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CREEL SURVEY ON PEWAUKEE AND NAGAWICKA LAKES, WAUKESHA COUNTY, SUMMER 1982

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ABSTRACT

Information concerning fishing and pleasure boat use of 2,359-acre Pewaukee Lake and 957-acre Nagawicka Lake was gathered by stratified creel census during the period 1 May through 30 September 1982. For Pewaukee and Nagawicka lakes, fishing pressure was estimated to be 95.1 and 155.7 hours/acre, respectively. Harvest rates based on all hours of fishing and all fish harvested were 0.846 and 1.142 fish/hour. Estimated harvest was 80.5 and 177.9 fish/acre.

For both lakes, most angling emphasis and harvest centered on panfish. Primary panfish species were bluegill, yellow perch, and black crappie. Largemouth bass was the principal game fish sought and harvested on both lakes. Most anglers traveled 50 miles or less to fish, and most fishing pressure occurred on weekdays.

Fishing was the primary recreational use of both lakes, although motorized pleasure boat use was intense. Motorized pleasure boat use levels at midday on midsummer weekends and holidays were high enough to render boating conditions unsafe.

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INTRODUCTION

Pewaukee and Nagawicka lakes are two well-known recreational lakes located in the populous southeastern corner of Wisconsin (Fig. 1). Although in different drainages, the lakes are located within 2 miles of each other. Both lakes are located within 20 miles of the City of Milwaukee, Wisconsin's largest city (population 636,300). The lakes are located north centrally in Waukesha County, among a belt of glacially formed lakes, interspersed within the interlobate or "kettle" moraine glacial topography of the area. The basin of Pewaukee Lake is considered to be partly of preglacial origin (Poff and Threinen 1963). Pewaukee Lake forms the headwaters of one branch of the Fox (Illinois) River which flows southward to the Illinois River. Nagawicka Lake is drained by the Bark River, which drains part of the lake district to the west to the Rock River. Both drainages are tributary to the Mississippi River.

The two lakes are popular with southeastern Wisconsin residents for water-based recreation. The main public access to the lakes is controlled by the Waukesha County Park Department through two separate boat landings within the county's Nagawaukee Park. The boat launch fee is currently $3.50 for all boats and all sizes of motors. There are several privately owned boat liveries and launches on each lake, which generally charge a higher fee than Waukesha County for launching or boat rental.

Consistent with the urban character of both lakes, year-round residences occupy nearly the entire buildable upland. Many of these dwellings are old seasonal cottages converted into year-round homes. The area has only recently been serviced by sanitary sewer. The historical demand for lake frontage in southeastern Wisconsin has resulted in channel construction to provide more lots with water frontage. This type of basin alteration is more prevalent on Nagawicka than Pewaukee. Characteristic of southern Wisconsin lakes in general, the regions calcareous soils and dolomitic bedrock along with watershed urbanization, have contributed to the fertility of both lakes. This fertility is expressed in the high total alkalinity values of 210 ppm for Pewaukee and 200 ppm for Nagawicka (Poff and Threinen 1963).

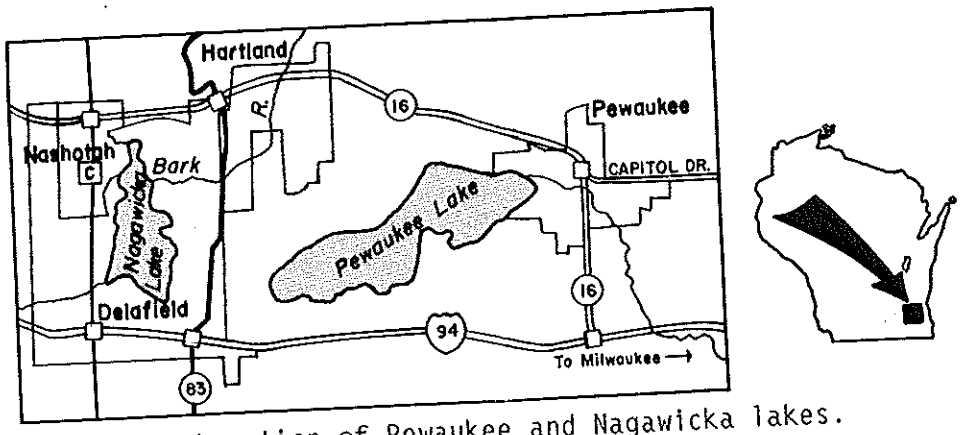

FIGURE 1. Location of Pewaukee and Nagawicka lakes.

Pewaukee Lake

Pewaukee Lake, with an area of 2,359 acres, is the largest lake in Waukesha County (Fig. 2). The maximum depth is 45 ft. Nearly half the acreage is the result of impoundment by an artificial dam of 8-ft head on the outlet stream, the Pewaukee River. Impoundment has resulted in a very shallow east end. There are 3 small contributing streams in addition to springs supplying waters. Weeds and algae are typically major use problems, and the use of herbicides or mechanical vegetation removal is a common practice. The 42 fish species known to exist in Pewaukee Lake within the last 25 years are summarized in Table 1. The present fish management program on Pewaukee Lake centers around planned annual stocking of 1,250 true muskellunge fingerlings and 1,250 hybrid muskellunge fingerlings. A muskellunge stocking program has been in effect since 1967. Walleye fingerling were stocked in 1980 and 1982 and walleye fry stocked in 1981, to bolster a low adult native walleye population of less than 1 fish/acre (Claggett 1981). No recent (within the last 15 years) walleye stocking has been done except for the 1980-1982 plants.

The musky stocking in Pewaukee Lake has fostered a regionally unique fishery characterized by exceptional muskellunge growth (Holzer 1976, Claggett 1981). Over a 3-year period (1973-1975), 182 muskies (108 larger than 30 inches) were tallied through a voluntary registration program. Pewaukee is now firmly established as a muskellunge fishery, and fish near or over 40 lbs have been verified in the catch 3 of the last 5 years.

Despite the obvious value of the Pewaukee Lake fishery to southeastern Wisconsin, no evaluation of the yield to the angler has been attempted for species other than muskellunge. Although conducted too early to assess the contribution of walleye stocking to the creel, it was believed that a survey of this nature and the baseline data generated was overdue.

Nagawicka Lake

Nagawicka Lake is a relatively large (957 acres), deep (90 ft maximum depth) drainage lake (Fig. 3). The water is generally clear, and most of the east shoreline is gravel. The west shoreline has primarily soft sediments.

Regionally, Nagawicka is known as a good fishing lake, with bluegill the primary species sought. The lake is also known for production of largemouth bass and northern pike. Rooted aquatic vegetation is generally a use problem. Vegetation treatment with herbicides and mechanical removal also occur. Water levels are augmented by a dam with a 7-ft head in the City of Delafield.

As with Pewaukee, Nagawicka Lake contains a diverse fish population (Table 1). More studies with emphasis on nongame fish would probably add several more species to the 30 species now known to be present. Although stocked with walleyes in the 1940s-50s, the only recent (within the last 15 years) fish management program conducted was a walleye fry plant in 1981 and fingerling plant in 1982. A literature review and assessment of the 1981 walleye fry stocking indicated the adult walleye population was very low (Bruch and Schumacher 1982). A 1978 spring fyke net survey yielded a catch of only 0.6 walleyes/net day (1 fyke net fished 24 hours).

No quantitative assessment of the yield to the angler of any fish species has been conducted on Nagawicka Lake. The value of this creel survey as with Pewaukee Lake, lies in the data gathered serving as a basis to assess future management programs or unintentional fishery changes.

TABLE 1. Fish species known to reside in Pewaukee and Nagawicka lakes and their relative abundance.*

Species	Scientific Name	Pewaukee	Nagawicka
Northern pike	Esox lucius	Present	Abundant
Walleye	Stizostedion vitreum vitreum	Present	Present
Largemouth bass	Micropterus salmoides	Common	Common
Smallmouth bass	Micropterus dolomieui	Common	Present
Muskellunge	Esox masquinongy	Common	
Black bullhead	Ictalurus melas	Common	Common
Brown bullhead	Ictalurus nebulosus	Common	Common
Yellow bullhead	Ictalurus natalis	Common	Common
Bluegill	Lepomis macrochirus	Abundant	Abundant
Yellow perch	Perca flavesens	Abundant	Abundant
Black crappie	Pomoxis nigromaculatus	Common	Common
Rock bass	Ambloplites rupestris	Common	Common
Pumpkinseed	Lepomis gibbosus	Common	Common
Warmouth	Lepomis gulosus	Common	Common
White sucker	Catostomus commersoni	Common	Common
Common carp	Cyprinus carpio	Common	Common
Bluntnose minnow	Pimephales notatus	Common	Common
Golden shiner	Notemigonus crysoleucas	Present	Present
Spottail shiner	Notropis hudsonius	Common	
Fathead minnow	Pimephales promelas	Present	Present
Brook silverside	Labidesthes sicculus	Common	Common
Green sunfish	Lepomis cyanellus	Common	Common
Goldfish	Carassius auratus	Present	
Creek chub	Semotilus atromaculatus	Present	
Johnny darter	Etheostoma nigrum	Present	Present
Central mudminnow	Umbra limi	Present	
Tadpole madtom	Noturus gyrinus	Present	Present
Brook stickleback	Culaea inconstans	Present	
Mimic shiner	Notropis volucellus	Present	Present
Spotfin shiner	Notropis spilopterus	Present	
Freshwater drum	Aplodinotus grunniens	Common	
Rainbow darter	Etheostoma caeruleum		Present
Blacknose shiner	Notropis heterolepis	Present	Present
Emerald shiner	Notropis atherinoides		Present
Iowa darter	Etheostoma exile		Present
Lake chubsucker	Erimyzon sucetta	Present	Common
Grass pickeral	Esox americanus vermiculatus	Present	Common
White bass	Morone chrysops	Common	Common
Bowfin	Amia calva	Present	Present
Longnose gar	Lepiososteus osseus	Present	
Pugnose shiner	Notropis anogenus	Present	
Common shiner	Notropis cornutus	Present	
Bigmouth shiner	Notropis dorsalis	Present	
Banded killifish	Fundulus diaphanus	Present	

* From Claggett (1981), Fago (1982), Becker (1964), and miscellaneous data from both lakes contained in DNR Eagle Headquarters files. Relative abundances are judgments made by the author. The species list may be longer for Pewaukee Lake due to more extensive nongame fish surveys.

