Bennett Lake
Livingston County, T4N, R5E, Section 1, 2
Shiawassee River, Last surveyed 2006

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Environment

Bennett Lake is a 150 acre lake located in Deerfield Township of Livingston County three miles southeast of Argentine. The lake lies within the boundaries of the Shiawassee River watershed and North Ore Creek sub-watershed. North Ore Creek flows northerly entering Bennett Lake at the southeast shore, then exits to the north, flowing into Lobdell Lake and eventually discharging to the Shiawassee River.

Public access to Bennett Lake is obtained using the Lobdell Lake Pubic Access Site (PAS) and motoring through the connecting channel (North Ore Creek) to the main basin. Michigan Department of Natural Resources (MDNR), Parks and Recreation Division administers the Lobdell Lake PAS, which services approximately 30 vehicles. The boat launch and parking lot are paved with capabilities for launching most boat sizes used for general recreation.

The geographic region of Bennett Lake is characterized by gently sloping ground moraine interspersed with 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, high in organic content. Outwash channels developed by glacial retreat generally formed the river and stream drainage pattern of the watershed. Groundwater inflow is moderate resulting in a cluster of lakes in the immediate area surrounding Bennett Lake.

Bennett Lake is typified as a warm water, medium size, deep lake of mesotrophic characteristics. The lake shoreline is irregular in shape and can be divided into east and west portions (Figure 1). The west portion forms a semi-circular main basin reaching 57 feet in depth while the east portion forms a shallow water marsh complex with a single deep-water zone of 20 foot depth. The shoreline is moderately developed with approximately 60 residences. The north and south shores of the west portion are most developed with approximately 30 dwellings. The east basin is undeveloped and considered valuable marsh and emerging wetland habitat.

Limnological parameters measured in August 2006, included temperature and oxygen profiles (Table 1). Thermal stratification in Bennett Lake occurred in mid-summer with thermocline development between 15 and 30 feet. Critical oxygen concentrations for fish (< 3 ppm) were observed at depths greater than 27 feet. The 2006 temperature and oxygen profiles are comparable to historical profiles and indicate significant portions of the deep water zones become oxygen deprived and unsuitable for most fish species when the lake stratifies.

Total alkalinity of Bennett Lake has historically ranged from 160 ppm to 240 ppm indicating moderately hard water. In August 2006, total alkalinity measured 143 ppm. The lower alkalinity measurement is most likely a natural fluctuation that could be attributed to a number of things such as

precipitation, lake turnover, or elemental cycling within the lake. Water pH ranged from 7.4 to 8.1 indicating good buffering ability. Other limnological parameters measured in 2006 included nitrate (16.2 ug/L), total nitrogen (8.5 ug/L), total phosphorus (29.1 ug/L), chlorophyll a (2.77 ug/L), and secchi disk (19 ft.).

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 along a scale from 0 to 100 with lowest values reflecting oligotrophic conditions and highest values reflecting hypereutrophic conditions. The TSI value for Bennett Lake was 43 suggesting fair to good water quality and productive mesotrophic conditions.

Aquatic vegetation is the dominant form of fish cover in Bennett Lake. The overall fertility of the lake along with its relatively shallow average depth make it well suited for aquatic vegetative growth. Cursory observations during a 2006 survey effort indicated coontail was abundant in the littoral zone with common occurrence of large-leaf pondweed, white lily, Eurasian milfoil, chara, and filamentous algae. Emergent vegetation, particularly cattail and bulrush, were common to the west basin forming ideal waterfowl marsh habitat. The North Ore Creek channel between Bennett and Lobdell lakes is routinely treated with herbicides for nuisance aquatic vegetation.

History

Bennett Lake fish community assessments have been conducted by MDNR, Fisheries Division in 1979, 1990, 1997, and 2006. These assessments document the presence of 23 native fish species, 1 colonized species, and one introduced species (Table 2). It is likely other species are present but have not been documented due to collection bias. Of the fish species present, each would be considered common to the region and typical of warmwater fish assemblages in southern Michigan. Walleye have not been stocked in Bennett Lake and their presence reflects movement from Lobdell Lake where they were introduced. The lake herring or "cisco" has not been not been found since 1979 and is believed extirpated.

Extensive fisheries management has not occurred on Bennett Lake. There has been no fish stocking and past assessments have indicated a fair to good fishery for most sportfish present. Bennett Lake is extremely popular for recreational use and maintains a very good reputation for largemouth bass, northern pike, bluegill, black crappie, and pumpkinseed sunfish. Numerous largemouth bass angling tournaments occur annually and often combine catches from both Lobdell and Bennett lakes.

