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THE BRITISH AND IRISH GOBIES.

BY

E. W. L. HOLT AND L. W. BYRNE.

(Appendix No. III. to Part II. of the Report on the Sea and Inland Fisheries
of Ireland for the Year 1901.)

APPENDIX, No. III.

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PLATES I. AND II.

The British and Irish Gobies form a group of fishes too small to be of direct value for food purposes, since the largest of them only exceptionally exceeds a length of five inches; but they are not inedible, and kindred species are regarded on the southern coasts of France with considerable interest from the point of view of the table, while affording a mild form of sport to the enthusiastic sea-angler.

We are concerned, however, chiefly with their rôle in the general marine cosmos, little as we may at present understand it, since it is certain that forms so numerous in individuals, living in association with fish and crustaceans of market value, cannot but exercise an influence direct or indirect upon their neighbours, whether as food, as enemies, or merely as competitors for the available food supply.

Absolute promiscuity of distribution and habit is a condition unknown to nature, and the closer the bionomical study the clearer does it appear that each organism has its own defined sphere of influence. Such study, however, is impracticable when it is not possible for the student to determine the identity of the forms under observation; and, in the case of the Gobies, it will be generally agreed that existing literature, of a readily accessible nature, gives no satisfactory assistance.

It is in the hope of removing this difficulty that we put forward the present notes and drawings. We believe that they will enable others, who may not have had the same opportunities of comparing the different species, to readily recognise any which come under their observation; and so to augment, without uncertainty of determination, our very imperfect knowledge of the habit and environment of the various forms. As Smitt remarks, it is the giants and pygmies among vertebrates that give the systematist most trouble. Some of our Gobies are among the smallest of known fishes, and, as will appear later, their proper definition demands a wealth of illustration apparently, but, as we think, not really out of proportion to their importance.

Our studies of the anatomy of the *Gobiidae* have not been carried to a point that will permit us to deal, usefully, at any length with the systematic position of the family. Dr. Günther, in his "Introduction to the Study of Fishes" (1880), placed the *Gobiidae* (including therein *Callionymus*) and the *Discoboli* (*Cyclopterus* and *Liparis*) in a division termed by him *Gobiiformes*, which appears to have been, as constituted, impossible to accurately define. Jordan and Evermann ("Fishes of North and Middle America," 1898), following Gill and Garman, relegated the *Discoboli* to what appears on anatomical grounds to be their true position near the *Cottidae*, and

reconstructed the group *Gobioidea* from Günther's *Gobiidae*, placing in it two families, the *Callionymidae* and *Gobiidae*, but without finding any satisfactory definition of the group. As Cunningham suggested some years ago (*Journ. M. B. Assoc.*, N.S., vol. I., p. 37) and as Boulenger has recently demonstrated (*Ann. Mag. Nat. Hist.*, ser. 7, viii., 261 [1901]), the *Callionymidae* are in fact most nearly related to the Trachinid Acanthopterygians, and must also be moved from the position previously assigned to them near the *Gobiidae*. Through the kindness of Mr. Boulenger we have been enabled to examine the skeletons of several members of the *Gobiidae*; and these do not seem to indicate any close relationship either with the *Callionymidae* or the *Discoboli*, but point rather to a position near the Perciform Acanthopterygians. From these they may readily be distinguished by the form of the pectoral girdle in which the scapula and coracoid are much reduced, and the pterygials large and four in number; in the British *G. niger* and in *G. capito*, which we have dissected, the pterygials were almost completely fused into a semi-circular plate which supported the pectoral fin-rays.

In view of these characters there seems to us no good reason for disturbing Günther's group *Gobioformes*, as limited by the exclusion of the *Callionymidae* and *Discoboli*; and, without in any way attempting either to accurately define the characters of the group or to forestall the result of Mr. Boulenger's researches into the anatomy of the Teleostei, the position of the *Gobiidae* may be provisionally indicated as follows:—

Order,	TELEOSTEI.
Sub-order,	ACANTHOPTERYGII.
Group,	GOBIOFORMES.
Family,	GOBIIDÆ.
British and Irish species,	<i>Gobius niger</i> L.
	<i>paganellus</i> . Gm. L.
	<i>Friesii</i> . Collett.
	<i>Ruthensparri</i> . Euphras.
	<i>minutus</i> . L.
	<i>pictus</i> . Malm.
	<i>Jeffreysii</i> . Gthr.
	<i>orca</i> . Collett.
	<i>scorpioides</i> . Collett.
	<i>Aphia pellucida</i> . Nardo.
	<i>Cryсталlogobius Nilssoni</i> . Düb. and Kor.

These notes are confined to the species of *Gobius* occurring in our waters, as the excellent account of *A. pellucida* and *C. Nilssoni* given by Collett,* cannot be amplified in any material respect from our observations on those species.

We have counted the numbers of vertebræ in the following species:—

	Precaudal.		Caudal.	
<i>G. niger</i> (2 specimens),	12	+	15-16	= 27-28
<i>G. paganellus</i> (4), . . .	12	+	15-17	= 28-29
<i>G. Ruthensparri</i> (2), . .	12-13	+	18-19	= 31
<i>G. minutus</i> (6),	12-13	+	18-20	= 30-32
<i>G. pictus</i> (3),	11-12	+	16-17	= 28

* P.Z.S., 1878, p. 318; for a short note on the breeding season and ova of *A. pellucida*, see M. B. A. Journal, V., p. 338 (1898).

The members of the genus *Gobius* found in the British area, are fishes of stout or slender habit, and subfusiform or subcylindrical form, with more or less depressed heads, and sometimes slightly compressed bodies. The head is large, rounded, and usually blunt in front, and is contained $3\frac{1}{2}$ to 5 times in the total length (excluding the caudal fin, as throughout in this paper). The eyes are comparatively large, situate high up, and close together, and never separated by an interval exceeding their horizontal diameter; frequently they almost touch. The snout, as a rule, is not very much longer or shorter than the horizontal diameter of the eye. The scales are irregularly arranged, and are far larger posteriorly than anteriorly; those of the lateral line are not differentiated. There are sometimes well-marked lines of dermal papillæ on the head and operculum. The spinous dorsal consists of VI. or VII. (rarely V. or VIII.) rays, and almost reaches to or is only separated by a very short interval from the soft dorsal, which is opposite and similar in form to the anal; the pectoral is of moderate size and rounded, its upper rays sometimes separate and silk-like; the ventrals, each of which has one spinous and five soft rays, lie together in the mid-ventral line, and form a single fan-like fin, which functions as a sucker, and may or may not have its anterior walls united by a basal membrane. There is a large and conspicuous urogenital papilla.

The colours of the body are usually darkest on the head and fore-part of the body, and in the region of the lateral line, which is not infrequently marked by a series of more or less well-defined blotches or spots; the smaller species frequently possess several paler saddle-shaped patches along the back, and traces of similar markings may be observable in examples of some of the larger species.

As genera are at present understood among fishes, the genus *Gobius* is too large and loosely defined to be either "natural" or convenient; no satisfactory attempt has yet been made to sub-divide it, and it would be useless to found any such attempt upon the British and Irish members of the genus alone, but it seems worth while to point out the five well-marked groups into which these members fall:—

1. Gobies of comparatively large size, stout habit, and sub-cylindrical form, with the upper rays of the pectorals silk-like, and with moderately developed lines of dermal papillæ on the head and the operculum.
G. niger and *G. paganellus*.

2. Gobies of moderate size, moderately stout habit, and somewhat compressed form, with no silk-like rays, but well-marked rows of dermal papillæ.
G. Friesii.

3. Small gobies of somewhat compressed form, and moderately slender habit, adapted for living among weeds and not on the bottom.
G. Ruthensparri.

4. Gobies of moderate or small size, slender or moderately stout habit, and sub-cylindrical form, adapted for living at the bottom.
G. minutus, *G. pictus*, and *G. Jeffreysii*.

5. Very small gobies, without an anterior membrane to the ventral fins (the genus *Lebetus* of Winther).

G. scorpioides and *G. orca*.

In the case of fishes of such small size, the ready identification of the various species, especially in their younger stages, is a matter

of some difficulty. The irregular arrangement and variation in size of the scales makes it difficult to count them with uniformity and accuracy; the number of fin-rays is frequently not diagnostic; measurements are so small that a difference between two observers in the method of taking them (however small in itself) may cause considerable discrepancies in tables of proportions founded upon them, and make them unreliable.*

Although it is never safe to rely upon colours alone to distinguish species, the form and colouration of the spinous dorsal fin appear in most cases to provide the readiest method of "spotting" gobies, but should only be used in conjunction with and carefully checked by other methods.

A matter which ought always to be regarded in dealing with these fishes—but which has never (in systematic literature) received the attention it deserves—is the great difference between the sexes, more especially at the breeding season, and between adult and immature males. The following characters appear to be sexual, and must be borne in mind in identifying the species to which an example belongs:—

(1.) The urogenital papilla of the male is long and pointed, of the female short and blunt.

(2.) The colours of the male (more especially those of the dorsal fins) are more brilliant than those of the female; the throat, ventrals, and anal fin are often darkly pigmented in the male, while pale in the female.

(3.) The posterior rays of the soft dorsal and anal are often comparatively longer in the male than in the female; and sometimes a few rays of the spinous dorsal are prolonged in the male.†

(4.) The head of the male may be heavier and blunter, the habit somewhat stouter, and the caudal peduncle comparatively deeper than in the female.

Some only of these characters are found in most species; they are, as a rule, more marked in the breeding season, and appear to vary considerably in the extent to which they are developed in different individuals. Young examples of either sex cannot be distinguished by conspicuous external differences, and in some species the male may be sexually mature before the secondary characters are fully developed.

The intenser colours of the male may be to some extent lost and again assumed almost instantaneously under the influence of any excitement, and the iridescent colours of the dorsal fins and sides of some of the smaller species are equally evanescent.

In habits all of our gobies have much in common. All are more or less gregarious, and (with the exception of *G. paganellus*, whose habitat rather prevents it) all of them appear ordinarily to live in larger or smaller assemblages; and even in the breeding season the gregarious habit is not entirely lost. *G. Ruthensparri*, which seems to move in shoals (as contrasted with the mere "gregariousness," and local abundance of other species), swims among weed at some distance from the bottom, but with this exception all of them live on the bottom, hiding under stones or shells, or lying flat upon or

* The measurements given at the end of this paper were made by Mr. Byrne.

† It is probable that these differences obtain in all species, but in some they are so slight as to be quite inconspicuous.

partly buried in mud or sand. Their food mainly consists of crustaceans, worms, and other marine invertebrates. The ova are demersal and are laid in closely-set masses in some sheltered spot, each individual ovum being attached by its base to the object upon which they are laid; in shape they are roughly circular, pear-shaped or fusiform, contain no single, well-defined oil-globule,* and are attached by a basal network of hyaline strands radiating from the micropylar region; in comparison to the size of the fish they are very large. The larva emerges in an advanced condition with the mouth already open and still retaining the larval fin-fold, but very rapidly attains the form of the adult.

