

Gobioid fishes from the north eastern Atlantic and the Mediterranean: new records and rarely found species

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Abstract

New records and new depth ranges are given for the following gobiid species from the north-eastern Atlantic and the Mediterranean: *Corcyrogobius liechtensteini*, *Didogobius splechnai*, *Gobius niger*, *Gobius gasteveni*, *Gobius roulei*, *Lesueurigobius friesii*, *Lesueurigobius suerii*, *Odondebuena balearica*, *Pomatoschistus norvegicus* and *Vanneaugobius dollfusi*. *Gobius gasteveni* was found on the south and south-western coast of Spain and is a new faunal element for the Mediterranean. *Vanneaugobius dollfusi*, before known only from six specimens from the eastern Atlantic and the Adriatic, is reported from an additional 28 specimens from the Adriatic and Aegean.

Key words: Gobiidae; Atlantic - Mediterranean; new records; habitats; distribution.

Zusammenfassung

Für folgende Gobiidenarten des Nordost-Atlantiks und des Mittelmeeres werden Neunachweise bzw. neue Tiefenangaben gegeben: *Corcyrogobius liechtensteini*, *Didogobius splechnai*, *Gobius niger*, *Gobius gasteveni*, *Gobius roulei*, *Lesueurigobius friesii*, *Lesueurigobius suerii*, *Odondebuena balearica*, *Pomatoschistus norvegicus* und *Vanneaugobius dollfusi*. *Gobius gasteveni* wird erstmals von der Süd- und Südwestküste Spaniens nachgewiesen und stellt ein neues Faunenelement für das Mittelmeer dar. *Vanneaugobius dollfusi*, bisher nur von sechs Exemplaren aus dem Ostatlantik und der Adria bekannt, wird mit weiteren 28 Exemplaren aus der Adria und der Ägäis dokumentiert.

Introduction

QUIGNARD & TOMASINI (2000) listed 25 genera and 60 species of Gobiidae for the Mediterranean Sea *sensu stricto*, the most speciose fish family and the one with the highest number of endemics (25 species). Since the work of these authors, three more gobiid species have been reported as new for the Mediterranean: *Gobius gasteveni* MILLER (this study), *Gobius kolombatovici* KOVACIC & MILLER (KOVACIC & MILLER 2000) and *Vanneaugobius dollfusi* BROWNELL (PALLAORO & KOVACIC 2000). On the other hand two species listed by QUIGNARD & TOMASINI (2000) should be excluded: *Gobius arenae* BATH, synonymized with *Gobius geniporus* VALENCIENNES in CUVIER & VALENCIENNES by MILLER (1986) and *Benthophilus stellatus* (SAUVAGE), which is endemic to the Ponto-Caspian area. Thus today 61 gobiid species are known to occur in the Mediterranean *sensu stricto*.

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Recent studies of the gobiid fauna of the Mediterranean have resulted in descriptions of new species (HEYMER & ZANDER 1992, MILLER 1992, AHNELT & PATZNER 1995, KOVACIC & MILLER 2000), records of rarely found or rare species (for example GRAMITTO 1993, AHNELT & PATZNER 1996, KOVACIC 1997, SCSEPKA & AHNELT 1999, STEFANNI & MAZZOLDI 1999, PALLAORO & KOVACIC 2000) and a better knowledge of the life styles of several species, for example discovery of cave dwelling gobies (AHNELT & PATZNER 1995, 1996, HERLER & al. 1999) or facultative associations of gobies with sea urchins (AHNELT & PATZNER 1996, PATZNER 1999a, b). Most data on gobies are available for species occurring in shallow inshore waters to 100 m (KINZER 1960, MILLER 1986, ZANDER 1996, KOVACIC 2001a, b). However, gobies seemingly settle in deeper areas than is often assumed (WEBB 1980, GUEMES & al. 1994, SANCHEZ & al. 1995, this study).

Today the faunal composition of the Mediterranean Sea is changing, e.g. by the invasion of exotic species (summarized in QUIGNARD & TOMASINI 2000). Reasons for these changes may be numerous and could indicate changes in temperature, salinity, currents etc. But also invasions mediated by ships could contribute to the dispersal, especially of gobies, e.g. by ballast-water. Gobies are worldwide the most often documented invaders due to unintentional ship transport (WONHAM & al. 2000). Nevertheless, there is still little information on the biology, ecology and habitats of many gobiid species from the Mediterranean and the Atlantic, and even their distribution is often only incompletely known (summarized in KOVACIC 2001b).

Materials and Methods

Material listed below is mostly based on results from the following expeditions: the Austrian-Hungarian Deep-Sea Expeditions in the eastern Mediterranean (16 July – 5 October 1893) and in the Adriatic Sea (31 May – 1 August 1894) and the sampling cruises of the Fauna Iberica programme which covered the Atlantic and Mediterranean coasts of north and south Spain and the waters around the Balearic Islands (Fauna I, July 1989; Fauna II, June - July 1991; Fauna III, June - July 1994). Common species collected during the Fauna I - III cruises and available for this study are listed completely, if noteworthy data (for example extension of geographic range, new depth range) are provided from at least one sample. Some collections of *Deltentosteus quadrimaculatus* and *Gobius niger* from the Fauna I cruise are published by GUEMES & al. (1994) but are partly misidentified. These samples are included in this study. For an easier identification of stations, whether they are from the Atlantic or from the Mediterranean, following acronyms are used: ADR (Adriatic Sea), ATL (north eastern Atlantic) or MED (Mediterranean Sea).

Values given for preserved specimens of the following species are: collection number, number of specimens, sex, standard length + caudalis length in mm (d = damaged), sampling site, date, field or station number (if available), name of collector(s).

Institutions: IZUW = Institut für Zoologie, Universität Wien. NMW = Naturhistorisches Museum Wien. MNCN = Museo Nacional de Ciencias Naturales, Madrid.

Results

Corcyrogobius liechtensteini (KOLOMBATOVIC, 1891)

1 specimen. MNCN 107514, 1 female, 14.8+4.2, MED, Spain, Balearic Islands, Cabo Menorca, Mallorca, 39°52.31'N, 3°11.57'E, 0 - 22 m, 27 June 1994, F191B, Fauna III.

