11. FISHERIES MANAGEMENT

INTRODUCTION:

The fish populations in Lake Winona are managed by the Minnesota Department of Natural Resources (DNR), with the volunteer assistance of the Lake Winona Committee. DNR biologists have annually made biological surveys of Lake Winona since 1974; survey reports are also available for 1953 and 1960. A copy of the DNR Fisheries Population Assessment for 1984 is included as Appendix 11-1. During a lake survey, gillnets, trapnets and electrofishing gear are utilized to sample the fish community (Fig. 11-1). Shoal waters are seined to assess natural reproduction of all fish species and levels of forage abundance. Lengths and weights are recorded and scales are taken from the major game fish species for age and growth determination (Fig. 11-1). A lake survey may also include water chemistry measurements, especially for temperature and dissolved oxygen. The survey includes management recommendations.

Figure 11-1. Minnesota Department of Natural Resources lake survey crew using electrofishing equipment to sample fish populations.

Figure 11-2. Left: DNR personnel measure fish and remove scales to determine growth rates.

Right: Stunted buffalofish dominated Lake Winona after the winter kill of 1965.

Table 11-1. Fish Stocked Into Lake Winona.

Year	Species	Size	Number
1973	channel catfish	fingerling	722
	bluegill	fingerling/ yearling	88,080
	largemouth bass	fingerling	8,085
1974	northern pike	adult	98 (Boller Lake)
	northern pike	fingerling	21,000
	walleye	fry	350,000
	largemouth bass	adult	70
	smallmouth bass	adult	35
	bluegill	adult	1,572
	channel catfish	fry	50,000
1975	muskellunge	fingerling	300
1976	northern pike	fingerling	480
	northern pike	adult	120
1978	northern pike	fingerling	1,955
1979	northern pike	fingerling	4,200
1980	northern pike	fingerling	2,007
1981	flathead catfish	fingerling	1,500
1982	northern pike	fingerling	1,065
1983	northern pike	fingerling	3,905
1984	northern pike	fingerling	3,759
	bowfin	adult	453
1985	northern pike	fingerling	755
	bowfin	adult	1,223

Prior to the winter kill of 1965, Lake Winona was a good fishing lake, but after the kill the lake became dominated by stunted fish, especially buffalo, carp and bullheads (Fig. 11-2). A second winter kill occurred in 1969, making the situation even worse. It was evident that winter kills would occur with increased frequency in future years because the lake was becoming increasingly eutrophic. The reclamation project which was initiated in 1973 has prevented winter kills and it has also caused the return of aquatic plants which rough fish had destroyed in the 1965-1973 interval.

The reclamation project was aimed specifically at making Lake Winona a sport fishery for children, the elderly and the handicapped. After the rotenone treatment of September 1973, the lake was stocked with bluegills, channel catfish, largemouth bass, smallmouth bass, walleyes and northern pike (Table 11-1). Bluegills were the fish of choice because they could be caught by children and inexperienced or handicapped anglers with a minimum of equipment. Bass and northern pike were stocked as predators, but also as good sport fish which were relatively easy to catch. Channel cats and walleyes were stocked as additional "bonus" sport fish which would grow rapidly in the

Figure 11-3. Bluegill fishing was excellent during the early post-reclamation years.

