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GROWTH RATE OF SOME MICHIGAN GAME FISHES

by

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The following tables were compiled in order to have a basis for the comparison of the growth of fishes in the lakes and streams of Michigan, and to be able to estimate the production of fish in a lake from the creel census records.

The fish, with but few exceptions, were collected from 1931-1941 by the Lake and Stream Survey parties of the Institute for Fisheries Research. Data from approximately 400 lakes surveyed throughout the State have been combined. The fish were measured to the nearest millimeter and weights were recorded to the nearest gram.

A brief explanation of the methods used in the preparation of the tables is given, so that later workers may know the procedure followed when revisions are made.

Conversion Factors For Changing Standard to Total Length, etc.

The standard length was tabulated under its total length on column paper. Then the average standard length for each total length was determined. The ratio between standard and total length was derived by dividing the average standard length by the total length. For example, in the pumpkinseeds, 9 fish in the 61-millimeter total length group

averaged 49 millimeters in standard length. The ratio, 49/61 = 0.803, is the conversion factor for that group. Then total lengths were combined into 5-millimeter groups (except northern pike, in which centimeter groups were used), and the average standard and total lengths, and average conversion factor were determined. Weighted averages were used in all calculations.

The averages of the 5-millimeter groups were then tabulated. This tabulation usually showed definite changes in the conversion factor with change in fish length. This change made desirable further combination into two or three main groups. Other factors were determined that made possible ready conversion between total and standard lengths with and without change in the unit of measurement (for example, conversion between standard length in millimeters and total length in inches).

These factors were derived as follows:

The method by which the factor for changing total length to standard length with no change in units has been described above. The reciprocal of that factor is used to change standard to total length with no change in units. To convert total length in inches to standard length in millimeters, the total length to standard length factor is multiplied by 25.4 and the product is the conversion factor. To convert standard length in millimeters to total length in inches, the standard length to total length factor is divided by 25.4 and the product is the factor.

Factors for the conversion of total and standard lengths

of the bluegill (Lepomis macrochirus) in Michigan

Interval of standard length in millimeters	Number of fish	Conversion factors: T.L.* to S.L.* (no change in units of length)	Conversion factors: S.L. to T.L. (no change in units of length)	S.L. (mm.) to T.L. (inches)	T.L. (inches) to S.L. (mm.)
under 102	2,335	0.782	1.278	0.05031	19.86
102 - 163	3,712	0.793	1.261	0.04965	20.14
over 163	1,253	0.803	1.246	0.04906	20.39

* T.L. = total length; S.L. = standard length

Factors for the conversion of total and standard lengths

of the pumpkinseed (Lepomis gibbosus) in Michigan

Interval of standard length in millimeters	Number of fish	Conversion factors: T.L.* to S.L.* (no change in units of length)	Conversion factors: S.L. to T.L. (no change in units of length)	S.L. (mm.) to T.L. (inches)	T.L. (inches) to S.L. (mm.)
under 95	843	0.794	1.259	0.04957	20.17
over 95	1,460	0.807	1.239	0.04878	20.50

* T.L. = total length; S.L. = standard length.

Factors for the conversion of total and standard lengths of the rock bass (Ambloplites rupestris) in Michigan

Interval of standard length in millimeters	Number of fish	Conversion factors: T.L.* to S.L.* (no change in units of length)	Conversion factors: S.L. to T.L. (no change in units of length)	S.L. (mm.) to T.L. (inches)	T.L. (inches) to S.L. (mm.)
under 116	1,066	0.789	1.268	0.04992	20.04
over 116	925	0.802	1.247	0.04909	20.37

* T.L. = total length; S.L. = standard length

Factors for the conversion of total and standard lengths of the perch (P. flavescens) in Michigan

Interval of standard length in millimeters	Number of fish	Conversion factors: T.L.* to S.L.* (no change in units of length)	Conversion factors: S.L. to T.L. (no change in units of length)	S.L. (mm.) to T.L. (inches)	T.L. (inches) to S.L. (mm.)
under 83	422	0.833	1.200	0.04724	21.16
84 - 169	3,610	0.847	1.181	0.04649	21.51
over 170	1,569	0.852	1.174	0.04622	21.64

* T.L. = total length; S.L. = standard length.

Factors for the conversion of total and standard lengths of the largemouth black bass (H. salmoides) in Michigan

Interval of standard length in millimeters	Number of fish	Conversion factors: T.L.* to S.L.* (no change in units of length)	Conversion factors: S.L. to T.L. (no change in units of length)	S.L. (mm.) to T.L. (inches)	T.L. (inches) to S.L. (mm.)
under 173	527	0.820	1.220	0.04803	20.83
173 - 314	843	0.825	1.212	0.04772	20.96
over 314	86	0.834	1.199	0.04720	21.18

* T.L. = total length; S.L. = standard length.

