Manual of Fisheries Survey Methods II: with periodic updates

Chapter 17: Length-Weight Relationships

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Chapter 17: Length-Weight Relationships

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The relationship between total length (L) and total weight (W) for nearly all species of fish is expressed by the equation:

$$W = aL^b$$

Values of W usually have been calculated from the logarithmic (base 10) equivalent:

$$\log W = \log a + b \cdot \log L$$

A graph of log W against log L forms a straight line with a slope of b and a Y-axis (log W) intercept of log a. Invariably, b is close to 3.0 for all species.[a]

The exact relationship between length and weight differs among species of fish according to their inherited body shape, and within a species according to the condition (robustness) of individual fish. Condition sometimes reflects food availability and growth within the weeks prior to sampling. But, condition is variable and dynamic. Individual fish within the same sample vary considerably, and the average condition of each population varies seasonally and yearly. Sex and gonad development are other important variables in some species, especially percids. Surprisingly, type of habitat – stream, inland lake, Great Lake – is not a reliable predictor of fish condition. Chapter 13 discusses traditional coefficients of condition which may be derived from length-weight data. A more direct approach is, for a given length, to calculate a weight from the regression and compare it to a reference weight such as a state average weight.

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Even for routine population surveys it is both practical and worthwhile to collect length-weight data on individual fish. Fish of all sizes can be accurately and easily weighed on portable electronic balances in a sheltered location. Number of fish sampled need not be high, 5-10 fish per inch group over a wide size range are enough to establish a regression line for each important species. Weight data for species which are scale-sampled can be conveniently recorded on the same envelopes. The resulting length-weight regressions are useful for (a) calculating total weight of fish caught from length-frequency data (thereby eliminating the need for bulk weighing of groups of fish while at the lake or stream), (b) measuring changes in robustness/health of this population (relative to past or future samples at the same place and season), (c) determining the relative condition of small fish compared to large fish (from the slope of the regression), and (d) comparing condition of this population to the state-wide standards discussed below.

State average length-weight relationships (analogous to state average growth rates) have been compiled for 16 species of fish. For two of these species, brook and brown trout, there is one set of regressions for stream dwellers and another set for lake dwellers (which tend to be significantly plumper at larger sizes). These data were obtained mainly from wild fish in inland lakes and streams, of both sexes, in all seasons. Included for each species were several to many populations and a variety of growth rates.

A recent compilation of data indicates Great Lakes fish populations are not consistently heavier at the same length than populations in inland waters and it is not practical to present separate regressions by habitat. Across all habitats, deviations from the accepted standards rarely exceeded 15%. Sources of

[a] In previous versions of this appendix, and in much fisheries literature, the regression constant is represented by "c" rather than "a", and the regression slope is represented by "n" rather than "b". Equations in the form of natural logarithms (base e) and power functions are commonly used instead of log10.

these data were publications, reports, and the Great Lakes Sport Fishing Survey (Rakoczy 1996). For example, for yellow perch the average length-weight regression based on seven Great Lakes samples was identical to that long-used as the State average (inland). Likewise, lake trout and rainbow trout (including stream residents and steelhead) seem to be adequately represented by single equations developed earlier. Brown trout in streams, inland lakes, and the Great Lakes seem to vary the most; consequently, both stream and lake equations are offered. Very large brown trout in the Great Lakes may exceed predictions derived from the lake equation by 20%. Smallmouth bass condition may also vary with habitat, but additional sampling is needed to confirm its consistency and importance. Fish in Lake Superior are often relatively thin, but do not warrant separate equations at this time.

For 61 other species (or species groups) for which no Michigan average has been determined, length-weight data or regressions were assembled from various sources. These will be the standard until more data are available. Preference was given to Michigan or Midwestern sources when possible. Sources included: (1) median values, or the best data, compiled in Carlander's Handbooks (1969 and 1977); (2) data or regressions in the original literature; and (3) unpublished data, kindly supplied by Peter Bayley (formerly Illinois National History Survey, Urbana), Mike Wiley (The University of Michigan, Ann Arbor), and Jerry Rakoczy (Michigan Department of Natural Resources, Charlevoix).

Table 17.1 lists the coefficients for the regression equations and sources of the data. For all but two fishes, splake and Atlantic salmon, the regressions cover the size range likely to be collected in routine fisheries surveys. The regressions may not be as accurate for relatively small fish (less than 2 inches) or for very large fish that tend to have high variability.

For example, to calculate weight in pounds of a 20-inch largemouth bass, the equation would be:

$$\begin{aligned} \log_{10} Lb &= -3.43162 + 3.12735 \cdot \log_{10}(20) \\ &= 0.63716 \\ Lb &= 4.34 \end{aligned}$$

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Tables 17.2-17.8 contain some commonly used lengths and weights calculated from these equations.

Tables 17.9-17.11 contain average lengths and weights typical of some hatchery-reared fish.

