

# Checklist of hermit crabs (Decapoda: Paguroidea) fauna from the Hormuz Island, Persian Gulf

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The hermit crabs in the intertidal zone of the Hormuz Island, Persian Gulf, were identified by seasonal sampling at six intertidal stations during 2010–2011. Nine species were identified, including one Coenobitidae (*Coenobita scaevola*) and eight Diogenidae (*Clibanarius signatus*, *C. longitarsus*, *Diogenes avarus*, *D. planimanus*, *D. tirmiziae*, *D. karmarensis*, *Areopaguristes perspicax*, and *Dardanus tinctor*). All species in this study are new records for the Hormuz Island. Checklist Information and the habitats of these hermit crabs are presented.

**Key words:** Checklist, hermit crab, new records, Hormuz Island, Persian Gulf

## INTRODUCTION

Hermit crabs are a superfamily of the decapod crustaceans that currently comprises more than 1100 species of wide distribution around the world (McLaughlin et al., 2010). Representing an important portion of many intertidal and sub tidal communities, hermit crabs display a very important role in the marine trophic chain (Fransozo & Mantelatto, 1998).

The Persian Gulf is a subtropical and semi-enclosed marginal sea of the north-west Indian Ocean, connected to the Gulf of Oman via the waterway of the Hormuz Strait. Hormuz Island is a very important Iranian island to the north of Hormuz Strait, with 38 km of coastline, an area of 42 km<sup>2</sup>, and very diverse ecosystems (Sheppard et al., 1992).

Hermit crab fauna of the Persian Gulf, Strait of Hormuz and the Gulf of Oman are poorly known. Identification and distribution of hermit crabs have been the subject of a number of papers in this region. Earlier field works and surveys conducted within the Persian Gulf (Jones, 1986; Apel, 2001; Kazmi et al., 2007; Naderloo et al., 2012), Gulf of Oman (Moradmand & Sari, 2007a, b), Qeshm Island (Asgari et al., 2012) and Chabahar Bay along the coast of the Gulf of Oman (Mirbagheri et al., 2010), have reported a total of 38 species of hermit crabs within 3 families; specifically, 28 species of Diogenidae, nine species of Paguridae and one species of Coenobitidae. However, there are no reports from three families (Parapaguridae, Pylochelidae and Pylojacquesidae) in the Persian Gulf and the Gulf of Oman. In the adjacent region (northern Arabian Sea, Pakistan coast), the superfamily Paguroidea is well-represented (Tirmizi & Siddiqui, 1981; Tirmizi & Siddiqui, 1982; Tirmizi & Kazmi, 1983; Siddiqui & Kazmi, 2003; Siddiqui et al., 2004; Kazmi & Siddiqui, 2006; Kazmi et al., 2007; Siddiqui & Komai, 2008).

The present paper is the first documentation of hermit crab fauna in the intertidal zones of the northern Strait of Hormuz (Hormuz Island). This basic information is important and useful in understanding the biology of the hermit crabs in this region.

## MATERIAL AND METHODS

Six stations were selected along the intertidal zones of Hormuz Island (Fig. 1). Station 1 (Marine Research Center, 27°03' N, 56°29' E), Station 2 (Mangrove forest, 27°05' N, 56°28' E), Station 3 (North coast, 27°05' N, 56°27' E), Station 4 (Hormuz Quay, 27°04' N, 56°25' E), Station 5 (West coast, 27°03' N, 56°25' E), Station 6 (Red soil mine (27°01' N, 56°27' E)). The crab samples, collected seasonally during summer 2010 to spring 2011, were fixed in 70% ethanol and transported to the laboratory where each individual was removed from its occupied shell for further analysis. All specimens were identified via the systematic arrangement used in that of McLaughlin (2003), Kazmi and Siddiqui (2006) and McLaughlin et al. (2010). The abbreviation SL is used for the shield length (mm), defined as the distance from the tip of the rostrum to the midpoint of the posterior margin of the shield. After identifications, some the hermit crabs were deposited in the Zoological Museum, University of Tehran (ZUTC – Catalogue number: Anom 1083, 1084, 1085, 1086, 1087, 1088, 1089 and 1090).