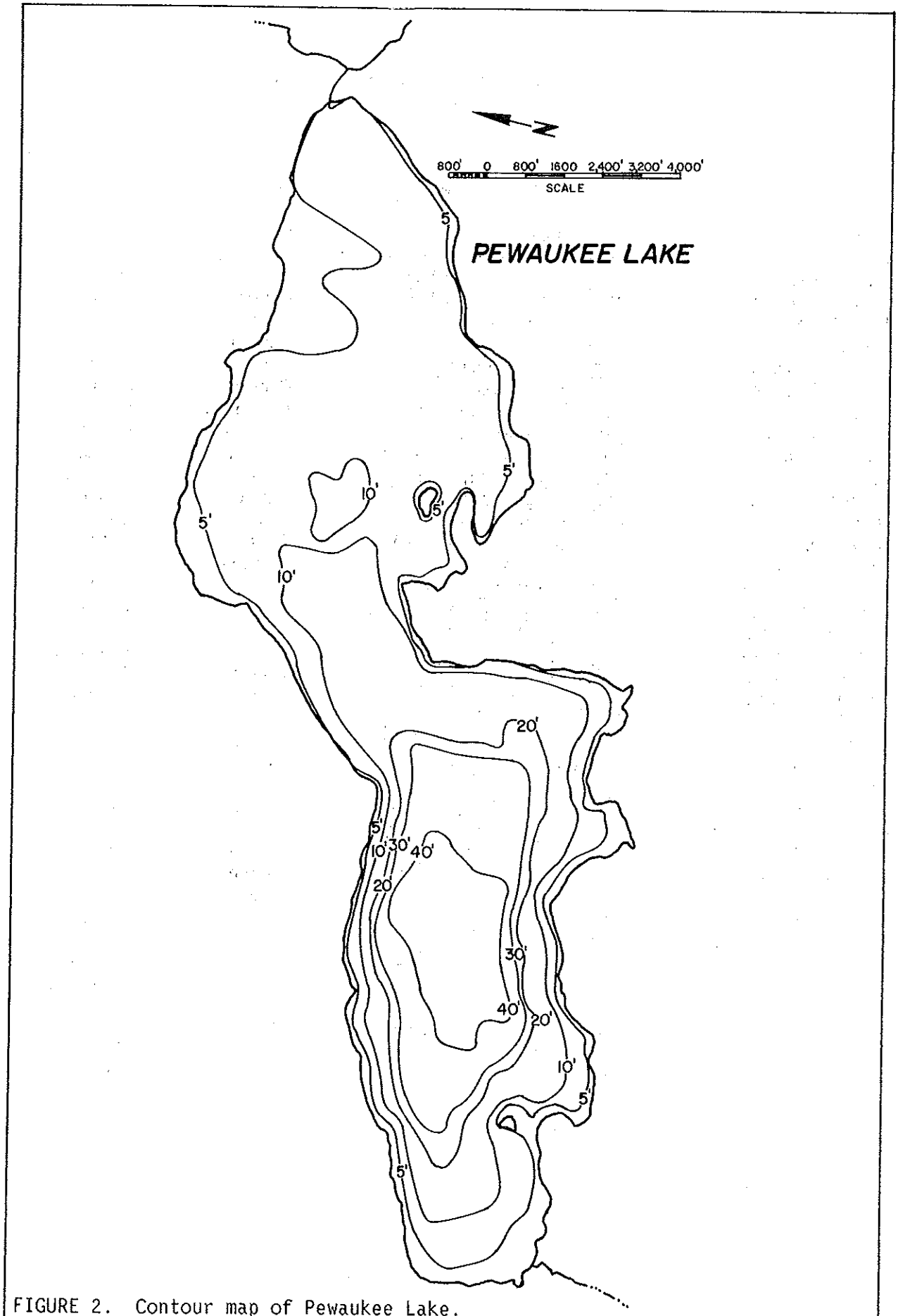

FIGURE 2. Contour map of Pewaukee Lake.

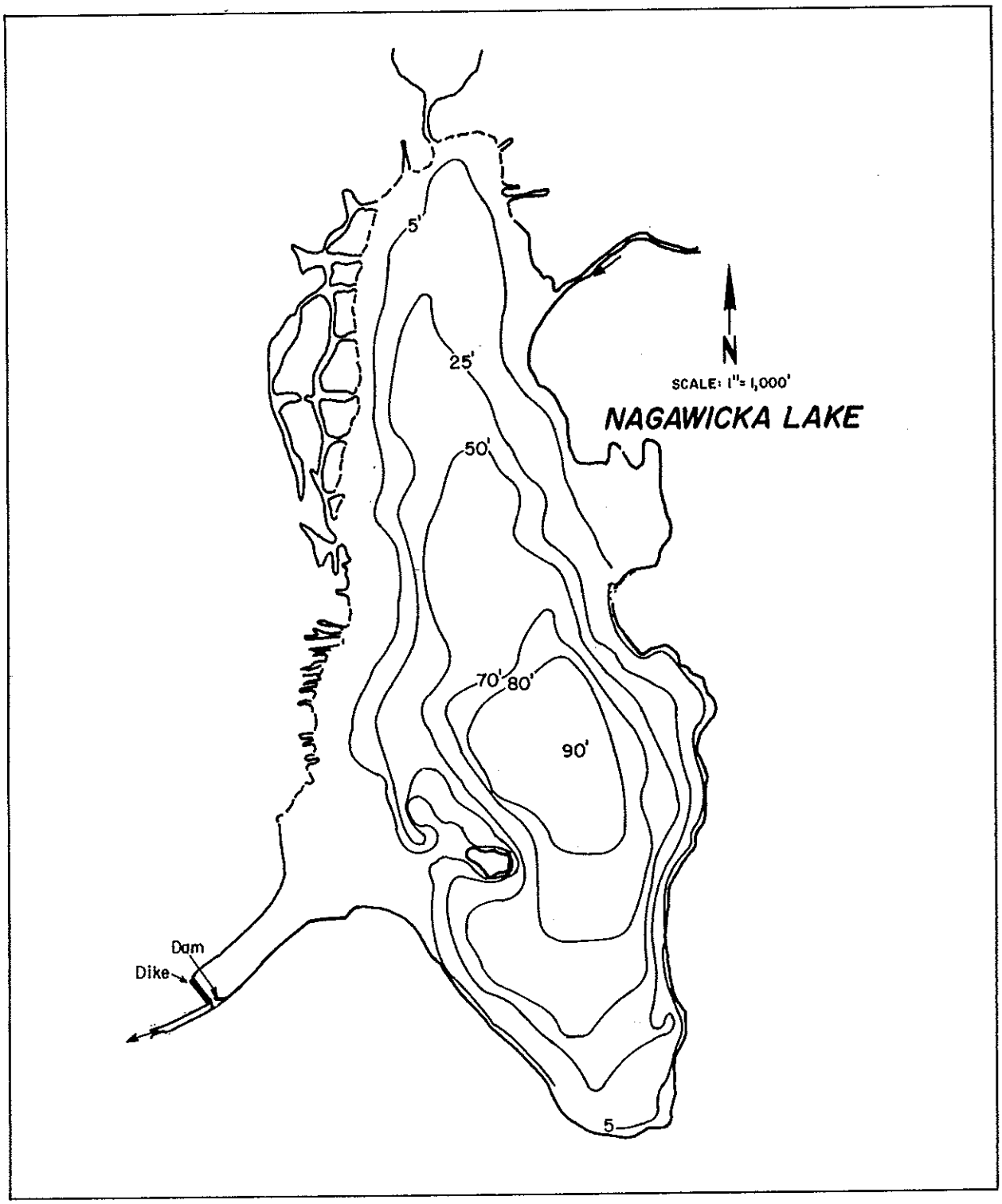

FIGURE 3. Contour map of Nagawicka Lake.

METHODS

The creel census covered the period 1 May 1982 (opening day of the general fishing season) to 30 September 1982. One creel clerk was hired to work a 40-hour week, with half the time devoted to each lake. Both weekend days and all legal holidays were sampled along with 3 randomly selected weekdays. The typical work day was an 8-hour shift, beginning at either 6:00 a.m. or 1:00 p.m. (2:00 p.m. after June 15). The shift starting time and order in which the lakes were surveyed was randomly selected.

A typical 4-hour check period would begin with the creel clerk counting the number of pleasure boats and anglers, while traversing the long axis of the lake by motorboat. Anglers were classified as fishing from boats, dock, or shore, as well as by the type of fishing equipment in use. An angler interview form is included in Appendix I.

Catch data gathered included time fished, species fished for, number of each species caught and kept, and length and weight (when time allowed) of the catch or a random sample of the catch.

Demographic information obtained included age and sex of the anglers interviewed as well as distance traveled to fish each lake.

Near the end of the 4-hour check period, the second count of numbers of anglers and pleasure boats was made. The number of occupants within each pleasure boat was not counted. A pleasure boat was defined as a motorized craft without fishing equipment on board.

Most of the catch and harvest data gathered was from incomplete angler trips. Two assessments of creel census methods have indicated no significant statistical difference between data from complete or incomplete angling trips (Fierstine et al. 1978, Malvestuto et al. 1978). Since there were often many more anglers than time would allow to be interviewed, the clerk randomly selected the anglers to be interviewed.

Classifying the angler on the basis of the species fished for occasionally involved judgmental decisions on the part of the creel clerk. A very common example was an angler stating that he was fishing for panfish (no specific species), when his catch was dominated by bluegills. In this case, the angler would be classified as fishing for bluegills. It was also possible for an angler to fish for more than one species per trip, either by fishing for two or more species at the same time, or alternating between different species. Estimating the percent of time devoted to fishing for each species allowed an apportionment of effort to that species.

Average pressure data gathered from instantaneous counts was expanded to an estimate of total pressure in hours for weekends and holidays combined, and weekdays over the course of the census. The catch and harvest rate data necessary to estimate the total catch and harvest was obtained from angler interviews.

The creel census monitored 7,016 angler hours (2,049 anglers) on Nagawicka Lake and 6,313 angler hours (2,004 anglers) on Pewaukee Lake. The number of completed trips among the anglers interviewed varied from 635 on Nagawicka (31%) to 414 on Pewaukee Lake (20.7%). Based on total estimated hours of fishing pressure, the percent of possible angling hours monitored was 4.7% for Nagawicka and 2.8% for Pewaukee Lake.

RESULTS AND DISCUSSION

Fishing Pressure

Between 1 May and 30 September 1982, Pewaukee Lake received an estimated 224,450 hours of angling pressure (95.1 hours/acre) and Nagawicka Lake received 149,046 hours of angling pressure (155.7 hours/acre). Both estimates of pressure are within the upper ranges of pressure compared to available data on other Wisconsin lakes with similar acreages (Table 2). The winter angling season was not covered by this census. Since both lakes have very popular winter ice fisheries, it is likely that year-round pressure is much higher.