Factors for the conversion of total and standard lengths

of the smallmouth black bass (M. d. dolomieu)

in Michigan

Interval of standard length in millimeters	Number of fish	Conversion factors: T.L.* to S.L.* (no change in units of length)	Conversion factors: S.L. to T.L. (no change in units of length)	S.L. (mm.) to T.L. (inches)	T.L. (inches) to S.L. (mm.)
under 50	8	0.800	1.250	0.04921	20.32
50 - 265	678	0.826	1.211	0.04767	20.98
over 265	135	0.820	1.220	0.04803	20.83

* T.L. = total length; S.L. = standard length.

Factors for the conversion of total and standard lengths of the northern pike (E. lucius) in Michigan

Interval of standard length in millimeters	Number of fish	Conversion factors: T.L.* to S.L.* (no change in units of length)	Conversion factors: S.L. to T.L. (no change in units of length)	S.L. (mm.) to T.L. (inches)	T.L. (inches) to S.L. (mm.)
under 440	1,034	0.860	1.162	0.04575	21.84
440 - 690	457	0.867	1.153	0.04539	22.02
over 690	22	0.877	1.140	0.04488	22.28

* T.L. = total length; S.L. = standard length.

Factors for the conversion of total and standard lengths

of the black crappie (Pomoxis nigro-maculatus) in Michigan

Interval of standard length in millimeters	Number of fish	Conversion factors			
		T.L.* to S.L.* (no change in units of length)	S.L. to T.L. (no change in units of length)	S.L. (mm.) to T.L. (inches)	T.L. (inches) to S.L. (mm.)
48-270	751	0.791	1.264	0.04977	20.09

* T.L. = total length; S.L. = standard length

Length-weight relationships

The weights of the fish were tabulated under the total lengths, and the average weight determined for each total length. Then the data were combined by 5 mm. groups (the same grouping as had been made for the standard lengths). The data were then tabulated as shown below.

Aver. 5 mm. groups T.L.	Aver. S.L.	No. of fish	Aver. wt.	log L	log W	log L x log W	$(\log L)^2$	Calc. wt.	Calc. log W
127	99	135	35	1.9956	1.5441	3.0814	3.9824	36	1.5545

The logarithms of the length and weight were found. These were then multiplied, and the log of the length was squared. These numbers were filled in the table and summed, for substitution in the following equation (for fitting a parabola).

$$\log C = \frac{\Sigma \log W \cdot \Sigma(\log L)^2 - \Sigma \log L \cdot \Sigma(\log L \cdot \log W)}{N \cdot \Sigma(\log L)^2 - (\Sigma \log L)^2}$$

The data for the bluegill follows:

$N = 44; \Sigma \log L = 88.2411; \Sigma \log W = 69.8052; \Sigma \log L \cdot \log W = 147.3072;$

$\Sigma(\log L)^2 = 179.3173; (\Sigma \log L)^2 = 7786.4917.$

$$\log C = \frac{69.8052 \cdot 179.3173 - 88.2411 \cdot 147.3072}{44 \cdot 179.3173 - 7786.4917}$$

$$= \frac{12517.27998996 - 12998.54936592}{7889.9612 - 7786.4917} = \frac{-481.2694}{103.4695}$$

$$\log C = -4.651316$$

$$n = \frac{\log W - N \cdot \log C}{\log L}$$

$$n = \frac{69.8052 - 44 \cdot -4.651316}{88.2411} = \frac{69.8052 + 204.6579}{88.2411}$$

$$= \frac{274.4631}{88.2411} = 3.11037$$

The values determined for log C and n are substituted in the following equation to determine the calculated weights:

$$\log W = \log C + n \log L$$

In the comparison of individual calculated weights, the value log L is taken from the data sheet already used (or the logarithm of any length for which the weight is desired may be used). In the preparation of the graphs (on file at the Institute), however, the logarithms of the average lengths used in the table were taken.

The weights calculated for the various lengths are plotted on the graph. In the graphs, the solid line represents calculated weights. The empirical weights are represented by the dots.

The log C and n factors are given in a table.

