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ORIGINAL ARTICLE

First substantiated records of some benthopelagic fishes (Actinopterygii: Nemipteridae, Holocentridae, Kyphosidae, Sciaenidae and Coryphaenidae) in north eastern Gulf of Aden, Hadhramout coast

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Abstract
In the Hadhramout coast, the Gulf of Aden, six substantiated records fish species were recorded for first time. Review of all previous studies and publications show that these species from different families were not previously reported in the Gulf of Aden. The species identified include *Parascolopsis eriomma* (Nemipteridae), *Kyphosus vaigiensis* (Kyphosidae), *Sargocentron rubrum* (Holocentridae), *Coryphaena equiselis* (Coryphaenidae), *Argyrosomus japonicus* (Sciaenidae) and *Scarus nigar* (Scaridae). This paper describes the detailed characteristics of each species.

Keywords: Morphometric, Hadhramout coast, *Parascolopsis eriomma*, *Scarus nigar*, Yemen.

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INTRODUCTION

Rational use of fish resources is impossible without a comprehensive investigation of the ichthyofauna, determination of species composition, and biogeography of individual species (Manilo & Bogorodsky 2003). If we ignore the opinion of some authors who believe that the Gulf of Aden is a barrier between the Red and Arabian Seas (Kemp 2000; Abdel-Rahman 2006), from point of view of marine biodiversity, we believe and support the researchers who consider the Gulf of Aden is a transitional zone between the Red Sea, southern Arabia, and east Africa. The variety of species inhabiting there is relatively large due to the overlapping distribution of species from each of them with endemic ones (Wilson & Klaus 2000; Di Battista et al. 2017; Al Saafani et al. 2015; Bogorodsky & Randall 2019). We assure that the Gulf of Aden, in addition to being rich in marine biodiversity, is characterized by climate change factors, environmental conditions, and phenomena that have helped to attract more components of this diversity in recent years, especially fish (Manilo & Bogorodsky 2003; Ali et al. 2009; Ali & McNoon 2010; Al Saafani et al. 2015).

It is known that many fish species during their life cycle show different needs for spatial and zonal constructions. Thus, different habitats are a major factor in their distribution, especially those that allow them to maximize their prey consumption and reduce the risk of predators' attack (Gilliam & Fraser 1987; Ciannelli et al. 2008). Here, for the first time, we describe some species on the Hadhramout coast and the Gulf of Aden through some samples from commercial fishing; although some authors mentioned some of them in Socotra Archipelago and the eastern Somali coast without a detailed description (Randall 1996; Kemp 1998; Knudsen & Clements 2013; Zajonz et al. 2019). It should be pointed out that most of what is reported about the documented registration of species for Yemen is not from the Gulf of Aden, but from the coast of Yemen on the Red Sea. This despite the fact that the Gulf of Aden is a transitional zone between the Indo-Malaysian, East-African, and Red Sea provinces, where ichthyofauna mix, which leads to an increase in the number of species composition in this area (Manilo 1994; Manilo & Bogorodsky 2003). What we notice of the species here from the Gulf of Aden was not mentioned even in the comprehensive work

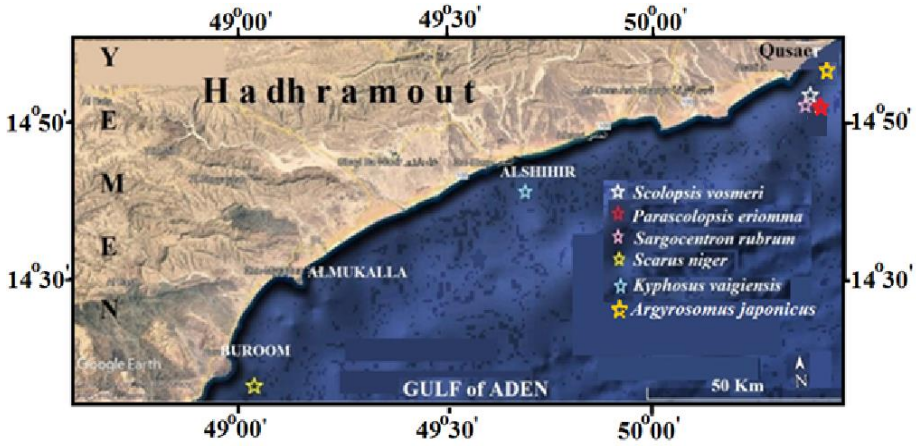

Fig.1. Map of the Gulf of Aden showing the locations where the specimens were caught.

of Manilo & Bogorodsky (2003).

MATERIAL AND METHODS

The fishing stations of the collected specimens' representatives of Nemipteridae, Scaridae, Holocentridae, Kyphosidae, Coryphaenidae and Sciaenidae were along Hadhramout coast in the districts of Qusayr and Al-Shihir north of the city of Al-Mukalla (capital of Hadhramout Province, Yemen), and Burum southwest of Al-Mukalla (Fig. 1). These locations are geographically characterized by being between the Gulf of Aden and the Arabian Sea. This region is influenced yearly by two distinct, the South West monsoon, which occurs between May and September and the dry monsoon i.e. northeast one, which prevails between October and April every year. The specimens recovered throughout 2017-2019 and 2022 were being described, measured and photographed.

RESULTS

Order: Perciformes
Family: Nemipteridae
Genus: *Parascolopsis* Boulenger, 1901
Parascolopsis eriomma (Jordan & Richardson, 1909)
Rosy dwarf monocle bream (Fig. 2)
Material examined: One female (II maturation stage): 21.5cm SL, caught 10.12.2020 at the vicinity fisheries harbor of Qusayr district, Hadhramout coast at depth of 20m.
Synonyms: *Scolopsis eriomma* Jordan & Richardson, 1909; *Parascolopsis cf. eriomma*: Hung et al. 2016; *Parascolopsis eriomma*: Fujiwara 2017.
Holotype: FMNH 52247, 190.9mm SL, Kaohsiung (Takao), Taiwan.
Diagnostic: *Parascolopsis eriomma* is distinguished from other *Parascolopsis* species by having 17-19 on first arch versus 8 to 12 in others. A small rudimentary spine below eye. Having rosy-colored dursum with a diffuse yellow longitudinal band right along middle of its side. Body depth 2.5 to 3.0 in SL. Snout length less than eye diameter. Scales of head reach to farther of between eyes. Distinguishing by its moderately long pelvic fins, which reach almost up to vent. Dorsal spines (total): 10; Dorsal soft rays (total): 9; Anal spines: 3; anal soft rays 7, 2nd anal-fin spine longer and more robust than 3rd anal fin spine. Pectoral fins with 2 unbranched and 14-15 branched rays. Preopercle naked.
Description: Measurements and counts are presented in Table 1. Body moderately deep with 2.7 in SL; head moderate, head length 3.4 in SL; snout length more than half of eye diameter; eyes large, round, located in upper portion of anteroposterior axis, diameter 3.3 times in HL; 3–5 pairs of quite noticeable canines on front of both jaws, single row of small conical teeth follows with canines. Gill rakers 19; head scales reaching forward to between middle of eyes. Posterior margin of suborbital finely denticulate, with a small spine at upper corner (Fig.