As the breeding season approaches, each male appears to select a suitable site for the deposition of eggs, and to expend more or less trouble in rendering it suitable for that purpose; after the completion of this task he remains constantly in the neighbourhood, endeavouring to attract the attention of any female who passes, and fighting (with more or less serious results) with any other male who endeavours to come near him. Having secured a female, he mounts guard during the deposition of the ova, and after they have been deposited, remains in the "nest," guarding them until they hatch, circulating the water about them with his fins. The female after depositing her ova departs, and takes no further interest in her offspring, but after a decent interval (of about a week in *G. minutus*) proceeds to perform a similar service for another male; while the dutiful father, so soon as he is relieved of the cares of one family, begins to look for a fresh female, who will enable him to burden himself with another.

Collett has, many years since, shown that the allied *Aphia* and *Crystallogobius* are truly "annual" vertebrates, and it is very possible that the lives of many gobies are no longer; we have no detailed observations upon this point to record, but some remarks upon the subject will be made when treating of the individual species.

So far as geographical distribution is concerned all our gobies appear to be normal members of the fauna of the N.E. Atlantic; the majority of them are found in Scandinavian waters, and a few extend into the Mediterranean. *G. paganellus* has the most southerly distribution, and does not reach the north of our area. Many of them are so little known and so consistently overlooked that no remarks on their distribution can have much value.

In the following descriptions the terms and abbreviations used are, as a rule, those employed in the British Museum Catalogue. References to literature since the date of Day's British and Irish Fishes only are given for species recorded as British in that work.†

We take this opportunity of expressing our indebtedness to Mr. Boulenger, of the British Museum, who has most kindly allowed us to figure a specimen in the collection under his charge, while assisting us in many other ways; to the late Mr. M. F. Woodward, Mr. J. E. S. Moore, and Miss A. J. Holt for help in making the original sketches upon which several of our figures are based; to Mr. G. P. Farran, for several observations on the habits of different species; and to Miss G. M. Woodward, whose figures sufficiently show the help she has rendered us, without any added comment on our part.

* A large number of minute globules are present in the yolk matter.

† References to "Smitt" are to Smitt's History of Scandinavian Fishes.

We may add our regret that the exigencies of the process employed make it impossible for us to reproduce in colour the most beautiful and life-like picture of *G. Ruthensparri*, by the late Mr. M. F. Woodward, upon which Miss Woodward's figure is based.

Our observations were commenced at the Laboratory of the Marine Biological Association, to whom we desire to express our obligations.

KEY TO THE SPECIES.

The following table may assist in the identification of the British and Irish species:—

A. Ventrals with anterior membrane.

1. Superior rays of pectoral, separate and silk-like.

(a.) Not more than 42 scales in a longitudinal series; middle rays of spinous dorsal longest. *G. niger*.

(b.) 50 or more scales in a longitudinal series; spinous dorsal with a superior pale horizontal band.

G. paganellus.

2. Pectoral without separate or silk-like rays.

(a.) Conspicuous rows of dermal papillæ on head and operculum; about 29 scales in a longitudinal series.

G. Friesii.

(b.) No papillæ on operculum.

i. Interorbital space $\frac{3}{4}$ or more of snout, spinous dorsal with vii. (or viii.) rays, a conspicuous black spot at origin of caudal fin. *G. Ruthensparri*.

ii. Interorbital space less than half of snout; spinous dorsal with vi. (rarely vii.) rays.

a. Muzzle blunt, 34 or more scales in a longitudinal series.

(1.) 34-41 scales in a longitudinal series, rows of black spots on dorsal fins; not attaining a length of more than $2\frac{1}{4}$ inches. *G. pictus*.

(2.) Rarely less than 40 scales in a longitudinal series (usually many more); not more than one (or two) large dark spots at posterior end of spinous dorsal; attaining a length of at least $3\frac{1}{4}$ inches.

G. minutus.

b. Muzzle somewhat pointed; scales large, 25-30 in a longitudinal series. *G. Jeffreysii*.

B. Anterior membrane of ventrals wanting or vestigial. (*Lebetus*).

1. Habit slender; soft dorsal with a black band superiorly; no pale band on caudal peduncle. *G. orca*.

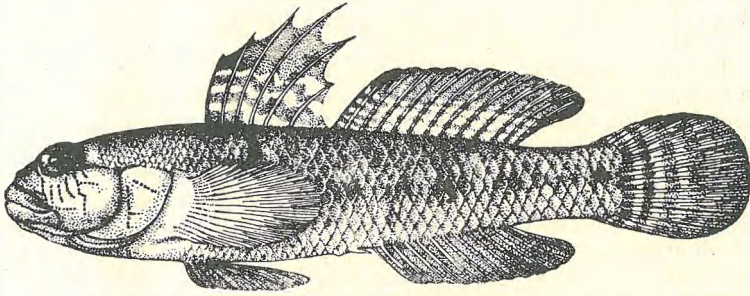
2. Habit stout; soft dorsal banded with red; a broad pale band on caudal peduncle. *G. scorpioides*.

GobiUS NIGER, L.

BIT GOBY, BLACK GOBY.

Fig. 1.

G. niger.—Day, I., p. 163 (1884); Petersen, Fiskeri-Beretning Kbhvn., 1891, p. 244, Pl. v., Fig. 5; Smitt, I., p. 245.

Fig. 1. *G. niger* ♂ × $\frac{4}{5}$.

D. VI, 12-14; A. 11-13; Sc. 36-40, tr. 13-15. Habit, stout; form, subcylindrical; depth of body, 5 to $6\frac{1}{2}$ times in total length; length of head, about 4 times; eye, 3 to 4 times; snout, $3\frac{1}{2}$ to 5 times in length of head; interorbital space, narrow; scales, larger posteriorly than anteriorly; minute, and almost embedded in the skin on the head and front part of back. Conspicuous rows of dermal papillæ on the head and gill-cover. Pectoral fin, having the branched extremities of the first two or three upper rays produced into short silk-like filaments, not usually exceeding five in number, and not reaching the level of the dorsum. Central rays of the spinous dorsal longer than the rest; their extremities markedly depressed, giving a characteristic form to the fin.

Ground colour of the body of any shade from pale ochreous yellow to brownish or blackish grey, diversified by several large dark brown or blackish patches extending obliquely forward across the sides when distinct in outline, but often so obscure as to merely impart a darker cloudiness to the colouration. The sides are never distinctly banded, the lighter and darker areas being profusely speckled and marbled with darker and lighter markings. Nape and top of head usually rather pale; sides of head dark, with lighter markings, but without rounded or oval pale spots.

Pectoral fins, with rather inconspicuous yellow and brown markings, indistinct on distal parts. Spinous dorsal grey or yellowish, with a few rather broad, irregular, reddish-madder bands and some darker markings, but without a pale border.

Soft dorsal grey or yellowish with numerous indistinct madder spots, which are arranged in the form of inverted chevrons about the fin rays, and do not form oblique bands.* There is no pale marginal

* Our figure is taken from a specimen preserved in formaline, and therefore does not show the chevron markings. The division of the lower part of the fin into alternate horizontal bands of darker and lighter tone is largely a *post-mortem* effect due to the disappearance of the coloured chromatophores,

band. Both spinous and soft dorsal may have a dark spot at the anterior upper edge. Caudal marked in much the same way as soft dorsal.

Isthmus, ventrals, and anal grey or dark grey in the male, little or not at all pigmented in the female.

The above description presents what appears to be the most usual colouration of the species, but it is subject to considerable variation, and often the general effect approaches an uniform blackish brown. Some specimens which we took on the zostera beds in the Helford River, Cornwall, were smoky black, with hardly a trace of brown.

Total length, 122 mm. (5 inches).

The male appears to be slightly darker than the female, but there is no material difference, and our friend Mr. G. P. Farran, who has kept breeding members of both sexes under observation, informs us that no special livery is assumed by the male during the breeding season. In addition to the greater comparative length of the posterior rays of the soft dorsal and anal, the adult male is marked by the prolongation of the third and fourth rays of the spinous dorsal, which are longer than in the female, and may be produced into filamentous processes of considerable length. It is possible that this condition is of a temporary character and only manifest in the breeding season, but beyond that it is variable in males of the same size, we are not in a position to make a positive statement.

The presence of silk-like rays in the pectorals and the large size of the scales, render the recognition of this species sufficiently easy; the form of the spinous dorsal appears also to be diagnostic. The accounts sometimes given of this species seem, nevertheless, to show that it has been more or less confused with *G. paganellus*; and the English title of "rock-goby," sometimes applied to it, does not appear to be a particularly happy one.

Our observations of the habitat of this species lead us to conclusions somewhat different from those of Couch, who regarded it as essentially a rock-haunting fish, and named it the rock-goby on that account. He records that his largest specimens, up to $9\frac{1}{2}$ inches in length were always found in rock pools above the reach of ordinary tides, and often containing practically fresh water, whereas those which keep to the open shore were smaller and usually found in oozy places. We have never found specimens of more than about 5 inches in length on British and Irish coasts, nor any at all in rock-pools, and the species is common in Denmark, where, as Dr. Petersen informs us, there are no rocks. It seems possible, as suggested by Boulenger (Ann. Mag. Nat. Hist., Ser. 7, iv., p. 229 [1899]), that these large rock-gobies may have been specimens of *G. capito*; though, as Couch found no difficulty in distinguishing *G. paganellus* from *G. niger* it seems strange that he should have confused the latter with *G. capito*, which much more closely resembles the former species.

Couch explained the large size of his specimens by the circumstances of their environment—freedom from larger enemies and abundance of food. Such pools are often very richly stocked with dwarf prawns, of the species (or variety?) described as *Palæmon leachi*, and we do not consider the explanation as unreasonable.

We regard *G. niger* as the estuarine representative of the larger British and Irish Gobies, since it seems most abundant in estuaries and bays having a certain taint of fresh water. In such places we have found it abundant on comparatively clean, muddy, or sandy ground from above low water mark to a depth of a few fathoms,

wherever there are sufficient small stones, shells, and other debris to afford it shelter and suitable breeding sites. On a beach of muddy gravel, strewn with boulders, at Ballynakill, we have taken it in company with *G. paganellus*, the diverse character of the shore being apparently suitable to both species.

The ova are deposited in the spring in any suitable shelter, and are watched over by the male during incubation; they are regularly fusiform in shape, with a blunt or rounded apex, and measure about 1.5 mm. in height; the rounded apex (cf. Petersen, *loc. et fig. cit.*) serves to distinguish them from those of *G. paganellus*, which are the only known British or Irish goby's ova they at all resemble.

G. niger occurs upon all our coasts and upon those of Western Europe, from Norway to the Bay of Biscay; authors differ as to whether it occurs in the Mediterranean or not, but some gobies sent to us by Dr. Kyle from Naples, do not appear to be in any way distinguishable from the typical *G. niger*.

GOBIUS PAGANELLUS, Gm. L.

