

RESULTS OF A PARTIAL RENOVATION OF A PUBLIC FISHING LAKE

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Abstract: In September 1976, 1/4 of Lake Orange was treated with rotenone to reduce an overabundant black crappie (*Pomoxis nigromaculatus*) population. Following the treatment 5,232.4 kg of dead fish were recovered, of which 2,050.0 kg were black crappie. Impact of the treatment on the fishery was monitored by a 2-year pre-treatment and a 2-year post-treatment creel survey. Following the treatment, the number of black crappie harvested decreased but average size increased. Average size of creel bluegill (*Lepomis macrochirus*) and pumpkinseed (*Lepomis gibbosus*) doubled. The largemouth bass (*Micropterus salmoides*) and channel catfish (*Ictalurus punctatus*) fisheries and total fishing pressure were similar before and after the treatment.

Proc. Ann. Conf. S.E. Assoc. Fish & Wildl. Agencies 35:376-382

Lake Orange is a public fishing lake owned and managed by the Virginia Commission of Game and Inland Fisheries. Management includes fertilization, fish attractor construction, and the annual stocking of channel catfish and northern pike (*Esox lucius*). Primary species in the fishery are largemouth bass, bluegill, black crappie, pumpkinseed, and channel catfish. Largemouth bass are subject to an 8 per day creel limit and a 304 mm minimum size limit. There are no harvest restrictions on other species.

Lake Orange supports an extremely abundant black crappie population which has persisted since this species became established in the late 1960's. Black crappie have augmented crowding of bluegill and pumpkinseed which has resulted in slow growth for all 3 species (Sledd and Steinkoenig 1976). This phenomenon has been noted by other authors and is considered a major problem in lake management (Hooper and Crance 1960, Byrd and Crance 1965).

A literature review was made to determine the most feasible way to reduce the black crappie population. Shoreline rotenone applications have been used to reduce sunfish (*Lepomis* spp.) populations. However, this approach is generally not effective for black crappie (Byrd and Crance 1965). Black crappie can be taken by various types of nets and traps but these methods are labor intensive and often fail to adequately reduce the population (Boussu 1955, Rutledge and Barron 1972). Total renovation by draining or poisoning is considered an alternative of last resort because it requires the lake to be closed to fishing for an extended period of time.

Partial renovation by poisoning a portion of a lake has been used to thin populations of various species, including black crappie. Several authors have noted that fishing improved very quickly following such partial renovations. A major disadvantage of this technique is that over-population and stunting often recur in 1 to 3 years (Rutledge and Barron 1972).

Based on this information a decision was made to reduce the black crappie population by poisoning a portion of the lake, followed by a predator introduction. This paper details the impact of the partial renovation on the Lake Orange fishery.

METHODS

The study area, Lake Orange, is a 50.2-ha soft water (alkalinity, <20 mg/l) lake located in piedmont Virginia. It has a maximum depth of 12 m, a mean depth of 6 m, and a watershed to surface area ratio of 18:1. Fishing pressure and harvest generally range between 375 - 750 hours and 50 - 100 kg/ha annually.

Prior to renovation the water level was drawn down $\frac{3}{8}$ m which reduced the surface area to 46.5 ha and reduced the amount of rotenone required. On 27 September 1976 water discharge from the lake was stopped and 15.8 ha (34% of the surface area) were treated with 5% emulsified rotenone (Fig. 1). The treated area had a volume of 261,000 m³ and required the application of 261 l of rotenone to yield the desired 1 mg/l concentration. Maximum depth of the treated area was 5.2 m and surface water temperature was 21.1C. The treated area was not isolated from the remainder of the lake.