The length-weight relationships in these tables may be used for computing biomass estimates from length-frequency distributions when weight data specific to the time and site are not available. The FISH COLLECTION form provides columns for biomass, and if empirical weights were not taken during a survey, the standards may be used to calculate biomass estimates. Be sure to note on the form if the standards were used in lieu of empirical weights. A computerized version of the FISH COLLECTION form has been developed with these equations built in as defaults. It automatically calculates biomass estimates and performs other required computations.

State average length-weight regressions may also be used to evaluate the relative condition of populations. If a population has a length-weight curve which is below the average curve, then its fish are relatively skinny. Conversely, if a population's curve is above the average curve, then its fish are relatively plump. The curves may cross, possibly indicating a change in condition caused by a change in diet as fish grow. For many species, a nationwide system of relative weight indices has been developed (Murphy et al. 1991). However, it advocates the use of the 75th percentile rather than the 50th percentile (the average) as a standard for condition.

Table 17.1.–Length-weight regression coefficients for Michigan fishes. Values for the intercept (a) are given in both English (E) and metric (M) systems; the value for the slope (b) is the same in both systems. English equations are in lb and in; metric equations are in g and mm. The standard equation is: $\log_{10}$ Weight = a + b·($\log_{10}$ Length).

Species[a]	slope (b)	Intercept (a)		Notes[b]
		E	M	
Alewife	3.06370	-3.64198	-5.28911	VA (Boaze and Lackey 1974)[c]
Bass, Largemouth	3.12735	-3.43162	-5.16885	
Smallmouth	3.02635	-3.31934	-4.91466	
Rock	3.05438	-3.17738	-4.81208	
White	3.0342	-3.41794	-5.0233	IL (Bayley and Austen 1987)[c]
Bloater	3.1110	-3.71552	-5.429045	L. MI (Carlander 1969)[d]
Bluegill	3.17266	-3.30288	-5.10377	
Bowfin	2.96004	-3.39775	-4.89906	MI+(Carlander 1969)[e]
Bullhead, all	2.88495	-3.20930	-4.60512	Brown, yellow, black (Carlander 1969)[d]
Buffalo, Bigmouth & all	3.09298	-3.36229	-5.05036	(Carlander 1969)[d]
Burbot	3.03888	-3.60272	-5.21478	(Carlander 1969)[d]
Carp, Common	2.83840	-3.11203	-4.44245	(Carlander 1969)[d]
Catfish, Channel	3.2764	-3.8665	-5.8116	IL (Bayley and Austen 1987)[c]
Flathead	3.16495	-3.60167	-5.39084	MI+(Carlander 1969)[d]
Chub, all				Use hornyhead
Creek	2.92494	-3.39611	-4.84812	(Carlander 1969)[d]
Hornyhead	3.170	-3.4740	-5.2702	IL (Bayley unpublished)[c]
River				Use hornyhead chub
Chubsucker, all	3.18937	-3.41781	-5.24128	Blueberry Lake + Carlander (1969)[d]
Cisco, all				Use lake herring
Crappie, Black	3.17980	-3.43238	-5.24330	
White	3.3835	-3.7282	-5.8236	IL (Bayley and Austen 1987)[c]
Dace, all				Use fathead minnow
Darter, all				Use blackside
Blackside	3.236	-3.6003	-5.4899	IL(Bayley unpublished)[c]
Johnny	3.198	-3.5686	-5.4040	IL (Bayley unpublished)[c]
Rainbow	3.403	-3.5391	-5.6619	IL (Bayley unpublished)[c]
Drum, Freshwater	3.1973	-3.6007	-5.4353	IL (Bayley and Austen 1987)[c]
Eel, American	3.47	-4.722	-6.94	(Carlander 1969)[d]
Gar, Longnose	3.5070	-4.7973	-7.067	MO (Carlander 1969)[c]
Shortnose	2.9811	-3.8730	-5.4039	SD (Carlander 1969)[d]
Herring, Lake	2.85755	-3.45588	-4.81321	(Carlander 1969; except tullibee)[d]
Killifish, all				Use topminnow
Lamprey, ammocete spp	2.65465	-4.09370	-5.16569	W. brook (Carlander 1969)[d]
Brook	2.8355	-4.0634	-5.3917	W. brook (Carlander 1969)[d]
Chestnut	3.21468	-4.38861	-6.23605	MI (Hall 1963)[c]
Sea	2.63133	-3.66299	-4.70251	Ocqueoc R. (Applegate 1950)[e]
Logperch				Use blackside darter
Madtom, all				Use tadpole madtom
Tadpole	3.102	-3.3401	-5.0396	IL (Bayley unpublished)[c]
Minnow, all				Use bluntnose
Bluntnose	3.390	-3.6038	-5.7089	IL (Bayley unpublished)[c]
Fathead	3.07650	-3.36851	-5.03343	(Carlander 1969)[e]
Mooneye	3.12105	-3.6165	-5.3459	L. Erie (Carlander 1969)[d]
Mudminnow				Use creek chub
Musky, Northern	3.44346	-4.25593	-6.43636	MI+WI (Hanson 1986)[d]
Tiger	3.07273	-3.82649	-5.48612	Limited sites
Perch, Pirate	3.102	-3.2306	-4.9310	IL (Bayley unpublished)[c]
White	3.21747	-3.51718	-5.38013	NE (Thoits 1958 and Reid 1972)[e]
Yellow	3.17285	-3.53359	-5.33475	
Pickerel, Grass	3.00982	-3.72313	-5.29438	WI (Kleinert and Mraz 1966; pooled)
Pike, Northern	3.14178	-3.85333	-5.61083	

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Table 17.1.–Continued.

