	3.8±0.3
	Summer	6.2±1.2	11.4±2.5	4.7±0.5
	Autumn	6.5±0.5	10.1±0.5	4.4±0.3
North Basin	Spring	3.7±0.7	7.6±1.3	4.2±0.3
	Summer	5.1±1.4	10.5±1.7	4.7±0.3
	Autumn	5.5±1.3	10.5±1.4	4.1±0.3
South Basin	Spring	3.3±0.6	7.2±1.4	4.1±0.3
	Summer	4.9±1.1	10.4±1.9	4.4±0.4
	Autumn	5.2±0.8	9.9±1.4	4.1±0.4
OVERALL		4.8±0.8	9.8±0.9	4.2±0.2

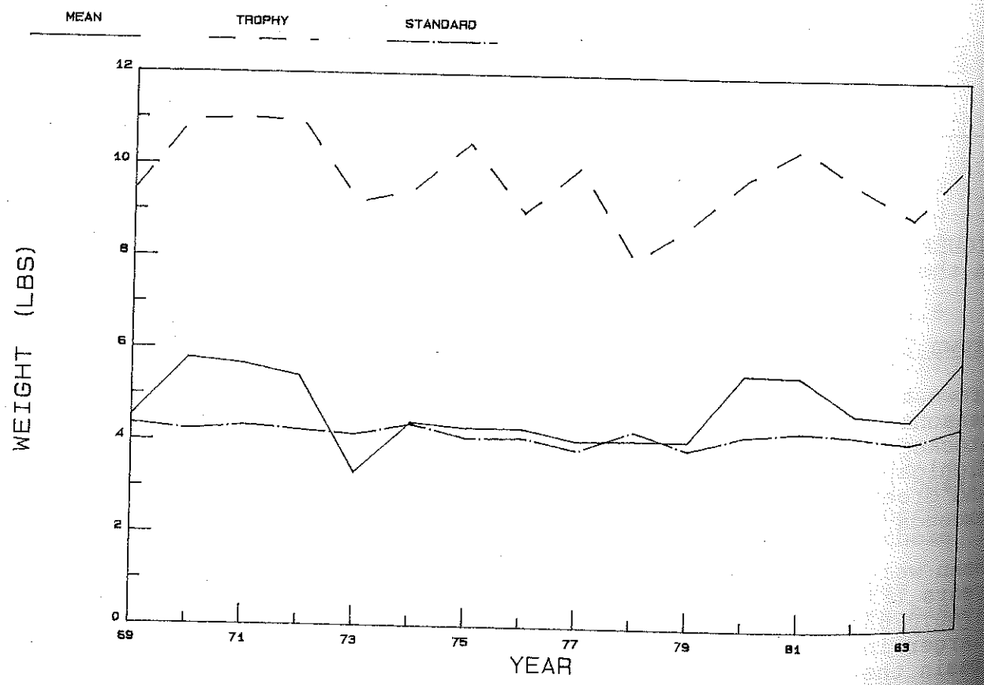

FIGURE 5. Mean, trophy, and standard weight of brown trout in the Wisconsin waters of Lake Michigan, 1969-84.

Similarly, trophy weight of brown trout exhibited no overall trend through the years (Fig. 5) or in any zone or season. Also, trophy weight was generally greater in Green Bay than in the lake and decreased from the north to south basins. Trophy weight increased from spring through autumn, averaging nearly 10 lbs overall (Table 4).

Condition of brown trout varied overall through the years with no apparent pattern (Fig. 5), but increased in the southern basin in spring (P=0.0125) and autumn (P=0.0421). Evidently, improving condition of brown trout in the southern lake basin led to a corresponding improvement in their mean weight. Condition of 25-inch brown trout was greatest in summer, averaging more than 4 lbs overall (Table 4). This pattern in brown trout condition confirms the rapid increase in mean and trophy weight from spring to summer and subsequent slowdown from summer to autumn.

Rainbow Trout

Rainbow trout samples were generally adequate from the lake zones in all seasons and inadequate from Green Bay. Wisconsin first stocked rainbow trout in Lake Michigan in 1963, starting with 9,000 fish. Today, more than 1 million are stocked annually along the Wisconsin shoreline and in tributary streams. Their absence from Green Bay probably reflects the unfavorably warm waters there during much of the open water season.

Overall, the mean weight of rainbow trout increased through the years (P=0.0593; Fig. 6), specifically in the northern basin in spring (P=0.0558) and in the northern (P=0.0051) and southern (P=0.0108) basins in summer. Mean weight, as in brown trout, was lowest in spring, peaked in summer, and fell off slightly in autumn, averaging more than 5 lbs overall (Table 5).

TABLE 5. Mean, trophy, and standard weight of rainbow trout from Lake Michigan, 1969-84.

Lake Zone	Season	Weight Parameter (±1 s.e.) Mean	Trophy	Standard
Green Bay	Spring	-	-	-
	Summer	-	-	-
	Autumn	5.3±1.1	11.8±1.8	5.4±0.6
North Basin	Spring	5.2±1.0	10.6±1.7	4.5±0.5
	Summer	5.7±0.9	11.7±1.9	4.6±0.4
	Autumn	5.7±0.8	10.4±1.2	4.8±0.3
South Basin	Spring	4.5±1.0	9.0±1.2	4.3±0.3
	Summer	5.9±0.7	11.6±1.1	4.7±0.4
	Autumn	5.3±0.9	9.6±1.3	4.7±0.4
OVERALL		5.4±0.7	10.5±0.8	4.5±0.3

