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Propagation of Pike in Multi-purpose Lake Management

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ABSTRACT — Methods for rearing, harvesting, and management use of pike (*Esox lucius* L.) in Minnesota are described, especially as related to multiple use of shallow water areas. Principal emphasis is placed on the method of removing fingerling and yearling pike in winter from shallow lakes. Such lakes often raise wild rice and also are utilized by waterfowl. The pike, spawned naturally in these lakes, are harvested by pumping aerated water through fish traps when oxygen levels in the lake become low. Pumping is most effective when oxygen levels in the lake fall below 2 parts per million but is higher in the trap area.

Northern pike (*Esox lucius* L.) account for about one-third of the estimated poundage of the more than 27 million pounds of sport fish taken annually from Minnesota waters. Pike are found throughout the state, occur in most fish lakes, and thrive in waters of quite varied types, including shallow prairie lakes. Although northern pike attain weights up to 40 pounds, most of the catch is of 2- to 4-pound fish ranging in age from 1 to 4 years. Although there is no legal size limit, pike in the northern part of Minnesota do not reach a size acceptable by the angler until their third year. In the more fertile lakes of the southern part of the state they are often of acceptable size in their second year.

Pike are quite easily caught, and one-third to one-half of the standing crop of catchable-size fish may be taken in any year. They are fished by angling in both summer and winter. Spearing of pike from dark houses on the ice is permitted on most lakes, and this kind of fishing is concentrated on lakes where they are known to be abundant. Northern pike often make up about half the poundage of the catch from large walleye lakes.

A substantial part of the fisheries program in Minnesota is directed toward management of northern pike. There have been two major approaches: (1) the use of large, shallow, multiple-purpose lakes as rearing areas for naturally-spawned fish and (2) preservation by purchase and development of marshy natural spawning areas connected to deep lakes.

NATURE AND NUMBER OF LAKES MANAGED

The lakes managed for northern pike production are shallow; mostly averaging less than 10 feet deep. When covered with ice and snow, these lakes frequently have such low oxygen levels by late winter that fish may not survive until spring. The "winter-kill" lakes that are used for pike production are mostly located in northern Minnesota. Some of the old glacial basin lakes are as large as 2,000 acres. On these the ice is usually about 3 feet thick and often blanketed with snow. Many of these lakes are of a fairly high basic fertility, have moderately-hard to hard carbonate waters, and extensive growths of submerged and emergent aquatic plants in summer. Lakes that average less than four feet deep often have crops of wild rice (*Zizania aquatica*) and are used as waterfowl breeding and hunting areas.

Frequently adult pike enter such shallow lakes by running upstream from deeper lakes during the spring spawning period. The shallow lakes are favorable for spawning and rearing, and they produce sizable crops of young pike. In many winters, however, especially when there is deep snow atop the ice, oxygen levels in the water drop through the winter to suffocation levels for any fish present.

To forestall winter kills, personnel of the Minnesota section of fisheries "rescue" pike from shallow lakes when oxygen levels become dangerously low. These rescue operations have led to the development of methods for efficient removal of the fish and the current management concept of using such lakes for production of yearling and sometimes two-year old pike (if there had been no winter kill the preceding year). The comparatively large fish produced have been used subsequently to stock heavily fished lakes. It is expected that a large proportion of these pike will be caught within two years of planting. The fish harvested have varied considerably in size, depending upon age and population density, but those taken often weigh as much as a pound.

When the improved and expanded fish rescue program got under way in 1957-58, the catch totalled 92,000 pike weighing 34,000 pounds. This was increased to a harvest of 464,000 fish weighing 329,000 pounds in the winter of 1966-67. The number of lakes from which pike were so harvested has increased from 26 to 197 during this nine-year period.