Species[f]	slope (b)	Intercept (a) E	Intercept (a) M	Notes[g]
Pumpkinseed	3.21060	-3.25719	-5.11138	
Quillback	3.09633	-3.46781	-5.16059	(Carlander 1969)[d]
Redhorse, all				Use golden
Golden	2.908	-3.3410	-4.7690	(Bayley unpublished)[c]
Shorthead	2.94414	-3.33201	-4.81098	(Carlander 1969)[d]
Silver	2.778	-3.2034	-4.4489	IL (Bayley unpublished)[c]
Salmon, Atlantic	2.78090	-3.22020	-4.47028	To 25" (Dexter 1991)[c]
Chinook	3.113913	-3.594065	-5.31348	L. MI 1983-93 (Wesley 1996)[c]
Coho	3.42700	-4.01200	-6.16900	G. L. 1992-94 (Rakoczy)[e]
Pink	2.877	-3.344	-4.737	MI (Wagner 1985)[c]
Sculpin, all	3.25202	-3.38754	-5.29903	MI (Wiley unpublished)[c]
Shad, Gizzard	3.03707	-3.46799	-5.07752	(Carlander 1969)[d]
Shiner, all				Use spottail shiner
Common	3.320	-3.6055	-5.6124	Assume same as striped shiner
Emerald	2.730	-3.5320	-4.7100	IL (Bayley unpublished)[c]
Golden	3.08217	-3.57486	-5.24775	(Carlander 1969)[d]
Spottail	2.98913	-3.49145	-5.03363	MN (Smith and Kramer 1964)[c]
Striped	3.320	-3.6055	-5.6124	IL (Bayley unpublished)[c]
Smelt, Rainbow	2.96408	-3.63360	-5.12117	Lake Superior (Bailey 1964)[e]
Stonecat	2.862	-3.3759	-4.7390	IL (Bayley unpublished)[c]
Stoneroller				Use horneyhead chub
Sturgeon, Lake	3.13960	-3.86356	-5.61713	MI (Baker 1980)[c]
Sucker, all				Use white
Hog	3.16433	-3.57116	-5.35946	(Carlander 1969)[e]
Longnose	3.05946	-3.41194	-5.05295	(Carlander 1969)[d]
Spotted				Use golden redhorse
White	3.00004	-3.40672	-4.96508	
Sunfish, all				Use longear
Green	3.1644	-3.2813	-5.0697	IL (Bayley and Austen 1987)[c]
Longear	3.16	-3.26	-5.04	IL (Lewis and Elder 1952)[c]
Redear	3.33276	-3.43879	-5.46370	(Carlander 1977)[d]
Topminnow, Blackstripe	3.326	-3.5513	-5.5659	IL (Bayley unpublished)[c]
Trout, Brook (lakes)	3.14041	-3.57650	-5.33120	
(streams)	2.98634	-3.43599	-4.97427	
Brown (lakes)	3.00809	-3.37430	-4.94311	
(streams)	3.01000	-3.46113	-5.03265	
Lake	3.17882	-3.71034	-5.51900	
Rainbow (all)	3.05253	-3.51688	-5.14777	
Splake	3.37517	-3.91829	-6.00279	to 21". Higgins L. + WI (Brynildson & Kempinger 1970)[e]
Trout-perch				Use white sucker
Walleye	3.03606	-3.53280	-5.14176	
Warmouth	3.20625	-3.27670	-5.12390	MI (Schneider unpublished)[e]
Whitefish, Lake	3.29176	-3.82670	-5.79403	Carlander 1969)[d]
Round	3.18825	-3.76016	-5.58208	(Carlander 1969)[e]

[a] Under the species heading, the lines ending in "all" (e.g., Bullhead, all) are to be used for either: fish not identified to species, any species not listed separately, or each species in the group.
[b] Restrictions because of size range or source are noted. Otherwise, regression is based on an average of several to many Michigan populations.
[c] A regression equation from the source was used to calculate English and metric equivalents.
[d] Regressions were fit to the means, mean of means, or medians provided by Carlander (1969; 1977).
[e] Regressions were fit to raw or pooled data provided by the source.
[f] Under the species heading, the lines ending in "all" (e.g., Bullhead, all) are to be used for either: fish not identified to species, any species not listed separately, or each species in the group.
[g] Restrictions because of size range or source are noted. Otherwise, regression is based on an average of several to many Michigan populations.