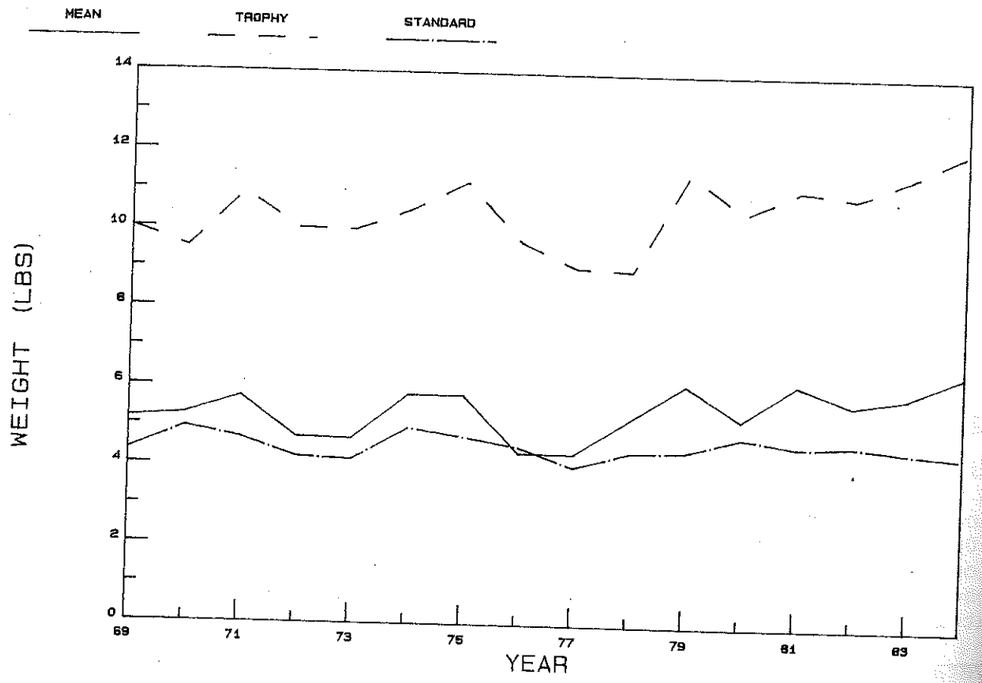

FIGURE 6. Mean, trophy, and standard weight of rainbow trout caught in the Wisconsin waters of Lake Michigan, 1969-84.

The trophy weight of rainbow trout also increased overall (P=0.0342; Fig. 6), specifically in the northern (P=0.0765) and southern basins (P=0.0026) in summer. As with mean weight, trophy weight was lowest in spring, peaked in summer, and fell off slightly in autumn, averaging more than 10 lbs overall (Table 5).

The condition of rainbow trout varied overall through the years with no apparent pattern (Fig. 6) but improved in the southern basin in summer (P=0.0818). As with mean and trophy weights, condition of 22-inch rainbow trout was lowest in spring and increased in summer and autumn, averaging more than 4 lbs overall (Table 5). Thus, improved condition of rainbow trout over the years may have led to increased mean and trophy weight, at least in the southern basin in summer. Also, the seasonal pattern in size of rainbow trout corresponded to the seasonal pattern in their condition.

Brook Trout

There were no detectable trends in mean or trophy weights of brook trout but their condition declined overall by 0.02 lbs per year (P=0.0651; Fig. 7). Mean weight overall was 1.2±0.4 lbs, trophy weight was 2.8±0.7 lbs, and condition was 1.0±0.1 lbs. Few brook trout were measured during the years of the survey, limiting the ability of the analyses to detect significant relationships. Thus, the lack of many detectable relationships may be more a function of statistical power than biological effect. Conversely, the decline in overall condition that was detected is not convincing, given the level of significance, the small size of the slope, and the lack of corroborating evidence from the remaining analyses.

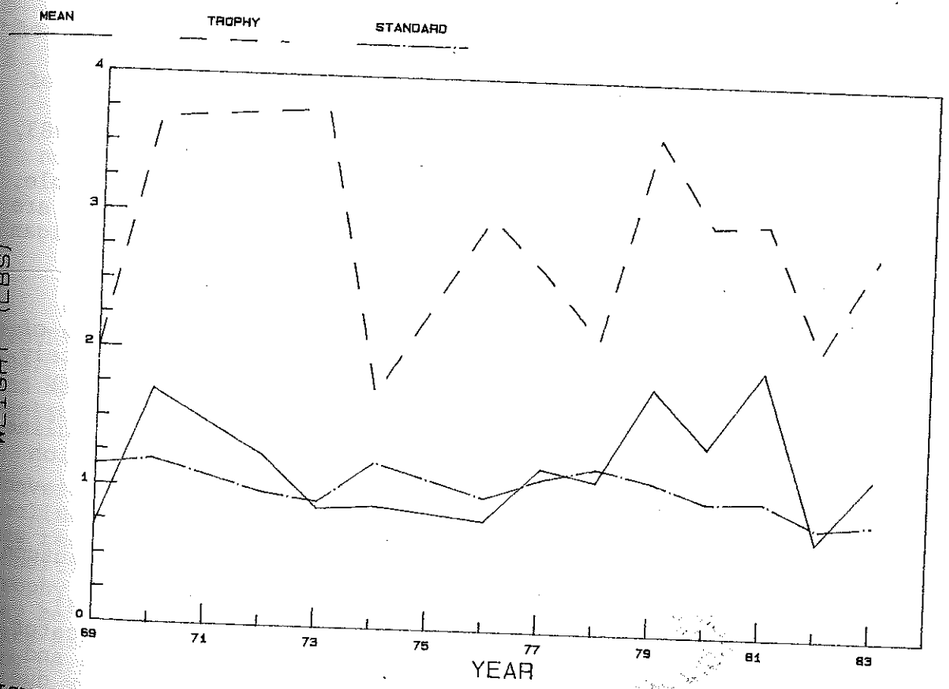

FIGURE 7. Mean, trophy, and standard weight of brook trout caught in the Wisconsin waters of Lake Michigan, 1969-84.

DISCUSSION

The results of my study lend little support to the hypothesis that size and condition of trout and salmon declined from 1969 to the present. Mean weight of creeled trout and salmon declined only for chinook salmon from the northern basin in autumn. Conversely, mean weight increased for chinook salmon (in other seasons and zones), coho salmon, lake trout, brown trout, and rainbow trout. Similarly, trophy weight increased for lake and rainbow trout over the study period, and declined only for chinook salmon from 1975-84 and for coho salmon from 1969-73. Finally, condition tended to improve through the years for brown and rainbow trout and decline for chinook salmon, lake and brook trout.

My data for coho salmon from the southern basin in autumn approximate apical growth of coho (essentially a single-aged species in the sport harvest), strongly suggesting that growth of coho salmon remained constant from 1969-84. These results contradict those of Hay (1984), who found that average weight of coho salmon at the Little Manistee River weir in Michigan decreased from 1968 through 1979 and then increased through 1983, and those of Hagar (1984), who found that growth of coho salmon declined from 1967 through 1983. Though not directly comparable, my data are continuous and derived from a constant source, as are Hay's. Hagar's data, however, are drawn from studies in Michigan in 1967 and Wisconsin in 1971, 1982, and 1983.