Fishing pressure was highest in June on both lakes (Table 3, Fig. 4). Both lakes also received more total fishing pressure on weekdays than weekends. September fishing pressure was by far the lowest of the five months monitored, contributing only 9.7% of the summer fishing pressure on Pewaukee and 10.4% of the summer pressure on Nagawicka. Both lakes received 70-72% of their summer fishing pressure from May through July.

Harvest

An estimated 190,005 fish were harvested (taken home) from Pewaukee Lake and 170,241 fish from Nagawicka. This represents an estimated harvest of 80.5 and 177.9 fish/acre for Pewaukee and Nagawicka, respectively (Table 4). Bluegills made up over 59% of the harvest from Nagawicka Lake. The harvest from Pewaukee was led by yellow perch (37.6%), followed closely by bluegill (33.8%). Black crappie made up a significant portion of the fish harvest (17.7%) from Pewaukee Lake and a somewhat lower portion of the harvest from Nagawicka (10.2%). The three principal panfish species (bluegill, yellow perch, black crappie) comprised 89% of the total numerical fish harvest from Pewaukee and 94% from Nagawicka Lake.

Largemouth bass was the principal game fish in the harvest on both lakes. Harvest of largemouth bass ranged from an estimated 2.6/acre on Pewaukee to 3.1/acre on Nagawicka. Northern pike were a close second in the harvest on Nagawicka, with an estimated 3.0/acre harvested. Very few northern pike were creeled on Pewaukee Lake in 1982, as shown by a low harvest rate of only 0.05/acre. In comparison, Thuemler (1981) recorded a lower summer harvest of 0.56 largemouth bass along with 1.55 northern pike per acre on 2,409-acre Lake Noquebay in northeastern Wisconsin. Northern pike and largemouth bass were the principal game fish harvested in Lake Noquebay. Creel census results for muskellunge harvested from Pewaukee Lake are not believed to be reliable because of the one bag limit and 30-inch size limit in effect at the time of this census. Only 2 muskellunge (both hybrids) were monitored in the creel. One was a 39.4-inch fish encountered by the creel clerk while the fish was being landed. The other was a 20.0-inch hybrid muskellunge, mistakenly harvested as a northern pike.

The monthly distribution of the harvest of 5 principal fish species taken from both lakes is shown in Figure 5. May was the principal month for largemouth bass harvest on both Pewaukee and Nagawicka. Over 45% of the largemouths harvested from Nagawicka and over 33% from Pewaukee were taken in May. Northern pike harvest from Nagawicka was similar in May, June, and July. The low Pewaukee Lake northern pike harvest was confined mostly to May.

TABLE 2. Summary of estimated fishing pressure in hours/acre on selected Wisconsin lakes.*

Lake	Census Date**	Reference	Size (Acres)	Angler Hours/ Acre
Nagawicka Lake (Waukesha Co.)	5/01/82 - 9/30/82	This study	957	155.7
Pewaukee Lake (Waukesha Co.)	5/01/82 - 9/30/82	This study	2359	95.1
Fox Lake (Dodge Co.)	5/74 - 9/74	J. Congoon (pers. comm.)	2625	150.6
Big Arbor Vitae (Vilas Co.)	5/03/80 - 11/15/80	C. Goodman (pers. comm.)	1065	70.8
Little Arbor Vitae (Vilas Co.)	5/08/80 - 11/12/80	D. Hansen (pers. comm.)	534	63.3
Lake Sisabagama (Sawyer Co.)	5/03/80 - 11/15/80	"	719	50.5
Lake Noquebay (Marinette Co.)	5/07/77 - 9/30/77	Thuemler (1981)	2409	34.4
Lake Beulah (Walworth Co.)	5/20/82 - 8/31/82	C. Goodman (pers. comm.)	834	62.9
Lake Beulah (Walworth Co.)	5/20/80 - 8/31/80	Michaelis (1982)	834	44.0
Big McKenzie (Burnett Co.)	5/02/81 - 11/19/81	D. Hansen (pers. comm.)	1185	33.5
Mud-Callahan (Sawyer Co.)	5/06/79 - 11/07/79	"	586	35.7
Lake Winter (Sawyer Co.)	5/06/79 - 11/07/79	"	676	42.7
Big Lake (Vilas Co.)	5/02/81 - 11/20/81	"	835	31.2
Sand Lake (Sawyer Co.)	5/02/81 - 9/29/81	C. Goodman (pers. comm.)	928	25.5
Day Lake (Ashland Co.)	5/02/81 - 11/19/81	"	641	25.1
Browns Lake (Racine Co.)	5/03/80 - 9/28/80	Michaelis (1982)	396	76.0
Rockland Lake (Racine Co.)	5/03/80 - 9/28/80	"	40	139.0
Stormy Lake (Vilas Co.)	6/02/70 - 8/23/70	McKnight and Serns (1974)	522	16.2
Black Oak Lake (Vilas Co.)	6/02/70 - 8/23/70	"	584	19.0
Laura Lake (Vilas Co.)	6/02/70 - 8/23/70	"	599	20.2

* Data from random stratified creel census.
** During these creel surveys, the Wisconsin game fish fishing season ran from the first Saturday in May until 1 March, except for muskellunge which closed 30 November.

TABLE 3. Percent distribution of overall fishing pressure by month, 1 May - 30 September 1982.

Month	Pewaukee Lake (224,450 Hours) Weekends	Weekdays	Total	Nagawicka Lake (149,046 Hours) Weekends	Weekdays	Total
May	13.4	9.5	22.9	12.3	8.4	20.7
June	10.1	15.9	26.0	10.5	14.7	25.2
July	7.7	15.1	22.8	8.1	16.2	24.3
August	6.9	11.7	18.6	6.8	12.6	19.4
September	5.7	4.0	9.7	4.1	6.3	10.4
Total	43.8	56.2	100	41.8	58.2	100

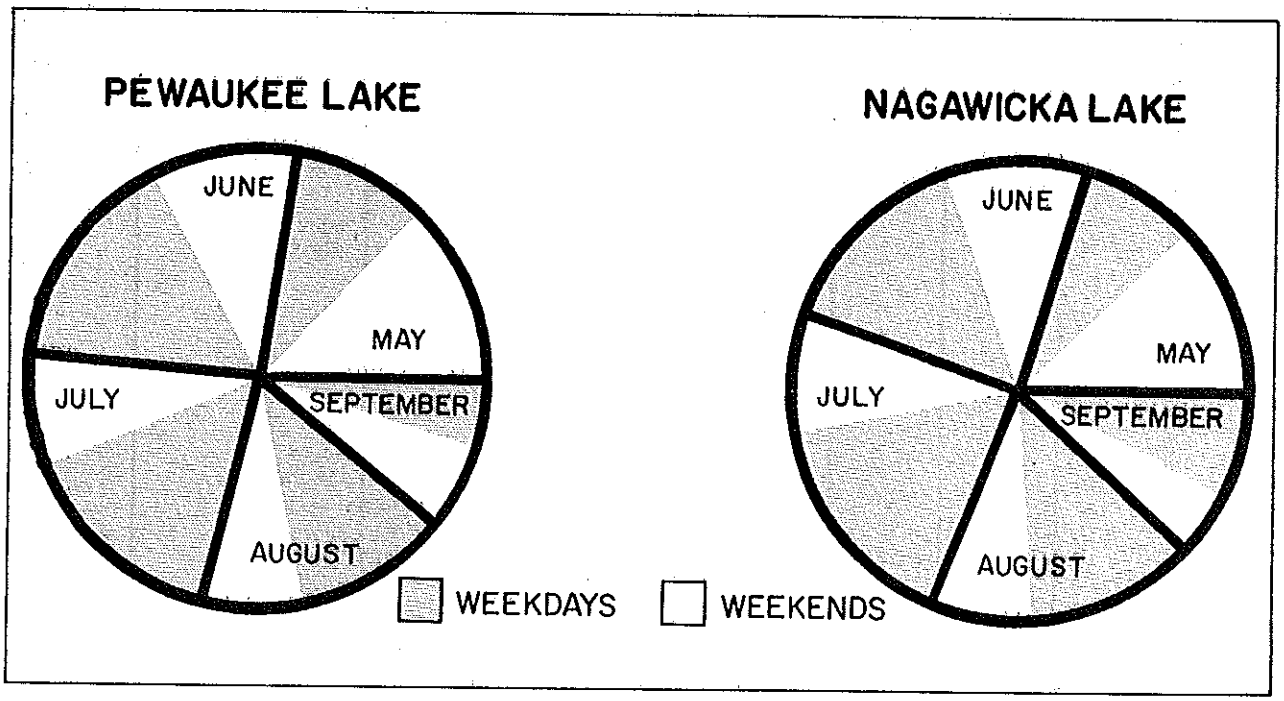

FIGURE 4. Distribution of fishing pressure by month, 1 May - 30 September 1982.

TABLE 4. Estimated fish harvest from Pewaukee and Nagawicka lakes during the period 1 May - 30 September 1982.

Species	Pewaukee Lake (2,359 acres) Number Harvested	No./ Acre	% of Harvest	Nagawicka Lake (957 acres) Number Harvested	No./ Acre	% of Harvest
Bluegill	64,194	27.2	33.8	101,629	106.2	59.7
Yellow perch	71,529	30.3	37.6	41,206	43.1	24.2
Black crappie	33,587	14.2	17.7	17,306	18.1	10.2
Largemouth bass	6,083	2.6	3.2	3,011	3.1	1.8
Northern pike	112	0.05	0.1	2,832	3.0	1.7
Pumpkinseed	7,909	3.4	4.2	1,779	1.9	1.0
Warmouth	206	0.1	0.1	844	0.9	0.5
White bass	2,164	0.9	1.1	681	0.7	0.4
Rock bass	655	0.3	0.3	439	0.5	0.3
Bullhead*	1,422	0.6	0.7	290	0.3	0.1
Walleye	382	0.2	0.2	209	0.2	0.1
Carp	67	0.03	0.1	15	0.03	0.1
Smallmouth bass	920	0.4	0.5	None recorded		
Fresh water drum	700	0.3	0.4	None recorded		
Muskellunge**	75	0.03	0.1	None Recorded		
Total	190,005	80.5		170,241	177.9	

* Includes black, brown, and yellow bullheads.
** Not believed to be a reliable estimate of harvest (see narrative).