Rock Goby.

Pl. I, Fig. 2 (♂), 1 (♀).

G. paganellus.—Day, I., p. 162; Holt and Byrne, Jour. M.B.A., V., p. 335 (1898).

D. VI. (V.), 13-15; A. 11-13; Sc. 52-58, tr. 17-22. Habit, stout; form, sub-cylindrical; depth of body, 5 to $5\frac{3}{4}$ times; length of head, about 4 times in total length; eye, 3 to 3.4-5th times; snout, 4 to 5 times in length of head; interorbital space, narrow; scales, larger posteriorly, minute, and almost buried in the skin on the head and forepart of the back. Rows of dermal papillæ on the head and operculum, generally similarly arranged to those in *G. niger*, but less conspicuous; 4 or 5 upper rays of pectoral, with silk-like filaments, which are much more numerous than in *G. niger*.

Colour, greyish or yellowish brown, varying much in tone in different individuals, marbled with darker shades of brown; colour generally darkest on the head and in the region of the lateral line, which is usually marked by a series of irregular dark patches. The dorsal fins are similar in colour to the body, with dark, usually reddish, oblique bands; along the top of the spinous dorsal runs a well-marked horizontal band of yellow or buff colour, sometimes almost white.*

The breeding male is deep purplish madder all over the head and body, becoming almost black anteriorly, and has the band along the top of the first dorsal orange or bright buff. This colour phase is gradually assumed, darker patches, especially on the fins, manifesting themselves at a period considerably antecedent to the breeding season, but the normal phase can be resumed at any moment.

Total length, 120 mm. ($4\frac{3}{4}$ inches).

* Except in the case of breeding males, it is not easy to express the difference in colouration which exists between *G. paganellus* and *G. niger*. The former, however, never assumes an uniform blackish brown or smoky black colour, and the transverse banding or marbling is more marked than in *G. niger*, even in very dark specimens. The pale areas on the gill cover usually assume a rounded or oval form, while the madder markings on the dorsal fins tend to arrange themselves in the form of oblique vermicular bands.

The band along the top of the spinous dorsal, which is well marked from a length of less than an inch upwards, usually renders the immediate identification of this species easy; in any case the presence of numerous silk-like rays to the pectorals, combined with the number of scales and the normal form of the ventrals, is absolutely diagnostic.

G. paganellus is, in our fauna, the rock goby *par excellence*; it is usually abundant among rock-pools and under stones between tide-marks and on rough or rocky ground in shallow water, but seems never to be found in water of any considerable depth, and only exceptionally on smooth ground. This is a more southerly species in its distribution than *G. niger*; it is found at Madeira and in the Mediterranean, and appears to be common in all suitable localities on our coasts, as far north as the Firths of Forth and Clyde, and the North of Ireland; it has not been found North of the British Isles.

Breeding takes place in the spring (in Ireland and Devonshire about Easter), and the ova are most commonly laid on the underside of an overhanging rock or stone, and there guarded by the male until they hatch; probably any suitable shelter, such as a shell or old tin, is used for breeding purposes, but the underside of a stone appears to be the usual site.

The ova are regularly fusiform in shape, about twice as high as wide, and pointed at the apex; specimens measured were from 1.84 to 1.9 mm. high. They may be distinguished from those of all our other gobies (except *G. Friesii*, the ova of which are unknown) by their size and shape, as they are always more or less acutely pointed at the apex, those of *G. niger*, which resemble them in size, being blunt and rounded.

The following species, though not as yet recorded, may occur in British or Irish waters:—

Gobius capito, C. and V.

G. capito Moreau Poissons de la France, II., p. 203, Fig. 102 (1881); *Holt*, Ann. Mus. Marseille, v. p. 43 (1899); *Boulenger*, Ann. Mag. Nat. Hist., Ser. 7, iv., p. 229 (1899).

D. VI. 14-15; A. 11-13; Sc. 60-62, tr. 18-20.

Habit, stout and heavy; depth of body, 5 to 6 times in total length; length of head, $3\frac{2}{3}$ to $4\frac{1}{4}$; eye, $5-6\frac{1}{2}$ times in head; snout, $3\frac{1}{2}-4\frac{1}{2}$; interorbital space slightly less than diameter of eye.

Pectoral with upper rays silk-like; *ventrals with well-developed anterior membrane which forms an obtusely pointed lobe on either side.*

Attains a length of 10 inches or more.

Our information as to changes of colouration in the breeding male is of a negative character. These gobies breed regularly in the tanks at the Maritime Laboratory of Endoume, Marseilles, but during two seasons spent by one of us at the Laboratory, no change of colouration was observable in the males guarding the ova.

Apparently allied to *G. paganellus*, but a much larger species; it may be distinguished by the form of the ventrals, wide interorbital space, and number of scales.

This fish is common in the Mediterranean, and has lately been recorded by Boulenger from the Gulf of St. Malo; there is no record as yet of its occurrence on our coasts, unless Couch's large rock gobies are referable to it. In habits it appears to be intermediate

between *G. niger* and *G. paganellus*, and the ova resemble those of the latter species, but are much larger, measuring about 3.6 mm. by 1.23 mm.

Gobi *Friesii*, Collett.

FRIES' GOBY.

Pl. I. Fig. 3.

G. Friesii Collett, Forh. Vid. Selsk. Christ., 1874, p. 154; *Holt and Calderwood*, Sci. Trans. Roy. Dub. Soc., Ser. 2, v. p. 417, Pl. xli., Fig. 3 (1895); *G. microlepis*, Scharff, Proc. Roy. Ir. Acad., Ser. 3, L., p. 458 (1891).

D. VI., 14-15; A. 13-15; Sc. 28-29, tr. 8-9. Habit, moderately stout; form, subfusiform and compressed (markedly compressed in comparison with the other British and Irish gobies); length of head, about 4 times, or somewhat less in total length; depth, about 5 times; eye, $2\frac{2}{3}$ to $3\frac{1}{3}$ in length of head; snout, about $\frac{2}{3}$ diameter of eye; interorbital space, very narrow; several well marked rows of dermal papillæ on head and operculum; scales large, extending as far forward as the eyes, decreasing somewhat in size anteriorly; spinous dorsal with some of its rays produced into filaments (this does not appear to be a sexual character, but we are unacquainted with the breeding male); pectoral fin, without silk-like rays; caudal fin, large and lanceolate in form.

Colour, pale grey; more or less tinged with brownish or yellowish green, especially on the dorsum. Rows of golden yellow blotches or spots on the back and sides, and on the unpaired fins. The filaments of the spinous dorsal rays sometimes black.*

Total length, 4 inches (100 mm.)

We are not aware of any sexual differences.

The compressed form, large scales extending far forwards, dermal papillæ on the head and operculum, and absence of silk-like rays from the pectorals, make the identification of this species sufficiently easy. Fries' Goby has not yet been recognised on the coasts of England or Scotland, but appears to be not uncommon locally in the West and South-west of Ireland, and must be abundant in the Irish sea on the soft muddy sand which extends from within a few miles of the coasts of Counties Louth and Down to the neighbourhood of the Isle of Man. Here it has been taken by one of us at depths between 15 and 30 fath., the deeper area having not as yet been properly explored. As many as six were caught on one occasion (22-20 fath., off Skerries Bay, 28/1/02) in a bag of mosquito mesh, with a mouth of about 2 ft. by 1 ft., attached to the back of a beam trawl†—a capture which seems to argue that the species was

* Specimens from about 20 fathoms are semi-translucent, and usually show hardly any colour except the yellow spots, but become darker by the *post-mortem* expansion of the darker chromatophores.

† A bag of fine material, having its mouth laced to the back of the trawl, about midway between the cod-end and the head-rope, appears to be the most reliable engine for the capture of small ground-fish and invertebrates, too small to be retained in a large-mesh trawl, and too active to be caught in a bottom-net of fine material hauled at a pace safe for such gear. The ground-rope of the trawl appears to sweep the small creatures upwards and to concentrate them about the centre of the back of the net, through the large meshes of which they easily pass. Apart from being more effective in capture this device has the merit of eliminating sand and other material from which delicate organisms are liable to injury in a net fished actually on the bottom. We believe the credit of its invention is due to Mr. W. S. Green.

very abundant on the ground fished over. Most of our specimens were obtained in January and February; and the same gear, with the addition of a much larger bag of sprat mesh, caught only two in July. Without further work it is only possible to suggest that the crop of adults dies off for the most part after spawning some time in the spring, since failure to touch small areas of particular local abundance would be an equally good explanation of the apparent relative scarcity of the species over the same general area in summer.

To the southward of the muddy area the bottom of the Irish sea is of firmer sand, and although this ground has been fairly well explored down to a depth of about 70 fathoms, it has not so far yielded any specimens of *G. Friesii*. The latter would therefore seem to have a predilection for muddy sand, and may perhaps be looked for with reasonable prospect of success on grounds known to be frequented by the white sole (*P. cynoglossus*), smareen (*H. platessoides*), and the crustacean, *Nephrops norvegicus*, though it may not descend to the same depths as some or any of these.

Of its breeding season or habits we have no knowledge, but practically the only available objects for the attachment of its ova (if similar to those of other gobies) on the Irish Sea habitat are empty shells of *Fusus antiquus*, which here attains a very large size.

Fries' Goby was first added to the Irish list (under the name of *G. macrolepis*) by Scharff, from an example recorded as taken at 5 fath. on the S.W. of Ireland, no other data being apparently available when it reached the Museum. Several specimens were taken by one of us in Killybegs outer harbour in June, 1890, in shallow water close to the shore, but no record was kept of the nature of the bottom. Specimens were also taken between 6 and 10 fathoms in Inver Bay, Co. Donegal, in the same month, other organisms recorded from the same haul appearing to indicate a sandy bottom. The record given by one of us in the same year from Cleggan Bay appears to have been erroneous, and may probably have been due to a confusion of the temporary labels of the two years of the Royal Dublin Society's Survey. Since 1899 we have made many attempts to find the species in Cleggan Bay and its neighbourhood, but without success.*

Outside Ireland *G. Friesii* is only known from three specimens, from the Strömstad and Gullmar Fjords in Sweden, and Christiania Fjord in Norway, all apparently from deepish water, as Smitt regards it as a deep-sea form. That it is by no means confined to even moderately deep water is sufficiently apparent from the evidence which we have adduced above, while beyond the Scandinavian records, which do not specify the exact soundings, we have as yet no knowledge of its existence much below the 30-fathom line.†

* On the 29th August, 1902, a single specimen was taken by Captain Macauley in Blacksod Bay, the depth recorded being 9 fath. The bottom here is generally sandy.

