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Live coloration and diet of *Gobius gasteveni* (Teleostei: Gobiidae), with a first record from continental Europe.

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Abstract: The gobiid fish *Gobius gasteveni,* hitherto known only from 39 specimens found in the English Channel, at Madeira and the Canaries, was found in fairly good numbers on the north-western Spanish coast. This first record for the continental European fauna allows us to recognize and describe for the first time the normal and defensive live coloration, as well as the diet of this species.
The general coloration is orange-brown, pale or dark depending on mood, with 6 to 9 darker blotches along the lateral mid line. The high colour contrast in the defensive mood shows a conspicuous white terminal fringe of the dorsal fins, and also sparse light-blue spots on the membrane.
The diet is based mainly on crustacea, with a high percentage of the decapod *Pisidia longicornis,* and polychaetes.

Résumé : *Coloration sur le vivant, régime alimentaire et première signalisation de* Gobius gasteveni *sur les côtes continentales européennes.*
L'espèce *Gobius gasteveni,* jusqu'ici représentée seulement par 39 spécimens récoltés dans la Manche, à Madère et aux Iles Canaries, a été rencontrée en différents lieux du nord-est de la côte Atlantique espagnole. Cela nous a permis de décrire, pour la première fois, la coloration des individus vivants dans leur état normal et en état de défense, et aussi d'avoir quelques détails sur le régime alimentaire, jusqu'à présent inconnu chez cette espèce.
La couleur générale du corps est marron orangé, avec une tonalité claire ou sombre selon l'humeur de l'individu. On distingue de 6 à 9 taches plus sombres sur la ligne médio-latérale. En état de défense, le contraste de couleur augmente, les individus montrant alors une bande blanche visible à l'extrémité des première et deuxième nageoires dorsales, ainsi que des taches de couleur bleue sur leur membrane.
Le régime alimentaire des individus étudiés est essentiellement basé sur les Crustacés, principalement le Décapode *Pisidia longicornis,* et sur les Polychètes.

Keywords : *Gobius gasteveni,* Spanish Atlantic coast, colour, diet.

Introduction

The name "*Gobius auratus*" encompassed, until the work of Miller & El-Tawil (1974), a group of species difficult to distinguish one from the other. These authors demonstrated the morphological differences between *Gobius auratus* Risso, 1810 and three other gobiid species: *Gobius couchi* Miller & El-Tawil, 1974, *Gobius luteus* Kolombatovic, 1891 and *Gobius gasteveni* Miller, 1974. Later, Heymer & Zander (1992) described a new species, *Gobius xanthocephalus,* the fifth species of this group, differentiating it from *Gobius auratus*.

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Gobius gasteveni, described by Miller (1974) from preserved specimens, has been reported only from the English Channel, Madeira and the Canaries. Our capture of 81 specimens of *G. gasteveni* on the coast of Galicia (Spain) makes this region a point of connection between the Macaronesian sites and the English Channel. Furthermore, our specimens constitute the first report of this species for continental Europe. We have also been able to describe for the first time the live coloration of this species and to obtain the first data on its diet.

Material and methods

Eighty-one specimens of *Gobius gasteveni* were captured: 76 in the Ría de Arousa during July and August 1989, 2 in the Ría de Pontevedra in July 1990, and 3 in the Ría de Ferrol in September 1990 (Fig. l). The captures were made using a beam trawl (Arnaiz & De Coo, 1990), consisting of a seine net 12 m in total length and 7 m in width at the wings; the mesh is from 15 to 40 mm and the wings are held open by a rigid rod. The gear allows good manoeuvrability with a single boat of 50 hp, and is thus very appropriate for use between the numerous trays for farming mussels, *Mytilus edulis* Linnaeus, 1758, present in the estuaries, precisely where we found most of our specimens.

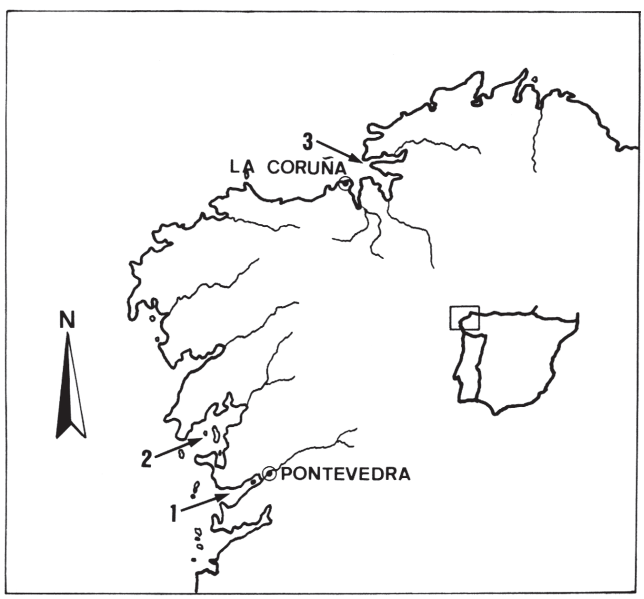

Figure 1. Galician sites where specimens of *Gobius gasteveni* were captured. **1**.- Ría de Pontevedra, **2**.- Ría de Arousa, **3**.- Ría de Ferrol.

