Murphy Lake

Tuscola County, T10N, R8,9E, Sections 5, 1, 7
Cass River Watershed

Joseph M. Leonardi

Environment

Murphy Lake is located approximately 3 miles northeast of Millington in southern Tuscola County. Originally, Murphy Lake was one of three small lakes interconnected by Goodings Creek of the Cass River system. A dam constructed in the 1850's enlarged Murphy Lake to facilitate the lumber industry of the era. A new dam installed in the early 1930's enlarged Murphy Lake to include Nest and Robins lakes and form the current 209 acre water body (Figure 1).

The Murphy Lake watershed lies within the Huron district of the Southern Lower Michigan Regional Landscape Ecosystem and is characterized by features identified in the Lum Interlobate sub-district (Albert 1995). The Lum Interlobate sub-district is characterized by end-moraine ridges surrounded by outwash deposits containing kettle lakes and wetlands. Broad expanses of flat outwash surrounding hills of gravelly end moraines result in undulating topography fairly unique within the thumb area of Michigan. Soils on raised moraines generally consist of medium texture sand and loam and are well drained while outwash soils are typically fine texture, high in organic content, and more variable ranging from well drained to poorly drained. Principle soil association of southern Tuscola County is of the Marlette-Capac-Spinks series (United State Department of Agriculture 2007).

Groundwater and surface water patterns follow outwash channels and geological soil types. Hilly topography and permeable, medium-textured soils found in the Goodings Creek headwater region provide hydraulic head for moderate groundwater inflows to Goodings Creek and Murphy Lake. Groundwater inflow provides a stable water source necessary to maintain the aquatic ecosystem. Surface water contributions tend to be more variable but also help maintain the lake's water level.

Pre-settlement vegetation surrounding Murphy Lake was described as beech-sugar maple forest with moderate amounts of white pine, eastern hemlock, and white oak (Albert 1995). Outwash depressions typically supported swamp forests containing black ash, tag alder, white cedar, and tamarack. Pre-settlement vegetation was greatly altered during the lumber era (1840's) and with the "Great Fire" of 1881 which burned most of the thumb region. Although land use in the thumb area is dominated by agriculture, the immediate shoreline of Murphy Lake is dominated by second growth beech-maple forest with marsh habitat common to the south shore.

Goodings Creek is the primary inlet and outlet of Murphy Lake. The creek enters Murphy Lake from the south and exits to the north flowing to the Cass River and to the Saginaw River and Lake Huron. Murphy Lake water level is maintained via an earthen dam with a concrete/steel water control structure on the north shore. Dam head is estimated at 7 feet and water levels are maintained at a fixed crest with board manipulation and overspill discharge. In March, 1987, a court ordered summer level was set at 747 feet (above mean sea level) for the period of March 10 (or ice out) through September 1 and a winter level set at 745.5 feet.

As a result of the Murphy Lake Dam, vast areas of original marsh lands were inundated resulting in an irregular shaped shoreline with expanded littoral zones of shallow water. Original lake boundaries can be reasonably surmised by following hydrographical contours (Figure 1). Four deep water basins indicate original lake locations.

The southern portion of Murphy Lake, where Gooding Creek enters, is relatively shallow and intersected by Murphy Lake Road. A large culvert, navigable by small boats, connects the southern portion to the main basin. Bottom substrate in the southern lake portion is predominantly organic with high silt deposition. Shoreline habitat is typically marsh with moderate growth of reed, rush, cattail, and arrowhead emergent vegetation. This portion of the lake is known to concentrate esocid fish species during spawning periods (Leonardi, personal observation).

The main basin shoreline is highly irregular with four distinguishable peninsulas and one small island. Small coves created by peninsulas typically contain marsh shoreline habitat with organic substrate. Substrate in the main basin is dominated by sand. Three deep water zones are associated with the main basin with the primary zone being located in the center of the lake.

In general, Murphy Lake is classified as a warmwater, medium size, deep lake of mesotrophic characteristics. Medium size lakes are considered between 100 acres to 1000 acres and deep lakes are those known to stratify. Average depth is estimated to be 7.8 feet with a maximum depth of 41 feet found just southwest on the largest island in the center portion of the lake. An estimated 62% of the lake is 10 feet or less in depth.

