

Tessellate goby, *Coryogalops tessellatus* Randall, 1994 (Teleostei: Gobiidae), an additional fish element for the Iranian marine waters

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Abstract

The gobiid genus *Coryogalops* is a group of small-sized benthic fishes, living in calm shallow waters of estuaries and lagoons in the coasts of central and western Indian Ocean, Red Sea and southeastern Atlantic Ocean. This study presents the first record of Tessellate goby, *Coryogalops tessellatus* Randall, 1994 from the Iranian intertidal coast of Persian Gulf and Strait of Hormuz. The morphological description and coloration of collected individuals are provided.

Keywords: Gobies, Biodiversity, Taxonomic Diversity, Morphology, Geographical range, Indian Ocean.

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Introduction

Recent field investigations in the Persian Gulf and Strait of Hormuz have resulted in the discovery or new records of different fish groups (Uiblein and Heemstra 2011; Sadeghi et al. 2017; Mehraban and Esmaeili 2018) including gobies. Gobiidae with 1904 valid species is the richest family of marine fish belonging to the Gobiiformes and indeed one of the largest families of vertebrates according to Fricke et al. (2019). They live on many different bottom habitats of tropical and subtropical regions of marine, brackish, and freshwater environments including sandy or rocky habitats, tide pools, mudflats and sandy flats (Patzner et al. 2012; Nelson et al. 2016). Due to their cryptic nature, small size and lack of immediate economic importance, gobies are poorly understood. Blegvad and Løppenthin (1944) for the first time reported 12 species of gobiids in their studies on fishes of Iranian waters of the Persian Gulf. Recently Rahimian and Pehpouri (2006) reported eight gobies from the Qeshm Island. Also, Ghanbarifardi and Malek (2007) have done one survey on fishes of the Persian Gulf and Makran/Oman Sea and reported seven species of gobiids in their studies but no record of *Coryogalops* species.

Coryogalops Smith, 1958 is a genus of small-sized benthic gobies, living in calm shallow waters of estuaries and lagoons. They are restricted to the coasts of central and western Indian Ocean, the Red Sea and the southeastern Atlantic Ocean along the coasts of South Africa to Pakistan (Goren 1991; Randall 1994; Patzner et al. 2012). The genus *Coryogalops* currently comprises 12 valid species. A generic diagnosis and key for identification of the 12 known species of *Coryogalops* were provided by Kovačić et al. (2016). Of these only *C. adamsoni* has been recorded from the Iranian coast of the Persian Gulf (Rahimian and Pehpouri 2006; Daryanavard et al. 2015). Though *C. tessellatus* has been reported from the coastal areas of southern Persian Gulf and Oman Sea, including Bahrain, Saudi Arabia and Oman (Randall 1994), there has been no record of it from the northern side (Iranian coast of the Persian Gulf and Strait of Hormuz). Hence, the aim of this paper is recording *C. tessellatus* for the first time from the Iranian coast of the Persian Gulf by providing its detailed morphological characteristics.

Material and Methods

The specimens of *C. tessellatus* (Fig. 1) were collected at low tide from a shallow sandy and rocky coastline at the depth of 10 cm in three localities of intertidal zones of the Iranian coast of the Persian Gulf, including