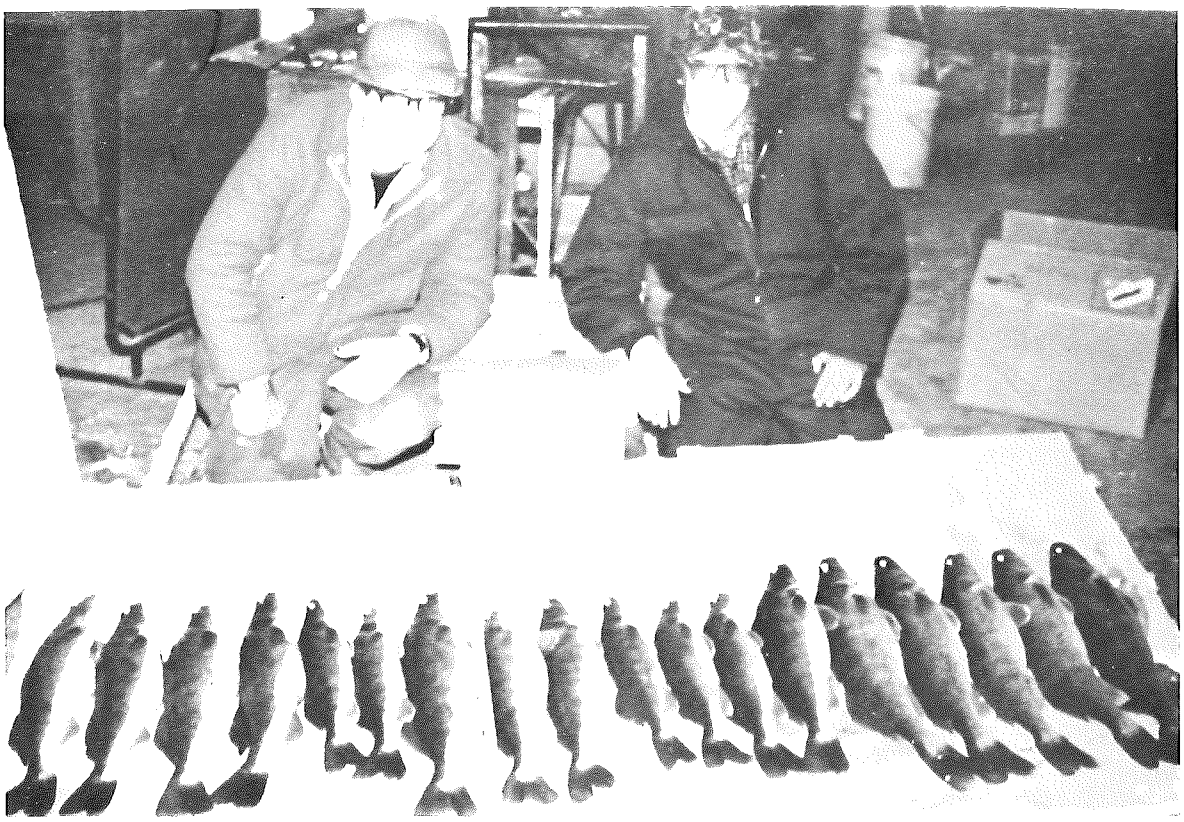

Figure 11-4. Walleyes grew rapidly, but were caught mainly by experienced anglers.

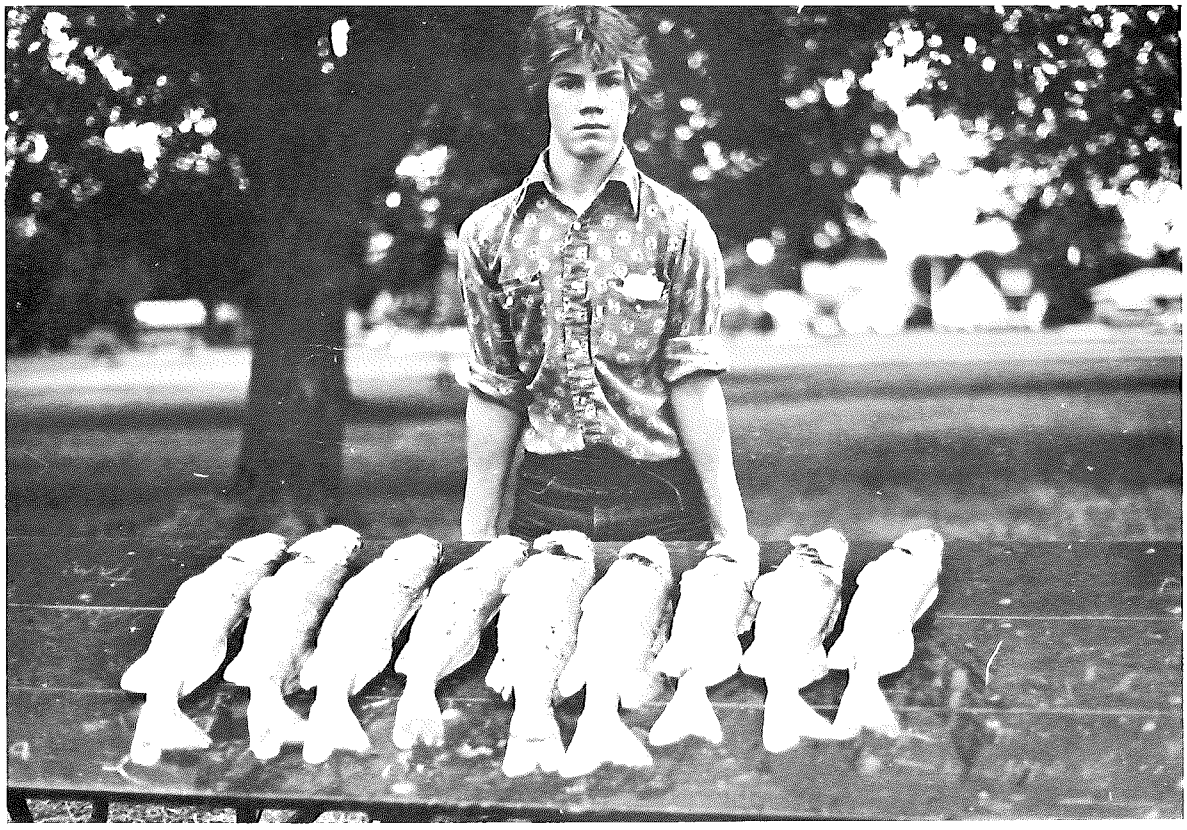

Figure 11-5. Late summer stagnation caused oxygen deficiencies in 1978, resulting in a loss of some large walleyes.

Figure 11-6. Northern pike are important predators and are popular sport fish. Many trophy-sized northern pike have been taken from Lake Winona.

absence of high populations of competitors and predators. Black crappies and yellow perch were not stocked, but predictably found their way into the lake somehow. The rotenone treatment did not kill all black bullheads. A malfunctioning electric weir at the Lake's outlet let a variety of river fish (including carp and buffalo) into the lake in the spring of 1974.