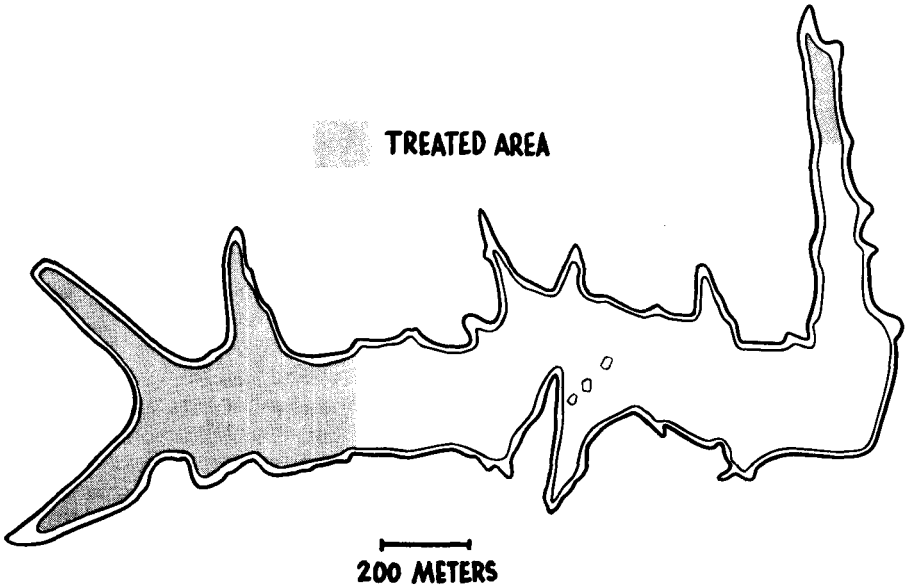


Fig. 1. Lake Orange, showing $\frac{3}{8}$ m drawdown and areas treated with 1 mg/l rotenone on 27 September 1976.

Dead and dying fish were collected for 5 days immediately following the rotenone application. During the 1st 2 days, fish were sorted by species and weighed. For the remaining 3 days only a record of total weight was maintained. This was separated into species based on the percent by weight of each species collected during the 1st 2 days. The lake was stocked with 1,350 fingerling (100 mm) largemouth bass 6 weeks after renovation and with 20,000 fingerlings (50 mm) walleye (*Stizostedion vitreum vitreum*) in June 1977.

A concession providing rental boats, and bait and tackle sales is operated at the only developed access area to the lake. All boat fishermen and an estimated 50% of the shore fishermen use this access area (Prosser 1972). From 1975 through 1978 all fishermen using the access area were interviewed by the concessionaire upon trip completion to determine hours fished and number and weight of each species creeled. Shore fishermen data were doubled and added to boat fishermen data to obtain total pressure and harvest estimates. Surveys were discontinued during the winter months due to extremely low fishing pressure. This study limits presentation of harvest data to largemouth bass, bluegill, pumpkinseed, black crappie, and channel catfish since these 5 species comprised 98% of the weight of fish harvested during the 4 study years.

RESULTS

Following the rotenone treatment 5,232.4 kg of fish were recovered (Table 1). The target species, black crappie, comprising 39% of the weight of fish recovered. Black crappie, bluegill, and pumpkinseed together comprised 83% of the kill.

Table 1. Weight of fish collected from Lake Orange following partial renovation with rotenone on 27 September 1976.

Species	Kg	Percent of Total	Kg/Treated Hectare	Kg/Lake Hectare
Black crappie	2,050.0	39.2	129.7	40.8
Pumpkinseed	1,411.2	27.0	89.3	28.1
Bluegill	859.4	18.3	60.7	19.1
Largemouth bass	375.4	7.2	23.8	7.5
Channel catfish	192.3	3.7	12.2	3.8
Brown bullhead	106.0	2.0	6.7	2.1
Redear	105.7	2.0	6.7	2.1
Golden shiner	16.7	0.3	1.1	0.3
Goldfish	11.4	0.2	0.7	0.2
Warmouth	4.3	0.1	0.3	0.1
Total	5,232.4	100.0	331.2	104.1

During 1975 and 1976, prior to renovation, the Lake Orange fishery was dominated by black crappie (Table 2). This species comprised 75% of the total number and 64% of the total weight of fish creeled. In both years the catch rate for black crappie exceeded 1 fish/hour but average weight was only 91 g.

Following renovation there was a distinct change in the black crappie fishery (Table 2). The total number of black crappie harvested decreased from 62,535 fish in 1975 - 1976 to 11,540 in 1977 - 1978, but average weight increased. The average weight of black crappie harvested in March 1977 was 136 g. By October the average weight had increased to 227 g (Fig. 2). Average weight of black crappie creeled in 1978 was 272 g. Catch rate for 1977 - 1978 was 0.26 fish/hour.

Bluegill and pumpkinseed creeled from Lake Orange prior to renovation were small with average weights of only 77 g and 68 g, respectively (Table 2). Following

Table 2. Estimated harvest of fish from Lake Orange based on creel surveys conducted prior to (Mar - Nov 1975 and Mar - Sept 1976) and after renovation (Mar - Oct 1977 and Mar - Oct 1978).