This tiny goby was first reported from the central Adriatic Sea (KOLOMBATOVIC 1891). In 1970 a single specimen was found in a submerged cave near Marseille (France) but was misidentified as *Gammogobius steinitzi* BATH, 1971 (SCSEPKA & AHNELT 1999). *C. liechtensteini* is a cave dwelling species which occupies the ceilings and walls of caves (AHNELT & al. 1994, HERLER & al. 1999). Because of its cryptic life style this tiny goby is easily overlooked and from the western Mediterranean to date is known only from the Balearic Island of Ibiza (AHNELT & al. 1994; AHNELT & PATZNER 1996) and from Elba (Tyrrhenian Sea) (AHNELT & al. 1998). *C. liechtensteini* is now also reported from a second Balearic island, Mallorca.

The specimen is characterized by: Fins: D1 VI, D2 I/9, A1/8, P 15, VI/5+5/I, pelvic disc emarginate. Coloration: distinctive branchiostegal spot present.

Deltentosteus quadrimaculatus VALENCIENNES in CUVIER & VALENCIENNES, 1837

30 specimens. MNCN 73654 - 73664, 6 males, 32.3+6.9 - 63.1+11.9, 2 females, 40.2+d - 63.7+12.2 and one head, MED, Spain, Prov. Malaga, Rincon de la Victoria (Velez), 36°40.34'N, 4°11.55'E - 36°40.40'N, 4°7.36'E, 60 m, sand with mud, 10 July 1989, F4A, Fauna I. MNCN 73681 - 73683, 1 male, 67.7+12.6 and 2 females, 54.6+11.2 - 67.7+13.1, same data, Velez, 36°41.93'N, 4°4.88'E - 36°41.36'N, 4°7.36'E, 67 - 68m, mud, 10 July 1989, F5A, Fauna I. MNCN 73971 - 73973, 1 male, 64.0+13.1 and 2 females, 56.5+11.6 - 58.8+d, MED, Spain, Prov. Granada, La Herradura, 36°41.26'N, 3°43.15'E - 36°42.03'N, 3°43.63'E, 84 - 96 m, sand and mud, 10 July 1989, F7A, Fauna I. MNCN 73996 - 73997, 2 males, 67.6+12.3 - 1damadged, MED, Spain, Prov. Malaga, opposite Marbella, 36°24.32'N, 4°55.11'E - 36°24.70'N, 4°57.70'E, 130 - 164 m, detritus, 13 July 1989, F21A, Fauna I. MNCN 74074 - 74077, 3 males, 30.2+ - 33.6+d, ATL, Spain, Prov. Huelva, opposite La Redondola, 37°7.8'N, 7°12.27'E - 37°8.91'N, 7°13.50'E, depth ? [22 m (GUEMES & al. 1994)], muddy sand, 23 July 1989, F70A, Fauna I. MNCN 74285 - 74287, 2 males, 64.7+12.6 - 67.5+12.8, 1 female, 59.4+12.5, MED, Spain, Prov. Malaga, Cabo Sacratif (Motril), 36°41.10'N, 3°29.41'E - 36°41.88'N, 3°31.18'E, 62 - 64 m, rocks, 11 July 1989, F12A, Fauna I. MNCN 78553, 1 female, ATL, Spain, Prov. Vizcaya, N of Cabo Santa Catalina (Bilbao), 43°25.29'N, 2°31.5'E - 43°25.9'N, 2°29.83'E, 82 - 86 m, sand, 22. June 1991, F151A, Fauna II. MNCN 107620, 1 male, 66.5+13.3, MED, Spain, Balearic Islands, Prov. Mallorca, Cabo Nati, NE of Menorca, 40°05.41'N, 3°40.76'E - 40°06.14'N, 3°44.41'E, 149 - 153 m, muddy sand, 28 June 1994, F202A, Fauna III. MNCN 107810 - 107811, 1 male, 57.6+11.7 and 1 female, 58.7+12.0, same data, SE of Mallorca, 39°15.20'N, 2°53.60'E - 39°12.80'N, 2°55.20'E, 87 - 90 m, detritus, 02 July 1994, F227A, Fauna III. MNCN 107869 - 107870, 1 male, 62.4+12.8 and 1 female, 35.2+8.2, same data, opposite Isla de Torro, 39°24.30'N, 2°24.30'E - 39°24.30'N, 2°20.73'E, 111 - 113 m, detritus and mud, 04 July 1994, F231A, Fauna III. MNCN 108104, 1 male, 67.4+13.6, same data, Prov. Formentera, SE of Formentera, 38°35.53'N, 1°32.33'E - 38°37.24'N, 1°34.52'E, 122 - 128 m, muddy sand, 06 July 1994, F242A, Fauna III. MNCN 108346, 1 male, 60.2+12.6, same data, NE of Formentera, 38°47.57'N, 1°20.10'E - 38°45.17'N, 1°18.97'E, 92 m, bottom unknown, 08 July 1994, F252A, Fauna III. MNCN 108432 - 108437 [out of MNCN 108432 - 108440], 5 males, 60.3+d - 66.9+13.2 and 1 female, 61.1+12.1, MED, Spain, Prov. Castellon, 28 mi S of Placer de Barra Alta (Isla Columbretes), 39°40.61'N, 0°28.40'E - 39°40.44'N, 0°30.85'E, 110 - 113 m, bottom unknown, 11 July 1994, Fauna III. MNCN 108475 - 108478, 2 males, 56.9+12.1 - 63.7+12.5 and 2 females, 54.0+10.8 - 68.4+12.7, MED, Spain, Prov. Castellon, Columbretes, 39°49.65'N, 0°37.57'E - 39°52.56'N, 0°37.59'E, 82 - 86 m, same data.

Except for one specimen from the Bay of Biscay near Bilbao (Atlantic) and four specimens from southern Spain, off La Redondela (Atlantic), all specimens of *D. quadrimaculatus* were collected in the Mediterranean at the Balearic Islands and near the coast of the Iberian Peninsula. MILLER (1986) gives a maximum depth range of 90 m for this species. In the western Mediterranean it seems most abundant in shallow waters between 30 - 50 m (DEMESTRE & al., 2000). Owing to their depth ranges two collections from the Fauna I and the Fauna III expeditions are noteworthy, the first from between 149 - 153 m (MNCN 107620) at Menorca and the second from between 130 - 164 m (MNCN 73996 - 997) near Marbella. For the latter collection GUEMES & al. (1994) give a depth of 146 m, possibly the mean value from the lowest and highest point between which the trawling was carried out.

