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Length–weight relationships for 22 fish species of the Mar Menor coastal lagoon (western Mediterranean Sea)

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Summary

Length–weight relationships were estimated for 22 species of the Mar Menor coastal lagoon (south-eastern Spain): *Lipophrys dalmatinus*, *Salaria pavo*, *Callionymus pusillus*, *Aphanius iberus*, *Engraulis encrasicolus*, *Gobius cobitis*, *G. niger*, *G. paganellus*, *Pomatoschistus marmoratus*, *Symphodus cinereus*, *Chelon labrosus*, *Liza aurata*, *L. ramado*, *L. saliens*, *Mugil cephalus*, *Diplodus puntazzo*, *D. sargus sargus, Lithognathus mormyrus*, *Sarpa salpa*, *Sparus aurata*, *Hippocampus guttulatus* and *Syngnathus abaster*. The captures were made in shallow areas of the lagoon during 2002–2004. Significant length–weight relationships were found for all species.

Introduction

Length–weight relationships for fish have been used extensively to provide information on the condition of fish, their isometric or allometric growth, in the analysis of ontogenic changes, to compare life histories of fish species between regions as well as other aspects of fish population dynamics. In fisheries biology, length–weight relationships are useful for the conversion of growth-in-length equations to growth-in-weight for use in stock assessment models and to estimate stock biomass from limited sample sizes (Binohlan and Pauly, 1998; Koutrakis and Tsikliras, 2003; Valle et al., 2003; Ecoutin et al., 2005).

In this study we report the length–weight relationships for 22 fish species collected from the Mar Menor coastal lagoon (south-eastern Spain). Included are the most common species of shallow areas as well as juvenile fish species of commercial interest that use the coastal lagoon as a nursery area.

Materials and methods

Study area

The Mar Menor is a hypersaline coastal lagoon located in a semiarid region of the south-eastern Iberian Peninsula. It is one of the largest coastal lagoons in the Mediterranean region and in Europe, with a surface area of 135 km^2 and average depth of 3–4 m. It is separated from the Mediterranean Sea by a 22 km long sandbar, with three narrow channels connecting it to the sea. The lagoon shows a salinity range of 39–45 with a temperature varying from 10°C in winter to 32°C in summer. The bottom is principally covered with dense meadows of the invasive macroalga *Caulerpa prolifera*, although shallow areas are covered with meadows of *Cymodocea nodosa*.

The lagoon supports important commercial fisheries, mainly fishes such as eel (*Anguilla anguilla*), grey mullets (*Liza* spp. and *Mugil cephalus*), gilthead bream (*Sparus aurata*), sea bass (*Dicentrarchus labrax*) and striped bream (*Lithognathus mormyrus*) (Pérez-Ruzafa et al., 2004).

Sampling design

Field studies were conducted in the period of 2002–2004 in the shallow areas of the Mar Menor coastal lagoon.

Samples were collected using a 10-m long bag seine net with 0.5 mm mesh size, which allowed the collection of juvenile fish and adults of small size species. Specimens were preserved in 7% formaldehyde, identified and measured for total length (TL) to the nearest 0.1 cm and weighed (total weight, TW) to the nearest 0.01 g.

The relationship was established using linear regression analysis, TW vs TL (log-transformed): $TW = \log(a) + b\log(TL)$, where a is the intercept of the regression curve (coefficient related to body form) and b the regression coefficient (exponent indicating isometric growth when equal to 3). The significance of the regression was assessed by ANOVA, and the b-value for each species was tested by t-test to verify that it was significantly different from the isometric growth ($b = 3$) (Sokal and Rohlf, 1981).

Results and discussion

Overall, 11 158 specimens of 22 different species belonging to nine families were weighed and measured. During the course of the study, Mugilidae and Gobiidae were the most abundant families.

The length–weight relationships are summarized in Table 1. Linear regressions were significant for all species ($P < 0.001$). The sample size ranged from 2955 for *L. aurata* to 17 for *Engraulis encrasicolus*.