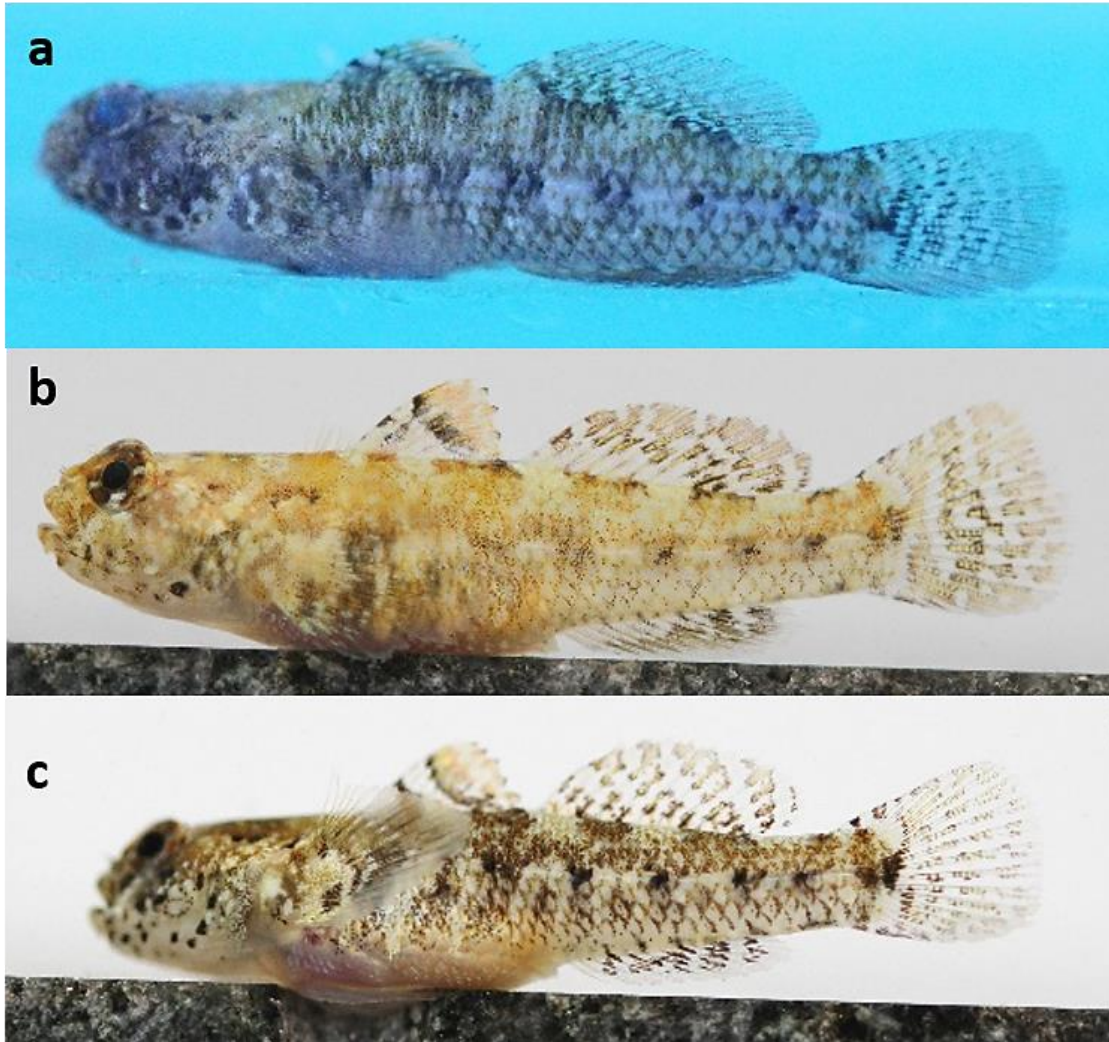


Figure 1. *Coryogalops tessellatus*: (a) male, 22.5 mm, Bushehr, Dayyer; (b) male, 23.5 mm, Parsian, Bostanu; (c) male, 22.3 mm SL, Qeshm island, Messen.

Bushehr (27°50'N, 51°53'E), Parsian (26°59'N, 53°32'E) and Qeshm island (26°44'N, 56°00'E) by hand nets with mesh size 1.30 mm in seven trips from August 2016 to May 2018 (Figs. 2-3). After anesthesia with Quinaldine sulphate, the collected specimens were fixed in 10% formalin solution and brought to the laboratory. The specimens were classified according to sex based on the shape of genital papilla. Specimens are deposited in the Zoological Museum of Shiraz University, Collection of Biology Department, Shiraz (ZM-CBSU) under museum numbers of ZM-CBSU F4-01 to ZM-CBSU F4-36. The specimens were identified following Smith and Heemstra (1987), Randall (1994; 1995) and the comparative data on the later described *Coryogalops* species (Kovačić et al. 2014, 2016).

