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The genus *Gobio* in France, with redescription of *G. gobio* and description of two new species (Teleostei: Cyprinidae)

by

Maurice KOTTELAT (1) & Henri PERSAT (2)

ABSTRACT. - The gudgeon *Gobio gobio* is redescribed and a neotype is designated. The type locality is stream Sieg at Eitorf, in the Rhine drainage, Germany. Two new species are described from France: *G. alverniae* from the upper Dordogne, Garonne and Loire drainages (Massif Central) and *G. occitaniae* from southern drainages (from Vidourle to Tech on Mediterranean slope, from Eyre to Charente on Atlantic slope). *Gobio lozanoi* is redescribed based on material from Adour drainage. These species are distinguished by a combination of lateral line and transverse scale counts, presence or absence of scales on breast, shape of pelvic axillary scales, shape and width of interorbital area, shape of mouth, and details of colour pattern.

RÉSUMÉ. - Le genre *Gobio* en France, avec redescription de *G. gobio* et description de deux espèces nouvelles (Teleostei : Cyprinidae).

Le goujon *Gobio gobio* est redécrit et un néotype est désigné. La localité type est la rivière Sieg à Eitorf, dans le bassin du Rhin, en Allemagne. Deux nouvelles espèces sont décrites de France : *G. alverniae* de la partie amont des bassins de la Dordogne, de la Garonne et de la Loire (Massif Central) et *G. occitaniae* des bassins du Midi (du Vidourle au Tech sur le versant méditerranéen, de l'Eyre à la Charente sur le versant atlantique). *Gobio lozanoi* est redécrit sur la base de matériel du bassin de l'Adour. Ces espèces se distinguent l'une de l'autre par des combinaisons du nombre d'écailles de la ligne latérale et du nombre d'écailles en rangée transversale, la présence ou l'absence d'écailles sur la poitrine, la forme des écailles pelviennes axillaires, la forme et la largeur de la région interorbitaire, la forme de la bouche et des détails de coloration.

Key words. - Cyprinidae - Gobiinae - *Gobio gobio* - *Gobio alverniae* - *Gobio occitaniae* - Gudgeons - France - Taxonomy - New species.

The gudgeon, *Gobio gobio*, is a “common” fish species usually reported to occur throughout Europe and northern Asia, with a native range extending from northern Spain (Ebro drainage) to Korea. There has been a number of general summaries of its systematics and biology (e.g., Banareescu and Nalbant, 1973; Banareescu, 1999). While these studies have looked in some details at a few populations, the remaining populations from most of the reported range have not been examined and compared with the same attention. Vast generalities have been drawn from facts observed at a few localities and have been hypothesised to apply to all populations, if not to the whole genus. Throughout its range, there have been little efforts to compare populations from adjacent drainages.

This pattern of knowledge distribution is not unique to *G. gobio*. It is in fact observed in most if not all western European freshwater fishes. Many have large “pan-European” or “pan-palaeartic” distributions. Some of these “species” have been re-examined in recent years and have proved to be assemblages of several species. For example, the former “common” loach *Cobitis taenia* is now considered to be

an artificial assemblage of probably more than 20 species (see, e.g., Nalbant, 1993; Kottelat, 1997; Bohlen and Rab, 2001). Legitimate suspicion evolved that the same pattern had possibly been overlooked in several other genera (e.g., Persat and Keith, 2001, 2002) and that the European freshwater fish diversity was grossly underestimated (Kottelat, 1997). These large distribution ranges are usually artefacts resulting from low resolution studies, or a combination of poor concepts, poor material, poor work, incompetence, nationalism, linguistic barriers, and the disregard for taxonomic research on the native fauna in western countries during the xxth century (Kottelat, 1997).

In recent years, some “populations” of *G. gobio* have been recognised as distinct species (e.g., *G. benacensis* in the Po drainage, Italy; Bianco, 1994, 1995; Kottelat, 1997). The use of the Phylogenetic Species Concept (for a review, see Kottelat, 1997) or of the Evolutionary Species Concept (see Mayden, 2002) and comparison of material from various drainages of southern Europe suggested that several species are confused under the name *G. gobio* and that a sound revision of the genus could not be addressed by vaguely

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comparing old and more or less well preserved museum material from largely disjunct populations, but should proceed by the direct comparison of freshly (and well) preserved material of adjacent populations.

The incidental observation of striking differences in general appearance between specimens from the Rhône and upper Loire drainages (France) prompted a closer comparison of these populations and led to the conclusion that two species are involved. Further recent field work in southern France showed that the upper Loire species is also distributed in at least the upper part of some of the tributaries of the Garonne and Dordogne flowing from the Massif Central, and that there are two additional morphologically distinct lineages, one in small coastal drainages on the Mediterranean slope and in Garonne, Dordogne and Charente drainages, and the other in the Adour drainage. The first two of these new species are described here; this necessitated to redescribe *G. gobio*, to review its nomenclature, and to designate a neotype. We had originally included the description of the Adour species in the present work, but having discovered that Doadrio and Madeira (2004) had simultaneously reached the same conclusion, we allowed time for their results to appear in order to use the name *G. lozanoi* which they proposed. It nevertheless appears useful to provide here a more detailed and explicit description of the species.

MATERIAL AND METHODS

Methods for counts and measurements follow Kottelat (1984, 2001). SL stands for Standard Length, HL for Head Length. Note that these methods and terminology follow international standard practices and are often not equivalent to those used in eastern European compilations (e.g., Banarescu, 1999). Differences especially relate to SL (measured from tip of snout to end of hypural complex, at mid-height of caudal-fin base), length of caudal peduncle (from behind base of last anal-fin ray to end of hypural complex, at mid-height of caudal-fin base), lateral line scale count (anterior most scale counted is the first one to touch the shoulder girdle, posterior most one at end of hypural plate; scales on the caudal fin itself are indicated by "+"), dorsal and anal-fin ray counts (last two branched rays articulated on a single pterygiophore noted as "1½"), transverse scale count (number of longitudinal scale rows, scale on dorsal and ventral mid-lines noted as "½"). All measurements are made point to point, never by projections. The number of scales between the anus and the anal-fin origin is counted laterally on the scale row immediately above the anal-fin origin (scales are very irregularly shaped and set in *G. alverniae* and a direct count between these two points is not reliable). Only specimens in the size range 64-127 mm SL were measured; juve-

nile, smaller, bent, injured or damaged specimens were discarded from measurements and from some counts. Some specimens were used for all measurements, while additional ones were used only for measurements that had been identified as of potential diagnostic use. The purpose of the morphometric data is to describe the general shape of individuals of some populations; they do not aim to be a morphometric analysis of the global variability of the species.

Raw individual morphometric data were processed by standard Principal Component Analysis (Yoccoz, 1993), using ADE-4 Software (Thioulouse *et al.*, 1997) to evaluate intra- and inter-population/sample variability. A scatterplot (not included here) of depth against length of caudal peduncle shows that allometry is negligible in the size range of the measured specimens. Fin length measurements were discarded as they show a large individual variability apparently depending on habitat, population density, predation, etc.

Specimens examined are in: CMK, first author's collection; MNCN, Museo Nacional de Ciencias Naturales, Madrid; MNHN, Muséum national d'histoire naturelle, Paris; NMW, Naturhistorisches Museum, Wien; NRM, Naturhistoriska Riksmuseet, Stockholm. The species concept adopted here is the phylogenetic species concept (Cracraft, 1989; Kottelat, 1997), as an operational tool for the evolutionary species concept (Wiley and Mayden, 2000; Mayden, 2002).

Key to the species of *Gobio* in France

1a. - ½5 scale rows between dorsal-fin origin and lateral line; 3-3½ scale rows between lateral line and pelvic-fin origin; Adour drainage..... *G. lozanoi*

1b. - ½6-7 scale rows between dorsal-fin origin and lateral line; 3½-4½ scale rows between lateral line and pelvic-fin origin..... 2

2a. - ½3/1/3½ scale rows on caudal peduncle (16 circumpeduncular rows); interorbital space concave in specimens larger than about 80 mm SL; last simple dorsal ray shorter than first branched one; margin of dorsal fin straight to slightly concave; lower edge of last pelvic axillary scale united to pelvic base by a membrane which may extend backwards on following scale; upper Loire, upper Dordogne, upper Lot and upper Tarn drainages..... *G. alverniae*

2b. - ½2-3/1/2-3½ scale rows on caudal peduncle (12-15 circumpeduncular rows), no population with all specimens only ½3/1/3½; interorbital space flat to convex, rarely slightly concave; last simple dorsal ray longer, as long or slightly shorter than first branched one; margin of dorsal fin markedly concave; last pelvic axillary scale free on most of its length..... 3

3a. - Caudal peduncle slender (depth 8.7-10.8% SL, length 18.8-24.0% SL, ratio length/depth 2.0-2.7); body width 13.8-

17.8% SL; scales on belly extending forward at most to posterior extremity of pectoral-fin base; black midlateral blotches conspicuous, contrasted and with discrete margins; lips thin, lower one without notch; Rhône drainage, rivers draining to Atlantic Ocean and North Sea, except Charente, Garonne, Adour and upper Loire drainages (where possibly introduced locally). *G. gobio*
3b. - Caudal peduncle stout (depth 9.7-12.5% SL, length 17.4-22.3% SL, ratio length/depth 1.5-2.2); body width 14.6-19.6% SL; scales on belly extending forward beyond origin of pectoral fin; midlateral blotches not conspicuous, not contrasted and with fuzzy margins; lips thickened and widened, posterior part of lower lip separated from anterior part by a small notch; Mediterranean drainages west of Rhône, Atlantic drainages from Charente to Eyre.....
 *G. occitaniae*

GOBIO GOBIO (LINNAEUS)

(Fig. 1)

Cyprinus gobio Linnaeus, 1758: 320 (type locality: Germany, stream Sieg at Eitorf; neotype: NRM 50261, by present designation)

? *Cobitis fundulus* Wulff, 1765: 32 (available by description and by indication to earlier sources; type locality: Borussia [Prussia]; type material not extant)

Gobio fluviatilis Fleming, 1828: 186 (available by description and by indication to earlier sources; type locality: "gentle streams in England"; type material not extant)

Gobio phoxinoïdes De la Pylaie, 1835: 533 (*nomen nudum*; locality: France, Yon and other streams of Vendée)

Gobio vulgaris Heckel, 1836: pl. 21 (no stated locality; syntypes: possibly in NMW)

Gobio saxatilis Koch, in Koch, Herrich-Schäffer and Forster, 1840: 40 (unnecessary replacement name for *Cyprinus gobio* Linnaeus, 1758)

? *Gobio obtusirostris* Valenciennes, in Cuvier and Valenciennes, 1842: 311 (type locality: Germany, München; syntypes: MNHN 8 [6], Bertin and Estève, 1948: 87)

Material examined

Rhine drainage. - NRM 50261, neotype, 92.6 mm SL. - NRM 50326, 19 ex. - CMK 17820, 14 ex., 68.9-104.0 mm SL, Germany, Nordrhein-Westfalen, stream Sieg at Eitorf, 50°47'N-7°27'E; J. Freyhof, 6 Aug. 2002.

Rhône drainage. - CMK 16839, 2 ex., 33.9-92.4 mm SL, Dept. Savoie, stream Laysse (a tributary of Lake Bourget) at bridge of Le Trembley, northwest of Chambéry; M. Kottelat and H. Persat, 20 Jul. 2001. - CMK 17811, 3 ex., 97.4-100.5 mm SL, Dept. Rhône, stream Yzeron at Francheville (a western tributary of Rhône at Lyon); H. Persat, 4 Jun. 2002. - CMK 17809, 9 ex., 55.8-89.5 mm SL, Dept. Saône-et-Loire, stream Saône at Tournus; H. Persat, Oct. 2002. - MNHN 98-76 and 98-77, 2 ex., 110.8-119.7 mm SL, Dept.

Côte-d'Or, stream Ouche; E. Paris, 1913. - CMK 16885, 6 ex., 86.5-102.8 mm SL, Switzerland, Jura, stream Doubs, from bridge at Ocourt to 300 m upstream, 47°20'50"N-04°32'E; M. Kottelat *et al.*, 1 Sept. 2001. - CMK 18283, 2 ex., 121.7-130.7 mm SL, Dept. Rhône, Saône drainage, stream Azergues at Ternand; H. Persat and CSP staff, 24 Sept. 2003.

Seine drainage. - MNHN 1993-3499, 6 ex., 96.5-121.7 mm SL, Dept. Seine-et-Marne, "River Seine" [error, probably stream Morin] at Crécy-la-Chapelle, downstream of dam; Dingerkus and Guilbert, 1989. - CMK 18372, 5 ex., 87.5-96.0 mm SL, Dept. Yonne, stream Yonne at Merry-sur-Yonne; H. Persat and CSP staff, 12 Nov. 2003.

Loire drainage. - CMK 17524, 26 ex., 34.4-83.8 mm SL, Dept. Deux-Sèvres, stream Thouaret about 2 km west of Boussais, about 1 km south of road D725, 46°49'58"N-0°16'49"W; M. Kottelat and CSP staff, 27 Aug. 2002. - CMK 17293, 5 ex., 71.0-75.8 mm SL, Dept. Saône-et-Loire, River Loire at St-Agnan, a few km downriver of Digoin; L. Dauvergne, 4 May 2002. - CMK 17810, 5 ex., 76.0-89.9 mm SL, Dept. Saône-et-Loire, stream Arroux at Vendennes (3 km upstream of Gueugnon); L. Dauvergne, May 2002. - MNHN 1986-817, 8 ex., 50.3-94.4 mm SL, Dept. Loir-et-Cher, stream Cher at St-Aignan; F. d'Aubenton, 1973. - MNHN 3181, 6 ex., 98.2-110.1 mm SL, stream Sarthe; Anjubault, 1858. - CMK 18281, 3 ex., 115.9-135.0 mm SL, Dept. Loire, stream Renaison at Roanne; H. Persat and CSP staff, 3 Sept. 2003. - CMK 18355, 1 ex., 87.3 mm SL, Dept. Puy-de-Dôme, stream Allier at Nonette; H. Persat, 14 Aug. 2003.

