

Comparative Taxonomical Studies on the Egyptian Red Sea Cephalopods (Cephalopoda: Mollusca)

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Abstract

Cephalopods are known to be commercially important around the world. Worth mentioning it constitutes a major part of the Egyptian fishing industry. Samples of cephalopods were collected from fishing boats in the Suez Gulf and Egyptian Red Sea. Cuttlefishes, squids, and octopuses had their club of the tentacle, arm IV hectocotylus, sucker of the club of the tentacle, sucker ring of the club of the tentacle, arm sucker, arm sucker ring, radula, gill, and shell. Various organs were photographed using a Canon G7X digital Camera. Eleven Egyptian Red Sea cephalopod species were encountered; three of them are cuttlefish species namely: *Sepia dollfusi*, *Sepia pharaonis*, and *Sepia elongata*. Three squid species namely: *Loligo forbesii*, *Uroteuthis Photololigo duvaucelii*, and *Sepioteuthis lessoniana* were also encountered. Five octopus species were also recorded namely: *Octopus vulgaris*, *Callistoctopus macropus*, *Macrotritopus defilippi*, *Amphyoctopus aegina*, and *Amphyoctopus membranaceus*. Aims of the current work are to differentiate between some Cephalopod species living in the Red Sea of Egypt and evaluate the status to achieve a reliable differentiation between these species.

Keywords

Comparative Cephalopods, Egyptian, Red Sea, Taxonomy

1. Introduction

Cephalopods (class Cephalopoda) are the phylum Mollusca's most perplexing group of invertebrates. If not all are of the invertebrate phyla. It simply gathers marine animals found in all areas of the world save the Black Sea, from the Arctic to the Antarctic, and from surface waters to deep seas.

For cephalopods, salinity is a limiting factor in their circulation.

They are mostly limited to salinities in the range of 27. However, *Lolliguncula brevis*, which lives and imitates in water with a salinity of 17, has a better salt resistance (Hendrix *et al.* [1]).

The Red Sea and the southern banks of the Liberian Peninsula have a few different types of cephalopods (Riad and Gabr [2]) where salinity exceeds 37. The Sea of Marmara has a diverse diversity of species, with salinities ranging from 25 to 18 (Unsal *et al.* [3]).

Many investigations were conducted in the twentieth century. Robson [4] identified six cephalopod species and recorded three Cephalopod species from the Suez Canal. Adam [5] recorded ten Cephalopod species in the Suez Gulf and three in the Aqaba Gulf. Adam [6] recorded seven Cephalopod species from the Gulf of Aqaba.

Many investigations in the 20 and 21st century Emam [7] investigated *Sepia prashadi* and *Sepia savignyi* from the Gulfs of Suez and Aqaba in the Red Sea waters.

The male reproductive system of *Sepioteuthis lessoniana* from the Suez Gulf was investigated by Mangold [8].

Emam, *et al.* [9] studied morphology, morphometry, age, and growth of *Loligo duvaucelii* from the Suez Gulf. Riad & Gabr [2] performed a comparative study on *Octopus vulgaris* from the Egyptian Mediterranean and Red Sea. Gabr and Riad [10] investigated the reproductive biology and morphometric characteristics of *Loligo forbesii* from Suez Gulf. Riad and Abd EL Hafez [11] conducted bioeconomic importance of the Egyptian Red Sea squid. Kilada and Riad [12] studied the seasonal biochemical composition of *Loligo forbesii* in the Egyptian Mediterranean and the Gulf of Suez, Red Sea. The population dynamics of *Octopus defilippi* caught from the Egyptian Red Sea was examined by El-ganainy and Riad [13]. In the Egyptian Red Sea, Kilada and Riad [14] investigated the seasonal reproductive biology of *Uroteuthis duvaucelii* (Cephalopoda: Loliginidae).

Osman, *et al.* [15] investigated the feeding science and biochemical organization of Lessepsian *Octopus Octopus aegina* from the Egyptian Red Sea's Suez Gulf.

The goal of this study is to learn more about the cephalopod species that live in the Egyptian Red Sea waters and to distinguish between them based on the little taxonomic information available (Roper, *et al.* [16], Jereb & Roper [17], Jereb & Roper [18] and Jereb, *et al.* [19]).

2. Materials and Methods

Seasonally, cephalopod samples were obtained from commercial fishing trawlers in the Suez Gulf and the Egyptian Red Sea (Figure 1).

The samples were kept in seawater that contained 5% formalin. The following traits for cuttlefishes, squids, and octopuses were thoroughly analyzed to identify

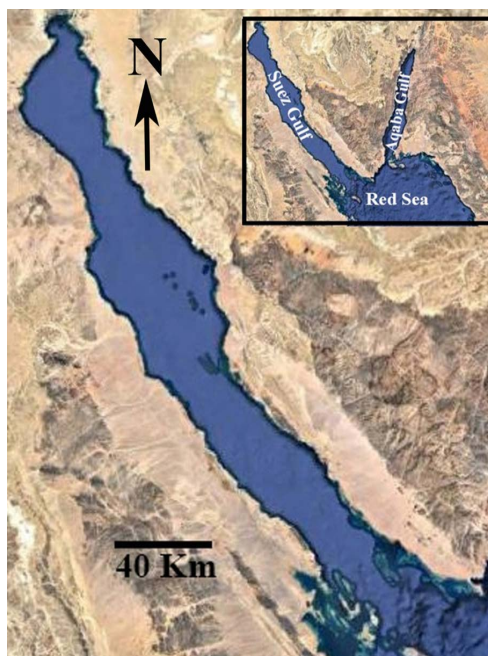


Figure 1. The Egyptian red sea including the Suez gulf.

specimens to the species level, according to Jereb & Roper [17], Jereb & Roper [18]), and Jereb, *et al.* [19] respectively. These are tentacular club sucker, tentacular club sucker ring, arm IV of hectocotylus, arm sucker, arm sucker ring, radula, gill, and shell.

A Canon G7X digital camera was used to photograph the various organs.

3. Results and Discussion

The following cephalopod species namely: *Sepia dollfusi*, *Sepia pharaonis*, *Sepia elongata*, *Loligo forbesii*, *Uroteuthis* *Photololigo duvaucelii*, *Sepioteuthis lessniana*, *Octopus vulgaris*, *Callistoctopus macropus*, *Macrotritopus defilippi*, *Amphyoctopus aegina*, and *Amphyoctopus membranaceus* were encountered during the present study.

The following is the taxonomic order of the species that have been recorded

Phylum: Mollusca;

Class: Cephalopoda Cuvie, 1798;

Subclass: Coleoidea Bather, 1888;

Superorder (A): Decapodiformes;

Order (I): Sepiida Naef, 1916;

Suborder: Sepiina;

Superfamily: Sepioidea;

Family: Sepiidae Keferstein, 1866;

Genus *Sepia* Linnaeus, 1758.

