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Short communication

Length–weight relationships of fishes from South African estuaries

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Summary

Length–weight relationships are presented for some 83 fish species representing 31 families captured in South African estuaries.

Introduction

Fish length–weight relationships, which describe mathematically the correlation between fish length and weight, are useful for converting length observations into weight estimates to provide some measure of biomass (Froese 1998). In fish studies, the length of a fish is often more rapidly and easily measured than is its mass; it is therefore convenient to be able to determine mass where only the length is known. This paper describes the length–weight relationship of 83 fish species captured in South African estuaries.

Materials and methods

The ichthyofauna of approximately 250 South African estuaries were sampled from 1993 to 1999 using a 30-m × 1.7 m × 15 mm bar mesh beach seine net fitted with a 5-mm bar mesh purse and, where possible, a fleet of monofilament gill nets with a range of mesh sizes (45 mm, 75 mm and 100 mm stretch mesh). Specimens collected by seine netting were preserved in 10% formalin for transport to the laboratory where they were identified, measured to the nearest mm standard length (SL) using a measuring board, and weighed to the nearest 0.01 g using a Mettler PJ 3000 balance (Mettler-Toledo, Switzerland). Specimens collected by gill net were, where possible, identified in the field, measured to the nearest mm SL and weighed to the nearest 1.0 g using a Bonso model 323 balance (Bonso Electronics Intl, Hong Kong).

The length–weight relationships of all species collected were determined by the expression $w = al^b$, where w is the derived weight (g), l is the standard length (mm), a is the intercept of the regression curve and b the regression coefficient (Tesch 1971). The parameters a (intercept) and b (slope) are most easily estimated by linear regression based on logarithms: $\log(w) = \log(a) + b \log(l)$ (Cone 1989). The length and weight measurements of fishes collected from sampled estuaries on the South African coast were combined and the regressions for each species calculated by the method of least squares.

Results and Discussion

The length–weight relationships of 83 species, representing 31 families, are summarized in Table 1. The species, sample size (n), size range (mm SL), length–weight parameters (a; b), and the correlation coefficient (r^2) are given. The exponent (b) often

Table 1
Length–weight relationships of fishes captured in South African estuaries. Species in bold are also represented in FishBase 99 (Froese and Pauly 1999)

Family	Species	n	Size (mm SL) Min	Max	a	b	r^2
Ambassidae	*Ambassis gymnocephalus*	96	19	56	2.613×10^{-5}	2.987	0.979
	Ambassis natalensis	99	12	72	2.837×10^{-5}	2.964	0.984
	Ambassis productus	82	27	154	2.771×10^{-5}	3.003	0.991
Ariidae	***Galeichthys feliceps****	251	43	340	1.984×10^{-5}	3.003	0.980
Atherinidae	*Atherina breviceps*	766	16	74	7.268×10^{-6}	3.135	0.987
Bothidae	***Pseudorhombus arsius****	10	21	138	1.047×10^{-5}	3.132	0.995
Carangidae	***Caranx ignobilis****	161	29	400	2.962×10^{-5}	2.978	0.994
	Caranx papuensis	7	113	265	8.822×10^{-5}	2.738	0.958
	Caranx sexfasciatus	183	28	310	2.624×10^{-5}	3.005	0.997
	Lichia amia*	133	41	630	3.180×10^{-5}	2.894	0.973
	Scomberoides lysan	68	22	322	5.787×10^{-5}	2.685	0.986
Chanidae	***Chanos chanos****	5	193	268	1.927×10^{-5}	3.024	0.988
Cichlidae	***Oreochromis mossambicus****	797	12	300	3.106×10^{-5}	3.029	0.992
	Tilapia rendalli	14	36	150	2.581×10^{-5}	3.096	0.994
Clariidae	***Clarias gariepinus****	117	206	648	1.689×10^{-5}	2.945	0.966
Clinidae	*Clinus superciliosus*	216	20	135	1.714×10^{-5}	3.036	0.963
Clupeidae	*Gilchristella aestuaria*	994	18	67	6.096×10^{-6}	3.182	0.971
	Hilsa kelee	127	20	290	6.098×10^{-6}	3.248	0.998
	Sardinops sagax	28	23	208	4.137×10^{-6}	3.230	0.984
Elopidae	***Elops machnata***	281	24	800	2.286×10^{-6}	3.224	0.987

Table 1 *continued*.