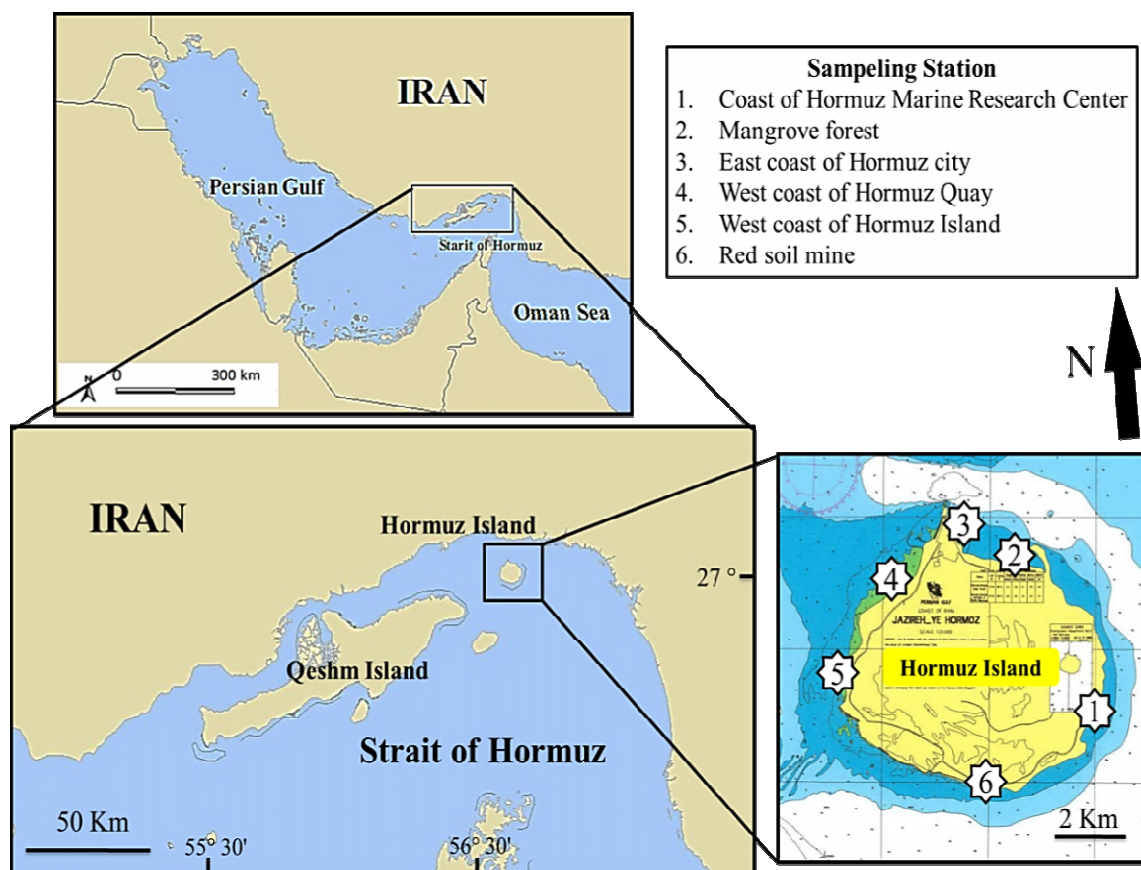


FIGURE 1. Location of all sampling sites in the intertidal zones of Hormuz Island (Persian Gulf).