1) *Sepia dollfusi* Adam, 1941b;

2) *Sepia pharaonis* Ehrenberg, 1831;

3) *Sepia elongata* d'Orbigny, 1839-1842;

The three cuttlefish species found in Egypt's Red Sea are *Sepia dollfusi*, *Sepia pharaonis*, and *Sepia elongata*.

1) *Sepia dollfusi* Adam, 1941:

World distribution: Red Sea waters and the Suez Canal (Nesis [20]);

Local name: Sobia (Riad [21]);

Local distribution: Suez Gulf (Emam & Saad [22]) and (Gabr & Hanlon [23]) & Suez Gulf and Red Sea (Riad [21]);

Habitat: *Sepia dollfusi* dwell the Red Sea and Gulf of Suez waters (Jereb & Roper [17]).

2) *Sepia pharaonis* Ehrenber, 1831:

Synonymy: *Sepia (Acanthosepion) pharaonis*, Ehrenberg, 1831;

World distribution: The IndoPacific region including the Red Sea, Arabian Sea, South China Sea, East China Sea, and northern and northern Australia (Jereb & Roper [17]);

Local name: Sobia (Riad [21]);

Local distribution: Gulf of Suez and Red Sea (Gabr *et al.* [24]);

Habitat: From the beach to around 110 metres deep, this neritic demersal species can be found. With the Upper 40 meters deep (Jereb & Roper [17]).

3) *Sepia elongata*: d'Orbigny, 1839-1842:

World Distribution: Indopacific and Red Sea (Nesis [20]);

Local name: Sobia (Riad [21]);

Local distribution: Suez Gulf and Red Sea (Riad [21]);

Habitat: A neritic, demersal species that can be found from the beach to around 110 metres deep, but is more;

Common in the Upper 40 meters deep (Jereb & Roper [17]).

Description

A comparison for the 3 Egyptian Red Sea cuttlefishes:

The descriptions of the specimens in hand (**Tables 1-5**) are in good agreement with the descriptions given by previous authors (Roper *et al.* [16]) and (Jereb & Roper [17]).

Remarks

According to Robson [25], *Sepia pharaonis* possesses a transverse Zebra stripe pattern, which vanished in our study after preservation in formalin solution. Besides, gill was found to be 45 gill lamellae.

Table 1. External morphological features: (**Plate 1**).

<i>Sepia dollfusi</i>	<i>Sepia pharaonis</i>	<i>Sepia elongata</i>
Large mantle with weak open mantle cavity. The long arms hold 4 rows of suckers (Plate 1(a)).	Broad mantle. Broad Fin, approximately as mantle length (Plate 1(b)).	Elongate body. The arms are endowed with four series of suckers, among which the averages are slightly larger than the lateral Suckers in the distal parts of the arms, first and second in males and second and third pairs in females, are in two rows (Plate 1(c)).

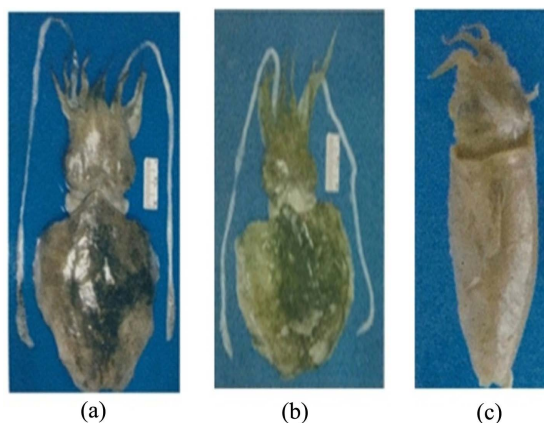


Plate 1. External morphological features: (a) *Sepia dollfusi*; (b) *Sepia pharaonis*; (c) *Sepia elongata*.

Table 2. Tentacular club: (**Plate 2**).

<i>Sepia dollfusi</i>	<i>Sepia pharaonis</i>	<i>Sepia elongata</i>
The tentacular club has 5 to 7 suckers in the center row that are greater than the others. Tentacular suckers of the club gradually decrease in size towards the edge of the tentacular club. The club's protecting membranes are parallel at the carpal section and terminate on the tentacular club's stalk (Plate 2(a)).	Well differentiated club. There aren't any suckers on the stem. Eight transverse rows of suckers run across the center of the club. A few medium Suckers. (5 or 6 longitudinal suckers). The club swimming membrane is well developed, but it does not extend all the way to the stem (Plate 2(b)).	The club of tentacle small with a well-developed keel in length, it measures around 15% of the tentacles and holds a series of five large suckers, the other tentacular club suckers are small (Plate 2(c)).

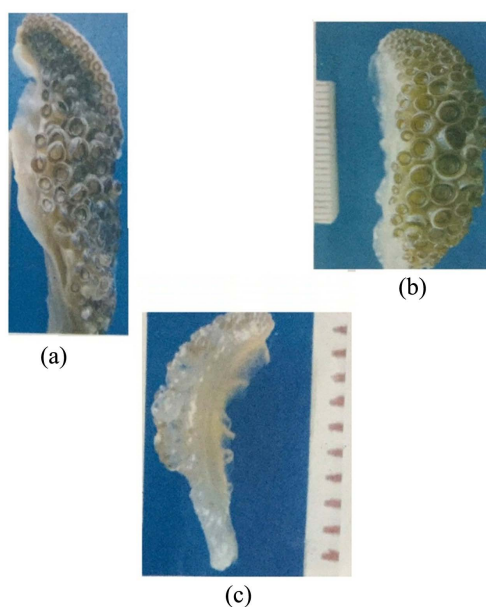
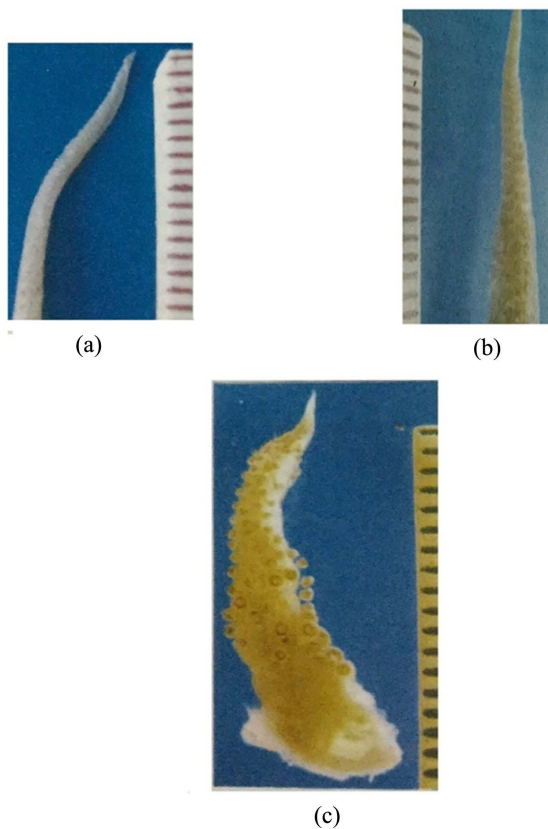


Plate 2. Tentacular club: (a) *Sepia dollfusi*; (b) *Sepia pharaonis*; (c) *Sepia elongata*.