Limnological parameters measured in August, 2007 included temperature, oxygen, and pH (Table 1). Thermal stratification occurred before in mid-summer with thermocline development between 18 and 24 feet. Critical oxygen concentrations for fish (< 3 ppm) were observed at depths greater than 18 feet. Temperature and oxygen analysis appear consistent with historical records and indicate deep water zones become oxygen deprived and unsuitable for most fish species when the lake stratifies. Historical data indicates total alkalinity of Murphy Lake typically ranges from 175 ppm to 214 ppm. The pH values of 6.4-8.4 suggest moderately hard and well buffered water typical of this region.

Aquatic vegetation is the dominant form of fish cover in Murphy Lake but submerged stumps and root wads from the original flooding of the land are also common. The overall fertility of the lake along with its relatively shallow average depth make it well suited for aquatic vegetative growth. Macrophytes common to the lake include Eurasian milfoil, large leaf and curly leaf pondweed, elodea, and coontail. Semi-annual chemical treatments for nuisance vegetation have occurred in Murphy Lake since 1997.

Murphy Lake is one of only a few public water bodies in Tuscola County making it a valued resource to the local area. Approximately one half of the shoreline is contained within the boundaries of the Murphy Lake State Game Area and remains in a natural state. Shoreline development on the other half of the lake is moderate with an estimated 102 dwellings. Dwelling density is estimated to be one dwelling for every 142 feet of lake frontage. Most occupied dwellings have some sort of armor (sea wall, rip rap) protecting their shoreline. Interestingly, only 25 dwellings were indicated in a 1957 survey.

Public access to Murphy Lake is restricted to shoreline and two crudely developed gravel clearings on Murphy Lake Road within the boundaries of the state game area. Both clearings often require the use of four wheel drive to launch vessels. For years, a private boat livery provided public access but ceased operations in the early 1980's. The most common location to launch a boat on Murphy Lake requires navigation through the road culvert restricting boat size to 16 feet and under. Parking is also limited to space available along side the road or in a small hunter access lot a short distance from the launch. As a result, recreational use of the lake is primarily from the immediate landowners.

History

Murphy Lake has a long history of MDNR fisheries management. File records indicate Murphy Lake was stocked and managed for trout from 1949 to 1952 but discontinued when northern pike populations grew. In 1957, the lake was stocked with northern muskellunge and soon after became a brood stock muskellunge source for the State's hatcheries program. Stocking of northern muskellunge occurred semi-annually until 1979. In 1985, in a somewhat contentious decision, Murphy Lake was discontinued as a brood stock source and special muskellunge regulations were discontinued on the lake. In 1987, a declining fishery resulted in a decision to rehabilitate the lake beginning with a total fish reclamation using rotenone. Post-reclamation and current fisheries management has concentrated on warm and cool water species (largemouth bass, bluegill) with particular emphasis on stocking channel catfish, northern pike, and walleye (Table 2).

Recent fish community assessments have occurred on Murphy Lake in 1987, 1993, and 1995. Additionally, walleye recruitment surveys were conducted in 1988 and 1998. These assessments document the presence of 14 fish species (Table 3). It is likely other species are present but have not been documented due to the types of fish sampling gear used. All fish species found in Lake Murphy are common to this region of Michigan.

Assessments in 1993 and 1995 reported good fisheries for largemouth bass, black crappie, walleye, and northern pike. Bluegill size structure was dominated by small slow growing fish and reported as poor. A sizeable carp population was found in both assessments. Channel catfish appeared in low but acceptable abundance. The 1988 and 1998 walleye recruitment surveys estimated young of the year walleye density at less than 2/acre suggesting insufficient survival of stocked fish to create a significant walleye fishery. Young of the year walleye densities of 10/acre are generally believed necessary to create a significant walleye fishery of 3-5 adults/acre.

