LITERATURE CITED

Buntz, J. and C. S. Manooch, III. 1968. *Tilapia aurea* (Steindachner), a rapidly spreading exotic in South Central Florida. Proceedings of the Annual Conference, Southeastern Association of Game and Fish Commissioners 22: 495-501.

Chew, R. L. 1972. The failure of largemouth bass, *Micropterus salmoides floridanus* (Le Sueur), to spawn in eutrophic, over-crowded environments. Proceedings of the Annual Conference, Southeastern Association of Game and Fish Commissioners 26: 306-319.

Courtenay, W. R., Jr. and C. R. Robbins. 1973. Exotic aquatic organisms in Florida with emphasis on fishes: a review and recommendations. TAFS 102: 1-12.

Crittenden, E. 1962. Status of *Tilapia nilotica* Linnaeus in Florida. Proceedings of the Annual Conference, Southeastern Association of Game and Fish Commissioners 16: 257-262.

Gleastine, B. W. 1974. A study of the cichlid *Tilapia aurea* (Steindachner) in a thermally modified reservoir. Unpublished M. S. thesis, Texas A&M University. 258 pp.

Kaya, C. M. and A. D. Hasler. 1972. Photoperiod and temperature effects on the gonads of green sunfish, *Lepomis cyanellus* (Rafinesque), during the quiescent, winter phase of its annual sexual cycle. TAFS 101: 270-275.

Swingle, H. S. 1960. Comparative evaluation of two tilapias as pondfishes in Alabama. TAFS 89: 142-148.

THE USE OF ISOLATION COVES IN ASSESSING MUSKELLUNGE STOCKING MORTALITY

by

LAWRENCE C. BELUSZ

Missouri Department of Conservation

R. #2, Sedalia, Missouri 65301

ABSTRACT

A method to determine short term muskellunge stocking mortality by using isolation coves is discussed. The method allows for free movement and feeding of muskellunge while restricting lakeward movement. Mortality of muskellunge was readily determined with the use of SCUBA. Stocking mortality due to stress of handling and transportation was considered minimal. Observations indicate that future stocking of muskellunge be made in areas of extensive weed cover.

INTRODUCTION

Periodic stocking of fingerling muskellunge *(Esox masquinongy)* is commonly practiced by the various states in an effort to maintain strong year-classes and ultimately the muskellunge fishery. Supplemental stocking of muskellunge is practiced in waters which may also have naturally sustaining muskellunge populations. Contribution to the creel by stocked muskellunge has been documented in Wisconsin lakes to vary from 2% to 60% (Johnson, 1969) and has averaged as high as 63% in Little Green Lake, Wisconsin (Hacker, 1966). Sampling for yearling muskellunge in the fall at Lake Chautauqua in New York State indicated that hatchery reared fish made up 88.5% of the total over a four year period (Mooradian and Shepherd, 1973). Generally, return to the creel is quite good and the stability of muskellunge populations and fishing success is dependent on hatchery fish.

Investigators in several states experiencing high initial stocking mortality (up to 70%) have been forced to reassess their programs to determine if yearly expenditures are justified. However, if mortality of hatchery fish can be reduced, the net result would be increased production at no additional program cost. To assess short-term mortality of stocked muskellunge, fingerlings were released behind a block-net and observations using SCUBA were made to determine extent of mortality and behaviour of hatchery fish.

MATERIALS AND METHODS

Pomme de Terre Reservoir, an 8,000 acre (3238 ha) Corps of Engineers flood control impoundment, located in West Central Missouri, supports the state's only muskellunge fishery. It is a clear, Ozark-plateau reservoir with secchi disk readings commonly of 6 feet (1.8m) or more. Muskellunge were first stocked in the reservoir in 1966, with yearly plantings through 1974 except in 1971 and

1973. Fry and marked fingerlings have been stocked. It is doubtful if any part of the fry stocking was successful because only marked fish have been harvested. The first legal-size muskellunge (30-inch) was creeled in 1968 and since that time they have been actively sought by fishermen as a trophy fish. Attempts to monitor the extent of natural reproduction have been carried out yearly since 1970 with the use of nets and electroshocker. Ripe males and females have been captured each year, with some eggs successfully taken for hatchery propagation. But, while it appears that adult fish are physiologically capable of reproducing, no evidence of successful reproduction and recruitment has been found.

Since 1971, stocking policy has been to release as many 9-inch (22.9cm) fingerlings as possible within strict budgetary and hatchery limitations. In some years hatchery space has been pre-empted by other species, eliminating muskellunge production. In these years muskellunge have been purchased from commercial sources in northern states.

Hatchery limitations, cannibalism, and lack of sufficient forage at critical stages have plagued the program resulting in high cost and few muskellunge. Faced with a small number of expensive fingerlings, and realizing that stocking mortality might be high, the idea of using isolation coves was initiated.

A one-fourth inch bar measure (0.64 cm), 150 foot long (45.7m) × 10 foot deep (3.05m) block seine was used to seal off a cove from the main body of the lake. An area of 0.6 acres (.24 ha) with maximum depth of 8 feet (2.4m) was isolated. Approximately 30% of this area was weed-bed. After setting the net, the isolated area was electroshocked to remove large predators. The area was then checked using SCUBA to determine if any predators remained and to secure the net on the bottom. Forage species were not added to the area as planned however, because several large schools of brook silversides *(Labidesthes sicculus)* were trapped in the area. Along with restricting lakeward movement, it was felt that early feeding opportunity would also encourage survival. The isolation cove was prepared by two men in half a day. Total isolation time was planned to be a minimum of 48 hours.

