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Fisheries Research 78 (2006) 368–373
FISHERIES RESEARCH
www.elsevier.com/locate/fishres

Short communication

Length–girth relationships for 30 marine fish species

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Received 9 August 2005; received in revised form 11 January 2006; accepted 12 January 2006

Abstract

This study reports the estimated relationships between body length and girths (head and maximum) for 30 commercially important marine fish species from the Algarve coast (southern Portugal). A total of 15,005 specimens were sampled. Both G_h and G_{max} increased linearly with body length for all the species. Estimated mesh sizes to produce minimal catches of juveniles and/or undersized specimens and the implications for the management of those species are also discussed. The results suggest that the minimum legal mesh size is not suitable for some of the studied species.

Keywords: Length–girth relationships; Marine fish species; Mesh size; Southern Portugal

1. Introduction

Many fisheries harvest fish from a particular size range due to the size-selective characteristics of the fishing gears used. Knowledge of the size range of fish that is vulnerable to capture is therefore of critical importance for management. Consequently, the variability in size has important implications for diverse aspects of fisheries science and population dynamics (Erzini, 1994). In particular, both length and girth are related to other biological parameters, such as condition and swimming capability (Wootton, 1999). Additionally, both variables are essential for defining predator–prey relationships and establishing the ecological position of fish species within food webs in which they are embedded (Hambright, 1991; Pauly, 2000), as these variables can determine whether a gape-limited predator can ingest a particular fish. On the other hand, these relationships allow life history and morphological comparisons between different species, or between populations of a species from different habitats and/or regions. Finally, these variables are particularly important for gear technologists as both influence the retention of fish by different fishing gears and thus can be used to estimate selectivity (Sechin, 1969; Kawamura, 1972; Hamley, 1975; Reis and Pawson, 1992, 1999; Santos et al., 1995, 1998; Purbayanto et al., 2000). The later assumes that a fish, upon swimming into a gill or trammel net, is caught if its head girth is smaller but maximum girth larger than the mesh perimeter. Thus, species-specific length–girth relationships are of great importance because they allow the computation of girth from length measurements, which are generally easier to be obtained (Stergiou and Karpouzi, 2003).

Herein we present length–girth relationships for 30 fish species, which are commonly caught by the polyvalent fleet (multi-gear) on a multi-species artisanal fishery off the Algarve coast (southern Portugal). According to the Portuguese Fisheries Directorate (DGPA) database, the catches of the present group of species in 2004 amounted to 51% of the total landings of finfish (in weight) on the Algarve coast. The present study presents a further contribution to the length–girth relationships for some of the commercially most important marine fish species from the Algarve coast (see Tables 1 and 2).

2. Materials and methods

The data reported in this study were collected between 1990 and 2004, on research fishing surveys and whole fish

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doi:10.1016/j.fishres.2006.01.008

Table 1

Descriptive statistics and length–head girth relationship parameters for 30 selected fish species of the Algarve coast, southern Portugal