Elbe drainage. - CMK 17821, 10 ex., 81.5-100.2 mm SL, Germany, Brandenburg, Lower River Oder close to Schwedt at river-km 685-697 NP "Untere Odertal", 53°03'N-14°19'E; K. Wysujak, 19 Nov. 2002. - CMK 17822, 19 ex., 55.4-111.9 mm SL, Germany, Sachsen, River Elbe at Torgau; J. Freyhof, 1 Oct. 2002.

Po drainage (introduced). - CMK 17849, 1 ex., 92.3 mm SL, Switzerland, Ticino, stream Scairolo at Figino, 45°57'02"N-8°54'23"E; M. Kottelat *et al.*, 28 Apr. 2003.

Garonne drainage (introduced). - CMK 18376, 1 ex., 80.3 mm SL, Dept. Tarn, stream Dadou at Arifat; P. Derenne, 10 Oct. 2003.

Mediterranean drainages (introduced). - CMK 18382, 1 ex., 99.8 mm SL, France, Dept. Pyrénées-Orientales, River Agly at bridge downstream of Latour-de-France, 42°46'09"N-2°39'39"E; M. Kottelat and CSP staff, 27 Sept. 2002.

Diagnosis

Gobio gobio is distinguished from all other species of *Gobio* in western Europe in having a more slender caudal peduncle (depth 8.7-10.8% SL, *vs* 9.1-12.5; length 18.8-24.0% SL, *vs* 18.4-23.1; ratio length/depth 2.0-2.7, *vs* 1.5-2.3) and lips thin, lower one without notch (*vs* thickened and widened, posterior part of lower lip separated from anterior part by a notch).

It further differs by the combination of the following character states (none unique to the species): scales on belly extending forward at most to posterior extremity of pectoral-fin base (*vs* extending forward beyond origin of pectoral fin in *G. alvernicae* and *G. occitanicae*), usually 1/2/1/2/1/2 scale rows on caudal peduncle (12-13 circumpeduncular rows) (*vs* 1/2/3/1/3/1/2 in *G. alvernicae*); interorbital area flat to slightly concave (*vs* slightly convex to flat in *G. lozanoi*, conspicuously concave in *G. alvernicae* larger than about 80 mm SL);

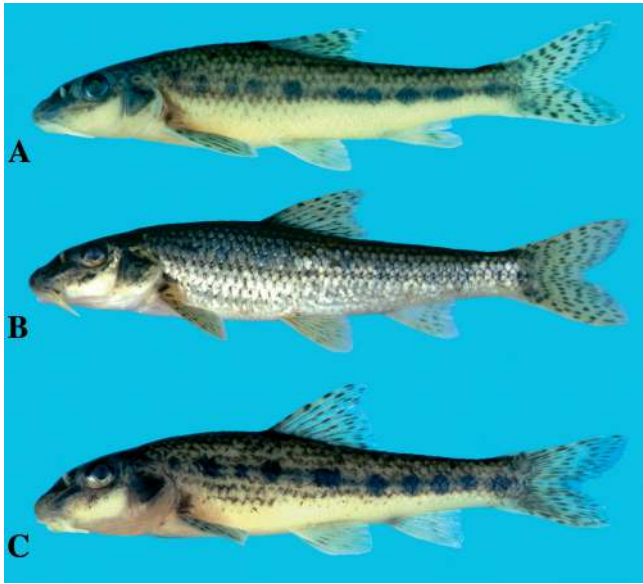


Figure 1. - *Gobio gobio*. **A**: Neotype, NRM 50261, 92.6 mm SL; Germany: Rhine drainage: stream Sieg; **B**: CMK 16885, 101.1 mm SL; Switzerland: Rhône drainage: stream Doubs; **C**: CMK 17524, 79.3 mm SL; France: Loire drainage: stream Thouaret. [*A* : Allemagne: bassin du Rhin: rivière Sieg ; *B* : Suisse: bassin du Rhône: rivière Doubs ; *C* : France: bassin de la Loire: rivière Thouaret.]

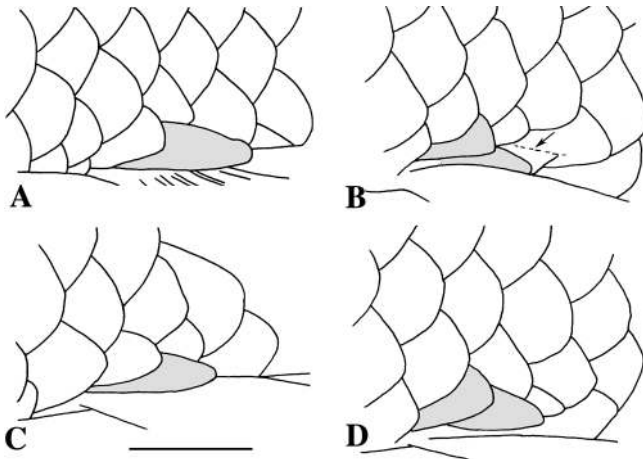


Figure 2. - Pelvic axillary scales. **A**: *Gobio gobio*, CMK 16885, 101.1 mm SL; **B**: *G. alverniae*, CMK 17005, 104.8 mm SL; **C**: *G. lozanoi*, CMK 17584, 105.7 mm SL; **D**: *G. occitaniae*, CMK 17600, 96.8 mm SL. Scale bar: 5 mm. Arrow: membrane connecting inner lower edge of axillary scale to body. [*Écailles axillaires pelviennes*. Échelle : 5 mm. Flèche : membrane reliant le bord inférieur interne de l'écaille axillaire au corps.]

depth of caudal peduncle 2.0-2.7 times in its length (vs 1.4-2.2 in *G. occitaniae*, 1.5-2.3 in *G. alverniae*, 1.6-2.2 in *G. lozanoi*).

Description

Based on material from the Rhine and Rhône drainages (see discussion below). General appearance shown in figure

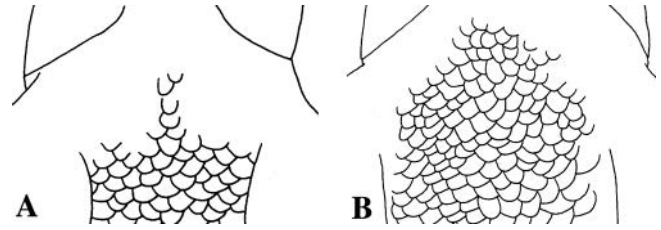


Figure 3. - Extent of scales in pectoral area. **A**: *Gobio gobio* and *G. lozanoi*; **B**: *G. alverniae* and *G. occitaniae*. [*Extension des écailles dans la région pectorale*.]



Figure 4. - Dorsal (above) and ventral (below) view of head of *Gobio gobio*, CMK 16885, 102.8 mm SL (left) and *G. alverniae*, holotype, MNHN 2004-2079, 104.8 mm SL (right). [*Vues dorsales et ventrales de la tête de Gobio gobio (à gauche) et G. alverniae (à droite)*.]

1; morphometric data of 19 specimens given in table I. Dorsal fin with 3 simple and 7½ branched rays; last simple ray as long or very slightly shorter than first branched one; margin concave when fin stretched. Pectoral fin triangular, posterior margin straight to slightly concave, reaching about 2/3 of distance to pelvic-fin origin, with 15-17 rays. Pelvic fin broadly triangular, reaching about 2/3 of distance to anal-fin origin, with 8(10) or 9(3) rays; a single modified axillary scale, length of exposed part about double its depth and about equal to length of preceding unmodified scale, free on most of its length (Fig. 2A). Pelvic-fin origin on a vertical through base of branched dorsal ray 3 or space between rays

Table I. - Morphometric data of neotype and 24 specimens of *Gobio gobio* and 29 specimens of *G. lozanoi*. [Données morphométriques du néotype, de 24 *Gobio gobio* et de 29 *G. lozanoi*.]

Drainage	<i>G. gobio</i>							<i>G. lozanoi</i>	
	Rhine			Rhône		Lower Loire		Adour	
	Neotype	Range	n	Range	n	Range	n	Range	n
Standard length (mm)	92.6	79.5-104.0	12	86.5-102.8	7	73.8-83.8	6	66.6-119.0	29
Total length (mm)	113.7	98.2-126.5	12	106.7-128.8	7	--		88.6-143.0	29
Percents of SL									
Head length	27.1	26.6-28.7	12	26.7-28.6	7	28.0-30.3	6	25.2-30.7	29
Pre-dorsal length	48.4	48.4-51.2	12	48.2-51.3	7	--		47.3-51.3	20
Pre-pelvic length	49.2	49.2-52.9	12	49.5-52.9	7	--		48.9-54.7	20
Pre-anal length	71.5	71.5-74.7	12	70.5-74.8	7	--		66.6-75.2	20
Body width	14.9	13.8-15.9	12	14.8-16.1	7	15.0-17.8	6	14.9-18.6	29
Head depth	16.0	15.5-16.4	12	15.3-16.8	7	17.1-18.9	6	16.7-19.4	29
Body depth	21.7	19.5-23.8	12	20.1-22.2	7	20.8-23.4	6	20.8-25.8	29
Depth of caudal peduncle	9.5	8.7-10.8	12	8.7-9.7	7	9.7-10.5	6	9.1-11.6	29
Length of caudal peduncle	21.9	19.3-24.0	12	18.8-22.5	7	19.8-21.3	6	18.5-23.1	29
Eye diameter	6.0	5.4-6.2	12	5.4-6.5	7	6.3-6.9	6	4.7-7.4	29
Snout length	11.6	11.6-13.0	12	11.8-13.5	7	11.8-12.8	6	11.0-13.5	29
Interorbital width	7.8	7.5-8.1	12	6.5-7.8	7	7.2-8.2	6	7.1-9.0	29
Length of last simple dorsal ray	20.7	19.6-22.5	12	19.6-21.6	7	--		15.9-25.0	20
Depth of anal fin	16.5	15.0-17.1	12	15.5-17.1	7	--		15.5-20.5	20
Length of pelvic fin	16.4	14.4-17.0	12	14.4-16.3	7	--		12.4-18.9	20
Length of pectoral fin	20.8	18.2-20.8	12	16.0-20.3	7	--		13.6-24.3	20
Length of upper caudal lobe	22.6	20.3-25.6	12	21.4-25.3	7	20.7-23.7	6	19.9-26.6	29
Length of middle caudal rays	11.4	10.1-14.0	12	12.6-14.4	7	11.3-13.7	6	11.4-15.6	29
Length of lower caudal lobe	21.9	20.2-23.3	12	20.2-23.9	7	--		18.4-24.7	18
Percents of head length									
Head depth	59	56-60	12	56-61	7	60-64	6	60-72	29
Eye diameter	22	20-23	12	20-23	7	21-25	6	19-24	29
Snout length	43	43-47	12	44-49	7	40-44	6	41-49	29
Interorbital width	29	27-29	12	24-29	7	25-29	6	26-35	29
Ratios									
Caudal peduncle length/depth	2.3	2.0-2.7	12	2.2-2.4	7	2.0-2.2	6	1.6-2.2	29
Snout length/eye diameter	1.9	1.9-2.4	12	2.0-2.5	7	1.7-2.0	6	1.6-2.5	29
Interorbital width/eye diameter	1.3	1.3-1.5	12	1.1-1.5	7	1.0-1.3	6	1.0-1.8	29
Caudal upper lobe/median rays	1.97	1.58-2.07	12	1.59-1.85	7	1.60-1.83	6	1.33-2.03	29

3 and 4. Anal with 2 simple and 6½ branched rays. Caudal fin deeply forked, lobes pointed to slightly rounded, with 10+9 principal rays, 9+8 branched. Caudal peduncle 2.0-2.7 times longer than deep. 40+2(10), 41+2(6) or 42+2(3) scales along lateral line, about 15-18 irregularly set predorsal scales, ½6(-7)/1/7-8½ longitudinal rows of scales between dorsal-fin origin and belly, counted about 5 scale rows in front of pelvic-fin base, ½2-3/1/2-3½ scale rows on caudal peduncle (counts on right and left side often different, when 3½ on one side, 2½ on other, 12-13(14) circumpeduncular rows), 4-4½ scale rows between lateral line and pelvic-fin origin and 4½ or 5½ between lateral line and anal-fin origin.

Scales on belly extending forward at most to posterior extremity of pectoral-fin base, often restricted to a single median row of scales (Fig. 3A). Scale rows between anus and anal-fin origin 5.

Barbel reaching vertical through middle of eye. Mouth strongly arched, somewhat squarish, median (anterior) part of lower jaw almost straight (Fig. 4). Postlabial groove broadly interrupted medially. Lips thin, lower lip not swollen, without or with only poorly marked constriction at level of interruption of postlabial groove. In lateral view, eye not or just reaching dorsal profile of head. Interorbital space slightly convex to flat.

Coloration (in ethanol)

Ground colour yellowish brown, darker dorsally, paler on belly. A series of 8-11 black blotches, medium-sized (on caudal peduncle about 1/3-1/2 of depth), contrasted, with sharp edges. In dorsal half of body, pigments organised into blackish stripes running between scale rows. In lower half of body, pigments usually in scale pocket and along posterior margin of exposed part of scales, forming one or more incomplete longitudinal rows of spots. Top of head dark grey with black vermiculations; sides brownish grey to brown, with a darker area on opercle and a short irregular black oblique bar under eye. Ventral surface of head, belly and caudal peduncle without markings. All fins hyaline; dorsal, caudal and pectoral fins with conspicuous rows of dark brown to blackish dots; pelvic and anal fins usually with only 1-2 rows of faint dots.

Distribution

Rhône drainage (Fig. 5); England; rivers draining to Atlantic Ocean from Loire northwards; rivers draining to North and Baltic Seas; upper Dniestr and Dniepr drainages. Eastern limits unknown, possibly extending to southern part of rivers draining to Arctic Ocean east to Urals. *Gobio* populations from uppermost Danube drainage possibly conspecific or representing an introgression zone with *G. obtusirostris* (Freyhof, pers. comm., 2002). Introduced in southern France (M. K., H. P., pers. obs.) and Po drainage (Bianco and Ketmaier, 2001; M. K., pers. obs.).

Nomenclature

The name *Cyprinus gobio* is made available by Linnaeus (1758: 320), who based his account on Artedi's (1738: gen. 4 [13], syn. 11, spec. 13 [4]) and Gronovius's (1756: 2, n. 149) "*Cyprinus quinculialis maculosus*". Linnaeus lists three sets of meristic characters, the first one without bibliographic reference indicates that he has personally examined specimen(s). The second refers to Artedi and the third to Gronovius (see below). Fernholm and Wheeler (1983) and Wheeler (1991) report that there is no known specimen identifiable as *C. gobio* in the surviving Linnaeus's collection, but NRM 8076 is a specimen possibly examined by Linnaeus but this can neither be confirmed nor negated (see below; Kullander and Silfvergrip, pers. comm., 2003).