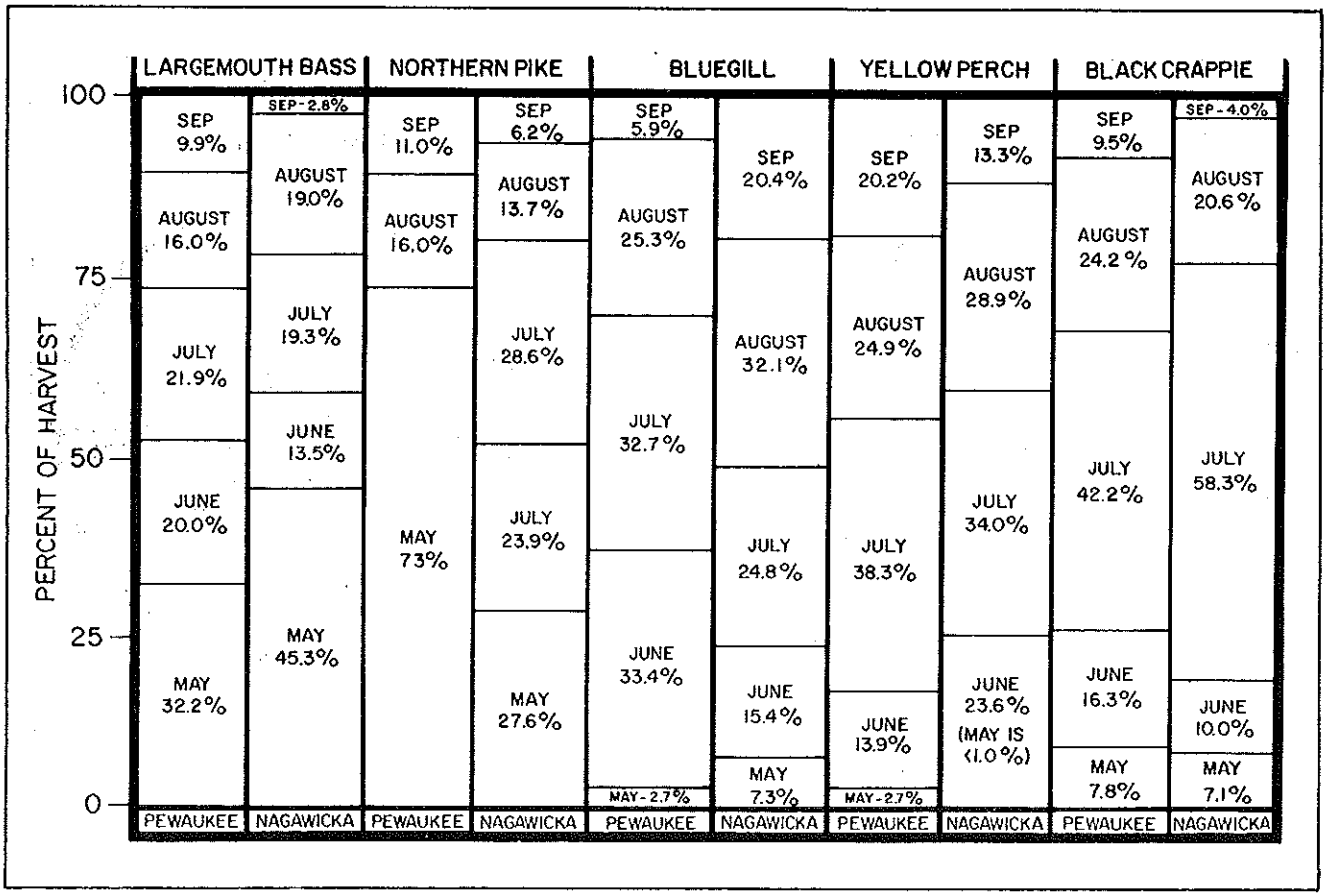

FIGURE 5. Monthly distribution of the angler harvest of 5 principal fish species during 1 May - 30 September 1982 on Pewaukee and Nagawicka lakes.

Surprisingly, bluegill harvest from both lakes was distributed throughout the summer, rather than predominantly centered within the traditional late May through mid-June peak spawning period. Black crappie harvest occurred mostly in July, also after the traditional peak of spawning activity. Yellow perch harvest was distributed from June-September with May having a relatively insignificant harvest.

Harvest Rate

Anglers on Pewaukee Lake harvested (took home) an estimated 190,005 fish caught in 224,450 hours of angling for an overall harvest rate of 0.846 fish/hour. Nagawicka Lake anglers harvested an estimated 170,241 fish in 149,046 hours for an overall harvest rate of 1.142 fish/hour.

Tables 5 and 6 list the harvest rates for the major species observed in the creel on Pewaukee Lake and Nagawicka Lake, respectively. Harvest rates based on all hours fished divided by the estimated catch is recorded as "all hours". A more meaningful expression of the harvest rate was derived by dividing the estimated catch by anglers specifically fishing for a species by the estimated number of that species those anglers caught. Incidental catches by other anglers were not included in this computation of harvest rates. These 'species specific' harvest rates are listed under Specific in Tables 5 and 6.

Harvest rates for anglers specifically fishing for a particular species are typically much higher than those derived from a blending of all hours and total catch.

Harvest Characteristics

The average lengths of the fish observed in the creel is shown in Table 7. A length frequency of the principal fish species in the harvest is included as Appendixes IIA and IIB.

Scale samples were taken from game fish observed in the creel when time and conditions allowed. We were able to take scales from 80% of the largemouth bass, 100% of the northern pike, 64% of the walleye, and 62% of the smallmouth bass observed in the creel on Pewaukee Lake. Scales were obtained from 76% of the largemouth bass, 80% of the northern pike, and 90% of the walleye observed on Nagawicka. Ages were assigned to all fish observed in the creel based on the percentage composition by 1-inch length group observed among the scale samples taken. Because of the high percentage of scale samples taken compared to total fish observed, many 1-inch length groups were completely aged. The age distribution of the catch of principal game fish for Pewaukee and Nagawicka lakes is shown in Table 8. The average length at each annulus for game fish harvested throughout the 1 May-30 September 1982 period is summarized in Table 9.

Largemouth Bass. Largemouth bass age 3 and younger made up the majority of the harvest on both lakes. The harvest of largemouth bass age 3 and under (11.5 inches and less) comprised 71.7% of the harvest on Pewaukee Lake. Escapement appeared somewhat better on Nagawicka, where 56.3% of the harvest were age 3 or younger (10.9 inches and less).

TABLE 5. Pewaukee Lake harvest rates (fish/hour) based on total catch and hours fished (all hours) and anglers fishing for a particular species (specific).

Species	Harvest (fish/hour)					
	Overall	May	June	July	August	September
Largemouth bass						
All hours	0.027	0.039	0.021	0.026	0.024	0.028
Specific	0.101	0.085	0.068	0.195	0.126	0.106
Smallmouth bass						
All hours	0.004	0.005	0.001	0.002	0.010	0.002
Specific	0.293	0.471	--	--	0.318	0.151
Northern pike						
All hours	0.001	0.003	--	--	--	--
Specific	0.024	0.037	--	--	0.051	0.091
Walleye						
All hours	0.002	0.005	0.001	0.002	0.001	0.001
Specific	--	--	--	--	--	--
Bluegill						
All hours	0.140	0.033	0.267	0.234	0.075	0.069
Specific	1.919	0.468	2.190	2.477	1.463	4.000
Yellow perch						
All hours	0.156	0.024	0.058	0.327	0.101	0.288
Specific	2.735	1.392	0.966	3.763	2.087	4.115
Black crappie						
All hours	0.095	0.046	0.066	0.193	0.088	0.080
Specific	0.803	0.371	0.570	0.951	0.966	1.408

TABLE 6. Nagawicka Lake harvest rates (fish/hour) based on total catch and hours fished (all hours) and anglers fishing for a particular species (specific).

Species	Harvest (fish/hour)					
	Overall	May	June	July	August	September
Largemouth bass						
All hours	0.020	0.048	0.012	0.017	0.021	0.006
Specific	0.076	0.100	0.023	0.086	0.118	0.047
Northern pike						
All hours	0.019	0.026	0.019	0.023	0.014	0.012
Specific	0.134	0.137	0.730	0.128	0.095	0.079
Walleye						
All hours	0.001	0.002	--	0.004	0.001	--
Specific	0.030	0.040	--	0.106	--	--
Bluegill						
All hours	0.629	0.210	0.308	0.568	0.929	1.161
Specific	2.111	0.688	1.867	2.240	2.490	2.792
Yellow perch						
All hours	0.215	0.001	0.205	0.278	0.305	0.271
Specific	2.756	0.040	2.092	2.793	3.496	3.476
Black crappie						
All hours	0.107	0.042	0.035	0.278	0.127	0.041
Specific	1.286	0.426	0.820	1.897	1.495	0.877

TABLE 7. Average length of fish harvested from Pewaukee and Nagawicka lakes, 1 May - 30 September 1982.

Species	Pewaukee Lake No. Measured	Pewaukee Lake Avg. Length	Nagawicka Lake No. Measured	Nagawicka Lake Avg. Length
Bluegill	763	6.6	1706	6.5
Yellow perch	874	6.9	742	7.3
Black crappie	499	7.4	254	8.5
Largemouth bass	155	11.9	135	12.5
Northern pike	4	27.9	117	22.1
Pumpkinseed	105	5.5	46	5.8
Warmouth	3	6.3	8	5.9
White bass	11	9.3	24	13.2
Rock bass	11	7.1	14	7.9
Yellow bullhead	4	10.8	2	11.2
Brown bullhead	10	10.1	8	11.0
Black bullhead	1	10.8	3	10.7
Walleye	12	10.9	10	19.3
Carp	4	21.2	1	18.7
Smallmouth bass	24	13.7	None Recorded	
Freshwater drum	17	12.1	None Recorded	
Muskellunge*	2	29.2	None Recorded	

* One legal (39.4-inch hybrid) and 1 sublegal (20.0-inch hybrid) were monitored in the creel.

TABLE 8. Age distribution (%) of game fish monitored in the creel during 1 May–30 September 1982.