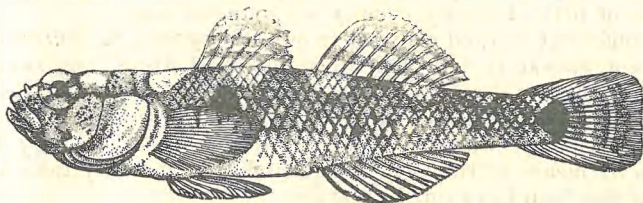
† Collett has suggested the possible identity of *G. Friesii* with *G. Lesueurii* Risso a native of the Mediterranean shores of France and Italy. We do not know whether the types of that species are in existence, and have not access to any properly authenticated specimens. Neither Risso in his original description (*Ichthyologie de Nice*, 1810) nor Cuvier and Valenciennes make any mention of the dermal papillæ on the head and operculum which are so conspicuous in *G. Friesii*, with which their description in other respects substantially agrees, but these are stated to be present by Canestrini and Moreau. We can only say that Collett's suggestion appears to us to be well founded, but unless or until Risso's types are examined it is impossible to pronounce on the identity of the two species.

GobiUS RUTHENSPARRI, Euphras.

SPOTTED GOBY.

Fig. 2.

G. Ruthensparri.—Day, I., p. 160 (1884); Petersen, Fiskeri-Beretning Kbhvn, 1891, p. 251 (1892); Guitel, Arch. Zool., Exp. et. Gen. Ser. III., iii., p. 263 (1895). *G. flavescens*.—Smitt, I., p. 251 (1893); McIntosh and Masterman, British Marine Food-Fishes, p. 172 (1897).

Fig. 2. *G. Ruthensparri* ♂ × 14.

D. VII-VIII., 10-11; A. 10-11; Sc. 35-40, tr. 12-15. Habit, slight; form, subfusiform, somewhat compressed laterally; depth of body, 5 to 6 times in total length; length of head, 4 to 5 times; eye, 3 to $3\frac{1}{2}$ times in length of head; interorbital space wide, half or more of the diameter of the eye, and equal to or slightly less than the length of the snout.

The general body colour is yellowish or olive brown, sometimes almost green, or reddish brown of any shade from rich chestnut to pink. The ventral parts are yellowish white, even in mature males. Along the back is a series of about five or six saddle-like pale markings, more or less confluent dorsally. They vary much in distinctness during life, both in individuals and momentarily in the same individual, and often disappear after death. Along each side from the base of the pectoral fin to the root of the tail is a row of some seventeen (more or less) short transverse markings, which vary momentarily in colour from pale grey to pale blue in the female and young male, or intense azure blue in the mature male. In the centre of the root of the tail is a large black spot, diamond-shaped, or roughly circular in outline, and partly enclosed by the last pair of grey or blue markings. In life the chromatophores of this spot are subject to control, and it is occasionally inconspicuous. Usually, however, it is very conspicuous in life; always so, according to our experience, *post mortem*, and is not affected by either alcohol or formaline. Another similar spot occurs on the male a little behind the base of the pectoral.

The caudal spot offers a ready method of recognising the species, being, when the chromatophores are (as usually) expanded, of a full intense continuous black, whereas the dark markings which occur in the same place in some other species are easily resolved by the naked eye into aggregations of minute black specks without any regular outline.

The spinous dorsal has three, the soft dorsal three or four horizontal bands of red or pink, the intervening parts of these fins being yellowish or milky white—blue in the adult male when viewed against a dark background. The remaining fins are without conspicuous colouration.

Among fish of adult size the male differs from the female at all times in the greater brilliance and boldness of his colouration. The blue element becomes especially conspicuous in moments of excitement. The posterior rays of the soft dorsal and anal are comparatively longer in the adult male than in the female.

Total length, 64 mm. ($2\frac{1}{2}$ inches).

The wide interorbital space, the number of rays in the spinous dorsal, and the conspicuous black spot at the root of the caudal fin (which, as already mentioned, seems to be retained, however the specimen is preserved), render the identification of this species a matter of little difficulty even in its youngest stages.

In somewhat marked contrast to our other gobies, *G. Ruthensparri* does not appear to habitually rest on the bottom, but swims, in larger or smaller shoals, among oar-weed (*Laminaria*) and mill-seed or sea grass (*Zostera*) at a short distance above the bottom, usually in quite shallow water. It can cling with some tenacity to an object by means of the ventral fins, and may probably take advantage of this faculty in rough weather.

The breeding season continues throughout the summer from April to August, and during this period there is a constant succession of broods; the breeding habits have been excellently described by Guitel (*loc. cit.*), and appear to resemble those of other gobies; perhaps the most notable point about them is the very small number of casualties which result from the persistent but discreet combats which take place among the males for their mates. The eggs seem to be laid upon any sheltered and fairly smooth surface, *e. g.*, inside the "bulbs" of *Laminaria bulbosa*, and are pear-shaped, with a somewhat pointed apex, measuring about .8 mm. in height by .6 mm. in greatest breadth. So far as any conclusions can be drawn from merely examining specimens of a species with such an extended breeding season, it appears that members of this species do not ordinarily survive the second winter following the summer in which they are hatched; but, as we have never kept specimens for a long period in captivity, we can do no more than express an opinion upon this point.

This species appears to occur in suitable localities on all our coasts, and its range extends from about 65° N. on the Norwegian coast to the Bay of Biscay.

Gobi *minutus*, L.

COMMON GOBY, FRECKLED GOBY.

G. minutus and *G. Parnelli*; Day, I., p. 164 (1884); *G. minutus*, Guitel, Arch. Zool. Gen. et Exper. ser. II. x., p. 499, pl. xxii. (1892).

G. minutus and *G. microps*, Petersen, Fiskeri-Beretning Kbhvn, 1891, p. 246, pl. v., 10-12 (1892); Smitt, I., pp. 256-262 (1893).

D. VI. (VII.), 9-12; A. 9-12; Sc. 39-65, tr. 13-19. Habit, moderately stout, subject to considerable variation in form; head somewhat depressed; depth of body, $5\frac{2}{3}$ to nearly 8 times in total length; head, 4 to $4\frac{1}{2}$ times; eye, 3 to 4 times in head, usually somewhat larger than, but sometimes equal to or even shorter, than the snout, which is contained 3 to 5 times in head; interorbital space, narrow; scales, larger on the posterior part of the body than anteriorly; head, and a larger or smaller area of the front part of the back, scaleless; pectoral fins, without silk-like upper rays.

Colour very variable, sandy-brown or ochreous to dull grey, darker on the back and usually most intense along the exposed edges of the scales—a condition which results in an irregular and discontinuous network of darker colour over the dorsum and upper parts of the sides. There is commonly a series of dark blotches varying in intensity and number (from as few as six or seven to over a dozen) along the middle line of the sides, terminating in a somewhat more conspicuous group of black chromatophores at the base of the caudal fin; some of these blotches are sometimes prolonged into vertical bars. The dorsal and caudal fins are obliquely banded with brown or brownish-grey,* and there is usually a single conspicuous† black or deep blue spot at the posterior end of the spinous dorsal (when, as sometimes happens, this fin has seven rays there may be two such spots).

In the breeding male the colour of the body is usually darker, and there is often a marked tendency for the lateral blotches to form bars; the head and body are stouter and thicker set, the snout somewhat shorter and blunter, and the caudal peduncle comparatively deeper than in the female. The ventral fin and underside of the head become suffused with dark pigment, and the posterior rays of the soft dorsal and anal fins are prolonged and edged with blue-black, the bands on both dorsal fins become dull red or reddish brown, and the interspaces between them of a bluish tint, while the dark spot on the first dorsal becomes an intense and often brilliant blue, surrounded by an opaque white ring. These sexual characters seem to be developed to very different extents by different individuals, and are seemingly lost after breeding has ceased, the brilliant colouration soon fading, and the prolonged fin-rays sloughing away more gradually. The anal papilla of the male is long and pointed; that of the female short and blunt.

Total length, over 80 mm. ($3\frac{1}{4}$ inches).

There appear to be two main races of this very variable species:

(A.) Typical race.

(*G. minutus major*, Heincke.)

D. VI. (VII.), 11-12; A. 10-12; Sc. 53-65, tr. 14-19.

Generally slighter in build than the estuarine race, with a lighter and finer head and a larger average number of scales and fin-rays; the scaleless area of the head and anterior part of the back only extends as far back as the front rays of the spinous dorsal. Usually of a sandy-brown or ochreous colour, without any very marked tendency to the extension of the lateral markings into bars.

Total length, over 80 mm. ($3\frac{1}{4}$ inches).

Usually found on our coasts in water of normal salinity at all depths down to about 50 fathoms, commonest between low-tide mark and 20 fathoms. This race is very variable in form and colour, but specimens from deeper water seem usually to be longer, slighter in build, and paler in colour, and to retain some of their larval characters to a comparatively large size.

* Very rarely black on the spinous dorsal.

† Only inconspicuous, according to our experience, in some examples from deep water. One such, though of a size at which even the larger of the inshore forms is commonly mature, had fin-rays and membranes as delicate as in young examples, or as in the adult *G. Jeffreysii*. (See p. 30.)

(B.) Estuarine race. Fig. 3.

(*G. microps*, Kroyer, Danm. Fiske (1838-1840), and subsequent Scandinavian authors; *G. Parnelli*, Day (1884).)

D. VI. 9-11; A. 9-11; Sc. 39-55, tr. 13-19.

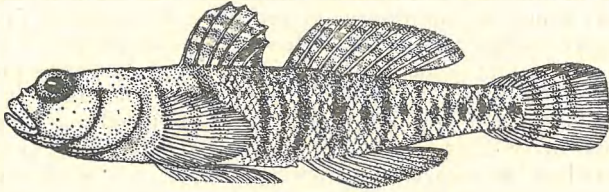


Fig. 3. *G. minutus* ♂ × 1½.*

Generally stouter in habit than the preceding race, with a heavier and blunter head and a smaller average number of fin-rays and scales; the scaleless area of the head and anterior part of the back is somewhat larger, extending as far as the posterior end of the spinous dorsal, and at some distance from it, but is not constant in shape and size; this larger scaleless area in part accounts for the smaller number of scales in a longitudinal series. This race does not attain such a large size as the typical race, is dirtier and greyer in colour, and especially in males, frequently has the dark body markings prolonged into bars.

Total length, about 60 mm. (2½ inches).

Specimens of this race from different localities differ considerably from one another, more especially in size and in the extent of the scaleless area and number of scales, and these differences seem to be in some degree the results of the habitat; the largest and brightest specimens we have seen came from the clean and sandy estuaries in the North of Cornwall,† where the water at high tide is of almost normal salinity [Fig. 3, and *post*, p. 64], and the smallest and most dingy specimens from the muddy and brackish estuaries of the North Sea [*post*, p. 65]. The specimens from the estuary of the Cuckmere whose measurements are given on p. 64, approach the typical race in the comparatively large number of scales and small scaleless area, though in form and colour they resemble the estuarine race. In all probability a sufficient series of specimens from various localities would show a complete gradation from one race to the other.

The form termed *G. microps* by the Scandinavian writers, which occurs in the shallow and nearly fresh waters of the Baltic, appears to mark the extreme development of this race. In appearance it is so different from the typical *G. minutus* as to appear specifically distinct, but after examining specimens kindly sent us by Professor Petersen, we can only regard it as the ultimate result of a variation whose earlier developments are seen in the estuarine forms of the Western Channel and North Sea.