Linnaeus recorded the distribution of the species as "in Anglia & adjacentibus" [in England and nearby; probably taken from Artedi] and this is probably the reason why subsequent authors (e.g., Banarescu and Nalbant, 1973; Banarescu, 1999) listed the type locality as England. Although "Anglia" is part of the locality stated by Linnaeus, it is erroneous to treat England as type locality. It would be more correct to list "England and nearby" as type locality, where it remains open what "nearby" really includes. It is

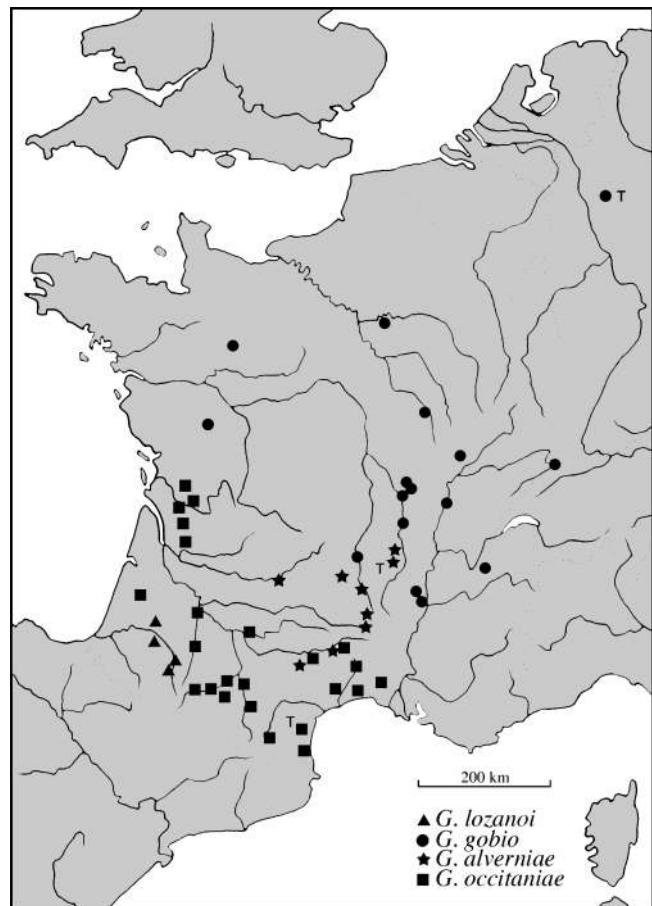


Figure 5. - Distribution of *Gobio* species in France and adjacent waters, based on examined material. Introduced populations omitted. T: Type localities. [Distribution des espèces de *Gobio* en France et dans les eaux adjacentes, d'après le matériel examiné. Populations introduites non représentées. T: Localités types.]

not clear whether this is the locality of the specimen(s) examined by Linnaeus or a general statement summarizing the whole known distribution of the species. In fact, formally, the type locality is the locality of the name-bearing type specimen(s), that is either the very locality of the holotype, lectotype or neotype, or the sum of the localities of the syntypes (the totality of the material constituting the type series).

The type series consists of all specimens on which Linnaeus's, Artedi's and Gronovius's accounts are based. Artedi's account apparently is based on personal examination of specimen(s), but he did not state it explicitly and he mentioned neither their number nor origin. Artedi's mention (in the *Descriptiones Specierum* volume, p. 13) of "Gudgeon Anglorum" immediately under the heading indicates that the account is based on specimen(s) from England because he seems to always have implicitly given the local name of the specimens on which the account is based (Kullander, pers. comm., 2003), but, as indicated by the synonymy, Artedi was

aware of the presence of the species outside England. No specimen examined by Artedi is known to be extant in any museum. Besides, Artedi also referred to a number of literature accounts and the material on which these accounts are based is also part of the type series. These accounts are (in chronological sequence):

[1] “Gobio” of Ausonius (ca. 370) [Roman consul and poet, ca. 310-395]; based on material from the Mosel, Rhine drainage;

[2] “Gobio” of Cuba (**1485** [German edition] or **1491** [Latin edition]); most probably based on material from Rhine drainage as the author was a physician in Frankfurt;

[3] “Gobius” of Figulus (**1540: 4.a**); based on material from the Mosel, Rhine drainage (Dean, 1923: 243);

[4] “Fluviatilis Gobio” of Salviani (1554-58: 214a); material from northern Italy; reference to Ausonius [1] and Galenus (first printed edition **1490** [14]) [Roman medical doctor, 130-200, spent part of his life in Pergamum, Asia Minor] and to vernacular names in France [Lyon] and Germany;

[5] “Gobio fluviatilis” Rondelet (1555: 206); reference to Ausonius [1] and Galenus [14]; reference to vernacular names in France and Germany, explicit reference to vernacular name in Lyon; figure, brief description;

[6] “Gobio fluviatilis” of Gesner (1558: 473 and apparently **1563** German edition); compiled from Rondelet [5], Ausonius [1], Fabricius [no reference] and Albertus Magnus (i.a., 1495: folio 243 [15]) and own observations and figure, information on material from Italy, Germany [probably Regensburg, Danube drainage], Switzerland, France (Loire and Lyon explicitly cited) and England;

[7] “Gobius fluviatilis” of Aldrovandi (1613: 612); material from northern Italy; references to Aristoteles (first printed edition **1476** [16]) [Greek philosopher, 384-322 B.C.], Ausonius [1], Rondelet [5], Figulus [3], Gesner [6], and vernacular names in France [Lyon explicitly cited], Germany, Belgium and England;

[8] “Fundulus” of Schonevelde (**1624: 35**); based on material from Schleswig-Holstein and Hamburg;

[9] “Gobius non capitatus” of Jonstonus (**1649**); compiled on Belon, 1553, 1555: 322, fig. [17, see below], Aristoteles [16], Ausonius [1], Rondelet [5], Gesner [6], Olaus Magnus, **1555** [18] [Archbishop of Upsala], Schonevelde [8] and others (Dean, 1923: 265);

[10] “Gobio fluviatilis, Fundulus” of Charletonus (**1668: 157**); apparently a compilation of earlier works;

[11] “Gobio non capitatus” of Charletonus (**1668: 157**); as [10] above;

[12] “Gobius fluviatilis Gesneri” of Willughby (1686: 264); based on “Gobio fluviatilis” of Gesner, 1553: 473 [6], Rondelet [5] and Aldrovandi [7]);

[13] “Gobius fluviatilis Gesneri” of Ray (**1713: 123**); probably same as [12].

Gronovius’s (1756: 2, no. 149) account is based on Artedi (1738), Marsili (**1726: pl. 9 fig. 2**; material from Danube) [20] and Klein (1749: 60, n° 5, pl. 15 fig. 5) [21].

Among the above references:

Galenus’s [14] fish will probably be unidentifiable and could refer to either fish from Italy or from Turkey;

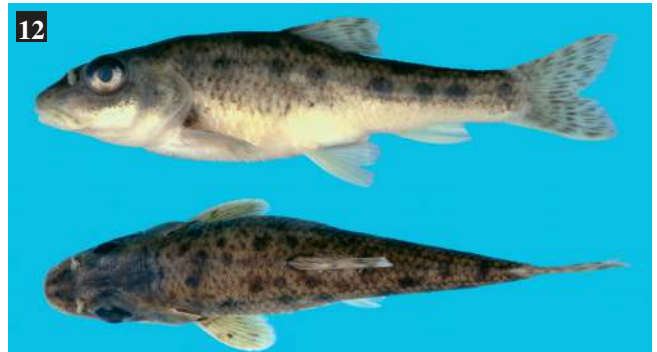
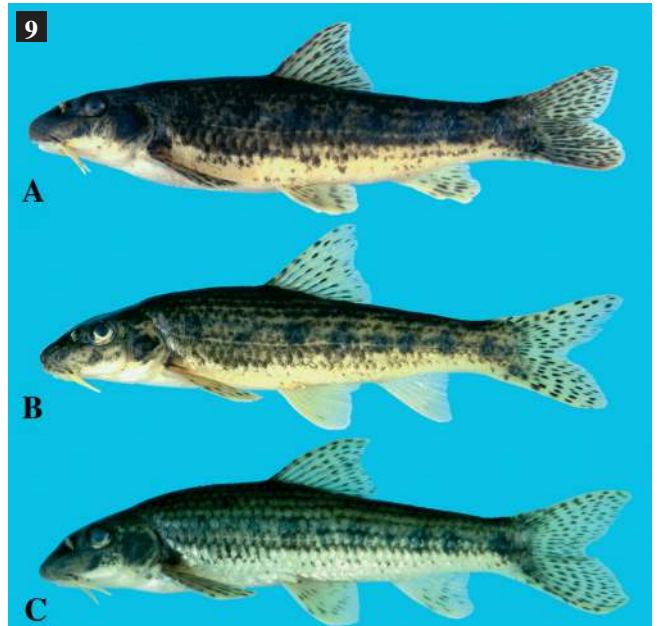
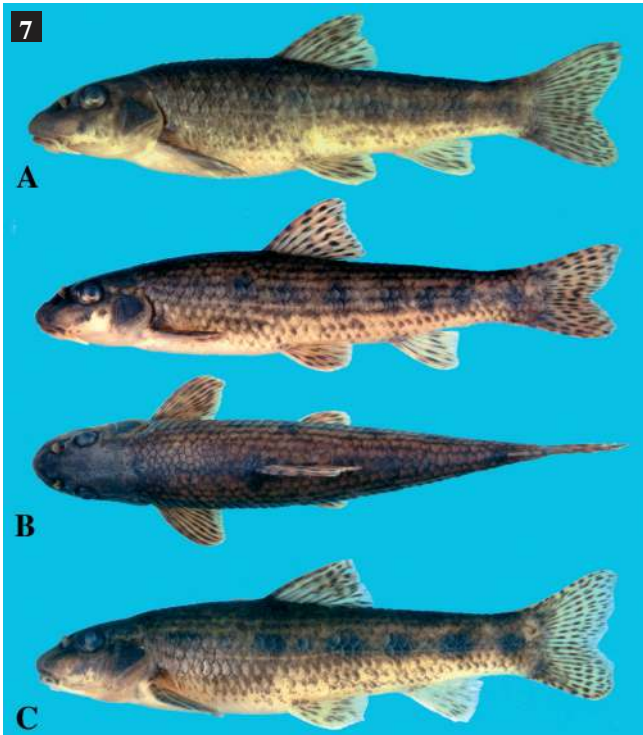
Aristoteles [16] fish is not a *Gobio* according to Valenciennes (in Cuvier and Valenciennes, 1837: 4), who considered it as a sculpin, but sculpins are unknown in Greece, at least nowadays;

Belon [17] refers to Ausonne [1], Aristoteles [16], figures a *Gobio* and reports material from Lyon, River Loire, Le Mans, Milan, Piacenza, Ferrara and Rom; the Italian “vairone” references could possibly be in part *Telestes muticellus* (whose local name nowadays is vairone) and some unidentifiable fish;

Klein [21] possibly is a *Gobio*, but pl. 15 fig. 5 mentioned by Gronovius shows an unidentified fish (a cyprinid or a clupeid?); Klein’s account in fact refers to pl. 11 fig. 3, which shows a pomacentrid.

Although we have access to all these references, we have not tried to examine those marked in **bold**. This would require too much time and implies handling fragile antiquities for no really justifiable reasons and no added benefit to the discussion. In addition, several of the references are vague and it is impossible to locate the actual source without checking complete volumes. For example, Gesner [6] refers to “Ge. Fabricius”, but does not state which work or the page number [probably Georgius Fabricius, author of various works published before Gesner, 1558, dealing with Roman antiquities and poets]. As shown above for the few titles examined, several of these works will refer to further earlier references, etc., each times with more lacunary or enigmatic descriptions, indications and vernacular names. Nevertheless, it is clear from the above that the type series of *G. gobio* includes material identifiable as various *Gobio* species from the Elbe, Rhine, Mosel, Rhône, Po and Danube drainages, England, and possibly Scandinavia, Greece and Asia Minor, as well as cyprinids, pomacentrid and possibly gobies and/or bullheads. This area is inhabited by at least four allopatric species, *G. gobio*, *G. alverniae*, *G. bulgaricus* and *G. benacensis*, plus at least two Danubian species (see below), and possibly some Turkish species. In order to definitively link the name *C. gobio* to the “common” gudgeon, it is necessary to designate a lectotype or a neotype. Problems arise because of the uncertainties surrounding the possible status of NRM 8076 (Fig. 6) as a syntype. The following is extracted from correspondence with A. Silfvergrip (NRM).

Specimen NRM 8076 was part of the NRM (or at the time The Royal Academy of Sciences) collection at an early stage. The small, printed label (“Museum R. Ac. Sc.”) is of



a unique kind (it is the only original label; all others are much more recent), not previously noted elsewhere in the fish collection but known in the invertebrate collections as from the early XIXth century. Further, the natural history collections of The Royal Academy of Sciences were renamed into Naturhistoriska riksmuseet in 1819, and the label therefore probably predates that year. This is the only “*Gobio*

gobio” from that time at NRM and the only one accessioned before 1851.

The species is listed by Linnaeus (1764: 107) as part of the King’s collection, which was later transferred to NRM. Therefore, a specimen of *Cyprinus gobio* was part of the collection at the time.

In the 1809 collection catalogue by Swartz there is only one specimen of “*Cyprinus gobio*”.

The specimens in the King’s collection were all known

Figure 6. - *Gobio gobio* (?), NRM 8076, 63.4 mm SL, unknown origin; possible syntype, possibly examined by Linnaeus. [*Origine inconnue ; peut-être un syntype, peut-être examiné par Linné.*]

Figure 7. - *Gobio alverniae*. **A**: Paratype, CMK 17005, 129.5 mm SL; France: Loire drainage: stream Ance; **B**: Holotype, MNHN 2004-2079, 104.8 mm SL; France: Loire drainage: stream Ance; **C**: CMK 18328, 118.0 mm SL; France: Garonne drainage: stream Dadou. [**A** : France: bassin de la Loire: rivière Ance ; **B** : France: bassin de la Loire: rivière Ance ; **C** : France: bassin de la Garonne: rivière Dadou.]

