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Intertidal polychaetes from Abu Musa Island, Persian Gulf, with a new species from the *Perinereis cultrifera* species complex (Annelida: Nereididae)

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Polychaetes of 31 species from 17 families (Amphinomidae, Chrysopetalidae, Eunicidae, Glyceridae, Hesionidae, Iphionidae, Lumbrineridae, Maldanidae, Nereididae, Oenonidae, Phyllodocidae, Polynoidae, Sabellidae, Serpulidae, Syllidae, Terebellidae, Trichobranchidae) were studied from five locations around Abu Musa Island, the Persian Gulf. Perinereis iranica *sp. nov. is described as a new species for the Persian Gulf.* Perinereis iranica *sp. nov. is most similar to members of the* Perinereis cultrifera *species complex, which are also found in the Persian Gulf, but can be most easily distinguished from them by the number, shape and arrangement of paragnaths in Areas V and VI.* Perinereis camiguana *is compared to members of the genus Pseudonereis, and found to resemble them closely, but until type specimens can be re-examined, we recommend treating this species as* Nereidinae incertae sedis. *Fifteen species, belonging to 13 genera:* Eunice *'sp_Abu Musa',* Marphysa *'sp_Abu Musa',* Glycera *cf.* tesselata, Hesione splendida, Lumbrineris *'sp_Abu Musa',* Notoproctus *'sp_Abu Musa',* Nereis *sp. cf.* N. pelagica, Eteone *'sp_Abu Musa',* Harmothoe liaoi, Potamilla *'sp_Abu Musa',* Branchiosyllis *cf.* exilis, Trypanosyllis *'sp. 1_Abu Musa',* Trypanosyllis *'sp. 2_Abu Musa',* Terebella *'sp_Abu Musa',* Terebellides *cf.* stroemi *are reported for the first time from the Persian Gulf; nine species remain to be named formally. Three genera:* Notoproctus, Eteone, Terebella *are recorded for the first time from the Persian Gulf.*

Keywords: Taxonomy, new records, Indo-Pacific, polychaete fauna

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INTRODUCTION

The most important published works on the polychaete fauna of the Persian Gulf are those by Fauvel (1911, 1919, 1932), Wesenberg-Lund (1949), Mohammad (1970*a*, *b*, *c*, 1971, 1972*a*, *b*, 1973, 1980), Bonyadi-Naeini & Rahimian (2009) and Bonyadi-Naeini *et al.* (2017).

So far, about 256 species of polychaete worms have been recorded from the Persian Gulf, which includes both intertidal and subtidal species collected from the northern and southern coasts of the Persian Gulf (Wehe & Fiege, 2002; Wehe, 2006, 2007; Bonyadi-Naeini & Rahimian, 2009; Bonyadi-Naeini *et al.*, 2017). Literature records indicate that the most speciose genus of the Nereididae in the Persian Gulf is *Perinereis* with 10 species including *Perinereis arabica* Mohammad, 1971, *P. cultrifera* (Grube, 1840), *P. heterodonta* Gravier, 1901, *P. horstii* Gravier, 1901, *P. kuwaitensis* Mohammad, 1970*a*, *P. nigropunctata* (Horst, 1889), *P. nuntia* (Savigny in Lamarck, 1818), *P. cultrifera* (Grube, 1840) species complex, *P. suluana* (Horst, 1924) and *P. vancaurica* (Ehlers, 1868).

Perinereis cultrifera (Nereididae) was first described by Grube (1840) from the Adriatic Sea. Scaps *et al.* (2000) and Rouabah & Scaps (2003) indicated that, based on morphological and biochemical divergence, a complex of species may be referred to *P. cultrifera*. The spawning season, mode of reproduction, age of maturity and biometric characteristics of specimens assigned to *P. cultrifera* differ largely according to the geographic location of populations in question (Rouabah *et al.*, 2009).

Bonyadi-Naeini *et al.* (2017) reported a specimen belonging to the *P. cultrifera* species complex, collected from Qeshm Island, Persian Gulf. That single specimen was very similar to the published descriptions of *P. cultrifera*, and its allies. However, initial observations indicated that the specimen did not agree with any other members of the species complex that have been previously reported from the region (Wehe & Fiege, 2002). After further sampling in the Persian Gulf, two more specimens were collected, one of which was from Abu Musa Island. More thorough studies revealed that those specimens were certainly distinguishable from the other members of the *P. cultrifera* species complex, reported from the area and adjacent waters, including *P. floridana*

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(Ehlers, 1868), *P. striolata* Grube, 1878, *P. obfuscata* Grube, 1878, *P. perspicillata* Grube, 1878, *P. helleri* (Grube, 1878) and *P. cultrifera*. The new species was distinguished from the aforementioned species by colouration, length of the longest tentacular cirri, the number, shape and arrangement of paragnaths in areas V, VI, VII–VIII, and also the shape of heterogomph falcigers blade.

In the present study we document the intertidal polychaete diversity of Abu Musa Island, Persian Gulf, identify and describe new geographic records and describe a new species for science. A taxonomic key to the *P. cultrifera* species complex from the Indo-West Pacific is also presented.

MATERIALS AND METHODS

Abu Musa Island is located 75 km south of Bandar Lengeh and 63 km north-northwest of Sharjah. The present material was collected from April 2014 to May 2015 at five stations along the coasts of Abu Musa (Figure 1, Table 1).

Specimens were relaxed using Dentol® (Khoraman laboratory, Iran) (Bonyadi-Naeini *et al.*, 2016), fixed in 5% formalin diluted in seawater, washed in tap water and transferred to 70% ethanol for permanent storage. Parapodia from the anterior and posterior parts of the body were removed and permanent slides prepared, particularly for Nereididae species, following Bonyadi-Naeini *et al.* (2017). Specimens were studied under stereo and compound light microscopes. Digital images were taken using a camera (Dino-Lite AM423X) mounted on a compound microscope and drawings were prepared using a camera lucida. All measurements are in mm unless stated and characters are measured to the nearest tenth of a mm. All specimens and slides are deposited in the Zoological Museum, University of Tehran (ZUTC), Tehran, Iran.