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Fig.2. *Parascolopsis eriomma* (Jordan & Richardson, 1909), 21.5cm SL, from Hadhramout coast, Yemen (photograph by M.A. Algurabi).

Table 1. Morphometric values for *Parascolopsis eriomma* Jordan & Richardson, 1909 from Hadhramout coast, Gulf of Aden, Yemen.

Characters	*Parascolopsis eriomma*	
	Value, mm	
Total length (mm)	262	100
Forked length (mm)	238	90.8% TL
Standard length (mm)	215	82.1 % TL
% SL		
Head length	63	29.3
Eye diameter	19	8.8
Snout length	12	5.6
Post-orbital length	32	14.9
Pre-dorsal length	59	27.4
Pre-pectoral length	60	27.9
Pre-pelvic length	70	32.5
Pre-anal length	120	55.8
Body depth	80	37.2
Caudal peduncle high	20	9.3
Dorsal-fin base length	117	54.4
Longest dorsal-fin spine length	25.1	11.7
Pectoral-fin length	63	29.3
pelvic-fin length	49	22.9
Anal-fin base length	38.1	17.7
3rd anal-fin spine length	27.3	12.7
Upper lob of caudal-fin length	53.5	24.9
Lower lob of caudal-fin length	45.8	21.3
% HL		
Snout length	12	19
Eye diameter	19	30.2
Interorbital width	19.3	30.6
Meristic characters:		
Dorsal-fin rays	X, 9	
Anal-fin rays	III, 7	
Pectoral-fin rays	16	2 unbranched+14
Pelvic-fin rays	I, 5	
Pored lateral-line scales	36	
Scales upper lateral-line	2½	
Scales below lateral-line	11	
Scale rows on preopercle	4	
Scale rows on opercle	5	
Gill rakers	19	
Vertebras	10 + 13	

3). Lateral-line scales 36, 2.5 scales upper LL, 13 below. Scales cycloid, large and smooth to touch, covering most head. Pectoral-fin rays 16; pectoral fins long, reaching to or almost to level of anus; pelvic fins long, reaching to level of anus.

Coloration: In life: Body pinkish. Post orbital head and body with a faint yellow band laterally against the background of the general pinkish red color of

Fig.3. The head of *Parascolopsis eriomma* shows the small spine below eyes.

the body, paler ventrally. Dorsal fin pink, spinous margin reddish; pectoral and caudal fins light reddish pink.

Distribution: Widespread in the Indo-West Pacific. Indian Ocean, including the Gulf of Oman, Red Sea, east Africa, Seychelles and Zanzibar. Sri Lanka, Andaman Sea; and West Pacific, including southern Japan, Taiwan, South China Sea, Philippines, Indonesia. Not mentioned in yet. This species is not yet reported from the Gulf of Aden and this is the first report from these coastal waters of Yemen.

Remarks: A second specimen was taken at the same place, but the tail section was cut off, with traces of predation; it was a female with an ovary at the fourth stage of maturity (matured ovum). Since *P. eriomma* has now appeared in the fishery along with other famous nemipterid fish in the Gulf of Aden, its presence cannot be accidentally or associated with the discharge of ballast water but is most likely due to climate change. An increase in water temperature has led to the movement of the species north from the waters of the southern Indian Ocean. It is also due to the first monsoon (upwelling) that can be the main reason for attracting a large number of fishes from the southern Indian Ocean in the last years under the influence of climate change. It is found in coral reefs and coastal to offshore shelf waters with sandy or muddy bottoms, down to about 300 m depth. Carnivorous, feed on small fishes, crustaceans, cephalopods, and polychaetes (Kimura et al. 2009).

Order: Perciformes

Family: Kyphosidae

Genus: *Kyphosus* Lacépède, 1801

Kyphosus vaigiensis (Quoy & Gaimard, 1825) Lowfin chub (Fig. 4)

Material examined: Eighteen females with 36.86cm mean SL (II-III maturation stage), one specimen was male 37.4cm SL (III maturation stage): caught by hook and line, March 2021 at vicinity of Qusayr district, Hadhramout coast at depth of 75-100m.

Synonyms: *Khyphosus vaigiensis* (Quoy & Gaimard, 1825); *Kyphosus bleekeri* Fowler, 1933; *Kyphosus gibsoni* Ogilby, 1912; *Kyphosus lembus* (Cuvier, 1831); *Kyphosus vaigensis* (Quoy & Gaimard, 1825); *Pimelepterus fuscus* (non Cuvier, 1831); *Pimelepterus lembus* Cuvier, 1831; *Pimelepterus marciac* Cuvier, 1831; *Pimelepterus ternatensis* Bleeker, 1853; *Pimelepterus vaigiensis* Quoy & Gaimard, 1825: 386, pi. 62, fig. 4; *Segutilum gibsoni* (Ogilby, 1912).

Type locality: Waigeo Island, Indonesia.

Diagnosis: It is characterized by single continuous dorsal fin, with 11 spines and 13 to 14 (usually 14) soft rays; anal fin with 3 spines and 12-14 (usually 13) soft rays; pectoral fins short, with 18 soft rays. Gill rakers on first-gill arch 19 (rarely 19). Scales small, ctenoid covering most of head (except the snout). Body with prominent bronze lines on body. On side of head, two yellow-bronze lines present around eyes and under it, lower one leaning towards base of pectoral fin. Tail with large symmetrical lobules.

Description: Body lliptical, compressed laterally,

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Fig.4. *Kyphosus vaigiensis* (Quoy & Gaimard, 1825) from Hadhramout coast, Yemen: Female 39.3cm (Scale bar = 5cm).

Fig.5. Upper (A) and lower (B) Jaws of *Kyphosus vaigiensis* with main teeth arrangement, note the villiform teeth markings on the vomer, palatine, and tongue.

covered with small, thick ctenoid scales, including most of head, naked in front of medium-sized eyes. Mouth terminal, small, horizontally positioned, retractable, posterior end of praemaxillare protrudes outward. Head before eye gently convex, without a bump. Supramaxillare missing; praemaxillare issued from under praeoculare. Jaws with one outer row of blunt lanceolate narrow incisor teeth, rounded tips and a curved, hockey-stick shape; bases arranged horizontally and fan-shaped, forming together the appearance of a radially striped bone plate inside mouth, behind them present a row of a narrow band of villiform teeth; fine teeth on vomer, palatinum and tongue (Fig. 5). Scales form a thick cover on base of soft parts of all fins except ventral one. Lateral line continuing, in form of a low arch. Caudal fin wide and strongly notched. Precaudal and caudal vertebrae 10 and 15, respectively. Proportional measurements and counts are presented in Table 2.