Figure 8. - *Gobio lozanoi*. **A**: CMK 17574, 97.8 mm SL; France: River Adour at Tarbes; **B**: CMK 18333, 86.6 mm SL; France: Adour drainage: stream Estampon. [**A** : fleuve Adour à Tarbes ; **B** : bassin de l'Adour, rivière Estampon.]

Figure 9. - *Gobio occitaniae*. **A**: Holotype, MNHN 2004-2084, 113.0 mm SL; France: stream Agly; **B**: Paratype, CMK 17563, 82.4 mm SL; France: stream Tech; **C**: CMK 18250, 100.5 mm SL; France: River Garonne in Muret. [**A** : France, rivière Agly ; **B** : France, rivière Tech ; **C** : France, fleuve Garonne à Muret.]

Figure 11. - *Gobio kovatschevi*, CMK 18354, 82.8 mm SL; Bulgaria: Provadiiska River.

Figure 12. - *Gobio ohridanus*, CMK 17382, 89.4 mm SL; Macedonia: Lake Ohrid.

to Linnaeus. The first volume of *Museum Adolphi Friderici* (Linnaeus, 1754) was printed in 1754. The second volume was already in manuscript, but was not published until 1764. There is no indication that there were additions to the collection between the two publications.

Linnaeus' 1758 descriptions often contain references to *Museum Adolphi Friderici*. References to the first volume normally include a page number, while they are missing in references to the (then unpublished) second volume.

In the 12th edition of *Systema Naturae*, Linnaeus (1766) gives page reference to both volumes of *Museum Adolphi Friderici*, including for *Cyprinus gobio*.

Gobio gobio does not occur in the Stockholm region, which indicates that the specimen may come from anywhere in its distribution. The geographic origin of the specimen is obscure, Linnaeus (1764) only gives "Mari Mediterraneo".

Linnaeus (1764) indicated that the fish has reddish pelvic and anal fins and is similar to *Aspius aspius*. This, together with the recorded 11 anal rays, suggests that the fish reported in Linnaeus (1764) is possibly not *G. gobio*. The uncertainties about the origin of the specimen is not unique to *G. gobio*. Linnaeus (1758: 320) indicated the locality of his *Cyprinus barbatus* as Europa australi, while in 1764 he wrote Hispania. This could indicate that the 1764 locality data represent real information, whereas the 1758 ones are generalizations (Kullander, pers. comm., 2003).

To designate NRM 8076 as lectotype creates an obvious risk if it is later found not to be a syntype. Further, this action would be pointless as this specimen is in poor state and of unknown origin. To designate an other specimen as neotype also presents a risk as it might one day be possible to demonstrate that NRM 8076 indeed is a syntype.

The only way around is to deprive NRM 8076 of its potential syntype status by the designation of a lectotype. We designate here as lectotype the specimen on which is based the figure of "*Gobio fluviatilis*" in Rondelet (1555: 206 ["gouion de riuere" in the 1558: 151 translation). The origin of the figured specimen is not known; Rondelet mentions the species from Lyon (France) and Germany. If it were a syn-

type, NRM 8076 now becomes a paralectotype and is no longer eligible as a lectotype. The lectotype is lost: Rondelet is not known to have preserved specimens and there has never been a claim anywhere that a museum specimen dates back to Rondelet.

We now designate specimen NRM 50261, 92.6 mm SL (Fig. 1A), from stream Sieg at Eitorf (Germany, Rhine drainage), as neotype of *Cyprinus gobio* Linnaeus, 1758. This satisfies requirements of ICZN art. 75.3 as the neotype is needed to clarify the taxonomic status and the type locality of *G. gobio* (art. 75.3.1), the diagnosis is given above (art. 75.3.2), the unique catalogue number allows identification of the neotype (art. 75.3.3) which corresponds to what we know of the former types (art. 75.3.5) and comes from a locality part of the original type locality (Germany; art. 75.3.6) and is now deposited in NRM (art. 75.3.7).

For the record, the specimen possibly seen by Linnaeus (NRM 8076, 63.4 mm SL; Fig. 6) has a flat interorbital area, 41+2 scales in lateral line, 1/25 or 6 scales rows between dorsal-fin origin and lateral line, 4 between lateral line and pelvic-fin base, 1/22/1/21/2 transverse scale rows on caudal peduncle, 5 scales between anus and anal-fin origin, scales on throat reaching forward to pectoral-fin base, length of caudal peduncle 11.3 mm (17.8% SL), depth 5.3 mm (8.4% SL).

Fricke (1999) designated a neotype for *G. gobio*. This designation is not valid, as the qualifying conditions are not met (ICZN art. 75.3). To be valid, a neotype designation needs to be for exceptional cases and that need should be expressly described. Fricke did not state explicitly why a neotype is needed; he did not provide any information suggesting that more than one species is involved in the type series (our data and discussion above show that several species are involved, but Fricke did not show that and he merely listed Linnaeus bibliographic sources).

Also, any neotype designation as an end in itself or as a curatorial routine is invalid (art. 75.2). In the same paper, Fricke designated neotypes for 72 species. The associated

discussions do not justify the designation of neotypes, and the neotypes are clearly “designated as an end in itself”. The fact that most of these neotypes are deposited in the same collection also sounds more like a curatorial routine than in view of an exceptional need to clarify taxonomy. As most of these species were named by Linnaeus, it would have been elegant that they be deposited in NRM where most researchers look for Linnaeus types.

***GOBIO ALVERNIAE*, NEW SPECIES**

(Fig. 7)

Holotype

MNHN 2004-2079, 104.8 mm SL, France, Dept. Haute-Loire, stream Ance du Nord at Le Galy, Tirange commune, H. Persat, 19 Oct. 2001.

Paratypes

All from France. - Loire drainage: CMK 17005, 3 ex., 115.2-129.5 mm SL, same data as holotype. - CMK 18278, 3 ex., 72.7-86.5 mm SL, same locality, H. Persat and CSP staff, 4 Sept. 2003. - CMK 18267, 3 ex., 106.4-118.9 mm SL, Dept. Lozère, stream Chapeauroux (tributary of Allier) at L’Hermet, near St-Jean-la-Fouillouse, H. Persat and CSP staff, 10 Sept. 2003. - MNHN 2004-2080, 2 ex. and CMK 18271, 3 ex., 84.8-126.5 mm SL, Dept. Haute-Loire, stream Alagnon (tributary of Allier) at Pont-du-Vernet, near Joursac, H. Persat and CSP staff, 17 Jul. 2003. - MNHN 2004-2081, 2 ex. and CMK 17826, 5 ex., 63.5-87.9 mm SL, Dept. Haute-Loire, stream Allier at Langeac, CSP Clermont-Ferrand, 17 Sept. 2002. - CMK 18277, 2 ex., 87.8-117.0 mm SL, Dept. Puy-de-Dôme, Ance du Nord at Sermoulis, near Sauvessanges, H. Persat and CSP staff, 4 Sept. 2003.

Additional material (non types)

All from France. - Garonne drainage: MNHN 2004-2082, 2 ex., NRM 50324, 2 ex., CMK 17531, 5 ex., 71.8-126.5 mm SL, Dept. Lot, River Dordogne at Tauriac, 44°54’22”N-1°48’27”E; M. Kottelat and CSP staff, 30 Aug. 2002. - MNHN 1986-0820, 4 ex., 90.0-110.8 mm SL, Dept. Lozère, Lot drainage, Bramont [Bramont, a tributary of Lot, entering it near Mende]; Velay, 1968. - MNHN 2004-2083, 2 ex. and CMK 17553, 5 ex., 45.5-148.7 mm SL, Dept. Aveyron, stream Cernon at railway bridge about 3 km downstream of St-Rome-de-Cernon, 44°02’11”N-2°57’52”E; M. Kottelat and CSP staff, 4 Sept. 2002. - CMK 18328, 6 ex., 71.8-133.0 mm SL, Dept. Tarn, stream Dadou at Arifat; P. Derenne, 10 Oct. 2003.

Diagnosis

Gobio alverniae is distinguished from all other species of *Gobio* in western Europe in having $1/23/1/3^{1/2}$ scale rows on caudal peduncle (16 circumpeduncular rows) (*vs* usually

$1/22-3/1/2^{1/2}-3$; 12-15 circumpeduncular rows), the interorbital space markedly concave in specimens larger than about 80 mm SL in most populations (*vs* from convex to slightly concave, usually flat), and the lower edge of the last pelvic axillary scale united to the base of the pelvic fin by a membrane which may extend backwards on the following scale.

It further differs by the combination of the following character states (none unique to the species): scales on belly extending forward beyond origin of pectoral fin (*vs* reaching at most to posterior extremity of pectoral-fin base in *G. gobio* and *G. lozanoi*); 4 scale rows between lateral line and pelvic-fin origin (*vs* $3-3^{1/2}$ in *G. lozanoi*); caudal peduncle depth 1.5-2.3 times in its length (*vs* 2.0-2.7 in *G. gobio*).

Description

General appearance shown in figure 7; morphometric data of holotype and 28 paratypes in table II. Selected morphometric and meristic data based on 8 additional paratypes. Dorsal fin with 3 simple and $7^{1/2}$ branched rays ($8^{1/2}$ in a single specimen); last simple ray shorter than first branched ray, margin straight to slightly concave when fin stretched out. Pectoral fin broadly triangular with slightly concave posterior edge, reaching about middle of distance to pelvic-fin base, with 14-16 rays. Pelvic fin rounded, reaching about half of distance to anal-fin origin, with 8(12) or 9(4) rays; 2 or 3 modified axillary scales, length of exposed part of last scale about equal to its depth and about half of length of preceding unmodified scale, lower edge of last scale united to pelvic base by a membrane which may extend backwards on following scale (Fig. 2B). Pelvic-fin origin on a vertical through space between branched dorsal rays 1 and 2 to ray 3. Anal with 2 simple and $6^{1/2}$ branched rays ($5^{1/2}$ in a single specimen). Caudal fin slightly forked, with rounded lobes, with 10+9 principal rays, 9+8 branched (9+9 principal, 8+8 branched rays in two specimens with damaged and regenerated fin); in many specimens, upper lobe longer than lower, but apparently a result of mechanical abrasion and possibly depending of substrate). Caudal peduncle 1.5-2.3 times longer than deep. $37+3(1)$, $38+2(5)$, $38+3(4)$, $39+2(10)$, $39+3(1)$, $40+2(4)$, $40+3(2)$ or $41+2(1)$ scales along lateral line, 14-19 irregularly set predorsal scales, $1/26-7/1/7-9^{1/2}$ longitudinal rows of scales between dorsal-fin origin and belly (counted about 5 scale rows in front of pelvic-fin base; scales very irregularly shaped and set on belly, somewhat irregularly set on back, therefore a variable count; most common count $1/26/1/7^{1/2}$, $1/23/1/3^{1/2}$ ($1/23/1/2^{1/2}$ in 3 of 41 specimens) scale rows on caudal peduncle (16 circumpeduncular rows), 4 or $4^{1/2}$ scale rows between lateral line and pelvic-fin origin and 4 or $5^{1/2}$ between lateral line and anal-fin origin. Scales on belly

Table II. - Morphometric data of holotype (H) and 41 specimens of *Gobio occitaniae* from Garonne drainage and Mediterranean drainages, and holotype (H) and 28 paratypes of *G. alverniae*. [Données morphométriques de l'holotype (H) et de 41 spécimens de *Gobio occitaniae* des bassins de la Garonne et méditerranéens, et de l'holotype (H) et de 28 paratypes de *G. alverniae*.]

Drainage	<i>G. occitaniae</i>					<i>G. alverniae</i>				
	Garonne		Mediterranean			Loire			Garonne	
	Range	n	H	Range	n	H	Range	n	Range	n
Standard length (mm)	63.8-111.7	16	113.0	72.5-122.7	26	104.8	62.9-129.5	16	71.8-126.5	13
Total length (mm)	107.7-137.1	4	140.4	104.9-148.8	12	138.0	76.0-158.0	16	89.0-153.0	13
Percents of standard length										
Head length	25.3-28.9	16	26.5	26.4-29.4	26	25.0	24.5-28.5	16	25.0-27.5	13
Pre-dorsal length	49.1-51.5	4	51.2	49.0-52.2	12	49.3	47.5-51.8	16	49.3-51.3	9
Pre-pelvic length	51.3-53.2	4	53.5	49.5-54.6	12	51.3	50.0-54.5	16	49.8-53.1	13
Pre-anal length	71.8-74.2	4	76.1	71.2-78.0	12	73.0	70.6-77.0	16	71.9-75.6	9
Body width	14.6-16.7	16	19.6	15.7-19.6	26	17.2	14.4-18.8	16	16.4-19.4	9
Head depth	15.9-17.5	16	17.4	16.8-18.2	26	16.0	14.5-18.0	16	15.9-17.9	13
Body depth	19.9-22.7	16	25.0	21.7-25.0	26	21.1	21.1-24.6	16	20.6-23.9	13
Depth of caudal peduncle	9.4-11.2	16	12.4	10.4-12.5	26	10.8	9.7-11.7	16	10.2-12.5	13
Length of caudal peduncle	19.3-22.9	16	18.8	17.4-22.0	26	21.7	18.8-22.7	16	18.4-22.0	13
Eye diameter	5.4-7.2	16	5.2	4.8-6.4	26	5.7	4.3-6.5	16	4.6-6.3	13
Snout length	11.1-13.1	16	12.9	11.4-13.5	26	11.3	11.0-13.5	16	11.4-12.4	9
Interorbital width	7.4-9.2	16	8.7	7.3-9.2	26	8.1	7.2-9.5	16	7.5-8.9	13
Length of last simple dorsal ray	18.2-23.3	4	19.4	19.0-25.8	12	18.0	16.1-22.3	16	18.1-22.9	9
Depth of anal fin	17.2-19.9	4	18.4	17.8-19.4	12	15.1	15.0-18.8	16	15.5-18.5	9
Length of pelvic fin	16.7-19.3	4	17.3	16.6-19.6	12	15.0	14.5-17.9	16	15.8-18.1	9
Length of pectoral fin	20.2-22.8	4	21.9	20.4-23.9	12	18.0	15.6-21.5	16	17.2-22.9	9
Length of upper caudal lobe	20.0-26.1	16	22.7	18.6-27.3	26	20.5	16.3-22.8	16	17.5-23.2	13
Length of middle caudal rays	12.5-16.0	16	12.9	11.5-15.2	26	13.4	10.6-16.5	15	11.2-14.6	13
Length of lower caudal lobe	20.3-25.0	4	21.3	19.6-23.7	12	17.7	16.4-21.5	15	17.1-21.6	9
Percents of head length										
Head depth	58-66	16	66	60-68	26	64	58-67	16	60-67	13
Eye diameter	20-26	16	20	17-21	12	23	16-24	16	18-22	13
Snout length	42-48	16	49	42-49	12	45	41-48	16	41-48	9
Interorbital width	26-33	16	33	25-34	12	33	28-33	16	29-32	13
Ratios										
Caudal peduncle length/depth	1.9-2.4	16	1.5	1.5-2.0	26	2.0	1.7-2.3	16	1.5-2.0	13
Snout length/eye diameter	1.7-2.4	16	2.5	1.9-2.7	26	2.0	1.8-2.8	16	2.1-2.5	9
Interorbital width/eye diameter	1.1-1.6	16	1.7	1.3-1.7	26	1.4	1.3-2.0	16	1.3-1.8	13
Caudal upper lobe/median rays	1.46-1.82	16	1.76	1.52-1.96	26	1.54	1.25-1.67	16	1.43-1.66	13

extending forward beyond pectoral-fin origin (Fig. 3B). Scale rows between anus and anal-fin origin 4-6.