Fish growth was rapid during the early post-reclamation years, and fishing success was excellent (Fig. 11-3). Walleyes grew rapidly, but were taken mainly by experienced anglers (Fig. 11-4). Some walleyes died of oxygen deficiency during a late summer stagnation period in 1978 near Mankato Avenue (Fig. 11-5). Northern pike, many of trophy size, were caught by many anglers (Fig. 11-6). Channel catfish have grown to large size and are occasionally caught (Fig. 11-7). Nesting structures made of barrels and flue tiles were installed by Winona State University students in hopes that natural reproduction would occur.

A May-September creel survey (Appendix 11-2) by the DNR in 1980 revealed that fishing was excellent in Lake Winona. There were an estimated 21,210 fisherman-hours expended on weekends and 22,740 fisherman-hours on weekdays. The bluegill was the fish most caught and sought after; 170 pounds of bluegills (average weight 0.25 pounds) were caught per acre. About 80% of the anglers were from the immediate Winona area, the rest came from many states, especially Illinois.

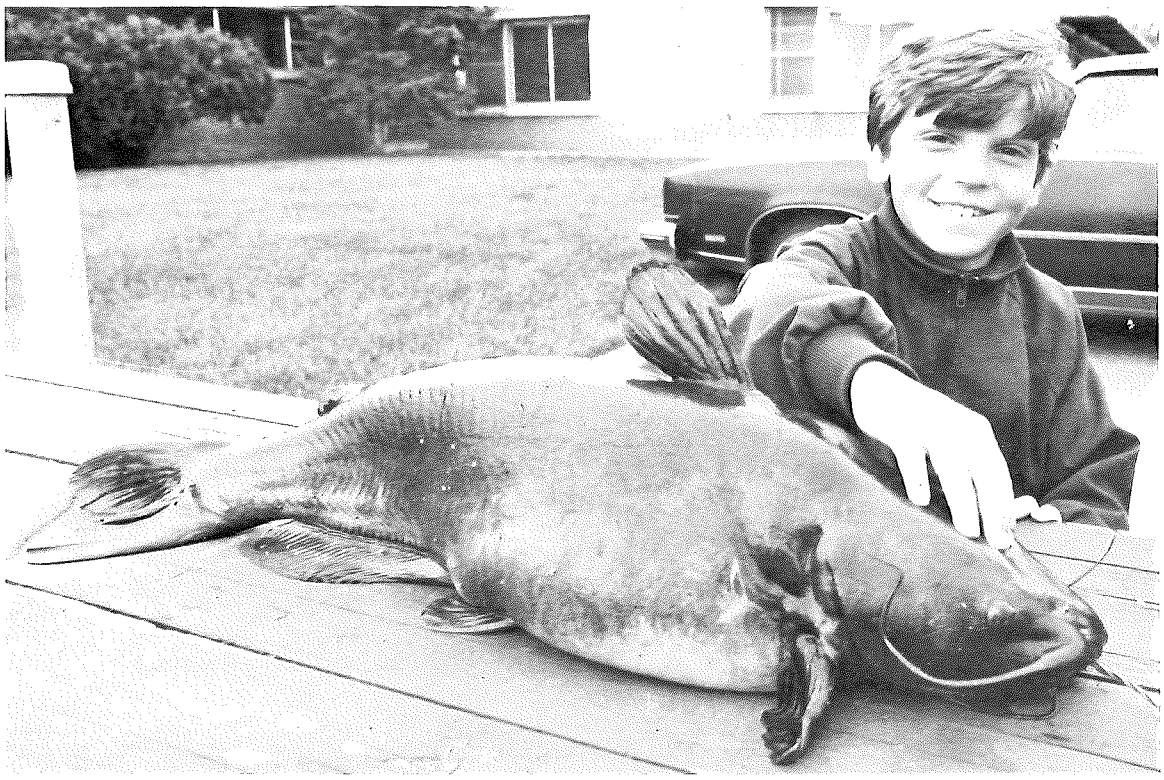

Figure 11-7. Channel catfish as large as 16 pounds are occasionally caught.

Table 11-2. Age and Growth of Lake Winona Bluegills

Trapnetting, Number and Average Weight

Year	No.	Avg. Wt.*
1980	464	0.25
1981	557	0.19
1982	1,050	0.11
1983	1,425	0.11
1984	538	0.10
1985	469	0.12

*Average from bluegills ≥5.0 inches

Table II.

Growth
Length at Last Annulus Formation

	I	II	III	IV	V	VI	VII
Lake Winona 1982	1.6	3.3	4.4	4.9	5.7	6.7	7.0
1983	1.9	3.1	4.0	6.1	6.2	7.3	
1984	1.9	2.7	4.2	4.9	6.2	7.2	
1985	1.8	3.0	3.8	4.9	5.7		
State average	1.9	3.4	4.9	6.1	7.1	7.8	
Miss. River average	3.8	5.7	6.7	9.3			

Table III.

