Introduction
In April, 2006, Fisheries Division implemented changes to Statewide bass regulations and included an early catch/release season on Lower Peninsula inland lakes beginning on the last Saturday of April extending to the Friday before Memorial Day. A Fisheries Division "Bass Regulation Evaluation Task (BRET) Group" outlined a number of strategies to evaluate the regulation changes focusing on angler attitudes and behavior, the role of lake temperature on nesting and recruitment success, and nesting success in the presence of an early catch/release season. An additional strategy identified a study of bass population changes on four Lower Peninsula lakes (Chemung, Woodland, Warner, and North). It was felt that population data from these lakes would provide supplemental data to the other strategies being investigated by the BRET Group. Lake Chemung was selected as a medium size lake with high fishing pressure and high shoreline development.

Lake Chemung is located between Howell and Brighton in central Livingston County. It is classified as a warmwater lake of mesotrophic characteristics (Leonardi 2008). The fish community is diverse with a common occurrence of bluegill and largemouth bass. The lake is 310 acres with an estimated 4.08 miles of shoreline. Shoreline development is moderate with an estimated 58 dwellings/mile, 273 docks, and 38% of the shoreline is artificially armored. Lake Chemung also has an aggressive aquatic plant management program and was recently treated with fluridone (May, 2008).

Study objectives specific to Lake Chemung were to estimate adult bass abundance and size and age characteristics. Analysis presented in this report summarizes the Southern Lake Huron Management Unit surveys of Lake Chemung for the study period (2008-2010).

Methods and Materials
For the study period, largemouth bass population estimates were conducted using fin clips and electrofishing gear to capture the fish. All sampling occurred after sunset during the fall season (Sept.-Oct.) with water temperatures ranging from 55-69F. Sampling was conducted for 3-4 consecutive nights for each year. The entire Lake Chemung shoreline was sampled during each effort. All largemouth bass were collected and measured to the tenth of an inch. Representative samples were weighed and scales/spine samples were collected for age and growth analysis. In 2008, passive integrated transponder (PIT) tags were inserted on largemouth bass $\geq$ 9 inches and checked for subsequent recapture. Additional tissue samples were collected for DNA analysis.

Results
A complete database for this study is maintained by the author. Summaries of pertinent information are provided in Tables 1-7 and Figures 1-3.

Abundance
The total number of largemouth bass collected, marked and recaptured, and the catch per unit effort (CPUE) varied between years (Table 1). Largemouth bass catch was highest in 2010 (2,812 fish) and lowest in 2008 (530 fish). Catch per unit effort followed suit being highest in 2010 (240/hr.) and lowest in 2008 (38/hr.). The high abundance and CPUE of largemouth bass in 2010 is attributed to the presence of a large young of the year (YOY) class.

During 2009 and 2010, Lake Chemung was divided into 4 relatively uniform transects to determine if largemouth bass density was higher in one area of the lake compared to another (Table 2). The mean number of largemouth bass/mile showed slightly higher abundance in Transects 3 and 4 in both years but density was different between years. Transects 1 and 2 appeared to have greater shoreline development

with more docks which may have affected electroshocking efficiency. In general, largemouth bass density/transect did not appear to be significantly different and bass appeared to be well distributed throughout the lake during the fall season.

Reliability of mark and recapture population estimates increases with the recapture of marked fish. Generally speaking, a recapture rate >10% is desirable. Recapture rates for Lake Chemung were 8% in 2008 and 2009 and 4% in 2010. Using these recapture rates, the largemouth bass population estimates were 2,875 (2008), 2,944 (2009), and 24,702 (2010) (Table 3). Largemouth bass density (# fish/acre) was 9.3 (2008), 9.4 (2009), and 79.7 (2010). The dramatic increase in bass abundance in 2010 was partially the result of a very large YOY class. However, if largemouth bass density was estimated using bass 1+ years of age, the 2010 density would still remain more than twice that found in 2008 and 2009. Density of largemouth bass ≥ 14 inches was estimated to be 1-2 fish/acre for all 3 years.