Current Status

In 2007, Fisheries Division conducted two separate surveys on Murphy Lake. An assessment using inland trap nets specifically targeting walleye and northern pike during spawning season was conducted in early April. In mid-May, a more intensive survey was conducted using trap net, gill net, seine, and electrofishing gear.

The April assessment yielded low catches of northern pike and walleye suggesting low abundance. Five northern pike averaged 26.5 inches and 4 walleye averaged 22.3 inches. Contrary, largemouth bass catch rates were high with a catch per unit effort (CPUE) of 4.7 fish/lift. A total of 28 largemouth

bass averaging 12.6 inches comprised 16% if the April catch. The current status of these fisheries will be discussed in ensuing paragraphs.

On May 14-17, 2007, Fisheries Division conducted a second survey on Murphy Lake. Three inland trap nets were fished for three nights at four locations. Two experimental gill nets were fished for one night at two locations. Four 25 foot seine tows were made at 4 locations and 3 ten minute night electrofishing runs were conducted at 3 locations. All fish were measured to the nearest inch group and scales samples were collected from common sportfish for age-growth analysis.

A total of 627 fish representing 13 species were collected from the May efforts. Black crappie and bluegill were the most abundant comprising 82% of the total catch by number and 28% by weight (Table 4). Other fish species collected included brown and yellow bullhead, channel catfish, carp, green sunfish, largemouth bass, northern pike, pumpkinseed, walleye, white sucker, and yellow perch.

A total of 418 bluegill averaging 5.8 inches comprised 67% of the total May catch (Table 4). Bluegill ranged from 3 to 8 inches with 39% of the fish meeting or exceeding the acceptable harvest size of 6 inches. Age-growth data indicates bluegills are growing above State average having a mean growth index of +0.7 (Table 5). Age distribution indicates sufficient recruitment with good representation of bluegill aged 3 through 5 (Table 6). Bluegill longevity peaks at age 6 and older fish appear to experience high mortality either by harvest or natural causes.

A total of 92 black crappie averaging 7.1 inches comprised 15% of the total May catch (Table 4). Black crappie ranged from 4 to 11 inches with 43% of the fish meeting or exceeding the acceptable harvest size of 7 inches. Age-growth data indicates black crappie are growing below State average having a mean growth index of -0.9 (Table 5). Age distribution indicates sufficient recruitment to the fishery with good representation of age 3 fish (Table 6). Black crappie longevity appears to peak at age 6 and older fish appear to experience high mortality either by harvest or natural causes.

A total of 19 walleye averaging 17.6 inches comprised 3% of the total May catch (Table 4). Walleye ranged from 12 to 26 inches with 63% meeting or exceeding the minimum harvest size of 15 inches. Four additional walleye ranging from 17 to 26 inches were collected in the April effort. Age-growth analysis indicates walleye are growing above State average having a mean growth index of +0.8 (Table 5). Age distribution indicates a low level of natural reproduction with representation of year classes in non-stocked years (Table 6).

A total of 14 largemouth bass averaging 12.5 inches comprised 2% of the total May catch (Table 4). Largemouth bass ranged from 6 to 19 inches with 36% meeting or exceeding the minimum harvest size of 14 inches. Twenty-eight additional largemouth bass averaging 12.6 inches were collected in the April effort. Age-growth analysis indicates largemouth bass are growing above State average having a mean growth index of +1.4 inches (Table 5). Age distribution indicates multiple year classes make up the harvestable sport fishery with representation of fish up to 13 years of age (Table 6).

Other important sportfish occurred at lower abundance. Eleven channel catfish ranging from 16 to 26 inches averaged 21.4 inches comprised 1.8% of the total May catch (Table 4). Ten northern pike ranging from 22 to 35 inches averaged 26.9 inches and comprised 1.6% of the total May catch. An

additional 5 northern pike averaging 26.5 inches were collected in the April effort. Only a few specimens of pumpkinseed sunfish and yellow perch were collected.

Common carp were the most abundant non-sportfish species collected. A total of 41 carp averaging 15 inches comprised 7% of the total catch (Table 4). Other non-sportfish species collected in low abundance included brown and yellow bullhead, green sunfish, and white sucker.