Similarly, my results supporting the stability of coho salmon condition contradict Hagar's (1984) conclusion that condition of coho in Lake Michigan declined from 1969 to 1983. Unfortunately, he based his conclusion on a subset of the data analyzed in my study (1969-73) with one year (1983) of his own data. The importance of the missing data is apparent (Fig. 2). The decline from 1970 through 1973 noted by Hagar appears as mere variation when viewed in the context of the inclusive data from 1969 through 1984.

Mean weight of creeled chinooks from the northern basin in autumn closely paralleled mean weight of age 3+ spawners at the Strawberry Creek weir (M. Toneys, WDNR, unpubl. data; Fig. 8), lending confidence to the creel survey data as a valid indicator of population growth trends. Discrepancies between my data and that from Strawberry Creek occurred only in 1974, apparently due to unusually large numbers of smaller, younger fish creeled in that year. Hay (1984) reported a similar pattern in mean size of age 3+ chinooks at the Little Manistee River weir in Michigan; peak size occurred in 1976, declined through 1978, then rose through 1983. These results all conflict with Hagar's (1984) conclusion that growth of chinook salmon declined from 1971 through 1983. My data and that of Hay (1984) suggest that growth peaked in 1976, then stabilized in the late 70s and early 80s.

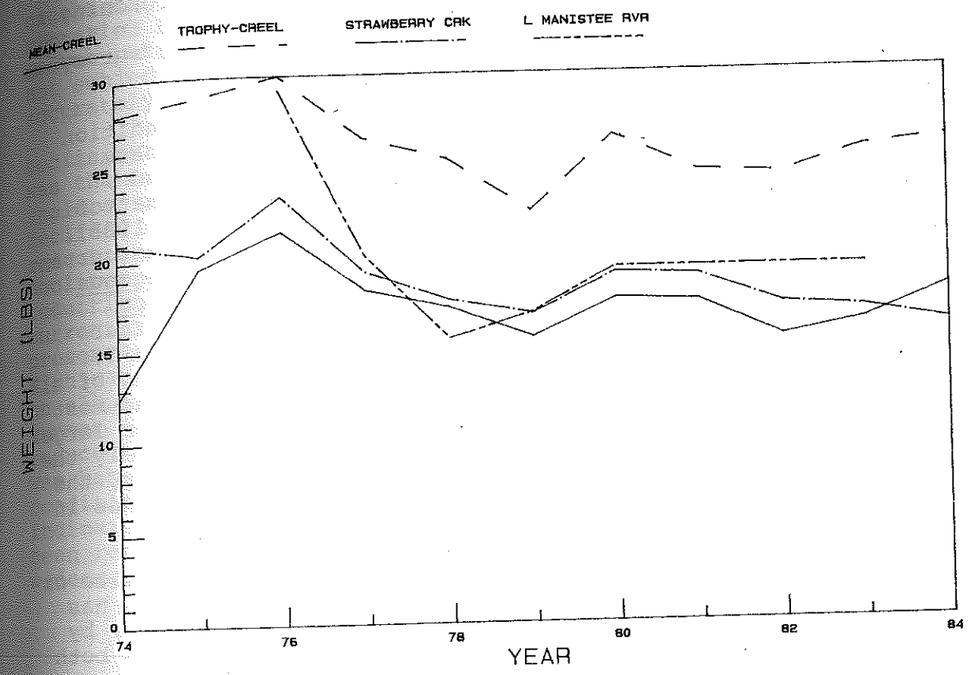

FIGURE 8. Autumn weight of chinook salmon caught by Wisconsin anglers in northern Lake Michigan (average and trophy weights) and harvested for spawn at the Strawberry Creek and Little Manistee River weirs (average weight), 1974-84.

Conversely, my results for chinook salmon condition confirm the decline noted by Hagar (1984), though they indicate the decline was restricted to the southern lake basin. This decline in condition, taken in conjunction with the observed decline in trophy size of chinooks, lends support to the notion that there may be a forage base limitation on growth of chinook salmon in Lake Michigan, especially larger individuals caught in the southern basin.

Finally, my results for lake, brown, rainbow, and brook trout fail to document any declines in size or condition over the years. Mean and trophy size of all four species either increased or were stable from 1969 through 1984. Condition of lake and brook trout declined overall at modest rates of 0.02 lbs per year. Such modest declines are certainly not alarming and could be indicative of factors other than forage availability, especially since these species are less susceptible to reduced alewife abundance than the more pelagic salmon species (Eck and Brown 1985). Condition of 25-inch lake trout declined from an

estimated 6.0 lbs in 1969 to 5.6 lbs in 1984, thus approaching their more typical historical level of 5.7 lbs observed in March 1937 and November 1938 (R. J. Poff, WDNR, unpubl. creel survey data).

I conclude that only the declines in trophy size and condition of chinook salmon are likely linked to observed forage base declines. First, the timing of declining trophy size and condition of chinook salmon corresponded roughly with that of declining alewife abundance (Jude and Tesar 1985, Wells 1985). Second, pelagic salmon predators are disadvantaged by the current mix of less pelagic forage species (i.e., bloaters (Coregonus hoyi), rainbow smelt (Osmerus mordax), yellow perch (Perca flavescens) (Jude and Tesar 1985, Wells 1985) than are other salmonid predators (Stewart et al. 1981, Eck and Brown 1985). Third, chinook salmon are the most energetically demanding of all salmonids examined (Stewart et al. 1981) and thus, are the most susceptible to reduced forage availability, especially the larger "trophy" individuals. Finally, the southern basin is likely the area where alewives have declined the most--coincidentally, the location where most declines in trophy size and all declines in condition were detected.

It might be argued that a failure to detect a decline in size or condition does not preclude the possibility that a decline has occurred. Any statistical analysis is limited in its power by the strength of the data set. The data set I analyzed was both large and continuous for most species, though variable within years, zones, and seasons. Consequently, significant trends were generally detected in cases where sample sizes were large. Also, most such significant relationships were easily interpretable in some biological way. The difficulty with my results is that they run counter to popular opinion. Weight and condition of most species did not decline in any meaningful way.

It is possible, also, that sizes of fish creeled do not accurately represent the size distribution of the underlying population, and thus cannot be used for drawing conclusions about that population. Anglers have a strong tendency to "high-grade" their catch, both by learning to catch bigger fish in the population and by physically selecting larger fish caught. It may also be true that larger, faster-growing fish are more easily caught by anglers than their smaller, slower-growing counterparts. Anglers may thus influence the size distribution of targeted fish populations. These weaknesses with creel data have been recognized for some time and may also apply to the data set used in my analysis. It is nonetheless true that changes in the population size structure will eventually be evident in the angler's creel, though perhaps less dramatically or after a time lag.