It is not usually difficult to distinguish *G. minutus* from any other of our native gobies; in the case of the typical form, the number of scales and radial formula are quite distinctive in cases where the

* The colouration scheme in the typical race only differs in the absence or less development of the dark vertical bars on the sides.

† Almost identical specimens were found by Guitel in the sandy bays of Brittany, and a very similar form occurs in the Exe estuary.

"freckled" appearance of the body and the nature of the markings on the body and fins are not sufficient for identification. Some estuarine forms resemble *G. pictus* in these respects rather closely, but *G. minutus* never has the plainly-marked rows of black spots on the dorsal fins which are found in that species, and as *G. pictus* appears never to be truly estuarine in habitat, confusion is not very likely to occur.

In one or other of its forms, this species appears to be almost ubiquitous on our coasts; it is apparently able to accommodate itself equally well to deep water in the open sea and to the dirtiest and most brackish estuary (where its usual companion is the three-spined stickleback), even living, and seemingly breeding, in small almost fresh puddles, quite beyond the reach of ordinary tides. The ground upon which *G. minutus* is usually found is either sandy or muddy, and never (in our experience) gravelly or rocky, but it seems to prefer places in which it can find empty shells, small stones, old cans, or other extraneous substances, to provide it with suitable shelter and sites for breeding; the presence or absence of weeds seems not to affect it. Essentially a gregarious fish, it usually occurs in large numbers in its favourite haunts, either resting on the bottom or half buried in the sand, or darting rapidly from one shelter to another, as it is disturbed. The breeding season lasts throughout the spring and summer, and on its approach each male selects a breeding site, usually under an empty shell or stone; having taken possession of this, he proceeds to carefully cover every entrance but one, and then hollows out a space in the sand or mud in his chosen shelter, and waits with his head outwards for the approach of a rival male, against whom he may sally out to battle or a female before whom he may display the full glory of his nuptial dress. The combats between rival males are furious and not infrequently result in the death of the weaker, perhaps as much from exhaustion as from wounds. Having finally induced a female to enter his home, the male mounts guard outside while she deposits her eggs, and on the completion of this operation again enters and watches over them until they hatch, preventing the approach of enemies, and keeping up a circulation of water round the ova until the young emerge. The female takes no further interest in her offspring, but proceeds after a short interval to lay another batch of eggs for some other male to protect. There appears to be a constant succession of broods throughout the spring and summer, and no sooner is a male relieved of the cares of one family than he takes upon himself those of another.

A most delightful account of the breeding habits of this species is given by Guitel,* whose observations are entirely borne out by what we have ourselves seen.

The ova are attached to the surface upon which they are laid by a micropylar net-work similar to that found in other gobies, and are of a more or less elongated pear-shape, varying considerably in size according to the size of the parent; those of the typical form are usually from 1.1 to 1.2 mm. in height, those of *G. microps*, described by Petersen, were only .9 to 1 mm. in height. The young when hatched already have their mouths open and yolk sacs nearly absorbed, and soon attain the form of the adult. Probably the life of this species seldom extends over two winters; a specimen kept in a tank at Plymouth attained a length of 75 mm., and was fully adult about a year after the probable date of hatching.

* *loc. cit.*

The geographical range of *G. minutus* extends from 69° N. on the Norwegian coast to the Adriatic.

Its food consists of any animal substances it can swallow, but is mainly composed of small worms and crustaceans.

Gobi *PICTUS*, Malm.

PAINTED GOBY.

Pl. II. Fig. 1.

G. pictus.—Day I., p. 167; *Holt and Byrne*, Jour. M.B.A., V., p. 336 (1898).

D. VI., 9-10; A. 9-10; Sc. 35-41, tr. 10-13.

Habit, moderately stout; depth of body, $5\frac{1}{2}$ to 7 times; length of head, 4 to 5 times in total length; snout, $4\frac{1}{2}$ to 5 times; eye, about $3\frac{1}{4}$ (in full grown) to $2\frac{1}{2}$ (in young) times in length of head; inter-orbital space, narrow; scaleless area of head and back similar in area to that of the estuarine race of *G. minutus*.

Pale yellowish grey to pale brown in colour, boldly marbled with darker shades of the same colour; there are the usual paler dorsal saddle-shaped markings and darker patches on the head and operculum, and dark brown and yellowish grey patches on the region of the lateral line; these latter markings not infrequently (and more usually in males) take the form of perpendicular yellowish grey or dull ochre bars. Usually the centre of each dark area has a fairly conspicuous group of black chromatophores and the markings are much bolder in character than those of *G. minutus*. The dorsal fins are longitudinally banded with red, and bear one or more rows of black spots.*

In the breeding male the colours are much intensified and there is a much greater contrast between the pale and dark markings; the dark markings in the region of the lateral line usually show a more or less marked tendency to form perpendicular bars, and some of the other markings in that region show a distinct opalescent play of colour; the membrane of the dorsal fins becomes a brilliant opalescent green or azure blue, and the black spots on them a deep blue-black.

Total length, 55 mm. ($2\frac{1}{4}$ inches).

It is not easy to find any single character or even combination of characters (apart from the colouration) by which *G. pictus* may be readily distinguished from *G. minutus*. In the former species the head is as a rule stouter and the snout shorter in comparison to the eye, and the number of scales in the lateral line smaller; but the former character is apt to vary somewhat according to sex, and the latter is, in view of the irregular arrangement of the scales and of the fact that in some of the estuarine forms of *G. minutus* their number may be no greater than in some *G. pictus*, unsatisfactory. Indeed both the form and proportions of the head and the number of scales appear in the breeding males of some races of *G. minutus* to be practically identical with those found in *G. pictus*. Both these points are shown in the tables (pp. 59-66). The markings of

* Our coloured figure is taken from a pale specimen, and the body colours are often much darker and the black spots on the dorsal fins larger and more numerous than there represented.

the body are bolder in *G. pictus* than in *G. minutus*, and the rows of black spots found on the dorsal fins of *G. pictus* do not occur in *G. minutus*,* and, as they appear to be permanent in alcohol and formol, provide, in our opinion, the readiest means of telling these two species apart. As far as our experience goes, however, the number of the scales and the proportions of the head nearly always serve, if not to identify this species without recourse to the colours of the dorsal fins, at least to render more certain any identification founded upon that character. It appears that *G. pictus* is not a species liable to great variation, and in this it contrasts strongly with *G. minutus*. We have examined the otoliths of a few examples of each species, and have found them to present a slight but constant difference.

G. pictus is found on fine or coarse sand, on the muddy sand of *Zostera* beds, and on shelly or even gravelly ground, its preference, so far as we know it to exhibit one, being for coarse sand. It ranges from between tide-marks to about 15 fathoms, and though often taken in company with the last species, it neither penetrates into such deep water nor so high up estuaries. The breeding habits, so far as observed, resemble those of *G. minutus*, and the males are equally bellicose. The ova are pear-shaped, and measure about .80 mm. in height by .65 mm. in greatest breadth; the female commences to breed at a length of about 28 mm., and probably produces a series of batches of eggs in the course of the summer.

G. pictus has never been found south of our islands, but its range extends as far north as the Baltic. In our area it is abundant on the south of Devon and Cornwall, and in the West of Ireland, and has been recorded from Wales; in all probability it occurs all round our coasts in suitable localities.

GOBIUS JEFFREYSII, Gthr.

JEFFREY'S GOBY.

Fig. 4.

G. quadrimaculatus.†—Day (nec. auct.), I., p. 168 (1884).

G. jeffreysii, Günther, Proc. Roy. Soc., Edin., xiv., p. 120, *partim* (1888); Smitt, I., p. 261 (1893); Holt and Calderwood, Sci. Trans. Roy. Dublin Soc., Ser. 2, v., p. 420 (1895); Holt, Jour. M.B.A., V., p. 89 (1897); Holt and Byrne, Jour. M.B.A., V., p. 337 (1898).

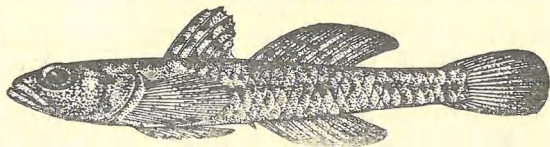


Fig. 4. *G. jeffreysii* $\times 1\frac{1}{2}$.

D. VI.,† 9-10; A. 9-10; Sc. 26-29, tr. 7. Habit, slender; body, elongated; head depressed and somewhat pointed; depth of body,

* Very rarely (See p. 54) there may be rows of very insignificant black spots on the spinous dorsal of *G. minutus*.

† The true *G. quadrimaculatus* is a common Mediterranean species which has not as yet been found on our coast. Day figures and describes the present species under that name, but attributes to it in his description (although not in his figure) 37-40 scales in a longitudinal series, that being the number possessed by the true *G. quadrimaculatus*.

‡ Smitt figures a specimen with only 5 rays in an obviously injured spinous dorsal.

6 to 7 times; length of head, about 4 times in total length; eye, 3 to $3\frac{1}{2}$ times in length of head; snout, 4 to $4\frac{1}{2}$ times; eyes, almost touching superiorly.

General colour pale grey, mottled with rusty brown, with four conspicuous dark spots in the region of the lateral line. Dorsal fins pale bluish grey, with dark horizontal bands; their rays are comparatively long, and both rays and fin-membrane very delicate and easily torn or broken. Sometimes one or more of the central rays of the spinous dorsal are much longer than the others; this is possibly a sexual character of the male, but may occasionally appear merely as the result of injuries to the other rays. The breeding male is not known to possess any distinctive colouration, but the colours of the male* seem generally to be more pronounced than those of the female.

Total length, 47 mm. (nearly 2 inches).

This species can hardly be confused with any other found in our waters; the form of the ventral fins at once distinguishes it from *G. scorpioides* and *G. orca*, and the number of scales from *G. minutus*, while in fresh examples the rusty brown colouration is characteristic.

The ova and breeding habits are not known; we believe that the ova attributed by us to *G. Jeffreysii* (*loc. cit.*) were so attributed on insufficient grounds.

It is found in water of 19 to 180 fathoms depth, usually on mud, sand, or fine gravel, and appears to be confined to the western shores of Europe, from Stavanger Fjord and the Färöe Channel on the North to the mouth of the English Channel on the South. In our waters it has been recorded from the Färöe Channel, the Hebrides, the Clyde Estuary, the South-west coast of Ireland, and near the Eddystone Lighthouse.

We believe that our figure shows the true form of the spinous dorsal fin, but unfortunately, owing to the depth of the water in which it lives and the delicate nature of the fin-membrane, we cannot say we have ever seen a specimen of *G. Jeffreysii* which was beyond doubt uninjured.

GOBIUS SCORPIOIDES, Collett.

Pl. II. Fig. 3 (♂), 2 (♀).