**RESULTS****Systematics****Order Decapoda****Suborder Anomura****Family Coenobitidae Dana, 1851****Genus *Coenobita* Latreille, 1829*****Coenobita scaevola* (Forskål, 1775)**

**Material examined.** Persian Gulf, Hormuz Island; **Station 1:** September 2010, 2 males (SL= 16, 17 mm); April 2011, 1 ovigerous female (SL= 14 mm); **Station 4:** January 2011, 1 female (SL= 14 mm); 1 female (SL= 14 mm, ZUTC Anom 1090).

**Remarks.** So far, only one species of the genus *Coenobita* has been recorded from the Persian Gulf and the Gulf of Oman (Apel, 2001; Moradmand & Sari, 2007a; Mirbagheri et al., 2010; Naderloo et al., 2012; Seyfabadi et al., 2013). Nevertheless, in the Indo-Pacific region this genus is represented by ten species (Nakasone, 1988). *C. scaevola* is a rare species in supralittoral zone in the sandy beach of the Hormuz Island. However, *C. rugosus* H. Milne Edwards, 1937 and *C. perlatus* H. Milne Edwards, 1937 have also been recorded in the sandy beaches of neighboring Pakistan (Siddiqui & Kazmi, 2003).

**Habitat.** Semi-terrestrial or supralittoral zone of sandy beaches. Hormuz Island (Stations: 1 and 4).

**Family Diogenidae Ortmann, 1892****Genus *Dardanus* Paulson, 1875*****Dardanus tinctor* (Forskål, 1775)**

**Material examined.** Persian Gulf, Hormuz Island; **Station 1:** November 2010, 2 males (SL= 14, 15 mm); January 2011, 1 female (SL= 14 mm), 1 male (SL= 15 mm), April 2011, 2 ovigerous females (SL= 14, 10 mm); **Station 4:** April 2011, 3 males (SL= 14, 17, 13 mm); 1 male (SL= 15 mm, ZUTC Anom 1083), 1 female (SL= 14 mm, ZUTC Anom 1088).

**Remarks.** Kazmi et al. (2007) discussed the morphological diagnosis and coloration of this species. Upper margin of left cheliped with strong spinulose tubercles (mostly pink or sepia coloration). Female specimens in the Hormuz Island were bigger than same specimens in Qatar (Kazmi et al., 2007). This species mostly lives in sublittoral zones and sometimes comes into the intertidal zones for feeding. This species in the Hormuz Island lives in sublittoral and intertidal zones, especially in the coral reefs.

**Habitat.** More in sublittoral zone of coral reef beaches and sometimes in the intertidal zone of sandy beaches of the Hormuz Island (Stations: 1 and 4).

**Genus *Clibanarius* Dana, 1852*****Clibanarius signatus* Heller, 1861**

**Material examined.** Persian Gulf, Hormuz Island; **Station 1:** September 2010, 2 males (SL= 10, 12 mm), 2 females (SL= 9, 8 mm); November 2010, 1 male (SL= 8 mm), 1 ovigerous female (SL= 8 mm); January 2011, 3 males (SL= 14, 9, 10 mm), 1 female (SL= 6 mm), 1 ovigerous female (SL= 9 mm); April 2011, 1 female (SL= 8 mm), 2 ovigerous females (SL= 7, 8 mm); **Station 3:** September 2010, 1 ovigerous female (SL= 8 mm); January 2011, 2 males (SL= 12, 11 mm), 3 females (SL= 8, 9, 7 mm), 3 ovigerous females (SL= 7, 6, 9 mm); April 2011, 3 males (SL= 8, 7, 8), 2 ovigerous females (SL= 7, 6 mm); **Station 4:** September 2010, 2 males (SL= 9, 10 mm), 3 females (SL= 6, 9, 8 mm), 1 ovigerous female (SL= 7 mm); November 2010, 3 males (SL= 11, 13, 8 mm), 1 female (SL= 8 mm); January 2011, 2 females (SL= 9, 7 mm), 1 ovigerous female (SL= 9 mm); **Station 5:** September 2010, 2 males (SL= 9, 11 mm); January 2011, 1 male (SL= 10 mm), 2 ovigerous females (SL= 6, 9 mm); April 2011, 2 females (SL= 8, 8 mm), 2 ovigerous females (SL= 7, 6 mm); **Station 6:**