Family/species (common name)	N	TL/FL mean ± S.D. (min–max)	Mean G_h ± S.D. (min–max)	Length–girth equation	Determination coefficient (r^2)	S.E. of a	S.E. of b	Notes
Carangidae								
Trachurus trachurus (Atlantic horse mackerel)	596	23.54 ± 7.49 (12.9–44.2)	10.33 ± 3.28 (6.0–19.0)	$G_h = 0.1611 + 0.4322$TL	0.97 ($p < 0.01$)	0.0727	0.0029	3
Centracanthidae								
Spicara smaris (picarel)	239	17.50 ± 1.75 (14.1–22.1)	9.42 ± 0.89 (7.7–11.7)	$G_h = 0.6141 + 0.4462$TL	0.77 ($p < 0.001$)	0.2800	0.0159	4
Citharidae								
Citharus linguatula (*spotted flounder*)	306	19.14 ± 1.91 (13.0–24.3)	8.84 ± 0.73 (6.5–10.8)	$G_h = 2.3001 + 0.3416$TL	0.81 ($p < 0.001$)	0.1838	0.0096	1
Gadidae								
Trisopteus luscus (pouting)	334	21.66 ± 2.58 (16.2–35.0)	10.43 ± 1.76 (7.3–19.3)	$G_h = -2.6546 + 0.6040$TL	0.78($p < 0.001$)	0.3812	0.0175	1
Merlucciidae								
Merluccius merluccius (European hake)	2405	41.78 ± 7.49 (16.0–68.2)	15.57 ± 2.99 (5.8–26.1)	$G_h = 0.2803 + 0.3660$TL	0.84 ($p < 0.001$)	0.1376	0.0032	3
Mullidae								
Mullus surmuletus (red mullet)	588	22.76 ± 4.10(12.4–37.0)	11.76 ± 2.54(5.8–20.7)	$G_h = -1.6513 + 0.5893$TL	0.90($p < 0.001$)	0.1844	0.0080	4
Scombridae								
Auxis rochei (bullet tuna)	268	37.55 ± 4.19 (29.0–46.1)	19.01 ± 2.70 (13.4–24.4)	$G_h = -4.5497 + 0.6274$FL	0.94($p < 0.001$)	0.3521	0.0093	1
Euthynnus alletteratus (Atlantic little tuna)	97	41.05 ± 2.11(35.0–45.5)	21.74 ± 1.26 (18.1–24.6)	$G_h = -1.4050 + 0.5637$FL	0.89 ($p < 0.001$)	0.8439	0.0205	1
Sarda sarda (Atlantic bonito)	66	49.77 ± 8.8 (40.4–63.4)	22.91 ± 4.08 (18.2–27.9)	$G_h = 0.1436 + 0.4574$FL	0.97 ($p < 0.001$)	0.7047	0.0139	1
Scomber japonicus (chub mackerel)	699	26.17 ± 4.71 (17.0–44.4)	9.84 ± 1.59 (6.8–16.1)	$G_h = 1.3952 + 0.3229$FL	0.91 ($p < 0.001$)	0.1019	0.0038	1
Scomber scombrus (Atlantic mackerel)	213	32.36 ± 3.69 (25.5–40.4)	11.38 ± 1.14 (8.8–13.8)	$G_h = 2.3897 + 0.2778$FL	0.81 ($p < 0.001$)	0.3043	0.0093	1
Scorpaenidae								
Scorpaena notata (scorpionfish)	259	15.53 ± 1.37 (11.0–19.2)	10.61 ± 1.02 (8.0–13.5)	$G_h = 1.0679 + 0.6306$TL	0.72 ($p < 0.001$)	0.3757	0.0247	1
Serranidae								
Serranus cabrilla (comber)	68	20.78 ± 1.55 (18.4–24.8)	10.42 ± 0.90 (9.0–12.9)	$G_h = -1.3469 + 0.5664$TL	0.95 ($p < 0.001$)	0.3411	0.0164	1
Soleidae								
Dicologoglossa cuneata (little sole)	277	21.52 ± 1.86 (15.2–27.5)	8.98 ± 0.85 (6.3–11.5)	$G_h = 0.6146 + 0.3889$TL	0.73 ($p < 0.001$)	0.3109	0.0144	4
Microchirus azevia (bastard sole)	833	22.02 ± 4.11 (13.8–37.0)	11.59 ± 2.28 (7.2–19.8)	$G_h = 0.3208 + 0.5120$TL	0.85 ($p < 0.001$)	0.1650	0.0074	4
Solea senegalensis (Senegalese sole)	208	35.50 ± 4.80 (23.7–45.2)	18.58 ± 2.71 (12.0–24.6)	$G_h = 0.1864 + 0.5180$TL	0.84 ($p < 0.001$)	0.5584	0.0156	1