EXAMPLE OF A CASS COUNTY LAKE

Laura Lake, in Cass County in north central Minnesota, is one of the more successful sites and is quite typical of shallow multiple-use lakes where such winter trapping or "rescue" has been carried on. It is a 1,454-acre lake with a maximum depth of 7.5 feet and an average depth of 2.5 feet. Its principal forage fish is yellow perch. In years of fairly stable and not excessively high water levels, the lake is covered in summer with stands of wild

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rice. From this as much as 73,000 pounds (50 pounds per acre) of the non-processed or "green" grain has been taken.Laura Lake also is a fair to good production area for waterfowl. Over the past seven years the pike production from Laura Lake has ranged from 25,000 to 123,000 fish per year, and in terms of weight from 7,000 to 43,000 pounds. The foregoing figures represent an annual production per acre ranging from 17 to 85 pike and 7 to 29 pounds of pike. The pike enter Laura lake naturally each spring to spawn from adjacent deeper lakes.

LAKE DEVELOPED BY CONSTRUCTION

Because of demonstrated success of multiple-purpose management on Laura and other lakes that are naturally suitable, the Minnesota Department of Conservation has developed through engineering, an area of this type in the northwestern part of the state. This "man-made" area is Upper Rice Lake in Clearwater County; a lake of 1,706 acres. Construction of water-level controls was scheduled in 1968 both to restore the wild rice production by lowering water levels and to control cattails and other perennials that compete with wild rice. Water levels can be raised in occasional years when this is desirable. The control range is four feet. It is estimated that Upper Rice Lake also will produce as much as 50,000 pike a year by winter trapping operations and be much improved for waterfowl.

OPERATIONAL METHODS

The bulk of the fish are taken out in winter, often when air temperatures are below 0° F. The rescue method has been described by Harley Hanson (1958) but improvements have been developed since. Success of the operation depends on attracting the fish into a box-like trap. This is done by pumping a sizable stream of aerated water into the lakes while natural oxygen levels are declining. Two channels are dug fairly close together on a low-lying shore, more or less perpendicular to the shoreline. They extend into moderately deep water. The channels may either be parallel or form a "V" converging at the shore. A gasoline-powered centrifugal pump is placed between the channels, and water is pumped from the lake through one channel and released into the lake again through the other channel after having been aerated while passing through a large wooden box. The pumps used most commonly have a capacity of 20,000 gallons a minute and produce a flow in the channels of about 0.75 c.f.s.

Traps are placed in both channels with their throats facing the lake. The trap consists of a box with a V-throat. It is framed from 2 x 2-inch lumber and covered with 19-gauge ½ inch galvanized hardware cloth. Since the operation depends on the fish moving into the trap, pumping is started when there is still enough oxygen in the lake water to permit the fish to move (usually at about 2.0 p.p.m. dissolved oxygen) and when an appreciable differential in oxygen content can be created between water released by the pump and water in the lake, usually a difference of 2.0 to 6.0 p.p.m. As many as 5,000 pike have been taken in one day at a single trapping site by this equipment. Figure 1 is a diagram of a typical setup.

STOCKING WITH RESCUED PIKE

Since it has often been demonstrated that the value of fish stocking varies with the situation, size of fish, and potential use of them, the question arises as to how stocking with such rescued pike affects fishing. Scidmore (1964) has pointed out that results obtained in lakes with dissimilar indigenous fish populations may be quite different.

CREEL CENSUS RESULTS

Returns to fishermen of stocked rescued pike averaging 0.9 pound per fish have been determined by creel census on Grace Lake in Beltrami County (Wesloh and Olson, 1962). This is an 886-acre lake whose natural reproduction of pike was inadequate. Stocking of pike marked by finclipping resulted in a return to anglers of 5.2 pounds of pike per acre. Within two years following stocking, 44 per cent of the marked pike had been taken, and the average weight of the fish increased from 0.9 to 3.7 pounds by the end of the second winter. The pike substantially reduced a dense perch population, which is not fished, but also may have had an adverse effect on the walleye population. Stocking of large pike can, therefore, be expected to have both advantages and disadvantages in larger lakes containing other game fishes.

At Fish lake in Cottonwood County, a 78-acre black bass-panfish lake in southwestern Minnesota, pike were stocked at a rate of 17.7 fish or 21.2 pounds per acre. Anglers recovered 64 per cent of these the first summer after stocking (Woods, 1963), but these fish gained little weight and had almost disappeared by the following spring. There was little apparent influence on the other fishes in the lake.