Analysis and Discussion

In southern Michigan warmwater lakes, bluegill are typically the most abundant fish species present and play a key role in community structure and overall sportfishing quality (Schneider 1981). Schneider (1990) suggests indices of bluegill characteristics can be used to classify populations. The "Schneider Index" uses size scores of length frequency and growth data and relates them to an adjective ranking system ranging from "very poor" to "superior". Using the Schneider Index for classifying bluegill populations, Murphy Lake scored 4.25 for a "good" rank Table 7). Bluegill size structure was considered poor prior to the 1987 reclamation and remained poor in 1993 and 1995.

Typically, bluegill populations with poor size structure are the result of an over abundance of young fish which exhibit poor growth due to competition, an absence of adult fish due to high mortality, and an imbalanced predator-prey ratio. These conditions appeared as the likely scenario of the bluegill community in the 1990's. However, although current age data for Murphy Lake indicates high adult mortality, growth of young fish is very good and is likely the primary factor for recruitment into the fishery and the "good" Schneider Index rank. Sufficient numbers of age 3 bluegills are entering the 6 inch acceptable size fishery. Since growth is typically density dependant, it is reasonable to surmise sufficient forage (zooplankton) is available for bluegill and a somewhat balanced predator-prey ratio exists.

Black crappie have been an important component of the sport fishery in Murphy Lake for many years. They have typically been the second most abundant species collected in assessments. In addition to the 92 crappie collected in May, an additional 59 crappie averaging 7.0 inches were collected in the April assessment. Size structure and average length have remained fairly consistent over the years and generally indicate an acceptable fishery for 8 and 9 inch fish.

Walleye are an important component of the predator community and highly desirable sportfish. Although past fall indexing has indicated young of the year walleye survival would not result in a significant fishery, adult walleye seem to be common in sampling efforts. The capture of 23 walleye in the 2007 assessments demonstrates survival potential and indicates a fishery can be provided with stocking.

Northern pike have fared well through post-reclamation stocking and natural reproduction. The 1995 assessment found a moderate abundance with 57 fish averaging 23.3 inches. Catch per unit effort was 4.8 fish/lift. Age frequency of those fish indicated several year classes present and sufficient natural reproduction to justify a discontinuation of stocking. The 2007 assessments collected 15 northern pike averaging 26.7 inches yielding a CPUE of 0.8 fish/lift. The decline in catch rate and numbers may reflect the contribution of past stocking but more likely reflects differences survey timing and

collection gear. Compared to 1995, northern pike appear in lower abundance but with an improved size structure.

Murphy Lake has maintained a good reputation for its largemouth bass fishery. Although the 1995 and 2007 efforts are not directly comparable, a significant fishery with sizable fish was found in 1995. The combined 2007 efforts yielded a total of 42 fish averaging 12.6 inches. Seventeen percent of these fish were 16 inches or greater providing anglers the opportunity for trophy size fish. The presence of multiple year classes and the tendency for bass anglers to practice catch/release methods preserves large fish for multiple recapture by anglers and assures a highly desirable fishery.

The stocking of channel catfish in the late 1980's and early 1990's has resulted in a small population. A total of 11 channel catfish averaging 21.4 inches were collected. Similar abundance and size structure was reported in 1995. Although age data was not collected, the presence of juvenile fish suggests some level of natural reproduction is occurring. Presently, channel catfish occur in low abundance but provide for incidental catch and harvest.

Management Direction

Presently, Murphy Lake is in good condition in terms of its overall fishery. The lake offers very good angling opportunities for several species including bluegill, black crappie, largemouth bass, walleye, and northern pike. Additional opportunities are available for channel catfish and non-game species.

Fisheries management of Murphy Lake should continue to focus on warm and cool water species. Sustainable populations of largemouth bass, northern pike, and channel catfish as top predators will help maintain an improved bluegill size structure. Presently, these species occur in sufficient numbers and health and no management actions are directed toward them. Continued management for walleye is also desirable. Currently, there is insufficient natural reproduction of walleye to sustain a fishery and continued stocking is recommended. Management recommendations are to stock spring fingerling walleye at a rate of 50/acre (10,450 fish) on an alternate schedule.