Finally, even if the angler creel is exactly representative of the underlying population, the average weight of fish caught is still not necessarily an index of growth. Average weight of fish

caught can be influenced by stocking rates, exploitation rates, migration rates, and habitat shifts--all factors unrelated to growth rates. Condition of fish caught, on the other hand, is not subject to influence by such factors and would more accurately illustrate growth patterns.

Declining condition and trophy weight of chinook salmon, then, was the only evidence produced from my analysis to support anglers' assertions that the size of trout and salmon caught has declined over the years. It is possible that more widespread reductions in size would have been a function of observed declines in alewife abundance. In the absence of more widespread reductions, however, I conclude that alewife abundance is currently not limiting the growth of most salmonid predators at present stocking levels. Indeed, food habit studies in Lake Michigan indicate that salmonids have continued to forage largely on alewives and have switched to alternate prey only in late summer (Hagar 1984). Unfortunately, Hagar's conclusion that reduced forage has retarded the growth of chinook and coho salmon was based on his presentation of limited data on these salmonids' condition and growth. My analysis of more complete data indicates that only the growth of larger chinook salmon may have been reduced. Nonetheless, such declines may portend more widespread forage base impacts on salmonid growth and condition.

MANAGEMENT IMPLICATIONS

The Lake Michigan sport fishery was developed through the intensive stocking efforts of Michigan, Wisconsin, Illinois, and Indiana. The stocking program was primarily conceived to control abundant stocks of exotic alewives and secondarily to provide a recreational fishery. However, the success of the fishery soon became legend and stocking grew dramatically as a result. Wisconsin alone increased its stocking from 9,000 rainbow trout in 1963 to more than 3 million brown, rainbow, brook, and lake trout and coho and chinook salmon only a decade later. Today, Wisconsin and Michigan each stock twice that number, while Illinois and Indiana stock lesser amounts.

The widespread belief that depleted alewife populations have resulted in starved and undersized salmon and trout has caused management agencies to modify their stocking rates. It is likely that these decisions to reduce or stabilize stocking are premature and that there is still room in Lake Michigan for more salmonids, as was proposed recently for lake trout (Eck and Brown 1985). While this may be good policy for re-establishing a self-sustaining lake trout population in Lake Michigan (Eck and Brown 1985), it is questionable for other species, especially since growth in the fishery has apparently leveled off, at least in Wisconsin. Thus, a reasonable stocking policy for Wisconsin seems to have been reached, though perhaps for the wrong reason.

For the present, stabilized stocking remains a sound management policy.

It is now widely held that salmonid predators in Lake Michigan have mechanistic control over alewife population structure and, conversely, that salmonid growth is controlled by alewife abundance (Stewart et al. 1981). However, alewife year-class strength may be primarily under environmental control, with salmonid predation playing only a secondary role (Eck and Brown 1985). Whether salmonid predators have played a primary or secondary role in structuring alewife year-class strength, the alewife population reduction observed in recent years has afforded other species such as yellow perch, rainbow smelt, and bloater chubs an opportunity to rebound (Jude and Tesar 1985, Wells 1985). The resultant community is more diverse and, thus, more desirable. Consequently, the salmonid stocking program is still a critical link in the effective management of the Lake Michigan ecosystem.

I recommend that stocking of chinook salmon be reduced lakewide (initially, at least a 10% reduction should be tried) and that their condition and trophy size be monitored for overall improvement, especially in the southern lake basin. Similarly, I recommend that monitoring of the size and condition of other salmonids be continued to assess ecosystem health in the future and to allow subsequent changes in the present stocking policy. Stocking of a particular species should be reduced when that species' growth is hindered.

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APPENDIX TABLE 1. Number, mean, trophy, and standard weight of salmonids from the Wisconsin waters of Lake Michigan over all seasons and lake zones, 1969-84.

COHO SALMON

YEAR	NUM	AVERAGE	TROPHY	STANDARD
69	145	5.62069	12.29	4.34550
70	638	5.49498	11.00	4.43550
71	686	5.45481	9.80	4.26834
72	2385	5.31623	9.00	3.96131
73	1863	3.49678	7.50	3.87655
74	2737	4.59233	8.30	4.31359
75	1489	5.13096	9.50	4.33734
76	1531	3.94265	7.70	4.37418
77	2434	3.97453	7.00	3.83983
78	1261	4.96622	9.00	4.57961
79	1241	3.97333	7.00	3.84213
80	1167	6.18329	10.00	4.14114
81	1069	5.22993	8.50	3.97892
82	1038	4.34441	7.00	4.19854
83	639	5.37778	9.00	4.02975
84	815	4.36356	7.00	3.81845

CHINOOK SALMON

YEAR	NUM	AVERAGE	TROPHY	STANDARD
70	34	6.5353	22.1249	11.6762
71	102	4.4216	15.9700	11.5425
72	195	5.7036	21.4200	10.8566
73	763	5.8391	22.0800	10.4719
74	693	4.9776	21.5000	8.0512
75	582	12.7096	26.0850	10.4363
76	1334	14.0942	28.5000	11.1001
77	1812	12.2345	24.5000	9.8814
78	1361	12.8065	24.0000	11.5412
79	1890	12.8022	21.5000	9.5989
80	2301	11.6386	25.0000	10.1518
81	2103	12.2913	23.5000	9.5990
82	1635	12.5354	21.0400	9.3304
83	2768	14.3281	22.5000	10.2517
84	2383	13.5363	22.1000	10.4103

LAKE TROUT

YEAR	NUM	AVERAGE	TROPHY	STANDARD
69	71	3.54085	6.88	6.35606
70	268	5.04888	8.91	6.14554
71	522	5.58333	9.80	5.91814
72	577	5.76170	10.22	5.65720
73	1058	5.44802	9.90	5.50063
74	601	6.84759	11.48	6.03886
75	473	5.95307	11.00	5.86077
76	1998	6.54479	12.00	5.84667
77	877	6.40673	12.00	5.43895
78	567	6.34885	11.00	5.75774
79	822	6.48224	11.50	5.74096
80	584	6.96644	11.50	5.61063
81	783	7.10805	12.20	5.66508
82	582	6.91529	12.00	5.55688
83	1008	7.51230	14.00	5.77328
84	524	7.60840	13.65	5.93453

