

GOBIES OF THE BRITISH ISLES (TELEOSTEI: GOBIIDAE)

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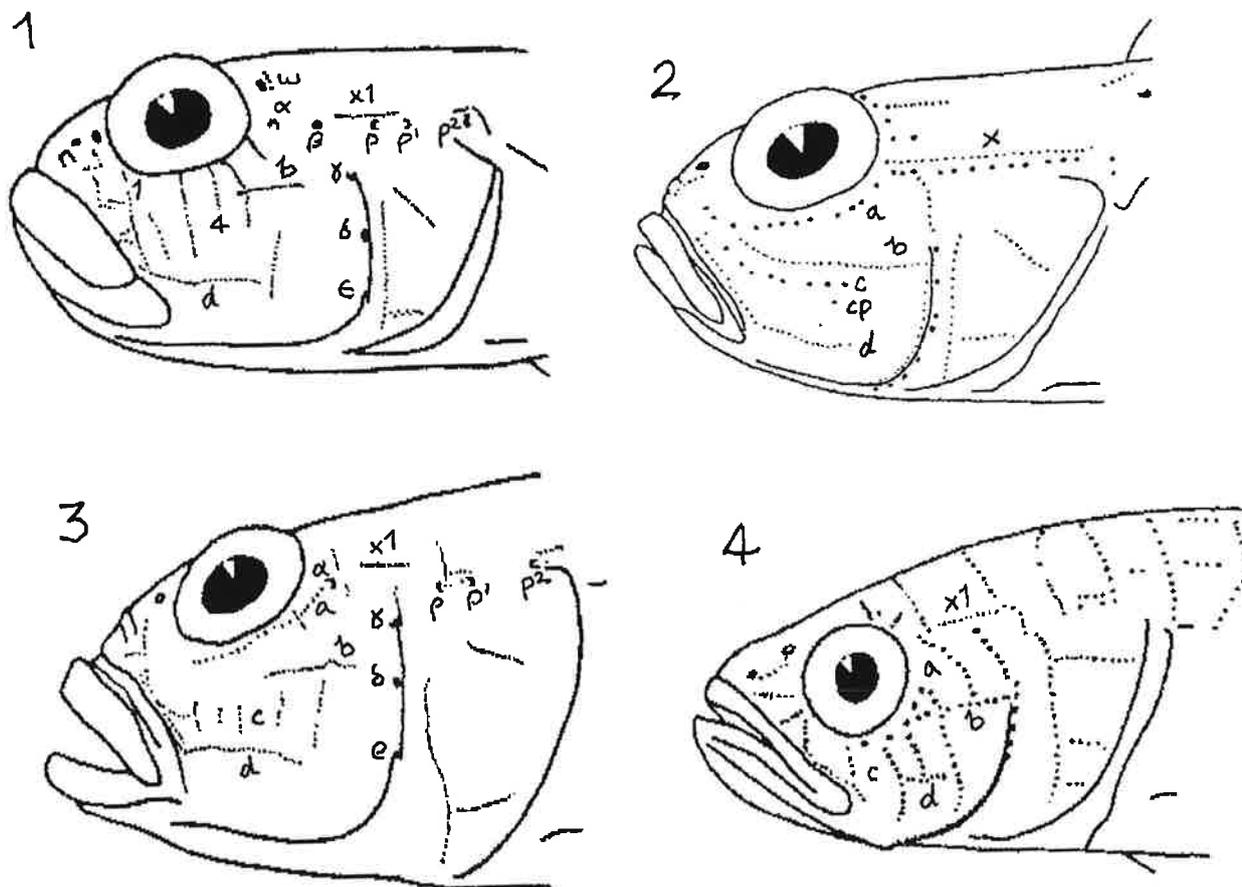
The gobioid fishes form the large suborder Gobioidae of percomorph teleosts (at least 2500 species worldwide). They are chiefly tropical and warm temperate benthic fishes, mostly inshore marine but many estuarine and freshwater. There are three major grades: loach gobies (Rhyacichthyidae), retaining a body lateral-line; sleeper gobies (Odontobutidae and Eleotridae), with separate pelvic fins; and the 'goby-grade gobioids', whose pelvic fins are united into a simple suctorial disc, with an anterior transverse membrane (frenum) connecting the spinous ray of each fin across the midline of the abdomen, and a posterior median membrane linking the fifth branched ray of each fin. By far the largest family of true gobies, the Gobiidae, houses all the nineteen species summarised below.

In body form, the British gobies are typically moderately elongate, subcylindrical to laterally compressed. Most are bottom-living, with depressed head, dorsolateral eyes, narrow interorbit and prominent rounded cheeks. Three midwater species (*Gobiusculus flavescens* and the aphiines) are more laterally compressed, with eyes lateral on the head, and the caudal fin somewhat emarginate rather than rounded. In all species, two nostrils are present on each side of the snout, the anterior more or less tubular, sometimes with a rim process, the posterior usually pore-like, near the eye. There are two dorsal fins and one anal fin, the first dorsal usually with 6 or 7 flexible spines, the second dorsal and anal fins of a single spinous ray and typically about 8-14 branched rays, the last divided to the base. In *Lebetus* species the pelvic anterior membrane is absent and female *Crystallogobius* have only a rudimentary pelvic disc and no first dorsal fin. The pectoral fins are large, sometimes with free uppermost rays. Scale cover is normally imbricate (overlapping) and ctenoid, at least on the body, with uniseriate cteni, and scales along the lateral midline can number from less than 30 to over 70, counted from axilla ('arm-pit' behind the pectoral fin base) to the origin of the caudal fin.

The lateral-line system in all gobies is much modified and provides important criteria for classification. A lateral-line canal is absent from the side of the body in the true gobies and, on the head, at best development, only supraorbital, post-ocular and preopercular canals are present, with intermediate and terminal pores. All head canals are lost in *Lebetus*, *Lesueurigobius* and the aphiines. The head and body bear characteristic patterns of exposed neuromast organs (sensory papillae, ciathiform organs, genipores) of great systematic importance. Four basic types are seen among British gobies, and used here to divide the British species into four groups. The *Gobius*-group (gobiines) has a 'transverse' pattern, but the other three categories are 'longitudinal', Fries Goby (*Lesueurigobius*) showing the simplest arrangement whereas the sand-gobies (pomatoschistines) and the transparent gobies (aphiines) have essentially longitudinal patterns that also incorporate transverse cheek rows. All three latter groupings possess row a running along the lower margin of the eye, diagnostic for 'longitudinal' species and so absent in *Gobius*-group members.

The diagram shows these arrangements, transverse as represented by *Gobius niger*, the simple longitudinal kind by *Lesueurigobius friesii*, and the modified longitudinal patterns by *Pomatoschistus microps* and *Aphia minuta* respectively. Terminology of canal pores and papillae rows is based on Wongrat & Miller (1991). Canal pores: Greek lettering: λ - ρ , anterior oculoscapular canal; ρ 1- ρ 2, posterior oculoscapular canal; γ - ϵ , preopercular canal. Sensory papillae rows: series of dots, with Roman lettering.

Sensory papillae and canal pores are best viewed by oblique lighting under a binocular microscope, with the specimen under water or alcohol. Canals may be injected with a dye, such as ink. In the past, sensory papillae have been stained with chromic acid, ferric tannate, or potassium permanganate, but treatment with acids in the first two techniques decalcifies at least superficial bony structures, and all these chemical methods have a more or less deleterious effect on the appearance of the specimen. Best avoided.



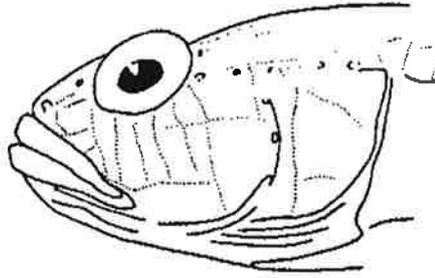
1. Transverse (*Gobius niger*); 2. Longitudinal (*Lesueurigobius friesii*, no canals); 3. & 4. Modified longitudinal: 3. *Pomatoschistus microps* & 4. *Aphia minuta* (no canals).

Gobius group (Gobiines)

Seven larger species, to 90-240 mm, free pectoral rays present or absent; anterior nostril usually with a process from rim; coloration darker in males but never with vertical bars; no row of papillae around lower border of the eye; cheek transverse rows well-developed, 4 before horizontal row b, 2 above and 2 below; vertebrae 28 dorsal pterygiophore sequence beginning (3)2211.

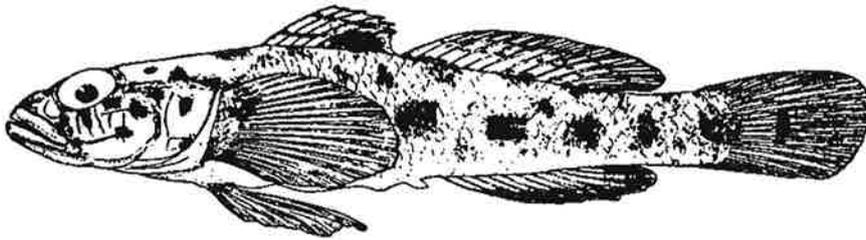
THOROGOBIUS Miller, 1969

Suborbital papillae with 6 transverse rows, plus 1 papilla within pore α ; 4 rows before and 2 lower parts below longitudinal row *b*. No row *a*. Anterior and posterior oculoscapular and preopercular head canals present. Predorsal area and head naked. Anterior nostril tubular, without process from rim. Pectoral fin uppermost rays not free from membrane. Pelvic disc complete in *T. ehippiatus* (rear edge emarginate and anterior membrane reduced or absent in Mediterranean *T. macrolepis* (Kolombatovic, 1891). First dorsal fin usually VI. Scales in lateral series 27-42, ctenoid. Vertebrae 28, dorsal pterygiophore sequence beginning (3)221. Atlantic-Mediterranean species are cryptobenthic, chiefly encountered by aqualung diving.