Improvements to the small gravel boat launch within the Murphy Lake State Game Area should also be considered. During wet conditions, launching is prohibitive due to soft substrate resulting in stuck vehicles. As a result, further damage occurs to the launch and shoreline. A firm base launch pad of limestone mix is recommended. Preliminary estimates indicate 50 cubic yards are necessary to help stabilize the launch site for continued small boat use.

References

Albert, Dennis A. 1995. Regional landscape ecosystems of Michigan, Minnesota, and Wisconsin: A working map and classification, fourth edition. Michigan Natural Features Inventory, July 1994, Lansing, Michigan.

Schneider, J.C. 1981. Fish communities in warmwater lakes. Michigan Department of Natural Resources, Fisheries Division, Fisheries Research Report 1890, Ann Arbor, Michigan.

Schneider, J.C. 1990. Classifying bluegill populations from lake survey data. Michigan Department of Natural Resources, Fisheries Division, Fisheries Technical Report No. 90-10, Ann Arbor, Michigan.

United States Department of Agriculture 2007. Soil Survey Staff, Natural Resources Conservation Service, U.S. General Soil Map (STATSGO) for Michigan. Available URL: "http//soildatamart.nrcs.usda.gov" (Accessed 30/10/2007).

Figure 1. Hydrographic contour map of Murphy Lake, Tuscola County.

