

Reproduction, growth and feeding habits of stout beardfish *Polymixia nobilis* (Polymixiidae) off the Canary Islands (NE Atlantic)

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Summary

The present study provides fisheries biology knowledge which will allow the implementation of regulatory measures contributing to the sustainability of the fisheries and the conservation of the stout beardfish *Polymixia nobilis* Lowe, 1838 off the Canary Islands, north eastern Atlantic Ocean. Males ranged between 16.5 and 38.4 cm fork length (FL) and females from 14.2 to 46.5 cm FL. Sex ratio by size classes provided significant differences in classes higher than 36 cm, being clearly unbalanced in favour of females. Individuals in maturing and mature stages were present during all months sampled, although a spawning peak is evident between April and June. Size at first maturity was estimated as 26 cm FL for females and 30 cm FL for males. Age was determined from annuli in whole otoliths. Age range was found to be 0–14 years for fish measuring 14.2 to 46.5 cm FL. It is a slow-growing and long-lived species. Significant differences in the growth parameters between sexes were detected. The von Bertalanffy growth parameters estimated for females ($n = 213$) were $L_{\infty} = 45.92$ cm LF, $k = 0.16$ years⁻¹ and $t_0 = -2.84$ years; and for males ($n = 186$) $L_{\infty} = 36.44$ cm LF, $k = 0.26$ years⁻¹ and $t_0 = -2.16$ years. Stomach analysis indicated some variations in the feeding habits with growth: individuals of small and medium sizes preyed on crustaceans and fishes, while large specimens preyed mainly on fishes.

Introduction

Until the 1980s the family Polymixiidae was included within the order Beryciformes due to the morphological affinity of certain characters (Rosen, 1973; Zehren, 1979). Rosen (1985) and other authors provided new morphological evidence to create another order, Polymixiiformes, formed by only one family, Polymixiidae (Nelson, 2007). This family contains just one genus, *Polymixia*, which is composed of ten valid species (Froese and Pauly, 2009). In most cases, knowledge on these species is focused on taxonomical and ecological aspects, as biological information is very scarce (Ono, 1982; Kotlyar, 1986, 1988, 1993a,b,c, 2004).

The stout beardfish *P. nobilis* is a bathydemersal species occurring in tropical and subtropical seas (45° N–16° S) of the western Indian Ocean (Seychelles, Madagascar, Mauritius, Reunion, Mozambique, and the Durban region), western Atlantic (Bahamas, Cuba, Leeward Islands, Saba Bank, West Indies, US Virgin Islands, and on the northern coast of South America) (Guthertz et al., 1987), and eastern Atlantic (the Azores, Madeira, the Canaries, the Great Meteor Seamount, the Cape Verde Islands, and St. Helena) (Hureau, 1990;

Cervigón et al., 1992; Froese and Pauly, 2009). In the East Atlantic it has been only found to be associated with oceanic islands and seamounts (Vinnichenko, 1997, 1998; Ramos et al., 2001), and one specimen has been recently reported from an Atlantic locality near the Strait of Gibraltar (Farias et al., 2007).

In the Canary Islands (Fig. 1), this is a frequent species that is more abundant in the western islands, being collected on semi-hard and soft bottoms of the insular shelves and slopes (270–700 m) (Franquet and Brito, 1995; Brito et al., 2002). This species is fished year round with line-and-hook (mainly off El Hierro Island) and trammel nets (mainly in the eastern sector of Tenerife Island). Catches are relatively important within the local small-scale fisheries, as it is a secondary resource in the target fishery for alfonosinos (*Beryx splendens* Lowe, 1834, and *Beryx decadactylus* Cuvier, 1829) off El Hierro, and also in a mixed fishery together with large specimens of *Trachurus*. However, the fishery cannot be managed because no biological parameter is available. The study aim is to acquire enough scientific knowledge to allow implementation of regulatory measures for the sustainability of the fisheries and conservation of the species involved from an ecosystemic approach.

Material and methods

Between December 1995 and March 2002, 472 specimens of stout beardfish were obtained from commercial catches of the artisanal fishery using vertical longlines as well as from research cruises using trammel nets around the Canary Islands (Fig. 1).

Fork length (FL, cm), total weight (TW, g) and gutted weight (GW, g) were taken from each fish (Table 1). Relationships between FL-TW and FL-GW were calculated for both sexes and for the whole sample, using a power function to fit the data (TW or $GW = aFL^b$). Analysis of covariance (ANCOVA) was used to determine the effect of sex in such relationships. A *t*-test was used to determine if the slope of both relationships was significantly different from 3 (Pauly, 1984).