Barbels reaching vertical through middle of eye. Mouth strongly arched. Postlabial groove broadly interrupted medially. Upper lip thin, lower lip swollen, with a constriction at level of interruption of postlabial groove defining a lateral lobe on each side (Fig. 4). In lateral view, eye flushed with or protruding over dorsal profile of head. Interorbital space flat in medium-sized (up to about 80 mm SL) specimens to markedly concave in larger ones.

Coloration (in ethanol)

Ground colour pale olive brown, darker dorsally, yellowish in lower half of flank, paler on belly. Back plain dark brown. A series of 7-9 black blotches, large (on caudal peduncle about 2/3 of depth), not very contrasted (or sometimes inconspicuous), with diffuse edges. In dorsal half of body, pigments organised into dark brown to blackish stripes running between scale rows. In lower half of body, pigments usually as a dark grey patch on posterior half of exposed part of scale, forming more or less complete longitudinal rows of

crescentiform spots. Top of head plain dark brown; sides dark grey to blackish, with a conspicuous blotch on opercle and under eye. Ventral surface of head, belly and caudal peduncle without markings. All fins hyaline with conspicuous series of dark brown to blackish dots.

Variability

All specimens identified as *G. alverniae* were readily identifiable by their stocky, rounded body, dark coloration and concave interorbital area. Some variation was observed for some characters. Although the interorbital area is generally concave at least in specimens larger than about 80 mm SL, in the sample from Dourbie, a headwater of Tarn (CMK 17543), the interorbital area is flat. This is hypothesised as a possibly introgression with *G. occitaniae* (see discussion).

Distribution

Gobio alverniae has been collected in the northeastern part of the Garonne drainage (Dordogne, Lot and Tarn drainages) and in the upper Loire drainage.

Etymology

Named for Alvernia (Arvernia; Plechl and Plechl, 1972), a Roman province inhabited by the Arverne tribe, approximately corresponding to today's Auvergne. A noun in the genitive case.

Remarks

Besides the characters mentioned under diagnosis, *G. alverniae* is distinguished from *G. gobio* in having a plumper appearance, with a blunter snout (compare Figs 1 and 7). Although the snout appears shorter, this is not shown by the morphometric data (snout length 11.0-13.5% SL, vs 11.8-13.5): the smaller snout length on the longitudinal axis is compensated by the greater vertical distance between the respective levels of the tip of the snout and of the eye (not quantifiable). The snout length is 1.30-1.57 times in head depth (vs 1.18-1.38 in the Rhine and Rhône populations, 1.40-1.53 in the lower Loire samples). The interorbital area is flat to conspicuously concave in the largest specimens, with the eyes clearly protruding over the dorsal profile in lateral view (vs convex to flat, and eyes not or just reaching dorsal profil). The interorbital width is 1.30-1.63 times in snout length (vs 1.49-1.84).

The caudal peduncle is stouter (depth 9.7-12.5% SL, vs 8.7-10.8; 1.5-2.3 times in its length, vs 2.0-2.7), the interorbital area wider (interorbital width 7.2-9.5% SL, vs 6.5-8.1; 28-33% HL, vs 24-29; 1.3-2.0 times eye diameter, vs 1.1-1.5), and pelvic-fin origin on vertical through base of branched dorsal rays 1 to 3 (vs 3 to 4).

The mouth of *G. alverniae* is less arched than in *G. gobio* (not quantified; see Fig. 4), the lips thicker and the latero-

posterior parts of the lower lip slightly swollen, with a marked constriction at the level of the interruption of the postlabial groove, resulting into a lobate appearance in the largest specimens.

Gobio alverniae has slightly fewer lateral line scales than *G. gobio* (37-41+2-3, usually 38-39+2, vs 40-42+2, usually 40-41+2). The scales are somewhat smaller (not quantifiable) and less regularly set on belly and in predorsal area. On the belly, scales extend anteriorly to a point slightly anterior to pectoral-fin origin (vs not reaching forwards to level of base of last pectoral-fin ray, or only as a single median row; Fig. 3). There are 2-3 modified pelvic axillary scales (vs 1), the last one broadly triangular with an exposed length about equal to its depth and about $\frac{1}{3}$ - $\frac{1}{2}$ of unmodified anterior axillary scale (vs elongated, exposed length at least twice its depth and about equal to unmodified anterior axillary scale; Fig. 2).

Gobio alverniae has shorter fins than *G. gobio* (see Tabs I-II) and the caudal fin is less deeply forked. The upper lobe is 1.3-1.9 times longer than middle rays (vs 1.6-2.1).

Gobio alverniae has a dark brown general coloration (vs yellowish brown), with 7-9 dark blotches, not very contrasted or even indistinct, relatively large (depth of those on caudal peduncle about $\frac{2}{3}$ of peduncle depth; vs 8-11 contrasted blotches, those on caudal peduncle $\frac{1}{3}$ - $\frac{1}{2}$ of peduncle depth).

See under *G. occitaniae* for characters distinguishing the two species.

GOBIO LOZANOI DOADRIO & MADEIRA

(Fig. 8)

Gobio lozanoi Doadrio & Madeira, 2004: 109 (type locality: Spain, Segovia, Coca, Eresma River, Duero basin; holotype: MNCN 153558)

Material examined

All from France. - Adour drainage: MNHN 2004-2089, 5 ex. and CMK 17584, 8 ex., 68.4-105.7 mm SL, Dept. Hautes-Pyrénées, River Adour downstream of bridge at Estirac, about 20 km north of Tarbes, 43°29'59"N-0°01'46"E; M. Kottelat and CSP staff, 25 Sept. 2002. - CMK 17574, 7 ex., 76.8-119.0 mm SL, France, Dept. Hautes-Pyrénées, River Adour in Tarbes (Séméac), 43°13'39"N-0°05'27"E; M. Kottelat and CSP staff, 25 Sept. 2002. - NRM 50327, 3 ex. and CMK 18333, 6 ex., 61.4-102.5 mm SL, Dept. Landes, stream Estampon at Roquefort; P. Derenne and CSP staff, 16 Oct. 2003. - CMK 18336, 10 ex., 43.1-98.7 mm SL, Dept. Landes, stream Bahus at Classun; P. Derenne and CSP staff, 16 Oct. 2003.

Diagnosis

Gobio lozanoi is distinguished from all other species of *Gobio* in western Europe in having fewer scale rows between lateral line and pelvic-fin origin (3-3 $\frac{1}{2}$, vs 4-4 $\frac{1}{2}$), fewer scale rows between dorsal-fin origin and lateral line ($\frac{1}{2}$ 5, vs $\frac{1}{2}$ 6-7)

and a deeper head (depth at nape 60-72% HL, vs 56-68).

It further differs by the combination of the following character states (none unique to the species): scales on belly extending forward at most to posterior extremity of pectoral-fin base (vs extending forward beyond origin of pectoral fin in *G. alverniae* and *G. occitaniae*), $\frac{1}{2}2/1/2\frac{1}{2}$ scale rows on caudal peduncle (12 circumpeduncular rows) (vs $\frac{1}{2}3/1/3\frac{1}{2}$ in *G. alverniae*); caudal peduncle 1.6-2.2 times longer than deep (vs 2.0-2.7 in *G. gobio*) and fewer lateral line scales (usually 36-37 + 2, vs 38-39 + 2 in *G. alverniae* and *G. gobio*).

Description

General appearance shown in figure 8; morphometric data of holotype and 28 paratypes given in table I. Dorsal fin with 3 simple and $7\frac{1}{2}$ branched rays; last simple ray longer than first branched ray; margin markedly concave when fin stretched. Pectoral fin falcate, almost reaching pelvic-fin origin (somewhat shorter in females), with 14(2), 15(8) or 16(10) rays. Pelvic fin broadly triangular, reaching about to $\frac{1}{2}$ of distance to anal-fin origin, with 8(17) or 9(3) rays; a single (rarely 2) modified axillary scale, length of exposed part about 1.5 times its depth and about equal to length of preceding unmodified scale, lower edge free on most of its length (Fig. 2C). Pelvic-fin origin on a vertical through space between base of branched dorsal rays 2 and 3 and space between rays 3 and 4. Anal with 2 simple and $6\frac{1}{2}$ branched rays. Caudal fin forked, lobes rounded to pointed, with 10+9 principal rays, 9+8 branched. Caudal peduncle 1.6-2.2 times longer than deep. 36+2 (6), 36+3 (3), 37+2 (12), 37+3 (2), 38+2 (1), 38+3 (2), 39+2 (1), 39+3 (1) and 40+3 (1) scales along lateral line, about 13-19 irregularly set predorsal scales, $\frac{1}{2}5/1/7\frac{1}{2}$ (12), $6/1/7\frac{1}{2}$ (2), $\frac{1}{2}6/1/7\frac{1}{2}$ (2), $\frac{1}{2}5/1/8\frac{1}{2}$ (1) or $\frac{1}{2}5/1/6\frac{1}{2}$ (2) longitudinal rows of scales between dorsal-fin origin and belly (counted about 5 scale rows in front of pelvic-fin base), $\frac{1}{2}2/1/2\frac{1}{2}$ (27), $\frac{1}{2}3/1/2\frac{1}{2}$ (1) or $3/1/2\frac{1}{2}$ (1) scale rows on caudal peduncle (12-14 circumpeduncular rows), 3 (9) or $3\frac{1}{2}$ (20) scale rows between lateral line and pelvic-fin origin and $3\frac{1}{2}$ or 4 between lateral line and anal-fin origin. Scales on belly extending forward at most to posterior extremity of pectoral-fin base (Fig. 3A). Scale rows between anus and anal-fin origin 4-5.

Barbel reaching vertical through posterior margin of eye. Mouth arched. Postlabial groove broadly interrupted medially. Lips thin, covered by minute papillae, lower lip swollen, with a constriction at level of interruption of postlabial groove defining a lateral lobe on each side. In lateral view, eye not or just reaching dorsal profile of head. Interorbital space slightly convex to flat.

Coloration (in ethanol)

Ground colour yellowish brown, darker dorsally, paler

on belly. A series of 6-9 black blotches, medium-sized (on caudal peduncle somewhat less than half of depth), contrasted, posterior ones with sharp edges. In dorsal half of body, pigments organised into dark brown to blackish stripes running between scale rows. In lower half of body, pigments usually as a dark grey patch on posterior half of exposed part of scales of row below lateral line and on anterior scales of next row below, forming one incomplete longitudinal row of crescentiform spots. Top of head dark grey with black vermiculations; sides dark grey to brown, with a darker area on opercle and a short irregular black oblique band under eye. Ventral surface of head, belly and caudal peduncle without markings. All fins hyaline; dorsal, anal, caudal and pectoral fins with conspicuous series of dark brown to blackish dots; pelvic fin usually with only 1-2 rows of dots.

Distribution

In France, *G. lozanoi* has only been collected in the Adour and Nivelle drainages, two rivers flowing to the Atlantic Ocean, bordering the Garonne drainage to the south. In Spain, Doadrio and Madeira (2004) consider that *G. lozanoi* is native in the Ebro and Bidasoa drainages, and allochthonous in the other drainages (Duero, Mondego, Guadalete, Guadiana, Guadalquivir, Júcar, Llobregat, Mijares, Nalón, Nansa, Miño, Segura, Tajo and Turia).

Remarks

The four available samples share the distinctive characters listed in the diagnosis. The individuals in two samples (CMK 17574, 18336) are distinctly deeper and wider-bodied than the others, the caudal-fin lobes are more rounded, the fins shorter, the pectoral rounded (vs falcate in largest specimens) and the eye set more away from the dorsal profile of head in lateral view. One of these samples was obtained within the city of Tarbes, which may explain that they appear better fed than specimens obtained outside the city (material of other species collected at this station also had a stouter appearance than those of other localities).

Darracq (1836) recorded the presence of a gudgeon in the Adour drainage. He used the vernacular "trogue", a noun then used for gudgeons elsewhere in southwestern France, for example in the Eyre by Laporte (1853). This indicates that a species of *Gobio* was present in the Adour in 1836 and that *G. lozanoi* is unlikely to be of allochthonous origin.

Although they considered that *G. lozanoi* is native to the Ebro, Bidasoa and Adour drainages, Doadrio and Madeira (2004) designated as holotype a specimen from the allochthonous Duero population.

GOBIO OCCITANIAE, NEW SPECIES

(Fig. 9)

Holotype

MNHN 2004-2084, 113.0 mm SL, France, Dept. Pyrénées-Orientales, River Agly at bridge downstream of Latourde-France, 42°46'09"N-2°39'39"E; M. Kottelat and CSP staff, 27 Sept. 2002.