Table 17.2.–Length-weight relationships (inches-pounds) for wild panfish.

Length (inches)	Bluegill	Pumpkin-seed	Redear sunfish	Warmouth	Green sunfish	Longear sunfish	Rainbow smelt
1.5	.0018	.0020	.0014	.0019	.0019	.0020	.0008
2.5	.0091	.0105	.0077	.0100	.0095	.0099	.0035
3.5	.0265	.0309	.0237	.0294	.0276	.0288	.0095
4.5	.0588	.0692	.0547	.0657	.0611	.0637	.0201
5.5	.1112	.1318	.1068	.1251	.1152	.1201	.0364
6.5	.189	.225	.186	.214	.195	.204	.060
7.5	.297	.357	.300	.338	.301	.320	.091
8.5	.442	.533	.456	.505	.457	.475	.132
9.5	.630	.762	.660	.721	.650	.676	.184
10.5	.865	1.051	.922	.994	.892	.927	.247
11.5	1.15	1.41	1.25	1.33	1.19	1.24	.32
12.5	1.50	1.84	1.65	1.74	1.54	1.61	.41

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Table 17.2.–Continued

Length	Perch		Rock	Crappie		White	Bull-
(inches)	Yellow	White	bass	Black	White	bass	head[a]
1.5	.0011	.0011	.0023	.0013	.0007	.0013	.0020
2.5	.0054	.0058	.0109	.0068	.0042	.0062	.0087
3.5	.0156	.0171	.0305	.0198	.0130	.0171	.0229
4.5	.0346	.0384	.0657	.0441	.0303	.0366	.0473
5.5	.0654	.0733	.1213	.0835	.0598	.0674	.0845
6.5	.111	.125	.202	.142	.105	.112	.137
7.5	.175	.199	.313	.224	.171	.173	.207
8.5	.260	.297	.459	.333	.261	.252	.297
9.5	.370	.425	.644	.475	.380	.354	.409
10.5	.509	.587	.874	.653	.533	.479	.545
11.5	.68	.79	1.15	.87	.73	.63	.71
12.5	.88	1.03	1.49	1.14	.96	.81	.90
13.5	1.13	1.32	1.88	1.45	1.25	1.03	1.13
14.5	1.42	1.66	2.34	1.82	1.59	1.28	1.38
15.5	1.75	2.05	2.87	2.25	1.99	1.56	1.68

[a] Weights for brown, yellow, and black bullheads are similar.

Table 17.3.–Length-weight relationships (inches-pounds) for large wild sport fish.

Length (inches)	Large-mouth Bass	Small-mouth Bass	Walleye	Northern pike	Muskel-lunge	Lake sturgeon	Channel Catfish	Flathead Catfish	Lake whitefish
1.5	.0013	.0016	.0010	.0005	.0002	.0005	.0005	.0009	.0006
2.5	.0065	.0077	.0047	.0025	.0013	.0024	.0027	.0045	.0030
3.5	.0186	.0212	.0132	.0072	.0041	.0070	.0082	.0132	.0092
4.5	.0409	.0454	.0282	.0158	.0098	.0154	.0188	.0292	.0211
5.5	.0765	.0834	.0519	.0297	.0197	.0289	.0362	.0551	.0408
6.5	.129	.138	.086	.050	.035	.049	.063	.094	.071
7.5	.202	.213	.133	.079	.057	.077	.100	.147	.113
8.5	.299	.311	.195	.117	.088	.113	.151	.219	.171
9.5	.423	.436	.273	.165	.129	.161	.217	.311	.246
10.5	.578	.590	.369	.226	.182	.220	.302	.427	.343
11.5	.77	.78	.49	.30	.25	.29	.41	.57	.46
12.5	1.00	1.00	.63	.39	.33	.38	.53	.74	.61
13.5	1.27	1.26	.79	.50	.43	.48	.69	.95	.78
14.5	1.59	1.57	.98	.62	.55	.61	.87	1.19	.99
15.5	1.95	1.92	1.21	.77	.70	.75	1.08	1.46	1.23
16.5	2.38	2.32	1.46	.94	.86	.91	1.33	1.78	1.52
17.5	2.86	2.77	1.74	1.13	1.06	1.09	1.61	2.15	1.84
18.5	3.40	3.28	2.06	1.34	1.28	1.30	1.93	2.56	2.21
19.5	4.01	3.84	2.42	1.58	1.54	1.54	2.29	3.03	2.63
20.5	4.68	4.47	2.82	1.85	1.82	1.80	2.70	3.55	3.10
21.5	5.44	5.17	3.26	2.15	2.15	2.09	3.16	4.13	3.63
22.5	6.27	5.93	3.74	2.48	2.51	2.41	3.66	4.76	4.21
23.5	7.18	6.76	4.26	2.85	2.92	2.76	4.22	5.47	4.86
24.5	8.18	7.67	4.84	3.24	3.37	3.15	4.84	6.24	5.57
25.5	9.27	8.66	5.46	3.68	3.87	3.57	5.52	7.08	6.36
26.5			6.14	4.15	4.42	4.03	6.26	8.00	7.22
27.5			6.87	4.66	5.02	4.52	7.07	8.99	8.15
28.5			7.66	5.22	5.67	5.06	7.95	10.07	9.17
29.5			8.50	5.81	6.39	5.64	8.90	11.23	10.27
30.5			9.41	6.46	7.16	6.26	9.92	12.48	11.46
31.5			10.4	7.1	8.0	6.9	11.0	13.8	
32.5			11.4	7.9	8.9	7.6	12.2	15.3	
33.5			12.5	8.7	9.9	8.4	13.5	16.8	
34.5			13.7	9.5	11.0	9.2	14.9	18.4	
35.5			14.9	10.4	12.1	10.1	16.3	20.2	
36.5				11.4	13.3	11.0	17.9	22.0	
37.5				12.4	14.6	12.0	19.5	24.0	
38.5				13.4	16.0	13.0	21.3	26.1	
39.5				14.5	17.5	14.1	23.2	28.3	