Age	Pewaukee Lake				Nagawicka Lake		
	Largemouth Bass	Northern Pike	Walleye	Smallmouth Bass	Largemouth Bass	Northern Pike	Walleye
0+	0.6 (1)**						
1+	5.2 (8)		50.0 (6)	4.2 (1)		0.8 (1)	
2+	6.5 (10)	25.0 (1)	50.0 (6)	8.3 (2)	11.0 (15)	33.3 (39)	20.0 (2)
3+	59.4 (92)			41.7 (10)	45.2 (61)	36.8 (43)	40.0 (4)
4+	12.3 (19)			20.8 (5)	10.4 (14)	14.5 (17)	20.0 (2)
5+	8.4 (13)	50.0 (2)		8.3 (2)	16.3 (22)	9.4 (11)	10.1 (1)
6+	4.5 (7)	25.0 (1)		12.5 (3)	8.9 (12)	2.6 (3)	
7+	1.9 (1)				5.2 (7)	1.7 (2)	
8+	0.6 (1)			4.2 (1)	2.2 (3)	0.8 (1)	
9+	0.6 (1)				0.7 (1)		10.0 (1)
Total	100% (155)	100% (4)	100% (12)	100% (24)	100% (135)	100% (117)	100% (10)

* Age shown is a count of annuli not including the scale margin. For example, an age 3 bass was caught in its 4th summer of life.
** Numbers in parentheses are numbers of each age fish in the creel.

TABLE 9. Average lengths (inches) at each annulus for the principal game fish monitored in the creel census, summer 1982.*

Age	Pewaukee Lake				Nagawicka Lake		
	Largemouth Bass	Northern Pike	Walleye	Smallmouth Bass	Largemouth Bass	Northern Pike	Walleye
1+			10.6 (2)			13.5 (1)	
2+	10.0 (9)	21.0 (1)	11.2 (5)	9.6 (2)	9.5 (10)	19.3 (32)	15.0 (2)
3+	11.5 (84)			12.5 (6)	10.9 (46)	22.3 (40)	19.6 (3)
4+	13.4 (18)			14.8 (4)	13.6 (11)	23.6 (18)	20.0 (2)
5+	14.3 (13)	28.5 (2)		13.4 (1)	14.9 (18)	25.7 (10)	19.8 (1)
6+	16.3 (8)	33.5 (1)		17.7 (2)	15.9 (11)	24.1 (3)	
7+	16.7 (3)				18.4 (9)	30.7 (2)	
8+	19.0 (1)			20.0 (1)	18.6 (2)	37.5 (1)	
9+	19.7 (1)				19.4 (1)		26.4 (1)
Total	(137)	(4)		(16)	(108)	(107)	(9)

* Scale samples used to determine ages were taken from fish harvested from May to September. Numbers in parentheses are numbers of fish aged.

The average lengths of harvested largemouth bass separated by month (Table 10) varied from 11.9 to 13.3 inches for the two lakes.

A T-test of significance between two means was used to test if any month produced significantly larger (longer) largemouth bass. This test was done for each lake, comparing monthly mean length of bass harvested to total mean length of bass harvested throughout the summer (all 5 months) and total mean length of bass harvested throughout the summer excluding the month tested for.

No significant difference in average lengths between months existed for Nagawicka Lake largemouth bass at the 95% confidence level. Thus, for Nagawicka Lake in the summer of 1982, no month yielded significantly larger or smaller largemouth bass in terms of length.

For Pewaukee Lake largemouth, the 13.1-inch average length of bass harvested in June was significantly longer and the 10.6-inch average length of September harvested largemouth significantly shorter than the overall 11.9-inch mean length and cumulative mean excluding the month tested for. Based on these observations, it appears that larger (longer) largemouth bass made up a proportionately larger part of the catch in June of 1982. Conversely, smaller (shorter) bass were selected for in September on Pewaukee Lake.

Northern Pike. The low harvest of northern pike from Pewaukee Lake was characterized by fish age 5 and over. Although only 4 northern pike were tallied in the census, their average length was 27.9 inches.

Harvest of northern pike from Nagawicka contrasted sharply to that from Pewaukee. Nagawicka produced a heavy harvest of 3.0 northern pike/acre, compared to only 0.05/acre for Pewaukee. Nagawicka Lake northern pike averaged 22.1 inches and over 85% were age 4 and younger (Table 8).

Walleye. The walleye harvest from Pewaukee was confined to very young fish (age 1 and 2) corresponding in age and length to the stocked 1980 and 1981 year classes. Harvested walleyes averaged only 10.9 inches in length.

Walleyes observed in the creel on Nagawicka Lake were distributed over several ages and averaged 19.3 inches in length. As expected from information obtained in past fishery evaluations, both lakes yielded poor walleye harvests of only 0.2 fish/acre.

Mortality Rate

Catch curves were constructed from the age distribution of the 155 and 135 largemouth bass observed in the creel on Pewaukee and Nagawicka lakes, respectively. The same was done for the 117 northern pike observed in the creel on Nagawicka Lake. From these catch curves, annual and instantaneous total (annual) mortality rates were calculated (Table 11).

Catch curves indicated that largemouth bass reached full vulnerability to harvest at age 3 (during their 4th summer) on both lakes. Mortality rates between age 3 and 4 were higher than between any succeeding years (see Table 8). Pewaukee Lake exhibited a higher largemouth bass annual mortality rate than did Nagawicka.

A probable selection for larger game fish should be considered in assessing mortality rates from creeled game fish on Pewaukee and Nagawicka lakes. I assume that a smaller game fish is more likely to be released by an angler than is a larger game fish. Thus, the younger game fish are very likely at a proportionately lower abundance in a catch curve constructed from creel data than in the population at large. Therefore, it is likely that these mortality rates from creel data represent a minimum value.

Nagawicka Lake northern pike exhibited the highest annual mortality rates calculated. Catch curves indicated full angling vulnerability to occur at age 3 (see Table 8), although 34.1% of the harvested northern pike were age 2 and younger. This likely early recruitment of fast growing females is not reflected in the mortality data. If the harvested northern pike had been sexed and the proportion of age 2 northern pike females determined, sex differential mortality could have been assessed. This process likely would have increased annual mortality by adding age 2 females to the portion of the population considered fully vulnerable to angling.

Angler Demographics

The vast majority of anglers on both lakes were Wisconsin residents. State residents made up 97.6% of the anglers on Pewaukee Lake and 96.2% of the anglers on Nagawicka. The majority of resident anglers traveled less than 50 miles to fish (Table 12) and of those travelling less than 50 miles, most travelled 26-50 miles. This data indicates a heavy interest within the Milwaukee urban area for recreation on both lakes.

Anglers fishing Pewaukee and Nagawicka lakes rarely used professional guides. Less than 0.2% of the anglers interviewed on both lakes were fishing with a guide.

Male anglers made up over 87% of the anglers fishing both lakes (Table 13). Female anglers averaged 12.7% and 12.4% of the anglers on Pewaukee and Nagawicka, respectively.

The age distribution of the anglers fishing both lakes was similar. Most of the males and females fishing both lakes were between the ages of 16 and 64.

Angler Interest

Most of the anglers interviewed on both lakes indicated they were fishing for panfish (Table 14). Panfish accounted for approximately 60% of the fishing attempts on both lakes. Largemouth bass was the primary game fish sought, accounting for about 20% of the angling attempts on both lakes. The poor northern pike population of Pewaukee Lake is reflected in northern pike accounting for only 4.5% of the attempts on Pewaukee, compared to almost 17% of the angler attempts on Nagawicka. The muskellunge fishery on Pewaukee Lake attracted a respectable 9.9% of the total angling attempts for that lake.

Anglers could fish for a possible 11 panfish species. Some panfish anglers stated a species preference, while others had none. Of those who expressed a species preference, about 97% of the panfish anglers on both lakes were fishing for either bluegill, black crappie, or yellow perch (Table 15).

TABLE 10. Mean length (inches) by month for harvested largemouth bass observed in the creel, 1 May-30 September 1982.

Lake	Avg. Length May	June	July	August	September
Pewaukee	12.1	13.1*	11.9	12.2	10.6**
Nagawicka	12.8	12.1	13.3	12.4	12.1

* Significantly longer (T-test).
** Significantly shorter (T-test).

TABLE 11. Total annual mortality rate (A) and instantaneous total annual mortality rate (Z) determined from the age distribution of harvested largemouth bass and northern pike.*

Species	(A)	(Z)
Largemouth bass (Pewaukee Lake)	0.523	0.74
Largemouth bass (Nagawicka Lake)	0.446	0.59
Northern pike (Nagawicka Lake)	0.533	0.76

* Determined from the age distribution of fish observed in the creel, 1 May - 30 September 1982.

TABLE 12. Distances traveled by resident anglers to reach Pewaukee and Nagawicka lakes.

Distance Traveled	% Anglers Travelling Each Distance Pewaukee Lake	Nagawicka Lake
0-25 miles	39.5	40.8
26-50 miles	58.9	57.8
Over 50 miles	1.6	1.4

TABLE 13. Age and sex distribution (%) of Pewaukee and Nagawicka lake anglers.

	Pewaukee Lake		Nagawicka Lake	
	Males	Females	Males	Females
% of all Anglers	87.3	12.7	87.6	12.4
Age				
Under 16	8.4	9.8	7.8	16.4
16 to 64	87.2	85.8	86.5	78.2
65 and over	4.4	4.4	5.7	5.4

TABLE 14. Distribution of angling attempts among interviewed anglers.*

Species	No. Times a Species Was Fished For			
	Pewaukee Lake	(%)	Nagawicka Lake	(%)
Panfish	1,697	(62.2)	1,710	(59.4)
Largemouth bass	520	(19.1)	600	(20.8)
Northern pike	124	(4.5)	486	(16.9)
Walleye	65	(2.4)	76	(2.6)
Muskellunge	271	(9.9)	--	
Smallmouth bass	26	(1.0)	--	
Bullhead	16	(1.0)	1	(1.0)
Carp	7	(1.0)	1	(1.0)
Total	2,726		2,874	

* Since some anglers fished for more than 1 species per trip, the total number of angling attempts exceeds anglers interviewed.

TABLE 15. Species preference among those panfish anglers fishing for a particular species.

Species	% Anglers Seeking Each Species	
	Pewaukee Lake	Nagawicka Lake
Bluegill	26.3	59.8
Yellow perch	23.7	17.9
Black crappie	47.0	18.9
All other panfish	3.0	3.4

Despite ranking third in the panfish harvest on both lakes, black crappie was second in preference among panfish anglers. There apparently was a very strong preference among panfish anglers for black crappies on Pewaukee Lake, where 47% of those who expressed a preference were seeking black crappie. Bluegill was a strong first in preference among panfish anglers on Nagawicka Lake (59.8%).

Fishing Techniques

Most anglers interviewed on both lakes were still fishing (Table 16). The next most common fishing method, comprising slightly less than 1/3 of the angling methods observed, was casting. Trolling was a minor angling method on both lakes, despite the muskellunge fishery on Pewaukee Lake.

