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HOLLOWAY RESERVOIR

Genesee & Lapeer counties (T8N, R8, 9E, Section Many)

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Environment

Holloway Reservoir is a 1,973 acre impoundment on the Flint River (Figure 1). It is located in eastern Genesee and western Lapeer counties. Most of the reservoir is encompassed by the Holloway Reservoir Regional Park. Mott Reservoir, a smaller impoundment, is located about 5 miles downstream. Because of its size and proximity to Flint, Holloway Reservoir provides a major aquatic resource for this otherwise relatively lakeless area of south-central Michigan.

The upper Flint River watershed contains a wide mixture of soils (24 main soil types have been identified) of glacial drift origin. The watershed contains 1,400 square miles, and is part of the Saginaw River drainage basin. The river drains 95% of Genesee County, 80% of Lapeer County, and 10% of Shiawassee County. The Holloway Reservoir shoreline varies greatly from marshy edge to gently sloping open shoreline to steep sand bank shoreline. The Flint River is designated as a top quality, warmwater stream, but three smaller tributaries are presently being managed for trout.

The City of Flint began construction of Holloway Reservoir in 1951. Full operation of the dam began in 1955. The original uses of the Reservoir were potable water supply and flow augmentation. Recreation, in addition to flow augmentation, became emphasized when the City began to obtain its potable drinking water from Lake Huron in 1967.

Flint River water is of the calcium bicarbonate type and is very hard. Hardness has been recorded in the range of 240 to 300 ppm (Ellis Arndt, and Truesdell, Inc. 1972). Agricultural nonpoint sources (NPS) are a major contributor to the overall pollutant level in the Flint River. McColley and Karkowski (1982) reported that one year's loadings of phosphorus in the Flint River from NPS equalled that of 14 years of wastewater treatment plant operation.

Fishery Resource

Fisheries Division's management of the Holloway Reservoir fishery resources has been vigorously pursued since early in its existence. The first netting survey, conducted in 1969, revealed that a warmwater fish population, rather typical of eutrophic southern Michigan waters, was already well established. Black crappies were, by far, the most abundant species collected. Carp, the second most abundant species, contributed to the significant turbidity. Dense summer phytoplankton blooms, another cause of turbidity, developed relatively early in the reservoir's existence.

The first attempt to alter the resident fish stocks in Holloway Reservoir occurred in 1961 with the introduction of fingerling muskellunge. This stocking effort was unsuccessful; no muskies were ever taken in nets or reported caught by anglers. The reservoir and it's upstream watershed were treated with rotenone in the fall of 1971 in an attempt to totally eradicate the fish population. Later that fall, and in 1972 and 1973, the reservoir was stocked with large numbers of young largemouth bass, northern pike, bluegill, channel catfish, and walleye. Additionally, rainbow trout were

introduced those same years to produce an interim fishery.

A netting survey in 1972 revealed that carp, in particular, had not been eradicated by the treatment. Instead, survival of young carp was evidently greatly increased, as often follows attempts to artificially lower carp abundance. In 1976, Holloway Reservoir was again treated with rotenone to suppress the carp population in the headwaters and upper impoundment. Substantial numbers of fingerlings, and in some cases adults, of 10 sport fish species were stocked after the treatment.

A 1978 survey determined that carp were again abundant. Black crappies of acceptable size to anglers were exceptionally numerous. Young-of-the year walleye were collected during a 1980 electrofishing survey which suggested that significant natural reproduction of this species was occurring. Surveys in 1983 and 1984 revealed that bluegills were abundant and growing well. Black crappies were also abundant, but were growing somewhat slowly. Walleyes were growing exceptionally well and were providing a summer fishery. Despite heavy stockings in 1976 and 1977, only one tiger muskie was collected. These results, plus earlier (1961 and 1962) stockings and a lack of angler success, combine to indicate very poor survival of this species in this reservoir habitat.

The most recent trap-netting survey was in 1989. The results, summarized in Table 1, confirmed the findings of earlier surveys showing reservoir fish population dominated by black crappies and carp. Gizzard shad are not listed in Table 1, but they have gained access to the lake, from unknown sources in recent years, and are now an additional dominant species. Age analyses presented in Tables 2 and 3 clearly indicate that growth of fishes most important to the fishery-e.g., bluegill, yellow perch, black crappie, and walleye was quite satisfactory (well above state averages). Channel catfish apparently grow very well. A cursory age analysis was made of several 1990 angler-caught catfish from the Flint River below the Holloway Dam. The mean length of seven age-VI catfish was 19.5 inches, and 11 age-VII catfish averaged 22.9 inches long. This growth, if representative of the reservoir population, would be exceptionally good. Most fish species of angler importance in the Reservoir become more piscivorous with increasing size. The expansion of the gizzard shad population, which at a small size are ideal forage, has probably enhanced the growth of sport fish.

