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# **Invertebrates Records from the Hadhramout Coast, Gulf of Aden, Yemen**

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## **Authors' contributions**

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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## **ABSTRACT**

During our research in the Hadhramout coast, the Gulf of Aden, six invertebrate's species were recorded for first time in this region. Review of previous publications shows that these species from different families were not previously reported in the Gulf. The species identified include two gastropods: *Murex scolopax* (Muricidae) and *Tibia insulaechorab* (Rostellariidae), one bivalve: *Pinna bicolor* (Pinnidae), three crustaceans: *Anchistus custos* (Palaemonidae), *Gonodactylus smithii* (Gonodactylidae), and *Calappa dumortieri* (Calappidae). This paper describes the detailed characteristics of each species.

**Keywords:** *Invertebrates; hadhramout; gastropods; bivalves; crustacean; Gulf of Aden; Yemen.*

## **1. INTRODUCTION**

Management of fisheries depends first and foremost on understanding the taxonomic

position of any individual and marine inhabitants, without which chaos prevail in the management and exploitation of these living resources (Smith et al., 1991).

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Our current understanding of the Gulf of Aden marine organisms derived from studies and surveys mostly undocumented and was presented in the form of not exhaustive reports and therefore limited regional organisms groups appeared here confined to limited numbers of families and genera mostly belong to class Actinopterygii – ray finned fishes. That mentions here and there of some species of mollusks and crustaceans, are the result of what come across developed nets of traditional fishermen, making this species lacks the diagnosis and classification. The rare studies that took place afterwards suggest that the majority of what reported from the species are merely cut and paste for many modern synonyms from between East Africa and regions of the Western Pacific (Druzhinin, 1973).

Although the Gulf of Aden is hosting a limited range of marine habitats, shallow and deep, including coral formations near the beach, that plays an essential role in embracing a variety of fish, shellfish and crustaceans. However, the contribution of mollusks and crustaceans, to the commercial harvest is still insignificant, large numbers of them remain unknown to the commercial and scientific fields.

As for crustacean and mollusks of Gulf of Aden, one did not find any scientifically documented study of the fauna of these organisms. In this respect, what intentionally or coincidentally appeared during some field surveys at the current subject were documented and published [1, 2] (Ali et al., 2020).

We know that the basic nature of crustaceans in the Indian Ocean in general is still not fully known, especially for Decapods and

Stomatopoda, despite being among the most studied animal groups in the World Ocean ([3]. What had done by some researchers in Yemeni universities of preliminary studies to some areas from Yemen's southern coast, have focused on the initial inventory of some crustaceans and mollusks or marine pollution concepts [4,5]. There are no studies of real visualize fauna of this rich coastal biodiversity and important economically. The region did not attract scientific interest and remained fauna, specifically mollusks, and an especially unknown group of the order Pterioida and Decapoda. Instead, as we know Hadhramout coast has great potential for interactions between marine invertebrates as a result of diversity in the ecosystems, which supports the existence of various biosystems [6,7].

It appears that the entire adult and juveniles of crustaceans and mollusks are important members of the live community in the bottom and can represent an important food source for, and an integral of, the diversity of marine benthic invertebrates and vertebrates, making it a vital component and economically important in this area and thus it deserves study and research. This article discusses the presences of a number of species hitherto unrecorded from the Hadhramout coast, Gulf of Aden.

## 2. MATERIALS AND METHODS

For the purpose of given scientific paper, the coast of Hadhramout that include the distance between the city of Mukalla and the east of the village of Bir Ali (about 83 km) to the west of Mukalla, and the east of the village of Musaina'a (about 185 km) to the east of Mukalla (Fig. 1).



Fig. 1. The coast of Hadhramout, the study locations

The coast of Hadhramout at all is characterized by a relatively narrow continental shelf, with which the great depths of the coast are close with the prevalence of rock formations and patches of coral formations scattered along its western part. It is devoid of vegetation density and mangrove, except some intertidal macroalgae and seaweeds occurs on a seasonal basis in eastern part. It is also characterized by the extension of sandy beaches and seasonal estuaries of small arid wadies, except for the two most sustainable valleys, namely Wadi Al-Masila in the east and Wadi Hajar at the western border of the coast of Hadhramout.