Coloration: Alive body often grey to silvery with a number of weak horizontal lines of slightly pronze coloured scales along the body, lighter ventrally. The distal halves of the dorsal, anal and caudal fins darker in color. There are two yellowish-bronze stripes on the sides of the head, inherent characteristic of this species, the upper one starts from the front of the snout and passes through the eye to the end of the preopercle, and lower one starts from the beginning of the upper jaw and passes under the eye socket to the end of the preopercle as well, but it seems to continue, reaching and covering the base of the pectoral fin.

Distribution: *Kyphosus vaigiensis* is a circumtropical species distributed along the Indian, Atlantic, and Pacific oceans, the Red Sea, and the Mediterranean (Knudsen & Clements 2013, 2016; Evans et al. 2020). It is inshore species found over hard bottoms. It can also occur offshore under floating objects or following ships (Nelson 1994). This species is the Twelfth non-indigenous marine fish recorded in the Hadhramout coast, Aden Gulf last years (Ali & Bazar 2005; Ali & McNoon 2010; Ali et al. 2009, 2020, 2021; Moteah & Ali 2018), but the first of circumtropical origin. None of the ichthyological investigations carried out on the coasts of Yemen had mentioned it, either on Aden Gulf or Red Sea. This species is known for its local and oceanic migration and for more than 400 km between feeding and breeding area (Sakihara et al. 2015).

Remarks: Despite mentioning Yanulov (1968) and Manilo & Bogorodsky (2003) about the possible presence of *K. vaigiensis* in the Gulf of Aden, however, they did not provide a confirmed substantiation of what they put in their resolutions. However, for more than half a century, this species

Table 2. Morphometric values of *Kyphosus vaigiensis* from Hadhramout coast, Gulf of Aden, Yemen.

Characters	18 Females	Range		1 Male	
Total length (TL), cm	46.78±0.15	43.1–50		45.5	
Weight kg.	2.1±0.38	1,4–2.7		1.8	
Fork length, cm	42.32±0.19	42–47		42	
Standard length, cm	36.86±0.17	36–39.5	% SL	37.4	% SL
Head length (HL)	9.61± 0.15	8.7–10.8	26.1	9	24.1
Snout length	2.77±0.10	2.3–4	7.5	2.4	6.4
Eye diameter	2.22±0.11	1.6–2.5	6	2.2	5.9
Post orbital length	4.6±0.20	3.1–5.3	12.5	4.4	11.8
Pre-dorsal length	14.88±0.21	13.6–15.8	40.4	13.5	36.1
Pre-pectoral length	9.36±0.23	8.3–10.2	25.4	9	24.1
Pre-pelvic length	11.5±0.4	9–13.2	31.2	11.2	29.9
Pre-anal length	24.83±0.16	20.5–27.4	67.3	23.6	63.1
Body depth	17.66±0.17	16–19.4	47.9	17.3	46.3
Caudal peduncle depth	4.85±1.6	3.6–5.3	13.2	4.2	11.2
Dorsal fin base length	20.16±0.14	18.8–22.4	54.7	19.6	52.4
Pectoral fin length	6.49±0.06	5.8–7	17.6	6.3	16.8
Pectoral fin base	2.55±0.00	2.4–2.7	6.9	2.4	6.4
Anal fin base length	10.05±0.14	9.7–11.2	27.3	9.7	25.9
Pelvic fin length	5.88±0.11	5.6–6.6	15.9	5.6	14.9
Head length (HL)	9.61± 0.15	8.7–10.8	% HL	9	% HL
Snout length	2.77±0.10	2.3–4	28.8	2.4	27.1
Eye diameter	2.22±0.11	1.6–2.5	23.1	2.2	24.4
Post orbital length	4.6±0.18	4.3–4.8	47.9	4.37	48.5
Interorbital width	5.2	4.2–6	54.1	4.8	53.3
Upper jaw length	2.33	2.1–3.5	24.2	2.1	23.3
Lower jaw length	1.72	1.3–2.9	17.9	1.5	16.7
	Meristic characters:				
Dorsal fin spines	11(16), 10(2)	10–11		11	
Dorsal fin soft rays	14(15), 13(3)	13–14		12	
Anal fin spines	3			3	
Anal fin soft rays	13(13), 12(5)	12–14		13	
Pectoral fin rays	18(12),17(5)	17–19		18	
Pelvic fin rays	1, 5	1, 5–5		1,5	
Caudal fin rays	19	19–19			
Vertebrae total	24			24	
Preanal Vertebrae	10			10	
Caudal Vertebrae	14			14	
Total Gill rakers (GR)	9 + 21			9 + 21	
Lateral line scales (LL)	78	73 - 88		82	
Pored scales in LL	64	57 - 69		61	
Scales Above LL	10			10	
Scales Below LL	18			18	
Incisor-like teeth on upper jaw	36			36	
Incisor-like teeth on lower jaw	37			36	

has not been mentioned and has not been fished in this gulf. The morphology of the caught specimen, and its meristic, and metric characteristics, confirm that it represents *K. vaigiensis*, as described in the literature (Tortonese 1986; Azzurro et al. 2013; Sgano 1981; Carpenter 2002; Knudsen & Clements 2013; Orsi-Relini et al. 2011; Sakai & Nakabo 2016).

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Fig.6. *Sargocentron rubrum* (Forsskål, 1775), 189 mm SL, from Hadhramout coast, Gulf of Aden (photograph by M.A. Algurabi).

Kyphosus vaigiensis is a species that is often observed and found at the FADs construction (Taquet et al. 2007). Otherwise, Aden gulf an international waterway receives hundreds of ships per year from all regions of the world, and its coasts are exposed to the introduction of exotic species (Aideed et al. 2018). Thus, the recorded *K. vaigiensis* individual would have arrived by ships' ballast water from one of its natural geographic ranges. Indeed, sea chubs are often observed around ships in subtropical waters waiting for the dumping of garbage (Orsi Relini et al. 2011) and are commonly referred to as "rudderfish" (Evans et al. 2020). This behavior exposes them to being "embarked" on board the boats. Hence, their appearance in the Gulf of Aden can be regarded as anthropogenic. It has not been widely studied because they are not very important from a fishery perspective.