The sagittal otoliths were used to determine fish age. They were extracted from all individuals, cleaned and stored dry in plastic vials. To find the best method for age determination, a random subsample of 20 individuals was studied by interpreting growth rings from whole otoliths and sections of them. Results did not indicate differences between both reading methods, thus age was estimated from whole otoliths. Otoliths were placed in a black disk with alcohol (70%) and examined under a compound microscope with reflected light. Two

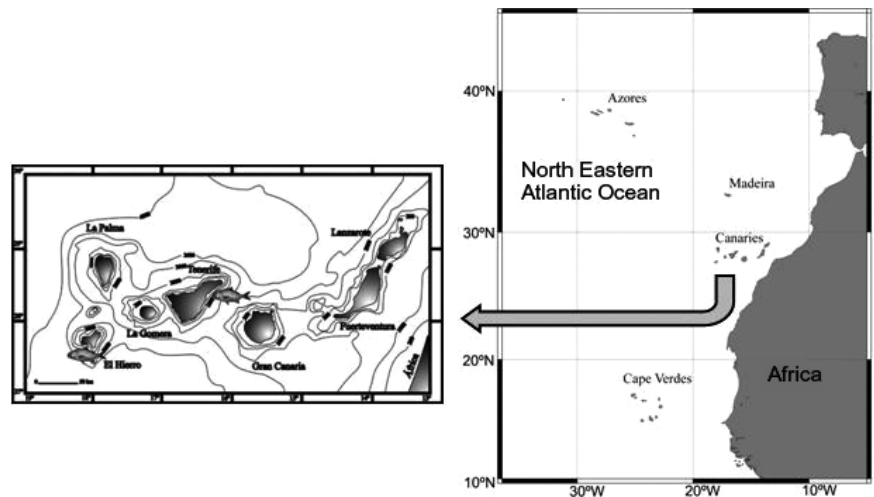


Fig. 1. Location of *Polymixia nobilis* fishing grounds off Canary Islands

Table 1

Estimated relationship parameters between fork length (*FL*, cm), total weight (*TW*, g) and gutted weight (*GW*, g) for *Polymixia nobilis* males, females and all individuals and the ANCOVA test for comparison of slopes between sexes

Variable	a	b	SE (b)	r ²	n	ANCOVA
FL-TW equation						
Males	0.025	2.958	0.038	0.971	187	$F = 3.68$
Females	0.018	3.060	0.036	0.971	213	$P > 0.05$
Total	0.017	3.073	0.021	0.978	473	
FL-GW equation						
Males	0.023	2.970	0.037	0.972	187	$F = 1.38$
Females	0.018	3.030	0.037	0.970	213	$P > 0.05$
Total	0.017	3.055	0.021	0.978	473	

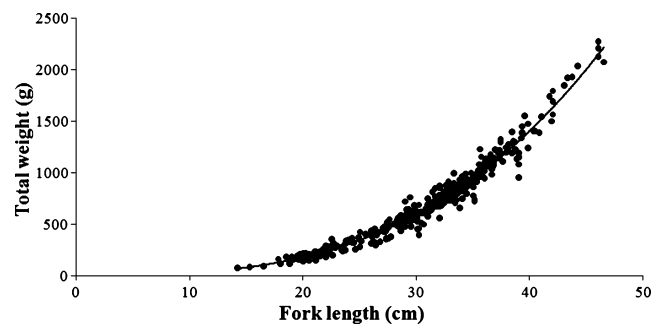


Fig. 3. Relationship between fork length and total weight total sample (n = sample size) in *Polymixia nobilis*

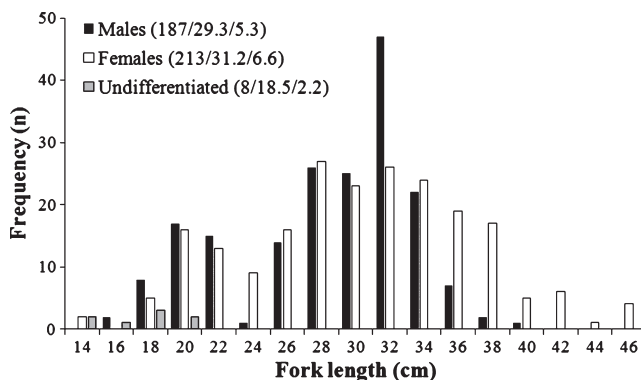


Fig. 2. Fork length frequency distributions for *Polymixia nobilis* males, females and undifferentiated sexes (n = sample size/mean/SD = standard deviation)

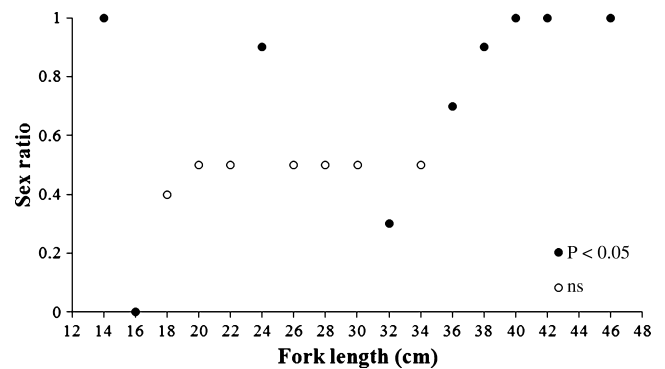


Fig. 4. Distribution of sex-ratio by size classes in *Polymixia nobilis*

readers independently counted opaque zones in each otolith, and only concurring readings were accepted. Of the 472 specimens studied only 333 otoliths could be examined, 285 (85.6%) were readable and used for the age and growth study. Coefficient of variation ($CV = SD/\text{mean}$) was used to measure precision of annuli counts together with a paired t -test to statistically compare differences between readers (Chang, 1982; Campana, 2001). Ageing was validated indirectly by examining monthly changes in the appearance of the otolith margin (Morales-Nin, 1992). 1 April (spawning peak)

