

RELATIONSHIPS BETWEEN MAXIMUM GIRTH AND BODY LENGTH FOR SEVERAL MARINE FISHES

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Abstract

In the present study, we estimated the relationships between maximum girth (G) and total length (TL) for *Boops boops*, *Diplodus annularis*, *D. vulgaris*, *Merluccius merluccius*, *Mullus barbatus*, *M. surmuletus*, *Pagellus acarne*, *P. erythrinus* and *Trachurus mediterraneus*. G increased linearly with TL for seven out of the nine species examined, whereas for *D. vulgaris* and *M. barbatus*, G was a loglinear function of TL. The implications of such relationships for selectivity estimates are discussed.

Keywords : Aegean Sea, Cyclades Islands, biometrics

Introduction

The estimation of the relationship among various morphological characteristics (e.g. length, mouth and girth dimensions) is of primary importance for fisheries research (e.g. trophic ecology, selectivity estimates : 1-3). In this study, the relationship between length and maximum girth dimensions was determined for nine fish species in the Greek Seas.

Materials and methods

Sampling was conducted in the waters off Naxos Island (Cyclades), on a seasonal basis, from October 1997 to October 2000, with a commercial vessel. Samples were collected with gill nets (mesh sizes : 22, 24, 26 and 28 mm bar length), trammel nets (inner mesh sizes : 20, 24 and 28 mm bar length), and longlines (hook sizes No 11, 12, 13, and 15). All fish caught were measured for total length (TL) to the nearest mm. Maximum girth (G) was measured for a subsample to the nearest mm and consequently, the relationship between G and TL was estimated, using least - square regression.

Results and discussion

The relationships between G and TL for the nine fish species examined are summarized in Table 1 and Figure 1. The number of individuals examined per species ranged from 73, for *Merluccius merluccius*, to 234, for *Mullus surmuletus* (Table 1). G ranged from 5.7 cm, for *Boops boops* and *Pagellus acarne*, to 24.6 cm, for *P. erythrinus*, and was a linear function of TL for seven out of nine species, whereas it was loglinearly related to TL for *Diplodus vulgaris* and *M. barbatus*. All r^2 values were higher than 0.69 ($P < 0.05$). The frequency distribution of G (not shown here) was unimodal for *B. boops*, *D. annularis*, *M. barbatus*, *M. surmuletus*, *P. acarne* and *Trachurus mediterraneus* and bimodal for *D. vulgaris*, *M. merluccius* and *P. erythrinus*.

Table 1. Relationships between maximum girth (G, in cm) and total length (TL, in cm) for nine marine fish species, in Greek waters. N : number of individuals examined; SE(b) : standard error of slope; and r^2 : coefficient of determination.

Species	N	TL range	G = a + bTL	SE (b)	r^2
<i>Boops boops</i>	188	11.5-26.3	$G = -1.748 + 0.5797TL$	0.017	0.86
<i>Diplodus annularis</i>	221	9.8-17.8	$G = -1.523 + 0.897TL$	0.020	0.90
<i>Diplodus vulgaris</i>	110	9.9-29.4	$\text{Log}(G) = -0.094 + 0.996\text{Log}(TL)$	0.018	0.97
<i>Merluccius merluccius</i>	73	20.8-41.6	$G = 0.039 + 0.426TL$	0.026	0.79
<i>Mullus barbatus</i>	103	13.1-22.8	$\text{Log}(G) = -0.319 + 1.040\text{Log}(TL)$	0.063	0.73
<i>Mullus surmuletus</i>	234	14.8-29.3	$G = -1.384 + 0.642TL$	0.016	0.88
<i>Pagellus acarne</i>	97	10.6-22.0	$G = -0.270 + 0.598TL$	0.024	0.87
<i>Pagellus erythrinus</i>	195	12.9-37.0	$G = -0.740 + 0.676TL$	0.008	0.98
<i>Trachurus mediterraneus</i>	192	18.3-33.7	$G = -3.265 + 0.580TL$	0.028	0.69

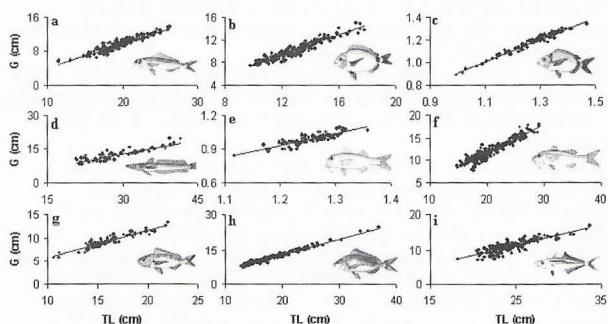


Figure 1. Relationships between maximum girth (G, in cm) and total length (TL, in cm) for nine fish species : (a) *Boops boops*, (b) *Diplodus annularis*, (c) *D. vulgaris*, (d) *Merluccius merluccius*, (e) *Mullus barbatus*, (f) *M. surmuletus*, (g) *Pagellus acarne*, (h) *P. erythrinus*, and (i) *Trachurus mediterraneus*. G and TL for (c) and (e) are log-transformed.

Various authors have also reported relationships between G and TL. For instance, Santos *et al.* [2] state that G is a linear function of TL for *Diplodus annularis* and *D. bellottii*. The same is also true of *Trachurus trachurus* [4]. Santos and Monteiro [5] report that G increases linearly with TL for *D. vulgaris*, *Pagellus acarne*, *P. erythrinus*, *Lithognathus mormyrus*, *Spicara smaridis*, *Dicologlossa cuneata*, and *Microchirus azevia*, and exponentially with TL for *Mullus surmuletus*.

The catchability of fish and their size-selection by fishing gears are affected by factors related either to the characteristics of the fishing gear or of the fish [6, 7]. The probability of fish being captured depends on it encountering a gear, its ability to avoid it, which is related to the swimming capability and consequently to its length, and other body dimensions, such as girth [6, 7]. In general, the girth of fish caught is proportional to gill net mesh size [e.g. 4, 6, 7] and thus to length at 50% capture (L_{50}). Indeed, the estimated L_{50} for *Diplodus annularis*, *Pagellus erythrinus*, *Mullus surmuletus*, *Boops boops* and *Trachurus mediterraneus*, for the 22 and 24 mm gill nets (Stergiou and Erzini, unpubl. data) increase with a corresponding decrease in G (Fig. 2, $r^2 = 0.95$, $P < 0.05$, for both 22 and 24 mm gill nets).

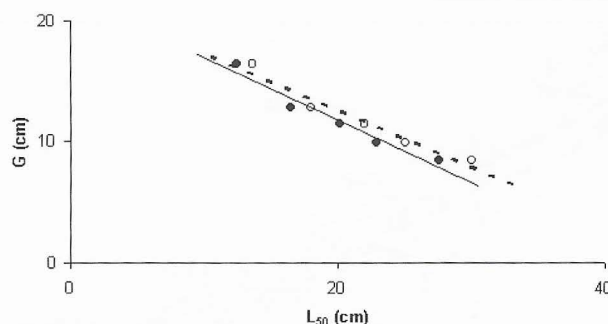


Figure 2. Relationship between maximum girth (G, cm, at 20 cm TL) (this study) and length at 50% capture (L_{50} , cm), for *Diplodus annularis*, *Pagellus erythrinus*, *Mullus surmuletus*, *Boops boops*, and *Trachurus mediterraneus*, for 22 (black circle) and 24 mm (open circle) gill nets (Stergiou and Erzini, unpubl. data).

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