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Table 17.4.–Length-weight relationships (inches-pounds) for salmonids in streams and inland lakes.

Length (inches)	Stream trout[b]	Trout in lakes[a]				Atlantic salmon
		Lake	Splake	Brown	Brook	
1.5	.0012	.0007	.0005	.0014	.0009	.0019
2.5	.0056	.0036	.0027	.0066	.0047	.0077
3.5	.0150	.0105	.0083	.0183	.0136	.0196
4.5	.0320	.0232	.0193	.0390	.0298	.0395
5.5	.0590	.0440	.0381	.0712	.0560	.0690
6.5	.097	.075	.067	.118	.095	.163
7.5	.148	.118	.108	.181	.148	.231
8.5	.220	.175	.165	.264	.220	.315
9.5	.306	.250	.241	.369	.312	.417
10.5	.411	.343	.338	.498	.427	.417
11.5	.54	.46	.46	.66	.57	.54
12.5	.70	.60	.61	.84	.74	.68
13.5	.87	.76	.79	1.06	.94	.84
14.5	1.08	.96	1.00	1.32	1.18	1.02
15.5	1.33	1.18	1.26	1.61	1.45	1.23
16.5	1.60	1.44	1.55	1.94	1.77	1.46
17.5	1.90	1.74	1.89	2.32	2.12	1.72
18.5	2.26	2.08	2.28	2.74	2.53	2.01
19.5	2.64	2.46	2.73	3.21	2.98	2.33
20.5	3.08	2.88	3.23	3.73	3.49	2.68
21.5	3.54	3.35	3.79	4.30	4.05	3.06
22.5	4.05	3.87	4.42	4.93	4.68	3.47
23.5	4.63	4.45	5.12	5.62	5.36	3.91
24.5	5.25	5.08	5.89	6.37	6.11	4.39
25.5	5.92	5.76	6.75	7.19	6.93	4.91
26.5	6.65	6.51	7.68	8.07		5.47
27.5	7.44	7.33	8.70	9.02		6.06
28.5	8.28	8.21	9.82	10.05		6.69
29.5	9.18	9.16	11.03	11.14		7.37
30.5	10.15	10.19	12.34	12.32		8.08
31.5		11.3	13.8	13.6		8.8
32.5		12.5	15.3	14.9		9.6
33.5		13.7	16.9	16.3		10.5
34.5		15.1	18.7	17.8		11.4
35.5		16.5	20.6	19.5		12.3
36.5		18.0	22.6			13.3
37.5		19.6	24.8			14.4
38.5		21.4	27.1			15.4
39.5		23.2	29.5			16.6

[a] Rainbow trout in lakes are similar to stream trout.
[b] Brook, brown, and rainbow trout in streams are similar in weight.

Table 17.5.–Length-weight relationships (inches-pounds) for other large wild fish.