RESULT

A total of 31 species of polychaetes, belonging to 17 families: Amphinomidae (1), Chrysopetalidae (1), Eunicidae (3), Glyceridae (1), Hesionidae (2), Iphionidae (1), Lumbrineridae (1), Maldanidae (1), Nereididae (7), Oenonidae (1), Phyllodocidae (1), Polynoidae (3), Sabellidae (1), Serpulidae (1), Syllidae (4), Terebellidae (1) and Trichobranchidae (1) were identified. Among them, *Perinereis iranica* sp. nov. is a new species from the Persian Gulf, and 15 species, belonging to 13 genera are new geographic records for the Persian Gulf (Tables 2 & 3); among these new records, nine remain to be named using Linnean binomina, which reflects the lack of regional taxonomic information for the respective genera. The list of all species is as follows:

Eurythoe complanata (Pallas, 1766)
Bhawania goodei Webster, 1884
Eunice 'sp_Abu Musa'
Lysidice ninetta Audouin & Milne-Edwards, 1833
Marphysa 'sp_Abu Musa'
Glycera cf. *tesselata* Grube, 1840
Hesione splendida Savigny in Lamarck, 1818
Leocrates claparedii (Costa in Claparède, 1868)
Iphione muricata (Lamarck, 1818)
Lumbrineris 'sp_Abu Musa'
Notoproctus 'sp_Abu Musa'
Nereis coutieri Gravier, 1900
Nereis sp. cf. *N. pelagica* Linnaeus, 1758
Perinereis iranica sp. nov.
Perinereis kuwaitensis (Mohammad, 1970*a*)
Perinereis nigropunctata (Horst, 1889)
Pseudonereis anomala Gravier, 1900
Pseudonereis trimaculata (Horst, 1924)
Arabella iricolor (Montagu, 1804)
Eteone 'sp_Abu Musa'
Harmothoe liaoi Barnich, Sun & Fiege, 2004
Lepidonotus tenuisetosus (Gravier, 1902)
Thormora jukesii Baird, 1865*b*
Potamilla 'sp_Abu Musa'
Spirobranchus kraussii (Baird, 1865*a*)
Branchiosyllis cf. *exilis* (Gravier, 1900)
Trypanosyllis 'sp.1_Abu Musa'
Trypanosyllis 'sp.2_Abu Musa'
Trypanosyllis zebra (Grube, 1860)
Terebella 'sp_Abu Musa'
Terebellides cf. *stroemii* Sars, 1835

Taxonomy

Perinereis iranica sp. nov.
(Figures 2A–E & 3A, B)

Perinereis cultrifera species complex. – Bonyadi-Naeini *et al.*, 2017: 104–105.

MATERIAL EXAMINED

Holotype, Iran, Persian Gulf, Qeshm Island – Tola village, behind military region, intertidal zone, Sandy-cobble beach, collector Bonyadi Naeini. A., 4 May 2008, one specimen (ZUTC 6142). Paratypes: Iran, Persian Gulf, Abu Musa, Park-e Qadir, rocky, in some places sandy with boulders, collector Bonyadi Naeini. A., 29 April 2014, one specimen, epitoke, male (ZUTC 6371). Hormoz Island, Center of Ecosystem Research, intertidal zone, rocky-cobble beach, collector Chitgaran M., 12 November 2016, one specimen (ZUTC 6398). See Table 1 for further collection details.

ETYMOLOGY

The species name refers to the country where the material was collected.

DESCRIPTION

Material examined about 105 chaetigers, colour of body in alcohol creamy with orange pigments in anterior part of body. Total length after fixation 49 mm long, 3.5 mm wide. Body flattened, tapering posteriorly. Prostomium slightly wider than long with two orange lines extending from base of antennae to between eyes. Palps stout, longer than wide and longer than antennae. One antenna is missing (Figure 2A). Four pairs of short tentacular cirri, longest one reaching to chaetiger 2. Pharynx not everted with brown to dark jaws with 11–12 teeth. Paragnaths on maxillary ring arranged as follows: I = 4 conical paragnaths; II = 12–13 conical paragnaths; III = group of 30–35 conical paragnaths, lateral group absent; IV = about 40 conical paragnaths arranged in wedge shape without any bars. Paragnaths on oral ring arranged as follows: V = 5 conical paragnaths in one row, median one larger than others; VI = a long arcuate bar that covers total length of area VI (Figure 2B);

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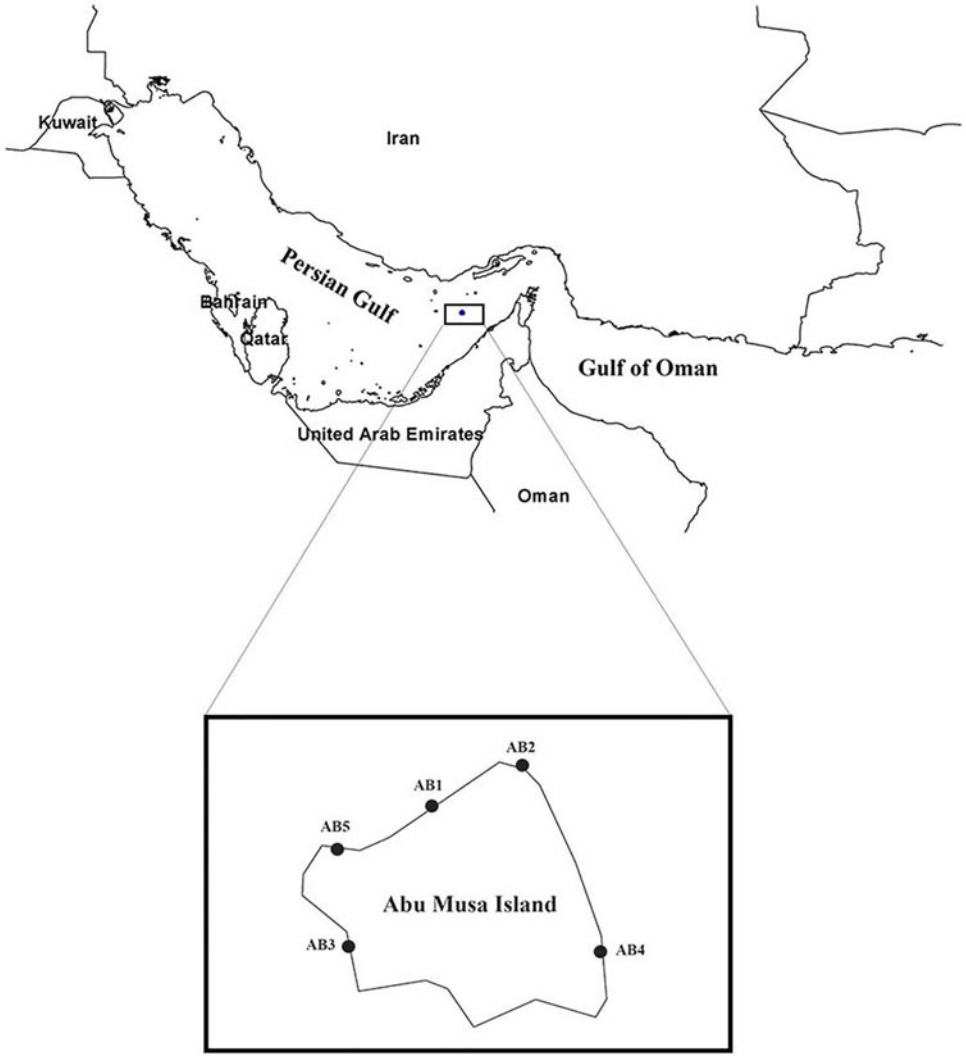

Fig. 1. Map showing Abu Musa Island. Highlighted area indicates sampling localities along the coasts of the Abu Musa Island. Location numbers are described in Table 1.