The coast of Hadhramout is influenced by seasonal Upwelling phenomena (Al Saafani and Shenoi, 2007); which apparently is the reason of the biological richness and increase in the presence of some deepwater species of fishes

and invertebrates on the shores of this coast recent years [8-13].

Most our discoveries were made while snorkeling diving and traditional fishing in different areas of Hadhramout coast, Gulf of Aden, in a depth range of 0-60 m (14° 45' N, 48° 30' E – 15° 00' N, 50° 00' E), in October 2013 to October 2018. Animals were photographed in the field and laboratory, collected and analyzed.

Shells measured by digital Vernier for all morphometric characters.

A thorough description will be given with photos and detailed graphic images of some parts of registered species. In addition, a comparison will be made to differentiate between the registered species.

### 3. RESULTS

**Order: Neogastropoda** (Wenz, 1938)

**Family: Muricidae** (Rafinesque, 1815)

**Genus: Murex** (Linnaeus, 1758)

***Murex scolopax*** (Dillwyn, 1817)



**Fig. 2. Scalloped Murex from Hadhramout coast**

**Synonyms:**

*Murex crassispina* (Lamarck, 1822),

*Murex hystrix sensu* (Morch, 1852)

**Material examined:** One specimen of 180 mm length, + one specimen of 105 mm length picked up in Sheher Shoal (14° 45' 37 N, 49° 38' E) 13 April 2014.

One specimen 77 mm length, picked up from Khird Shoal (14° 46' 34 N, 49° 42' E) 27 September 2014.

Two specimens of 120mm each picked up in Rayan Shoal (14° 40' N, 49° 25' E) 7 February 2015. All these Shoals are within Hadhramout coast.

**Diagnosis:** Shell up to 180 mm in length with an average size of 124 mm, protoconch is small with 1.5 – 2 whorls, teleoconch whorls 6 or 7. Protoconch small, whorls rounded, last whorl with narrow abapical keel, smooth, and glossy [14].

Siphonal canal long, broad, straight, open, with 5-7 acute, long spines.

**Colour:** Shell pale creamy-white, light tan, with brown streaks on cords, tip of primary spines usually tinged with purple. Aperture is white.

**Description:** A medium to large size oval shell with a long siphonal outgrowth; acutely pointed apex with rounded whorls; protoconch of 1.5 - 2 whorls (Fig. 2). Shell club shaped. The axial a keel-shaped structure have sharp and thin spines of various lengths; the spiral ridge-like ribs are covered with small tubercles. The mouth is oval, white or white and pink. The color of the outer surface is from white to cream shades with light brown spiral cords. Large size, curved spines and smooth (not granular) surface distinguish it from similar species: *Murex carbonnieri* Jousseaume, 1881, *Murex forskoehlii* Röding, 1798. Body whorl are large, rounded, suture deep canalculated. Outer lip erect.

**Distribution:** Red Sea, Indian Ocean, Arabian Sea, Gulf of Oman, Persian gulf, Bay of Bengal, Andaman Sea, Indonesia, Gulf of Siam (Ponder & Vokes, 1988; Subba Rao, N. V. & Dey, A., 2000).

**Remarks:** The Hadhramout shell is one of the largest in the Indian Ocean with long, slightly curved spines on the body and also on the canal, very similar to *M. pecten*, but different in the character of spines. It is also very similar to *M. brevispina*, but differs in the presence of a number of spines on the canal and a raised spire.

It is believed that this species, which stands at the head of a group of several sister species whose number has changed according to different researchers [14-16], was acquired for the first time from the southern Red Sea, but the holotype specimen was lost and was described and recorded by Dillwyn, 1817 on the basis of a lectotype designated by Dean (1936) from national museum of wells.