Current Status

In May 2006, Fisheries Division conducted a fisheries assessment using trap net, gill net, seine, and electrofishing gear. Three inland trap nets were fished for three nights at three locations. One experimental mesh gill net was used to sample deep water zones at two locations for one night. Three 25-foot seine tows were made at three locations and three ten minute nighttime electrofishing runs were conducted at three locations. All fish were measured to the nearest inch group and scales samples were collected for age-growth analysis on common sportfish.

A total of 1,606 fish representing 22 species were collected. Bluegill, bowfin, brown and yellow bullhead, carp, largemouth bass, and yellow perch were the most abundant comprising 96% of the total catch by number and 89% of the catch by weight (Table 3). Other species collected included black crappie, blackchin shiner, central mudminnow, golden shiner, grass pickerel, green sunfish, lake chubsucker, longnose gar, northern pike, rock bass, walleye, warmouth, and white sucker.

A total of 1,200 bluegill averaging 5.9 inches comprised 75% of the total catch (Table 3). Fifty percent of these fish met or exceeded the acceptable harvest size of 6 inches. Age-growth data indicates bluegills were growing below State average having a mean growth index of -0.9 (Table 4). Age frequency indicates sufficient recruitment is occurring with good representation of bluegill aged 4 to 7 years (Table 5). Bluegill longevity peaks at age 7 and older fish appear to experience high mortality from either harvest or natural causes.

A total of 89 pumpkinseed sunfish averaging 6.1 inches comprised 6% of the total catch (Table 3). Sixty-six percent of these fish met or exceeded the minimum harvest size of 6 inches. Age-growth data indicates pumpkinseed sunfish are growing slightly above State average having a mean growth index of +0.2 (Table 4). Age frequency indicates sufficient recruitment to harvest size with good representation of age 3 and 4 fish (Table 5). Fully recruited pumpkinseeds are well represented as age 5 and 6 fish. Pumpkinseed longevity peaks at age 6 and older fish appear to experience high mortality either by harvest or natural causes.

A total of 38 yellow perch averaging 3.5 inches comprised 2% of the total catch (Table 3). Ninety-two percent of these fish were captured with electrofishing gear and all fish were aged between 1 to 3 years accounting for the small average size. Age-growth data indicates yellow perch were growing below State average having a mean growth index of -0.9 (Table 5). The absence of yellow perch older than age 3 indicates high mortality most likely the result of natural causes.

A total of 29 largemouth bass averaging 11.6 inches comprised 2% of the total catch (Table 3). Twenty-eight percent of these fish met or exceeded the minimum harvest size of 14 inches. Age-growth data indicates largemouth bass are growing below State average having a mean growth index of -1.1 (Table 4). Slow growth was observed at early age with age 3 fish averaging 8.2 inches compared to the State average 9.4 inches. Although age frequency was based upon a relatively small sample, multiple year classes were represented and recruitment to harvest size appears acceptable (Table 5).

Other important sportfish occurred in low abundance. Fifteen black crappie averaged 9.0 inches, eight northern pike averaged 26.1 inches, and one walleye measured 24.5 inches. Non-sportfish found in relative abundance included 106 brown and yellow bullhead, 41 bowfin, and 35 carp.

Analysis and Discussion

Direct comparison of the 2006 fisheries assessment to previous assessments is tenuous due to collection bias. Seasonal timing, gear selection, and procedural differences greatly affect catch rates. However, the 2006 catch does allow for discussion of the current fish community and some comparison to previous findings is possible.

In southern Michigan warmwater lakes, bluegill are one of 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 relates them to an adjective ranking system ranging from "very poor" to "superior". Using the Schneider Index for classifying bluegill populations using trap net data, Bennett Lake scored 4.25 for a good rank (Table 6).

Bluegill size structure has fluctuated between assessments in 1990, 1997, and 2006 (Table 6). In 1990, bluegill size structure ranked "poor/acceptable" but improved significantly to "excellent" in 1997. In 2006, a decline to "good" was observed. The time span between assessments makes it difficult to ascertain cause but differences are most likely attributed to natural cycles of abundance and harvest. Age data from 1997 indicates a high percentage of older and larger fish in the catch. It is reasonable to expect higher natural mortality and increased harvest mortality when the size structure is skewed toward older and larger fish. When older and larger fish are removed from the population faster than new recruits enter, a decline in size structure is likely. In 1990, when the bluegill size structure was skewed toward younger and smaller fish, mortality was likely lower allowing higher recruitment into the fishery. Presently, bluegill appear as the most abundant species in the lake and provide good recreational angling opportunity to catch harvestable fish.

