

An updated list of cryptobenthic fishes (Syngnathidae, Gobiidae, Gobiesocidae, Tripterygiidae, Blenniidae, Scorpaenidae) in the IUSHM fish collection

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Abstract

In the Mediterranean Sea, data on the cryptobenthic fishes are limited and the number of specimens kept in museum collections is fragmentary. Hydrobiology Museum of Istanbul University, the only documented fish collection of Turkey, accommodates only a few specimens among these cryptobenthic species. The purpose of this paper is to enrich the number of collections in the Hydrobiology Museum and to exhibit an updated list of cryptobenthic fishes collected from the Turkish waters. A total of 164 specimens belonging to 18 species have recently been added to the collection. In total, the number of specimens in the IUSHM reached up to 219 with 32 species belonging to six families.

Introduction

There are three groups of marine fishes according to their ecotopes: nektonic, epibenthic and cryptobenthic (Miller, 1979). Cryptobenthic fishes can be defined in various ways. Miller (1979) defined cryptobenthic fishes as “small bodied fishes (<10 cm) that exploit restricted habitats where food and shelter are obtained in, or in relation to, conditions of substrate complexity and/or restricted living space, with a physical barrier likely to be interposed between the small fish and sympatric predators”. More recently, Depczynski & Bellwood (2003) described (tropical) cryptobenthic fishes as “adult fishes of typically <5 cm that are visually and/or behaviourally cryptic, and maintain a close association with the benthos”.

Cryptobenthic fishes mainly include combtooth and threespin blennies, clingfishes, dragonets, gobies and scorpionfishes. Typical behaviours of cryptobenthic fishes are to spend most of the time closely associated with the bottom surface and to swim away with rapid sprints only for short distances (Gibson, 1969; Thompson, 1983). They rest on the substrate, and due to their cryptic coloration, they can reduce the risk of predation. Their small size and relatively small home range shows that the habitat choice in cryptobenthic fishes is related to the environmental features (La Mesa, 2005). Patzner *et al.* (2009) asserted that most of the blennies are small bottom-dwelling, site-attached fishes and many of them are territorial, showing strong associations with the microhabitats they inhabit such as holes, crevices, under overhangs or small boulders.

The smaller fishes, due to their abundance, compose a significant proportion of the fish biomass in reef ecosystems and play a substantial role in the reef processes with their high turnover rates and role as potential preys (Ackerman & Bellwood, 2000). The contributions of these small fishes also play a key role in the trophodynamics of reef food webs; as fishes <5 cm potentially use 25 % of the total energy required by reef fishes (Ackerman & Bellwood, 2000; Depczynski & Bellwood, 2003). Moreover, comb-toothed blennies may have a significantly underestimated role in the ecological process of grazing on reefs (Townsend & Tibbetts, 2000). Likewise, detritivorous blennies are important secondary consumers (Wilson, 2001). Cryptobenthic fishes produce approximately one-third of the carbonate, a tropical carbonate supply, which is an important component of the marine mud (Perry *et al.*, 2011).

It is confirmed that the standard visual census technique applied to cryptobenthic reef fish assemblages is not adequate to identify and accurately determine these fishes and it is usually restricted to shallow depths (Kovačić *et al.* 2012). There are several new approaches in order to improve the determination of the cryptobenthic fauna. Beldade *et al.* (2006) and Beldade & Gonçalves (2007) tried to overcome the incapability of the standard visual census technique to define the cryptobenthic fauna. The mentioned technique is called “interference visual census technique”. In the performing, microhabitats are being disturbed to make the cryptobenthic fishes to take alarm and become visible. However, even visual census technique improved by interference, compared with the anaesthetic census and missed some cryptobenthic species (Beldade & Gonçalves, 2007).