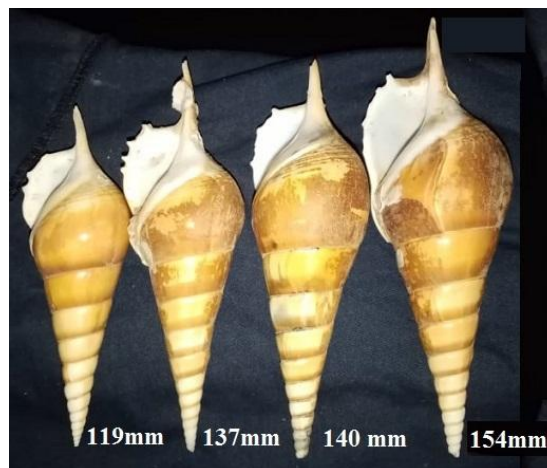
Because of the loss of the type location, the recording was considered from the Red Sea and then attributed to the Persian Gulf by the researcher Houart [17].

**Order: Sorbeconcha**

**Family: Rostellariidae (Strombidae)**

**Genus: Tibia**

***Tibia insulaechorab* (Röding, 1798)**



**Fig. 3. Arabian tibia**

**Synonyms:**

*Rostellum ternatanum* (Montfort, 1810),  
*Rostellaria dentula* (Perry, 1811),  
*Rostellaria curvirostra* (Lamarck, 1816),  
*Rostellaria brevisrostris* (Schumacher, 1817),  
*Rostellaria magna* (Mörch, 1852),  
*Tibia luteostoma* (Angas, 1878)

**Material examined:** Four specimens were obtained in Sheher district, at the sandy beach, (14° 46' N, 49° 41' E) eastern of Mukalla, Hadhramout coast. 10 October 2014

**Measurements:** Shell length 119, 137, 140 and 154 mm.

**Diagnosis:** The shell is with a distinctive sculptural character. Conical shell is with high curl. The last whorl is slightly swollen. The suture between the turns are clear, the shoulder of the turns is rounded. The siphonal outgrowth is relatively short, it is of moderate width. The outer edge of the lip bears only four short blunt teeth.

**Description:** The shell is ovoid-oblong shape, with a short body whorls and a narrowly conical spire with 11-12 whorls. The smaller whorls are finely sculpted by transverse ridges; the larger whorls are almost smooth. The aperture is slit-like in the upper part and semicircular in the lower part. The inner lip is thickened and overly turned towards the outside. The outer lip is moderately thickened, and has about four blunt teeth on its lower edge, the length of which is almost the same. It creates a keeled ending downward almost in width previous whorl. The shell is smooth, not sculpted. Growth lines are thin.

**Colour:** The color of the shell is light brown with obscure vertical stripes of a darker color. The uppermost turns of the shell are brownish. The outer and inner lips, the mouth are polished white.

**Distribution:** Red Sea, Arabian Sea, Bay of Bengal. It exists in the Persian Gulf. It inhabits sandy and silty soils, at depths of up to 20 m.

**Remarks:** This species was first described by the German malacologist Peter Friedrich Röding in 1798, the type locality was the Red Sea. He gave it the name *Tibia insulaechorab* [18]. At first it was included in the family Strombidae, but later this large family was split and the genus *Tibia* was transferred to the family Rostellariidae. The fact that record of *Tibia insulaechorab* in the Gulf of Aden indicated is related to the Tajura Gulf in Djibouti and not the northern coast of the Gulf of Aden [19].

The shell can grow to a length of 200 mm [20].