LEOPARD-SPOTTED GOBY
Thorogobius ehippiatus (Lowe, 1839)

Best-known synonym: *Gobius forsteri* Corbin, 1958.



Morphology: Pelvic disc complete, with anterior membrane as deep in ventral midline as length of pelvic spinous ray, and rear edge rounded, fifth branched ray longer than fourth. DI VI (VI-VII); D2 I/11 (10-12); A I/10; P 17-19 (17-20). Scales in lateral series 36-38 (33-42). Vertebrae 28.

Coloration: pale fawn or sandy with large orange to brick-red blotches over head and body; first dorsal fin with posterior dark blotch; males may become dark purple.

Size: to 13 cm.

Habitat: inshore, in or near crevices of steep rock faces, to 40 m, usually 6-12 m; rarely in deep intertidal pools.

Diet: crustaceans (copepods, amphipods, decapods), polychaetes, gastropods, algae.

Reproduction: May-July (Plymouth; Connemara); sexually mature at 3 or 4 years. Fecundity 2,532-12,056 at 6.1-8.8 cm. Lifespan: 9 years.

Distribution: eastern Atlantic (Western Sweden) to Azores, Madeira, Salvages, and Canaries; Mediterranean.

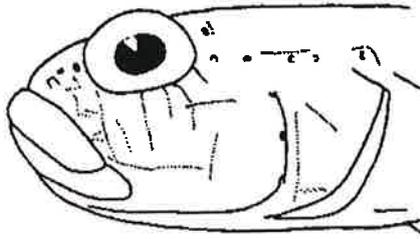
GOBIUS Linnaeus, 1758

Suborbital papillae with 6 transverse rows, 4 complete before and 2 above and below longitudinal row *b*; sometimes 1 to a few papillae visible in pore α . No row *a*. Anterior and posterior oculoscapular, and preopercular, head canals present. Nape and predorsal area scaled, sometimes rear cheek. Anterior nostril with triangular to tentacle-like or digitate process from posterior rim. Pectoral fin with at least uppermost 2 or 3 rays more or less free from membrane. Pelvic disc complete to deeply emarginate with reduced anterior membrane. D1 VI; D2 I/11-15(16); A I/11-14 (10-14); P 16-21 (15-22). Scales in lateral series 30-70, ctenoid. Vertebrae usually 28, dorsal pterygiophore sequence beginning (3)221. Mostly larger gobies, from intertidal rock pools to offshore fine deposits, some in brackish waters.

BLACK GOBY
Gobius niger Linnaeus, 1758

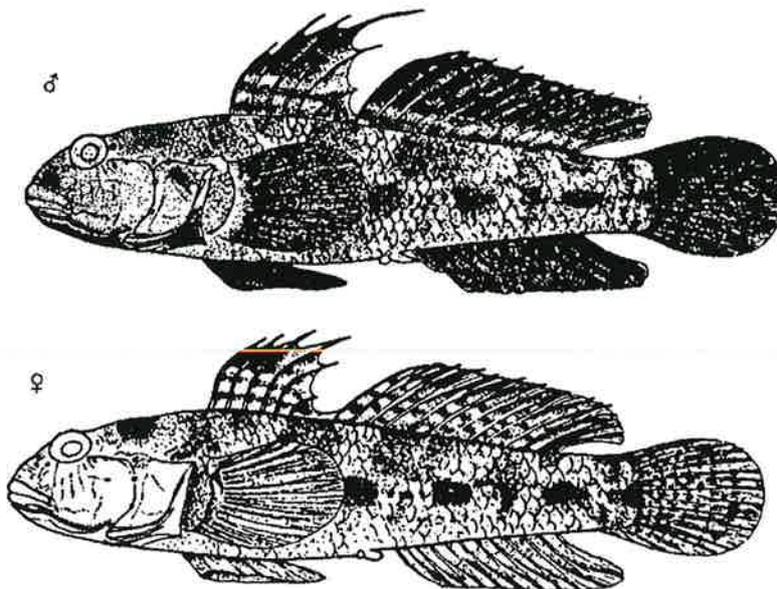
Best-known synonym: *Gobius jozo* Linnaeus, 1758.

Morphology: Nape scaled, to varying extent; cheek naked. Anterior nostril with lappet on rim. Pectoral free rays moderately developed. Pelvic disc rounded to oblong; anterior membrane without prominent lateral lobes. D1 VI (V-VII), rays elongate; D2 I/12-13 (11-13); A I/11-12 (10--13); P 17-19 (15- 20). Scales in lateral series 35-41 (32-42). Vertebrae 28 (27-29).



Lateral-line system :suborbital row *d* continuous, row *x1* ending anteriorly behind pore β and pore α behind eye on course of oculoscapular canal; pores may be relatively large

Coloration: pale brown, with lateral dark blotches and spots; males dusky; dark blotch in upper anterior



corner of each dorsal fin; branchiostegal membrane dark.

Size: to 15 cm.

Habitat: estuaries, lagoons and inshore waters, to 50-75 m, on sand or mud, in sea-grass or algae, rarely intertidal at ELWS.

Diet: crustaceans (larger amphipods, isopods, shrimps, mysids, small crabs), bivalves, gastropods, polychaetes, chironomid larvae, sometimes small fish.

Reproduction: March-May (Naples), April-early June (Veerse Meer, Netherlands), May-August (Baltic), April-September (Vama, Black Sea); repeat-spawning. Eggs spindle-shaped, blunt apex, 1.5 x 0.45 mm, under stones and shells; hatch at 2.5 mm. Sexually mature at 2 years. Lifespan at least 4 years.

Distribution: eastern Atlantic, from Norway and Baltic Sea to Canaries and Mauritania, Mediterranean and Black Sea, including Sea of Azov; lessepsian immigrant into Suez Canal and northern Gulf of Suez. .

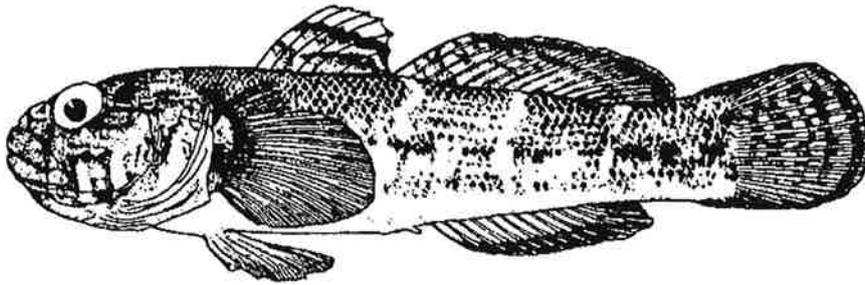
Subspecies

Gobius niger niger. nape scales smaller, coverage incomplete; eastern Atlantic.

Gobius niger jozo L.: nape scales larger, imbricate; Mediterranean and Black Sea.

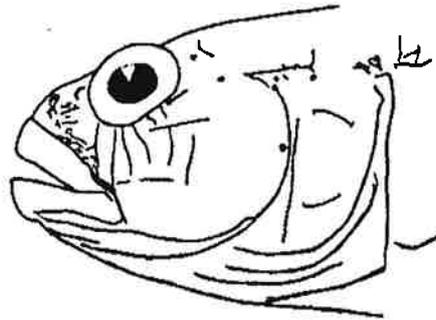
ROCK GOBY

Gobius paganellus Linnaeus, 1758



Best-known synonyms: none.

Morphology: Nape scaled; cheek sometimes scaled in upper rear corner. Anterior nostril with digitate process. Pectoral free rays well developed, reaching to or near first dorsal origin, especially in small examples. Pelvic disc rounded, anterior membrane sometimes with small lateral lobes. D1 VI; D2 I/13-14 (12-15); A I/11-12 (10-13); P 21-22 (18-23). Scales in lateral series 50-55 (46-59). Vertebrae 28.



Lateral-line system: suborbital row *d* in two parts and transverse rows 2 and 3 sometimes ending near orbit; row *x1* ending anteriorly behind pore β ; pore α on short side-branch from oculoscapular canal along lower border of orbit.

Coloration: fawn with dark mottling and lateral blotches, to dark brown; upper margin of first dorsal fin with pale band, rear corner with dark blue spot in juveniles; breeding males deep purplish-brown, with first dorsal band yellow to orange.

Size: to 12 cm.

Habitat: inshore, on rocky grounds, to about 15 m, and intertidal, under stones and in pools on sheltered rocky shores with much weed cover.

Diet: in adults, crustaceans (larger amphipods, isopods, small crabs) and polychaetes; juveniles eat harpacticoid copepods, amphipods, polychaetes and mites.

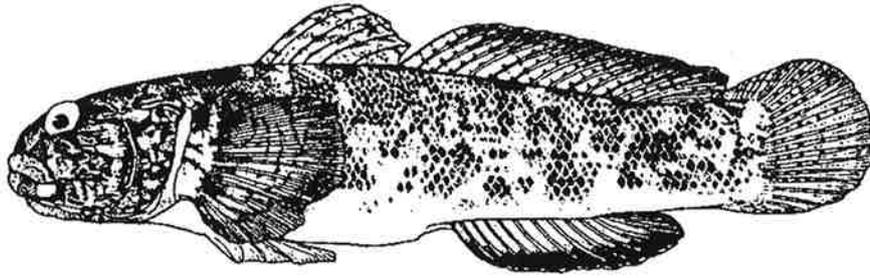
Reproduction: January-June (Naples), April-June (Isle of Man, Irish Sea), March to mid-May (Varna, Black Sea); repeat spawning. Eggs fusiform, with bluntly pointed apex, 2.2-2.6 (1.84-3.0) mm, in patches of up to several thousand (110-140 per cm), on undersurface of stones, shells, polychaete tubes or *Ciona* mantles. Development time about 20 days, hatch at 3.6-4.8 mm, metamorphosing at 9.5-10.5 mm. Fecundity 1,054-8,978 at standard length 4.85-8.8 cm. Sexually mature at 2-3 years. Lifespan: to 10 years.