Figure 1. Localités en Galice où les exemplaires de *Gobius gasteveni* ont été capturés. **1**.- Ría de Pontevedra, **2**.- Ría de Arousa, **3**.- Ría de Ferrol.

For identification of the species we used the description of Miller (1974, 1986). The lateral line system terminology used is that of Sanzo (1911) and Miller (1974). The sex was determined by the external form of the urogenital papillae (Miller, 1961). All the measurements, taken following the criteria of Parr (1931), were made with a calliper to the nearest 0.1 mm. The fin base measurements include the membrane. Instead of absolute biometric dimensions, we give certain body proportions to reduce age variation, enabling comparisons between males and females. For comparisons between samples, we used the Student t test, and $p \leq 0.05$. The number of sensory papillae of the lateral line system was counted on the left side of the fish.

The description of the coloration in live is based on the appearance of specimens freshly captured and on photographs taken in their environment. It is well known that gobies occasionally show very marked changes in coloration, ranging from pale tones to dark ones depending on environmental conditions. An individual can change colour, as a response to such conditions, in a short lapse of time. What we describe here are the two extreme colorations: that presented by the male and the female in normal circumstances (pale) and that acquired as a display behaviour (dark).

The diet study is based on analysis of the content of the digestive tube of a total of 21 preserved specimens, of which 5 were males and 16 females, with total lengths from 51.3 to 108.2 mm. The fishes were fixed in 4% formaldehyde and then preserved in 65º alcohol. The belly was opened from the anus to the pelvic disk, and the digestive tube was extracted, cutting at the beginning of the oesophagus and at the end of the rectum. The digestive tube was then cut longitudinally and its contents were collected by washing with 65º alcohol into Petri dishes. The remains were identified at the lowest possible taxonomic level. Previous studies in the zone have revealed the composition and abundance of species, both animals and algae, that are available as part of the diet of *Gobius gasteveni* (Chesney & Iglesias, 1979; Iglesias, 1981, 1983; López-Jamar et al., 1984; Fernández et al., 1995), and this helped greatly in the task of identifying the remains found in the digestive tube of our specimens.

Because most of the prey species were small, instead of biomass, we considered better to use the number of preys or their parts found in the digestive tube to calculate the frequency of occurrence and the percentage in number or index of relative frequency. In order to avoid duplication in the estimation of the number of prey specimens, we only counted the cephalothorax or head exoskeleton, depending on the crustacean groups. The frequency of occurrence is the number of stomachs in which an identified taxonomic group appears, divided by the total number of stomachs analysed, and expressed as a percentage. The index of

relative frequency is the total number of specimens of a prey species found in all the stomachs, divided by the total number of specimens of all prey species found in all the stomachs, and expressed as percentage (Hyslop, 1980; Amezaga, 1988).

Results

I - Geographical and ecological distribution

Gobius gasteveni has previously been found on the coasts of the English Channel (32 specimens) (Miller, 1974), Madeira (2 specimens) (Miller, 1974, 1984), and the Canaries (4 specimens - 3 at Gran Canaria, Miller, 1984; and 1 at Tenerife, Brito, 1991). The 81 specimens we found in the NW of Spain are therefore the first report for the Iberian Peninsula and for continental Europe.

Ninety-four percent of the specimens were captured in the Ría de Arousa, which is heavily affected by the monoculture of mussels on trays. The specimens of *Gobius gasteveni* were captured at depths of between 12 and 30 m on sea beds of which the surface was covered by trays of mussels, and always associated with *Gobius niger* Linnaeus, 1758 and *Lesueurigobius friesii* Malm, 1874. Other samplings made in the estuaries on beds without surface mussel trays, on beds of sand, on beds of gravel, and on beds of maerl* showed no presence of the species. Only isolated specimens were captured on the bed (30-60 m) of a channel in the Ría de Arousa. The two individuals captured in the Ría de Pontevedra were also found in areas of mussel trays, between 10 and 20 m in depth. In the Ría de Ferrol, in contrast, there are no culture trays, and the only 3 specimens were captured on silty sea beds, between 5 and 10 m. The water temperature in the capture areas ranged between 12.5 and 16.5 °C.