**Order Pterioida**

**Family: Pinnidae Leach, 1819**

**Genus: Pinna Linnaeus, 1758**

***Pinna bicolor* (Gmelin, 1791)**



**Fig. 4. Bicolor Pen Shell (Razor fish)**



**Synonyms:**

*Atrina bicolor* (Gmelin, 1791)  
*Pinna atropurpurea* (Sowerby, 1825)  
*Pinna cochlearis* (Fischer, 1901)  
*Pinna bicolor* Gmelin, 1791.  
*Pinna deltodes* Menke, .1843;  
*Pinna trigonium* Dunker, 1852;  
*Pinna electrina* Reeve, 1858;  
*Pinna fumata* 'Hanley' Reeve, 1858;  
*Pinna madida* Reeve, 1858;  
*Pinna mutica* Reeve, 1858;  
*Pinna fimbriatula* Reeve, 1859;  
*Pinna inermis* Tate, 1887;  
*Pinna natalensis* Smith 1906;  
*Pinna isosceles* Hedley 1924:  
*Pinna scapula* Hedley, 1924;  
*Pinna densecostata* Turton, 1932;

**Material examined:** One specimen of 34.5 cm length was picked up in mouth of Al-Mukalla creek shoal (14° 31'50 N, 49° 07' 29 E) 13 April 2014.

**Diagnosis:** The shell is relatively large, thick, elongated, and wide to slightly triangular in shape. Specimen also has a dorsal convex posterior margin, inclined ventrally. The longitudinal carina on the anterior half of the shell is also much more developed. The shell valves are heavy and thick, sculptural with relatively weak longitudinal radiant ribs.

The dorsal edge is almost straight. The ventral margin is mostly convex at the back and concave at the front, forming a straight but flattened sigmoid arc. The nacreous region is iridescent, occupies the anterior half of the shell and is mainly divided by a relatively narrow longitudinal furrow, which leads to moderately well-separated dorsal and ventral nacreous lobes, spread in the back direction creating a narrow letter V. The ventral lobe is shorter than the dorsal lobe; its edge is unevenly truncated. The scar of the anterior adductor muscle is small, subapical, located just before the end of the longitudinal furrow. The scar of the posterior adductor muscle is larger, subterminal, located on the ventral half of the dorsal lobe and never enters the ventral lobe.

The primary articular ligament extends from the anterior end of the shell almost to the posterior border of the mother-of-pearl layer.

**Descriptions:** The *Pinna bicolor* shell has an elongated triangular outline with a longitudinal fissure filled with cartilage in the middle of each valve; the main characteristic features are the protrusion of the shell towards the apex, which has an external angle and cracks. The Pinna has a long, narrow sinus that runs through the middle of the mother-of-pearl tracked by approximately its length. The posterior mother-of-pearl borders are not so sharply oblique, without forming deep "V"; with very dissimilar muscle scars. Posterior largest adductor muscle scar located in the middle of shell valve and lies within the dorsal nacreous lobe. Byssuses are fine and abundant (Fig. 4).

Morphometric characters were as follow (mm):

1. Length of anterior to posterior adductor 155
2. Posterior adductor to posterior shell margin 155
3. Dorsal posterior margin 99
4. Dorsal margin 279
5. Width of shell 152
6. Total shell length 345
7. Width of sulcus 11
8. Posterior adductor to posterior nacreous lobe 00
9. Dorsal nacreous length 157

**Coloration:** The coloration of shell dark purplish brown, possess radiating bands of alternating dark and light bands, at times to peer with a colorful pattern.

**Distribution:** Cosmopolitan. Red Sea and the Persian Gulf, distributed in the in East and Southeast Africa, including the islands of Madagascar and Mauritius. Found in New Caledonia, Japan and South Australia. Occasionally it found in Hawaii.

**Remarks:** Shells might be very oblique, wedge-shaped, triangular, equivalve, more or less thin, gaping posteriorly; surface smooth if it not populated by other benthic species of algae and macroinvertebrates and sediments; hinge line noticeably short; umbos terminal; valves not carinate. Margin of the shell mostly smooth but some mild signs fragmented at the posterior end. The common habitat of pinnipeds is a substrate of soft, sandy silt with a narrow top of the shell down. They are sedentary animals, and after they have taken root, they probably move little horizontally, and excursions are limited to vertical digging.

Its surfaces are usually colonized by other benthic species, including algae and macroinvertebrates. Given specimen bring us a commensal crustacean species as pair male and female of pontoniine shrimp, *Anchistus custos* under its gills (Fig. 5).