This goby is characterized by: Fins: D1 V - IV (V:1, VI: 29), D2 I/7 - 10 (7: 1, 9: 28, 10:1), A I/9 - 10 (9: 28, 10:2), P 18 - 20 (18: 19, 19: 8, 20: 3). Scales: LL 33 - 36 (33: 1, 34: 8, 35: 14, 36: 5, d: 2). These data fit well with MILLER (1986) except for the pectoral fin ray count and the numbers of the scales in lateral series which have both a somewhat higher range in the present material: P 18 - 20 vs P 17 - 18 fin rays and LL 33 - 36 vs LL 33 - 35.

Didogobius splechnai AHNELT & PATZNER, 1995

1 specimen. MNCN 107992 [out of MNCN 107992 - 108042], 1 female, 14.7+4.3, MED, Spain, Balearic Islands, Ibiza, 38°54.07'N, 1°31.14'E - 38°56.29'N, 1°32.77'E, 55 - 56 m, mud, 5 July 1994, F238A, Fauna III.

Didogobius splechnai has been found 1991 at Ibiza (AHNELT & PATZNER 1995), 1996 at Lampedusa south of Sicily (Italy) (STEFANNI 1999), 2000 at Elba (Tyrrhenian Sea) and 2001 at Pula (northern Adriatic) (HERLER & PATZNER 2002). Most records are from submerged caves, but the specimen from Lampedusa (pit covered with gravel), from Elba (among rhizomes of *Posidonia*) and the present specimen (mud bottom) have been collected outside caves. Seemingly this goby occurs outside of caves regularly. *D. splechnai* is reported from a maximum depth of 40 m (PATZNER 1999b). The present specimen was collected at 55 - 56 m, together with *Odondebuena balearica* (PELLEGRIN & FAGE, 1907) (MNCN 107993 - 108042).

Gobius gasteveni MILLER, 1974

22 specimens. MNCN 73576 - 73579, 3 males, 49.8+13.0 - 53.7+13.3, 1 female, 48.7+12.2, ATL, Spain, Prov. Cadiz, opposite Trafalgar, 36°23.58'N, 6°37.27'E - 36°22.79'N, 6°36.30'E, 114 - 116 m, detritus, 9 July 1989, F3A, Fauna III. MNCN 74036, 1 female, 51.1+13.5, MED, Spain, Prov. Almeria, Sea of Alboran, Isla de Alborán, 35°57.80'N, 3°0.10'E - 35°57.60'N, 3°0.80'E, 70 - 74 m, stones, F17A, 12 July 1989, Fauna I. MNCN 74214 [out of MNCN 74212 - 74214], 1 male, 51.5+12.0, ATL, Spain, Prov. Huelva, opposite Redondela, 37°7.8'N, 7°12.27'E - 37°8.91'N, 7°13.50', 82 - 96 m, muddy sand, F0A, 7 July 1989, Fauna I. MNCN 74417, 1 male, 58.4+15.9, ATL, Spain, Prov. Almeria, Sea of Alboran, Isla de Alboran, 35°57.80'N, 3°0.10'E - 35°57.60'N, 3°0.80'E, 70 - 74 m, stones, F17A, 12 July 1989, Fauna I. MNCN 79218 - 79219, 2 males, 50.1+12.6 - 52.2+13.1, ATL, Spain, Prov. La Coruna, north - east of Punta Candelaria, 43°45.13'N, 8°10.9' - 43°46.53'N, 8°9.59'O, 116 - 120 m, coralligene grounds, *Madrepora oculata*, 27 Jan. 1991, F169A, Fauna II. MNCN 107983 - 107984, 1 male, 46.6+11.9, 1 female, 40.8+10.7, MED, Spain, Balearic Islands, east of Island Ibiza, 38°54.07'N, 1°31.14'O - 38°56.29'N, 1°32.77'O, 55 - 56 m, mud, 5 July 1994, F238A, Fauna III. MNCN 108309 - 108315, 3 males, 34.1+9.8 - 473+12.2, 4 females, 39.4+10.6 - 48.5+12.5, same data, south - east of Island Formentera, 38°39.27'N, 1°20.47'O - 38°36.70'N, 1°20.03'O, 63 - 66 m, substrate undetermined, 8 July 1994, F250A, Fauna III. MNCN 108316 - 108317, 1 male, 39.6+11.1, 1 female, deformed, same data.

Gobius gasteveni is here reported as a species new to the Mediterranean fauna. It was previously known from widely distant sites in the north-eastern Atlantic, the English Channel and north-eastern Spain in the north, Madeira and the Canaries in the south (summarized in ALBERTO & al. 1999). MILLER (1974) suggested the probability that this species may occur in the Mediterranean Sea as well. The records from south-western Spain, Gulf of Cadiz (Atlantic) near the Straits of Gibraltar, connect the two geographically distant sites from which *G. gasteveni* was previously known. The other records are from the Mediterranean, south-east of Malaga (Alboran Island) and from the Balearic Islands. The specimens at La Coruna (NW Spain) are from a depth of 116 - 120 m and those from the Gulf of Cadiz (SW Spain) from 114 - 116 m. In the Atlantic this species is known to occur to a depth of about 180 m (MILLER 1984). In the Mediterranean this goby has been collected in a depth of 55 - 56 m at Ibiza and of 70 - 74 m in the Sea of Alboran. The present data confirm that this species occurs on different substrates (ALBERTO & al. 1999), on soft bottoms such as detritus, mud, muddy sand, sand or on stony grounds. The specimens at La Coruna were collected on coral ground.