II - Description

1. Biometry

Of the 81 specimens captured, only 27 were available for biometric studies, 9 males and 18 females. The range of total length in the preserved specimens studied was 51.30 to 108.15 mm (41.00 to 88.60 mm of standard length). The number of scales in the maximum longitudinal series ranged between 40 and 49 with the following frequency: 40 scales: 1 specimen; 42: 2; 43: 3; 44: 8; 45: 5; 46: 5; 47: 1; 49: 2.

The fin ray formulae were: First dorsal, VI; second dorsal, I + 13-15 with the following frequency: (13 rays: 2 specimens; 14: 23; 15: 2); anal, I + 12-14 with the following frequency: (12 rays: 2 specimens; 13: 19; 14: 5); and pectoral, 19-21 with the following frequency: (19 rays: 2 specimens; 20: 13; 21: 9).

We found statistically significant differences between males and females in the following means of body proportions: snout to anal fin origin, snout to pelvic disk origin, second dorsal fin base and anal fin base, all with respect to the standard length (see Table 1). We also found statistically significant differences between means, in both males and females, of our specimens and those of Miller (1974) in the following proportions: head length, first dorsal fin base, and pectoral fin length, in standard length; snout length and eye diameter, in head length; and interorbital width in eye diameter (Table 1).

Table 1. Body proportion measurements of *Gobius gasteveni*. The values given refer to range; the mean and standard error are given in brackets. * Proportion measurement in which we have found significant differences between males and females ($p \leq 0.05$). # Proportion measurement in which Miller (1974) found significant differences between males and females ($0.1 > p > 0.05$). † Proportion measurement in which we have found significant differences between our specimens and those of Miller (1974) in both males and females.

Tableau 1. Mesures des proportions corporelles de *Gobius gasteveni*. Les valeurs extrêmes sont données ; la moyenne et l'erreur standard sont indiquées entre parenthèses. * Proportions significativement différentes chez les mâles et les femelles ($p \leq 0.05$). # Proportions significativement différentes chez les mâles et les femelles ($0.1 > p > 0.05$), d'après Miller (1974). † Proportions significativement différentes chez nos exemplaires et ceux de Miller (1974), pour les mâles et les femelles.

	Males	Females
Number	9	18
Standard length in mm.	41.00 - 88.60	43.85 - 85.75
Body proportions		
In Standard length:		
Head length †	3.36 - 3.89 (3.71 ± 0.06)	3.38 - 3.91 (3.67 ± 0.03)
Snout to first dorsal fin origin	2.90 - 3.35 (3.15 ± 0.06)	2.81 - 3.99 (3.10 ± 0.06)
Snout to second dorsal fin origin	1.89 - 2.88 (2.05 ± 0.10)	1.82 - 3.18 (1.97 ± 0.07)
Snout to anal fin origin*, #	1.73 - 1.89 (1.81 ± 0.03)	1.62 - 1.78 (1.74 ± 0.01)
Snout to pelvic disk origin*, #	3.42 - 3.90 (3.60 ± 0.05)	2.98 - 3.69 (3.44 ± 0.05)
Caudal peduncle length	5.49 - 6.95 (5.96 ± 0.15)	5.32 - 7.21 (5.99 ± 0.10)
First dorsal fin base †	4.84 - 5.86 (5.43 ± 0.11)	4.90 - 5.97 (5.38 ± 0.08)
Second dorsal fin base*	2.86 - 3.25 (3.04 ± 0.04)	2.95 - 3.33 (3.14 ± 0.02)
Anal fin base*	3.54 - 3.80 (3.71 ± 0.03)	3.46 - 4.15 (3.85 ± 0.04)
Pectoral fin length †	3.73 - 4.77 (4.10 ± 0.11)	3.74 - 4.35 (3.96 ± 0.03)
Pelvic disk length	4.77 - 5.58 (5.15 ± 0.08)	4.68 - 5.91 (5.32 ± 0.07)
Pelvic origin to anus #	3.82 - 4.23 (4.05 ± 0.05)	3.59 - 4.62 (4.09 ± 0.06)
In head length:		
Snout length †	2.56 - 4.24 (3.86 ± 0.08)	3.41 - 4.55 (3.86 ± 0.07)
Eye diameter †	3.39 - 3.86 (3.67 ± 0.05)	3.36 - 4.04 (3.70 ± 0.05)
Postorbital length	1.87 - 2.01 (1.94 ± 0.02)	0.99 - 2.09 (1.84 ± 0.07)
In eye diameter:		
Interorbital width †	5.22 - 12.00 (6.98 ± 0.69)	5.80 - 12.17 (7.35 ± 0.37)
In pelvic disk origin to anus:		
Pelvic disk length #	1.16 - 1.42 (1.27 ± 0.03)	1.15 - 1.52 (1.31 ± 0.03)

* Biogenic beds originated by accumulation of arborescent calcareous algae, especially *Lithothamnion corallioides* (P. & H. Crouan) P. & H. Crouan (1867) and *Phymatolithon calcareum* (Pallas) Adey & Mckibbin (1970).