Family	Species	*n*	Size (mm SL) Min	Max	a	b	r^2
Engraulidae	***Engraulis japonicus***	8	20	46	8.156×10^{-7}	3.680	0.968
	Stolephorus holodon	62	19	79	4.196×10^{-6}	3.275	0.986
	Thryssa setirostris	6	25	36	1.021×10^{-6}	3.637	0.921
	Thryssa vitrirostris*	93	27	209	5.105×10^{-6}	3.189	0.997
Gerreidae	*Gerres acinaces*	14	28	120	1.160×10^{-5}	3.196	0.994
	Gerres methueni	80	14	240	2.858×10^{-5}	3.032	0.965
Gobiidae	*Awaous aeneofuscus*	6	42	73	1.308×10^{-5}	3.100	0.983
	Caffrogobius gilchristi	829	16	115	1.149×10^{-5}	3.177	0.972
	Caffrogobius natalensis	125	13	82	1.238×10^{-5}	3.157	0.976
	Caffrogobius nudiceps	210	18	86	8.531×10^{-6}	3.240	0.967
	Glossogobius biocellatus	6	38	69	4.090×10^{-6}	3.367	0.996
	Glossogobius callidus	306	14	85	1.344×10^{-5}	3.045	0.980
	Glossogobius giuris	43	23	119	1.158×10^{-5}	3.068	0.980
	Oligolepis acutipennis	79	16	56	1.617×10^{-5}	3.054	0.971
	Oligolepis keiensis	92	16	47	1.780×10^{-5}	2.970	0.953
	Oxyurichthys opthalmonema	41	37	79	8.536×10^{-6}	3.128	0.948
	Papillogobius reichei	7	20	45	1.004×10^{-5}	3.180	0.990
	Psammogobius knysnaensis	1057	12	64	1.224×10^{-5}	3.116	0.962
	Silhouettea sibayi	20	14	23	7.262×10^{-6}	3.312	0.956
Haemulidae	***Pomadasys commersonnii***	917	14	640	2.090×10^{-5}	3.001	0.997
	Pomadasys kaakan	39	26	174	1.307×10^{-5}	3.156	0.996
	Pomadasys multimaculatum	6	90	372	4.540×10^{-5}	2.876	0.992
	Pomadasys olivaceum	73	18	82	7.785×10^{-6}	3.267	0.988
Hemiramphidae	***Hemiramphus far***	11	87	172	1.327×10^{-7}	3.576	0.987
Leiognathidae	***Leiognathus equula****	57	12	170	3.515×10^{-5}	3.007	0.996
Lutjanidae	***Lutjanus argentimaculatus****	8	79	540	6.893×10^{-5}	2.823	0.994
	Lutjanus fulviflamma	4	16	61	4.222×10^{-5}	2.938	0.989
Megalopidae	***Megalops cyprinoids****	43	160	478	1.432×10^{-5}	3.052	0.995
Monodactylidae	***Monodactylus argenteus***	5	56	104	4.499×10^{-5}	3.000	0.983
	Monodactylus falciformis	508	10	160	4.315×10^{-5}	2.978	0.992
Mugilidae	*Liza alata*	232	151	572	4.581×10^{-5}	2.852	0.979
	Liza dumerilii	437	30	292	3.727×10^{-5}	2.858	0.994
	Liza macrolepis	399	31	322	2.860×10^{-5}	2.951	0.996
	Liza melinoptera	5	43	202	4.584×10^{-5}	2.892	0.999
	Liza richardsonii	2039	24	256	2.086×10^{-5}	2.976	0.996
	Liza tricuspidens	706	24	495	2.419×10^{-5}	2.943	0.996
	Mugil cephalus*	1779	18	520	2.446×10^{-5}	2.979	0.998
	Myxus capensis	938	16	405	1.554×10^{-5}	3.039	0.998
	Valamugil buchanani	140	48	470	4.565×10^{-5}	2.868	0.995
	Valamugil cunnesius	362	32	255	2.018×10^{-5}	3.023	0.995
	Valamugil robustus	159	30	362	2.660×10^{-5}	2.961	0.997
	Valamugil seheli	77	35	109	3.126×10^{-5}	2.930	0.987