September 2010, 1 male (SL= 11 mm), 2 ovigerous females (SL= 7, 6 mm); November 2010, 2 females (SL= 6, 8 mm), 1 ovigerous female (SL= 6mm); January 2011, 2 males (SL= 9, 10 mm); April 2011, 1 male (SL= 9 mm), 1 ovigerous female (SL= 6 mm); 5 ovigerous females (SL= 9, 8, 6, 7, 9 mm, ZUTC Anom 1087); 1 male (SL= 12 mm, ZUTC Anom 1085).

**Remarks.** This species is very common in rocky shores of peripheral seas coasts of the western Indian Ocean. Being very resistance against large waves, this species lives in the gravel shores of the Hormuz Island. McLaughlin and Dworchak (2001) represented the morphological diagnosis, coloration and distribution of this species. Moradmand and Sari, 2007a; Mirbagheri et al., 2010 and Naderloo et al., 2012 reported this species from the Iranian coasts of the Persian Gulf and the Gulf of Oman. In some specimens, ambulatory legs possessed brownish longitudinal stripes on all segments.

**Habitat.** Sandy beaches, Gravel and rocky shores. Hormuz Island (Stations: 1, 3, 4, 5 and 6).

### **Genus *Clibanarius* Dana, 1852**

#### ***Clibanarius longitarsus* (De Haan, 1849)**

**Material examined.** Persian Gulf, Hormuz Island; **Station 2:** January 2011, 1 male (SL= 9 mm), 1 female (SL= 8); April 2011, 2 females (SL= 9, 8); **Station 3:** January 2011, 2 males (SL= 7,10 mm), 3 females (SL= 7, 8, 6), 2 ovigerous females (SL= 7, 9 mm); April 2011, 1 female (SL= 9); 1 male (SL= 10 mm, ZUTC Anom 1086).

**Remarks.** This species is very common in the Papua (Indonesia), the Persian Gulf and the Gulf of Oman (Apel, 2001; Rahayu, 2003; Moradmand & Sari, 2007a; Naderloo et al., 2012), but this species was observed rarely in muddy shores and mangrove forests of the Hormuz Island. Rahayu (2003) described the diagnosis, coloration and distribution of this species in Indonesia. Naderloo et al. (2012) discussed the distribution of this species in the Persian Gulf and the Gulf of Oman. *C. longitarsus* is very variable in coloration (Morgan, 1987; Rahayu, 2003). Coloration of our specimens in the Hormuz Island agreed with Rahayu (2003) and had blue longitudinal stripe on the lateral face of each pereopods.

**Habitat.** Sandy beaches, high tidal zones of muddy shores and mangrove forests. Hormuz Island (Stations: 2 and 3).

### **Genus *Areopaguristes* Dana, 1851**

#### ***Areopaguristes perspicax* (Nobili, 1906)**

**Material examined.** Persian Gulf, Hormuz Island; **Station 1:** January 2011, 3 males (SL= 7, 6, 5 mm), 3 females (SL= 7, 6, 7 mm), 1 ovigerous female (SL= 5 mm); April 2011, 4 females (SL= 4, 3, 6, 5 mm); **Station 4:** September 2010, 3 males (SL= 5, 4, 7 mm), 3 females (SL= 4, 3, 5 mm); November 2010, 3 males (SL= 4, 6, 8 mm), 2 females (SL= 5, 4 mm), 1 ovigerous females (SL= 4 mm); January 2011, 3 males (SL= 3, 4, 7 mm), 1 female (SL= 6 mm); April 2011, 2 females (SL= 5, 4 mm); **Station 5:** September 2010, 3 males (SL= 6, 7, 9 mm), 2 females (SL= 5, 7 mm); November 2010, 4 males (SL= 6, 9, 7, 6 mm), 2 females (SL= 6, 5 mm), 1 ovigerous female (SL= 6 mm); 7 males (SL= 3, 4, 7, 7, 5, 6, 9 mm, ZUTC Anom 1089).