Briefly, for a long time, the number of cryptobenthic fishes were believed to be extremely low, with only a small number of specimens kept in museum collections and a few publications (Kovačić *et al.*, 2012). However, with a closer examination, they appeared to be rather common (Gonçalves *et al.*, 1998; Gonçalves *et al.*, 2005) and their contribution to ecological processes has become increasingly apparent. The aim of this study is to present a catalogue of cryptobenthic fish specimens collected from the Turkish waters, since the number of the specimens in the Hydrobiology Museum is inadequate.

Material and Method

The specimens were obtained between the years 2008 and 2017 and the vast majority of them were caught by SCUBA in the Gökçeada Island and Saros Bay. They were collected between the depths of 1-38 m. During most of the dives, Quinaldine was used as an anaesthetic in order to collect cryptobenthic fishes using translucent bags.

All the collected specimens in this study are defined at least once as “cryptobenthic” in the relevant literature. Also, we adhered to Miller (1979)’s definition and only listed the species with the adults smaller than 10 cm in length. The specimens are preserved in 50% ethanol. The scientific names of fishes and taxonomic classification are in accordance with Eschmeyer *et al.* (2018).

Results and Discussion

The aim of the study is to provide an updated list of cryptobenthic fish species to the IUSHM fish collection. According to Meriç *et al.* (2007), there are 14 cryptobenthic species with 55 specimens of six families in the collection. With the contribution of this study, new specimens are added to the following families: Syngnathidae (1), Gobiidae (7), Gobiesocidae (1), Tripterygiidae (2), Blenniidae (8). A total of 164 specimens belonging to 18 species have recently added [Table 1], some of them are shown in the Figs. 1-5. As a result, the number of specimens in the IUSHM reached up to 219 with 32 species belonging to six families.

The vast majority of the specimens were collected from the Aegean Sea; with the exception of two being collected from the Sea of Marmara and one from the Levant Sea.

Bilecenoğlu *et al.* (2014) mentioned that the number of marine fishes in Turkish waters is 512. 52 of them belong to families which mostly consist of cryptobenthic members, such as Blenniidae, Gobiidae, Gobiesocidae, Tripterygiidae, Syngnathidae, and Scorpaenidae. Hence, about 10% of the marine fishes in Turkish waters can be considered as cryptobenthic. With this study, the IUSHM catalogue holds almost 62% of the cryptobenthic species of the Turkish waters.

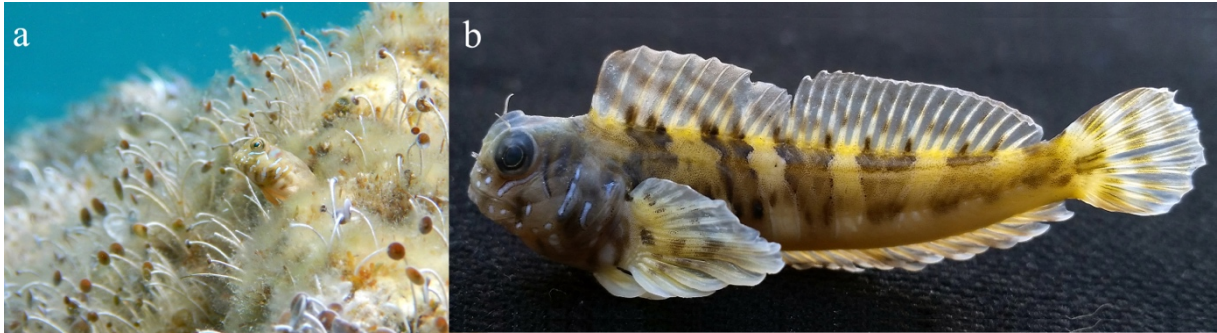


Figure 1. Photographs of *Aidablennius sphynx*; *Acetabularia* sp. habitat, Gökçeada Island, 2 m (a), fixed sample (b).



Figure 2. Photographs of *Gobius bucchichi*; sandy bottom, Gökçeada Island, 3 m (a), fixed sample (b).

