

Lake Chemung
Livingston County, T2N, R5E, Sections 3,4,9,10,11
Shiawassee River Watershed

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Environment

Lake Chemung is located between Howell and Brighton in central Livingston County. Although a natural lake, the Alger Creek outlet has been dammed enlarging the lake to an estimated 313 acres. Alger Creek flows out of Lake Chemung to Thompson Lake and then discharges to Bogue Creek of the South Branch Shiawassee River. The South Branch Shiawassee River flows to the mainstem Shiawassee River and to Saginaw Bay of Lake Huron.

The Howell/Brighton area lies within the Ionia district of the Southern Lower Michigan Regional Landscape Ecosystem and is characterized by features identified in the Lansing sub-district (Albert 1995). The Lansing sub-district is described as gently sloping ground moraine broke by outwash channels and numerous end-moraine ridges. Undulating topography formed alternating well drained rises and poorly drained depressions of variable soils. Soils on raised moraines generally consist of medium texture sand and loam while depressions along end moraine ridges are typically fine texture and high in organic content. Outwash channels developed by glacial retreat generally form the river and stream drainage pattern of the watershed.

Shiawassee River basin groundwater and surface water patterns follow geological soil types. Hilly topography and permeable, medium-textured soils found in the Howell area provide hydraulic head for moderate groundwater inflow. Most groundwater deposits in the Shiawassee River watershed are concentrated in southern and southeastern portions where Lake Chemung is located (Cooper 2005). 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 in the Howell/Brighton area was described as beech-sugar maple forest with hardwood swamps (Albert 1995). Some of the higher end moraine ridges supported oak-hickory forest while silver maple, American elm, red ash, and white oak were common to depressions.

The Lake Chemung catchment area encompasses 1,638 acres (L. Szabo Kraft, Michigan Department of Natural Resources (MDNR), unpublished data). Primary land uses in the catchment are forested (22%), wetland (21%), urban/residential (19%), open water (18%) agriculture (11%), and open/non-forest (9%). The primary inlet to Lake Chemung is an unnamed drain located on the north shore. Additional surface water drains when intermittent flow occurs at various locations along the south shore. Alger Creek is the primary outlet and is located in the northwest quadrant of the lake (Figure 1).

The Lake Chemung dam dates back to the 1920's however, the current structure was built in 1968. It is described as an earthen dam with a concrete water control structure and overspill discharge. The hydraulic and structural height of the control structure is 5 feet but normal head is maintained at 2 feet. A legal lake level has been established at 957.9 feet above mean sea level. The dam is considered low hazard and is owned and operated by the Livingston County Drain Commission.

Lake Chemung has a fairly regular shoreline and is elongated in shape with a fetch estimated at 1.6 miles. Contour changes are abrupt and the lake reaches a maximum depth of 70 feet. Approximately 10% of the total surface acreage is considered littoral (< 15 ft.). Bottom substrate is described as a combination of sand, organic muck, and marl.

In general, Lake Chemung is classified as a warmwater, medium size, deep lake of mesotrophic characteristics. Limnological parameters measured in August, 2007 included temperature, oxygen, and pH (Table 1). Thermal stratification occurred prior to mid-summer with a thermocline between 15 and 21 feet. Critical oxygen concentrations for fish (< 3 ppm) were observed at depths greater than 41 feet however, an abrupt decline to 4 ppm was observed at 15 feet. pH values ranged from 7.7 at the surface to 6.5 at the substrate interface. Historical alkalinity measurements range from 135 ppm to 175 ppm indicating Lake Chemung is reasonably buffered. Water transparency, as measured by Secchi disk, has typically ranged between 12 and 20 feet during mid-summer. In general, limnological parameters are consistent with other mesotrophic water bodies in southern Michigan.