**Fig. 5. illustrates the species location of the primary crustacean as a male and female pair of pontunin shrimp, anchistus custos below its gills**

It must be noted here that. Khor Al-Mukalla, in terms of its impacted by seawater, arose relatively recently, and since its bottom is dominated by mud mixed with sandy marine sediments, which creates a very suitable habitats for the embedded and growth of this species shells [21], in addition to that the Mukalla creek shoal has a very minimal wave action due to its location.

**Order Decapoda**  
**Family Palaemonidae**  
**Genus Anchistus**  
***Anchistus custos* (Forskål, 1775)**



**Fig. 6. Pinna shrimp**

**Synonym:**

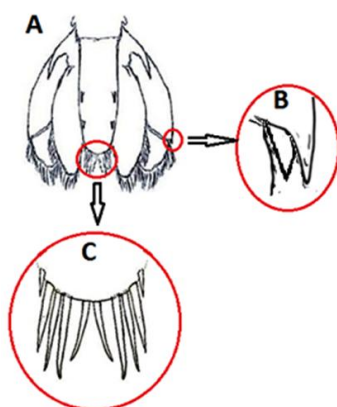
- *Anchistia aurantiaca* Dana, 1852
- *Anchistus inermis* (Miers)
- *Cancer custos* Forskål, 1775
- *Harpilius inermis* Miers, 1884
- *Pontonia inflata* H. Milne Edwards, 1840
- *Pontonia pinnae* Ortmann, 1894
- *Pontonia spinax* Dawydoff, 1952
- Orig. name: *Cancer custos* Forskal, 1775

**Material examined:** two specimen: Ovigerous female of 19,6 mm and male of 15.3 mm total length, they were picked up from *Pinna bicolor* specimen which picked up in mouth of Al-Mukalla creek shoal, Hadhramout coast (14° 31' 50" N, 49° 07' 29" E) 13 April 2014.

**Measurements:** Ovigerous Female: Total length 19.6 mm; Carapace and rostrum 7.8 mm; Body 8.6 mm; Telson 3.2 mm, Male: Total length 15.3 mm; Carapace and rostrum 6.9 mm; Body 6.0 mm; Telson 2.3 mm.

**Diagnosis:** Body is semi-cylindrical with smooth carapace, on whole body and legs barely visible starry brownish dots. The rostrum is moderately short, slightly distally directed downwards, toothless and with the apex broadly rounded in lateral view, cylindrical in basal part, laterally compressed. The rostrum is pointed in male. The basal process of the antennules is with a small sub apical spine. Carapace without antennal spine; 3rd maxilliped is with antepenultimate segment about twice as wide as penultimate segment. The first Pereopods are modified as specialized chelipeds, inflated to form open tube in both sexes. The dorsal surface of the Telson is with two pairs of small spines, which situated behind the middle of the Telson and placed close to the lateral margins.

**Description:** The female specimen is ovigerous with multiple small ova. The antennal spine is reduced; the antennal scale is with a strongly convex outer margin ending in a small spine. The basal process of the antennule is with a small sub apical spine. Carapace is smooth, glabrous supraorbital spines absent. Eye feebly developed, with large, well pigmented, globular cornea. Antennal spine is small, marginal, not exceeding inferior orbital angle. The Telson (Fig. 7A) of this unique organism is peculiar, approximately 1.6 times length of sixth pleonite. Uropods are broadly ovate, overreaching Telson. On the top of the exopod there is a dagger-shaped appendage with a sharp spike, almost directed towards the back side of the uropod; it is approximately half the length of exopod. That is in addition to lateral spine of exopod in distolateral angle of exopod (Fig. 7B). Posterior margin of the Telson is with four pairs of spines in addition to outerly pair, noticeably shorter than internal pairs (Fig.7C). Male is noticeably thinner and transparent than female (Fig.6). These characteristics make this species easy recognizable.



**Fig. 7. Telson of *Anchistus custos*, A, general dorsal view; B, close up of lateral tooth and spine of indopod; C, Telson, distal slightly soft spines**



**Coloration:** The colours of the living specimens are visually differentiated between female and male, where the female is predominantly brown with some transparency at the front of the body; the male is mostly semitransparent and tends to yellowish brown.