Distribution: eastern Atlantic, from western Scotland and southern North Sea to tropical West Africa (Senegal), including oceanic islands; Mediterranean and Black Sea (except north-west). lessepsian immigrant into Gulf of Eilat, Red Sea.

Hybridization: reported with *Gobius cobitis* in Black Sea.

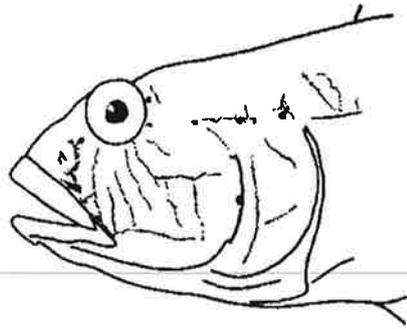
GIANT GOBY

Gobius cobitis Pallas, 1811



Best-known synonym: *Gobius capito* Valenciennes, 1837.

Morphology: Nape scaled, cheek naked. Anterior nostril with long tentacle, often digitate. Pectoral free rays well developed. Pelvic disc short, rounded, anterior membrane with lateral lobes. D1 VI; D2 I/13 (13-14); A I/11 (10-12); P 20-21 (19-22). Scales in lateral series 59-67.



Lateral-line system: suborbital row *d* continuous, row *x1* ending anteriorly behind pore β , and pore α behind eye on course of oculoscapular canal.

Coloration: brownish-olive 'pepper-and-salt' speckling, with dark mottling and blotches along and below lateral midline, the latter more distinct in juveniles; breeding males dark, with median fins edged white.

Size: to 27 cm.

Habitat: rocky and weedy pools and shallows, from estuaries to 10 m; in western Channel, occurs in pools at upper levels of sheltered shores, usually with some freshwater inflow.

Diet: green algae (*Enteromorpha*), crustaceans (amphipods, crabs), polychaetes, insects.

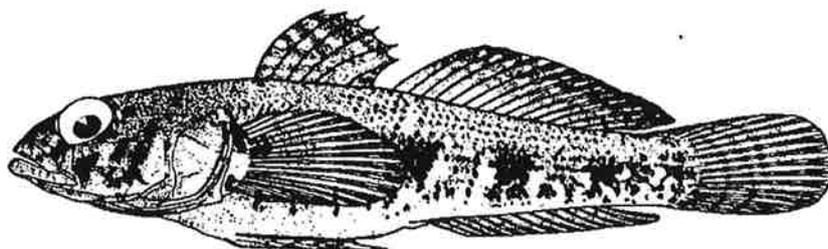
Reproduction: March to May (Naples), May-early July (Varna, Black Sea); repeat spawning (several times). Eggs 3.6-5.45 x 1.23-1.54 mm, under stones. Sexually mature at 2-3 years. Lifespan to 10 years.

Distribution: eastern Atlantic, from western English Channel to Morocco; Mediterranean and Black Sea (except north-west). Gulf of Suez (lessepsian migrant).

Note. Possible hybrid with *Gobius paganellus* in the Black Sea.

RED-MOUTHED GOBY

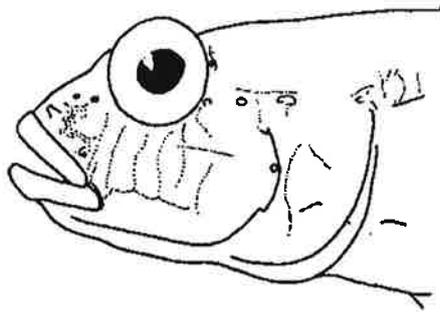
Gobius cruentatus Gmelin, 1789



Best-known synonyms: none

Morphology: Nape and rear cheek scaled. Anterior nostril with flap or tentacle. Pectoral free rays moderately developed. Pelvic disc somewhat emarginate, anterior membrane little to well developed, without conspicuous lateral lobes. 01 VI; 02 I/14; A I/12-13; P 20-21. Scales in lateral series 52-58.

Lateral-line system: head sensory papillae black; suborbital row *d* continuous and anterior transverse rows reaching border of orbit; row *x1* ends anteriorly above or before pore β ; pore α behind eye on course of oculoscapular canal. Body with additional short vertical papillae rows above lateral midline.



Coloration: mottled reddish-brown with larger dark blotches along lateral midline and more or less distinct smaller series below; lips and cheeks with vivid red markings.

Size: to 18 cm.

Habitat: inshore, 2-40 m, on rocky ground, in crevices, also on sand, and in sea-grass beds.

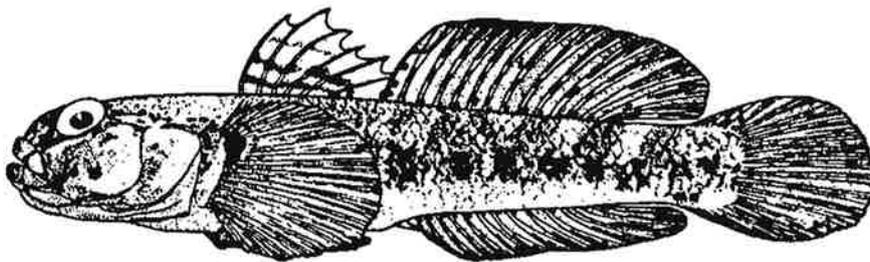
Diet: no data.

Reproduction: no data.

Distribution: eastern Atlantic, from south-west Ireland (Lough Hyne and adjoining areas) to Morocco; Mediterranean.

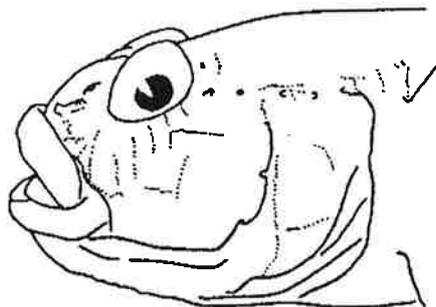
COUCH'S GOBY

Gobius couchi Miller & El- Tawil, 1974



Best-known synonyms: none.

Morphology: Nape scaled, cheek naked. Anterior nostril with triangular lappet. Pectoral free rays moderately developed. Pelvic disc rounded to truncate, anterior membrane one-third to one-half length of spinous ray in midline depth, without prominent lateral lobes. D 1 VI; D2 I/13 (12-14); A I/12 (11-13); P 16-17 (15-18). Scales in lateral series 40-41 (35-45). Vertebrae 28 (27-28).



Lateral-line system : suborbital row *d* in two parts, row *x1* ending anteriorly behind pore β , and pore α behind eye on course of oculoscapular canal.

Coloration: body with dark reticulation; gold flecks and mottling below midline; usually 1 (sometimes 2) dark cheek spots; geniohyoid spots present; pectoral base upper dark mark deeper than long, with pale posterior edge; 5 lateral midline blotches below second dorsal fin.

Size: to 9.0 cm.

Habitat: inshore, to 15m, among rocks and stones on muddy grounds, and intertidal, under stones on sheltered muddy sand at ELWST.

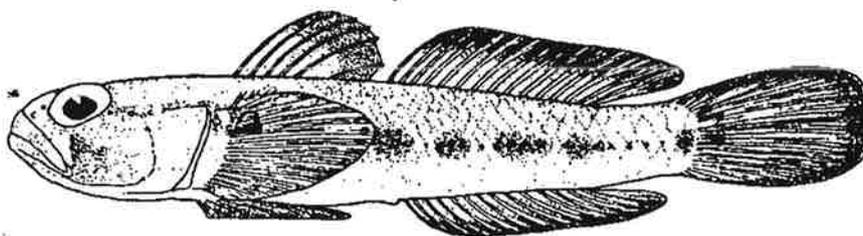
Diet: polychaetes, algae, crustaceans, bivalves.

Reproduction: spring (western English Channel). Lifespan: to 6 years.

Distribution: eastern Atlantic; southern Cornwall (Helford and Fal River), and Ireland (Lough Hyne, Co. Cork and Mulroy Bay, Co. Donegal; Western Mediterranean and Adriatic.

STEVEN'S GOBY

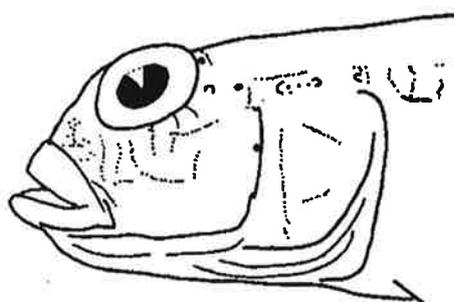
Gobius gasteveni Miller, 1974



Best-known synonyms: none

Morphology: Nape scaled, cheek naked. Anterior nostril with thin tentacle. Pectoral free rays moderately developed. Pelvic disc rounded to emarginate, anterior membrane about half length of spinous ray in midline depth and without prominent lateral lobes. DI VI (V-VI); D2 I/14 (13-15); A I/13 (12-14); P 19-21 (18-22). Scales in lateral series 40-45 (37-45). Vertebrae 28.

Lateral-line system : suborbital row *d* in two parts, row *x1* ending anteriorly behind pore β , and pore α behind eye on course of oculoscapular canal.



Coloration: pale grey to fawn; 4 brownish lateral midline blotches below second dorsal fin; cheek and opercle with white spots.

Size: to 12 cm.

Habitat: from estuary mouth (Portugal) to offshore, 35-100 m, on muddy sand and coarser deposits.

Diet: no data.

Reproduction: no data.

Distribution: eastern Atlantic, known so far from English Channel, Portugal, Madeira and Canaries.