2. Lateral line system:

The number of sensory papillae in the 27 specimens studied is shown in Table 2, together with the range of papillae reported by Miller (1974, 1984) for comparison.

With regard to the lateral series of pre-orbital papillae (series c), Miller (1974) divided the upper series c^2 into two short lines, the inner one with 2-6 papillae and the outer with 3-5 papillae. In our specimens we observed much variation in this series of papillae, so we have established two types of distribution for all the specimens we studied (Fig. 2). Type A are specimens with only two lines in the c^2 series, both with several papillae, and type B are specimens with three lines in the c^2 series, each with several papillae - although sometimes (18.5%) with one of the lines consisting of a single papillae (subtype B_1). Of the 27 specimens in which we counted the number of papillae of the c^2 series, most (85.2 %) were of type B, and the rest (14.8%) of type A. However, because of the difficulty of counting each line of the c^2 series, which occasionally even overlapped, we considered the total number of papillae of the c^2 series, without distinguishing the lines (Table 2).

III. Coloration on live animals

1. The pale coloration

The pale coloration shows tones from pale orange-brown to faint bluish-grey (Fig. 3 and Fig. 4), with diffuse orange-brown patches. On the lateral mid line appear rectangular orange-brown blotches darker than the general background, some with darker spots of colour. The number of blotches in the lateral mid line ranges between 6 and 9 (Miller, 1974, mentions only 6), the first below the first dorsal fin and the last on the caudal fin. From the pectoral fin to the caudal fin, below the blotches of the lateral mid line, there are no blotches of colour, and the general tonality is pale, with a slight orange-brown colour. Dorsal from the rectangular blotches of lateral mid line and along the whole body the background colour is pale with light bluish-grey tones, and more or less irregular and diffuse orange-brown patches that sometimes form longitudinal lines. There is a noticeable continuous band along each side of the body, from the eyes to the last ray of the first dorsal fin. Below this band can be seen another band, less marked, parallel to the former and which may extend in front of the eyes. This latter band is darker orange with, at the level of the posterior oculoscapular canal, several very characteristic round patches of different orange tones, occasionally with darker edges.

On the snout, cheeks, and pre-opercular and opercular areas, on a pale orange-brown background, there are noticeable circular bluish-white spots.

The dorsal fins and the caudal fin are horizontally striped with orange-brown patches at the level of the rays, weakly