**Remarks:** The species generally known as watch man prawn have adopted a secluded mode of life, living in the bronchial cavity of bivalve molluscs. The shrimp probably enters its host when it was a larva, and never leaves it during its life. The usual habitats are intertidal to shallow depths. Mainly occurs as heterosexual pairs in association with bivalves of families' pinnidae and pectinidae, even so its individuals can be found free-living [22]. It is one of the most common of all Pontoniines [23].

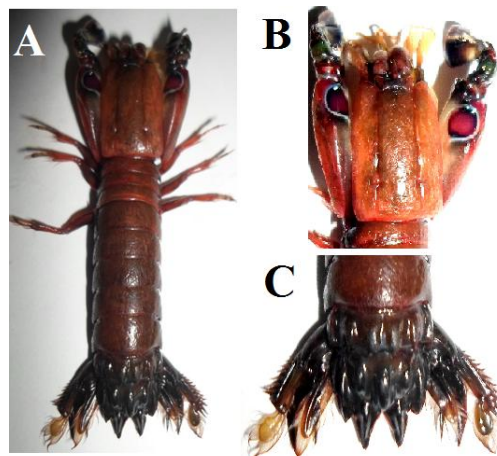
The species was first recorded in Red Sea Yemeni waters by Forskal, (1775) from Alluhaya shoal, northern of Al-Hodeida harbour.

In female the entire body and legs are covered with minute light brown asterisks dots. The eggs are pale straw yellow orange or brown. Males are semitransparent and lack the light brown dots found in the female.

The spineless rostrum is an adaptation to more freedom of movement on or with in its host [24].

**Distribution:** Wide spread in the Indo-Pacific - Red Sea (Al-Loheia (Yemen); Suakin (Sudan)); eastern Africa; South Africa; Sri Lanka; Andaman Islands; Singapore; Malaysia; Indonesia; Philippines; Australia.

**Order Stomatopoda**  
**Family Gonodactylidae**  
**Genus Gonodactylus**  
***Gonodactylus smithii* Pocock 1893**



**Fig. 8. Purple spot mantis shrimp**



**Fig. 9. *Gonodactylus smithii* Pocock 1893**



**Fig. 10. Image of Rostrum**

### **Synonyms**

*Gonodactylus arabica* Ghosh, 1990 (Espèce CD\_NOM = 691482)

*Gonodactylus chiragra* var. *anancyrus* Borradaile, 1900 (Espèce CD\_NOM = 691479)

*Gonodactylus chiragra* var. *intermedia* de Man, 1929 (Espèce CD\_NOM = 691480)

*Gonodactylus minikoiensis* Ghosh, 1990 (Espèce CD\_NOM = 691481)

**Material examined:** 15 August 2014, one specimen (male) was collected at 9 m deep, off Broom village western of Mukalla ((14° 21' N, 48° 49' E)), Hadhramout coast.

**Measurements:** Total length 98 mm, carapace length 33.5 mm, rostral plate length 6 mm, rostral plate width 8 mm. Pleotelson 23.5 mm. Propodus length 29.5 mm. Telson length 10.5 mm, sixth abdominal somite 5.5 mm.

**Diagnosis:** The specimen was small sized, stoutly built mantis shrimps of robust cylindrical body form (Fig. 8A). The carapace is smooth, naked, not inflated; Rostrum is well developed, reaching the posterior edge of the cornea, distally pointed, slightly depressed. Antennal scale is oblong ovate. The rostral plate with anterolateral angles is not acute (Fig. 10); its spine is acute with lateral minute spines. Merus spots on the inside of the distal end are intense purple with a white ring. The Telson length is subequal to width. Carinae of Telson are distinctly inflated, median carina sharp and spined. Six carinae of sixth abdominal somite somewhat inflated, with pointed ends (Fig 8B). Lateral teeth of uropod present, there are 11 of them.