Management Direction

Holloway Reservoir is extremely fertile, and this is reflected in the generally satisfactory growth and abundance of several fish species of angler interest. The lake should be supporting a satisfactory sport fishery; this needs to be confirmed by an on-site creel survey of angler effort and harvest.

Two attempts to alter the fish community by rotenone treatment have not eliminated carp. It is unclear whether the carp stock has been significantly reduced. However, it appears that sport fish and rough fish are presently coexisting at an acceptable level. Further attempts to reduce rough fish density by conventional methods (rotenone treatment or manual removal with nets) are probably not economically justified or realistically attainable.

The current stocking program for Holloway Reservoir calls for the planting of walleye and tiger muskies every other year. There appears to be little reason to continue to stock tiger muskies, since there has been a consistent absence of reports of angler success. Conversely, walleye are providing a fishery and they should continue to be stocked. Catfish appear to be very common with obvious natural reproduction. They should require no more than monitoring, and if necessary, harvest control measures can be considered. As time allows, a study should be conducted to ascertain the extent of natural reproduction of these two species. Walleyes, in particular, may prove to be fully self-sustaining in the reservoir. White bass is an additional species that might be considered for introduction. This fertile impoundment offers a rich forage fish source that might prove ideal for

supporting this species. It would add further variety to the fishery. A flourishing white bass population would, of course, introduce a risk of interspecific competition. This competition might be fairly small scale, but the potential risk should be thoroughly investigated before introduction of the species.

The apparent greater abundance of smallmouth bass rather than largemouth bass in the reservoir environment is puzzling and merits further study. Although unproven at this time, it is quite possible that the highly organic floc (from phytoplankton) settling out on the substrate causes difficulties for nest-building species that spawn in the lower (deposition) area of the reservoir. This floc material develops a strong septic odor, and it is probable that at the substrate/water interface dissolved oxygen (DO) becomes depleted, at times, during the warm months. This would occur most frequently in protected shoal areas favored by nest builders. Thorough testing of the DO near the substrate in late spring and early summer would be useful in ascertaining the extent of this problem. Walleye, smallmouth bass, and channel catfish are species that typically move into streams to spawn and thus avoid potential low DO problems from this source.

The abandoned New York Central Railroad bridge, spanning the upper part of the Reservoir in Columbiaville, prevents passage of all but very small boats. Removal of the bridge would allow greater use of the upper end of the impoundment by anglers, fisheries survey craft, and other watercraft. Fisheries Division should pursue removal of this bridge.

This report has stressed that high fertility and turbidity are major characteristics of this reservoir which must be considered in the management of its fishery resources. This eutrophic condition has undoubtedly contributed to the productivity of forage species and to valuable sport fish species which prey upon them. The case for walleye, channel catfish, and their prime forge, gizzard shad, has been made. This lake appears to have been spared some of the damaging effects of eutrophication-e.g., excessive weed growth and extensive DO depletion. I believe this is due primarily to the shallowness of the basin coupled with water circulated from the inflow of a fairly large stream (the Flint River). Limnological surveys conducted four different summers revealed little to no thermal stratification. DO measurements taken in 1968 and 1977 revealed adequate concentrations for fish at all depths except for suspected depletion at the substrate interface, as previously discussed. It is unlikely that thermal stratification, with its potential for adverse biological effects, becomes well established. Holloway Reservoir in its present condition is probably supporting about as productive and valuable a sport fish population as can be reasonably expected of it.

Each fall, the Holloway Reservoir's water level is dropped 4 feet to prevent ice damage to, or deactivation of, the water control structures for the dam. This drawdown normally begins about November 1 and restoration to normal level is targeted to occur by May 1 (J. Weisenberger, City of Flint Water Plant Supervisor). Effects of this mild drawdown on the fishery resource have not been studied but most probably are minimal. Bennett (1962), summarizing his Illinois work and many others' research findings, conclusively demonstrated that wide annual fluctuations in lake levels can have a pronounced favorable effect on game fish populations. This applies to both natural and man-made lakes.