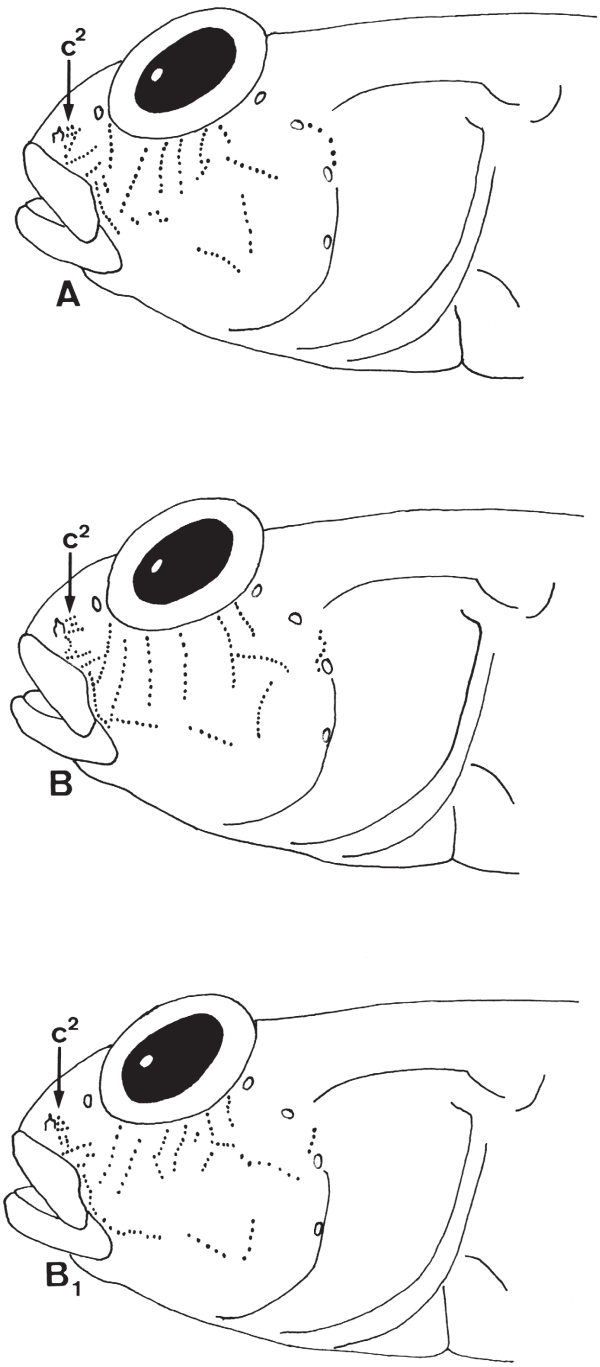

Figure 2. Diagram of the lateral series of pre-orbital papillae and suborbital lines (black dots). The two types of individual found are shown as **A** and **B** (including variation $\mathbf{B_1}$) depending on the lines of pre-orbital papillae of the upper series c^2.

Figure 2. Diagramme des séries latérales de papilles préorbitaires et des lignes suborbitaires (points noirs). Deux types d'individus ont été reconnus, **A** et **B** (y compris la variation $\mathbf{B_1}$) d'après la disposition des lignes de papilles préorbitaires de la série supérieure c^2.

Table 2. Number of sensory papillae of the lateral line system, by groups, following the terminology of Sanzo (1911) and Miller (1974). *Data on a specimen from Funchal (Miller, 1984); **value found in only one specimen; ab, line absent.

Tableau 2. Nombre de papilles sensorielles du système de la ligne latérale, par groupes, d'après la terminologie de Sanzo (1911) et de Miller (1974). *données sur un exemplaire de Funchal (Miller, 1984) ; **valeur sur un seul exemplaire ; ab, ligne absente.

	MILLER (1974)	Our specimens		MILLER (1974)	Our specimens
Nº specimens	13	27		13	27
Pre-orbital			Oculoscapular		
r^1	2 - 4	2 - 4	x^1	10 - 15	8 - 18
r^2	2 - 3	2 - 4	x^2	3 - 8	4 - 9
s^1	2 - 4	2 - 4	*z*	5 - 7	4 - 7
s^2	3 - 4	1 - 5	*q*	2 - 5	2 - 4
s^3	3 - 6	3 - 7	*tr*	1 - 2 (ab)*	(ab) 3**
c^2	5 - 11	4 -13	*y*	1 - 5	1 - 6
c^1	2 - 7	4 - 9	as^1	4 - 7	4 - 8
c^2	6 - 8 (12)*	6 -12	as^2	4 - 9	4 - 9
c^1	4 - 5	3 - 6	as^3	5 - 10	5 - 10
			la^1	1 - 3	2 - 4
Suborbital			la^2	1 - 3	2 - 3
1	8 - 14	7 -16			
2	6 - 10	6 -11	Opercular		
3	6 - 9	6 -12	*ot*	27 - 31	15 - 36
4	6 - 10	6 -11	*os*	11 - 14	7 - 13
5	6 - 13	6 -13	*oi*	6 - 8	6 - 10
6	10 - 15	10 -18			
b	9 - 15	9 -17	Anterior dorsal		
d	21 - 29	15 - 31	*n*	4 - 6	4 - 7
			g	7 - 8	6 - 9
Pre-opercular-mandibular			*o*	3 - 7	4 - 7
e	38 - 65	36 - 61	*m*	3 - 6	3 - 6
i	19 - 31	21 - 40	*h*	9 - 12	9 - 15
f	4 - 7	ab			

on the interradial membranes. On the dorsal fins this striping is more marked on the first ray. On the caudal fin the striping is stronger on the upper rays, decreasing progressively towards the lower ones. The first dorsal fin has a pale edging on the interradial membrane between rays I and V, although the orange-brown ends of the rays stand out. The second dorsal fin has a similar edge band, although less marked, between rays 1 and 13. The rest of the membrane of the dorsal fins is a translucent dirty-pale colour, with marked, elongated or rounded, whitish ocelli.

The pectoral, pelvic and anal fins are weakly striped. At the base of the pectoral fin there is a marked, right-angled, pale orange-brown patch. On the anal fin may occasionally be detected a slight dark subterminal band.