**Description:** Rostrum is relatively short, barely reaching the posterior edge of the cornea; rostral spine sharp with lateral very small spines (Fig.10). The basal part of the rostral plate with concave anterior edges, it is with not sharp anterolateral angles but not spiniform.

Carapace is with two grooves splitting its back to 3 equal in width longitudinal parts (Fig. 8B).

The eye is large, well pigmented, cornea subglobular, without a distinct additional pigment spot. Propodus is without proximal movable spines, opposable dactylus nearly smooth with very minute spines (Fig. 9A). Accessory median carinae sharp distally with sets of submedian denticles are converging under apex of median carina to form anchor. Median carina armed posteriorly with stout small spin. Intermittent organ located at the base of eighth thoratic appendage (Fig. 9B).

**Colour:** Alive specimen, have a brown colour; carinae of sixth abdominal somite and Telson become darker. The carapace and raptorial merus are light brown.

**Remarks:** *G. smithii* long time was closely resembles with *G. chiragra* and *G. platysoma* (Manning, 1965); but later, as a result of careful study and description of the characteristics of many samples obtained in localities in the Indo-Pacific; it was possible to confidently separate it from its relatives.

*G. smithii* can be discriminated from other species of the genus by the combination of characteristics: it is anterolateral angles of rostral plate sharp but not spiniform like *G. acutirostris* De Man (Manning and Lewinsohn, 1986). Rostral plate angles not rounded like in *G. chiragra* and *G. platysoma*. Latters have no anchor form on the posterior end of the median carina of the Telson. *Gonodactylus smithii* has purple spots not seen in any of its other closely related species (Caldwell and Dingle, 1974).

Males carry a pair of penes, penis-like organs attached to the bases of the last pair of pereopods (Fig. 9B).

**Distribution:** *G. smithii* distributed from Western Indian Ocean to Vietnam, Australia, New Caledonia and Okinawa. It recorded from Somalia, Madagascar, Mauritius, and South.

Africa. Was founds in Persian Gulf, Pakistan, Indonesia, and Philippines.

*G. smithii*, like most Crustaceans, is a benthic organism; mainly inhabited a depths ranging between intertidal, on coral reefs and more than 80 meter, but are most common in the low intertidal depths (Caldwell and Dingle, 1974).

#### Order Decapoda

#### Family Calappidae

#### Genus *Calappa*

#### Species *Calappa dumortieri* Guinot, 1964

#### Spectacled box crab



Fig. 11. *Calappa dumortieri* Guinot, 1964, Ovigerous female: frontal views showing chelipeds and its details



Fig. 12. dorsal view showing carapace with upper edge of chelipeds; and posterior spines

#### Synonyms

*Calappa cristata* Fabricius 1798

*Calappa philargius* Linnaeus 1758

**Material examined:** One specimen ovigerous female was obtained from diver in Shehir district, at 7 m deep, (14° 45' N, 49° 38' E) eastern of Mukalla, Hadhramout coast. 10 July 2013.

**Measurements:** Body width 83 mm, length 63 mm.

**Diagnosis:** Carapace is smooth. The teeth on the posterior edge of the carapace are conical, longer than the lateral ones. The front edges and teeth of the carapace covered with small granulate tubercles. Carapace covered with small brown spots, which become larger and spaced on the chelipeds; they grow larger and spread between the carapace's posterior teeth. The outer surface of the chela is fine-grained, vertically crossed by three nearly flattened tubercles. The crest of the chela is dissected into seven teeth, increasing in size distally, almost cusped.

**Description:** The carapace is markedly convex, 1.3 wide as long. Carapace is with two prominent colorless parallel grooves at posterior half, making longitudinal low median hump ending with the front of the posterior middle spine. On either side of these two grooves there to appear a faint speckled half-stripe nested succession along the carapace toward the sides of. Front with two triangular teeth, the distal edge of the first jaws is obliquely cut; the antero-inner angle is acute. External surface of chela minutely granulate, vertically traversed by three nearly flattened tubercles. Chelipeds Merus distally with a four-lobed plate, furthest two are pointed (Figs. 11 and 12).