A permanent solution to lessening the overfertility caused by phosphorus overloading, is long term, involving fundamental land use changes in the watershed. A Flint River Basin management study prepared for Genesee, Lapeer, and Shiawassee counties (GLS) concluded that improving water quality ranks low within the agricultural community, because of high costs to individual farmers in the face of depressed farm income (McColley and Karkowski 1982). Funding for watershed improvement projects is a necessity, but this has not occurred in the Holloway Reservoir watershed. The GLS study recommendation for artificial bank stabilization in the Plum Creek watershed upstream of the lake, has not occurred (J. Cousins, Lapeer County Drain Commissioner, personal communication). A substantial drawdown of the reservoir water level for a significant

period of time is a potential fishery management option to consider for the future, should the fishery seriously deteriorate.

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References

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Ellis, Arndt, and Truesdell, Inc. 1972. Master plan for the Holloway Reservoir Regional Park. Ellis Arndt, and Truesdell, Inc., Flint, Michigan.

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Table 1.-Number, weight, and length (inches) of fish collected from Holloway Reservoir with trap nets, July 16-18, 1989.

Species	Number	Percent by number	Weight[1] (pounds)	Percent by weight	Length range (inches)[2]	Average length	Percent legal size[3]
Bluegill	616	15.2	89.2	1.7	3-8	6.0	54.0
Largemouth bass	2	0.0	2.9	0.2	12-14	13.5	100.0
Walleye	74	1.8	107.8	5.6	11-24	16.5	76.0
Channel catfish	96	2.4	224.2	11.8	7-28	17.5	93.0
Smallmouth bass	57	1.4	54.5	2.8	7-17	12.3	65.0
Northern pike	10	0.2	35.0	1.8	22-28	25.1	100.0
Tiger muskie	1	0.0	0.8	0.0	15	15.5	-
Yellow perch	4	0.1	0.6	0.0	5-9	7.3	50.0
Black crappie	3009	74.0	872.3	45.8	5-11	7.1	51.0
Bullhead sp	9	0.2	3.0	0.2	9-10	9.9	100.0
Carp	162	4.0	483.8	25.4	15-24	19.1	-
White sucker	23	0.6	28.6	1.5	12-18	15.5	-
Bowfin	2	0.0	3.0	0.2	22-23	23.0	-
Total	4065	100.0	1905.7	100.0			

[1]Some weights were estimated from lengths.

[2]Note some fish were measured to 0.1 inch, others to inch group: e.g,. "5" = 5.0 to 5.9 inches, "12" = 12.0 to 12.9 inches; etc.

[3]Percent legal size or acceptable size for angling.

Table 2.-Average total length (inches) at age, and growth relative to the state average, for four fish sampled from Holloway Reservoir with trap nets on May 16-18, 1989. Number of fish aged is given in parentheses.

	Age								Mean growth
Species	I	II	III	IV	V	VI	VII	VIII	index[1]
Bluegill	-	5.8	6.8	7.6	-	8.7	-	-	+1.8
	-	(48)	(6)	(3)	-	(1)	-	-	-
Smallmouth bass	-	8.2	11.5	13.6	15.8	17.0	-	-	+1.0
	-	(9)	(12)	(10)	(5)	(2)	-	-	-
Black crappie	-	7.2	8.8	9.6	10.8	11.0	-	-	+1.2
	-	(19)	(18)	(7)	(3)	(1)	-	-	-
Walleye	-	12.2	14.8	16.5	18.4	18.3	21.2	24.9	+0.8
	-	(4)	(11)	(17)	(7)	(1)	(3)	(1)	-

[1]Mean growth index is the average deviation from the state average length at age.

Table 3.-Estimated age frequency (percent) of four species of fish caught from Holloway Reservoir with trap nets on May 16-18, 1989.

	Age								Number
Species	I	II	III	IV	V	VI	VII	VIII	caught
Bluegill	2	82	12	3	-	1	-	-	616
Smallmouth bass	-	17	35	31	14	3	-	-	57
Black crappie	-	97	2	1	1	1	-	-	3,009
Walleye	-	7	25	44	18	1	4	1	74

Age assumed from size (all in 3 inch group).

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Questions, comments and suggestions are always welcome! Send them to tinchert@michigan.gov