Length-Weight Relationship of Fishes and Cephalopods from the Balearic Islands (Western Mediterranean)

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Abstract

Length-weight relationship (LWR) parameters of 72 species of fishes and 15 species of cephalopods caught in the Balearic Islands demersal fishery are reported. This is the first compilation of LWR for these groups in the Balearic Islands.

Introduction

The length-weight relationship (LWR) is a useful tool to convert length to weight and vice versa. In some cases it is easier to take measurements of weight rather than length, such as for cephalopods (Bello 1991), and then weight data can be converted to length by using the LWR. Bibliographic compilations exist on the biological parameters of Mediterranean species (Quesada 1991; Campillo 1993), but relationships may vary geographically (Sparre et al. 1989) and it is often practical to make use of the local values.

This paper is a contribution that complements the current information on the biological parameters of fishes and cephalopods in the western Mediterranean and it is the first compilation of LWR for these groups in the Balearic Islands area.

Materials and Methods

From April 1995 to April 1996, during a sampling program on board commercial trawlers for the study of the demersal fisheries of the Balearic Islands (Fig. 1), representative samples of discards were taken. For each haul the position, duration, depth and course were noted. Trawling was performed between 40 and 80 m. In the laboratory, the length-weight data of various species of fishes and cephalopods were collected. The total length (TL) for fishes or the mantle length (ML) for cephalopods were measured with a measuring board to the nearest 0.1 cm. The weight was measured with a precision balance to the nearest 0.1 g.

The parameters a and b of the functional relationship between total length and weight, viz.

$$W = a \times L^b \qquad ...1)$$

were estimated by converting it into the logarithmic linear function (Anon. 1981, Sparre et al. 1989)

$$\ln W = \ln a + b \times \ln L \qquad ...2)$$

with a and b estimated via ordinary least-squares regression. The regression coefficient of the logarithmic function r (Anon. 1981) was calculated as:

$$r = \frac{\sum xy - \frac{\sum x \cdot \sum y}{n}}{\sqrt{\left[\sum x^2 - (\sum x)^2/n\right]\left[\sum y^2 - (\sum y)^2/n\right]}} \qquad ...3)$$

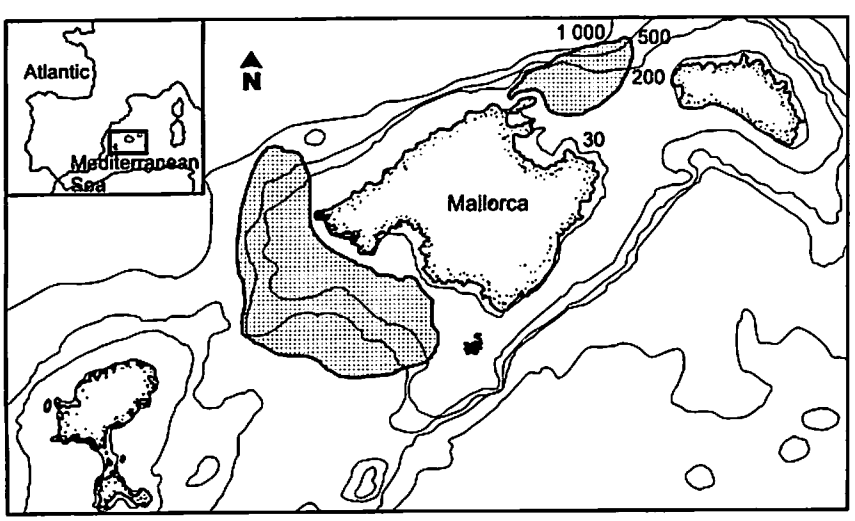

Fig. 1. The Balearic Islands showing the sampling area (shaded).

Table 1. Length-weight relationship and related statistics for 72 fish species (Merella et al.)