VII–VIII = 31 conical paragnaths in 3 rows, two distal-most rows composed of large conical paragnaths and proximal row comprising small conical paragnaths. Parapodium of chaetiger 10 with two rounded notopodial ligules; dorsal ligule slightly larger than ventral one. Notopodial prechaetal lobe present, minute, absent in posterior chaetigers (Figure 2C). Dorsal cirrus longer than dorsal ligule. Ratio of DC/DNL: 1.20. Dark pigmentation near base of dorsal cirri. Anterior neuropodia with two ligules and small prechaetal and postchaetal lobes. Neuropodial acicular ligule conical, rounded distally and smaller than dorsal neuropodial ligule (Figure 2C). Pale glands near base of dorsal cirri in anterior part of body and dorsal part of body near notopodia to mid-dorsum from chaetiger 60 to end of body. Ventral cirri smaller than

Table 1. Collection data for each of the five sites in the study.

Station number	Station name	Coordinates	Date	Habitat
AB1	Park-e Dowlat	25°53′27.00″ N55°01′40.00″E	1 May 2014 21–29 December 2014 12 May 2015	Rocky, in some places sandy with boulders
AB2	Park-e Qadir	25°53′45.00″ N55°02′38.00″E	23–25 December 2014 1 May 2014 12–16 May 2015	Rocky-cobble with abundant coral
AB3	Near meteorology station	25°52′08.00″ N55°01′ 06.00″E	1 May 2014 12 May 2015	Mostly sandy but in some places rocky
AB4	Southern part of the quay	25°52′05.00″ N55°03′11.00″E	23–25 December 2014 13–17 May 2015	Mostly sandy with large fragmented rocks
AB5	Desalination station	25°52′58.00″ N55°00′56.00″E	30 April 2014	Cobble beach with large shingle

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Table 2. List of polychaetes reported in this study from the Persian Gulf and Gulf of Oman. Present (+), Absent (–), Present study (P).

ID	Family	Species name	Gulf of Oman	Persian Gulf	Notes
1	Amphinomidae	*Eurythoe complanata* (Pallas, 1766)	–	+	
2	Chrysopetalidae	*Bhawania goodei* Webster, 1884	–	+	
3	Eunicidae	*Eunice* 'sp_Abu Musa'	+	P	New record
4		*Lysidice ninetta* Audouin & H. Milne Edwards, 1833	+	+	
5		*Marphysa* 'sp_Abu Musa'	–	P	New record; *Marphysa bellii* (Audouin *et al.*, 1833) and *Marphysa gravelyi* Southern, 1921, recorded by Wesenberg-Lund (1949), also, *Marphysa gemmata* Mohammad, 1973, *Marphysa sanguinea* (Montagu, 1813) *Marphysa stragulum* (Grube, 1878) recorded by Mohammad, 1973 from the Persian Gulf. The present material differs from the five species that have been recorded from the Persian Gulf in kind of chaetae and in which chaetiger gills started
6	Glyceridae	*Glycera* cf. *tesselata* Grube, 1840	–	P	New record; The present material differs from *G. tesselata*, as redescribed by Böggemann (2002) in some parapodial characters and the form of the aileron
7	Hesionidae	*Hesione splendida* Savigny in Lamarck, 1818	–	P	New record
8		*Leocrates claparedii* (Costa in Claparède, 1868)	–	+	
9	Iphionidae	*Iphione muricata* (Lamarck, 1818)	–	+	
10	Lumbrineridae	*Lumbrineris* 'sp_Abu Musa'	+	P	New record; *Lumbrineris bifurcata* (Mcintosh, 1885), *L. heteropoda* (Marenzeller, 1879), *L. latreilli* (Audouin & Milne-Edwards, 1833) by (Wesenberg-Lund, 1949) and *L. japonica* (Marenzeller, 1879) recorded by Fauvel (1911) from the Persian Gulf. The only specimen is missing the posterior part of the body. The present specimen differs from the other three in form of parapodia and the form and arrangements of chaetae
11	Maldanidae	*Notoproctus* 'sp_Abu Musa'	–	P	New genus for Persian Gulf; *Notoproctus pacificus* (Moore, 1906) was only tentatively identified by Monro (1937) for specimens collected from Gulf of Aden. Only one specimen was collected in this study. More specimens are required before definitive conclusions can be made about species identity
12	Nereididae	*Nereis coutieri* Gravier, 1900	+	+	
13		*Nereis* sp. cf. *N. pelagica* Linnaeus, 1758	–	P	New record; The single specimen available to study closely resembles recent descriptions of *N. pelagica*, but differs in the number and shape of paragnaths in all areas of pharynx, for example more paragnaths in Area I (7 *vs* 1–2) and Area II (17–19 *vs* 10–20) than *N. pelagica* from Scottish waters (Chambers & Garwood, 1992). Also, it has 7 paragnaths in Area V arranged in a circle, but *N. pelagica* from Scottish waters has no paragnaths in Area V. Also it closely resembles *Nereis* sp. cf. *N. pelagica* recorded by Bonyadi-Naeini *et al.* (2017) in the number of paragnaths in some areas of pharynx. *Nereis pelagica* is reported to be a cosmopolitan species (Bakken & Wilson, 2005)
14		*Perinereis nigropunctata* (Horst, 1889)	–	+	
15		*Pseudonereis anomala* (Gravier, 1900)	+	+	
16		*Pseudonereis trimaculata* (Horst, 1924)	+	+	
17		*Perinereis iranica* sp. nov.	–	P	New species for Persian Gulf
18		*Perinereis kuwaitensis* (Mohammad, 1970a)	+	+	
19	Oenonidae	*Arabella iricolor* (Montagu, 1804)	–	+	
20	Phyllodocidae	*Eteone* 'sp_Abu Musa'	+	P	New genus for Persian Gulf

