ILLUSTRATED ATLAS ON THE ZOOBENTHOS OF KUWAIT

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Mikhail Makarov, Vladimir Grintsov and
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Kuwait Institute for Scientific Research

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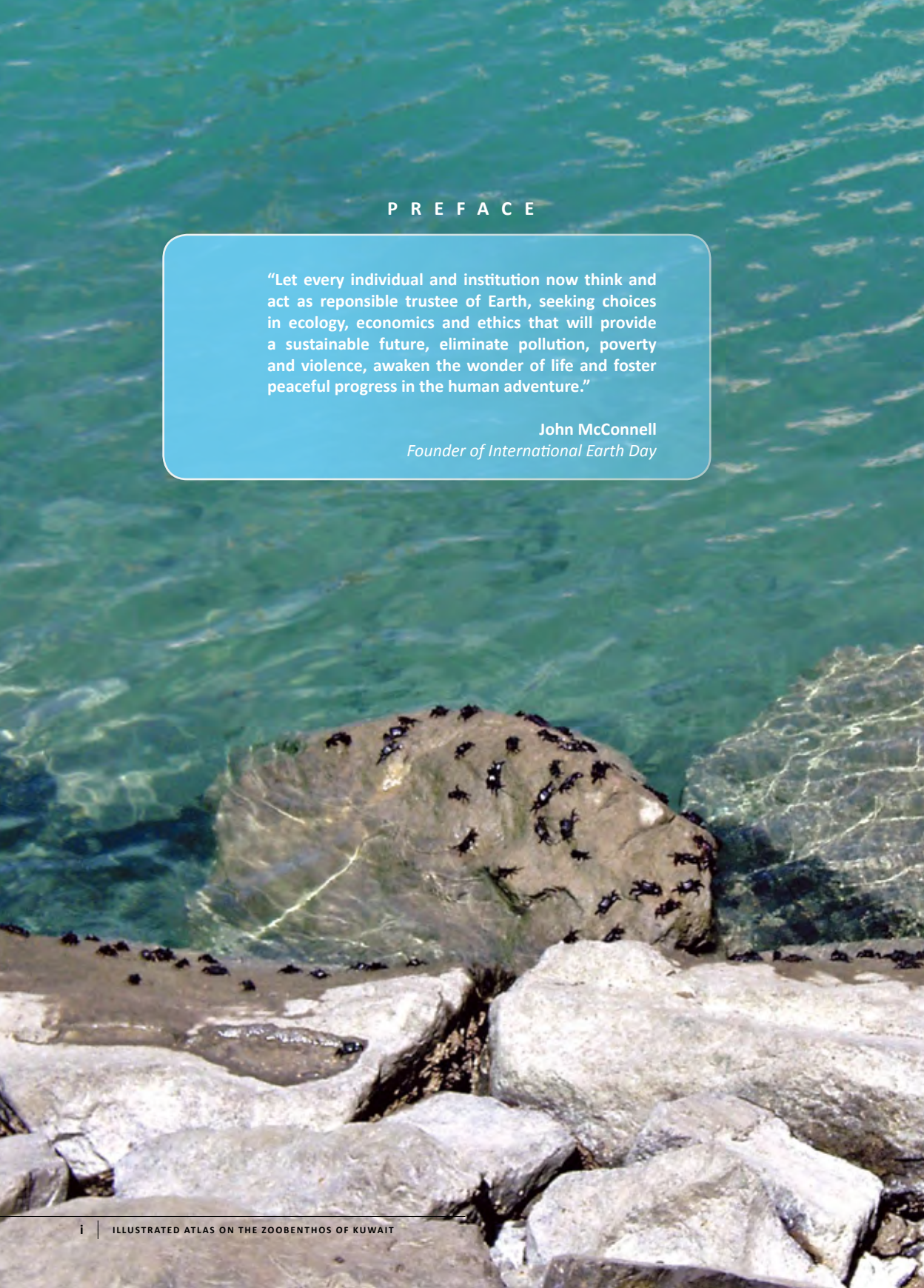
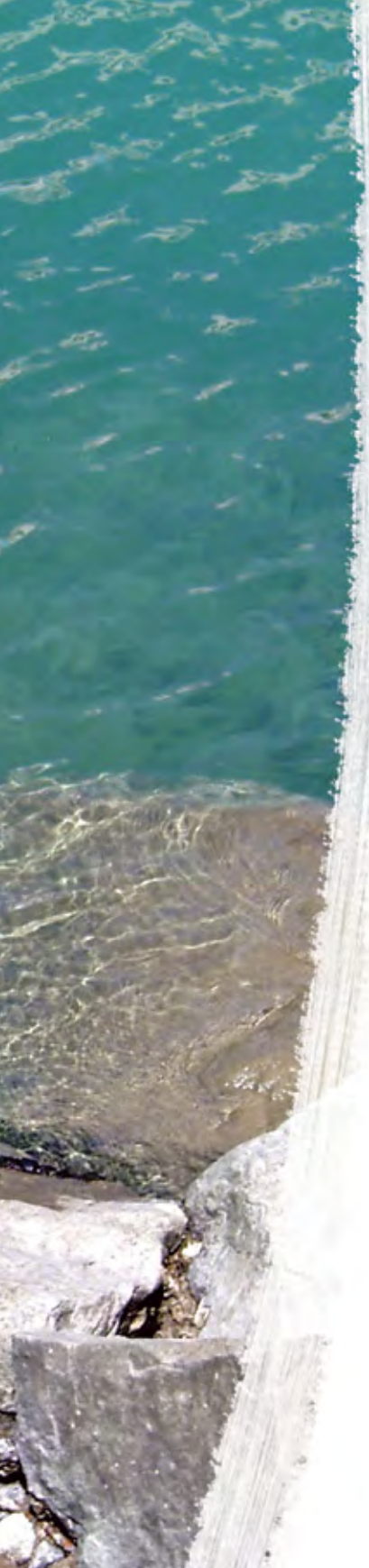
PREFACE

"Let every individual and institution now think and act as reponsible trustee of Earth, seeking choices in ecology, economics and ethics that will provide a sustainable future, eliminate pollution, poverty and violence, awaken the wonder of life and foster peaceful progress in the human adventure."

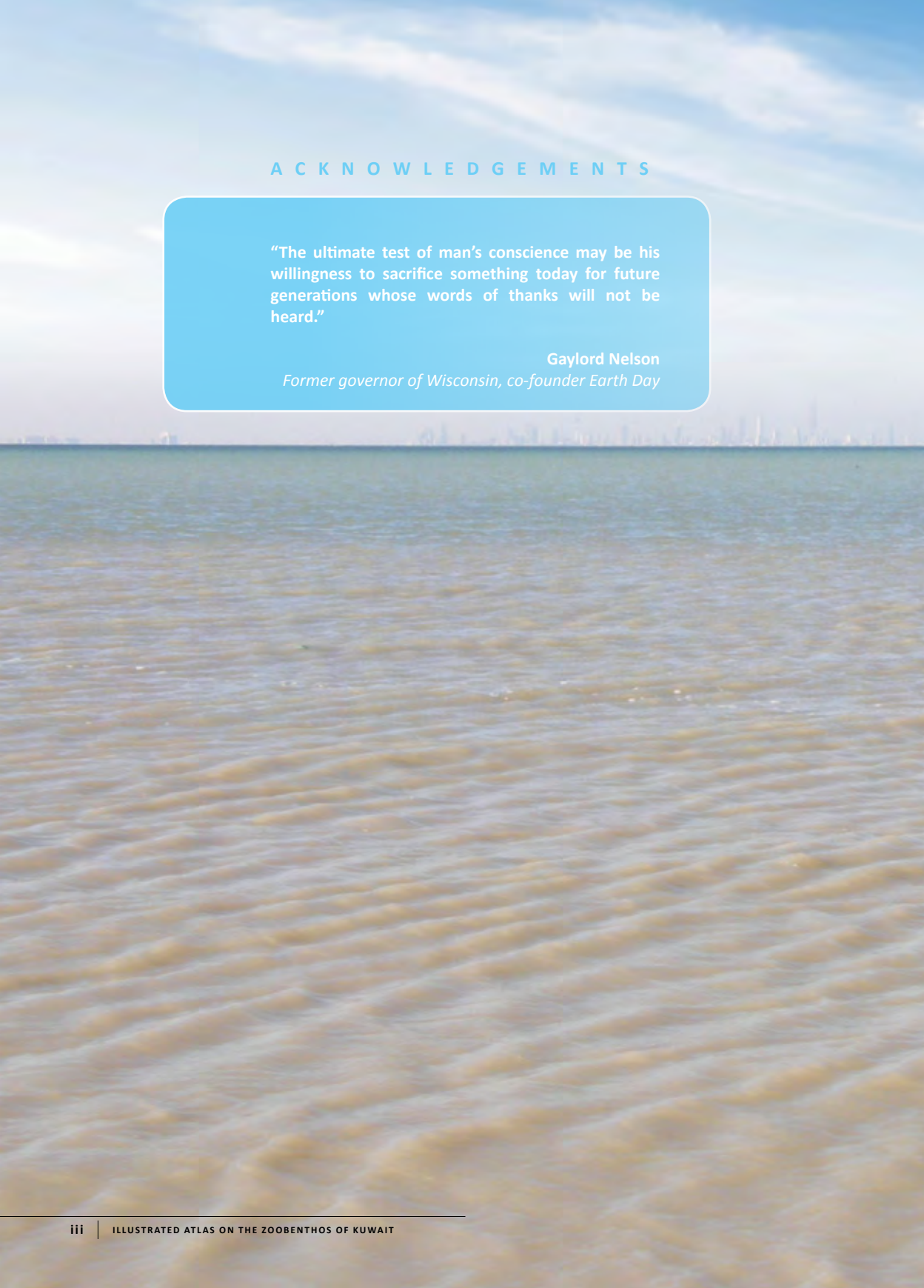
John McConnell
Founder of International Earth Day





PREFACE

This illustrated guide includes the common macrozoobenthos species inhabiting selected locations of Kuwait's intertidal and subtidal areas during the summer, fall, winter and spring seasons. Material for the study was collected from 17 stations in December 2004; from five stations in Kuwait Bay during December 2009 and March, June and September 2010; and from 16 stations from November 2011 until April 2012. A total of 476 species of macrozoobenthos and representatives of higher taxonomic groups belonging to 12 phyla were recorded and identified. Species diversity was highest for polychaetes, gastropods, bivalved mollusks and crustaceans (103, 121, 91 and 71 species, respectively). Polychaetes, gastropods and crustaceans prevailed in the subtidal zone. The obtained results indicate that in Kuwait waters the diversity of macrozoobenthos is relatively high while the level of dominance is low. It was also found that in Kuwait Bay macrozoobenthos community is less diverse than in other locations of the studied area.



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"The ultimate test of man's conscience may be his willingness to sacrifice something today for future generations whose words of thanks will not be heard."

Gaylord Nelson
Former governor of Wisconsin, co-founder Earth Day

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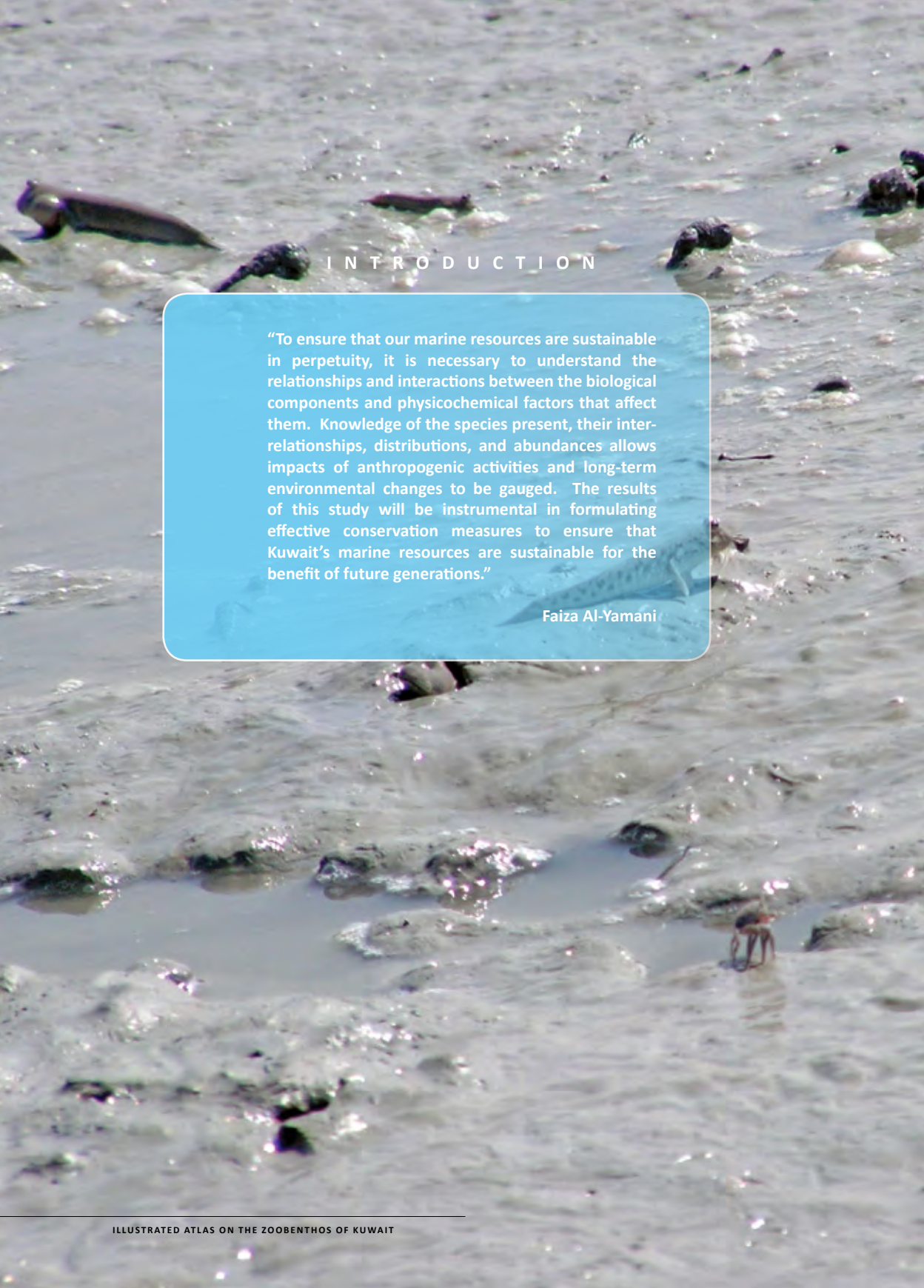


INTRODUCTION

"To ensure that our marine resources are sustainable in perpetuity, it is necessary to understand the relationships and interactions between the biological components and physicochemical factors that affect them. Knowledge of the species present, their inter-relationships, distributions, and abundances allows impacts of anthropogenic activities and long-term environmental changes to be gauged. The results of this study will be instrumental in formulating effective conservation measures to ensure that Kuwait's marine resources are sustainable for the benefit of future generations."

Faiza Al-Yamani

INTRODUCTION

Benthos, are organisms, which live on, in, or near the seabed. They include biota that are either on the surface of the sea bottom, or burrow into the bottom sediment. The term benthos comes from the Greek for "depths of the sea". Benthos, are generally divided into zoobenthos (invertebrate animals belonging to the benthos) and phytobenthos (plants belonging to the benthos).

Benthos include intertidal and subtidal fauna. They may be attached to the bottom or mobile, and they play a critical role in the natural flow of energy and nutrients. For example, benthic organisms, such as oysters, clams, sea cucumbers, and sea anemones, form good food sources for fish and humans. Hence, the quality and productivity of the benthos determine the abundance of fish resources. The main food sources for benthos are plankton and organic runoff from land. Therefore, benthos play an important role in the marine food chain.

Benthic communities are also important as they are used in marine ecological studies to assess pollution and eutrophication impacts. Their long life cycles allow studies conducted by aquatic ecologists to determine any decline in environmental quality, which could be assessed by studying the population responses of the coastal zoobenthos and the effect on the coastal biodiversity. The three major components of biodiversity are the community composition, structure, and subsequent functioning of the community.

The depth of water, temperature and salinity, and type of local substrate all determine the benthic community structure. In coastal waters and other places where light reaches the bottom, benthic photosynthesizing diatoms can proliferate, as is the case for Kuwait's marine environment. Filter feeders, such as sponges and pelecypods (bivalves), dominate on hard or sandy bottoms. Deposit eaters, such as polychaetes, populate softer bottoms.

Benthos, are also divided into groups based on their habitat location. The epibenthos live on the surface of sediment, and hyperbenthos live just above the sediment.

Moreover, the benthic biota, are categorized by their size into macro-, meio-, and microbenthos (Table 1).

Table 1. Size categories of benthos.

Term	Size	Examples
Macrobenthos	> 1 mm	Polychaeta, Pelecypoda, Anthozoa, Echinodermata, Porifera, Ascidia, Crustacea
Meiobenthos	0.1 - 1 mm	Polychaeta, Pelecypoda, Copepoda, Ostracoda, Cumacea, Nematoda, Turbellaria, Foraminifera
Microbenthos	< 0.1 mm	Bacteria, diatoms, ciliates, amoeba, flagellates

Communities of zoobenthos play an important role in the functioning of Kuwait's nearshore zone ecosystem. Benthos represents an extremely diverse group of aquatic animals, and the large numbers of species possess a wide range of responses to stressors such as organic pollutants, sediments, and toxicants. Many benthic macroinvertebrates are long-lived, allowing detection of past pollution events such as pesticide spills and illegal dumping. Benthic communities can be used to monitor the quality conditions of the marine and freshwater environment over a broad area or they can be used to determine the effects of point source discharges from sources such as sewage treatment plants and factories. Ecologists who evaluate environmental quality using the benthos often consider the following characteristics to be important indicators of the quality of the aquatic environment:

1. Taxa richness: a measure of the number of different types of animals; greater taxa richness generally indicates better water quality.

2. Pollution tolerance: many types of benthos are sensitive to pollutants such as metals and organic wastes. For example, in freshwater communities mayflies, stoneflies, and caddisflies are generally intolerant of pollution. If a large number of these insect types are collected in a sample, the water quality in the stream is likely to be good. If only pollution-tolerant organisms such as non-biting midges and worms are found, the water is likely to be polluted.

3. Functional groups: the presence or absences of certain feeding groups (such as scrapers and filterers) may indicate a disturbance in the food supply of the benthic animals in the stream and the possible effects of toxic chemicals.

The major abiotic factors useful for benthic sampling are salinity, temperature, depth, current speed and direction, as well as sediment grain size.

Present knowledge of the benthic fauna of the Arabian Gulf is insufficient and fragmentary. A comprehensive investigations on the biodiversity and quantitative distribution of macrobenthos for Kuwait waters are lacking. The most recent study on the abundance and community composition of Kuwait's macrobenthos for the winter season was conducted by Al-Yamani et al. (2009). Another study in Kuwait Bay was conducted by Al-Rifaie et al. (2012). This illustrated atlas includes the identification of all the encountered macrozoobenthic species during different seasons in the sampled subtidal and tidal zones of Kuwait waters. Several important references were utilized to produce this guide (Kisseleva, 1968; Mohammad, 1970, 1971, 1973, 1980; Jones, 1986; Stephensen 1945; Dance, 1992; Bosch et al., 1995; Gardiner et al., 2004 and Wesenberg-Lund, 1949).

MATERIALS AND METHODS

"The earth we abuse and the living things we kill will, in the end, take their revenge; for in exploiting their presence we are diminishing our future."

Marya Mannes

MATERIALS AND METHODS

In December 5-19, 2004 macrozoobenthos samples were collected from 17 stations, out of which 14 stations were located in the subtidal zone (from 2 to 20 m depths), and 3 stations were located in the intertidal zone. Subtidal samples were collected from three sections: near Failaka Island (stations 1–5), in Kuwait Bay (stations K6–K9) and off Bubiyan Island (stations 10–13 and 17) (Fig. 1, Table 2). Intertidal samples were collected from three sites: station 14 in Kuwait Bay (in a sewage polluted area), in the vicinity of the Head Office of Kuwait Institute for Scientific Research (KISR) in Shuwaikh; station 16 in the intertidal zone off the Mariculture and Fisheries Department (MFD) off Ras Al-Ardh and station 15 located at Ras Al-Zour (about 75 km southwards to MFD). Samples of subtidal macrozoobenthos were collected by Van Veen grab sampler with a capturing area of 0.05 m^2, and intertidal samples were collected with a bottom dredge with an opening of 0.09 m^2. At each station, from one to three samples were obtained (total of 34 zoobenthos samples), washed through a sieve of 0.5 mm mesh size and fixed with 4% formaldehyde. In the laboratory, benthic organisms were sorted, identified to species level when possible and counted. At intertidal stations some large organisms were additionally collected and identified.

Some zoobenthos species were obtained from three locations at Ras Al-Ardh and near the Mariculture and Fisheries Department (MFD, Salmiya) during the implementation of biofouling experiments during March-August 2009.

In December 2009, and in March, June and September 2010 macrozoobenthos samples were collected from five locations (K1–K5) in Kuwait Bay by Van Veen bottom grab sampler with a sampling area of 0.05 m^2 (Al-Rifaie et al., 2012).

Fig. 1. Location of benthic sampling stations (December 2004 – April 2012).

- December 2004;
- December 2009, March, June and September 2010;
- November 2011 – April 2012.

Table 2. Characteristics of Benthic Sampling Stations (December 2004– April 2012).

Survey	Stations	Transects, Locations	Coordinates	Depth, m	Bottom grab area sampled, m^2
2004	**1**	Failaka Island	29°19´59″N; 48° 10´04″E	18	0.1
	2		29°21´26″N; 48°17´52″E	3	0.1
	3		29°25´02″N; 48°29´59″E	14	0.1
	4		29°22´31″N; 48°23´20″E	3	0.1
	5		29°20´44″N; 48°21´25″E	5	0.1
	K 6	Kuwait Bay	29°27´00″N; 47°58´00″E	12	0.15
	K 7		29°29´02″N; 47°57´01″E	7	0.1
	K 8		29°30´48″N; 47°56´03″E	3	0.05
	K 9		29°31´44″N; 47°55´51″E	2	0.1
	10	Bubiyan Island	29°30´43″N; 48°14´47″E	5	0.1
	11		29°32´88″N; 48°14´47″E	4	0.1
	12		29°34´51″N; 48°12´29″E	5	0.15
	13		29°35´58″N; 48°09´50″E	7	0.1
	17		29°35´43″N; 48°16´42″E	3	qualitative
	14	Shuwaikh	29°20´13″N; 47°53´51″E	intertidal	0.18
	15	Ras Al-Zour	28°45´25″N; 48°20´36″E	intertidal	0.18
	16	Ras Al-Ardh, beach	29°20´37″N; 48°06´05″E	intertidal	0.18
2009 - 2010	**K 1**	Kuwait Bay	29°30.03´N; 47° 53.15´E	2.5	0.05
	K 2	Kuwait Bay	29°28.58´N; 47° 54.34´E	5.5	0.05
	K 3	Kuwait Bay	29°28.18´N; 47° 55.43´E	7.5	0.05
	K 4	Kuwait Bay	29°27.49´N; 47° 57.09´E	9.5	0.05
	K 5	Kuwait Bay	29°26.49´N; 47°58.59´E	12	0.05
2011 - 2012	**1.1**	Khor Al-Sabbiya	29°44´28″N; 48°05´45″E	intertidal	qualitative
	1.2	Khor Al-Sabbiya	29°44´33″N; 48°05´20″E	intertidal	qualitative
	1.3	Khor Al-Sabbiya	29°54´31″N; 48°00´17″E	intertidal	qualitative
	3.1	Doha West	29°21´46″N; 47°43´48″E	intertidal	qualitative
	3.2	Doha West	29°21´30″N; 47°42´49″E	intertidal	qualitative
	3.3	Kuwait Bay	29°22´46″N; 47°42´15″E	intertidal	qualitative
	4.1	Doha West	29°22´39″N; 47°45´49″E	intertidal	qualitative
	4.2	Doha West	29°22´10″N; 47°44´40″E	intertidal	qualitative
	4.3	Doha Port	29°23´06″N; 47°50´18″E	intertidal	qualitative
	5.1	Ras Al-Ardh, marina	29°20´47″N; 48°06´02″E	intertidal	qualitative
	5.2	Fahaheel	29°05´59″N; 48°08´18″E	intertidal	qualitative
	5.3	Mahboula	29°08´43″N; 48°07´48″E	intertidal	qualitative
	6.1	Ras Al-Julaiah	28°52´59″N; 48°16´44″E	intertidal	qualitative
	7.1	Kubbar Island	29°04′20″N; 48°29′36″E	intertidal	qualitative
	8.1	Qaruh Island	28°49′12″N; 48°46′27″E	intertidal	qualitative
	9.1	Abu Al-Hassaniya	29°12′30″N; 48°06′33″E	intertidal	qualitative

During the period of November 28, 2011 to April 5, 2012, macrozoobenthos organisms were collected manually from 16 stations in the intertidal zone along the coasts of Kuwait from Khor Al-Sabbiya and Kuwait Bay to Ras Al-Julaiah, Kubbar and Qaruh islands during the field trips of the Oceanography Group at KISR.

Kuwait waters are shallow. The northern waters (off Bubiyan Island) are influenced by the discharges from Shatt Al-Arab River and Shatt Al-Basrah Channel. Kuwait Bay is relatively vast and shallow (about 12 m deep). The mean salinity of Kuwait Bay is 41.4 PSU and mean turbidity is 10.4 mg/l. The bottom substrates of the Bay are composed mainly of silt or silty clay. During the survey, the sediments had a foul smelling of hydrogen sulphide. Sediments in the central part of Kuwait Bay contain a large fraction of urchin spines and shells debris. Bottom ground at the intertidal station 14 is muddy-silt with a strong smell of hydrogen sulphide, as it is under considerable anthropogenic load owing to municipal sewage discharge. In low intertidal zone of Doha West, reefs were observed which are formed by constructions of polychaeta *Pomatoleios kraussii*.

The waters off Bubiyan Island are very turbid (43.66 mg/l). Mean salinity (35.26 PSU) encountered in this area during the spring period was lower than in the rest of Kuwait waters. The seabed is predominantly silty, with sandy patches in the immediate vicinity of the Island. The coastal rocks in the middle part of Khor Al-Sabbiya consist of valves of *Ostrea* sp.

Samples collected from the deeper station near Failaka Island (about 20 m deep) displayed lower mean concentration of dissoved oxygen (1.46 mg/l), and lower mean turbidity (3.83 mg/l) than in Kuwait Bay and near Bubiyan Island.

At the southern intertidal stations in Ras Al-Julaiah and Ras Al-Zour, the seawater transparency was highest for the examined area. The seabed is sandy, with more or less developed coral reefs.

In assessing macrozoobenthos diversity, the biodiversity indices of Shannon-Weaver (Shannon and Weaver 1963) and Simpson (Simpson, 1949) (H´ and 1-λ´, respectively), as well as Margalef's index (D) (Margalef 1958) for species richness were used. Dominance was assessed by means of Simpson index (λ´) (Simpson 1949), and evenness by Pielou index (J´) (Pielou 1966).

"And God has created from water every living creature: so of them is that which walks upon its belly, and of them is that which walks upon two feet, and of them is that which walks upon four; Allah creates what He pleases; surely Allah has power over all things."

The Qur'an (English Translation)

DIVERSITY AND ABUNDANCE OF MACROZOOBENTHOS FROM KUWAIT WATERS

The bottom fauna displayed high taxonomic diversity, however, only 12 species were characteristic of the studied area (present in 25–50 % of stations): for polychaetes – *Nephtys tulearensis, Sternaspis scutata, Paraprionospio pinnata, Sigambra tentaculata* and *Cossura* sp.; for crustaceans – *Ampelisca* sp., *Iphinoe* sp. and *Gnathia* sp., and for mollusks – *Tornatina incospicua, Retusa* sp., *Chrysallida* sp., and *Tesseracme quadrapicalis*.

The number of species found at stations situated in the subtidal zone varied between 14 and 46, with an average of 30 species. Maximum number of species per station was registered at station 3 off Failaka Island (depth 2 m; salinity of 40.5 PSU; turbidity of 3.32 mg/l) and minimum at station 13 in Khor Al-Sabiyah off Bubiyan Island (depth 7 m; salinity of 35.26 PSU; turbidity of 43.66 mg/l). The abundance of macrozoobenthos varied in the range of 340–1800 ind./m^2, with an average of 795 ind./m^2. In general, the subtidal bottom grounds in the studied area are composed of silts. The most abundant benthic organisms are polychaetes, gastropods and crustaceans. Maximum abundance of macrozoobenthos was registered at station K8 (3 m depth) in Kuwait Bay; small gastropods, *Tornatina inconspicua* and *Chrysallida* sp. contributed 50% and 14%, respectively, to the total abundance of benthic organisms.

Quantitative characteristics of macrozoobenthos differed among Failaka-Bubiyan and Kuwait Bay. In Kuwait Bay, the average abundance of benthic organisms was greater and the number of species was lower than near Failaka and Bubiyan Islands. The polychaete *Magelona cornuta* and crustaceans *Periculodes* sp., *Eocuma* sp., and *Cyclaspis* sp. were absent from the sampled Kuwait Bay stations. The

percentage composition of the abundances of the different taxonomic groups inhabiting the Bay was different from that of the other sampled areas. The overwhelming majority in Kuwait Bay were bivalves (62%), followed by polychaetes (20%) and crustaceans (7%). Polychaetes and crustaceans prevailed at the other two areas of Bubiyan and Failaka Islands.

Analysis of macrozoobenthos distribution shows, that in the examined depth range of 2–20 m, the abundance of macrozoobenthos decreased with increasing station depth while the number of registered species increased.

Species richness (D) and diversity (H´, $\log_2$), were high (5.158 ± 0.812; 2.39 ± 0.64) in Kuwait Bay. In the area near Failaka Island Pielou index (J´) also yielded very high estimate (0.933 ± 0.028) approximating 1.0, which indicates high evenness level of the community. For Kuwait Bay, the corresponding Pielou index estimate decreased to 0.769 ± 0.125. Dominance index (λ´) fluctuated from 0.03 to 0.28, the maximum was registered at station K8 (Kuwait Bay), where about half of the total macrozoobenthos abundance was due to the abundance of the small gastropod *Tornatina incospicua*. In general, the level of dominance was high (0.184 ± 0.98) in the benthic community of Kuwait Bay and very low (0.046 ± 0.009) near Failaka Island that conforms to the statement that the higher the dominance, the less biodiversity in the area. Thus, the obtained results of the study suggest that the benthic community in Kuwait Bay is less diverse than that off Failaka Island.

Previous studies in Kuwait Bay, indicated that in polluted areas with high trace metal concentrations, lower species diversity of benthic organisms was recorded (Bu-Olayan and Thomas, 2005). Additionally, results of a study conducted by Al-Zamel et al. (2009), referred to the environmental setting of Sulaibikhat Bay in which tidal currents bring in exceptionally high amounts of nutrients and in which the tidal flats are strongly and adversely polluted.

For stations sampled near Bubiyan Island, all the studied indices varied in a broader range. The obtained averages indicate that, based on the entire set of measured biodiversity parameters, benthic community of this area should be regarded as intermediate between the communities of Failaka Island and Kuwait Bay.

Abundance of macrozoobenthos in the intertidal zone substantially differed among stations. Station 16 (MFD/Ras Al-Ardh) displayed the largest diversity (38 species) and highest abundance (nearly 18,000 ind./m^2); most abundant are the polychaete *Lumbrineris impatiens*, and the gastropod *Caecum* sp., lancelets (*Branchiostoma* sp.), small crustaceans, and juvenile bivalve mollusks of several species. It is noteworthy that the total macrozoobenthos abundance at station 16 is more than 75% higher than at the other intertidal stations owing to the high juvenile abundance of two bivalve mollusks of the genus *Tellina* (*Tellina donacina* and *Tellina* sp.). These larval or juvenile forms were encountered in the collected benthic samples, probably soon after the larvae had settled on the bottom substrate. The settling larvae were about 0.3 mm in size; the majority of larvae in the collected samples were of 1 mm size. The unusually high abundance of macrozoobenthos at station 16 was probably due to its position in an area with less wave actions.

A total of 18 species of macrozoobenthos were found at station 15 (Ras Al-Zour), with a total abundance of 260 ind./m^2. Most numerous were the polychaete *Glycera tridactyla*, the gastropod *Umbonium vestiarium* and small crustaceans of six species.

The least diversity (7 species) was registered at station 14 in Kuwait Bay (KISR/Shuwaikh). The gastropod *Cerithidae* sp. (38% of the total abundance), unidentified oligochaetes (18%) and large nematodes prevailed. These organisms are well adapted to the oxygen deficient substrate. Their presence in the absence of crustaceans and the extraordinary strong smell of hydrogen sulphide indicate anoxic conditions in the bottom sediment.

Though the obtained data are insufficient to provide for a detailed analysis of macrozoobenthos diversity in the intertidal zone, however, they indicate that the diversity is not as high as in the subtidal zone. Comparison between the three areas of Kuwait Bay, Failaka and Bubiyan Islands indicates that in Kuwait Bay the species richness and diversity both in the intertidal and subtidal zones are the lowest. Probably, this could be due to special oceanographic conditions as well as pollution impact from sewage and industrial discharges into the Bay (Al-Yamani et al. 2001).

Comparison of abundance of macrozoobenthos in the Arabian Gulf and in some other seas shows that the abundance of bottom-dwelling organisms in the silty biotope of the Arabian Gulf is superior to the Aegean, Mediterranean and Red seas but second to the Adriatic Sea.

High taxonomic diversity and the absence of dominating forms are characteristic of the bottom fauna of Kuwait's marine environment. The abundance of macrozoobenthos varied from 260 to 18,400 ind./m^2. At stations with 2 to 20 m depths, the average abundance of macrozoobenthos was 795 ind./ m^2. The groups prevailing in the subtidal zone were polychaetes, gastropods and crustaceans (32, 29 and 22%, respectively).

Generally, macrozoobenthos of Kuwait's marine environment has high species diversity and low dominance level though biodiversity estimates may markedly differ depending upon the locality. Compared with other locations under the study, Kuwait Bay harbors less diverse benthic community.

SYSTEMATIC ACCOUNT OF ZOOBENTHOS SPECIES FROM KUWAIT WATERS

Nearly 476 species, which represent 12 phyla of macrozoobenthos were recorded from the collected samples. The most diverse groups were Polychaeta (124 species), Gastropoda (130 species), Bivalvia (99 species) and Arthropoda (82 species). Lower number of species were encountered for Echinodermata (16 species), Cnidaria (5 species), Sipunculida (3 species), Scaphopoda (3 species), Echiurida (3 species), Chordata (3 species) Bryozoa (2 species) and Pantopoda (2 species). Brachiopoda, Polyplacophora, Tentaculata and Hemichordata were represented with one species each. Organisms attributed to Nemertini, Turbellaria and Oligochaeta were not identified to species level. The macrozoobenthic species that were encountered in Kuwait's intertidal and subtidal sampled areas are listed in Table 3.

Table 3. A list of the macrozoobenthic species encountered in Kuwait's Marine Environment

Phylum	Class	Order	Family	Genus / Species
CNIDARIA	**HYDROZOA**	**Thecata**	**Campanulariidae**	*Obelia dichotoma* (Linnaeus, 1758)
	ANTHOZOA	**Actiniaria**		Actiniaria gen. sp.1
				Actiniaria gen. sp. 2
				Actiniaria gen. sp. 3
				Actiniaria gen. sp. 4
ECTOPROCTA	**GYMNOLAEMATA**	**Cheilostomata**	**Bugulidae**	*Bugula neritina* (Linnaeus, 1758)
			Schizoporellidae	*Schizoporella errata* (Waters, 1878)
PHORONIDA			**Phoronidae**	*Phoronis* spp.
ANNELIDA	**POLYCHAETA**	**Amphinomida**	**Amphinomidae**	*Paramphinome* sp.
		Eunicida	**Dorvilleidae**	*Dorvillea* sp.
				Protodorvillea sp.*
				Schistomeringos incerta (Schmarda, 1861)
				Schistomeringos sp.
			Eunicidae	*Eunice indica* Kinberg, 1865
				Eunice laticeps Ehlers, 1868*
			Lumbrineridae	*Lumbrineris heteropoda* (Marenzeller, 1879)
				Lumbrineris impatiens Claparède, 1868**
				Lumbrineris latreilli (Audouin and Milne-Edwards, 1833)
				Lumbrineris sp.
				Ninoe pulchra (Wesenberg-Lund, 1949)
			Onuphidae	*Diopatra neapolitana* Delle Chiaje, 1841
				Onuphis sp.
		Phyllodocida	**Chrysopetalidae**	*Bhawania goodei* Webster, 1884
			Glyceridae	*Glycera rouxii* Audouin and Milne-Edwards, 1833
				Glycera tesselata Grube, 1840
				Glycera tridactyla Schmarda, 1861
				Glycera unicornis Savigny in Lamarck, 1818
			Goniadidae	*Glycinde* sp.*
				Goniada sp.
			Hesionidae	*Ophiodromus latifrons* (Grube, 1878)
				Hesionidae gen. sp.
			Nephtyidae	*Aglaophamus* sp.

Phylum	Class	Order	Family	Genus and Species
				Micronephtys sphaerocirrata (Wesenberg-Lund, 1949)
				Micronephtys sp.
				Nephtys tulearensis Fauvel, 1919
			Nereididae	*Leonnates indicus* Kinberg, 1866
				Leonnates persicus Wesenberg-Lund, 1949
				Nereis pelagica Linnaeus, 1761*
			Pilargidae	*Sigambra tentaculata* (Treadwell, 1949)*
				Ancistargis sp.*
				Ancistrosyllis sp.
			Phyllodocidae	*Eteone ornata* Grube, 1878**
				Phyllodocidae gen. sp.
			Polynoidae	*Harmothoe dictyophora* (Grube, 1878)
				Harmothoe minuta (Potts, 1910)*
				Harmothoe sp.
				Lepidasthenia sp.
			Syllidae	*Sphaerosyllis* sp.
				Exogone sp.
				Syllis cornuta Rathke, 1843
				Typosyllis cornuta (Rathke, 1843)
				Syllidae gen. sp.
		Sabellida	**Sabellidae**	*Branchiomma cingulata* (Grube, 1870)
				Sabellidae gen. sp.
			Serpulidae	*Hydroides heterocerus* (Grube, 1868)
				Pomatoleios kraussii (Baird, 1865)
				Spirobranchus tetraceros (Schmarda, 1861)
		Spionida	**Chaetopteridae**	*Chaetopterus* sp.
			Magelonidae	*Magelona cornuta* Wesenberg-Lund, 1949*
			Poecilochaetidae	*Poecilochaetus* sp.
			Spionidae	*Laonice cirrata* (Sars, 1851)
				Paraprionospio pinnata (Ehlers, 1901)
				Polydora sp.
				Prionospio aucklandica Augener, 1923

Phylum	Class	Order	Family	Genus and Species
				Prionospio cirrifera Wiren, 1883*
				Pseudopolydora sp. **
				Spionidae gen. sp.
			Chaetopteridae	*Spiochaetopterus* sp. *
		Terebellida	**Ampharetidae**	*Amage* sp.
				Amphicteis sp.**
				Melinna sp.
				Melinnopsis sp.
				Samythopsis grubei McIntosh, 1885
				Ampharetidae gen. sp.
			Cirratulidae	*Cirratulus* sp.1
				Cirratulus sp.2
				Cirriformia chrysoderma (Claparede, 1869) *
				Dodecaceria sp.*
				Tharyx multifilis Moore, 1909
				Tharyx sp.1
				Tharyx sp.2
			Flabelligeridae	*Brada mamillata* Grube, 1877
				Diplocirrus glaucus (Malmgren, 1867)**
				Flabelligera diplochaitos Otto,1821*
				Pherusa (Stylaroides) plumosa (O.F. Müller, 1776.)**
			Pectinariidae	*Pectinaria antipoda* Schmarda, 1861
			Sternaspidae	*Sternaspis scutata* (Ranzani, 1817)
			Terebellidae	*Lanice conchilega* (Pallas, 1766)
				Loimia medusa (Savigny, 1822)
				Lysilla pambanensis Fauvel, 1928 **
				Pista cristata (O.F.Muller, 1776) *
				Terebellidae gen. sp.
			Trichobranchidae	*Terebellides stroemi* Sars, 1835
				Terebellides sp.
				Trichobranchus sp.*
			Capitellidae	*Capitella capitata* (Fabricius, 1780)

Phylum	Class	Order	Family	Genus and Species
				Capitella sp.
				Capitomastus sp.*
				Dasybranchus sp.
				Heteromastus filiformis (Claparede, 1864)*
				Notomastus latericeus Sars, 1851
				Parheteromastus tenuis Monro, 1937**
				Rashgua rubrocincta Wesenberg-Lund, 1949
				Capitellidae gen. sp.
			Cossuridae	*Cossura laeviseta* Hartman-Shroder, 1962.*
			Maldanidae	*Euclymene annandalei* Southern, 1921
				Euclymene insecta (Ehlers, 1905)**
				Euclymene sp.
				Maldane cristata Treadwell, 1923
				Maldane sarsi Malmgren, 1865*
				Rhodine sp.
				Maldanidae gen. sp.
			Paraonidae	*Aricidea longobranchiata* Day, 1961
				Aricidea sp.
				Cirrophorus branchiatus Ehlers, 1908 *
				Cirrophorus harpagoneus (Storch, 1967)
				Cirrophorus sp.
				Levinsenia gracilis (Tauber, 1879) *
				Levinsenia sp.*
				Paraonis sp.*
				Tauberia (?) sp.
			Opheliidae	*Ophelina acuminata* Ørsted, 1843
			Orbiniidae	*Orbiniella* sp.
				Scoloplos (Leodamas) chevalieri (Fauvel, 1902)
				Scoloplos sp.
ECHIURA	**ECHIUROIDEA**	**Echiurida**	**Echiuridae**	*Anelassorhynchus branchiorhynchus* (Annandale and Kemp, 1915)
				Listriolobus brevirostris Chen and Yeh, 1958
			Ikedidae	*Ikeda pirotansis* (Menon and Datta Gupta, 1962)

Phylum	Class	Order	Family	Genus and Species
SIPUNCULA	**SIPUNCULIDEA**	**Golfingiida**	**Phascolionidae**	*Phascolion convestitum* Sluiter, 1902
				Phascolion valdiviae var.sumatrense V.Fisher, 1919
				Phascolion spp.
	PHASCOLOSOMATIDEA	**Phascolosomatida**	**Phascolosomatidae**	*Apionsoma trichocephalus* Sluiter, 1902
				Sipuncula gen. sp.
BRACHIOPODA	**LINGULATA**	**Lingulida**	**Lingulidae**	*Lingula* sp.
MOLLUSCA	**POLYPLACOPHORA**	**Neoloricata**	**Ischnochitonidae**	*Ischnochiton yerburyi* (E. A. Smith, 1891)
	GASTROPODA	**Caenogastropoda**	**Cerithiidae**	*Bittium* sp.
				Cerithium caeruleum Sowerby, 1855
				Cerithium scabridum Philippi, 1848
				Cerithidium cerithinum (Philippi, 1849)
				Cerithidea (Cerithideopsilla) cingulata (Gmelin, 1791)
				Clypeomorus bifasciatus bifasciatus (G.B. Sowerby II, 1855)
				Clypeomorus bifasciatus persicus Houbrick, 1985
				Potamides conicus (de Blainville, 1829)
				Rhinoclavis kochi (Philippi, 1848)
				Cerithiidae gen. sp.
			Cerithiopsidae	*Cerithiopsis* sp.
			Naticidae	*Glossaulax didyma* (Röding, 1798)
				Cellana rota Gmelin, 1791
			Cassidae	*Casmaria ponderosa* (Link, 1807)*
			Planaxidae	*Planaxis sulcatus* (Born, 1787)
			Littorinidae	*Echinolittorina arabica* (El Assal, 1990)
			Vermetidae	*Serpulorbis variabilis* Hadfield and Kay, 1972
			Epitoniidae	*Epitonium* sp.
		Hypsogastropoda	**Caecidae**	*Caecum* sp.
			Calyptraeidae	*Calyptraea pellucida* (Reeve, 1859)
				Calyptraea sp.
				Crepidula walshi Reeve, 1859
			Conidae	*Conus* sp. (juv.)
			Columbellidae	*Mitrella blanda* (Sowerby, 1884)
				Zafra selasphora (Melvill and Standen, 1901)

Phylum	Class	Order	Family	Genus and Species
			Turridae	*Pseudodaphnella (Costellaria) daedala* (Reeve, 1845)
				Turridae gen. sp.
			Costellariidae	*Costellaria* sp.
				Vexillum (Costellaria) diaconalis (Melvill and Stander, 1903)
				Vexillum (Pusia) osiridis (Issel, 1869)
				Costellariidae gen. sp.
			Muricidae	*Cronia konkanensis* (Melvill, 1893)
				Hexaplex kuesterianus (Tapparone-Caniferi, 1875)
				Murex scolopax Dillwyn, 1817
				Rapana rapiformis (Born, 1778)
				Rapana venoza (Valeciennses, 1846)
				Thais savignyi (Deshayes, 1844)
				Thaisella lacera (Born, 1778)
				Thaisella tissoti (Petit de la Saussaye, 1852)
			Mitridae	*Scabricola desetangsii* (Kiener, 1838)*
			Ranellidae	*Cymatium* sp.
			Cypraeidae	*Cypraea grayana* Schilder, 1930
				Cypraea lamarckii Gray, 1825
				Cypraea lentiginosa (J. E. Gray, 1825)
				Cypraea pulchra Gray, 1824
				Cypraea (Erosaria) turdus (Lamarck, 1810)
			Cystiscidae	*Gibberula mazagonica* (Melvill, 1892)
				Granulina oodes (Melvill, 1898)
			Iravadiidae	*Pseudonoba alphesiboei* (Melvill, 1912)
				Pseudonoba columen (Melvill, 1904)
			Eulimidae	*Hypermastus* epiphanes (Melvill, 1897)
				Melanella cumingi (A. Adams, 1854)
				Melanella sp.
			Nassariidae	*Nassarius albescens* (Dunker, 1846)
				Nassarius concinnus (Powys, 1835)
				Nassarius emilyae Moolenbeek and Dekker, 1994
				Nassarius frederici (Melvill and Standen, 1901)

Phylum	Class	Order	Family	Genus and Species
				Nassarius marmoreus (A. Adams, 1852)
				Nassarius persicus (Martens, 1874)
				Nassarius sp.
			Rissoidae	*Rissoina* sp.
			Strombidae	*Strombus decorus* (Röding, 1798)
				Strombus persicus (Swainson, 1821)
				Tibia insulaechorab Röding, 1798
				Terebellum terebellum (Linnaeus, 1758)
			Drilliidae	*Splendrillia* sp.
			Terebridae	*Terebra* sp.
				Terebridae gen. sp.
			Tonnidae	Tonnidae gen. sp. (juv).
			Vanikoridae	*Vanicoro* sp.
		Neogastropoda	**Olividae**	*Ancilla castanea* (Sowerby I, 1830)
				Fusinus arabicus (Melvill, 1898)
			Buccinidae	*Cantharus wagneri* (Anton, 1838)
		Heterostropha	**Acteonidae**	*Acteon* sp.
				Pupa affinis (A.Adams, 1855)
			Architectonicidae	*Architectonica* sp.
				Heliacus sp.
				Architectonicidae gen. sp.
			Amathinidae	*Leucotina gratiosa* Melvill, 1898
			Pyramidellidae	*Chrysallida* sp.
				Chrysallida sp. (juv.)
				Odostomia eutropia Melvill, 1899
				Odostomia sp.
				Pyramidella sp.
				Syrnola aclys (A. Adams, 1854)
				Syrnola brunnea (A. Adams, 1854)
				Syrnola sp.
				Turbonilla icela Melvill, 1910
				Turbonilla linjaica (Melvill and Standen, 1901)

Phylum	Class	Order	Family	Genus and Species
				Pyramidellidae gen. sp.
			Ringiculidae	*Ringicula propinquans* Hinds, 1844
		Heterobranchia	**Omalogyridae**	*Omalogyra japonica* (Habe, 1972)
				Omalogyra sp.
		Cephalaspidea	**Haminoeidae**	*Atys pellyi* (Smith, 1872)
				Atys sp.
				Atys sp.1
				Haminoea vitrea (A. Adams in Sowerby, 1850)
			Bullidae	*Bulla ampulla* Linnaeus, 1758
			Cylichnidae	*Cylichna collyra* Melvill, 1906
				Cylichna cylindracea Pennant, 1777
				Cylichna sp.
			Retusidae	*Retusa* sp.
			Scaphandridae	*Tornatina inconspicua* H. Adams, 1872
				Tornatina persiana Smith, 1872
				Tornatina sp.
		Basommatophora	**Siphonariidae**	*Siphonaria belcheri* Hanley, 1858
				Siphonaria savignui Krauss, 1848
		Cycloneritimorpha	**Neritidae**	*Nerita* sp.
		Eupulmonata	**Ellobiidae**	*Ellobium* sp.
		Nudibranchia	**Dotidae**	*Doto kya* Marcus, 1961**
			Eubranchidae	*Eubranchus misakiensis* Baba, 1960**
			Flabellinidae	*Flabellina amabilis* Hirano and Kuzirian, 1991**
			Tergipedidae	*Cuthona albocrusta* (MacFarland, 1966)**
				Nudibranhia gen. sp.
		Sacoglossa	**Limapontiidae**	*Placida daguilarensis* Jensen, 1990**
		Vetigastropoda	**Fissurellidae**	*Diodora funiculata* (Reeve, 1850)
				Diodora rueppellii (G.B. Sowerby I, 1835)
			Phasianellidae	*Tricolia* sp.
			Trochidae	*Clanculus pharaonius (Linnaeus, 1758)*
				Ethminolia degregorii (Caramagna, 1888)
				Euchelus asper (Gmelin, 1791)

Phylum	Class	Order	Family	Genus and Species
				Monilea chiliarches Melvill, 1910
				Monodonta nebulosa (Forsskal, 1775)
				Trochus erithreus Brocchi, 1823
				Trochus fultoni Melvill, 1898
				Umbonium vestiarum Linnaeus, 1758
				Priotrochus obscurus (W. Wood, 1828)
				Stomatella auricula Lamarck, 1816
			Turbinidae	*Lunella coronata* (Gmelin, 1791)
				Turbo radiatus Gmelin, 1791
		Systellommatophora	**Onchidiidae**	*Peronia peronii* (Cuvier, 1804)
	BIVALVIA	**Carditoida**	**Carditidae**	*Carditella* sp.
				Cardites bicolor (Lamarck, 1819)
				Cardites sp.
		Euheterodonta	**Periplomatidae**	*Periploma indicum* Melvill, 1898
			Galeommatidae	*Amphilepida faba* (Deshayes, 1856)
				Amphilepida peilei (Tomlin, 1921)
				Amphilepida spp.
				Scintilla sp.
			Cardiidae	*Fulvia fragile* (Fosskal, 1775)
				Trachycardium assimile (Reeve, 1845)
				Trachycardium lacunosum (Reeve, 1845)
				Trachycardium rubicundum (Reeve, 1845)
				Cardiidae gen. sp.
			Chamidae	*Chama brassica* Reeve, 1847
				Chama reflexa Reeve, 1846
				Chama sp.
			Corbulidae	*Corbula sulculosa* H. Adams, 1870
				Corbula taitensis Lamarck, 1818
			Lasaeidae	*Curvimysella* sp.
			Donacidae	*Donax* sp. (juv.)
			Psammobiidae	*Asaphis violascens* (Forsskal, 1775)
				Gari maculosa (Lamarck, 1818)

Phylum	Class	Order	Family	Genus and Species
				Gari sp.
				Hiatula ruppelliana (Reeve, 1857)
			Kelliidae	*Kellia* sp.
				Marikellia sp.
			Lucinidae	*Loripes* sp. (juv.)
			Mactridae	*Mactra lilacea* Lamarck, 1818
				Mactrinula sp.
			Semelidae	*Ervilia* sp. (juv.)
				Syndesmya sp.
				Theora cadabra (Eames and Wilkins, 1957)
			Tellinidae	*Tellina arsinoensis* Issel, 1869
				Tellina donacina (Linnaeus, 1758)
				Tellina methoria Melvill, 1897
				Tellina valtonis Hanley, 1844
				Tellina vernalis Hanley, 1844
				Tellina sp.1
				Tellina sp.2 (juv.)
				Soletellina rosea (Gmelin, 1791)
				Loxoglypta rhomboides (Quoy and Gaimard, 1835)
			Veneridae	*Amiantis umbonella* (Lamarck, 1818)
				Bassina calophylla (Philippi, 1846)
				Callista florida (Lamarck, 1818)
				Circe intermedia Reeve, 1863
				Diplodonta sp.
				Dosinia alta (Dunker, 1849)
				Dosinia erythraea Römer, 1860
				Dosinia sp.1 (juv.)
				Dosinia sp. 2 (juv.)
				Lioconcha ornata (Dillwyn, 1817)
				Marcia marmorata Lamarck, 1822
				Marcia opima (Gmelin, 1791)
				Paphia textile (Gmelin, 1791)

Phylum	Class	Order	Family	Genus and Species
				Paphia sp.
				Protapes cor (Lamarck, 1818)
				Protapes sinuosa (Lamarck, 1818)
				Tapes bruguierei (Hanley, 1845)
				Tapes sulcarius (Lamarck, 1818)
				Timoclea sp.1 (juv.)
				Timoclea sp.2 (juv.)
				Turtonia minuta (Fabricius, 1780)
				Turtonia sp.
				Venerupis rugosa (G.B. Sowerby II, 1854)
				Veneridae gen.sp.
			Trapezidae	*Trapezium sublaevigatum* (Lamarck, 1819)
			Solenidae	*Solen dactylus* Cosel, 1989
			Lucinidae	*Anodontia edentula* (Linnaeus, 1758)
		Arcoida	**Arcidae**	*Acar abdita* Oliver and Chesney, 1994
				Acar plicata (Dillwyn, 1817)
				Anadara ehrenbergi (Dunker, 1868)
				Anadara erythraeonensis Philippi, 1851
				Anadara sp. (juv.)
				Arca sp. (juv.)
				Barbatia decussata (Sowerby I, 1833)
				Barbatia foliata (Forsskal, 1755)
				Barbatia fusca (Bruguiere, 1789)
				Barbatia setigera (Reeve, 1844)
				Barbatia sp. (juv.)
			Glycymerididae	*Glycymeris livida* (Reeve, 1843)
				Glycymeris pectunculus (Linnaeus, 1758)
			Noetiidae	*Didimacar tenebrica* (Reeve, 1844)
		Mytiloida	**Mytilidae**	*Brachidontes variabilis* (Krauss, 1848)
				Gregariella simplicifilis Barnard, 1964
				Lithophaga robusta (Jousseaume MS in Lamy, 1919)
				Musculista senhousia (Benson, 1842)

Phylum	Class	Order	Family	Genus and Species
		Pectinoida	**Pectinidae**	*Chlamys livida* (Lamarck, 1819)
			Spondylidae	*Spondylus marisrubri* Röding, 1798
				Spondylus variegatus Schreibers, 1793*
		Nuculanoida	**Yoldiidae**	*Yoldia tropica* Melvill, 1897
			Nuculidae	*Nucula inconspicua* H.Adams, 1871
				Nucula sp.
				Nuculoma layardii (A. Adams, 1856)
			Ostreidae	*Ostrea* sp.
				Saccostrea cucullata (Born, 1778)
			Malleidae	*Malvifundus normalis* (Lamarck, 1819)
			Pinnidae	*Pinna bicolor* Gmelin, 1791
			Pteriidae	*Pinctada margarinifera* (Linnaeus, 1758)
				Pinctada radiata (Leach, 1814)
	SCAPHOPODA	**Gadilida**	**Gadilidae**	*Cadulus euloides* Melvill and Standen, 1901
		Dentaliida	**Dentaliidae**	*Dentalium octangulatum* Donovan, 1803
				Tesseracme quadrapicalis (Sowerby, 1869)
ARTHROPODA	**MAXILLOPODA**	**Cyclopoida**		Cyclopoida gen. sp.
		Sessilia	**Balanidae**	*Balanus amphitrite* Darwin, 1854
				Balanus sp.
				Euraphia withersi (Pilsbry, 1916)
				Megabalanus tintinnabulum (Linnaeus, 1758)
				Megabalanus sp.
	MALACOSTRACA	**Amphipoda**	**Ampeliscidae**	*Ampelisca* sp.
				Byblis sp.
			Ampithoidae	*Ampithoe* sp.
				Cymadusa sp.
			Cyproideidae	*Cyproidea* sp.
			Corophiidae	*Corophium* sp.
				Siphonoecetes sp.
			Isaeidae	*Cheiriphotis* sp.
				Microphotis blachei Ruffo, 1952
				Isaeidae gen .sp.