Morphometric characteristics were measured to the nearest 0.1 mm using digital calipers under the stereomicroscope (Zeiss Stemi sv6). A stereomicroscope was used for the meristic characters. Morphometric characters were taken from the left side of the body and were given as % standard length (SL) in Table 1. Meristic and morphometric methods follow Randall (1994). Meristic abbreviations are as follows: D1 = First dorsal fin; D2 = Second dorsal fin; V = Ventral fin; A = Anal fin; P = Pectoral fin; PSD = Predorsal scales; LSS= Longitudinal scales series; and TSS = Transverse scales series. The LSS is the number of scales from above the dorsal end of the gill opening to the base of caudal fin. TSS is the number of scales from the origin of the anal fin diagonally upward to the base of the first dorsal fin (Randall 1994).

Table 1. Measurements (expressed as % of standard length) of holotype (Randall 1994) and new newly fresh collected individuals of *Coryogalops tessellatus* from 3 localities in the Iranian coast of Persian Gulf and Strait of Hormuz.

Character	Holotype	Qeshm			Bushehr			Parsian		
		Mean	Male	Female	Mean	Male	Female	Mean	Male	Female
Locality	Bahrain									
Standard Length (mm)	31.3	25.03	25.91	23.72	19.22	19.45	18.99	25.01	26.91	23.74
Body depth	19.2	18.27	18.32	18.19	17.87	17.87	17.87	17.87	17.87	17.87
Body width	17.9	18.18	18.32	17.97	17.87	17.87	17.87	17.87	17.87	17.87
Head length	28.7	29.01	29.37	28.46	29.12	29.22	29.02	29.05	28.98	29.10
Snout length	6.4	6.69	6.75	6.58	6.76	6.81	6.70	6.80	6.82	6.78
Eye diameter	7.8	7.82	7.94	7.63	7.85	7.97	7.74	7.87	7.91	7.85
Upper jaw length	12.1	12.21	12.18	12.24	12.31	12.34	12.28	12.54	12.64	12.47
Caudal peduncle depth	12.2	11.79	11.83	11.73	11.74	11.62	11.85	11.69	11.77	11.63
Caudal peduncle length	21	21.19	21.17	21.23	22.06	22.23	21.88	21.45	20.75	21.91
Predorsal length	33.6	32.79	33.03	32.42	32.11	31.91	32.32	30.65	30.55	30.72
Preanal length	58.2	57.42	57.30	57.59	59.40	59.37	59.42	58.50	58.30	58.64
Prepelvic length	26.5	26.87	27.18	26.40	26.79	26.78	26.80	26.79	26.79	26.79
First dorsal base length	51.5	49.86	49.66	50.16	50.00	50.00	49.99	49.68	49.76	49.63
Anal base length	22.4	21.20	21.21	21.18	21.36	21.51	21.21	20.33	20.38	20.29
Caudal fin length	25.8	22.57	22.82	22.18	22.56	22.29	22.82	21.28	21.15	21.38
Pectoral fin length	25.5	25.90	26.13	25.55	27.48	27.48	27.47	27.48	27.48	27.48
Pelvic fin length	21.8	21.87	21.54	22.37	21.41	21.44	21.38	22.01	22.15	21.92

Results

Generic identification was consistent with diagnosis of Kovačić et al. (2016): (1) head and predorsal area naked (except for *C. tessellatus* and *C. monospilus*), (2) longitudinal scales rows 26-46 (*C. nanus* with 26-29 rows), (3) upper pectoral-fin rays at least partly free, (4) gill opening restricted, ending ventrally at lower base of pectoral fins, (5) united pelvic fins (fins separated in *C. anomolus* only), (6) cephalic sensory systems with separate anterior and posterior oculoscapular canals with pores σ , λ , κ , ω , α , β , ρ and $\rho 1$ and $\rho 2$, respectively, and preopercular canal with pores γ , δ and ϵ , (7) suborbital papillae pattern transverse, with six or seven suborbital rows (may be present in all *Coryogalops* species, including *C. anomolus*, except for *C. bulejiensis* that possesses five suborbital transversal rows (Goren 1985)).

Coryogalops tessellatus Randall, 1994

(Fig. 1)

Randall [J. E.] 1994:328, fig. 2; Pls. 10 (lower), 11 [Fauna of Saudi Arabia v. 14; Ras Hayan, Persian Gulf, Bahrain, depth 0-0.4 meters].