Continued

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Table 2. Continued

ID	Family	Species name	Gulf of Oman	Persian Gulf	Notes
21	Polynoidae	*Harmothoe liaoi* Barnich, Sun & Fiege, 2004	+	P	New record: the single specimen available to study resembles closely the specimens of Bonyadi-Naeini & Rahimian (2009) from the Gulf of Oman
22		*Lepidonotus tenuisetosus* (Gravier, 1902)	+	+	
23		*Thormora jukesii* (Baird, 1865b)	–	+	
24	Sabellidae	*Potamilla* 'sp_Abu Musa'	–	P	New record; Both *Potamilla ceylonica* Augener (1926) and *P. ehlersi* Gravier (1906) have been recorded from the Persian Gulf. The only specimen found in this study differs in some characters from both *P. ceylonica* and *P. ehlersi*. However, more specimens and more taxonomic studies are required before we can confidently identify the species
25	Serpulidae	*Spirobranchus kraussii* (Baird, 1865a)	–	+	
26	Syllidae	*Branchiosyllis* cf. *exilis* (Gravier, 1900)	–	P	New record
27		*Trypanosyllis* 'sp.1_Abu Musa'	–	P	New record; So far two species, *Trypanosyllis gigantea* (McIntosh, 1885) and *T. zebra* (Grube, 1860) are known from the Persian Gulf. The present specimens differ from both these species and, when formally described, will represent a third species of *Trypanosyllis* recorded from the Persian Gulf
28		*Trypanosyllis* 'sp.2_Abu Musa'	–	P	New record; See comments above; once formally described this species will represent the fourth record of the genus from the Persian Gulf
29		*Trypanosyllis zebra* (Grube, 1860)	–	+	
30	Terebellidae	*Terebella* 'sp_Abu Musa'	–	P	New genus for Persian Gulf
31	Trichobranchidae	*Terebellides* cf. *stroemi* Sars, 1835	–	P	New record; The present material differs from *T. stroemii*, as redescribed by Parapar & Hutchings (2014) in body length and presence of papilla projections, therefore likely represents a new species

neuropodial acicular ligule. Notochaetae homogomph spinigers. Neurochaetae in dorsal fascicle are homogomph spinigers and heterogomph falcigers; in ventral fascicle are heterogomph falcigers. Falcigers with short, serrated blades. Parapodium of posterior chaetigers (84th): dorsal cirrus longer than dorsal notopodial ligule; ratio of DC/DNL: 1.51. Dorsal notopodial ligule conical, about 2.5× longer than ventral notopodial ligule. Acicular neuropodial ligule conical and distinct digitiform postchaetal lobe reduced. Ventral neuropodial ligule conical and smaller than acicular neuropodial ligule (Figure 2D). Ventral cirri smaller than ventral neuropodial ligule. Neurochaetae in dorsal fascicle are homogomph spinigers and heterogomph falcigers with short blades. Neurochaetae in ventral fascicle are heterogomph falcigers (Figure 2E). Paired, cirriform long pygidial cirri present.

VARIATION IN PARATYPES

Size range from 26 to 35 mm (mean 31.5 mm) long, 3.1 to 4.5 mm (mean 3.8 mm) wide. Paragnath counts: I = 6 conical paragnaths; II = 15–16 conical paragnaths; III = group of 40–45 conical paragnaths, lateral group absent; IV = about 40–47 conical paragnaths arranged in wedge shape without any bars. Paragnaths on oral ring: V = 3 conical paragnaths in triangle; VI = a long arcuate bar covering total length of area VI, VII–VIII = 25 conical paragnaths in 3 rows, two distal-most rows composed of large conical paragnaths, proximal row comprising small conical paragnaths. Epitokal modification observed in one specimen, both females filled with eggs, parapodial modification (Figure 3A, B) from chaetiger 17 to chaetiger 83. Dorsal and ventral cirri of the first chaetigers show basal swelling up to chaetiger 9. Paddle-like (natatory) chaetae not present in this specimen.

REMARKS

Fauvel (1919, 1932, 1953) recorded and described *P. cultrifera* from India, and assigned several varieties to it, including *P. cultrifera* var. *typica*. Confusingly, in his 1932 paper Fauvel referred to these varieties also as subspecies, but in 1953 he reverted again to referring to them as varieties, viz. *P. cultrifera* var. *floridana*, *P. cultrifera* var. *perspicillata*, *P. cultrifera* var. *obfuscata* and *P. cultrifera* var. *striolata*. Varietal designation was continued by Rullier (1972), who provides a very clear diagnosis of each. In recent decades most authors have referred to these entities either as subspecies or species, and at present they have all been given species status in WoRMS (Gil *et al.*, 2016). Recently, another two species have been recognized as being morphologically similar to *P. cultrifera* and its allies: *P. euiini* Park & Kim, 2007 from East Asia and *P. anderssoni* Kinberg, 1866 from the Americas. *Perinereis euiini* encompasses all specimens from East Asia formerly identified as *P. cultrifera* var. *floridana* or *P. cultrifera floridana* (Park & Kim, 2007).

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Table 3. List of species and collection details of the examined specimens during this study.