2. The dark coloration

The fish's whole body -head, body and fins- is much darker (Fig. 3, Fig. 5). The body darkening means that the blotches of lateral mid line described under pale coloration do not stand out so much, since the generalized darkening equalizes the intensity in the dorsal and ventral parts of the fish. The general colour is dark orange-brown. More-orange iridescences stand out between the blotches of the lateral mid line, on the dorsal part, and especially on the line of the posterior oculoscapular canal, and at the base of the pectoral fins. The bluish-grey iridescences of the dorsal part already described under pale coloration remain, but now a bluish-grey area is also seen on the pectoral fins. The upper part of the head and snout is dark brown with diffuse bluish-grey patches, and there is a noticeable paler area in the commisure of the mouth, with another bluish-white spot above and immediately behind the upper "lip". The snout, cheeks and pre-opercular and opercular areas are mottled

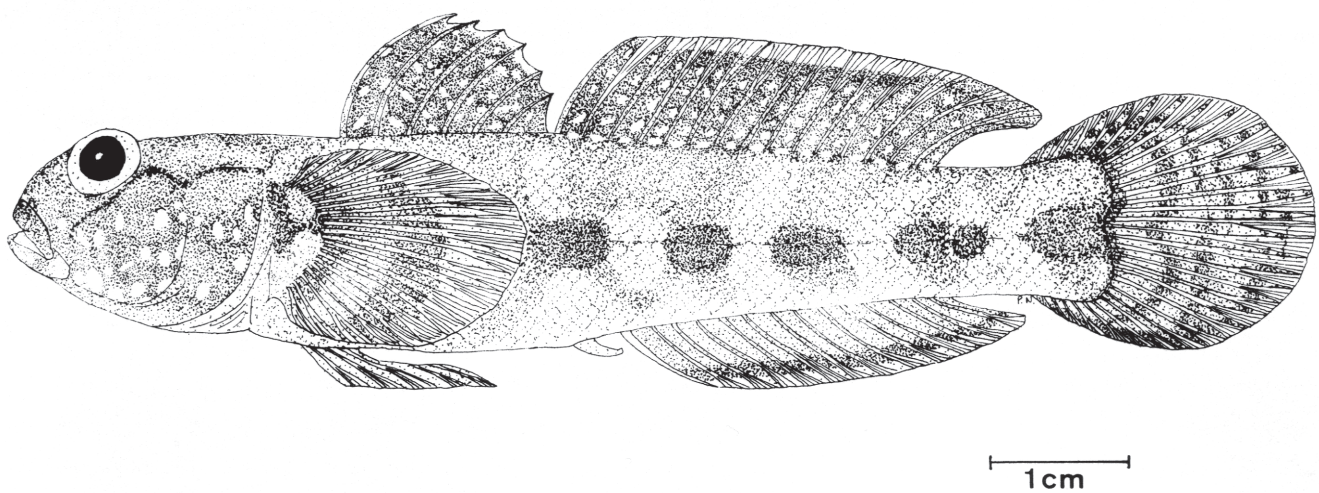

Figure 3. *Gobius gasteveni* based on a preserved male of 94 mm total length.
Figure 3. *Gobius gasteveni* d'après un exemplaire mâle fixé, d'une longueur totale de 94 mm.

Figure 4. Pale coloration of *Gobius gasteveni*. Picture by J. L. González.
Figure 4. Coloration claire de *Gobius gasteveni*. Photo de J. L. González.

Figure 5. Dark coloration of *Gobius gasteveni*. Picture by J. L. González.
Figure 5. Coloration sombre de *Gobius gasteveni*. Photo de J. L. González.

with circular, pale yellowish-white to gold spots. There are also some spots of gold on the head canal located above the pre-operculum and at the base of the upper rays of the pectoral fin.

The rays of the first dorsal fin are dark brown to the distal end. The membrane has a greenish-brown coloration, with generally elongated or elliptical very pale blue spots that occasionally reach the rays, above all the first. These spots

are not aligned. At the base of the rays of the first dorsal fin are occasionally seen orange patches that rise slightly up both sides of the rays. The distal part of the membrane of this fin, between rays 1 and 5, has a white or ivory band at the edge. This white band descends behind the first ray along 1/4 of its length.

The second dorsal fin has a similar aspect to the first. Here, the bluish spots have a certain longitudinal alignment; in addition, at most of the bases of the interradial membranes can be seen an elongated bluish spot. As in the case of the first dorsal fin, there is also in the second dorsal fin a marked white terminal band between rays 1 to 12-13. Below this pale band there is a diffuse, dark patch in each interradial space.

The caudal fin has some bluish patches, but basically in its upper half, and in this case along part of the length of the rays.

IV. Feeding

We carried out a very simple analysis of the feeding of this species. The groups most represented in the diet, measured as frequency of occurrence, were crustaceans and polychaetes (Table 3). Of the latter, in most cases only the hard parts and the chaetae were found, impeding calculation of the percentage in number as for some other groups of prey (Table 1). In the case of crustaceans we were able to make a more detailed study, although the advanced state of digestion of most of the prey prevented identification at species level.

In two of the specimens of *Gobius gasteveni* studied, fish remains were found in the digestive tube. One had fish vertebrae that could not be assigned to any species or group. The other specimen, of 87.25 mm total length, had a 28 mm long unidentified species of gobiid fish, partially digested, in the stomach. Chesney & Iglesias (1979) also found a gobiid species, *Aphia minuta* (Risso, 1810), forming part of the diet of *Gobius niger* in the Ría de Arousa.