A small but healthy pumpkinseed sunfish stock provides additional recreational angling opportunities in Bennett Lake Pumpkinseed sunfish abundance, size distribution, and age frequency have remained similar since 1990 indicating a stable fishery. Pumpkinseed growth was slightly above State average suggesting the relatively low abundance observed is not dependent on available food.

The largemouth bass fishery of Bennett Lake appears in satisfactory condition. Relative abundance, size distribution, and age frequency were similar to the 1997 assessment and indicate a healthy and stable fish community. Historically, largemouth bass growth in Bennett Lake has been below State average and likely reflects environmental and climatic influences. Bennett Lake is highly regarded by local bass anglers for large fish and remains a popular tournament fishing water in southern Michigan.

One of the significant differences between the 1997 and 2006 assessment was a decline in black crappie catch in 2006. Over 200 black crappie averaging 7.0 inches were collected in 1997 compared to 15 black crappie averaging 9.0 inches in 2006. The lower 2006 catch may reflect a decline in black crappie abundance but more likely is the result of collection bias.

Yellow perch seldom provide viable recreational fisheries in inland waters in the southeast Michigan area. None of the cluster of lakes surrounding Bennett Lake are known for yellow perch and most reflect Bennett Lake's size structure. High mortality is observed after age 3 and is believed to be the result of natural mortality due to unsuitable coolwater habitat, unavailable food, and predation. Preferred water temperatures for yellow perch are 66-70F. During summer months, the Bennett Lake epilimnion averages mid-70F with a small limited hypolimnion layer of preferred temperature and oxygen available for yellow perch. Additionally, food preferences of 2-3 inch yellow perch typically shift from zooplankton to larger macroinvertebrates which appear in limited supply based on cursory observations.

Northern pike typically do not exhibit high abundance in assessments unless they are specifically targeted after winter ice-out. Since only eight northern pike were captured in the 2006 assessment, it is difficult to provide comment. The northern pike observed were robust and healthy and the limited data obtained indicated good growth patterns. A small viable northern pike fishery exists and likely provides additional recreational fishing opportunities.

Other fish species found in Bennett Lake appear in satisfactory abundance. Brown and yellow bullheads function as bottom feeders and play an important role in the fish community. Carp, also a bottom feeder, appear in moderate abundance. Bowfin and longnose gar are important predator fish which help balance panfish populations.

Management Direction

Fisheries management of Bennett Lake should continue to concentrate on warmwater and coolwater species with emphasis on bluegill, pumpkinseed sunfish, black crappie, largemouth bass, and northern pike. Although the bluegill size structure has shown signs of decline, no immediate management actions are warranted nor are any recommended. Management goals should strive to maintain a bluegill fishery with and acceptable (or better) rating using the Schneider Index methodology. Future assessments should make a greater effort to target northern pike and largemouth bass to understand their population dynamics.