Family	Species	Localities	Sampling dates	Zoological code
Amphinomidae	*Eurythoe complanata* (Pallas, 1766)	Southern part of the quay	16/05/2015	ZUTC 6301
		Park-e Qadir	16/05/2015	ZUTC 6302
		Park-e Qadir	24/12/2014	ZUTC 6303
Chrysopetalidae	*Bhawania goodei* Webster 1884	Park-e Dowlat	12/05/2015	ZUTC 6304
Eunicidae	*Eunice* 'sp_Abu Musa'	Southern part of the quay	16/05/2015	ZUTC 6305
		Southern part of the quay	17/05/2015	ZUTC 6306
		Southern part of the quay	13/05/2015	ZUTC 6307
		Park-e Qadir	23/12/2014	ZUTC 6308
		Park-e Qadir	25/12/2014	ZUTC 6309
		Park-e Qadir	24/12/2014	ZUTC 6310
		Park-e Qadir	14/05/2015	ZUTC 6311
		Park-e Dowlat	21/12/2014	ZUTC 6312
		Park-e Dowlat	29/12/2014	ZUTC 6313
		Park-e Dowlat	12/05/2015	ZUTC 6314
		Park-e Dowlat	01/05/2014	ZUTC 6315
		Near meteorology station	01/05/2014	ZUTC 6316
	Lysidice ninetta Audouin & H. Milne Edwards, 1833	Southern part of the quay	13/05/2015	ZUTC 6317
		Park-e Qadir	24/12/2014	ZUTC 6318
		Park-e Qadir	25/12/2014	ZUTC 6319
		Park-e Qadir	13/05/2015	ZUTC 6320
		Park-e Qadir	12/05/2015	ZUTC 6321
		Park-e Dowlat	12/05/2015	ZUTC 6322
		Park-e Dowlat	01/05/2014	ZUTC 6323
		Near meteorology station	01/05/2014	ZUTC 6324
	Marphysa 'sp_Abu Musa'	Near meteorology station	12/05/2015	ZUTC 6325
Glyceridae	*Glycera cf. tesselata* Grube, 1840	Park-e Dowlat	01/05/2014	ZUTC 6326
Hesionidae	*Hesione splendida* Savigny in Lamarck, 1818	Southern part of the quay	16/05/2015	ZUTC 6327
		Southern part of the quay	23/12/2014	ZUTC 6328
		Park-e Qadir	24/12/2014	ZUTC 6329
	Leocrates claparedii (Costa in Claparède, 1868)	Southern part of the quay	17/05/2015	ZUTC 6330
Iphionidae	*Iphione muricata* (Lamarck, 1818)	Southern part of the quay	16/05/2015	ZUTC 6331
Lumbrineridae	*Lumbrineris* 'sp_Abu Musa'	Southern part of the quay	16/05/2015	ZUTC 6332
Maldanidae	*Notoproctus* 'sp_Abu Musa'	Southern part of the quay	25/12/2014	ZUTC 6333
Nereididae	*Nereis coutieri* Gravier, 1900	Park-e Dowlat	12/05/2015	ZUTC 6334
		Park-e Dowlat	29/12/2014	ZUTC 6335
	Nereis sp. cf. *N. pelagica* Linnaeus, 1758	Park-e Dowlat	21/12/2014	ZUTC 6336
	Perinereis iranica sp. nov.	Park-e Qadir	01/05/2014	ZUTC 6371
	Perinereis kuwaitensis (Mohammad, 1970a)	Near meteorology station	01/05/2014	ZUTC 6143
	Perinereis nigropunctata (Horst, 1889)	Park-e Dowlat	21/12/2014	ZUTC 6337
		Park-e Qadir	01/05/2014	ZUTC 6338
		Near meteorology station	01/05/2014	ZUTC 6339
	Pseudonereis anomala Gravier, 1900	Southern part of the quay	13/05/2015	ZUTC 6340
		Park-e Qadir	23/12/2014	ZUTC 6341
		Park-e Qadir	25/12/2014	ZUTC 6342
		Near meteorology station	01/05/2014	ZUTC 6343
	Pseudonereis trimaculata (Horst, 1924)	Park-e Dowlat	21/12/2014	ZUTC 6344
		Park-e Dowlat	29/12/2014	ZUTC 6345
		Near meteorology station	01/05/2014	ZUTC 6346
		Park-e Qadir	01/05/2014	ZUTC 6347
Oenonidae	*Arabella iricolor* (Montagu, 1804)	Desalination station	30/04/2014	ZUTC 6348
Phyllodocidae	*Eteone* 'sp_Abu Musa'	Park-e Dowlat	21/12/2014	ZUTC 6349
		Park-e Dowlat	29/12/2014	ZUTC 6350
		Near meteorology station	01/05/2014	ZUTC 6351
Polynoidae	*Harmothoe liaoi* Barnich, Sun & Fiege, 2004	Southern part of the quay	16/05/2015	ZUTC 6352
	Lepidonotus tenuisetosus (Gravier, 1902)	Park-e Dowlat	21/12/2014	ZUTC 6353
		Desalination station	30/04/2014	ZUTC 6354
		Near meteorology station	01/05/2014	ZUTC 6355
	Thormora jukesii (Baird, 1865b)	Park-e Qadir	25/12/2014	ZUTC 6356
		Park-e Qadir	23/12/2014	ZUTC 6357
		Park-e Qadir	01/05/2014	ZUTC 6358
		Park-e Dowlat	21/12/2014	ZUTC 6359
		Park-e Dowlat	29/12/2014	ZUTC 6360
Sabellidae	*Potamilla* 'sp_Abu Musa'	Southern part of the quay	16/05/2015	ZUTC 6361
Serpulidae	*Spirobranchus kraussii* (Baird, 1865)	Southern part of the quay	25/12/2014	ZUTC 6362

Continued

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Table 3. Continued

Family	Species	Localities	Sampling dates	Zoological code
Syllidae	*Branchiosyllis* cf. *exilis* (Gravier, 1900)	Southern part of the quay	16/05/2015	ZUTC 6363
	Trypanosyllis zebra (Grube, 1860)	Southern part of the quay	13/05/2015	ZUTC 6364
		Southern part of the quay	16/05/2015	ZUTC 6365
		Park-e Dowlat	21/12/2014	ZUTC 6366
	Trypanosyllis 'sp.1_Abu Musa'	Desalination station	30/04/2014	ZUTC 6367
	Trypanosyllis 'sp.2_Abu Musa'	Near meteorology station	01/05/2014	ZUTC 6368
Terebellidae	*Terebella* 'sp_Abu Musa'	Park-e Qadir	13/05/2015	ZUTC 6369
Trichobranchidae	*Terebellides* cf. *stroemii* Sars, 1835	Park-e Qadir	24/12/2014	ZUTC 6370

Bonyadi-Naeini *et al.* (2017) remarked that the present specimen is distinguishable from other members of the *P. cultrifera* species complex reported, mainly in the number and shape of paragnaths in Areas V and VI. Yousefi *et al.* (2011) recorded *P. cultrifera* from the Persian Gulf and Gulf of Oman, their material matches exactly with the syntypes as re-described by Hutchings *et al.* (1991). Reexamination of Yousefi's material and the material obtained from Abu Musa shows that the latter differs in the number of paragnaths in areas I, III, IV with more cones than recorded by Yousefi *et al.* (2011). Also they differ from the re-description of the syntypes by Hutchings *et al.* (1991), in the shape of the bars in area VI (a long arcuate bar that covers the total length of area VI *vs* a short bar in area VI) and also in the number and the arrangement of cones in area V (1–2 in triangular shape *vs* 5 in a row). Specimens from Abu Musa also differ from *P. cultrifera* in having heterogomph falcigers with long blades when compared with the short blade ones in *P. cultrifera* (see Table 4).