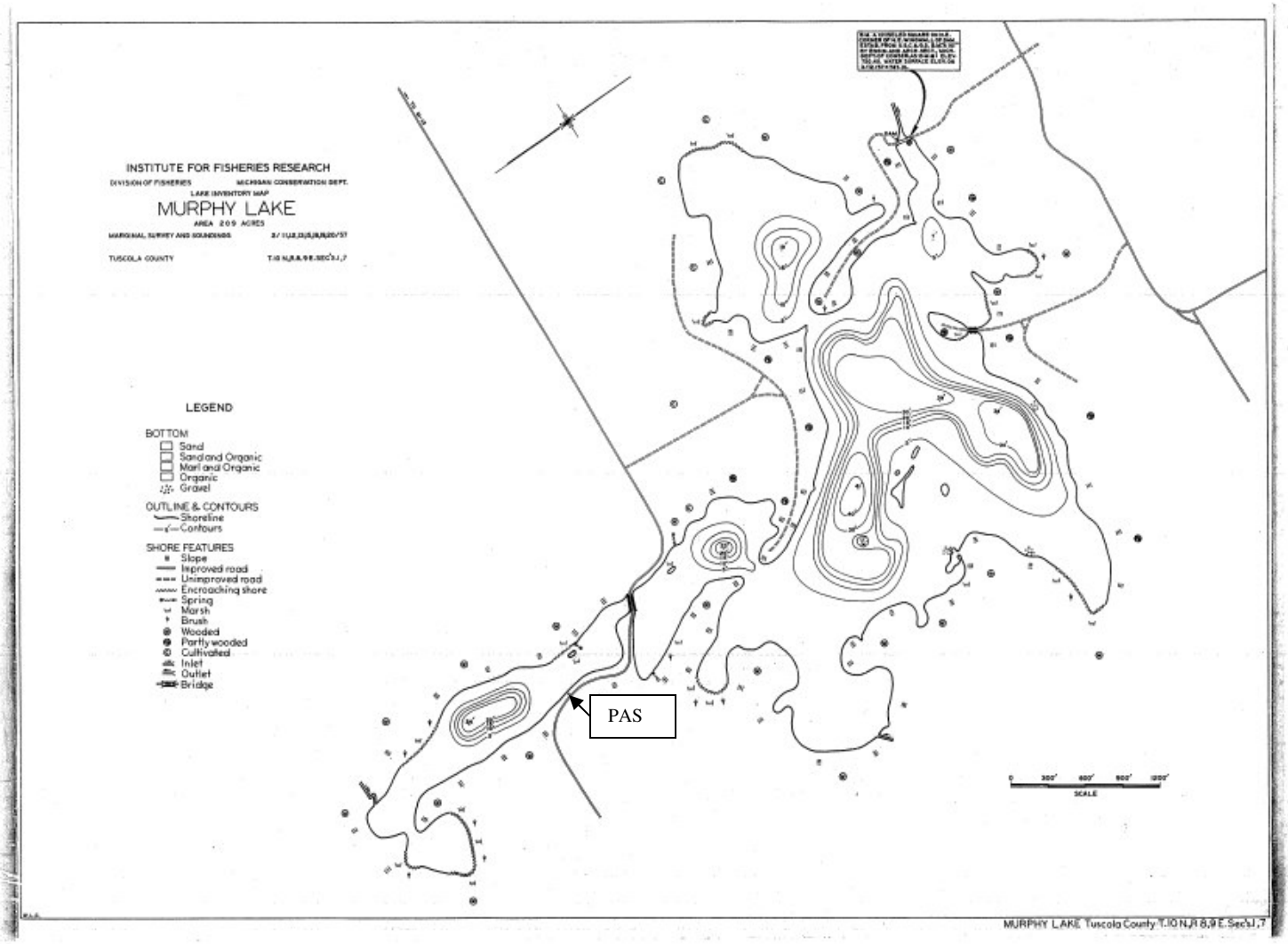

Table 1.-Temperature, oxygen, and pH profile from deep basin of Murphy Lake, Tuscola County. Data collected August, 2007 by MDNR, Fisheries Division.

Depth (ft.)	Temperature (F)	Oxygen (ppm)	pH
1	80	7.8	7.8
3	80	7.7	7.6
6	79	7.7	7.6
9	79	7.6	7.6
12	79	7.3	7.5
15	71	5.0	7.2
18	64	3.9	7.1
21	55	2.2	6.9
24	51	1.0	6.8
27	49	0.6	6.7
30	47	0.4	6.6
33	46	0.4	6.5
36	45	0.4	6.5
39	45	0.3	6.4
41	45	0.3	6.4

Table 2. Fish stocked into Murphy Lake, Tuscola County (1988 to present).

Year	Species	Number	Rate (#/acre)	Size
1988	channel catfish	13,000	63	3.7
	fathead minnow	27,500	133	2.2
	largemouth bass	8,400	41	6.0
	northern pike	4,000	19	3.0
	walleye	5,840	28	1.9
1989	channel catfish	12,000	58	3.4
1990	channel catfish	10,712	52	3.8
	largemouth bass	7,000	34	4.1
	northern pike	6,000	29	4.0
	walleye	7,536	36	1.7
1991	northern pike	10,000	48	2.2
	walleye	6,631	32	2.5
1993	walleye	11,184	54	1.3
1995	walleye	10,994	53	1.5
1998	walleye	8,020	39	1.9
2001	walleye	7,562	37	1.7
2004	walleye	12,715	61	1.9
2006	walleye	12,825	62	1.7

Table 3.–List of fishes (1987 – present) in Murphy Lake, Tuscola County. Origin: N= native, I= introduced, C= colonized. Status: P= recent observations. Data from: Michigan Department of Natural Resources, Fisheries Division records.

Common name	Scientific name	Origin	Status
Common carp	*Cyprinus carpio*	C	P
White sucker	*Catostomus commersoni*	N	P
Yellow bullhead	*Ameiurus natalis*	N	P
Brown bullhead	*Ameiurus nebulosus*	N	P
Channel catfish	*Ictalurus punctatus*	N, I	P
Northern pike	*Esox lucius*	N	P
Green sunfish	*Lepomis cyanellus*	N	P
Pumpkinseed	*Lepomis gibbosus*	N	P
Warmouth	*Lepomis gulosus*	N	P
Bluegill	*Lepomis macrochirus*	N	P
Largemouth bass	*Micropterus salmoides*	N	P
Black crappie	*Pomoxis nigromaculatus*	N	P
Walleye	*Sander vitreus*	N, I	P
Yellow perch	*Perca flavescens*	N	P

Table 4.-Number, weight, and length range of fishes collected with trap net, gill net, seine, and electro-fishing gear from Murphy Lake, Tuscola County in May, 2007. Data from Michigan Department of Natural Resources, Fisheries Division records.