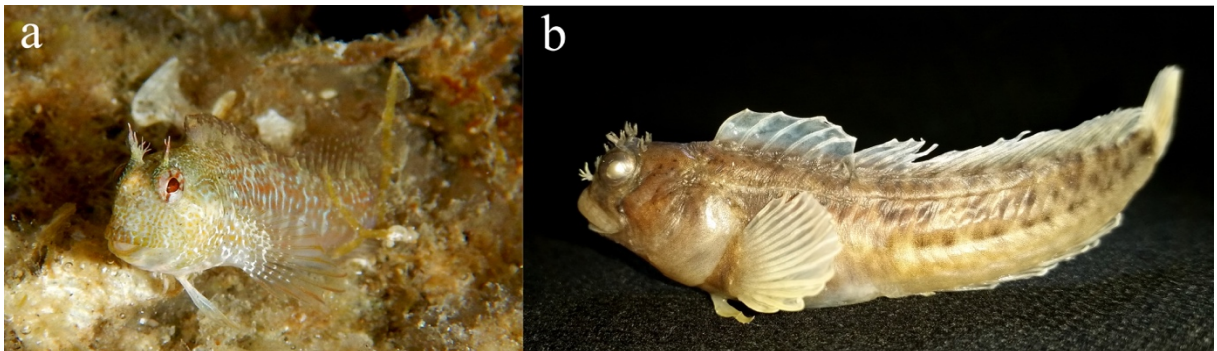


Figure 3. Photographs of *Parablennius zvonimiri*; algae covered rocky habitat, Gökçeada Island, 1 m (a), fixed sample (b).



Figure 4. Photographs of *Microlipophrys caneavae*; mussel covered rocky habitat, Gökçeada Island, 0.5 m (a), fixed sample (b).



Figure 5. Photographs of *Coryphoblennius galerita*; algae covered rocky habitat, Gökçeada Island, 0.5 m (a), fixed sample (b).

Table 1. An updated list of cryptobenthic fishes in the IUSHM (Istanbul University, Science Faculty, Hydrobiology Museum).