Phylum	Class	Order	Family	Genus and Species
			Ischyroceridae	*Ericthonius* sp.
			Lysianassidae	*Orchomene* sp.
			Melitidae	*Ceradocus* sp.
				Eriopisa sp.
				Melita sp.
				Melitidae gen. sp.
			Oedicerotidae	*Perioculodes aequimanus* (Korssman, 1880)
				Perioculodes sp.
				Synchelidium sp.
				Sinoediceros homopalmatus Shen, 1955
			Platyischnopidae	*Platyischnopus herdmani* Walker, 1904
			Urothoidae	*Urothoe grimaldii* Chevreux, 1895
				Urothoe sp.
			Pariambidae	*Deutella* sp.
			Photidae	*Photis* sp.
		Tanaidacea	**Apseudidae**	*Apseudes* sp.
				Apseudopsis sp.
				Apseudidae gen. sp.
		Isopoda	**Anthuridae**	*Apanthura sandalensis* Stebbing, 1900
			Arcturidae	Arcturidae gen. sp.
			Gnathiidae	*Gnathia* sp.
				Isopoda gen. sp.
		Cumacea	**Bodotriidae**	*Bodotria* sp.
				Cumopsis sp.
				Cyclaspis sp.
				Eocuma affine Calman, 1904
				Eocuma rosae Corbera and Galil, 2007
				Eocuma sp.
				Iphinoe maeotica (Sowinskyi, 1893)
				Iphinoe sp.
			Nannastacidae	*Campylaspis* sp.
				Cumella sp.

Phylum	Class	Order	Family	Genus and Species
		Mysida	**Mysidae**	*Gastrosaccus* sp.
		Decapoda	**Alpheidae**	*Alpheus* sp.1
				Alpheus sp.2
				Athanas sp.
			Scyllaridae	*Thenus orientalis* (Lund, 1793)
			Hippidae	*Emerita holthuisi* Sankolli, 1965
			Diogenidae	*Diogenes* sp.
				Paguristes sp.
				Diogenidae gen. sp.1
				Diogenidae gen. sp.2
			Porcellanidae	*Petrolisthes carinipes* (Heller, 1861)
				Petrolisthes rufescens (Heller, 1861)
				Raphidopus sp.
				Raphidopus sp.(megalopa)
				Porcellanidae gen. sp. (zoea)
			Callianassidae	*Callianassa* sp.
			Camptandriidae	*Tylodiplax* sp.
			Dotillidae	*Ilyoplax* sp.
			Grapsidae	*Metopograpsus messor* (Forskål, 1775)
				Grapsidae gen. sp.
			Leucosiidae	*Philyra* sp.
			Majidae	Majidae gen. sp.1
				Majidae gen. sp.2
			Camptandriidae	*Cleistostoma dotilliformis* Alcock, 1900
			Ocypodidae	*Nanosesarma minutum* (DeMann, 1887)
			Portunidae	*Portunus pelagicus* (Linnaeus, 1758)
			Xanthidae	*Atergatis integerrimus* (Lamarck, 1818)
				Epixanthus frontalis (H. Milne-Edwards, 1834)
				Eurycarcinus orientalis A. Milne-Edwards, 1867
				Medaeops granulosus (Haswell, 1882)
				Pilumnus vespertilio Fabricius, 1793
				Xantho (Leptodius) exaratus H. Milne-Edwards, 1834

Phylum	Class	Order	Family	Genus and Species
				Xanthidae gen. sp.
			Macrophthalmidae	*Macrophtalmus dentipes* Lucas, in Guérin Méneville, 1836
				Macrophthalmus depressus Rüppell, 1830
	PYCNOGONIDA	**Pantopoda**	**Ascorhynchidae**	*Ascorhynchus* sp.
			Phoxichilidiidae	*Phoxiphilyra* sp.
ECHINODERMATA	**OPHIUROIDEA**	**Ophiurida**	**Amphiuridae**	*Amphipholis squamata* (Delle Chiaje, 1828)
				Amphioplus (Lymanella) hastatus (Ljungman, 1867)
				Amphioplus (Lymanella) sp.
				Amphiura aff. *fasciata* Mortensen, 1940
			Ophiotrichidae	*Macrophiothrix* sp.
	ECHINOIDEA	**Echinothuroida**	**Diadematidae**	*Diadema setosum* (Leske, 1778)
			Echinometridae	*Echinometra mathaei* (de Blainville, 1825)
		Spatangoida	**Brissidae**	*Brissopsis persica* Mortensen, 1940
		Temnopleuroida	**Temnopleuridae**	*Temnopleurus toreumaticus* (Leske, 1778)
		Cidaroida	**Cidaridae**	Cidaridae gen. sp.
		Clypeasteroida	**Clypeasteridae**	*Clypeaster humilis* (Leske, 1778)
			Astriclypeidae	*Echinodiscus auritus* Leske, 1778
	HOLOTHUROIDEA	**Aspidochirotida**	**Holothuriidae**	*Holothuria (Halodeima) atra* Jaeger, 1833
				Holothuria (Thymiosycia) arenicola Semper, 1868.
		Dendrochirotida	**Phyllophoridae**	*Ohshimella ehrenbergii* (Selenka, 1868)
	ASTEROIDEA	**Valvatida**	**Asterinidae**	*Aquilonastra burtoni* (Gray, 1840)
HEMICHORDATA	**ENTEROPNEUSTA**	**Enteropneusta**	**Harrimaniidae**	*Saccoglossus* sp.
CHORDATA	**ASCIDIACEA**	**Aplousobranchia**	**Polyclinidae**	*Polyclinum constellatum* Savigny, 1816
		Phlebobranchia	**Ascidiidae**	*Phallusia nigra* Savigny, 1816
	LEPTOCARDII	**Amphioxiformes**	**Branchiostomidae**	*Branchiostoma* sp.

* - species reported for the first time in the Arabian Gulf.

** - species reported for the first time in the seas surrounding the Arabian Peninsula: Red Sea, Gulf of Aden, Arabian Sea, Oman Sea, and the Arabian Gulf.

Phylum CNIDARIA
Class HYDROZOA
Order Thecata
Family Campanulariidae Johnston, 1836
Description: Hydroid colony stolonal or erect, branching; hydrothecae bell- or cup-shaped, radially symmetrical, sometimes secondarily bilateral symmetric, pedicellate, with basal diaphragm or inward annular thickening of perisarc; hydranth generally tubular, with flared or globose hypostome with a pregastric cavity; gonophores in gonothecae, developing into free medusae, eumedusoids or sporosacs, Medusa with short manubrium, no gastric peduncle, four radial canals (exceptionally more); with or without velum (Obelia); gonads surrounding radial canals, separated from manubrium; with or without rudimentary bulbs; no cirri, excretory papillae or pores; eight and more closed statocysts; no ocelli.
Reference: Cornelius, 1995.

Genus *Obelia*
Obelia dichotoma (Linnaeus, 1758) (Plate 1 a-b)
Distribution: Biofouling community on hard substrates in the vicinity of MFD (Salmiya).

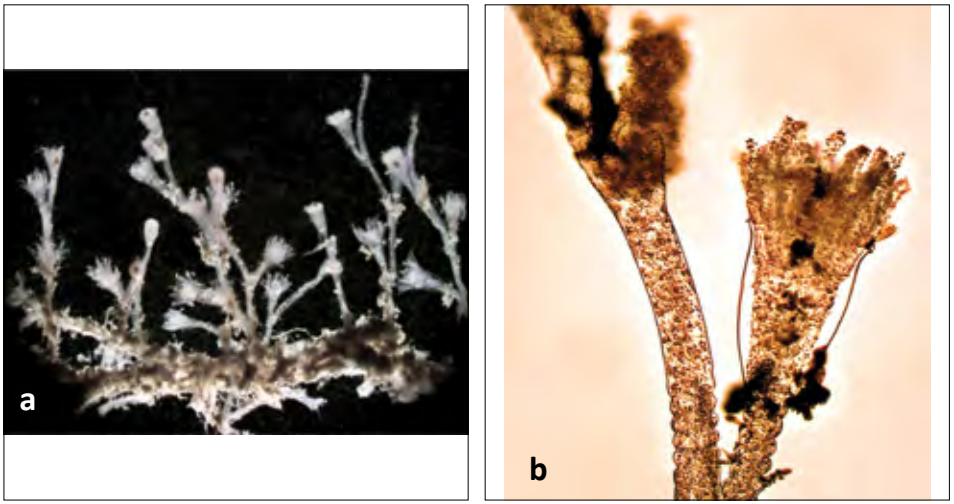


Plate 1. Hydroid polyp *Obelia dichotoma*, a. colony; b. zooid.

Class ANTHOZOA
Order Actiniaria Hertwig, 1882
Description: The order Actiniaria contains the true sea-anemones; these are solitary Hexacorallia which never possess a calcareous skeleton. Base rounded or forming an adherent disc, with or without basilar muscles. Column smooth or bearing various special organs or periderm, frequently differentiated into regions, only rarely with longitudinal ectodermal muscle. Tentacles usually arranged in cycles, more than eight present in adults, often very numerous. Mesenteries typically arranged in regular pairs and cycles but many variations occur; in most species at least some imperfect mesenteries are present. Ciliated tracts usually present on the filaments. Musculature variable in extent and development, often strong; sphincter, basilar and parietobasilar muscles may be present or absent, retractors always present.
Reference: Australian Faunal Directory, 2010.

Actiniaria gen. sp.1 (Plate 2)
Distribution: Muddy substrates around Failaka Island.

Actiniaria gen. sp.2 (Plate 3 a-b)
Distribution: Muddy substrates between Bubiyan and Failaka Islands.

Actiniaria gen. sp.3 (Plate 4)
Distribution: Muddy substrates around Failaka Island.

Actiniaria gen. sp.4 (Plate 5 a-b)
Distribution: Muddy substrates in Khor Al-Sabbiya.

Plate 2. Actiniaria gen. sp.1, general view.

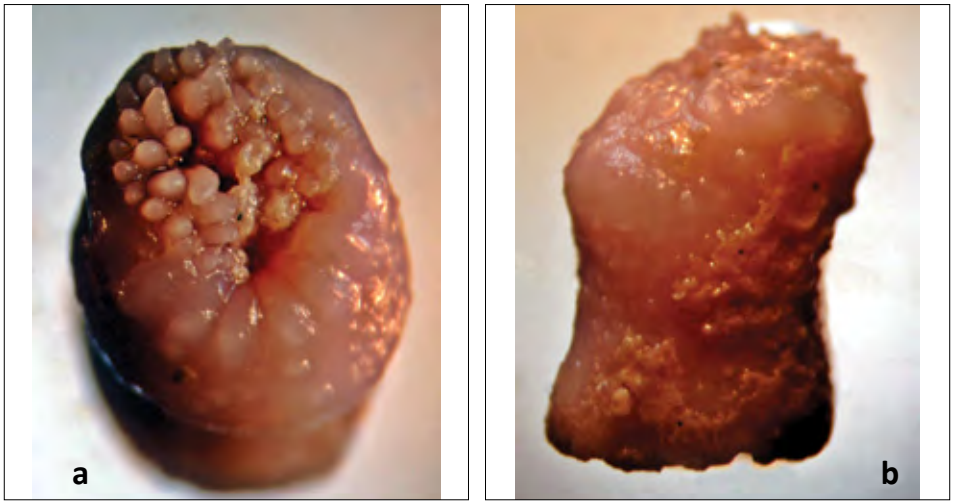


Plate 3. a-b. Actiniaria gen. sp.2, general view.

Plate 4. Actiniaria gen. sp.3, general view.

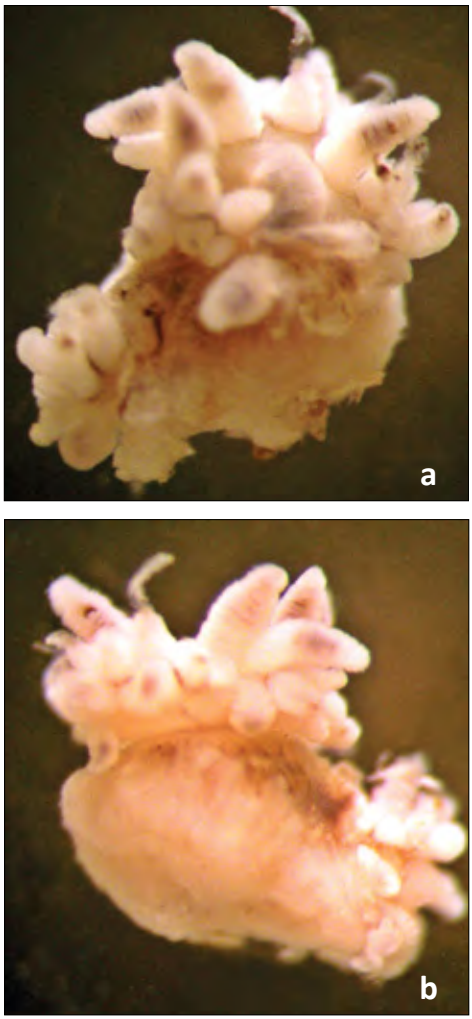


Plate 5. a-b. Actiniaria gen. sp.4, general view.

Phylum ECTOPROCTA (BRYOZOA)
Class GYMNOLAEMATA
Order Cheilostomata
Family Bugulidae Gray, 1848
Description: Colonies erect, unjointed, weakly calcified, flexible, attached by rhizoids; rarely adnate uniserial. Zooids with extensive frontal membrane, with terminal or subterminal flap for extrusion of tentacles. Avicularia pedunculate, or absent in a few species; interzooecial avicularia in one species. Marginal or distal spines present in most species. Ovicells usually prominent, independent or hyperstomial; absent in a few species. Reference: Australian Faunal Directory, 2010.

Genus *Bugula* Oken, 1815
Bugula neritina (Linnaeus, 1758) (Plate 6 a-b)
Distribution: Fouling organism growing on harbours and on intake pipes, as well as on and under rocks in tidal pools. Widely distributed in warm seas; observed in the vicinity of MFD (Salmiyah).

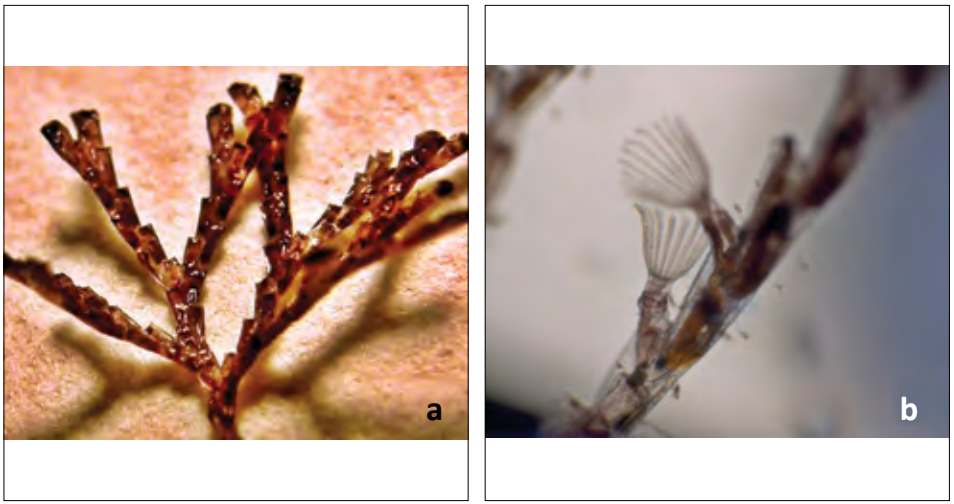


Plate 6. *Bugula neritina*, a. colony; b. zooid.

Family Schizoporellidae Jullien, 1883
Description: Colonies well calcified, encrusting with unilaminar or frontally budded expansions, occasionally bilaminar. Zooids with lepralioid frontal shield, often with pseudopores. Orifice with a proximal sinus. Avicularia adventitious, occasionally interzooidal and very large. Ovicell hyperstomial, sometimes very large, with similar structure to the zooid frontal, entooecium and ectooecium fused. Vertical walls with multiporous septula or basal pore chambers.
Reference: Australian Faunal Directory, 2010.

Genus *Schizoporella* Hincks, 1877
Schizoporella errata (Waters, 1878) (Plate 7)
Distribution: Hard substrates around Ras Al-Ardh.

Phylum PHORONIDA
Description: Phoronida or Horseshoe worms, are marine, benthic, suspension feeding vermiform animals. They have a planktonic larval stage. Together with the Brachiopoda and Bryozoa, the Phoronida are traditionally grouped as the Lophophorata. Characteristic for these three phyla is the lophophore, a food catching organ around the mouth, formed by a circular or horseshoe shaped fold of the body wall that is beset with numerous ciliated tentacles. Each tentacle is an outgrow of the body wall and contains an extension of the coelom. The ciliary tracts on the tentacles drive a water current, by which food particles (suspension and plankton) are transported towards the mouth. Adult Phoronida live in a chitinous tube that is usually either attached to, or burrowed in a hard substrate (rock, shell, etc.), or buried vertically in soft sediment (i.e. sand, mud). Their slender and cylindrical body is divided into three parts: at the top the flap-like epistome, then the lophophore bearing mesosome, and, as the largest part of the body, the elongated trunk or metasome; each body part has its own coelom. The digestive tract is U-shaped and the anus is located at the top of the animal, close to the mouth. The length of adult phoronids ranges from 5 to 25 cm. Phoronids are hermaphroditic or dioecious; also asexual reproduction occurs. The fertilization is internal. The egg develops into a characteristic ciliated and free-swimming actinotroch larva. The larvae are free swimming and feeding in the plankton for 2-3 weeks and then settle after a rapid metamorphosis during which the intestine becomes U-formed and the metasomal sac emerges, being the initial trunk. The life span is about one year.
Reference: Emig, C.C., 1982.

Genus *Phoronis* Wright, 1856
***Phoronis* sp.1** (Plate 8)
Distribution: Kuwait's marine environment.

***Phoronis* sp.2** (Plate 9 a-c)
Distribution: Muddy substrates near Bubiyan and Failaka Islands and in Kuwait Bay.

Plate 7. *Schizoporella errata*, **colony.**

Plate 8. *Phoronis* **sp.1, general view.**

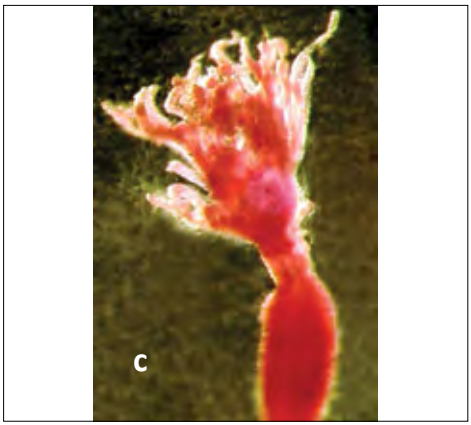


Plate 9. *Phoronis* **sp.2, a. general view; b. tubes; c. anterior end (stained with Rose Bengal).**

Phylum ANNELIDA
Class POLYCHAETA
Subclass Aciculata
Bristle-footed annelids. Polychaeta with a pair of sensory palps on the prostomium.
Order Amphinomida
Family Amphinomidae Savigny in Lamarck, 1818
Description: The prostomium comprises two parts, forming overall a triangle, rounded and widest anteriorly. The peristomium is reduced to lips. Paired lateral antennae and a median antenna are present on the anterior and posterior prostomial lobes, respectively. The ventro-lateral palps are slender and located on the anterior prostomium. The nuchal organs are attached to the edge of the caruncle, which extends posteriorly from the prostomium; these complex structures usually comprise several folds and ciliated tracts. The longitudinal muscles are grouped in four bundles and segmentation is present. The first segment curves around the prostomium and bears parapodia similar to those posteriorly. All parapodia are biramous and bear truncate cylindrical notopodia and tapering neuropodia, which project beyond the notopodia; dorsal and ventral cirri are present. The branchiae are branched structures attached to the notopodial bases. Epidermal papillae and pygidial cirri are absent, and lateral organs and dorsal cirrus organs have not been observed. The thickened muscular lower lip of the mouth is eversible, rugose and covered with a thick cuticle. A gular membrane is lacking. The gut comprises a straight tube. Mixonephridia are present, and presumed to be in most segments. A heart body is absent from the closed circulatory system. Aciculae and other chaetae, including variously ornamented capillaries and spines, often dentate, are calcified to some degree and usually very brittle.
Amphinomidae are commonly found in shallow waters. They are also known as fire worms. The spines of the worms, if touched, can cause general discomfort or infections.
Reference: Wilson et.al., 2003.

Genus *Paramphinome* Sars 1869
***Paramphinome* sp.** (Plate 10 a-b)
Distribution: Kuwait's marine environment.

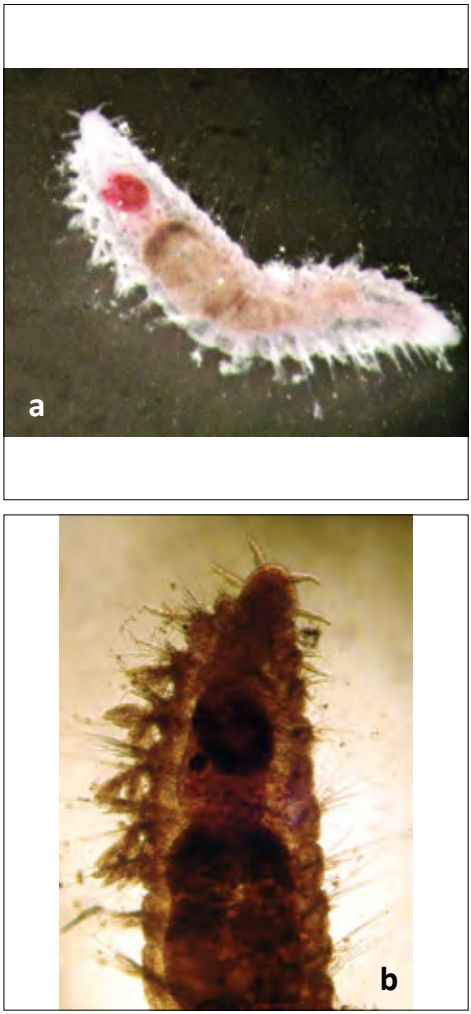


Plate 10. ***Paramphinome*** **sp., a. general view; b. anterior end.**

Order Eunicida

Family Dorvilleidae Chamberlin, 1919

Description: The prostomium is generally rounded and has a pair of ventro-lateral, simple to biarticulated palps and a pair of dorsal, simple or articulated antennae; both palps and antennae may be absent. Eyes are present or absent. The peristomium is a single ring or is subdivided into two rings. The parapodia are usually sub-biramous); the notopodium is represented only by a simple to biarticulated dorsal cirrus with or without an embedded acicula. Secondarily, the parapodia may be uniramous or absent. Branchiae are occasionally present. Neuropodia bear typically supra-acicular simple and furcate chaetae, and subacicular compound falcigers and/or spinigers. However, some or all chaetal types may be absent and the inferiormost chaetae may be simple. Ventral cirri may be present or absent. Pygidial cirri number two or four, may be absent, or may include an unpaired pygidial stylus. Dorvilleids, particularly the smaller species, are often ciliated in the form of ciliary bands around the prostomium, peristomial rings and trunk segments. The mandibles are unfused and the maxillae are not mineralized; both may be reduced or absent. Typically, maxillae consist of carriers, and paired superior and inferior basal plates with numerous anterior free denticles. Supplementary rows of spinous denticles may also be present.

Reference: Wilson et al., 2003.

Genus *Dorvillea* Parfitt 1866

***Dorvillea* sp.**

Distribution: Muddy substrates in Kuwait Bay.

Genus *Protodorvillea* Pettibone 1961

***Protodorvillea* sp.**

Distribution: Muddy substrates near Failaka Island and subtidal zone of Ras Al-Ardh.

Genus *Schistomeringos* Jumars 1974

Schistomeringos incerta (Schmarda, 1861)

Distribution: Intertidal zone near Ras Al-Ardh.

***Schistomeringos* sp.** (Plate 11)

Distribution: Kuwait's marine environment.

Plate 11. ***Schistomeringos*** **sp., anterior end.**

Family Eunicidae Berthold, 1827

Description: The prostomium is bilobed or entire, with a pair of reduced to well-developed buccal lips. Species of Eunice have five prostomial appendages comprising two palps and three antennae; one to two antennae and/or palps may be absent in other genera. Eyes are usually present. The peristomium consists of two rings; a pair of peristomial cirri is present or absent on the posterior ring. The parapodia are subbiramous; the notopodium is represented only by a dorsal cirrus with or without embedded aciculae. Branchiae, when present, consist of single or pectinate filaments. The neuropodia have superior limbate and pectinate chaetae, and inferior compound falcigers or spinigers, and subacicular hooks, and ventral cirri. Pygidial cirri number two or four. The jaws comprise ventral, unfused mandibles, and dorsal maxillae of the labidognath type. The maxillae are mineralized with aragonite and comprise a pair of short carriers and four to five toothed plates on the right and five to six toothed plates on the left. The maxillary plates are asymmetrical with the right maxilla III missing and the right maxilla IV being larger than the corresponding left one. Euncidae are typically large stout bodied worms; some are among the largest of polychaetes. Most eunicid genera (including the two most speciose genera, Eunice and Marphysa) have five prostomial appendages, although this number is reduced to three or one in some genera. The prostomial appendages are referred to as occupital antennae in much of the literature, however they are now known to comprise two palps and three antennae. They often have an irridescent epithelium with gills emerging dorsally from the base of the parapodia occurring along part of the body. In live specimens the gills are bright red. All species have well developed jaws, which are often partly visible at the front of the mouth.

Reference: Wilson et al., 2003.

Genus *Eunice* Cuvier 1817

Eunice indica Kinberg, 1865 (Plate 12 a)

Distribution: Indian Ocean and West Pacific, Red Sea and Arabian Gulf. In Kuwait waters, the species was registered on muddy substrates around Failaka Island.

Eunice laticeps Ehlers, 1868 (Plate 12 b)

Distribution: Muddy substrates between Bubiyan and Failaka Islands.

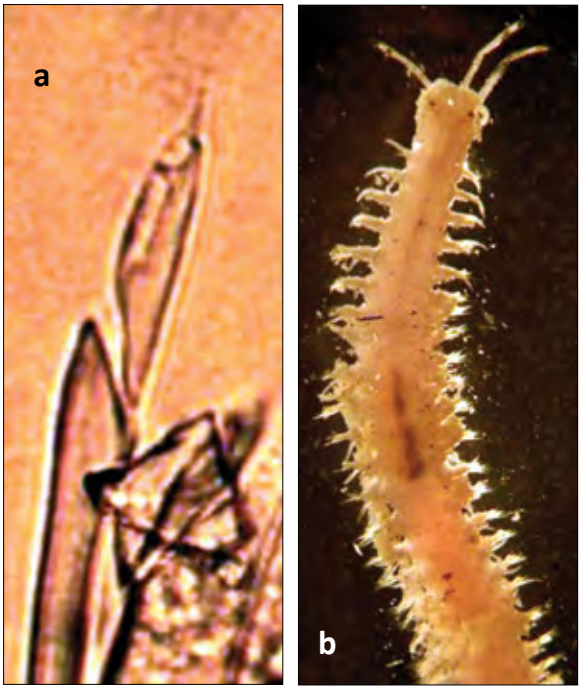


Plate 12. a. ***Eunice indica*****-bristle; b.** ***E. laticeps*****, anterior end.**

Family Lumbrineridae Schmarda, 1861
Description: Lumbrinerids have compact bodies without prostomial appendages and with small parapodial lobes; often the epithelium is irridescent. The prostomium is rounded or pointed, and only in species of *Lysarete* and *Kuwaita* does it bear small antennae. Small nuchal papillae are present or absent. The peristomium consists of two rings and lacks peristomial cirri. Parapodia are uniramous (neuropodia only) to sub-biramous where the notopodium is reduced and is only represented by conical knobs with internal aciculae, or flattened dorsal cirri. Branchiae are generally absent. The neuropodia have simple limbate chaetae and usually simple and/or compound hooks. Compound spinigers are rarely present (Lumbricalus). Pectinate chaetae and subacicular hooks are absent. Ventral cirri are generally absent and pygidial cirri number two or four. The jaws consist of ventral, fused mandibles and dorsal maxillae. In most of lumbrinerids the maxillae are of the labidognath type. Some, however, appear to be transitional to the prionognath type and have been referred to as sub-prionognath. The maxillae are mineralized with calcite, and composed of four or five pairs of symmetrical plates (maxilla I with lateral support or bridle) and a pair of usually short carriers.
Reference: Wilson et al., 2003.

Genus *Lumbrineris* de Blainville 1828
Lumbrineris heteropoda (Marenzeller, 1879) (Plate 13 a-b)
Distribution: Intertidal zone near Ras Al-Ardh.

Lumbrineris impatiens Claparède, 1868 (Plate 14 a-b)
Distribution: Intertidal zone near Ras Al-Ardh.

Lumbrineris latreilli (Audouin and Milne-Edwards, 1834) (Plate 15 a-b)
Distribution: Muddy substrates around Failaka Island.

***Lumbrineris* sp.** (Plate 15 c)
Distribution: Kuwait's marine environment.

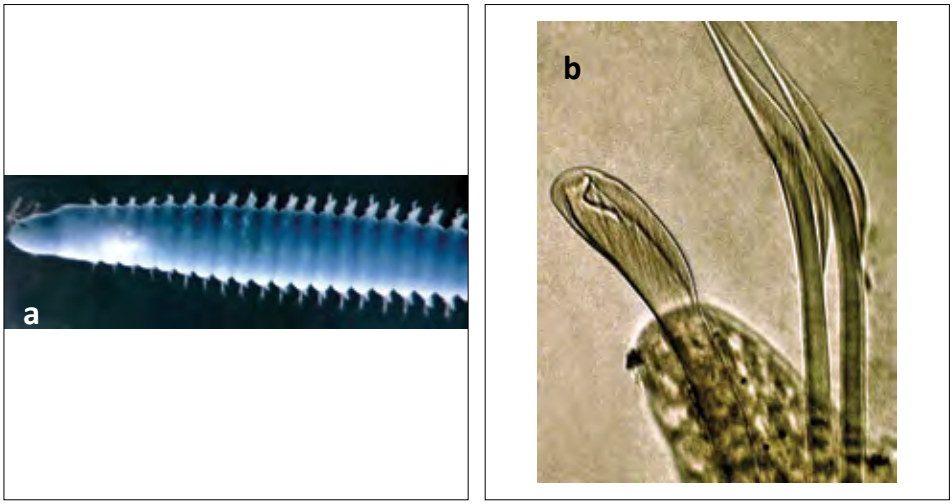


Plate 13. ***Lumbrineris heteropoda*****, a. anterior end; b. bristles.**

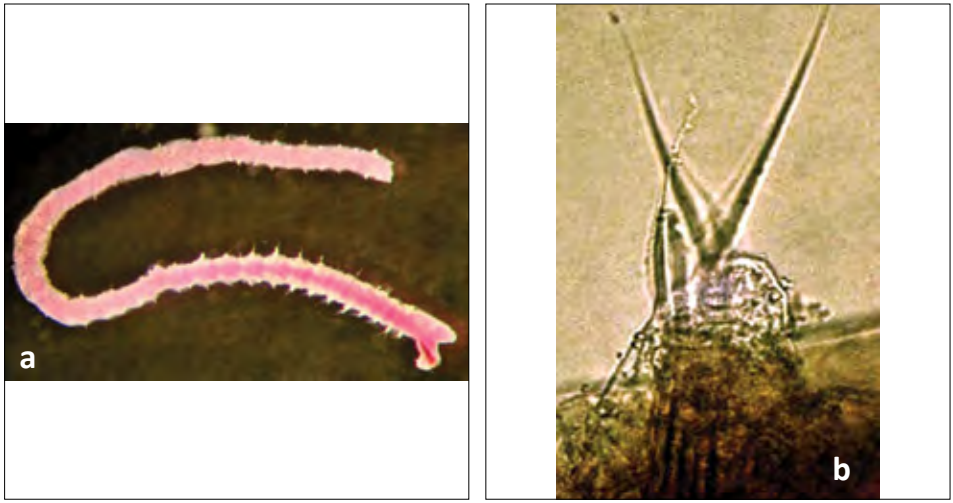


Plate 14. ***L. impatiens*****, a. anterior end; b. bristles.**

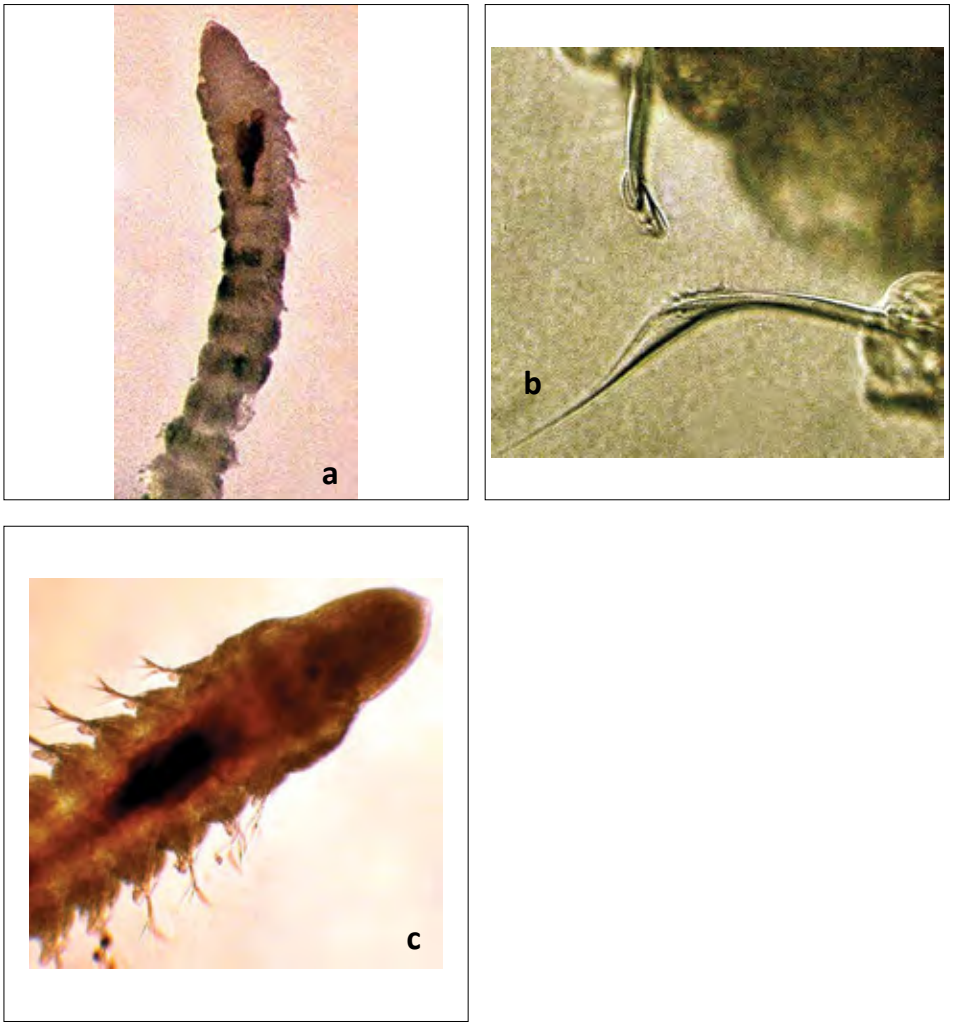


Plate 15. ***L. latreilli*****, a. anterior end; b. bristles; c.** ***Lumbrineris*** **sp., anterior end.**

Genus *Ninoe* Kinberg 1865
Ninoe pulchra Wesenberg-Lund, 1949 (Plate 16)
Distribution: Muddy substrates near Failaka Island (Station 2).

Plate 16. *Ninoe pulchra*, general view.

Family Onuphidae Kinberg, 1865

Description: The rounded prostomium bears a pair of small dorsal frontal lips (rarely absent), three antennae and two palps. Each of the antennae and palps comprises a basal ringed ceratophore and a distal smooth style. Ventrally, a pair of large bulbous upper lips is present. Eyes may be present or absent. The peristomium is a single apodous ring, with or without one pair of dorsal peristomial cirri. The first two to eight pairs of parapodia are modified. They are often longer, have different parapodial lobes and chaetae than those following, and thus are specialized for digging, locomotion or tube building. The modified parapodia have digitiform ventral cirri; the remaining unmodified ones have glandular pads. Dorsal cirri are present throughout or are reduced to absent on posterior chaetigers. Filaments of the branchiae, when present, are simple, pectinately or dichotomously branched, or spirally arranged. Parapodia are sub-biramous; the notopodium represented only by dorsal cirrus with or without embedded aciculae. Modified parapodia have simple or pseudocompound hooks; pectinate and/or limbate chaetae are present or absent. Chaetae of unmodified parapodia are pectinate, simple limbate and subacicular hooks; compound limbate chaetae (spinigers) are sometimes present and falcigers are rare. Pygidial cirri number two or four. The jaws consist of ventral, unfused mandibles, and dorsal maxillae of the labidognath type. The maxillae are mineralized with aragonite, and comprise a pair of short carriers and 3-5 toothed plates on the right and 4-toothed plates on the left. The maxillary plates are asymmetrical with the right maxilla III missing and the right maxilla IV being larger than the corresponding left one. Onuphid tubes are regularly collected, although anterior tube fragments are typically empty, as the animal having withdrawn further back down into the tube. Some tubes are characteristic consisting of shell fragments and gravel cemented together with a chitinous lining and may protrude several mm above the surface and forming dense colonies. In such situations worms can be enticed a few centimetres from the tube in pursuit of a fragment of algal or animal food. Reference: Wilson et al., 2003.

Genus *Diopatra* Audouin and Milne-Edwards 1833

Diopatra neapolitana Delle Chiaje, 1841 (Plate 17)

Distribution: Muddy substrates around Failaka Island.

Plate 17. *Diopatra neapolitana*, anterior end.

Genus *Onuphis* Audouin and Milne-Edwards 1833
***Onuphis* sp.** (Plate 18 a-b)
Distribution: Muddy substrates near Failaka Island.

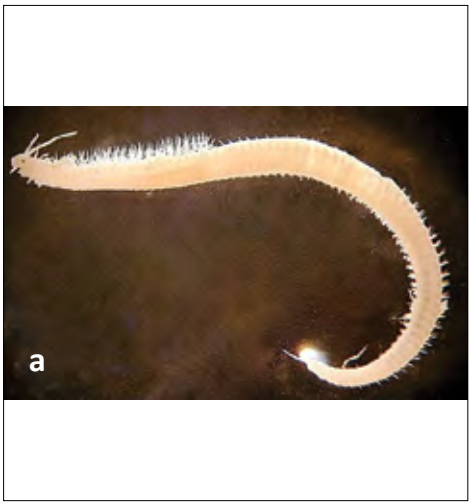


Plate 18. *Onuphis* sp., a. general view; b. anterior end.

Order Phyllodocida
Family Chrysopetalidae Ehlers, 1864
Description: These small, mobile polychaete worms are distinguished primarily by their biramous parapodia which support golden or silver-coloured, flattened notochaetae (= paleae) and/or spines that form semi-radiate, imbricating fans covering the dorsum. Elongate, dorsoventrally flattened bodies. Both notochaetae and the shafts of falcigerous compound neurochaetae are composed internally of longitudinal channels stacked with transverse septa. Chrysopetalids have a well-differentiated prostomium with a posterior nuchal organ, a pharynx with two jaws and a pygidium with two pygidial cirri and/or conical appendage. 1-3 short antennae and a pair of ventral palps. Peristomium with two pairs of tentacular cirri. Flattened notosetae in transverse rows, either held erect or having the appearance of tiles on a roof. Neurosetae compound falcigers.
Reference: Wilson et al., 2003.

Genus *Bhawania* Schmarda 1861
Bhawania goodei Webster, 1884 (Plate 19 a-b)
Distribution: Muddy substrates around Failaka Island and in Khor Al-Sabbiya.

Plate 19. *Bhawania goodei*, a. general view; b. palea.

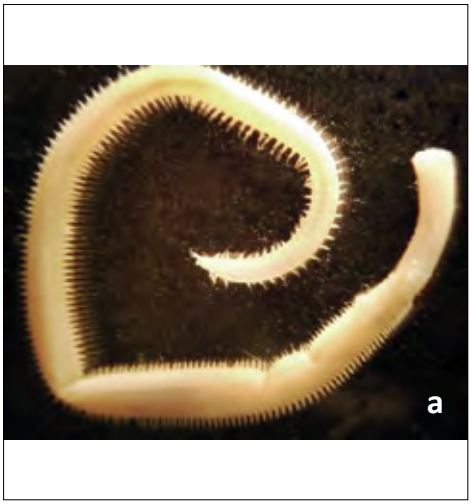
Family Glyceridae Grube, 1850
Description: Errant polychaetes with long bodies almost circular in cross-section. The prostomium is conical and annulated, and bears four small terminal appendages. The conical nuchal organs of *Glycera convoluta* are apparently the only published observations of nuchal organs in glycerids. A long muscular eversible pharynx is present, and terminates with four jaws arranged in a cross. Several types of pharyngeal papillae cover the pharynx, usually with one or two types present on any one species; species may be distinguished by the presence of different types of pharyngal papillae. The peristomium is reduced. Terminal papillae are absent. The first segment with parapodia is similar to subsequent segments. Parapodia are biramous in all genera except *Hemipodus*, in which all are uniramous. In biramous parapodia, the neuropodia are larger than the notopodia, and prechaetal and postchaetal lobes and lappets may be present. Dorsal and ventral cirri are present. True branchiae are absent, but the structures often termed branchiae are located dorsal to the parapodia and contain no circulatory system; these structures are referred to as coelomic loops. Coelomic loops are of taxonomic value, but are retractile in some taxa and thus their apparent absence may be difficult to verify. Aciculae are present. Notochaetae, if present, are simple; neurochaetae are compound. One pair of pygidial cirri is present.
Reference: Wilson et al., 2003.

Genus *Glycera* Savigny, 1818
Glycera rouxii Audouin and Milne-Edwards, 1833 (Plate 20 a-c)
Distribution: Muddy substrates near Bubiyan and Failaka Islands and in the mouth of the Kuwait Bay.

Glycera tesselata Grube, 1840
Distribution: Muddy and silty substrates in Kuwait Bay.

Glycera tridactyla Schmarda, 1861 (Plate 21 a-c)
Distribution: Intertidal zone near Ras Al-Zour.

Glycera unicornis Savigny, 1818 (Plate 22 a-c)
Distribution: Muddy substrates between Bubiyan and Failaka Islands.



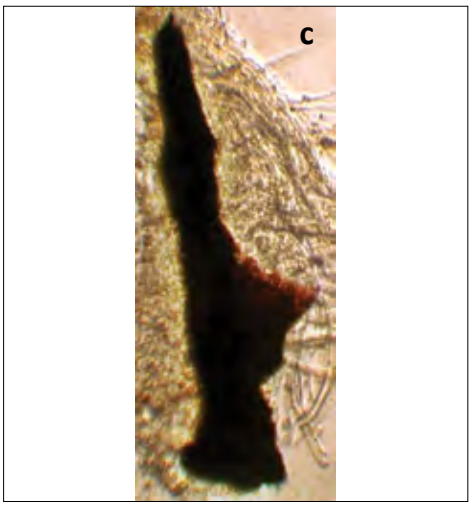


Plate 20. *Glycera rouxii*, **a. general view; b. papillae of the proboscis; c. aileron.**

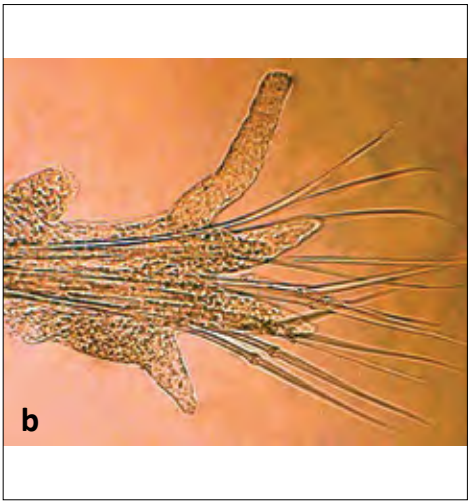
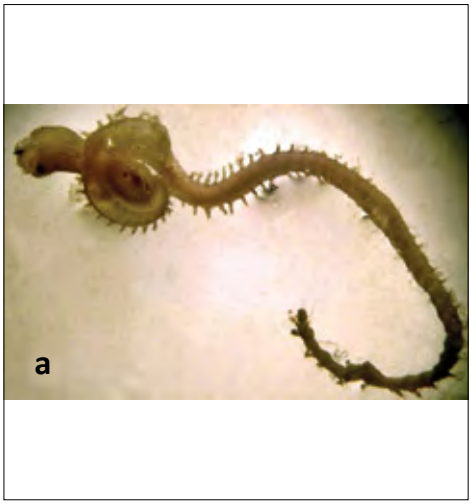
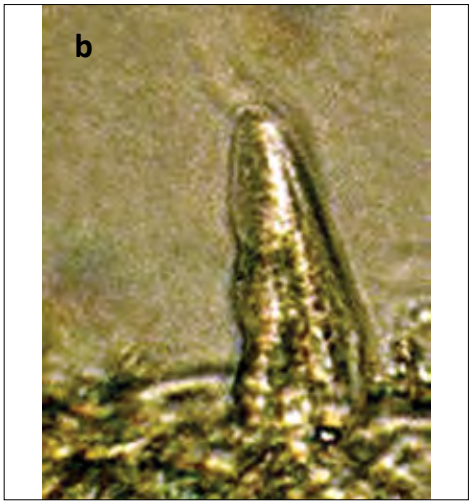


Plate 21. *G. tridactyla*, **a. general view; b. parapodia from the middle part of the body; c. aileron.**





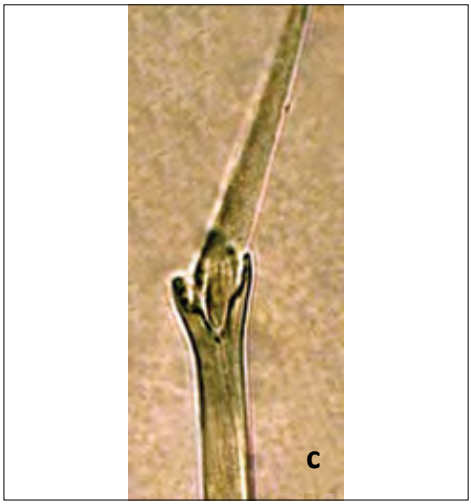


Plate 22. *G. unicornis*, **a. general view; b. papillae of the proboscis; c. compound bristle.**

Family Goniadidae Kinberg, 1866
Description: The prostomium is conical and annulated, and bears four small terminal appendages. A long, muscular eversible pharynx is present; it bears one pair of large jaws and a dorsal and ventral arc of numerous smaller denticles, which together form a complete circle. Pharyngeal papillae are well developed and are of several types; they may be differentiated along the pharynx. Terminal pharyngeal papillae are present. The peristomium is reduced to lips. The first segment has parapodia and is similar to subsequent segments. Parapodia are anteriorly uniramous with neuropodia and dorsal cirri only, and posteriorly biramous with notopodia almost as large as neuropodia. Dorsal and ventral cirri are present throughout. Coelomic loops (see Glyceridae) and branchiae are absent. Aciculae are present. Notochaetae, where present, are spines (straight or distally curved); neurochaetae are compound spinigers and falcigers. One pair of pygidial cirri is present. Goniadids are strong, muscular polychaetes with long bodies almost circular in cross-section. Live specimens exhibit a characteristic thrusting movement and the body wall is often irridescent.
Reference: Wilson et al., 2003.

Genus *Glycinde* Müller 1858
***Glycinde* sp.** (Plate 23 a-b)
Distribution: Muddy substrates near Failaka Island.

Genus *Goniada* Audouin and Milne-Edwards 1833
***Goniada* sp.**
Distribution: Silty substrates in Kuwait Bay.

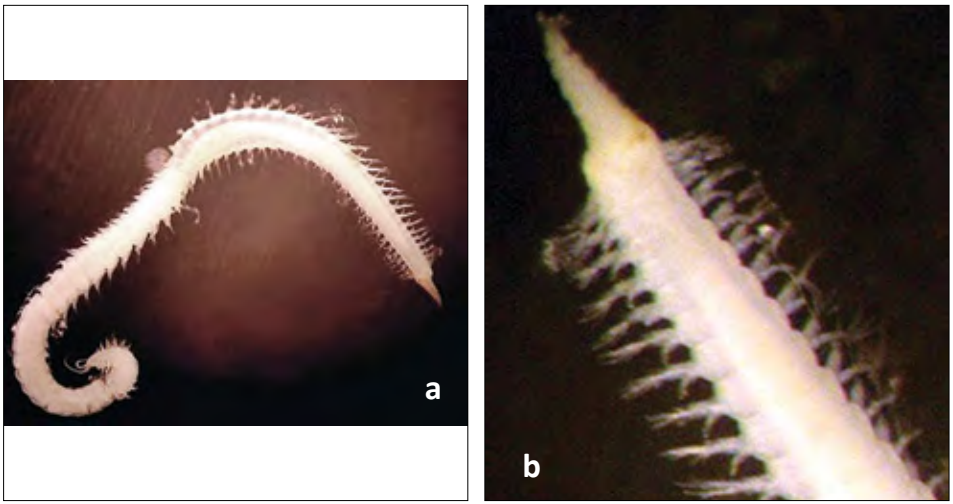


Plate 23. *Glycinde* sp., a. general view; b. anterior end.

Family Hesionidae Grube, 1850
Description: Hesionids range from large to very small interstitial errant worms. Body often dorsoventrally flattened; 2-3 antennae and as many as eight pairs of tentacular cirrae. Palps with 1-3 articles. Jaws are sometimes present. Parapodia either biramous or uniramous but notopodium always somewhat reduced. Long slender dorsal cirri. Synapomorphies for Hesionidae relate to the cephalization of the first segments, and include the enlarged dorsal and ventral cirri and cirrophores on segment 1-5 and 1-3, respectively and absence of neurochaetae on segment 1-4. Although several of these features are reversed within the group, enlarged ventral cirri with well developed cirrophores on segment 1-3 are present in all hesionids and not outside this group. Hesionids generally are provided with a pair of biarticulated palps, paired antennae, and, in some, a median antenna. When present, there are two pairs of eyes. The proboscis is externally smooth in most taxa. Usually, segments 1-4 or 1-5 show dorsal cirri and cirrophores that are larger and much longer than on the following segments, and the same is the case for the ventral cirri on segment 1-3 or 1-4. These segments also lack parapodial lobes and chaetae. Parapodia can have both simple noto- and compound neurochaetae, or compound neurochaetae only. They always carry dorsal and ventral cirri, and there is a single pair of pygidial cirri. External genital organs are usually absent. Most hesionids have separate sexes, although at least some members of Hesione are hermaphrodites.
Reference: Pleijel and Rouse, 2004.

Genus *Ophiodromus* Sars 1862
Ophiodromus latifrons (Grube, 1878) (Plate 24 a-b)
Distribution: Kuwait's marine environment.