Sand-gobies (*Pomatoschistines*)

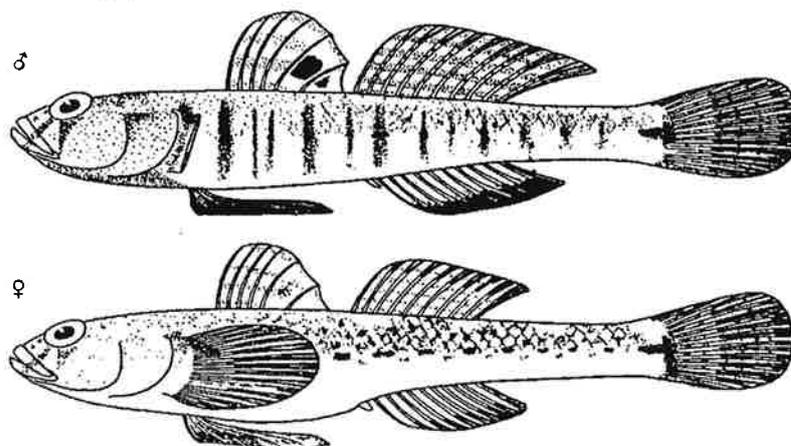
Nine (to be 11?) smaller species, to 80 mm, no free pectoral rays or process from anterior nostril; predorsal scales only in *P. minutus*; coloration in males darker with vertical bars; a row of papillae around the lower border of the eye; cheek transverse rows of variable development between species, sometimes represented by single papillae. Vertebrae more than 28 (except some *Lebetus*); dorsal pterygiophore sequence (3)1221.

POMATOSCHISTUS Gill, 1864

Suborbital papillae with row *a* around lower edge of orbit; usually at least 1 side row from row *a*; cheek series *c*, including *cp*, represented by several transverse rows, at least 1 below course of longitudinal row *b*. Anterior and posterior oculoscapular and preopercular head canals present. Usually lacking pore β , sometimes also pores ω . Head and nape naked, predorsal area with scales in *P. minutus*. Anterior nostril a short tube, without lappet on rim. Pectoral fin uppermost rays not free from membrane. Pelvic disc complete, anterior membrane without conspicuous lateral lobes but rear edge villose in some species. First dorsal rays VI. Vertebral modes 30~33. Scales ctenoid, in lateral series 36-75. Small epibenthic Atlantic-Mediterranean species, often very numerous, typically marine or estuarine.

COMMON GOBY

Pomatoschistus microps (Krøyer, 1838)

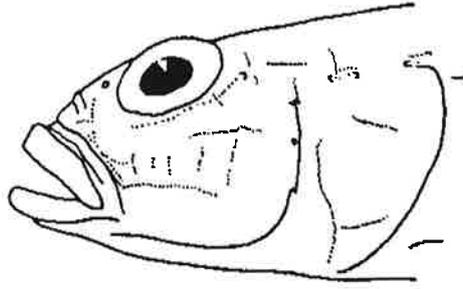


Best-known synonyms: none.

Morphology: Eyes dorsolateral. Branchiostegal membrane attached to entire lateral side of isthmus. Predorsal area, back to at least end of first dorsal fin base, and breast, naked. Pelvic disc anterior membrane with crenate rear edge. Caudal fin rounded. D1 VI (V-VII); D2 I/8-9 (8-11); A I/8-9 (7-10); P 17-19 (15-20). Scales in lateral series 39-52. Vertebrae 31 (30-32).

Lateral-line system: suborbital row *a* having 1 side row; row bending anteriorly below posterior half of eye; transverse rows below level of row *b* not descending through or behind row *d*; head

canals with no pore ω on anterior oculoscapular canal but pore δ on preopercular canal.



Coloration: grey to fawn, with pale saddles across back and coarse, dark reticulation; adult males with up to 10 vertical dark bars across sides, proximal dark spot on rear of first dorsal fin, dark breast and underside of head (tinged orange); females lack dark chin blotch.

Size: to 6.4 cm.

Habitat: inshore and intertidal, in brackish waters of estuaries, saltmarshes, and upper intertidal pools.

Diet: small crustaceans (gammarid and corophiid amphipods, isopod *Jaera*, copepods, mysids), worms, chironomid larvae, and mites.

Reproduction: April-August (Isle of Man; Baltic Sea); repeat spawning. Eggs 0.7-1.20 x 0.65-0.8 mm, on underside of empty bivalve shells or stones; hatch at 3-3.2 mm, in from 19 days at 12.5 °C to 6 days at 20°C. Fecundity 650-3,400 at 2.9-4.65 cm. Sexually mature at 7 months to 1 year. Lifespan: 1.6-2 years.

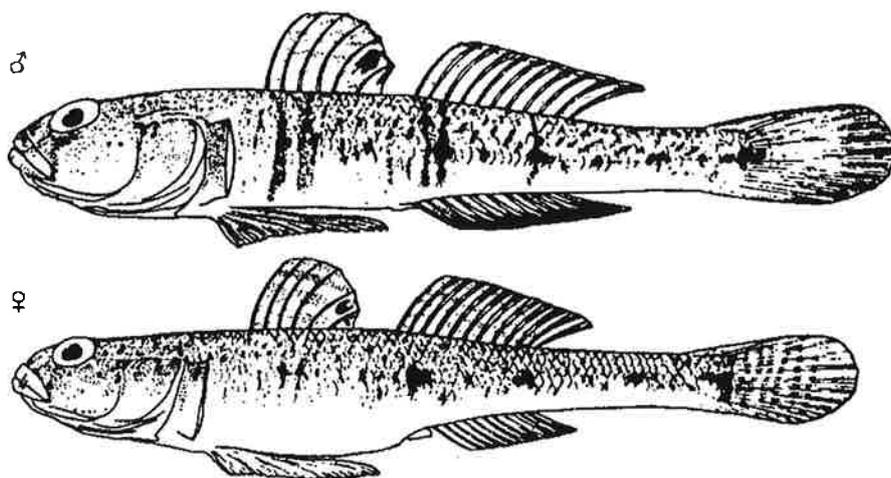
Distribution: eastern Atlantic (Trondheimfjord, Norway, and Baltic Sea to southern Portugal and Morocco) and north-western Mediterranean. Small sand-gobies from Mauritania probably belong to this species.

SAND GOBY

Pomatoschistus minutus (Pallas, 1770)

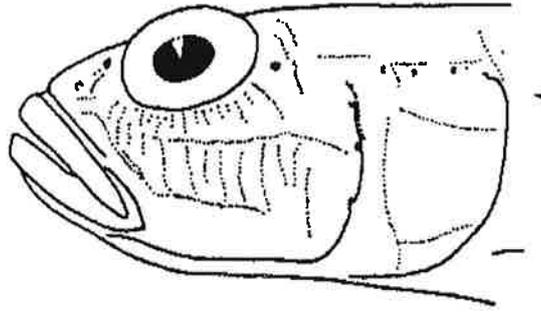
Best-known synonym: none.

Morphology: Eyes dorsolateral. Branchiostegal membrane attached to anterior half of isthmus side. Predorsal area and breast scaled. Pelvic disc anterior membrane with villose rear edge. Caudal fin rounded.



D1 VI (VI-VII); D2 I/10-12; A I/9-12; P 18-21. Scales in lateral series 55-75. Vertebrae 33 (32-34).

Lateral-line system: suborbital row *a* having numerous short side rows around lower edge of orbit; row *b* extending forwards to below anterior half of eye; transverse rows beneath row *b* with only *cp* descending below level of row *d*; head canals with pores ω and δ .



Coloration: sandy or grey with fine darker reticulation and ferruginous specks; males with 4 vertical dark bars and breast usually unpigmented; first dorsal fin rear dark spot present in both sexes, distal but not to edge of membrane.

Size: to 9.5 cm.

Habitat: inshore sand and muddy sand, typically to about 20 m, but may occur to 60-70 m; juveniles in lower estuaries.

Diet: small polychaetes, amphipods (corophiids, caprellids), cumaceans, mysids.

Reproduction: February-May (Plymouth), February-June (Ythan, Aberdeenshire), March-July (Varna, Black Sea); repeat-spawning. Eggs 0.9-1.4 x 0.7~0.8 mm, under empty bivalve shells (*Ostrea*, *Cyprina*, etc.) or small stones, hatching at about 3.0 mm, in 6 days at 20°C, 18 days at 10°C. Fecundity 2,878-3,000 eggs at 5.4-6.0 cm. Sexually mature at 7 months to 1 year. Lifespan: 1.3-2 years.

Distribution: eastern Atlantic (Faeroes and Tromso, Norway, to Spain); Mediterranean and Black Sea, but probably not throughout.

Hybridization: may interbreed with *P. lozanoi*.

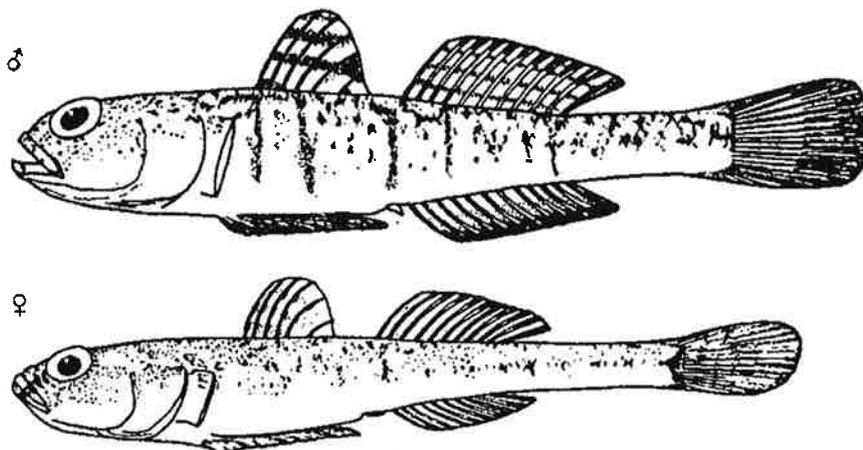
Subspecies

Pomatoschistus minutus minutus: Atlantic.