Species	Catalog No	N	Location	Area	Date	Method
<i>Aidablennius sphynx</i> (Valenciennes, 1836)*	2018-1401	4	Gökçeada Island	Aegean Sea	3.08.2017	SCUBA
<i>Aidablennius sphynx</i> (Valenciennes, 1836)*	2018-1402	1	Gökçeada Island	Aegean Sea	23.08.2017	SCUBA
<i>Aidablennius sphynx</i> (Valenciennes, 1836)*	2018-1403	2	Gökçeada Island	Aegean Sea	22.06.2017	SCUBA
<i>Aidablennius sphynx</i> (Valenciennes, 1836)*	2018-1404	3	Gökçeada Island	Aegean Sea	11.10.2017	SCUBA
<i>Coryphoblennius galerita</i> (Linnaeus, 1758)*	2018-1405	2	Gökçeada Island	Aegean Sea	22.08.2017	SCUBA
<i>Coryphoblennius galerita</i> (Linnaeus, 1758)*	2018-1406	2	Gökçeada Island	Aegean Sea	24.08.2017	SCUBA
<i>Coryphoblennius galerita</i> (Linnaeus, 1758)*	2018-1407	3	Gökçeada Island	Aegean Sea	11.10.2017	SCUBA
<i>Diplecogaster bimaculata</i> (Bonnaterre, 1788)	7700-143	1	Lapseki-Karabiga	Sea of Marmara	29.06.1993	Beam Trawl
<i>Gobius auratus</i> Risso, 1810*	2018-1430	3	Saros Bay	Aegean Sea	29.08.2016	SCUBA
<i>Gobius bucchichi</i> Steindachner, 1870*	2018-1431	3	Gökçeada Island	Aegean Sea	9.10.2017	SCUBA
<i>Gobius bucchichi</i> Steindachner, 1870*	2018-1432	2	Gökçeada Island	Aegean Sea	22.08.2017	SCUBA
<i>Gobius bucchichi</i> Steindachner, 1870*	2018-1433	1	Gökçeada Island	Aegean Sea	11.10.2017	SCUBA
<i>Gobius bucchichi</i> Steindachner, 1870*	2018-1434	2	Gökçeada Island	Aegean Sea	9.10.2017	SCUBA
<i>Gobius bucchichi</i> Steindachner, 1870*	2018-1435	2	Gökçeada Island	Aegean Sea	23.08.2017	SCUBA
<i>Gobius bucchichi</i> Steindachner, 1870*	2018-1436	8	Gökçeada Island	Aegean Sea	24.08.2017	SCUBA
<i>Gobius bucchichi</i> Steindachner, 1870*	2018-1437	1	Gökçeada Island	Aegean Sea	24.08.2017	SCUBA
<i>Gobius bucchichi</i> Steindachner, 1870*	2018-1438	1	Saros Bay	Aegean Sea	10.06.2014	SCUBA
<i>Gobius bucchichi</i> Steindachner, 1870*	2018-1439	1	Gökçeada Island	Aegean Sea	22.06.2017	SCUBA
<i>Gobius bucchichi</i> Steindachner, 1870*	2018-1440	2	Gökçeada Island	Aegean Sea	10.10.2017	SCUBA
<i>Gobius bucchichi</i> Steindachner, 1870*	2018-1441	2	Gökçeada Island	Aegean Sea	25.08.2017	SCUBA
<i>Gobius bucchichi</i> Steindachner, 1870*	2018-1442	12	Saros Bay	Aegean Sea	7.06.2013	Beam Trawl
<i>Gobius bucchichi</i> Steindachner, 1870*	2018-1443	2	Saros Bay	Aegean Sea	8.06.2013	Beam Trawl
<i>Gobius fallax</i> Sarato, 1889*	2018-1444	1	Gökçeada Island	Aegean Sea	25.08.2017	SCUBA
<i>Gobius fallax</i> Sarato, 1889*	2018-1445	2	Gökçeada Island	Aegean Sea	23.08.2017	SCUBA
<i>Gobius geniporus</i> Valenciennes, 1837*	2018-1446	3	Gökçeada Island	Aegean Sea	24.08.2016	SCUBA
<i>Gobius geniporus</i> Valenciennes, 1837*	2018-1447	2	Saros Bay	Aegean Sea	10.06.2014	SCUBA
<i>Gobius niger</i> Linnaeus, 1758*	2018-1448	1	Gökçeada Island	Aegean Sea	13.04.2016	SCUBA
<i>Gobius niger</i> Linnaeus, 1758	22000-426	1			1969	
<i>Gobius niger</i> Linnaeus, 1758	22000-435	4			1969	