Length (inches)	Lake herring	Burbot	Bowfin	Common carp	Freshwater drum	Longnose gar
1.5	.0011	.0009	.0013	.0024	.0009	.0001
2.5	.0048	.0040	.0060	.0104	.0047	.0004
3.5	.0126	.0112	.0163	.0271	.0138	.0013
4.5	.0257	.0241	.0343	.0552	.0307	.0031
5.5	.0457	.0444	.0622	.0976	.0584	.0063
6.5	.073	.074	.102	.157	.100	.011
7.5	.111	.114	.156	.235	.157	.019
8.5	.158	.167	.226	.336	.235	.029
9.5	.218	.234	.314	.460	.335	.043
10.5	.290	.317	.422	.612	.462	.061
11.5	.38	.42	.55	.79	.62	.08
12.5	.48	.54	.71	1.00	.81	.11
13.5	.59	.68	.89	1.25	1.03	.15
14.5	.73	.84	1.10	1.53	1.30	.19
15.5	.88	1.03	1.34	1.85	1.60	.24
16.5	1.05	1.25	1.61	2.21	1.96	.30
17.5	1.24	1.50	1.91	2.61	2.36	.36
18.5	1.46	1.77	2.25	3.05	2.82	.44
19.5	1.70	2.08	2.64	3.54	3.34	.53
20.5	1.96	2.42	3.06	4.09	3.92	.64
21.5		2.80	3.52	4.68	4.56	.75
22.5		3.21	4.02	5.32	5.28	.88
23.5		3.66	4.58	6.02	6.06	1.03
24.5		4.16	5.18	6.78	6.93	1.19
25.5		4.69	5.83	7.59	7.88	1.37
26.5		5.28	6.53	8.47		1.56
27.5		5.91	7.29	9.41		1.78
28.5		6.58	8.10	10.41		2.02
29.5		7.31	8.97	11.48		2.28
30.5		8.09	9.90	12.62		2.56
31.5		8.9	10.9	13.8		2.9
32.5		9.8	12.0	15.1		3.2
33.5		10.8	13.1	16.5		3.6
34.5		11.8	14.3	17.9		3.9
35.5		12.8	15.5	19.4		4.4
36.5		14.0		21.0		4.8
37.5		15.2		22.7		5.3
38.5		16.4		24.4		5.8
39.5		17.7		26.3		6.3

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Table 17.6.–Length-weight relationships (inches-pounds) for suckers and redhorses.

Length (inches)	Sucker			Redhorse		
	White	Hog	Longnose	Shorthead	Golden	Silver
1.5	.0013	.0010	.0013	.0015	.0015	.0019
2.5	.0061	.0049	.0064	.0069	.0065	.0080
3.5	.0168	.0141	.0179	.0186	.0174	.0203
4.5	.0357	.0313	.0386	.0390	.0362	.0409
5.5	.0652	.0591	.0713	.0704	.0649	.0713
6.5	.108	.100	.119	.115	.105	.114
7.5	.165	.158	.184	.176	.160	.169
8.5	.241	.234	.270	.254	.230	.239
9.5	.336	.333	.380	.352	.318	.326
10.5	.454	.457	.516	.473	.425	.430
11.5	.60	.61	.68	.62	.55	.55
12.5	.77	.79	.88	.79	.71	.70
13.5	.96	1.01	1.11	.99	.88	.86
14.5	1.20	1.27	1.38	1.22	1.09	1.05
15.5	1.46	1.57	1.70	1.49	1.32	1.27
16.5	1.76	1.91	2.06	1.79	1.58	1.51
17.5	2.10	2.30	2.46	2.13	1.89	1.78
18.5	2.48	2.75	2.92	2.50	2.21	2.07
19.5	2.91	3.24	3.43	2.92	2.57	2.40
20.5	3.38	3.80	3.99	3.39	2.98	2.76
21.5	3.90		4.62	3.90	3.42	3.15
22.5	4.47		5.31	4.46	3.90	3.57
23.5	5.09		6.06	5.07	4.43	4.03
24.5	5.77		6.89	5.73	5.00	4.52
25.5	6.50		7.79	6.44	5.61	5.06

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Table 17.7.–Length-weight relationships (inches-pounds) for some non-sport fish.

Length (inches)	Gizzard shad	Alewife	Chubsucker spp.	Chub		Grass pickerel	Stonecat
				Creek	Hornyhead		
1.5	.0012	.0008	.0014	.0013	.0012	.0006	.0013
2.5	.0055	.0038	.0071	.0059	.0061	.0030	.0058
3.5	.0153	.0106	.0208	.0157	.0178	.0082	.0152
4.5	.0328	.0229	.0463	.0327	.0395	.0175	.0312
5.5	.0603	.0423	.0878	.0588	.0746	.0320	.0554
6.5	.100	.071	.150	.096	.127	.053	.089
7.5	.155	.109	.236	.146	.200	.081	.135
8.5	.226	.161	.352	.210	.297	.119	.192
9.5	.317	.226	.502	.291	.422	.166	.265
10.5	.430	.307	.690	.390	.580	.224	.352
11.5	.567	.405	.923	.509		.295	.457
12.5	.730	.523	1.204	.649		.379	.580
13.5	.922	.662	1.539	.813		.478	.723
14.5	1.146	.824	1.933	1.002		.592	.887
15.5	1.403	1.011	2.391	1.218		.724	1.074
16.5	1.70						
17.5	2.03						
18.5	2.40						
19.5	2.82						
20.5	3.28						

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Table 17.7.–Continued.