This goby is characterized by: Fins: D1 V - VI (V: 1 specimen, VI 21), D2 I/12 - 14 (12: 1 specimen, 13: 5, 14: 16), A I/11 - 13 (11: 1 specimen, 12: 7, 13: 14), P 18 - 21 (18: 3 specimens, 19: 9, 20:8, 21: 2), V I/5+5/I, innermost rays (V 5) in most specimens shorter than V4, thus posterior margin of pelvic disc truncate to emarginate. Scales: LL 41 - 47 (41: 1 specimen, 42: 2, 43: 6, 44:2, 45:7, 46:1, 47:1, d: 2), TR 10 - 13 (10: 4 specimens, 11: 6, 12: 8, 13: 2, d: 2), predorsal 21 - 27 (21: 1 specimen, 22: 1, 24: 1, 25: 3, 26: 6, 27: 4, d: 6), breast 7 - 11 (7: 3 specimens, 8: 2, 9: 6, 10: 3, 11: 5, d: 3). Anterior nostril short, tubular with thin tentacle from dorsal rim. These data are in accordance with MILLER (1974, 1984) and ALBERTO & al. (1999). Because of to collecting techniques the superficial neuromasts of the lateral line system are in most specimens only hardly if at all detectable. ALBERTO & al. (1999) mention variability in certain neuromast rows.

Later authors report associations of *G. gasteveni* with *Gobius niger* LINNAEUS, 1758 and *Lesueurigobius friesii* (MALM, 1874). During the Fauna I - III Expeditions *G. gasteveni* was collected at six localities (see material) but was at one site only (MNCN 74214) associated with *G. niger*. In none of the collections it was associated with *L. friesii*.

***Gobius niger* LINNAEUS, 1758**

8 specimens. MNCN 73676 - 73677 [out of 73676 - 73680, 3 specimens not seen], 2 males, 90.7+21.9 - 105.8+27.1, MED, Spain, Prov. Malaga, Velez, 36°41.93'N, 4°4.88'E - 36°41.36'N, 4°7.36'E, 67 - 68 m, mud, 10 July 1989, F5A, Fauna I. MNCN 73731, 1 male, 73.6+17.4, MED, Spain, Prov. Granada, La Heradura, 36°41.93'N, 3°51.78'E - 36°43.41'N, 3°49.54'E, 70 - 74 m, sand with mud, 10 July 1989, F6A, Fauna I. MNCN 73966 [out of MNCN 73966 - 73967], 1 female, 96.5+21.6, same data, 36°41.26'N, 3°43.15'E - 36°42.03'N, 3°43.63'E, 84 - 96 m, sand and mud, 10 July 1989, F7A, Fauna I. MNCN 74212 - 74213 [out of MNCN 74212 - 74214], 2 males, 65.4+16.4 - 69.2+16.4, MED, Spain, Prov. Huelva, opposite Redondela, 37°7.8'N, 7°12.27'E - 37°8.91'N, 7°13.50', 82 - 96 m, muddy sand, F0A, 7 July 1989, Fauna I. MNCN 74278 - 74282, 1 male, 106.2+25.3 and 1 female, 98.0+21.6, MED, Spain, Prov. Malaga, Cabo Sacratif (Motril), 36°41.10'N, 3°29.41'E - 36°41.88'N, 3°31.18'E, 62 - 64 m, rocks, 11 July 1989, F12A, Fauna I.

Gobius niger is a common species in the eastern Atlantic, the Mediterranean and the Black Sea and is of local commercial importance. It occurs in inshore habitats to a depth of 70 m (MILLER, 1986). Specimens were collected in 84 - 96 m together with

Lesueurigobius friesii (MNCN 73966) and in 82 - 96 m together with *Gobius gasteveni* (MNCN 74214). A record from a depth of 287 m (GUEMES & al. 1994) is based on misidentification of *L. friesii* (see below).

The specimens, all from the Mediterranean Sea, are characterized by: Fins: D1 VI, D2 I/12 - 14 (12: 6, 13: 1, 14: 1), A I/11 - 13 (11: 4, 12: 2, 13:2), P 18 - 20 (18: 6, 19: 1, 20: 1). Scales: LL 39 - 45 (39: 1, 40: 2, 41: 2, 42: 1, 43: 1, 45:1); predorsal area completely scaled, nape scales small and imbricate in five specimens; nape scales small, not imbricate and coverage incomplete in one male (MNCN 73677); predorsal squamation is damaged in two specimens.

MILLER (1986) mentions two subspecies differing in the squamation of the nape, *G. niger niger* (Atlantic) and *G. niger jozo* (Mediterranean and Black Sea). The Mediterranean subspecies is characterized by nape scales which are imbricate and with a complete coverage. This type of squamation has been found in five of six specimens collected in the Mediterranean Sea. A single male (MNCN 73677) displays a type of nape squamation characteristic for the Atlantic subspecies with nape scales small, not imbricate and coverage incomplete. In all other specimens the nape scales are imbricate and generally small. Large nape scales are found only in one collection (MNCN 74278 - 74279). Possibly there is a zone of intergradation between the Atlantic and the Mediterranean populations near the Straits of Gibraltar, but this hypothesis needs to be tested.

ALBERTO & al. (1999) mention associations of *G. gasteveni* and *G. niger*. *G. niger* was collected on four sites during the Fauna I Expedition which investigated the south of the Iberian Peninsula. Three sites are from the Mediterranean Sea, the fourth in the Gulf of Cadiz (Atlantic), where two specimens have been collected together with one specimen of *G. gasteveni*.

***Gobius roulei* (DE BUEN, 1928)**

2 specimens. IZUW uncatalogued, 1 male, 33.3+9.2, 1 juvenile, 18.5+4.8, MED, Spain, Balearic Islands, Ibiza, Portinatx, sand bottom, 22 m, Sept. 1990, R.A. Patzner.

This rarely found goby is known for the Mediterranean from three sites, the north eastern Adriatic Sea, Sardinia and the Balearic Islands (DE BUEN 1928, MILLER 1986, KOVACIC 1995). The two specimens of this study are the first reported from the Balearic Islands since the description of the species.

The two specimens are characterized by: Fins: D1 VI, D2 I/11 - 12, A I/11, P 17 - 18, C 16 - 17 principle rays (adult specimen with 13 branched rays; branching of fin rays not completed in the juvenile specimen); all rays of the first dorsal fin are elongated in the adult specimen (tips pronounced in the juvenile), with D1 III longest. Scales: ctenoid, LL 37, including scales on caudal fin (squamation not completely developed in juvenile specimen), TR 8; head, nape, predorsal area, breast, ventral side of abdomen (midline) and base of P naked; area anterior of a line from the dorsal origin of the pectoral fin to the origin of the second dorsal fin naked; anterior most scales in lateral midline reach the base of the pectoral fin in the adult specimen (only near to it in the juvenile); some of these most anterior scales are cycloid. Lateral line system in accordance with MILLER (1986) and KOVACIC (1995). With four transversal suborbital neuromast

rows before and two below longitudinal suborbital neuromast row b (5i, 6i), and with a longitudinal oculoscapular row u, the specimens from Ibiza differ somewhat from those of the northern Adriatic Sea.