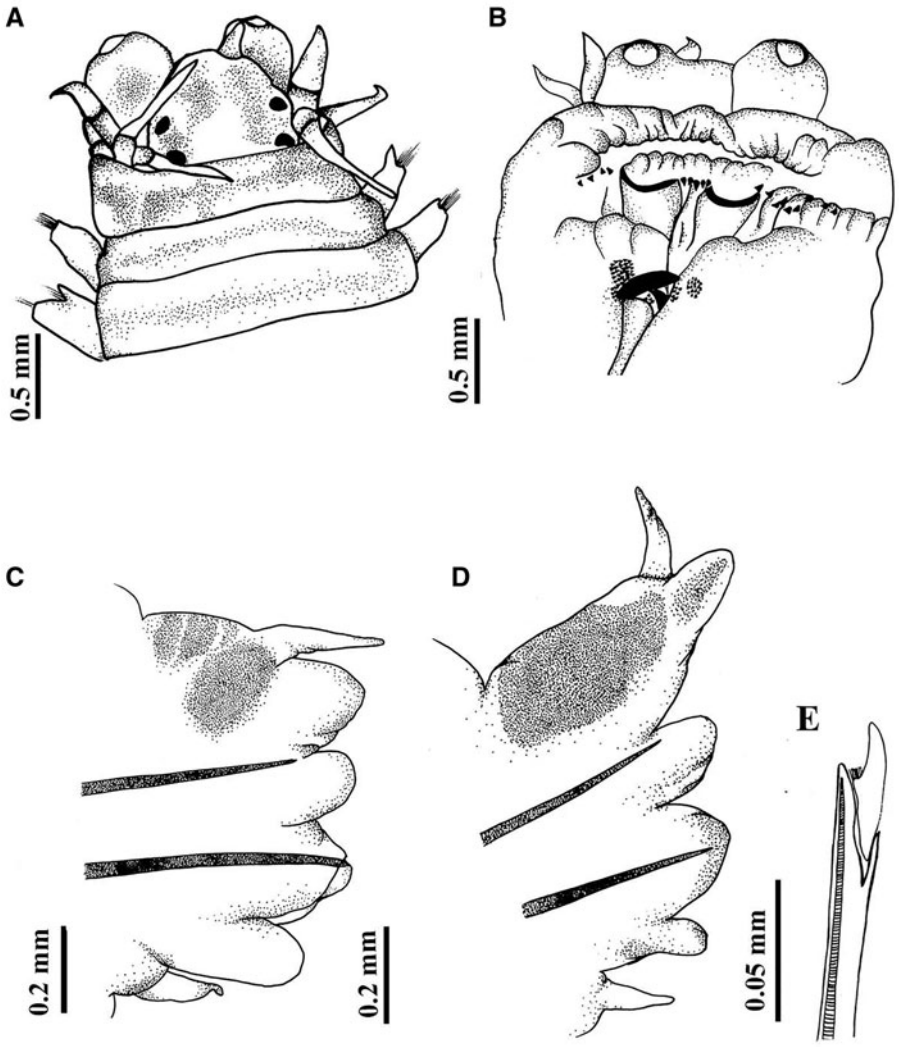

Fig. 2. *Perinereis iranica* sp. nov. (A) Anterior part of the body, Dorsal view; (B) View of everted proboscis; (C) Parapodium chaetiger 10, anterior view; (D) Posterior parapodium, anterior view; (E) Ventral fascicle neuropodial heterogomph falciger, chaetiger 10.

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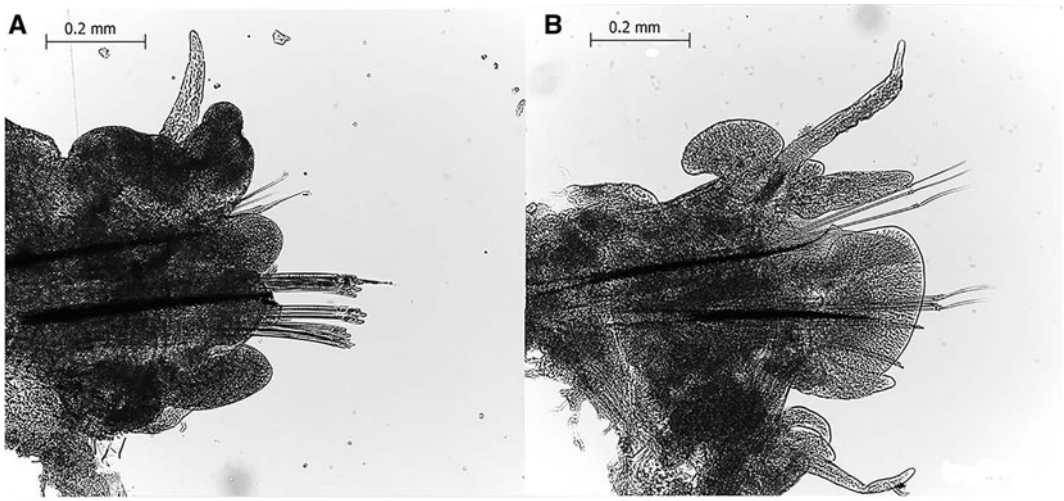

Fig. 3. *Perinereis iranica* sp. nov. (epitoke). (A) Parapodium chaetiger 10, posterior view; (B) Posterior parapodium, anterior view.

Monro (1931) distinguished *Perinereis obfuscata* Grube, 1878 from *P. cultrifera* by the position of epitokal modification, but later (Monro, 1939) he referred to *P. obfuscata* as a variety of *P. cultrifera*. Following a detailed analysis of geographic variation, Hutchings *et al.* (1991) preferred to retain *P. obfuscata* as a distinct species.

The present material differs from *P. obfuscata*, in its body colouration (see Table 4), number of paragnaths in areas III (30–35 *vs* 13–32), IV (40 *vs* 10–31), V (5 *vs* 1 rarely 2) and arrangement of paragnaths in areas V, VI (a long bar *vs* a short bar) and VII–VIII (2 rows *vs* 3 rows). Furthermore, the present material lacks heterogomph spinigers in the ventral fascicle of the neuropodia.