RESULTS

On September 26, 1972, 420 muskellunge averaging 9.0 inches (22.9cm) total length were released into the upper end of the isolation cove. Observations using SCUBA were begun immediately after stocking. Within a few minutes, muskellunge were distributed throughout the area with the majority positioned near the weed-beds. Many fingerlings appeared to be in a traumatic condition when stocked, with many lodging themselves under debris and rocks. These were extricated and pushed toward open water. Further observations were then directed toward locating any dead or dying muskellunge. At approximately fifteen hours after stocking, one muskellunge was found in a moribund condition. No outward abrasions were evident on the fish. Weed-beds and debris were carefully searched for additional dead muskellunge throughout the isolation period. With exceptional water clarity, we were convinced that we had not overlooked any dead muskellunge.

With SCUBA it was possible to closely observe muskellunge, they allowed divers to approach, and several could be touched before swimming off. Most were observed to remain in and around the weedy areas with occasional individuals venturing near the block-net. Muskellunge were frequently observed feeding on the available brook silversides. On September 29, 53 hours after stocking, the net was removed by pulling it to one side of the cove. Additional checking of the area one and three days later revealed no additional mortality.

Additional experimentation with the isolation method was attempted in late September of 1974 when a small number (223) of fingerling muskellunge averaging 11.0 inches (27.0cm) total length became available from a commercial source. The same general method of cove isolation was used as in the 1972 attempt. To provide food for the muskellunge, 2,000, 3 to 4-inch (7.6-10.2cm) golden shiners *(Notemigonus crysoleucas)* were added to the area. These fish were actively fed on by the muskellunge.

The mesh size of the block-net (1-inch bar, 2.5cm) was larger than used in the first attempt and muskellunge repeatedly challenged the net. Apparently the larger mesh did not appear as enough of a barrier to the muskellunge and many were caught trying to swim through the net. This necessitated one diver to constantly check the net and remove trapped muskellunge. It was hoped that muskellunge would eventually cease to challenge the net, but this did not occur. Therefore seven hours after release, the block-net was removed. It was feared that net injury might outweigh any beneficial effects of isolation under these conditions. After lifting the net, divers located ten dead muskellunge; all but one had net marks. Examination of the area the following day yielded an additional seven dead muskellunge, all had net marks. A further check of the entire cove three days after release yielded no additional muskellunge mortality.

DISCUSSION

Researchers have reported that fingerling muskellunge are in a traumatic condition from handling (Miles et al. 1972) thereby making them quite vulnerable to predation (Oehmcke, 1969). One muskellunge in my 1972 study was observed to get through an opening in the net and traveled over one mile the day of stocking. Movements over long distances immediately after stocking no doubt increases stress, and this is in itself a probable factor in stocking mortality. Studies by Johnson (1973) to define mortality factors in Wisconsin lakes have indicated that while handling stress can cause mortality, most mortality occurs within three to four weeks of stocking. Attempts by Johnson (1973) to condition fingerling muskellunge by holding them in pens in the lake for 48 hours did not show any increase in muskellunge survival. Miles et al. (1974) found little change in physiological stress symptoms for fish held in pens compared to fish released without holding. Indications are that the pens themselves caused additional stress. Muskellunge held in these attempts did not receive food.

The isolation cove, while restricting lakeward movement allows a high degree of freedom and the opportunity to begin feeding without harassment from large predators.

Observations with SCUBA revealed that given the opportunity, muskellunge prefer to locate near weed-beds. Future stocking of muskellunge, whether or not isolated, should be made in areas having considerable weed cover. In this way, the weeds may serve as a buffer to quiet down the muskellunge and reduce lakeward movement. The use of SCUBA as an aid in this type of study appears to be unequalled. With no other tool can an observer effectively monitor behaviour of a population without undue harassment of the fish.

REFERENCES

Hacker, Vernon A. 1966. An analysis of the muskellunge fishery of Little Green Lake, Green Lake County, Wisconsin 1957-65. Wis. Dept. of Nat. Res., Fish Mgt. Report No. 4. 22 pp.

Johnson, Leon D. 1969. Evaluation of muskellunge stocking. Progress Report, Wisconsin D-J Project No. F-83-R-4, Job No. 11-E.

_____. 1973. Development of improved muskellunge stocking procedures (Research). Progress Report, Wisconsin D-J Project No. F-83-R-8, Study No. 209.

Miles, Harry M, S. M. Loehner, D. T. Michaud, and S. L. Salivar. 1974. Physiological responses of hatchery reared muskellunge *(Esox masquinongy)* to handling. Trans. Amer. Fish. Soc. 103(3):336-342.

Mooradian, Stephen R. and William F. Shepherd. 1973. Management of muskellunge in Chautauqua Lake. N. Y. Fish and Game Jour., Vol. 20, No. 2, p. 152-157.

Oehmcke, Arthur A. 1969. Muskellunge management in Wisconsin. Wis. Dept. of Nat. Res., Bur. of Fish Mgt. Report No. 19, 22 pp.