Lesueurigobius friesii (MALM, 1874)

47 specimens. NMW 88348, 1 male, 50.2+15.0, ADR, central Adriatic Sea between Tremiti Islands (Italy) and Vis (Croatia), depth and substrate not known, June 1894, ST.26, Adria - Tiefsee - Expedition. NMW 88349, 1 female, 40.4+12.1, ADR, Italy, near Tremiti Islands, 42°2'7"N, 15°27'7"E, 112 m, grey - yellow mud, 16 June 1894, St.34, Adria - Tiefsee - Expedition. NMW 88350, 1 female, 33.4+d, ADR, Croatia, west of Island Andrija, 42°57'20"N, 15°37'40"E, depth and substrate not known, 22 June 1894, St. 52, Adria - Tiefsee - Expedition. MNCN 73967 [out of MNCN 73966 - 73967], 1 female, 49.4+d, ATL, Spain, Prov. Granada, La Herradura, 36°41.26'N, 3°43.15'E - 36°42.03'N, 3°43.63'E, 84 - 96 m, sand and mud, 10 July 1989, F7A, Fauna I. MNCN 74048 - 78049, 2 females, 48.4+13.6 - 50.2+15.1, same data, 36°41.6'N, 3°48.36'E - 36°41.14'N, 3°50.55'O, 238 - 291 m, mud, 10 July 1989, F8A, Fauna I. MNCN 74427, 1 female, 51.3 + d, Spain, Prov. Almeria, Punta Negra (Adra), 36°41.0'N, 3°18.32'E - 36°40.80'N, 3°18.90'E, 285 - 290 m, mud, 11 July 1989, F14A, Fauna I. MNCN 78543 - 78545 (part), 2 females, 53.6+13.7, ATL, Spain, Prov. Guipuzcoa, N of Zumaya, 43°22.88'N, 2°15.0'O - 43°23.14'N, 2°15.21'O, 93 - 101 m, sand of crushed mollusc shells and echinoderm skeletons, 22 June 1991, F150A, Fauna II. MNCN 78580 - 78583, 2 males, 46.1+14.2 - 49.3+14.4 and 2 females, 49.5+14.3 - 51.0+14.1, same data, N of Pasajes (San Sebastian), 43°25.29'N, 2°31.5'E - 43°25.9'N, 2°29.83'E, 82 - 86 m, sand, 22 June 1991, F151A, Fauna II. MNCN 78844 - 78846, 2 males, 39.4+d - 43.9+12.3 and one female, 48.3+13.8, ATL, Spain, Prov. La Coruna, NE of La Coruna, 43°35.48'N, 8°34.28'E - 43°35.53'N, 8°31.99'E, 151 - 152 m, sand and mud, 13 June 1991, F101A, Fauna II. MNCN 78976 - 78979, 1 male, 37.2+10.1 and 3 females, 41.7+11.5 - 50.4+13.2, Prov. Vizcaya, N of Ondarroa (Bilbao), 43°27.24'N, 2°23.42'E - 43°27.77'N, 2°24.81'E, 129 - 132 m, mud, 24 June 1991, F153A, Fauna II. MNCN 79081, 1 female, 41.8+11.6, ATL, Spain, La Coruna, NE of Islas Sisargas, 43°25.73'N, 8°59.76'E - 43°26.34'N, 8°58 - 95'E, 157 - 159 m, black mud, 12 June 1991, F98A, Fauna II. MNCN 79202 - 79203, 2 females, 48.4+12.8 - 51.2+14.2, ATL, Spain, Prov. Lugo, N of Ribadeo, 43°42.51'N, 6°59.30'E - 43°42.82'N, 7°1.10'E, depth?, sand and mud, 14 June 1991, F108A, Fauna II. MNCN 79204 - 79205, 2 males, 39.8+10.8 - 45.6+13.8, same data, 43°39.4'N, 6°59.38'E - 43°50.83'N, 6°59.58'E, 142 - 145 m, sand and mud, 14 June 1991, F109A, Fauna II. MNCN 79213 - 79215, 1 male, 41.8+11.7 and 2 females, 33.6+8.9 - 39.0+9.9, ATL, Spain, Prov. San Sebastian, N of San Sebastian, 43°29.46'N, 2°1.58'E - 43°29.88'N, 2°0.20E, 135 - 143 m, mud, 22 June 1991, F148A, Fauna II. MNCN 107623, 1 male, SL+CL not known, MED, Spain, Balearic Islands, Prov. Mallorca, Cabo Nati. NO de Menorca, 40°05.41'N, 3°40.76'E - 40°06.14'N, 3°44.41'E, 149 - 153 m, muddy sand, 28 June 1994, F202A, Fauna III. MNCN 107860 - 107868, 1 male, 35.8+11.7 and 8 females, 35.8+11.0 - 51.1+15.3, same data, across Isla de Toro, 39°24.30'N, 2°24.30E - 39°24.30'N, 2°20.73'E, 111 - 113 m, detritus and mud, 04 July 1994, F231A, Fauna III. MNCN 108107, 1 female, 44.9+12.3, MED, Spain, Balearic Islands, Prov. Formentera, SE de Formentera, 38°35.53'N, 1°32.33'E - 38°37.24'N, 1°34.52'E, 122 - 128 m, muddy sand, 06 July 1994, F242A, Fauna III. MNCN 108344 - 108345, 1 male, 32.4+11.3 and 1 female, 33.2+10.6, same data, 38°47.57'N, 1°20.10'E - 38°45.17'N, 1°18.97'E, 92 m, bottom unknown, 08 July 1994, F252A, Fauna III. MNCN 108438 - 108440 [out of MNCN 108432 - 108440], 1 male, 35.2+10.3 and 2 females, 47.5+14.4 - 50.5+13.9, MED, Spain, Prov. Castellon, Islands Columbretes, 28 mi S of Placer de Barra Alta, 39°40.61'N, 0°28.40'E - 39°40.44'N, 0°30.85E, 110 - 113 m, bottom unknown, 11 July 1994, F266A, Fauna III. MNCN 108499 - 108501, 3 females, 37.2+10.7 - 40.5+11.3, same data, 39°49.65'N, 0°37.57'E - 39°52.56'N, 0°37.59'E, 82 - 86 m, same data.