Species	n	TL min	TL max	a	b	r
1 *Alepocephalus rostratus*	12	11.0	39.0	0.0059	2.95	0.996
2 *Argentina sphyraena*	18	8.0	17.6	0.0047	3.05	0.994
3 *Arnoglossus imperialis*	17	8.5	13.6	0.0045	3.17	0.946
4 *Arnoglossus laterna*	20	8.0	13.0	0.0025	3.45	0.925
5 *Arnoglossus rueppelli*	87	5.4	13.8	0.0051	3.01	0.971
6 *Arnoglossus thori*	78	7.2	13.3	0.0064	3.17	0.976
7 *Chelidonichthys cuculus*	52	5.2	17.0	0.0091	2.94	0.991
8 *Blennius ocellaris*	30	8.0	20.6	0.0168	2.91	0.990
9 *Boops boops*	228	12.4	26.6	0.0082	3.00	0.986
10 *Callionymus maculatus*	13	6.1	9.6	0.0156	2.49	0.871
11 *Capros aper*	104	3.2	12.2	0.0282	2.81	0.991
12 *Centracanthus cirrus*	57	14.4	21.0	0.0063	3.04	0.980
13 *Cepola rubescens*	39	18.5	50.7	0.1031	1.51?	0.925
14 *Chauliodus sloani*	11	15.1	30.5	0.0009	3.18	0.988
15 *Chlorophthalmus agassizi*	39	9.1	17.7	0.0032	3.28	0.983
16 *Citharus linguatula*	50	8.6	20.0	0.0030	3.30	0.987
17 *Conger conger*	23	8.0	73.2	0.0006	3.22	0.996
18 *Deltentosteus quadrimaculatus*	28	7.0	9.2	0.0074	3.05	0.909
19 *Diplodus annularis*	94	4.3	14.5	0.0109	3.20	0.996
20 *Epigonus constanciae*	17	10.5	15.0	0.0019	3.59	0.968
21 *Epigonus denticulatus*	11	6.7	14.2	0.0045	3.26	0.991
22 *Etmopterus spinax*	151	10.4	48.5	0.0030	3.13	0.995
23 *Eutrigla gurnadus*	17	5.7	9.9	0.0029	3.49	0.973
24 *Galeus melastomus*	461	9.5	60.0	0.0025	3.02	0.996
25 *Glossanodon leioglossus*	18	8.3	15.0	0.0022	3.32	0.994
26 *Helicolenus dactylopterus*	103	6.3	15.9	0.0127	3.04	0.994
27 *Hoplostethus mediterraneus*	101	4.3	21.1	0.0083	3.15	0.998
28 *Lampanyctus crocodilus*	25	9.0	21.0	0.0051	2.98	0.990
29 *Lepidion lepidion*	79	8.9	23.1	0.0017	3.41	0.991
30 *Lepidopus caudatus*	40	43.7	106.0	0.0003	3.19	0.986
31 *Lepidorhombus boscii*	84	7.0	19.5	0.0045	3.14	0.990
32 *Lepidorhombus whiffiagonis*	11	9.9	18.7	0.0029	3.26	0.998
33 *Lepidotrigla cavillone*	102	6.6	13.1	0.0058	3.26	0.985
34 *Lepidotrigla dieuzeidei*	13	9.0	15.1	0.0078	3.12	0.996
35 *Lophius budegassa*	24	5.2	25.4	0.0111	3.00	0.992
36 *Lophius piscatorius*	19	7.5	16.2	0.0036	3.43	0.967
37 *Macroramphosus scolopax*	34	6.3	14.4	0.0040	3.15	0.991
38 *Merluccius merluccius*	240	5.9	21.4	0.0046	3.07	0.989
39 *Microchirus variegatus*	20	6.8	16.6	0.0151	2.85	0.983
40 *Micromesistius poutassou*	77	16.7	34.4	0.0007	3.69	0.979
41 *Molva macrophthalma*	32	16.6	40.9	0.0009	3.24	0.995
42 *Mora moro*	113	7.3	35.0	0.0024	3.37	0.994
43 *Mullus barbatus*	20	8.2	16.8	0.0131	2.85	0.990
44 *Mullus surmuletus*	13	10.3	16.7	0.0082	3.09	0.986
45 *Notacanthus bonapartei*	22	16.3	26.0	0.0012	3.06	0.886
46 *Ophidion rochei*	14	9.2	27.5	0.0023	3.20	0.994
47 *Pagellus acarne*	106	9.8	19.4	0.0049	3.30	0.994
48 *Pagellus erythrinus*	12	11.7	21.2	0.0110	3.01	0.994
49 *Peristedion cataphractum*	17	6.7	23.2	0.0044	3.03	0.999
50 *Phycis blennoides*	343	5.5	53.8	0.0026	3.27	0.997
51 *Raja asterias*	11	13.7	37.6	0.0018	3.27	0.993
52 *Raja clavata*	18	14.5	38.1	0.0024	3.20	0.996
53 *Raja miraletus*	28	16.6	41.0	0.0018	3.25	0.996
54 *Raja polystigma*	16	23.7	42.6	0.0003	3.78	0.983
55 *Sardinella aurita*	13	15.1	23.8	0.0068	2.99	0.987
56 *Scorpaena loppei*	12	7.0	10.3	0.0049	3.56	0.990
57 *Scorpaena notata*	90	5.1	14.0	0.0191	2.98	0.982
58 *Scyliorhinus canicula*	262	7.5	42.1	0.0016	3.16	0.994
59 *Serranus cabrilla*	23	7.2	18.6	0.0160	2.82	0.994
60 *Serranus hepatus*	61	4.7	11.1	0.0091	3.24	0.991
61 *Spicara maena*	11	15.3	18.2	0.0147	2.90	0.975
62 *Spicara smaris*	239	10.8	19.3	0.0177	2.70	0.959
63 *Squalus blainvillei*	27	19.5	35.0	0.0012	3.37	0.988
64 *Synodus saurus*	49	16.0	37.3	0.0040	3.19	0.984
65 *Trachinus draco*	14	9.6	24.2	0.0074	2.93	0.990
66 *Trachurus mediterraneus*	232	3.9	24.5	0.0138	2.76	0.998