BROWN TROUT

YEAR	NUM	AVERAGE	TROPHY	STANDARD
69	161	4.51553	9.430	4.3411
70	248	5.77702	10.955	4.2196
71	139	5.64964	11.000	4.3276
72	266	5.39850	10.930	4.2230
73	149	3.31275	9.200	4.1401
74	361	4.42244	9.480	4.3866
75	478	4.30628	10.500	4.0856
76	837	4.32186	9.000	4.1164
77	946	4.05391	10.000	3.8556
78	520	4.09808	8.000	4.2961
79	801	4.09563	8.790	3.8994
80	926	5.56436	9.800	4.2257
81	729	5.52003	10.500	4.3326
82	724	4.71519	9.675	4.2401
83	1169	4.59213	9.000	4.0840
84	1098	5.86448	10.200	4.4123

RAINBOW TROUT

YEAR	NUM	AVERAGE	TROPHY	STANDARD
69	154	5.15974	10.000	4.35128
70	231	5.27229	9.500	4.94125
71	278	5.73165	10.905	4.66702
72	302	4.69470	10.000	4.20095
73	602	4.66545	9.970	4.14473
74	843	5.79846	10.500	4.95225
75	756	5.79537	11.215	4.73755
76	946	4.35899	9.700	4.50291
77	1207	4.34673	9.060	4.01638
78	722	5.25443	9.000	4.41651
79	884	6.15215	11.500	4.45487
80	641	5.25491	10.500	4.82537
81	435	6.18667	11.120	4.59771
82	267	5.65506	10.920	4.65445
83	283	5.90035	11.480	4.50054
84	248	6.50161	12.155	4.39259

BROOK TROUT

YEAR	NUM	AVERAGE	TROPHY	STANDARD
69	75	0.69867	2.00000	1.14172
70	24	1.70000	3.67499	1.19455
72	53	1.23396	3.73000	0.96698
73	31	0.86129	3.76000	0.91017
74	59	0.89153	1.70000	1.20378
76	49	0.79592	3.00000	0.96630
77	64	1.19219	2.59999	1.11160
78	137	1.10219	2.13000	1.20203
79	57	1.79123	3.59999	1.10815
80	82	1.36707	2.97000	0.96983
81	40	1.93500	3.00000	0.98812
82	32	0.70000	2.07000	0.80321
83	28	1.16786	2.77499	0.84650

APPENDIX TABLE 2. Number, mean, trophy, and standard weight of salmonids in spring, summer, and autumn from the Green Bay, northern Lake Michigan, and southern Lake Michigan lake zones, 1969-84.

COHO SALMON

Green Bay Zone - Autumn

YEAR	NUM	AVERAGE	TROPHY	STANDARD
77	58	6.63448	9.52499	4.26430
80	142	6.73803	8.80000	5.08696

Northern Lake Zone - Spring

YEAR	NUM	AVERAGE	TROPHY	STANDARD
84	26	3.96154	5.825	3.88962

Northern Lake Zone - Summer

YEAR	NUM	AVERAGE	TROPHY	STANDARD
71	65	6.08000	9.940	4.44869
72	83	4.45783	9.380	4.11025
73	90	2.12222	5.500	3.84568
74	384	5.00677	7.500	4.65219
75	46	4.83913	8.465	4.24400
76	146	4.33219	7.165	4.10599
77	379	4.83404	7.200	3.81348
78	100	4.34200	7.100	3.84808
79	53	4.31132	7.510	4.09304
80	227	7.21630	10.500	4.84484
81	38	6.35789	10.525	4.03470
82	117	4.66667	6.730	3.76145
83	84	6.34405	10.875	4.04437
84	171	5.12749	8.040	4.37325

Northern Lake Zone - Autumn

YEAR	NUM	AVERAGE	TROPHY	STANDARD
69	73	7.94110	13.300	4.97418
70	282	7.08298	11.985	4.79509
71	34	8.70882	13.225	4.89049
72	156	6.47756	10.545	4.25663
73	207	5.14155	9.720	3.93189
74	138	4.74348	11.520	4.55442
75	46	7.16087	10.430	3.98141
76	77	6.53117	11.120	4.25569
77	97	6.03608	9.010	3.77784
79	70	5.50714	8.225	4.23016
80	81	7.33086	10.950	4.41944

Southern Lake Zone - Spring

YEAR	NUM	AVERAGE	TROPHY	STANDARD
69	47	2.20851	3.00000	2.88283
70	133	2.78571	4.00000	3.63732
71	106	3.10377	4.50000	3.71440
72	91	2.34066	4.59999	2.48763
73	138	2.01884	3.00000	3.19653
74	174	2.96724	4.00000	3.92354
75	206	2.71990	4.00000	3.78653
76	228	2.46140	3.50000	3.25828
77	623	2.55120	3.50000	3.25494
78	185	3.46432	7.00000	4.11508
79	164	2.61037	3.30000	3.22050
80	142	3.26549	4.50000	3.52992
81	307	3.71140	5.00000	3.91925
82	335	3.09851	4.11999	3.56537
83	195	4.40564	6.00000	3.87704
84	218	3.18165	4.10500	3.45398

Southern Lake Zone - Summer

YEAR	NUM	AVERAGE	TROPHY	STANDARD
70	181	5.25967	8.5	4.46126
71	465	5.74731	9.0	4.37337
72	1959	5.44497	8.6	4.05869
73	1261	3.35813	6.5	3.91386
74	1651	4.75421	7.7	4.35285
75	1072	5.21558	9.0	4.52051
76	1021	3.86709	6.5	4.16421
77	1208	4.06142	6.5	3.73532
78	874	5.19886	9.0	4.78367
79	845	3.93444	6.5	3.93688
80	483	6.10890	9.5	4.33752
81	642	5.83318	8.7	3.97452
82	520	4.87404	7.2	4.11446
83	319	5.48056	8.0	4.20257
84	353	4.56997	7.0	3.77925

Southern Lake Zone - Autumn

YEAR	NUM	AVERAGE	TROPHY	STANDARD
70	29	4.87241	9.750	4.51619
72	96	4.36458	9.015	3.43451
73	167	4.46707	8.180	4.38760
74	389	4.17455	10.000	4.26120
75	111	8.26667	11.500	4.77575
76	55	6.84000	11.000	4.65520
77	64	5.50937	9.000	3.92384
78	90	6.38333	9.500	4.61987
79	108	5.16389	8.410	4.13096
80	78	7.08205	10.045	4.55287
81	68	5.66765	8.855	4.00903
82	63	5.87778	8.90	3.91509
83	33	7.31818	10.65	5.77665
84	36	5.54167	8.00	3.38284