Nutrient input into Lake Chemung has been a concern to the Lake Chemung Riparian Association (LCRA) since the 1970's. Although nutrients are important in living food web dynamics, excessive nutrients from human perturbations can result in accelerated eutrophication. Michigan Department of Environmental Quality (MDEQ) and volunteer monitoring demonstrated excess phosphorus in the 1970's and 1980's with levels ranging from 21-40 ug/L (LCRA 2007). In 1994, residential sanitary sewers were installed around the lake and subsequent phosphorus measurements were greatly reduced. However, phosphorus reduction also coincides with zebra mussel introduction into Lake Chemung and their presence may also account for changes in concentration. Hecky et al. (2004) describes how zebra mussel colonization in Lake Erie has resulted in increased particulate and nutrient removal in near shore zones. Although still a concern, nutrient loading appears to have improved in Lake Chemung in recent years.

The Carlson Trophic State Index (TSI) is a quantitative index for the purpose of classifying and ranking lake trophic status using variables of chlorophyll a, total phosphorus, and secchi disk (Carlson 1977). The TSI scale ranges 0 to 100 with lowest values reflecting oligotrophic conditions and highest values reflecting hypereutrophic conditions. Using data provided from MDEQ and LCRA, the 2004 TSI value for Lake Chemung was 44 indicating fair to good water quality and productive mesotrophic conditions.

Aquatic vegetation serves primary ecosystem production by providing important habitat for zooplankton, macroinvertebrates, fish, and other aquatic species such as frogs and turtles. Additionally, vegetation can stabilize sediments and maintain water clarity. In Lake Chemung, aquatic vegetation is the dominant form of fish cover. Cursory observations made by MDNR, Fisheries personnel in May, 2007 indicated a common occurrence of Eurasian watermilfoil (*Myriophyllum spicatum*), curly-leaf pondweed (*Potamogeton crispus*), chara (*Chara vulgaris*), and American waterweed (*Elodea canadensis*). Observations made in September, 2007 by vegetation consultants hired by the LCRA indicate Eurasian watermilfoil, chara, and wild celery (*Vallisneria spiralis*) as principle plant species occupying the littoral zone (LCRA 2007). Eurasian watermilfoil and curly-leaf pondweed are exotic species which often occur in high densities in many southern Michigan mesotrophic lakes. To control high density plant growth, the LCRA has adopted an aggressive weed

management program using a variety of aquatic herbicides including copper agents, endothall agents, 2,4-D, and fluridone. All treatments have been conducted under permit by the MDEQ.

Lake Chemung's proximity to Howell and Brighton make it a valuable resource to the community. The shoreline is extensively developed with residential housing and a few commercial businesses. In 2007, a shoreline survey showed 301 dwellings on the lake yielding a dwelling density of 58/mile. Significant portions of the shoreline have been armored with seawalls or rip rap to reduce erosion. The lake is very popular for various recreational uses which, at times, may conflict with each other. The MDNR, Parks and Recreation Division has operated a public access site off Hughes Road since 1942.

History

Lake Chemung has a long history of MDNR fisheries management. File records indicate Lake Chemung was stocked and managed for trout from 1956 to 1970 but discontinued when northern pike and largemouth bass populations grew. A lake herring fishery persisted until its collapse in the early 1960's. In 1995, a one-time stock of adult lake herring and lake whitefish occurred but subsequent surveying indicated no survival. Recent fisheries management has shifted to warm and cool water species. In 1983, walleye were introduced and continue to be stocked on a semi-annual basis (Table 2). Redear sunfish were introduced with stockings in 1994, 1995, and 1997 in an effort to create a "trophy-size" panfish for anglers (Table 2).

Recent fish community assessments have occurred on Lake Chemung in 1986, 1991, 1995, and 2001. In 1997, a survey to estimate young of the year walleye survival was also conducted. These assessments document the presence of 20 fish species (Table 3). Coldwater species including rainbow trout and lake herring are believed extirpated while the status of longear sunfish and tadpole madtoms is unknown since they have not been collected in recent years. It is possible other species are present but have not been documented due to the types of fish sampling gear used. With the exception of redear sunfish, all fish species found in Lake Chemung are common to this region of Michigan. Redear sunfish have been successfully introduced to a number of southern Michigan lakes including Lake Chemung.

Past assessments of Lake Chemung have indicated good recreational fisheries for bluegill, pumpkinseed, redear sunfish, black crappie, northern pike, and largemouth bass. A slight decline in bluegill size structure was observed in 2001 but not enough to warrant significant concern. Redear sunfish appeared to be doing well and the population appeared self sustaining. A 1997 walleye survival assessment estimated fall fingerling density at less than 1 fish per acre. General recommendations suggest 10 fall fingerling walleye/acre necessary to create a significant fishery (3 adult/acre). Walleye appeared in low abundance and continued stocking was recommended.