**Remarks.** Tirmizi and Siddiqui (1981) represented an illustrated identification key of this species in the coast of Pakistan, but with name *Paguristes perspicax* Lewinsohn 1969. Surface body of this species is very hairy, especially on the pereopods and chelipeds. Antenna and antennal flagella in our specimens were blue and resplendent. Characteristics illustrated for *Paguristes perspicax* Lewinsohn 1969 in Tirmizi and Siddiqui (1981) agreed well with our specimens of *Areopaguristes perspicax* (Nobili, 1906) in the Hormuz Island. This species was very common in the muddy shores in the Hormuz Island.

**Habitat.** High tidal muddy shores (more under stones in small pools). Hormuz Island (Stations: 1, 4 and 5).

**Genus *Diogenes* Dana, 1851*****Diogenes planimanus* Henderson, 1893**

**Material examined.** Persian Gulf, Hormuz Island; **Station 1:** November 2010, 2 males (SL= 7, 8 mm), 2 females (SL= 6, 7 mm), 1 ovigerous female (SL= 8 mm); January 2011, 3 males (SL= 9, 7, 10 mm), 2 females (SL= 9, 6 mm), 1 ovigerous female (SL= 8 mm); April 2011, 2 males (SL= 7, 5 mm); **Station 2:** September 2010, 2 males (SL= 8, 10 mm), 1 females (SL= 8 mm), November 2010, 2 males (SL= 7, 8 mm), 1 female (SL= 6 mm); January 2011, 2 males (SL=7, 10 mm); **Station 3:** January 2011, 3 males (SL= 7, 6, 9 mm), 1 female (SL= 6 mm); **Station 4:** September 2010, 4 males (SL= 7, 8, 8, 9 mm), 1 female (SL= 8 mm); April 2011, 2 females (SL= 5, 6 mm).

**Remarks.** Siddiqui et al. (2004) presented diagnosis, coloration, distribution and habitat of this species in the coasts of Pakistan. Outer surface of palm (in left cheliped) in our specimens were flattened that agreed with Siddiqui et al. (2004), also *D. planimanus* had very dark gray stains on chelipeds, pereopods and ocular peduncles. Siddiqui et al. (2004) denoted the habitats of this species in the rocky intertidal coasts of Pakistan, but in the Hormuz Island, this species existed in the sandy and muddy beaches. In addition, Moradmand and Sari (2007a) denoted the habitat of this species in the wave acted sandy beaches of the Gulf of Oman.

**Habitat.** Sandy and muddy beaches (more lowtidal) and mangrove forest. Hormuz Island (Stations: 1, 2, 3 and 4).

**Genus *Diogenes* Dana, 1851*****Diogenes karwarensis* Nayak & Neelakantan, 1989**

**Material examined.** Persian Gulf, Hormuz Island; **Station 4:** November 2010, 3 males (SL= 7, 4, 5 mm), 3 females (SL= 5, 6, 5 mm), 2 ovigerous females (SL= 4, 5 mm); January 2011, 2 males (SL= 8, 6 mm), 1 female (SL= 6 mm), 1 ovigerous female (SL= 6 mm); April 2011, 4 females (SL= 7, 6, 6, 7 mm).

**Remarks.** *D. karwarensis* and *D. avarus* are very similar (Nayak & Neelakantan, 1989). We based the identification on the fourth segment of antennal peduncle that in *D. karwarensis* contained dorsodistal spine, but it was absent in *D. avarus* (Siddiqui et al., 2004). Rahayu and Komai (2000) had observed the presence of spines on the merus of left cheliped in *D. karwarensis*, but we did not observe this character in the specimens from the Hormuz Island.