This species differs from the following one in diagnostic characters like: nape scaled and lateral line system with antero-dorsal longitudinal neuromast rows g long and h reduced to a few papillae (MILLER 1986).

Lesueurigobius friesii is adapted to muddy sand bottoms and mud bottoms (DE BUEN 1931, MILLER 1986, DEMESTRE & al. 2000). It seems abundant in the north eastern Atlantic and the western Mediterranean but less frequent in the Adriatic Sea and the eastern Mediterranean (ABEL 1983 [as *Gobius macrolepis*], MILLER 1986, DEMESTRE &

al. 2000). This species was collected with a commercial fishing trawl in the western Mediterranean in 50 - 60 m in high numbers (average abundance of 116.69 ind h⁻¹) (DEMESTRE & al. 2000). MILLER (1986) gives a depth range from 10 – 130 m for this species, SANCHEZ & al. (1995) a depth of 200 m for northern Spain. During the Fauna I Expedition 1998 three specimens were collected in the Mediterranean (S Spain) at a depth range from 238 - 291 m (MNCN 74048 - 78049) and 285 - 290 m (MNCN 74427), the deepest known records for this species. The last specimen was erroneously identified as *Gobius niger* Linnaeus, 1758 by GUEMES & al. (1994). Specimens collected during the Fauna III Expedition 1994 at the Balearic Islands deserve also mentioning (MNCN 107623, MNCN 107860 - 107868, 108107). These eleven specimens have been also collected at the remarkable depths from 111 - 113 m to 149 - 153 m. Specimens from the Fauna II Expedition (Atlantic, NW and N Spain) fit well with records and depth distribution given by SANCHEZ & al. (1995).

L. friesii has been collected during the Fauna I - III Expeditions on 13 sites in the Atlantic (N and NW Spain, SW Spain) and in the Mediterranean (S Spain), but was there never associated with *G. gasteveni* or *G. niger*.

***Lesueurigobius suerii* (Risso, 1810)**

2 specimens. NMW 88351, 1 female, 27.5+9.3, MED, Greece, Aegean Sea, east of Island Astipalaia, 36°37'N, 26°58'O, 92 m, yellow-grey and grey mud, 22 Aug. 1893, 4. Österreichisch-Ungarische Tiefsee-Expedition 1893. NMW 88550, 2 juveniles, 17.6+d – 19.1+d, ADR, Croatia, west of Island Andrija, 42°57'20"N, 15°37'40"E, depth and substrate not known, 22 June 1894, St.52, Adria-Tiefsee-Expedition.

Lesueurigobius suerii appears to be abundant in the eastern Adriatic but less so in the Aegean (ABEL 1983, MILLER 1986). Contrary to *L. friesii*, this species was not been collected during the extensive trawlings of the "Hvar" Expedition 1948 - 1949 in the east Adriatic Sea (PALLAORO & JARDAS 1996). It occurs on muddy clay bottoms in the western Mediterranean (DEMESTRE & al. 2000), a habitat which fits well with the data for the specimens from the Aegean Sea (NMW 88351).

Lesueurigobius suerii differs from *L. friesii* in following diagnostic characters: nape naked and antero-dorsal longitudinal neuromast rows of the lateral line system distinct (MILLER 1986).

***Odontobuenia balearica* (PELLEGRIN & FAGE, 1907)**

55 specimens. MNCN 107680, 2 females, 22.6+d – 23.1+d, MED, Spain, Balearic Islands, Menorca, 40°04.23'N, 4°05.20'E – 40°05.20'N, 4°08.00'E, 55 - 60 m, coralline grounds, 29 June 1994, F213A, Fauna III. MNCN 107993 - 108042, 13 males, 15.2+5.1 – 22.2+6.9, 32 females, 14.9+d – 1.9+4.3, 4 juveniles, 12.9+4.3 – 13.9+4.6, same data, east of Ibiza, 38°54.07'N, 1°31.14'E - 38°56.29'N, 1°32.77'E, 55 - 56 m, mud, 5 July 1994, F238A, Fauna III. MNCN 108059, 1 male, 15.5+5.0, same data. MNCN 108086, 1 male, 25.2+d, same data, Ibiza, south of Island Espardell, 38° 42.71'N, 1°32.28'E – 38° 44.90'N, 1°30.51'E, 57 - 58 m, bottom undetermined, 6 July 1994, F239A, Fauna III. MNCN 108418, 1 female, 19.6+5.6, same data, Cala Eubarca, 39°4.40'N, 1°27.71'E, 0 - 25 m, bottom unknown, 10 July 1994, F263B2, Fauna III. MNCN 108528, 1 female, 19.7+6.3, MED, Spain, Prov. Castellón, north of Island Columbrete Grande, 39°54.2'N, 0°41.15'E, 0 - 47 m, coralline ground, F273B, Fauna III.

This small gobiid species is characterized by separate pelvic fins (no ventral suction disc), although a low membrane connects the bases of the innermost rays, and the uppermost and lowermost scales on the base of the caudal fin have elongate ctenii.

O. balearica is closest related to the genus *Vanneaugobius* (see below) from which it differs in a more reduced lateral line system (MILLER, 1986; VAN TASSEL & al. 1988). It is known from the European coasts of the western Mediterranean basin, the Adriatic Sea, the Ionian Sea and the Aegean Sea (summarized in AHNELT & al. 1994). For the Balearic Islands this species was reported from Mallorca and the neighbouring island of Cabrera (MILLER & TORTONESE 1968). The records for Ibiza, Menorca (both Balearic Islands) and Columbrete island (between Mallorca and the Iberian Peninsula) (see material) extend the known distribution of *O. balearica*. So far *O. balearica* was documented from coralline and stony grounds and from *Cladophora* turf (MILLER 1986, AHNELT & al. 1994). This fits well with three of the five above mentioned localities but not with those from south of Ibiza (MNCN 107993 - 108042, MNCN 108059) where a large sample has been collected on mud, the first documentation of this species on a soft bottom.