Table 3. Left arm IV of male hectocotylized: (Plate 3).

<i>Sepia dollfusi</i>	<i>Sepia pharaonis</i>	<i>Sepia elongata</i>
The left arm IV hectocotylize modified in the semi-terminal part forward by 12 transverse rows of 4 minute suckers (Plate 3(a)).	At the bottom of hectocotyli zed arm, there are ten rows of quadric normal suckers, followed by ten rows of ventral normal suckers. (there are two rows) (Plate 3(b)).	The hectocotylized arm has a special construction for a unique inflated body and is encased around a free edge. Normal suckers are present in the proximal and distal regions of the hectocotylized arm (Plate 3(c)).

**Plate 3.** Left arm IV of male hectocotylized: (a) *Sepia dollfusi*; (b) *Sepia pharaonis*; (c) *Sepia elongata*.**Table 4.** The gill: (Plate 4).

<i>Sepia dollfusi</i>	<i>Sepia pharaonis</i>	<i>Sepia elongata</i>
The gill has Over 30 gill lamellae (Plate 4(a)).	The gill with about 45 gill lamellae (Plate 4(b)).	The gill contains 20 gill lamellae (Plate 4(c)).

Table 5. The shell: (Plate 5).

<i>Sepia dollfusi</i>	<i>Sepia pharaonis</i>	<i>Sepia elongata</i>
Plate 5(a)	Plate 5(b)	Plate 5(c)

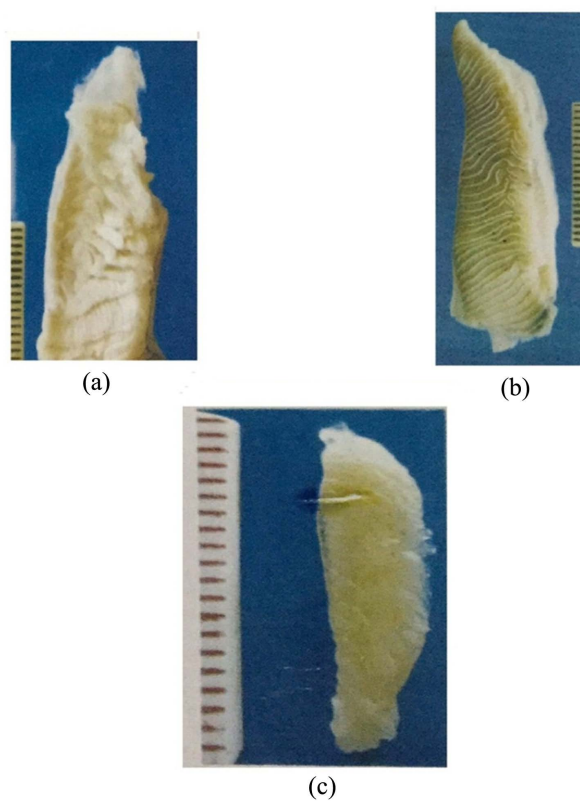


Plate 4. The gill: (a) *Sepia dollfusi*; (b) *Sepia pharaonis*; (c) *Sepia elongata*.

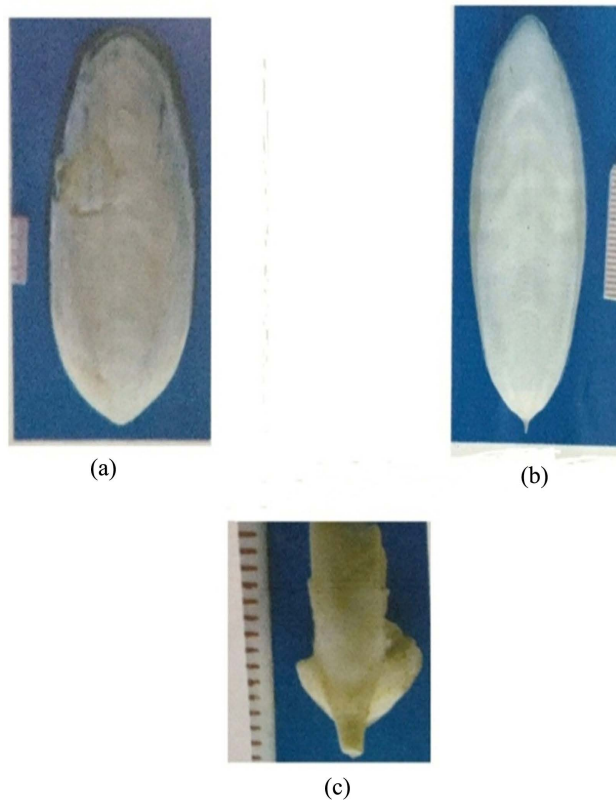


Plate 5. The shell: (a) *Sepia dollfusi*; (b) *Sepia pharaonis*; (c) *Sepia elongata*.

The largest sample in this study had a mantle length of 14.7 cm, while the smallest specimen had a mantle length of 9.5 cm. While according to Jereb & Roper [17] the common size ranges from 15 to 20 cm dorsal mantle lengths. *Sepia pharaonis* and *Sepia ramani* are nearly very similar but within the sight of a lengthy club, *Sepia ramani* differs from *Sepia pharaonis*. With 15 to 24 magnifying suckers that are semi-equal in size.

Six enlarged central club suckers exist in *Sepia pharaonis*, three or four of which are much larger than the rest. Instead of 10 to 12 rows of hectocotylized transverse rows of normal size suckers on the proximal end of the arm, *Sepia ramani* has 14 to 16 rows as in *Sepia pharaonis* (Jereb & Roper [17]). According to Adam [6] this species is easily differentiated from *Sepia aculeate*, by having the suckers of the two middle rows greatly enlarged.

Adam's ([5]) description of *Sepia elongata* is very similar to the description of the present work.

Apart from the gill, the specimens recovered from the Egyptian Red Sea feature 45-gill lamellae.

The species is recognized by its lengthy form and five suckers on the tentacular club that is substantially larger than the others. A remarkable hectocotylized arm and a shell with a hard puffed up ventral face and two broad lateral wings.

Sepia elongata has a similar club and hectocotylus to *Sepia trygonina*, but its shell is thicker (Jereb and Roper [17]).

Order (II): Myopsida d'Orbigny, 1845;

Family: Loliginidae Steenstrup, 1861;

Genus: Loligo Schneider, 1784.

1) *Loligo forbesii* Steenstrup, 1856:

Genus: Uroteuthis. Rehder, 1945;

Subgenus: *Photololigo*;

2) *Uroteuthis Photololigo duvaucelii* d'Orbigny, 1848:

Genus: Sepioteuthis Blainville, 1824;

3) *Sepioteuthis lessoniana* Lsson, 1830;

Three squid species were recorded in the Egyptian Red Sea waters:

Namely: *Loligo forbesii*, *Uroteuthis Photololigo duvaucelii*, and *Sepioteuthis lessoniana*.