was considered as the birthdate. All fish were assigned to an age equal to their annuli count, except for fish collected prior to 1 April, which were assigned 1 year less than their number of annuli. Nonlinear regression was used to estimate the parameters of the von Bertalanffy growth equation:

$$L = L_{\infty}[1 - e^{-k(t-t_0)}]$$

where L is fork length (cm), L_{∞} asymptotic length, k growth coefficient (year^{-1}), t age (year), and t_0 hypothetical age at which length is 0 (year). To better estimate growth parameters, ages of smallest individuals (undifferentiated) were used for both sexes. Hotelling's T^2 test was used to compare growth parameters obtained with each method (Cerrato, 1990; Gordo, 1996). Growth performance

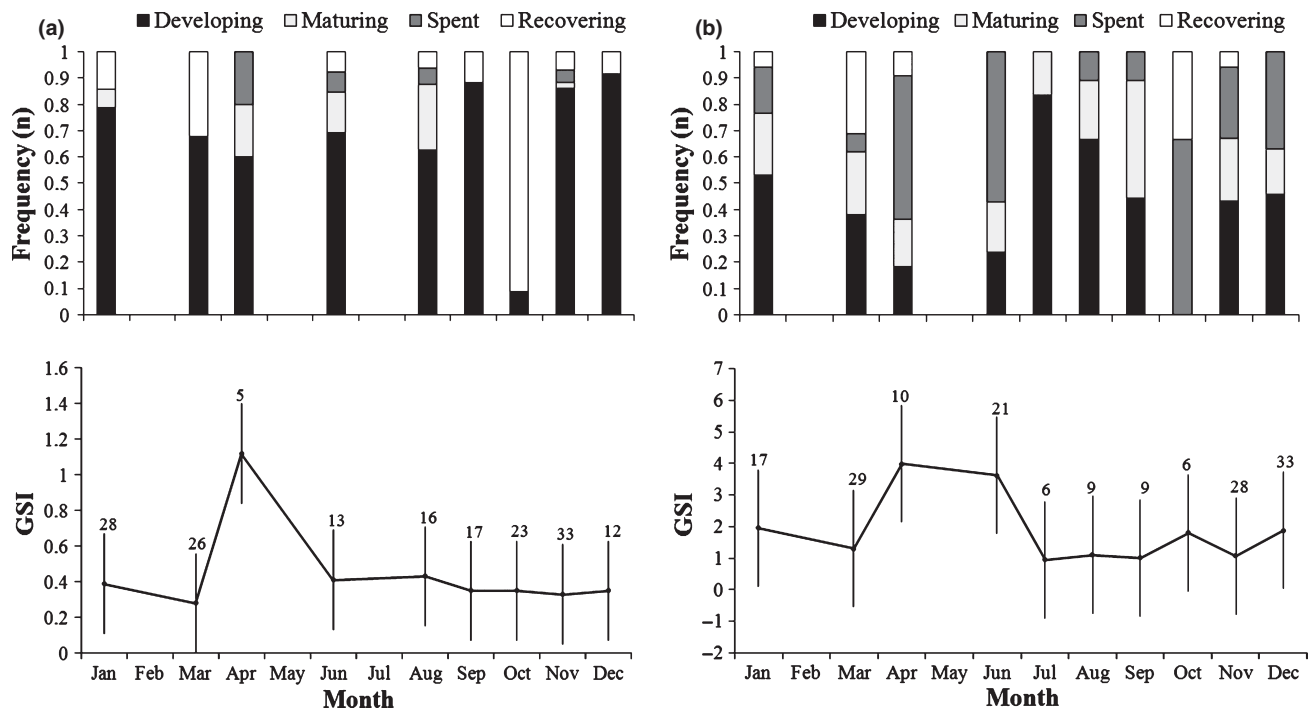


Fig. 5. Monthly variation in maturity stage (above) and gonadosomatic index (GSI, n, mean \pm SD) (below) for *Polymixia nobilis* males (a) and females (b).

$$(\Phi' = 2\log(L_{\infty}) + \log(k))$$

was calculated for comparison among growth parameters obtained for other authors (Munro and Pauly, 1983).

The sex and the stage of sexual maturation of specimens were recorded by macroscopic examination of the gonads. Gonads were removed, weighed to the nearest 0.01 g (GNW), and examined macroscopically. Maturity stages (MS) were classified as immature (I), developing or resting (II), maturing (III), ripe (IV) and spent or recovering (V) (Holden and Raitt, 1975). The spawning season was determined following monthly changes in percent frequency of the maturity stages and values of the gonadosomatic index ($GSI = 100 (GNW / GW)$) (West, 1990).