Current Status

In May, 2007, Fisheries Division conducted a fisheries assessment using trap net, gill net, seine, and electrofishing gear. Three inland trap nets were fished for 3 nights at four locations. Two experimental mesh gill nets were fished for 1 night at 2 locations. Four 25 foot seine tows were made at 4 locations and three 10-minute electrofishing stations were sampled after dark. All fish were

measured to the nearest inch group and scale samples were collected for common sport fish for age and growth analysis.

A total of 3,194 fish representing 19 species were collected with combined efforts (Table 4). Bluegill and pumpkinseeds were the most abundant species comprising 68% of the total catch by number. Bluegill, pumpkinseed, redear sunfish, and brown bullheads accounted for 76% of the total biomass collected. Trap nets comprised 61% of the catch by number while electrofishing, seine, and gill nets comprised 27%, 11%, 1% respectively. Species composition and relative abundance appeared similar to the 2001 survey.

A total of 1,645 bluegill averaging 6.3 inches comprised 52% of the total catch (Table 4). Bluegill ranged from 1 to 9 inches with 70% of the fish meeting or exceeding the acceptable harvest size of 6 inches. Age and growth data indicated bluegill entered the harvestable fishery at age 3 and growth was above State average with a mean growth index of +0.6 (Table 5). Age distribution indicated sufficient recruitment with good representation of bluegill aged 3 through 5 (Table 6). Bluegill longevity peaked at age 5 and older fish appeared to experience mortality either by harvest or natural causes.

A total of 497 pumpkinseeds averaging 6.4 inches comprised 16% of the total catch (Table 4). Pumpkinseeds ranged from 3 to 9 inches with 72% of the fish meeting or exceeding the acceptable harvest size of 6 inches. Age and growth data indicated pumpkinseeds entered the harvestable fishery at age 4 and growth was above State average with a mean growth index of +0.5 (Table 5). Age distribution indicated sufficient recruitment with good representation of fish aged 3 through 6 (Table 6). Pumpkinseed longevity peaked at age 6 and older fish appeared to experience mortality either by harvest or natural causes.

A total of 217 redear sunfish averaging 9.2 inches comprised 7% of the total catch (Table 4). Redear sunfish ranged from 5 to 11 inches with 99% of the fish meeting or exceeding the acceptable harvest size of 6 inches. Age and growth data indicated redear entered the harvestable fishery as early as age 2 and growth was above State average with a mean growth index of +0.8 (Table 5). Age distribution indicated multiple year classes in the population with good representation of fish aged 3 to 6 years (Table 6). Redear longevity peaked at age 6 and older fish appeared to experience mortality either by harvest or natural causes.

A total of 109 yellow perch averaging 5.5 inches comprised 3% of the total catch (Table 4). Yellow perch ranged from 3 to 7 inches with only 2% of the fish meeting or exceeding the acceptable harvest size of 7 inches. Age and growth data indicated yellow perch were growing below State average having a mean growth index of -0.7 (Table 5). Yellow perch longevity peaked at age 4 prior to their ability to enter the sport fishery based on growth observed.

A total of 51 black crappie averaging 9.0 inches comprised 2% of the total catch (Table 4). Black crappie ranged from 7 to 10 inches and all fish met or exceeded the acceptable harvest size of 7 inches. Age and growth data indicated black crappie entered the harvestable fishery as early as age 2 and growth was slightly above State average with a mean growth index of +0.1 (Table 5). Age distribution indicated the sport fishery is mainly composed of 3 to 6 year old fish (Table 6). Black crappie longevity peaked at age 6 and older fish appeared to experience mortality either by harvest or natural cause.

A total of 48 largemouth bass averaging 12.4 inches comprised 2% of the total catch (Table 4). Largemouth bass ranged from 5 to 19 inches with 31% of the fish meeting or exceeding the legal harvest size of 14 inches. Age and growth data indicated largemouth bass entered the sport fishery at age 5 or 6 and growth was slightly above State average with a mean growth index of +0.3 (Table 5). Age distribution indicated multiple year classes make up the population with representation of fish up to 11 years of age (Table 6).