References

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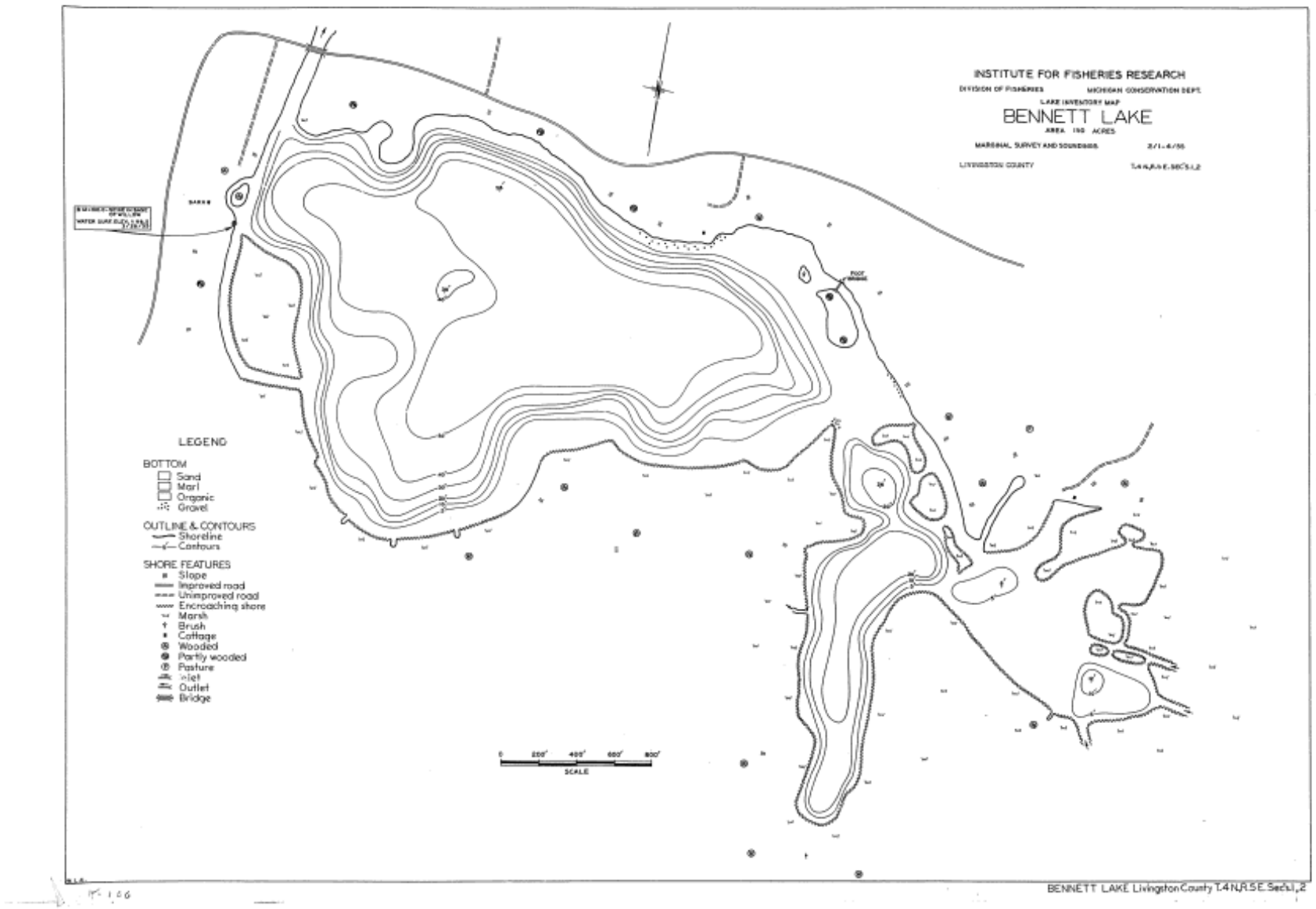

Figure 1. Hydrographic map of Bennett Lake, Livingston County, Michigan.

Table 1.-Temperature, oxygen, and pH profile from deep basin of Bennett Lake, Livingston County. Data collected August, 2006 by MDNR, Fisheries Division.

Depth (ft.)	Temperature (F)	Oxygen (ppm)	pH
1	77	10.5	7.97
3	77	10.3	8.08
6	76	10.2	8.17
9	76	10.2	8.19
12	75	10.0	8.14
15	74	9.1	8.07
18	66	9.3	8.01
21	59	8.0	7.95
24	52	5.0	7.87
27	50	3.2	7.80
30	47	2.6	7.76
33	46	2.5	7.74
36	44	2.4	7.69
39	44	1.5	7.63
42	44	1.0	7.61
45	43	0.7	7.58
48	43	0.5	7.57
51	43	0.4	7.56
54	43	0.3	7.54
57	43	0.2	7.40

Table 2.–List of fishes in Bennett Lake, Livingston County. Origin: N= native, I= introduced, C= colonized. Status: P= recent observations, X=extirpated. Data from: Michigan Department of Natural Resources, Fisheries Division records.

Common name	Scientific name	Origin	Status
Longnose gar	*Lepisosteus osseus*	N	P
Bowfin	*Amia calva*	N	P
Common carp	*Cyprinus carpio*	C	P
Blackchin shiner	*Notropis hererodon*	N	P
Golden shiner	*Notemigonus crysoleucas*	N	P
White sucker	*Catostomus commersoni*	N	P
Brook silverside	*Labidesthes sicculus*	N	P
Lake chubsucker	*Erimyzon sucetta*	N	P
Lake herring	*Coregonus artedi*	N	X
Brook silverside	*Labidesthes sicculus*	N	P
Black bullhead	*Ictalurus melas*	N	P
Yellow bullhead	*Ameiurus natalis*	N	P
Brown bullhead	*Ameiurus nebulosus*	N	P
Northern pike	*Esox lucius*	N	P
Grass pickerel	*Esox americanus*	N	P
Central mudminnow	*Umbra limi*	N	P
Green sunfish	*Lepomis cyanellus*	N	P
Pumpkinseed	*Lepomis gibbosus*	N	P
Warmouth	*Lepomis gulosus*	N	P
Bluegill	*Lepomis macrochirus*	N	P
Rock bass	*Ambloplites rupestris*	N	P
Largemouth bass	*Micropterus salmoides*	N	P
Black crappie	*Pomoxis nigromaculatus*	N	P
Walleye	*Sander vitreus*	I	P
Yellow perch	*Perca flavescens*	N	P

Table 3.-Number, weight, and length range of fishes collected with trap net, gill net, seine, and electro-fishing gear from Bennett Lake, Livingston County. Data from Michigan Department of Natural Resources, Fisheries Division records. Blank indicates miniscule value.