CHINOOK SALMON

Green Bay Zone - Summer

YEAR	NUM	AVERAGE	TROPHY	STANDARD
82	39	13.8000	22.0	10.8359
83	160	13.8594	22.0	10.2593
84	127	14.1031	23.4	12.2343

Green Bay Zone - Autumn

YEAR	NUM	AVERAGE	TROPHY	STANDARD
77	68	16.9603	25.55	10.8647
80	151	16.4768	25.10	10.6790
82	126	14.2548	20.36	9.9480
83	222	16.1131	24.00	10.1942
84	249	16.1080	22.95	10.6124

Northern Lake Zone - Spring

YEAR	NUM	AVERAGE	TROPHY	STANDARD
83	96	15.1396	21.00	10.9668
84	35	18.2943	25.22	12.0778

Northern Lake Zone - Summer

YEAR	NUM	AVERAGE	TROPHY	STANDARD
71	30	5.5267	23.515	11.3377
73	109	3.1239	22.150	11.2469
74	51	4.8843	19.520	11.6915
75	52	8.2769	26.750	11.2063
76	304	5.5062	24.500	10.9167
77	320	7.6087	23.955	10.2471
78	156	14.3314	25.415	10.3703
79	197	13.6599	23.230	10.0074
80	392	10.7166	27.000	10.8612
81	548	13.1131	24.110	10.1977
82	472	12.7424	21.500	9.2019
83	879	14.7534	23.000	10.3090
84	681	13.4799	22.300	11.7511

Northern Lake Zone - Autumn

YEAR	NUM	AVERAGE	TROPHY	STANDARD
72	27	3.5630	14.5599	9.9534
73	139	11.4799	24.5000	9.9014
74	73	12.4986	28.1100	7.1948
75	194	19.5387	28.9250	11.8591
76	522	21.4743	30.0000	11.2080
77	222	18.2225	26.5000	9.9723
78	56	17.1679	25.3300	11.1229
79	285	15.5386	22.410	9.2897
80	484	17.6070	26.500	9.8940
81	345	17.3667	24.500	9.9334
82	42	15.4357	24.275	8.1743
83	148	16.2716	25.665	10.5406
84	170	18.0759	26.245	13.5316

Southern Lake Zone - Spring

YEAR	NUM	AVERAGE	TROPHY	STANDARD
77	39	4.4769	17.0000	13.62[illegible]
79	124	9.5685	16.8000	9.87[illegible]
80	31	12.7613	24.2000	11.08[illegible]
81	52	12.6846	21.1650	11.55[illegible]
82	81	11.5111	20.9800	10.95[illegible]
83	332	13.5672	20.4799	10.55[illegible]
84	235	10.9949	18.6800	9.36[illegible]

Southern Lake Zone - Summer

YEAR	NUM	AVERAGE	TROPHY	STANDARD
71	52	4.5500	16.6200	12.357[illegible]
72	139	6.0432	21.4000	11.566[illegible]
73	410	5.3029	22.3250	11.061[illegible]
74	453	3.9190	16.3600	11.223[illegible]
75	249	7.6201	22.1500	11.701[illegible]
76	321	7.6414	24.8299	11.549[illegible]
77	669	9.4852	23.5998	10.004[illegible]
78	842	12.3259	23.4550	11.897[illegible]
79	907	11.5914	21.0000	10.680[illegible]
80	716	7.8841	22.3300	10.389[illegible]
81	976	9.8592	22.3150	10.008[illegible]
82	625	11.9971	20.9100	9.5224
83	820	13.3757	21.4750	10.2949
84	480	12.0477	20.9950	9.5925

Southern Lake Zone - Autumn

YEAR	NUM	AVERAGE	TROPHY	STANDARD
73	105	3.2838	10.620	10.8642
74	116	4.4198	15.075	9.5000
75	85	14.6612	26.200	10.9178
76	186	18.5172	27.000	12.3129
77	491	16.2544	24.500	10.7933
78	300	12.6473	23.190	11.4388
79	355	14.1817	21.600	9.2537
80	508	10.4720	24.000	10.4259
81	172	13.0006	22.000	9.1941
82	247	12.2328	21.3	9.05327
83	107	14.5748	22.0	9.98623
84	404	12.8530	19.5	9.30489

LAKE TROUT

Northern Lake Zone - Spring

YEAR	NUM	AVERAGE	TROPHY	STANDARD
74	65	8.25846	11.260	5.58132
75	36	8.07778	12.640	5.97327
76	277	7.21480	12.500	5.85104
77	210	7.28190	12.635	5.48254
78	56	5.91964	12.830	5.47602
80	47	8.08936	13.260	5.93895
81	79	7.34937	13.000	5.62388
82	43	6.95349	14.400	5.63628
83	49	7.96327	13.500	5.95170
84	28	6.03929	13.320	5.80342

Northern Lake Zone - Summer

YEAR	NUM	AVERAGE	TROPHY	STANDARD
69	62	3.40484	6.7550	6.28847
70	143	5.02028	9.3600	6.06753
71	376	5.65878	9.8000	5.90895
72	290	5.58276	9.6900	5.73740
73	343	5.50583	10.4000	5.30746
74	272	6.83162	11.5000	6.30170
75	178	5.40112	10.2400	5.91897
76	1429	6.56242	12.0000	5.78044
77	492	6.18801	11.3700	5.54509
78	324	6.54074	11.0750	5.73370
79	459	6.73399	11.5000	5.63483
80	276	6.89891	11.5000	5.90177
81	414	7.45000	12.5000	5.84279
82	281	7.17865	13.0000	5.45344
83	522	7.71820	14.4249	5.77716
84	180	7.30389	15.4800	6.20687

Northern Lake Zone - Autumn

YEAR	NUM	AVERAGE	TROPHY	STANDARD
70	107	5.02804	8.180	6.21276
71	20	6.12500	8.775	5.74861
72	54	5.39815	9.750	5.32288
73	161	5.18696	9.340	5.44314
74	31	7.45484	13.520	5.89458
75	43	8.01395	14.660	5.38461
76	103	5.71942	9.960	5.33062
77	41	6.76829	11.850	5.20371
78	41	5.15854	12.250	5.40305
79	78	6.71667	12.500	5.10109
80	101	7.28911	13.500	5.59829
81	27	7.46667	12.000	6.08702
83	30	7.58333	14.450	5.71077