Species	Catalog No	N	Location	Area	Date	Method
<i>Gobius niger</i> Linnaeus, 1758	22000-436	5	Sea of Marmara	Sea of Marmara	8.07.1967	
<i>Gobius paganellus</i> Linnaeus, 1758	22100-785	1	Bozcaada Island	Aegean Sea	1.05.2000	Dredge
<i>Gobius paganellus</i> Linnaeus, 1758	22100-786	1	Bozcaada Island	Aegean Sea	1.05.2000	Dredge
<i>Gobius paganellus</i> Linnaeus, 1758*	2018-1449	3	Gökçeada Island	Aegean Sea	26.07.2015	SCUBA
<i>Gobius vittatus</i> Vinciguerra, 1883*	2018-1450	1	Gökçeada Island	Aegean Sea	9.10.2017	SCUBA
<i>Gobius vittatus</i> Vinciguerra, 1883*	2018-1451	1	Gökçeada Island	Aegean Sea	22.06.2017	SCUBA
<i>Gobius xanthocephalus</i> Heymer & Zander, 195	2018-1452	1	Saros Bay	Aegean Sea	11.06.2014	SCUBA
<i>Lepadogaster candolii</i> Risso, 1810*	2018-1455	1	Saros Bay	Aegean Sea	11.06.2014	SCUBA
<i>Lepadogaster candolii</i> Risso, 1810*	2018-1456	2	Gökçeada Island	Aegean Sea	24.08.2017	SCUBA
<i>Lepadogaster candolii</i> Risso, 1810*	2018-1457	3	Gökçeada Island	Aegean Sea	23.08.2017	SCUBA
<i>Lepadogaster candolii</i> Risso, 1810*	2018-1458	2	Gökçeada Island	Aegean Sea	11.10.2017	SCUBA
<i>Lepadogaster candolii</i> Risso, 1810	7800-142	1	Baltalimani	Sea of Marmara		Trammel Net
<i>Lepadogaster lepadogaster</i> (Bonnaterre, 1788)*	2018-1459	1	Saros Bay	Aegean Sea	10.06.2014	SCUBA
<i>Lepadogaster lepadogaster</i> (Bonnaterre, 1788)*	2018-1460	1	Gökçeada Island	Aegean Sea	22.06.2017	SCUBA
<i>Lepadogaster lepadogaster</i> (Bonnaterre, 1788)*	2018-1461	1	Gökçeada Island	Aegean Sea	11.10.2017	SCUBA
<i>Lipophrys trigloides</i> (Valenciennes, 1836)*	2018-1408	2	Gökçeada Island	Aegean Sea	24.08.2017	SCUBA
<i>Lipophrys trigloides</i> (Valenciennes, 1836)*	2018-1409	1	Gökçeada Island	Aegean Sea	11.10.2017	SCUBA
<i>Lipophrys trigloides</i> (Valenciennes, 1836)	20800-409	1				
<i>Microlipophrys canevae</i> (Vinciguerra, 1880)*	2018-1410	1	Gökçeada Island	Aegean Sea	3.08.2017	SCUBA
<i>Microlipophrys canevae</i> (Vinciguerra 1880)*	2018-1411	1	Gökçeada Island	Aegean Sea	11.10.2017	SCUBA
<i>Microlipophrys canevae</i> (Vinciguerra 1880)*	2018-1412	1	Gökçeada Island	Aegean Sea	22.08.2017	SCUBA
<i>Microlipophrys canevae</i> (Vinciguerra 1880)*	2018-1413	1	Gökçeada Island	Aegean Sea	24.08.2017	SCUBA
<i>Microlipophrys dalmatinus</i> (Steindachner & Ko	2018-1414	1	Gökçeada Island	Aegean Sea	23.08.2017	SCUBA
<i>Microlipophrys dalmatinus</i> (Steindachner & Ko	2018-1415	1	Gökçeada Island	Aegean Sea	22.08.2017	SCUBA
<i>Microlipophrys dalmatinus</i> (Steindachner & Ko	2018-1416	1	Gökçeada Island	Aegean Sea	3.08.2017	SCUBA
<i>Parablennius gattorugine</i> (Linnaeus, 1758)*	2018-1417	1	Saros Bay	Aegean Sea	6.09.2014	SCUBA
<i>Parablennius gattorugine</i> (Linnaeus, 1758)*	2018-1418	1	Gökçeada Island	Aegean Sea	25.08.2017	SCUBA
<i>Parablennius gattorugine</i> (Linnaeus, 1758)	20900-408	2	Florya	Sea of Marmara	18.05.1989	Trammel Net
<i>Parablennius gattorugine</i> (Linnaeus, 1758)	20900-520	1	Florya	Sea of Marmara	18.05.1989	Trammel Net