Order: Holocentriformes Betancur-R et al., 2014
Family: Holocentridae Richardson, 1846
Sargocentron Fowler, 1904
Sargocentron rubrum Forsskål, 1775
Redcoat Squirrelfish (Fig. 6)

Examined materials: One specimen, female (IV maturity stage) (22.7cm total length), were caught in proximity to rock formations in the Qusayr city district, within the Hadhramout coast (Fig. 1). The specimens were caught at depth of more than 20m by local traps.

Synonyms: *Perca rubra* Forsskål, 1775; *Holocentrus rubrum* Forsskål, 1775; *Adioryx rubra* (Forsskål, 1775); *Holocenthrus aureoruber* Fowler, 1904; *Holocentrum dimidicauda* Marshall, 1953; *Holocentrum orientale* Cuvier, 1829; *Holocentrus alboruber* Lacepède, 1802; *Holocentrus alborubrum* Lacepède, 1803; *Holocentrus ruber* (Forsskål, 1775); *Sciaena rubra* Forsskål 1775. *Descriptiones Animalium*: 48.

Type locality: off Customs dock, Port Sudan Harbour, Sudan, Red Sea (neotype).

Diagnosis: Long dorsal fin with spiny portion and soft rayed portion divided by a notch. Color pattern, a stout daggered spine in lower corner of preopercle and two noticeable spines at middle of operculum, at eye level; in addition to three small spines in upper corner of opercle, distinguishing this species from its relatives (Fig. 7). Body ovate and moderately compressed with large eyes and very rough skin with hard ctenoid scales. Dorsal fin has 11 spines and 13 soft rays. Anal fin 4 spines, 9 soft rays, light pink. 3rd anal spine prominent and longest of all rays, strong and dagger-like. Caudal fin deeply forked; its borders brownish red, edges of soft rays of ventral fin colored dark red and three small spines in the upper corner of opercle.

Description: Dorsal fin XI, 13; Anal fin IV, 9; Pectoral fin 14; Lateral-line scales 35; Scale rows above lateral line 3; Oblique scale rows on cheek 5. Body depth 2.52 in SL; head length (HL) 2.77 in SL; snout short, blunt, its length 4.8 in HL. Body with almost similar longitudinal successive stripes of red and silvery, upper one darker; dorsal spines faded red

Fig.7. The daggered spine in the preopercle and two spines at middle of operculum, and three small spines in the upper corner of opercle.

with whitish blotch in middle of each membrane forming a median band; dorsal membrane tips dark red. Head red but with white vertical bar behind eyes on preopercle. A stout, venomous spine on corner of its cheek, and 2 opercule spines at level with eye plus small on at upper edge of opercule. Back edge of opercle serrated. Caudal fin very forked. Oval body with a short snout, slightly compressed on sides, showing large eyes for a perfect view. One dorsal fin, with 11 spiny rays folding and 13 soft, always get up; anal fin with 4 spiny rays and 9 soft rays; pectoral fins count 14 soft rays, ventral fin with 1 spin and 7 soft rays. Cheek with 5 oblique rows of scales. Body depth 2.5 in SL; head length (HL) 3.2 in SL. Snout short, its length 4.8 in HL. Preopercle spine relatively long, almost equal to diameter of orbit. Mouth terminal to slightly inferior, maxilla usually extending nearly to or a short distance beyond a vertical through center of eye, upper jaw length 2.6 in HL; premaxillary groove often ending above anterior edge of orbit; anterior end of nasal bone with a blunt spine; surface or medial edge of nasal bone spineless; nasal fossa usually without spinules on its edge. The remaining characters and proportions are given in Table 3.

Coloration: On the background color, fiery red, darker on the back, they stretch on the slopes with longitudinal stripes of light, with a silvery tint, perpendicular to similar vertical stripes on the head, which is worn in the most suddenly oblique under the eye. The tail fin edges are brownish red. The general appearance of the body is red. There is a triangular red streak on cheek from eye to lower corner of preopercle.

Distribution: Indo-West Pacific, Red Sea, Oman Sea to the western Pacific where it ranges from southern Japan to New Caledonia western coast of India and Sri Lanka, Australia. This species is common in the Gulf of Thailand, on the north coast of Australia; East coast of Africa from Tanzania to South Africa, Madagascar, Seychelles and Maldives. It is already invading the Mediterranean via the Suez Canal. In recent times, the species expanded geographically (Golani et al. 2021), reaching the coasts of Tunisia in 2013 (Ounifi-Ben Amor et al. 2016; Bradai et al. 2019). It inhabits coastal reefs in lagoons, bays and harbors, often rocky reefs in areas subject to strong currents. During the day it shelters in caves, crevices and beneath ledges.

Remarks: It differs from the Omani and Andaman samples in that the rounded dark spot above the base of the soft part of the anal fin became faint, but its traces are noticeable. In all other characteristics, they are identical (Randall 1995; Kimura et al. 2009). Since it was found on this coast at the fourth stage of maturation, it can certainly reproduce here, indicating that it has already settled here for a long time. The first documented occurrence of squirrelfishes in the Mediterranean Sea was made by Haas & Steinitz (1947) from Palestine, who reported *Holocentrus ruber* (Forsskål, 1775), which was later transferred to the genus *Sargocentron*. The Redcoat, *Sargocentron rubrum* (Forsskål, 1775), is one of the first Red Sea species that entered the Mediterranean

Table 3. Morphometric values of *Sargocentron rubrum* from Hadhramout coast, Gulf of Aden, Yemen.

Characters	mm	% TL	SL/ Character
Total length (mm)	227	100	
Forked length (mm)	205	90.3	
Standard length (mm)	189	83.2	
		% SL	
Head length	58	30.7	3.26
Eye diameter	21.2	11.2	
Snout length	12.0	6.3	
Post-orbital length	24.8	13.1	
Pre-dorsal length	52	27.5	
Pre-pectoral length	61	32,3	
Pre-pelvic length	65	34.4	
Pre-anal length	142	75.1	
Body depth	75	39.7	2.5
Caudal peduncle high	16	8.5	
Dorsal-fin base length	105	55.5	
Longest (3rd) dorsal spine length	33	17.5	5.7
Pectoral-fin length	46	24.3	
pelvic-fin length	47	24.9	
Anal-fin base length	20	10.5	
3rd anal-fin spine length	39	20.6	
Upper lob of caudal-fin length	40	21.2	
Lower lob of caudal-fin length	41	21.7	
% of HL			SL/ Character
Snout length	12	20.7	4.8
Eye diameter	21.2	36.6	2.7
Interorbital width	19	32.7	3.1
Length of preopercle spine	18	31	3.2
Length of third dorsal spine	33	56.9	1.75
3rd anal-fin spine length	39	67.2	1.5
Upper jaw	22	37.9	2.6
Lower jaw	21	36.2	2.76
Counts			
Dorsal-fin rays	XI, 13		
Anal-fin rays	IV, 9		
Pectoral-fin rays	14		
Pelvic-fin rays	I, 7		
Pored lateral-line scales	35		
Scales upper lateral-line	3		
Scales below lateral-line	6		
Scale rows on preopercle	5		
Scale rows on opercle	0		
Gill rakers	6 + 10		
Vertebras	26		

Sea via the Suez Canal (Golani & Ben-Tuvia 1985) and it is recognized today as one of the most successful invaders of the Basin (Azzurro et al. 2014; Artüz & Golani 2018; Bradai et al. 2019; Golani et al. 2021). They live in depths from 0-84m. They can be found both in pairs and in groups. The Redcoat squirrelfish is just like other squirrelfish species, a nocturnal fish that hunts during the night and will hide in a shaded place during the day.