1) *Loligo forbesii*:

World distribution: Mediterranean sea (Roper *et al.* [16]), North-Western Mediterranean (Boletzky & Mangold [26]), Red Sea and East Africa (Roper *et al.* [16]), Catalanian Sea (Sanchez [27]) and East of Atlantic from 20°N to 60°N (Except the Baltic sea) (Jereb & Roper [18]);

Local name: Kalimaria (Riad [28]);

Local distribution: by combing for samples from Rosetta 2 m to 36 m (Egyptian Mediterranean waters) (Riad [28]);

As well as fishing boats from the Red Sea and the Suez Gulf, Ataka port (Riad [21]);

Habitat: A temperate shelf species that can be found in deep subtropical waters. Its depth ranges from 100 to 400 meters deep (Jereb & Roper [18]).

2) *Uroteuthis Photololigo duvaucelii*:

Synonymy: *Uroteuthis duvaucelii* d'Orbigny [inFerassac & d'Orbigny 1835];

World distribution: The Indian Ocean, which encompasses the Red Sea and the Arabian Sea, and includes the South China Sea and the Philippine Islands, stretching eastward from Mozambique Sea, as well as northward to Taiwan, is known as the Indopacific (area of China) (Jereb & Roper [18]);

Local name: Kalimaria (Riad [28]);

Local distribution: Red Sea, Gulf of Suez (Riad [21]);

Habitat: Neritic shallow water that occurs at depths between 30 and 170 meters deep (Jereb & Roper [18]).

3) *Sepioteuthis lessoniana*:

World distribution: The Indo-Pacific region is widespread: the Red Sea, the Arab Sea East to 160°E, the Hawaiian Islands to the east, northern Australia, north-central Japan (Jereb & Roper [18]);

Local name: Kalimaria (Riad [28]);

Local distribution: Egyptian Mediterranean waters (Riad [29]). And from fish trawlers operating in the Suez Gulf (Ataka Harbor), Red Sea (Riad [21]);

Habitat: A neritic species occurs from the surface down to at least 100 meters deep (Jereb & Roper [18]).

Description

A comparison for the 3 Egyptian Red Sea squids:

The descriptions of the specimens in hand (**Tables 6-10**) are in good agreement with the descriptions given by previous authors Roper *et al.* [16] and Jereb & Roper [18].

Remarks

The morphology of *Loligo forbesii* taken from Egyptian Red Sea waters agrees well with Jereb & Roper [18].

Table 6. External morphological features: (**Plate 6**).

<i>Loligo forbesii</i>	<i>Uroteuthis Photololigo duvaucelii</i>	<i>Sepioteuthis lessoniana</i>
Mantle slender; The fins are elongated and concave from the back, extending to about 75% of ML, arms with two rows of suckers (Plate 6(a)).	Relatively short mantle. Rhombic fins, just over 50% length of the mantle (Plate 6(b)).	Mantle Long, sturdy, about 43% wide of the mantle length extremely long balances over 90% of the length of the mantle, wide (like sepia yet a lot more wide and more strong), as wide as 73% of the length of the mantle, most prominent width happens back to the midpoint of the fins The width of the head is a lot bigger than the length of the head and it bears two oval side eyes (Plate 6(c)).

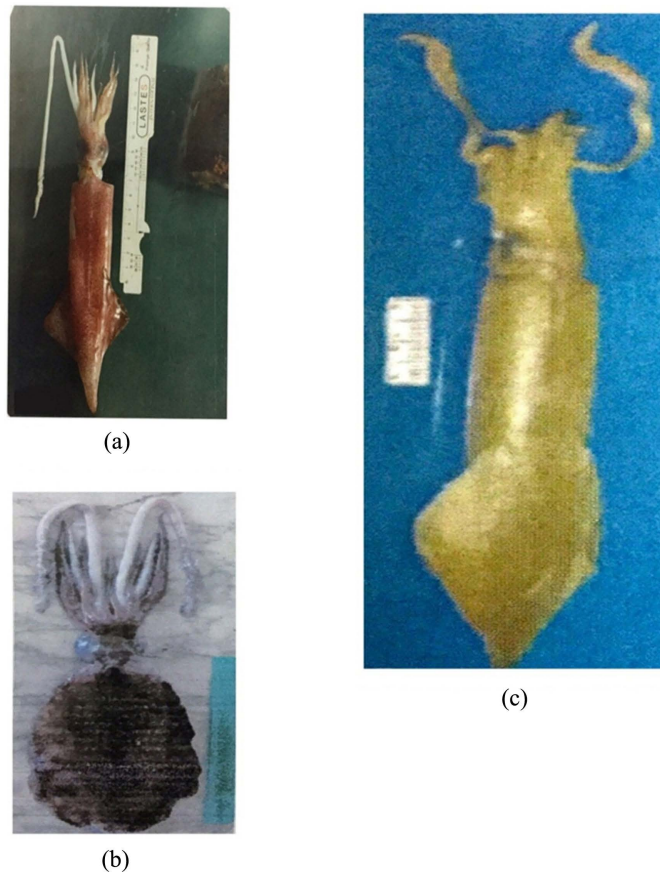


Plate 6. External morphological features: (a) *Loligo forbesii*; (b) *Uroteuthis Photololigo duvaucelii*; (c) *Sepioteuthis lessoniana*.

Table 7. Tentacular club (**Plate 7**).

<i>Loligo forbesii</i>	<i>Uroteuthis Photololigo duvaucelii</i>	<i>Sepioteuthis lessoniana</i>
The manus of the tentacular club are equipped with semi-equal suckers (Plate 7(a)).	Tentacular club with medium suckers larger than marginal suckers with 14 to 17 short, sharp teeth in sucker ring (Plate 7(b)).	The club of tentacle is long and stretched with 4 rows of suckers, Manus medium suckers are developed (Plate 7(c)).

Table 8. Left arm IV of male hectocotylized: (**Plate 8**).

<i>Loligo forbesii</i>	<i>Uroteuthis Photololigo duvaucelii</i>	<i>Sepioteuthis lessoniana</i>
The distal piece of the left arm, IV hectocotylized is changed possesses around 35% of its length, covered with long papillae (28 - 30), decreasing in size distally (Plate 8(a)).	More than half of male Hectocotylized arm with two rows of large papillae (Plate 8(b)).	The modified part of the hectocotylized arm is formed about 1/3 to 1/4 of the arm length (Plate 8(c)).