A total of 22 northern pike averaging 21.6 inches comprised less than 1% of the total catch. Northern pike ranged from 17 to 26 inches with 14% of the fish meeting or exceeding the minimum harvest size of 24 inches (Table 4). Age and growth data is tenuous due to the small sample number but growth for age III was below State average resulting in a mean growth index of -0.4. Age distribution showed the presence of multiple year classes, up to age 8, but growth suggested high mortality either by natural or human causes as the fish approached legal harvest size (Tables 5, 6).

Other sport fish collected in the 2007 assessment occurred in low abundance. Fourteen rock bass averaging 6.9 inches and 3 walleye averaged 19.8 inches. Of the non-sport fish collected, brown bullheads were the most common and accounted for 6% of the total catch. Other non-sport fish collected included black and yellow bullheads, warmouth, and bowfin. Forage minnows collected included banded killifish, spottail and golden shiners, brook silversides, and bluntnose minnows.

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 sport fishing 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, Lake Chemung scored 5.25 for a "good" ranking. Past assessments have also indicated good bluegill size structure (Table 7). The prevailing commonality between assessments appears to be the above State average growth which allows fishery recruitment at an early age. Longevity appears to play a lesser role in size structure since high mortality was observed after age 5.

Although not as abundant, pumpkinseeds showed similar tendencies as bluegill. Good size structure appeared the result of above State average growth and early recruitment into the fishery. Relative abundance, size structure, and growth compared similarly to past assessments suggesting a stable population. The existing fishery is dominated by 6 and 7 inch fish but also has good representation of juvenile fish for future recruitment.

The primary goal of stocking redear sunfish in Lake Chemung was to create a "trophy-size" (> 10 inches) panfish fishery. The rapid growth of redear sunfish, along with being more difficult to catch with hook and line, allow for the species to attain large size (Towns 2003). However, successful stocking would require survival at the northern edge of their range.

The first documentation of redear survival in Lake Chemung occurred in the 2001 assessment where 63 fish averaged 9.1 inches. At that time, age and growth analysis indicated above State average growth with a mean growth index of +1.1. The 2007 assessment showed similar average size, size range, and growth but catch rates had tripled compared to those found in 1997 (24 fish/lift vs. 8 fish/lift) suggesting higher overall abundance. Eleven percent of the total redear catch was ten inches or greater suggesting a trophy fishery had been established. Although redear sunfish stocking in southern Michigan remains experimental, Lake Chemung represents a success story and the current population appears self sustaining.

The largemouth bass population of Lake Chemung appeared in excellent shape. Relative abundance, size range, growth, and age distribution were similar to 2001 indicating a healthy and stable fish community. The presence of multiple year classes and the tendency for bass anglers to practice catch/release methods preserves large fish for multiple recapture and assures a highly desirable fishery.

Although black crappie and northern pike populations are not as abundant as other sport fish, they appear in sufficient numbers to provide reasonable recreational fisheries. Relative abundance, size structure, and growth compared similarly to past assessments suggesting stable populations.

Yellow perch seldom provide viable recreational fisheries in inland waters in southeast Michigan. Poor growth and high mortality at an early age, as observed in Lake Chemung, typically results in few fish attaining a harvestable size. High natural mortality is believed to occur due to marginal coolwater habitat, insufficient food supply, and predation.

Previous assessments have yielded low catches of walleye suggesting low abundance despite stocking efforts. The 3 adult walleye collected in 2007 compare to 7 in 1995 and 6 in 2001. Even doubling stocking rates in 1997, 1998, and 2000 failed to increase abundance substantially. Poor survival is believed the result of marginal coolwater habitat and high predation on stocked spring fingerlings. Despite this poor survival, Fisheries Division receives anecdotal reports from anglers of catching walleye in Lake Chemung, particularly during the winter ice fishery.

Management Direction

Presently, Lake Chemung is in good condition in terms of its overall fish community. The lake offers very good angling opportunities for several species including bluegill, pumpkinseed, redear sunfish, largemouth bass, black crappie, and northern pike. Additional opportunities are available for non-game species.