Hesionidae gen.sp.
Distribution: Muddy substrates in Kuwait Bay.

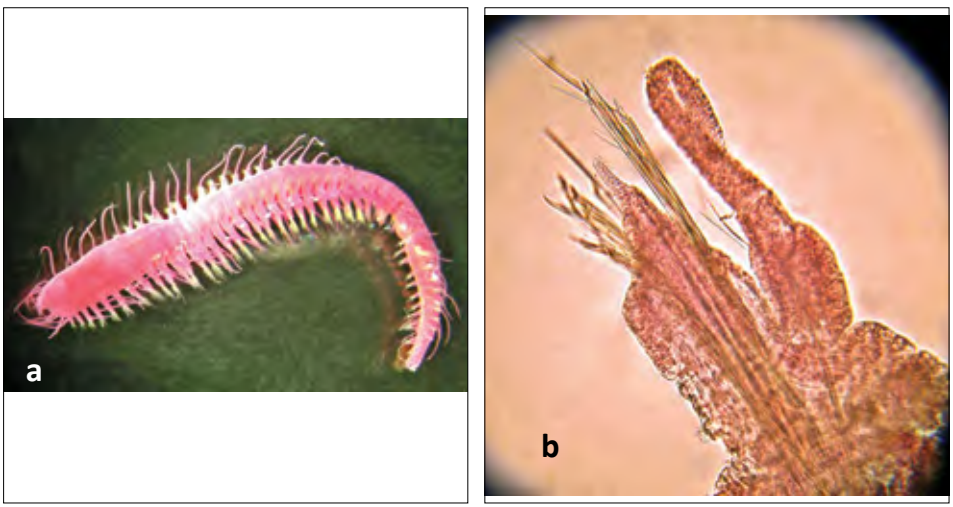


Plate 24. *Ophiodromus latifrons*, a. general view (stained with Rose Bengal); b. parapodia.

Family Nephtyidae Grube, 1850

Description: Nephtyids have a quadrangular prostomium that flattens anteriorly, terminating in a pair of antennae and a more ventrally located pair of simple palps. The peristomium is reduced, and parapodia of anterior chaetigers surround the mouth. The first chaetigerous segment is smaller than the next and is usually anteriorly directed with prolonged dorsal and ventral cirri sometimes termed tentacular cirri. All subsequent segments are similar in form, and all parapodia are biramous; unlike most polychaetes, the body is distinctly squarish in cross section. Posterior segments taper gradually to the pygidum; the anus is terminal and has a single ventral cirrus. An eversible muscular pharynx is present, with a terminal ring of papillae and rows of subdistal papillae. Proximally the surface of the pharynx is bare or may carry verrucae, forming a granulate appearance. One pair of lateral jaws is present. The biramous parapodia have dorsal and ventral aciculae throughout. Chaetae are capillaries and may be smooth, serrate, or barred; lyrate chaetae are also present in *Aglaophamus* and *Micronephthys*.

Reference: Wilson et al., 2003.

Genus *Aglaophamus* Kinberg 1866

***Aglaophamus* sp.** (Plate 25 a-b)

Distribution: Muddy and silty substrates in Kuwait Bay and near its mouth.

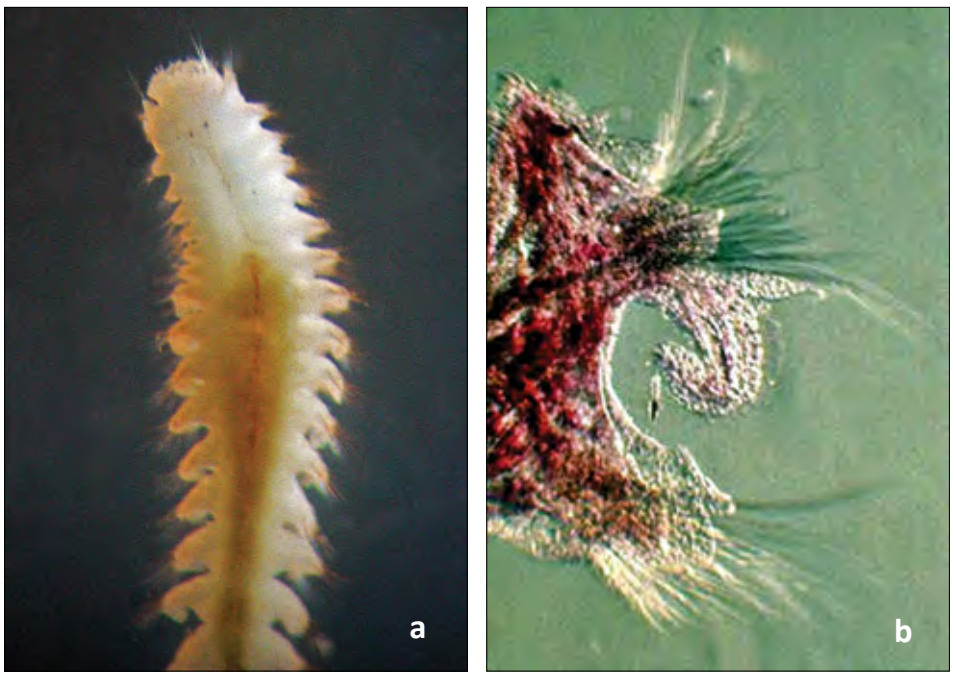


Plate 25. *Aglaophamus* sp., a. anterior end; b. 10-th parapodia.

Genus *Micronephtys* Friedrich 1937
Micronephtys sphaerocirrata (Wesenberg-Lund, 1949) (Plate 26 a-b)
Distribution: Muddy substrates between Ras Al-Ardh and Failaka Island.

***Micronephtys* sp.** (Plate 26 c)
Distribution: Muddy substrates between Bubiyan and Failaka Islands.

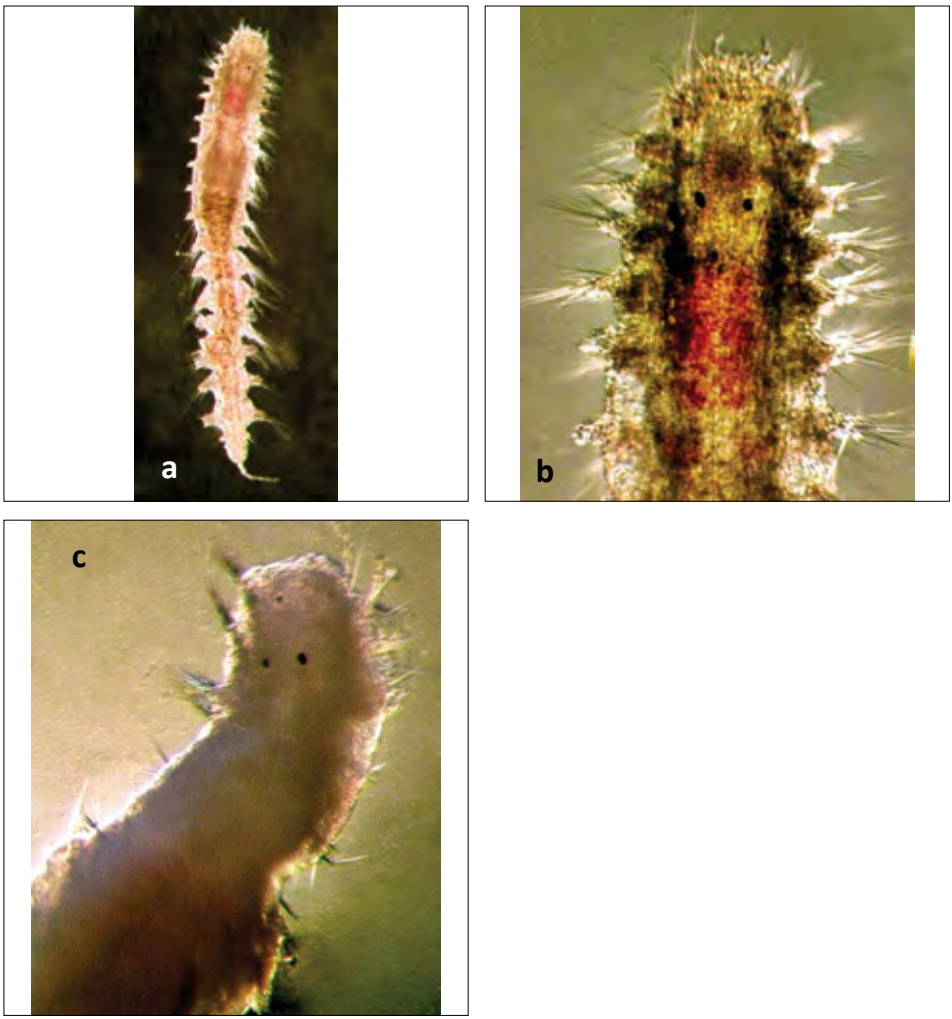


Plate 26. *Micronephtys sphaerocirrata*, a. general view; b. anterior end; *Micronephtys* sp., c. anterior end.

Genus ***Nephtys*** Cuvier 1817

Nephtys tulearensis Fauvel, 1919 (Plate 27 a-c)

Distribution: Western Indian Ocean, Arabian Gulf. In Kuwait waters, registered on muddy and silty substrates in Kuwait Bay, around Failaka Island and in Khor Al-Sabbiya.

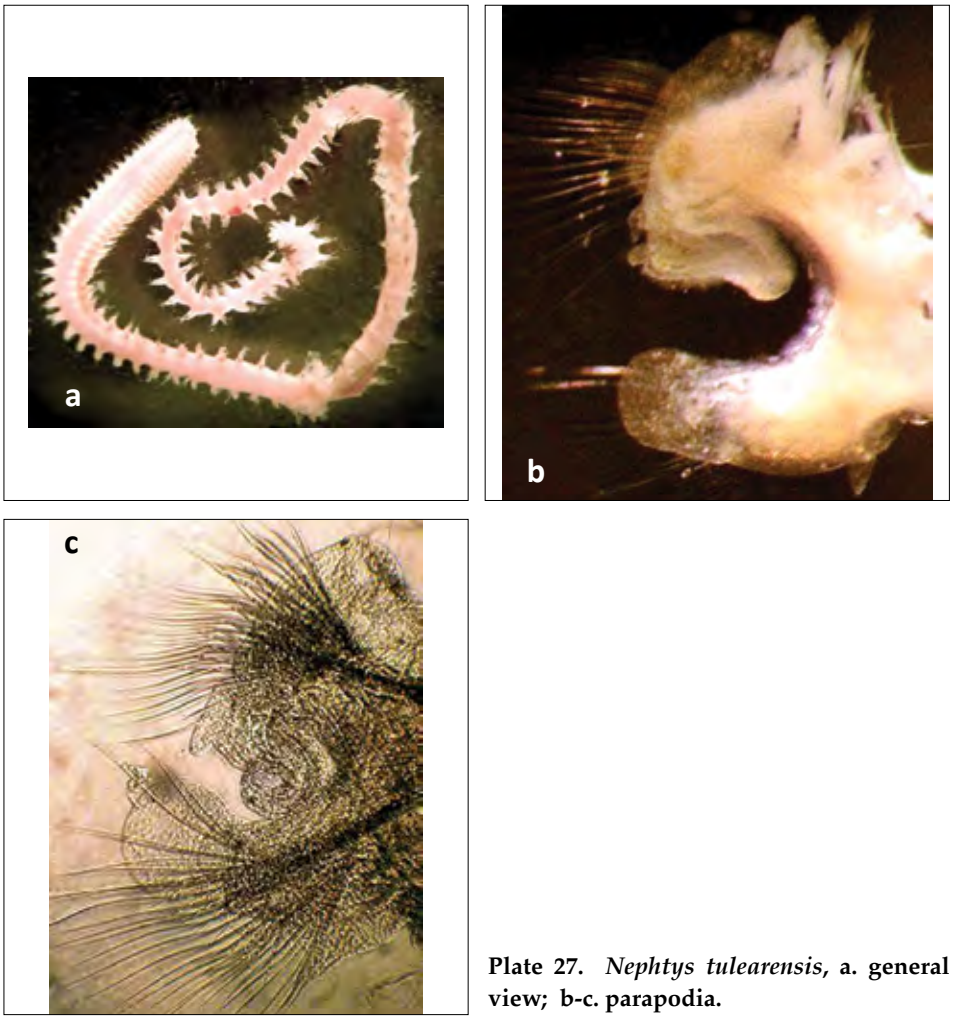


Plate 27. ***Nephtys tulearensis*****, a. general view; b-c. parapodia.**

Family Nereididae Johnston, 1865
Description: Large elongate worms. The prostomium is triangular to T-shaped and is at its widest posteriorly. It has one pair of antennae, rarely a single antenna or none, and one pair of articulated ventral palps. The peristomium and the first segment are fused and carry two to four pairs of tentacular cirri, four pairs in most genera. The tentacular cirri are derived from peristomial cirri and tentacular cirri from the first segment, but the peristomium and first segment are fused; the distinction is only apparent during development. The muscular eversible pharynx is differentiated into distinct regions; it has a pair of lateral jaws and usually accessory denticles (paragnaths) or papillae (or both) are present in a regular arrangement. Terminal papillae are absent. Nuchal organs are present as short ciliated grooves, barely exposed. Notopodia and neuropodia are present, usually each with at least one flattened lobe. Aciculae are present. Notochaetae may be compound spinigers or falcigers or both; neurochaetae include compound spinigers and falcigers in two fascicles. All chaetae are compound, but chaetal articulation may be fused in posterior segments in some taxa. One pair of pygidial cirri is present.
Reference: Wilson et al., 2003.

Genus *Leonnates* Kinberg, 1865
Leonnates indicus Kinberg, 1866 (Plate 28 a-c)
Distribution: Muddy substrates near Failaka Island.

Leonnates persicus Wesenberg-Lund, 1949
Distribution: Muddy and silty substrates in Kuwait Bay.

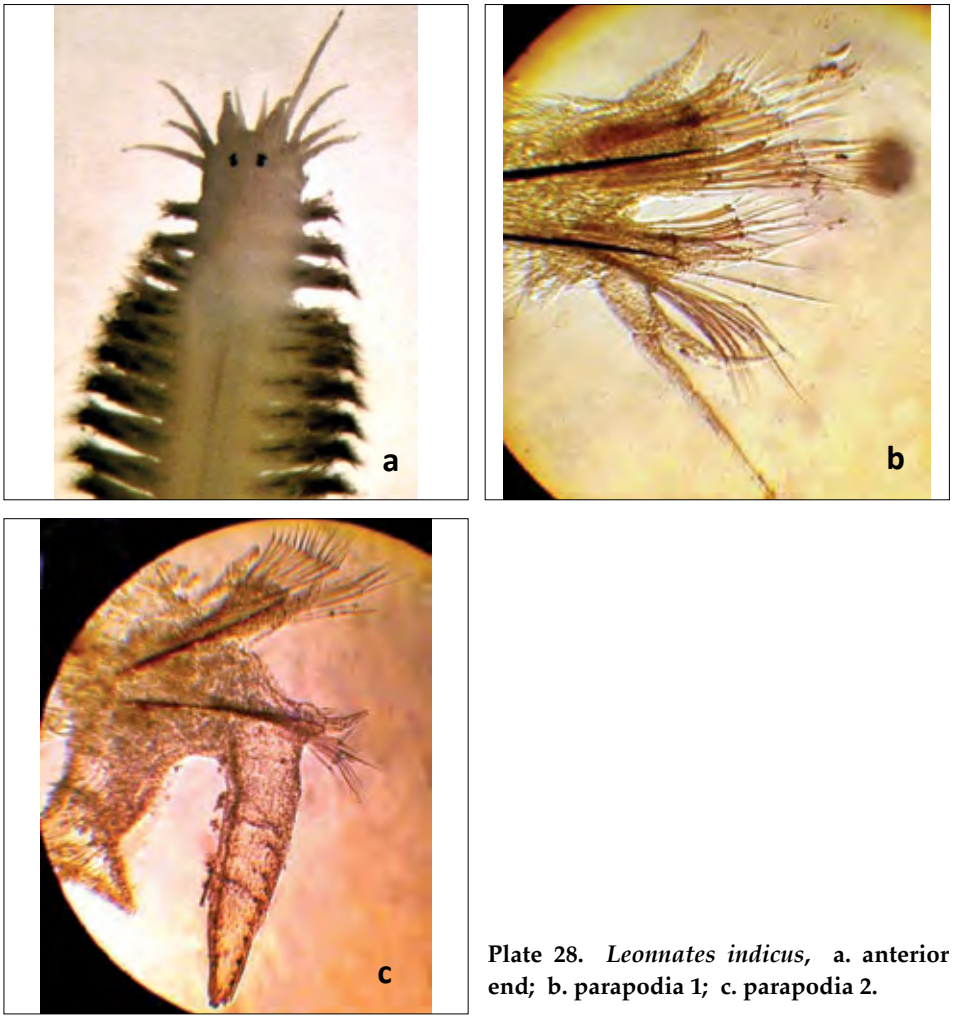


Plate 28. ***Leonnates indicus,*** **a. anterior end; b. parapodia 1; c. parapodia 2.**

Genus *Nereis* Linnaeus, 1758
Nereis pelagica Linnaeus, 1761 (Plate 29 a-b)
Distribution: Muddy substrates in Kuwait Bay and between Bubiyan and Failaka Islands.

Plate 29. ***Nereis pelagica*****, a. general view; b. parapodia.**

Family Pilargiidae Saint-Joseph, 1899
Description: Pilargiids are similar to the Nereidae but with all setae simple and unarmed proboscis. They have an elongate, cylindrical or dorso-ventrally flattened body that is sometimes inflated anteriorly. The prostomium, which may be incised, bears two or three antennae, or antennae are absent. The palps are usually biarticulate, but they may be fused together or reduced, and two pairs of peristomial (or tentacular) cirri are usually present (rarely absent). The pharynx is usually unarmed and has a circlet of distal papillae. The parapodia are biramous, but with the notopodial ramus reduced. Notochaetae are spines (may be absent), and neurochaetae include capillaries, furcate chaetae and spines. In some species the notopodium may be reduced or lacking. Setae are always simple. Notopodia may be represented by a strongly reflexed hook or an acicular spine; neurosetae always simple, serrated.
Reference: Wilson et al., 2003.

Genus *Sigambra* Müller 1858
Sigambra tentaculata (Treadwell, 1949) (Plate 30 a-c)
Distribution: Muddy and silty substrates in Kuwait Bay and around the Failaka Island.

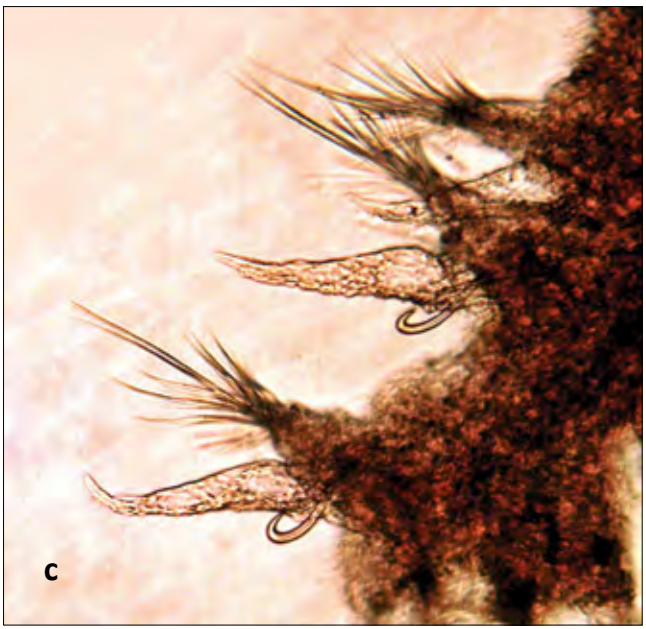


Plate 30. ***Sigambra tentaculata*****, a. general view; b. anterior end; c. parapodia with hooks.**

Genus *Ancistargis* Jones 1961
***Ancistargis* sp.** (Plate 31 a-c)
Distribution: Kuwait's marine environment.

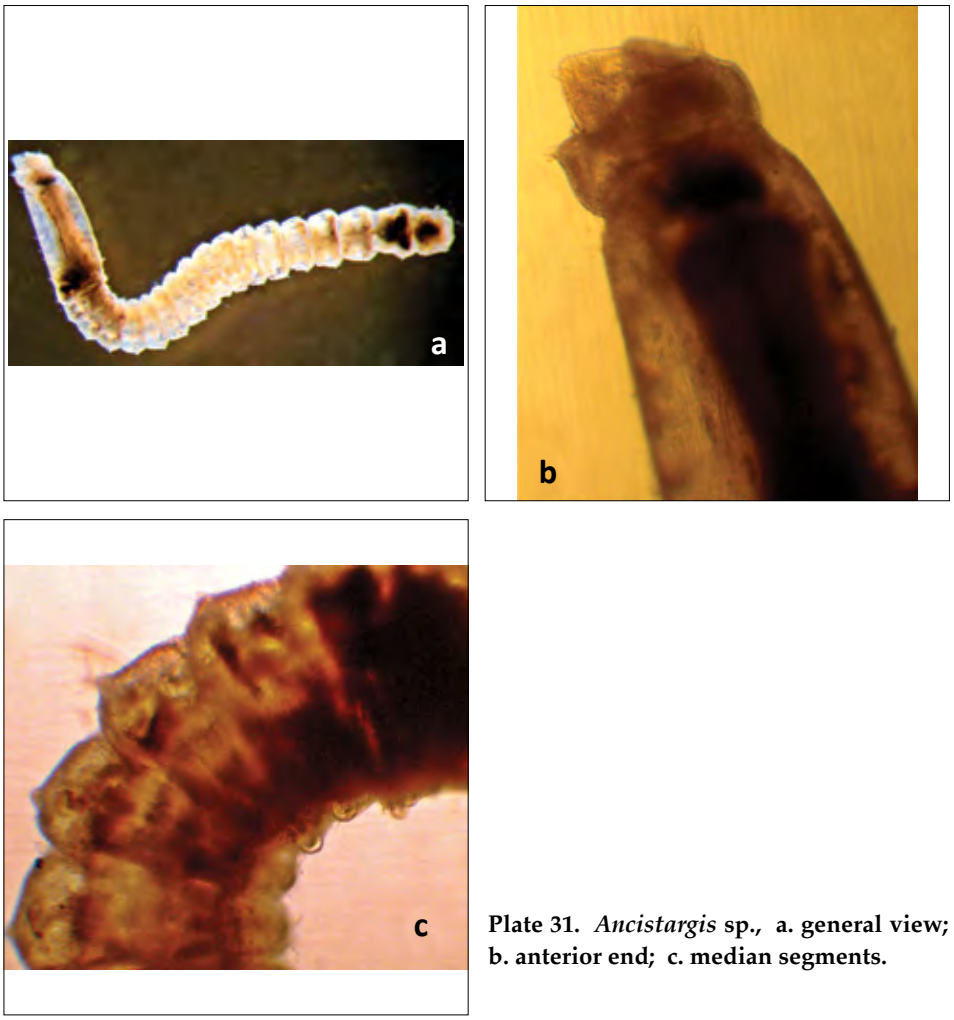


Plate 31. ***Ancistargis* sp., a. general view; b. anterior end; c. median segments.**

Genus *Ancistrosyllis* McIntosh, 1879
***Ancistrosyllis* sp.**
Distribution: Muddy and silty substrates in Kuwait Bay.

Family Phyllodocidae Örsted, 1843
Description: Highly mobile animals with long vermiform bodies; segments numerous (more than about 15); regionation absent. Body opaque, gut usually not visible. Pygidium simple ring or cone. Pygidial appendages present; one pair of cirri, or one pair of cirri and single medial papilla. Head discrete and compact, dorsal to mouth. Prostomium bluntly conical to trapezoidal (narrow end anteriorly). Eyes present; one pair; situated on prostomium; compound with lenses. Prostomial antennae present; paired arising anterolaterally, or include paired anterolateral ones and single medial one; smooth. Palps paired (resemble antennae); unarticulated; ventrolateral. Nuchal organs indistinct paired dorsolateral patches, or paired posterior projections. Peristomial ring absent. Foregut a muscular axial pharynx; surface smooth, or with soft papillae; papillae irregularly arranged, or in distinct rows; distal ring of papillae present. First body segment with tentacular cirri. Tentacular cirri 2–4 pairs; arise on a single segment, or over two or more segments (segments often fused); internal aciculae absent. First chaetiger with neurochaetae only. Parapodia uniramous throughout; notopodial lobes absent; neuropodial lobes represented by at least one chaetal lobe. Dorsal cirri flattened and foliaceous. Ventral cirri present, cirriform or tapering, or foliaceous. Branchiae absent. Notochaetae absent, or present. Aciculae present; in ventral position. Capillary chaetae absent, or present; hair-like; smooth. Spines absent. Hooks absent. Compound chaetae present; appendage distally tapering to slender tips, not canaliculated, without hoods or guards; joint distinctly asymmetrical, effected by ligaments; shaft distinctly inflated distally near joint, without distinct core. Compound falcigers present in most or all chaetigers.
Reference: Wilson et al., 2003.

Genus *Eteone* Savigny 1818
Eteone ornata (Grube, 1878) (Plate 32)
Distribution: Muddy substrates near Failaka Island.

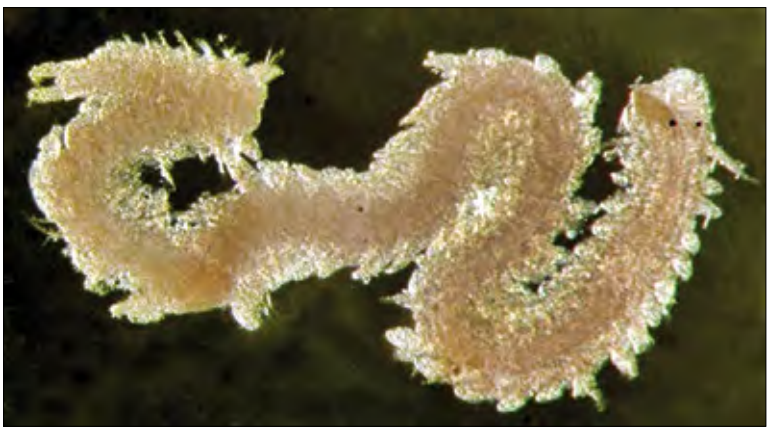


Plate 32. *Eteone ornata*, general view.

***Phyllodocidae* gen. sp.**
Distribution: Muddy and silty substrates in Kuwait Bay.

Family Polynoidae Malmgren, 1867
Description: Worms with two dorsal rows of scales (also known as elytrae), present over part or all of the body. The prostomium is bilobed or rounded, and the peristomium is reduced to lips around the mouth. Paired lateral antennae are present in most taxa, and a median antenna is present in many taxa. The ventral palps are fused to the first segment and are tapering without articulations. Nuchal organs are present. The longitudinal muscles are grouped into bundles, and segmentation is distinct. The first segment curves around the prostomium, and usually has very small biramous parapodia, with the neuropodia fused to the lower side of the head, and two pairs of tentacular cirri. The parapodial rami are distinct, and the neuropodia are usually longer than the notopodia in all segments; sometimes the notopodia are very short with few chaetae. Dorsal cirri and elytra occur on alternate segments, at least anteriorly; the posterior end may or may not be covered by elytra. Ventral cirri are present. Branchiae are absent as are epidermal papillae. A pair of pygidial cirri is present. Lateral organs and dorsal cirrus organs have not been observed. The buccal organ is an axial, muscular eversible pharynx with terminal papillae and two pairs of dorso-ventral jaws. A gular membrane is absent, and the gut has segmentally arranged side-branches (caeca). Mixonephridia, are present in many segments. The circulatory system is closed and a heart body is absent. Aciculae are present. Chaetae occur as variously ornamented capillaries and spines.
Reference: Wilson et al., 2003.

Genus *Harmothoe* Kinberg 1855
Harmothoe dictyophora (Grube, 1878) (Plate 33 a-b)
Distribution: Muddy substrates in Khor Al-Sabbiya Strait.

Harmothoe minuta (Potts, 1910) (Plate 34 a-b)
Distribution: Muddy substrates near Failaka Island.

***Harmothoe* sp.**
Distribution: Muddy substrates in Kuwait Bay and between Bubiyan and Failaka Islands.

Genus *Lepidasthenia* Malmgren, 1867
***Lepidasthenia* sp.**
Distribution: Muddy and silty substrates in Kuwait Bay.

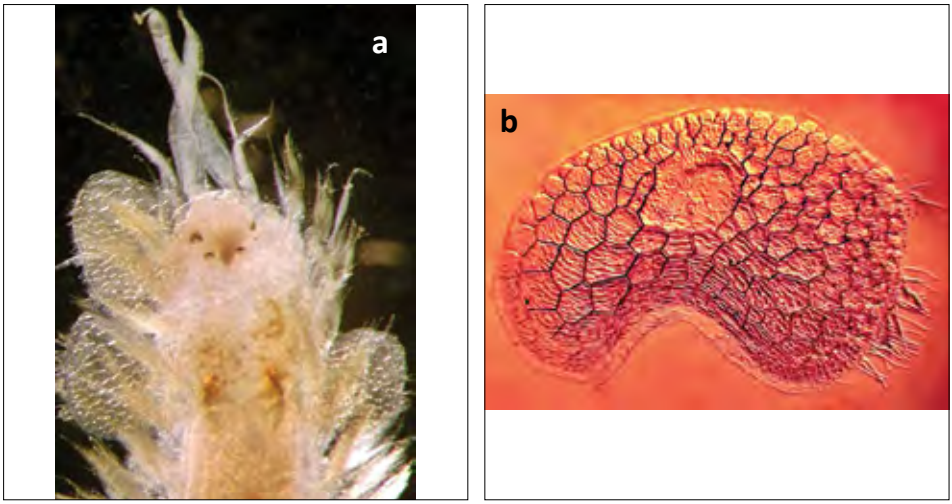


Plate 33. *Harmothoe dictyophora*, **a. anterior end; b. elytron.**

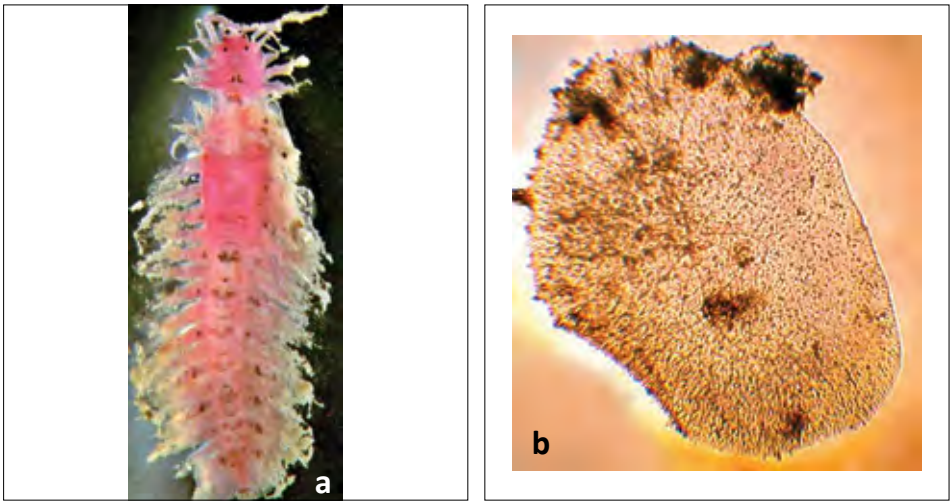


Plate 34. *H. minuta*, **a. dorsal view (stained with Rose Bengal); b. elytron.**

Family Syllidae Grube, 1850
Description: Mostly small slender bodied mobile animals. The Syllidae are distinguished by the presence of a uniquely muscularized region of the anterior digestive tract, the proventricle, which is often visible through the body wall. Other features setting syllids apart from other nereidiforms include: a pair of lateral and one median antenna (antennae rarely absent); paired, simple palps that may be fused together to varying degrees; one or two pairs of peristomial cirri (also called tentacular cirri; rarely absent); a muscular axial-type pharynx that may be armed or unarmed. Reduced parapodia (notopodia represented by dorsal cirri only in non-reproductive forms) having simple or compound neurochaetae. Reference: Wilson et al., 2003.

Genus *Sphaerosyllis* Claparède 1863
***Sphaerosyllis* sp.** (Plate 35 a-b)
Distribution: Muddy substrates near Failaka Island.

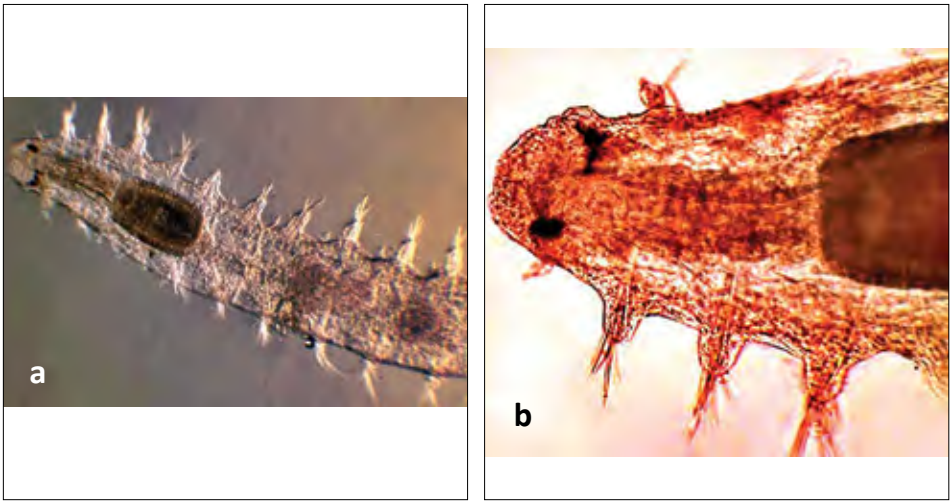


Plate 35. *Sphaerosyllis* sp., a. dorsal view; b. anterior end.

Genus *Exogone* Örsted 1845
***Exogone* sp.**
Distribution: Muddy substrates between Bubiyan and Failaka Islands (Station 10).

Genus *Syllis* Lamarck, 1818
Syllis cornuta Rathke, 1843
Distribution: Muddy and silty substrates in Kuwait Bay.

Genus *Typosyllis* Langerhans 1879
Typosyllis cornuta (Rathke, 1843) (Plate 36)
Distribution: Silty substrates in Kuwait Bay.

Syllidae gen. sp.
Distribution: Silty substrates in Kuwait Bay.

Plate 36. *Typosyllis cornuta*, general view.

Subclass Canalipalpata
The Canalipalpata have no teeth or jaws. Most are filter feeders. They have grooved palps, which are covered in cilia. These cilia are used to transport food particles to the mouth. However, the cilia and grooves have been lost in the Siboglinidae family.
Reference: Wilson et al., 2003.

Order Sabellida
Family Sabellidae Malmgren, 1867
Description: Worms with smooth tapering cylindrical bodies living in tough non calcareous tubes. The body is clearly divided into thorax and abdomen. There is no operculum. The prostomium and peristomium are fused and have developed into a tentacular crown (bi-pinnate radioles) that often obscures a pair of grooved palps. Peristomium ring shaped; usually with an anterior collar and an anteriorly projecting section around terminal mouth. Anterior appendages have brachial crown and extensions of dorsal loops. Nuchal organs present. Longitudinal muscles grouped in bundles; segmentation distinct. First segment similar to next following segment, but with notopodial chaetae only. Parapodia biramous; anterior notopodia cylincrical or tapering and anterior neuropodia tori; posterior notopodia tori and posterior neuropodia short cylinders. Dorsal and ventral cirri are absent. Gills, epidermal papillae and pygidial cirri are absent. Lateral organ and dorsal cirrus organs not observed. Stomodaeum without buccal organ. Gular membrane absent; gut a straight tube. Segmental organs mixonephridia; first pair excretory, posterior ones gonoducts. Circulatory system closed; heart body absent. Aciculae absent; chaetal inversion present. Chaetae variously modified capillaries, dentate hooks without hoods and uncini. The tentacular crown is easily lost during collection and preservation.
Reference: Wilson et al., 2003.

Genus *Branchiomma* Kölliker, 1858
Branchiomma cingulata (Grube, 1870) (Plate 37 a-b)
Distribution: Intertidal zone near Ras Al-Ardh.

Sabellidae gen. sp.
Distribution: Muddy and silty substrates in Kuwait Bay and between Bubiyan and Failaka Islands.

Plate 37. ***Branchiomma cingulata*****, a. gill; b. anterior end.**

Family Serpulidae Rafinesque, 1815
Description: Fan worms with a clearly divided body living in calcareous tubes, which they close by means of an operculum, developed from one of their radioles. Prostomium fused to peristomium; forming a branchial crown anteriorly. Peristomium forming a ring with partial anterior collar. Antennae are absent. Branchial crown homologous to palps of other polychaetes; emerging in juveniles from prostomial region. Nuchal organs present. Longitudinal muscles grouped in bundles; segmentation present. First segment similar to next following segments; buth with notopodial chaetae only. Variably developed thoracic membrane present. Thoracic notopodia short, truncate cylinders and thoracic neuropodia tori; in abdomen notopodia tori and neuropodia short cylinders. Dorsal and ventral cirri, gills, epidermal papillae and pygidial cirri absent; gut a straight tube. Segmental organs mixonephridia; first pair excretory, posterior ones gonoducts. Circulatory system closed; heart body absent. Aciculae absent; chaetal inversion present. Chaetae variously ornamented capillaries and uncini. Often colonial and reef-forming.
Reference: Wilson et al., 2003.

Genus *Hydroides* Gunnerus 1768
Hydroides heteroceros (Grube, 1868) (Plate 38 a-b)
Distribution: Intertidal zone near Ras Al-Zour.

Plate 38. *Hydroides heteroceros*, a. general view; b. operculum.

Genus *Pomatoleios*

Pomatoleios kraussii (Baird, 1865) (Plate 39)

Distribution: On hard substrates in lower part of intertidal zone along the coast of Kuwait. This species forms reefs in Kuwait Bay.

Plate 39. ***Pomatoleios kraussii*****, a. tubes, b. reefs formed by constructions of *P. kraussii* in Kuwait Bay.**

Genus *Spirobranchus* de Blainville 1818
Spirobranchus tetraceros (Schmarda, 1861) (Plate 40)
Distribution: Intertidal zone near Ras Al-Ardh.

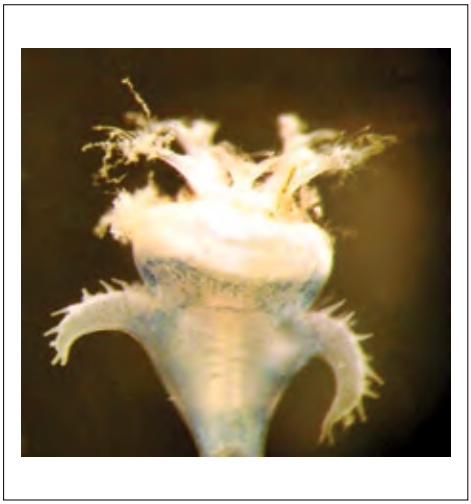


Plate 40. *Spirobranchus tetraceros*, anterior end.

Order Spionida
Family Chaetopteridae Audouin and Milne-Edwards, 1833
Description: Soft easily broken body divided into three clear regions. The prostomium is small and rounded; antennae are absent. Anterior body somewhat spionid-like with a pair of grooved feeding palps. Nuchal organs are located laterally on the prostomium. Differentiation of parapodia divides the body into three regions: the first and subsequent anterior segments have notopodia only; the mid-body segments have biramous parapodia with prominent achaetous notopodia and neuropodia, and; posterior segments have less prominent parapodia, with both lobes pointed or with neuropodia present as tori. Dorsal and ventral cirri, branchiae and pygidial cirri are all absent. Aciculae are absent. Chaetae are lancet-shaped capillaries, anteriorly, modified, greatly enlarged, usually dark-coloured spines on setiger 4, and uncini in median and posterior neuropodia. Tube-dwelling, mucous-net filter feeders.
Reference: Wilson et al., 2003.

Genus *Chaetopterus* Cuvier 1827
***Chaetopterus* sp.** (Plate 41)
Distribution: Muddy substrates in Kuwait Bay.

Genus *Spiochaetopterus* Sars, 1853
***Spiochaetopterus* sp.**
Distribution: Muddy and silty substrates in Kuwait Bay.

Plate 41. *Chaetopterus* sp., general view.

Family Magelonidae Cunningham and Ramage, 1888
Description: Body clearly divided into two regions. The prostomium is flattened and shovel-shaped with one pair of palps attached ventro-laterally; nuchal organs are absent. The palps are round basally and have an expanded papillated distal region. The pharynx is eversible; jaws are absent. The first segment, in adults, lacks parapodia and chaetae. The parapodia of remaining segments are biramous; each ramus has a low ridge of chaetae and supporting podial lobes. Dorsal and ventral cirri and branchiae are absent. Aciculae are absent. Chaetae are simple; capillaries and dentate hooded hooks are present. Chaetae of chaetiger 9 are modified spinelike capillaries. One pair of pygidial cirri is present.
Reference: Wilson et al., 2003.

Genus *Magelona* F. Müller 1858
Magelona cornuta Wesenberg-Lund, 1949 (Plate 42 a-c)
Distribution: Muddy substrates near Failaka Island.

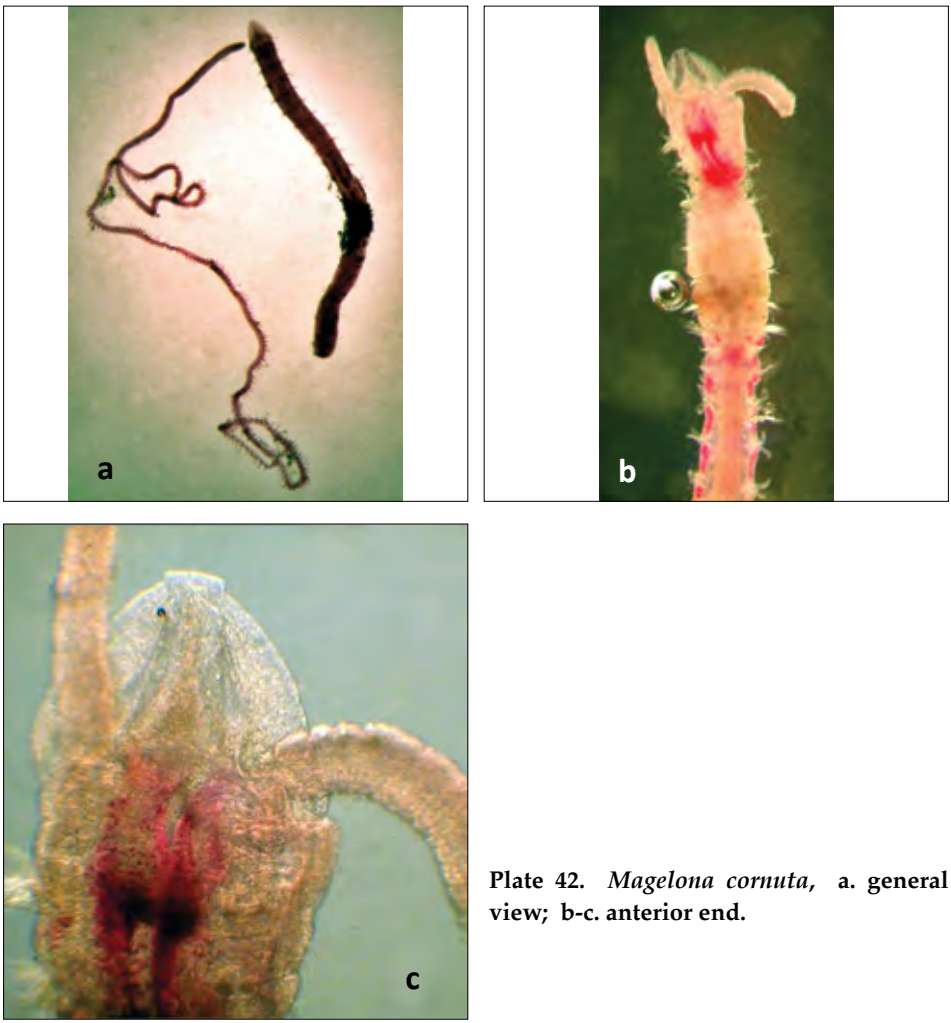


Plate 42. ***Magelona cornuta*****, a. general view; b-c. anterior end.**

Family Poecilochaetidae Hannerz, 1956

Description: The prostomium is anteriorly truncate. A median ventral papillose antenna is present. Nuchal organs are present as three posteriorly directed digitiform lobes. The peristomium is reduced to lips, and one pair of grooved peristomial palps is present. The first segment is similar to subsequent segments, though it may be slightly enlarged and parapodia and chaetae project anteriorly. The parapodia are biramous; each lobe is a ridge with a flask-shaped tapering postchaetal lobe. Dorsal and ventral cirri are absent. Branchiae are present as flattened parapodial structures. Numerous pygidial cirri are present. Aciculae are absent. Chaetae are all simple; feathered or otherwise modified capillaries or thick spines are present. The Poecilochaetidae have a pair of grooved feeding palps, forward-projecting chaetae which makes a cephalic 'cage' and flask-shaped parapodial lobes.

Reference: Wilson et al., 2003.

Genus *Poecilochaetus* Claparède 1875

***Poecilochaetus* sp.** (Plate 43 a-b)

Distribution: Kuwait's marine environment.

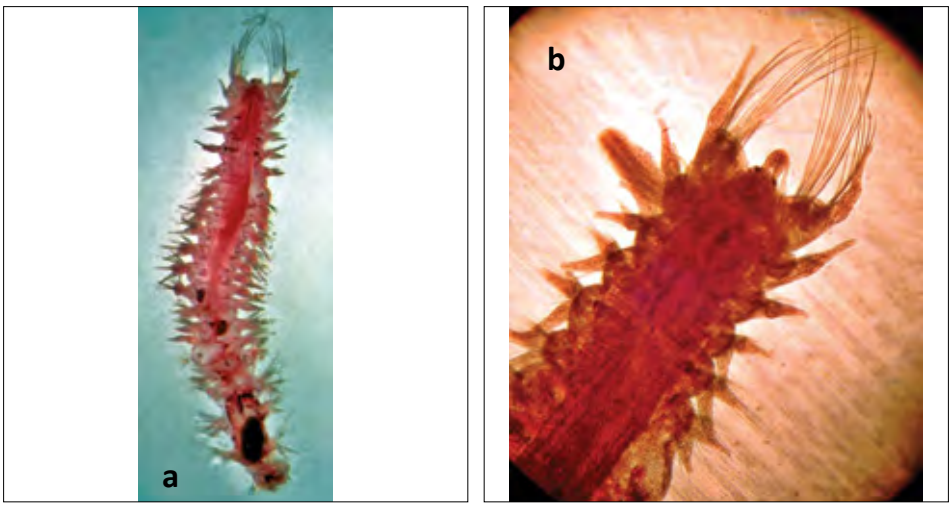


Plate 43. *Poecilochaetus* sp., a. general view; b. anterior end.

Family Spionidae Grube, 1850

Description: Tube builders with an elongate body. The prostomium is often rounded and truncate, but may be pointed or have a pair of lateral horns. A pair of highly mobile, grooved tentacular feeding palps, which arise from the peristomium, is always present; they are often lost in preserved specimens. A median antenna may also be present. The prostomium is elongated posteriorly and bears paired nuchal organs. The parapodia are biramous, except for the first segment, which may lack notochaetae in some taxa. Dorsal and ventral cirri are absent. Branchiae are often present, either restricted to a few anterior segments or present on most segments; they are located on the dorsum adjacent to the notopodial lobes to which they may be partially or completely fused. Branchiae are usually some-what flattened, and may be simple and laterally ciliated, or may carry pinnae or lamellae. Other structures also referred to as branchiae may occur ventrally or as accessory structures on notopodia. The pygidium may have paired elongate anal cirri, or more numerous and smaller cirri and/or lobes. Aciculae are absent. Notochaetae and neurochaetae include simple capillaries, either smooth or limbate, and simple hooks with apical teeth; compound chaetae are absent. Both hooks and capillaries may be sheathed, the latter in some taxa as stout sabre chaetae in ventral neuropodial positions. Other chaetal types present include recurved hooks and modified spines. Spionidae should be readily distinguished by the presence of one pair of palps, a prostomium that is prolonged posteriorly, and leaf-like notopodia and neuropodia. Often there are gills as well. The palps are often lost.

Reference: Wilson et al., 2003.

Genus *Laonice* Malmgren 1867

Laonice cirrata (Sars, 1851) (Plate 44 a-b)

Distribution: Muddy substrates near Failaka Island.

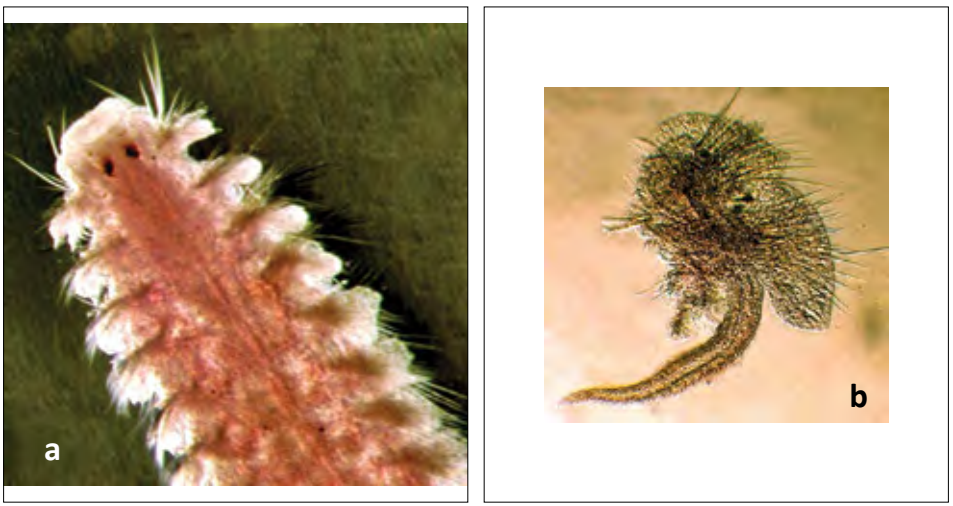


Plate 44. ***Laonice cirrata*****, a. anterior end; b. parapodia.**

Genus *Paraprionospio* Caullery 1914
Paraprionospio pinnata (Ehlers, 1901) (Plate 45 a-b)
Distribution: Cosmopolitan. In Kuwait waters registered on muddy substrates around Failaka Island and between Bubiyan and Failaka Islands.

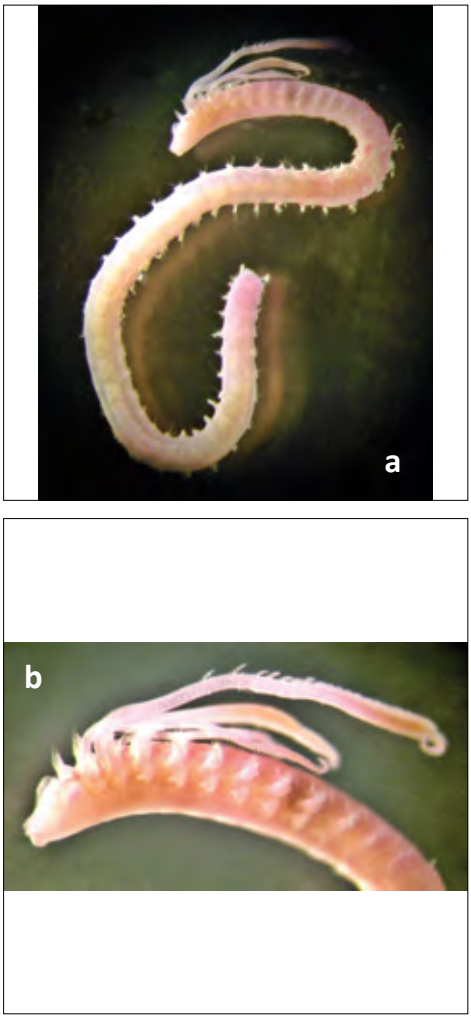


Plate 45. ***Paraprionospio pinnata*****, a. general view; b. anterior end.**

Genus *Polydora* Bosc, 1802
***Polydora* sp.**
Distribution: Muddy and silty substrates in Kuwait Bay.

Genus *Prionospio* Malmgren 1867
Prionospio aucklandica Augener, 1923 (Plate 46 a-b)
Prionospio cirrifera Wirén, 1883 (Plate 45 c)
Distribution: Muddy and silty substrates in the Kuwait Bay.

Genus *Pseudopolydora* Czerniavsky, 1881
***Pseudopolydora* sp.**
Distribution: Muddy and silty substrates in Kuwait Bay.

Spionidae gen. sp.
Distribution: Intertidal zone near Shuwaikh, Ras Al-Ardh and Ras Al-Zour.