Size and age characteristics

The size distribution and size structure for largemouth bass in Lake Chemung was different for each sampling year (Figure 1, Table 4). Average largemouth bass size was 10.7 inches in 2008, 8.9 inches in 2009, and 5.3 inches in 2010. The 2008 size structure showed a higher abundance of larger fish with 56% of the total being ≥ 10 inches. The 2009 size structure was skewed toward smaller fish with 25% of the total being ≥ 10 inches. The 2010 size structure was heavily skewed toward smaller fish with 71% of the total being ≤ 4 inches and 14% of the total ≥ 10 inches.

Age frequency varied for largemouth bass in Lake Chemung for each year (Figure 2). Age frequency followed size trends with larger and older fish being more prevalent in 2008, then shifting to smaller and younger bass in 2009 and 2010. The frequency of bass between the ages of 0-4 years was 78% in 2008 and 91% in 2009 and 2010. The 2007 year class appears to be relatively strong throughout the study period. The 2010 year class appears exceptionally strong.

Growth characteristics

Mean length at age for largemouth bass from Lake Chemung was slightly lower in 2009 and 2010 compared to 2008 (Table 5, Figure 3). The mean growth index, a value which compares growth deviation to State averages, was -0.7(2008), -1.0(2009), and -1.3(2010). The decline in growth may be related to the increase in abundance of smaller bass in 2009 and 2010 and competition for food.

The use of PIT tags allows for growth comment on individual fish. Twenty-five largemouth bass PIT tagged in 2008 were recaptured in subsequent years (Table 6). Annual growth of 9 inch bass ranged between 1.0-1.8 inches. Annual growth of 10 inch bass ranged between 1.5-2.8 inches. Annual growth of bass ≥ 11 inches generally declined to < 1 inch/year. The highest growth rate observed for an individual bass was for one that measured 10.6 inches in 2008, 12.1 inches in 2009, and 14.9 inches in 2010.

Anomalies

During the 2008 sampling season, a prevalence of black melanoma in largemouth bass was observed but not tracked. Black melanoma occurs as small to large black blotching and typically occurs on larger fish (>12 inches). The cause of the melanoma is not understood but appears harmless to the fish. Anomalies were tracked in 2009 and 2010 (Table 7). For both 2009 and 2010, the occurrence of black melanoma was <1%. A higher prevalence may have occurred in 2008 since larger fish were more abundant. All other anomalies were found in low occurrence.

Discussion

This effort was intended to provide the BRET Group with information on one of four lakes. Comparison and trend data between the four lakes is not discussed here and will be reported separately by the BRET Group. Data collected in this study allows for discussion specific to the bass population of Lake Chemung.

Impacts of the early catch/release bass season were not apparent in Lake Chemung based on the biological data collected in this study. After the three years of study, only a glimpse of bass population dynamics was revealed. The Lake Chemung bass population appeared to shift from fewer, larger, and older fish to a population of more abundant, smaller, and younger fish. There was insufficient data available to relate this shift to an early catch/release season. There was insufficient evidence to associate this shift to the 2008 fluridone treatment. Bass growth appeared to be consistent and near State average for the first 4 or 5 years of life but then exhibited wide variation in subsequent years. Some bass continued to grow and achieve lengths >14 inches while others exhibited very little growth. The mechanisms that drive recruitment of bass into the harvestable fishery were not apparent in this study. Year class strength appeared to be variable and is likely influenced by a number of weather and temperature factors. The 2007 and 2010 year classes appear strong and further investigation is needed to determine their future influence on the population.

Since largemouth bass are a relatively long lived fish (>10 yrs.), it is difficult to discern trends in a 3 year study period. Continued research would likely yield a better understanding of the population dynamics being observed and it would be of interest to continue to follow the stronger 2007 and 2010 year classes in Lake Chemung.

Recommendations

Management recommendations pertaining to the Statewide bass regulations will be forthcoming from the BRET Group. No specific recommendations are suggested for Lake Chemung. As a lake with high shoreline development and high fishing pressure, Lake Chemung continues to support a relatively stable and good largemouth bass fishery.

