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was continued in part to try to explain the different age ratios between the sexes in the harvest, and to glean detailed kill information during a period when the mallard population at Lake Odessa and within the Mississippi Flyway was depressed.

ACKNOWLEDGEMENT

We express our appreciation and thanks to all the personnel of the Iowa Conservation Commission who operated the checking stations, and to E. B. Speaker, W. C. Brabham, and others whose encouragement and insistence made this project a reality.

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Notes on the First Rearing and Introduction of *Esox masquinongy* in Iowa Waters

K. M. MADDEN and A. D. LYNCH¹

Abstract. The Iowa State Conservation Commission purchased 1,535 muskellunge ($\frac{3}{4}$ - to 1-inch fry) in 1960, from "Kenu," a Land-O-Lakes, Wisconsin commercial fish hatchery. Siewers Spring State Fish Hatchery and rearing pond facilities were used for the experimental rearing project. Eighty-five fish survived the June 7 to September 30 rearing period. Forty fish were stocked in each of the following Iowa lakes: West Okoboji, Dickinson County and Clear Lake, Cerro Gordo County. Two specimens have subsequently been recovered and identified from each lake.

The experimental rearing of muskellunge fingerlings at Siewers Springs State Fish Hatchery, near Decorah, Iowa, was attempted with some success during the period June 7 to September 30, 1960. The goal of the experimental rearing was to provide muskellunge fingerlings for experimental stocking in Clear Lake in Cerro Gordo County and West Okoboji Lake in Dickinson

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County and to develop "muskie" culture techniques for Iowa fish management use. The ultimate objective of the rearing and stocking experiment will be to ascertain growth and survival rates of this species.

REARING POND SELECTION

A rearing pond was selected that fulfilled some of the known ecological requirements of this fish. The pond had a clay bottom, was 0.95 acre in size, an average depth of 2.2 feet and a maximum depth of 7 feet. The water source, from Siewers Spring, was controlled by a gate valve at the head of the pond. Removable stop logs in the concrete outlet structure, at the lower end of the pond, controlled the water level. This pond has been used for smallmouth rearing and has had a history of dense *Glycerice grandis* covering the upper one-third of the pond.

POND PREPARATION

A spring-tooth harrow was used on May 2 to uproot the vegetation in the upper areas, but due to excessive moisture over the 7-day period prior to filling, control of the growth failed. One hundred pounds of fertilizer (mixed cow manure and straw) were spread on the pond bottom May 9. The water-filling operations were completed the 10th of May. *Daphnia* cultures were added over the 5-day period ending May 17. Another 100 pounds of fertilizer of the same type was added May 21st to complete the pond preparation.

REARING POND STOCKING

Delivery dates promised by the Kenu Fish Hatchery at Land-O-Lakes, Wisconsin, for the muskellunge fry were between May 16 and May 22, but unseasonably cold weather delayed the fry production.

Observations by Mr. Lynch indicated the zooplankton had passed its maximum population density 3 days prior to the arrival and stocking of the muskellunge fry on June 7. Fifteen hundred thirty-five fry, averaging $\frac{3}{4}$ inch in length, were flown from Kenu Hatchery to Decorah by the Iowa Conservation Commission plane in sealed plastic bags containing water and charged with oxygen under low pressure. The fry were tempered forty-five minutes in the rearing pond from 60 degrees F. bag temperature to 68 degrees F. water temperature. They were distributed directly from the plastic bag and scattered uniformly around the vegetated pond perimeter. No mortality was observed. An unknown number of sucker fry, accompanying the muskies in the separate bag, were introduced simultaneously to assure a supply of familiar feed to reduce the possibility of cannibalism or deleterious effects of sudden change in diet.

FOOD REQUIREMENTS

The feeding habits and food requirements of the muskellunge at this hatchery can be divided into two phases: zooplankton feeding, and fish feeding. The fry fed exclusively on live zooplankton for the first 3 to 4 days. A period of transition followed in which the muskellunge fed on either the zooplankton or the forage fish fry depending upon which was most readily available. After one-week's time, the muskellunge preferred live fish. The Muskellunge, in all periods of growth, were sedentary, lying in the vegetation near the surface of the pond. Large insect larva, tadpoles, and forage fish which provided moving targets were attractive as food. Non-mobile food organisms were not consumed. There seemed to be no roaming tendency.

After the initial sucker fry stocking, ten thousand fathead minnows, *Pimephales promelas*, $\frac{3}{4}$ to $1\frac{1}{2}$ inch long, were stocked weekly through July 31. Additional stocking included ten thousand goldfish *Carassius auratus* advance fry, June 20, and thirty thousand carp fry *Cyprinus carpio* on July 15. From August 1 through September 23 supplemental forage fish were added at the rate of 50 pounds per week.

OBSERVED PREDATION

Muskie fry were subject to predation by the diving beetle larva and some dragonfly nymphs. Control of these insects was accomplished with a mixture of vegetable oil and water, using tincture of green soap as a emulsifying agent. Application was made to the pond surface on June 18. This control resisted wind and wave action and remained effective until the September 30 drawdown. Predation by birds was observed on June 28, July 7, 29 and August 26.

VEGETATION CONTROL

Attempts were made to control the excess algae *Spirogyra spp.* and pond weed *Potamogeton spp.* On July 27. Kuron, a Dow chemical 2-2,4,5 (trichlorophenoxy propionic acid) was used at two parts per million at a pond temperature of 69 degrees F. The inlet valve was closed at the time of application but reopened 18 hours later, to compensate for excessive seepage which had resulted in a loss of 1 foot in water level. Vegetation control was limited and confined to shallow marginal areas of the pond.