Paratypes

All from France. - MNHN 2004-2085, 5 ex., NRM 50325, 5 ex. and CMK 17600, 13 ex., 32.1-122.7 mm SL, same data as holotype. - MNHN 2004-2086, 5 ex. and CMK 17563, 9 ex., 72.5-98.9 mm SL, France, Dept. Pyrénées-Orientales, River Tech about 3 km upriver of bridge on road N114 south of Elne, 42°35'02"N-2°58'13"E; M. Kottelat and CSP staff, 6 Sept. 2002. - CMK 18347, 9 ex., 70.7-100.5 mm SL, Dept. Gard, River Hérault at Le Gasquet, municipality Notre-Dame-de-la-Rouvière; P. Fleith, 30 Jul. 2003. - CMK 18225, 2 ex., 71.7-93.5 mm SL, Dept. Gard, stream Vidourle at Quissac; D. Beaudou and CSP staff, 13 Jun. 2003.

Additional material (non type)

All from France. - *Mediterranean drainages*. - MNHN 1986-819, 9 ex., 56.9-120.7 mm SL, Dept. Pyrénées-Orientales, Aude drainage, réservoir of Puyvalador; F. d'Aubenton, 1967. - MNHN 1986-821, 15 ex., 50.2-104.7 mm SL, Dept. Hérault, stream Dourbie [tributary of Hérault] at Villeneuve; Oliver, 1964. - CMK 18230, 11 ex., 73.9-77.3 mm SL, stream Lez at Castelnau-le-Lez, at Parc Montplaisir; D. Beaudou and CSP staff, 6 Jun. 2003.

Eyre drainage. - CMK 18331, 8 ex., 73.9-127.4 mm SL, stream Petite-Leyre at Moustey; P. Derenne and CSP staff, 16 Oct. 2003.

Garonne drainage. - CMK 17543, 10 ex., 82.7-118.5 mm SL, Dept. Aveyron, stream Dourbie [tributary of Tarn] downstream of dam at Cantobre, 44°03'36"N-3°18'07"E; M. Kottelat and CSP staff, 3 Sept. 2002. - MNHN 2004-2087, 5 ex. and CMK 17557, 11 ex., 63.8-111.7 mm SL, Dept. Ariège, stream Hers-Vif, about 1 km north of Besset, 3.5 km west of Mirepoix, 43°05'04"N-1°50'09"E; M. Kottelat and CSP staff, 5 Sept. 2002. - CMK 18341, 10 ex., 81.9-93.8 mm SL, same locality; P. Derenne and CSP staff, 4 Aug. 2003. - CMK 18310, 10 ex., 35.7-84.0 mm SL, Dept. Haute-Garonne, stream Volp at Le Plan, between Cazères and Ste-Croix-Volvestre; P. Derenne and CSP staff, 13 Aug. 2003. - CMK 18261, 9 ex., 65.8-95.2 mm SL, Dept. Aveyron, Tarn drainage, stream Dourdou-de-Camarès at Montlaur, 42 km SW of Millau; P. Derenne and CSP staff, 2 Jul. 2003. - CMK 18319, 11 ex., 48.4-102.8 mm SL, Dept. Tarn-et-Garonne, stream Aveyron at Piquecos; P. Derenne and CSP staff, 12 Sept. 2003. - CMK 18259, 8 ex., 65.0-114.0 mm SL, Dept. Tarn-et-Garonne, River Garonne at Bourret, about 15 km WSW of Montauban; P. Derenne and CSP staff, 27 Sept. 2002. - CMK 18321, 10 ex., 64.6-102.3 mm SL, Dept. Haute-Garonne, stream Ariège at Venerque; P. Derenne and CSP staff, 16 Sept. 2003. - CMK 18338, 2 ex., 52.0-53.4 mm SL, Dept. Gers, stream Baïse at Beaucaire; P. Derenne and CSP staff, 29 Oct. 2003. - CMK 18325, 8 ex., 44.0-59.0 mm SL, Dept. Lot-et-Garonne, River Garonne at Saint-Léger; P. Derenne and CSP staff, 24 Sept. 2003. - MNHN 2004-2088, 5 ex. and CMK 18250, 12 ex., 50.4-114.9 mm

SL, Dept. Haute-Garonne, River Garonne at old bridge in Muret, 42°27'33"N-1°19'40"E; M. Kottelat and CSP staff, 10 Jul. 2003. - CMK 18244, 5 ex., 25.0-112.0 mm SL, Dept. Haute-Garonne, River Garonne at bridge in Montespan, 43°05'39"N-0°50'26"E; M. Kottelat and CSP staff, 9 Jul. 2003. - CMK 18237, 15 ex., 75.2-122.0 mm SL, Dept. Haute-Garonne, River Garonne at bridge in Clarac, 45°05'55"N-0°37'47"E; M. Kottelat and CSP staff, 9 Jul. 2003. - CMK 18315, 10 ex., 73.8-112.2 mm SL, Dept. Ariège, stream Salat at Caumont; P. Derenne and CSP staff, 2 Sept. 2003.

Dordogne drainage. - CMK 18295, 2 ex., 34.6-98.1 mm SL, Dept. Charente-Maritime, stream Lary at St-Martin-d'Ary; O. Robin, 7 Oct. 2003. - CMK 18298, 3 ex., 58.5-93.8 mm SL, Dept. Charente-Maritime, stream Palais at St-Pierre-du-Palais; O. Robin, 14 Oct. 2003.

Charente drainage. - CMK 18305, 2 ex., 94.7-106.1 mm SL, Dept. Charente-Maritime, stream Antenne at Le Seure; O. Robin, 10 Sept. 2003. - CMK 18289, 3 ex., 67.8-98.7 mm SL, Dept. Charente-Maritime, stream Seugne at Clion-sur-Seugne; O. Robin, 26 Sept. 2003. - CMK 18292, 2 ex., 80.6-103.6 mm SL, Dept. Charente-Maritime, stream Seugne at Les Gonds; O. Robin, 26 Sept. 2003. - CMK 18302, 3 ex., 72.7-96.9 mm SL, Dept. Charente-Maritime, stream Boutonne at St-Pierre-de-l'Île; O. Robin, 12 Sept. 2003.

Diagnosis

Gobio occitaniae is distinguished from all other species of *Gobio* in western Europe by the combination of the following character states (none unique to the species): scales on belly extending forward beyond origin of pectoral fin (*vs* reaching at most to posterior extremity of pectoral-fin base in *G. gobio* and *G. lozanoi*); transverse scale count on caudal peduncle variable, $\frac{1}{2}$ -3/1/2-3 $\frac{1}{2}$ (usually $\frac{1}{2}$ 3/1/2 $\frac{1}{2}$ or $\frac{1}{2}$ 2/1/2 $\frac{1}{2}$) (12-16 circumpeduncular rows, modally 14) (*vs* $\frac{1}{2}$ 3/1/3 $\frac{1}{2}$ in *G. alvernicae*, $\frac{1}{2}$ 2/1/2 $\frac{1}{2}$ in *G. lozanoi*); 3 $\frac{1}{2}$ -4 scale rows between lateral line and pelvic-fin origin (*vs* 3-3 $\frac{1}{2}$ in *G. lozanoi*); interorbital space flat (*vs* concave in *G. alvernicae* larger than about 80 mm SL in most populations); caudal peduncle depth 1.5-2.2 times in its length (*vs* 2.0-2.7 in *G. gobio*; depth 9.7-12.5% SL, *vs* 8.7-10.8).

Description

General appearance shown in figure 9; morphometric data of holotype and 41 paratypes given in table II. Dorsal fin with 3 simple and 7 $\frac{1}{2}$ branched rays; last simple ray slightly shorter than first branched ray; margin slightly concave when fin stretched out. Pectoral fin triangular to slightly falcate, with rounded tip, reaching about $\frac{1}{2}$ of distance to pelvic-fin origin, with 15(9), 16(2) or 17(1) rays. Pelvic fin broadly triangular, reaching about to $\frac{2}{3}$ of distance to anal-fin origin, with 8(6) or 9(6) rays; two (rarely one) modified axillary scales, length of exposed part of last one about double its depth and about double length of preceding unmodified scale, lower edge free on most of its length (Fig. 2D). Pelvic-fin origin on a vertical through space between base of branched dorsal rays 1 and 3. Anal with 2 simple and 6 $\frac{1}{2}$

branched rays. Caudal fin forked, lobes rounded, with 10+9 principal rays, 9+8 branched. Caudal peduncle 1.48-2.03 times longer than deep. 36+3(1), 37+2(8), 37+3(2), 38+2(11), 38+3(3), or 39+2(2) scales along lateral line, about 15-17 irregularly set predorsal scales, $\frac{1}{2}5-6/1/6-7\frac{1}{2}$ (most specimens with $\frac{1}{2}6/1/7\frac{1}{2}$) longitudinal rows of scales between dorsal-fin origin and belly (about 5 scale rows in front of pelvic-fin base), $\frac{1}{2}2/1/2\frac{1}{2}$ (8), $3/1/2\frac{1}{2}$ (2), $3/1/3$ (1), $\frac{1}{2}3/1/2\frac{1}{2}$ (9), $\frac{1}{2}3/1/3$ (1), or $\frac{1}{2}3/1/3\frac{1}{2}$ (7) scale rows on caudal peduncle (12-16 circumpeduncular rows), $3\frac{1}{2}$ (11) or 4 (17) scale rows between lateral line and pelvic-fin origin and 4 or $4\frac{1}{2}$ between lateral line and anal-fin origin. Scales on belly extending forward in front of pectoral-fin origin (Fig. 3B). Scale rows between anus and anal-fin origin 5.

Barbel reaching vertical through middle to posterior margin of eye. Mouth strongly arched. Postlabial groove broadly interrupted medially. Lips thin, lower lip not swollen. In lateral view, eye not or just reaching dorsal profile of head. Interorbital space slightly convex to flat, rarely slightly concave in largest individuals.

Coloration (in ethanol)

Ground colour yellowish brown, darker dorsally, paler on belly. A series of 7-8 black blotches, large (on caudal peduncle about $\frac{1}{2}$ of depth), not very contrasted (more distinct in specimens smaller than about 70 mm SL), with diffuse edges. In dorsal half of body, pigments organised into irregular dark brown to blackish stripes running between scale rows. In lower half of body, pigments usually as a brown patch on upper half of exposed part of scales, sometimes forming a few incomplete longitudinal rows of spots. Top of head grey to dark brown, plain or with darker vermiculations; sides dark grey to blackish, with dark vermiculation, usually with a conspicuous blotch on opercle and under eye. Ventral surface of head, belly and caudal peduncle without markings. All fins yellowish with conspicuous series of dark brown to blackish dots.

Distribution

Gobio occitaniae inhabits most of southern France, except the Adour drainage and the uppermost reaches of Dordogne, Lot and Tarn drainages. It extends eastwards at least to the Vidourle drainage, southeastwards to the Tech drainage at the Spanish border, and northwestwards to the Charente drainage.

Etymology

Named for Occitanie, the southern part of France, which includes most of the distribution range of the species. A noun in the genitive case.

Remarks

Gobio occitaniae is distinguished from *G. alvernicae* in having a longer caudal fin (length of upper lobe 18.6-27.3% SL, vs 16.3-23.2) and more deeply forked (ratio upper lobe length/median ray length 1.5-2.0, mean 1.7, vs 1.2-1.7, mean 1.5), and a longer pelvic fin (16.6-19.6% SL, vs 14.5-18.1).

The interorbital space is slightly convex to flat in *G. occitaniae*, or very slightly concave in isolated individuals, while it is markedly concave in *G. alvernicae* above about 80 mm SL. There is 2, rarely 1, modified axillary scales in *G. occitaniae* (vs 2 or 3 in *G. alvernicae*) and the length of the exposed part of the last modified scale is double its depth (vs about equal to its depth) and about double length of preceding unmodified scale (vs about half of length of preceding unmodified scale). The transverse scale count on caudal peduncle is $\frac{1}{2}3/1/3\frac{1}{2}$ in all but one of the examined *G. alvernicae* while the counts $\frac{1}{2}2/1/2\frac{1}{2}$, $\frac{1}{2}3/1/3\frac{1}{2}$ and $\frac{1}{2}3/1/2\frac{1}{2}$ are about equally frequent in the examined *G. occitaniae*.

The mouth of *G. occitaniae* is more arched (not quantified) than that of *G. alvernicae* and the lips are thinner. The colour pattern of *G. occitaniae* is more contrasted than that of *G. alvernicae* and the stripes in the dorsal half of the body are less regular.

Besides the characters mentioned under diagnosis, *G. occitaniae* is distinguished from *G. gobio* in having a plumper appearance, with a more rounded snout (compare Figs 1 and 9). The snout length is 1.24-1.53 times in head depth (vs 1.18-1.38 in Rhine and Rhône populations, 1.40-1.53 in Loire sample). The caudal peduncle is stouter (depth 9.7-12.5% SL, vs 8.7-10.8; 1.5-2.2 times in its length, vs 2.0-2.7), the interorbital area wider (interorbital width 7.3-9.2% SL, vs 6.5-8.2; 25-34% HL, vs 24-29; 1.1-1.7 times eye diameter, vs 1.0-1.5), the body slightly wider (width at dorsal-fin origin 14.6-19.6% SL, vs 13.8-17.8), and pelvic-fin origin on vertical through base of branched dorsal rays 1 to 3 (vs 3 to 4).

The mouth of *G. occitaniae* is less arched than that of *G. gobio* (not quantified), the lips thicker and the latero-posterior parts of the lower lip slightly swollen, with a marked constriction at the level of the interruption of the postlabial groove, resulting into a lobate appearance in the largest specimens.

Gobio occitaniae has fewer lateral line scales than *G. gobio* (usually 37-38 + 2, vs usually 40-41 + 2). On the belly and in predorsal area, the scales are somewhat smaller (not quantifiable) and less regularly set. On the belly, the scales extend anteriorly to a point slightly anterior to pectoral-fin origin (vs not reaching forwards to level of base of last pectoral-fin ray, or only as a single median row; Fig. 3). There are usually 2 modified pelvic axillary scales (vs 1), the last one elongate with an exposed length about double its depth and about double length of preceding unmodified scale (vs

elongated, exposed length at least twice its depth and about equal to unmodified anterior axillary scale; Fig. 2).

Gobio occitaniae has a dark brown general coloration (vs yellowish brown), with 7-8 dark blotches, not very contrasted or even indistinct, relatively large (depth of those on caudal peduncle about $\frac{1}{2}$ - $\frac{1}{3}$ of peduncle depth; vs 8-11 contrasted blotches, those on caudal peduncle $\frac{1}{3}$ - $\frac{1}{2}$ of peduncle depth).