Pomatoschistus minutus elongatus (Canestrini, 1861): Mediterranean and Black Sea; dark chin spot in females, and breast pigmentation more or less developed in both sexes.

LOZANO'S GOBY

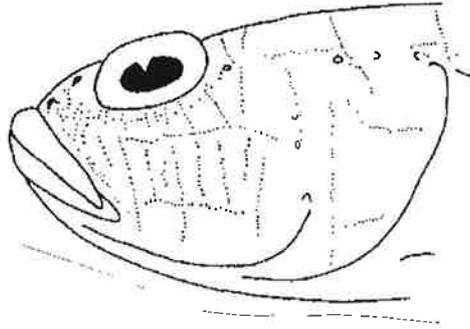
Pomatoschistus lozanoi (de Buen, 1923)



Best-known synonym: *Pomatoschistus minutus* auct. (not Pallas, 1770).

Morphology: Eyes dorsolateral. Branchiostegal membrane attached for anterior quarter to half isthmus side. Predorsal area and breast scaled. Pelvic disc anterior membrane with villose rear edge. Caudal fin rounded. D1 VI; D2 I/9-12; A I/9-12; P 18-21.

Lateral-line system : suborbital row *a* having numerous short side rows around lower edge of orbit; row *b* extending forwards to below anterior half of eye; transverse rows beneath row *b* include *cp* and 2 other rows descending through or below level of row *d*, at angle of jaws, middle and rear of latter row respectively; head canals with pores ω and δ . Scales in lateral series 57-65. Vertebrae 32 (30--33).



Coloration: brownish, with fine darker reticulation and ferruginous to orange specks; adult male with about 7-9 vertical dark striae, pale or dark breast, and males with distal dark spot of first dorsal fin reaching edge of membrane; female lacks first dorsal spot and chin blotch.

Size: to 8 cm.

Habitat: usually inshore (to 70--80 m) and off mouths of estuaries.

Diet: small crustaceans (mysids, amphipods, copepods), nematodes.

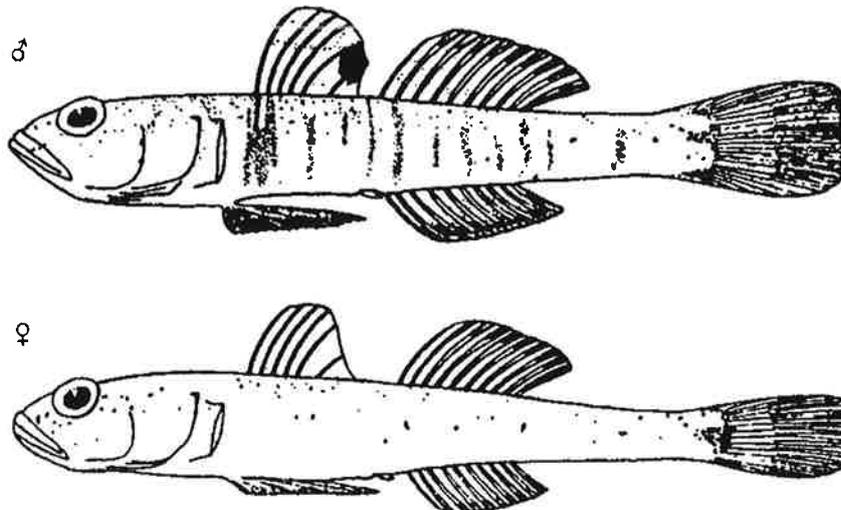
Reproduction: May-August (Waddensea); repeat spawning. Eggs 0.95-1.20 x 0.5-0.63 mm, usually on empty *Mactra*, *Laevicardium* and *Cardium* valves. Sexually mature by 1 year. Lifespan probably not more than 2 years.

Distribution: eastern Atlantic (North Sea to Portugal).

Hybridization: may interbreed with *P. minutus* and *P. norvegicus*.

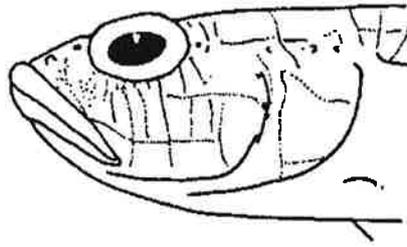
NORWAY GOBY

Pomatoschistus norvegicus (Collett, 1903)



Best-known synonym: *Gobius elongatus* auct. (not Canestrini, 1861).

Morphology: Eyes dorsolateral. Branchiostegal membrane attached to not more than anterior quarter of isthmus side. Predorsal area scaled but breast usually naked. Pelvic disc anterior membrane with villose rear edge. Caudal fin rounded. D1 VI; D2 I/9-10 (8-10); A I/9-10 (8-11); P 17 (16-18). Scales in lateral series 5~0. Vertebrae 32 (31-33).



Lateral-line system: suborbital row *a* having several side rows around lower edge of orbit; row *b* ending anteriorly under posterior half of eye; transverse rows beneath row *b* include *cp* and 2 other rows descending through, or below level of, row *d*, at angle of jaws, at middle and to rear of latter row respectively; head canals with pores ω and δ .

Coloration: pale fawn, somewhat translucent, with faint darker reticulation and scattered ferruginous to orange dots; adult male with about 10-12 vertical dark striae across sides, pigmented breast and distal dark spot in rear of first dorsal fin; female without first dorsal spot and chin blotch.

Size: to 6.5 cm (7.2 cm total length).

Habitat. Offshore mud and coarse shell deposits, 18-325 m.

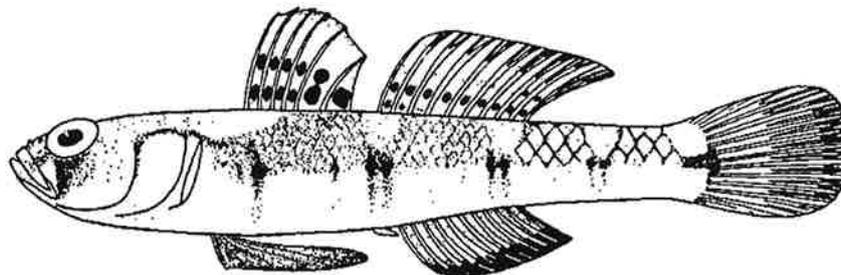
Reproduction: March-July, western Scotland); post-larvae, July-September (Plymouth). Life-span 2.5 years.

Distribution: eastern Atlantic (Lofotens to western English Channel) and Mediterranean.

Hybridization: may interbreed with *P. lozanoi*.

PAINTED GOBY

Pomatoschistus pictus (Malm, 1865)

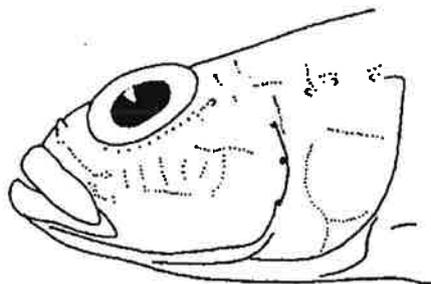


Best-known synonyms: none.

Morphology: Eyes dorsolateral. Branchiostegal membrane attached to entire side of isthmus. Predorsal area and breast naked. Pelvic disc anterior membrane with more or less straight rear edge.

Caudal fin rounded. D1 VI (V-VI); D2 I/9 (7-10); A I/8-9; P 18-19 (16-20). Scales in lateral series 34-43.

Vertebrae 30 (30-31).



Lateral-line system : suborbital row *a* with 1 side row; row bending anteriorly below rear edge of eye; transverse rows below level of row *b* not descending through row *d*; head canals with pores ω and δ .

Coloration: fawn to yellowish-olive, with coarse dark reticulation, 4 pale saddles across back and 4 'double spots' along lateral midline; first and second dorsal fins in both sexes with at least 1 row of large dark spots, surmounted by oblique rosy bands.

Size: to 5.7 cm.

Habitat: inshore gravel and sand, to 50-55 m; young may occur in shore pools at and below LWN.

Diet: small crustaceans (copepods and amphipods).

Reproduction: February-June (Connemara), March-July (Isle of Man). Eggs 0.8 x 0.65 mm, on underside of empty valves of *Pecten*, *Glycimeris*, etc., hatching at 2.7-3.0 mm, in 11-12 days at 13-14°C. Fecundity 311-1,544 at 2.65-4.2 cm. Sexually mature by 1 year. Lifespan: 2 (rarely 3) years.

Distribution: eastern Atlantic (Trondheimfjord to Portugal) and Mediterranean (Adriatic and Sea of Marmora).

Subspecies

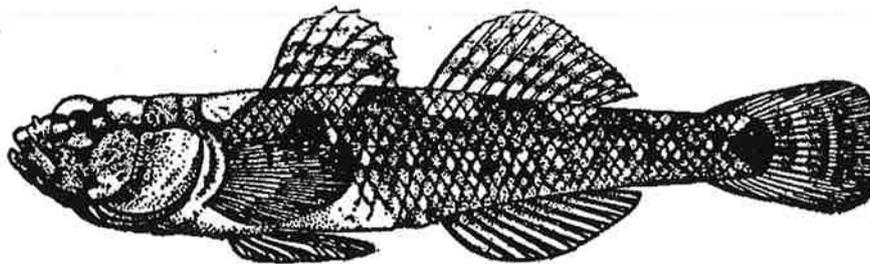
Pomatoschistus pictus pictus: eastern Atlantic; second dorsal fin with complete row of black spots and posterior part of second, upper, row; scales in lateral series 36-43; anal branched rays 9 (8-10).

Pomatoschistus pictus adriaticus Miller, 1972; Mediterranean; second dorsal fin with 2 complete rows of black spots; scales in lateral series 34-40; anal branched rays 8 or 9.