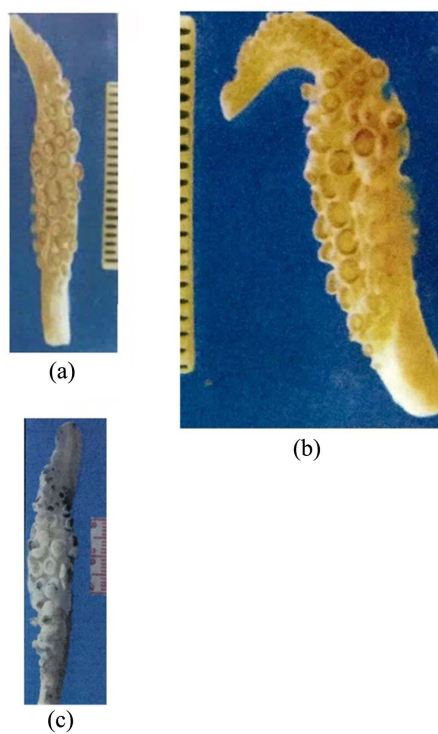


Plate 7. The Tentacular club. (a) *Loligo forbesii*; (b) *Uroteuthis* (*Photololigo* *duvaucelii*); (c) *Sepioteuthis lessoniana*.

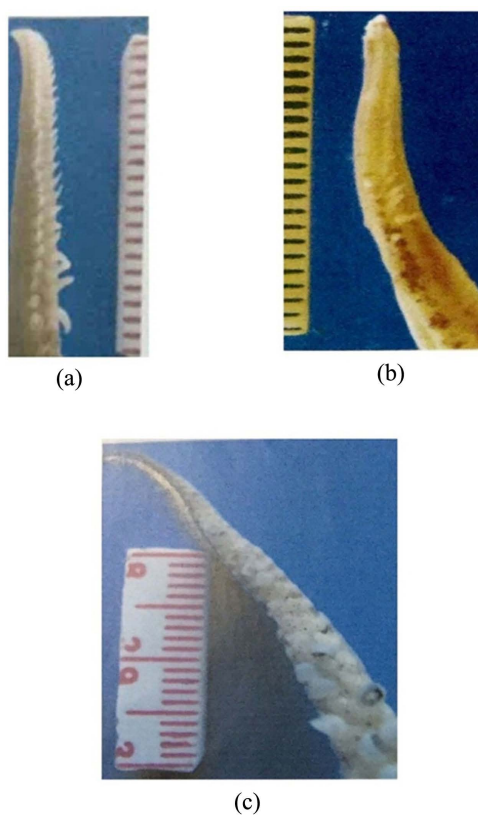


Plate 8. Left arm IV of male hectocotylized: (a) *Loligo forbesii*; (b) *Uroteuthis* (*Photololigo* *duvaucelii*); (c) *Sepioteuthis lessoniana*.

Table 9. Sucker rings: (Plate 9).

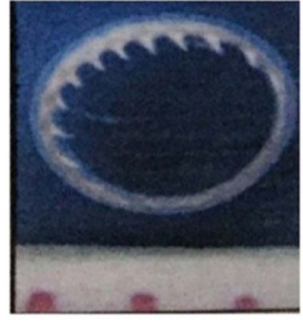
<i>Loligo forbesii</i>	<i>Uroteuthis</i> <i>Photololigo duvaucelii</i>	<i>Sepioteuthis lessoniana</i>
Each manus sucker ring has about 16 - 20 sharp teeth but some suckers had fewer teeth (13). (Plate 9a(i)). Arm sucker ring with 20 - 30 sharp teeth, the biggest arm sucker rings with 7 to 8 teeth (Plate 9a(ii)).	Club sucker ring with 14 to 17 teeth, short and sharp (Plate 9b(i)); sucker ring for arm from 9 to 11 broad teeth (Plate 9b(ii)).	Tentacular club sucker ring (manus sucker ring) with 17 - 22 sharp teeth (Plate 9c(i)). Arm sucker ring with 20 - 25 long sharp teeth (Plate 9c(ii)).
 a(i)  a(ii)  b(i)  b(ii)  c(i)  c(ii) (a) (b) (c)		

Plate 9. The Sucker rings: (a) *Loligo forbesii*; (b) *Uroteuthis Photololigo duvaucelii*; a(i) Tentacular club sucker ring. b(i) Sucker ring of tentacular club; a(ii) Sucker rin of arm; b(ii) Sucker ring of arm; (c) *Sepioteuthis lessoniana*; c(i) Tentacular club sucker ring.

Table 10. The shell: (Plate 10).

<i>Loligo forbesii</i>	<i>Uroteuthis</i> <i>Photololigo duvaucelii</i>	<i>Sepioteuthis lessoniana</i>
(Plate 10(a))	(Plate 10(b))	(Plate 10(c))

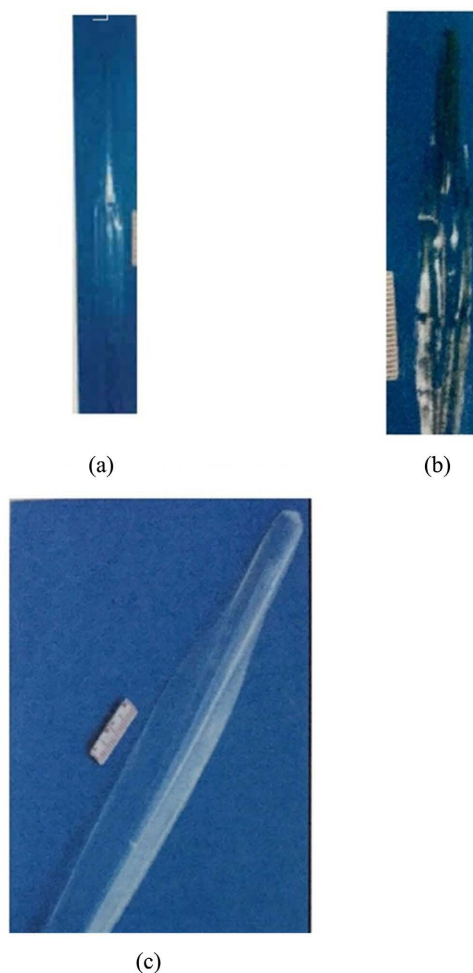


Plate 10. The shell: (a) *Loligo forbesii*; (b) *Uroteuthis Photololigo duvaucelii*; (c) *Sepio-teuthis lessoniana*.

It is worth noting that Riad [28] recorded *Loligo forbesii* in the Egyptian Mediterranean waters and also recorded it from the Egyptian Red Sea waters (Riad [21]).

The current study found that the features of *Uroteuthis Photololigo duvaucelii* are consistent with previous Research, and that the gill has more than 60 gill lamellae. The present study found that the dorsal mantle length of *Uroteuthis Photololigo duvaucelii* ranged from 8.6 to 15.2 cm, whereas Jereb & Roper [18] found that the Maximum dorsal mantle length of *Uroteuthis Photololigo duvaucelii* is 29 cm.

Superorder (B): Octopodiformes;

Order: Octopoda Leach, 1818;

Suborder: Incirrata Grimpe, 1916;

Superfamily: Octopodoidea;

Family: Octopodidae; d'Orbigny, 1845;

Genus: *Octopus* Lamrck, 1798.