Shoreline Seining to Access
Natural Reproduction
(Young-of-year Fish)

	Bluegills	Black Crappie
Year	No.	No.
1980	496	0
1981	889	0
1982	14	0
1983	261	0
1984	151	0
1985	209	0

Data from Minnesota Department of Natural Resources

BLUEGILLS

Growth of bluegills (and black crappies) was rapid during the early post-reclamation years, but growth slowed markedly in 1980 and the fish have been stunted ever since (Table 11-2). Lake Winona's stunted panfish problem is caused by: 1) the entire shoreline being suitable for spawning, 2) excessive weed growth protecting young-of-the-year and juveniles, 3) insufficient predation, and 4) insufficient forage of a size suitable for large panfish. Because most of Lake Winona's sediments are anaerobic during the summer, they produce relatively few invertebrates. Hence, zooplankton is the main panfish forage. Only small panfish do well on zooplankton. Fishermen now find the 0.1-lb. fish unacceptable and this further aggravates the overcrowding and stunting problem. Growth rates for bluegills and crappies are summarized in Figs. 11-8 and 11-9.

It was obvious at the outset that largemouth bass, which also reproduce naturally in the lake, could not control the panfish. Therefore, northern pike were routinely stocked to prey on

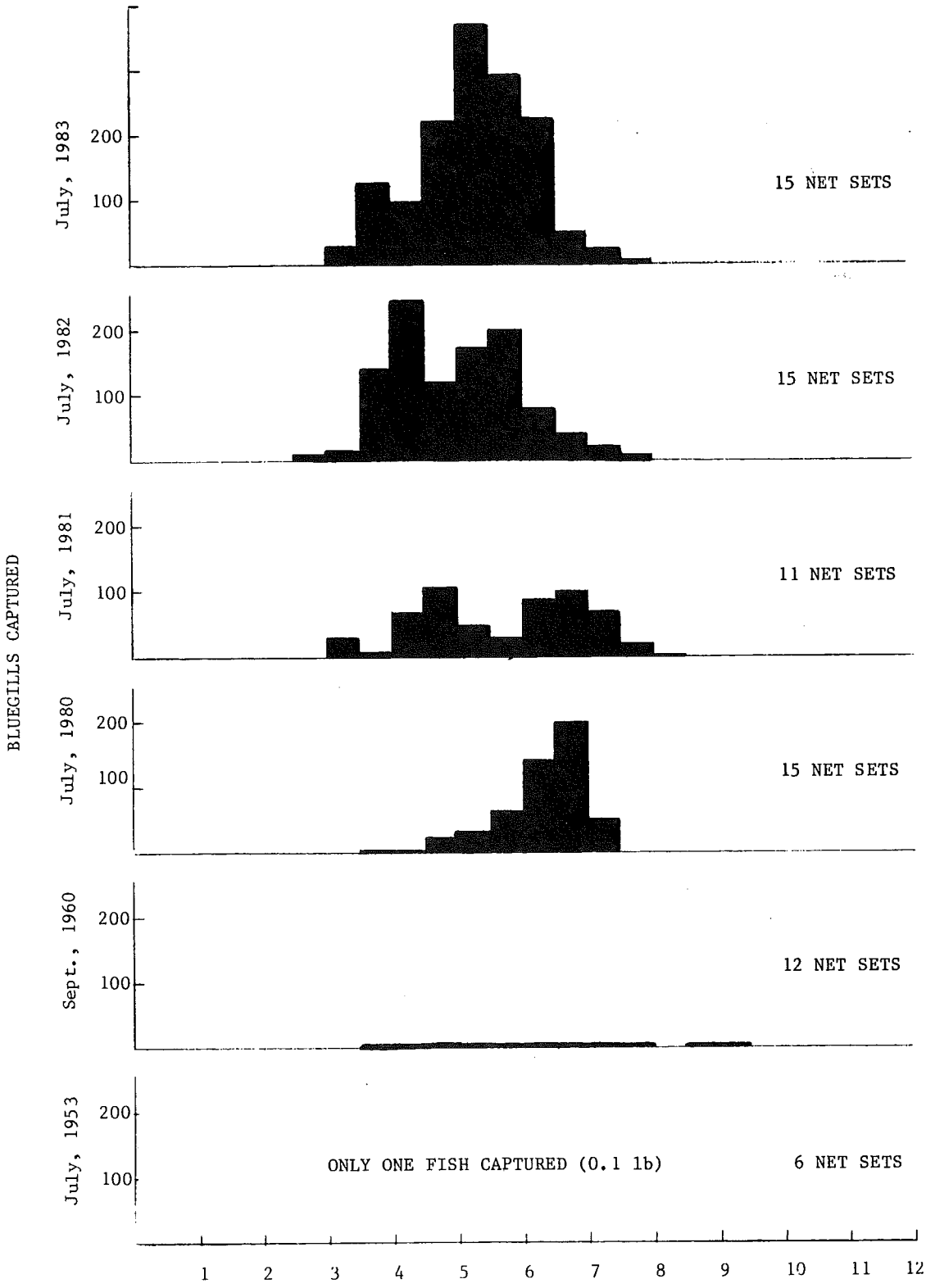

Figure 11-8. Length frequency distributions for bluegills in Lake Winona 1953-1983. Data from Minnesota DNR.