References

Leonardi, Joseph M. 2008. Lake Chemung – Status of the fishery report. Michigan Department of Natural Resources, Fisheries Division, Report 2008-48, Ann Arbor, Michigan.

Table 1. Summary of largemouth bass data from Lake Chemung, 2008-2010.

Table 1a - 2008

Date	Total fish captured	Total fish marked	Total 2008 recaps	Total fish PIT tagged	Total <4" captured	Total <4" preserved	Shock time (hr.)	CPUE (#/hr.)	Shoreline distance (miles)	CPUE (#/mile)
10/20/08	123	123	0	86	0	0	4.07	30.22	4.08	30.15
10/21/08	154	154	7	97	0	0	3.52	45.74	4.08	37.75
10/2208	144	144	14	77	0	0	3.07	51.47	4.08	35.29
10/23/08	109	109	20	77	0	0	3.12	40.35	4.08	26.72
Total	530	530	41	337	0	0	13.78	38.46	16.32	32.48

Table 1b - 2009

Date	Total fish captured	Total fish marked	Total 2009 recaps	Total 2008 PIT captured	Total <4" captured	Total <4" preserved	Shock time (hr.)	CPUE (#/hr.)	Shoreline distance (miles)	CPUE (#/mile)
9/27/09	238	235	0	10	4	3	3.23	73.68	4.08	58.33
9/29/09	186	172	13	8	1	1	2.90	64.14	4.08	45.58
9/30/09	247	205	36	13	6	6	3.18	77.67	4.08	60.54
Total	671	612	49	31	11	10	9.31	72.07	12.24	54.82

Table 1c - 2010

Date	Total fish captured	Total fish marked	Total 2010 recaps	Total 2008 PIT captured	Total <4" captured	Total <4" preserved	Shock time (hr.)	CPUE (#/hr.)	Shoreline distance (miles)	CPUE (#/mile)
9/27/10	637	534	0	7	442	103	2.90	219.7	4.08	156.1
9/28/10	647	592	20	6	391	0	2.82	229.4	4.08	158.6
9/29/10	689	629	39	5	507	0	3.07	224.4	4.08	168.9
9/30/10	839	839	46	8	656	0	2.92	287.3	4.08	205.6
Total	2812	2594	105	26	1996	103	11.71	240.1	16.32	172.3

Table 2. Largemouth bass catch per transect from Lake Chemung, 2009-2010.

Date	Transect 1 (1.20 miles)	Transect 2 (0.99 miles)	Transect 3 (1.04 miles)	Transect 4 (0.85 miles)
2009 Total	155	167	192	157
2009 Mean	52	56	64	52
2009 Mean #/mile	43	57	62	61
2010 Total	616	549	841	806
2010 Mean	154	137	210	202
2010 Mean #/mile	128	138	202	238

Table 3. Population estimates (Schnabel method from Ricker 1975) for largemouth bass from Lake Chemung, 2008-2010.

	2008	2009	2010
Population estimate	2,875	2,944	24,702
Upper 95% confidence limit	4,653	4,526	32,452
Lower 95% confidence limit	2,080	2,181	19,941
Density (#/acre)	9.3	9.4	79.7

Table 4. Largemouth bass size structure for Lake Chemung, 2008-2010.

	2008	2009	2010
Number caught	571	671	2812
Average size (inches)	10.7	8.9	5.3
% $\leq$ 4 inches	0.9	5.1	71.3
% $\geq$ 6 inches	90.7	82.9	27.8
% $\geq$ 8 inches	70.7	64.5	22.9
% $\geq$ 10 inches	55.9	25.3	14.0
% $\geq$ 12 inches	36.4	16.1	6.7
% $\geq$ 14 inches	19.6	7.0	2.8

Table 5. Weighted mean at length and age composition for largemouth bass from Lake Chemung, 2008-2010.