Fisheries management of Lake Chemung should continue to focus on warm and cool water species. With the exception of walleye, the principle sport fish of Lake Chemung appear to be self sustaining and no management action is directed toward them. Continued walleye management and stocking is questionable given the marginal survival occurring. Management recommendations are to cautiously extend the fisheries prescription for another six year period. It is recommended walleye be stocked on an alternate year schedule at a rate of 50-75 spring fingerlings/acre (15,000-24,000 fish). Efforts should be made to evaluate the walleye population to justify continued stocking.

MDEQ, the lead regulatory agency for control of aquatic vegetation, typically requests comments from MDNR, Fisheries on proposed activities. The importance of submerged vegetation to the lake ecosystem is well documented in scientific literature. Fish and macroinvertebrate abundance and diversity is typically higher where diverse plant communities exist. Contrary, homogeneous canopies of Eurasian milfoil may suppress macroinvertebrate biomass and contribute to stunted fish populations (Cheruvilil et al. 2001, Schneider 2000). Fish managers seek a level of plant abundance and diversity which supports high sport fish production and growth. In general, optimum macrophyte coverage should be approximately 25-36% of the total lake area with minimum representation of 5-8 species of the architectural plant groups (Schneider 2000).

Future whole lake herbicide treatments must consider ecosystem impact. O'Neal and Soulliere (2006) provide conservation guidelines for decision making. Whole lake treatments, particularly with fluridone are risky. Despite low target concentrations designed to selectively remove Eurasian watermilfoil, non-target plant species can also be eliminated and post treatment regeneration typically favors chara. Established chara growth may suppress desirable native plants resulting in a significantly altered plant community. The indirect effects of whole lake treatment are not well understood and resource managers should be cautious with permitting. Whole lake herbicide treatments of Lake Chemung should be closely reviewed by MDNR and MDEQ to assure ecosystem and resource protection.

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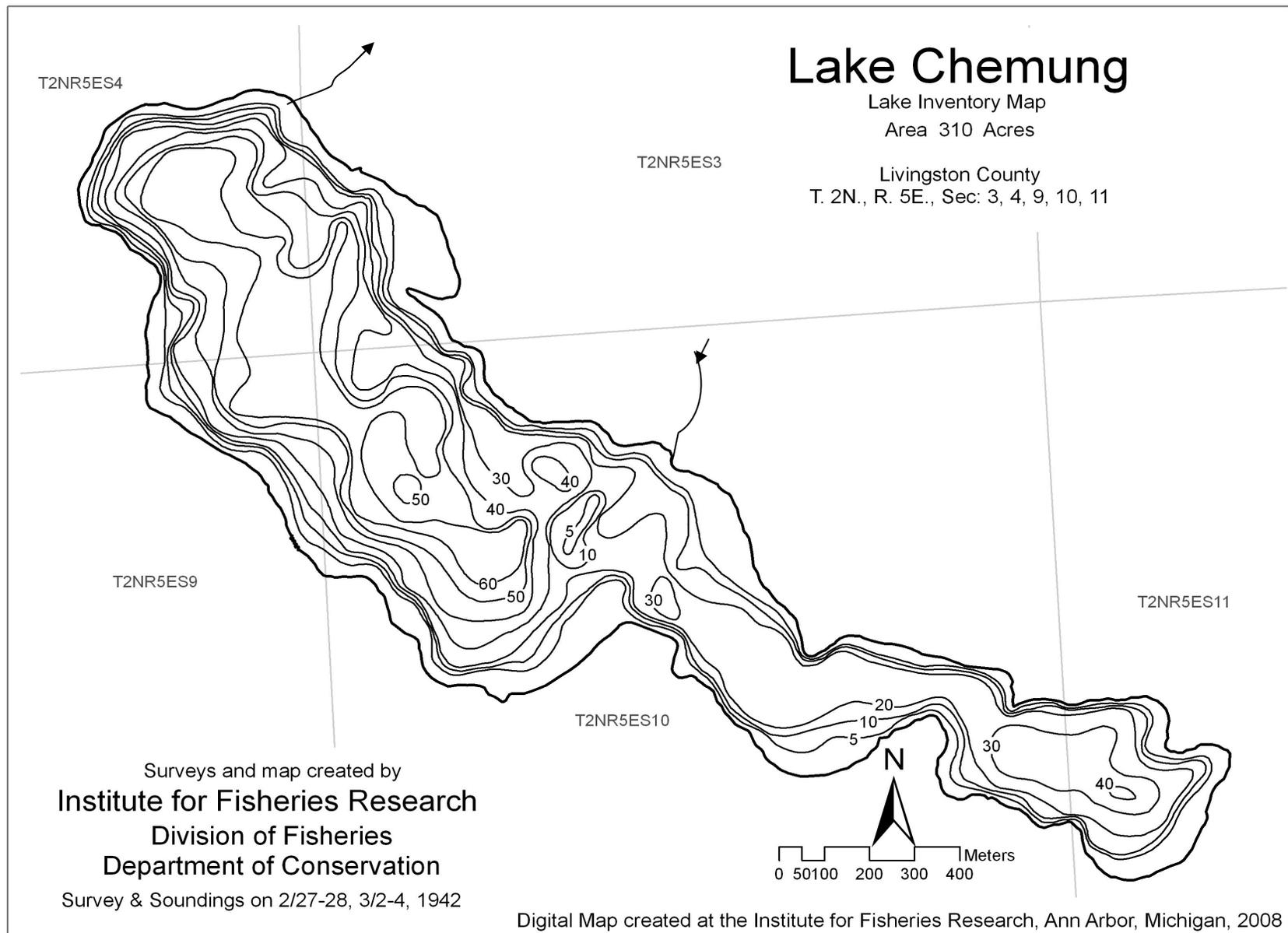