**Remarks:** The *C. dumortieri* differs from all species of this genus in its characteristic features from a smooth carapace, the large and prominent thorns spines surrounding the posterolateral edges of the carapace, to a spiny trait of the colour. *C. dumortieri* is distinguished from the closely related *C. philargius* in having longer spiniform teeth on posterior margin, and granulate tubercles on ridge running parallel to larger chela lower margin. It distinguished from *C. biliniata* in that the latter having two dark brown strips in the carapace grooves, and the large brown patch surrounds the orbit. In addition to the short posterior spines. *C. dumortieri* lacks the conspicuous maroon crescents near eyes and large maroon spots on chelipeds characteristic of *C. philargius*. Hind spines of the carapace, especially middle three, longer than in closest species *C. philargius*; they are conical and sharpened, all spines obviously facing slightly back downward.

**Distribution:** This species, despite its early registration, is known only from limited areas in the northwest Indian Ocean: Red Sea: Eilat, Eretria, and Somalia, Gulf of Oman ([25]. Habitat: sandy or slightly muddy substrates at depths 5-80 m.

#### 4. DISCUSSION

The absence of a taxon from a certain area may be the result of that the taxon having not yet been discovered (Glasby & Alvarez, 1999). This factor is thought to be of considerable importance in the Aden Gulf areas, where there is no interest and work on the search and collection of biological materials at all, if not to count sporadic records added last years [1, 7,11,13]. Here we can confidently assert that numerous species are awaiting official discovery in the waters of this bay, especially if we knew that there are a coral reef environments wide spread in the coasts of this gulf.

Therewith, these new records for benthic organisms from the northern coast of the Gulf of Aden are points, to the potential of the healthy ecological ecosystem of this coast to host more and more aliens of vertebrates and invertebrates from the depths of the Indian Ocean.

If the marine crustaceans pose of more than 40 percent of what exported from India every year to the world, Yemen with its relatively high marine live resources (up to 180 000 tones in some years) hardly reaping from crustaceans and mollusks only a tiny fraction, is negligible and that is what is reflected in the scientific interest in these marine organisms and the lack of search for and in which in this fishery country. Thus we cannot find a literature in this field to compare and discuss.

When some authors write that *Anchistus custos* was recorded by Forsskal, 1775, from Yemen, that not mean it is from The Gulf of Aden, but from Loheia district northern of Yemeni port of Hodeida at the Red Sea. So, this species was recorded from the Red Sea, eastern coast of Somali, Andaman Islands and Zanzibar (Kemp, 1922) [26]. While the *Calappa dumortieri* was recorded only from the Red Sea, Gulf of Tajura in Djibouti and Gulf of Oman [25,27]. The only Pontonine shrimp from Yemen, the Gulf of Aden, was *Yemenicaris trullicauda* [28]. As for other organisms discussed in this paper, without any doubt they are all recorded for first time in this gulf, the Gulf of Aden [29-38].

Recently, we got evidence on the occurrence of some more peculiar invertebrates' species previously unknown from Gulf of Aden. This evidence announce about richness of this gulf biodiversity.

It is necessary to note here, that it is noticeable and Strangely that we through a review of registration sources and classification of marine organisms we see not to mention the Gulf of Aden when passing on the distribution of registered organisms or new, an especially those that distributed in Red Sea a through the Persian Gulf and the East African coast and down to the states and Islands of Western Pacific and East Indian.

## 5. CONCLUSION

After conducting our survey of the Yemeni coast in the Gulf of Aden in terms of fish, crustaceans and shellfish species, we found that the environment of this coast is rich in marine fauna and still hides many exotic species. These records of new crustaceans and mollusks to the list of marine organisms of Yemen by describing and confirming their presence here, is one of the important additions and evidence of the richness of this environment. Arguably one of the reasons for the absence of many potential species is the lack of interest of fishermen and citizens in these species and their focus on fish, as well as the lack of scientific interest in them.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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