The length-weight data are presented in tabular form.

log C and n factors

in length-weight relationship of game species of Michigan

Species	log C	n
Bluegill	- 4.651316	3.11037
Yellow perch	- 4.854310	3.05445
Rock bass	- 4.319450	2.96914
Smallmouth black bass	- 4.725066	3.0515
Largemouth black bass	- 4.625223	2.99278
Northern pike	- 5.223632	3.06647
Pumpkinseed	- 4.789026	3.19857

Relationship between the length and the weight of the bluegill (L. macrochirus) in Michigan

Number of fish	Standard length in millimeters	Weight (in grams) Calculated	Weight (in grams) Empirical	Total length in inches	Weight in ounces
24	29	1	1	1.4	0.04
45	33	1	1	1.7	0.04
56	37	2	2	1.9	0.07
42	41	2	2	2.1	0.07
37	45	3	3	2.3	0.10
41	48	4	5	2.4	0.14
42	52	5	6	2.7	0.18
25	56	6	7	2.8	0.21
26	60	8	10	3.0	0.28
30	64	9	10	3.3	0.32
39	68	11	12	3.4	0.39
61	72	13	14	3.6	0.45
59	76	16	16	3.8	0.56
122	80	18	18	4.1	0.63
109	84	21	21	4.2	0.73
87	88	25	24	4.4	0.88
100	92	29	27	4.6	0.95
137	95	32	32	4.8	1.13
135	99	36	35	5.0	1.26
155	105	43	39	5.2	1.51
174	109	48	44	5.4	1.69
215	113	54	50	5.6	1.90
189	117	60	57	5.8	2.12
221	121	67	64	6.0	2.36
217	125	74	71	6.2	2.61
182	128	80	76	6.4	2.82
183	132	88	85	6.6	3.09
168	136	96	95	6.8	3.38
162	140	105	103	7.0	3.70
176	144	115	119	7.2	4.06
172	148	125	127	7.4	4.41
214	152	136	141	7.6	4.79
191	156	148	149	7.8	5.21
182	160	160	162	8.0	5.64
163	166	179	174	8.2	6.31
197	170	193	185	8.3	6.80
142	174	207	200	8.6	7.30
103	178	223	221	8.8	7.86
88	182	238	235	9.0	8.39
91	186	255	254	9.2	8.99
82	191	277	272	9.3	9.77
47	194	291	285	9.5	10.26
27	198	310	309	9.7	10.93
11	202	330	334	10.0	11.64

Relationship between the length and the weight of the pumpkinseed (L. gibbosus) in Michigan

Number of fish	Standard length in millimeters	Weight (in grams)		Total length in inches	Weight in ounces
		Calculated	Empirical		
4	34	1	1	1.7	0.04
5	37	2	2	1.8	0.07
3	41	2	2	2.0	0.07
21	45	3	4	2.2	0.10
59	49	4	4	2.4	0.14
68	53	5	5	2.6	0.18
51	57	6	6	2.8	0.21
38	61	8	8	3.0	0.28
41	65	10	10	3.2	0.35
50	69	12	13	3.4	0.42
71	73	15	15	3.6	0.53
80	77	18	18	3.8	0.63
70	81	21	21	4.0	0.74
57	85	24	25	4.2	0.84
57	89	28	28	4.4	0.98
58	93	32	32	4.6	1.13
82	98	38	37	4.8	1.33
68	102	43	42	5.0	1.51
72	106	49	46	5.2	1.73
76	110	55	53	5.4	1.94
76	114	62	60	5.6	2.19
69	118	69	67	5.8	2.43
73	122	77	76	6.0	2.71
77	126	85	84	6.2	3.00
99	130	94	95	6.3	3.31
84	134	103	109	6.5	3.63
112	139	116	125	6.7	4.10
86	143	127	135	7.0	4.48
64	147	139	145	7.2	4.90
54	152	154	156	7.4	5.43
50	155	165	176	7.6	5.82
27	159	179	183	7.8	6.31
36	163	194	207	8.0	6.84
44	167	209	229	8.1	7.37
28	172	230	238	8.4	8.11
27	175	243	246	8.5	8.46
11	179	261	244	8.7	9.20
8	183	280	272	8.9	9.88
7	187	300	303	9.1	10.58
6	188	306	282	9.2	10.79
3	194	337	292	9.5	11.88

Relationship between the length and the weight of the rock bass (A. rupestris) in Michigan