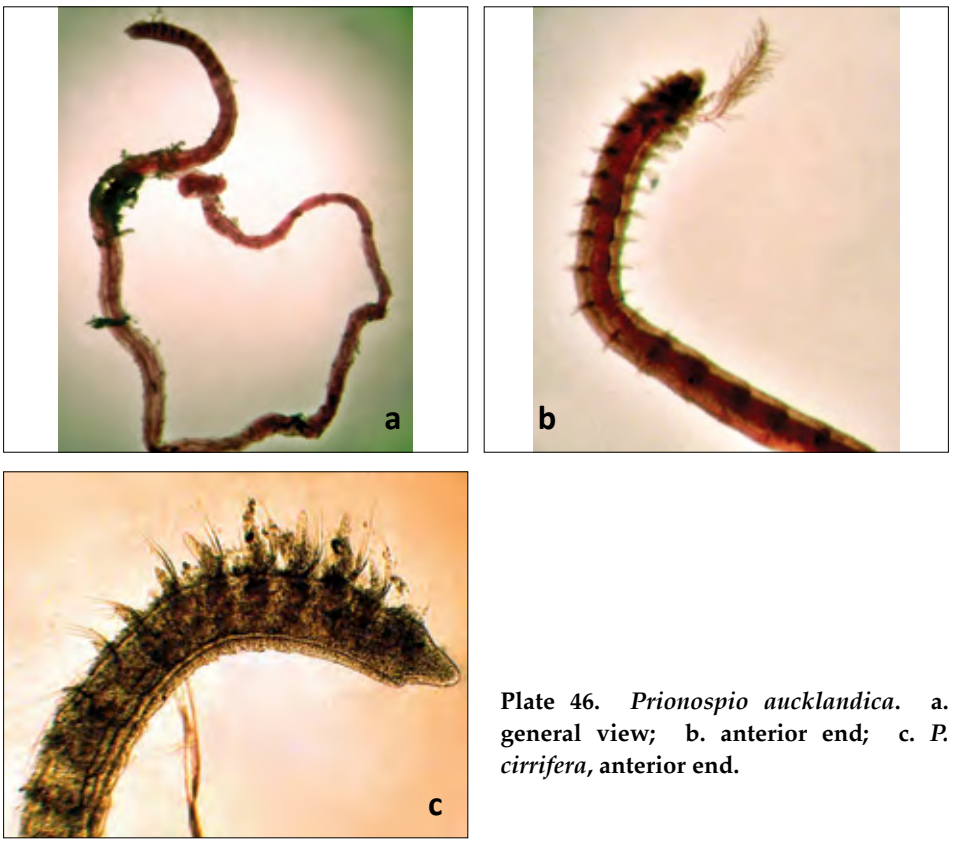


Plate 46. ***Prionospio aucklandica*****. a. general view; b. anterior end; c.** ***P. cirrifera*****, anterior end.**

Order Terebellida

Family Ampharetidae Malmgren, 1866

Description: The prostomium is relatively small, and is elongated, rounded, or pointed. It is situated on top of a larger unit consisting of the fused first and second segments. The peristomium is reduced to lips and the roof of the mouth. Antennae are absent. Palps are short, slender peristomial buccal tentacles attached to a dorsally located curtain within the buccal cavity; occasionally one or two very much larger grooved palps are present. Nuchal organs are comma-shaped, and are situated laterally on the prostomium. Longitudinal muscles are in four bands; segmentation is welldefined. Parapodia first occur on segments III to V. Short cylindrical notopodia are present on the thorax and neuropodia are tori throughout. Dorsal and ventral cirri are absent. Up to four pairs of branchiae are present on the anterior segments; branchiae may all be similar or structurally different along the body or between species. Epidermal papillae are absent. The pygidium may be unadorned or may have many cirri. Lateral organs are present, but dorsal cirrus organs have not been observed; presumably, they are absent. The buccal organ is non-eversible (this structure has also been called a foodsorter). A gular membrane is present between two anterior segments. The gut is straight in some taxa-but is mostly looped. Segmental organs are mixonephridia; the first pair is excretory, the others act as gonoducts (only a few anterior pairs are present). The circulatory system is closed and a heart body is present. Aciculae are absent. Chaetae are present as notopodial thoracic capillaries and neuropodial uncini; in some taxa, slender, peg-like chaetae are present in anterior neuropodia. Anterior notopodial paleae are present in some taxa; other taxa have paired large hooks dorsally in paleal positions, but many taxa are without either paleae or hooks.

Reference: Wilson et al., 2003.

Genus *Amage* Malmgren 1866

***Amage* sp.** (Plate 47 a-b)

Distribution: Muddy substrates near Failaka Island and between Bubiyan and Failaka Islands.

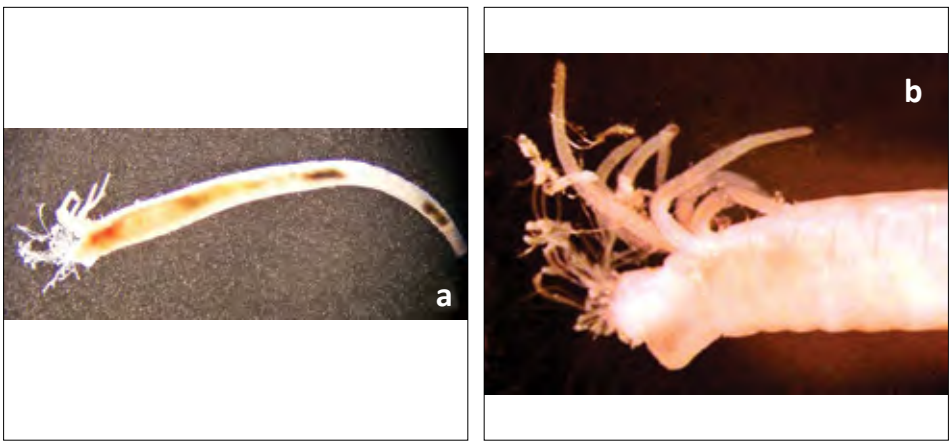


Plate 47. *Amage* sp., a. general view; b. anterior end.

Genus *Amphicteis* Grube 1850
***Amphicteis* sp.** (Plate 48)
Distribution: Muddy substrates between Bubiyan and Failaka Islands.

Plate 48. *Amphicteis* sp., general view.

Genus *Melinna*
***Melinna* sp.** (Plate 49)
Distribution: Kuwait's marine environment.

Plate 49. *Melinna* sp., general view.

Genus *Melinnopsis* McIntosh 1885
***Melinnopsis* sp.**
Distribution: Muddy substrates near Bubiyan Island.

Genus *Samythopsis* McIntosh 1885
Samythopsis grubei McIntosh, 1885
Distribution: Kuwait's marine environment.

Ampharetidae gen. sp.
Distribution: Muddy substrates between Bubiyan and Failaka Islands.

Plate 50. *Samythopsis grubei*, general view.

Family Cirratulidae Carus, 1863
Description: Body cylindrical with reduced parapodia. Cirratulids have a conical or anteriorly rounded prostomium that lacks appendages and a peristomium fused with at least two segments. Palps are present either as paired, grooved tentacles arising from the posterior prostomium or as multiple filaments arising from the anterior segments. Parapodia are biramous with papillar lobes and simple chaetae (capillaries, hooks and spines). Paired, slender branchial filaments arise from the dorsal surface of each segment usually, over much of the body. When alive, the body of cirratulids is often red, orange or yellow in colour, as are the branchiae and tentacular filaments, which may almost cover the body (however, species of *Dodecaceria* are dark green or black).
Reference: Wilson et al., 2003.

Genus *Cirratulus*
***Cirratulus* sp.1** (Plate 51)
Distribution: Kuwait's marine environment.

***Cirratulus* sp.2**
Distribution: Muddy substrates near Failaka Island.

Plate 51. *Cirratulus* sp.1, general view.

Genus *Cirriformia* Hartman, 1936
Cirriformia chrysoderma (Claparede, 1869)
Distribution: Muddy and silty substrates in Kuwait Bay.

Genus *Dodecaceria*
***Dodecaceria* sp.**
Distribution: Muddy substrates near Failaka Island and between Bubiyan and Failaka Islands.

Genus *Tharyx*
Tharyx multifilis Moore, 1909
Distribution: Muddy substrates near Failaka Island.

***Tharyx* sp.1** (Plate 52 a)
Distribution: Kuwait's marine environment.

***Tharyx* sp.2** (Plate 52 b)
Distribution: Muddy substrates near Failaka Island.

Plate 52. a. *Tharyx* sp.1, general view; b. *Tharyx* sp.2, anterior end.

Family Flabelligeridae Saint-Joseph, 1894
Description: Papillated body of relatively few segments although surface may be partially obscured by mucus bound sediment. The prostomium is a narrow ridge, often referred to as the prostomial lobe, and the peristomium is reduced. Antennae are absent, and peristomial paired grooved palps are located at the corners of the mouth. Nuchal organs are paired ciliated ridges lateral to the prostomium. The longitudinal muscles are arranged in bundles. The first segments are fused to form the branchial membrane (or cephalic hood). Parapodia are biramous and poorly developed. All notopodia and neuropodia are short, and are distally truncate or tapering. Dorsal and ventral cirri are absent. Dorsal segmental branchiae are present and arise from the cephalic hood. Lateral organs and dorsal cirrus organs have not been observed. Papillae of a characteristic structure are present, often especially dense and long around chaetae. An eversible ventral buccal organ is present and the gut is looped. A gular membrane is present. Segmental organs are present as mixonephridia; the anteriormost pair is excretory and the more posterior ones function as gonoducts. The circulatory system is closed, and a heart body is present. Aciculae are absent. Chaetae are present as falcate compound falcigers and variously ornamented capillaries. The relatively thick, distally blunt chaetae present in many species of flabelligerids have been referred to as spines and as modified capillaries. Flabelligerids are frequently collected in benthic samples, especially in poorly sorted sediments.
Reference: Wilson et al., 2003.

Genus *Brada* Simpson 1954
Brada mamillata Grube, 1877 (Plate 53 a-b)
Distribution: Muddy substrates near Failaka Island and between Bubiyan and Failaka Islands.

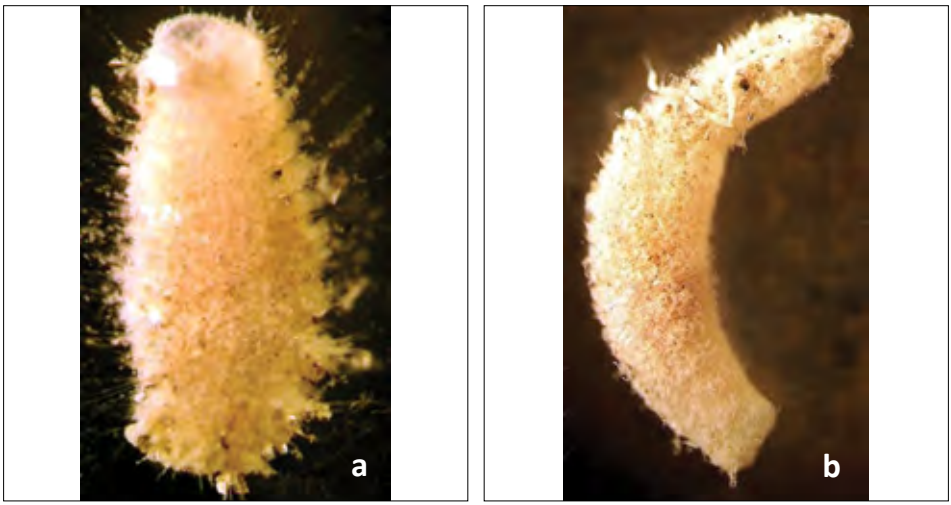


Plate 53. *Brada mamillata*, a. dorsal view; b. lateral view.

Genus *Diplocirrus* Haase 1915
Diplocirrus glaucus (Malmgren, 1867) (Plate 54 a-c)
Distribution: Muddy substrates near Failaka Island.

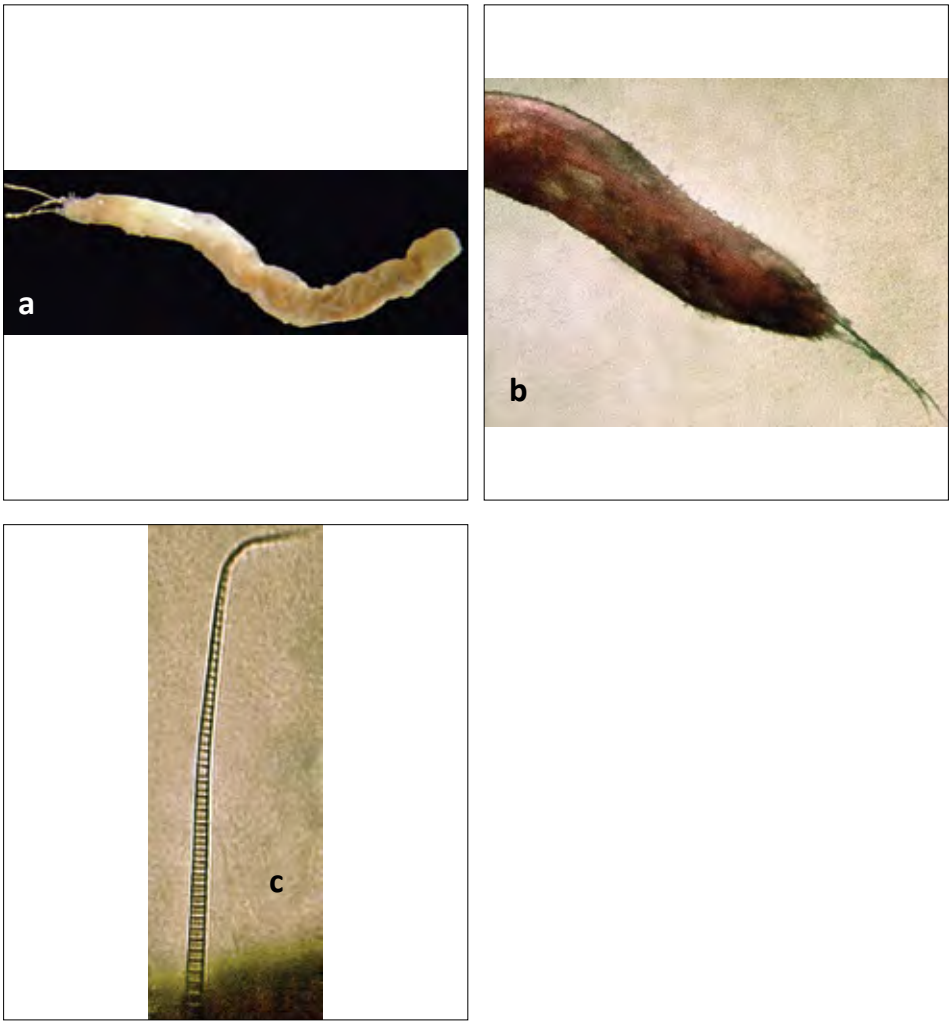


Plate 54. ***Diplocirrus glaucus*****, a. general view; b. anterior end; c. bristle.**

Genus *Flabelligera* Sars 1829
Flabelligera diplochaitos (Otto, 1821) (Plate 55)
Distribution: Muddy substrates near Failaka Island.

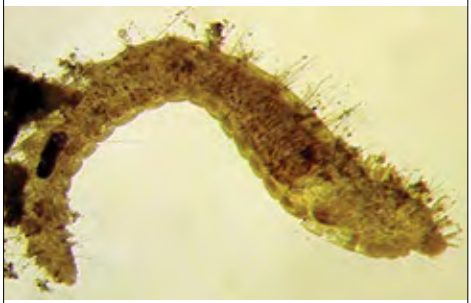


Plate 55. *Flabelligera diplochaitos*, general view.

Genus *Pherusa* Oken 1807
Pherusa (Stylaroides) plumosa (Müller, 1776) (Plate 56)
Distribution: Muddy substrates between Bubiyan and Failaka Islands.

Plate 56. *Pherusa plumosa*, general view.

Family Pectinariidae Quatrefages, 1866
Description: Pectinariids are characterised by having a reduced prostomium, which is completely fused to the peristomium; the latter is reduced to lips around the mouth. The body is divided into three sections. Antennae are absent. The peristomial palps (buccal tentacles) are grooved and inserted on or around the lips, and cannot be retracted into the buccal cavity. A cephalic veil (tentacular membrane) is present, and nuchal organs appear to be represented by dorsal ciliated crests. The longitudinal muscles are grouped in bundles. Segmentation is distinct and the first segment is completely fused to the head and bears golden notopodial paleae. Other notopodia are short, truncate cylinders; the neuropodia are tori. Anteriorly, two pairs of dorsal, branching branchiae are present. Lateral organs are present, as internally ciliated pits between the notopodia and neuropodia. There is a ventral buccal organ and the gut is looped. A gular membrane, between two anterior segments, is present. Nephridia are mixonephridia, comprising a few pairs of anterior nephridia and posterior gonoducts. The circulatory system is closed, and heart body is present. The posterior end is a flattened scaphe with spine-like chaetae. Aciculae are absent. Chaetae are present as notopodial capillaries, spines (paleae) and neuropodial uncini. Pectinariids should be easily recognised by their distinctive golden paleae (large flattened chaetae) which surround the mouth. Their tube is also distinctive and resembles an ice-cream cone made of cemented sand grains.
Reference: Wilson et al., 2003.

Genus *Pectinaria* Savigny1818
Pectinaria antipoda Schmarda, 1861 (Plate 57)
Distribution: Muddy substrates near Failaka Island.

Plate 57. *Pectinaria antipoda*, general view.

Family Sternaspidae Carus, 1863

Description: Highly distinctive short body with a posterior ventral chitinized shield. The prostomium is distinct and truncate anteriorly, and the peristomium is reduced to lips around the mouth. Antennae and palps are absent; nuchal organs are also lacking. Longitudinal muscles are grouped in many bands, and segmentation is distinct. The first segment is similar to those behind, and bears similar chaetae. The whole of the anterior part of the body is retractable. Several segments of the posterior venter are covered by a sclerotinised shield. The parapodia are biramous except at the posterior end. Only notopodia are present in the posterior region covered by the shield, and consist of very short, truncate cylinders. Rami are short, barely raised papillae. Dorsal and ventral cirri are absent. The simple branchiae are situated posteriorly and dorsally. Epidermal papillae similar to flabelligerid papillae are present. Pygidial cirri are absent. There is an eversible axial sac-like pharynx and the gut is folded. A gular membrane is lacking. The segmental organs are mixonephridia, of which the anteriormost pair is excretory, and the posterior pair are gonoducts. The circulatory system is closed, and a heart body is lacking. Aciculae are absent. Chaetae consist of capillaries and heavy spines. Sternaspids should be readily recognized by their short inflated bodies and the ventral sclerotinised plate which is reddish and surrounded by chaetae.

Reference: Wilson et al., 2003.

Genus *Sternaspis* Otto 1821

Sternaspis scutata (Ranzani, 1817) (Plate 58 a-b)

Distribution: Muddy substrates near Failaka Island.

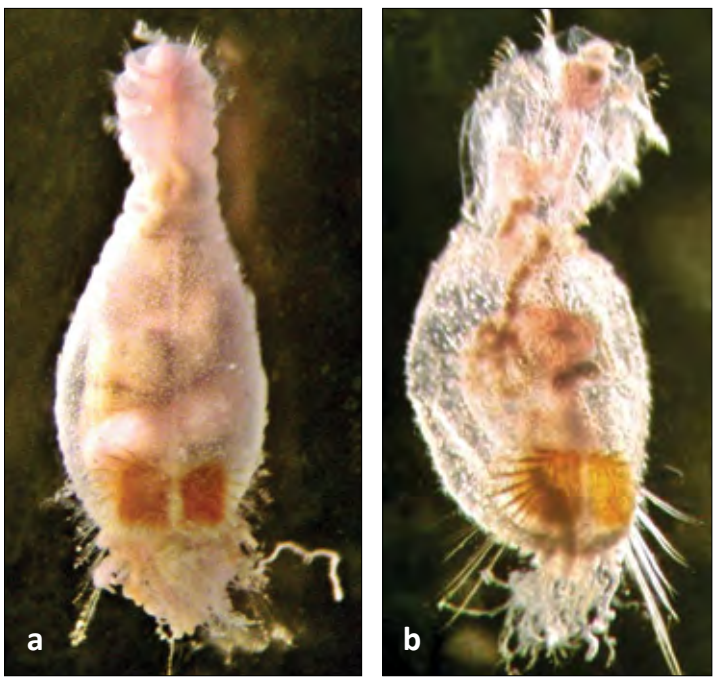


Plate 58. a-b. *Sternaspis scutata*, general view.

Family Terebellidae Mamlgren, 1867
Description: The Terebellidae have a reduced prostomium, which is fused along its posterior edge to the peristomium. The peristomium is also fused with the first anterior body segment, and projects forward beneath the prostomium as an extended upper lip. Palps are usually present as numerous (buccal) tentacles, which emerge at the point of fusion between the peristomium and the prostomium. Nuchal organs are usually present, and the longitudinal muscles form bands. Body clearly divided into two regions. Segmentation is typically distinct. The first segment, fused to the head, has no parapodia or chaetae. Parapodia are typically biramous; they are lacking in some species (for example, *Hauchiella* species). The notopodia are cylindrical, either slender or truncate, and are often restricted to the anterior segments of the body. Neuropodia are present as tori or may be absent. Branchiae, if present, are dorsal and situated only on a few anterior segments. Epidermal papillae and pygidial cirri are absent. There is a non-eversible ventral buccal organ. Mixonephridia are present in each segment; anteriorly, these ones function as excretory organs and the posterior ones are used as gonoducts. Chaetae are present as a variety of ornamented capillaries and uncini; they are rarely absent. Aciculae are absent. Terebellids are common in soft bottom communities as well as on rocky reefs.
Reference: Wilson et al., 2003.

Genus *Lanice* Mamlgren 1866
Lanice conchilega Pallas, 1766
Distribution: Muddy substrates near Ras Al-Ardh.

Genus *Loimia* Mamlgren 1866
Loimia medusa (Savigny, 1822) (Plate 59 a-b)
Distribution: Cosmopolitan in warm waters. In Kuwait waters, they were registered on muddy substrates near Failaka Island and between Bubiyan and Failaka Islands.

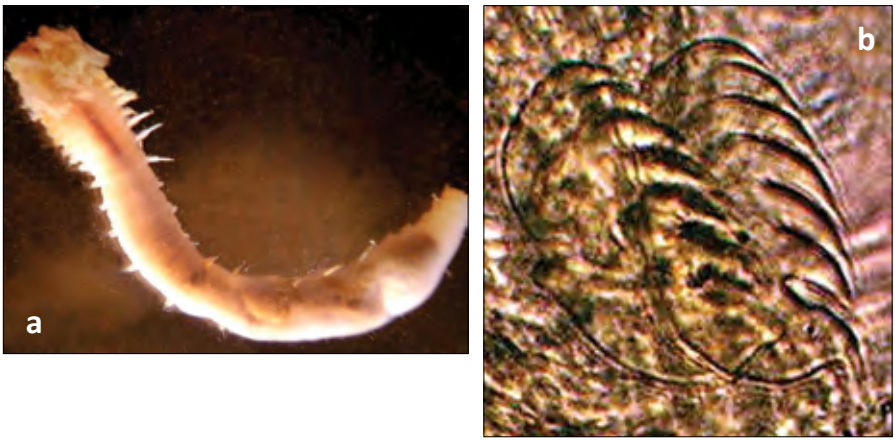


Plate 59. *Loimia medusa*, a. general view; b. uncinus.

Genus *Lysilla* Malmgren, 1866
***Lysilla pambanensis* Fauvel, 1928**
Distribution: Muddy and silty substrates in Kuwait Bay.

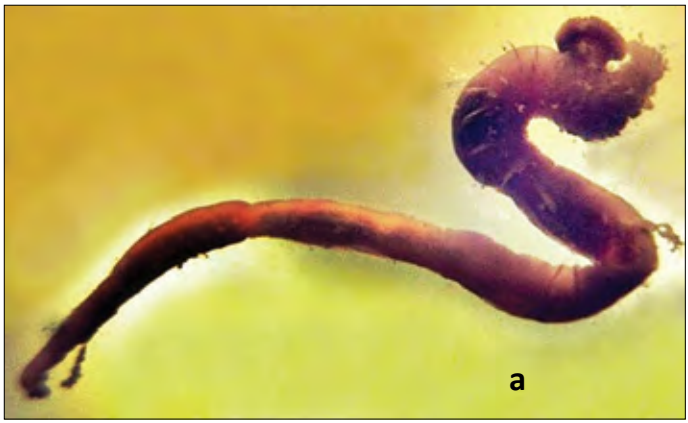
Genus *Pista* Malmgren, 1866
***Pista cristata* (O.F.Muller, 1776)**
Distribution: Muddy and silty substrates in Kuwait Bay.

Terebellidae gen. sp.
Distribution: Muddy substrates in Kuwait Bay.

Family Trichobranchidae Malmgren, 1866
Description: The Trichobranchidae is characterised by the fusion of the prostomium to the peristomium along the anterior margin of the prostomium. The peristomium forms extended lips; the upper lip may be expanded to form lateral lobes and the lower lip may be greatly expanded to form a ridged, conical eversible proboscis, which may be completely retracted. The palps are represented by multiple grooved buccal tentacles, which cannot be retracted into the mouth. Nuchal organs are present in *Trichobranchus* species, but not in Terebellides species; the condition is unknown for other genera. Segmentation is distinct. The first segment is fused to the head and lacks parapodia and chaetae. The body is divided into two regions: the thorax, bearing notochaetae and neurochaetae, and the abdomen, with neurochaetae only. Branchiae occur dorsally on segments 2 to 4; the filaments may be filiform, foliaceous, rosette-like in two or three groups or may form a single large branchia bearing two to five lamellate lobes. Ventral glandular pads are absent. The pygidium is smooth or lobed and small cirri may be present. Lateral organs and dorsal cirrus organs have not been observed. There is a non-eversible ventral buccal organ and the gut is looped. A gular membrane is present. Nephridia are present as metanephridia; the relation to coelomostomes has not been documented. The anteriormost pair of nephridia are excretory in function; the posterior ones presumably act as gonoducts. The circulatory system is closed and a heart body is present. Aciculae are absent; other chaetae are variously ornamented capillaries and uncini which may be acicular, or avicular with short or long shafts. Trichobranchids tend to have short compact bodies. They have a fixed number of thoracic segments, and a variable number of abdominal segments with neuropodia only.
Reference: Wilson et al., 2003.

Genus *Terebellides* Sars 1835
Terebellides stroemi Sars, 1835 (Plate 60 a-b)
Distribution: Muddy substrates between Bubiyan and Failaka Islands.

***Terebellides* sp.**
Distribution: Muddy substrates near Failaka Island.



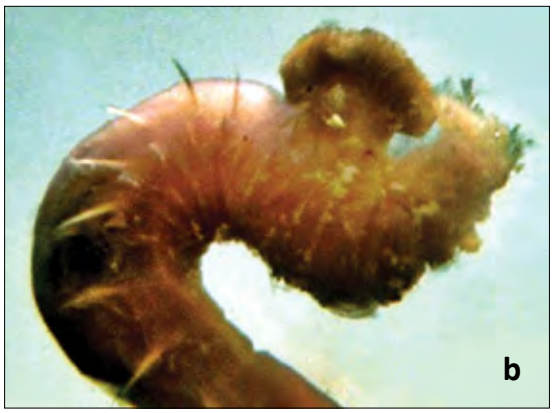


Plate 60. ***Terebellides stroemi,*** **a. general view; b. anterior end.**

Genus *Trichobranchus* Mamlgren 1866
***Trichobranchus* sp.**
Distribution: Muddy substrates near Failaka Island.

Subclass Scolecida
Polychaeta with parapodia with similar rami, with prostomium clearly demarcated, with first segment and its appendages similar to those following, with capillary chaetae, without structures on the head, except for nuchal organs. Head usually conical (T-shaped tip in Scalibregmatidae) and lacks palps and other head appendages, although minute eyespots may be present and a median antenna may be present in Paraonidae. The parapodia lack lobes but have notopodial and neuropodial chaetae as simple capillaries, or capillaries and hooks in the Capitellidae. Hooks may be hooded and/or multi-toothed. Cossuridae have a single median gill on an anterior segment and simple segmental gills may be present in other families. The pharynx is eversible as a ventral unarmed, sac-like and usually papillate proboscis, which may have finger-like lobes.
Reference: Rouse and Pleijel, 2001.

Family Capitellidae Grube, 1862
Description: The distinctly grooved prostomium is a short, blunt cone and the peristomium forms a complete ring. Antennae and palps are absent. The nuchal organs comprise a pair of dorso-lateral pits. The longitudinal muscles form distinct bundles. Segmentation is distinct. The first segment lacks parapodia and chaetae and is longer than the second segment which carries the first chaetae. In a variable number of anterior chaetigers, both parapodial rami, bearing short truncate lobes, may be deeply recessed into the body wall; tori replace these lobes in more posterior chaetigers. Dorsal and ventral cirri, and epidermal papillae are absent; 'branchiae' are also considered as absent, although extensions of the posterior body wall, in some species, may have a respiratory function. Pygidial cirri may be present or absent; when present their number varies in different taxa. Lateral organs are present, and dorsal cirrus organs have not been observed and are presumed to be absent. A simple axial eversible pharynx (= proboscis) is present. A gular membrane is situated between chaetigers 4 and 5, and the gut is a straight tube. A circulatory system and heart body are lacking. Aciculae are absent; other chaetae include capillaries and hooded hooks. Capillary chaetae and hooded hooks occur on both rami on a variable number of anterior chaetigers; posteriorly, hooks are present on both rami. The hooks are small and in a single row on each torus. Capitellids are the polychaetes, which most resemble terrestrial earthworms, usually with a rounded head and a long cylindrical body with poorly developed parapodia and clearly visible segments. In life, capitellids are often reddish in colour.
Reference: Wilson et al., 2003.

Genus *Capitella* de Blainville 1828
Capitella capitata (Fabricius, 1780)
Distribution: Muddy substrates near Failaka Island.

***Capitella* sp.**
Distribution: Muddy substrates near Failaka Island.

Genus *Capitomastus* Eisig 1887
***Capitomastus* sp.** (Plate 61 a-b)
Distribution: Muddy substrates near Ras Al-Ardh.

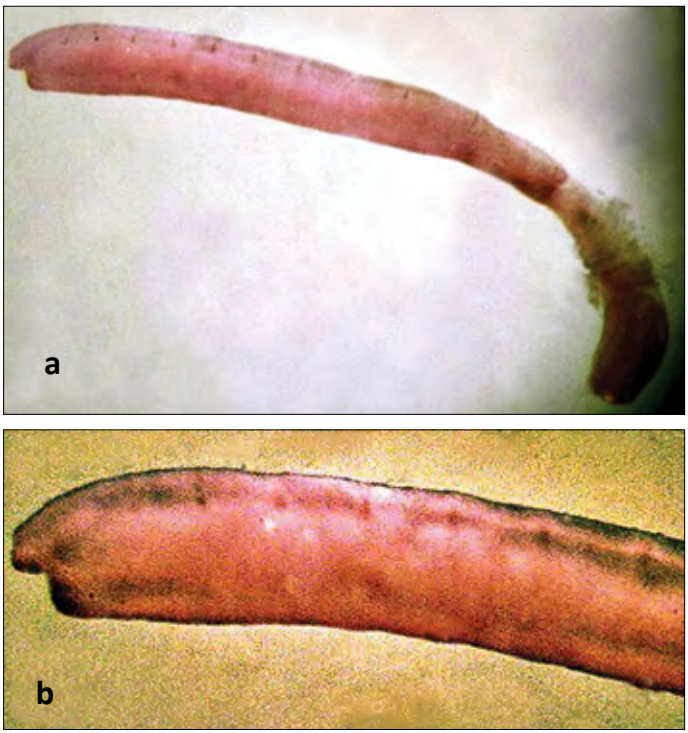


Plate 61. *Capitomastus* sp., a. general view; b. anterior end.

Genus *Dasybranchus* Grube, 1850
***Dasybranchus* sp.**
Distribution: Muddy and silty substrates in Kuwait Bay.

Genus *Heteromastus* Augener 1914
Heteromastus filiformis (Claparède, 1864)
Distribution: Muddy substrates near Ras Al-Ardh.

Genus *Notomastus* Sars 1850
Notomastus latericeus Sars, 1851
Distribution: Intertidal zone of Ras Al-Ardh.

Genus *Parheteromastus* Monro1937
Parheteromastus tenuis Monro, 1937 (Plate 62 a-b)
Distribution: Muddy substrates near Failaka Island.

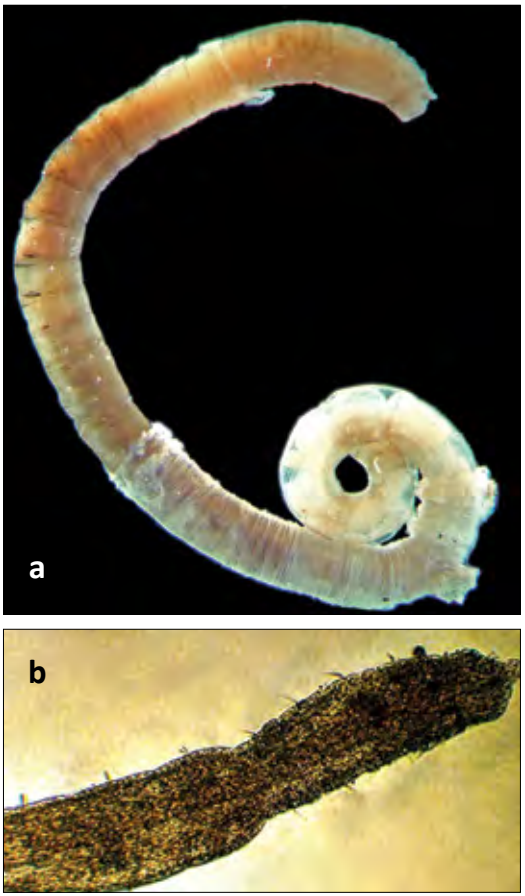


Plate 62. *Parheteromastus tenuis*, a. general view; b. anterior end.

Genus *Rashgua* Wesenberg-Lund 1949
Rashgua rubrocincta Wesenberg-Lund, 1949 (Plate 63)
Distribution: Kuwait's marine environment.

Capitellidae gen. sp.
Distribution: Kuwait's marine environment.

Plate 63. *Rashgua rubrocincta*, general view.

Family Cossuridae Day, 1963

Description: The prostomium is bluntly conical. The peristomium forms a distinct ring; it is sometimes referred to as an achaetous segment and has been often confused with a segment. Anterior appendages are lacking. Pair of nuchal organs is present as short dorso-lateral ciliated grooves on the posterior prostomium. The longitudinal muscles are grouped in bundles, and segmentation is distinct. The first segment and appendages are similar to subsequent ones; parapodia have similar rami and capillary chaetae. The parapodial rami are often nearly confluent in the first or first few segments. Both notopodia and neuropodia are low, ridge-shaped or papillalike structures; dorsal and ventral cirri are absent. A single median branchia (often referred to as a median tentacle) is present dorsally on one anterior chaetiger. Epidermal papillae are lacking. Three or more pygidial cirri are present in some taxa. Lateral organs and dorsal cirrus organs have not been observed. Aciculae are lacking; the chaetae are limbate, slender capillaries, and in one genus, Cossurella, acicular spines are also present on posterior segments. Cossurids are small thread like worms with pointed or slightly rounded prostomium characterized by a single median branchial filament, which tends to be retained. The absence of prostomial appendages and the single dorsal branchial filament arising from a median position on an anterior segment distinguish cossurids from other polychaetes.

Reference: Wilson et al., 2003.

Genus *Cossura* Webster and Benedict (1887)

Cossura laeviseta Hartman-Shröder, 1962 (Plate 64 a-b)

Distribution: Muddy and silty substrates in the Kuwait Bay, near Failaka Island and between Bubiyan and Failaka Islands.

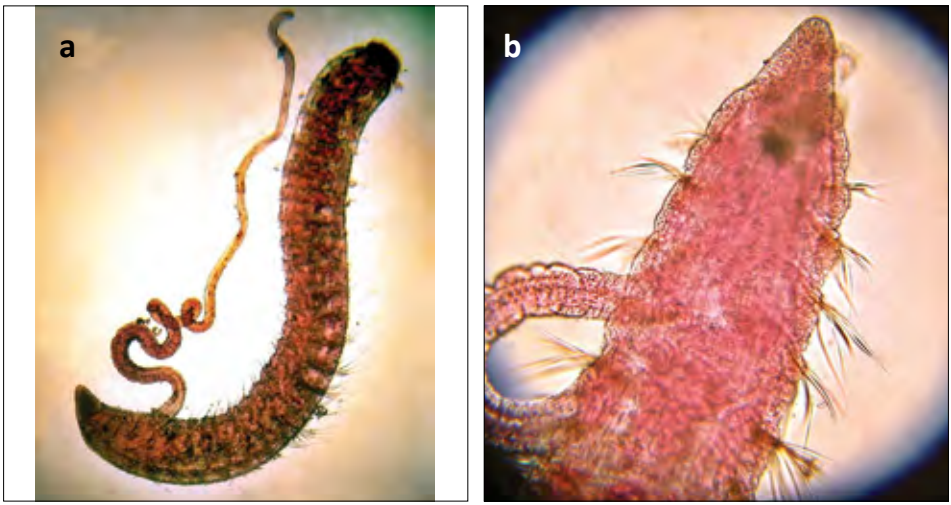


Plate 64. *Cossura laeviseta*, a. general view; b. anterior end;

Family Maldanidae Malmgren, 1867
Description: Maldanids usually have a fixed, maximum number of body segments. The head is formed from the prostomium, the peristomium and, sometimes, at least one achaetous segment. An eversible pharynx, with a simple axial or ventral buccal organ, is present; gular membrane is also present. Maldanids have paired nuchal slits and there is often a cephalic rim and cephalic keel. An anal plaque may also be present; it may have crenulations or cirri on the margin. Each small parapodium consists of a low, rounded notopodium, which has capillary chaetae of various kinds and a neuropodium, which forms a long torus with hooks in one or two rows. The hooks have a large main fang surmounted by a series of smaller teeth; a fringe, or 'beard', usually surrounds the basal teeth. The nephridial/coelomoduct system is restricted to a few anterior segments. Maldanids are tubicolous. The tubes usually have a membranous lining and are covered with mud, shell or sand, though some 'tubes' are as simple as consolidated burrows. The tubes often extend slightly above the sediment surface. This family is known as the "Bamboo worms", as segments are elongate and the notopodia and neuropodia form distinct ridges at the segmental margins. Maldanids vary considerably in size, from a few millimeters to several centimeters in length. The structure of the anterior and posterior ends is variable. Some taxa have a well-developed cephalic plate while in others this structure is poorly developed. The posterior end may have either a well-developed anal plaque with crenulated margins or a final simple segment with either a dorsal or a terminal anus. Prior to the pygidium, a number of achaetous segments may be present. Some genera possess a variable number of segments.
Reference: Wilson et al., 2003.

Genus *Euclymene* Verill 1900
Euclymene annandalei Southern, 1921
Distribution: Muddy substrates between Bubiyan and Failaka Islands.

Euclymene insecta (Ehlers, 1905) (Plate 65 a-c)
Distribution: Muddy substrates between Bubiyan and Failaka Islands.

***Euclymene* sp**. (Plate 65 d)
Distribution: Muddy substrates near Failaka Island and in Khor Al-Sabbiya.

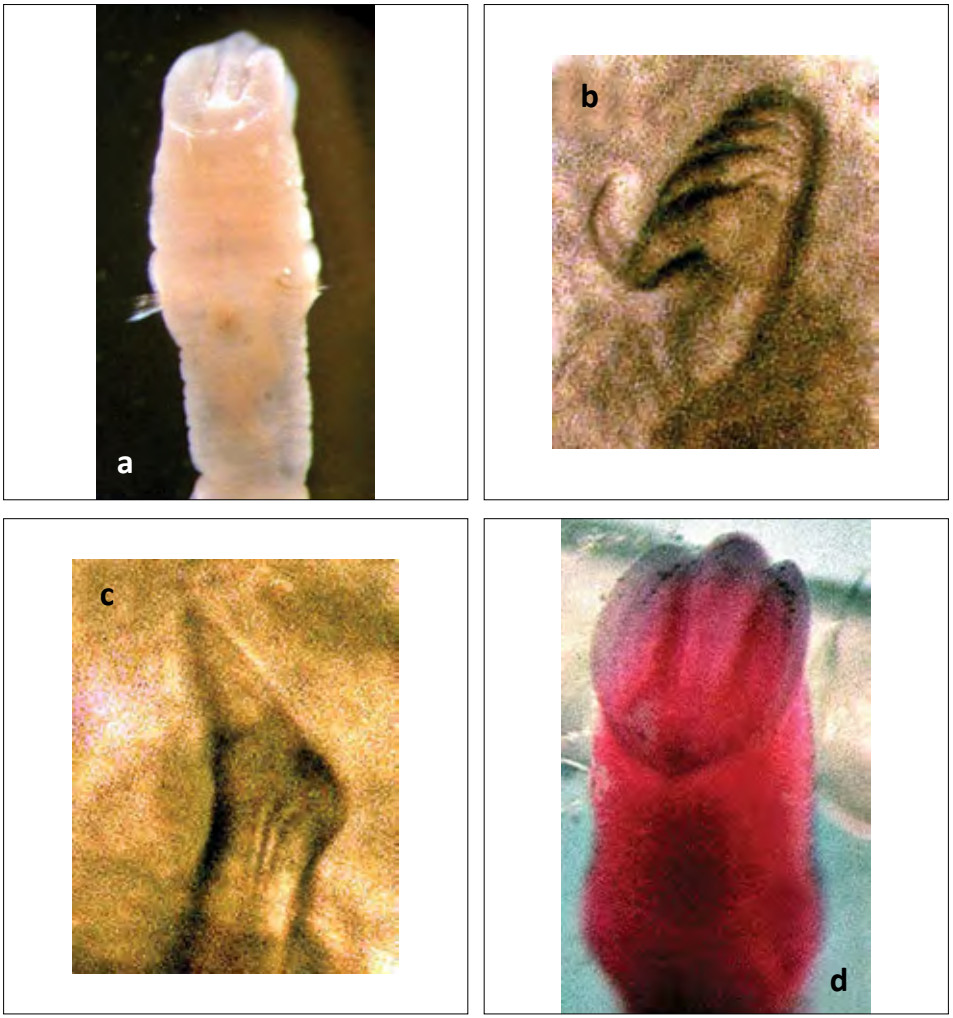


Plate 65. *Euclymene insecta*, **a. anterior end; b-c. hooks;** *Euclymene* **sp., d. anterior end (stained with Rose Bengal).**

Genus *Maldane* Grube 1860
Maldane cristata Treadwell, 1923 (Plate 66 a)
Distribution: Muddy substrates between Bubiyan and Failaka Islands.

Maldane sarsi Malmgren, 1865 (Plate 66 b-d)
Distribution: Muddy substrates near Failaka Island.

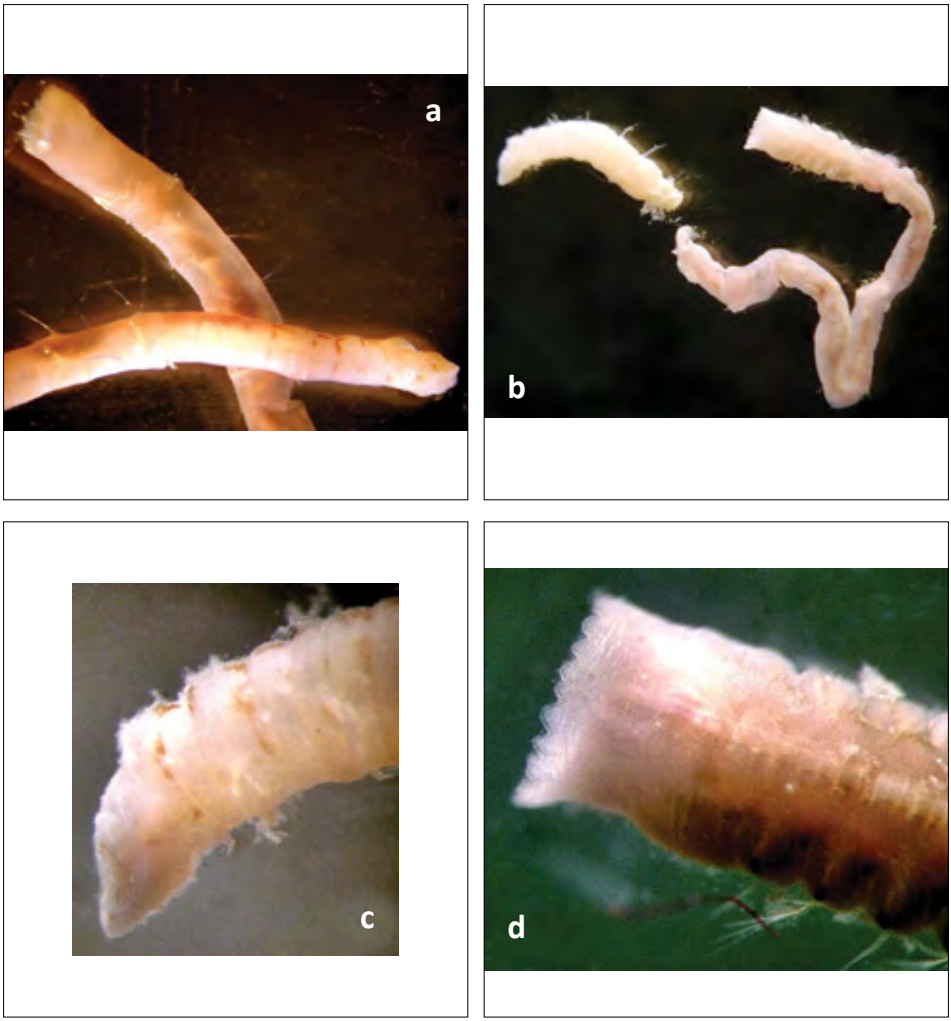


Plate 66. *Maldane cristata*, a. anterior and posterior ends; *Maldane sarsi*, b. general view; c. anterior end; d. posterior end.

Genus *Rhodine* Malmgren, 1865
***Rhodine* sp.**
Distribution: Muddy substrates near Failaka Island.

Maldanidae gen. sp.
Distribution: Muddy substrates near Ras Al-Ardh and in Kuwait Bay.

Family Paraonidae Cerruti, 1909
Description: Paraonids are small, slender, thread-like polychaetes with up to 200 segments. They range in length from 2-3 mm up to 40 mm and are usually uniform yellow to brown in color. The body comprizes an abranchiate anterior and posterior regions and a slightly wider branchiate mid-section where parapodia are best developed and which may be flattened dorso-ventrally. The prostomium is well developed, more-or-less bluntly conical, and carries a single postero-dorsal median antenna (*Aricidea*, *Cirrophorus*) or the antenna may be absent (*Levinsenia*, *Paraonis*, *Paraonides* and *Paradoneis*); a pair of eyes is often present. The peristomium is poorly developed, comprizing only the ventral area around the mouth in adults. The anal lobe is slanted obliquely dorsally and usually bears two to three pygidial cirri. Paraonids typically have a non-muscular axial eversible buccal organ. The pharynx opens to a ventral mouth, which is surrounded by lips, of which the lateral ones are ciliated. Parapodia are biramous, although both rami are poorly developed and have no aciculae. The postchaetal notopodial lobe is long and cirriform to foliose and the postchaetal neuropodial lobe is often smaller, more rounded, but absent in the posterior body. The cirriform to strap-like branchiae emerge from the dorsal surface above the parapodia on the mid-anterior body. Transverse rows of cilia occur on the dorsal surface of branchial segments and on the lateral margins of the branchiae. Capillary chaetae are present throughout the body together with specialized, mainly, acicular chaetae in posterior parapodia, which purportedly function as anchor points during locomotion. Capillaries in anterior parapodia are flanged and finely serrated, whereas those of posterior parapodia are thin, straight and rounded in cross-section. Thicker specialized chaetae include the lyrate and bayonet types, pseudocompound chaetae, hooks with a subterminal or terminal spinelet, hooded hooks and spines with or without distal teeth. Specialized chaetae may occur either in the notopodia (*Paradoneis* and *Cirrophorus*) or in the neuropodia (*Aricidea*, *Levinsenia* and *Paraonis*).
Reference: Wilson et al., 2003.

Genus *Aricidea* Webster 1879
Aricidea longobranchiata Day, 1961 (Plate 67 a-b)
Distribution: Kuwait's marine environment.

***Aricidea* sp.** (Plate 68 a-b)
Distribution: Muddy and silty substrates near Ras Al-Ardh and in Kuwait Bay.

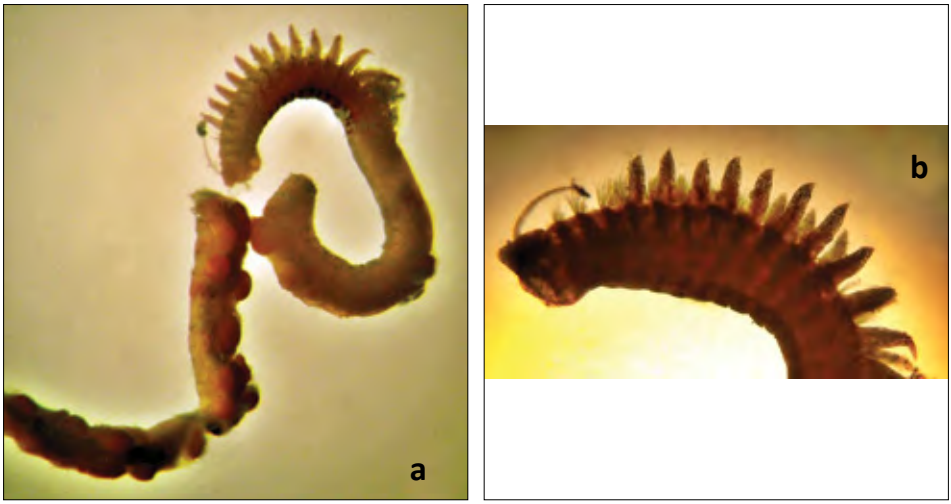


Plate 67. *Aricidea longobranchiata*, **a. general view; b. anterior end.**

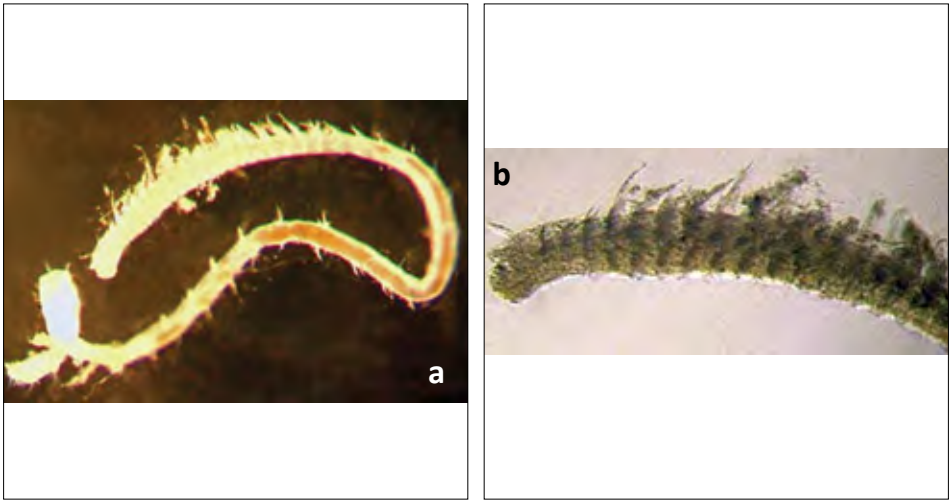


Plate 68. *Aricidea* **sp., a. general view; b. anterior end.**

Genus *Cirrophorus* Ehlers 1908
Cirrophorus branchiatus Ehlers, 1908
Distribution: Muddy and silty substrates in Kuwait Bay.

Cirrophorus harpagoneus (Storch, 1967) (Plate 69 a)
Distribution: Muddy substrates in Khor Al-Sabbiya.

***Cirrophorus* sp.** (Plate 68 b-c)
Distribution: Muddy substrates near Failaka Island.

Plate 69. *Cirrophorus harpagoneus*, a. bristle; *Cirrophorus* sp., b. general view; c. anterior end.

Genus *Levinsenia* Mesnil, 1897
Levinsenia gracilis (Tauber, 1879)
Distribution: Muddy and silty substrates in Kuwait Bay.

***Levinsenia* sp.**
Distribution: Muddy substrates near Failaka Island.

Genus *Paraonis* Cerruti 1909
***Paraonis* sp.** (Plate 70)
Distribution: Muddy substrates between Ras Al-Ardh and Failaka Island.

Plate 70. *Paraonis* sp., general view.

Genus *Tauberia* Strelzov 1973
***Tauberia* sp.** (Plate 71 a-b)
Distribution: Muddy substrates in Khor Al-Sabbiya.

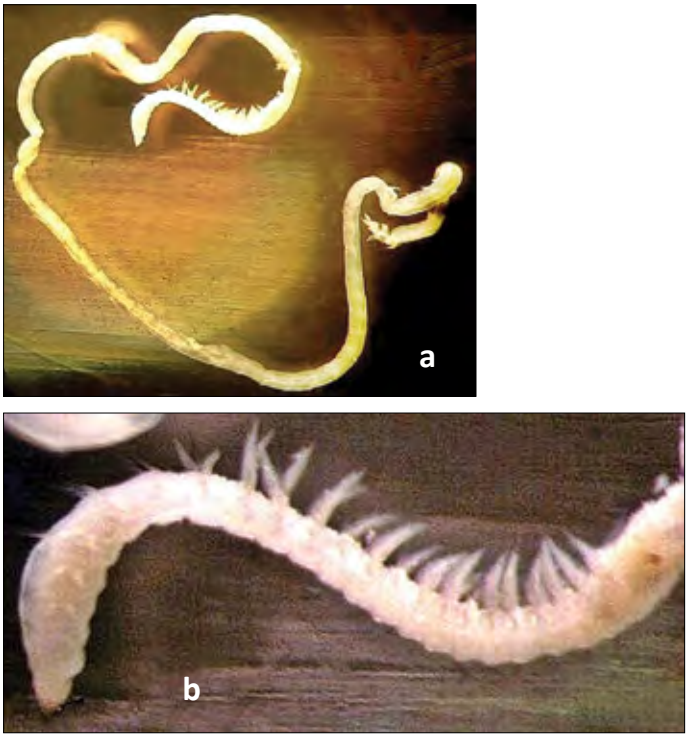


Plate 71. *Tauberia* sp., a. general view; b. anterior end.