For the estimation of size at first maturity ($SFM_{50\%}$), a logistic function was fitted to the proportion of 'mature' individuals (MS III, IV or V) using a linear regression (Pope et al., 1983):

$$p = (100 / (1 + e^{-(a+bFL)})),$$

where p is the percentage of mature individuals as a function of size class, and a and b are specific parameters which can change during the life cycle. A logarithmic transformation was applied to the equation in order to calculate the parameters a and b by means of linear regression. Analysis of covariance (ANCOVA) was used to compare the curves of maturity between sexes.

Stomach contents were fixed in 70% alcohol for later analysis. When possible, prey items were identified to species or nearest taxonomic level, and counted under a binocular microscope. Quantitative importance of different prey in the diet (Berg, 1979; Hyslop, 1980) was expressed as follows: (i) vacuity index ($V = Ev * 100 / N$): percentage of empty stomachs; (ii) percentage of frequency of occurrence ($Fp = Tp * 100 / Nt$), percentage of non-empty stomachs in which a food item was found; and (iii) percentage of numerical

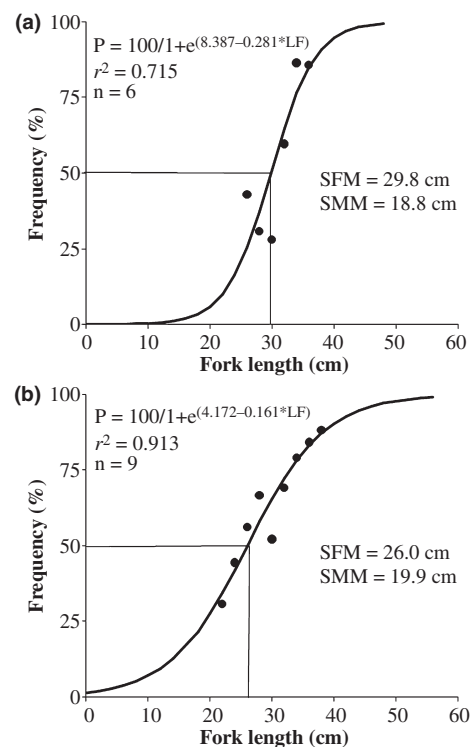


Fig. 6. Sexual maturity curves for *Polymixia nobilis* males (a) and females (b) (n = sample size, SFM = size first mature, SMM = size minimum mature).

abundance ($C_n = p * 100 / Np$), with each prey item a percentage of the total number of food items in a sample; with N the number of fish examined, Ev the number of fish with an empty digestive tract, Nt the number of digestive tracts with food, Np the total number of prey detected, p the number of a particular

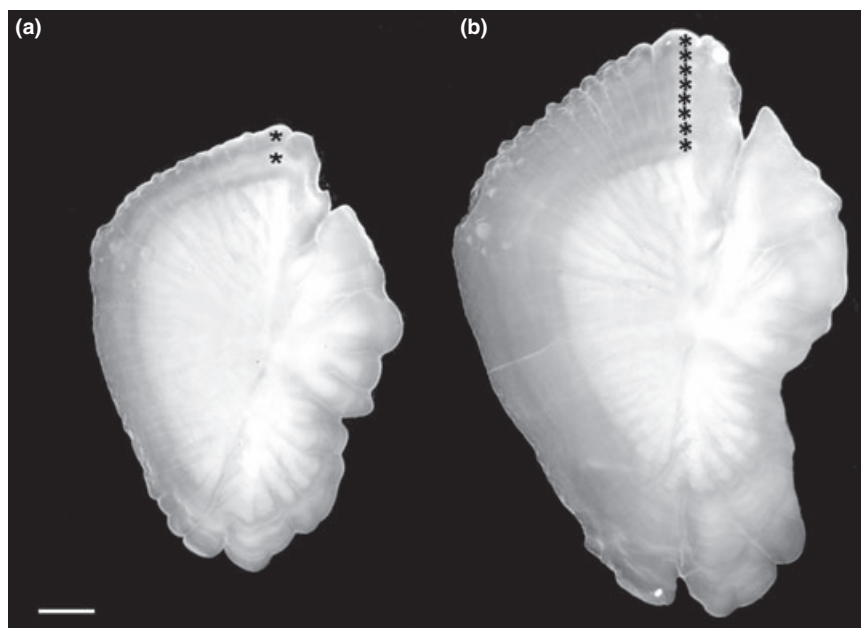


Fig. 7. Growth annuli in *Polymixia nobilis* otoliths. (a) 2 years; (b) 8 years. Scale bar = 1 mm

prey, and Tp the number of fish containing a given type of prey. The independence G-test (Zar, 1996) was applied to the main items (cephalopods, crustaceans and teleosts) in the Fp and Cn frequencies, in order to ascertain whether consumption of these items was dependent on the fish length. Individuals were thus separated into five size classes (<29; 30–33; 34–36; 37–39; >39 cm FL).