Number of fish	Standard length in millimeters	Weight (in grams)		Total length in inches	Weight in ounces
		Calculated	Empirical		
5	30	1	1	1.5	0.04
2	33	2	0.8	1.7	0.07
1	36	2	3	1.8	0.07
2	42	3	4	2.0	0.10
3	46	4	4	2.3	0.14
2	48	5	4	2.4	0.18
3	54	7	6	2.7	0.25
4	57	8	9	2.8	0.28
5	61	10	10	3.1	0.35
9	65	12	12	3.2	0.42
9	69	14	14	3.4	0.49
24	73	16	17	3.6	0.56
49	77	19	18	3.8	0.67
79	80	21	21	4.1	0.73
71	84	25	25	4.2	0.88
56	88	28	27	4.4	0.98
57	92	32	32	4.6	1.12
50	96	37	37	4.8	1.30
47	100	41	41	5.0	1.44
68	104	47	48	5.2	1.65
97	108	52	52	5.4	1.83
54	112	58	60	5.6	2.04
53	116	65	67	5.8	2.29
46	122	75	72	6.0	2.65
70	126	83	82	6.2	2.92
66	130	91	88	6.4	3.20
72	134	99	96	6.6	3.49
62	138	108	103	6.8	3.80
53	142	118	114	7.0	4.16
34	146	128	125	7.2	4.51
35	150	139	134	7.4	4.90
35	154	150	148	7.6	5.29
36	158	162	155	7.8	5.71
45	162	174	166	8.0	6.13
27	166	187	185	8.2	6.60
24	170	201	206	8.3	7.08
18	174	215	223	8.6	7.58
13	178	230	223	8.8	8.11
13	182	246	241	8.9	8.67
10	186	262	277	9.2	9.24
14	190	280	270	9.3	9.88
15	194	297	317	9.5	10.47
23	198	312	331	9.7	11.00
18	202	335	341	9.9	11.81
13	205	350	362	10.1	12.35
14	210	376	371	10.3	13.26
17	213	392	427	10.5	13.82
5	217	414	399	10.7	14.60
5	221	437	477	10.9	15.41
5	226	467	449	11.1	16.47
2	231	500	524	11.3	17.64

Relationship between the length and the weight of the yellow perch (P. flavescens) in Michigan

Number of fish	Standard length in millimeters	Weight (in grams)		Total length in inches	Weight in ounces
		Calculated	Empirical		
7	43	1	2	2.1	0.04
12	47	2	2	2.3	0.07
17	52	3	3	2.4	0.10
29	56	3	3	2.7	0.10
61	60	4	4	2.8	0.14
68	64	5	5	3.1	0.18
58	68	6	6	3.2	0.21
46	72	7	7	3.4	0.25
46	77	8	8	3.6	0.28
31	81	9	10	3.8	0.32
49	86	11	12	4.0	0.38
45	91	13	14	4.2	0.45
46	95	15	16	4.4	0.53
41	99	17	17	4.6	0.60
72	103	20	20	4.8	0.70
77	108	23	21	5.0	0.80
106	112	25	24	5.2	0.88
111	116	28	27	5.4	0.98
141	120	31	32	5.6	1.08
214	125	35	34	5.8	1.23
272	129	39	37	6.0	1.37
242	133	43	41	6.2	1.51
236	137	47	43	6.4	1.65
170	141	51	48	6.6	1.79
135	146	57	52	6.8	2.01
143	150	62	58	7.0	2.18
97	154	67	63	7.2	2.35
81	158	73	72	7.4	2.57
78	163	80	78	7.6	2.82
126	167	86	82	7.8	3.02
123	172	94	89	8.0	3.33
116	176	101	95	8.2	3.55
101	181	110	103	8.3	3.88
92	185	117	113	8.6	4.12
66	189	125	125	8.8	4.41
63	193	134	133	8.9	4.72
61	198	145	145	9.2	5.11
56	202	154	149	9.3	5.43
42	206	163	161	9.6	5.74
47	210	173	179	9.8	6.09
73	215	186	194	9.9	6.56
57	219	197	196	10.1	6.90
60	223	208	216	10.3	7.33
49	227	220	225	10.5	7.76
62	231	233	246	10.7	8.21
53	236	247	264	10.9	8.71
45	240	261	275	11.1	9.20
34	245	278	288	11.3	9.80
20	249	292	320	11.5	10.29

Relationship between the length and the weight of the yellow perch (P. Flavescens) in Michigan (continued)

Number of fish	Standard length in millimeters	Weight (in grams)		Total length in inches	Weight in ounces
		Calculated	Empirical		
31	253	306	323	11.7	10.78
30	257	322	311	11.9	10.96
35	261	337	372	12.1	11.89
25	266	357	379	12.3	12.59
14	270	374	380	12.5	13.19
16	274	391	446	12.7	13.78
13	278	408	454	12.9	14.38
9	282	426	495	13.1	15.02
12	287	450	491	13.2	15.87
12	291	470	525	13.4	16.58

Relationship between the length and the weight of the largemouth black bass (H. salmoides) in Michigan