Family Opheliidae Malmgren, 1867
Description: Torpedo- or grub-shaped with relatively few segments and often a ventral groove. The head is compact and lacks appendages. Some species are iridescent. They burrow head downwards in sand or mud. The prostomium is usually conical, and a distal palpode is present in some taxa. The peristomium is reduced and fused with the prostomium or forms a distinct ring. Antennae and palps are absent. The nuchal organs are paired and eversible. The longitudinal muscles are grouped in bundles, and segmentation is usually not distinct. The first segment is similar to subsequent segments, and all parapodia are similar. Both parapodial rami are small, and in most taxa the notopodium is slightly smaller than the neuropodium, but in Travisia-both rami are well developed and large. The branchiae are single filaments closely associated with the notopodium. Dorsal and ventral cirri and epidermal papillae are lacking. The pygidium is either hoodshaped without internal and marginal cirri or hoodless with multiple cirri. Lateral organs are present, but dorsal cirrus organs have not been observed. The buccal organ is axial and simple, and has a sac-like eversible proboscis. Opheliids have a distinctive fusiform-shaped body with relatively few, indistinct segments and poorly developed parapodia. The head is compact and lacks appendages. Live specimens of opheliids often exhibit a characteristic whip-like motion, and may be bright red in color (the haemoglobin is visible through the thin body wall).
Reference: Wilson et al., 2003.

Genus *Ophelina* Ørsted, 1843
Ophelina acuminata Ørsted, 1843 (Plate 72)
Distribution: Muddy substrates between Bubiyan and Failaka Islands and in Khor Al-Sabbiya.

Plate 72. *Ophelina acuminata*, general view.

Family Orbiniidae Hartman, 1942

Description: Orbiniids have a regionated body; muscular flattened thoracic segments bear lateral parapodia and more cylindrical abdominal segments have dorsal parapodia. The prostomium lacks appendages and precedes one or two achaetigerous annuli. The ventral pharynx is unarmed and when everted is either sac-like or branched. Chaetae may be capillary, furcate or different types of spines, but rarely hooks. Parapodia are oriented laterally in the anterior part of the body, but changes to a dorsal orientation of the parapodia in the posterior part of the body. Parapodia are biramous, though anterior ones lack aciculae and do not project far from the body wall. Each notopodium consists of a single postchaetal lobe, which varies, in shape from short and triangular through cirriform to foliaceous. Posterior ones are supported by one to several aciculae and carry crenulate capillaries and, sometimes, furcate chaetae. Neuropodia are more variable along the body of an individual. Thoracic neuropodia are low, ranging in shape from digitate to mammiform, unlike those on the abdomen which are more elongate, may be flanged or notched basally and are supported by one to several acicula. Neuropodia carry crenulate capillaries as well as spines, which may be hooded and are often arranged in conspicuous fascicles in the thoracic neuropodia; subuluncini occur in Protoaricia and Nainereis. Abdominal neuropodia may carry modified crenulate capillaries or flail-tipped chaetae or strongly bent, crested hooks. Age-related gain and loss of spines has been reported in members of *Scoloplos*. Dorsal and ventral cirri are absent. Podal, subpodal and stomach papillae occur in many species and their distribution is a useful specific character. Also of specific importance is the presence and distribution of interramal cirri (also called lateral organs when reduced in size to a low mound) of posterior thoracic and abdominal chaetigers. Segmentally paired branchiae are present over most of the body in most orbiniids; usually they are conspicuous straplike or triangular processes with fimbriated or ciliated lateral margins; in some genera cilia continue on dorsal ridges between the bases of the paired branchiae or on the dorsal edge of the notopodial lobe (*Scoloplos*). The pygidium carries from one to many pygidial cirri, or cirri may be absent.

Reference: Wilson et al., 2003.

Genus *Orbiniella* Day 1954

***Orbiniella* sp.** (Plate 73 a-c)

Distribution: Muddy substrates between Ras Al-Ardh and Failaka Island.

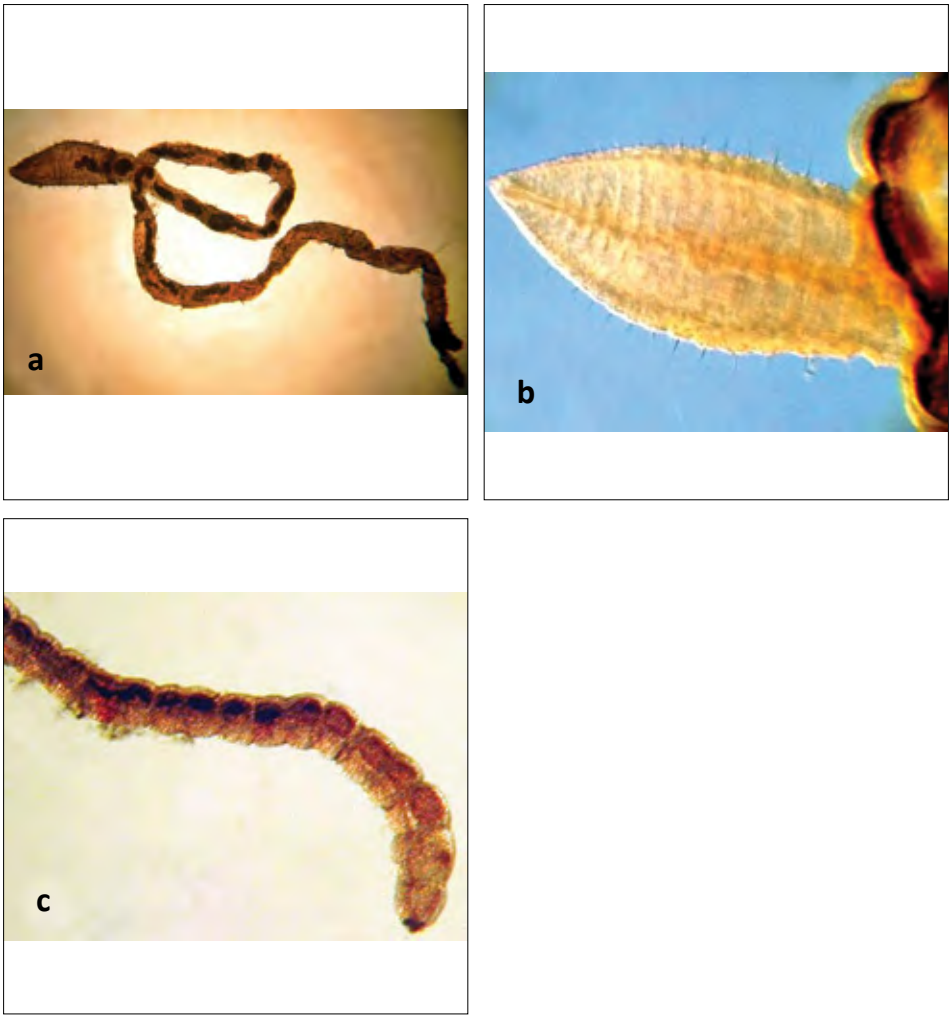


Plate 73. ***Orbiniella*** **sp., a. general view; b. anterior end; c. posterior end.**

Genus *Scoloplos* de Blainville1828
Scoloplos (Leodamas) chevalieri (Fauvel, 1902) (Plate 74 a-b)
Distribution: Muddy substrates near Failaka Island and in Khor Al-Sabbiya.

***Scoloplos* sp.** (Plate 75 a-b)
Distribution: Muddy substrates near Failaka Island.

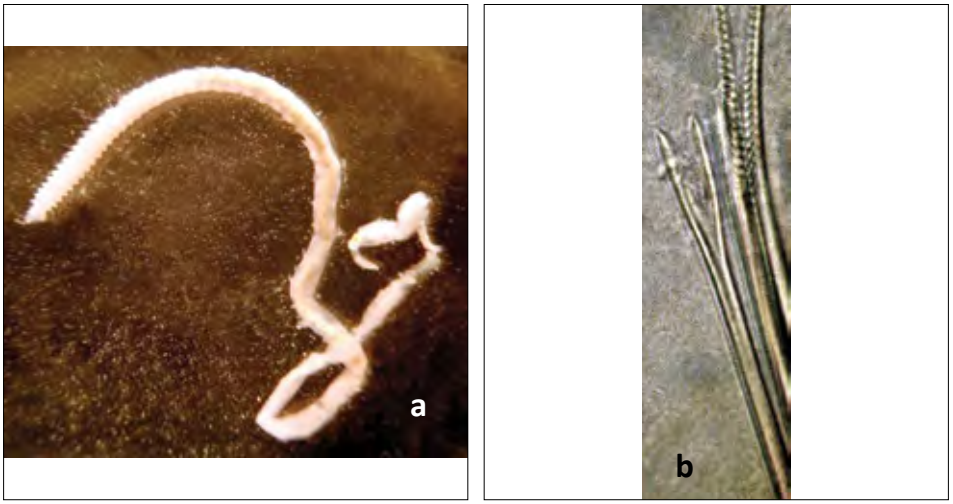


Plate 74. ***Scoloplos (Leodamas) chevalieri*****, a. general view; b. bristle.**

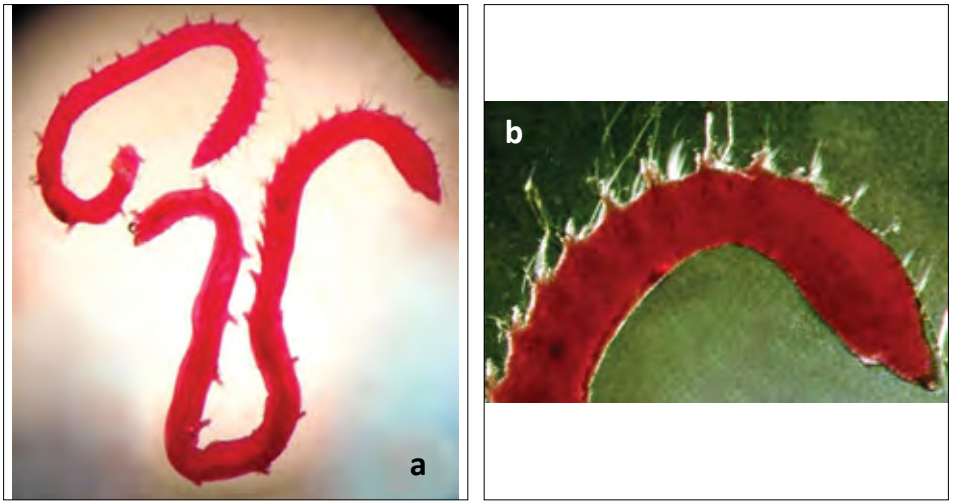


Plate 75. ***Scoloplos*** **sp., a. general view; b. anterior end.**

Phylum ECHIURA
Class ECHIUROIDEA
Order Echiurida
Proboscis usually normally developed, bifid or not bifid at tip. Blood vascular system present. Posterior region of intestine not enlarged, does not act as respiratory organ; cloaca not modified, but may be expanded. Nephridia paired or unpaired, varying in number. Ventral and anal setae present or absent.

Family Echiuridae Quatrefages, 1847
Description: The body is saclike or sausage-shaped and often highly colored. Anteriorly there is a short and flaplike prostomium, which is readily detached. The sexes are separate, without sexual dimorphism. Proboscis usually well developed, but never bifid. Pair of ventral setae present in all genera, while anal setae present only in *Echiurus*. Longitudinal muscles continuous, in some genera of subfamily Thalassematinae forms longitudinal muscle bands. Nephridia usually paired; one to seven pairs (sometimes to 10-32 pairs) present; more rarely nephridia unpaired and very numerous, to 200-400. Anal vesicles usually elongate or swollen sacs and not branched. Dorsal and neurointestinal blood vessels usually connected through ring vessel in posterior region of foregut. Family contains eight genera and more than 70 species.
Reference: Tokinova, et al., 2008.

Genus *Anelassorhynchus*
Anelassorhynchus branchiorhynchus (Annandale and Kemp, 1915) (Plate 76)
Distribution: Muddy substrates near Ras Al-Ardh.

Plate 76. *Anelassorhynchus branchiorhynchus*, general view.

Genus *Listriolobus* Spengel, 1912
Listriolobus brevirostris Chen and Yeh, 1958 (Plate 77)
Distribution: Muddy substrates in Kuwait Bay.

Plate 77. *Listriolobus brevirostris*, general view.

Family Ikedidae Bock, 1942
Description: Ikedids are large, the trunk reaching up to 400 mm long and 20 mm wide. The longitudinal musculature of body wall is reported to lie exterior to the circular musculature and is thickened to form bands. The proboscis is very long (up to 1 m in the extended state) and flat. Nephridia are numerous (more than 200) and unpaired; the nephrostome is situated distally. The family contains only two species.
Reference: Australian Faunal Directory, 2010

Genus *Ikeda*
Ikeda pirotansis (Menon and Datta Gupta, 1962) (Plate 78)
Distribution: Borrows in sand and muddy substrates in Kuwait Bay.

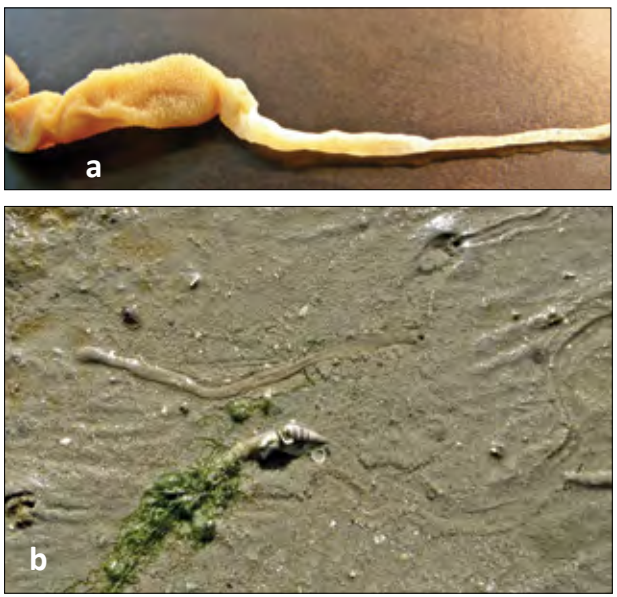


Plate 78. *Ikeda pirotansis*, a. oral part of the trunk and basal part of the proboscis, b. the proboscis: borrows and tracks of the proboscis of *I. pirotansis* on mudflat in western part of Kuwait Bay.

Phylum SIPUNCULA
Class SIPUNCULIDEA
Order Golfingiida
"Peanut worms". Unsegmented marine worms lacking chaetae. The body is divided into a trunk and a slender, retractable introvert. The mouth is located at the tip of the introvert and in some taxa is surrounded by tentacles (not usually seen without narcotization of live specimens or dissection). The surface of the body usually has a distinctively "leathery" texture and is often covered with warts or papillae. The long gut is typically coiled in a tight helix - if this is visibile, it is a distinctive clue allowing quick recognition as a sipunculan. The anus is not terminal, but is located on the side of the trunk.

Family Phascolionidae Cutler and Gibbs, 1985
Description: Phascolionids are small animals with a trunk ranging in size from 3-35 mm. They have tentacles, which surround the mouth. Only one nephridium is present. The musculature of the body wall is continuous. The degree of asymmetry (body coiling, single nephridium, irregular gut coil and retractor muscles) is greater in this family than in others. Phascolionids are typically found in subtidal cold water, and often within a protective shelter. *Phascolion* species usually live in the empty shells of gastropods and scaphopods, less frequently in the empty tubes of polychaetes and in solitary coralsl. They are commonly collected by dredging. The trunk may be twisted or coiled according to the shape of the shell, which the animal inhabits. The introvert is of variable length and may be armed with hooks. Characteristic, swollen, papillate structures called 'holdfasts' are usually present on the body wall. The retractor muscles tend to fuse so that one to four may be present. The contractile vessel lacks villi. The gut is often loosely wound and lacks a spindle muscle.
Reference: Edmonds, 2000.

Genus *Phascolion* Théel, 1875
Phascolion convestitum Sluiter, 1902 (Plate 79)
Distribution: Intertidal zone near Ras Al-Ardh.

Plate 79. *Phascolion convestitum*, general view.

Phascolion valdiviae* var. *sumatrense Fisher, 1919 (Plate 80 a-c)
Distribution: Muddy substrates near Ras Al-Ardh.

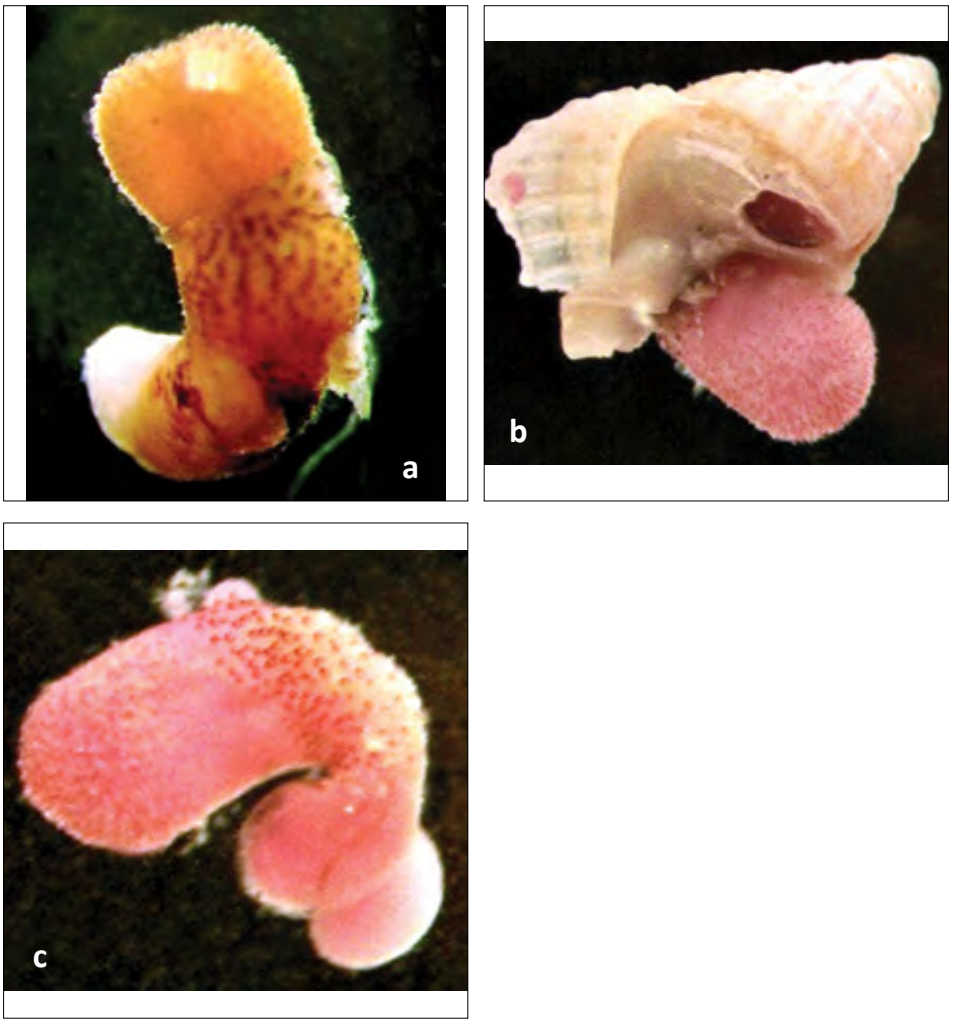


Plate 80. a-c. *Phascolion valdiviae*, general view.

***Phascolion* sp.1** (Plate 81 a)
Distribution: Muddy substrates Near Failaka Island, in Kuwait Bay and between Bubiyan and Failaka Islands.

***Phascolion* sp.2** (Plate 81 b)
Distribution: Muddy substrates Near Failaka Island, in Kuwait Bay and between Bubiyan and Failaka Islands.

***Phascolion* sp.3** (Plate 81 c)
Distribution: Muddy substrates Near Failaka Island, in Kuwait Bay and between Bubiyan and Failaka Islands.

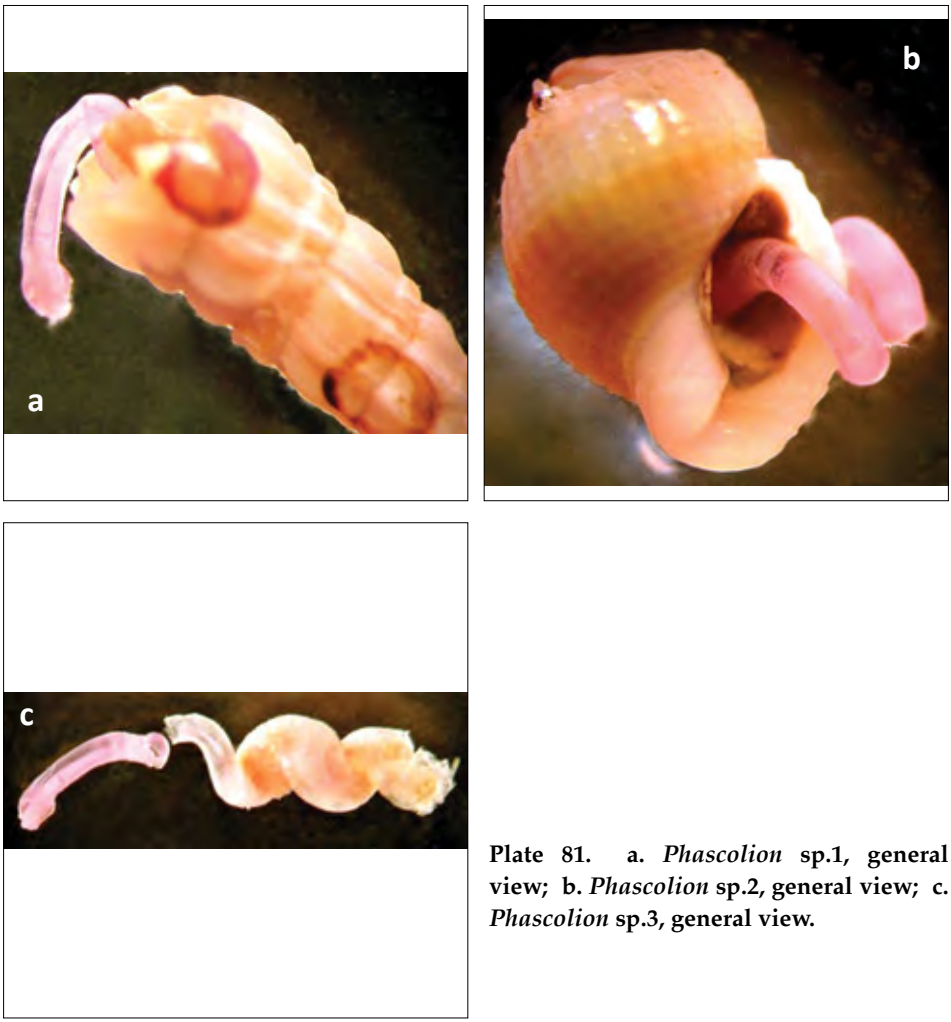


Plate 81. a. *Phascolion* sp.1, general view; b. *Phascolion* sp.2, general view; c. *Phascolion* sp.3, general view.

Class PHASCOLOSOMATIDEA
Order Phascolosomatida
Animals without epidermal shields.

Family Phascolosomatidae Stephen & Edmonds, 1972
Description: Phascolosomatidae is the only family in the order . All tentacles of this sipunculids are enclosing the nuchal organ; spindle muscle attached posteriorly.
Reference: Marine Species Identification Portal, 2010.

Genus *Apionsoma* Sluiter, 1902
Apionsoma trichocephalus Sluiter, 1902
Distribution: Muddy and silty substrates in Kuwait Bay.

Sipuncula gen. sp.
Distribution: Muddy and silty substrates in Kuwait Bay.

Phylum BRACHIOPODA
Brachiopoda, commonly known as lamp-shells, are solitary, sessile benthic marine invertebrates, mainly related to the other lophophorate phylum the Phoronida. They are two-shelled with a dorsal (formerly named brachial) valve and a ventral (formerly named pedicule) valve, and filter-feeding with a ciliated, tentaculated feeding organ named the lophophore, usually supported by the brachidium. Most brachiopods are attached to the substrate by means of a pedicle, while others are cemented or lie freely. Some species that have long pedicles do not attach to a hard substrate but anchor the pedicle deep in the sand. The two main types (with either articulated or inarticulated valves) are recorded since the Lower Cambrian (about 600 million years ago) but they probably date back to at least 800-1,000 million years ago. The brachiopods were particularly abundant in the Palaeozoic but have progressively decreased in diversity toward the recent. Brachiopods are found from the littoral waters (generally subtidal) through to the abyssal zone, and are generally epifaunal on hard substrata; only the lingulides are exclusively infaunal in soft substrata. They range in size from one millimeter to over nine centimeters. Larvae are either planktotrophic or non-planktotrophic.
Reference: Emig et al., 2011.

Class LINGULATA
Order Lingulida Waagen, 1885
Family Lingulidae Menke, 1828
Shell elongate oval to subrectangular, gently and subequally biconvex, subequivalved; lateral margins generally subparallel. Ventral valve with wide triangular pedicle groove and lateral vestigial propareas. Dorsal valve with posterior margin rounded, with a more or less developed median beak; anterior adductor and anterior oblique muscle scars closely spaced.Asymmetrical muscle system with internal oblique muscles; unpaired posterior

adductor muscle; pedicle nerve curving around posterior adductor muscle. Mantle canal system bifurcate; vascula lateralia of both valves converging anteriorly to become subparallel; vascula media absent. Long flexible pedicle; lophophore spirolophous, with apices of spires directed medially.
Reference: Emig, 2003.

Genus *Lingula* Bruguière, 1791
***Lingula* sp.** (Plate 82)
Distribution: Sandy substrates around Qaruh Island.

Plate 82. *Lingula* sp. (juvenile), general view.

Phylum MOLLUSCA
Class POLYPLACOPHORA
Common name: Chitons, Sea Cradles or Coat-of-mail Shells. Polyplacophores have a shell, which is composed of eight separate shell plates or valves. These plates overlap somewhat at the front and back edges, and yet the plates articulate well with one another. Because of this, although the plates provide good protection for impacts from above, they nonetheless permit the chiton to flex upward when needed for locomotion over uneven surfaces, and also the animal can slowly curl up into a ball when it is dislodged from the underlying surface. The calcareous valves that chitons carry dorsally are protective, made wholly of aragonite and variously colored, patterned, smooth or sculptured. The shell is divided into eight articulating calcareous valves embedded in the tough muscular girdle that surrounds the chiton's body. This arrangement allows chitons to roll into a protective ball.

Order Neoloricata
Family Ischnochitonidae Dall, 1889
Description: The body is oval to elongate, rarely exceeding 60 mm in length. Valve dorsal surface sculpturing is variable but generally costate and reticulate, and divides the intermediate valves into lateral and central regions as a result of different orientations of the papillae. All valves have insertion plates, the head and tail valves have numerous notches and the intermediate valves have between one and three pairs of notches depending on the species. The insertion plates are not pectinated. The articulamentum produces well-developed sutural laminae on valves 2-8. The girdle is covered by scales, spicules and minute hairs and is fringed by bluntly pointed spines.
Reference: Jones and Baxter, 1987.

Genus *Ischnochiton*
Ischnochiton yerburyi (E. A. Smith, 1891) (Plate 83)
Distribution: Hard substrates in intertidal zone of Ras Al-Ardh.

Plate 83. *Ischnochiton yerburyi*, general view.

Class GASTROPODA
Subclass Caenogastropoda
Family Cerithiidae Fleming, 1822
Description: The shell of Cerithiidae is slender, elongated with a pointed spire. They vary in size from 3 mm to 150 mm. The smallest shells are found in the subfamily Bittiinae. The many whorls have radial sculpture with axial ridges and nodules. The aperture shows at its base a vague curve or a distinct siphonal canal. The aperture is closed off by a thin oval brown operculum that is corneous and paucispiral. The palatal wall of the aperture is somewhat enlarged and often shows a varix. The taenioglossan radula has seven teeth in each row. The single rachidian tooth is flanked on each side by one rhomboidal lateral tooth and two long, hook-like marginal teeth.
Ceriths are herbivores and detrivores that graze on the seabed.
Reference: Houbrick, 1992. From: Beechey, 2009.

Genus *Bittium*
***Bittium* sp.** (Plate 84)
Distribution: Intertidal zone near Shuwaikh and Ras Al-Zour.

Plate 84. *Bittium* sp., general view.

Genus *Cerithium*

Cerithium caeruleum Sowerby, 1855 (Plate 85)

Distribution: Intertidal zone from Mahboula to Ras Al-Zour.

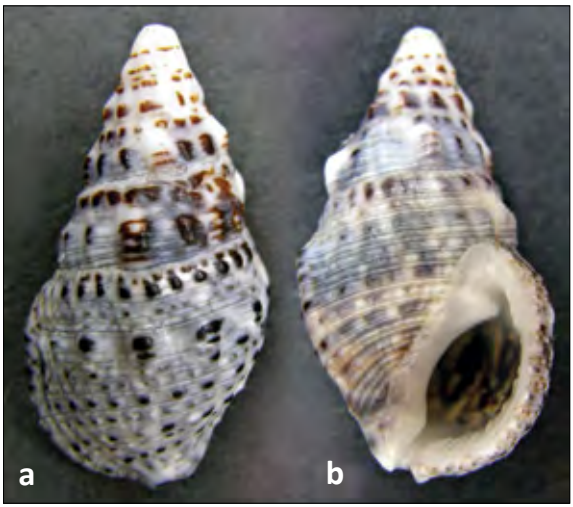


Plate 85. *Cerithium caeruleum*, a-b. general view.

Cerithium scabridum Philippi, 1848 (Plate 86)

Distribution: Rocks on sandy and muddy shores in Kuwait Bay.

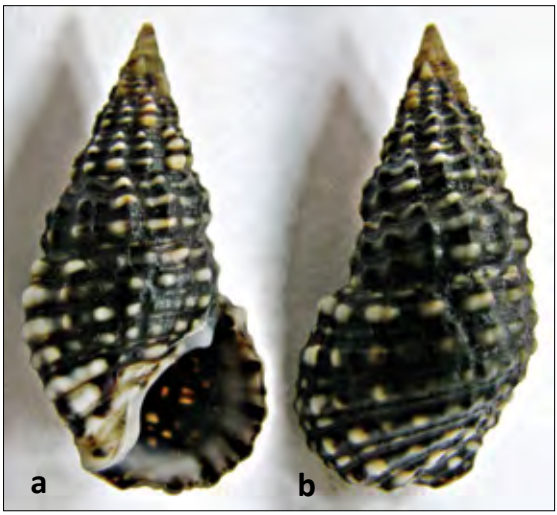


Plate 86. *Cerithium scabridum*, a-b. general view.

Genus *Cerithidium*
Cerithidium cerithinum (Philippi, 1849) (Plate 87)
Distribution: Intertidal zone near Shuwaikh.

Plate 87. *Cerithidium cerithinum*, general view.

Genus *Cerithidea*
Cerithidea (Cerithideopsilla) cingulata (Gmelin, 1791) (Plate 88)
Distribution: Intertidal zone of Kuwait Bay.

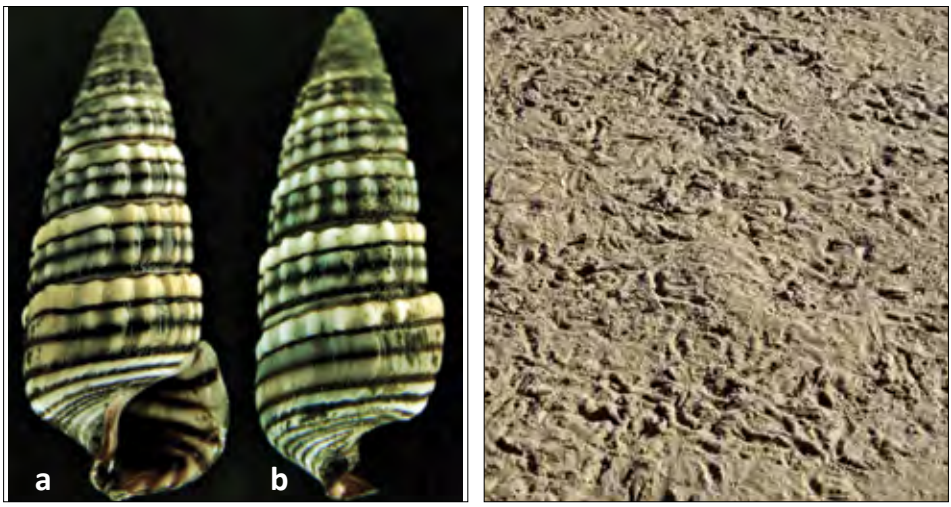


Plate 88. *Cerithidea (Cerithideopsilla) cingulata*, a-b. general view, mollusks *C. cingulata* on the sand beach of the northern coast of Kuwait Bay.

Genus *Clypeomorus*

Clypeomorus bifasciatus bifasciatus (G.B. Sowerby II, 1855) (Plate 89 a-b)
Distribution: Associated with rocks on sandy and muddy shores in Kuwait Bay.

Clypeomorus bifasciatus persicus Houbrick, 1985 (Plate 89 c-d)
Distribution: Associated with rocks on sandy and muddy shores in Kuwait Bay.

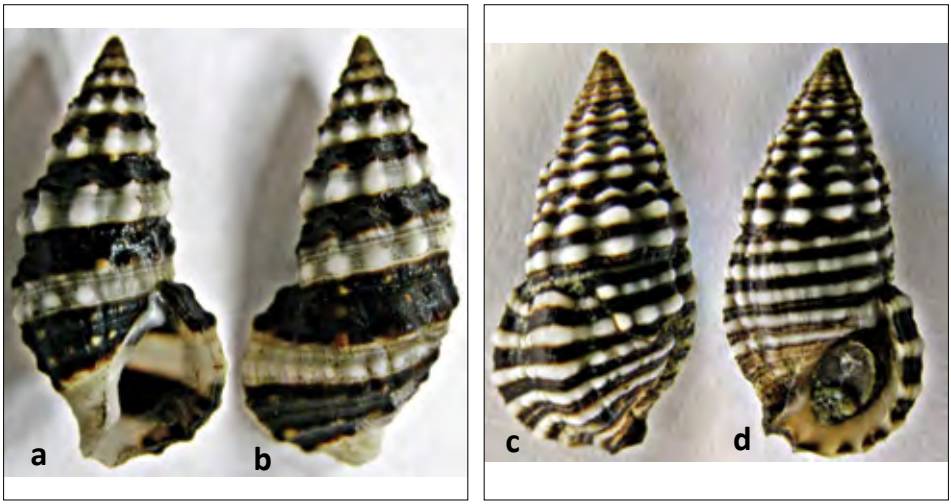


Plate 89. a-b. *Clypeomorus bifasciatus bifasciatus*, general view, c-d. *Clypeomorus bifasciatus persicus*, general view.

Genus *Potamides*
Potamides conicus (de Blainville, 1829) (Plate 90)
Distribution: Intertidal zone of Kuwait Bay.

Plate 90. ***Potamides conicus*****, a-b. general view.**

Genus *Rhinoclavis*
Rhinoclavis kochi (Philippi, 1848) (Plate 91 a-b)
Distribution: Intertidal zone near Shuwaikh.

Plate 91. ***Rhinoclavis kochi*****, a-b. general view.**

Cerithiidae gen. sp. (Plate 92)
Distribution: Intertidal zone of Ras Al-Zour.

Plate 92. Cerithiidae gen. sp., general view.

Family Cerithiopsidae H. Adams and A. Adams, 1854
Description: Cerithiopsidae are a family of very small and minute sea snails, marine gastropod mollusks in the informal group Ptenoglossa, known as the cerithiopsids. The Family Cerithiopsidae is closely related with the Family Cerithiidee. The shells are always small, usually less than 10mm long. The shape of the shells is quite similar to the Cerithiidae, but the mouth is longer and the dimensions much smaller.
Reference: Beechey, 2009.

Genus *Cerithiopsis*
***Cerithiopsis* sp.** (Plate 93)
Distribution: Intertidal zone of Ras Al-Ardh.

Plate 93. *Cerithiopsis* sp., general view.

Family Naticidae Guilding, 1834

Description: The sand-dwelling moon snails have thick or thin, mostly smooth and glossy shells with an unthickened outer lip. Some shells are globose or ovate, with a semilunar aperture; others are compressed and have a wide aperture; the sutures are seldom conspicouous. The umbilicus may be open or obscured by a thick calcareous plug (which may continue as a rige into the umbilicus and is known as a "funicle"). In some species the operculum is smooth, chitinous and yellow to brown; in others it is calcareous, spirally ribbed and white. A thin, fibrous periostracum is usually present. Eggs of most species are cemented into flattened, coiled ribbons of sand or mud, these ribbons being common sights on sand in shallow water.

These mollusks are largely found in sea floor sand of the tropics, but also in waters beyond the Arctic and Antarctic Circles. They make a living by plowing just below the surface. When they find another mollusk, it is enveloped by their massive foot -- often too large to be withdrawn into the shell. The rasp-like radula is then applied to drill an extremely neat, beveled hole. Drilling is facilitated, as it is also in muricids, by an accessory boring organ on the anterior portion of the foot. It secretes a non-acid calcium-chelating compound that softens shells.

References: Bosch et al., 1995; Beechey, 2009.

Genus *Glossaulax*

Glossaulax didyma (Röding, 1798) (Plate 94)

Distribution: Intertidal zone of Mahboula.

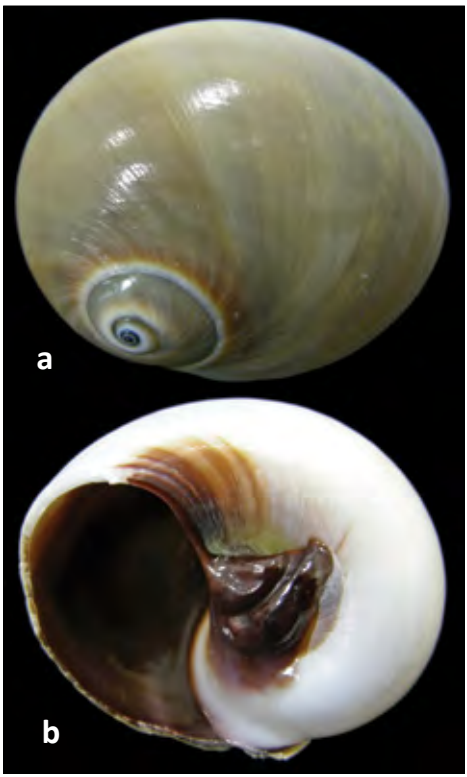


Plate 94. *Glossaulax didyma*, a-b. general view.

Genus *Cellana*
Cellana rota Gmelin, 1791 (Plate 95)
Distribution: Muddy substrates near Failaka Island.

Plate 95. *Cellana rota*, general view.

Family Cassidae Latreille, 1825
Description: Mostly warm-water gastropods, usually bearing a thin, chitinous operculum. All species have a capacious last whort; most have varices, a toothed outer lip and columellar folds; some have pronounced knobs. Shells of males and females may differ in size and some species may hybridize with others. The sand-dwelling animals feed upon sea urchins and other invertebrates.
Reference: Bosch et al., 1995

Genus *Casmaria*
Casmaria ponderosa (Link, 1807) (Plate 96)
Distribution: Kubbar Island.

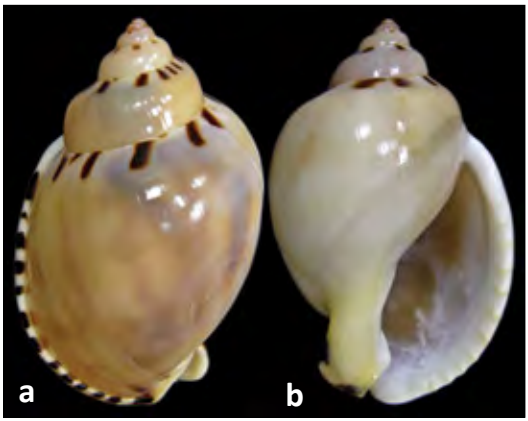


Plate 96. *Casmaria ponderosa*, a-b. general view.

Family Planaxidae Gray, 1850
Description: Planaxids snails have a strong, ovate shell which is sometimes covered with a persistent, fibrous periostracum but is often eroded on spire. The posterior canal is a distinct groove, the outer lip has fine ridges inside, and there is no umbilicus; the operculum is chitinous with few spiral turns. Planaxids browse algae between tide marks where they may congregate in large numbers.
Reference: Bosch et al., 1995

Genus *Planaxis*
Planaxis sulcatus (Born, 1778) (Plate 97)
Distribution: Rocks in intertidal zone from Kuwait Bay to Ras Al-Ardh.

Plate 97. *Planaxis sulcatus*, a. general view; b. mollusks *P. sulcatus* congregate on coastal rocks in Ras Al-Ardh.

Family Littorinidae Children, 1834
Description: The shells of Littorinids are smooth or have spiral ribs or rows of nodules and a thin periostracum. Except for the tiny species of *Peasiella* none has an umbilicus but all have a smooth, concave columella, a thin outer lip and a thin, chitinous operculum with few spiral whorls. Compact, ovate-conical shells of Littorinids being familiar objects on stony surfaces intertidally or high up on the shore where they feed mostly on algae.
Reference: Bosch et al., 1995

Genus *Echinolittorina*
Echinolittorina arabica (El Assal, 1990) (Plate 98)
Distribution: Rocks in intertidal zone from Kuwait Bay to Ras Al-Ardh.

Plate 98. ***Echinolittorina arabica*****, a. general view; b. mollusks *E. arabica* on coastal rocks in Kuwait Bay.**

Family Vermetidae Rafinesque, 1815
Description: Worm shells, which may not be recognizable immediately as gastropod mollusks, have irregularly coiled, tubular shells cemented to hard surfaces. The animals capture floating organic matter by mucus threads or by ciliary actions. In most species an operculum is present, which is just as well because it is one of the few reliable features in identification.
Reference: Bosch et al., 1995

Genus *Serpulorbis*
Serpulorbis variabilis Hadfield and Kay, 1972 (Plate 99)
Distribution: Rocks in intertidal zone of Kuwait Bay.

Plate 99. *Serpulorbis variabilis*, general view.

Family Epitoniidae Berry, 1910 (1812)
Description: Epitoniidae (Wentletraps) have tall, narrow cone-shaped shell of many tumid whorls; sutures deep or whorls not in contact, connected by thin transverse costae; shells have large, eversible proboscis, no snout. Aperture small, circular. Males lack penis. Animals are carnivorous, usually associated with anthozoans.
Reference: Hayward et al., 1990.

Genus *Epitonium* Röding, 1798
***Epitonium* sp.**
Distribution: Muddy and silty substrates in Kuwait Bay.

Order Hypsogastropoda
Family Caecidae Gray, 1850
Description: Very minute tubular shells; at first spiral-shaped but soon becoming cylindrical. The spiral portion is almost always lost.
Reference: Beechey, 2009.

Genus *Caecum*
***Caecum* sp.** (Plate 100)
Distribution: Intertidal zone of Ras Al-Ardh.

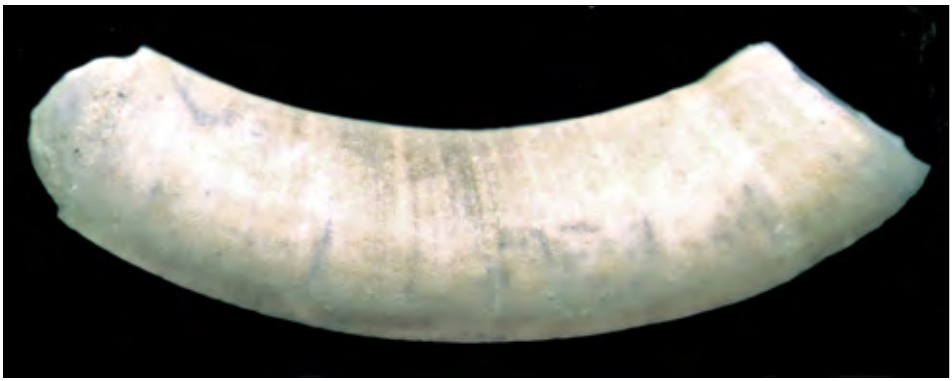


Plate 100. *Caecum* sp., general view.

Family Calyptraeidae Lamarck, 1809
Description: The Calyptraeidae is a family of mollusks with flattened shells with expanded aperture and an internal shelf. A coiled spire is always present, but in some species its size is much reduced and the shells appear limpet-like. Some species live in sandy or muddy habitats intertidally, but there are many deeper water species. Most live on solid substrates, but some live on dead bivalves or on the inner lip of gastropods inhabited by hermit crabs, where they take up the shape of the substrate shell. Most are solitary, but some form stacks of shell upon shell, with small males stacked on larger females. Animals in this family are nearly sedentary, capable of slow creeping, but have difficulty reattaching to their substrate when removed. They feed by filtering plankton from the water stream that passes over the gills; the food, enmeshed in mucus, is pulled into the mouth by the radula and consumed. They are consecutive hermaphrodites, male at first then changing to female. Once fertilized by the male, the female broods egg capsules in sacs in the space under the shell, attached to the foot or to the substrate. Embryos hatch as pelagic larvae in some species or as crawling juveniles in others.
Reference: Hoagland, 1977

Genus Calyptraea
Calyptraea pellucida (Reeve, 1859) (Plate 101 a-b)
Distribution: Kuwait's marine environment.

***Calyptraea* sp.**
Distribution: Muddy and silty substrates in Kuwait Bay.

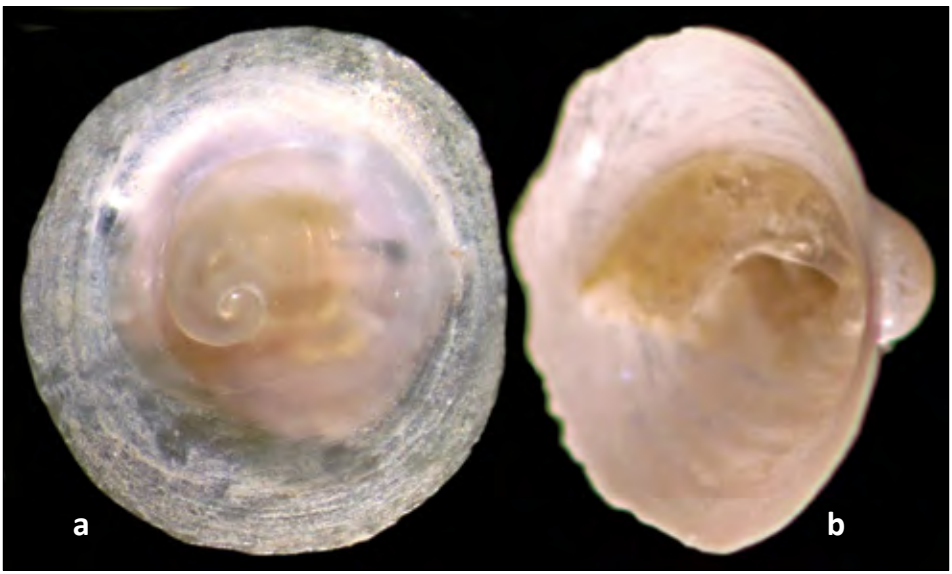


Plate 101. ***Calyptraea pellucida*****, a-b. general view.**

Genus *Crepidula*

Crepidula walshi Reeve, 1859 (Plate 102 a-b)

Distribution: Kuwait's marine environment.

Plate 102. ***Crepidula walshi*****, a-b. general view.**

Family Conidae Fleming, 1822
Description: Nearly all of the 500-600 species have a distinctively similar shape. Characteristic features are: a flat top, conical shell; and, a long slit-like aperture lip extending from a very short siphonal opening to nearly the top. Some species have moderate spires, although generally similar. The shell may be smooth or spirally ornamented, and the patterns and colors are extraordinarily varied. All are carnivorous and feed on other mollusks, worms and small fish, which they stun by projecting a venomous harpoon connected to a muscular poison gland. The cone can extend its proboscis lightning fast for a lethal sting and engulf and digest a fish the size of its shell or larger. It can also selectively alter the makeup of the injected toxin complex, in order to better target a specific fish or mollusks species. In some cones, the venom is powerful enough to be lethal to collectors who are not careful in handling the mollusk. Interestingly, specific components of the toxin complex are currently considered important for medical uses.
Reference: Beechey, 2009.

Genus *Conus*
***Conus* sp.** (juv.)
Distribution: Muddy substrates near Failaka Island.

Family Columbellidae Swainson, 1840
Description: Columbellids are active, crawling snails that live in a variety of habitats. The majority of species live on hard substrates, crawling on the underside of stones or on algae, but some species crawl in sand in seagrass beds. They are unusual among advanced gastropods in that a few species include both plant and animal material in their diets. Species that live on seagrass are grazers, consuming the diatoms, sponges and other animal life forms on the seagrass fronds, while also consuming the plant material. Carnivorous species are known to include other mollusks, polychaete worms, crustaceans and ascidians in their diet. Shell form and sculpture in this family is extremely variable. Shape varies from short and squat to elongate. Sculpture may be smooth, axially ribbed, spirally corded, or both, but a constant feature is spiral cords on the base. Shells show the overall features of the highly evolved gastropods, most noticeably a siphonal canal, in common with families such as Buccinidae, Nassariidae and Turridae. The specific shell features, which assist in placement into the Columbellidae are listed below. There is a very short siphonal canal, often little more than a gap at the anterior end of the aperture. Outer lip sinus: there is a sinus, or gap, in the top of the outer lip, a feature also found in the Turridae. In the Columbellidae it is usually shallow, but much deeper in the Turridae. Outer lip dentition: there are usually denticles inside the outer lip, although some species have just a single indistinct bulge. The strength of the denticles varies from species to species, and with growth stage of the shell. In some species, the denticles are only developed in the most mature specimens, therefore only being seen in a small percentage of shells. Inner (columellar) lip dentition: the inner lip of the aperture is without plaits, providing a point of separation from Marginellidae, Mitridae, and Volutidae. There are often weak denticles on the inner lip, aligned on an axial ridge just inside the edge of the callus, but these also tend to be restricted to mature shells.
Reference: Beechey, 2009.

Genus Mitrella
Mitrella blanda (Sowerby, 1844) (Plate 103 a-b)
Distribution: Intertidal zone of Abu Al-Hassaniya.

Plate 103. ***Mitrella blanda*****, a-b. general view.**

Genus Zafra
Zafra selasphora (Melvill and Standen, 1901) (Plate 104 a-b)
Distribution: Kuwait's marine environment.

Plate 104. ***Zafra selasphora*****, a-b. general view.**

Family Turridae H. Adams and A. Adams, 1853
Description: Most turrids are rather small with a height under 2 cm. However, the height of the shell may vary between 0.6 and 11.4 cm. The shape of turrid shells is more or less fusiform, varying from very high-spired to broadly ovate. The spiral whorls are elongate to broadly conical. The sculpture of the shell is very diverse and can take almost any form, but most have an axial sculpture or spiral sculpture (or a combination of both). Others are retuculate, beaded, nodulose or even striate. The aperture of the shell often has a V-shaped sinus or notch in it, an indentation on the upper end of the outer lip. This accommodates the anal siphonal notch, commonly known as the "turrid notch". The siphonal canal is usually open, varying from short and stocky to long and slender. The position of this turrid notch and the form and sculpture of the whorls is a primary method to classify the turrids. The columella is usually smooth and shows only seldom labial plicae. The operculum is horny, but may not always be present. Turrids are predatory carnivorous gastropods. Most species have a poison gland used with the toxoglossan radula, used to prey on animals (mostly polychaete worms) or in self-defense. Others have lost the radula and the poison gland. The radula, when present, has two or three teeth in a row. It lacks lateral teeth and the marginal teeth are of the wishbone or duplex type. The teeth with a duplex form are not shaped from two distinct elements but grow from a flat plate, by thickening at the edges of the teeth and elevation of the rear edge from the membrane. Female turrids lay their eggs in lens-shaped capsules.
Reference: Poppe and Goto, 1991.

Genus *Pseudodaphnella*
Pseudodaphnella daedala (Reeve, 1846) = *Costellaria daedala* (Plate 105)
Distribution: Muddy and silty substrates in the Kuwait Bay and near Failaka Island.

Plate 105. *Pseudodaphnella daedala*, general view.

Turridae gen.sp. (Plate 106)
Distribution: Intertidal zone of Ras Al-Ardh.

Plate 106. ***Turridae*** **gen. sp., general view.**

Family Costellariidae MacDonald, 1860
Description: The Costellariidae family is closely related to the Mitridae family, and the life styles of these mollusks are similar. The hypobranchial gland secretes a greenish-yellow fluid, unlike the purple stain secreted by the Mitridae. As with the Mitridae, *Vexillum* inserts their proboscis deep into prey and rasp out soft tissue with a hooked radula. *Vexillum* miters are found in Indo-Pacific waters, and the highly colored striped shells are a characteristic of this family. By comparison, the Mitridae, found in tropical waters of the Americas run to darkish brown or duller colors. Costellariidae shells also tend to have predominantly axial sculpture, unlike the Mitridae. The family designation, Costellariidae is synonymous with Vexillidae.
Reference: Beechey, 2009.

Genus *Costellaria*
***Costellaria* sp.**
Distribution: Muddy substrates in the Kuwait Bay, between Bubiyan and Failaka Islands and in Khor Al-Sabbiya.

Genus *Vexillum*
Vexillum (Costellaria) diaconalis (Melvill and Standen, 1903)
Distribution: Muddy substrates in Khor Al-Sabbiya.

Vexillum (Pusia) osiridis (Issel, 1869) (Plate 107 a-b)
Distribution: Sandy substrates in Abu Al-Hassaniya.

Plate 107. Vexillum (*Pusia) osiridis*, a-b. general view.

Costellariidae gen. sp.
Distribution: Muddy substrates between Bubiyan and Failaka Islands.

Family Muricidae da Costa, 1776
Description: The muricid shells are variably shaped, generally with a raised spire and strong sculpture with spiral ridges and often axial varices (typically three or more varices on each whorl), also frequently bearing spines, tubercles or blade-like processes. Periostracum is absent in this family. The aperture is variable in shape, may be ovate to more or less contracted, with a well marked anterior siphonal canal that may be very long. The shell's outer lip is often denticulate inside, sometimes with a tooth-like process on its margin. The columella is smoothish to weakly ridged. The operculum is corneous, of variable thickness, with nucleus near the anterior end or at about midlength of outer margin. Many muricids have episodic growth, which means that the shell grows in spurts, remaining the same size for a while (during which time the varix develops) before rapidly growing to the next size stage. The result is the series of above mentioned varices on each whorl.