GOBIUSCULUS Duncker, 1928

Suborbital papillae with row *a* around rear lower edge of orbit; rows *a* and *c* without transverse rows but *cp* is a short transverse row. Anterior and posterior oculoscapular and preopercular head canals present, the first lacking pore β but extending onto snout. Predorsal area and head naked. Anterior nostril a short tube, without process from rim. Pectoral fin uppermost rays within membrane. Pelvic disc complete. First dorsal rays 7. Vertebral mode 32, dorsal pterygiophore sequence beginning (3)122. Scales ctenoid, 35-40 in lateral series. Small midwater species of the temperate eastern Atlantic.

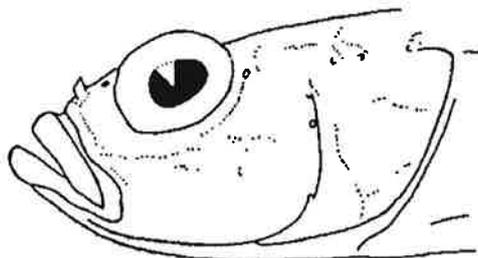
TWO-SPOTTED GOBY



Gobiusculus flavescens (Fabricius, 1779)

Best-known synonym: *Gobius ruthensparri* Valenciennes, 1837.

Morphology: see genus. D1 VII (VII-VIII); D2 I/9-10; A I/9-10; P 17-18. Scales in lateral series 35-40. Vertebrae 32 (32-33).



Coloration: reddish- to olive-brown with dark reticulation and pale saddles across back; dark and bluish spots along lateral midline; large black spot, partly edged yellow, at base of caudal fin; males with another large black lateral spot below first dorsal fin; dorsal fins banded red.

Size: to 6 cm.

Habitat: inshore, midwater, in shoals about weed-grown structures and over *Laminaria* or *Zostera* beds, to 20 m; also intertidal pools, among fucoids, to HWN.

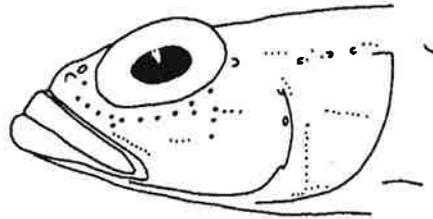
Diet: small crustaceans (copepods, amphipods, mysids), chaetognaths, various planktonic larvae.

Reproduction: typically April-August (western English Channel) with repeat spawning; post-larvae from February to September off western Ireland; April-July (Trondheim). Eggs 0.7-0.8 x 0.6 mm, inside hollow *Sacchoriza* holdfasts or on other smooth substrates; hatch in about 10 days, at 2.2-2.6 mm.

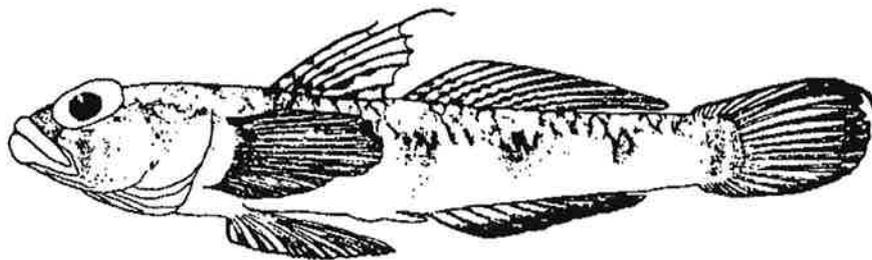
Distribution: eastern Atlantic, from the Faeroes, Vesteralen (Norway), and western Baltic to Portugal, excluding south-eastern North Sea. Mediterranean records, from Sicily and the Adriatic, are doubtful.

BUENIA Iljin, 1930

Predorsal area and head naked. Anterior nostril a short tube, lacking process from rim. Pectoral fin uppermost rays within membrane. Pelvic disc complete, anterior membrane without villi along rear edge. First dorsal rays VI. Vertebrae 30, dorsal pterygiophore sequence beginning (3)122. Scales ctenoid, 25-36 in lateral series. Suborbital papillae with row *a* around lower edge of orbit; rows *a* and *c*, including *cp* without transverse rows; row *b* short, behind rear border of eye. Anterior and posterior oculoscapular, and preopercular head canals present, not expanded but with a few extra pores in the interorbit. Anterior oculoscapular canal extends onto snout.



JEFFREY'S GOBY
Buena jeffreysii (Günther, 1867)



Best-known synonyms: none.

Morphology: see genus. D1 VI (V-VI); D2 I/8-10; A I/7-8; P 18. Scales in lateral series 25-30; second ray of first dorsal fin elongate in males. Vertebrae 30.

Coloration: body with coarse dark reticulation, flecked rusty red; pale dorsal saddles opposite dark blotches on lateral midline.

Size: to 6 cm.

Habitat: usually offshore, 5-330 m, on sand, mud, shell debris, gravel, corallines.

Diet: no data.

Reproduction: post-larvae May-September (off Plymouth).

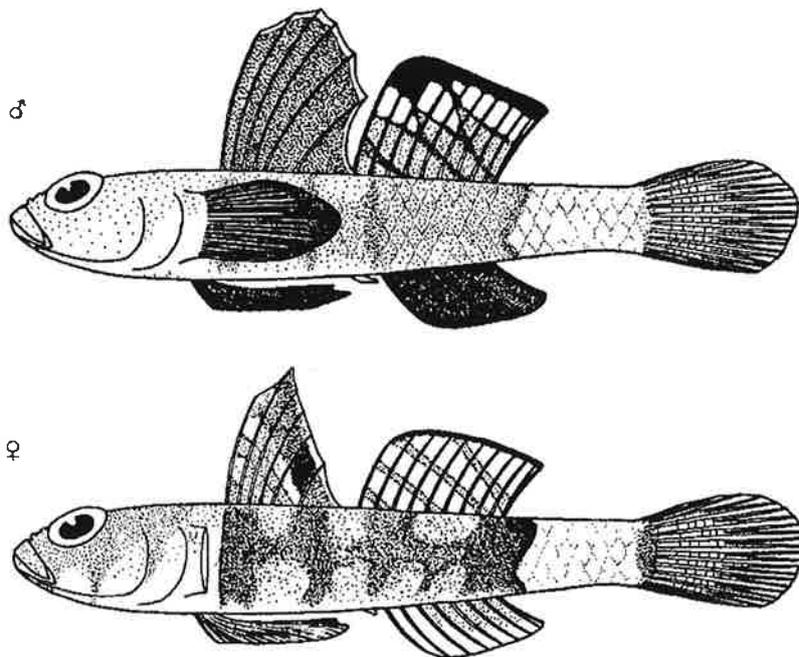
Distribution: eastern Atlantic, from south-west Iceland and Folden fjord, Norway (64°45' N) to Brittany and Celtic Sea, excluding southern North Sea. Recorded from Banyuls-sur-Mer, western Mediterranean probably refer to the Mediterranean species *B. affinis*.

LEBETUS Winther, 1877

Suborbital papillae with longitudinal row *a* around lower edge of orbit; rows *a* and *c* without transverse rows; row *b* represented by merely 1 or 2 papillae. No head canals. Anterior back, predorsal area and head naked. Anterior nostril a short tube, lacking process from rim. Pectoral fin uppermost rays within membrane. Pelvic disc with emarginate rear edge and no anterior membrane. First dorsal rays 6. Scales ctenoid, 25-29. Vertebrae 25-29, dorsal pterygiophore sequence beginning (3)122. Very small, typically offshore, eastern Atlantic species, probably cryptobenthic.

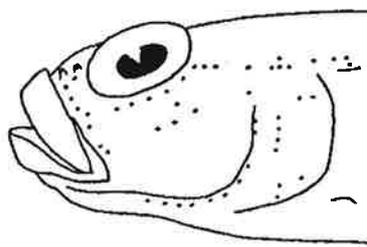
DIMINUTIVE GOBY

Lebetus scorpioides (Collett, 1874)



Best-known synonym: *Lebetus orca* (Collett, 1874).

Morphology: see genus. D1 VI (VI-VII); D2 I/9-10; A I/7-8; P 18-20 (17-21). Scales in lateral series 26-27 (2~29). Vertebrae 27-29.



Coloration: caudal peduncle with pale band; dark spot in upper anterior corner of second dorsal fin. Adult

male yellowish to dusky grey, with greyish lateral bars; first dorsal fin enlarged, dusky yellow, edged white; second dorsal fin with oblique yellow and white bands, edged intense black. Adult female pale brown, with purplish-brown vertical bars; dorsal fins with yellow to orange-red, dark delimited bands; first dorsal fin with distal dark spot in rear corner.

Size: to 3.9 cm.

Habitat: offshore, to 375 m, chiefly on coarse grounds, especially coralline deposits, but also on muddy areas.

Diet: small crustaceans (decapods, amphipods), polychaetes and bivalves.

Reproduction: February-October (western English Channel), March-August (Isle of Man). Fecundity 270 at 2.8 cm. Sexually mature at 1 or 2 years. Lifespan: at least 2 years.

Distribution: eastern Atlantic (south-west Iceland, the Faeroes and Hønefjord, Norway, to northern Bay of Biscay).

GUILLET'S GOBY

Lebetus guilleti (Le Danois, 1913)

Best-known synonym: *Lebetus scorpioides* auct. (not Collett, 1874).

Morphology: see genus; described from post-larvae and juveniles and distinguished from *L. scorpioides* by meristic criteria: D1 VI; D2 I/7-9; A I/5-6; P 16-17 (15-17). Vertebrae 25-26.

Size: to 2.4 cm.

Habitat: inshore, coarse ground, including coralline deposits, to 29 m.

Reproduction: post-larvae June-September (western English Channel).