Number of fish	Standard length in millimeters	Weight (in grams) Calculated	Weight (in grams) Empirical	Total length in inches	Weight in ounces
7	44	2	2	2.1	0.07
11	48	3	3	2.2	0.10
12	51	3	4	2.4	0.10
7	56	4	4	2.6	0.14
8	59	5	5	2.8	0.18
11	63	6	6	3.1	0.21
10	69	7	7	3.2	0.25
17	72	9	8	3.4	0.32
19	76	10	10	3.6	0.35
9	82	13	12	3.8	0.45
7	86	15	14	4.0	0.53
10	89	16	16	4.2	0.57
8	93	18	18	4.4	0.63
8	96	20	20	4.6	0.70
15	102	24	23	4.8	0.84
10	106	27	27	5.0	0.95
13	109	30	26	5.2	1.06
11	112	32	30	5.4	1.13
12	117	37	33	5.6	1.30
12	120	40	39	5.8	1.41
7	125	45	42	6.0	1.59
10	129	49	50	6.2	1.74
6	132	53	51	6.4	1.86
8	139	61	55	6.6	2.15
9	142	65	62	6.8	2.29
10	146	71	72	7.0	2.50
11	150	77	79	7.2	2.71
19	154	83	87	7.4	2.92
21	158	90	90	7.6	3.17
13	164	101	96	7.8	3.56
13	167	106	107	8.0	3.74
22	170	113	112	8.2	3.98
19	174	121	127	8.4	4.27
14	180	133	131	8.6	4.68
20	185	145	141	8.8	5.11
18	188	152	156	8.9	5.36
18	192	161	165	9.2	5.68
21	196	172	175	9.4	6.07
22	199	180	176	9.6	6.35
14	205	197	186	9.7	6.95
24	210	211	210	9.9	7.44
16	213	221	221	10.1	7.80
24	216	230	228	10.3	8.11
23	221	246	239	10.6	8.68
21	225	260	258	10.7	9.17
35	230	278	265	10.9	9.80
26	236	300	294	11.1	10.58
43	238	308	310	11.3	10.86

Relationship between the length and the weight of the largemouth black bass (H. Salmoides) in Michigan (continued)

Number of fish	Standard length in millimeters	Weight (in grams)		Total length in inches	Weight in ounces
		Calculated	Empirical		
33	242	323	338	11.5	11.39
49	245	336	345	11.7	11.85
34	251	362	364	11.9	12.77
33	253	369	397	12.1	13.02
21	259	396	392	12.3	13.96
23	262	410	419	12.5	14.46
11	268	438	458	12.7	15.44
19	270	449	463	12.8	15.84
17	277	485	463	13.1	17.11
5	280	500	461	13.3	17.64
11	281	505	534	13.5	17.81
12	287	539	580	13.7	19.01
9	292	567	568	13.8	20.00
8	297	597	561	14.1	21.01
9	300	615	656	14.3	21.69
9	308	666	649	14.5	23.49
3	309	672	699	14.7	23.70
8	313	698	780	14.8	24.61
8	314	705	751	15.1	24.87
3	321	753	843	15.3	26.56
6	327	795	868	15.4	28.04
6	329	811	1,005	15.7	28.60
1	337	871	907	15.8	30.71
5	348	959	1,020	16.1	33.83
3	345	934	1,068	16.2	32.94
4	351	984	1,057	16.4	34.71
4	350	976	1,027	16.6	34.42
1	366	1,112	1,191	16.8	39.22
4	362	1,108	1,186	17.0	39.07
2	363	1,109	1,381	17.2	39.11
5	373	1,118	1,384	17.4	39.43
1	360	1,106	836	17.6	39.01
1	383	1,277	1,247	17.8	45.04
5	390	1,348	1,350	18.0	46.91
2	392	1,369	1,816	18.2	48.28
1	392	1,369	1,552	18.4	48.28

Relationship between the length and the weight of the smallmouth black bass (*M. d. dolomieu*) in Michigan

Number of fish	Standard length in millimeters	Weight (in grams)		Total length in inches	Weight in ounces
		Calculated	Empirical		
1	41	2	2	2.0	0.07
2	46	2	2	2.2	0.07
1	54	4	3	2.6	0.14
1	55	4	4	2.7	0.14
1	62	6	5	2.9	0.21
1	63	6	6	3.0	0.21
2	68	7	7	3.2	0.25
4	73	9	10	3.4	0.32
1	79	11	11	3.7	0.38
1	81	13	13	3.8	0.45
3	85	15	15	4.1	0.53
5	91	18	22	4.3	0.63
5	93	19	21	4.4	0.67
4	98	23	24	4.7	0.80
2	103	26	23	4.9	0.91
4	106	29	31	5.1	1.04
1	111	33	31	5.3	1.16
6	112	34	36	5.4	1.20
4	117	39	37	5.6	1.37
3	122	44	43	5.8	1.55
1	126	49	45	6.0	1.72
2	127	50	52	6.2	1.76
2	134	58	54	6.4	2.04
4	137	63	61	6.6	2.22
5	141	68	70	6.8	2.39
5	146	76	76	7.0	2.68
4	151	84	72	7.2	2.96
4	154	89	89	7.3	3.14
1	159	99	103	7.6	3.49
6	162	105	106	7.7	3.70
5	167	114	110	8.0	4.02
6	171	124	126	8.2	4.37
4	174	130	134	8.3	4.59
4	175	132	130	8.6	4.65
14	181	146	154	8.8	5.14
11	187	162	155	8.9	5.71
16	190	169	159	9.2	5.96
12	196	187	184	9.3	6.59
27	198	193	192	9.6	6.80
49	203	208	213	9.8	7.33
50	208	223	220	9.9	7.86
44	211	234	237	10.1	8.25
46	216	251	250	10.3	8.85
39	220	265	264	10.5	9.35
34	224	280	274	10.7	9.88
40	228	296	280	10.9	10.44
27	231	308	309	11.1	10.86
25	236	329	331	11.3	11.60