**Habitat.** Mixture of sand and mud beaches. Hormuz Island (Station: 4).

**Genus *Diogenes* Dana, 1851*****Diogenes avarus* Heller, 1865**

**Material examined.** Persian Gulf, Hormuz Island; **Station 1:** November 2010, 1 male (SL= 3 mm), 1 female (SL= 3 mm); January 2011, 2 males (SL= 4, 4 mm), 1 ovigerous female (SL= 3 mm); April 2011, 3 females (SL= 4, 5, 5 mm), 2 ovigerous females (SL= 4, 3 mm); **Station 2:** September 2010, 5 males (SL= 5, 6, 4, 7, 6 mm); November 2010, 4 females (SL= 6, 5, 7, 6 mm); January 2011, 3 males (SL= 4, 5, 5 mm), 2 ovigerous females (SL= 2, 4 mm); April 2011, 1 ovigerous female (SL= 4 mm); **Station 3:** January 2011, 5 males (SL= 7, 7, 8, 6, 7 mm), 1 female (SL= 6 mm); April 2011, 3 females (SL= 4, 6, 6 mm), 1 ovigerous female (SL= 5 mm); **Station 4:** September 2010, 5 males (SL= 6, 7, 7, 8, 6 mm), 3 females (SL= 7, 4, 8 mm); November 2010, 2 females (SL= 6, 6 mm); January 2011, 2 females (SL= 4, 6 mm), 1 ovigerous female (SL= 4 mm); April 2011, 1 female (SL= 8 mm); **Station 5:** September 2010, 4 males (SL=7, 8, 6, 5 mm), 2 females (SL= 5, 8 mm); April 2011, 1 female (SL= 3 mm), 1 ovigerous female (SL= 4 mm); 3 females (SL= 6, 5, 7 mm, ZUTC Anom 1084).

**Remarks.** This species was the dominant hermit crab in the Hormuz Island and very abundant in the mangrove forest and muddy beaches.

**Habitat.** Intertidal sandy beaches, mangrove forest and mixture of sand-mud beaches. Hormuz Island (Stations: 1, 2, 3, 4 and 5).

### Genus *Diogenes* Dana, 1851

#### *Diogenes tirmiziae* Siddiqui & McLaughlin, 2003

**Material examined.** Persian Gulf, Hormuz Island; **Station 2:** November 2010, 2 males (SL= 4, 5 mm), 1 female (SL= 5 mm), 2 ovigerous females (SL= 5, 3 mm); January 2011, 2 males (SL= 5, 4 mm), 3 females (SL= 3, 5, 4 mm).

**Remarks.** *D. tirmiziae* has been recorded from Pakistan (Siddiqui et al., 2004) and Chabahar Bay of the Gulf of Oman (Mirbagheri et al., 2010). This species is rare in mangrove forest of the northern part of the Hormuz Island. Siddiqui et al. (2004) presented details of this species in the Pakistan coasts. Siddiqui and McLaughlin (2003) presented a detailed comparison of *D. tirmiziae* and *D. guttatus* and discussed the morphological variation of this species. Left chela in *D. tirmiziae* lacks the three prominent spines on the lower outer proximal surface. In *D. tirmiziae* antennal acicles short and subquadrate, but in *D. lophochir* Morgan 1989, antennal acicles are elongate and triangular.

**Habitat.** Sandy beaches and mangrove forest. Hormuz Island (Station: 2).

## DISCUSSION

Hermit crabs enjoy a wide distribution in various marine and semi terrestrial environments. The present study has attempted to identify nine hermit crab species in two families (Eight species in Diogenidae and one species in Coenobitidae) in the intertidal zones of the Hormuz Island (Persian Gulf). The nine species demonstrated that relatively high species diversity of hermit crab existed in this island, with its wide range of habitats, including rocky shores, mangrove forest, sandy beaches, sand flats, gravel and muddy shores, and coral reef platforms.