Species	Catalog No	N	Location	Area	Date	Method
<i>Parablennius gattorugine</i> (Linnaeus, 1758)	20900-706	1	Bozcaada Island	Aegean Sea	1.06.2000	Trammel Net
<i>Parablennius incognitus</i> (Bath, 1968)*	2018-1419	3	Gökçeada Island	Aegean Sea	25.08.2017	SCUBA
<i>Parablennius incognitus</i> (Bath, 1968)*	2018-1420	2	Gökçeada Island	Aegean Sea	3.08.2017	SCUBA
<i>Parablennius incognitus</i> (Bath, 1968)*	2018-1421	1	Gökçeada Island	Aegean Sea	22.06.2017	SCUBA
<i>Parablennius incognitus</i> (Bath, 1968)*	2018-1422	1	Gökçeada Island	Aegean Sea	11.10.2017	SCUBA
<i>Parablennius incognitus</i> (Bath, 1968)*	2018-1423	5	Gökçeada Island	Aegean Sea	24.08.2017	SCUBA
<i>Parablennius rouxi</i> (Cocco, 1833)*	2018-1424	1	Gökçeada Island	Aegean Sea	25.08.2017	SCUBA
<i>Parablennius rouxi</i> (Cocco, 1833)*	2018-1425	1	Gökçeada Island	Aegean Sea	9.10.2017	SCUBA
<i>Parablennius rouxi</i> (Cocco, 1833)*	2018-1426	1	Gökçeada Island	Aegean Sea	22.06.2017	SCUBA
<i>Parablennius sanguinolentus</i> (Pallas, 1814)	21000-407	1	Selimpaşa	Sea of Marmara	22.07.1987	Trammel Net
<i>Parablennius tentacularis</i> (Brünnich, 1768)	21100-519	1		Sea of Marmara	8.07.1967	
<i>Parablennius tentacularis</i> (Brünnich, 1768)	21100-406	4	west of Şarköy	Sea of Marmara	21.10.1992	Dredge
<i>Parablennius zvonimiri</i> (Kolombatović, 1892)*	2018-1427	1	Gökçeada Island	Aegean Sea	3.08.2017	SCUBA
<i>Parablennius zvonimiri</i> (Kolombatović, 1892)*	2018-1428	1	Gökçeada Island	Aegean Sea	24.08.2017	SCUBA
<i>Pomatoschistus pictus</i> (Malm, 1865)*	2018-1453	1	Saros Bay	Aegean Sea	9.06.2014	SCUBA
<i>Pomatoschistus pictus</i> (Malm, 1865)*	2018-1454	3	Saros Bay	Aegean Sea	11.06.2014	SCUBA
<i>Salapia basilisca</i> (Valenciennes, 1836)	20700-410	1	Edremit Bay	Aegean Sea	17.05.1969	Trammel Net
<i>Salapia pavo</i> (Risso, 1810)*	2018-1429	1	Güreçe	Sea of Marmara	27.07.2008	Skin Dive
<i>Scorpaena maderensis</i> Valenciennes, 1833	33200-889	1	Iskenderun Bay	Mediterranean Sea	1.02.2003	Trawl
<i>Scorpaena notata</i> Rafinesque, 1810	10800-201	1	Fish Market		15.03.1989	
<i>Scorpaena notata</i> Rafinesque, 1810	10800-208	1	Fish Market		16.03.1989	
<i>Scorpaena notata</i> Rafinesque, 1810	10800-209	10	Altinkum	Aegean Sea	10.09.1963	Beam Trawl
<i>Scorpaena notata</i> Rafinesque, 1810	10800-744	1	Iskenderun Bay	Mediterranean Sea	1.04.2004	Trawl
<i>Scorpaena porcus</i> Linnaeus, 1758	10900-207	2	north of Kapıdağ Peninsula	Sea of Marmara	24.10.1992	
<i>Scorpaena porcus</i> Linnaeus, 1758	10900-206	4	Gülbahçe Bay	Aegean Sea	2.02.1960	
<i>Scorpaena porcus</i> Linnaeus, 1758	10900-200	1	Fish Market		16.03.1989	
<i>Scorpaena porcus</i> Linnaeus, 1758	10900-524	1	Fish Market		16.03.1989	
<i>Scorpaena porcus</i> Linnaeus, 1758	10900-735	1	Iskenderun Bay	Mediterranean Sea	1.01.2003	Trawl
<i>Scorpaena porcus</i> Linnaeus, 1758	10900-736	3	Karaburun	Black Sea	12.06.2005	Trammel Net