G. scorpioides.—Collett, Ann. Mag. Nat. Hist., Ser. 4, xiii., p. 447 (1874), Forh. Vid. Selsk, Christ., 1874, p. 175, Pl. iii., Fig. 4-6; Tilægsh, Forh. Vid. Selsk, Christ., 1874, p. 58; Malm. Goteborgs och Boh. Fauna, p. 651 (1877). *Lebetus scorpioides*.—Winther, Naturhist, Tidskr., Kbhvn., Ser. 3, xi. p. 49 (1877), and xii., p. 18 (1879). *G. scorpioides*.—Hansen, Zool. Dan. Fisk., p. 36, Pl. vi., Fig. 7 (1885); Lilljeborg, Sveriges och Norges Fiskar I., p. 620 (1891); Smitt, I., p. 260 (1893); Holt and Byrne, Journ. M. B. A., V., p. 337 (1898).

D. VI., 9; A. 8; Sc. 28-30.

Habit, stout; depth of body, about 5 times in total length; length of head about 4 times; eye, about $3\frac{1}{2}$ times in head, slightly longer than snout; ventrals without basal membrane.

* The specimen described and figured by Günther (Proc. Roy. Soc., Edin., xvi., p. 120) as the breeding male of this species is really referable to *G. orca*.

Colour yellowish, sometimes with a muddy tinge, with irregular dark madder-brown bands and markings, a broad and conspicuous pale band across the caudal peduncle. Spinous dorsal nearly black, with alternate red and white horizontal bands on its anterior margin; soft dorsal whitish, obliquely banded with pale red. In the breeding male the yellow ground colour has a distinct red tinge, and the brown pigment is more generally distributed and richer in tone, both dorsal fins are obliquely banded with red and white, and the two colours are separated by narrow black bands; there is a brilliant blue spot at the posterior end of the spinous dorsal.

Total length, less than 1 inch. The largest breeding male we have seen was 21 mm. long, and a female 21 mm. long contained ripe ova.

The stout habit, the form of the spinous dorsal and the pale band on the caudal peduncle, combined with the form of the ventrals, seem to provide the best means of identifying this species.

Nothing is known of the habits of *G. scorpioides*, which has been found on rough ground in from about 2 to 74 fathoms of water. The ova apparently resemble those of other gobies, but are much smaller and spherical in shape; they are deposited in the summer months.

It is one of the smallest of known fishes, and little liable to capture by any ordinary method; in fact, excepting from Ballynakill Harbour, there are only five records of its capture, viz., two from the Norwegian coast, one from the Cattegat, one from Falmouth Harbour, and one, hitherto unpublished, from 30 mi. W.N.W. of Cleggan Head, 74 fath.

In Ballynakill Harbour it may occur in some numbers, since several specimens have been secured with an iron-wire dredge, fitted with mosquito net bag and worked so as to engage the ground as lightly as possible. Its chief haunt, *vide* Mr. G. P. Farran, is the outer edge of the bar of Fahy Bay, the ground consisting of fragments of Lithothamnium, littered with old shells and small stones. The depth is about one to three fathoms.

GOBIUS ORCA, Collett.

Fig. 5.

G. orca.—Collett, Ann. Mag. Nat. Hist., Ser. 4, xiii., p. 446 (1874); Forh. Vid. Selsk. Christ., 1874, p. 172, Pl. iii., Fig. 1-3; Tillaeg. Forh. Vid. Selsk. Christ., 1874, p. 57. *Lebetus orca*.—Collett, Forh. Vid. Selsk. Christ., 1879, p. 34. *G. orca*.—Collett, N. Mag. Natur. Christ., xxix., p. 61, Pl. i., Fig. 1-2 (1885). *G. jeffreysii*.—Günther, Proc. Roy. Soc., Edin., xv., p. 210, Pl. iii., Fig. B. (1888). *G. orca*.—Lilleborg, Sveriges och Norges Fiskar I., p. 616 (1891); Smitt, I., p. 259 [Fig.] (1893). *L. orca*.—Collett, Result. Camp. Scient. Monaco, X., p. 41 (1896).

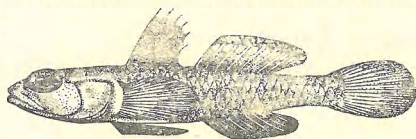


Fig. 5. *G. orca* $\times 1\frac{1}{2}$.

D. VI-VII., 9-11; A. 9-10; Sc. 25-28.

Habit, comparatively slight; form, subfusiform, somewhat compressed; head, $3\frac{1}{2}$ times in total length; depth of body, about 6 times; snout shorter than eye, which is contained about $2\frac{1}{2}$ times in head. Generally similar to the last species, but much more slender and greyish brown in colour, with a few indistinct dusky markings on the upper part of the body, and without any pale band on the caudal peduncle. Spinous dorsal higher than soft, and of an uniform dull black; soft dorsal dusky black, with a deep black upper margin separated from the rest of the fin by a row of white spots.

Total length, about $1\frac{1}{2}$ inches.

Only some eight specimens of this little known fish appear ever to have been taken, all on sandy ground and in water of 10 to 200 fathoms depth; five were found off the Norwegian coast, two off Sables d'Olonne, in the Bay of Biscay, and one (originally recorded as *G. Jeffreysii* ♂) in Kilbrennan Sound, in the Hebrides. The last specimen is in the British Museum, and it is from this that our figure, unfortunately owing to the state of the specimen somewhat of a "restoration," is taken.

In all probability this species occurs off our coasts in suitable localities, and should be carefully looked for whenever gear capable of capturing so small a fish is used. Nothing is known of its habits or breeding.

TABLES OF MEASUREMENTS OF EXAMPLES OF VARIOUS SPECIES OF GOBY FROM BRITISH AND IRISH WATERS.

These were all made by the same observer at different periods, and, in spite of the varying circumstances under which they have been made (sometimes at sea), and of the fact that some specimens were fresh and some had been preserved for varying periods, it is hoped that sufficient uniformity of method has been attained to make them useful for purposes of comparison.

In some cases notes made at the time of measurement or capture are added.

All measurements are in millimetres.* The measurements in the several columns are—1. Length; 2. Length, inclusive of Caudal Fin; 3. Head; 4. Snout; 5. Eye; 5A. Interorbital width; 6. Depth of Body; 7. Depth of Caudal Peduncle. The symbols ♂ and ♀ are used to express sexual maturity.

*These are taken to the nearest half-millimetre, and smaller differences are sometimes shown by the use of the symbol +; thus, $1.5+$ means more than $1\frac{1}{2}$ mm. and less than 2 mm.

GOBIUS NIGER.

PLYMOUTH (September).

	1.	2.	3.	4.	5.	6.	7.	Fin-rays.		Scales. Sc. Tr.
								D.	A.	
(1)	93	117	22	5.5	6.5	17	10	VI	13 13	37 14
(2)	88	103	21	5	6.5	15	9	VI	13 12	38 15
(3)	86	104	21	5	6.5	15	9	VI	13 13	39 15
(4)	84	101	20	5	6	16	9	VI	13 11	37 14
(5)	83	99	20	5	6	16	9	VI	14 12	37 14
(6)	82	98	20	5	6	16	9	VI	13 12	36 14
(7)	80	97	20	5	6	16	9	VI	13 13	36 14
(8)	79	96	19	4.5	6	15	9	VI	13 12	39 14
(9)	78	94	18.5	4.5	5.5	15	9	VI	13 12	36 15
(10)	77	93	18	4	6	16	9	VI	13 13	37 15
(11)	75	89	17.5	4	5.5	14	8	VI	13 12	39 14
(12)	74	89	17.5	4	5.5	14	8	VI	12 12	38 14
(13)	73	88	17	4	5	13	7.5	VI	12 12	40 14
(14)	72	87	17	3.5	5	13	7.5	VI	13 12	37 15
(15)	66	78	15	3.5	5	11	6.5	VI	13 13	38 14
(16)	63	76	15	3	4.5	11	6	VI	13 11	40 15

Measured in the autumn when all had seemingly finished spawning for some time.

BALLYNAKILL HARBOUR, CO. GALWAY (Summer).

	1.	2.	3.	4.	5.	6.	7.	Fin-rays.		Scales. Sc. Tr.
								D.	A.	
(1)	♂ 94	118	24	7	6.5	16	10.5	VI	14 13	37 13
(2)	♀ 96	116	24	6.5	7	22*	11	VI	14 12	38 14
(3)	85	104	22	6	6	16	10	VI	13 12	36 13
(4)	62	76	15	4	4.5	12	7	VI	14 12	36 14
(5)	46	57	11	2.5	3.5	9	5	VI	13 12	36 13
(6)	32	40	8.5	1.5	3	5.5	3	VI	13 12	36 13

* Nearly ripe, ovaries large and remains of a *Polynoe* in stomach.

(3), (4), and (5) were males not breeding; the two latter probably immature.

The lengths of the rays of the spinous dorsal were as follows in millimetres:—

- (1) 13, 15, 21, 29, 13, 8, longest ray reaching base of 7th ray of soft dorsal.
 (2) 11, 13, 16, 18, 12, 7, " " 3rd "
 (3) 12, 15, 17, 18, 15, 7, " " 4th "
 (4) " " 3rd "
 (5) " " 1st "
 (6) " not reaching beyond base of spinous dorsal.

Gobijs Paganellus.

INISBOFIN, CO. GALWAY (various dates).

	1.	2.	3.	4.	5.	6.	7.	Fin-rays.		Scales. Sc. Tr.
								D.	A.	
(1)	♂ 85	101	22	5	6	17	11	VI	15 12	55 20
(2)	♂ 85	101	22	4·5	6	17	11	VI	15 13	54 21
(3)	76	91	18	4	5	15	9·5	VI	15 12	58 22
(4)	67	80	16	4	5	13	8	VI	15 13	54 19
(5)*	62	74	15	3·5	4	11·5	7	VI	15 13	55 20
(6)	59	70	14	3·5	4	10·5	6·5	VI	14 12	54 20
(7)*	57	68	14	3·5	4	10	6	VI	15 13	55 18
(8)*	57	69	14	3·5	4	10·5	6·5	VI	15 13	53 18
(9)*	54	65	13·5	3·5	4	10	6	VI	15 13	56 21
(10)*	53	64	13·5	3	3·5	10	6	VI	15 13	52 19
(11)*	51	62	13	3	4	9	6	VI	14 11	53 18
(12)	48	58	12	3	3·5	9	6	V	14 12	55 20
(13)	47	57	12	3	3·5	9·5	6	VI	14 13	55 20
(14)	46	56	11·5	2·5	3	8·5	5·5	VI	15 12	55 19
(15)*	31	37·5	8	2	2·5	6	3·5	VI	15 12	57 19
(16)*	30	36·5	8	2	2·5	6	3·5	VI	15 12	53 20
(17)	27	33	7	1·5+	2·+	5	3	VI	15 12	53 18

*Collected early in September.

Gobijs Friesii.

OFF CLOGHER HEAD, 20-22 FATHOMS (January).