In 7 specimens, eggs were found in the stomach, but their species could not be identified.

Parasites (nematodes and helminths) were frequently present, above all in the final part of the digestive tube.

Table 3. Number of *Gobius gasteveni* (males, females, and total) where the different types of preys have been found. The number of specimens of a prey type, when possible, is given in brackets. In the last two columns are given the frequency of occurrence of the different preys and their percentage in number (Hyslop, 1980; Amezaga, 1988) or index of relative frequency in number (see text for definition of these terms). U = Unidentified.

Tableau 3. Nombre de *Gobius gasteveni* (mâles, femelles, et total) où les différents types de proies ont été trouvés. Les nombres d'exemplaires appartenant à des proies identifiées sont donnés entre parenthèses quant cela est possible. Les deux dernières colonnes représentent le pourcentage de présence des différentes proies et leur pourcentage numérique (Hyslop, 1980; Amezaga, 1988) ou index de pourcentage numérique relatif (voir le texte pour la définition de ces termes). U = non identifié.

	Males n = 5	**Females** n = 16	**Total** n = 21	**Frequency of Occurrence**	**Percentage in Number**
ALGAE AND PLANT REMAINS	**0**	**3**	**3**	**14.3**	**-**
BRYOZOA	**0**	**1**	**1**	**4.8**	**-**
HYDROZOA	**1**	**5**	**6**	**28.6**	**-**
POLYCHAETES	**1**	**11**	**12**	**57.1**	**-**
MOLLUSCS (Total)	**1 (1)**	**4 (4)**	**5 (5)**	**23.8**	**8.2**
Cerastoderma sp. / *Venus* sp.	0	1 (1)	1 (1)	4.8	1.6
Venerupis sp.	0	1 (1)	1 (1)	4.8	1.6
Mytilus edulis Linnaeus, 1758	1 (1)	1 (1)	2 (2)	9.5	3.3
Gastropods (U.)	0	1 (1)	1 (1)	4.8	1.6
Byssal threads of *M. edulis*	2	8	10	47.6	-
CRUSTACEANS (Total)	**5 (16)**	**10 (38)**	**15 (54)**	**71.4**	**88.5**
Gamarids	2 (3)	2 (2)	4 (5)	19	8.2
Leptostraceans: *Nebalia bipes* (Fabricius, 1780)	0	1 (3)	1 (3)	4.8	4.9
Decapods: *Inachus dorsettensis* (Pennant, 1777)	0	1 (1)	1 (1)	4.8	1.6
Pisidia longicornis (Linnaeus, 1767)	2 (12)	10 (30)	12 (42)	57.1	68.9
Pseudoprotella phasma (Montagu, 1804)	1	1 (2)	2 (3)	9.5	4.9
Remains (U.)	1	5	6	28.6	-
FISHES	**0**	**2 (2)**	**2 (2)**	**9.5**	**3.3**
EGGS	**1**	**6**	**7**	**33.3**	**-**

Discussion

I - Geographical and ecological distribution

The present report of *Gobius gasteveni* in the coast of Galicia, in spite of being the first record for continental Europe, does not widen the overall geographical distribution of the species, since the new site is between those already reported; in fact Miller (1984) suggested the probability of finding this species in Iberia.

Brito (1991) and Miller (1974, 1984) reported as habitat for *Gobius gasteveni,* depths ranging between 35 and 270 m and bottoms of rocks and sand, or silt, and less frequently of shell or small-stone deposits. The habitat in which we have found *G. gasteveni* seems to be very similar to that described by Brito (1991) and Miller (1974, 1984) but at a lesser depth. However, in our case, a marked preference of *G. gasteveni* should be noted for areas of mussel cultures, probably due to the abundance there of the main prey *Pisidia longicornis*. The temperature of the water in which the previous captures were made was not given, but Miller (1974) considered that the requirement of *G. gasteveni* is

warm-temperate waters, which fits well with the water temperature range in the areas of our captures.

In spite of the fact that the number of specimens we collected is more than double that previously known, our results do not invalidate the type of distribution already known for the species, but confirms it. Thus, *Gobius gasteveni* continues to be characterized by inhabiting specific, geographically distant sites, in temperate waters.

II - Biometry

The specimens we captured in the north-west of the Iberian Peninsula fit well the original description made by Miller (1974). Only small differences in certain aspects have been found, such as the maximum total length, which does not reach the 120 mm reported as the maximum size known for *G. gasteveni* (Miller, 1986); the number of scales in the maximum longitudinal series, which exceeds the maximum known range of scales (37-45) (Miller, 1974, 1984, 1986); or the slightly smaller pectoral fin ray formulae with respect to the 18-22 reported by Miller (1974, 1986). The reason for these differences lies in the small number of specimens compared.