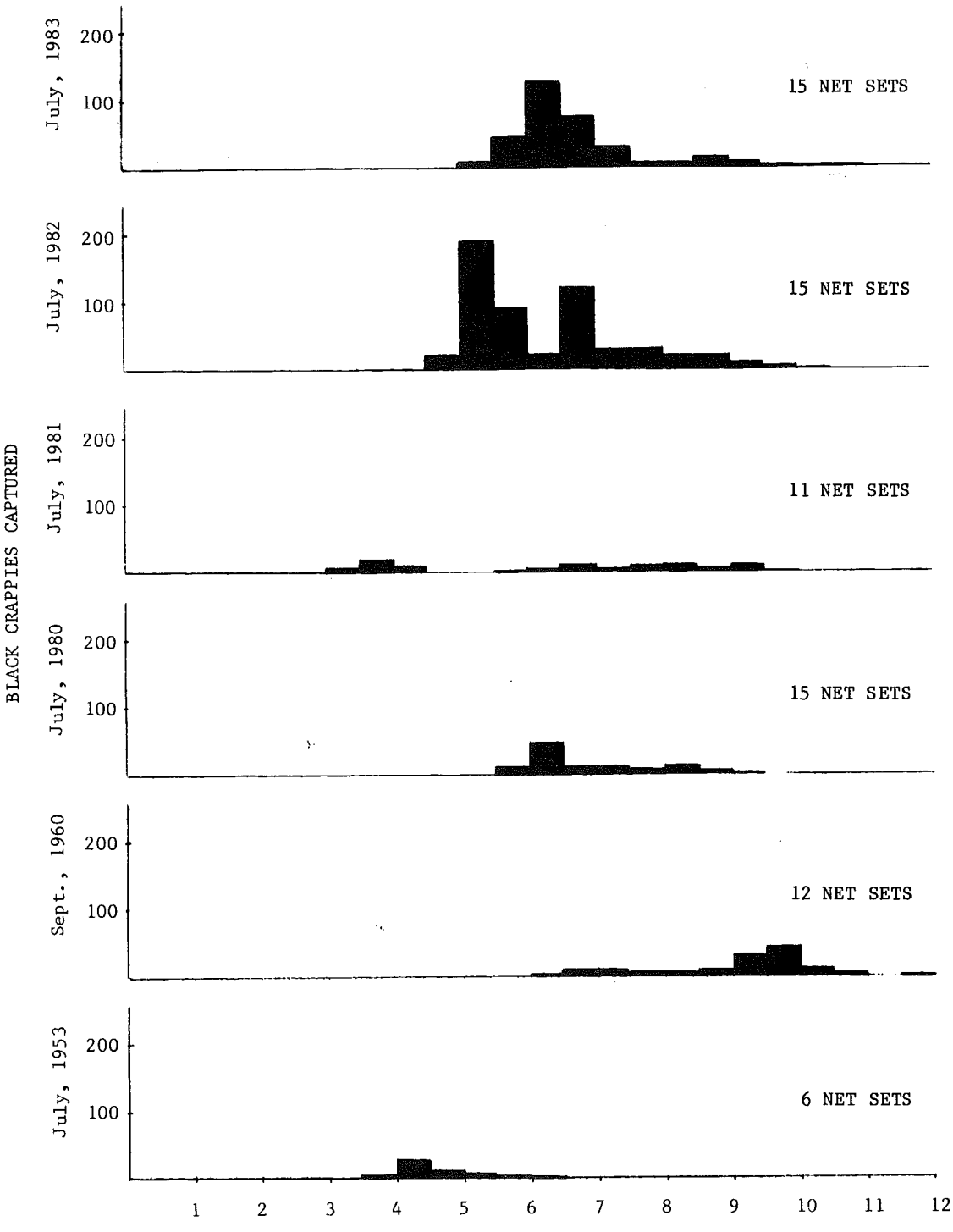

Figure 11-9. Length frequency distributions for black crappies in Lake Winona 1953-1983. Data from Minnesota DNR.

bluegills. Although northern pike are voracious predators and will eat almost any living animal small enough to swallow, they are selective in what they feed upon. Their first choice is long, slender, spineless fish like suckers and small northern pike. Next in order of preference are spindle-shaped spiney fish like perch, bass and small walleyes. Less desired (but also eaten if necessary) are saucer-shaped spiney fish like bluegills and crappies. Because they are easily caught, and because spawning habitat in Lake Winona is extremely limited, northern pike must be stocked regularly to maintain adequate numbers. Present plans call for the DNR to stock 3,000 yearlings per year.

In spite of intensive stocking of northern pike raised in Boller Lake and from freeze-out lakes in northern Minnesota, bluegills have proliferated. Excessive weed growth has provided so much cover that the predators cannot function. Northern pike, for example, tend to cruise along the edges of weed beds or to lie in wait there to ambush passing prey; they do not penetrate the heaviest weed patches very well.

Other methods of bluegill control could include mechanical removal, partial selective chemical treatment and biological control. As an attempt at biological control, 3,000 flathead catfish fingerlings and yearlings were stocked in 1981 and 1982. It was hoped that they would become additional bluegill predators. It is too early to assess the success of the flathead introduction, but hopes are not high.

Another predator, the bowfin (dogfish) was stocked in 1984-1985. The rationale for this action is presented in a March 26, 1984 letter to the Lake Winona Committee from Larry F. Gates, DNR area fisheries manager.