Table 5a - 2008

	No. aged	Length range (in.)	State avg. length (in.)	Weighted mean length (in.)	Weighted age frequency	Mean growth index
Largemouth bass						-0.7
Age 0	5	4.1-5.2	4.2	4.88	2.08 %	
Age 1	37	5.0-6.9	7.1	6.92	33.37 %	
Age 2	74	9.2-11.4	9.4	9.97	15.73 %	
Age 3	84	9.4-13.2	11.6	11.58	16.62 %	
Age 4	57	11.3-14.2	13.2	12.97	10.60 %	
Age 5	26	11.6-15.1	14.7	13.7	4.78 %	
Age 6	24	14.0-16.9	16.3	15.33	4.57 %	
Age 7	23	13.3-17.6	17.4	15.59	4.54 %	
Age 8	20	14.8-18.9	18.3	17.11	3.89 %	
Age 9	15	15.1-19.2	19.3	16.84	2.60 %	
Age 10	6	18.1-20.5	19.3	18.87	0.82 %	
Age 11	1	18.9-18.9		18.9	0.19 %	
Age 12	1	19.0-19.0		19.00	0.04 %	
Age 15	1	16.8-16.8		16.80	0.18 %	

Table 5b - 2009

	No. aged	Length range (in.)	State avg. length (in.)	Weighted mean length (in.)	Weighted age frequency	Mean growth index
Largemouth bass						-1.0
Age 0	14	2.4-4.5	4.1	3.56	3.01 %	
Age 1	27	4.5-7.6	6.9	5.75	21.04 %	
Age 2	25	6.4-9.9	9.3	8.23	35.18 %	
Age 3	19	8.3-11.0	11.2	9.38	20.49 %	
Age 4	24	10.6-18.0	12.7	12.42	11.84 %	
Age 5	9	13.5-15.2	14.4	14.12	3.75 %	
Age 6	8	13.9-16.3	16.0	14.86	1.97 %	
Age 7	4	14.6-16.6	17.1	15.5	1.07 %	
Age 8	3	16.3-17.1	18.0	16.8	0.60 %	
Age 9	3	13.4-18.0	19.1	15.45	0.86 %	
Age 10	1	17.7-17.7	19.3	17.7	0.19 %	

Table 5c - 2010

	No. aged	Length range (in.)	State avg. length (in.)	Weighted mean length (in.)	Weighted age frequency	Mean growth index
Largemouth bass						-1.3
Age 0	23	2.3-4.2	4.1	3.15	71.08 %	
Age 1	20	4.6-6.8	6.9	5.99	2.36 %	
Age 2	14	5.6-9.1	9.3	7.34	3.44 %	
Age 3	38	7.7-12.0	11.2	9.72	14.48 %	
Age 4	19	10.8-14.2	12.7	12.11	5.20 %	
Age 5	11	13.8-15.6	14.4	14.38	1.64 %	
Age 6	8	12.5-16.0	16.0	14.35	1.05 %	
Age 7	1	15.9-15.9	17.1	15.90	0.09 %	
Age 8	2	15.7-16.6	18.0	16.16	0.19 %	
Age 9	4	16.7-17.5	19.1	17.00	0.27 %	
Age 10	2	17.4-17.5	19.3	17.45	0.11 %	
Age 11	1	18.1-18.1		18.10	0.11 %	

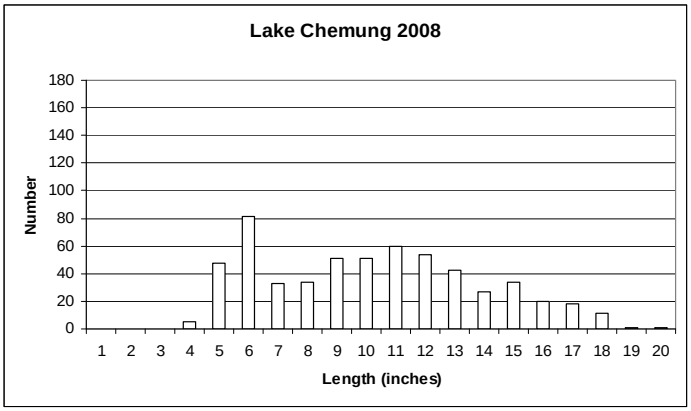
Table 6. Growth and weight characteristics of specific largemouth bass from Lake Chemung, 2008-2010.