Results

Study of the gonads confirmed that *P. nobilis* is a gonochoristic species. It displays two lobes with a roughly hollow cylindrical shape fused posteriorly, rosy in colour for females and off-white for males. Identification of sex and maturity stages was clear, except for individuals smaller than 20 cm FL where sex was not determined.

Comparative analysis of mean size and size frequency distribution showed significant differences between sexes (U test = -2.55, $P < 0.05$; $K-S$ test = 2.02, $P < 0.01$, respectively) (Fig. 2). ANCOVA analyses for $FL-TW$ and $FL-GW$ regressions showed no significant differences between sexes (Table 1), hence the relationships were calculated for all individuals (Fig. 3). Slopes of the relationships $FL-TW$ and $FL-GW$ ($b = 3.073$, $SE = 0.021$; $b = 3.055$, $SE = 0.021$, respectively) were significantly different from 3 (t -test,

$t = 3.47$ and $t = 2.62$, $P < 0.05$, respectively), indicating positive allometric growth of weight respect to size.

Overall ratio of males to females was 1 : 1.14 and the chi square test did not show a significant difference ($P > 0.05$) from the theoretical 1 : 1 sex ratio. Analysis of sex ratios by size classes provided significant differences in classes higher than 36 cm (Fig. 4). Monthly evolution of the GSI indicated for both sexes that highest values occurred between April and June, the pre-spawning phase taking place in winter, and post-spawning in summer and autumn (Fig. 5). However, the macroscopical appearance of the gonads showed the presence of maturity (III) and ripe stages (IV) along the year in both sexes. Size at first maturity in males was calculated at 29.8 cm FL, corresponding to 78% of the maximum observed size. In females, the offset size was estimated at 26.0 cm FL, representing 58% of the maximum observed size. No significant differences in the slopes of the maturity curves were found between sexes (ANCOVA, $F = 3.472$, $P > 0.05$) (Fig. 6).

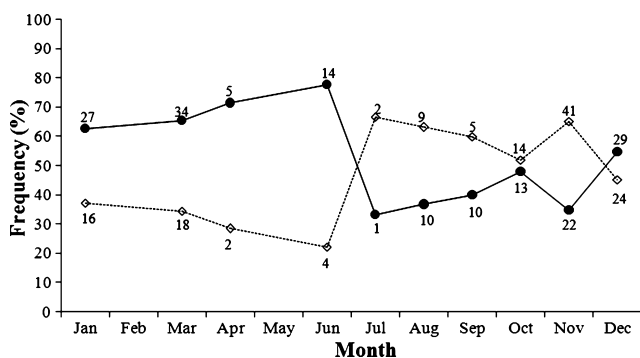


Fig. 8. Monthly changes in otolith frequency with opaque and translucent edges (n = sample size)

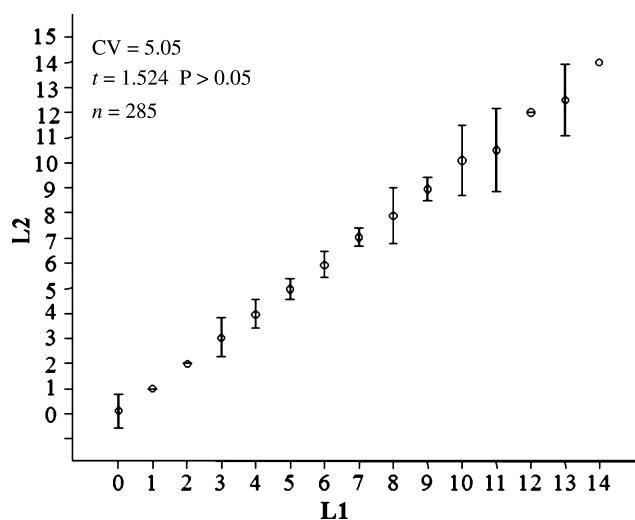


Fig. 9. Ageing variability and precision measurements (CV, coefficient of variation; paired t -test) between readers L1 and L2 (n = sample size)

Table 2
Length-age key for *Polymixia nobilis* males (m), females (f) and all sampled fish