> "...After reclamation of Lake Winona in 1973, the lake was stocked with a potpourri of fishes including largemouth bass, northern pike, and bluegills. Our fish sampling and the results of a May-September, 1980 creel census suggested that optimum fish populations were present in the lake at about this time. During that five-month period in 1980, fishermen spent an estimated 44,000 hours catching an estimated 157,000 bluegills, 4,400 black crappies, 2,200 largemouth bass, 2,200 northern pike and about 2,000 fish of other species (bullhead, walleye, perch). The bluegills being kept by anglers at this time were very acceptable with an average weight of 0.25 pounds. From that point forward, however, things went downhill. The attached two charts show the situation that has developed since 1980. *Table I shows trapnet catches of bluegills for the last four years. During that period of time

*Included as Table 11-2.

the catch has increased annually from 464 in 1980 to 1,425 in 1983 and the average weight of bluegills greater than five inches has decreased from 0.25 pound to 0.11 pound. Aging of bluegills collected in 1982 and 1983 show that these fish are growing below the statewide average and well below that of bluegills from the adjoining Mississippi River. This is a problem that we thought we would potentially be faced with, but it was one which we had hoped would have been several years distant.

It is obvious that we do not need more bluegills. Methods available to us to limit their abundance and improve the growth of the survivors are mechanical removal, partial selective chemical treatment and biological control.

Mechanical removal could be accomplished in a variety of ways, all of which involve a tremendous amount of hard work. We estimate that at least 1,000,000 bluegills of all sizes would have to be removed annually in order to make an appreciable "dent" in the population. We then might find this dent is not large enough. Experience gained by others in Minnesota who have tried this has been that it is not practical to keep up the level of effort necessary to remove enough bluegills mechanically to reduce the population to the point where you see improved growth of survivors. We estimate that approximately 6,000 to 7,000 twenty-four-hour trapnet sets would be necessary to remove this many bluegills. Boats and outboards are required to set and lift nets and transport fish. Trucks are needed to transport fish. Labor required for a project of this magnitude would be very impressive. One should also remember that this would be an annual project meaning support equipment would have to be maintained and a work force would have to be recruited every year.

Partial chemical treatment has been effectively tried in some areas of the upper midwest on stunted panfish populations. The current recommendation is to treat shoreline areas less than five feet deep or the entire lake to a depth of five feet in the fall with antimycin. The timing is critical so that water temperatures are such that largemouth bass have mostly vacated this zone and that large numbers of mostly young-of-year and juvenile bluegill are still present. This procedure would probably have to be repeated periodically, perhaps as often as every three years. It has the additional disadvantages of relatively high cost, intensive labor, mortalities

of non-target fish species and no guarantee. The cost of antimycin for one lakewide treatment is about $6,000. Labor for application and clean up of dead fish is estimated to be about 100 man days. This does not include hauling to a disposal site.

The third method available to us is biological control, or the manipulation of the existing fish community to impose some constraints on the bluegills. On the predator side, Lake Winona currently has a very healthy largemouth bass population. Annual reproduction is almost always at a high level and the size structure of the population is very good with large numbers of fish greater than ten inches represented. These are very effective predators on bluegills. Northern pike at this time are not as abundant in the lake as we would hope for. Since this species does not reproduce well in the lake, an annual quota of 3,000 winter rescued northern pike from Boller's Lake is designated for the lake. Because of a few difficulties at Boller's Lake during the past few years, we have not been able to get these. Problems at Boller's Lake with the Gilmore Creek by-pass and northern pike traps have, or are now, being taken care of. Furthermore, as additional insurance that this quota will be met, we will submit an annual request for 3,000 winter rescued fish. And while the northern pike is a fierce predator, his effectiveness on bluegill is questionable. The current thinking is that no practical level of northern stocking would have the desired effect of bluegill population reduction and increased growth.

What is still needed is a predator that operates in depths of five feet to less than a foot, is at home in dense vegetation, will not compete with desirable species, will not in itself become a nuisance and which has an insatiable appetite for bluegill. The fish that meets this bill is one known by several names, amongst them mudfish, blackfish, grindle, scaled ling and cypress trout. It is known to most as bowfin or dogfish.

The bowfin is commonly found throughout much of Minnesota and is a recognized (and may be an important) component of most bass-panfish lakes. Spawning occurs in May when water temperatures reach 60 to 65°F. The male constructs a concave

depression in shallow water. Eggs hatch after eight to ten days in the nest attached to vegetation and debris by an adhesive organ located on the tip of their snout. The young then leave the nest in a swarm in which they remain and are vigorously guarded by the male until they reach a length of about four inches. At this point, the swarm disperses and the male gives up his parenting duties.

When bowfins attain a length of about four inches their diet becomes mostly fish and remains so. The literature reports a range of fish in the diet of adults from 59% to 90% with most reported in the upper part of this range. Bowfin are described as voracious, gluttonous, opportunistic predators. The mouth is large and equipped with sharp teeth. Growth is rapid and by the end of three growing seasons, fish are 16 to 19 inches long and up to 2.5 pounds. Individuals up to 15 pounds have been recovered. The Minnesota record is ten pounds.

Bowfin inhabit shallow heavily vegetated zones. With the ability to gulp air, they can live in water with low oxygen. They are capable of withstanding high water temperatures and become quite inactive at temperatures below 50°F. Occupying this type of habitat when active, it is suggested that competition with most game fish would be minimal. This is the zone within which most small panfish are found, however, and it explains the high percentage of juvenile bluegills found in food studies of bowfin.