Order: Perciformes

Family: Coryphaenidae

Coryphaena equiselis Linnaeus, 1758

Pompano dolphinfish (Fig. 8)

Examined material: Two juvenile specimens, female 65.5 and male 55.3 Standard lengths; collected from

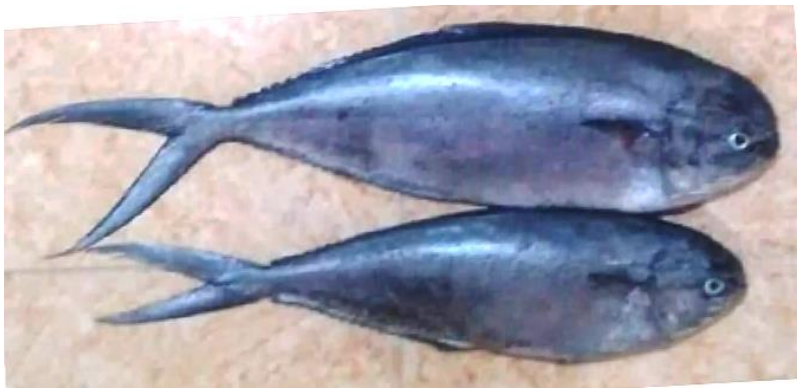

Fig.8. *Coryphaena equiselis* from Hadhramout coast, Gulf of Aden.

fish landing station of Broom Fisheries Company, AL- Shihir city, Hadhramout province.

Synonyms: *Coryphaena equiselis* Linnaeus, 1758; *Coryphaena equisetis* Osbeck, 1765; *Coryphena aurata* Rafinesque, 1810; *Coryphaena azorica* Valenciennes in Cuvier and Valenciennes, 1833; *Coryphaena lessonii* Valenciennes in Cuvier and Valenciennes, 1833; *Lampugus neapolitanus* Valenciennes in Cuvier and Valenciennes, 1833; *Lampugus punctulatus* Valenciennes in Cuvier and Valenciennes, 1833.

Type locality: Sicily.

Diagnosis: Single dorsal fin; no dorsal spines, dorsal soft rays 52-59; no anal spine, anal soft rays 24-28; Vertebrae 33; dorsal fin originating on nape, almost reaching caudal fin. Pectoral fin about half of head length. *Coryphaena equiselis* have a square shaped tooth patch on the tongue which aids in distinguishing it from its cousin *C. hippurus*, having a smaller oval tooth patch. Body depth 3.12-3.7 in SL usually with 52-59 rays. Anal fin with 23-29 rays. Pectoral with 18-21 rays. Anal fin is with convex outline. Caudal fin deeply forked; vertebrae 33. Tooth patch on tongue broad and square; bands of teeth on jaws, vomer and palatines. Anal fin margin straight compared to falcate at *C. hippurus.*

Description: Body elongated and compressed. Greatest depth of body 30-32% SL, much less than 4 - 3.12 - 3.27 (Table 4). Samples with 54 dorsal fin rays, 27 anal fin rays; Pectoral with 20 rays and 33 vertebrae, caudal vertebrae 20. Anal fin convex; Pectoral fin about half length of head (61.8-63.6% HL). Plaque on tongue wide and almost square compared to triangular in *C. hippurus*. Tongue with a wide tooth patch covering 50 to 60 percent of its surface; pectoral fins located near middle of head; single dorsal fin extending from just behind eye almost to caudal fin; a convex anal fin extending from anus almost to caudal fin. Head profile in males vertical of bony crest. Lateral line with a sharp curve over pectorals, lateral line scales 42.

Coloration: The color in life of *C. equiselis* was brilliant metallic blue-green dorsally, fading to grey with green tinge upon death; side's silvery with little separated black round spots. Dorsal fin is dark; body shiny blue green. Pectoral fin darker; pelvic fin unpigmented.

Distribution: It is widespread and circumtropical, mainly oceanic, and usually a surface-dwelling species. This species inhabits the Indian Ocean from the red sea to Southeast Asia, east Africa passing through almost all islands of the central Indian Ocean. It exists on both sides of the Atlantic Ocean, from Canada to Brazil to the west, and from Spain to Namibia in the east of the ocean. *Coryphaena equiselis* widespread across the entire Pacific Ocean, from Mexico at the east of this ocean to Japan, passing through Philippines and Indonesia to Australia and New Zealand at the far south. It is new spreading is noticeable in Mediterranean, Black and Caribbean Seas.

Remarks: *Coryphaena equiselis* is pelagic, inhabiting in open waters but also approaches the coasts. Probably resembles *C. hipppurus* in following ships and forming aggregations. It feeds on small fishes and squids. It is similar to *C. hippurus*

Table 4. Morphometric values of *Coryphaena equiselis* (Linnaeus, 1758) from Hadhramout coast, Gulf of Aden.

Characters	Values, cm		In % of SL	
	Male	Female	Male	Female
Total length	79	68.5		
Forked length	67.2	57		
Standard length	65.5	55.3		
Head length	13.2	11	20.15(4.96)	19.9 (5)
Body depth (BD)	21	16.9	32.1(3.12)	30.5 (3.27)
Pre-dorsal length	9	7.5	13.7	13.5
Pre-pectoral length	15.2	13	23.2	23.5
Pre-pelvic length	16.1	13.8	24.6	24.9
Pre-anal length	36.4	30.7	55.6	55.5
Dorsal fin base	52.8	42.8	80.6	77.4
Anal fin base	24.3	21	37.1	37.9
Head depth	16	13	24.4	23.5
Pectoral fin length	8.4	6.8	12.8	12.3
Pelvic fin length	12.5	10.4	19.1	18.8
Upper caudal lob length	21.8	16.8	33.3	30.4
Lower caudal lob length	20.2	15.5	30.8	28
Caudal peduncle depth	4.2	3.5	20% BD	20.7 %BD
Eye diameter	2.5	2	18.9 %HL	18.2 %HL
Pre-orbit length	3.6	2.6	27.3 %HL	23.6 %HL
Post orbit length	7.1	6.2	53.8 %HL	56.4 %HL
Pectoral fin length	8.4	6.8	63.6 %HL	61.8 %HL
Meristic characters:				
Dorsal spins	Nil	Nil		
Dorsal soft rays	54	54		
Anal spins	Nil	Nil		
Anal fin rays	27	27		
Pectoral fin rays	20	20		
Pelvic fin spins	1	1		
Pelvic fin rays	5	5		
Lateral line scales	42	42		
Vertebrates	33	33		
Gill rakers	11	11		