1) *Octopus vulgaris* Cuvie, 1797;

Genus: *Callistoctopus* Taki, 1964;

2) *Callistoctopus macropus* Risso, 1826;

Genus: *Macrotritopus* Grimpe, 1922;

3) *Macrotritopus defilippi* Verany, 1851;

Genus: *Amphyoctopus* Fisher, 1882;

4) *Amphyoctopus aegina* Gray, 1849;

5) *Amphyoctopus membranaceus* Quoy & Gaimard, 1832.

In the Egypt's Red Sea, five octopus species have been recorded:

namely: *Octopus vulgaris*, *Callistoctopus macropus*, *Macrotritopus defilippi*, *Amphyoctopus aegina* and *Amphyoctopus membranaceus*;

1) *Octopus vulgaris* Cuvier, 1797:

World distribution: Western Mediterranean as the Adriatic Sea and the Eastern Atlantic (Roper, *et al.* [16]). Turkish spring water (Catagan & Kocatas [30]). In the Gulf of Mexico and the Caribbean, from the island to Brazil, and from the North Sea to Cape Hope in the North Sea (Nesis [20]);

Local name: Okhtaboot or Folby (Riad [28]);

Local distribution: Egyptian Mediterranean waters. Egyptian Red Sea and Gulf of Suez (Riad [21]);

Habitat: On sandy bottoms, muddy with gravel and also living in cavities. The depth between 10 and 300 m deep (Robson [31] & Roper *et al.* [16]).

2) *Callistoctopus macropus* Risso, 1826:

World distribution: Worldwide distributed in warm waters (Jereb *et al.*, [19]): Western & Eastern Mediterranean and Adriatic Sea (Fisher [32]); Aqaba Gulf, North Atlantic, Indian Ocean, Central and Western Pacific Oceans (Adam [6]); North African Bank (Fisher [32]); Tropical species from the Atlantic Ocean; Indo-West Pacific, particularly in Bermuda and the Bahamas, Western Atlantic from South Florida to Brazil, the Caribbean Sea, West Africa to the Gulf of Guinea, and the Ascension and Santa Helena Islands (Nesis [20]);

Local name: Okhtaboot or Hebal (Riad [28] & Riad [33]);

Local distribution: Egyptian Mediterranean waters (Riad [28]), and Egyptian Red Sea & the Gulf of Suez (Riad [21]);

Habitat: This species inhabited rocky bottoms, cracks and holes, and sometimes also on vegetative substrates (Fisher [32]). Benthic shoals are that can be found on reefs, reef flats, and open bottoms (Roper *et al.* [16]);

In this study, the species was caught from the muddy sandy lands of the Suez Gulf.

3) *Macrotritopus defilippi* Verany, 1851:

World distribution: Mediterranean Sea, from Morocco to Angola (Eastern Atlantic), Cape Verde Islands, Western Atlantic, Bahamas, Mexico Gulf, Caribbean Sea, Brazil, Indian Ocean, Arabian Peninsula to Burma and Southwest Pacific (Roper *et al.* [16]) (Nesis [20]) (Mangold [8]);

Local name: Okhtaboot (Riad [21]);

Local distribution: Egyptian Mediterranean waters. And Egyptian Red Sea &

Gulf of Suez (Riad [21]);

Habitat: This species is a benthic species that lives on sandy to muddy bottoms 6 to 60 meters deep (Jereb *et al.* [19]).

4) *Amphyoctopus aegina* Gray, 1849:

World distribution: Western Pacific, Indian Ocean, Red Sea, Japan to Mozambique from 30 to 120 meters deep (Jereb *et al.* [19]);

Local name: Okhtaboot (Riad [21]);

Local distribution: Suez Gulf, Red Sea (Riad [21]);

Habitat: is a benthic species with a low level of secrecy that can be found in depths of 30 to 120 metres on the continental shelf (Jereb *et al.* [19]).

5) *Amphyoctopus membranaceus* Quoy & Gaimard, 1832:

World distribution: Indo-Pacific, Indian Ocean to Japan, China, Philippines and ward South to Australia (Jereb *et al.* [19]);

Local name: Okhtaboot (Riad [21]);

Local distribution: Red Sea, Gulf of Suez (Riad [21]);

Habitat: A benthic shallow-water species occurring down to about 60 m. deep. It shows strong cryptic behavior and usually hides on flat bottoms (Jereb *et al.* [19]).

Description

A comparison regarding five Egyptian Red Sea octopuses:

The descriptions of the Specimens in hand (**Tables 11-13**) are in good agreement with the descriptions given by previous authors (Roper *et al.* [16] & (Jereb *et al.* [19]).

Remarks:

The morphology of *Octopus vulgaris*, *Callistoctopus macropus*, *Macrotritopus defilippi*, *Amphyoctopus aegina*, and *Amphyoctopus membranaceus* from the Egyptian Red Sea waters agrees well with that previously reported by Roper *et al.* [16]& Jereb *et al.* [19].

Table 11. External morphological features: (**Plate 11**).

<i>Octopus vulgaris</i>	<i>Callistoctopus macropus</i>	<i>Macrotritopus defilippi</i>	<i>Amphyoctopus aegina</i>	<i>Amphyoctopus membranaceus</i>
<i>octopus vulgaris</i> ' body is round and lacks contrast With its head and arms, which are covered in flat Tubercles. Three cirri over each eye (Plate 11(a)).	White dots can be found on the dorsal body. The arms are abnormally lengthy, measuring 6 - 7 times the length of the body. There are two lines of suckers on each arm, with the principal pair of arms I being Substantially longer. Cirri over each eye absent (Plate 11(b)).	Relatively small mantle, with smooth skin, the head narrower than the mantle (Plate 11(c)).	Mantle round to oval, covered with minute papillae arranged in a reticular pattern, one cirri above each eye (Plate 11(d)).	Mantle elongate. Two cirri over each eye. Arms moderately long. (Short web, On the web at the base of arms II, anteroventral of the eyes, there is a ringed ocellus (Plate 11(e)).