	1.	2.	3.	4.	5.	6.	7.	Fin-rays.		Scales. Sc. Tr.
								D.	A.	
(1)	72	90	16·5	4	6	13	6·5	VI	15 14	29 9
(2)	67	83	16	4	6	13	6	VI	15 14	28 9
(3)	66	85	16	3·5	5	13	7	VI	15 14	28 8
(4)	65	83	16	4	6	12	6	VI	15 14	29 9
(5)	65	81	16	4	6	13	6	VI	15 14	29 8
(6)	63	79	15	3·5	5·5	13	6·5	VI	15 14	29 9
(7)	61	80	15	3·5	5·5		6·5	VI	14 13	29 8
(8)	48	60	12	2·5	4	8	5	VI	14 13	

GobiUS RUTHENSPARRI.

BALLYNAKILL HARBOUR, Co. GALWAY (August).

	1.	2.	3.	4.	5.	5A.	Fin-rays.		Scales.	
							D.	A.	Sc.	Tr.
(1)	55	64	11.5	2.5	3.5	2	VII	11 11	38	12
(2)	51	60	11	2.5	3.5	2	VII	11 11	38	13
(3)	51	60.5	11	2.5	3.5	2	VIII	11 11	38	14
(4)	46	54	10	2	3	2	VII	11 11	40	13
(5)	45	53	10	2	3	1.5	VII	10 10	37	14
(6)	45	53	10	2	3	1.5+	VII	11 11	38	13
(7)	44.5	52.5	9.5	2	3	1.5+	VII	11 11	37	14
(8)	42	50	9.5	2	3	1.5+	VII	11 10	36	12
(9)	40	47.5	9.5	2	3	2	VII	11 11	39	12
(10)	39	47	9	1.5+	2.5+	1.5+	VII	11 11	36	13
(11)	38	45	8.5	1.5	2.5	1.5	VII	11 11	37	12
(12)	38	43.5	8.5	1.5	2.5	1.5	VII	11	38	12
(13)	37	43	8.5	1.5	2.5	1+	VII	11 11	37	12
(14)	37	43	8.5	1.5	2.5	1.5	VII	11 11		
(15)	37	43	8	1.5+	2.5	1.5+	VII	11 11	39	13
(16)	36	42	8	1.5+	2.5	1.5	VII	11 11	39	12
(17)	36	42	8	1.5	2.5	1.5	VII	11 11		
(18)	34.5	40.5	8	1.5	2.5	1.5	VII	11 11		
(19)	30	35.5	7	1+	2+	1+				
(20)	28	33	6.5	1+	2+	1+				

INISBOFIN, Co. GALWAY, IN HARBOUR (August).

	1.	2.	3.	4.	5.	6.	7.	Fin-rays.		Scales.	
								D.	A.	Sc.	Tr.
(1)	50	59	11.5	2.5	3.5	10	4.5	VII	11 11	38	12
(2)	47	55	10.5	2+	3+	8	4	VII	11 10	36	13
(3)	46	54.5	10	2	3	8	4	VII	11 11	40	15
(4)	46	54	10	2	3	9	4.5	VII	11 10	39	13
(5)	44	52	9.5	2	3	7	3.5	VII	10 11	39	14
(6)	44	52	9.5	2	3	7.5	4	VII	11 11	39	13
(7)	37	44	8.5	1.5+	2.5	6	3	VII	11 11	40	15
(8)	35	42	8	1.5+	2.5	6	3	VII	11 11	38	13
(9)	23.5	27.5	5.5	1+	2	4	2			38	13
(10)	20.5	24	5	1+	2	3.5	2	VII	11 11		

Gobijs minutus.

INISBOFIN, Co. GALWAY (August).

	1.	2.	3.	4.	5.	6.	7.	Fin-rays.		Scales. Sc. Tr.
								D.	A.	
(1)	♀ 72	82	16	4.5	4.5	12	5	VI	12 12	64 17
(2)	♀ 65	76	16	4	4.5	10	5	VI	12 12	64 16
(3)	♀ 65	75.5	15	4	4	10	5	VI	12 12	65 18
(4)	♀ 64	73	15	4	4	9	5	VI	12 12	62 16
(5)	♂ 63	73	15	4	4	9	5	VI	12 11	62 16
(6)	♂ 58	69	14	4	4	9	4.5	VI	11 12	66 17
(7)	♂ 55	64.5	13	3+	3.5	8.5	4	VI	11 11	61 15
(8)	♂ 55	64.5	12.5	3.5	3.5	8	4	VI	12 12	62 17
<p>All spent (5) with some small ripe spermatozoa. Very slight traces of dark pigment on undersides of ♂ ♂, a slight tendency to bars in both sexes, perhaps slightly more marked in ♂ ♂, spot on spinous dorsal slightly more intense in ♂ ♂. Genital papilla very small in all.</p> <p>Height and run of soft dorsal similar in both sexes, ♀ 9½/5, 8/4½, 7½/4, 7/4 ♂ 9/6, 7/5, 7/4, 8/4.</p>										
(9)	71	82	16.5	4	4.5	11	5	VI	12 11	66 18
(10)	68	78	16	4	4.5	10	5	VI	11 12	67 18

INISBOFIN, Co. GALWAY (August)

	1.	2.	3.	4.	5.	Fin-rays.		Scales. Sc. Tr.
						D.	A.	
(1)	67	77	15	4	4	VI	11 12	60 15
(2)	64	74	15	4	4	VI	12 11	65 16
(3)	63	73	15	4	4	VI	12 12	63 17
(4)	63	74	15	4+	4+	VI	12 11	61 17
(5)	60	69	13.5	3	3.5	VI	11 12	64 16
(6)	58	68	13	3.5	4	VI	12 12	61 15
(7)	55	64	13	3.5	3.5	VI	12 11	64 15
(8)	55	64	13	3.5	3.5	VI	11 11	58 17
(9)	54	64	12.5	3.5	3.5	VI	12 12	60 17
(10)	52	61	12	3.5	3.5	VI	11 11	61 18
(11)	50	59	12	3	3	VII	12 12	64 17
(12)	49	58	12	3+	3	VI	12 11	60 17
(13)	49	57.5	11.5	3	3	VI	12 11	65 19
(14)	47	56	11	3	3	VI	12 11	63 19
(15)	46	55	11	3	3	VI	12 11	60 17
(16)	43	51	10	3	3	VI	12 11	59 16
(17)	41	49	10	3	3	VI	11 11	58 14
(18)	39	47	9.5	2.5	2.5	VI	11 11	58 16
(19)	39	47	9.5	3	2.5	VI	12 11	63 17
(20)	38	45	9.5	2+	2.5	VI	12 11	60 16

CLEGGAN BAY, CO. GALWAY (September).

	1.	2.	3.	4.	5.	6.	7.	Fin-rays.		Scales. Sc. Tr.
								D.	A.	
(1)	♂ 56	66	14	3	4	7.5	4	VI	12 12	62 16
(2)	♀ 51	60	12	3.5	3.5	7	3.5	VI	11 10	61 17

♂ with testes enlarged and full of ripe spermatozoa.

♀ Spent.

No tendency to bars in either specimen.

♂ with very marked dark pigmentation of ventral and anal fins and posterior part of soft dorsal; no marked dark pigmentation on throat; spot on spinous dorsal bright with an opaque white ring surrounding it.

Soft dorsal and anal much higher posteriorly in ♂, not in ♀.

♂ D. 8-9 mm. A. 5½-8 mm.

♀ D. 8-4 mm. A. 5-4 mm.

1, 2. BURFORD BANK, IRISH SEA.

3. OFF CLOGHER HEAD, 20-22 FATHOMS (January).

	1.	2.	3.	4.	5.	6.	7.	Fin-rays.		Scales. Sc. Tr.
								D.	A.	
(1)	♂ 60	68	14	4	4	8	5	VI	12 12	53
(2)	45	53	11.5	3	3.5	6.5	3	VII	10 11	51
(3)	♀ 59	65	14	3.5	4	10	5	VI	12 12	57

(1) shows four or five bars; (2), after preservation in formol, appears to have barely attained the colouration and characters of the adult.

DEEPISH WATER (15 FATHOMS) AT MOUTH OF BALLYNAKILL HARBOUR,
CO. GALWAY (August).

	1.	2.	3.	4.	5.	Fin-rays.		Scales. Sc. Tr.
						D.	A.	
(1)	52	61	13	3.5	4	VI	12 12	57 16
(2)	45	53	11	3.5	3	VI	11 12	51 17
(3)	44	52	11	3	3	VI	12 12	51 16
(4)	44	52	11	3	3	VI	12 12	54 16
(5)	43	51	11	3	3	VI	12 12	57 16
(6)	42	50	10	2.5	3	VI	11 12	53 16
(7)	41	49	10	3	3	VI	11 10	55 15
(8)	40	47	9.5	3	3	VI	12 12	53 14
(9)	40	48	9.5	2.5	3	VI	12 12	54 14
(10)	38	45	9	3	3	VI	12 11	
(11)	36	42.5	8.5	2	2.5	VI	11 11	
(12)	34	40.5	8	2	2.5	VI	11 12	
(13)	33	40	8	2	2.5	VI	11 12	
(14)	32.5	39	8	2	2.5	VI	12 12	
(15)	32	38.5	7.5	2	2.5	VI	11 11	
(16)	30	36	7.5	2	2.5	VI	12 11	
(17)	28	34	6.5	2	2			

ST. COLUMB ESTUARY, N. CORNWALL (August).

	1.	2.	3.	4.	5.	6.	7.	Fin-rays.		Scales.	
								D.	A.	Sc.	Tr.
(1)	♂ 46	55	11	2.5	3	8	5	VI	10 10	43	
(2)	♂ 45	54	11	2.5	3	7	4.5	VI	10 10	45	
(3)	♂ 44	53	11	2.5	3	6.5	4	VII	10 10	45	
(4)	♂ 44	52	11	2.5	3	6.5	4	VI	10 10	45	14
(5)	♂ 44	52	10.5	2.5	3	6.5	4	VI	10 10	46	13
(6)	♂ 44	52	10.5	2.5	3	6	4	VI	10 10	42	
(7)	♂ 43	52	11	2.5	3	6	4	VI	10 10	47	14
(8)	♂ 40	47	10	2	3	6	4	VI	10 10	43	
(9)	♀ 51	60	11.5	2.5+	3+	9	4	VI	9 10	48	14
(10)	♀ 50	58	11.5	2.5	3	8	4	VI	11 10	43	14
(11)	♀ 48	57	11	2.5	3	8	3.5	VI	10 10	45	
(12)	♀ 48	57	11	2.5	3	7.5	3.5	VI	10 11	50	13
(13)	♀ 44	52	11	2.5	3	8	4	VI	10 10	47	13
(14)	♀ 44	52	11	2.5	3	6.5	3.5	VI	10 9	42	14
(15)	♀ 41	48	10	2.5	3	6.5	3	VI	10 10	43	
(16)	♀ 40	48	10	2.5	3	7	3	VI	10 10	42	

Water—part of open sea at high tide, clean and bright.