By far the most popular fishing gear, comprising 89-91% of the gear used, was spinning equipment. Bait casting gear was second in popularity, although not exceeding 10% of the gear in use.

Pleasure Boat Use

For the purpose of this creel census, pleasure boats were defined as motorized watercraft without fishing equipment on board. Numbers of pleasure boats were counted along with anglers in the instantaneous counts. Numbers of occupants in the pleasure boats were not counted. Appendixes IIIA and IIIB list the average number of pleasure boats counted by time period for Pewaukee and Nagawicka lakes, respectively.

Very few pleasure boats were counted in the 6:00 a.m.-8:00 a.m. or 8:00 p.m.-10:00 p.m. counts. To arrive at an estimate of pleasure boat hours, these two periods were deleted. Thus, a 12-hour pleasure boat day (8:00 a.m.-8:00 p.m.) is assumed. Table 17 incorporates the instantaneous counts from 8:00 a.m.-8:00 p.m. into an estimate of pleasure boat hours by month and weekdays or holidays/weekends. Since counts of pleasure boats did not include a count of boat occupants, the hours given in Table 17 are not directly comparable to estimated angling hours.

Table 18 summarizes the monthly percent occurrence of pleasure boat hours during weekdays or holidays/weekends. Monthly use levels by pleasure boats are shown graphically in Figure 6.

I could find no available reference data concerning the average number of occupants in a pleasure boat. To help estimate total pleasure boat hours, I counted the average number of occupants in motorized pleasure boats on Saturday, 28 July 1984. Occupants averaged 4.2/boat on Pewaukee and 3.7 on Nagawicka. Counts were made on a warm, calm day from 1:00 p.m. to 3:30 p.m.

Using these averages for numbers of occupants per motorized pleasure boat yields an estimate of 190,650 and 95,974 total pleasure boat occupant hours for Pewaukee and Nagawicka, respectively. These estimates are 46% and 39% of the total (fishing plus motorized pleasure boating) lake use.

The Southeastern Wisconsin Regional Planning Commission (SEWRPC) has utilized an observed mix of fast boating activities consisting of 43% water skiing, 33% motor boating, and 24% sailing in assessing the carrying capacity for lakes in

TABLE 16. Summary (%) of angling methods and gear used on Pewaukee and Nagawicka lakes during 1 May-30 September 1982.

Species	% Anglers Using a Method or Gear	
	Pewaukee Lake	Nagawicka Lake
Angling Method		
Still fishing	68.7	70.7
Casting	29.3	28.3
Trolling	2.0	1.0
Angling Gear		
Spinning	89.3	91.0
Bait casting	9.4	7.2
Fly casting	0.2	1.0
Cane pole	1.1	0.8

TABLE 17. Estimated pleasure boat hours based on instantaneous counts from 8:00 a.m. to 8:00 p.m., 1 May-30 September 1982.

	Pewaukee Lake			Nagawicka Lake		
	Weekdays	Holidays/ Weekends	Total	Weekdays	Holidays/ Weekends	Total
May	615	2,348	2,963	682	1,959	2,641
June	4,601	6,336	10,937	2,561	2,984	5,545
July	4,941	11,238	16,179	3,465	6,610	10,075
August	3,353	7,502	10,855	2,231	3,186	5,417
September	1,273	3,186	4,459	492	1,769	2,261
Total	14,783	30,610	45,393	9,431	16,508	25,939
Hours/Acre	6.3	13.0	19.2	9.8	17.2	27.1

TABLE 18. The distribution of estimated pleasure boat hours (%) from 1 May-30 September 1982.

	Pewaukee Lake			Nagawicka Lake		
	Weekdays	Holidays/ Weekends	Total	Weekdays	Holidays/ Weekends	Total
May	1.3	5.2	6.5	2.6	7.5	10.2
June	10.1	14.0	24.1	9.9	11.5	21.4
July	10.9	24.8	35.7	13.4	25.5	38.8
August	7.4	16.5	23.9	8.6	12.3	20.9
September	2.8	17.0	9.8	1.9	6.8	8.7
Total	32.5	67.5		36.4	63.6	

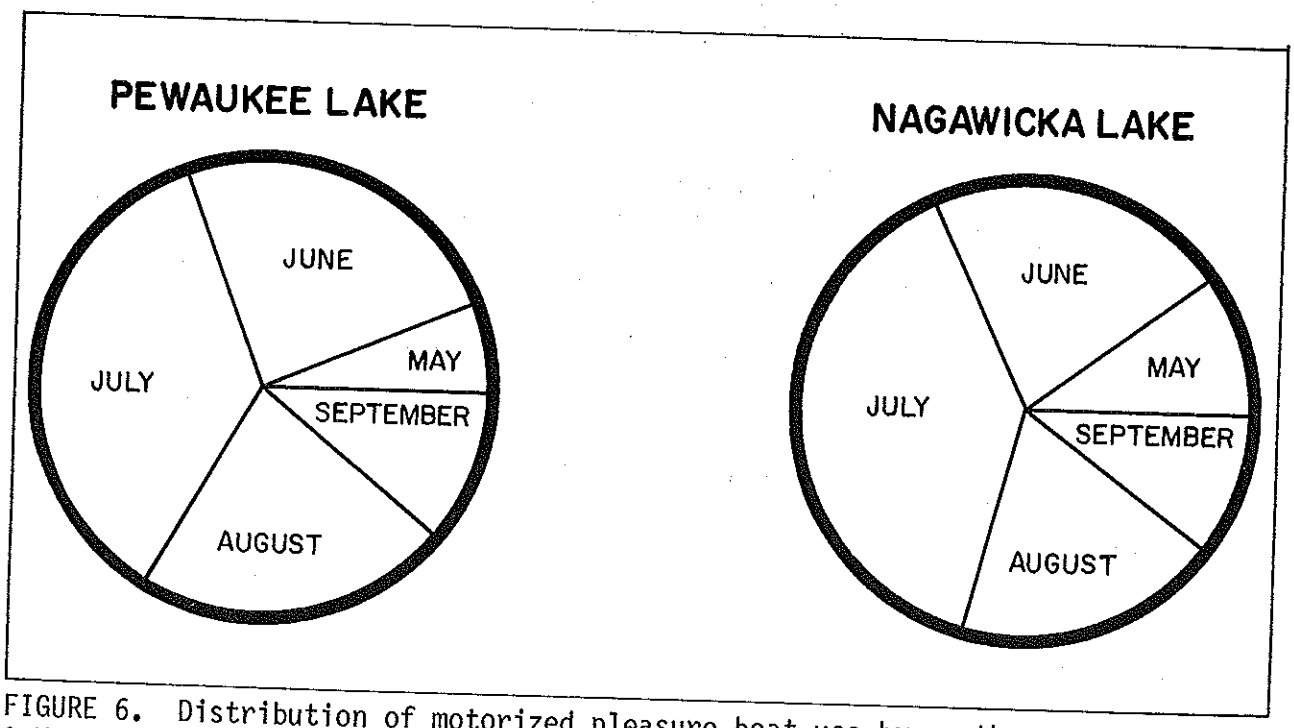

FIGURE 6. Distribution of motorized pleasure boat use by month, 1 May - 30 September 1982.

excess of 200 acres in southeastern Wisconsin (Southeast. Wis. Reg. Plann. Comm. 1977). Based on these activities occurring at the same time, a minimum of 15.9 acres/water craft is desirable. A minimum area of 20 acres for safe water skiing, 15 acres for safe motorboating, and 10 acres for safe sailing is used in carrying capacity calculations. In considering motorized pleasure boats alone (as in our creel census counts), a minimum of 17.8 acres/pleasure boat is required for safe motorized pleasure boating. This determination ignores the fact that other competing recreational pursuits (sailing, fishing, canoeing, etc.) are occurring at the same time. Thus, it is a determination of the raw carrying capacity of the lake for motorized pleasure boating alone.

Pewaukee and Nagawicka offer 2,020 and 599 acres, respectively, of usable fast boating water (Southeast. Wis. Reg. Plann. Comm. 1977). Based on these criteria, the raw carrying capacity for motorized pleasure boats at any one time is 113 on Pewaukee and 34 on Nagawicka.

Reviewing the instantaneous counts of motorized pleasure boats (Append. IIIA and IIIB) shows that the carrying capacity of Nagawicka Lake on July weekends and holidays was habitually exceeded. On both lakes, midday instantaneous counts on weekends or holidays in June, July, and August regularly approached or met the raw carrying capacity for motorized pleasure boating, assuming no other activity was occurring at the same time.

From the data gathered, it appears that in the interest of safety, both lakes (but Nagawicka in particular) need a mechanism to lower the motorized pleasure boat use during the midsummer, midday weekend and holiday hours.

SUMMARY AND MANAGEMENT IMPLICATIONS

This creel census was designed to categorize and compare the fish production from a large (Pewaukee) and medium-sized (Nagawicka) lake in southeastern Wisconsin. Characteristics of the fishery of these two lakes are similar to other southeastern Wisconsin lakes with stable and diverse fish populations.

Largemouth bass fishing was popular and accounted for about 20% of the angling attempts on both study lakes. On Lake Noquebay, a 2,409-acre northern Wisconsin lake with a similar game fish species composition, largemouth bass were sought by only about 7% of the anglers interviewed (Thuemler 1981). The age composition of the largemouth bass harvest in both lakes was composed mostly of young bass (age 3 and younger). Annual mortality rates (from catch curves) between ages 3 and 4 were higher than between any succeeding years. The average length of all largemouth bass harvested was slightly longer than the average length of an age 3 bass in each lake; and smaller than the average length of an age 4 bass in each lake. May was the month of highest bass harvest in both lakes (33-45% of total harvest). However, bass taken in May were not significantly larger (longer) than those taken in other months.

Harvest of the abundant northern pike population of Nagawicka Lake was also confined mainly to age 3 and younger fish. Age 2 northern pike, the second most abundant year class in the harvest, are probably faster growing females exploited at an earlier age than slower growing males.

Panfish, although accounting for about 60% of the angling attempts on the study lakes, accounted for a lower proportion of the fishing interest than was anticipated. For example, on Lake Noquebay, a hefty 76% of the angler trips were for panfish. Panfish comprised over 95% of the number of fish harvested in both study lakes. The average size of the 3 principal panfish species (bluegill, yellow perch, black crappie) was generally small and near the size of minimum acceptability to anglers.

in comparison to other Wisconsin lakes of similar acreages, both lakes were heavily fished.