Species	Catalog No	N	Location	Area	Date	Method
<i>Syngnathus acus</i> Linnaeus, 1758*	2018-1462	4	Saros Bay	Aegean Sea	7.06.2013	Beam Trawl
<i>Syngnathus acus</i> Linnaeus, 1758*	2018-1463	5	Saros Bay	Aegean Sea	8.06.2013	Beam Trawl
<i>Syngnathus acus</i> Linnaeus, 1758	10200-683	1	West of Imralı Island	Sea of Marmara	11.02.1995	Trawl
<i>Syngnathus acus</i> Linnaeus 1758	10200-709	1	Bozcaada Island	Aegean Sea	1.01.2001	Trammel Net
<i>Tripterygion delaisi</i> Cadenat & Blache, 1970*	2018-1464	1	Saros Bay	Aegean Sea	9.06.2014	SCUBA
<i>Tripterygion delaisi</i> Cadenat & Blache, 1970*	2018-1465	2	Saros Bay	Aegean Sea	10.06.2014	SCUBA
<i>Tripterygion delaisi</i> Cadenat & Blache, 1970*	2018-1466	1	Saros Bay	Aegean Sea	5.06.2013	SCUBA
<i>Tripterygion delaisi</i> Cadenat & Blache, 1970*	2018-1467	3	Gökçeada Island	Aegean Sea	26.07.2015	SCUBA
<i>Tripterygion delaisi</i> Cadenat & Blache, 1970*	2018-1468	1	Saros Bay	Aegean Sea	12.06.2014	SCUBA
<i>Tripterygion delaisi</i> Cadenat & Blache, 1970*	2018-1469	2	Gökçeada Island	Aegean Sea	9.10.2017	SCUBA
<i>Tripterygion delaisi</i> Cadenat & Blache, 1970*	2018-1470	4	Gökçeada Island	Aegean Sea	9.10.2017	SCUBA
<i>Tripterygion delaisi</i> Cadenat & Blache, 1970*	2018-1471	1	Gökçeada Island	Aegean Sea	11.10.2017	SCUBA
<i>Tripterygion delaisi</i> Cadenat & Blache, 1970*	2018-1472	6	Gökçeada Island	Aegean Sea	11.10.2017	SCUBA
<i>Tripterygion delaisi</i> Cadenat & Blache, 1970*	2018-1473	1	Gökçeada Island	Aegean Sea	25.08.2017	SCUBA
<i>Tripterygion melanurum</i> Guichenot, 1850*	2018-1474	1	Saros Bay	Aegean Sea	29.08.2016	SCUBA
<i>Tripterygion tripteronotum</i> (Risso, 1810)*	2018-1475	4	Gökçeada Island	Aegean Sea	24.08.2017	SCUBA
<i>Tripterygion tripteronotum</i> (Risso, 1810)*	2018-1476	2	Gökçeada Island	Aegean Sea	23.08.2017	SCUBA
<i>Tripterygion tripteronotum</i> (Risso, 1810)*	2018-1477	2	Gökçeada Island	Aegean Sea	24.08.2017	SCUBA
<i>Tripterygion tripteronotum</i> (Risso, 1810)*	2018-1478	3	Gökçeada Island	Aegean Sea	24.08.2017	SCUBA
<i>Tripterygion tripteronotum</i> (Risso, 1810)*	2018-1479	1	Gökçeada Island	Aegean Sea	10.10.2017	SCUBA
<i>Tripterygion tripteronotum</i> (Risso, 1810)*	2018-1480	1	Gökçeada Island	Aegean Sea	22.06.2017	SCUBA
<i>Tripterygion tripteronotum</i> (Risso, 1810)	20400-401	1	Incekum-Alanya	Mediterranean Sea	6.02.1966	

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