Material collected: ZM-CBSU F4-01 to ZM-CBSU F4-15, 23.72-25.91 mm SL; Iran: Hormozgan Prov.: Qeshm, Messen village 26°44'N, 56°00'E; R. Sadeghi, J. Tavalai, 20 May 2018. - ZM-CBSU F4-16 to ZM-CBSU F4-21, 18.99-19.45 mm SL; Iran: Bushehr Prov.: Bushehr, Dayyer, Ouli village 27°50'N, 51°53'E; R. Sadeghi, 14 Nov. 2016. - ZM-CBSU F4-22 to ZM-CBSU F4-36, 23.74-26.91 mm SL; Iran: Hormozgan Prov.: Parsian, Bostanu village 26°59'N, 53°32'E; R. Sadeghi, 31 Aug. 2016.

Species diagnosis: (from Randall (1994), updated for the later described *Coryogalops* species in Kovačić et al. (2014; 2016)): No tentacle on upper margin of orbit, dorsal rays VI-I, 10-11; anal rays I, 9-10; pectoral rays 16-19 (16-17 in the present specimens), the upper three free of membrane; pelvic fins united, forming elliptical pelvic disc, pelvic frenum present; longitudinal scale series 30-33 (30-32 in the present specimens); transverse scales 11; scales ctenoid except ventrally on abdomen; head naked; no predorsal scales; no scales on side of nape, prepectoral area, or ventrally on thorax; gill opening ending at level of lower edge of pectoral fin base; body depth 5.1-5.8 in SL (16.9-19.5/SL); caudal fin rounded and short, its length 3.85-4.35 in SL (21.9-25.9/SL); fresh coloration: a narrow mid lateral stripe composed of alternating double white and black spots,