Under existing fishing regulations, both lakes are producing generally young game fish and small panfish. Yet, locally both lakes are considered to be very good fishing lakes. Apparently, enough large game fish are caught to maintain high angler expectations. Nagawicka Lake at times produces large panfish, particularly bluegills (8-10 inches in length).

Any future regulations designed to increase the average length, hence age, of largemouth bass harvested from both lakes should consider that --

- most bass are caught in May.
- age 3 largemouth bass (10.9-11.5 inches) are the major component of the harvest.
- average length of all bass harvested is close to the average length of an age 3 bass.
- highest annual mortality rates occur from age 3 to 4.

Northern pike age composition data also suggests a high harvest rate that limits the average size of harvested pike to small, young fish. Differential growth between sexes makes correction of this situation by a size limit difficult. However, southeastern Wisconsin anglers seem satisfied to harvest 19-22 inch northern pike.

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APPENDIX I.

DEPARTMENT OF NATURAL RESOURCES

ANGLER INTERVIEW

FORM 3600-114 REV. 5-82

COUNTY	COUNTY CODE*	WATER NAME	WATER NUMBER*	1. ☐ LAKE* 2. ☐ STREAM*	SHEET NUMBER*
	— —		— — — —		— — — —

CENSUS SITE	DATE (MONTH-DAY-YEAR)*	1. ☐ WEEKDAY* 2. ☐ WEEKEND/HOLIDAY
— — —	— — / — — / — —	

WAS THE ANGLER A: 1. ☐ DRIVER 2. ☐ PASSENGER 3. ☐ NO VEHICLE

2. AGE: 1. ☐ UNDER 16 2. ☐ 16-64 3. ☐ 65 & OVER

3. SEX: 1. ☐ MALE 2. ☐ FEMALE

4. ANGLER RESIDENCE: 1. ☐ WIS. 2. ☐ NON-RES.

DISTANCE (MILES): 1. ☐ 0-25 2. ☐ 26-50 3. ☐ OVER 50

WIS. COUNTY CODE OR NON-RESIDENT STATE: — —

5. LICENSE: 1. ☐ NONE 2. ☐ SPORT 3. ☐ RES. COMB. 4. ☐ PERM. RES. 5. ☐ ANNUAL 6. ☐ FAMILY 7. ☐ 15-DAY 8. ☐ 4-DAY

6.* NUMBER OF ANGLERS IN PARTY: — —

7. TYPE OF TACKLE (MAX. OF 2):
1. ☐ SPINNING 2. ☐ BAIT CASTING 3. ☐ FLY 4. ☐ CANE POLE 5. ☐ JIG POLE 6. ☐ TIP UP 7. ☐ OTHER _____

8. ANGLING METHOD (MAX. OF 2):
1. ☐ STILL FISHING 2. ☐ CASTING 3. ☐ TROLLING 4. ☐ JIGGING 5. ☐ SNAGGING 6. ☐ OTHER _____

9. BAITS USED (MAX. OF 2):
1. ☐ WORM 2. ☐ MINNOW 3. ☐ OTHER NAT. BAIT 4. ☐ PREPARED BAIT 5. ☐ SPINNERS 6. ☐ SPOONS 7. ☐ PLUGS 8. ☐ FLY 9. ☐ JIGS 10. ☐ OTHER _____

10. ANGLER WAS: 1. ☐ GUIDED 2. ☐ NOT GUIDED

11.* FISHING WAS FROM: 1. ☐ BOAT 2. ☐ SHORE OR DOCK 3. ☐ WADING 4. ☐ ICE SHANTY 5. ☐ OPEN ICE

12.* COMPLETED FISHING: 1. ☐ YES 2. ☐ NO

13.* TIME STARTED FISHING: — — : — —

TIME INTERVIEWED OR
14.* TIME ENDED FISHING: — — : — —

15.* CATCH AND HARVEST INFORMATION:

SPECIFICALLY FISHED FOR	% OF TIME FISHED FOR	NUMBER CAUGHT	NUMBER KEPT

16. LENGTH IS RECORDED IN: 1. ☐ INCHES & TENTHS 2. ☐ CM & MM

17. WEIGHT IS RECORDED IN: 1. ☐ POUNDS & OUNCES 2. ☐ KGS. & GRAMS

SPECIES CODE		18. SPECIES	LENGTH IN. CM.	LENGTH 10TH MM.	WEIGHT LBS. KGS.	WEIGHT OZ. GMS.	FIN CLIP	TAG TYPE	TAG COLOR	TAG NUMBER
L. STURGEON	B01									
SHOVELNOSE	B02									
GAR, UNSP.	D00									
BOWFIN	E01									
HIODON, UNSP.	H00									
CISCO	I04									
L. WHITEFISH	I05									
COHO S.	I14									
CHINOOK S.	I16									
ATLANTIC S.	I20									
TROUT, UNSP.	I01									
RAINBOW T.	I19									
BROWN T.	I21									
BROOK T.	I22									
LAKE T.	I23									
TIGER T.	I27									
SPLAKE	I28									
SMELT	J01									
N. PIKE	L02									
MUSKIE	L03									
HYB. MUSKIE	L08									
CARP	M12									
BUFFALO, UNSP.	N03									
REDHORSE, UNSP.	N04									
SUCKER, UNSP.	N02									
WH. SUCKER	N09									
BULLHD., UNSP.	O00									
BLACK BHD.	O05									
BROWN BHD.	O07									
YELLOW BHD.	O06									
CH. CATFISH	O08									
FLATHD. CAT.	O12									
BURBOT	R01									
WHITE BASS	V01									
YELLOW BASS	V02									
PANFISH	Z97									
SUNFISH, UNSP.	W03									
ROCK BASS	W04									
GREEN SUNFISH	W05									
PUMPKINSEED	W06									
WARMOUTH	W07									
BLUEGILL	W09									
WH. CRAPPIE	W13									
BL. CRAPPIE	W14									
Y. PERCH	X15									
SM. BASS	W11									
LM. BASS	W12									
SAUGER	X21									
WALLEYE	X22									
FW. DRUM	Y01									

19. COMMENTS:

GENERAL INSTRUCTIONS

A SEPARATE SHEET IS REQUIRED FOR EACH ANGLER

The following information must be correctly entered or the sheets will be returned for recoding:

COUNTY CODE	SHEET NUMBER (sequential for water censused)
WATER NUMBER	DATE, and WEEKDAY or WEEKEND/HOLIDAY (Check one)
LAKE or STREAM (Check one)	Items 1*, 6*, 11*, 12*, 13*, 14*, 15*

The spaces for WATER NAME and COUNTY are included for your convenience and are not necessary for processing. CENSUS SITE may be used to designate the stream section, pool, access site, etc., and up to three numbers must be entered to specify the interview site for computer processing. Corresponding census site designations must also be entered on the instantaneous counts forms.

Item *1-3. Self explanatory, check one box only for each item.

4. Check RESIDENCE, MILES, and enter the appropriate Wis. county code. Non-resident's state should be entered as IL (Illinois), MI (Michigan), MN (Minnesota), IA (Iowa), IN (Indiana), OH (Ohio), MO (Missouri), etc.

*6. Enter the TOTAL NUMBER IN THE ANGLER'S PARTY (a lone angler is entered as 01).

7-10. Check no more than two boxes each for items 7, 8, and 9. Check item 10.

*11. Check only one box for FISHING WAS FROM.

*12. Check one.

*13-*14. Enter as military time. If the trip is still underway, enter the time of the interview; if the trip was completed, enter the time it ended.

*15. Enter the code for each species the angler SPECIFICALLY FISHED FOR. Species groups like PANFISH (Z97) or TROUT, UNSPECIFIED (I01) may be used if necessary. Use only the species codes listed on this form.

The percent of angler's trip that is spent fishing for each species must be recorded as a whole number. For example, if an angler fishes one hour for muskie and four hours for panfish, allocate 20% of the time to muskie and 80% to panfish. An angler who uses two rods and fishes for different species simultaneously (i.e., minnow fishing for walleye while casting for muskie) could have 100% of the time allocated to each species. If an angler reports fishing simultaneously for two species with one rod (i.e., casting for bass and northern pike), each could be allocated 100% of the angler's time. Any incidental catch (e.g., picking up a northern pike while bait fishing for panfish) should be allocated 0% of the angler's time.

NUMBER CAUGHT and NUMBER KEPT must be entered. "0" must be entered if no catch was reported.

16-17. Check the appropriate box if length or weight measurements are made.

18. Enter the SPECIES CODE and LENGTH. If inches are used, enter inches and tenths. *Fractions are not acceptable.* If millimeters are used, a 900 mm fish would be entered as:

cm	mm
90	0

Weight *must be* entered as kilograms and grams or as pounds and ounces.