Figure 1. Hydrographic map of Lake Chemung, Livingston County.

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

Depth (ft)	Temperature (F)	Oxygen (ppm)	pH
1	78	8.5	7.7
3	78	8.4	7.6
6	78	8.4	7.6
9	78	8.3	7.6
12	78	8.2	7.6
15	73	7.1	7.3
18	67	3.7	7.1
21	59	3.5	7.0
24	54	3.7	6.8
27	49	4.1	6.8
30	47	4.3	6.7
33	45	4.3	6.7
36	44	3.9	6.7
39	43	3.7	6.6
41	43	3.0	6.6
44	43	1.9	6.6
47	43	0.9	6.6
50	43	0.05	6.5
53	43	0.04	6.5

Table 2. Fish stocked into Lake Chemung, Livingston County (1991 to present).

Year	Species	Number	Rate (#/acre)	Size (in)
1991	walleye	22,000	71	1.9
1994	redeer sunfish	5,106	16	2.1
1995	lake herring	307	1	10.0
	redeer sunfish	38,400	124	2.0
1997	redeer sunfish	29,466	95	2.5
	walleye	46,198	149	1.6
1998	walleye	31,000	100	2.4
2000	walleye	28,110	91	1.9
2003	walleye	17,256	56	1.5
2004	walleye	18,704	60	2.0
2006	walleye	16,521	53	1.8

Table 3.—List of fishes in Lake Chemung, Livingston County. Origin: N= native, I= introduced, C= colonized. Status: P= recent observations. E=extirpated, U=unknown. Data from: Michigan Department of Natural Resources, Fisheries Division records.