Common name	Number	Percent by number	Length range (inches)	Weight (lbs.)	Percent by weight	Percent legal size	Average size (inches)
Black crappie	92	15	4-11	19.8	7	43	7.1
Bluegill	418	67	3-8	61.9	21	39	5.8
Brown bullhead	1	< 1	13.5	1.1	< 1	100	13.5
Channel catfish	11	2	16-26	36.6	12	100	21.4
Common carp	41	7	12-21	70.7	24	100	15.0
Green sunfish	2	< 1	5-6	0.3	< 1	50	6.0
Hybrid sunfish	7	1	5-6	0.5	2	0	4.8
Largemouth bass	14	2	6-19	17.9	6	36	12.5
Northern pike	10	2	22-35	46.4	16	80	26.9
Pumpkinseed	1	< 1	6.5	0.2	< 1	100	6.5
Walleye	19	3	12-26	39.5	13	63	17.6
White sucker	2	< 1	14-15	2.7	1	100	15.0
Yellow bullhead	5	1	2-12	1.5	< 1	40	6.7
Yellow perch	4	1	5-6	0.3	< 1	0	5.8

Table 5.-Weighted mean length (inches) at age, and growth relative to the State average for fish sampled from Murphy Lake with trap nets, gill nets, and electro-fishing gear, May, 2007. Number of fish aged is in parentheses. Data from Michigan Department of Natural Resources, Fisheries Division records.

	Age/Length													
Species	1	2	3	4	5	6	7	8	9	10	11	12	13	Mean growth index[1]
Black crappie		5.1 (9)	6.3 (23)	7.4 (7)	8.4 (25)	9.9 (5)		9.9 (1)	9.7 (1)					- 0.9
Bluegill		4.0 (16)	5.8 (34)	6.6 (11)	7.7 (8)	8.0 (1)								+ 0.7
Largemouth bass		7.9 (9)	10.9 (9)	13.5 (11)	14.1 (6)		7.1 (3)			18.2 (1)		18.3 (1)	19.7 (1)	+ 1.4
Northern pike			24.4 (4)	24.4 (4)	30.2 (5)	26.0 (1)								+ 4.7
Walleye			14.7 (10)	17.2 (1)	15.6 (2)	21.6 (3)	20.5 (3)	25.1 (2)		26.1 (1)				+ 0.8
Yellow perch		5.1 (1)	5.3 (3)	6.3 (1)										

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

Table 6.-Weighted age frequency (percent) of six fish species collected May, 2007 from Murphy Lake, Tuscola County. Data from Michigan Department of Natural Resources, Fisheries Division records.

	Age/Percent													
Species	1	2	3	4	5	6	7	8	9	10	11	12	13	Number caught
Black crappie		11	44	12	28	4		1	1					92
Bluegill		10	71	13	6	<1								418
Largemouth bass		21	21	26	14		7		2	1		1	1	14
Northern pike			29	29	36	7								10
Walleye			46	7	9	13	9	9		9				19
Yellow perch		19	56	25										4

Table 7.-Murphy Lake bluegill classification using trap net data and the Schneider Index (Schneider 1990). Size score is given in parentheses. Data from Michigan Department of Natural Resources, Fisheries Division records.

Sample date	4/17/84	6/14/93	5/14/07
Sample size	354	209	299
Average length (inches)	5.1 (2)	3.8 (1)	6.0 (4)
% ≥ 6 inches	2 (1)	5 (1)	52 (4)
% ≥ 7 inches	<1 (1)	2 (2)	19 (4)
% ≥ 8 inches	0 (2)	0 (2)	2 (5)
Schneider Index	1.5	1.5	4.25
Rank[1]	V. Poor/Poor	V. Poor/Poor	Good

[1]Rank: 1 = Very poor, 2 = Poor, 3 = Acceptable, 4 = Good, 6 = Excellent, 7 = Superior