The biometry analysis of this species made by Miller (1974) shows statistically significant differences between sexes in the mean of some body proportions (see Table 1). We also found differences between sexes in some body proportions, but the coincidence with the above author's observations is reduced to two (Table 1): Snout to anal fin origin and snout to pelvic disc origin, with respect to standard length, both of which in our data are larger in males than in females. As, on the other hand, we have not found differences between males and females in the proportion of snout to second dorsal fin length, with respect to standard length, this would mean that in females, the start of the anal fin with respect to the second dorsal fin is located a little further back than in males. This is directly visible in our specimens where, in 100 % of the males, the origin of the anal fin is located below the space between the first and the second articulated rays of the second dorsal fin, while in 94 % of the females, it is located between the second and third articulated rays. This feature could be taken as a further aid in sex differentiation of *G. gasteveni*.

Some body proportions of our specimens from NW Spain also show slight statistical differences with those specimens studied by Miller (1974) from the English Channel. The significance of these differences is difficult to interpret. We suggest that they could be due to slight differences in the method of measurement, as already expressed in a previous work regarding fin base measurements (Nieto & Alberto, 1992), rather than reflecting differences between populations. This needs to be confirmed with more data and larger population samples.

III. Lateral line system

The cephalic canals and pores (Table 2) also coincide with those described by Miller (1974) for the species. In our specimens, the range in most of the papillary series is greater, probably because we were able to count the papillae in more specimens. In spite of the fact that the number of papillae is rather variable, within specific limits, our data contribute to a better knowledge of *G. gasteveni*.

We have focused particularly on the c^2 series, divided by Miller (1974) into external and internal parts, which raised problems of interpretation. This led us to the analysis of its variation, and the proposal of the types A and B (Fig. 2). In any case, we consider that, if a detailed comparison between different populations is not required, it seems more appropriate to state for this species the total number of papillae in overall c^2 series.

IV. Coloration on live animals

The coloration of *Gobius gasteveni* described by Miller (1974, 1984, 1986) was based on preserved specimens. Miller (1974, 1984) gave only some brief comments about the coloration in live according to notes of Mr. G.E. Maul on a male specimen captured at Madeira, and on another immature male from Plymouth. These comments refer to the general coloration of the body, the spotting of the cheeks and opercle, and the coloration of the fins. Some of these coloration patterns match our description, such as the lateral dark blotches and the spots on cheek and opercle, but others do not, such as the dark edging on the anal and caudal fins, which is absent on our specimens.

The most characteristic features of the coloration in live are the lateral mid line blotches, the orange-brown general body colour and the cheek and opercle light spots. In the dark coloration, other outstanding features appear, such as the colour pattern in the dorsal fins.

V. Feeding

Until now, the feeding habits of *Gobius gasteveni* were unknown. The gobiids, in general, are small predators that feed on invertebrates and sometimes on small fishes (Miller, 1986). The specimens of *G. gasteveni* we analysed follow this general rule for the group. The diet we found is based mainly on animal material, because algal and plant remains were found in only 3 specimens (Table 3). The high value we found for *Pisidia longicorni*s as a prey is noteworthy. This result is in accordance with ecological aspects associated with mussel culture in the area. Thus, Zariquiey (1968) has already reported *P. longicornis* as closely associated with the mussels; López-Jamar et al. (1984) and Fernández et al. (1995) also reported this small decapod as frequent in the mussel trays of the Ría de Arousa, the locality where most of the analysed specimens came from.

On the other hand, López-Jamar et al. (1984) demonstrated that the monoculture of mussels in the Ría de Arousa has a considerable effect on the surrounding fauna, favouring the growth of a community of epifauna associated with the mussel trays, to the detriment of the infauna, which is reduced to only those species very well adapted to eutrophic environments. However, based on the qualitative and quantitative results of the prey available in that capture site (López-Jamar et al., 1984), we see that only a few of those prey species of the epifauna are involved in the diet of *Gobius gasteveni,* the decapod *Pisidia longicornis* having the highest percent. Similar results were found in this habitat of the Ría de Arousa with other species of gobiids (*Gobius niger* and *Lesueurigobius friesii*) and also with fish species of other families (*Callionymus lyra* Linnaeus, 1758 and *Trisopterus luscus* Linnaeus, 1758) which appeared to select positively *P. longicornis* as a prey (Chesney & Iglesias 1979; López-Jamar et al., 1984; Fernández et al., 1995). However, the ecological significance of the presence of *Pisidia longicornis* on the abundance of *Gobius gasteveni* needs to be proved.

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