Common name	Number	Percent by number	Length range (inches)	Weight (lbs.)	Percent by weight	Percent legal size	Average size (inches)
Black crappie	15	1	7-8	0.40	1	100	9.0
Blackchin shiner	6	< 1	1-2		< 1	100	2.0
Bluegill	1200	75	1-8	193.3	29	50	5.9
Bowfin	41	3	12-26	142.8	22	100	21.1
Brook silverside	5	< 1	3		< 1	100	3.5
Brown bullhead	40	2	9-14	27.3	4	100	11.3
Central mudminnow	2	< 1	3		< 1	100	3.5
Common carp	35	2	5-30	144.5	22	100	19.8
Golden shiner	5	< 1	3-9	0.4	< 1	100	5.7
Grass pickerel	2	< 1	9	0.3	< 1	100	9.5
Green sunfish	2	< 1	3-4	0.1	< 1	100	4.0
Hybrid sunfish	3	< 1	5-6	0.4	< 1	33	5.8
Lake chubsucker	4	< 1	4-7	0.4	< 1	100	5.5
Largemouth bass	29	2	5-17	29.2	4	28	11.6
Longnose gar	2	< 1	31-32	6.1	1	100	32.0
Northern pike	8	1	18-36	38.	6	63	26.1
Pumpkinseed	89	6	2-7	17.6	3	66	6.1
Rock bass	5	< 1	4-9	1.3	< 1	80	6.7
Walleye	1	< 1	24.5	4.8	1	100	24.5
Warmouth	5	< 1	5-6	0.9	< 1	100	6.1
White sucker	3	< 1	19-20	9.7	1	100	20.2
Yellow bullhead	66	4	8-12	34.2	5	100	10.2
Yellow perch	38	2	2-4	0.7	< 1	0	3.5

Table 4.-Weighted mean length (inches) at age and growth relative to the State average for fish sampled from Bennett Lake with trap nets, gill nets, and electro-fishing gear, May, 2006. 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	Mean growth index[1]
Black crappie				8.6 (4)	9.1 (9)	9.8 (2)				-0.3
Bluegill	1.8 (12)	2.6 (5)	3.4 (8)	4.7 (11)	5.8 (27)	6.7 (10)	7.4 (5)	8.2 (2)	7.7 (4)	-0.9
Largemouth bass		6.1 (2)	8.2 (7)	10.5 (6)	11.7 (4)	13.5 (3)	14.7 (4)	16.7 (2)	16.5 (2)	-1.1
Northern pike		19.2 (3)	25.1 (1)	30.4 (1)	29.3 (2)	27.3 (1)				
Pumpkinseed		3.6 (2)	5.0 (8)	5.7 (8)	6.7 (9)	6.8 (8)	7.6 (1)	7.2 (1)		+0.2
Redear sunfish			6.3 (5)	7.5 (10)						+0.1
Yellow perch	2.8 (15)	4.0 (14)	5.9 (1)							-0.9

Table 5.-Weighted age frequency (percent) of six fish species collected from Bennett Lake in May, 2006. Data from Michigan Department of Natural Resources, Fisheries Division records.

	Age/percent									
Species	1	2	3	4	5	6	7	8	9	Number caught
Black crappie				26	60	14				15
Bluegill	1	1	3	15	49	23	5	< 1	3	1200
Largemouth bass		7	21	21	14	10	14	7	7	29
Northern pike		38	13	13	25	13				8
Pumpkinseed		7	13	18	32	27	1	1		89
Yellow perch	53	45	3							38

Table 6.-Bennett 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	7/26/90	6/11/97	5/25/06
Sample size	336	895	917
Average length (inches)	5.4 (2)	7.2 (6)	6.2 (4)
% $\geq$ 6 inches	15 (2)	93 (6)	60 (4)
% $\geq$ 7 inches	2 (2)	65 (6)	24 (4)
% $\geq$ 8 inches	0.2 (4)	16 (6)	2 (5)
Schneider Index	2.50	6.0	4.25
Rank[1]	Poor/Acceptable	Excellent	Good

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