OBSERVATION TECHNIQUES

Several techniques were used to enable Mr. Lynch to determine the condition of the pond, the abundance of forage fish, the growth rate and or general condition of the muskellunge. (See Figure 1.) The techniques were: (1) Individual station

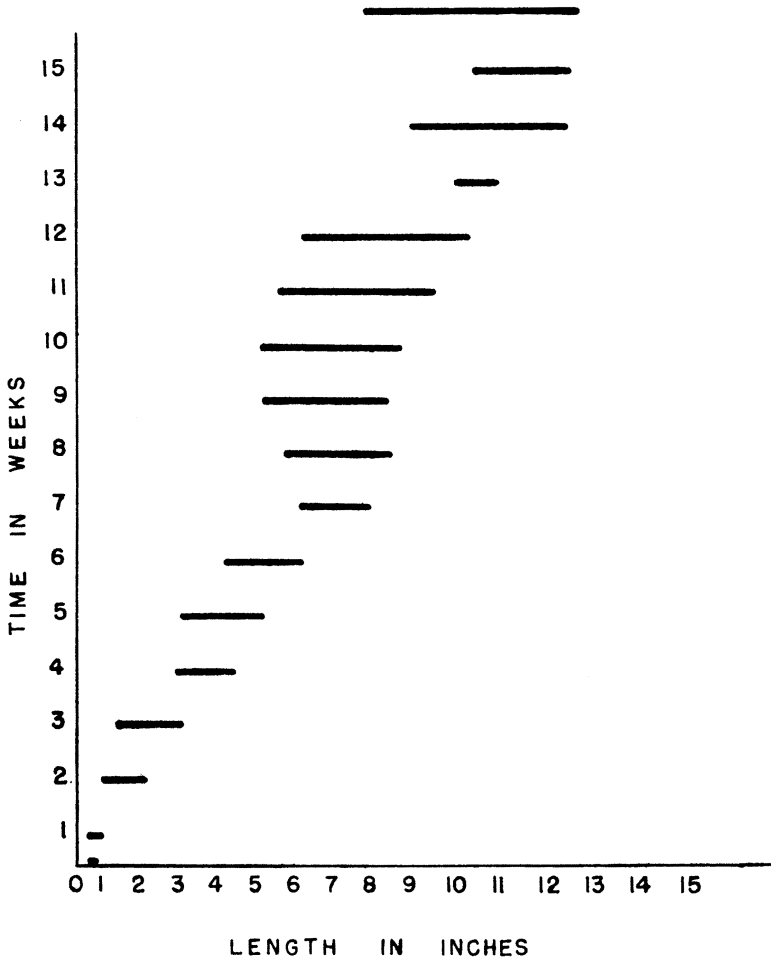


Fig. 1. Observed size distribution of muskellunge at Siewer's Spring Rearing Ponds.

observation; (2) Cruising the pond by small rowboat; and (3) Walking the shoreline. The latter method proved most productive when used during the hours of 7:00 a.m. to 8:00 a.m. and 5:00 p.m. to 6:00 p.m. During the first 3 weeks there was no observed number that could serve as an index of total population present; this figure varied from 9 to 50. After the third week, the observed number varied from 7 to 9 until the draw-down, September 30, at which time 85 muskellunge were recovered. Numbers observed daily were not a reliable index of muskellunge survival.

STOCKING

On September 26 preparation for the muskellunge removal

and lake stocking began. The pond was slowly drawn down and the vegetation was cleared just ahead of the receding water line. At 10:30 a.m. on September 30, 85 muskellunge were recovered. Their length ranged from 7 to 12.5 inches. The average weight per fish was 0.25 pounds. Eighty of these fish were placed in Lansing fish distribution unit #492 and taken immediately to Clear Lake and West Okoboji Lake. Forty muskellunge, in apparent excellent condition, ranging from 9 inches to 12.5 inches were stocked in each lake. The five smallest, averaging about 7 inches in length, were retained at the Decorah Hatchery for future development and study.

Since the stockings in 1960, there have been four known recoveries. During routine pond netting operations in West Okoboji Lake, two fish taken were identified as "muskie" by Biologist, Tom Moen. One "muskie" taken on November 6, 1961, weighed 1.4 pounds and measured 19.4 inches in total length. Two were recovered at Clear Lake on September 17, 1961; one had a total length of 12.5 and the other 17 inches. The Wisconsin Age Class I muskellunge has a total length of 7.0 to 18.0 inches and weighs 0.3 pounds to 1.0 pounds (Wisconsin Conservation Department, Publication #225). The growth rate of three of these individuals compares favorably with the average growth rate in Wisconsin. Our knowledge of the growth rates and survival of this species experimentally reared and stocked in Iowa is limited.

Creel Census of Des Moines River Fishermen in Boone, Dallas, and Polk Counties, Iowa

HARRY M. HARRISON¹

Abstract. Creel censuses were conducted on the Des Moines River during the open water seasons, usually April through November, from 1953 through 1961. The data indicated a relatively constant catch of fish. The rate of annual catch varied between a minimum of 0.26 and a maximum of 0.61 fish per fisherman-hour. The data were also analyzed by "proficiency categories" involving (1) all fishermen, (2) fishermen with one fish, (3) fishermen with two fish, and (4) fishermen with three or more fish. The most proficient fishermen (those with three or more fish at the time of interview) constituted 13 per cent of all anglers, and caught 65 per cent of all fish. The average length of the angler day for the census period was 2.3 hours. Channel catfish, carp, bullheads, and walleye pike, in that order, were the important fish taken. Fisherman aptitude or skill is concluded to be the significant factor related to both the catch of fish and the rate at which they are caught.

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