Length (inches)	Pirate perch	Tadpole madtom	Sculpin spp.	Blackside	Darter Johnny	Rainbow
1.5	.0021	.0016	.0015	.0049	.0010	.0011
2.5	.0101	.0078	.0081	.0145	.0051	.0065
3.5	.0286	.0223	.0241	.0326	.0148	.0205
4.5	.0625	.0485	.0545	.0624	.0331	.0483
5.5	.1164	.0905	.1047	.1072	.0630	.0956

Table 17.8.–Length-weight relationships (inches-pounds) for shiners and minnows.

Length (inches)	Shiner				Minnow		
	Golden	Spottail	Emerald	Common/ striped	Fathead	Bluntnose	Blackstripe topminnow
1.5	.0009	.0011	.0009	.0010	.0015	.0010	.0011
2.5	.0045	.0050	.0036	.0052	.0072	.0056	.0181
3.5	.0126	.0136	.0090	.0159	.0202	.0174	.0418
4.5	.0274	.0289	.0178	.0366	.0438	.0408	.0815
5.5	.0509	.0527	.0308	.0722	.0811	.0805	.1421
6.5	.085		.049	.124			
7.5	.133		.072	.199			
8.5	.195		.101	.302			
9.5	.275		.137	.437			
10.5	.374		.180	.609			
11.5	.495			.824			
12.5	.640			1.087			
13.5	.811			1.404			
14.5	1.011			1.779			
15.5	1.241			2.220			

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Table 17.9.–Length-weight relationships for hatchery-reared muskellunge, if pounds = 0.0001600 L^3.

Total length		Weight		Total length		Weight	
inches	mm	pounds	grams	inches	mm	pounds	grams
0.3	8	.0000043	0.00196	4.2	107	.0118	5.38
0.4	10	.0000102	0.00464	4.3	109	.0127	5.77
0.5	13	.0000200	0.00907	4.4	112	.0136	6.18
0.6	15	.0000346	0.0157	4.5	114	.0146	6.61
0.7	18	.0000549	0.0249	4.6	117	.0156	7.06
0.8	20	.0000819	0.0372	4.7	119	.0166	7.54
0.9	23	.000117	0.0529	4.8	122	.0177	8.03
1.0	25	.000160	0.0725	4.9	124	.0188	8.54
1.1	28	.000213	0.0966	5.0	127	.0200	9.07
1.2	30	.000276	0.0125	5.1	130	.0212	9.63
1.3	33	.000352	0.159	5.2	132	.0225	10.2
1.4	36	.000439	0.199	5.3	135	.0238	10.8
1.5	38	.000540	0.245	5.4	137	.0252	11.4
1.6	41	.000655	0.297	5.5	140	.0266	12.1
1.7	43	.000786	0.357	5.6	142	.0281	12.6
1.8	46	.000933	0.423	5.7	145	.0296	13.4
1.9	48	.00110	0.498	5.8	147	.0312	14.2
2.0	51	.00128	0.581	5.9	150	.0329	14.9
2.1	53	.00148	0.672	6.0	152	.0346	15.7
2.2	56	.00170	0.773	6.1	155	.0363	16.5
2.3	58	.00195	0.883	6.2	158	.0381	17.3
2.4	61	.00221	1.00	6.3	160	.0400	18.2
2.5	64	.00250	1.13	6.4	163	.0419	19.0
2.6	66	.00281	1.28	6.5	165	.0439	19.9
2.7	69	.00315	1.43	6.6	168	.0460	20.9
2.8	71	.00351	1.59	6.7	170	.0481	21.8
2.9	74	.00390	1.77	6.8	173	.0503	22.8
3.0	76	.00432	1.96	6.9	175	.0525	23.8
3.1	79	.00477	2.16	7.0	178	.0549	24.9
3.2	81	.00524	2.38	7.1	180	.0573	26.0
3.3	84	.00575	2.61	7.2	183	.0597	27.1
3.4	86	.00629	2.85	7.3	185	.0622	28.2
3.5	89	.00686	3.11	7.4	188	.0648	29.4
3.6	91	.00746	3.39	7.5	190	.0675	30.6
3.7	94	.00810	3.68	7.6	193	.0702	31.9
3.8	96	.00878	3.98	7.7	196	.0730	33.1
3.9	99	.00949	4.31	7.8	198	.0759	34.4
4.0	102	.0102	4.64	7.9	201	.0789	35.8
4.1	104	.0110	5.00	8.0	203	.0819	37.2

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Table 17.10.–Length-weight relationships for hatchery-reared walleye, if pounds = 0.000300 L^3.