The present material differs from *Perinereis helleri* in the length of the longest tentacular cirri (longest tentacular cirri extending to chaetiger 2 *vs* 16). Also the present material has more cones in areas I (4 *vs* 2 occasionally 1), III (30–35 *vs* 11–20), IV (40 *vs* 10–19) and V (5 *vs* 3) than *P. helleri*. Moreover, they differ in the arrangement of paragnaths in areas V and VII–VIII and in the shape of heterogomph falcigers (see Table 4).

Perinereis perspicillata was recorded by Fauvel (1911) from the Persian Gulf (Bushehr and Bahrain) and by Mohammad (1971) as *P. cultrifera perspicillata*. The present material differs from *P. perspicillata* in the number of paragnaths in areas I (4 cones *vs* 6–8) and V (5 cones *vs* 3). Also the present material differs from that reported by Fauvel (1911) and Mohammad (1971) in the arrangement of paragnaths in area V (5 cones in one row, median one larger than others *vs* 3 cones in triangle) and the shape of the bars in area VI. *Perinereis striolata* Grube, 1878 has also been recorded from the Persian Gulf (Bushehr) by Fauvel (1908). The present material differs from *P. striolata* in the number and arrangement of paragnaths in area V (5 cones *vs* 1 cone) and shape of bar in area VI.

Perinereis floridana was recorded by Wesenberg-Lund (1949) as *Perinereis cultrifera* var. *floridana* Fauvel 1932 from the Persian Gulf (Farur Island) and also as *Perinereis cultrifera floridana* Ehlers, 1868 by Mohammad (1971). The present material differs from those specimens in number of paragnaths in areas I (4 cones *vs* 1 cone) and V (5 cones *vs* 1 cone), arrangement of paragnaths in areas VII–VIII (cones in three rows *vs* cones in two rows) and in the shape of paragnaths in area VI (long arcuate bar covering the total length of area VI *vs* 1 single, broad, flat, triangular paragnath). We doubt whether the *P. floridana* of these authors is the same as that of the Ehlers (1868) species originally described from the Caribbean Sea, or indeed is the same as *P. euiini* Park & Kim, 2007, which appears to be restricted to East Asia, and suggest that it represents another undescribed species. *Perinereis iranica* sp. nov. differs from *P. euiini* in having a greater number of paragnaths in areas III and IV (III: 30–45 *vs* 10–15; IV: 40–47 *vs* 16–26).

Finally, Fauvel (1932) and Hutchings *et al.* (1991) considered *Perinereis camiguina* Grube, 1878 as a synonym of *P. helleri*. We disagree with this synonymy because Grube (1878) states that 'The species differs from *P. helleri*, apart from the number of paragnaths in Area I, also by the shortness of the dorsal cirrus, which reach only to the tip of the ligule in anterior and posterior parapodia' (this is illustrated clearly by Hutchings *et al.*, 1991, figs 9a, b which shows the parapodia from chaetiger 33, 130 of the syntype). More importantly, the paragnaths in Area VI resemble a line of cones more than a pair of bars. Grube stated this character in Latin as 'utrinque 1, transverse linearis' (one transverse line on both sides), and he shows 4–5 cones in a tight line in Plate 4, Figure 8. Also, in the remarks he talks about one of the non-type specimens having, 'In Area VI, the left is less broad than usual, and instead of the right one sees three small ones in a transverse row'. So, we understand that the total variation for Area VI for *P. camiguina* is 3–5 cones. Unfortunately, no mention is made of the paragnath type and arrangement in the syntype by Hutchings *et al.* (1991). Since *P. camiguina* lacks bars in area VI it cannot be a member of *Perinereis* as currently conceived. Possibly it belongs to *Pseudonereis* based on the shape and arrangement (comb-like rows) of paragnaths in Areas II and VI. The only members of *Pseudonereis* known to have 3–5 cones in Area VI are *P. anomala* and *P. multisetosa* (Bakken, 2007), but the parapodia and chaetae of these species do not match those of the syntypes as illustrated by Hutchings *et al.* (1991). Therefore, until type specimens can be re-examined, we recommend that *Perinereis camiguina* be regarded as Nereidinae *incertae sedis*.

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Table 4. Comparison between selected characters in *Perinereis cultrifera* (Grube, 1840), *P. iranica* sp. nov., *P. floridana* (Ehlers, 1868), *P. striolata* Grube, 1878, *P. obfuscata* Grube, 1878, *P. perspicillata* Grube, 1878, and *P. helleri* (Grube, 1878) (See the last row for literature).

Characters	*Perinereis cultrifera* (Grube, 1840)	*P. iranica* sp. nov. Holotype (Paratypes)	*P. floridana* (Ehlers, 1868)	*P. striolata* Grube, 1878	*P. obfuscata* Grube, 1878	*P. perspicillata* Grube, 1878	*P. helleri,* (Grube, 1878)
Colouration	Faint narrow transverse pigmented bands on several anterior chaetigers; otherwise lacking pigmentation patterns	In alcohol creamy with orange pigmentation in anterior body	No data	No data	Colour in alcohol cream, often with brown pigmentation on prostomium and 3 transverse patches on anterior dorsal chaeigers	No data	Colour in alcohol cream-pink or light brown
Length of longest tentacular cirri	Extend back to chaetigers 4–5	Extend back to chaetiger 2	Extend back to chaetiger 5	Extend back to chaetiger 6–7	Extend back to chaetiger 1	No data	Extend back to chaetiger 16 (range 8–16)
Paragnaths in Area I	1–2 cones	4 cones (6 cones)	1 large cone	4–7 cones	2–9 cones	Cluster of 6–8 cones	2 cones (occasionally 1)
Paragnaths in Area II	3–15 cones, usually 5–9	12–13 cones (15 cones)	Group of cones in three oblique rows	19–33 cones in 2–3 curved rows	7–27 cones in 2–3 crescent-shaped rows (usually between 10–20)	Cluster of very dark cones	4–17 cones
Paragnaths in Area III	5–11 cones	Group of 30–35 conical paragnaths, (40–45 cones)	Group of very small cones in three parallel rows	26–33 cones	13–32 cones, sometimes with 1–2 cones displaced laterally, separate from the main group	Cluster of very dark cones	11–20 in ovoid-rectangular patch with 2–3 cones displaced laterally, separate from main group
Paragnaths in Area IV (cones and bars)	6–20 cones, usually 10–15, no bar	About 40 conical paragnaths arranged in wedge shape, no bar (40–47 cones)	Group of cones in four parallel rows, the last shorter than the others and ending in a cluster in the central corner	21–40 cones, no bars	10–31 cones, no bar	Cluster of very dark cones	lo–19 cones (1 specimen with 4), no bar
Paragnaths in Area V	2–5 cones, usually 3–4	5 cones in a row median one larger than others (3 cones)	1 large cone	1 large cone	1 cone rarely 2	3 cones in triangle	3 cones in triangle
Paragnaths in Area VI	One short bar	long arcuate bar covering total length of area VI	1 single, broad, flat, somewhat triangular paragnath	1 short crescent-shaped bar	1 short crescent-shaped bar	Single large bar widened transversally, with sharp edge	l long straight bar
Paragnaths in Area VII–VIII	20–50 cones, usually 30–40	31 cones (25 cones) in 3 rows	Group of large cones in two distinct rows	Group of 36 cones in two rows, or three rows according to Fauvel (1911)	22–38 cones in 2 rows	Central group with three rows, lateral ones with one row	21–40 cones in 2 rows
Length of dorsal cirri/ length of dorsal notopodial ligule (DC/ DNL)	Dorsal cirrus as long as dorsal notopodial ligule anteriorly	Dorsal cirrus longer than dorsal ligule	No data	No data	Dorsal cirrus slightly longer than dorsal notopodial ligule	No data	Dorsal cirri longer than dorsal ligule on all chaetigers
Heterogomph falcigers	Present (similar to *P. cavifrons* Ehlers (1920) and *P. helleri* Grube (1878), but have longer blades than those of most other species of *Perinereis*)	Present with short blades (Present)	Present with short, sickle-shaped blades	No data	Present with short blades	No data	Present with long blades
Reference	Hutchings *et al.*, 1991	Present study	Wesenberg-Lund, 1949	Grube, 1878 unless stated otherwise	Hutchings *et al.*, 1991	Fauvel, 1911, Mohammad, 1971	Mohammad, 1971; Hutchings *et al.*, 1991