***Pomatoschistus norvegicus* (COLLETT, 1903)**

5 specimens. IZUW uncatalogued, 1 male, 38.9+d, 4 females, 38.2+d – 40.8+d, MED, France, Banyuls-sur-Mer, May 1995, sand bottom, 50 m, R. Hofrichter.

This sand goby of the *Pomatoschistus minutus*-complex (WEBB 1980) is known from the Lofotens (Norway), south to the Mediterranean Sea and in the Mediterranean from four localities: off Malaga (Spain), Gulf of Gaeta (Italy), Gulf of Aegina (Greece) and from the northern Adriatic Sea, Venice (Italy) (summarized in STEFANNI (2000).

The specimens from Banyuls-sur-Mer are the first record of this species for France. They are characterized by: Fins: D1 VI, D2 I/8 - 9 (8: 1, 9:4), A I/9, P 16 - 17 (16: 1, 17: 4), C 15 principle rays (12 branched rays), V I/5+5/I. Scales: abraded, breast naked (no scale pockets). Attachment of the branchiostegal membrane on the isthmus is narrow. Lateral line system: anterior section of row i and supralabial section of row d in single series; longitudinal suborbital row b anteriorly ending below anterior third to half of eye; suborbital transversal rows c2 and c4 penetrating through longitudinal row d, last row c passing row d. The male specimen shows the characteristic colouration with a black spot in the rear of D1 and 11 dark vertical striae on the sides, pigmented breast and ventral disc. These data are in accordance with WEBB (1980) and MILLER (1986).

Pomatoschistus norvegicus is closely related to *P. minutus* (PALLAS, 1770) and *P. lozanoi* (DE BUEN, 1923) (WEBB 1980). The latter two live inshore on sand, but *P. norvegicus* is an offshore species found on mud and coarse shell deposits, and is reported from depths to 325 m (MILLER 1986). HAMERLYNCK (1990) concluded it unlikely that *P. norvegicus* occurs with the other two species. Recent records from the Mediterranean Sea show that this species may also occur inshore, on sand and in relatively shallow waters (STEFANNI 2000; present data). *P. norvegicus* is the only 'sand-goby' from the Atlantic and the Mediterranean known to occur in depths below 100 m (MILLER 1986). Possibly the *Pomatoschistus* specimen from NW Spain (Atlantic) collected in a depth of 200 m (SANCHEZ & al.1995) belongs to this species.

***Vanneaugobius dollfusi* BROWNELL, 1978**

28 specimens. NMW 87961, 10 males, 26.0+6.9 – 36.2+7.4, 4 females, 22.6+5.8 – 28.8+6.6, ADR, Croatia, near Island Palagruza, 128 m, "Algengrund", 10 June 1894, St.23, Adria-Tiefsee-Expedition 1894.

NMW 87962, 4 males, 24.7+6.0 – 33.5+7.6, 7 females, 22.7+5.2 – 30.0+6.8, same data. NMW 88542, 1 female, 16.5+4.1, same data, between Island Vis and Island Bisevo, 102 m, sandy mud, 21 June 1994, St. 46, Adria-Tiefsee-Expedition 1894. NMW 88352, 1 female, 15.8+3.6, MED, Aegean Sea, Greece, near Island Astipalaea, 92 m, yellow-grey and grey mud, 22 Aug. 1893, 4. Österreichisch-Ungarische Tiefsee-Expedition 1893. NMW 88353, 1 male, damaged, MED, Greece, Peloponnes, between Island Kithira and Andikithira, 160 m, "Nulliporen" [Dasycladaceae] with sand, 22 July 1893, St. 201, 4. Österreichisch-Ungarische Tiefsee-Expedition 1893.

The first record of *V. dollfusi* for the Mediterranean Sea is based on four specimens from four collecting sites in the central Adriatic Sea between Split and the Island Palagruza (PALLAORO & KOVACIC 2000). Earlier this goby was only known from the two type specimens off Agadir (Morocco, Atlantic) (VAN TASSEL & al. 1988). Morphological values such as meristics and coloration which separate *V. dollfusi* from the second species known from the Mediterranean, *V. pruvoti* (FAGE, 1907), were known only from these six specimens.

This species is characterized by: Fins (n = 28) D1 VI; D2 I/9 - 10 (9:1, 10: 27); A I/9; P 15 - 17 (15: 2, 16: 12, 17: 14); C (branched rays) 14 - 15 (14: 12, 15: 5, d: 11); V I/5, separate; first spine of D1 longest, very prominent in males which may, depressed, reach the D2 8; discrepancy in the pectoral fin ray counts is present to BROWNELL's (1978) description who mentioned 17 and 19 rays for the two type specimens. Scales (n = 28) ctenoid, breast cycloid; LL 26 - 29 (26: 4, 27: 10, 28: 10, 29: 4); TR 7 - 8 (7: 11, 8: 8, d: 11); uppermost and lower most scales on caudal fin origin more or less elongated, of triangular shape with pointed posterior tip and long ctenii which decrease in size towards tip of scale; these scales lack in several specimens due to collecting techniques (dredging). Head lateral line system: in accordance with descriptions of BROWNELL (1978) and PALLAORO & KOVACIC (2000); lack of row m of the anterior dorsal series in the two type specimens (BROWNELL 1978) may be due to abrasion of skin during dredging.

The preserved specimens are pale fawn with an intense black blotch covering the lower half of the first dorsal fin along its base from D I I to D I V or VI. Franz Steindachner, scientific head of the Adriatic-Deep-Sea Expedition, mentioned in a letter dated 14 June 1894 that a new goby species had been collected near the Island Palagruza (SCHEFBECK 1991, pers. information G. Schefbeck, 27 March 1992). As life coloration he noted that this goby is vermilion. Like most other fishes collected during the Austrian-Deep-Sea-Expeditions F. Steindachner did not publish these gobies (AHNELT & ELVERIA 1990).

The specimens from the Adriatic Sea were collected on similar grounds to those described by PALLAORO & KOVACIC (2000), individuals from near Palagruza were collected possibly on coralligenous ground ("Algengrund" of STURANY 1896), and the specimen collected between Vis and Bisevo (NMW 88542) was dredged on sandy mud. The two specimens from Greece were collected on mud and on sand respectively (STURANY 1896). These specimens are new records for the Aegean Sea and for Greece.