that it has probably been confused with this species. This species is originated from the Pacific Ocean and is widespread in the world's oceans, and begun to appear in recent years in abundance in coastal areas (Randall 1995; Bañon et al. 2010; Rizkalla & Heneish 2020, Kapoor et al. 2002; Akash et al. 2020). Mature males of *C. equiselis* develop large bony crests on top of their heads. There are no other fishes that can be confused with a dolphinfish, they are unique. While the common dolphin *C. hippurus* is common, and *C. equiselis* caught much less, or is mistakenly identified and reported along with general data on dolphin landings.

Order: Perciformes

Family Sciaenidae

Genus Argyrosomus (De la Pylaie, 1835)

Argyrosomus japonicus (Temminck & Schlegel, 1843)

Dusky kob (Japanese meagre) (Fig. 9)

Examined material: Fourteen specimens, ten female 65.5 and four male 55.3 Standard lengths; collected from fish landing stations of Qusayr and Musaina'a districts within Hadhramout province in 06 July 2022.

Synonyms: Parent: Argyrosomus De la Pylaie, 1835; Orig. name: Sciaena japonica Temminck & Schlegel, 1843; Argyrosomus antarctica (Castelnau, 1872); Nibea japonica (Temminck & Schlegel, 1843); Nibea japonicus (Temminck & Schlegel, 1843); Sciaena antarctica Castelnau, 1872 · unaccepted; Sciaena japonica Temminck &

Fig.9. *Argyrosomus japonicus* from Hadhramout coast, Gulf of Aden.

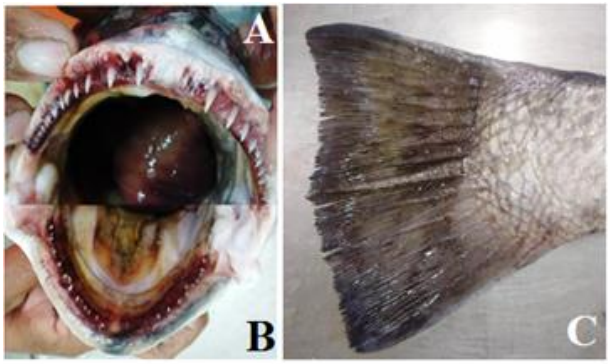

Fig.10. The position and shape of the teeth on the upper jaw, (A) the lower jaw (B) and that the scales of the lateral line continue to the almost end of the caudal fin rays (C).

Schlegel, 1843; Sciaena margaritifera Haly, 1875 · unaccepted; Sciaena neglecta Ramsay & Ogilby, 1887.

Diagnosis: *Argyrosomus japonicus*, with large, silvery steel-grey body with regularly sparkling scales along lateral line. Caudal fin not pointed wedge-shaped, but cut off, slightly truncated rear tail margin with 2 shallow recesses along the posterior edge. Dorsal fin X+I, 25-30 (X, 29); dorsal fin deeply notched dividing fin into short anterior spinous portion and elongate slightly lower posterior portion. Anal fin II,7; pectoral-fin rays 15-17 (17); lateral-line scales 50-53 (51); gill-rakers 4-5 + 9-12 (4+9); swim-bladder appendages 21-31 (30); vertebrae 11+14. Dorsal margin slightly convex. Teeth in jaws generally sharply pointed.

Description: Dorsal fin X, I, 26; anal fin II, 7; pectoral fin I, 16; pelvic fin I, 5; lateral-line scales 56; gill-rakers 20. Anal fin base short, typically with seven or eight soft rays. Body elongated and compressed; dorsal margin slightly convex; posterior margin generally straight; species with an acute snout and a large terminal mouth. Body moderately deep (22.9%SL; 3.87 times the SL). The eye small; their diameter 8.14 times HL; 3.4% SL. Teeth absent in the vomer and palatine. A noticeable irregular spaced large canine, particularly in upper jaw; in lower jaw significantly smaller (Fig. 10A, B). Lateral line with regularly sparkling white scales along lateral line; evenly curved. Scales weakly ctenoid on body; those on body not easily lost. Lateral line extending to end of caudal fin which nearly truncate, biconcave (Fig. 10C). Swim-bladder is typically carrot-shaped with 32 pairs of arborescent appendages. Further features and proportions as % SL and HL are shown in Table 5.

Coloration: In life, greyish green to steel blue above, silvery grey below, with darker oblique bands following scale rows in small individuals; inside of mouth and opercula bright orange; fins slightly yellowish; prominent black spot at upper base of each pectoral fin. Dorsal surface with a bluish bronze sheen may become coppery on head in fresh ones. Fins colored like body, dorsal-fin spines and rays pale grey.

Distribution: The species is widely distributed in estuaries and nearshore coastal waters of the Pacific and Indian Oceans, including sub-tropical and temperate waters in Australia (Griffiths & Heemstra 1995; Silberschneider et al. 2008). It is found along the African southeast coast from the Cape of Good Hope to southern Mozambique and Madagascar; in the northern Indian Ocean, it occurs off Pakistan and

Table 5. Morphometric values for *Argyrosomus japonicus* (Temminck & Schlegel, 1843) from Hadhramout coast.