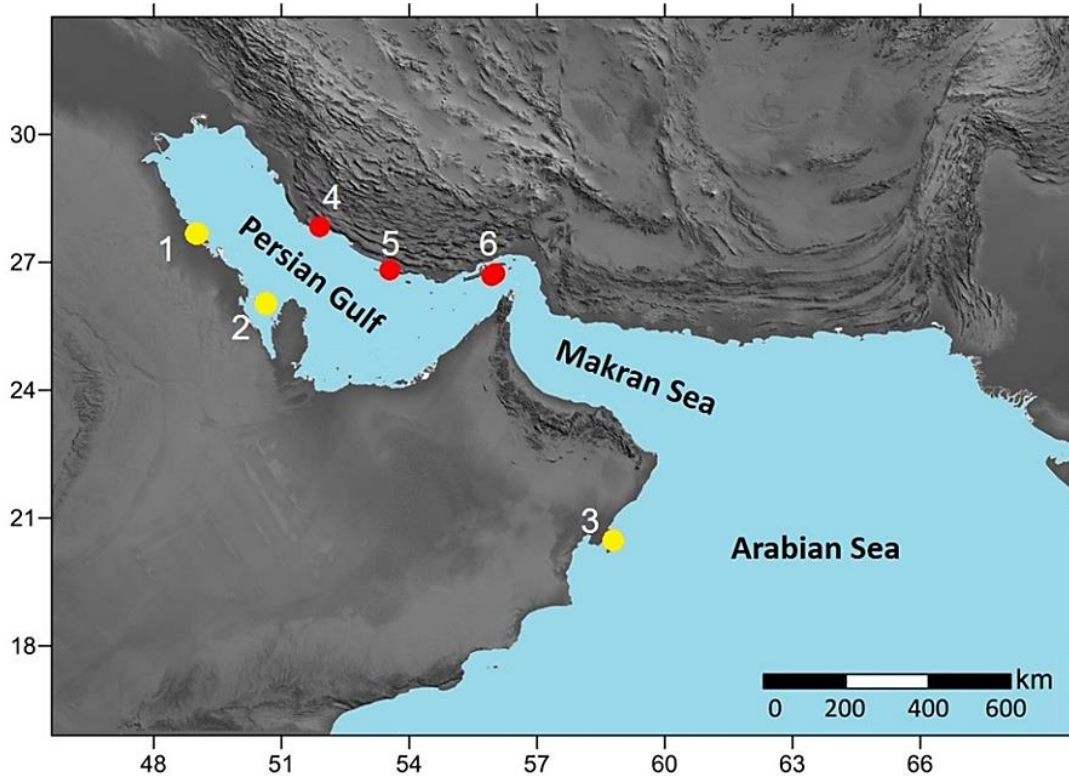


Figure 2. Distribution map of *Coryogalops tessellatus*. The solid yellow circles are the previously known locality: (1) Persian Gulf, Manifa Reef, 27°39.7'N 49°1.3'E, sand and rubble patch in reef, (2) holotype locality, Bahrain, Persian Gulf, Ras Hayan, algae and sand, (3) Arabian Sea, central coast of Oman, Masirah Island, west side, 1 km north of Marsis, tidal flat, seagrass and small rocks. The solid red circles are the new record localities, (4) Bushehr, Dayyer (5) Parsian, Bostanu and (6) Qeshm Island, Messen.

ending in a triangular brown spot on base of caudal fin; body above stripe mottled brown and whitish; body below stripe white, the edges of scales dark brown without dark orange spots; ventral part of head with a series of dark brown to black spots; first dorsal fin diagonally banded with blackish and white, without black blotches or spots.

Morphological description: D1: VI; D2: I, 10-11; A: I, 9-10; P: 16-17; PSD: 0; LSS: 30-32; TSS: 11. See Figure 1 for general appearance and Table 1 for morphometric characteristics of holotype (Randall 1994) and collected individuals. Body moderately elongate, body depth 17.87-18.32% SL; head length 28.46-29.37% SL, dorsal profile of head smoothly convex except dorsal part of eye projecting above contour; snout short and its length 23.21 (22.72-23.54) % head ; orbit diameter 27.01 (27.26-27.27)% head; no tentacle on eye; interorbital space very narrow; pectoral rays 16-17, the upper three pectoral rays free of membrane; scales ctenoid except ventrally on abdomen, scales progressively larger posteriorly on body, head and nape naked, no predorsal scales, no scales on side of nape, prepectoral area, or ventrally on chest; gill opening ending at level of lower edge of pectoral fin base; caudal fin rounded and short; caudal peduncle length 75.8 (76.67-81.55)% head, caudal peduncle depth 39.93 (39.32-40.95)% head; mouth large and oblique; maxilla reaching to below center of eye; lower jaw slightly projecting; tongue nearly truncate; anterior nostril in a membranous tube at edge of upper lip in front of lower edge of pupil; a slender flap posteriorly on anterior nostril which reaches nasal pore when laid back; posterior nostril near edge of orbit in front of upper edge of pupil; dorsal-fin origin above basal half of pectoral fins; anal-fin origin posterior below base of second dorsal-soft ray; origin of pelvic-fins origin anterior to base of pectoral fins; pelvic fins fully connected and short, not approaching anus.

Color: Body with a narrow mid-lateral stripe composed of alternating double white and double black spots, ending in a triangular brown spot on base of caudal fin; body above stripe mottled brown and whitish; lower



Figure 3. Natural habitats of *Coryogalops tessellatus*. (a) Bushehr, Dayyer, (b) Parsian, Bostanu, and (c) Qeshm Island, Messen.

part of body white with dark brown edges on scales, head brown, finely mottled with small whitish and dark brown spots; lower part of head with a series of dark brown spots; the largest two on lower opercle and subopercle; a series of dark brown blotches along edge of preopercle; first dorsal fin white with a narrow irregular diagonal blackish and yellowish band from first to base of fourth spine, a narrow whitish band above this, then a broad yellowish band, outer edge of fin white; second dorsal fin brown, shading to light brown distally, with numerous small irregular whitish and brownish spots and an irregular row of small dark brown spots along base; pectoral fins pale brown with a few small indistinct brown spots at base; anal fin colored like second dorsal fin on basal half, light brown on outer half; pectoral fins pale brown with a few small indistinct brown spots at base; pelvic fins with brown rays and dark brown membranes.

Habitat: The specimens were found in the substrates with sand, rubble, gravel, some rock with algae and seagrass in the intertidal coasts of the Persian Gulf and Strait of Hormuz at depths of 10-20 cm (Figs. 2, 3).