Age class															
Size class (FL, cm)	0 (m/f)	I (m/f)	II (m/f)	III (m/f)	IV (m/f)	V (m/f)	VI (m/f)	VII (m/f)	VIII (m/f)	IX (m/f)	X (m/f)	XI (m/f)	XII (m/f)	XIII (m/f)	XIV (m/f)
14	/2														
16			1/ 2/1												
18		/1	3/5	1/3	1/1										
20		1/ 1/	3/2	1/2	2/ /1										
22	1/ /														
24				/3	/1	/1	/1								
26		2/1	2/1	3/3	4/1	1/2	/1								
28	1/2	3/1	3/1	8/2	8/4	3/6	3/2	/2							
30		/3	/3	1/1	7/1	6/7	4/3	2/2		1/ 4/					
32		/2	/2	/7	6/4	6/5	9/3	11/ 2/3	3/ 1/2	3/2	3/ 2/1				
34		/1	/1	/3	1/2	3/1	/6	2/3	1/2	1/ /2		1/1			
36						/2	1/6	1/5	/1	/2	/2	1/ /3	/1		
38						/4	/1	/1	/3	/1		/3			
40						/1				/1					
42															
44															
46															
Males (n)	1	5	14	14	29	19	17	16	4	9	5	2	0	0	0
Mean size (cm)	22.00	24.40	22.42	26.71	28.55	30.74	31.06	33.25	32.50	32.88	32.80	37.00	—	—	—
S.D.	—	3.28	4.09	2.67	3.29	2.23	2.01	1.43	1.00	1.76	1.09	1.41	—	—	—
Females (n)	2	4	16	24	14	29	23	13	6	5	6	4	2	1	1
Mean size (cm)	14.00	25.00	25.25	27.75	29.14	31.52	32.60	33.53	36.33	36.80	39.00	40.50	43.00	46	46.50
S.D.	0.00	4.76	5.50	4.87	3.98	4.36	3.64	3.38	1.96	2.68	3.28	3.00	4.24	—	—
All fish (n)	16	20	38	40	43	48	40	29	10	14	11	6	2	1	1
Mean size (cm)	15.50	20.30	22.58	26.85	28.74	31.20	31.95	32.82	34.80	34.28	36.18	39.33	43.0	46.00	46.50
S.D.	2.00	4.82	5.28	4.68	3.49	3.66	3.12	2.53	2.52	2.81	4.04	3.01	4.24	—	—

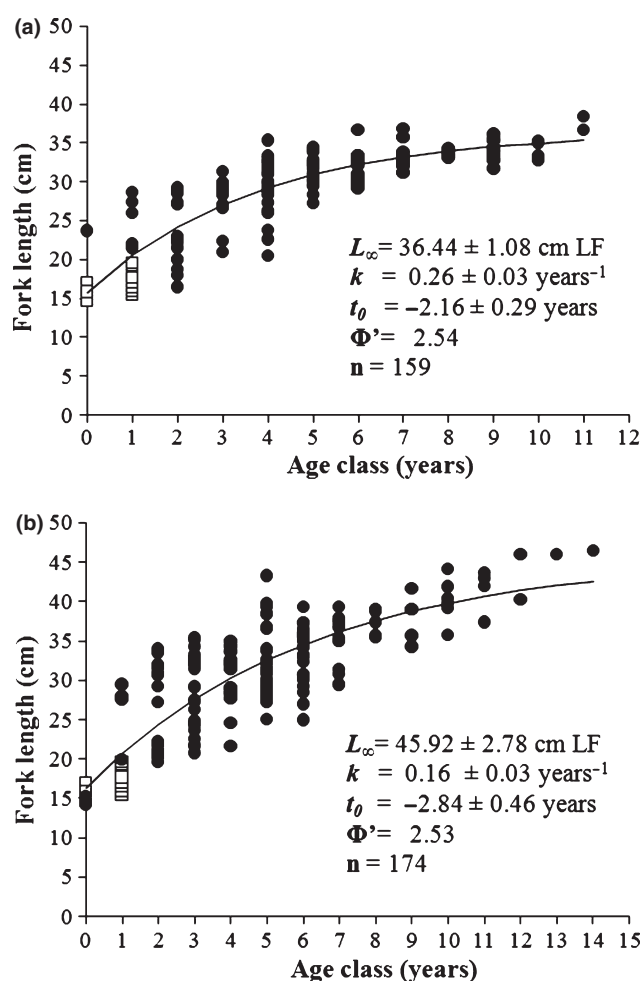


Fig. 10. Von Bertalanffy growth curves for *Polymixia nobilis* males (a) and females (b) (n = sample size)

Otoliths of stout beardfish clearly showed the growth annuli (Fig. 7). One growth increment consisting of one opaque and one hyaline band was assumed to be formed on an annual basis, with the opaque band being deposited mainly between January and June (Fig. 8). There were no significant differences in age estimation between the two readers ($CV = 5.05\%$; $t = 1.524$, $P > 0.05$) (Fig. 9). Fish ages 0–14 years were found for females and from 0 to 11 years for males (Table 2). Comparison of von Bertalanffy growth parameters (Fig. 10) noted significant differences between sexes (Hotelling's T^2 -test, $T^2 = 13.838 > \chi^2_{0.05, 3} = 7.815$).