	14 females and males	Range	
Total length (TL), cm	100.76±0.30	73.0 123.5	
Weight kg.	8.25±0.38	3.4–15.65	
Standard length, cm	88.62±0.24	64–108	% SL
Head length (HL)	25.41±0.19 (1.45)	16.4–33.5	28.6
Snout length	6,26±0.21	4.3–8.3	7.1
Eye diameter	3.12±0.17	2.4–4.1	3.5
Post orbital length	16.05±0.27	11.1–21.3	18.1
Pre-dorsal length	29.49±0.33	21.7– 37.6	33.3
Pre-pectoral length	25.49±0.33	18 –32.5	28.7
Pre-pelvic length	29.17±0.32	21.2–36.3	32.9
Pre-anal length	60.05±0.55	43.7–77	87.7
Body depth (BD)	22.9±0.22 (3.87)	16–28.3	25.8
Caudal peduncle depth	7.19±0.3	5.8–9	31.4%BD
Dorsal fin base length	50.40±0.28	36–60.3	56.9
Pectoral fin length	15.41±0.37	9.5–19.8	17.4
Anal fin base length	10.12±0.36	8.9–12	11.4
Pelvic fin length	13.05±0.61	10–18	14.7
Head length (HL)	25.41± 0.19	16.4–33.5	% HL
Snout length	6,26±0.21	4.3–8.3	24.6
Eye diameter	3.12±0.17	2.4–4.1	12.3
Post orbital length	16.05±0.27	11.1–21.3	63.1
Interorbital width	6.26±0.23	3.8–8.5	24.6
Meristic characters:			
Dorsal fin spines	11		
Dorsal fin soft rays	27		
Anal fin spines	2		
Anal fin soft rays	7		
Pectoral fin rays	16		
Pelvic fin rays	1, 6		
Caudal fin rays	17		
Vertebrae total	25		
Preanal Vertebrae	10		
Caudal Vertebrae	14		
Total Gill rakers (GR)	20		
Lateral line scales (LL)	56		
Scales Above LL	10		
Scales Below LL	16		
Canine-like teeth on upper jaw	30		
Canine-like teeth on lower jaw	20		

the northwest coast of India (Psomadakis et al. 2015). In the Northern Pacific, it has been reported from Hong Kong, northwards along the Chinese coast, to southern Korea and Japan; from the Philippines to Japan (Griffiths & Heemstra 1995; Gomon et al. 2008).

Remarks: The Japanese meagreknown as mulloway, is a large, predatory sciaenid reaching up to 181cm, 75kg and 42 years of age (Griffiths 1996). *Argyrosomus japonicus* has been known by more than 13 different synonyms but an in-depth comparison of habitat distribution, morphometric, and anatomical structure was approved and established as *A. japonicus* (Griffiths & Heemstra 1995; Jenkins 2018). Despite the fact that *A. japonicus* is found in the estuarine and coastal waters of the Pacific, Indian Oceans, and the waters surrounding Australia, South Africa, India, Pakistan, China, Korea and Japan, but it apparently more confined to the moderately cold waters of the ocean (Black & Dixon 1992; Silberschneider & Gray 2008). *Argyrosomus japonicus*, so far its natural spawning has not been noted north of latitude S 20^{o} and above 25^{o}C water temperature if we do not take

Fig.11. *Scarus niger* Forsskål 1775, 194mm SL, from Hadhramout coast, Gulf of Aden.

into account artificial spawning for aquaculture in Taiwan and China (Farmer 2008; Jenkins 2019). *Argyrosomus japonicus* is suitable for aquaculture because of its high price, marketability, high fecundity, fast growth, non-territorial or cannibalistic nature, and saline resilience (Fitzgibbon et al. 2008; Farmer 2008).

Order: perciformes
Family: Scaridae
Scarus niger Forsskål 1775
Rusty parrotfish (Swarthy Parrotfish) (Fig. 11)
Examined materials: One specimen, male (Terminal phase) (IV maturity stage). Total length 23cm (to the end of the caudal fin lobes), was caught in proximity to rock formations in the Burum city district, within the Hadhramout coast (Fig. 1). The specimen caught at depth of about 7m by hand.
Synonyms: *Callyodon madagascariensis* (Steindachner, 1887); *Callyodon niger* (Forsskål, 1775); *Callyodon nuchipunctatus* (Valenciennes, 1840); *Pseudoscarus flavomarginatus* Kner, 1865; *Pseudoscarus madagascariensis* Steindachner, 1887; *Pseudoscarus niger viridis* Klunzinger, 1871; *Scarus chadri* Lacepède, 1802; *Scarus limbatus* Valenciennes, 1840; *Scarus makaravar* Montrouzier, 1857; *Scarus nigar* Forsskål, 1775; *Scarus nuchipunctatus* Valenciennes, 1840
Diagnosis: Dorsal fin IX, 10; Anal fin III, 9; Pectoral fin 13-15. Total gill rakers on first arch 44 to 50. Cheek with 3 rows of scales, 6 to 8 scales in upper row, 6 to 9 in middle row and 2 to 5 scales in lower row. Body depth 2.2 to 2.5 times in standard length. Teeth fused to form dental plates; dental plates relatively smooth, and moderately covered by lips; with 2 canine teeth on side at rear of upper dental plates. Scales large, 24 in lateral line, 3 rows of scales on cheek, median predorsal scales 6 to 9 (usually 7). Its coloration with a dark violet-blue body and by colorful head ornament. Caudal fin truncate with prolonged upper and lower ray lobes with distinctive orang color. Dentition with one of characteristics of family: their incisors combined into four dental plates, two for each jaw.
Description: Dorsal fin with 9 spines, 10 soft rays, anal fin with 3 spines and 9 soft rays. Pectoral fin 12 soft rays, pelvic fin with I spine and 5 soft rays. Total gill rakers on first arch 46. Body plump, upper outline of head smoothly transitions to outline of back creating an arched body contour. Body scales large, cycloid, their count 24 on lateral line. Seven predorsal scales (median); scale rows on cheek 3. Specimen with 2 conical teeth on sides of upper tooth plate; lips mainly covering dental plates. Caudal fin with prolonged upper and lower lobes in large adults. Body depth 2.4 times in SL, head length 2.8 in SL. Snout 2.4 in head length, orbit 6.9 in head length. Caudal fin truncate surrounded dorsally and ventrally by enlargement of three prominent solid rays longer than rest of middle fin rays, lobes pointed, forming what looks like a dagger of a light maroon color, surrounded by blue edges. Dorsal lobe slightly longer than ventral. Characters and proportions are given in Table 6.
Coloration: Body dark purple-red in front, tending to

Table 6. *Scarus niger* Forsskål 1775 from Hadhramout coast, Gulf of Aden.