Relationship between the length and the weight of the smallmouth black bass (M. d. dolomieu) in Michigan)
(continued)

Number of fish	Standard length in millimeters	Weight (in grams)		Total length in inches	Weight in ounces
		Calculated	Empirical		
12	240	346	328	11.5	12.20
11	244	364	369	11.7	12.84
20	248	384	376	11.9	13.54
13	253	407	392	12.1	14.36
13	256	421	421	12.3	14.85
9	263	458	430	12.6	16.15
6	265	468	498	12.7	16.50
3	266	474	481	12.9	16.71
8	272	507	491	13.1	17.88
8	278	542	495	13.3	19.11
9	283	572	569	13.5	20.18
6	283	572	547	13.7	20.18
6	288	604	581	13.9	21.30
12	293	636	628	14.1	22.43
7	296	657	616	14.3	23.17
9	299	677	677	14.4	23.88
5	305	720	688	14.7	25.40
5	307	734	699	14.8	25.89
9	314	786	865	15.1	27.73
5	316	802	781	15.2	28.29
11	320	833	857	15.4	29.38
1	330	915	878	15.7	32.27
6	331	923	927	15.8	32.55
6	346	1,058	1,010	16.1	37.31
8	339	994	1,064	16.3	35.24
7	340	1,003	1,089	16.5	35.43
1	342	1,020	1,148	16.6	35.97
3	354	1,134	1,214	16.8	40.00
10	355	1,143	1,161	17.1	40.31
3	358	1,173	1,226	17.3	41.37
2	361	1,203	1,135	17.4	42.42
3	363	1,224	1,211	17.6	43.17
4	373	1,330	1,375	18.0	46.91
2	370	1,298	1,276	18.2	45.78
1	374	1,341	1,530	18.4	47.30
2	403	1,684	1,588	18.6	59.40
2	401	1,658	1,708	19.0	58.48

Relationship between the length and the weight of the northern pike (E. lucius) in Michigan

Number of fish	Standard length in millimeters	Weight (in grams)		Total length in inches	Weight in ounces
		Calculated	Empirical		
10	56	1	1	2.6	0.04
6	64	2	1	2.9	0.07
8	74	3	2	3.4	0.10
1	82	4	8	3.8	0.14
2	90	6	9	4.2	0.21
3	100	8	9	4.6	0.28
2	106	10	12	4.8	0.35
3	115	13	16	5.3	0.45
1	126	17	19	5.8	0.60
1	132	20	20	6.1	0.71
2	138	22	28	6.3	0.78
2	148	27	33	6.8	0.95
8	159	34	35	7.3	1.20
7	167	39	43	7.6	1.37
8	175	45	48	8.0	1.59
8	183	52	56	8.4	1.83
13	192	60	57	8.8	2.12
19	200	68	60	9.2	2.39
13	210	79	67	9.6	2.79
24	217	87	79	9.9	3.15
9	225	98	88	10.3	3.45
7	237	114	113	10.8	4.02
5	245	126	125	11.2	4.44
8	256	145	140	11.7	5.11
13	262	156	156	12.0	5.50
10	273	177	166	12.5	6.24
26	279	189	183	12.8	6.66
16	289	210	198	13.2	7.41
31	297	228	221	13.6	8.03
32	306	250	239	14.0	8.82
41	314	271	268	14.4	9.55
42	322	293	286	14.7	10.33
30	331	319	305	15.2	11.25
43	339	343	322	15.6	12.09
39	349	375	351	16.0	13.23
40	355	395	388	16.3	13.93
21	361	416	438	16.5	14.66
23	372	455	461	17.0	16.05
23	383	498	523	17.6	17.56
23	388	518	544	17.8	18.26
34	398	561	567	18.2	19.78
29	407	601	603	18.6	21.19
30	416	642	640	19.1	22.64
27	425	686	717	19.5	24.19
27	434	732	748	19.8	25.82
30	445	790	777	20.2	27.86
41	452	828	857	20.5	29.20
29	462	886	905	21.0	31.25

Relationship between the length and the weight of the northern pike (E. lucius) in Michigan
(continued)