Discussion

Although 12 species of the genus *Coryogalops* have been identified and reported from different biogeographic regions from the southeastern Atlantic Ocean and the western Indian Ocean along the coasts of Africa and Asia from South Africa to Pakistan (Fricke et al. 2019), but there was no record of *C. tessellatus* from Iran. Ichthyological survey in different intertidal coasts of the Persian Gulf and Strait of Hormuz revealed presence of this additional species that has been previously recorded only from three localities in the southern regions of the Persian Gulf in Bahrain and central coast of Oman (Randall 1994). The new records from northern side of Persian Gulf and Strait of Hormuz are the first documented occurrence of *C. tessellatus* in the Iranian waters and it is a new addition to the marine fish species list for Iran and indicates presence of a suitable habitat for this species along the Iranian coast of the Persian Gulf and Strait of Hormuz.

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Literature cited

- Blegvad H., Løppenthin B. 1944. Fishes of the Iranian Gulf. Einar Munksgaard, Copenhagen. 26 + 416 p.
- Daryanavard A., Abdoli A., Ranjbar M.S., Shokri M.R., Kiabi B.H. 2015. Spatial and temporal dynamics of the rock-pool ichthyofauna on Qeshm Island, Persian Gulf (Osteichthyes). *Zoology in the Middle East* 61(2): 133-138.
- Fricke R., Eschmeyer W.N., van der Laan R. 2019. Eschmeyer's catalog of fishes: genera, species references. Available from: <https://www.calacademy.org/scientists/projects/eschmeyers-catalog-of-fishes>. Retrieved 13 April 2019.
- Ghanbarifardi M., Malek M. 2007. Permanent intertidal fish from the Persian Gulf and Gulf of Oman, Iran. *Iranian Journal*

- of Animal Biosystematics 3(1): 1-14.
- Goren M. 1985. A review of the gobiid fish genus *Monishia* Smith, 1949, from the western Indian Ocean and Red Sea, with description of a new species. Contributions in Science (Los Angeles) 360: 1-9.
- Goren M. 1991. A new *Coryogalops* species (Pisces: Gobiidae) from South Africa. JLB Smith Institute of Ichthyology Special Publication 52: 1-7.
- Kovačić M., Bogorodsky S.V. 2014. A new species of *Heteroleotris* (Perciformes: Gobiidae) from the Red Sea. Zootaxa 3764(4): 475-481.
- Kovačić M., Bogorodsky S.V., Mal A.O. 2016. A new species of *Coryogalops* (Perciformes: Gobiidae) and the first adult record of *Feia nympha* from the Red Sea. Zootaxa 4097(3): 341-352.
- Mehraban H., Esmaeili H.R. 2018. Comb-tooth blennies of the intertidal zones of Persian Gulf and Makran Sea: Morphology, taxonomy, distribution and conservation status (Blenniiformes: Blenniidae). Iranian Journal of Ichthyology 5(3): 192-211.
- Nelson J.S., Grande T.C., Wilson M.V. 2016. Fishes of the world. John Wiley & Sons. 752 p.
- Patzner R., Van Tassell J.L., Kovacic M., Kapoor B.G. 2012. The biology of gobies. Science Publishers, Enfield, UK. 650 p.
- Rahimian H., Pehpouri A. 2006. Intertidal fishes of Qeshm Island, the Persian Gulf, I. Gobiidae (Pisces: Perciformes). Journal of Science (University of Tehran) 33(4): 69-76.
- Randall J.E. 1994. A new genus and six new gobiid fishes (Perciformes: Gobiidae) from Arabian waters. Fauna of Saudi Arabia 14: 317-340.
- Randall J.E. 1995. Coastal fishes of Oman. University of Hawaii Press. 439 p.
- Sadeghi R., Esmaeili H.R., Fricke R., Larson H. 2017. New geographical record and morphological features of the Indo-Pacific tropical sand goby, *Favonigobius reichei* (Bleeker, 1854) from Iranian coast of the Makran Sea (Teleostei, Gobiidae). Check List 13(5): 641-645.
- Smith M.M., Heemstra P.C. 1987. Smith's Sea fishes. Springer-Verlag, Berlin. 1047 p.
- Uiblein F., Heemstra P.C. 2011. Description of a new goatfish species, *Upeneus randalli* n. sp.(Mullidae), from the Persian Gulf, with remarks and identification keys for the genus *Upeneus*. Scientia Marina 75(3): 585-594.