The bowfin is a very good sport fish having much greater strength and endurance than most game fish. It is said to be very good smoked and palatable when properly prepared in other ways.

A few other things which Lake Winona has going for it at this time are:

1) Mechanical Vegetation Removal. Removal of submerged aquatic vegetation will enable predators to perform more efficiently and remove more bluegills. In addition, some bluegills are entrained with the vegetation as it is removed. Cal Fremling picked apart several loads last year and found that 60 bluegills per load were leaving the lake.

2) Flathead Catfish. Three thousand fingerlings and yearlings were stocked in 1981 and 1982. While we are unsure how many of these remain, those which survive will be an additional bluegill predator.

In summary, the bluegills of Lake Winona are currently slow growing, poor conditioned and of a size unacceptable to most anglers. Considering the possibilities available to us to turn this situation around, biological control through the addition of another predator appears most promising. This has advantages over either of the other techniques considered, mechanical removal or selective chemical removal, in that it is cheaper, should not have to be repeated, and it is not as labor intensive. With the improvements made at Boller's Lake and with a backup request for winter-removed fish, the annual northern pike quota for Lake Winona should be met. The largemouth bass population has remained high and has good representation of fish greater than ten inches. Mechanical vegetation removal, in addition to entraining some bluegills with the vegetation that is taken, reduces cover for bluegills and enable predators to operate more effectively. Survivors from the stocking of three thousand flathead catfish should be large enough this summer to begin eating fish.

This summer we intend to stock 15,000 pounds of adult bowfin collected from the Mississippi River. We will continue our spring and fall assessments and carefully monitor the impacts of this introduction. Hopefully, within a few years, we will be closer to the situation we had in 1980, i.e. nice bluegills and thousands of satisfied anglers...."

As of July 1, 1985, 2,220 adult bowfin have been stocked into Lake Winona. An intensive public education campaign via schools and news media (Fig. 10-13)has been quite effective in convincing most fishermen that it is desirable to release bowfin after they have been caught. Some bowfin are still being clubbed or thrown up on shore to die. It is difficult to "unteach" prejudices of long standing.

WALLEYES

The catch of walleyes has dwindled steadily in Lake Winona in recent years. They did very well after 350,000 fry were stocked in 1974, but they have not been restocked, and there is no significant natural reproduction in the lake. Area anglers maintain that more walleyes should be stocked, arguing that such stocking is done routinely in northern Minnesota and Metro-area lakes. The following is the rationale for not stocking more walleyes in Lake Winona.

In his letter of November 30, 1981, to the Lake Winona Committee, DNR Area Fisheries Manager Bruce Hawkinson stated,

> "For years we have talked about the walleye in Lake Winona. And for years I have discouraged continuation of walleyes in Lake Winona. I will continue to talk and consider their future use as a management tool, however, I will not stock walleye in Lake Winona now or in the near future.
>
> Lake Winona is an outstanding success. It has the best catch rate and the highest harvest in pounds/acre of any lake in the state. It's the fishery manager's challenge to continue and exceed these targets.
>
> This 320-acre lake with luxuriant plant growth is a bluegill-largemouth lake, with northern pike as an additional predator. The lake has to be managed with cost and the lake's future in mind. Walleye will do nothing for the ecology or management of the system. Bluegill and crappie overproduction and stunting appears to have the highest probability of being a potential problem. Largemouth bass and northern pike appear to have the best predation results on these panfish species. Walleye compete with these predators and will not allow for the best results of any species.
>
> We have experimentally added flathead catfish to Lake Winona to help control panfish, but yet not compete with bass or northern pike. We are going to evaluate this species' value very closely.
>
> Your questions regarding the management of Lake Minnetonka and Lake Winona are of value with regard to the previous discussion. Lake Minnetonka is a 14,000-acre lake in the Metro area. There is heavy fishing pressure, panfish stunting, and a diversity of habitat. The lake is so large that reclamation is impossible. The habitat is very diverse. Habitats vary from shallow, weedy eutrophic bays to large open water areas with sunken rubble islands. A habitat for walleye exists; however, something will not allow the natural walleye population to be self-sustaining and supplemental stocking is done.
>
> Lake Winona, on the other hand, has no typical habitats available for walleye. When stocked in the absence of competition, they did very well and existed. They compete with other managed species and add little to solving potential problems.

I agree that the walleye is a valuable table fish but the costs are excessive and the Mississippi River one mile from the lake has a good self-sustaining population of walleye and sauger which can be harvested continuously.

The money spent on walleye spawning, hatching, pond raising, netting and transporting could more effectively be spent in other ways on Lake Winona..."

There are additional reasons for not stocking walleyes: 1) There are no hatching or rearing facilities in S.E. Minnesota. 2) Walleye stocking would benefit very few people. Creel census data shows that 90% of walleyes harvested are harvested by about 1% of the anglers. 3) Other management procedures for Lake Winona have much higher priority. 4) The DNR agreed to assist in the Lake Winona Reclamation Project with the understanding that the fishery was to be managed mainly for the benefit of the elderly, children and the handicapped. Walleyes are seldom caught by these anglers.