Reference: Beechey, 2009.

Genus *Cronia*

Cronia konkanensis (Melvill, 1893) (Plate 108 a-b)

Distribution: Intertidal zone from Kuwait Bay to Ras Al-Ardh.

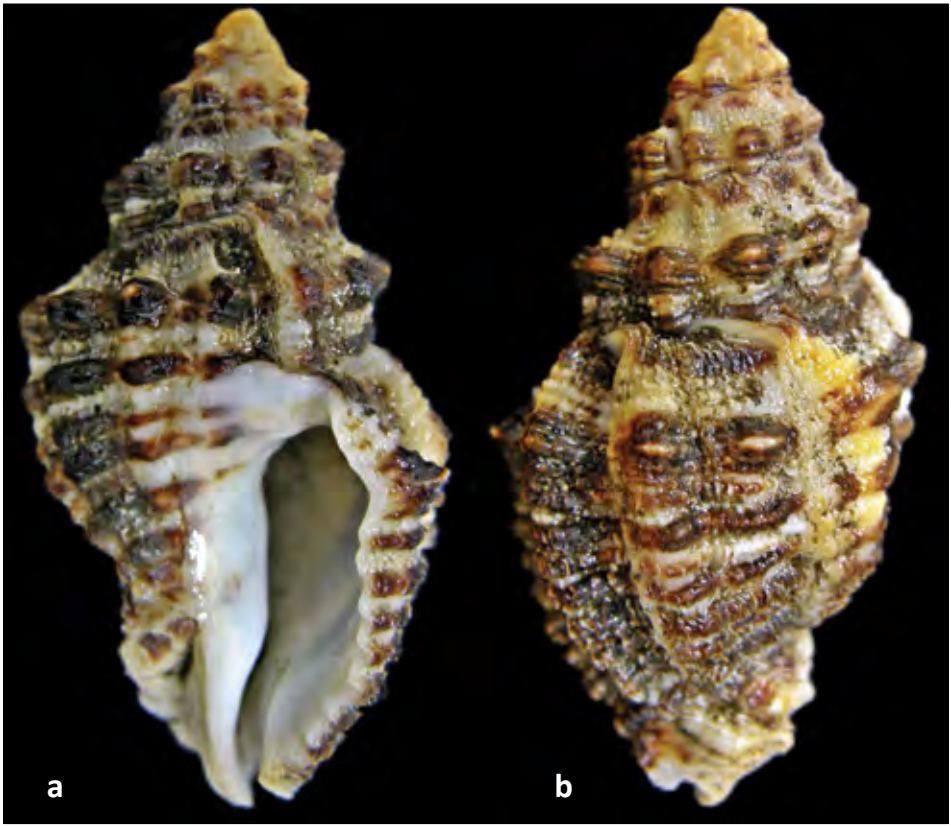


Plate 108. ***Cronia konkanensis*****, a-b. general view.**

Genus *Hexaplex*
Hexaplex kuesterianus (Tapparone-Caniferi, 1875) (Plate 109 a-b)
Distribution: Muddy and sandy substrates in Kuwait Bay.

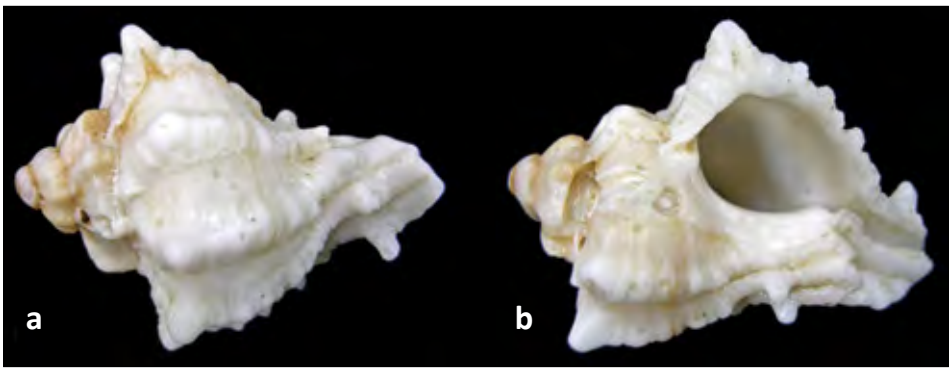


Plate 109. ***Hexaplex kuesterianus*****, a-b. general view.**

Genus *Murex*
Murex scolopax Dillwyn, L.W., 1817 (Plate 110 a-b)
Distribution: Muddy and sandy substrates in Kuwait Bay.

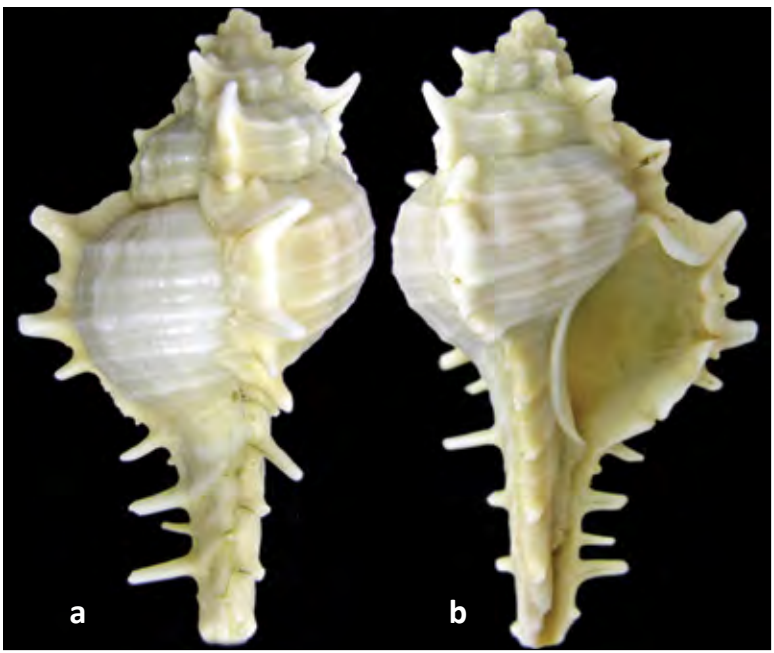


Plate 110. ***Murex scolopax*****, a-b. general view.**

Genus *Rapana*

Rapana rapiformis (Born, 1778) (Plate 111)

Distribution: Sandy substrates in Ras Al-Julaiah.

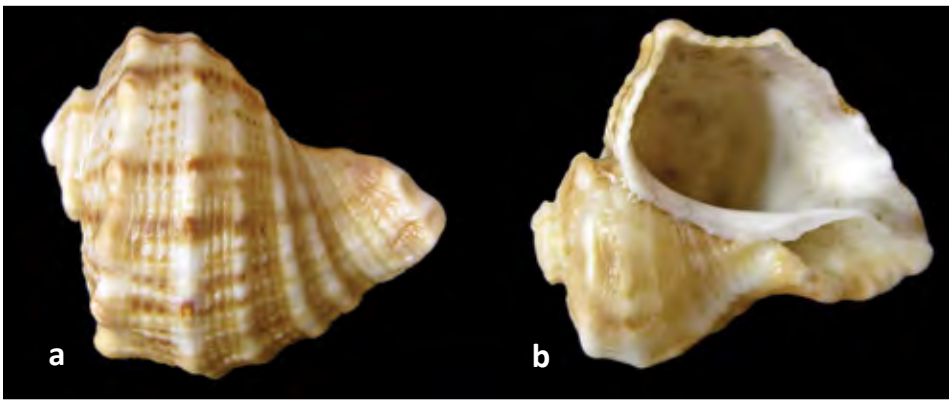


Plate 111. ***Rapana rapiformis*****, a-b. general view.**

Rapana venosa (Valenciennes, 1846) (Plate 112)

Distribution: Muddy substrates in Khor Al-Sabbiya.

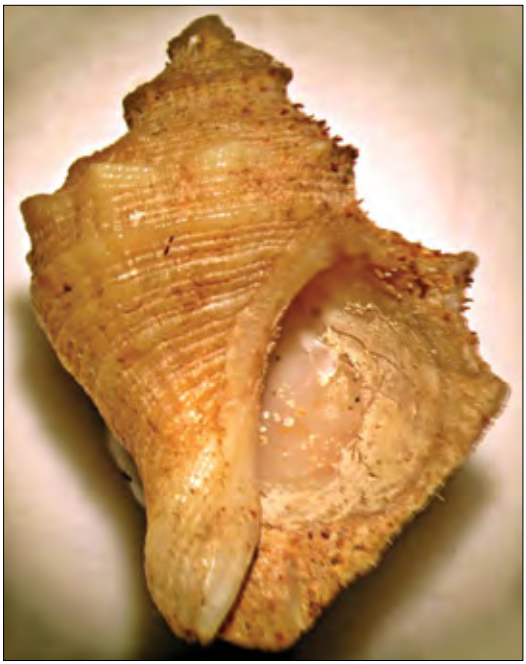


Plate 112. ***Rapana venosa*****, general view.**

Genus *Thais*
Thais savignyi (Deshayes, 1844) (Plate 113)
Distribution: In Kuwait waters from Ras Al-Ardh to Ras Al-Zour.

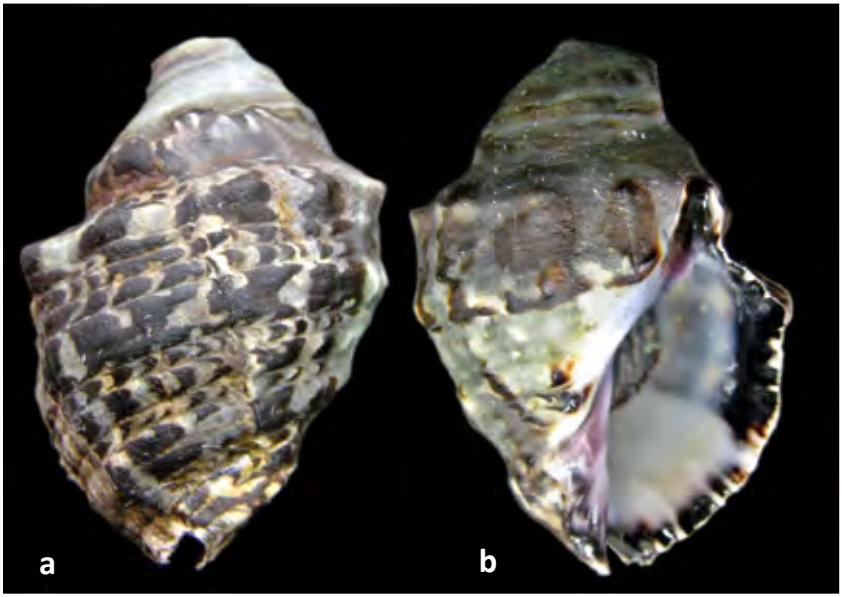


Plate 113. ***Thais savignyi*****, a-b. general view.**

Genus *Thaisella*
Thaisella lacera (Born, 1778) (Plate 114)
Distribution: In Kuwait waters from Khor Al-Sabbiya to Ras Al-Zour.

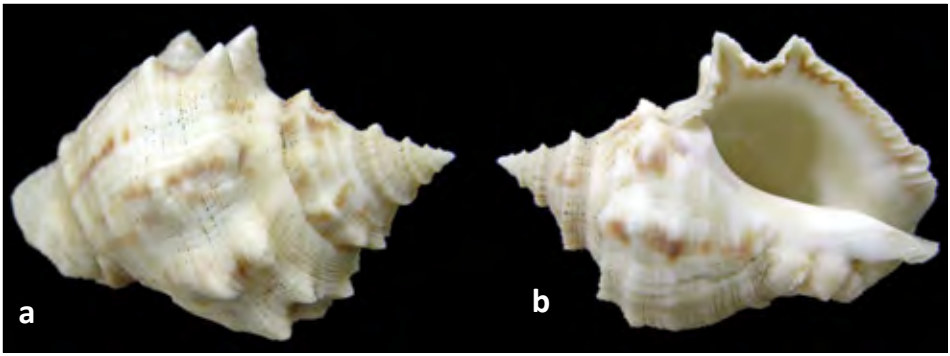


Plate 114. ***Thaisella lacera*****, a-b. general view.**

Thaisella tissoti (Petit de la Saussaye, 1852) (Plate 115)
Distribution: In Kuwait waters from Ras Al-Ardh to Ras Al-Zour.

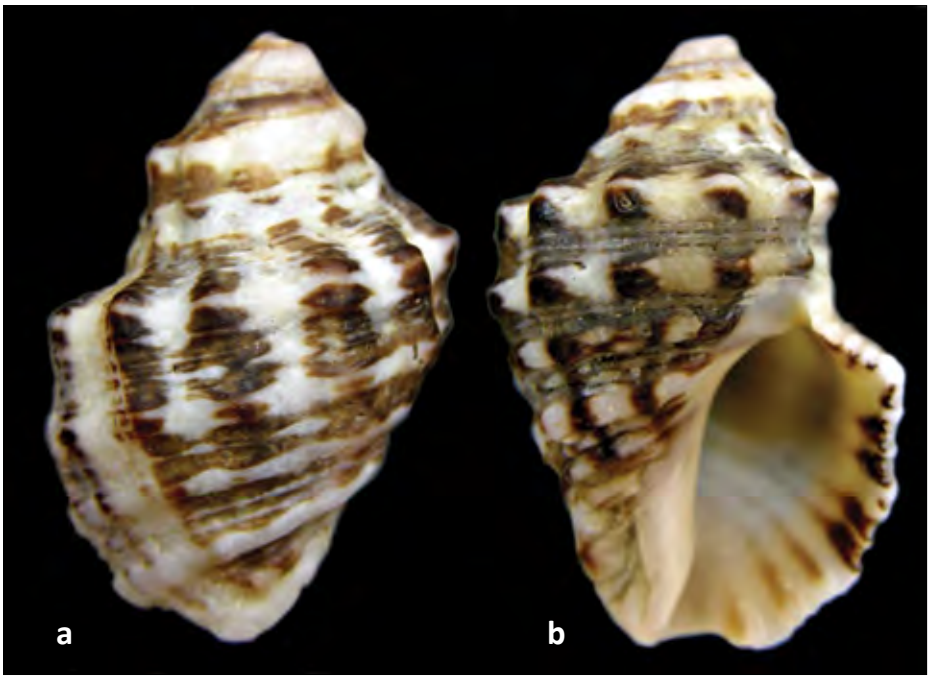


Plate 115. ***Thaisella tissoti*****, a-b. general view.**

Family Mitridae Swainson, 1829
Description: Shells have 3 to 10 columellar folds, according to the species and, with few exceptions, have spiral ribs and grooves. Color patterns provide useful clues to identification but sculptural features are equally important. Few are smooth externally but the aperture of mature shells is always smooth inside (not lirate as in the Costellaridae). An operculum is never present. Sand and reef dwellers, most species appear to be carnivorous.
Reference: Bosch, 1995.

Genus *Scabricola*
Scabricola desetangsii (Kiener, 1838) (Plate 116 a-b)
Distribution: Intertidal zone of Abu Al-Hassaniya.

Plate 116. *Scabricola desetangsii*, a-b. general view.

Family Ranellidae Gray, 1854
Description: Shells are variable in size and solidly constructed. They are often fancifully ornamented. The name, triton refers to the widely flared lip and columellar fold, giving the shell a prominent flared opening. Many have blunt teeth or convex folds on the inside lip that extends to the wavy stout edge. Some tritons are closely similar to Murex Shells, but a distinctive difference is that no more than two varices are found on a whorl and those on adjacent whorls rarely connect. The Ranellidae feed on other mollusks and sea urchins, and like many other carnivorous mollusks, they either spray or inject a cholinergic secretion in their saliva that paralyzes their prey.
Reference: Beechey, 2009.

Genus *Cymatium*
***Cymatium* sp.**
Distribution: Intertidal zone of Ras Al-Zour.

Family Cypraeidae Rafinesque, 1815
Description: Cypraeidae have adult shells, which are very rounded, almost like an egg; they do not look like a typical gastropod shell. In virtually all of the species in the family Cypraeidae, the shells are extremely smooth and shiny. This is because in the living animal, the shell is nearly always fully covered with the mantle. Typically, no spire is visible in the fully adult shell, and there is a long, narrow, aperture, which is lined with "teeth." Cowries have no operculum. Juvenile cowry shells are not at all similar to adult cowry shells. The juvenile shells of cowries perhaps more closely resemble the shells of some "bubble snails" in the order Cephalaspidea. Also the shells of juvenile cowries seldom exhibit the same color patterns as the adult shells do, and thus can be hard to identify to species.
Reference: Beechey, 2009.

Genus *Cypraea*
Cypraea grayana Schilder, 1930 (Plate 117 a-c)
Distribution: Hard substrates around Qaruh Island.

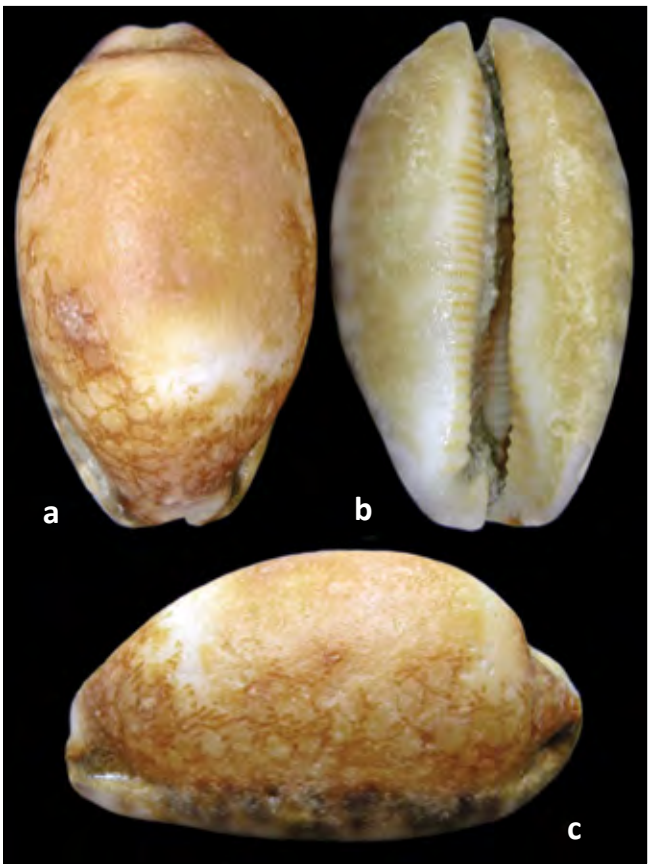


Plate 117. *Cypraea grayana*, a-b. general view.

Cypraea lamarckii Gray, 1825
Distribution: Kuwait's marine environment.

Cypraea lentiginosa (J. E. Gray, 1825) (Plate 118 a-d)
Distribution: Abundant in Kubbar Island, rare in mainland coast from Mahboula to Ras Al-Zour.

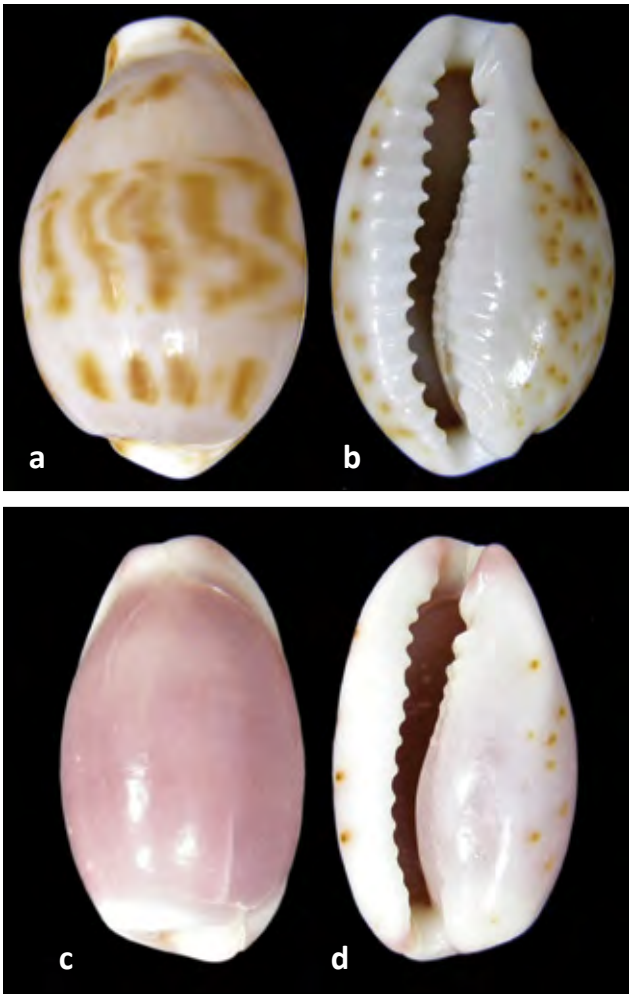


Plate 118 ***Cypraea lentiginosa*****, a-b. general view of adult specimen; c-d. juvenile specimen.**

Cypraea pulchra Gray, 1824 (Plate 119 a-b)
Distribution: Kubbar Island.

Plate 119. ***Cypraea pulchra*****, a-b. general view.**

Cypraea turdus (Lamarck, 1810) (Plate 120 a-b)
Distribution: Abundant in Kubbar Island, rare in mainland coast from Mahboula to Ras Al-Zour.

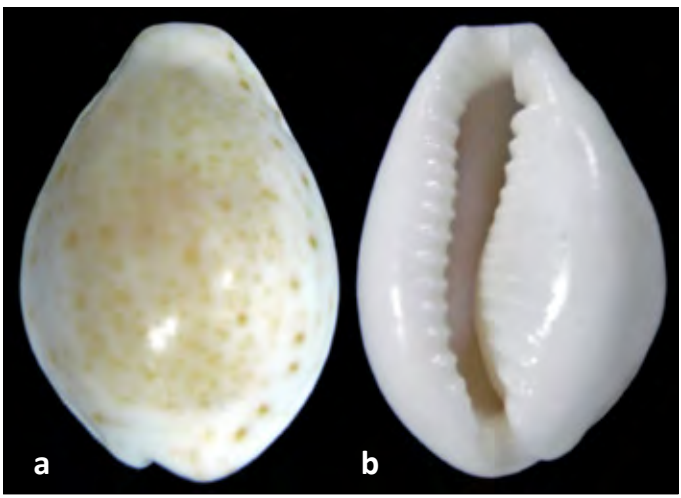


Plate 120. ***Cypraea turdus*****, a-b. general view.**

Family Cystiscidae Stimpson, 1865
Description: The shell is minute to large, either white, uniformly colored, or patterned; the surface is smooth, sculptured, or axially costate; the spire is flat to immersed, or low to tall; the protoconch is paucispiral; the lip is thickened, smooth or denticulate; an external varix is present or absent; a siphonal notch is present or absent; a posterior notch is present or absent; the columella is multiplicate, internal whorls cystiscid or modified cystiscid type. Mantle cavity with monopectinate ctenidium and bipectinate osphradium. Proboscis pleurembolic; jaws absent; typical radular sac present.
Reference: Beechey, 2009.

Genus *Gibberula*
Gibberula mazagonica (Melvill, 1892) (Plate 121 a-b)
Distribution: Muddy substrates near Failaka Island and between Bubiyan and Failaka Islands.

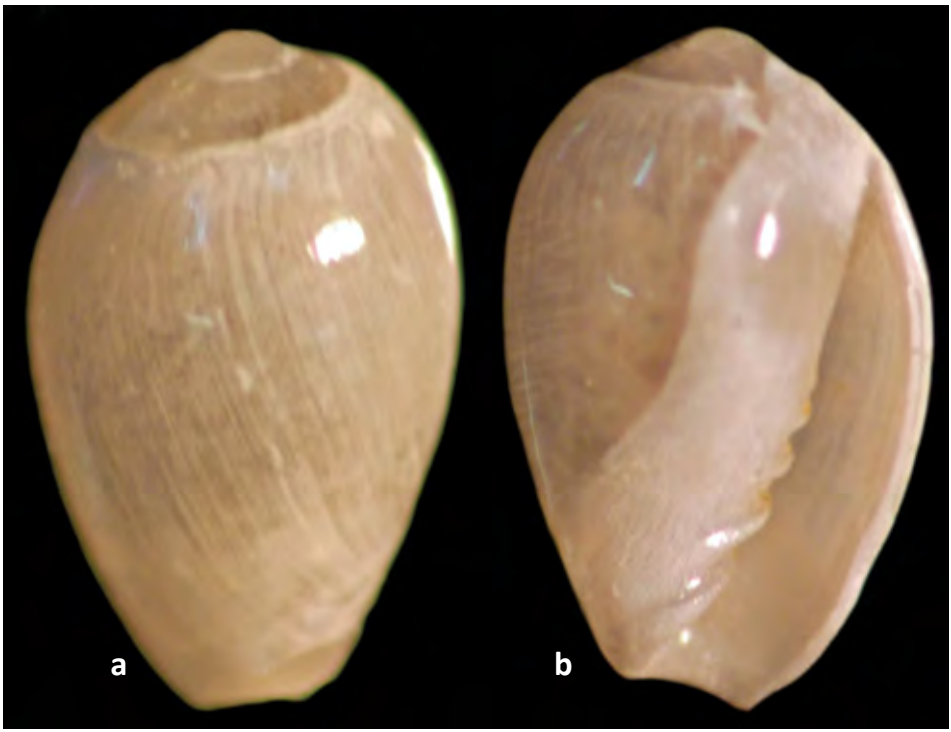


Plate 121. ***Gibberula mazagonica*****, a-b. general view.**

Genus Granulina

Granulina oodes (Melvill, 1898) (Plate 122)

Distribution: Kuwait's marine environment.

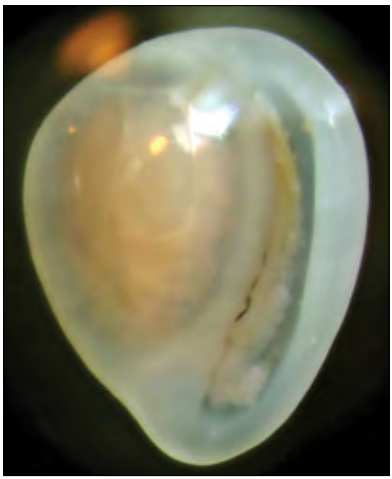


Plate 122. ***Granulina oodes*****, general view.**

Family Iravadiidae Thiele, 1928
Description: Iravadiidae shells are elongate, always higher than broad and mostly smaller than 5mm. Shells smooth or with spiral sculpture. A diagnostic feature for the family is the planorbid or depressed dome-shaped protoconch, which has two whorls, the first one of which is minute. The animals live in shallow water, mostly in mangrove habitats, some live in brackish water, but some live in deep water.
Reference: Beechey, 2009.

Genus *Pseudonoba*
Pseudonoba alphesiboei (Melvill, 1912)
Distribution: Muddy and silty substrates in Kuwait Bay.

Pseudonoba columen (Melvill, 1904) (Plate 123 a-c)
Distribution: Silty substrates in Kuwait Bay (Station 9).

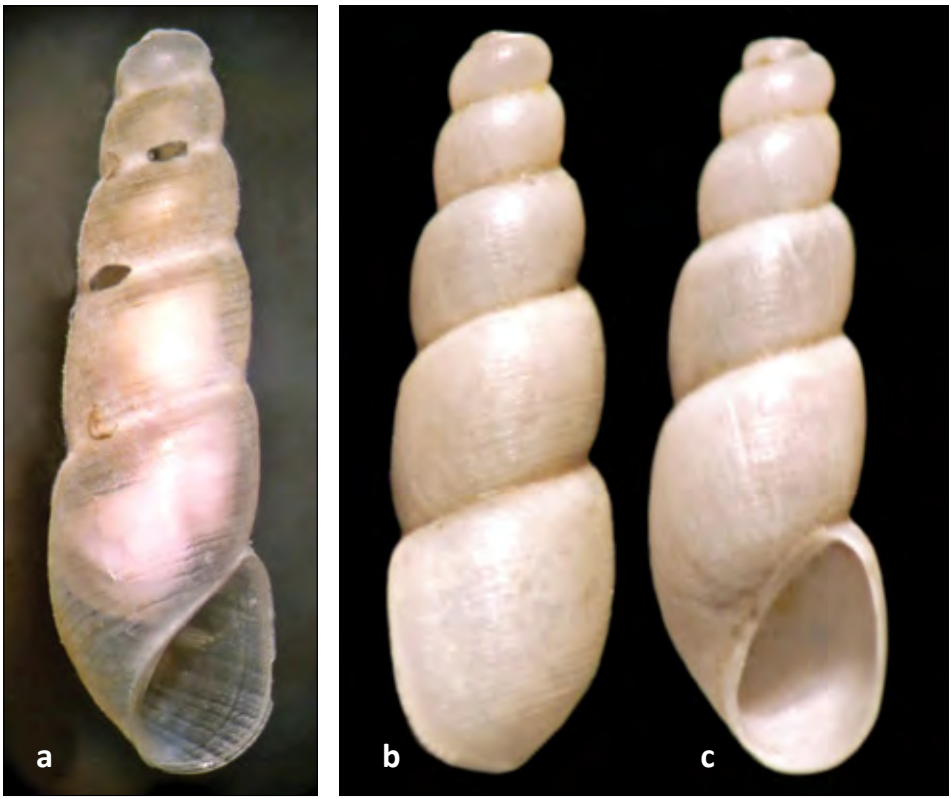


Plate 123. *Pseudonoba columen*, a-c. general view.

Family Eulimidae Philippi, 1853
Description: Eulimidae is a taxonomic family of small parasitic marine gastropod mollusks. White or semi-transparent snails that derive nutrition by siphoning body fluids from various echinoderms. Shell long, awl-shaped, smooth and highly polished; whorls numerous flat-sided. Animals ectoparasitic on echinoderms, feeding by means of a long, eversible proboscis; foot with a large anterior pedal gland.
Reference: Hayward et al., 1990.

Genus *Hypermastus*
Hypermastus epiphanes (Melvill, 1897) (Plate 124 a-b)
Distribution: Silty substrates in Kuwait Bay.

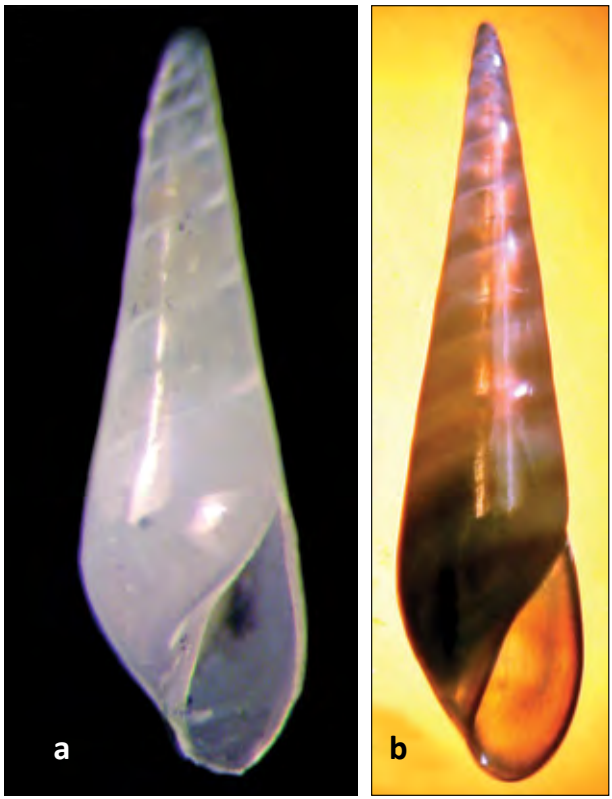


Plate 124. ***Hypermastus epiphanes*****, a-b. general view.**

Genus *Melanella*
Melanella cumingi (A. Adams, 1854)
Distribution: Muddy and silty substrates in Kuwait Bay.

***Melanella* sp.** (Plate 125)
Distribution: Muddy substrates between Ras Al-Ardh and Failaka Island.

Plate 125. *Melanella* sp., general view.

Family Nassariidae Iredale, (1835)
Description: Mud snails, or basket shells. The Nassariidae is a group of small to very small species, generally less that 20 mm in length. The operculum is chitinous. The animals are relatively large in comparison to shell size, and are generally agile and active. Nassariids are generally carrion feeders, and are equipped with a very long proboscis for reaching food in cracks or crevices and have a good chemical sensory mechanism. Common to abundant in intertidal sandy and muddy habitats, but with some species occurring subtidally and a few extending to abyssal depths. Often form large colonies. Occur in tropical, temperate and cold waters, but are most common in the tropics.
Reference: Beechey, 2009.

Genus *Nassarius*
Nassarius albescens (Dunker, 1846) (Plate 126)
Distribution: Muddy and sandy substrates in Kuwait Bay.

Nassarius concinnus (Powys, 1835)
Distribution: Muddy and silty substrates in Kuwait Bay.

Plate 126. ***Nassarius albescens*****, general view.**

Nassarius emilyae Moolenbeek and Dekker, 1994
Distribution: Intertidal zone of Ras Al-Zour.

Nassarius frederici (Melvill and Standen, 1901)
Distribution: Muddy and silty substrates in Kuwait Bay.

Nassarius marmoreus (A.Adams, 1852) (Plate 127)
Distribution: Intertidal zone of Ras Al-Ardh, Kubbar Island.

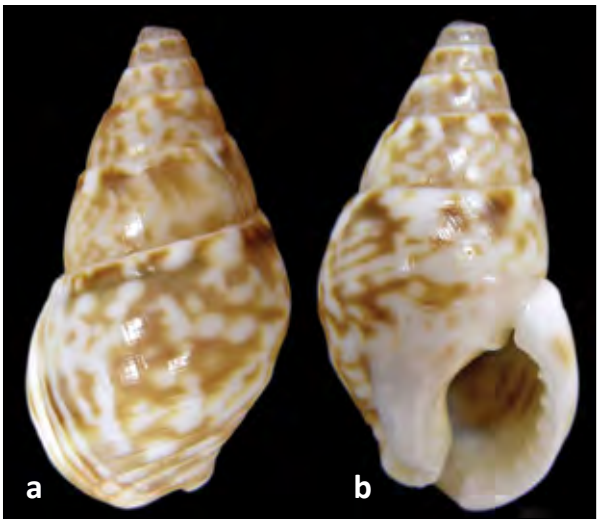


Plate 127. ***Nassarius marmoreus*****, a-b. general view.**

Nassarius persicus (Martens, 1874) (Plate 128)
Distribution: Muddy and sandy substrates from Kuwait Bay to Fahaheel.

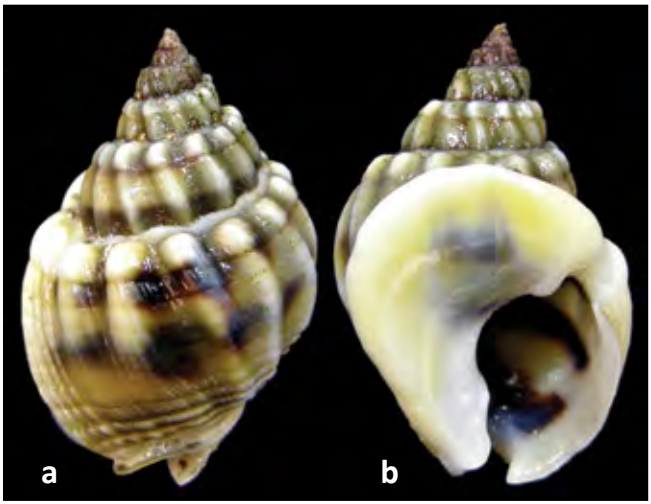


Plate 128. ***Nassarius persicus*****, a-b. general view.**

***Nassarius* sp.** (Plate 129 a-b)
Distribution: Muddy substrates between Ras Al-Ardh and Failaka Island.

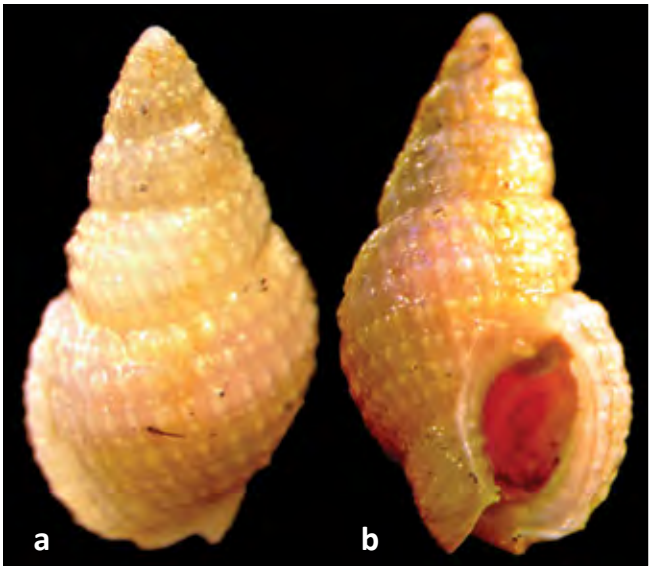


Plate 129. ***Nassarius*** **sp., a-b. general view.**

Family Rissoidae Gray, 1847
Description: Rissoidae is a family of very small and minute sea snails with an elongated shell and operculum. The shell of the Rissoidae is tall-spired, usually quite solid and variously sculptured or smooth, but most have a spire higher than the aperture. The aperture is ovate, typically channeled anteriorly and posteriorly. Rissoidae live for the most part on stones, shells and sponges. They occur in nearly all seas.
Reference: Hayward et al., 1990.

Genus *Rissoina*
***Rissoina* sp.** (Plate 130)
Distribution: Intertidal zone of Ras Al-Ardh.

Plate 130. *Rissoina* sp., general view.

Family Strombidae Rafinesque, 1815

Description: The Strombidae is a small family of medium to large size shells. They are intertidal and shallow subtidal animals that feed on macroalgae and epiphytes on sandy or slightly muddy substrates. Sexes are separate, with internal fertilization. After fertilization, the female deposits eggs in long thin gelatinous strings that hatch as planktonic larvae. After 2-3 weeks in the plankton, larvae settle out and begin to grow to adults. Two features of strombid organization are notable. The first is the effective and prominent eyes on stalks. The right stalk extends through a notch, termed the stromboid notch, in the outer lip of the shell, and the left stalk extends through the anterior canal. The second feature is the method of locomotion. In most gastropods, the animal slides along the substrate on a mucous-lubricated path by waves of contraction in the foot. In strombs, the serrated, pointed operculum on the end of the foot is dug into the substrate and the animal pulls itself forward in a series of leaps with the operculum as an anchor.

Reference: Beechey, 2009.

Genus *Strombus*

Strombus decorus (Röding, 1798) (Plate 131 a-c)

Distribution: Sandy substrates from Ras Al-Ardh to Ras Al-Zour.

Plate 131. ***Strombus decorus*****, a-b. general view; c. alive mollusk: eyes, tentacles and knife-shaped operculum are visible.**

Strombus persicus (Swainson, 1821) (Plate 132 a-b)
Distribution: Muddy and sandy substrates in Kuwait Bay.

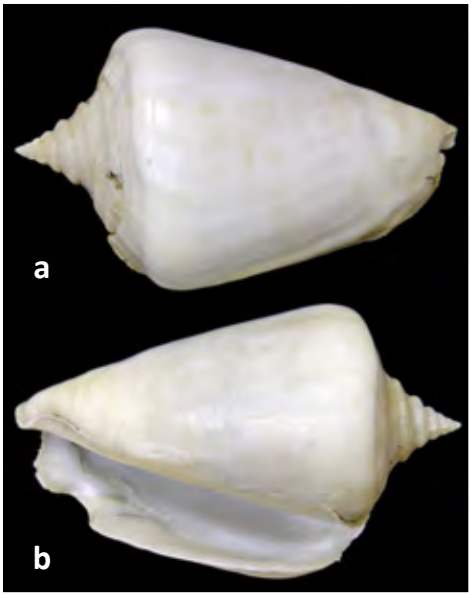


Plate 132. ***Strombus persicus*****, a-b. general view.**

Genus *Tibia*
Tibia insulaechorab Röding, 1798 (Plate 133 a-b)
Distribution: Muddy substrates in Kuwait Bay and Khor Al-Sabbiya.

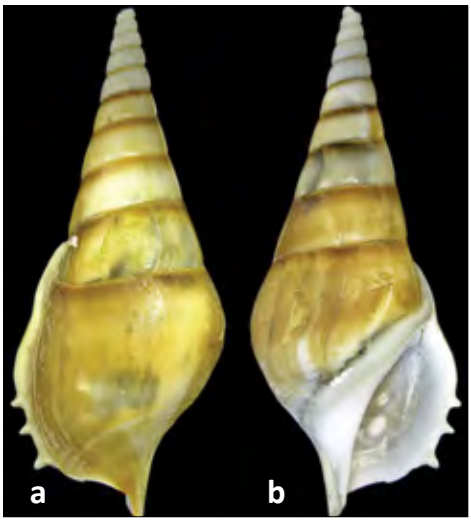


Plate 133. ***Tibia insulaechorab*****, a-b. general view.**

Genus *Terebellum*
Terebellum terebellum (Linnaeus, 1758) (Plate 134 a-b)
Distribution: Sandy substrates in Mahboula.

Plate 134. ***Terebellum terebellum*****, a-b. general view.**

Family Drilliidae Olsson, 1964
Description: Drilliidae is taxonomic family of sea snails, marine gastropod mollusks. This family has no subfamilies. The radula of the species in this family has characteristically five teeth in each row with comb-like lateral teeth and flat pointed marginal teeth.
Reference: Hayward et al., 1990.

Genus *Splendrillia*
***Splendrillia* sp.** (Plate 135)
Distribution: Muddy substrates in Kuwait Bay.

Plate 135. ***Splendrillia*** **sp., general view.**

Family Terebridae Mörch, 1852
Description: The Terebridae, commonly referred to as auger shells or auger snails, are a group or taxonomic family of small to large predatory sea snails, marine gastropod mollusks. These gastropods have extremely high-spired shells with numerous whorls, and the common name refers to the resemblance of their shells to rock drill-type drill bits. The shells of Terebridae are typically shaped like slender augers or screws. In that respect, they share certain shell characters with the family Turritellidae, the turret shells. One characteristic that distinguishes Terebridae from Turritellidae is the short anterior canal or notch in the aperture of the shell. Terebridae shells also tend to have characteristically flattened versus convex whorls, and they often have one or two plaits on the columella.
Reference: Beechey, 2009.

Genus *Terebra*
***Terebra* sp.** (Plate 136)
Distribution: Muddy substrates between Ras Al-Ardh and Failaka Island.

Terebridae gen. sp.
Distribution: Muddy substrates between Ras Al-Ardh and Failaka Island.

Plate 136. *Terebra* sp., general view.

Family Tonnidae Suter, 1913
Description: The family Tonnidae is represented by the genera: *Tonna* and *Eudolium*. Species of *Tonna* are large, globular lightweight shells, mainly tropical in distribution, that live from the shallow subtidal down to several hundred meters. They live mainly in sandy areas, where they can burrow beneath the sand and leave just the tip of their siphon exposed. They feed on sea cucumbers (holothurians). The genus *Eudolium* contains smaller shells, up to about 80 mm in length, which occur in deeper water. Although a relatively small family, the Tonnidae has not been revised for many years, and there are taxonomic problems with many species.
Reference: Beechey, 2009

Tonnidae gen. sp. (juv.) (Plate 137)
Distribution: Kuwait's marine environment.

Plate 137. Tonnidae gen. sp. (juv.), general view.

Family Vanikoridae J.E. Gray, 1840
Description: Shell is umbilicate and last whorl is large and globose. The prootoconch is disproportioately small. Apical whorls are strongly sculptured but this sculpture becomes less obsolete on the last whorl. They live under rubble in tidepools or under large coral boulders at moderate depths.
Reference: Hayward et al., 1990.

Genus *Vanikoro*
***Vanikoro* sp.**
Distribution: Intertidal zone of Ras Al-Ardh and Ras Al-Zour.

Order Neogastropoda
Family Olividae Latreille, 1825
Description: Olivids are sand dwelling carnivores and scavengers. The animal has a large flat foot that may extend twice the length of the shell, completely covering the shell. In some species the foot provides a limited swimming capability, probably used to escape predators. In ancillids the spire is covered with a glaze (also referred to as 'callus' if it is thick) applied after the creation of the normal spiral shell. There may be two layers of callus, applied at different times, over different parts of the shell. The callus on the spire may be smooth or spirally ribbed. The subsutural callus is a spiral band of callus below the suture. Below the center of the body whorl there is a groove known as the ancillid groove, which may be weak or strong. Below the ancillid groove is the ancillid band, and below that the anterior fasciole, or fasciolar band. The fasciolar band usually has a ridge in the center, which again may be weak or strong. The columellar pillar may be smooth or with plaits, varying in number and strength.
Reference: Beechey, 2009

Genus *Ancilla*

Ancilla castanea (G.B. Sowerby I, 1830) (Plate 138 a-d)

Distribution: Sandy substrates from Kuwait Bay to Ras Al-Zour.

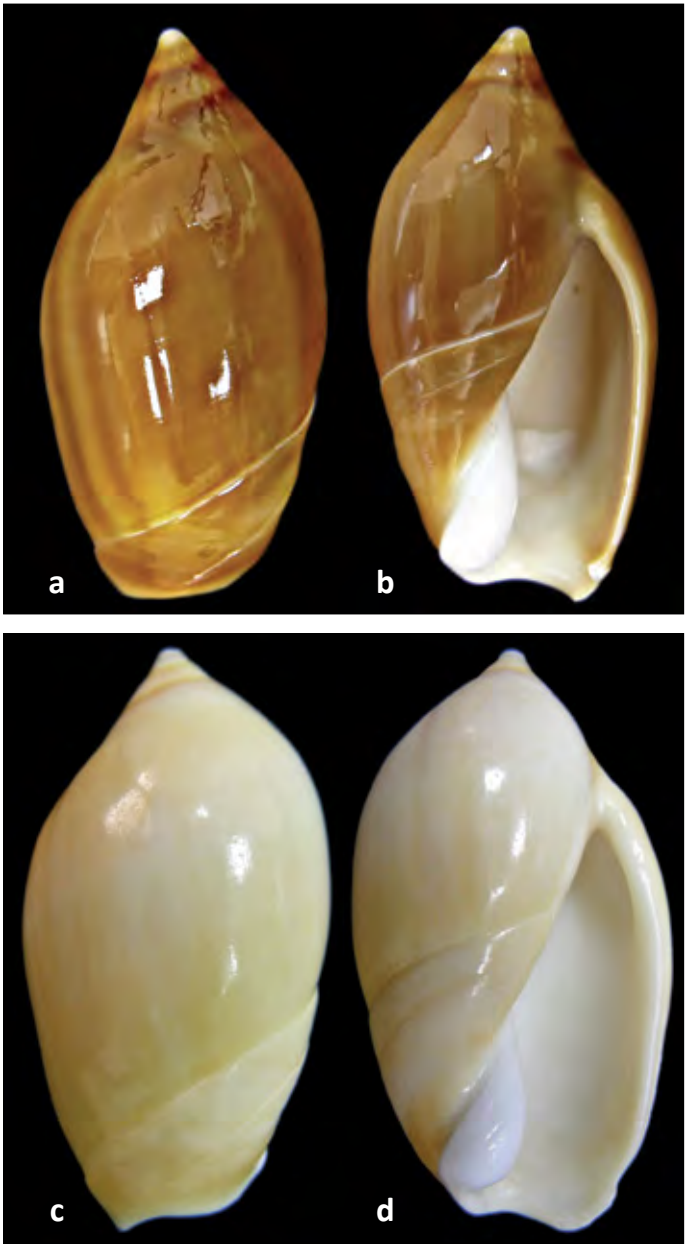


Plate 138. ***Ancilla castanea*, general view, a-b.dark form; c-d. light form.**

Genus *Fusinus*
Fusinus arabicus (Melvill, 1898) (Plate 139 a-b)
Distribution: Muddy and sandy substrates from Kuwait Bay to Ras Al-Zour.

Plate 139. *Fusinus arabicus*, a-b. general view.

Family Buccinidae Rafinesque, 1815
Description: Shell with a tall spire, last whorl 60-75 % of the shell height; adult shell of most species large (commonly 50-100 mm or more). Sculpture of spiral striae, which may or may not be prominent, with or without costae. When present, the costae are very prominent, crescentic or orthocline. Aperture commonly large, broadly oval, sometimes more elongate; siphonal canal frequently short, never closed. Proboscis eversible; no snout. Siphon long, commonly projecting well beyond tip of canal in active animals. Foot like that of muricids, but lacks an accessory boring organ; operculum with a terminal or a central nucleus. Common on soft substrates.
Reference: Hayward et al., 1990.

Genus *Cantharus* Röding, 1798
Cantharus wagneri (Anton, 1838)
Distribution: Muddy and silty substrates in Kuwait Bay.

Subclass Heterobranchia
Order Heterostropha
Family Acteonidae d'Orbigny, 1843
Description: Common name of Acteonidae is the "barrel bubble snails". The shell of these sand-dwelling micromollusks is small, but it is large enough to house the retracted soft parts including the entire mantle. The narrow shell aperture, which is ovate and pointed on the top, can be closed with an operculum. The thick shell is oviform to fusiform, with a short (sometimes sunken) conical apex. They have spiral sculpturing. The elongated aperture opens up from narrow at the posterior notch to enlarged at the base. The base of the columella has several characteristic plaits. The radula has no central tooth, and there are five or six laterals on each side. The teeth are very similar in shape and size across the radula, which is specialised for a diet of polychaete worms. The eggs are enclosed in a long, gelatinous mass, which is attached to the substrate with a short stalk.
Reference: Hayward et al., 1990.

Genus *Acteon*
***Acteon* sp.** (Plate 140)
Distribution: Muddy substrates near Failaka Island.

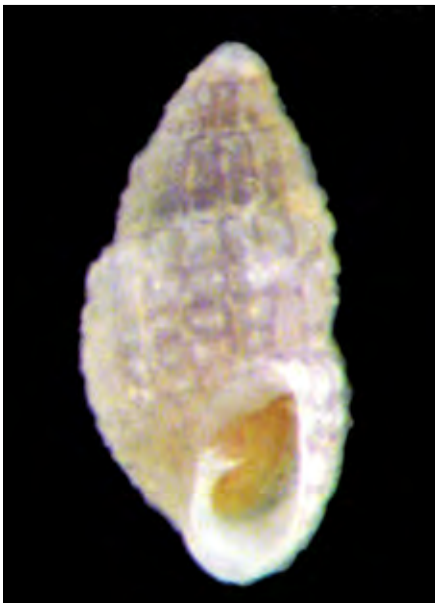


Plate 140. *Acteon* sp., general view.

Genus *Pupa*
Pupa affinis (A.Adams, 1855) (Plate 141)
Distribution: Kuwait's marine environment.

Plate 141. *Pupa affinis*, general view.

Family Architectonicidae Gray, 1850
Description: Architectonicidae, common name the staircase shells or sundials, are a family of sea snails, marine gastropod mollusks of the family Heterobranchia. Sundial shells are rather unique in being markedly flattened and in showing a lenticular edgewise appearance. Ever-widening whorls leave a deep umbilicus open to the tip of the spire, showing a beautifully detailed banding pattern that is reminiscent of a spiral staircase. The operculum is beehive shaped and chitonous (horny) rather than calcareous. Comparing principal genera, *Architectonica* shells are distinctively flattened sundials, whereas *Heliacus* shells have a wider aperture opening to the side. The operculum is also different in having a several turn chitonous spiral. Shallow sands are normal habitat, and the mollusk is fairly widely distributed in warmer waters of the West and East coasts of North and South America, as well as Indo-Pacific regions.
Reference: Hayward et al., 1990.

Genus *Architectonica*
***Architectonica* sp.**
Distribution: Muddy substrates between Bubiyan and Failaka Islands.

Genus *Heliacus*
***Heliacus* sp.** (Plate 142 a-b)
Distribution: Muddy substrates between Ras Al-Ardh and Failaka Island.

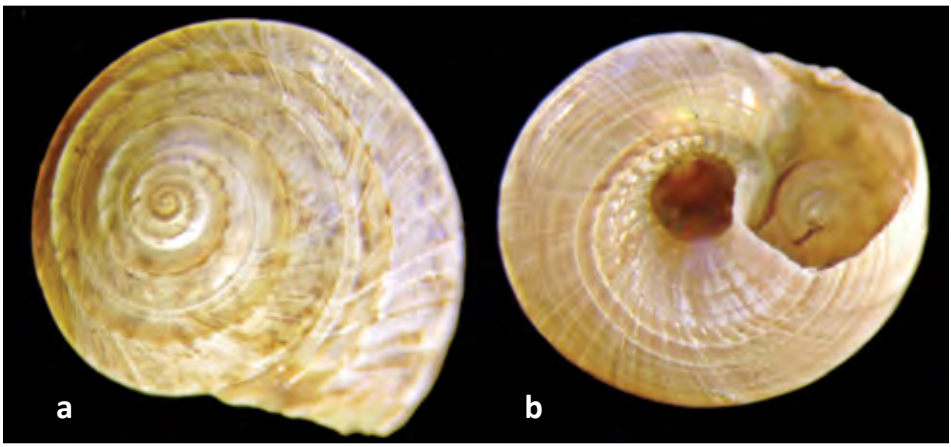


Plate 142. *Heliacus* sp., a-b. general view.

Architectonicidae gen. sp. (Plate 143)
Distribution: Muddy substrates between Ras Al-Ardh and Failaka Island and in Kuwait Bay.