Sparidae								
Boops boops (bogue)	50	24.71 ± 2.52 (20.2–30.5)	10.91 ± 0.87 (9.1–12.7)	$G_h = 2.8734 + 0.3253$TL	0.90 ($p < 0.001$)	0.3943	0.0159	2
Diplodus annularis (annular seabream)	187	14.03 ± 1.65 (10.7–21.0)	10.39 ± 1.32 (8.1–14.8)	$G_h = 0.2227 + 0.7246$TL	0. 82 ($p < 0.001$)	0.3567	0.0253	4
Diplodus bellottii (Senegal seabream)	438	14.66 ± 2.18 (10.8–22.5)	10.47 ± 1.47 (7.8–15.8)	$G_h = 0.8223 + 0.6617$TL	0.87 ($p < 0.001$)	0.1818	0.0123	4
Diplodus sargus (white seabream)	71	30.05 ± 8.29 (18.8–48.2)	21.02 ± 5.69 (14.0–34.9)	$G_h = 0.7089 + 0.6757$TL	0.97 ($p < 0.001$)	0.4503	0.0145	1
Diplodus vulgaris (two-banded seabream)	221	20.5 ± 3.81 (12.6–36.3)	14.61 ± 2.56 (9.4–25.0)	$G_h = 1.6961 + 0.6298$TL	0.88 ($p < 0.001$)	0.3244	0.0156	4
Lithognathus mormyrus (striped seabream)	232	25.02 ± 5.51 (18.2–42.2)	15.76 ± 3.33 (11.0–25.6)	$G_h = 0.9290 + 0.5927$TL	0.96 ($p < 0.001$)	0.1981	0.0077	4
Pagellus acarne (axillary seabream)	559	20.21 ± 3.58 (12.1–33.2)	11.70 ± 2.52 (6.5–21.3)	$G_h = -1.9660 + 0.6761$TL	0.92 ($p < 0.001$)	0.1685	0.0082	4
Pagellus erythrinus (common pandora)	772	20.81 ± 3.13 (13.5–35.7)	12.59 ± 2.29 (7.8–23.2)	$G_h = -1.9149 + 0.6969$TL	0.90 ($p < 0.001$)	0.1738	0.0083	4
Pagrus pagrus (common seabream)	91	30.0 ± 11.12 (15.7–57.4)	19.86 ± 8.05 (9.9–41.5)	$G_h = -1.7322 + 0.7198$TL	0.99 ($p < 0.001$)	0.2785	0.0087	1
Spondyliosoma cantharus (black seabream)	296	21.34 ± 3.80 (13.1–30.5)	13.06 ± 2.73 (8.0–19.5)	$G_h = -1.2069 + 0.6685$TL	0.87 ($p < 0.001$)	0.3303	0.0152	2
Trachinidae								
Trachinus draco (common weever)	651	25.34 ± 3.68 (14.8–38.7)	8.74 ± 1.26 (5.7–12.9)	$G_h = 1.0801 + 0.3024$TL	0.78 ($p < 0.001$)	0.1598	0.0062	1
Triglidae								
Aspitrigla obscura (*longfin gurnard*)	195	23.47 ± 3.40 (15.2–32.0)	10.39 ± 1.58 (6.9–14.5)	$G_h = -0.1378 + 0.4487$TL	0.93 ($p < 0.001$)	0.2064	0.0087	1
Trigla lucerna (tub gurnard)	50	26.15 ± 3.77 (19.0–34.5)	12.98 ± 2.02 (9.6–17.8)	$G_h = -0.5022 + 0.5156$ TL	0.93 ($p < 0.001$)	0.5305	0.0201	1
Trigloporus lastoviza (streaked gurnard)	51	23.51 ± 2.76 (17.2–28.3)	12.01 ± 1.35 (9.0–14.5)	$G_h = 0.9285 + 0.4713$ TL	0.93 ($p < 0.001$)	0.4302	0.0182	1

N: sample size; TL: total length (cm); FL: fork length (cm); G_h: head girth (cm); min: minimum; max: maximum; S.D.: standard deviation; S.E.: standard error; CI: confidence interval. Fish nomenclature according to Whitehead et al. (1986). *Notes*: (1) first L–G_h relationship reference for the species; (2) first L–G_h relationship reference for the north-eastern Atlantic; (3) first L–G_h relationship reference for the Algarve coast (southern Portugal); (4) updated L–G_h relationship reference for the Algarve coast (southern Portugal).