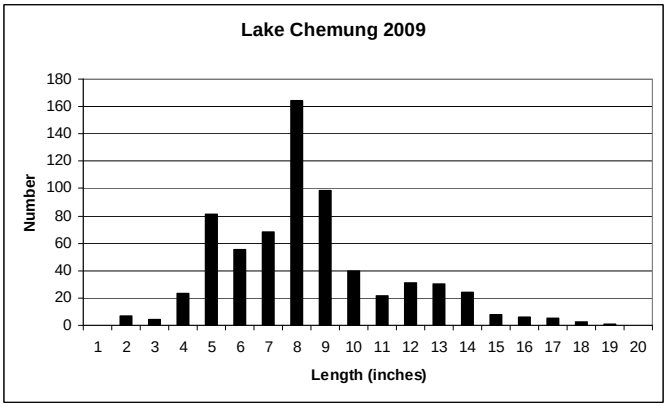
PIT tag number	2008 length (in.)	2009 length (in.)	2010 length (in.)	Annual length difference (in.)	Biannual length difference (in.)
985121014291985	9.3	11.1		+1.8	
985121015533699	9.4	11.1		+1.7	
985121015522256	9.9	10.9		+1.0	
985120024681185	10.0	11.9		+1.9	
985121014305940	10.3	12.3		+2.0	
985121015522253	10.5	12.4		+1.9	
985120024701466	10.6	12.1	14.9	+1.5/+2.8	+4.3
985120024730843	11.0		15.0		+4.0
985121014305734	11.3	12.6	14.2	+1.3/+1.6	+2.9
985121015515927	11.3	11.6		+0.3	
985121014204635	11.7		13.3		+1.6
985121014308277	12.0	12.0		0.0	
985121014192779	12.2	14.0		+1.8	
985120024723922	12.9	12.9		0.0	
985120024678382	13.0	13.2	13.1	+0.1/-0.1	
985120024725546	13.0	13.8		+0.8	
985120024679063	13.1		13.8		+0.7
985121016278372	14.0	14.7		+0.6	
985121014332165	15.2		15.2		0.0
985120024730412	15.7		17.2		+1.5
985121015536478	16.6	17.0		+0.4	
985120024681907	17.2		17.8		+0.6
985120024681030	18.9		18.8		-0.1
985121015522641	19.0	19.1		+0.1	
985120024707023	19.2		19.4		+0.2

Table 7. Largemouth bass anomalies (number of observations) observed from Lake Chemung, 2009-2010.

Anomaly	2009	2010
Black melanoma	7	3
Black spot parasite	13	0
Body wound	2	8
Emaciation	2	4
Fungus	3	0
Hook wound on jaw	9	0
Red sore	5	9
Wart like cysts	11	0

Figure 1. Size distribution of largemouth bass from Lake Chemung, 2008-2010.





