

LENGTH-WEIGHT RELATIONSHIPS OF MESOPELAGIC FISHES IN THE NORTH-WESTERN MEDITERRANEAN

M. Pilar Olivar ^{1*}, Balbina Molí ¹ and Ainhoa Bernal ¹
¹ Institut de Ciències del Mar (CSIC) - polivar@icm.csic.es

Abstract

In the present study we analysed the length-weight relationships of the most common and abundant mesopelagic fishes of the northwestern Mediterranean: 11 Myctophidae, 1 Gonostomatidae, 1 Phosichthyidae and 1 Sternoptichyidae. Data of fish length and weight were fitted to a power function, and estimations of the fitted equation parameters were given as background information for subsequent studies on body condition. The slope estimation was taken as indicative of the relative increase in weight in relation to growth in length. The small fish *Cyclothone braueri* has a lower allometric coefficient with significant negative value, than that corresponding to larger species such as myctophids (some of them showing positive allometric growth).

Keywords: Fishes, Growth, North-Western Mediterranean

The largest biomasses of the open ocean have been attributed to meso and bathypelagic fishes that occur together with small crustaceans, cephalopods and a few other invertebrates. The most common and abundant mesopelagic fishes in the western Mediterranean are lanternfish of the family Myctophidae and bristlemouth of family Gonostomatidae (1, 2). The diversity of these groups of species in the Mediterranean Sea is lower than in open oceans and the maximum sizes tend to be smaller than those reported for the same species in the Atlantic. They constitute a key component of the food web in oceanic waters, being commonly cited as prey for larger marine inhabitants (e. g. commercial pelagic fishes, cetaceans, marine birds). In the present study the body length- weight relationships of the most common and frequent mesopelagic fishes in the north-western Mediterranean were analysed. Information regarding to allometry in fish has been indicated as an important issue to approach body condition (3, 4); however related data are not always complete and lacks for many species, particularly for those inhabiting the water column, which are less frequently sampled in routine surveys. Information related to this issue has been already presented for some meso and bathypelagic species of the central Mediterranean (5). Mesopelagic fishes studied here were collected during winter (December 2009) and summer (July 2010) off Mallorca Island by means of different midwater trawls towed in the epipelagic layers (up to 80 m), the 400 m deep scattering layer (DSL) and benthic boundary layer (50 m above the bottom, BBL). After collection and identification on board, fishes were preserved in formalin 5%. Measures of fish length and weight were taken in the laboratory (length to the nearest mm and weight to the nearest mg). Weight and length data were fitted to a potential equation $W=aSL^b$, where W is the weight in mg, SL is the standard length in mm, a is the intercept and b the allometric coefficient. Fitting was performed after log transformation of data, and results are given as 95% confidence intervals (95%CI). Values of b significantly different from 3 indicated that growth in weight is relatively faster than that in length (positive allometry $b>3$) or lower (negative allometry $b<3$). Mathematically the values of the intercept, a, indicated the expected weight at SL 1 mm. As generally found in many other fish species, the obtained length-weight relationships for mesopelagic fishes in the present study as well, as in those from the central Mediterranean (5), fit a potential function with a coefficient of nearly 3 and correlation coefficients always close to 1 (Table 1). Significantly positive allometric relationships were observed for several myctophid species, i.e. *Benthoosema glaciale*, *Ceratoscopelus maderensis*, *Diaphus holti*, *Lampanyctus crocodilus*, *L. pusillus*, *Lobianchia dofleini*, *Notoscopelus elongatus* and *Symbolophorus veranyi*. Significant negative allometry was only observed for the gonostomatid *Cyclothone braueri*, indicating a relatively slower growth in weight than in length across development. Therefore, this species/*C. braueri* tends to have a pronounced slender body shape in contrast to those species with positive allometry, such as myctophids. Differences in body shape could be related to the different behaviour of myctophids, characterized by performing extensive diel migrations from near the bottom to the epipelagic layers, whereas *Cyclothone braueri*, do not perform such migrations (1,2). Robust bodies with higher muscular and osteological development must contribute in the vertical migration, while the more attenuated shape of *Cyclothone braueri* reflects a less energetic demanding behaviour.

Tab. 1. Parameters of the allometric relationship between body length (SL mm) and weight (mg) for the most common and abundant mesopelagic fishes occurring in the upper 400 m of the water column in the western Mediterranean. a: intercept, b: slope (allometric coefficient), 95%CI: 95% confidence interval, n: number of individuals measured, r: correlation coefficient. Significant positive or negative allometry is marked in bold, black and grey, respectively.

	a	b	95%CI	n	r	SL range
F. Gonostomatidae						
<i>Cyclothone braueri</i>	0.008	2.769	0.173	113	0.9488	12-27
F. Sternoptichidae						
<i>Argyropelecus hemigymnus</i>	0.018	3.032	0.179	63	0.9744	13-34
F. Phosichthyidae						
<i>Vinciguerria attenuata</i>	0.010	2.942	0.190	26	0.9884	14-35
F. Myctophidae						
<i>Benthoosema glaciale</i>	0.008	3.093	0.088	249	0.9751	14-47
<i>Ceratoscopelus maderensis</i>	0.005	3.191	0.048	188	0.9947	16-64
<i>Diaphus holti</i>	0.004	3.360	0.207	32	0.9866	25-53
<i>Hygophum benoiti</i>	0.015	2.938	0.133	34	0.9921	13-48
<i>Hygophum hygomii</i>	0.010	3.136	0.326	40	0.9533	39-58
<i>Lampanyctus crocodilus</i>	0.002	3.345	0.089	117	0.9898	22-128
<i>Lampanyctus pusillus</i>	0.004	3.232	0.059	238	0.9902	14-43
<i>Lobianchia dofleini</i>	0.005	3.338	0.279	53	0.9587	21-43
<i>Myctophum punctatum</i>	0.009	3.052	0.175	37	0.9864	19-60
<i>Notoscopelus elongatus</i>	0.004	3.248	0.069	209	0.9883	30-107
<i>Symbolophorus veranyi</i>	0.005	3.181	0.100	25	0.9974	23-90

Acknowledgements: This research was funded by Spanish program CTM2008-04489-C03-01-02.

References

- Goodyear R. H., Gibbs R. H. Jr., Roper C. F. E., Kleckner R. C. and Sweeney M. J. 1972. Mediterranean Biological Studies. 2, Smithsonian Institution Washington DC Rep., pp 1-278.
- Olivar M.P., Bernal A., Molí B, Peña M., Balbín R., Castellón A., Miquel J. and Massutí E. 2012. Vertical distribution, diversity and assemblages of mesopelagic fishes in the western Mediterranean. Deep-Sea Res. Part I 62:53-69.
- Safran P. 1992. Theoretical analysis of the weight-length relationship in fish juveniles. Mar. Biol. 112: 545-551.
- Petrakis G. and Stergiou K.I. 1995. Weight-length relationships for 33 fish species in Greek waters. Fish. Res. 21: 465-469
- Battaglia P., Malara D., Romeo T. and Andaloro F. 2010. Relationships between otolith size and fish size in some mesopelagic and bathypelagic species from the Mediterranean Sea (Strait of Messina, Italy). Sci. Mar. 74(3): 605-612.