Some anglers have stated that they would pay for stocking walleyes if the DNR would not. A cost analysis made in consultation with James Cady (Peterson Trout Farm) in October, 1981 revealed that such an operation would be expensive. Walleye fry would be lucky to have a 1% chance to reach catchable size in Lake Winona because there are so many predators (e.g., bluegills) already there. Assuming that 1% would survive, 957,000 fry would have to be stocked in the 319-acre lake to yield 30 catchable walleyes per acre. At $17.50 per thousand, the total cost would be $16,747, for a per-fish cost of $1.75. Survival rates would be much higher (10-30%) if walleye fingerlings were stocked, but the cost would be even higher.

ROUGH FISH CONTROL

In the spring of 1974, carp and buffalo tried to enter the lake from the Mississippi River via County Ditch No. 4. Their pre-spawning migration was thwarted, at first, by the electric weir at Mankato Avenue. Unfortunately, a series of accidents allowed them access to the lake.

As the river rose during the spring flood, the steel gate at the outlet of the Mankato Avenue culvert had to be closed to prevent the river from backing into the lake, flooding the city. The steel gate entered the electric field of the electric weir located within the culvert; the electric weir turned off automatically. The steel gate jammed frequently, however, during opening and closing, thus turning off the electric weir with the gate only partially closed. Carp and buffalo rushed through the breach, but were stopped, at first, by the steel grating at the entrance to the culvert. The steel grating had been erected in case such an event occurred.

Unknown to anyone, however, the grating had been installed on top of about a foot of sand which built up on the floor of the culvert. Debris plugged the grating, causing it to function like a dam. As the water level of the lake rose higher than that in the culvert, a scour hole developed beneath the grating, allowing the buffalo and carp to pass through.

The carp swam through lower Lake Winona, through the Huff Street culvert, into upper Lake Winona, up County Ditch No. 3 for almost two miles and entered Boller Lake where they spawned successfully.

The appearance of the carp in Boller Lake was a mystery for over a year. Lake Winona Committee members were quick to react, however, and they erected and maintained a carp trap in County Ditch No. 3 near Boller Lake for two spawning seasons. A second trap was built and installed in County Ditch No. 3 at Junction Street. Adult carp were taken in both traps.

In the fall of 1976, the state-owned sand pit (Ziebart Pit) which lies between Boller Lake and Highway 61 was treated with rotenone; about 1,100 2-year-old carp were killed. It was obvious by this time that the Boller Lake carp situation was critical.

A by-pass constructed in 1975 at Boller Lake made it possible to divert Gilmore Creek around Boller Lake, thus purposely causing a winter kill to occur there. The Boller Lake carp populations was thus destroyed, averting a potential disaster. Boller Lake was subsequently used as a northern pike rearing area for several years. A detailed discussion of the complex Boller Lake project is presented in Chapter 14.

Lake Winona Committee members ran gill nets during the spring in Lake Winona for several years to assess the rough fish situation. They consistently captured large carp and buffalo (Table 11-3).

TABLE 11-3 Summary of fish collected in a 300-foot, 8-inch stretched, monofilament gill net in Lake Winona March 28-May 11, 1981

Species	Number	Average Weight	Total Weight
*carp	29	10.5 lb.	307 lb.
**channel catfish	18	11.5 lb.	207 lb.
*l.m. buffalo	2	10.0 lb.	20 lb.
***northern pike	4	8.0 lb.	32 lb.
*gizzard shad	1	1.5 lb.	1.5 lb.
*drum	1	7.25 lb.	7.25 lb.

*removed from lake
**3 died, the rest were returned to lake
***one fish was 40 inches long and was estimated to weigh over 20 pounds. It was returned to the lake unharmed. The other 3 were dead in the net.

Scale Analysis: The scales from 7 carp, one buffalo and one drum were examined and the fish all appeared to be 7 years old.

The carp and buffalo in Lake Winona are senescent; they apparently do not constitute much of a hazard because they do not seem to spawn successfully in Lake Winona. They must be kept out of Boller Lake, however. In 1982 the Lake Winona Committee (in cooperation with the DNR), constructed a carp barrier in the culvert at the downstream end of County Ditch No. 3 (Fig. 11-8). These efforts have been successful in keeping carp and buffalo out of Boller Lake.

Figure 11-10. A carp barrier at the downstream end of County Ditch No. 3 prevents carp and buffalo from swimming upstream into Boller Lake to spawn.

In 1984, a new permanent pumping station was constructed in County Ditch No. 4 in Winona's permanent dike at the Wastewater Treatment Plant. The new station eliminates the temporary pumps at Mankato Avenue. More important, the steel flood gate at Mankato Avenue is no longer needed. Water now can fall freely through the Mankato Avenue culvert regardless of river stage, if the pumps are running. A new electric weir was installed in the culvert when it was reconstructed in 1984. There are actually two electric weirs, one in each of two parallel culverts. Two red indicator lights are readily seen at Mankato Avenue when the weirs are functioning.

SUMMARY

Present plans call for maintenance stocking of 3,000 northern pike per year. Weed harvesting will be maximized to reduce protective cover for bluegills and allow recreational use of the lake. For additional results of DNR fisheries surveys on Lake Winona, refer to Appendix 11-3.