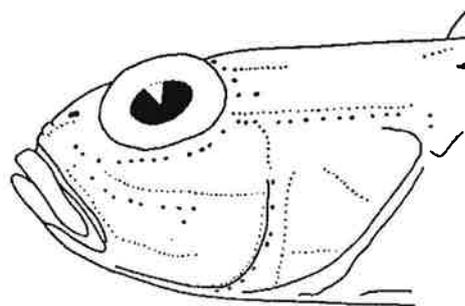
Distribution: eastern Atlantic (Kattegat and Belt Seas to Portugal); also recorded from Banyuls, western Mediterranean.

LESUEURIGOBIUS

As genus

LESUEURIGOBIUS Whitley, 1950

Suborbital papillae with row *a* around lower edge of orbit; rows *a* and *c*, including *cp*, without transverse rows. Interorbit with longitudinal rows of papillae. No head canals. Predorsal area and nape scaled or naked. Anterior nostril a short tube, lacking process from rim. First dorsal fin rays more or less elongate, especially



anteriorly. Pectoral fin uppermost rays within membrane. Pelvic disc complete. First dorsal rays VI. Caudal fin more or less lanceolate. Scales large, ctenoid, 25-29 in lateral series. Vertebrae 27. Several Atlantic-Mediterranean species of offshore, soft deposits, probably all cryptobenthic, in burrows.

FRIES' GOBY

Lesueurigobius friesii (Malm, 1874)

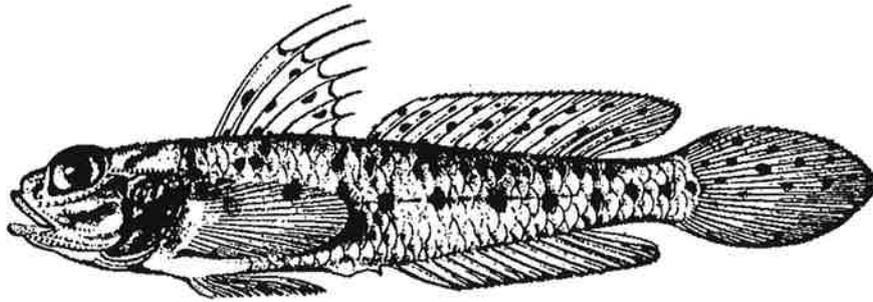
Best-known synonym: *Gobius macrolepis* auct. (not Kolombatovic, 1891).

Morphology: lateral-line system with suborbital row *b* reaching back to edge of preopercle. Nape scaled.

D1 VI; D2 I/13-16; A I/12-15; P 18-19. Scales in lateral series 28-29. Vertebrae 27.

Coloration: fawn with numerous small golden-yellow spots over nape, body and caudal fin.

Size: to 10 cm.



Habitat: burrows in muddy sand and mud, 10-130 m, associated with decapod *Nephrops norvegicus*.

Diet: polychaetes; also small crustaceans and molluscs.

Reproduction: late May to August (Loch Linnhe, western Scotland); with two or more spawnings. Eggs in burrows, 1.8-1.9 x 0.9-1.0 mm. Sexually mature at 2 years, 4--5 cm. Lifespan: 11 years.

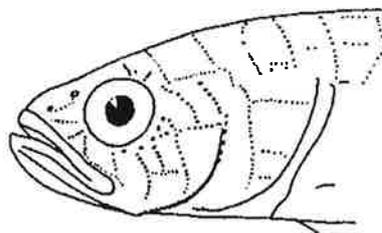
Distribution: eastern Atlantic (Skagerrak and Kattegat to north-western Spain and Portugal); Mediterranean (into Sea of Marmara). Records from Mauritania need confirmation.

Transparent gobies (Aphiines)

Two small midwater species with larval features of translucent/transparent lateral compressed body, pigmented if at all mostly along median fin bases and on head; eyes lateral; first dorsal fin reduced, normally not more than five rays and is absent in female *Crystallogobius*; males have large canine teeth; dorsal pterygiophore sequence beginning (3)122

APHIA Risso, 1826

Body transparent in life, laterally compressed. No head canals. Lower jaw teeth in single row. Scales cycloid. Predorsal area and head naked. Anterior nostril a short tube, lacking process from rim. Pectoral fin uppermost rays within membrane. Pelvic disc complete. First dorsal fin with 5 rays. Vertebral mode 27 (10+17); dorsal pterygiophore sequence beginning (3)122. Suborbital papillae with short row *a* around lower edge of orbit; 3 transverse rows before, 1 above and 2 below longitudinal row *b*, which ends anteriorly below pupil. Nektonic, inshore, with progenetic features, sexual dimorphism and short 'annual' lifespan.

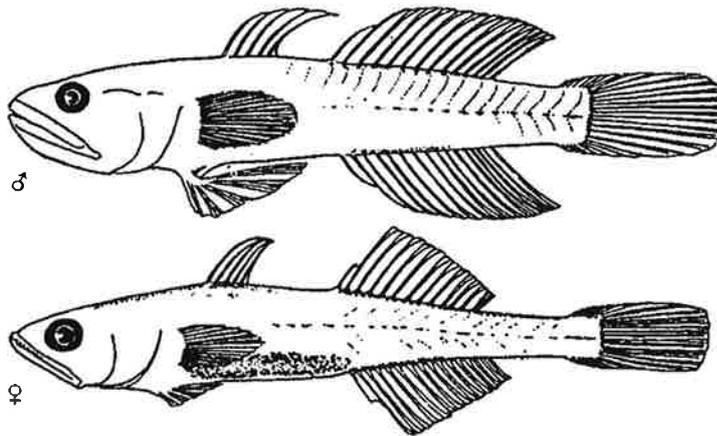


TRANSPARENT GOBY *Aphia minuta* (Risso, 1810)

Best-known synonym: *Aphya pellucida* (Nardo, 1824).

Morphology: see genus. Adult males with large canine teeth and longer pelvic disc. D1 V (IV-VI); D2 I/12

(11-13); A I/13-14 (11-15); P 17-18 (15-19). Scales in lateral series 19-25 (18-25) (easily lost). Vertebrae 27 (26--28).



Coloration: body transparent, more or less reddish, with chromatophores along bases of median fins and on head.

Size: to 5.8 cm (males) and 5.3 cm (females).

Habitat: nektonic, inshore and estuarine, surface to 70-80 m, over sand, mud, eel-grass, etc.

Diet: zooplankton, especially copepods, cirripede larvae and mysids.

Reproduction: May (central Adriatic), May-July (Vama, Black Sea), June-August (Oslofjord). Sexually mature by 1 year, adults die after breeding. Lifespan 'annual'.

Distribution: eastern Atlantic, from western Baltic and Trondheim, Norway, to Morocco; Mediterranean and Black Sea.

Subspecies

Aphia minuta atlantica De Buen, 1931: larger, total lengths of adults 4.6-5.8 cm (males), 4.4--5.3 cm (females); Atlantic.

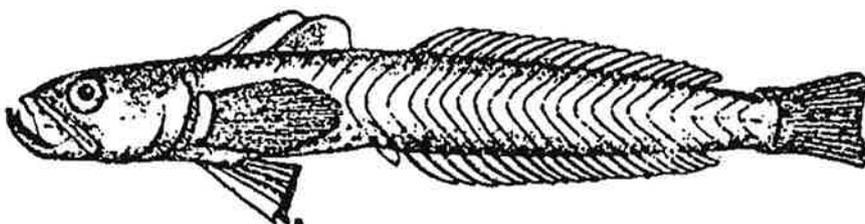
Aphia minuta mediterranea De Buen, 1931: smaller adults, 3.7-4.5 cm (males), 3.0-4.5 (females), Mediterranean.

CRYSTALLOGOBIUS Gill, 1864

Body transparent in life, laterally compressed. Lower jaw teeth in single row. Anterior nostril a short tube, lacking process from rim. Pectoral fin uppermost rays within membrane. Pelvic disc complete and deep in male, but reduced or lacking in female. First dorsal with only 2 spinous rays in male, absent in female. Vertebral mode 30. Scales absent. Nektonic, with progenetic features, pronounced sexual dimorphism and short 'annual' lifespan.

CRYSTAL GOBY

Crystallogobius linearis (von Düben, 1845)



Best-known synonym: *Crystallogobius nilssonii* (von Düben & Koren, 1846).

Morphology: see genus, but patterns of sensory papillae still require detailed description. Male with prominent front canine teeth in markedly curved lower jaw. D1 II-III (male), absent or rudimentary (female); 02 I/18-20; A I/20-21. Vertebrae 30 (29-31).

Coloration: body transparent; some chromatophores on lower jaw and along bases of median fins.

Size: to 4.7 cm (male) and 3.9 cm (female).

Habitat: nektonic, coastal to offshore in 400 m, over shell, sand, mud; males bottom-living during breeding season.

Diet: zooplankton.

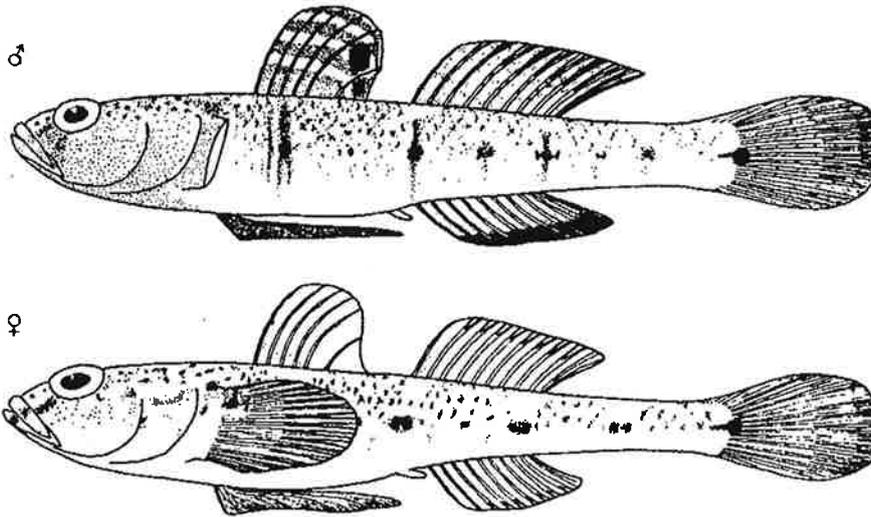
Reproduction: May-August (Oslofjord); post-larvae from June to September (south-west Ireland). Males guard eggs (1.2-1.5 x 0.4-0.5 mm) in empty tubes of larger worms, such as *Chaetopterus*. Fecundity to 340. Sexually mature by 1 year, adults die after breeding. Lifespan: 'annual'.