The sample from the Agly (CMK 17600) includes a specimen 99.8 mm SL (now CMK 18382) with a much paler coloration, very contrasted lateral blotches and whose morphometrics mostly are largely outside the range of the rest of the sample. It is especially noteworthy in having the shallowest body and the only individual with 40+2 lateral line scales. It generally agrees with *G. gobio* except that it has a deeper caudal peduncle. We suspect that this might be due to hybridisation with *G. gobio*, which might have been accidentally introduced with other species. *Perca fluviatilis*, *Esox lucius* and *Rutilus rutilus* have been stocked upstream in the drainage; the source material was from the Dombes area (middle Rhône drainage). This specimen was excluded from the description, comparisons and tables.

Similarly, the sample from stream Dadou (CMK 18328) includes a specimen (CMK 18376, 80.3 mm SL) immediately distinguishable from the rest of the lot and in complete agreement with *G. gobio* as diagnosed above (no scales on belly in front of posterior extremity of pectoral-fin base, $\frac{1}{2}$ / $\frac{1}{2}$ / $\frac{1}{2}$ transverse scale rows on caudal peduncle, depth of caudal peduncle 2.49 times in its length). This is evidently the result of introduction.

DISCUSSION

Variability within *G. gobio*

A comparison of our data with those compiled by Banarescu (1999) for populations from England and the Vistula, Oder and Dniepr drainages suggests that the character states distinguishing the two new species from *G. gobio* also distinguish them from the *G. "gobio"* of the rest of the range (we did not consider data for other drainages further eastwards and southeastwards as unpublished morphological and molecular data suggest they represent several distinct species; Freyhof, pers. comm., 2003; M. K., pers. obs.). Not all of Banarescu's data can be compared with ours. To be comparable, data should have been obtained by the same method. The data in Banarescu are compiled from a variety of sources, many of them not stating which methods were used. Thus, data as length of caudal peduncle and snout length should not be compared as they are known to be taken in different ways by different authors. In fact, this reservation potentially applies to most morphometric characters

expressed in %SL as SL itself might have been measured in different ways by different authors. Similarly, although a basic count, a lateral line scale count may be obtained in different ways.

The *G. gobio* populations from the middle and lower Loire drainage generally agree with the Rhône and other northern European populations. They share the diagnostic deeply forked caudal fin, the absence of scales between pectoral fin bases, the strongly arched and somewhat squarish mouth, and the relatively paler ground colour with conspicuous, contrasting black blotches. They also share most morphometric characters considered diagnostic for *G. gobio* when compared with *G. alverniae* and *G. occitaniae* but differ for some (Tabs I, II). In some instances, they have intermediates values (body width, depth of caudal peduncle and in others they are distinctive from both *G. gobio* and *G. occitaniae* (head length and head depth are greater than in both species). The specimens from the middle Loire (CMK 17293) have a slightly concave interorbital area. The number of scale rows around the caudal peduncle is not fixed. In CMK 17524 (Thouaret), out of 26 specimens, 12 have $\frac{1}{2}$ / $\frac{1}{2}$ / $\frac{1}{2}$ scale rows (as in the Rhône populations), 7 have $\frac{1}{2}$ / $\frac{1}{3}$ / $\frac{1}{2}$, 5 have $\frac{1}{2}$ / $\frac{1}{2}$ / $\frac{1}{2}$, 1 has $\frac{3}{1}$ / $\frac{1}{2}$ / $\frac{1}{2}$ and 1 could not be counted. Most of the specimens with counts other than $\frac{1}{2}$ / $\frac{1}{2}$ / $\frac{1}{2}$ have very irregularly set scale rows on the body and caudal peduncle, to the point that in some the scale rows are no longer clearly distinct; this possibly results from damage caused by handling as the specimens have been obtained at a site sampled every year for a census and where all fishes are weighted and measured before being returned to the water. This variability was not observed in other Loire samples. Material from the Seine drainage (MNHN 1993-3499) is not distinguishable from lower Loire material.

Morphometry

The results of the Principal Component Analysis are compiled in figure 10. As the first factor is trivial (direct expression of overall size component), the figure summarizes the information provided by the next two most informative axes (F2 and F3) on the relevant factorial graphs for variables and specimens. The main dimensions involved in these structures are Eye diameter, Body width and Depth of caudal peduncle on axis 2, and Length of caudal peduncle on axis 3. For specimens, the overall factorial graph F2 x F3 has been split in 14 sub-graphs (one graph per locality, all graphs being equal and superimposable). The intra-sample variability is rather low in many populations while others exhibit more heterogeneous patterns with a few or most specimens more dispersed (for example Ance). However, the global positions of specimens in each population fit rather well with their taxonomic placement. The *G. gobio* populations from

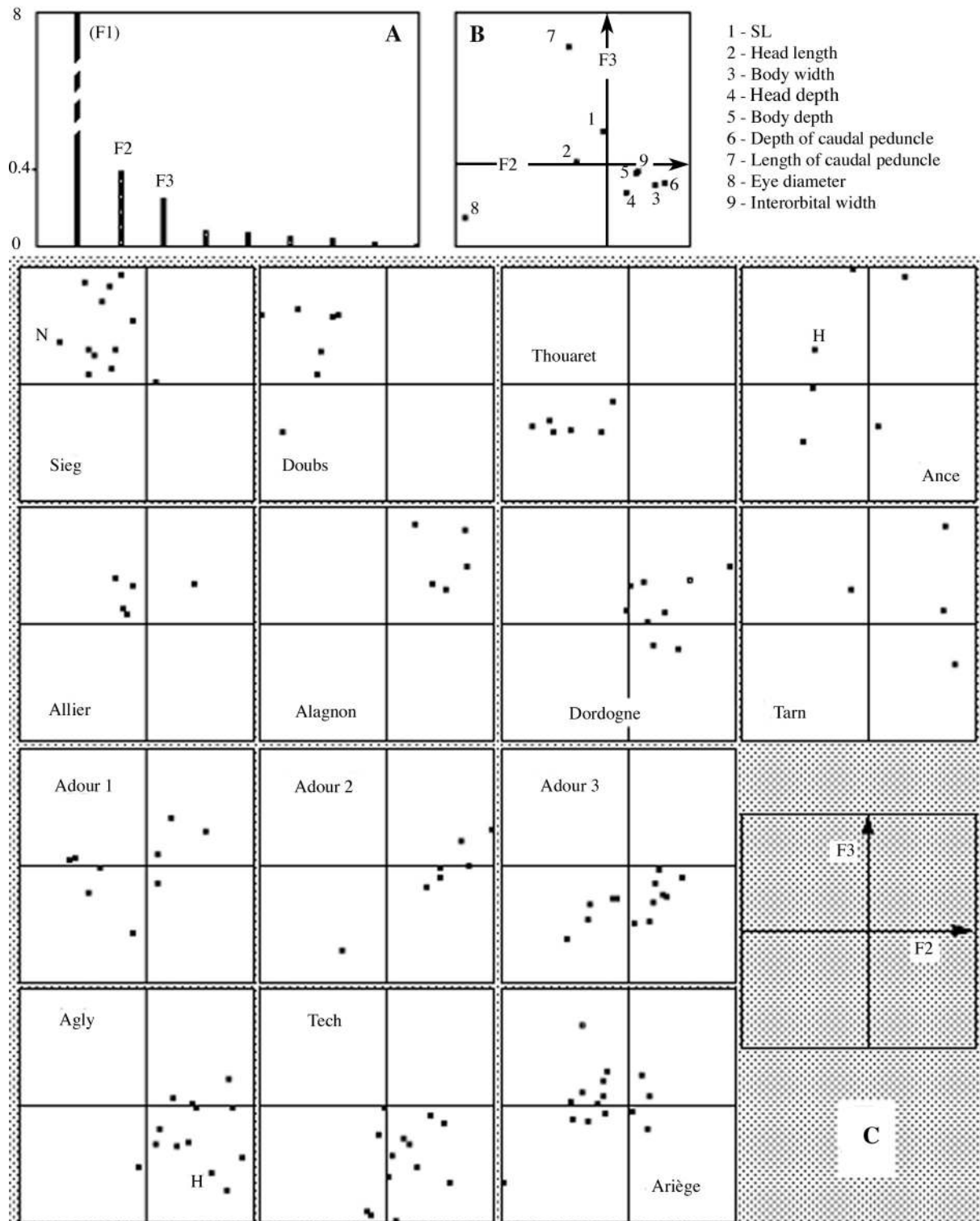


Figure 10. - Principal Component Analysis on morphometric data of *Gobio* specimens, all species pooled. **A**: Eigenvalue graph; **B**: Contribution of variables on factorial graph F2 x F3; **C**: Factorial graph F2 x F3 of individuals split in 14 sub-graphs according to the locations. *Gobio gobio*: Rhine, Rhône, Thouaret (lower Loire); *G. alverniae*: Ance, Allier, Alagnon, Dordogne, Tarn; *G. lozanoi*: Adour 1-3; *G. occitaniae*: Agly, Tech, Ariège. H: holotype; N: neotype. [Analyse en Composantes Principales des données morphométriques des spécimens de *Gobio* toutes espèces confondues. **A** : Graphe des valeurs propres ; **B** : Contribution des variables sur le plan factoriel F2 x F3 ; **C** : Plan factoriel F2 x F3 des individus décomposé par stations (14 populations). *Gobio gobio* : Rhin, Rhône, Thouaret (Loire inférieure) ; *G. alverniae* : Ance, Allier, Alagnon, Dordogne, Tarn ; *G. lozanoi* : Adour 1-3 ; *G. occitaniae* : Agly, Tech, Ariège. H : holotype ; N : néotype.]

Rhine and Rhône are well congruent, in the same corner; while the Thouaret sample looks somewhat different, it shares with them the position in the left side of the factorial graph. The *G. alverniae* populations are more variable, with some drainage specificity. However, globally they are not superimposed on the *G. gobio* populations. The *G. occitaniae* populations from Agly and Tech (adjacent drainages on the Mediterranean slope) agree rather well, while the Ariège population is slightly different. In *G. lozanoi* (Adour), populations 2 and 3 are rather congruent, while the individuals from population 1 appear more diverse.

Globally, this analysis confirms that the 4 species differs despite the intra- and inter-populations variability. Further, the scattered distribution of specimens in some graphs suggests a possible excessive within population variability that might trace ancient or more recent introgressions due to either natural range overlaps (range expansion) and/or stockings. Such introgressions blur the morphometric discrimination.

Comparison with eastern European species

Using the key in Banarescu (1999), *G. alverniae* and *G. occitaniae* key out as *G. g. kovatschevi*, a “subspecies” recorded from the Provadiiska River, a Black Sea tributary in southeastern Bulgaria, and southern Crimea; *G. lozanoi* keys out as *G. g. ohridanus*, a “subspecies” from Lake Ohrid (Macedonia and Albania). Although geographically very distant and unlikely to be conspecific with the species described here, a few words on these two taxa are justified. Subspecies are not recognised under the species concept used here [PSC] and Kottelat (1997) listed both *G. g. kovatschevi* and *G. g. ohridanus* in the synonymy of *G. gobio*; this requires re-examination.

Gobio kovatschevi (Fig. 11) inhabits the Provadiiska River and adjacent drainages in southeastern Bulgaria and we tentatively consider them as a diagnosable lineage, thus a species under the PSC. We have recently examined fresh material of *G. kovatschevi*, which confirms this hypothesis (also confirmed by molecular data; Freyhof, ms., pers. comm., 2003). This species will soon be rediagnosed elsewhere (Kottelat and Freyhof, ms.). Banarescu (1999) also refers populations from Crimea to *G. kovatschevi*. This is quite an intriguing distribution, paralleled by no other known fish species, but recent surveys have shown that the Crimean populations actually represent different taxa (Freyhof, ms., pers. comm., 2003).

A recurrent difficulty when analysing fish diversity and distribution in western Europe is that it is often difficult to ascertain whether a given population is really native. This is especially true when several small-sized species have been confused under a single name and the “species” has been widely transported, stocked or accidentally released, often without written record. Not only French populations/species

of *Gobio* have been much transplanted around France, but also there have been a number of importations from Italy and eastern Europe. To our knowledge, there have never been imports of this genus from Bulgaria, Ukraine and Russia. Old museum material could be useful to determine whether a species is native or not to a given drainage. Unfortunately there are only very few samples of *G. alverniae*, *G. occitaniae* or in fact any gudgeon from southern France in the collections of major museums. MNHN 1986-0820 demonstrates that *G. alverniae* was present in Lot drainage in 1968. MNHN 1986-0821 demonstrates that *G. occitaniae* did exist in Hérault drainage in 1964 and MNHN 1986-0819 that it was present in Aude drainage in 1967.

Gobio lozanoi is distinguished from *G. ohridanus* (Fig. 12) by a very different appearance, a shorter head (head length 25.2-30.7% SL, vs 30.1-33.5), $\frac{1}{2}$ scale rows between lateral line and dorsal origin (vs $\frac{1}{2}$ 6), 3-3 $\frac{1}{2}$ scale rows between lateral line and pelvic origin (vs 4-5), a flat to convex interorbital area (vs markedly concave) and the absence (vs presence) on the back of irregular dark blotches somewhat smaller than midlateral blotches. There is a possibility that *G. ohridanus* is present in some French waters. In June 2002, fishermen on Lake Ohrid in Macedonia informed MK that *G. ohridanus* had regularly been harvested alive and exported to France. One of the most common fish in Lake Ohrid is *Pachychylon pictum*, a species which appeared in France in the Garonne drainage in 1987 (Tales *et al.*, 1997) from unknown origin; it could easily have been present in shipments of *G. ohridanus*.

Gobio in western Europe

The existing data on the different “populations” or “subspecies” of *G. gobio* sensu Banarescu (1999) are too heterogeneous and not detailed enough to allow a re-analysis of all European *Gobio* species. Also, we do believe that this is only feasible by direct comparison and not by the compilation of published data, and that the compared material should be of similar preservation state (many old – and not so old – museum holdings are useless for most purposes; many recent museum holdings are simply useless because they have been fixed or handled carelessly, without thoughts at the meaning or the use of museum collections). For example, the discussion of the Morava specimens by Banarescu (1999) is based solely on a scale count recorded by Soric and Ilic (1987). Comparison of Soric’s data for species in other genera (e.g., Soric, 1983) with those in the literature shows that his lateral line scale counts are smaller by 2-3 scales than those of other authors, apparently the result of the use of different methods. A revision of all European *Gobio* is clearly beyond the scope of the present study.