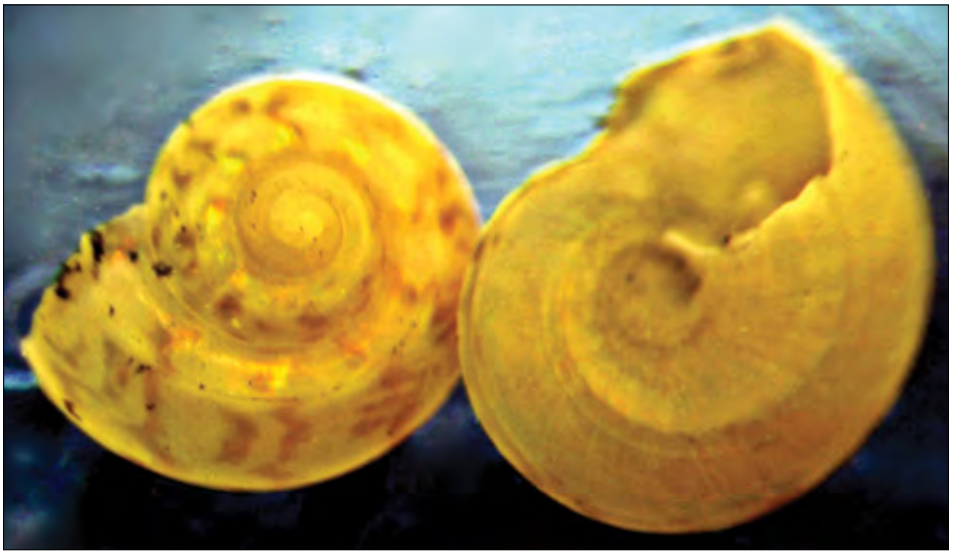


Plate 143. Architectonicidae gen. sp., general view.

Family Amathinidae Ponder, 1987
Description: Amathinidae is a family, mostly consisting of small and minute sea snails. The shells of Amathinidae are usually flat without coiling. They usually have strong axial ribs. Ponder described giant neurons in the cerebral ganglion.
Reference: Schanderet al., 1999.

Genus *Leucotina*
Leucotina gratiosa Melvill
Distribution: Muddy substrates in Kuwait Bay.

Family Pyramidellidae J.E. Gray, 1840

Description: The shell of Pyramidellidae has a blunt, heterostrophic protoconch, which is often pointed sideways or wrapped up. The length of the slender, elongated (turreted or conical) shells varies between 0.5 mm and 3.5 cm, but most species in the family have shells, which are smaller than 13 mm. The texture of these shells is smooth or sculptured in various forms such as ribs and spirals. Their color is mostly white, cream or yellowish, sometimes with red or brown lines. The teleoconch is dextrally coiled, but the larval shells are sinistral. This results in a sinistrally coiled protoconch. The columella has usually one, but sometimes several, spiral folds. The aperture is closed by an operculum.

The Pyramidellidae are ectoparasites, feeding mainly on other mollusks and on annelid worms, but some are known to feed on peanut worms and crustaceans. They do not have a radula. Instead, their long proboscis is used to pierce the skin of its prey and suck up its fluids and soft tissues. The eyes on the grooved tentacles are situated toward the base of the tentacles. Between the head and the foot, a lobed process called the mentum (= thin projection) is visible. These gastropods are hermaphrodites, laying eggs in jelly-like masses on the shell of its host. Some species have spermatophores.

Reference: Hayward et al., 1990.

Genus *Chrysallida*

***Chrysallida* sp**. (Plate 144 a)

Distribution: Muddy substrates in Kuwait Bay, between Bubiyan and Failaka Islands and intertidal zone of Ras Al-Zour.

***Chrysallida* sp. (juv)** (Plate 144 b)

Distribution: Muddy substrates between Bubiyan and Failaka Islands.

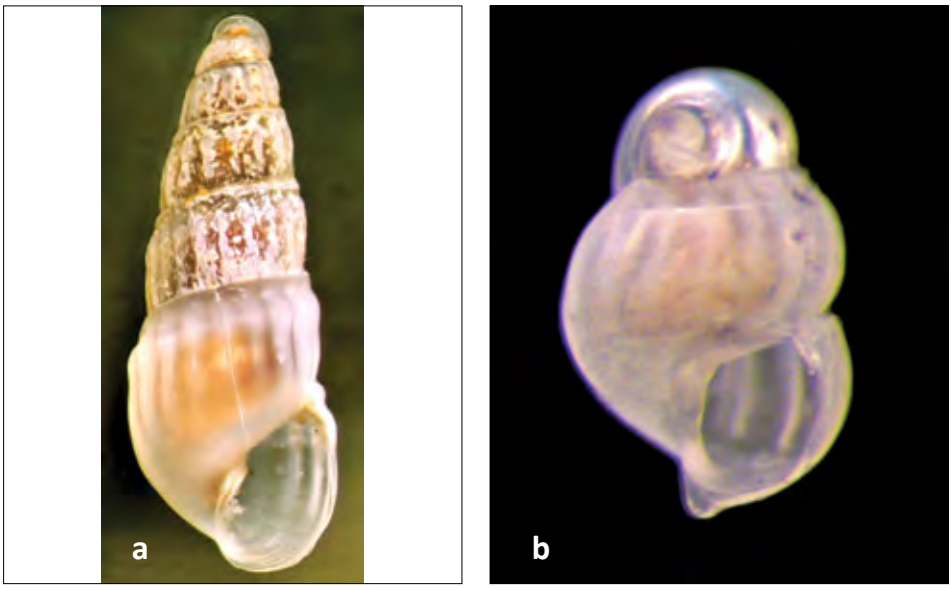


Plate 144. *Chrysallida* sp., a. general view; *Chrysallida* sp. (juv), b. general view.

Genus *Odostomia*
Odostomia eutropia Melvill, 1899 (Plate 145 a)
Distribution: Muddy substrates in Kuwait Bay, near Failaka Island and intertidal zone of Ras Al-Ardh.

***Odostomia* sp.** (Plate 145 b)
Distribution: Intertidal zone near Shuwaikh.

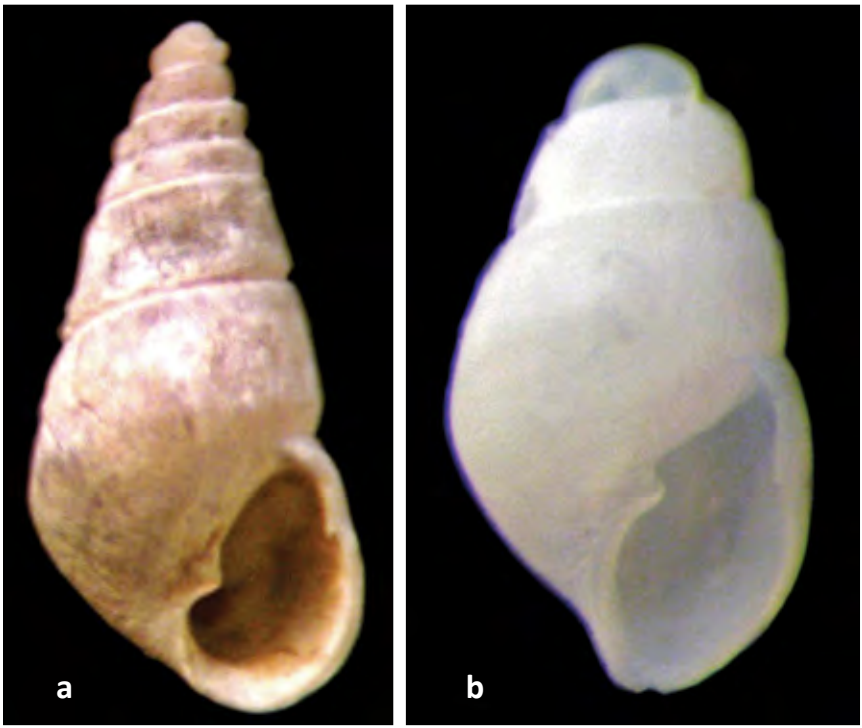


Plate 145. *Odostomia eutropia*. a. general view; *Odostomia* sp., b. general view.

Genus *Pyramidella* Grube, 1850
***Pyramidella* sp.**
Distribution: Muddy and silty substrates in Kuwait Bay.

Genus *Syrnola*
Syrnola aclis (Adams, A., 1854) (Plate 146)
Distribution: Muddy substrates near Failaka Island.

Plate 146. *Syrnola aclis*, general view.

Syrnola brunnea (Adams A., 1855) (Plate 147)
Distribution: Muddy substrates in Kuwait Bay, sandy substrates in Ras Al-Julaiah.

***Syrnola* sp.**
Distribution: Muddy substrates in Khor Al-Sabbiya Strait and intertidal zone of Ras Al-Zour.

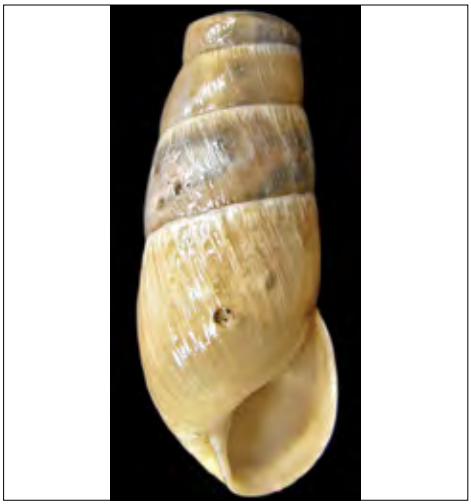


Plate 147. *Syrnola brunnea*, general view.

Genus *Turbonilla*
Turbonilla icela Melvill, 1910 (Plate 148)
Distribution: Kuwait's marine environment.

Turbonilla linjaica (Melvill and Standen, 1901)
Distribution: Muddy and silty substrates in Kuwait Bay.

Plate 148. *Turbonilla icela*, general view.

Pyramidellidae gen. sp. (Plate 149)
Distribution: Muddy substrates near Failaka Island, in Khor Al-Sabbiya and intertidal zone of Ras Al-Ardh.

Plate 149. Pyramidellidae gen. sp., general view.

Family Ringiculidae Philippi, 1853
Description: Ringiculidae are a family of minute deep-water sea snails or micromollusks, marine opisthobranch gastropod mollusks. The shells of species in this family resemble minute versions of the shells of the Cassinae.
Reference: Hayward et al., 1990.

Genus *Ringicula*
Ringicula propinquans Hinds, 1844 (Plate 150)
Distribution: Kuwait's marine environment.

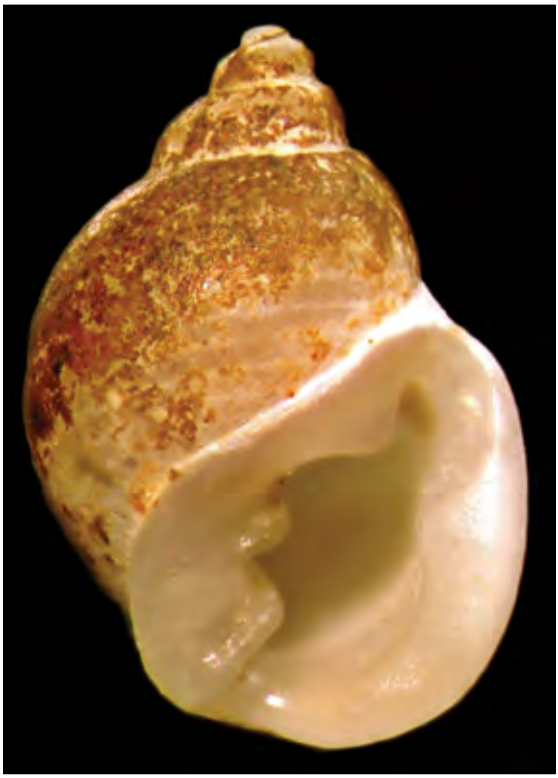


Plate 150. ***Ringicula propinquans*****, general view.**

Order Heterobranchia incertae sedis
Family Omalogyridae P. Fischer, 1885
Description: Omalogyridae are a family of minute and microscopic sea snails. This family includes the smallest gastropods known to science, with adult sizes of 1 mm and even less. Shells of Omalogyridae are brown, small, planispiral, discoidal. No spire visible.
Reference: Hayward et al., 1990.

Genus *Omalogyra*
Omalogyra japonica T. Habe, 1972 (Plate 151 a-b)
Distribution: Intertidal zone of Ras Al-Ardh.

***Omalogyra* sp.**
Distribution: Muddy substrates in Khor Al-Sabbiya.

Plate 151. ***Omalogyra japonica*, a-b. general view.**

Infraclass Opisthobranchia
Order Cephalaspidea
Family Haminoeidae Pilsbry, 1895
Description: Shell of Haminoeidae varies in size according to the species, from 3 mm to 30 mm. The shell is ovoid, thin and translucent. It may be smooth or have spiral grooves (striae). The umbilical apex is sunken or enclosed and no longer visible. Large body whorl with fine spiral striations. Smooth columella. The thin outer lip of the aperture extends beyond the apex of the shell and is thus longer than the body whorl. The aperture narrows posteriorly and is wider anteriorly. The snails are colorful; they can partially take the color of the sea floor. Their large cephalic shield is rounded at the front, but deeply lobed behind. The mantle protrudes behind the shell. The shell is partially or completely enfolded by lateral parapodial (= fleshy winglike outgrowths) lobes. Haminoeidae are sand dwellers or they live on muddy bottoms, in bays, estuaries, and close to the shore in tidepools. These snails are herbivorous. Their diet consists of various kinds of green algae. Haminoeidae can survive in brackish water. They are hermophroditic. Their eggs are deposited in round or oval jellylike strings, attached to eelgrass or sand.
Reference: Hayward et al., 1990.

Genus *Atys*
Atys pellyi (Smith, 1872) (Plate 152 a)
Distribution: Muddy substrates between Bubiyan and Failaka Islands.

***Atys* sp.1** (Plate 152 b)
Distribution: Kuwait's marine environment.

***Atys* sp.2**
Distribution: Muddy substrates in Kuwait Bay.

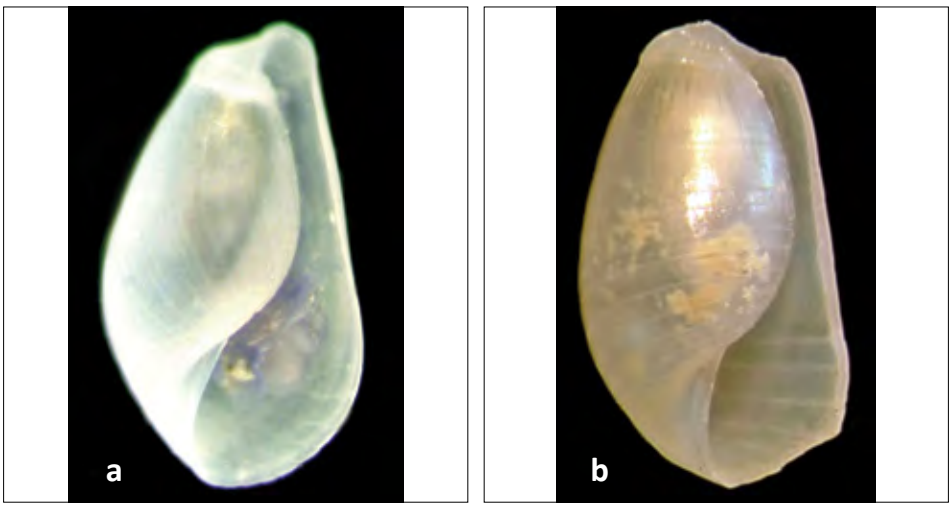


Plate 152. ***Atys pellyi,*** ***a.*** **general view;** ***Atys*** **sp.1, b. general view.**

Genus *Haminoea*

Haminoea vitrea (A.Adams, 1850) (Plate 153)

Distribution: Muddy substrates in Kuwait Bay.

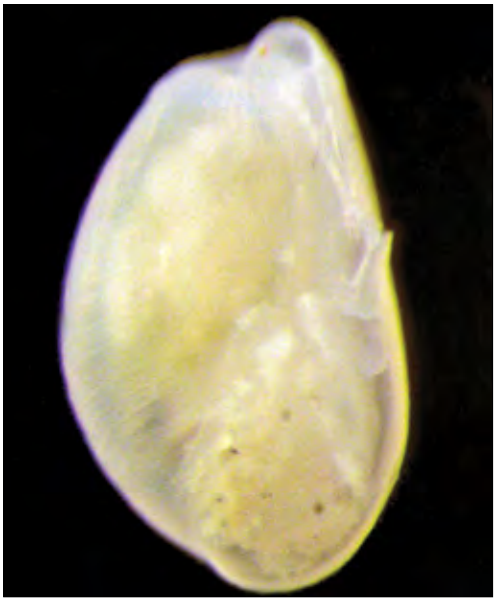


Plate 153. *Haminoea vitrea*, general view.

Family Bullidae (Lamarck, 1801)
Description: Shells in this family are bubble shaped, dark colored, and have a sunken spire. The aperture is as long as the shell and usually comma shaped, while the columella has a callus without folds. The shells are very thin. None of the Bullidae have an operculum. The mollusk can retract deeply into the shell, and may achieve some further protection by wrapping its parapodia and a head shield over the shell. These mantle parts also secrete polypropionate metabolites that are toxic and deterrent to predation by fish. The gizzard of Bullidae is rather different from that of other herbivorous groups. It has three large corneous crushing plates and ancillary corneous spines, instead of just grinding plates. The crawling snails show prominent, frilled or lobed parapodia. Bullidae species have a soft radula. These snails are mostly nocturnal and can be found on shallow, sandy coasts grazing among sea grasses, feeding primarily on green algae. They bury themselves in mud when the tide is out.
Reference: Hayward et al., 1990.

Genus *Bulla*
Bulla ampulla Linnaeus, 1758 (Plate 154 a-b)
Distribution: Intertidal zone from Kuwait Bay to Ras Al-Zour, Kubbar Island.

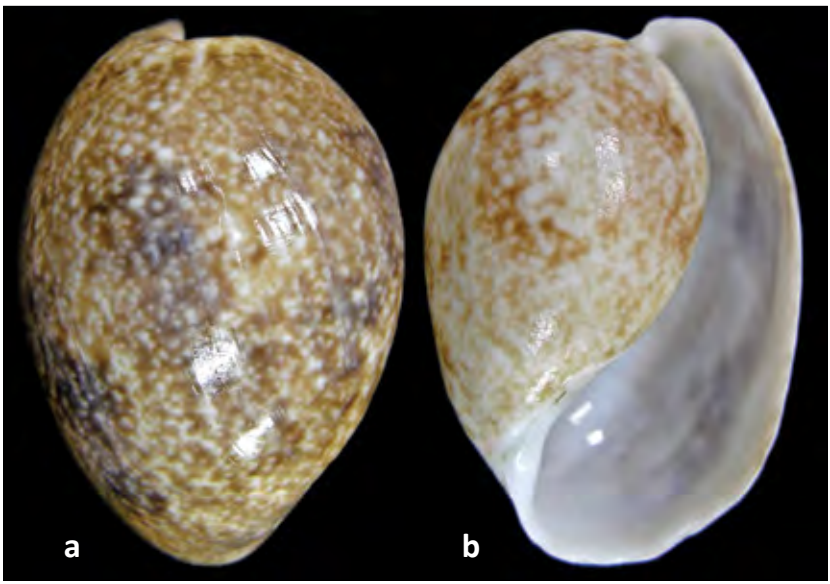


Plate 154. *Bulla ampulla*, a-b. general view.

Family Cylichnidae H. and A. Adams, 1850
Description: Cylichnidae, common name the "chalice bubble snails" or "canoe bubble snails" is a family of sea snails or bubble snails, marine gastropod mollusks in the superfamily Philinoidea. External shell is stout, rounded, but usually unable to accommodate the entire animal during defensive retraction; several whorls; operculum absent. Cephalic shield with or without tentacular processes. Parapodia are large or small, never meeting in the mid-dorsal line. Gill present in mantle cavity. Three calcareous gizzard-plates.
Reference: Hayward et al., 1990.

Genus *Cylichna*
Cylichna collyra Melvill, 1906 (Plate 155 a)
Distribution: Kuwait's marine environment.

Cylichna cylindracea Pennant, 1777 (Plate 155 b)
Distribution: Kuwait's marine environment.

***Cylichna* sp.**
Distribution: Muddy substrates between Ras Al-Ardh and Failaka Island, in Kuwait Bay and between Bubiyan and Failaka Islands.

Plate 155. ***Cylichna collyra*, *a*. general view; *Cylichna cylindracea*, b. general view.**

Family Retusidae Thiele, 1926
Description: The family Retusidae includes small burrowing species with well-calcified shells. External shell is rather frail, able to accommodate the animal during defensive retraction; several whorls; operculum usually absent. Cephalic shield bearing rounded or pointed postero-lateral tentacular processes, often concealing the front of the shell. Without conspicuous external posterior pallial lobe. Gizzard plates present (*Retusa*) or absent (*Rhizorus*). Radula is absent. Retusidae may feed on a variety of small sand-dwelling invertebrates.
Reference: Hayward et al., 1990.

Genus *Retusa*
***Retusa* sp.** (Plate 156 a-b)
Distribution: Muddy substrates near Failaka Island, in Kuwait Bay and between Bubiyan and Failaka Islands.

Plate 156. *Retusa* sp., a-b. general view.

Family Scaphandridae Sars 1878
Description: Shell more or less external, covering all or nearly all the animal; spire concealed; cephalic disc short, truncated, simple or notched behind; epipodia well developed; radula with first lateral very large; stomach with three well-developed calcareous plates.
Reference: Sedgwick et al., 1898.

Genus *Tornatina*
Tornatina inconspicua (Olsson and McGinty, 1958) (Plate 157 a)
Distribution: Muddy and silty substrates near Failaka Island, in Kuwait Bay and intertidal zone of Ras Al-Ardh and Ras Al-Zour.

Tornatina persiana E. A. Smith, 1872 (Plate 157 b)
Distribution: Muddy substrates in Kuwait Bay.

***Tornatina* sp.** (Plate 157 c)
Distribution: Muddy substrates near Failaka Island.

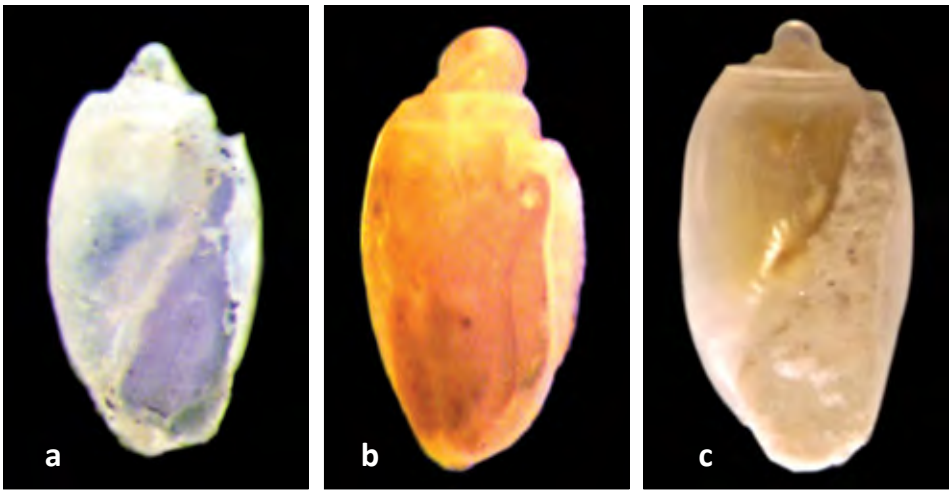


Plate 157. ***Tornatina inconspicua*****, a. general view;** ***Tornatina persiana*****, b. general view;** ***Tornatina* sp., c. general view.**

Order Basommatophora
Family Siphonariidae Gray, 1840
Description: Empty siphonariid limpet shells can be distinguished from true limpet shells by examining the interior. In the siphonariids, there is a well-marked lateral groove on the right side of the shell, and a corresponding interruption of the ring of muscle attachment scars. These markers show the positioning of the pneumostome or pulmonary orifice. Reference: Hayward et al., 1990.

Genus *Siphonaria*
Siphonaria belcheri Hanley, 1858 (Plate 158 a-c)
Distribution: Hard substrates from Ras Al-Ardh to Fahaheel.

Siphonaria savignui Krauss, 1848 (Plate 159)
Distribution: Kuwait's marine environment.

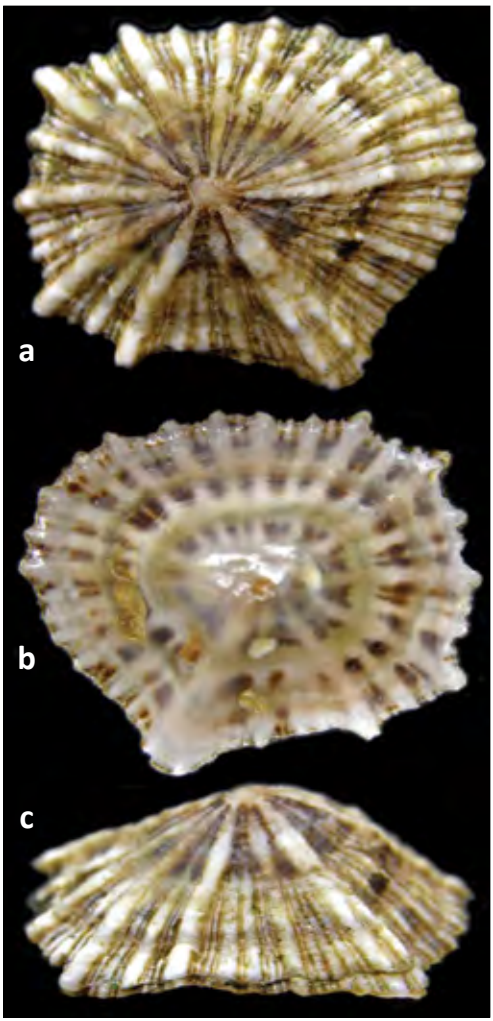


Plate 159. ***Siphonaria savignui,*** **general view.**

Plate 158. ***Siphonaria belcheri,*** **a-c. general view.**

Order Cycloneritimorpha
Family Neritidae Rafinesque, 1815
Description: All species have very solid, globular shells with a low or depressed spire, a large body whorl and callused columellar pad which may be smooth, granulated or ridged; there is no umbilicus. The shell surface may be smooth or spirally ribbed and the aperture may be denticulate at its outer edge. The calcareous operculum is half-moon shaped (as is the aperture); smooth or granulose on the outer surface, it is smooth on the inner surface which also bears a hook-like projection; usually grayish externally. Abundant on rocky shores worldwide. Nerites are vegetarians; many species live under intertidal rocks but some are conspicuous on rocky surfaces above high-tide level.
Reference: Bosch et al., 1995.

Genus *Nerita*
***Nerita* sp.** (Plate 160)
Distribution: Hard substrates on intertidal zone of Abu Al-Hassaniya.

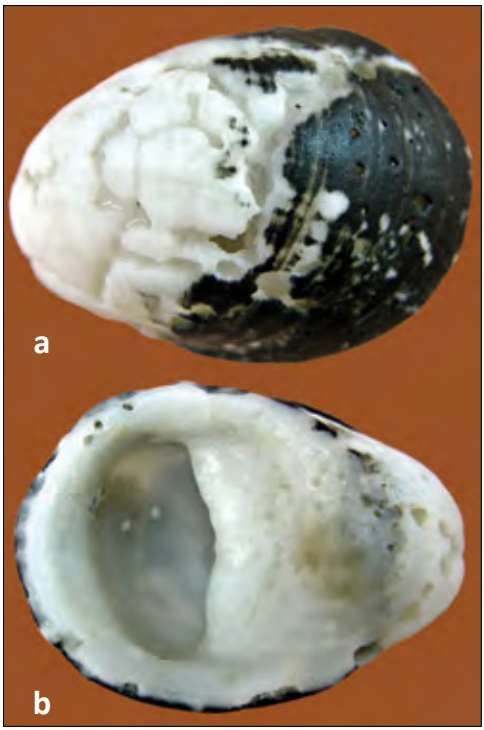


Plate 160. *Nerita* sp., general view.

Order Eupulmonata
Family Ellobiidae Pfeiffer, 1854
Description: The shell is inoperculate; rising-spiral; 4.5-7 whorled; typically dextral; higher than wide; high-spired and tapered gradually from the body whorl. The height of the is spire about 0.3–0.47 x that of the shell. The spire is acute to obtuse. The shell tear-shaped, or ovoid-symmetric; shallowly sutured to deeply sutured. The body whorl is moderately convex. The whorls of the spire are feebly convex to very strongly convex. The whorls neither shouldered nor keeled. The aperture is lunate (or auriculate); bearing teeth. The columella is folded, or twisted. The shell without an umbilicus. The shell is thick-lipped; thin and translucent, or opaque; plain. The animal with one pair of tentacles only. Eyes at the bases of the tentacles (slightly behind them).
Terrestrial or terrestrial to freshwater aquatic, or semi-marine, living around high tide mark, but terrestrial rather than aquatic. Breathing air directly via the lung-like mantle cavity. Hermaphrodite (but individuals acting as either male or female when mating).
Reference: Hayward et al., 1990.

Genus *Ellobium*
***Ellobium* sp.** (Plate 161)
Distribution: Muddy substrates near Failaka Island and between Bubiyan and Failaka Islands.

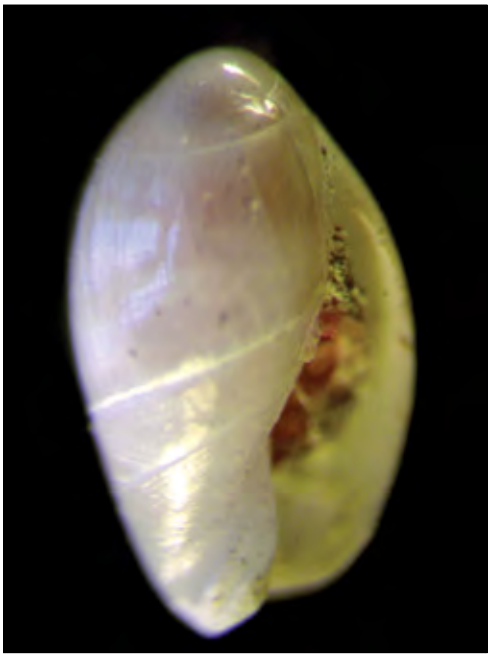


Plate 161. *Ellobium* sp., general view.

Order Nudibranchia
Family Dotidae Gray, 1853
Description: Body limaciform, bearing dorso-lateral pallial cerata, usually embossed with tubercles. These cerata are often stout and form a single row on each side, with the tubercles arranged in circlets, one above another. The cerata lack cnidosacs; in some species small gill-like excrescences (pseudobranchs) occur on the mesial faces of the largest cerata. The head bears lateral flap-like expansions. The rhinophores are smooth and finger-like, each arising from a tall flared pallial sheath. The genital openings lie on the right flank, beneath the first ceras, and the anal papilla (with the nephroproct close inside it) lies latero-dorsally, between the first and second ceras. The digestive gland ramifies so that nearly all the lobules lie within the cerata. The stomach lining is unarmed. The radula has the formula n x 0.1.0; frail jaws are usually present. The ovotestis lies dorsal to the digestive gland ducts; the penis is unarmed.
Reference: Thompson, 1988.

Genus *Doto*
Doto kya Marcus, 1961 (Plate 162)
Distribution: Hard substrates near Ras Al-Ardh. Species associated with hydroid polyp *Obelia dichotoma*.

Plate 162. *Doto kya*, general view.

Family Eubranchidae Odhner, 1934
Description: Active aeolidaceans having an acleioproctic anal position; cerata are swollen, sometimes with annular constrictions and rings of tubercles, and arranged in simple or branched rows. Propodial tentacles are absent, but smooth oral and rhinophoral tentacles (the latter usually much longer than the former) are conspicuous. The penis is unarmed, or armed with a stylet or thorns; having a bulb-like accessory gland near the base. A bursa copulatrix is present, opening into the female atrium. The cutting edges of the jaws may be smooth or denticulated. The radula is triseriate; the lateral teeth are rectangular and each bears a single cusp.
Reference: Thompson, 1988.

Genus *Eubranchus*
Eubranchus misakiensis Baba, 1960 (Plate 163 a-b)
Distribution: Hard substrates near Ras Al-Ardh. Species associated with hydroid polyp *Obelia dichotoma*.

Plate 163. ***Eubranchus misakiensis*****, a. dorsal view, b. ventral view.**

Family Flabellinidae Bergh, 1889
Description: Active aeolidaceans having a pleuroproctic (occasionally acleioproctic) anal position; cerata in even or irregular rows, sometimes clustered into groups set upon lobes or peduncles. There may be a distinct notal ridge separating the dorsum from the flanks. Distinct propodial tentacles and long and mobile oral tentacles are conspicuous; the rhinophores may be smooth, papillate or lamellate. The penis is unarmed; there is a coiled tubular ampulla acting as a seminal vesicle; a bursa copulatrix is present, usually located distally, opening into the female atrium, but in some species it is double and situated close to the fertilization chamber. The cutting edges of the jaws are denticulate. The radula is triseriate; the lateral teeth are usually denticulate, rarely smooth.
Reference: Thompson, 1988.

Genus *Flabellina*
Flabellina amabilis Hirano and Kuzirian, 1991 (Plate 164)
Distribution: Hard substrates near Ras Al-Ardh. Species associated with hydroid polyp *Obelia dichotoma*.

Plate 164. *Flabellina amabilis*, general view.

Family Tergipedidae Bergh, 1889
Description: Generally small aeolidaceans having an acleioproctic anal position; cerata in even rows, often reduced in number, fusiform or clavate. Propodial tentacles are rudimentary or absent. Oral and rhinophoral tentacles smooth, the latter 1.5 to twice as long as the former; oral tentacles reduced or lost in Tenellia. The penis sometimes has a tubular chitinous stylet; the vas deferens is prostatic and there is a small accessory penial gland, which opens separately into the penis sheath; a bursa copulatrix is present, opening into the female atrium. The cutting edges of the jaws are thin and often lack denticulations. The radula is uniseriate; the median cusp is sometimes dwarfed by lateral denticles, but more usually projects beyond them.
Reference: Thompson, 1988.

Genus *Cuthona*
Cuthona albocrusta (MacFarland, 1966) (Plate 165)
Distribution: Hard substrates near Ras Al-Ardh. Species associated with hydroid polyp *Obelia dichotoma*.

Nudibranhia gen. sp.
Distribution: Muddy and silty substrates in Kuwait Bay.

Plate 165. *Cuthona albocrusta*, general view.

Order Sacoglossa
Family Limapontiidae Gray, 1847
Description: Limapontiidae is a family of small non-shelled sacoglossans sea slugs. The limapontiids are distinguished from related groups by the presence of a single row of teeth on the radula. The teeth are adapted for the suctorial feeding habits of the group. The herbivorous limapontiids removes the cell sap from the algae on which they feed. In most, the cell contents are simply digested by the slug. Some species however have evolved branches of their gut which ramify throughout the body wall and contain plastids alive and operating. The limapontiids can metabolize the photosynthetic products; this process is termed kleptoplasty. The limapontiids are able to choose which method of feeding they utilize. The switch from active feeding to photosynthesis in limapontiids is triggered by the shortage of food resource, and typically not preferred. If food is readily available, the animal will actively consume. Periods of photosynthesis and no active feeding vary between species of limapontiids from less than a week to over four months and are used as a last resort mechanism to avoid mortality.
Reference: Thompson, 1988.

Genus *Placida* Trinchese, 1876
Placida daguilarensis Jensen, 1990 (Plate 166 a-c)
Distribution: Hard substrates near Ras Al-Ardh. Species associated with green algae *Bryopsis plumosa*.

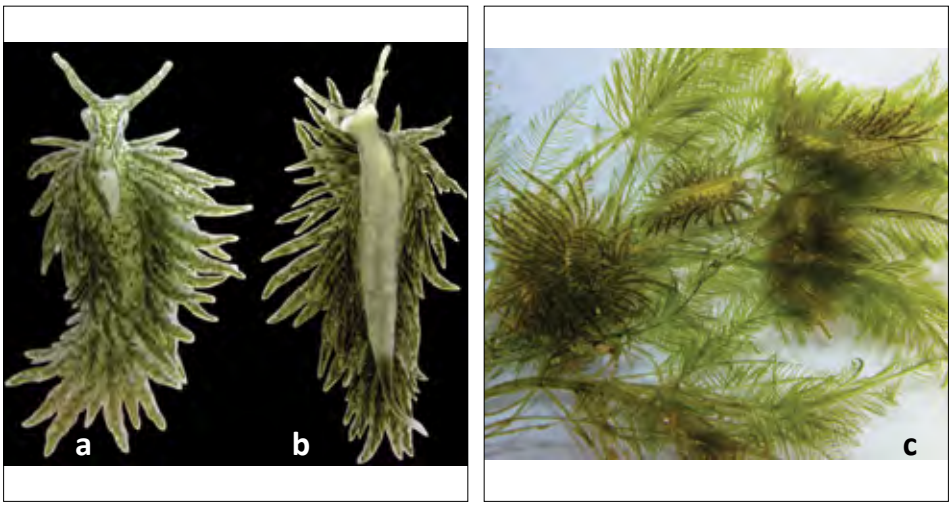


Plate 166. ***Placida daguilarensis*****, a-b. general view; c. mollusks *P. daguilarensis* on seaweeds *Bryopsis plumosa*.**

Subclass Vetigastropoda
Family Fissurellidae Fleming, 1822
Description: Fissurellidae, common name the keyhole limpets and slit limpets. Keyhole limpets somewhat resemble true limpets because of the simple conical shape of their shells, but in reality they are not closely related to true limpets, which are in the clade Patellogastropoda. For respiration, the shells of fissurellids have an apical perforation, marginal slit, notch, or internal groove. This allows a direct exit of exhalant water currents from the mantle cavity. In addition, keyhole limpets differ in several other ways both internally and externally from true limpets. Fissurellids live in habitats on and under rocks in the lower intertidal zones to deeper waters.
Reference: Hayward et al., 1990.

Genus *Diodora*
Diodora funiculata (Reeve, 1850) (Plate 167)
Distribution: Intertidal zone of Ras Al-Ardh.

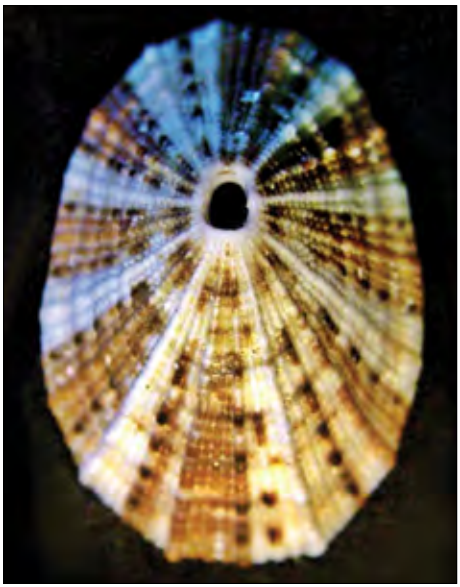


Plate 167. *Diodora funiculata*, general view.

Diodora rueppellii (G.B. Sowerby I, 1835) (Plate 168 a-c)
Distribution: Intertidal zone of Kuwait Bay.

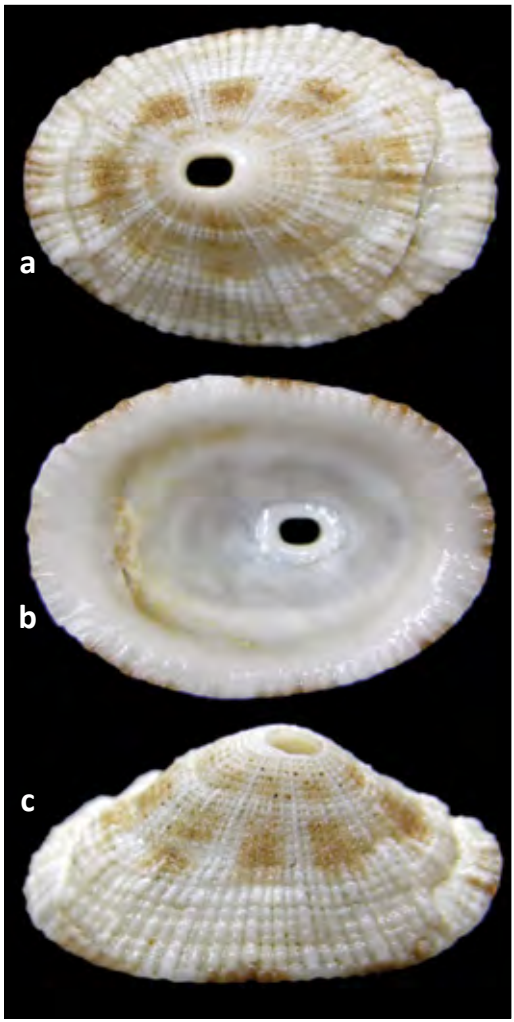


Plate 168. ***Diodora rueppellii*****, a-c. general view.**

Family Phasianellidae Swainson, 1840
Description: Phasianellidae, common name the "pheasant shells" or "pheasant snails". The shells are always small, high-spired, porcellaneous, very variable in shape and strikingly decorated. There is no periostracum. The operculum is present.
Reference: Hayward et al., 1990.

Genus *Tricolia*
***Tricolia* sp.**
Distribution: Muddy substrates in Kuwait Bay.

Family Trochidae Rafinesque, 1815
Description: Family Trochidae are commonly known as the "top snails". Shell spiral, conical (often pyramidal); frequently umbilicate mother-of-pearl inside often revealed at eroded apex. Plane of aperture markedly prosocline. Foot with extensile epipodial tentacles; operculum polygyrous, circular. Trochidae characterized by some primitive traits among the opisthobranchs: a heart with two atriums and external fertilization. They have retained only one kidney and the second osphradium has been lost in the course of evolution. Many species in the family live either in the intertidal zone or in the shallow subtidal zone, but some live in deeper water. They are usually abundant on solid substrate, like rocky shores and reefs. This family of snails feed by grazing on algae and detritus, and rarely by filter feeding. The Trochidae are dioecious, and the fertilization occurs internally. Eggs are laid individually or in gelatinous egg masses in the water. Individuals may hatch as free-swimming planktonic larvae or juvenile crawlers.
Reference: Hayward et al., 1990.

Genus *Clanculus*
Clanculus pharaonius (Linnaeus, 1758) (Plate 169 a-b)
Distribution: Kubbar Island.

Plate 169. ***Clanculus pharaonius*****, a-b. general view.**

Genus *Ethminolia*

Ethminolia degregorii (Caramagna, 1888) (Plate 170 a-b)

Distribution: Muddy substrates in Kuwait Bay.

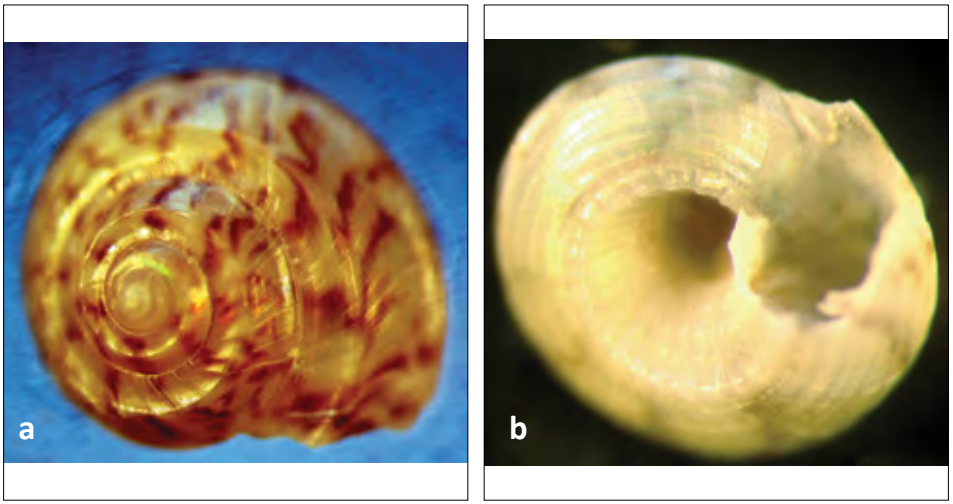


Plate 170. ***Ethminolia degregorii*****, a-b. general view.**

Genus *Euchelus*

Euchelus asper (Gmelin 1791) (Plate 171 a-b)

Distribution: Intertidal zone from Kuwait Bay to Ras Al-Zour.

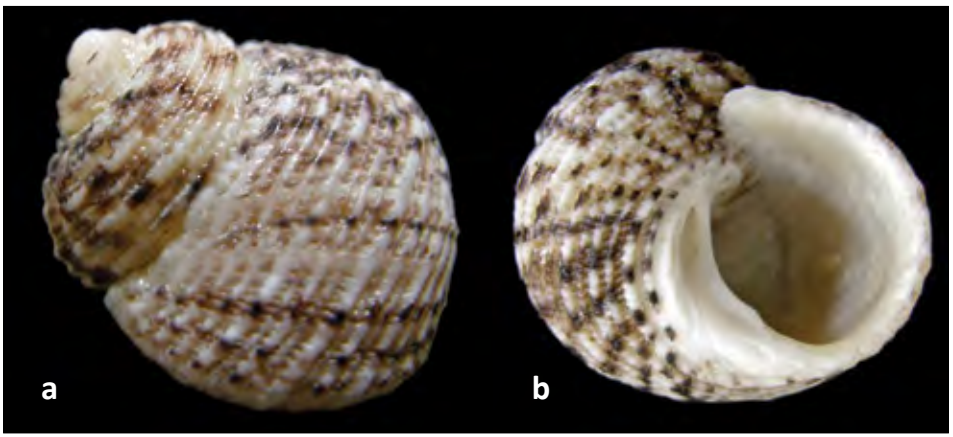


Plate 171. ***Euchelus asper*****, a-b. general view.**

Genus *Monilea*
Monilea chiliarches Melvill, 1910 (Plate 172)
Distribution: Muddy substrates in Kuwait Bay.

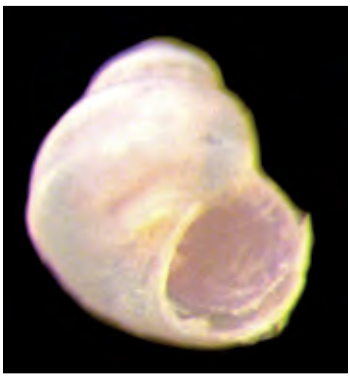


Plate 172. *Monilea chiliarches*, general view.

Genus *Monodonta*
Monodonta nebulosa Forskål, P. in Niebuhr, 1775 (Plate 173 a-b)
Distribution: Intertidal zone from Ras Al-Ardh to Ras Al-Zour.

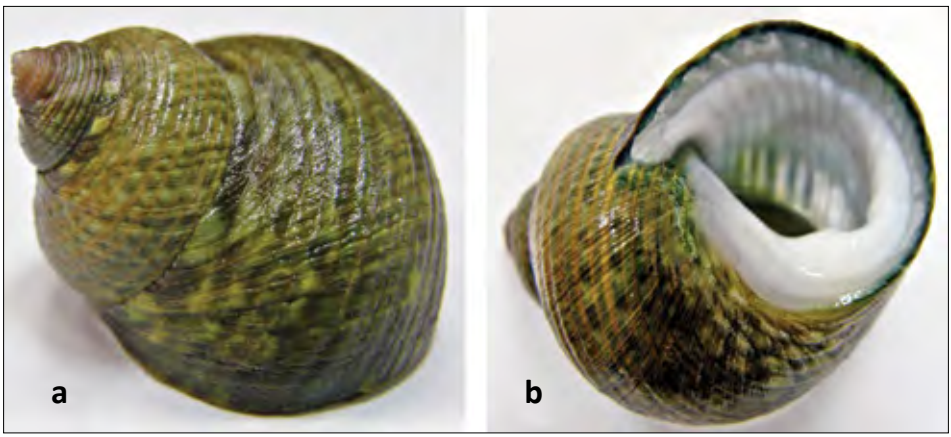


Plate 173. *Monodonta nebulosa*, a-b. general view.

Genus *Trochus*

Trochus erithreus Brocchi, 1821 (Plate 174 a-b)

Distribution: Intertidal zone from Kuwait Bay to Ras Al-Zour, Kubbar Island.

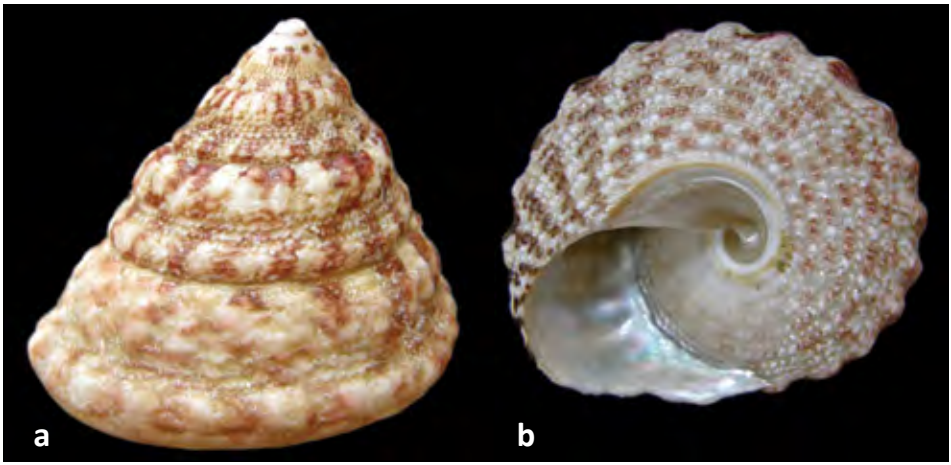


Plate 174. ***Trochus erithreus*****, a-b. general view.**

Trochus fultoni Melvill, 1898
Distribution: Intertidal zone of Ras Al-Zour.

Genus *Umbonium*
Umbonium vestiarium (Linnaeus, 1758) (Plate 175 a-c)
Distribution: Intertidal zone from Kuwait Bay to Ras Al-Zour.

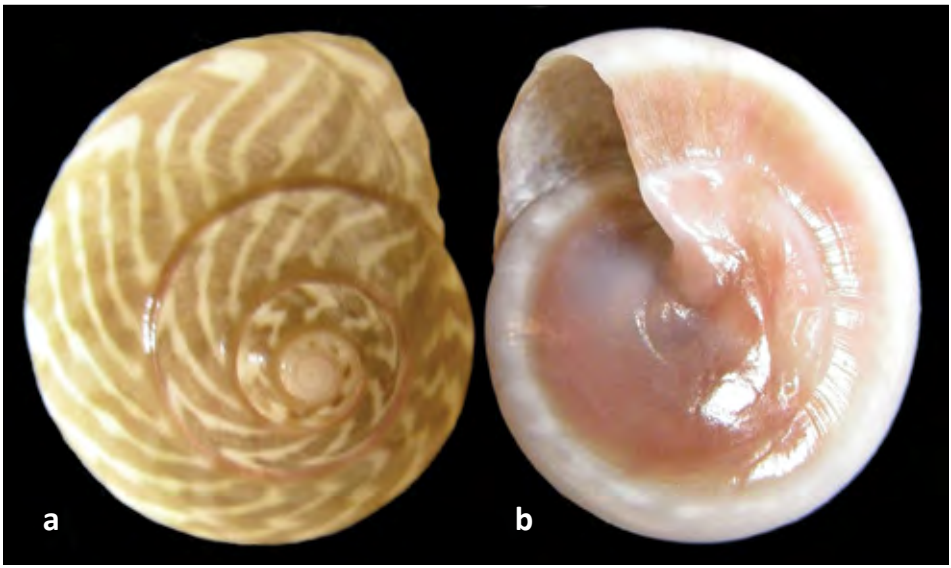


Plate 175. ***Umbonium vestiarium*****, a-b. general view; c. color variations.**

Genus *Priotrochus*

Priotrochus obscurus (W. Wood, 1828) (Plate 176 a-b)

Distribution: Hard substrates in Kuwait Bay.

Plate 176. *Priotrochus obscurus*, a-b. general view.

Genus *Stomatella*
Stomatella auricula Lamarck, 1816 (Plate177 a-b)
Distribution: Hard substrates from Kuwait Bay to Fahaheel.

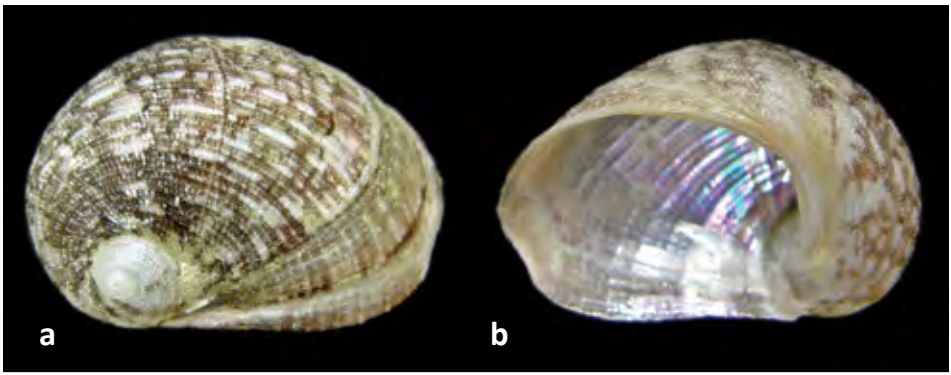


Plate 177. *Stomatella auricula*, a-b. general view.

Family Turbinidae Rafinesque, 1815
Description: Extensive, worldwide family of small to large shells which are mostly thick, solid, globose, few-whorled and strongly ornamented but of subdued color and pattern. The body whorl is well rounded in some genera, keeled in others. The columella is usually smooth and lacking teeth or folds. The aperture is nacreous within. The spiral operculum is calcareous and often thick and heavy, its inner surface bearing a thin, chitinous layer, its outer surface being smooth or variously ornamented and often brightly colored; its appearance may be diagnostic for some species. Most turban shells browse small algae from rocks.
Reference: Bosch et al., 1995

Genus *Lunella*
Lunella coronata (Gmelin, 1791) (Plate 178 a-b)
Distribution: Hard substrates in Kuwait Bay.