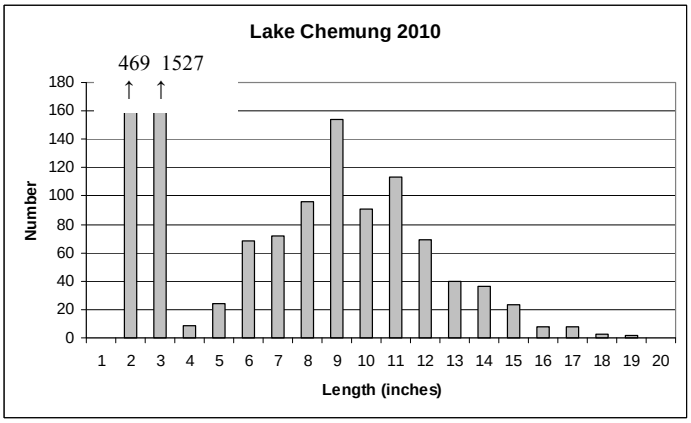
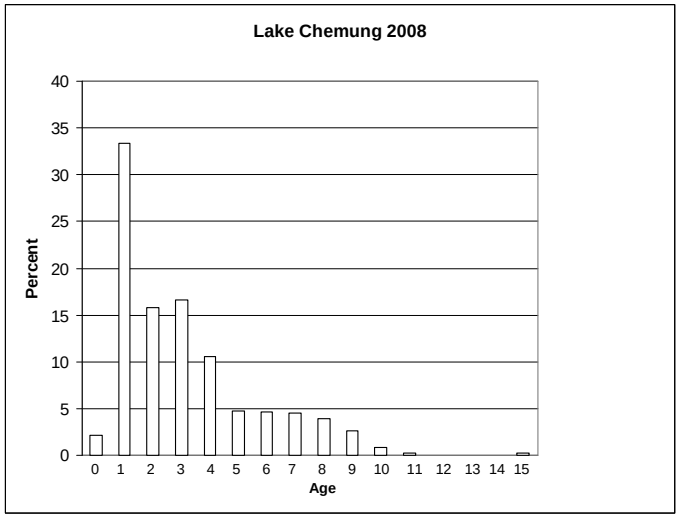
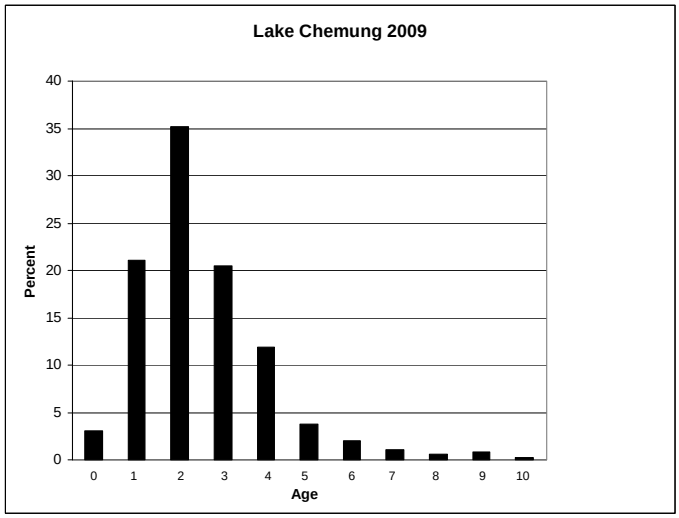


Figure 2. Weighted age frequency for largemouth bass from Lake Chemung, 2008-2010.





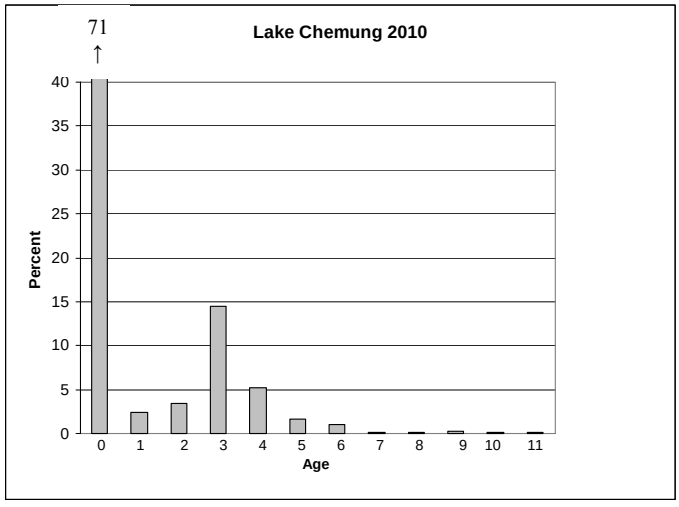


Figure 3. Weighted mean length at age of largemouth bass from Lake Chemung, 2008-2010.