It appears, therefore, that pike taken from shallow lakes in winter by the trapping operation as described can provide anglers with a percentage return of stocked fish comparable to returns obtained from stocked catchable trout. However, care must be exercised in lakes where walleyes are the most sought-after sport fish. Stocking of large northern pike must take into account both fish population management and angler preferences. Pike production can be easily increased if adequate funds and manpower are available.

SPAWNING AREA PROGRAM

In Minnesota, as elsewhere, the marshy shorelines and swampy areas adjacent to lakes in which northern pike spawn are being drained and often developed as shoreline property. Highway construction also sometimes eliminates such spawning areas. Since 1952, the state's basic long-term approach to maintaining pike populations has been a program for acquisition by purchase of present and potential spawning areas. This program received substantial funding in 1963 from a dedicated one-cent per pack tax on cigarettes. During the 1966-1968 biennium $300,000 was appropriated for purchase of fisheries

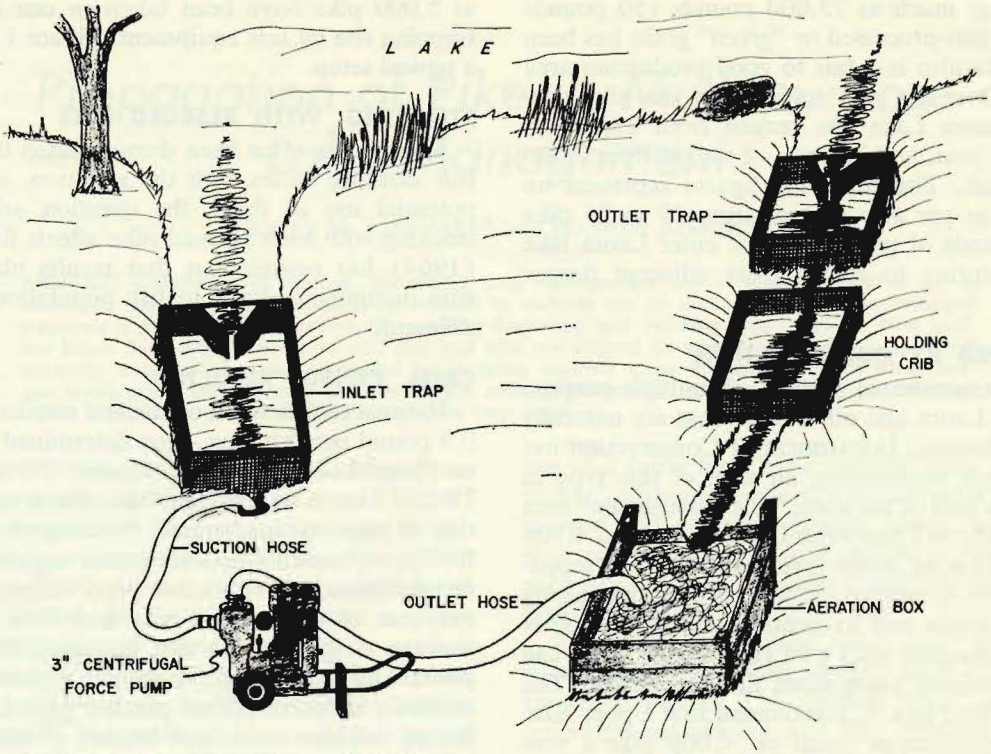

FIGURE 1. Fish trapping setup for taking of pike in winter when oxygen levels became low under the ice of shallow lakes. The screened traps are usually 4 feet long, 4 feet wide and 4 feet deep. The pump has a capacity of 20,000 gallons per minute.

lands, and the bulk of this was spent for northern pike spawning areas.

From the program's inception through 1967, 95 spawning areas totaling 3,707 acres had been purchased. Development, consisting of water level control structures, diking and channeling had been carried out on 70 of these sites. The purpose of such development is to create springtime flooding of low-lying grassy or reedy areas suitable for spawning and feeding of small pike until they are two to four inches long. The water level control structure is opened (usually in June), allowing fish to migrate into an adjacent lake. Fingerlings also can be trapped below the outlet structure and moved to other lakes as needed. Water level control structures range from simple placements of sand bags to engineered dams.