Southern Lake Zone - Spring

YEAR	NUM	AVERAGE	TROPHY	STANDARD
77	25	5.59600	13.0500	5.74740
79	20	5.50000	9.8800	5.84054
81	25	7.34000	13.8500	5.94835
83	92	6.71848	11.5000	6.15374
84	23	9.67826	20.3999	5.85011

Southern Lake Zone - Summer

YEAR	NUM	AVERAGE	TROPHY	STANDARD
71	99	5.20101	10.000	5.95867
72	195	5.92769	11.000	5.66255
73	432	5.46343	9.900	5.63376
74	200	6.36450	11.475	5.87678
75	198	5.50303	10.610	6.12113
76	182	5.88516	12.210	5.98285
77	103	5.81456	11.960	5.61501
78	116	6.56552	11.015	6.19279
79	194	5.84433	10.325	6.07504
80	86	6.60698	11.000	5.59420
81	220	6.40182	10.795	5.59594
82	136	6.56029	11.030	5.53923
83	265	7.29057	13.000	5.86759
84	182	7.92802	12.500	5.40691

Southern Lake Zone - Autumn

YEAR	NUM	AVERAGE	TROPHY	STANDARD
73	94	5.76170	9.6250	5.38463
74	20	7.96000	10.9900	6.05309
78	28	6.14286	9.8250	6.40628
79	46	6.72826	10.1600	5.29679
80	41	6.67805	9.4800	5.28759
82	86	6.73023	10.6500	5.38231
83	34	8.22059	15.3749	6.48027
84	101	7.49505	12.3600	5.08175

BROWN TROUT

Green Bay Zone - Spring

YEAR	NUM	AVERAGE	TROPHY	STANDARD
76	21	3.60952	8.500	3.76499
77	20	4.34000	8.375	3.70221
79	80	2.80625	5.475	3.39659
82	34	4.56176	10.500	4.42563
83	133	3.52030	6.790	3.84771
84	81	3.86420	6.880	3.65821

Green Bay Zone - Summer

YEAR	NUM	AVERAGE	TROPHY	STANDARD
77	122	7.73852	14.00	5.46798
80	236	5.86186	10.00	4.45264
82	68	6.90294	13.91	5.03807
83	217	4.42857	8.51	4.24913
84	253	6.02253	10.56	4.47486

Green Bay Zone - Autumn

YEAR	NUM	AVERAGE	TROPHY	STANDARD
80	178	6.73539	10.120	4.27944
82	44	6.40682	10.775	4.90660
83	81	5.82593	9.450	4.27366
84	59	6.99492	10.100	4.31906

Northern Lake Zone - Spring

YEAR	NUM	AVERAGE	TROPHY	STANDARD
69	24	3.44167	8.075	4.07813
70	41	4.59268	7.980	4.39153
71	53	4.63585	10.390	4.61750
74	69	2.60435	5.550	4.33757
75	107	2.81028	6.120	4.35327
76	356	3.16545	7.000	4.09249
77	306	3.64183	8.325	3.49381
78	117	3.56752	8.100	3.94708
79	241	3.27095	6.000	3.77531
80	66	4.11515	7.525	4.39205
81	221	4.59140	8.890	4.43607
82	252	3.44048	7.175	4.17991
83	207	3.99275	7.300	4.33846
84	123	4.38374	8.460	4.47333

Northern Lake Zone - Summer

YEAR	NUM	AVERAGE	TROPHY	STANDARD
69	67	3.97313	8.000	4.73190
70	69	6.91159	11.950	5.17700
72	43	5.46744	10.880	4.92286
73	20	3.13500	13.635	4.64214
74	66	3.39697	7.630	4.94811
75	35	4.99714	10.100	5.04675
76	56	4.98393	8.630	4.60962
77	130	2.99385	9.045	3.82261
78	126	4.51111	10.465	4.49090
79	65	4.56154	9.890	4.36989
80	67	6.23731	11.600	4.48650
81	144	7.24028	12.375	4.62716
82	75	5.18400	10.700	4.43223
83	121	6.02562	12.000	4.69892
84	209	6.66459	10.900	5.07222

Northern Lake Zone - Autumn

YEAR	NUM	AVERAGE	TROPHY	STANDARD
69	66	5.35909	9.930	4.34251
70	59	6.86271	11.800	4.59571
71	35	7.02571	13.000	4.59584
72	97	5.81546	11.510	4.16002
73	25	3.20400	10.470	3.83197
74	57	5.39825	8.620	4.10847
75	130	4.48231	10.415	3.86065
76	238	5.30042	10.420	4.05868
77	208	3.47692	9.000	3.70316
78	40	4.29250	7.745	3.77605
79	182	4.67308	9.800	3.92555
80	166	6.12952	10.500	4.10195
81	102	6.20588	10.125	4.23946
83	38	6.35263	12.000	4.32305
84	161	7.82609	12.050	4.38599

Southern Lake Zone - Spring

YEAR	NUM	AVERAGE	TROPHY	STANDARD
70	30	2.70000	4.45000	3.53385
75	53	3.35472	6.64999	4.04585
76	52	2.95962	6.76998	4.04355
77	22	2.66364	9.64997	3.80215
78	108	3.29259	7.54999	3.90645
79	62	3.29355	7.67999	3.88546
81	104	4.65962	7.72499	4.62385
82	26	3.14231	8.15997	4.53385
83	225	3.33956	6.00000	4.22355
84	112	3.92857	7.24000	4.28855

Southern Lake Zone - Summer

YEAR	NUM	AVERAGE	TROPHY	STANDARD
72	55	4.95455	12.140	4.49445
73	38	3.39211	10.045	4.44885
74	71	4.83239	10.700	4.85585
75	38	3.61053	9.600	4.77855
76	44	6.45227	14.975	4.64455
77	63	2.53492	7.160	3.17405
78	100	4.78200	8.000	4.56405
79	87	5.32989	11.000	4.26295
80	63	4.84603	9.900	4.49515
81	86	5.24186	10.660	4.35105
82	133	5.60451	11.560	4.38125
83	122	6.27623	10.000	4.82765
84	74	5.70135	9.625	4.33185