Of the 305 digestive tracts analyzed only 119 contained food items, giving a total vacuity index of $V = 60.98\%$. Of 22 prey types detected, two were cephalopod taxa and ten each were crustaceans and teleosts (Table 3). The prey classification allowed identification of two new teleosts for the Canarian waters: *Epigonus constanciae* (Giglioli, 1880) and *Centrodraco acanthopoma* (Regan, 1904). Data analysis showed a variation in the feeding habits with the increase of fish size, both in frequency of occurrence (test $G = 0.155$, $P < 0.01$) and in numerical percentage (test $G = 0.156$, $P < 0.01$). Teleosts were preferred prey in all size classes, although the values of F_p and C_n increased noticeably with fish length. In this sense, the most relevant species in the diet were *Chlorophthalmus agassizi* Bonaparte, 1840 and *E. constanciae*, where an increase in the ingestion of myctophids was also observed in larger fish. Crustaceans were preferred prey for fish below 36 cm LF,

whereas they were secondary prey for larger individuals. Pandalid shrimps (*Plesionika* and *Heterocarpus*) were the main prey within the crustaceans. Finally, cephalopods were always secondary prey; however, their numerical percentage (C_n) increased in larger fish (Table 3).

Discussion

The macroscopic study of the gonads of the stout beardfish population from the Canary Islands shows it to be a gonochoristic species without evidence of external sexual dimorphism features. Results suggest that it spawns almost throughout the year, with maximum activity in spring. Fish reproduction may be influenced by water temperature, available food and/or photoperiod (Hoar et al., 1983; van der Kraak and Pankhurst, 1996). Water temperature is considered the main factor in explaining the sexual maturation in most deep-sea fishes studied in the Atlantic Ocean, where waters are warmer in spring and summer (Pajuelo and Lorenzo, 1995, 1996; Lorenzo and Pajuelo, 1996, 1999; Allain, 2001; González et al., 2003; Pajuelo et al., 2008).

Population structure analysis indicated that females are more abundant than males, and an unequal sex-ratio in favour of females occurs in larger sizes. In this sense, Delgado (2007) found similar results in Madeiran waters, with the unique presence of females in sizes larger than 32 cm FL. This sex-ratio variation has also been described in other deep-sea species occurring off the Canary Islands, e.g. *Promethichthys prometheus* (Cuvier, 1832) (Lorenzo and Pajuelo, 1999), *B. splendens* (González et al., 2003), and *Aphanopus carbo* Lowe, 1839 (Pajuelo et al., 2008). Wirtz and Morato (2001) argued several options to explain this sexual phenomenon: variation in spatial distribution, different response to the given hook size or bait size, or differences in their feeding behaviour. However, it cannot assert that the unbalanced sex-ratio was directly related to these factors. In this sense, Horn and Massey (1989) found no variations in *B. splendens* off New Zealand. D'Onghia et al. (2000), however, demonstrated that the fishing method (long-lines and trawling) did not influence the maximum size of *Lepidopus caudatus* (Euphrasen, 1788) captured in the Mediterranean, females always being larger. Differences could be associated with variations in growth. In *B. splendens* from the south-west Indian Ocean (Santamaría et al., 2006) and in *P. nobilis* (present study), it has been determined that females attain higher asymptotic lengths and lower growth rates, which may affect the sex-ratio composition.

The stout beardfish exhibits a relatively long life-span, the oldest fish being 14 years (46.50 cm FL) of age. Age assignment was easily determined from whole otoliths, which are characterised by a large dense nucleus with concentric, well-visible surrounding growth rings. This morphological description is similar to otoliths from Beryciformes such as *B. splendens* or *B. decadactylus*, but false rings can appear in these species (Rico et al., 2001; Santamaría et al., 2006). A maximum age of 9 years (21.8 cm FL) was reported in scale readings for *Polymixia berndti* Gilbert, 1905 from the western Indian Ocean (Kotlyar, 1986), as well as 9 years (18.3 cm FL) for *Polymixia yuri* Kotlyar, 1982 from Chile (Kotlyar, 1988). Nevertheless, these maximum ages need to be confirmed since scales are not the best hard structure for ageing because they undergo reabsorption processes (e.g. Simkiss, 1974). In fact, the growth rate estimated for *P. yuri* is relatively low in comparison with *P. nobilis*, and would be even greater when considering that the maximum size is very small. In addition,

Table 3

Frequency of occurrence (Fp), numerical percentage (Cn) of prey for each size class (FL, cm) and total composition of food found in *Polymixia nobilis*