Common name	Scientific name	Origin	Status
Banded killifish	<i>Fundulus diaphanous monona</i>	N	P
Black bullhead	<i>Ameiurus melas</i>	N	P
Black crappie	<i>Pomoxis nigromaculatus</i>	N	P
Bluegill	<i>Lepomis macrochirus</i>	N	P
Bluntnose minnow	<i>Pimephales notatus</i>	N	P
Bowfin	<i>Amia calva</i>	N	P
Brook silverside	<i>Labidesthes sicculus</i>	N	P
Brown bullhead	<i>Ameiurus nebulosus</i>	N	P
Channel catfish	<i>Ictalurus punctatus</i>	I	P
Common carp	<i>Cyprinus carpio</i>	C	P
Golden shiner	<i>Notemigonus crysoleucas</i>	N	P
Green sunfish	<i>Lepomis cyanellus</i>	N	P
Lake chubsucker	<i>Erimyzon sucetta</i>	N	P
Lake herring	<i>Coregonus artedi</i>	N	E
Lake whitefish	<i>Coregonus clupeaformis</i>	I	E
Largemouth bass	<i>Micropterus salmoides</i>	N	P
Longear sunfish	<i>Lepomis peltastes</i>	N	U
Northern pike	<i>Esox lucius</i>	N	P
Pumpkinseed	<i>Lepomis gibbosus</i>	N	P
Rainbow trout	<i>Oncorhynchus mykiss</i>	I	E
Redear sunfish	<i>Lepomis microlophus</i>	I	P
Rock bass	<i>Ambloplites rupestris</i>	N	P
Spottail shiner	<i>Notropis hudsonius</i>	N	P
Tapole madtom	<i>Noturus flavus</i>	N	U
Walleye	<i>Sander vitreus</i>	I	P
Warmouth	<i>Lepomis gulosus</i>	N	P
White sucker	<i>Catostomus commersoni</i>	N	P
Yellow bullhead	<i>Ameiurus natalis</i>	N	P
Yellow perch	<i>Perca flavescens</i>	N	P

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

Common name	Number	Percent by number	Length range (in)	Weight (lb)	Percent by weight	Percent legal size	Average size (in)
Bluegill	1645	52	1-9	315.8	34	70	6.3
Pumpkinseed	497	16	3-9	112.8	12	72	6.4
Redear sunfish	217	7	5-11	131.0	14	99	9.2
Brown bullhead	194	6	9-14	153.0	16	100	11.8
Banded killifish	184	6	0-2	0.5	< 1		1.8
Spottail shiner	121	4	1-2	0.4	< 1		2.1
Yellow perch	109	3	3-7	7.5	< 1	2	5.5
Black crappie	51	2	7-10	20.4	2	100	9.0
Largemouth bass	48	2	5-19	56.8	6	31	12.4
Bluntnose minnow	42	1	1-2	0.1	< 1		2.0
Northern pike	22	< 1	17-26	49.5	5	14	21.6
Rock bass	14	< 1	3-8	3.7	< 1	71	6.9
Black bullhead	13	< 1	10-13	10.4	1	100	11.9
Warmouth	13	< 1	6-7	3.1	< 1	100	6.7
Bowfin	9	< 1	21-31	52.3	6		25.2
Brook silverside	5	< 1	3	< 0.1	< 1		3.5
Yellow bullhead	4	< 1	10-12	2.9	< 1	100	11.5
Golden shiner	3	< 1	8-9	0.7	< 1		9.2
Walleye	3	< 1	13-24	8.9	1	67	19.8

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

Species	Age/Percent													Number caught
	1	2	3	4	5	6	7	8	9	10	11	12	13	
Black crappie		2	13	32	43	10								51
Bluegill	5	7	32	39	17	1	1	1						1645
Largemouth bass		11	12	28	35	6	4	2			2			48
Northern pike		9	41	9	5	14	18	5						22
Pumpkinseed		3	9	46	30	11	2							497
Redear sunfish			7	49	22	17	3	1						217
Yellow perch			2	23	71	4								109

Table 7.-Lake Chemung 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	6/5/86	5/9/91	5/23/95	5/17/01	5/21/07
Sample size	494	1427	372	235	1172
Average length (inches)	6.5 (5)	6.5 (5)	7.4 (6)	5.6 (3)	6.8 (5)
% ≥ 6 inches	73 (4)	62 (4)	93 (6)	28 (3)	87 (6)
% ≥ 7 inches	38 (5)	38 (5)	65 (6)	16 (4)	45 (5)
% ≥ 8 inches	1 (5)	2 (5)	28 (6)	5 (5)	1 (5)
Schneider Index	4.75	4.75	6.0	3.75	5.25
Rank	Good	Good	Excellent	Satisfactory	Good

¹Rank: 1 = Very poor, 2 = Poor, 3 = Acceptable, 4 = Satisfactory, 5=Good, 6 = Excellent, 7 = Superior