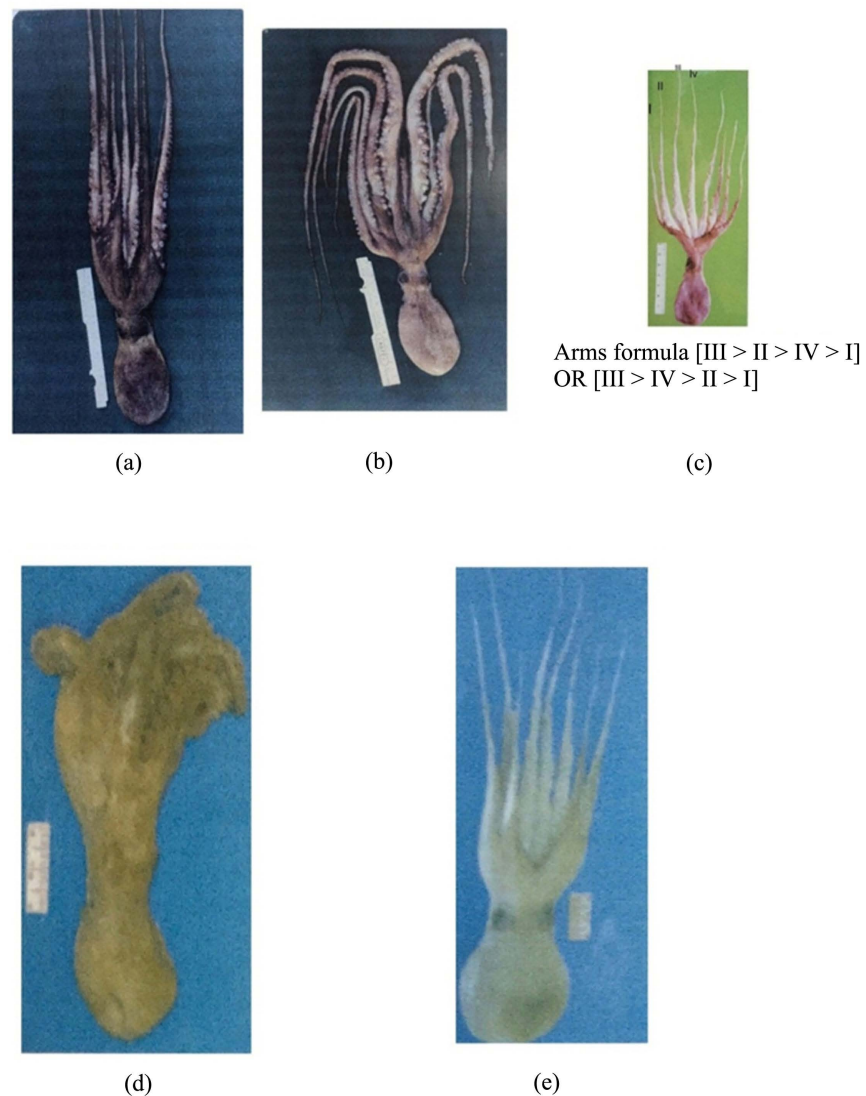


Plate 11. External morphological features: (a) *Octopus vulgaris*; (b) *Callistoctopus macropus*; (c) *Macrotritopus defilippi*; (d) *Amphyoctopus aegina*; (e) *Amphyoctopus membranaceus*.

Table 12. Male hectocotyized left arm III (Plate 12).

<i>Octopus vulgaris</i>	<i>Callistoctopus macropus</i>	<i>Macrotritopus defilippi</i>	<i>Amphyoctopus aegina</i>	<i>Amphyoctopus membranaceus</i>
portion of a male's third right arm modification Hectocotylize is a little spoonshaped ligula that takes up roughly 2.25% of the length of the hectocotylize (Plate 12(a)).	A big tubular ligula on the male's right arm III hectocotylize, extending 13% to 15% of its length (ligula index) (Plate 12(b)).	The male hoctocotylize's arm III is shorter than the opposite arm, which bears 60 - 100 suckers. Ligula is distinguished by a groove that is relatively Shallow and accounts for 1.8% to 2.5% of the hectocotylized arm length (Plate 12(c)).	Right arm III hectocotylzid with a short ligula, 5% to 8% of arm length, and a very shallow groove in the ligula (Plate 12(d)).	The male's third right arm III hectocotylized, with a slender and lengthy ligula that accounts for 4% to 6% of arm length (Plate 12(e)).

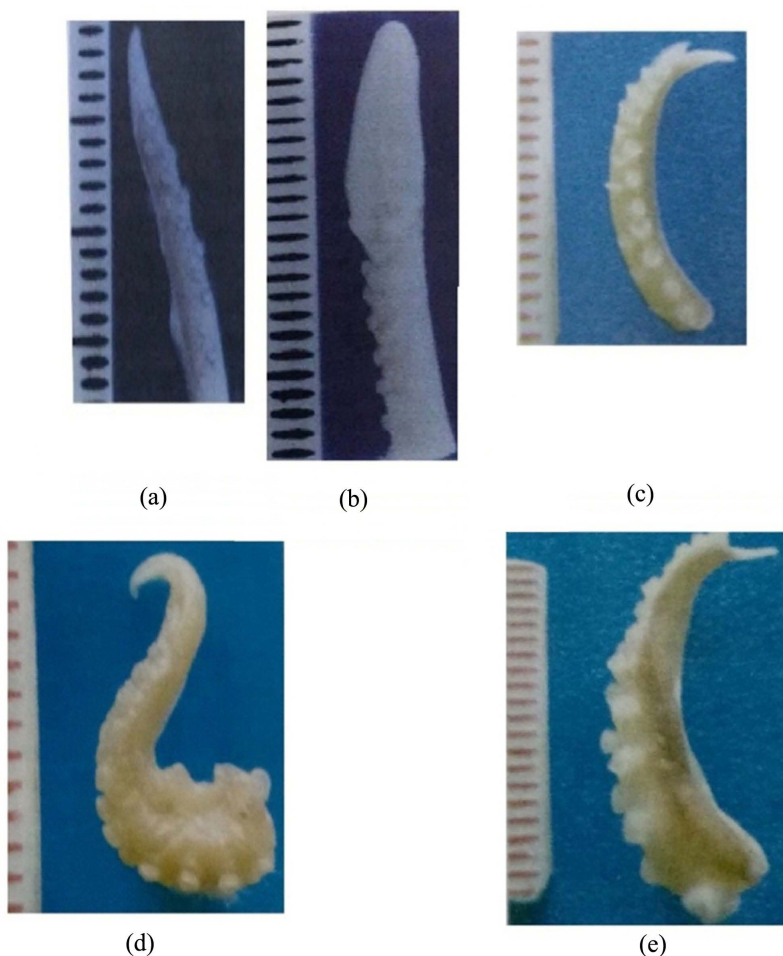


Plate 12. The right arm of the male hectocotylized: (a) *Octopus vulgaris*; (b) *Callistoctopus macropus*; (c) *Macrotritopus defilippi*; (d) *Amphyoctopus aegina*; (e) *Amphyoctopus membranaceus*.

Table 13. The gills (Plate 13).

<i>Octopus vulgaris</i>	<i>Callistoctopus macropus</i>	<i>Macrotritopus defilippi</i>	<i>Amphyoctopus aegina</i>	<i>Amphyoctopus membranaceus</i>
Eleven gill lamellae are present in the gill (Plate 13(a)).	13 gill lamellae are present in the gill (Plate 13(b)).	The gill with 8 - 11 gill lamellae (Plate 13(c)).	Seven-gill lamellae in the gill (Plate 13(d)).	Seven or eight-gill lamellae in the gill (Plate 13(e)).

***Octopus vulgaris*:** Arms that are shorter and a well-developed membrane between the branches distinguish *Octopus vulgaris* from *Callistoctopus macropus*.