Values of b equal to 3 indicate that the fish grows isometrically; values different from 3 indicates allometric growth. The exponent b varied between 2.36 for *Callionymus pusillus* and 3.36 for *M. cephalus*. It was also low ($b = 2.68$) for *E. encrasicolus*, whereas all remaining values of b were higher than 2.91 (Table 1). Nine species showed isometric growth ($b \sim 3$): *Lipophrys dalmatinus*, *Salaria pavo*, *Aphanius iberus*, *E. encrasicolus*, *Gobius niger*, *Chelon labrosus*, *L. ramado*, *Sarpa salpa* and *Hippocampus guttulatus*; two species showed negative allometric growth ($b < 3$): *Ca. pusillus* and *Syngnathus abaster*; all remaining species showed positive allometric growth ($b > 3$): *G. cobitis*, *G. paganellus*, *Pomatoschistus marmoratus*, *Symphodus cinereus*, *L. aurata*, *L. saliens*, *M. cephalus*, *Diplodus puntazzo*, *D. sargus sargus, Li. mormyrus* and *Sp. aurata*.

Table 1
Length–weight relationships for 22 species caught in the Mar Menor coastal lagoon (Spain)

Family	Species	n	Min	Max	*a*	*b*	SE (*b*)	r^2	P-value
Bleniidae	*Lipophrys dalmatinus*	68	16	58	0.00884	3.046	0.041	0.988	0.165
	Salaria pavo	724	15	127	0.01026	3.023	0.017	0.978	0.159
Callionymidae	*Callionymus pusillus*	22	25	54	0.02221	2.360	0.096	0.967	< 0.05
Cyprinodontidae	*Aphanius iberus*[a]	337	8	40	0.01673	2.981	0.020	0.985	0.500
Engraulidae	*Engraulis encrasicolus*	17	84	120	0.00932	2.679	0.218	0.903	0.167
Gobiidae	*Gobius cobitis*	526	22	83	0.01131	3.128	0.017	0.984	< 0.05
	Gobius niger	225	36	92	0.01239	2.971	0.036	0.969	0.500
	Gobius paganellus	21	25	87	0.01102	3.192	0.045	0.996	< 0.05
	Pomatoschistus marmoratus[a]	1710	14	55	0.00756	3.150	0.017	0.954	< 0.05
Labridae	*Symphodus cinereus*	58	22	106	0.01123	3.105	0.039	0.991	< 0.05
Mugilidae	*Chelon labrosus*	24	17	43	0.00997	3.099	0.068	0.991	0.164
	Liza aurata	2955	17	148	0.00735	3.185	0.006	0.990	< 0.05
	Liza ramado	562	18	52	0.00825	3.054	0.045	0.896	0.159
	Liza saliens	1410	12	109	0.00811	3.041	0.009	0.988	< 0.05
	Mugil cephalus	80	21	62	0.00661	3.357	0.056	0.979	< 0.05
Sparidae	*Diplodus puntazzo*	108	26	56	0.01082	3.273	0.035	0.988	< 0.05
	Diplodus sargus sargus	179	14	72	0.01506	3.152	0.042	0.968	< 0.05
	Lithognathus mormyrus	37	32	47	0.00680	3.285	0.113	0.959	< 0.05
	Sarpa salpa	138	35	59	0.01271	3.003	0.075	0.921	0.500
	Sparus aurata	666	16	61	0.00923	3.280	0.016	0.985	< 0.05
Syngnathidae	*Hippocampus guttulatus*[a]	31	42	73	0.00248	2.908	0.160	0.916	0.570
	Syngnathus abaster[a]	1260	13	109	0.00068	2.922	0.012	0.970	< 0.05

n, sample size; Min and max, minimal and maximal total length (mm); *a* and *b*, relationship parameters; SE (*b*), standard error of *b*; r^2, determination coefficient; P, is the P-value for *t*-test comparing differences for isometric growth ($b = 3$).
[a]Specimens were weighed and measured and then returned to their habitat.

The length–weight relationship in fishes can be affected by several factors including habitat, area/seasonal effect, degree of stomach fullness, gonad maturity, sex, health, preservation techniques and differences in the observed length ranges of the specimen caught (Tesch, 1971; Wootton, 1998), all of which were not considered in the present study.

This study could serve for comparison with similar studies of estuaries and coastal lagoons of the Mediterranean Sea, and could be of use when fish populations are subjected to commercial fisheries, recovery programmes or any other management activity.

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