Parameter	Largemouth bass		Bluegill		Black crappie	
	1975-76	1977-78	1975-76	1977-78	1975-76	1977-78
Number creeled	363	539	14,211	10,465	62,535	11,540
Weight creeled (Kg)	287.6	459.2	1,078.8	1,641.7	5,695.6	1,983.3
Average weight (g)	794	853	77	159	91	172
Number creeled/ hectare/year	3.7	5.4	141.5	104.2	622.9	114.9
Kg creeled/ hectare/year	2.9	4.6	10.8	16.4	56.7	19.7
Number creeled/hour	0.006	0.012	0.242	0.234	1.064	0.259
Kg creeled/hour	0.005	0.010	0.018	0.037	0.097	0.044

Parameter	Pumpkinseed		Channel catfish	
	1975-76	1977-78	1975-76	1977-78
Number creeled	5,168	1,996	1,322	1,035
Weight creeled (kg)	340.4	283.2	1,564.8	1,720.6
Average weight (g)	68	141	1,184	1,665
Number creeled/ hectare/year	51.4	19.8	13.1	10.4
Kg creeled/ hectare/year	3.4	2.8	15.6	17.1
Number creeled/hour	0.088	0.045	0.023	0.023
Kg creeled/hour	0.006	0.006	0.027	0.039