The specimens from Palagruza were collected in a depth of 128 m, one specimen from Greece in a depth of 160 m; both records are from deeper areas than previously known (115 m for the Atlantic, 85 m for the Adriatic Sea (BROWNELL 1978; PALLAORO & KOVACIC 2000)).

Discussion

Since WHITHEAD & al. (1984 - 1986) 45 fish species are reported as invaders of the Mediterranean from the Red Sea or from the Atlantic Ocean (QUIGNARD & TOMASINI 2000), one of them a goby: *Gobius couchi* MILLER & EL TAWIL, 1974. Like this species also *Gobius gasteveni* (present data) could have invaded the Mediterranean recently, but possibly was previously misidentified or overlooked. Latter is the case for *Vanneaugobius dollfusi*, a gobiid already collected during the Austrian-Hungarian Deep-Sea Expedition 1894 in the Adriatic Sea. Recognized as a new species during this expedition (SCHEFBECK 1991) the specimens remained in the unidentified material at the Natural History Museum Vienna.

For small and commercially not important species such as gobies it is difficult to decide whether a species is an invader of the Mediterranean Sea or if it has been previously overlooked. Lessepsian immigrants from the Red Sea must have arrived in the Mediterranean not earlier than 1869, the year of the opening of the Suez Canal. But to decide that a gobiid species recently has colonized the Mediterranean Sea from the Atlantic remains difficult, mostly because of lacking data on distribution and habitats of many gobiid species (MILLER 1986, KOVACIC 2001b). A possible indication for recent arrival of a species could be its absence from the eastern Mediterranean. *G. gasteveni* and *G. couchi* are to date known from the western basin, latter also from the Adriatic, but both are not documented from the eastern Mediterranean (STEFANNI & MAZZOLDI 1999, KOVACIC 2001a; this study). This is a “weak indication” and for example differences in abiotic factors (temperature, salinity etc.) may cause the absence of a species from one of the Mediterranean basins. Lower temperatures and somewhat lower salinity compared with the rest of the Mediterranean are believed to be the reasons that the sand-goby *Pomatoschistus pictus* (MALM, 1865), abundant in the north-eastern Atlantic and known from the Adriatic and the Sea of Marmora, is lacking in the western Mediterranean (MILLER 1972, 1991). This species (as *Pomatoschistus rhodopterus* (GÜNTHER, 1861)) has been repeatedly confused with *P. marmoratus* (RISSO, 1810). Like *P. pictus* also *V. dollfusi* is not reported from the western Mediterranean (PALLAORO & KOVACIC 2000; this study). A similar phenomenon is known for the pleuronectid *Platichthys flesus* (LINNAEUS, 1758) and the gobiesocid *Lepadogaster lepadogaster* (BONNATERRE, 1788) (MILLER 1972, BRIGGS 1986, NIELSEN 1986). Both are represented by two subspecies, one from the north-eastern Atlantic and the western Mediterranean, the other from the Adriatic Sea and the more eastern parts of the Mediterranean.

Corcyrogobius liechtensteini, *D. splechnai*, *G. rouli* and also *Thorogobius macrolepis* (KOLOMBATOVIC, 1891) are hitherto known from the western Mediterranean and the Adriatic only (KOVACIC 1995, 2001b, AHNELT & KOVACIC 1997, AHNELT & SCSEPKA 1999, STEFANNI 1999). Possibly their “absence” from the eastern Mediterranean is due to misidentification or insufficient collecting. These gobiids are to date known from distant sites and it is likely that further collecting will reveal a more continuous occurrence, possibly throughout the entire Mediterranean. A similar situation is known for *L. friesii* and *P. norvegicus*. Both gobiid species are abundant in the north-eastern Atlantic and also reported from the western Mediterranean and the Adriatic. But contrary to the aforementioned species these two gobies are also known from a few localities in the eastern Mediterranean (MILLER 1986, AHNELT & al. 1994, STEFANNI 2000, this study).

Today the hydrodynamic and the faunal composition of the Mediterranean is changing (summarized in QUIGNARD & TOMASINI 2000, BOUDOURESQUE 2001, ORSI RELINI 2002). Reasons for range extensions of gobiids may be numerous and could indicate changes in the temperature, salinity, currents etc. Possibly also ships contribute to the dispersal of gobies. Data for such translocations within the north-eastern Atlantic and the Mediterranean are lacking, but are available from various localities in the western Atlantic and the Pacific (WONHAM & al. 2000). Gobies have been passively transported by ships from the western Pacific to Australia and to the eastern Pacific (for example HOESE 1973, MATERN & FLEMING 1995) or along the eastern Pacific coast from south to north (LONG 1996). Three gobiid species from the north-eastern Atlantic and the Mediterranean (*Gobius niger*, *Pomatoschistus lozanoi* and *P. minutus*) have been found in ballast-water tanks of ships during surveys in harbours of the U.S.A. (WONHAM & al. 2000). Accidentally introduced from distant localities with differing fish assemblages these gobies were easily identified as aliens in their new environments. But nothing is known from possible translocations of gobiid species in the north-eastern Atlantic and the Mediterranean. It is likely that in this area the occurrence of a goby outside of its known range will be classified as active dispersal or as previously overlooked, than as transported by ships (on ship hulls or in ballast-water tanks). Such passive translocations of fishes by ships into the Mediterranean occur possibly more often than expected. Recently *Pinguipes brasilianus* CUVIER 1829, a species native to the south-western Atlantic has been documented for the Mediterranean (ORSI RELINI 2002).

Data on the distribution, biology and habitats of gobiid fishes are needed to understand their role in the aquatic food webs. Gobies are by far the most specious fish family in the Mediterranean. Many species are abundant in marine shelf or estuarine ecosystems and occur at least seasonally in large numbers (e.g. KINZER 1960, ZANDER 1996, DEMESTRE & al. 2000, IGLESIAS & MORALES - NIN 2001), suggesting that they are important secondary consumers. Because of small size (few species of the north-eastern Atlantic and the Mediterranean exceed 20 cm) gobies are only of local economic importance. But as small predators they are an important link between invertebrates and fish, cuttlefish or piscivorous birds (summarized in MILLER 1989, 1996, ZANDER 1996, BLANC & al. 1999, HOSTENS & MEES 1999, IGLESIAS & MORALES - NIN 2001, KOVACIC 2001).

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