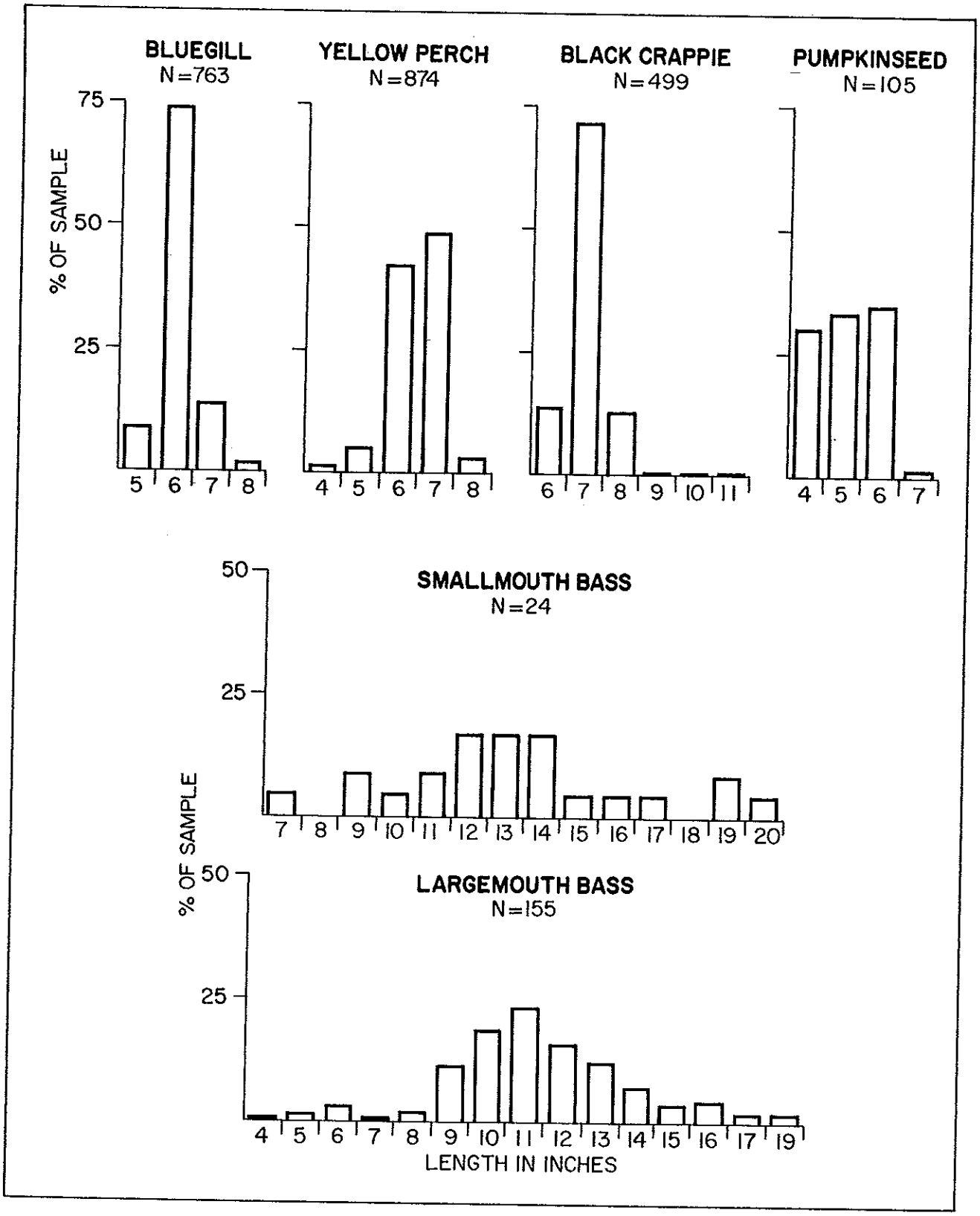
If grams are used, a 1,045 gm fish would be entered as:

kgs	gms
1	045

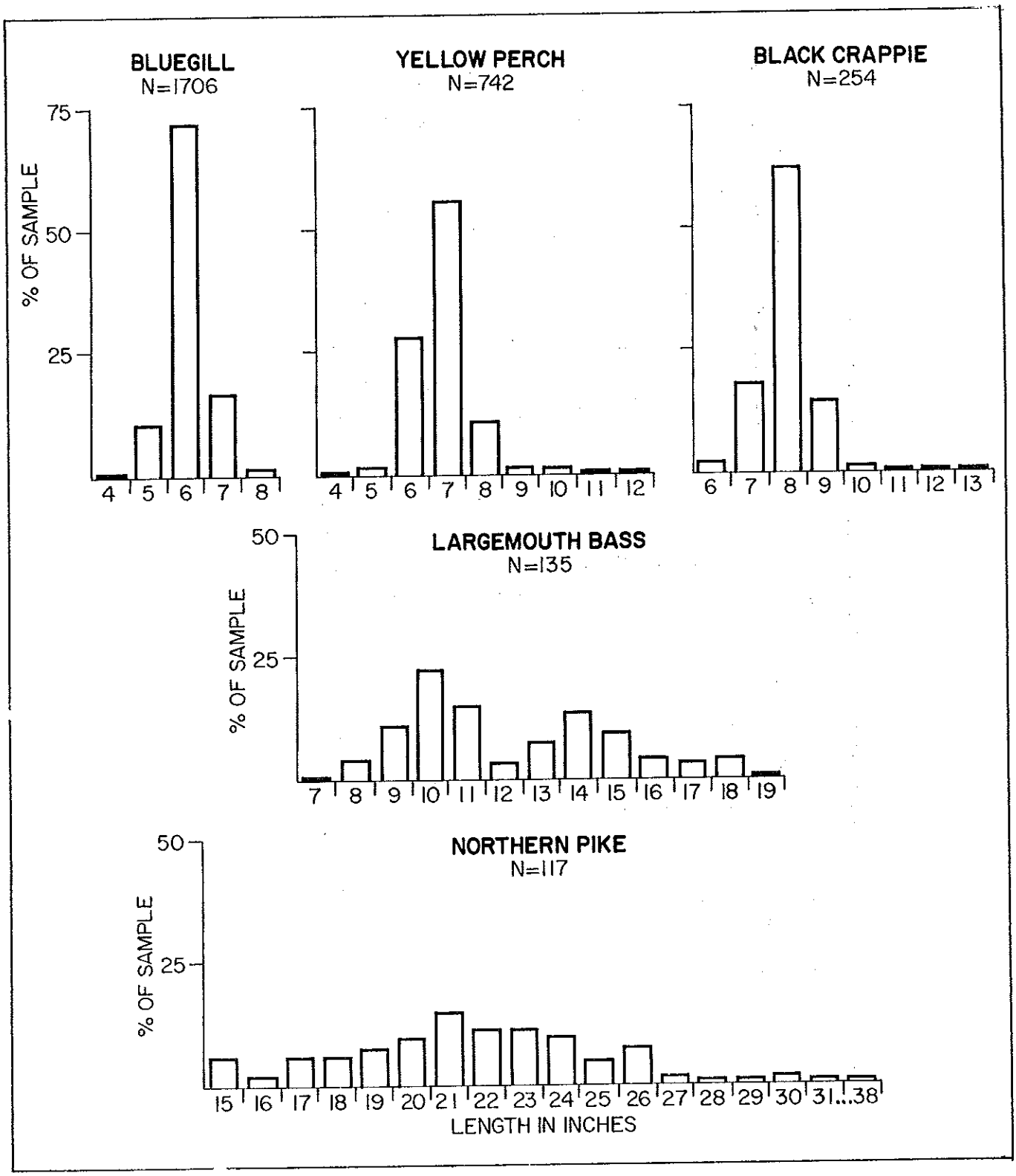
Enter fin clip code, tag type and color, and tag number as specified in the information package accompanying these forms.

19. Any additional information may be entered under COMMENTS. This information may be coded with up to three letters and/or numbers for computer processing.

APPENDIX IIA. Length frequency of principal fish species in the harvest, Pewaukee Lake.



APPENDIX IIB. Length frequency of principal fish species in the harvest, Nagawicka lake.



APPENDIX III A. Averages of Pewaukee Lake instantaneous motorized pleasure boat counts by month and time period.

Time Period	Weekdays					Weekends/Holidays				
	May	June	July	August	Sept	May	June	July	August	Sept
6:00–8:00 am	0 (4)	1 (3)	1 (1)	0 (2)	0 (3)	2 (4)	15 (2)	– (0)	0 (1)	0 (0)
8:01–10:00 am	1 (3)	1 (1)	1 (1)	4 (2)	0 (2)	4 (1)	– (0)	– (0)	84 (1)	0 (0)
10:01–12:00 noon	1 (3)	8 (4)	17 (3)	12 (2)	7 (4)	23 (3)	74 (3)	– (0)	80 (2)	12 (1)
12:01–2:00 pm	4 (2)	14 (3)	23 (5)	16 (2)	3 (5)	32 (4)	140 (1)	159 (2)	81 (4)	52 (6)
2:01–4:00 pm	6 (1)	25 (5)	39 (4)	14 (4)	16 (1)	– (0)	125 (1)	85 (3)	116 (2)	11 (1)
4:01–6:00 pm	3 (4)	18 (7)	24 (7)	14 (7)	6 (5)	12 (4)	31 (3)	76 (6)	50 (4)	24 (8)
6:01–8:00 pm	3 (3)	40 (1)	25 (3)	12 (3)	4 (3)	0 (2)	14 (1)	62 (4)	21 (2)	2 (2)
8:01–10:00 pm	0 (2)	3 (2)	7 (2)	1 (4)	– (0)	1 (2)	9 (3)	9 (3)	3 (2)	– (0)
Weighted Mean	1.8 (22)	14.3 (26)	22.4 (26)	9.9 (26)	4.4 (23)	12.9 (20)	46.3 (14)	71.1 (18)	58.2 (18)	29.3 (18)
12-hour Mean**	2.8	9.7	13.8	8.5	1.9	14.8	31.1	50.0	29.5	16.4

* Numbers in parentheses are instantaneous counts; averages (except weighted mean) rounded to nearest whole number.
** The 12-hour (8:00 am – 8:00 pm) mean values were used in estimates of use levels.

APPENDIX III B. Averages of Nagawicka Lake instantaneous motorized pleasure boat counts by month and time period.

Time Period	Weekdays					Weekends/Holidays				
	May	June	July	August	Sept	May	June	July	August	Sept
6:00-8:00 am	0 (2)*	0 (2)	0 (2)	1 (2)	0 (3)	0 (1)	0 (1)	- (0)	0 (2)	0 (1)
8:01-10:00 am	2 (1)	1 (1)	9 (2)	5 (1)	0 (1)	2 (1)	22 (1)	- (0)	31 (1)	- (0)
10:01-12:00 noon	3 (6)	11 (5)	14 (2)	8 (3)	0 (4)	11 (2)	33 (2)	52 (1)	18 (2)	27 (2)
12:01-2:00 pm	3 (8)	5 (4)	15 (2)	9 (5)	2 (7)	23 (9)	53 (3)	90 (2)	60 (2)	6 (1)
2:01-4:00 pm	1 (1)	35 (2)	20 (2)	10 (2)	- (0)	8 (1)	40 (2)	77 (2)	43 (1)	51 (1)
4:01-6:00 pm	3 (3)	6 (3)	16 (2)	7 (5)	3 (6)	7 (5)	13 (3)	45 (3)	19 (4)	26 (5)
6:01-8:00 pm	- (0)	6 (5)	12 (6)	10 (4)	3 (3)	8 (1)	7 (1)	26 (5)	24 (2)	3 (7)
8:01-10:00 pm	0 (1)	0 (6)	2 (6)	1 (4)	- (0)	2 (2)	1 (1)	3 (5)	1 (3)	2 (1)
Weighted Mean	2.5 (22)	28 (24)	9.6 (24)	6.7 (26)	1.7 (24)	13.0 (22)	26.7 (14)	37.0 (18)	21.0 (17)	9.0 (18)
12-hour Mean**	2.6		19.6	12.7	5.0	17.8	66.0	85.1	69.5	19.5

* Numbers in parentheses are instantaneous counts; averages (except weighted mean) rounded to the nearest whole number.
** The 12-hour (8:00 am - 8:00 pm) mean values were used in estimates of use levels.

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Edited by Donna Mears.