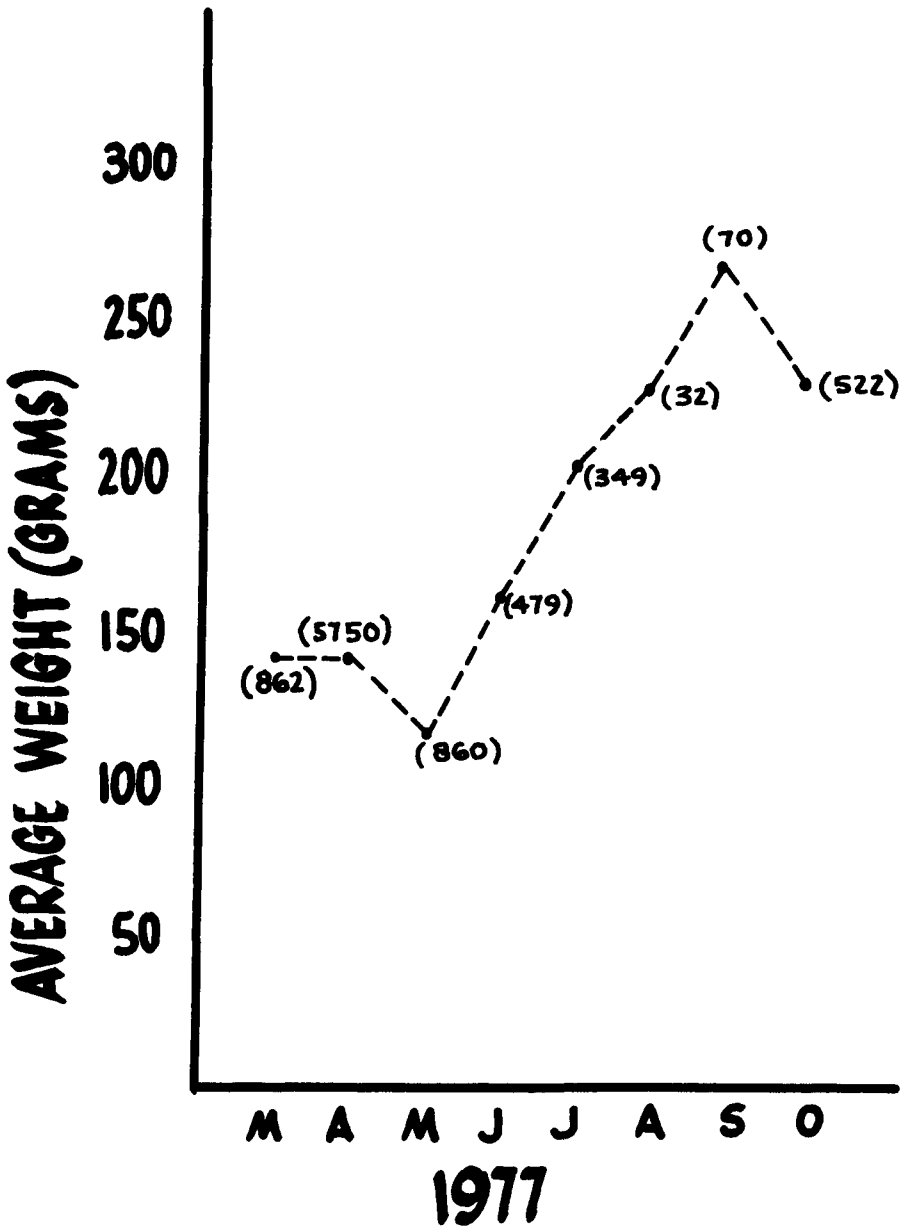


Fig. 2. Monthly average weight and number of black crappie harvested from Lake Orange during March-October 1977. Estimated number of fish creelcd monthly shown in parenthesis.

renovation the numerical harvest for these species decreased, but the average weight doubled, resulting in a 36% increase in weight creeled (Table 2).

During 1975 - 1976, a total of 363 bass were creeled (average weight 794 g). Their contribution to the overall harvest was less than 1.0% of the number and only 3.2% of the weight of fish creeled. The average annual harvest was 2.9 kg/ha. Largemouth bass harvest increased following renovation with 539 bass creeled in 1977 - 1978. Average weight increased to 853 g and annual harvest averaged 4.6 kg/ha (Table 2).

During 1975 - 1976 a total of 1,322 channel catfish was creeled. Harvest decreased slightly after renovation to 1,035 fish during 1977 - 1978 but average weight increased by 481 g resulting in a 10% increase in weight of channel catfish creeled (Table 2).

Lake Orange fishermen fished a total of 58,748 hours in 1975 - 1976 and 44,628 hours in 1977 - 1978. During the 4-year period they harvested more than 100,000 fish which weighed in excess of 15,000 kg (Table 3).

Table 3. Fishermen and harvest data for largemouth bass, bluegill, pumpkinseed, black crappie, and channel catfish from Lake Orange prior to (Mar - Nov 1975 and Mar - Sept 1976) and after renovation (Mar - Oct 1977 and Mar - Oct 1978).

Parameter	1975-1976	1977-1978
Number of fishermen	18,856	15,120
Hours fished	58,748	44,628
Average trip length (hours)	3.1	3.0
Annual hours fished/hectare	585.1	444.6
Number fish creeled	83,599	25,629
Weight fish creeled (kg)	8,967.3	6,088.1
Average weight (g)	109	236
Annual number fish/hectare	832.6	255.2
Number fish creeled/hour	1.4	0.6
Annual kilograms/hectare	89.3	60.6
Weight fish creeled/hour (g)	154	136

DISCUSSION

Overall, the renovation appeared to have the desired fishery impacts. Black crappie abundance was reduced and average size increased. Average size of bluegill and pumpkinseed doubled. This was accomplished without apparent adverse impact on the largemouth bass and channel catfish fisheries. However, fishing pressure did not increase in response to these fishery changes (Table 3). In fact, pressure was somewhat less in 1977 - 1978 than in 1975 - 1976, although the annual fluctuations were well within those routinely observed for Virginia lakes (McHugh and Steinkoenig 1980).

During the study period a major reservoir (Lake Anna) located about 30 km from Lake Orange opened to fishing. This reservoir probably attracted some

fishermen away from Lake Orange but this point was not documented (Sledd and Shuber 1981).

A change in the attitude of some black crappie fishermen was observed which may have affected fishing pressure. Prior to the renovation, most Lake Orange black crappie fishermen had little difficulty locating and catching fish. However, they often complained about the small average size. To a certain extent these complaints were the basis for the renovation. Following the renovation, black crappie were larger but less numerous and some fishermen now had considerable difficulty consistently locating fish. This created an entirely new group of unhappy fishermen. In retrospect, management in 1977 should have included the construction of new fishing reefs designed especially to concentrate black crappie. In addition, an educational program designed to keep fishermen informed of the best fishing locations would have been helpful.

The introduction of largemouth bass and walleye after the renovation was intended to increase the predator pressure on black crappie. The impact of these stockings has not been quantified but as of June 1981 apparent over-population and stunting have not recurred. In addition, a walleye fishery has now been established.

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