Distribution: Eastern Atlantic (Lofotens, Norway, to Gibraltar); Mediterranean.

POSSIBLE NEWCOMERS TO THE BRITISH GOBIID FAUNA

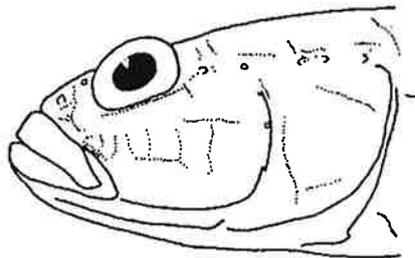
MARbled GOBY

Pomatoschistus marmoratus (Risso, 1810)



Best-known synonym: *Pomatoschistus microps leopardinus* (Nordmann, 1840).

Morphology: Eyes dorsolateral. Branchiostegal membrane attached to entire side of isthmus. Predorsal area naked, but rear breast scaled. Pelvic disc anterior membrane with villose rear edge. Caudal fin rounded. D1 VI (V-VII); D2 I/9 (8-10); A I/9 (8-10); P 19-20 (17-21). Scales in lateral series 40-46 (37-48). Vertebrae 33 (31-34).



Lateral-line system: suborbital row *a* with 1 side row; row bending anteriorly below rear edge of eye; transverse rows beneath level of row *b* not descending through row *d*; head canals with pores ω and δ , sometimes with a pore β (as shown).

Coloration: sandy, with darker reticulation and saddles; adult male with 4 vertical dark bars across side, dark breast and distal spot on first dorsal fin; female with conspicuous dark chin blotch.

Size: to 6.5 cm.

Habitat: inshore, sandy shallows, to 20 m (even 60-70 m over winter in Black Sea); enters brackish and hypersaline waters.

Diet: small crustaceans, chironomid larvae.

Reproduction: spring and summer (Mediterranean); March to mid-September (Varna, Black Sea); repeat spawning. Eggs, 1.0 x 0.6 mm, under stones and shells. Sexually mature at 1 year. Fecundity 307-1,226 at 2.8-4.8 cm. Lifespan: 2 years.

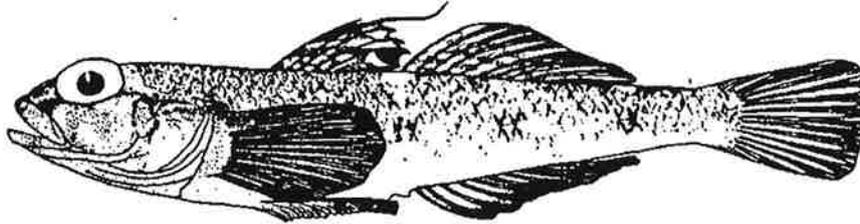
Distribution: eastern Atlantic (Iberian Peninsula, Bay of Biscay); Mediterranean, Black Sea and Sea of Azov; also Suez Canal and introduced to Lake Qarun, Egypt.

DELTENTOSTEUS Gill, 1864

Suborbital papillae row *a* around posterior lower edge of orbit; rows *a* and *c*, including *cp*, without transverse rows. Anterior and posterior oculoscapular, and preopercular head canals present, all expanded, with numerous extra pores. Predorsal area and nape scaled. Anterior nostril a short tube lacking process from rim. First dorsal rays 6; first dorsal fin with elongate second ray. Pectoral fin uppermost rays within membrane. Pelvic disc complete. Vertebrae 33. Scales ctenoid, 33-35 in lateral series. Small epibenthic species of the Mediterranean and adjacent eastern Atlantic, common on finer deposits.

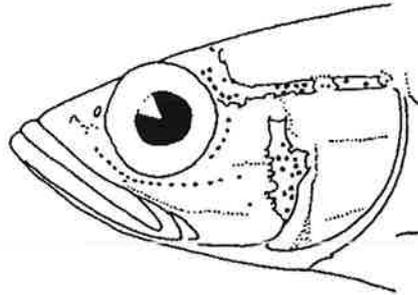
FOUR-SPOTTED GOBY

Deltentosteus quadrimaculatus (Valenciennes, 1837)



Best-known synonyms: none.

Morphology: angle of jaws below anterior half of orbit. D1 VI; D2 I/8-9; A I/8-9; P 17-18. Scales in lateral series 33-35. Vertebrae 33.



Coloration: body fawn, with coarse dark reticulation and 4 large dark blotches along lateral midline.. below pale saddles across back; first dorsal fin with distal black spot in rear corner and black streak along anterior edge; pelvic disc and anal fin more or less dusky.

Size: to 8 cm.

Habitat: sand or muddy sand, estuary mouths to 90 m.

Reproduction: spring (Mediterranean).

Distribution: eastern Atlantic (southern Bay of Biscay to Mauretania); Mediterranean.

Some Sources

Historic

Couch, J. 1863. *A History of the Fishes of the British Islands*. Vol. 2. London: Groombridge & Sons.

Holt, E. W. L. & Byrne, L. W. 1903. The British and Irish Gobies. *Rep. Sea Int. Fish. Ireland*, 1901, Pt 2: 37-66.

Systematics

McKay, S. M. and Miller, P. J. 1997: The affinities of European sand gobies (Teleostei: Gobiidae). *J. nat. Hist.* 31: 1457-1482.

Miller, P. J., 1986: Gobiidae. In *Fishes of the North-eastern Atlantic and the Mediterranean*, edited by P. J. P. Whitehead, M.-L. Bauchot, J.-C. Hureau, J. Nielsen and E. Tortonese. Paris, UNESCO, 3: 1019-1085.

Webb, C. J. 1980. Systematics of the *Pomatoschistus minutus* complex (Teleostei : Gobioidei). *Phil. Trans. Roy. Soc. Lond.*, B, 291, 201-241.

Synonymies of European gobies

Miller, P. J. 1973. Gobiidae. In *Check-List of the Fishes of the North-eastern Atlantic and of the Mediterranean* (Hureau, J.C. & Monod, T., eds.), 1, 483-515; 2, 320-321.

Goby anatomy

Birdsong, R. S., Murdy, E. O. and Pezold, F. L., 1988, A study of the vertebral column and median fin osteology in gobioid fishes with comments on gobioid relationships. *Bull. mar. Sci.*, 42, 174-214.

Miller, P. J. 1992. The sperm-duct gland: a visceral synapomorphy for the gobioid fishes. *Copeia* 1992 (2), 253-256.

Taylor, W. R. 1967. An enzyme method of clearing and staining small vertebrates. *Proc. US Nat. Mus.* 122 (3596): 17 pp. [in later techniques, cartilage can be stained with alcian blue in acid solution before staining bone red with alizarin].

Wongrat, P. & Miller, P. J. 1991. The innervation of head neuromast rows in eleotridine gobies (Teleostei: Gobioidei). *J. Zool., Lond.* 225, 27-42

Reproduction and life-history strategies

Miller, P. J., 1984: The tokology of gobioid fishes. In Potts, G.W. and Wootton, R.J. (Eds). *Fish Reproduction : Strategy and Tactics* : 119-153. Academic Press.

Miller, P. J. 1996. Functional ecology of small fish. In Miller, P. J. (ed). *Miniature Vertebrates*. Symp. Zool. Soc., Lond., 69: 175-199. O.U.P.

Young stages

Russell, F. S. 1978. *The Eggs and Planktonic Stages of British Marine Fishes*. Academic Press [Gobiidae pp. 253-281. Academic Press.

Species and ecology

Da Cunha, P. L. and Antunes, M. M. 2008. Notes on Gobiidae (Teleostei) from soft bottoms of the Portuguese coast. *Cybiurn* 32 (4) : 309-315.

Miller, P. J. 2004. *Pomatoschistus microps* (Krøyer, 1838). In Miller, P. J. (ed.), *The Freshwater Fishes of Europe*, 8, *Gobiidae* 2, 293-330. Wiesbaden: AULA-Verlag.

Wilkins, H. K. A. and Myers, A. A. 1991. The distribution of gobies (Teleostei: Gobiidae). In Myers, A. A., Little, C., Costello, M. J. and Partridge, J. C. (eds). *The Ecology of Lough Hyne*, 107-115. Dublin: Royal Irish Academy.

Farther south (source of newcomers from global warming ?)

Miller, P. J., 1984, The gobiid fishes of temperate Macaronesia (eastern Atlantic). *J. Zool., Lond.*, 204, 363-412. [Azores, Madeira, Canaries]

Miller, P. J., 1991, Gobiidae. In Quero, J. C., Hureau, Karrer, C., Post, A., and Saldanha, L. (eds), *Check-list of the Fishes of the Eastern Tropical Atlantic* 2, 925-951. Lisbon: JNICT, EIU, UNESCO.

Brito, A. and Miller, P. J. 2001: Gobiid fishes from the Cape Verdes Islands, including two new species of *Gobius* (Teleostei: Gobiidae). *J. nat. Hist.* 35: 253-277 .

Wirtz, P., Fricke, R. and Biscoito, M. 2008. The coastal fishes of Madeira Island - new records and an annotated checklist. *Zootaxa* 1715: 1-26.

Semi-popular

Miller, P. J. and Loates, M. 1997. *Collins Pocket Guide/Fish of Britain and Europe*. Harper-Collins.