Production of pike fingerlings in such managed spawning areas varies greatly. Counts of trapped fish emigrating from 19 such areas in 1962 and 1963 showed production ranging from 3 to 29,205 two- to five-inch fingerlings per acre. Average production was 4,834 per acre in 1962 and 1,788 in 1963. Study of the contribution of such northern pike fingerlings in a 9-acre controlled spawning marsh adjacent to 535-acre Lake George in Anoka County showed that most of the pike subsequently taken from the lake had come from this marsh (Groebner, 1964). An unusually large production of 96,000 fingerlings in 1956 provided most of the pike caught during the four following years. Survival of such fingerlings to the catch was low—probably not greater than 5 per cent—but with operation of spawning areas year after year, the pike population and pike fishing can be maintained.

GOOD RETURN OF LARGE PIKE

In summary, trapping of pike from shallow lakes in winter by use of a flow of aerated water from a large capacity pump has proved a fruitful source of large pike for stocking. In such lakes pike rearing can be combined with other uses of the lake. There has been a good return to anglers of the stocked pike. Acquisition and management of small natural pike-spawning areas connected to fish lakes has also proven of considerable value as a basic, long-term approach to maintaining pike populations in lakes with inadequate spawning habitat.

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BIOLOGY

Aphanizomenon Elenkinii Kissel in Minnesota Lakes

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ABSTRACT — *Aphanizomenon Elenkinii* Kissel., heretofore described only from the Black Sea area of Russia, has been observed during four summers in lakes near Minneapolis, Minn. A description of the Minnesota alga is given. It has features not noted in previous descriptions.

Aphanizomenon Elenkinii was first described from the Volga River by Kisselev (1951). Variations of it from the same region were later described by Kaschtanova (1955), Pitzyk (1956), and Komarek (1958). The variations here described were first seen by the writer in 1966, in lakes near Minneapolis, Minnesota. It is believed that these are the first observations of *A. Elenkinii* from North America.

The lakes and ponds in which the Minnesota alga has been found are listed in Appendix A. All of them are shallow and eutrophic. Several of the lakes listed have been observed each summer, 1966-69 inclusive. *A. Elenkinii* has never been plentiful in any of these lakes. Further, the amounts found have varied greatly from year to year – from relative abundance to virtual disappearance. In each year of observation *A. Elenkinii* has appeared in the plankton in late July, reached a maximum in September, and disappeared in late October.

The Minnesota alga is quite variable in form and habits. Three principal forms have been distinguished, hereafter designated Types I, II, and III. The dimensions of these types are given in Table 1, and the types are illustrated in Figures 1 and 2. The three types may be found together, but, so far, always with Types I or II dominant. Type III has never been found in quantity. None of the three types forms bundles as does *A. flos aquae.*

Type I is distinguished as a long trichome which may contain multiple heterocysts and multiple akinetes. The heterocysts appear before the akinetes do and at this stage are quite uniformly spaced in the trichome, Fig. 1, n. As many as 9 heterocysts have been seen in one trichome. The akinetes, when they appear, may have any position in the trichome, and may be single and spaced, or in sets of 2 to 5. As many as 12 akinetes have been seen in a trichome.

Heterocysts may be, usually are, present in trichomes having akinetes. However, though this alga was fairly abundant in Lotus Lake during September, 1969, only one heterocyst was seen. It has been noted that in this lake heterocysts are rarely seen in *Aphanizomenon flos aquae* during the akinete bearing season, and this was the case in 1969, as with *A. Elenkinii.*

The characteristic terminal structure of the Minnesota alga is narrow, tapers smoothly or in steps, and has hyaline, or nearly so, terminal cells, Figs. 1 and 2. The apical cells are not as fine and sharp pointed as those described by Kisselev and Pitzyk. It is believed that terminals such as b, e, d, Fig. 1, result when the apical cells break off.

The characteristic Type II trichome, aa and bb, Fig. 1, is relatively short, does not have the elongated terminal cells of Type I, and has one or two akinetes close to – typically 2 cells away from – a heterocyst which is approximately central in the trichome. A second developing (or abortive?) heterocyst is often found near one terminal. One or two terminal cells are decreased in diameter. These cells usually are well pseudovacuolated, but may be partially hyaline. The tip of the apical cell often is hyaline. When there are two akinetes they are usually not equally mature.

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