continued

Table 1. (continued)

Species	n	TL (cm) min	TL (cm) max	a	b	r
67 *Trachurus picturatus*	180	4.0	23.9	0.0089	2.96	0.996
68 *Trachurus trachurus*	119	3.9	21.6	0.0145	2.77	0.995
69 *Trigla lyra*	11	8.8	18.3	0.0082	2.96	0.996
70 *Chelidonichthys lastoviza*	50	6.3	14.6	0.0185	2.74	0.982
71 *Trisopterus minutus capelanus*	61	8.4	15.6	0.0075	3.06	0.987
72 *Zeus faber*	33	7.2	16.8	0.0186	2.88	0.990

Table 2. Length-weight relationships and related statistics for 15 species of cephalopods (Merella et al.)

Species	n	ML (cm) min	ML (cm) max	a	b	r
1 *Alloteuthis media*	12	3.5	9.9	0.1250	2.18	0.987
2 *Ancistroteuthis lichtensteini*	9	5.0	12.5	0.0707	2.60	0.988
3 *Bathypolypus sponsalis*	218	2.5	9.5	0.4870	2.62	0.896
4 *Eledone cirrhosa*	38	2.2	11.5	0.1332	3.18	0.980
5 *Eledone moschata*	45	3.8	17.0	0.2298	2.91	0.976
6 *Histioteuthis bonnellii*	13	4.1	15.5	0.6402	2.88	0.981
7 *Histioteuthis reversa*	68	2.5	12.0	0.6229	2.42	0.973
8 *Illex coindetti*	39	7.6	19.6	0.0188	3.20	0.968
9 *Neorossia caroli*	33	3.0	6.2	0.8178	2.30	0.941
10 *Octopus salutii*	41	5.0	12.0	0.4981	2.19	0.845
11 *Octopus vulgaris*	343	5.0	17.0	0.4373	2.89	0.939
12 *Pteroctopus tetracirrhus*	49	5.5	13.5	0.0921	3.34	0.912
13 *Scaeurgus unicirrhus*	16	3.0	10.5	0.4850	2.52	0.939
14 *Sepietta oweniana*	28	1.4	2.9	1.4853	1.37	0.792
15 *Todarodes sagittatus*	346	8.1	41.8	0.0102	3.31	0.994

Results and Discussion

A total of 72 species of fishes and 15 species of cephalopods were sampled. Tables 1 and 2 show, for each species, the number of sampled specimens, the minimum and the maximum length measured, the LWR coefficients and the regression coefficient, for fishes and cephalopods, respectively.

The length range of many commercial species was limited to small sizes (e.g., *Merluccius merluccius*, *Lepidorhombus* spp., *Lophius* spp., *Mullus barbatus*, *Zeus faber*, etc.) since the samples were composed largely of discards. The data collected for these species may complement the information concerning the LWR based on sampling of commercial sizes.

The LWR may change seasonally (Jones 1976), so the length-weight data were taken throughout a complete annual cycle. The parameters presented may thus be considered as average values.

Acknowledgments

We thank S. Deudero, B. Morales-Nin and E. Massuti for the length-weight measurements of juvenile specimens of *Trachurus* spp. and O. Reñones for making data of *Diplodus annularis* available.

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