KEY TO THE *PERINEREIS CULTRIFERA* SPECIES COMPLEX FROM THE INDO-WEST PACIFIC

1. Group V, a triangle of 3 paragnaths or more 2
   – Group V, a single paragnath 6
2. Group V, a triangle of 3 paragnaths 3
   – Group V, a line of 5 paragnaths .....*P. iranica* sp. nov.
3. Group I, 1 to 3 paragnaths; if more than 1 arranged in a longitudinal line 4
   – Group I, a small cluster of 4–8 paragnaths ....*P. perspicillata*
4. Tentacular cirri reaching backwards to chaetiger 4–8..... 5
   – Tentacular cirri reaching well beyond chaetiger 8 ....*P. helleri*
5. Area III paragnaths with a central and lateral patches ....*P. cultrifera*
   – Area III paragnaths without lateral patches ....*P. euiini*
6. Group I, 1 large paragnath *P. floridana* (not Ehlers, 1868)
   – Group I, a small cluster of 2–9 7
7. Tentacular cirri reaching backwards to chaetiger 1 ....*P. obfuscata*
   – Tentacular cirri reaching backwards to chaetiger 6–7 ....*P. striolata*

DISCUSSION

The polychaete species reported in this study from the Persian Gulf mark an increase in species diversity. Wesenberg-Lund (1949) reported 176 species in the Persian Gulf and Gulf of Oman, of which 168 species were from the Persian Gulf. Wehe & Fiege (2002) recorded 231 species from this region. Since 2002, Wehe (2006) recorded a further 11 species, Wehe (2007) recorded two more species, Bonyadi-Naeini & Rahimian (2009) recorded nine more species and Bonyadi-Naeini *et al.* (2017) added 12 more species to the list. So based on those reports, and excluding the present study, about 256 polychaete species have been recorded from the Persian Gulf. The present work adds a further 15 new records and one new species to the list. Consequently, so far at least 262 polychaete species have been reported from the Persian Gulf.

According to Glasby *et al.* (2000), the worldwide number of accepted polychaete species is about 8500, belonging to 1100 genera. Regarding this range of species number, about 3% of the known species occur in the Persian Gulf. This estimate is based on morphological species concepts; more recent studies investigating species complexes using molecular techniques suggest that the actual number of species may be 2–4 times greater (Chen *et al.*, 2002; Virgilio *et al.*, 2009; Glasby *et al.*, 2013); nevertheless, considering that the number of Persian Gulf species was also estimated using morphology, the figure of 3% is regarded as the current best estimate of polychaete species diversity in the Gulf.

Literature records indicate at least 40 species of Nereididae are known from the Persian Gulf. The most speciose genus in the Persian Gulf is *Perinereis* with 10 nominal species (Bonyadi-Naeini *et al.*, 2017). Of the 10 *Perinereis* species recorded from the Persian Gulf only one, *P. cultrifera* (Grube, 1840), belongs to the *P. cultrifera* species complex. The species has also been reported in the Red Sea, Suez Canal, Gulf of Aden, the Persian Gulf, Gulf of Oman (Wehe & Fiege, 2002; Yousefi *et al.*, 2011) Hong Kong (Muir & Bamber, 2008) and northern Bay of Bengal (Muir & Maruf Hossain, 2014). *Perinereis cultrifera floridana* was recorded by Mohammad (1971) from the Persian Gulf. Comparing the morphological characters of specimens of *Perinereis cultrifera* collected in this study with the other species in the complex, mostly recorded from seas surrounding Arabian peninsula and other nearby Indo-Pacific localities, demonstrates that the material from the Abu Musa Island, Persian Gulf represents a new species, *Perinereis iranica* sp. nov. (Table 4).

Of the 31 species recorded here from the coast of Abu Musa Island, Persian Gulf, some families are abundant including: Polynoidae collected from six locations, Eunicidae, Nereididae and Syllidae each from four locations, while others are apparently rare; each only collected from one or two locations (see Table 3). *Eunice* 'sp_Abu Musa' and *Lysidice ninetta* were most frequently encountered and each collected from four locations. The families Nereididae with seven species and Syllidae with four species were the most diverse taxa in our samples. The highest diversity of polychaetes found during this study was reported from the southern part of the Quay (AB4) located in the south-eastern part of the island, mostly a sandy habitat with large fragmented rocks. Three genera are newly reported for the first time from the Persian Gulf: *Notoproctus* Arwidsson, 1906 recorded by Moore, 1906 from Alaska also has been recorded from northern Australia, Southern California, Norway, Northern Greenland (Hartman, 1959) and Gulf of Aden (Wehe & Fiege, 2002); *Eteone* Savigny (1818) and *Terebella* Linnaeus (1767) have been recorded from the Red Sea (Wehe & Fiege, 2002).

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