Although most authors (Lozano-Rey, 1935; Bernet, 1960; Coelho, 1981) reported that Spanish *Gobio* result from

introductions, Doadrio (2001) considers that there are two distinct groups of populations in Spain, an apparently native one in the Ebro and Bidasoa drainages, and an introduced one in most other drainages. We have examined 2 specimens from the Ebro (CMK 16996; unfortunately without precise locality data) characterized by a short and deep caudal peduncle (length 18.9-20.2%SL, depth 11.0-11.2% SL and 1.7-1.8 times in length), 36+3 and 37+2 lateral line scales, $\frac{1}{2}5$ and $\frac{1}{2}6$ scale rows between lateral line and dorsal origin, 12-14 circumpeduncular scale rows, the scales on belly not extending forward beyond base of posterior pectoral-fin rays, a flat interorbital area, long barbels, which apparently distinguish them from *G. gobio*, *G. alverniae* and *G. occitaniae* and give them a physiognomy similar to that of our material from Adour. Doadrio and Madeira (2004) have now identified the Adour populations as conspecific with their *G. lozanoi* from Spain, based on molecular data. They do not, however, provide morphological data allowing to compare the Adour and the Iberian populations.

Gobio benacensis of the Po drainage has been considered as a distinct species by Bianco (1994, 1995) and Kottelat (1997). It is distinguished from all other European *Gobio* species (except the Greek *G. feraeensis*) in having only 3 scales between anus and anal-fin origin (vs 5) (Bianco and Taraborelli, 1984; Pizzul *et al.*, 1993; M. K., pers. obs.). Molecular data suggest that *G. benacensis* does not even have close relationships with other *Gobio* species (Freyhof, pers. comm., 2002).

On “ecological variation”

Banarescu (1999) commented that *G. gobio* is a variable species and provided as evidence a collection of tables of measurements and counts compiled from a variety of sources. Many of the tables show sets of data in different combinations of characters, making a real comparison very tedious, not to mention uncertainties about the compatibility of methods used by the different sources. Rightly, Banarescu commented that “geographical and ecological variation must be distinguished”, but he distinguishes ecological variation only in material from Romania and England for which he segregates data of “rheophilic” and “limnophilic” populations. Banarescu did not define his use of the words “rheophilic” and “limnophilic” populations and he did not provide information on the habitat type for populations from other areas and this further reduces the usefulness of the tables.

“Ecological variation” reported by Banarescu from Romania are greater depth of caudal peduncle and body, shorter caudal peduncle, paired fins and barbels, less intense and paler coloration and more rounded caudal lobes in “limnophilic” populations. Stated this way, all these characters (except coloration) could suggest that the pairs *G. gobio*-*G. alverniae*, *G. gobio*-*G. occitaniae* and *G. gobio*-*G. lozanoi*

could in fact be merely “rheophilic” and “limnophilic” populations of a single species. To be valid, such a comparison should be made among specimens or populations belonging to the same lineage. In the present case, as the different species partly occur in different drainages which have been isolated for long, they do not belong to the same lineage, and such a comparison would be pointless. We nevertheless note that our samples of *G. alverniae*, *G. lozanoi* and part of the *G. occitaniae* (which have the “limnophilic” physiognomy) were obtained in habitat with steeper gradient, faster current, coarser substrate than *G. gobio* (which has the “rheophilic” physiognomy) and this negates the hypothesis and/or the terminology. We cannot know whether the *G. alverniae*, etc., habitats would be called “rheophilic” by Banarescu, but they certainly have a much more “rheophilic” character than the *G. gobio* habitats. *Gobio alverniae* or a similar-looking species/population has not been observed in the Rhône drainage yet.

Further, we note that the order of magnitude of the differences exhibited by the Romanian “rheophilic” and “limnophilic” populations is much lower than implied by the wording used. It is also much lower than the differences we report between the different species we describe here. Banarescu (1999) claimed that the depth of the caudal peduncle (his minimum body depth) is greater in “limnophilic” than in “rheophilic” populations from Romania. His table 20 shows that this depth is 8.4-10.9% SL in “limnophilic” populations vs 8.7-10.7 in “rheophilic” ones. To us, this is not a difference but a broad overlap; even the mean values overlap (9.4-9.8 in “limnophilic” populations, vs 9.4-9.6 in “rheophilic” populations). The differences that we report between *G. alverniae* and *G. gobio* are much wider and with partial overlap only (9.5-12.5% SL, vs 8.7-10.5). The same comment applies to the difference in body depth, length of caudal peduncle, lengths of paired fins and length of barbel. The difference in coloration is better related to water turbidity and substrate type than to “rheophilic” vs “limnophilic” habitats.

Banarescu also reported similar differences between British populations of *G. gobio* and here again the order of magnitude of the differences is much lower than the one we report between the two species. On the other hand, we note that our samples of *G. gobio* s.s. from swift waters (e.g., the Doubs population; Fig. 1B) have a more slender habitus than those from sluggish waters (e.g., the Thouaret population; Fig. 1C), although it remains to demonstrate that this difference is due to different habitats rather than to geographic variability.

The samples of *Gobio* from the middle and lower Danube examined by Freyhof and M. K. (unpubl.) suggest that several species occur in this drainage.

Species status

As argued by Mayden (2002), species are individuals (a specific type of entity as defined by philosophy) and form lineages; this means that they can be diagnosed at a given time. It is not possible to give a definition of a given species because this definition cannot appreciate the evolution of traits (the lineage existed before and will exist later, but some of the traits were or will be different than those of today's representatives). Because they cannot be defined, clear cut boundaries are inherently difficult to establish and they may often appear fuzzy. But because they are lineages, species can be characterised (diagnosed) on the basis of heritable attributes that provide evidence of lineage independence. [NB: diagnosis and description are not synonyms].

The similarity between *G. occitaniae* and *G. alverniae* suggests that they are sister-species. Most characters distinguishing the two species exhibit some variability and it is legitimate to question whether the recognition of two species is justified. No species concept requires a minimum distance; they simply demand that the entities correspond to natural lineages and be diagnosable. As their respective distributions are disjunct (despite some overlaps in the Garonne drainage), the two groups of populations belong to distinct lineages and, as they are diagnosable, they are species under the species concept used here. That there might be introgression in part of the range does not negate the specific distinctness; at worst it creates a semantic problem as to how to name the concerned populations.

In earlier times, on the basis of fewer and more widely distributed samples (often not very well fixed and of disparate sizes), differences as reported here would have been interpreted as variation within a single species (or maybe as a polytypic species, sensu Mayr, e.g., 1969). The examination of larger and better samples of specimens of similar sizes shows that where there is variability for given traits, this variability is not random and that within an hypothesized lineage this variability is identical.

To take an example, the character "number of transverse scale rows on caudal peduncle" may have several traits: A $1/2/1/2^{1/2}$, B $1/2/1/3^{1/2}$, C $1/2/3/1/2^{1/2}$, D $1/2/3/1/3^{1/2}$. Some species exhibit a single trait: *G. gobio* trait A, *G. alverniae* trait D. Others exhibit several trait: *G. lozanoi* states A and C, *G. occitaniae* traits A, C and D (rare traits are ignored to simplify the discussion; they usually seem to result from some anomaly in the development of the scales, like injuries, etc.). The presence of a single trait is diagnostic for *G. gobio* and *G. alverniae*, while the presence of two traits is diagnostic for *G. lozanoi* and the presence of three traits is diagnostic for *G. occitaniae*. In the hypothesized sister species *G. alverniae* and *G. occitaniae*, in the absence of a phylogenetic framework, it is not possible to determine the polarity of the evolution of the traits, thus to decide

whether the presence of traits D in *G. alverniae* and traits A, C and D in *G. occitaniae* is because traits A and C have been acquired by *G. occitaniae* or lost in *G. alverniae*. Other characters may be discussed the same way.

A literature survey suggests that the dark overall coloration, the poorly contrasted and fuzzily outlined mid-lateral blotches, their large size seem to be synapomorphic for the pair *G. alverniae*-*G. occitaniae*. The markedly concave interorbital area seems to be autapomorphic for *G. alverniae*.

Evolutionary scenarios

There is not sufficient enough data yet to construct a phylogeny of the genus *Gobio* and a phylogeny based on a few species only would not make sense, and zoogeographic considerations without a phylogeny have only limited interest. Nevertheless, the wide distribution of *G. gobio* in northern Europe suggests that this area was colonised after the last glaciation. There is no data allowing to decide whether the colonisation was from the West or from the East. The usual credo is that recolonisation was from a lower Danubian refugium (e.g., Banarescu, 1992), based on the assumption that northern European waters are inhabited by the same species as the Danube. Molecular data contradict this hypothesis; in addition, two distinct lineages seem to co-occur in the lower Danube drainage (Freyhof, ms., pers. comm., 2002).

The restricted distribution of *G. alverniae*, *G. occitaniae* and *G. lozanoi* in southwestern France (and northern Spain) suggests that they have been isolated in their respective drainages since at least the last interglacial. The respective ranges of *G. alverniae* and *G. occitaniae* have certainly fluctuated since the last glaciations, probably first expanding or shifting northwards, until contacting the westward expanding *G. gobio*. There is probably some introgression between these species, but we have not found populations that we could unambiguously identify as resulting from introgression of *G. gobio* and *G. occitaniae* or *G. gobio* and *G. alverniae*. This is possibly an artefact resulting from the low density of sampling points in critical areas. Material from tributaries of the lower Rhône (Ardèche, Durance) could be informative. The patterns anyway are potentially blurred by the anarchic introductions and translocations of numerous populations and species (introductions by individuals, angler societies, administrations are notorious, although not recorded and not traceable) (Kiener and Ollier, 1970; Brunet and Hoestlandt, 1972; Kiener *et al.*, 1981; Kiener, 1985; M. K., pers. obs., 2002, 2003, 2004).

With the available data, we cannot entirely eliminate the hypothesis that there is an introgression between *G. occitaniae* and *G. alverniae* in the upper reaches of the Dordogne, Lot and Tarn drainages where we obtained individuals identifiable as *G. alverniae* but with diagnostic characters not as

sharply marked as in the Loire populations. Again, it is presently impossible to be certain that this is the result of a natural process or the result of introduction, or of recent range expansion following habitat alteration.

Fish endemism in southern France

The pattern emerging from a critical re-examination of taxa formerly believed to have a pan-European distribution is the presence of one or a few species with a wide distribution in northern Europe (to put it simply, the North and Baltic Sea drainages) while the Mediterranean and Black Sea drainages, and southern Atlantic drainage, are inhabited by a number of species with localised ranges, often one or several in each of the Iberian, Appennine and Balkanic peninsulas whose fish fauna consists mainly of endemic species. This high endemism rate is explained by historical factors. During each glacial period, most of the aquatic fauna of northern Europe was wiped out while it survived in isolation in the different drainages of southern Europe (see, e.g., Banarescu, 1992). In the interglacial periods, northern Europe was colonised again. This recolonisation is generally assumed to have been from the east as the Pyrénées and the Alps prevented communications between the southern and northern drainages (see, e.g., Thienemann, 1950; Banarescu, 1992; Durand *et al.*, 1999, 2000). In fact some recolonisation from the west should not be completely ruled out as refugia could have existed north of the Pyrénées as most of France was not glaciated (Debrand-Passard and Courbouleix, 1984; Persat and Berrebi, 1990; Persat and Keith, 1997, 2001; see also map in Banarescu, 1992).

The only area of southern Europe not fitting this endemism pattern is southern France. Southern France is drained by the Garonne, Adour and a few smaller drainages on the Atlantic slope, and by the Rhône and several short coastal streams on the Mediterranean slope. One therefore expects that, as other southern European drainages, they are inhabited by a number of endemic species. In recent ichthyological literature (e.g., Spillmann, 1961), a single endemic species is recorded for this area, *Zingel asper* in the Rhône drainage (Collette, 1997). If the distribution of some of the species inhabiting the Mediterranean drainages of France has been re-examined more accurately by Changeux and Pont (1995), their potential endemism has not been investigated. In the Garonne and Adour drainages, *Leuciscus burdigalensis* and *L. bearnensis* were considered as distinct in the XIXth century (e.g., Blanchard, 1866) but treated as synonyms of *L. leuciscus* in the XXth century (e.g., Keith and Allardi, 2001); they are distinct species (M. K., unpubl. data). *Chondrostoma toxostoma* was considered as distributed throughout southern France and northern Iberian peninsula, and subdivided into a number of subspecies; these are now treated as species (Elvira, 1987; Kottelat, 1997), with *C. toxostoma* north of

the Pyrénées. *Barbus meridionalis* has a somewhat similar range, but extends on a part of the Spanish Catalonia (Berrebi *et al.*, 1988; Persat and Berrebi, 1990; Doadrio, 2001). *Cottus petiti* was described from the Lez drainage near Montpellier (Bacescu and Bacescu-Mester, 1964) but until very recently (Persat *et al.*, 1996; Kottelat, 1997) its existence was not negated, but flatly overlooked.

In recent years, a variety of genetic studies have shown the presence of populations with particular genetic characters in several species from France but have not linked these with taxonomic diversity (e.g., Guyomard, 1989; Eppe *et al.*, 1999; Aurelle and Berrebi, 2001; Volckaert *et al.*, 2002; Weiss *et al.*, 2002; Salzburger *et al.*, 2003). In most cases, the idea of taxonomic diversity was not even envisioned. Morphological differences between such populations were negated without even been analysed, or despite existing previous analysis, however (un)satisfactory they might have been.

The existence of three species of *Gobio* endemic to southern France and unpublished information we are accumulating on other genera show that France is no exception in the endemism pattern observed in southern Europe. It also shows that the number of endemic species is significantly underestimated and this has an obvious impact on the conservation status of many “species” for which our perception has to move from “unthreatened widely distributed species” to an assemblage of “endemics with more or less narrow ranges and more sensitive to potential threats”, as already envisioned by Persat and Keith (2002).

Comparative material

Gobio ohridanus. - CMK 17382, 12 ex., Macedonia, Lake Ohrid. - *G. kovatschevi*, CMK 18354, 10 ex., Bulgaria, Provadiiska River.

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