Number of fish	Standard length in millimeters	Weight (in grams) Calculated	Weight (in grams) Empirical	Total length in inches	Weight in ounces
25	467	916	962	21.2	32.30
24	477	977	977	21.7	34.46
24	490	1,061	1,049	22.2	37.42
23	496	1,102	1,095	22.6	38.86
16	507	1,178	1,171	23.1	41.54
15	516	1,243	1,260	23.4	43.73
17	523	1,296	1,267	23.7	45.71
14	532	1,365	1,346	24.1	48.15
12	539	1,422	1,391	24.4	50.15
13	548	1,496	1,506	24.9	52.77
12	560	1,598	1,574	25.4	56.36
7	572	1,705	1,523	25.9	60.14
8	576	1,742	1,655	26.1	61.44
6	579	1,770	1,817	26.3	62.43
5	591	1,886	1,839	26.9	66.52
7	601	1,985	1,963	27.3	70.01
5	614	2,120	2,220	27.6	74.77
4	616	2,141	2,131	28.0	75.50
5	633	2,327	2,305	28.7	82.07
3	637	2,372	2,334	29.3	83.66
3	648	2,502	2,575	29.8	88.24
3	658	2,620	2,235	30.3	92.40
4	666	2,720	2,559	30.6	95.94
3	679	2,886	2,614	31.2	101.83
5	684	2,952	2,681	31.5	104.12
5	710	3,310	3,337	31.9	116.75
1	726	3,542	3,969	32.6	124.93
2	728	3,572	3,827	32.7	127.00
3	760	4,076	3,903	34.0	143.77
1	770	4,244	4,253	34.6	149.60
3	775	4,329	4,282	34.8	152.70
1	807	4,902	4,763	36.2	172.92
1	838	5,500	6,322	37.6	194.01
1	851	5,765	6,524	38.3	203.35
2	897	6,777	6,746	40.3	239.05

Except for the bluegill, the age and size data should be considered as tentative. Not all the available scale samples have been examined and ages determined, and when this task is done, the tables should be revised. The bluegill data which were based on nearly 5,000 specimens should be reasonably accurate. However, parts of it, too, might be revised on the addition of specimens.

The growth-data cards from which this material was summarized are filed in file box number 1. No additional cards will be added to this box until some future date when the data will be brought up to date. As the data is accumulated, it is to be filed in a new file box (number 2 box).

Age of fish upon reaching legal size

(tentative)

Species	Legal length	Age	
		Number of Annuli	Summer of life
Bluegill	6 inches	III	4th
Pumpkinseed	6 inches	III	4th
Rock bass	6 inches	IV	5th
Black crappie	6 inches	II	3rd
Yellow perch	6 inches	II	3rd
Largemouth black bass	10 inches	II	3rd
Smallmouth black bass	10 inches	II	3rd
Northern pike	14 inches	I	2nd
Walleyed pike	14 inches	II	3rd

Size at various ages for some Michigan game fishes

(Tentative)

AGE-GROUP (Roman numerals) / YEAR OF LIFE (Arabic numerals)	Bluegill			Pumpkinseed		
	Standard length in millimeters	Total length in inches	Number of fish	Standard length in millimeters	Total length in inches	Number of fish
0						
1	34	1.7	15	38	1.9	18
I						
2	60	3.0	415	54	2.7	108
II						
3	85	4.3	697	89	4.4	163
III						
4	113	5.6	1,320	118	5.8	147
IV						
5	135	6.7	1,256	131	6.4	89
V						
6	149	7.4	874	139	6.8	65
VI						
7	157	7.8	593	146	7.1	28
VII						
8	159	7.9	251	159	7.8	18
VIII						
9	169	8.3	186			
IX						
10	173	8.5	43			

Size at various ages for some Michigan game fishes

(Tentative)

AGE-GROUP (Roman numerals) / YEAR OF LIFE (Arabic numerals)	Rock bass			Black crappie		
	Standard length in millimeters	Total length in inches	Number of fish	Standard length in millimeters	Total length in inches	Number of fish
0						
1	32	1.6	12	...	...	...
I						
2	65	3.2	92	106	5.3	24
II						
3	86	4.3	181	119	5.9	101
III						
4	98	4.9	182	175	8.7	105
IV						
5	112	5.6	199	185	9.2	76
V						
6	134	6.6	116	195	9.7	42
VI						
7	170	8.3	73	203	10.1	38
VII						
8	177	8.7	57	215	10.7	15
VIII						
9	196	9.6	74			
IX						
10	210	10.3	17			
X						
11	220	10.8	12			

Size at various ages for some Michigan game fishes

(Tentative)