Characters	Value, cm	%%
Total length (mm)	23	100
Forked length (mm)	-	
Standard length (mm)	19.5	84.8 % TL
		%% SL
Head length	6.95	35.6
Eye diameter	1	5.1
Snout length	2.9	14.9
Post-orbital length	2.3	11.8
Pre-dorsal length	5.5	28.2
Pre-pectoral length	4.7	24.1
Pre-pelvic length	4.1	21
Pre-anal length	8	41
Body depth	8.2	42.1
Caudal peduncle high	2.5	12.8
Dorsal-fin base length	9.2	47.2
Pectoral-fin length	5.2	26.7
pelvic-fin length	4.6	23.6
Anal-fin base length	4.3	22.1
Upper lob of caudal-fin length	4.6	23.6
Lower lob of caudal-fin length	4.5	23.1
HL 6.95		% HL
Snout length	2.9	41.7
Eye diameter	1	14.4
Interorbital width	1.5	21.6
Meristic characters:		
Dorsal-fin rays	X, 9	
Anal-fin rays	III, 7	
Pectoral-fin rays	16	
Pelvic-fin rays	I, 5	
Pored lateral-line scales	24	
Scales upper lateral-line	3.5	
Scales below lateral-line	7	
Scale rows on preopercle	4	
Scale rows on opercle	5	
Gill rakers	61	
Vertebras	23	

pink regionally; posterior half greenish with dark margins of scales. A strip of light green patches from behind eye towards corner of upper gill cover, in addition to a set of green stripes emanating from corner of mouth in different directions above upper and lower lips, around preopercle and below gill cover (Fig. 11). Teeth bluish-green, upper lip pinkish with a green perpendicular stripe above it. Dorsal fin orange with a blue rim. Pectoral fins light maroon. Pelvic fins dull orange, edge with blue. Caudal fin distinguished by its dark greenish-blue color, surrounded from top and bottom by enlargement of three prominent solid rays longer than the rest of middle fin rays, forming what looks like a dagger of a light maroon color, surrounded by blue edges.

Distribution: *Scarus niger* is worldwide distributed species. Tropical Indo-Pacific, Red Sea to South Africa, from Japan to northern Australia to Polynesia.

Remarks: Dusky Parrotfish is a shallow water dweller found on coral reefs at a depth of 2-30m. Most often found in vicinity of coral reefs. It is herbivorous, usually scraping algae from coral substrates. Bits of rock eaten with the algae are crushed into sand and ground with the algae to aid in digestion, making it the most important producer of

sand on coral reefs and coasts. According to Smith (2003) and Choat et al. (1996), *S. niger* appears to be monandric were initial phase fish are females and the terminal fish are all secondary males. *Scarus niger* is herbivorous fish and as most scarids to play an important role in maintaining the health of coral reefs by consuming algae that grow on the reef substrate and in clearing new sites for coral larvae (Rassweiler et al. 2021).

DISCUSSION

Given the about 510 thousand km^2 maritime boundary of Yemen in the Gulf of Aden, marine fishes of Yemen are not thoroughly surveyed, accounting still old for about merely 600 species (Druzhinin 1973). However, in recent years, there are new interests and surveillance of the situation concerning fisheries in different places over the coast of the country by Yemeni young interested specialists. Cases became frequent of species from diverse taxa and habitats stipulate much higher species richness. However, these were largely from chance events by systematically visiting fish landing centers (Ali et al. 2020, 2021).

The Gulf of Aden is the point where numerous borders converge between different types of distribution of representatives of the ichthyofauna; it is believed that the border between the Indo-Malay and East African provinces passes in this gulf, with some species invading from the Red Sea. Thus, the Gulf of Aden is a zone of mixing of Indo-Malay and East African ichthyofauna (Manilo & Bogorodsky 2003). We think that the summer monsoon (Upwelling) is the main reason for attracting a large number of fishes from the southern Indian Ocean in last years under the influence of climate change.

The majority of authors repeats the same phrase of Russell (1990) which in turn was most likely relying on Randall et al. (1978), Rao & Rao (1981), Russell (1984), and Fischer & Bianchi (1984) concerning geographical distribution without any new registration evidence in this or that coast, so we have the right to consider this documentation the first record of these species in the Gulf of Aden. Unfortunately, all these references are not accompanied by descriptions, measurements and documentation. The authors do not provide a confirmed substantiation for what they list in their tables, which makes it difficult to appropriately identify the assumed species. All our work in this aspect, including this work, to some extent fills these gaps.

Despite the absence of a scientifically documented inventory of fish species and their number in the Gulf of Aden, data on five more fish species of important fishery relevance from the coast of Hadhramout further enrich the diversity of the ichthyofauna in the Gulf of Aden. It also highlights that the environment and conditions of this Gulf can attract more fish from the neighboring seas, which has been proven in recent years by our publications (Ali et al. 2009, 2020, 2021; Ali & McNoon 2010; Aideed & Muhaysin, 2017). It also requires constant monitoring of the ichthyofauna in the area to make sure of its fish wealth and its protection, preservation and upgrades.

The present records are also a pointer to the need for a further taxonomic inventory of the rich reef diversity of waters of Aden Gulf which may result in recording many more species hitherto not known from (Ali et al. 2022). Proper identification of organisms is necessary to monitor biodiversity at any level (Vecchione & Collette 1996). For this, accurate morpho-meristic descriptions are a prerequisite. As more range extensions of species are recorded, descriptions of those species have also to be put into place; hence this work acquires its importance.

With regard to the biological characteristics of the species recorded here, we do not have a comment on this aspect due to the limitations of the specimens on the one hand and the lack of observations about the limitations of their natural reproduction environments. However, it should be noted that all the specimens of *A. japonicus* caught and described here were at stages of sexual maturity IV and V (advanced sexual maturity), with the exception of one female with a standard length of 73.5cm, who was at stage II. This resulting situation raises many

questions in the light of the well-known principle that it has not been proven that the natural spawning of this species occurs northern of 20 degrees south latitude (Farmer 2008; Jenkins 2019). Especially if we know that exactly within this month (July) the coast of Hadhramout is coming under the influence of the annual phenomena of upwelling that cooling down this coast and makes it attraction for fishes preferring cold water. The finding of more species of fish of scientific significance, although not yet of commercial importance, in the Gulf of Aden further enriches the diversity of fish fauna in the area. It also highlights the need for ongoing monitoring of the ichthyofauna in the area to update previous records of availability.

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مقاله کامل

اولین شواهد حضور برخی از ماهیان بنتوپلاژیک (شعاع بالگان: گوازیم‌ماهیان، سنجاب‌ماهیان، چرم‌باله‌ماهیان، شوریده‌ماهیان و گالیت ماهیان) در شمال شرقی خلیج عدن، ساحل حضرموت

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چکیده: در ساحل حضرموت، خلیج عدن، برای اولین بار حضور شش گونه ماهی ثبت شد. بررسی تمام مطالعات و تالیفات قبلی نشان می‌دهد که این گونه‌های متعلق به خانواده‌های مختلف قبلاً در خلیج عدن گزارش نشده بودند. گونه‌های شناسایی شده عبارتند از: *Parascolopsis eriomma* (Nemipteridae)، *Kyphosus vaigiensis* (Kyphosidae)، *Sargocentron rubrum* (Holocentridae)، *Coryphaena equiselis* (Coryphaenidae)، *Argyrosomus japonicus* (Sciaenidae) و *Scarus nigar*(Scaridae). این مقاله مشخصات دقیق هر گونه را توصیف می‌کند.

کلمات‌کلیدی: ریخت‌سنجی، ساحل حضرموت، *Parascolopsis eriomma*، *Scarus nigar*،یمن.