Three cirri over each eye and up to a fifth of the length of the arms connected Except for three cirri over each eye, the anatomy of *Octopus vulgaris* in the current study is consistent with the publications. Forbes and Hanley [34] are the only ones that mentioned this character.

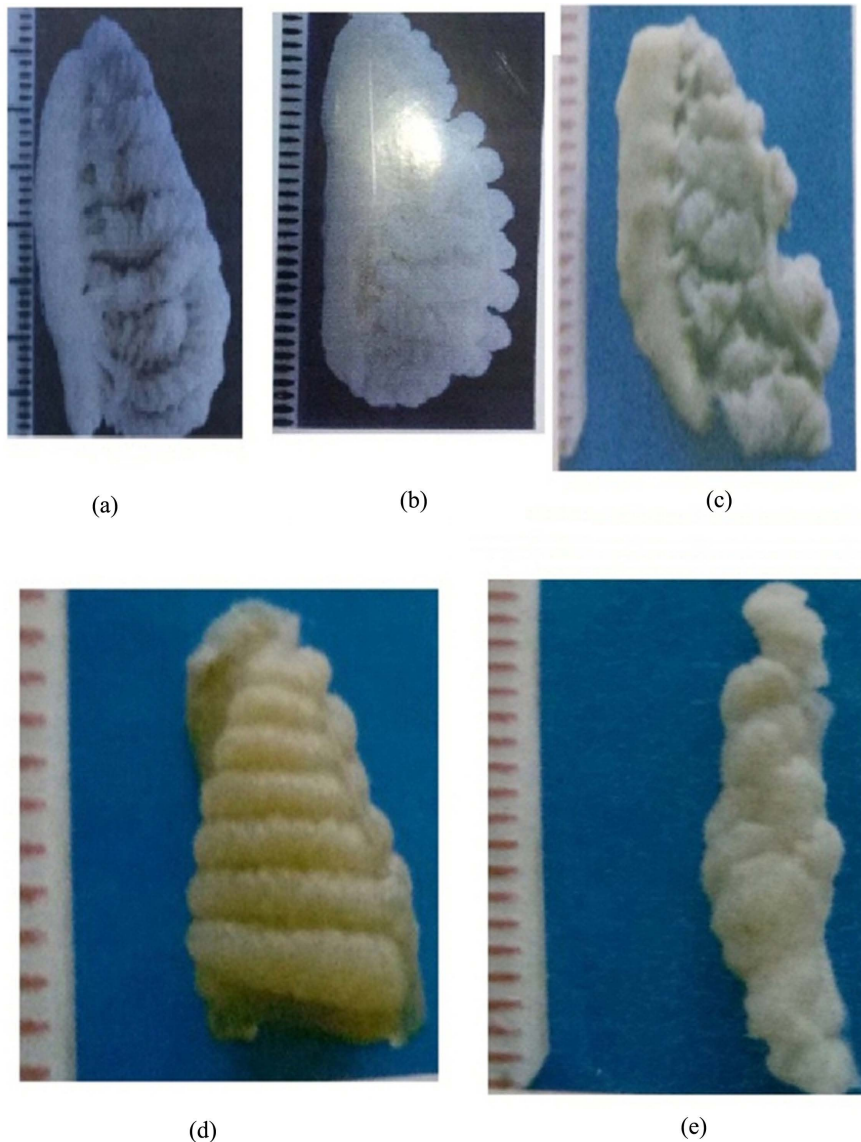


Plate 13. The gills. (a) *Octopus vulgaris*; (b) *Callistoctopus macropus*; (c) *Macrotritopus defilippi*; (d) *Amphyoctopus aegina*; (e) *Amphyoctopus membranaceus*.

The largest sample collected had a total length of 104 cm. for males and 99.6 cm. for females.

Fisher [32] suggested a maximum overall length of 90 to 110 cm. Jereb *et al.* [19] provided larger sizes, with males' all-out lengths of 130 cm and females' all-out lengths of 120 cm.

2) *Callistoctopus macropus*: Differed from *Callistoctopus macropus* in the following characteristics: The morphology of *Callistoctopus macropus* in this study matches that of the largest specimen, which measures 16.3 cm mantle length for males and 15.9 cm mantle length for females.

Males' total length is 138 cm while females' is 131 cm with an absolute weight of 880 grammes for males and 625 grammes for females.

Fisher [32] found that related species' maximum all-out lengths ranged from

90 to 110 cm. A total length 120 to 150 cm and mantle length of 14 cm were estimated by Roper *et al.* [16]. The tiniest sample acquired during this evaluation revealed the estimations that accompanied it. Male's mantle is 55 cm long, while female's is 52 cm long.

3) *Macrotritopus defilippi*: It is worth noting that Riad [35] recorded *Macrotritopus defilippi* in the Egyptian Mediterranean waters and also in the Egyptian Red Sea (Riad [21]).

4) *Amphyoctopus aegina*: The morphological descriptions of *Amphyoctopus aegina* are very similar to those of Adam ([5] and [6]). From the Suez Gulf and the Gulf of Aqaba the morphology of *Amphyoctopus aegina* in the current study is very similar to that of *Amphyoctopus aegina* in previous studies. Apart from Adam [6], who indicated that each demibranch's gills had 8 filaments, the dorsal mantle length in the current study demonstrated the largest example to be 4.2 cm. and the smallest specimen to be 2.5 cm, although Roper *et al.* [16] stated that the greatest dorsal mantle length is 10 cm.

5) *Amphyoctopus membranaceus*: The morphology of the *octopus membranaceus* in the current work is consistent with the literature a parted from, gill with 7 or 8-gill lamellae and in the current work the dorsal mantle length demonstrated the biggest example to be 5.5 cm., and the smallest specimen to be 4.2 cm while according to Roper *et al.* [16] maximum mantle length is 8 cm.

4. Conclusions

Cephalopods are known to be commercially important around the world. Worth mentioning it constitutes a major part of the Egyptian fishing industry. The present study aims to differentiate between cephalopod species dwelling the Egyptian Red Sea waters. Cephalopod samples were obtained from fishing vessels. Samples were photographed with a Canon G7X digital camera. Eleven Egyptian species of cephalopods are found in the Red Sea, they are:

Sepia dollfusi, *Sepia pharaonis*, *Sepia elongata*, *Loligo forbesii*, *Uroteuthis Photololigo duvaucelii*, *Sepioteuthis lessoniana*, *Octopus vulgaris*, *Callistoctopus macropus*, *Macrotritopus defilippi*, *Amphyoctopus aegina* and *Amphyoctopus membranaceus*.

Loligo forbesii and *Sepioteuthis lessoniana* are found in both Mediterranean and Red Sea waters of Egypt. It is worth noting that though *Sepioteuthis lessonian* is a Red Sea species proper, it succeeded to traverse the Suez Canal and inhabits the Egyptian Mediterranean waters. Lessepsian migration is still going on as some Red Sea cephalopod species were encountered in the Egyptian Mediterranean waters.

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Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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