Platycephalidae	***Platycephalus indicus****	27	28	450	1.144×10^{-5}	2.950	0.992
Pomatomidae	***Pomatomus saltatrix***	85	26	412	1.105×10^{-5}	3.087	0.998
Sciaenidae	***Argyrosomus japonicus***	680	14	720	2.823×10^{-5}	2.907	0.993
	Johnius dorsalis	13	25	220	2.385×10^{-5}	3.004	0.999
Sillaginidae	***Sillago sihama****	15	30	131	1.075×10^{-5}	3.029	0.995
Soleidae	*Heteromycteris capensis*	264	16	84	7.849×10^{-6}	3.102	0.976
	Solea bleekeri	409	14	105	1.242×10^{-5}	3.086	0.979
Sparidae	***Acanthopagrus berda***	92	21	255	3.325×10^{-5}	3.012	0.998
	Diplodus cervinus hottentotus*	16	16	66	2.125×10^{-5}	3.113	0.992
	Diplodus sargus capensis*	369	11	220	2.288×10^{-5}	3.081	0.993
	Lithognathus lithognathus	647	13	465	2.273×10^{-5}	3.011	0.996
	Rhabdosargus globiceps	201	15	77	1.293×10^{-5}	3.177	0.992
	Rhabdosargus holubi	1335	11	240	2.226×10^{-5}	3.087	0.993
	Rhabdosargus sarba	45	17	360	2.281×10^{-5}	3.085	0.998
	Sarpa salpa	238	19	268	1.204×10^{-5}	3.175	0.994
Sphyraenidae	***Sphyraena jello****	12	76	455	1.417×10^{-5}	2.884	0.998
Syngnathidae	***Syngnathus acus***	133	46	216	3.244×10^{-7}	3.074	0.961
Teraponidae	***Terapon jarbua****	70	10	148	3.889×10^{-5}	2.939	0.995
Tetraodontidae	*Amblyrhynchotes honckenii*	70	26	176	5.324×10^{-5}	2.970	0.984
	Arothron immaculatus	7	20	88	1.667×10^{-4}	2.762	0.982
	Chelonodon laticeps	18	10	89	2.971×10^{-4}	2.565	0.989

has a value close to 3, but varies between 2 and 4 (Tesch 1971). An exponent (*b*) value of 3 indicates that the fish grows symmetrically or isometrically; values other than 3 indicate allometric growth (Tesch 1971). Of these 83 species, additional length–weight information was available for 54 species in the FishBase 99 database (Froese and Pauly 1999); these are highlighted in bold in Table 1. Denoted by an asterisk are 18 species which had exponent (*b*) values within the range reported for each taxa in FishBase 99.

While it is recognized that a number of factors are known to influence the length–weight relationship in fishes, including growth phase, season, degree of stomach fullness, gonad maturity, sex, health and general fish condition, and preservation techniques (Tesch 1971), these factors were not accounted for in the present study. The aim of the length–weight relationships presented here is to enable estuarine fish biologists merely to derive weight estimates for fishes that are measured but not weighed. Overall, the values for the exponent (*b*) mostly remained within the expected range of 2.5–3.5.

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