AGE-GROUP (Roman numerals)	Yellow perch		
YEAR OF LIFE (Arabic numerals	Standard length in millimeters	Total length in inches	Number of fish
0			
1	61	2.9	45
I			
2	101	4.7	138
II			
3	133	6.2	332
III			
4	153	7.1	423
IV			
5	167	7.8	335
V			
6	203	9.4	215
VI			
7	220	10.2	122
VII			
8	225	10.4	60
VIII			
9	245	11.3	38
IX			
10	255	11.8	21

Size at various ages for some Michigan game fishes

(Tentative)

AGE-GROUP (Roman numerals) / YEAR OF LIFE (Arabic numerals)	Largemouth black bass			Smallmouth black bass		
	Standard length in millimeters	Total length in inches	Number of fish	Standard length in millimeters	Total length in inches	Number of fish
0						
1	76	3.6	142	79	3.7	26
I						
2	115	5.5	86	126	6.0	22
II						
3	174	8.4	95	181	8.8	49
III						
4	226	10.8	186	224	10.7	48
IV						
5	253	12.1	128	278	13.3	62
V						
6	280	13.3	107	287	13.8	44
VI						
7	302	14.4	32	316	15.2	23
VII						
8	366	16.8	11			

Sex ratio has been determined for the species from the material on which age determinations have been made. Age determinations have not been made on all the material in the files, and when sufficient additional data are available, these tables should be revised.

Sex ratio at the various ages for the bluegill in Michigan

Age-group	Number		Ratio (Number of females per 100 males)	Percentage of males
	Males	Females		
0	3	1	33	75
I	109	111	102	50
II	119	157	132	32
III	489	364	74	57
IV	420	437	104	49
V	262	348	133	43
VI	143	251	176	36
VII	60	100	166	37
VIII	18	43	238	30
IX	2	11	550	15
X	...	2	F	0
Combined	1,625	1,825	112	47

Sex ratio at the various ages for the pumpkinseed in Michigan

Age-group	Number		Ratio (Number of females per 100 males)	Percentage of males
	Males	Females		
0	10	2	20	83
I	30	29	96	51
II	78	46	59	63
III	83	19	23	81
IV	43	38	88	53
V	30	32	106	48
VI	19	7	37	73
VII	9	9	100	50
VIII	3	0	M	100
Combined	305	182	60	63

Sex ratio at the various ages for the rock bass in Michigan

Age-group	Number		Ratio (Number of females per 100 males)	Percentage of males
	Males	Females		
0	...	...	...	...
I	35	39	111	47
II	65	45	69	59
III	73	80	110	48
IV	80	98	123	45
V	36	72	200	33
VI	35	35	100	50
VII	30	26	87	54
VIII	45	29	64	61
IX	10	7	70	59
X	8	4	50	67
XI	...	...	...	...
XII	1	0	M	100
Combined	418	435	104	49

Sex ratio at the various ages for the black crappie in Michigan

Age-group	Number		Ratio (Number of females per 100 males)	Percentage of males
	Males	Females		
0	...	...	...	...
I	1	1	100	50
II	49	39	79	56
III	37	35	95	51
IV	42	26	62	62
V	17	22	129	44
VI	12	23	192	34
VII	6	9	150	40
VIII	...	2	F	0
IX	1	1	100	50
Combined	165	158	96	51

Sex ratio at the various ages for the perch in Michigan

Age-group	Number		Ratio (Number of females per 100 males)	Percentage of males
	Males	Females		
0	1	3	300	25
I	44	55	125	44
II	110	145	131	43
III	113	217	192	34
IV	103	181	175	36
V	54	146	270	27
VI	44	70	159	38
VII	14	41	293	25
VIII	8	26	325	23
IX	0	20	F	0
X	0	6	F	0
XI	0	2	F	0
XII	0	2	F	0
XIII	0	1	F	0
Combined	491	915	186	35

Sex ratio at the various ages for the largemouth black bass in Michigan

Age-group	Number		Ratio (Number of females per 100 males)	Percentage of males
	Males	Females		
0	...	...	...	...
I	22	15	68	59
II	39	27	69	59
III	68	64	94	52
IV	38	60	158	38
V	39	46	118	46
VI	14	11	79	56
VII	3	3	100	50
VIII	1	1	100	50
IX	...	...	...	...
X	0	1	F	0
XI	...	...	...	...
XII	1	0	M	100
Combined	225	228	101	50

Sex ratio at the various ages for the smallmouth black bass in Michigan

Age-group	Number		Ratio (Number of females per 100 males)	Percentage of males
	Males	Females		
0	2	3	150	40
I	8	4	50	67
II	24	13	54	65
III	23	19	83	55
IV	32	27	84	54
V	15	24	160	38
VI	6	13	217	32
VII	2	3	150	40
VIII	1	2	200	33
IX	0	1	F	0
Combined	113	109	96	51

INSTITUTE FOR FISHERIES RESEARCH

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