Southern Lake Zone - Autumn

YEAR	NUM	AVERAGE	TROPHY	STANDARD
70	45	5.69111	9.360	3.98105
72	62	5.15484	10.495	3.54105
73	45	3.74444	9.230	3.72955
74	86	5.70349	10.000	4.48055
75	114	5.88684	12.800	3.95455
76	70	6.23286	10.040	4.19105
77	66	4.47727	10.825	3.33055
78	28	4.90357	9.550	4.52505
79	77	5.36883	10.000	4.10155
80	133	3.74662	8.370	4.30455
81	54	5.91481	12.350	4.08955
82	73	4.80411	8.090	3.84055
83	25	6.12000	8.700	5.12105
84	26	5.22308	8.125	4.86955

RAINBOW TROUT

Green Bay Zone - Autumn

YEAR	NUM	AVERAGE	TROPHY	STANDARD
77	32	6.63437	10.675	5.17839
80	33	4.61212	13.890	5.03509
83	21	4.76667	10.800	6.05530

Northern Lake Zone - Spring

YEAR	NUM	AVERAGE	TROPHY	STANDARD
69	51	4.11765	8.1800	4.21721
70	22	5.67273	13.3700	4.50328
71	53	5.11321	8.9500	4.64246
74	34	4.06176	12.1000	4.22738
75	24	5.30000	11.9999	4.98825
76	105	3.96095	9.3800	4.22893
77	98	4.57143	9.7400	3.92946
78	51	4.75686	9.7000	4.11224
79	44	4.99773	9.2250	4.26626
81	45	5.36000	11.5000	4.53139
82	40	7.27750	9.9850	5.71323
83	39	6.83590	12.5000	4.38812

Northern Lake Zone - Summer

YEAR	NUM	AVERAGE	TROPHY	STANDARD
69	31	5.25484	10.800	5.26909
71	35	5.96571	12.260	4.76759
72	33	4.05758	12.690	4.41458
73	66	4.02576	9.230	4.30749
74	151	5.87152	11.040	4.79781
75	89	5.43933	11.300	4.77659
76	219	4.43653	10.000	4.49140
77	272	4.33860	9.535	4.20807
78	204	5.25392	9.350	4.25944
79	89	6.49326	11.900	4.64770
80	116	6.06207	12.000	4.89109
81	66	6.88939	10.955	5.38531
82	25	8.01600	16.350	4.10572
83	56	6.47143	13.525	4.45719
84	54	7.31481	13.875	4.84996

Northern Lake Zone - Autumn

YEAR	NUM	AVERAGE	TROPHY	STANDARD
69	57	5.66491	12.010	4.95464
70	98	5.66837	9.515	5.19622
71	45	6.70889	12.690	4.78433
72	71	4.25070	10.300	4.73948
73	52	5.02308	8.905	4.43172
74	97	6.44948	10.920	4.91688
75	65	6.13692	11.850	5.29162
76	238	4.19580	10.500	4.77458
77	278	4.96079	9.000	4.29737
78	98	6.05408	9.510	4.80453
79	194	6.49742	12.000	4.53383
80	201	4.95323	9.950	4.88302
81	97	6.31753	9.500	5.00495
82	21	6.11429	9.580	
83	30	5.82333	9.780	4.43532

Southern Lake Zone - Spring

YEAR	NUM	AVERAGE	TROPHY	STANDARD
71	49	5.16735	9.250	4.70530
72	31	5.55161	10.400	3.48709
73	30	3.08000	9.000	3.83353
74	47	3.77234	7.720	4.56404
75	101	5.19703	8.580	4.32863
76	50	3.05800	7.535	4.30278
77	129	3.35194	8.000	4.00961
78	141	4.18582	8.450	4.31378
79	142	4.60282	8.470	4.16170
81	58	4.80517	9.825	4.71590
82	43	4.96744	10.940	4.30526
83	40	3.97000	8.095	4.25616
84	87	6.51494	11.300	4.33955

Southern Lake Zone - Summer

YEAR	NUM	AVERAGE	TROPHY	STANDARD
71	28	5.70000	10.0500	4.67190
72	90	4.66556	10.7950	4.33271
73	331	5.00665	10.8799	4.11839
74	341	5.85073	10.5000	5.14921
75	292	6.03527	11.5000	4.84154
76	198	5.19949	10.8200	4.53077
77	155	4.41935	10.0400	4.29253
78	154	6.05779	9.5000	5.02497
79	189	6.94392	12.0000	4.77785
80	52	5.47885	13.0000	5.02447
81	101	7.01584	12.4400	4.51118
82	24	6.00000	15.0000	5.24132
83	36	6.45833	12.9850	4.69493
84	22	7.43182	12.9250	5.17574

Southern Lake Zone - Autumn

YEAR	NUM	AVERAGE	TROPHY	STANDARD
70	74	5.12162	8.625	4.76356
71	68	5.86618	10.000	4.37510
72	76	4.98158	9.015	4.69481
73	111	4.65946	9.380	4.48315
74	172	6.17267	10.205	5.20178
75	185	5.85892	11.470	4.84501
76	134	4.09328	8.500	4.37260
77	220	3.63727	7.500	3.91562
78	74	4.90405	8.000	4.87531
79	223	6.21076	11.380	4.37275
80	201	4.97413	9.950	4.83234
81	67	5.85373	10.980	4.75111
82	97	4.83093	8.100	4.62498
83	40	7.18750	11.475	5.38732
84	42	5.86190	9.365	5.28599

BROOK TROUT

Northern Lake Zone - Spring

YEAR	NUM	AVERAGE	TROPHY	STANDARD
69	61	0.49016	0.99	1.29233
76	31	0.36774	1.52	0.43725
78	31	1.29677	2.44	1.14339

Northern Lake Zone - Summer

YEAR	NUM	AVERAGE	TROPHY	STANDARD
74	34	0.74412	1.50	1.41777
77	22	1.12273	1.50	1.23366
78	81	0.98148	1.89	1.22191

Northern Lake Zone - Autumn

YEAR	NUM	AVERAGE	TROPHY	STANDARD
77	20	1.28500	4.08999	1.04026
79	27	1.45556	3.30000	1.00024
80	31	1.44194	3.31999	0.87403

Southern Lake Zone - Summer

YEAR	NUM	AVERAGE	TROPHY	STANDARD
72	24	0.975	3.32497	0.96836

Southern Lake Zone - Autumn

YEAR	NUM	AVERAGE	TROPHY	STANDARD
80	30	1.25	1.945	1.08889