All breeding, ♂ ♂ strongly barred, no bars on ♀ ♀

ESTUARY OF CUCKMERE RIVER, SUSSEX (April).

	1.	2.	3.	4.	5.	Fin-rays.		Scales.	
						D.	A.	Sc.	Tr.
(1)	44	53	10	3	3	VI	10 10	54	19
(2)	43	52	10	3	3	VI	9 9	53	19
(3)	43	51	10	3	3	VI	10 10	55	
(4)	42	51	9.5	3	2.5	VI	10 10	50	
(5)	41	49	9.5	3	3	VI	10 10	50	17
(6)	41	49	9.5	2.5	3	VI	10 10	52	18
(7)	38	46	9	2	3	VI	9 10		
(8)	38	45	9	2.5	3	VI	10 10		
(9)	35	42	8	2	2	VI	10 10		
(10)	33	40	8	2	2	VI	9 9		
(11)	26	32	6.5	1.5	2	VI	9 9		
(12)	25.5	30.5	6.5	1.5	2	VI	9 10		

Water—Brackish and very dirty

No ♂ in breeding dress (7) nearest, very slight tendency to bars.

A small dirty-looking form.

NOTE.—Comparatively large number of scales in a longitudinal series and comparatively small scaleless area for a small estuarine form.

ALDEBURGH, SUFFOLK, ESTUARINE (April).

	1.	2.	3.	4.	5.	Fin-rays.		Scales.
						D.	A.	Sc.
(1)	♂ 41	48	10.5	3	3.5	VI	9 11	40
(2)	♀ 39	46	9.5	2.5	3	VI	10 10	39
(3)	♀ 39	47	9.5	2.5	3	VI	10 10	41
(4)	♀ 38	45	9	2.5	3	VI	11 10	40
(5)	♀ 38	46	9	2	2.5	VI	10 10	40
(6)	♀ 37	44	9	2.5	3	VI	10 10	43
(7)	♂ 37	45	9	2	2.5	VI	10 10	43
(8)	♂ 37	45	9	2.5	3	VI	10 9	41
(9)	♂ 37	44	8.5	2	2.5	VI	10 10	41
(10)	♀ 36	44	9	2.5	3	VI	10 10	43
(11)	♂ 36	43	8.5	2.5	2.5	VI	10 10	41
(12)	♂ 36	44	8.5	2	2.5	VI	11 10	44
(13)	♀ 35	42	8.5	2.5	3	VI	10 —	42
(14)	♂ 34	41	8.5	2	2.5	VI	10 10	—

Water—Brackish, often in small pools beyond reach of ordinary tides.

♂ ♂ with moderate tendency to bars.

A small rather dull form of subdued colour.

WELLS-NEXT-THE-SEA, NORFOLK (September).

	1.	2.	3.	4.	5.	Fin-rays.		Scales.
						D.	A.	Sc.
(1)	♂ 32	38	—	—	—	VI	10 10	—
(2)	♂ 30	36	—	—	—	VI	9 10	—
(3)	♀ 41	48	10	2.5	3	VI	10 10	41
(4)	♀ 41	47	10	2.5	3	VI	10 10	43

Water tidal, but somewhat brackish. Very similar to last in general appearance.

G O B I U S P I C T U S .

INISBOFIN HARBOUR, CO. GALWAY (August).

	1.	2.	3.	4.	5.	6.	7.	Fin-rays.		Scales.
								D.	A.	Sc.
(1)	46	54	10.5	2+	3+	7	4	VI	10 9-10	40
(2)	46	54	10.5	2+	3	7.5	4			
(3)	45	53	10	2	3	7.5	4			
(4)	45	52	10	2+	3	8	4			39
(5)	44	52	10	2	3	7	3.5			
(6)	43	51	10	2	3	7	4			
(7)	43	51	10	2	3	8	4			37
(8)	43	51	10	2+	3	8	4			
(9)	43	51	10	2	3	7.5	4			
(10)	42	49	10	2	3	7.5	4			40

BALLYNAKILL HARBOUR, CO. GALWAY (August).

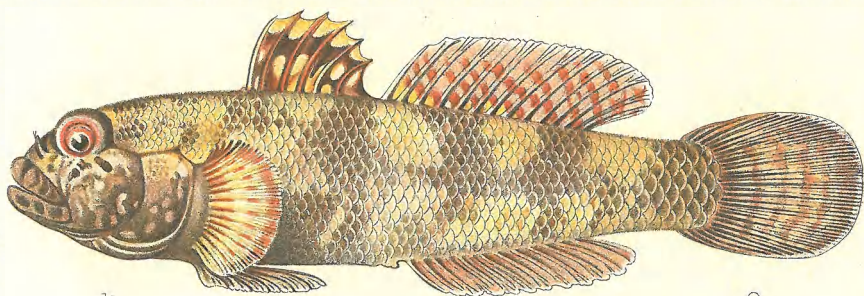
	1.	2.	3.	4.	5.	6.	7.	Fin-rays.		Scales.	
								D.	A.	Sc.	Tr.
(1)	44	51.5	10	2+	3	7	4	VI	10 10	40	11
(2)	43	50	10	2	3	6.5	3.5	VI	10	41	13
(3)	37	44	9	2	3	6.5	3	VI	10 10	35	13
(4)	♀ 32	38	7	1.5	2.5	5.5	3	VI	10 9	37	10
(5)	♀ 31	36	7	1.5	2.5	5.5	2.5	VI		40	11
(6)	♀ 30	35.5	7	1.5	2.5	5.5	2.5	VI	9 9	38	11
(7)	29	35	6.5	1.5	2.5	4.5	3	VI	10 10	37	10
(8)	♀ 28	34	6.5	1.5	2.5	5	2.5				
(9)	24	29	6	1+	2+	3.5	2				
(10)	23	27.5	6	1+	2	3.5	2				

G. JEFFREYSII.

PLYMOUTH, 4 MILES INSIDE EDDYSTONE (September).

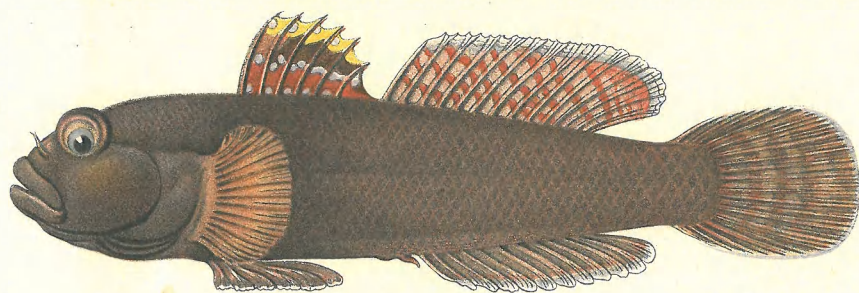
	1.	2.	3.	4.	5.	6.	7.	Fin-rays.		Scales.	
								D.	A.	Sc.	Tr.
(1)	39	47	10	2+	3+	6	3	VI	10 9	26	7
(2)	32	37*	8.5	2	2+	4.5	2.5	VI	9 9	*	7

* Injured.



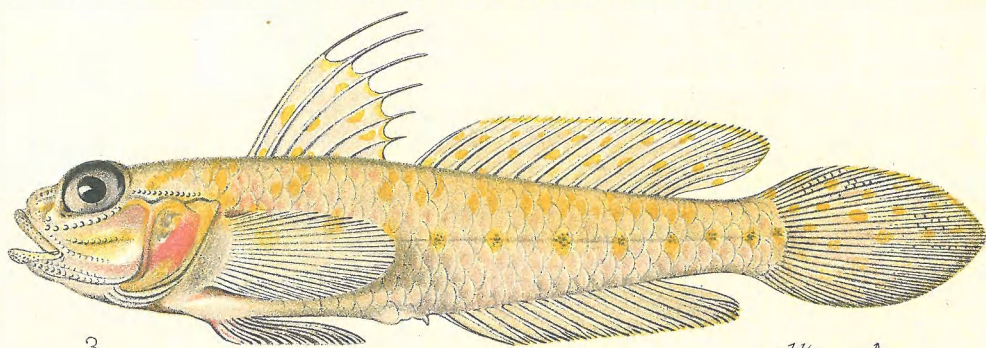
1

♀



2

♂



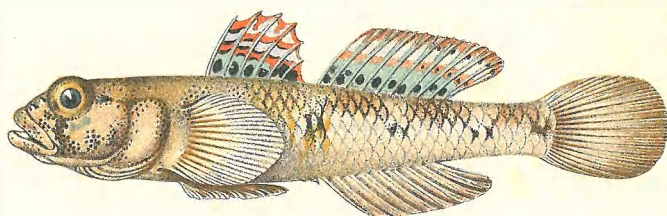
3

x 1 1/2 ♂

1 & 2. G.M.W. after A.J. Holt.
3. G.M. Woodward del.

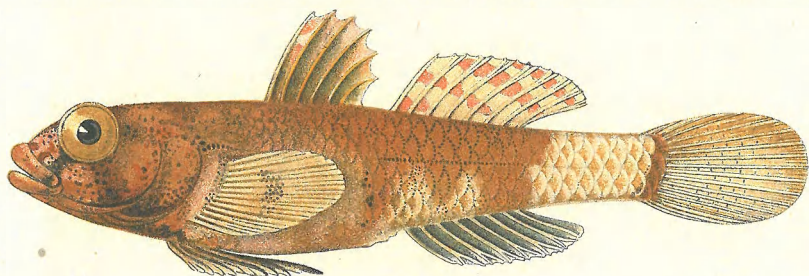
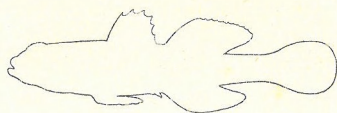
West, Newman chromo.

1 & 2. *Gobius paganellus*, Grn. L. ♀ & ♂.
3. *Gobius friesii*, Collett, ♂.



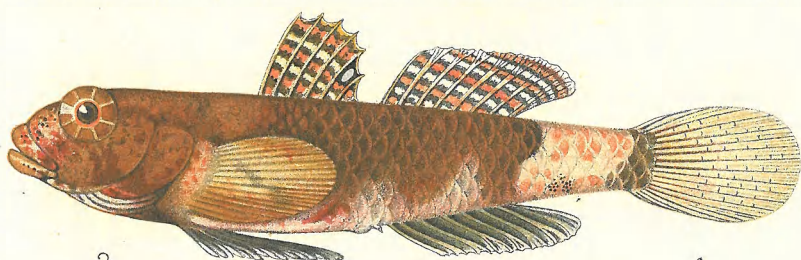
1.

♂



2

♀



3

♂



1 & 2. G.M.W. after A.J. Holt.
3. G.M. Woodward del.

West, Newman chromo.

1. *Gobius pictus* Malm, ♂.
2 & 3. *Gobius scorpioides*, Collett, ♀ & ♂.