Totally nine species were recorded in this study, all of which are new records in this regions. Genus *Diogenes* with four species was the most abundant genus in this island. *Coenobita scaevola*, as the only supralittoral species, was recorded from sandy beaches, while the other eight species (Family: Diogenidae) were distributed in intertidal zones. Our finding is in correspondence with the earlier works conducted in the area (Tirmizi & Siddiqui, 1981; Jones, 1986; Apel, 2001; Siddiqui & Kazmi, 2003; Mirbagheri et al., 2010; Seyfabadi et al., 2013). The dominant species were, respectively, *Diogenes avarus*, *Clibanarius signatus* and *Areopaguristes perspicax*, which are inhabitants of rocky shores, sandy beaches, muddy and mangrove forest.

*Paguristes perspicax* has already been recorded in earlier studies (Tirmizi & Siddiqui, 1981; Jones, 1986; Apel, 2001; Markham, 2003; Siddiqui & Kazmi, 2003). This species has been recorded under the generic name *Stratiotes* by Kazmi and Siddiqui (2006) and Mirbagheri et al. (2010). However, in 2010 this generic name was altered to *Areopaguristes* (Rahayu & McLaughlin, 2010), so we utilized this new generic name.

Similar hermit crab species have been identified in other regions of the Indo-Pacific waters such as the Gulf of Oman, Persian Gulf, Arabian Sea, Red Sea, and the China Sea, with which our results have been compared (Table 1).

Position for Table 1

Hermit crabs highly similar to Hormuz Island hermit crabs had also been observed in the Chabahar Bay (Gulf of Oman), northern Arabian Sea and the Persian Gulf (Mirbagheri et al., 2010; Kazmi & Siddiqui, 2006; Apel, 2001). In addition, Hogarth (1988) demonstrated that hermit crabs in

Persian Gulf have the greatest similarities to those of Pakistan, Dhofar, the Gulf of Aden, and the Red Sea. In general, this similarity demonstrated that the population of the hermit crabs in the Persian Gulf is similar to the populations of the hermit crabs in the Gulf of Oman and northern Arabian Sea.

**TABLE 1.** Comparison of Hormuz Island hermit crab species by similar studies

Regions	Hermit crab species (Hormuz Island)									References
	<i>C. scaevola</i>	<i>D. avarus</i>	<i>D. karwarensis</i>	<i>D. planimanus</i>	<i>D. dimiziae</i>	<i>C. signatus</i>	<i>C. longitarsus</i>	<i>A. perspicax</i>	<i>D. tinctor</i>	
India		*		*		*				Alcock, 1905
Kuwait		*						*	*	Jones, 1986
Dhofar (southern Oman)	*	*				*	*		*	Hogarth, 1988
Singapore & Malaysia		*		*			*			Rahayu, 1996
South China Sea		*					*		*	Rahayu, 2000
Persian Gulf	*	*		*		*	*	*	*	Apel, 2001
Red Sea, Persian Gulf		*				*	*			McLaughlin & Dworschak, 2001
Pakistan coasts	*	*	*			*		*		Siddiqui & Kazmi, 2003
Pakistan		*	*	*	*					Siddiqui et al., 2004
Northern Arabian Sea	*	*	*	*	*	*		*	*	& Siddiqui, 2006 Kazmi
Qatar (Persian Gulf)			*						*	Kazmi et al., 2007
Gulf of Oman	*	*		*		*	*			Moradmamand & Sari, 2007a
Red Sea	*									Sallam et al., 2008
Chabahar Bay (Oman Sea)	*	*	*	*	*	*		*	*	Mirbagheri et al., 2010
Persian Gulf- Gulf of Oman	*	*	*	*	*	*	*	*	*	Naderloo et al., 2012
Larak Island (Persian Gulf)	*									Seyfabadi et al., 2013

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