Systematic group	< 29		30–33		34–36		37–39		> 39		Total	
	Fp	Cn	Fp	Cn	Fp	Cn	Fp	Cn	Fp	Cn	Fp	Cn
CEPHALOPODS												
Octopoda												
Octopodidae												
<i>Octopus vulgaris</i>					6.67	3.125	5.88	2.50	12.50	8.70	4.20	1.95
Teuthida												
Loliginidae												
<i>Loligo vulgaris</i>	3.85	1.61									0.84	0.39
CRUSTACEANS												
Mysidacea												
Mysidae			3.33	1.47							4.20	1.95
Amphipoda					3.33	1.56					0.84	0.39
Isopoda							5.88	2.50			0.84	0.39
Euphausiacea			3.33	7.35							0.84	0.39
Decapoda												
Penaeidae												
<i>Penaeopsis serrata</i>	7.69	4.84	3.33	1.47	3.33	1.56					3.36	1.95
Pandalidae												
<i>Heterocarpus ensifer</i>	15.38	9.68	3.33	1.47	16.67	9.38			6.25	4.35	9.24	5.45
<i>Plesionika edwardsii</i>					3.33	1.56					0.84	0.39
<i>Plesionika ensis</i>	11.54	4.84	6.67	2.94	3.33	1.56					5.04	2.33
<i>Plesionika narval</i>			3.33	2.94	3.33	3.13					1.68	1.56
<i>Plesionika</i> sp.	3.85	1.61	3.33	1.47							1.68	0.78
<i>Plesionika williamsi</i>			6.67	7.35							1.68	1.95
TELEOSTS												
Aulopiformes												
Chlorophthalmidae												
<i>Chlorophthalmus agassizi</i>	7.69	3.23	6.67	4.41	13.33	10.94	5.88	2.50	12.50	8.70	9.24	5.84
Myctophiiformes												
Myctophidae												
<i>Ceratoscopelus</i> sp.									6.25	4.35	0.84	0.39
<i>Gymnoscopelus</i> sp.	3.85	1.61					5.88	2.50			1.68	0.78
<i>Lampadena</i> sp.					3.33	1.56	5.88	2.50			1.68	0.78
Unidentified			6.67	4.41	3.33	1.56					2.52	0.30
Zeiformes												
Zeidae												
<i>Cyttopsys rosea</i>			10.00	4.41	3.33	1.56	5.88	7.50			3.36	2.72
Scorpaeniformes												
Scorpaenidae												
<i>Pontinus kuhlii</i>	3.85	1.61	6.67	2.94			11.76	5.00			4.20	1.95
<i>Setarches guentheri</i>									12.50	8.70	1.68	0.78
Unidentified					10.00	6.25	5.88	2.50			3.36	1.95
Perciformes												
Serranidae												
<i>Anthias anthias</i>	3.85	1.61	3.33	2.94			5.88	2.50	12.50	13.04	4.20	2.72
Epigonidae												
<i>Epigonus constanciae</i>	7.69	3.23	6.67	2.94	3.33	1.56	17.65	7.50	6.25	8.70	7.56	3.89
Draconettidae												
<i>Centrodraco acanthopoma</i>			3.33	1.47							0.84	0.39

Table 4

Parameters and performances of growth in species of the genus *Polymixia* and *Beryx*

Species	Area	Group	L_{∞} (LF, cm)	k (years ⁻¹)	t_0 (years)	Φ'	Reference
<i>P. yuri</i>	Chile	All	21.30 (SL)	0.197	−0.04	1.95	Kotlyar (1988)
<i>P. nobilis</i>	Canaries	All	41.93	0.182	−2.42	2.50	Present study
		Males	36.44	0.264	−2.16	2.54	
		Females	45.92	0.157	−2.84	2.53	
<i>B. splendens</i>	Indian Ocean	All	53.50	0.085	−4.33	2.39	Santamaría et al. (2006)
		Males	49.1	0.099	−4.11	2.38	
		Females	57.1	0.081	−4.16	2.42	
	Canaries	All	44.51	0.150	−3.41	2.47	Rico et al. (2001)
	Madeira	All	58.71	0.060	−5.71	2.32	
	Azores	All	43.10	0.170	−2.80	2.50	
<i>B. decadactylus</i>	Canarias	All	58.11	0.110	−4.70	2.57	González et al. (1998)
	Madeira	All	70.10	0.070	−4.83	2.53	
	Azores	All	68.40	0.110	−1.90	2.69	

the growth performance value given for *P. yuri* is also very low in comparison with the *P. nobilis* and *Beryx* species (Table 4). The biological affinity between Polymixiidae and Berycidae can be also observed in the growth parameters and performance index, which are also similar in the Canary Islands.

Feeding habits of species can change due to the reproductive cycle, seasonal period or variations with fish growth (Costa et al., 1992; King, 1993; Gerking, 1994). In many demersal species, fishes acquire more relevance in diet when the predator size increases. In general, that variation is due to changes in the habitat as well as in the feeding behaviour (Recasens et al., 1998; Dürr and González, 2002; present study). Small and medium size classes of stout beardfish feed as a stenophagous carnivore, which mainly prey upon pandalid shrimps. Large specimens (> 37.0 cm FL) are ichthyophagous, mostly feeding on bathydemersal prey such as *Pontinus kuhlii* (Bowdich, 1825), *Cyttopsis rosea* (Lowe, 1843), and *E. constanciae*. This suggests a bigger-deeper pattern, which may be related to downward direct ontogenic migrations as occurs in other fishes from the Canary Islands (Uiblein et al., 1998). The stout beardfish inhabits a similar environment like the *Beryx* species off the Canary Islands; in fact, their fishing catches are recorded as a whole (Rico et al., 2001). However, their feeding habits are completely different in order to avoid diet competition and to define an ecological niche for each species. *Beryx* species feed on myctophids and mesopelagic decapods, mainly oplophorids (Dürr and González, 2002). Therefore, it can be concluded that *P. nobilis* lives and moves close to hard bottoms, while *Beryx* species inhabit the water column slightly above the bottom.

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