Total length		Weight		Total length		Weight	
inches	mm	pounds	grams	inches	mm	pounds	grams
0.3	8	.0000081	0.00367	4.2	107	.02223	10.1
0.4	10	.0000192	0.00871	4.3	109	.02385	10.8
0.5	13	.0000375	0.0170	4.4	112	.02556	11.6
0.6	15	.000065	0.0294	4.5	114	.02734	12.4
0.7	18	.000103	0.0467	4.6	117	.02920	13.2
0.8	20	.000154	0.0697	4.7	119	.03115	14.1
0.9	23	.000219	0.0992	4.8	122	.03318	15.0
1.0	25	.000300	0.136	4.9	124	.03529	16.0
1.1	28	.000399	0.181	5.0	127	.03750	17.0
1.2	30	.000518	0.235	5.1	130	.03980	18.0
1.3	33	.000659	0.299	5.2	132	.04218	19.1
1.4	36	.000823	0.373	5.3	135	.04466	20.3
1.5	38	.001013	0.459	5.4	137	.04724	21.4
1.6	41	.001229	0.557	5.5	140	.04991	22.6
1.7	43	.001474	0.669	5.6	142	.05268	23.9
1.8	46	.001750	0.794	5.7	145	.05556	25.2
1.9	48	.002058	0.933	5.8	147	.05853	26.6
2.0	51	.002400	1.09	5.9	150	.06161	28.0
2.1	53	.002778	1.26	6.0	152	.06480	29.4
2.2	56	.003194	1.45	6.1	155	.06809	30.9
2.3	58	.003650	1.66	6.2	158	.07150	32.4
2.4	61	.004147	1.88	6.3	160	.07501	34.0
2.5	64	.004687	2.13	6.4	163	.07864	35.7
2.6	66	.005273	2.39	6.5	165	.08239	37.4
2.7	69	.005905	2.68	6.6	168	.08625	39.1
2.8	71	.006586	2.99	6.7	170	.09023	40.9
2.9	74	.007317	3.32	6.8	173	.09433	42.8
3.0	76	.008100	3.67	6.9	175	.09855	44.7
3.1	79	.008937	4.05	7.0	178	.10290	46.7
3.2	81	.009830	4.46	7.1	180	.10737	48.7
3.3	84	.01078	4.89	7.2	183	.1120	50.8
3.4	86	.01179	5.35	7.3	185	.1167	52.9
3.5	89	.01286	5.83	7.4	188	.1216	55.1
3.6	91	.01400	6.35	7.5	190	.1266	57.4
3.7	94	.01520	6.89	7.6	193	.1317	59.7
3.8	96	.01646	7.47	7.7	196	.1370	62.1
3.9	99	.01780	8.07	7.8	198	.1424	64.6
4.0	102	.01920	8.71	7.9	201	.1479	67.1
4.1	104	.02068	9.38	8.0	203	.1536	69.7

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Table 17.11.–Length-weight relationships for hatchery-reared brook, brown, and rainbow trout.

Length (inches)	Weight (pounds)	Length (inches)	Weight (pounds)	Length (inches)	Weight (pounds)
1.0	.0004	5.3	.0565	9.6	.352
1.1	.0006	5.4	.0600	9.7	.364
1.2	.0007	5.5	.0645	9.8	.376
1.3	.0009	5.6	.0685	9.9	.388
1.4	.0011	5.7	.0730	10.0	.399
1.5	.0013	5.8	.0775	10.1	.410
1.6	.0015	5.9	.0835	10.2	.422
1.7	.0018	6.0	.0900	10.3	.435
1.8	.0021	6.1	.0950	10.4	.447
1.9	.0025	6.2	.1000	10.5	.461
2.0	.0029	6.3	.105	10.6	.475
2.1	.0033	6.4	.110	10.7	.489
2.2	.0037	6.5	.115	10.8	.503
2.3	.0042	6.6	.120	10.9	.518
2.4	.0046	6.7	.126	11.0	.532
2.5	.0050	6.8	.132	11.1	.545
2.6	.0058	6.9	.138	11.2	.560
2.7	.0069	7.0	.144	11.3	.575
2.8	.0080	7.1	.151	11.4	.590
2.9	.0095	7.2	.158	11.5	.605
3.0	.0109	7.3	.165	11.6	.621
3.1	.0122	7.4	.172	11.7	.639
3.2	.0138	7.5	.179	11.8	.655
3.3	.0152	7.6	.186	11.9	.672
3.4	.0165	7.7	.193	12.0	.690
3.5	.0180	7.8	.199	12.1	.706
3.6	.0195	7.9	.205	12.2	.723
3.7	.0210	8.0	.211	12.3	.740
3.8	.0225	8.1	.219	12.4	.758
3.9	.0245	8.2	.227	12.5	.777
4.0	.0265	8.3	.235	12.6	.798
4.1	.0287	8.4	.244	12.7	.819
4.2	.0308	8.5	.251	12.8	.839
4.3	.0329	8.6	.259	12.9	.860
4.4	.0350	8.7	.267	13.0	.880
4.5	.0370	8.8	.274	13.1	.904
4.6	.0390	8.9	.282	13.2	.928
4.7	.0410	9.0	.290	13.3	.952
4.8	.0434	9.1	.300	13.4	.975
4.9	.0459	9.2	.310	13.5	1.00
5.0	.0482	9.3	.320	13.6	1.02
5.1	.0509	9.4	.330	13.7	1.05
5.2	.0535	9.5	.340	13.8	1.07

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