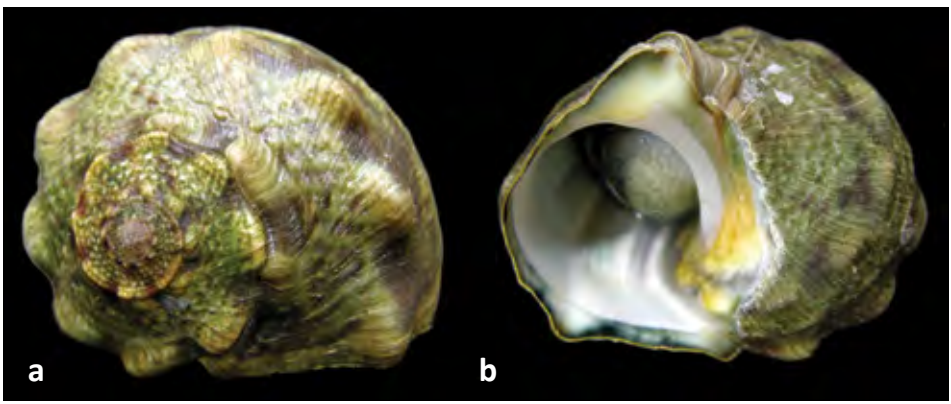


Plate 178. *Lunella coronata*, a-b. general view.

Genus *Turbo*

Turbo radiatus Gmelin, 1791 (Plate 179 a-d)

Distribution: Abundant on hard substrates in Kubbar Island, rare in mainland coast from Ras Al-Julaiah to Ras Al-Zour.

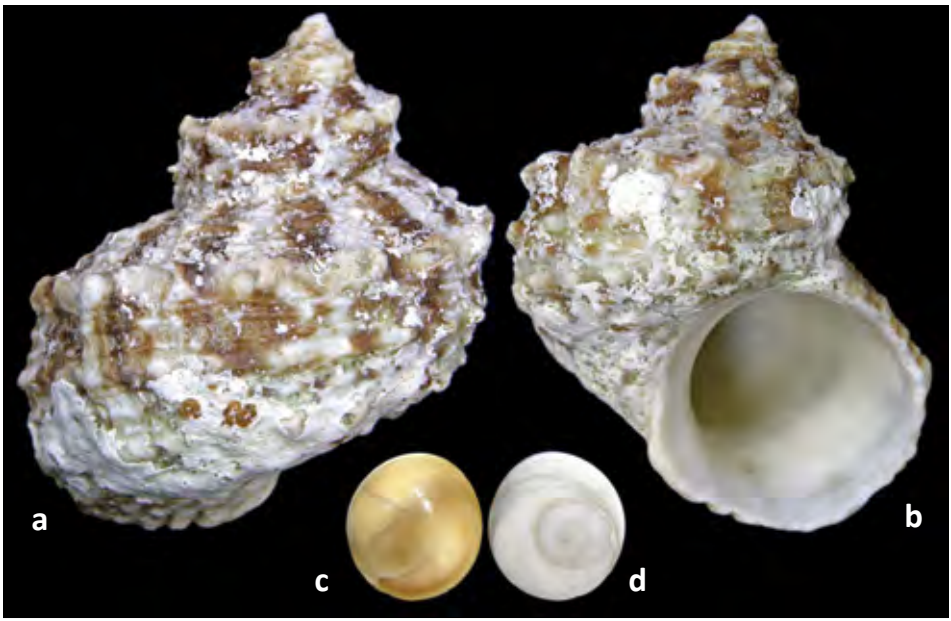


Plate 179. ***Turbo radiatus*****, a-b. general view; c-d, operculum.**

Subclass Heterobranchia

Order Systellommatophora Pilsbry, 1948

Description: Systellommatophora is an order in the infraclass Pulmonata. Systellommatophora are air-breathing slug-like mollusks that lack a shell as adults. They have separate external male and female orifices, lack a mantle cavity, have a posterior anus and excretory pore, and bear eyes on the tops of two contractile, but not retractile, tentacles.

Family Onchidiidae Rafinesque, 1815

Description: Onchidiids are true slugs: they lack an internal shell. However, they bear a vestigal, non-mineralized shell sac and possess a larval shell. Most species are marine and live in the upper intertidal zone, either in rocky, sandy, or muddy habitats, including mangroves. Onchidiids have a worldwide distribution, with the exception of the Arctic and Antarctic.

Reference: Dayrat, 2009

Genus *Peronia*

Peronia peronii (Cuvier, 1804) (Plate 180)

Distribution: Hard substrates in Fahaheel.

Plate 180. Sea slug *Peronia peronii* grazing on intertidal rocks in Fahaheel.

Class BIVALVIA
Subclass Heterodonta
Order Carditoida
Family Carditidae Lamarck, 1809
Description: Strong, compact, and heart-shaped, the cockleshell can be rolled over the sands and banged about without any damage to the live mollusk. Its siphons are short, and the foot is also well developed --indeed capable of moving the animal about in short leaps at the surface, where it normally lives. In many cockles, the siphons also bear light receptors. Shell features are: completely symmetrical and equal sized valves; prominent umbones; strong radial ribs, which in some species carry spines; equal size muscle scars; no pallial sinus; and, two cardinal teeth in each valve. The internal margin of the lip may vary from lightly serrated to the definitely crenulated edge view.
Reference: Hayward, 1990.

Genus *Carditella*
***Carditella* sp.** (Plate 181)
Distribution: Muddy substrates near Failaka Island.

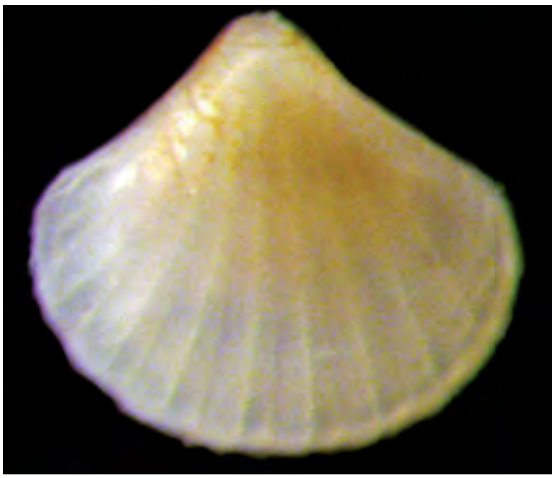


Plate 181. *Carditella* sp., general view

Genus *Cardites*
Cardites bicolor (Lamarck, 1819) (Plate 182 a-b)
Distribution: Sandy substrates from Mahboula to Ras Al-Julaiah.

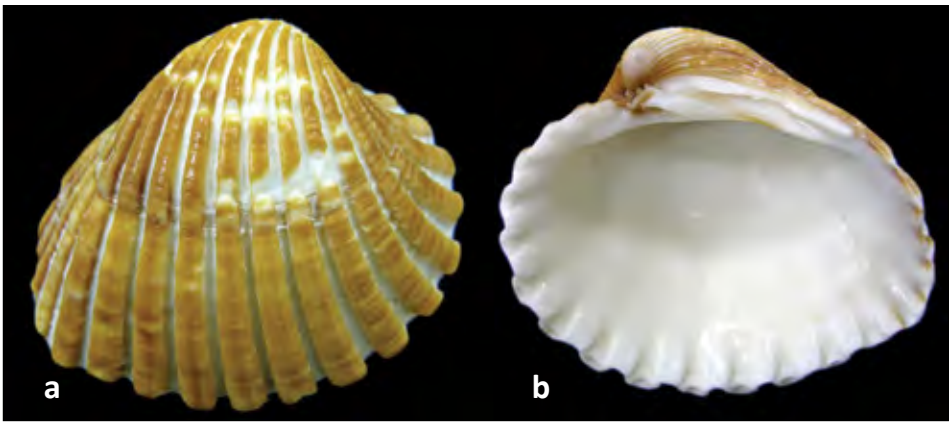


Plate 182. ***Cardites bicolor*****, a-b. general view**

Cardites **sp. (**Plate 183)
Distribution: Muddy substrates between Bubiyan and Failaka Islands.

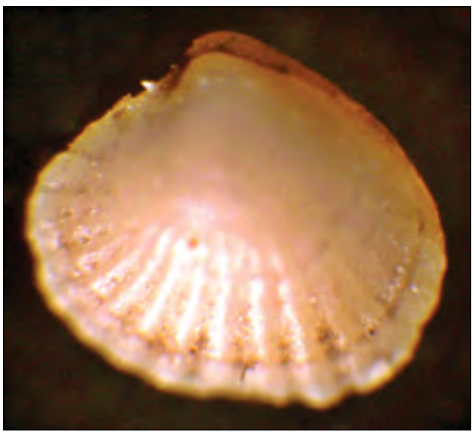


Plate 183. ***Cardites*** **sp., general view.**

Order Euheterodonta incertae sedis
Family Periplomatidae Dall, 1895
Description: Shell inequivalve, right valve more convex than left one; inequilateral. Ligament external and internal, latter component in an oval chondrophore. No hinge teeth. Umbones typically with a discontinuity in the calcification. Pallial line with a sinus.
Reference: Hayward, 1990.

Genus *Periploma* Schumacher, 1817
Periploma indicum Melvill, 1898
Distribution: Muddy and silty substrates in Kuwait Bay.

Family Galeommatidae Gray, 1840
Description: Shell small, quadrate; hinge with small teeth; resilium not sharply defined; shell surface sculptured, usually with radial riblets.
Reference: Hayward, 1990.

Genus *Amphilepida*
Amphilepida faba (Deshayes, 1856) (Plate 184 a-b)
Distribution: Muddy substrates in Kuwait Bay and between Bubiyan and Failaka Islands (Stations 8 and 10).

Amphilepida peilei (Tomlin, 1921)
Distribution: Muddy and silty substrates in Kuwait Bay.

***Amphilepida* sp.**
Distribution: Intertidal zone of Ras Al-Ardh (Station 16).

Genus *Scintilla* Deshayes, 1856
***Scintilla* sp.**
Distribution: Muddy and silty substrates in Kuwait Bay.

Plate 184. ***Amphilepida faba*****. a. general view; b. juvenile.**

Family Cardiidae Lamarck, 1809
Description: Shell equivalve, tumid, both valves strongly convex; inequilateral, umbones just anterior to midline, prominent. Sculpture of bold radiating ribs is often with conspicuous spines, tubercles, or scales. Two peg-like cardinal teeth in each valve. Lateral teeth present. Adductor scars about equal, pallial line without sinus.
Reference: Hayward, 1990.

Genus *Fulvia*
Fulvia fragile (Fosskal, 1775) (Plate 185 a-b)
Distribution: Sandy substrates from Ras Al-Ardh to Ras Al-Zour.

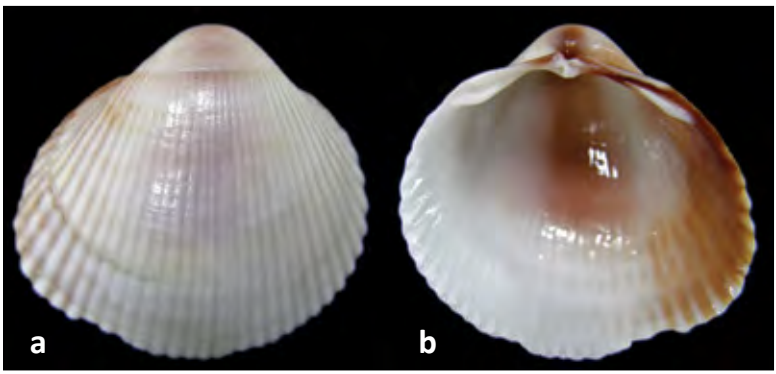


Plate 185. ***Fulvia fragile*****, a-b. general view.**

Genus *Trachycardium*
Trachycardium assimile (Reeve, 1845) (Plate 186 a-b)
Distribution: Sandy substrates from Mahboula to Ras Al-Zour, Kubbar Island.

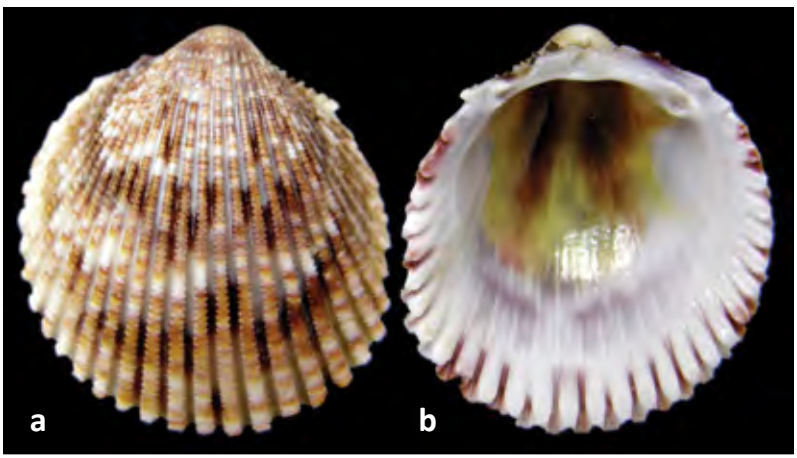


Plate 186. ***Trachycardium assimile*****, a-b. general view.**

Trachycardium lacunosum (Reeve, 1845) (Plate 187 a-b)
Distribution: Sandy substrates from Mahboula to Ras Al-Zour, Kubbar Island.

Trachycardium rubicundum (Reeve, 1845)
Distribution: Intertidal zone of Ras Al-Zour.

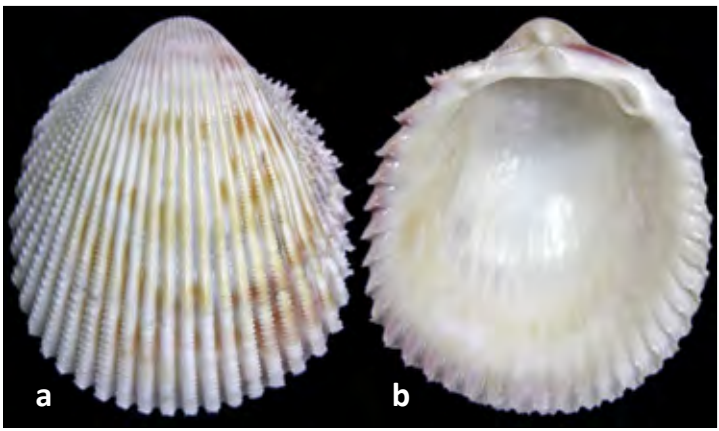


Plate 187. ***Trachycardium lacunosum*****, a-b. general view.**

Cardiidae gen. sp. (Plate 188 a-b)
Distribution: Muddy and sandy substrates in Kuwait Bay.

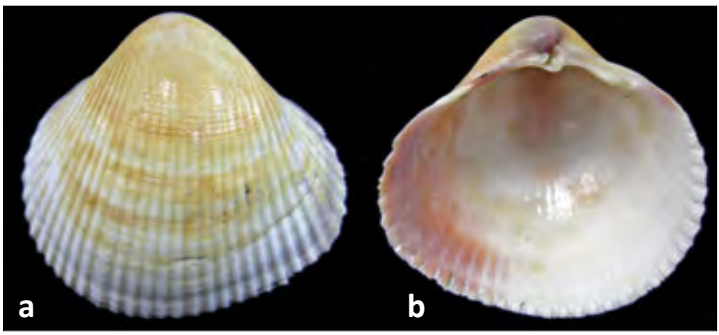


Plate 188. Cardiidae gen. sp., a-b. general view.

Family Chamidae Lamarck, 1809
Description: Chamidae (Jewel Boxes) are oyster-like bivalves that have developed a permanently attached mode of life. Its deeply conical right valve is cemented to some substrate, while the somewhat flattened left valve forms an operculum-like cover. Consistent with its immobility, the foot is greatly reduced.
Reference: Hayward, 1990.

Genus *Chama*
Chama brassica Reeve, 1847 (Plate 189 a-b)
Distribution: Sandy substrates near Mahboula and Fahaheel, Kubbar Island.

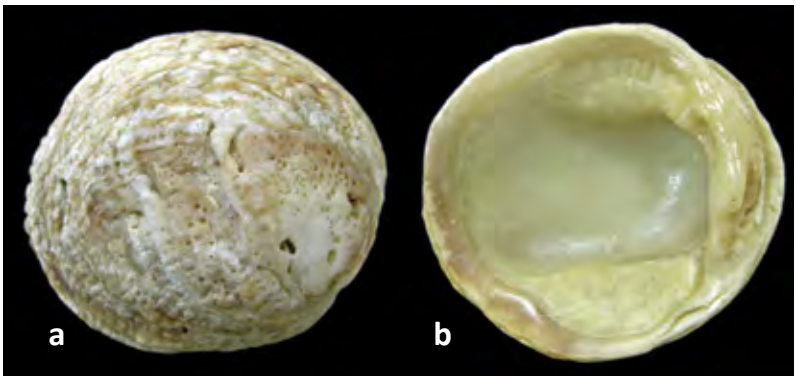


Plate 189. ***Chama brassica*****, a-b. general view.**

Chama reflexa Reeve, 1846 (Plate 190 a-c)
Distribution: Kubbar Island.

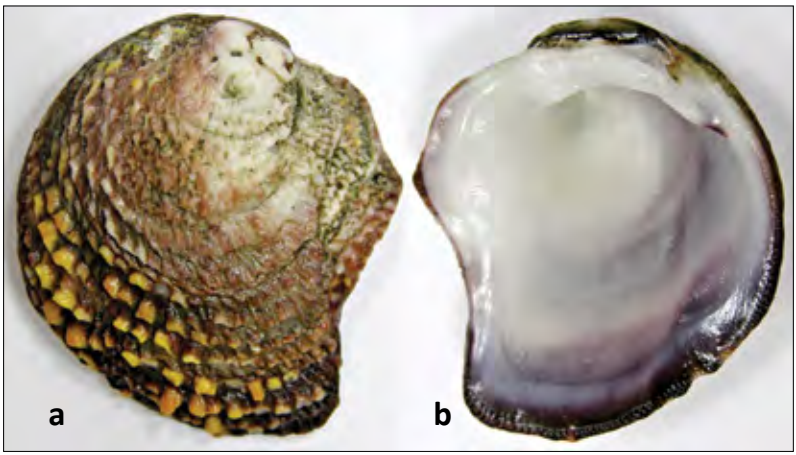


Plate 190. ***Chama reflexa*****, a-b. general view; c. valve attached to a coral.**

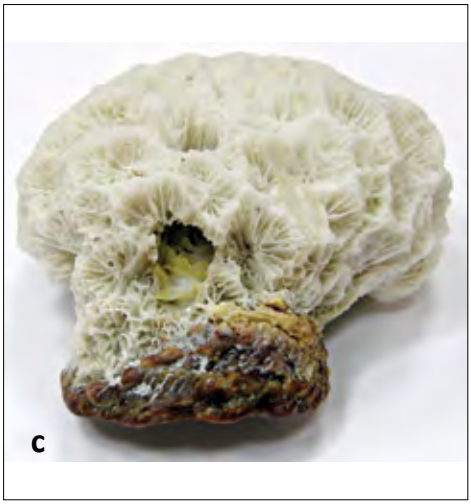


Plate 190. Continued.

***Chama* sp.** (Plate 191)
Distribution: Intertidal zone of Ras Al-Zour.

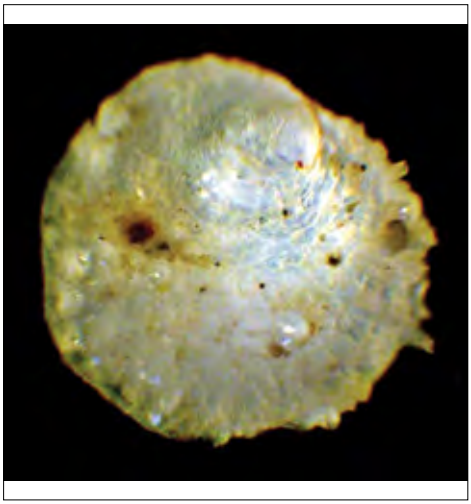


Plate 191. *Chama* sp., general view.

Family Corbulidae Lamarck, 1818
Description: Shell inequivalve, more or less equilateral. Ligament internal, in a chondrophore recessed within the hinge line. True cardinal teeth are absent, lateral teeth present. Pallial line with a very small sinus.
Reference: Hayward, 1990.

Genus *Corbula*
Corbula sulculosa H. Adams 1870 (Plate 192 a)
Distribution: Muddy substrates from Ras Al-Ardh to Failaka Island and in Khor Al-Sabbiya.

Corbula taitensis (Lamarck, 1818) (Plate 192 b)
Distribution: Muddy substrates in Kuwait Bay.

Plate 192. a. *Corbula sulculosa*, general view; b. *Corbula taitensis*, general view.

Family Lasaeidae Gray, 1847
Description: Shell equivalve, inequilateral, small. Ligament internal; hinge line with cardinal and lateral teeth, few and small. Adductor scars about equal, pallial line without sinus.
Reference: Hayward, 1990.

Genus *Curvimysella*
***Curvimysella* sp.** (Plate 193)
Distribution: Muddy substrates in Khor Al-Sabbiya.

Plate 193. *Curvimysella* sp., general view.

Family Donacidae Fleming, 1828
Description: Donacidae, the bean clams or wedge shells. Shell equivalve, inequilateral. Ligament is external. Hinge line with two cardinal teeth in each valve, anterior and posterior teeth also present. Adductor scars about equal. Pallial line with a pallial sinus. Cruciform muscles present extending between valves, involved in siphon retraction: cruciform muscles scars often visible close to the lower edge of the pallial sinus. Shell margin crenulate. Donacidae are a prolific filter feeder that provides an important link in coastal food chains including sea birds and people. It is an indicator species for the status of sandy beach-ocean front habitats. As such, the clam's population is drastically reduced by dam building, dredging, erosion control, and conventional beach remediation practices. The clam is a nimble surf-rider, with the capability of using its foot to leap out of the sand and ride an in-bound wave using its foot and extended syphons much like a "sail".
Reference: Hayward, 1990.

Genus *Donax*
***Donax* sp. (juv.)** (Plate 194)
Distribution: Intertidal zone of Ras Al-Zour.

Plate 194. *Donax* sp. (juv.), general view.

Family Psammobiidae Fleming, 1828
Description: The shells of Psammobiidae are oblong to oval, slightly gaping, equivalve, or slightly inequivalve; almost equilateral, with beaks just in front of midline; sculpture mostly concentric, ligament external, strong, attached behind umbones on projecting narrow shelves. Hinge with two small, usually unequal, cardinal teeth, one or both typically bifid. Pallial sinus is large. They usually live in subtidal zone in shallow water, in sandy or sandy Muddy bottoms.
Reference: Hayward, 1990.

Genus *Asaphis*
Asaphis violascens (Forskkal, 1775) (Plate 195)
Distribution: Kuwait's marine environment.

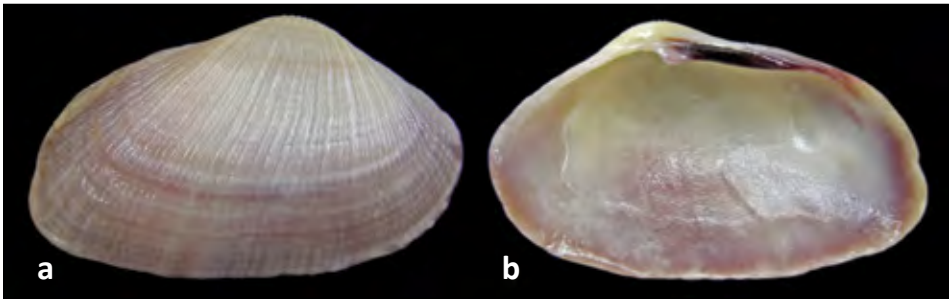


Plate 195. ***Asaphis violascens*****, a-b. general view.**

Genus *Gari*
Gari maculosa (Lamarck, 1818) (Plate 196 a-b)
Distribution: Kubbar Island.

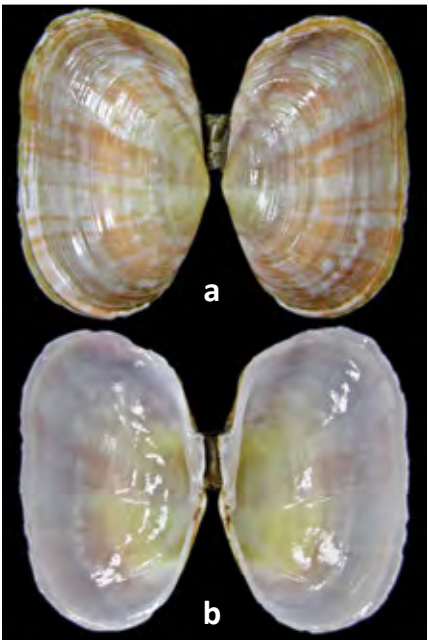


Plate 196. ***Gari maculosa*****, a-b. general view.**

***Gari* sp.** (Plate 197 a-b)
Distribution: Muddy and sandy substrates in Kuwait Bay.

Plate 197. *Gari* sp., a-b. general view.

Genus *Hiatula*
Hiatula ruppelliana (Reeve, 1857) (Plate 198 a-b)
Distribution: Intertidal zone of Ras Al-Zour.

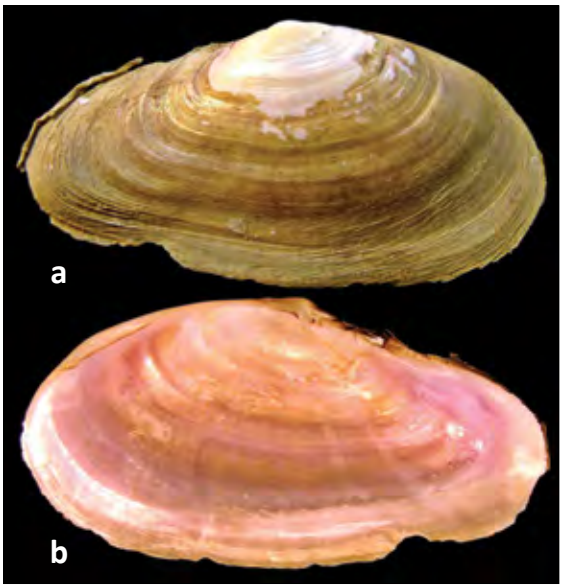


Plate 198. *Hiatula ruppelliana*, a-b. general view.

Family Kelliidae Forbes and Hanley, 1848
Description: Shell equivalve, inequilateral, small. Ligament internal and external; hinge with cardinal teeth, typically small and indistinct, and poorly developed lateral teeth. Pallial line broad, ill-defined, without a pallial sinus.
Reference: Hayward, 1990.

Genus *Kellia*
***Kellia* sp.** (Plate 199 a-b)
Distribution: Muddy substrates in Khor Al-Sabbiya.

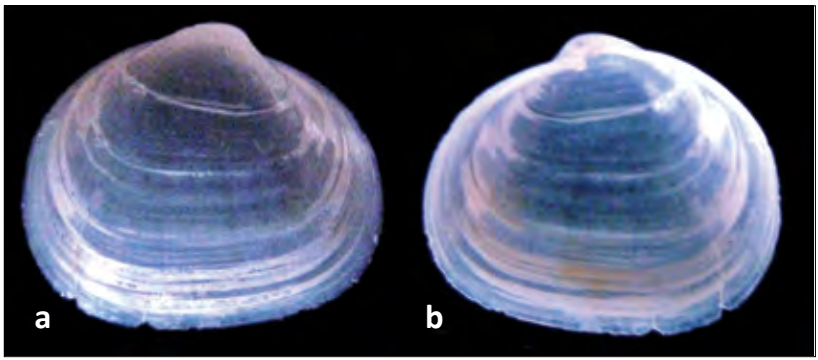


Plate 199. *Kellia* sp., a-b. general view.

Genus *Marikellia*
***Marikellia* sp.** (Plate 200)
Distribution: Muddy substrates near Bubiyan Island.

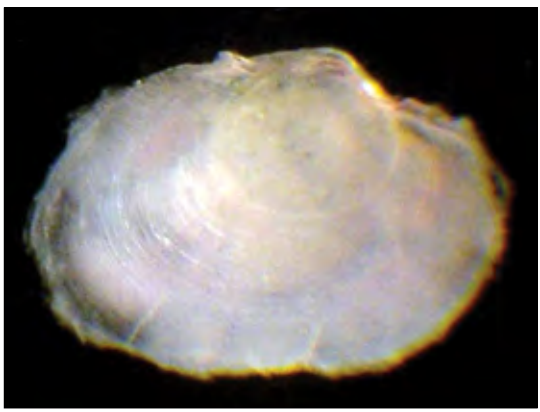


Plate 200. *Marikellia* sp., general view.

Family Lucinidae Fleming, 1828
Description: Shell equivalve; inequilateral, umbones just anterior to midline. Hinge line with cardinal and lateral teeth; ligament external, often deeply inset, lunule and/or escutcheon typically well developed. Pallial line without sinus. Adductor scars unequal: anterior larger, often partly or largely separated from pallial line. Shell usually is white and dull.
Reference: Hayward, 1990.

Genus *Loripes*
***Loripes* sp. (juv.)** (Plate 201)
Distribution: Intertidal zone of Ras Al-Ardh.

Plate 201. *Loripes* sp. (juv.), general view.

Family Mactridae Lamarck, 1809
Description: Shell equivalve, equilateral or just inequilateral. Ligament external, thin, and internal, in a small chondrophore recessed within the hinge line. Two or three cardinal teeth in each valve; in the left, two cardinals fused to form a single forked structure. Lateral teeth present. Pallial line with a pallial sinus.
Reference: Hayward, 1990.

Genus *Mactra*
Mactra lilacea Lamarck, 1818 (Plate 202 a-c)
Distribution: Muddy substrates in Khor Al-Sabbiya.

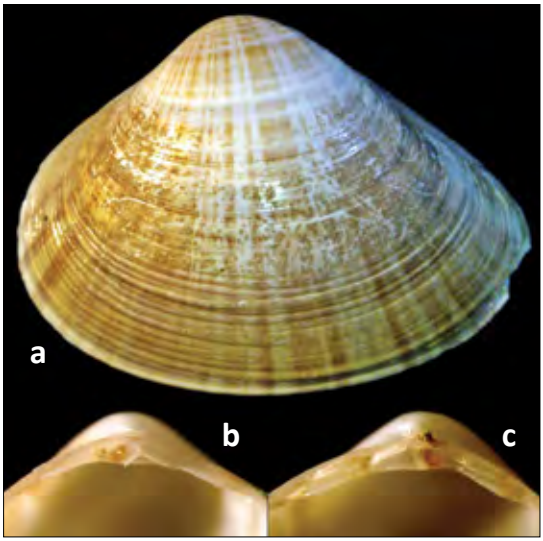


Plate 202. ***Mactra lilacea*****. a. general view; b-c. teeth.**

Genus ***Mactrinula***
Mactrinula **sp. (juv.)** (Plate 203)
Distribution: Muddy substrates near Failaka Island.

Plate 203. ***Mactrinula*** **sp. (juv.), general view.**

Family Semelidae Stoliczka, 1870
Description: The shells of Semelidae are rounded to ovate, mostly of medium size (some large) smooth or concentrically sculptured. The two main diagnostic features are the ligament, the major part of which is lodged in a capsule on the hinge plate back of the two small cardinal teeth, and the deep, widely rounded pallial sinus. The internal portion of ligament called the resilium. The hinge also has well-developed lateral teeth in both valves. They usually live in unconsolidated, mainly muddy substrata.
Reference: Hayward, 1990.

Genus *Ervilia*
***Ervilia* sp. (juv.)** (Plate 204)
Distribution: Muddy substrates in Kuwait Bay.

Plate 204. *Ervilia* sp. (juv.), general view.

Genus *Syndesmya*
***Syndesmya* sp.** (Plate 205 a-c)
Distribution: Muddy substrates near Failaka Island.

Plate 205. *Syndesmya* sp., a-c. general view.

Genus *Theora*
Theora cadabra (Eames et Wilkins, 1957) (juv.) (Plate 206 a-b)
Distribution: Muddy and silty substrates near Failaka Island, in Kuwait Bay and between Bubiyan and Failaka Islands.

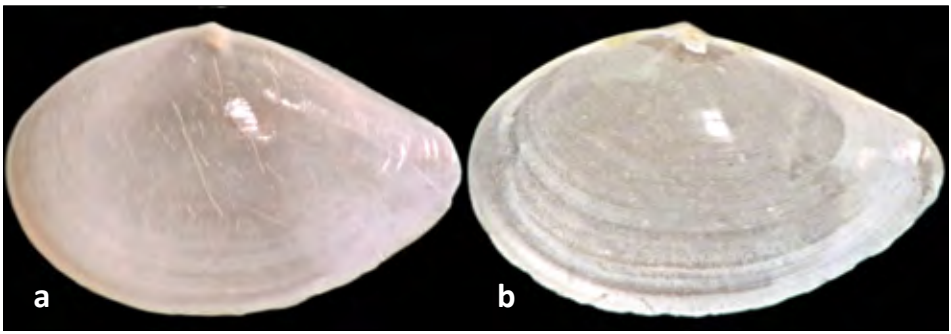


Plate 206. *Theora cadabra*, a-b. general view.

Family Tellinidae de Blainville, 1814
Description: Shell equivalve, inequilateral, posterior ventral border frequently with a dent or twist. Ligament external. Hinge line with two cardinal teeth in each valve, lateral teeth usually present. Adductor scars about equal. Pallial line with sinus. Cruciform muscles present, linking the valves, and leaving scars close to lower edge of the pallial sinus.
Reference: Hayward, 1990.

Genus *Tellina*
Tellina arsinoensis Issel, 1869 (Plate 207)
Distribution: Muddy and sandy substrates in Kuwait Bay.

Tellina donacina Linnaeus, 1758 (Plate 208 a-c)
Distribution: Intertidal zone of Ras Al-Ardh and muddy substrates between Ras Al-Ardh and Failaka Island.

Tellina methoria Melvill, 1897 (Plate 209 a-b)
Distribution: Intertidal zone of Ras Al-Zour.

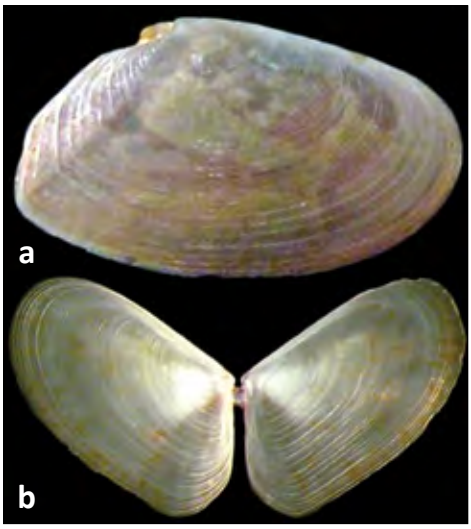
Tellina valtonis Hanley, 1844 (juv.) (Plate 210)
Distribution: Muddy substrates between Ras Al-Ardh and Failaka Island.

Tellina vernalis Hanley, 1844 (Plate 211 a-b)
Distribution: Muddy substrates near Failaka Island and in Kuwait Bay.

***Tellina* sp.1** (Plate 212 a-b)
Distribution: Muddy substrates near Failaka Island.

***Tellina* sp. 2 (juv.)** (Plate 213 a-c)
Distribution: Intertidal zone of Ras Al-Ardh and Ras Al-Zour.

Plate 207. ***Tellina arsinoensis*, a-b. general view.**



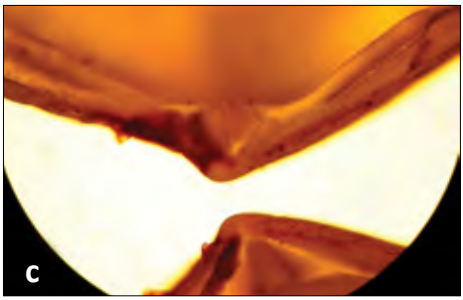


Plate 208. ***Tellina donacina*, a-b. general view; c. teeth.**

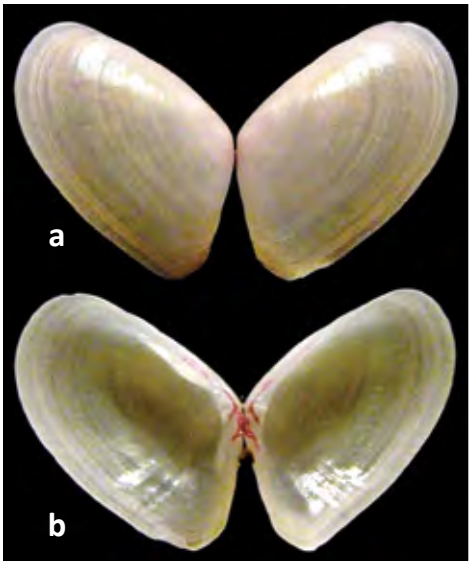


Plate 209. ***Tellina methoria*****, a-b. general view.**

Plate 210. ***Tellina valtonis*** **(juv.), general view.**

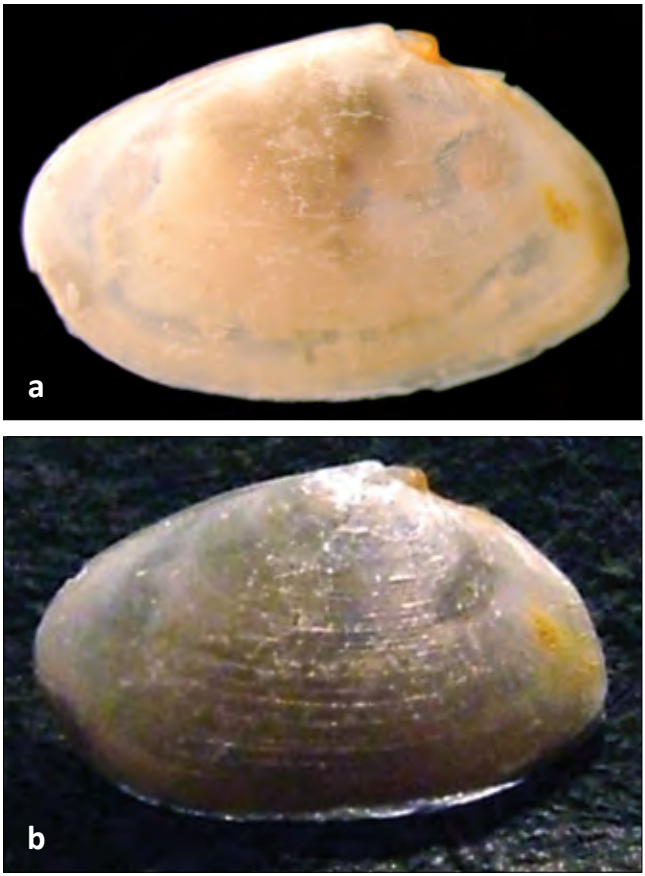


Plate 211. ***Tellina vernalis,*** **a-b. general view.**

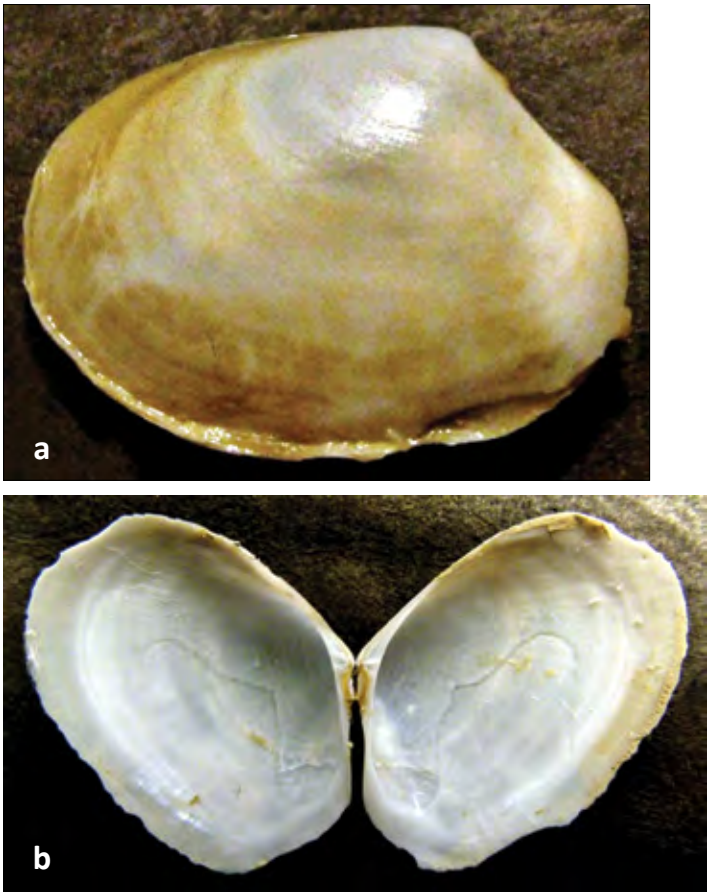


Plate 212. ***Tellina*** **sp.1, a-b. general view.**

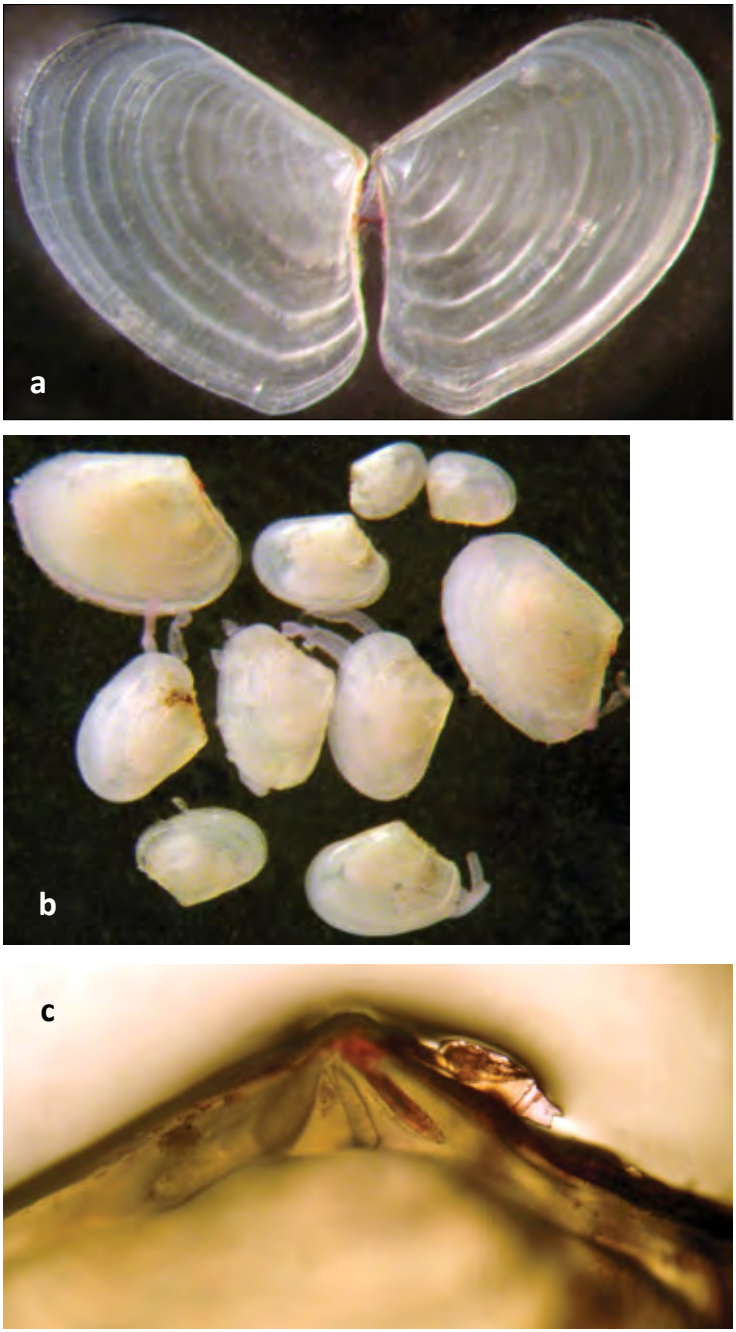


Plate 213. ***Tellina*** **sp. 2 (juv.), a-b. general view; c. teeth.**

Genus *Soletellina*
Soletellina rosea (Gmelin, 1791) (Plate 214 a-b)
Distribution: Sandy substrates near Funaitees.

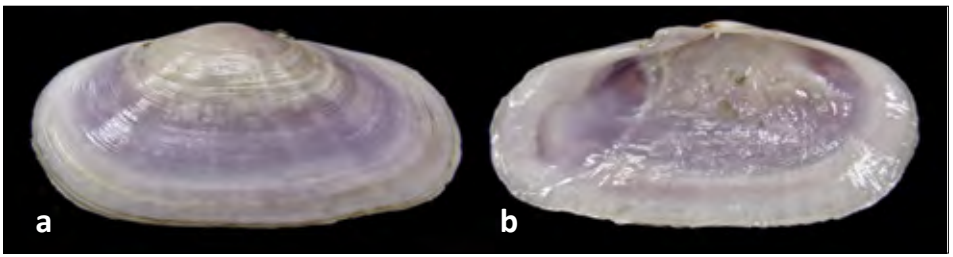


Plate 214. ***Soletellina rosea*****, a-b. general view.**

Genus *Loxoglypta*
Loxoglypta rhomboides (Quoy and Gaimard, 1835) (Plate 215 a-b)
Distribution: Sandy substrates around Qaruh Island.

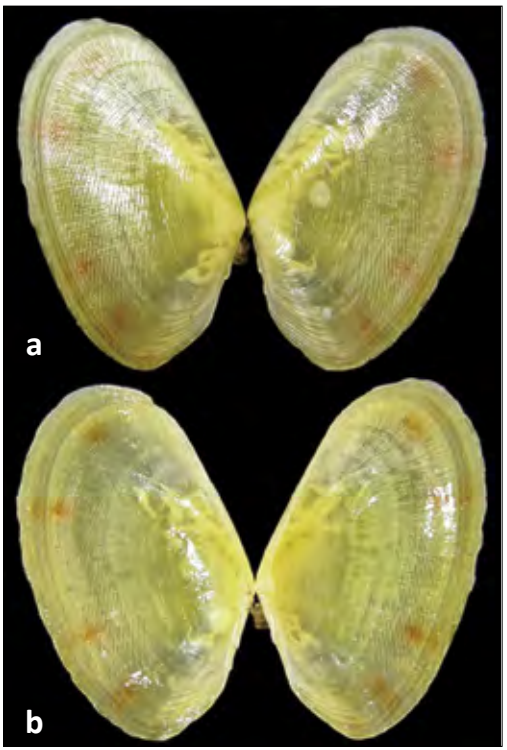


Plate 215. ***Loxoglypta rhomboides*****, a-b. general view.**

Family Veneridae Rafinesque, 1815
Description: Shell typically thick and strong, equivalve; inequilateral, umbones anterior to midline, usually prominent. Sculpture principally of concentric grooves. Characteristically with three cardinal teeth in each valve, occasionally with anterior lateral teeth. Lunule distinct. Ligament external. Adductor scars about equal, pallial line with a sinus.
Reference: Hayward, 1990.

Genus *Amiantis*
Amiantis umbonella (Lamarck, 1818) (Plate 216)
Distribution: Muddy and sandy substrates in Kuwait Bay.

Plate 216. ***Amiantis umbonella*****, a-b. general view.**

Genus *Bassina*
Bassina calophylla (Philippi 1836) (Plate 217 a-b)
Distribution: Intertidal zone of Ras Al-Zour.

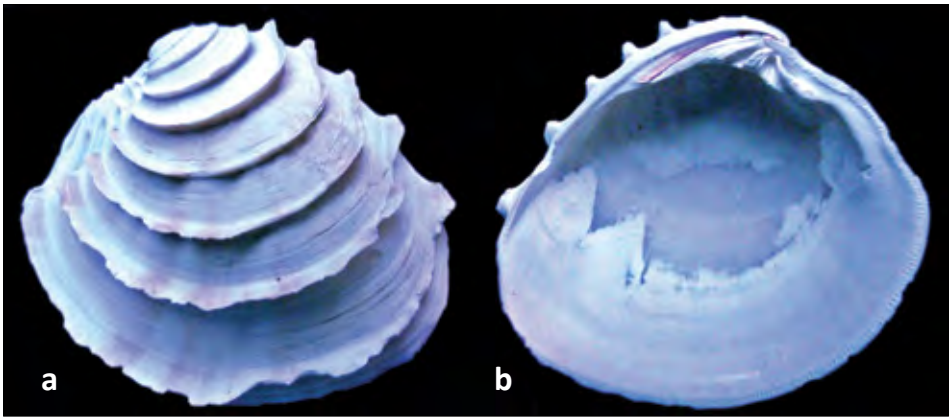


Plate 217. ***Bassina calophylla*****, a-b. general view.**

Genus *Callista*
Callista florida (Lamarck, 1818) (Plate 218 a-b)
Distribution: Muddy and sandy substrates in Kuwait Bay.

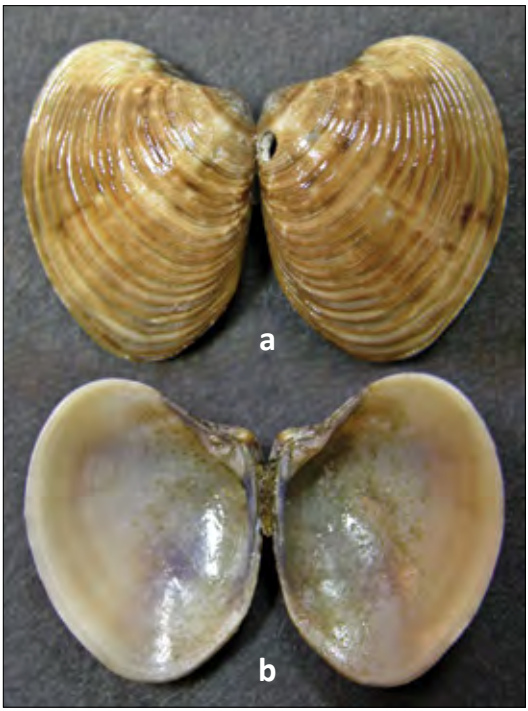


Plate 218. ***Callista florida*****, a-b. general view.**

Genus *Circe*
Circe intermedia Reeve, 1863 (Plate 219 a-b)
Distribution: Muddy and sandy substrates from Kuwait Bay to Ras Al-Zour.

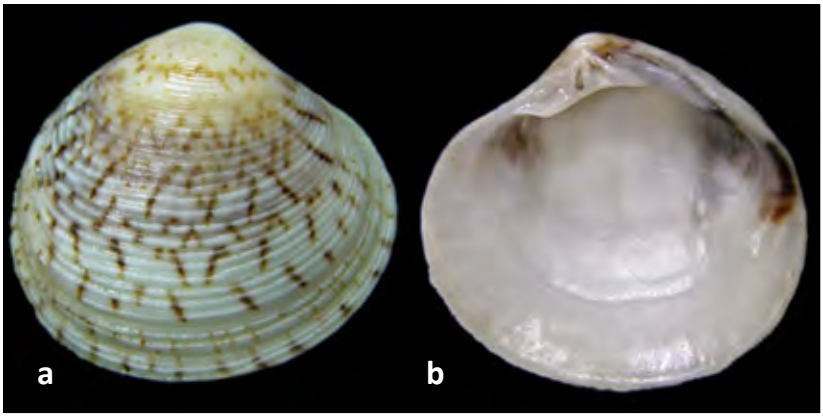


Plate 219. *Circe intermedia*, a-b. general view.

Genus *Diplodonta* Bronn, 1831
***Diplodonta* sp.**
Distribution: Muddy and silty substrates in Kuwait Bay.

Genus *Dosinia*
Dosinia alta (Dunker, 1849) (Plate 220 a-b)
Distribution: Sandy substrates near Mahboula and Kubbar Island.

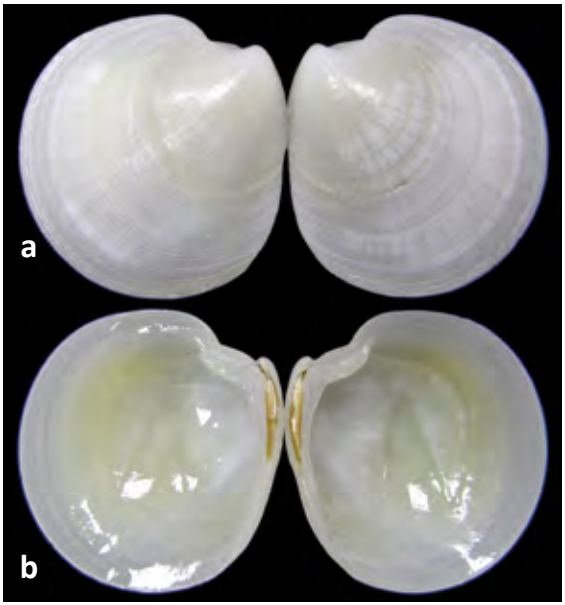


Plate 220. *Dosinia alta*, a-b. general view.

Dosinia erythraea Römer, 1860 (Plate 221 a-b)
Distribution: Sandy substrates near Mahboula.

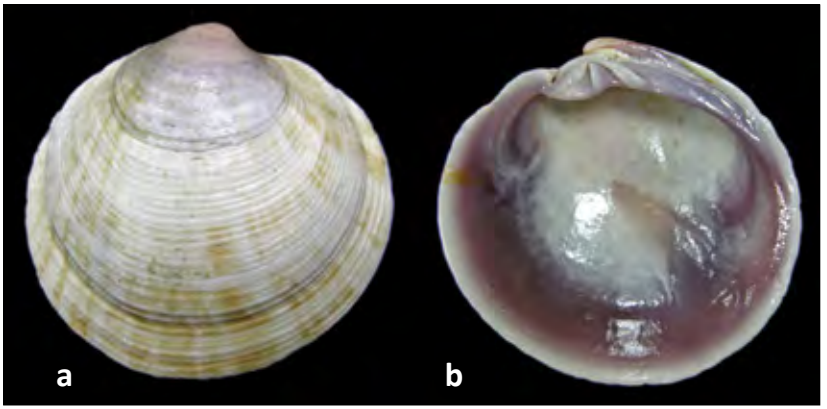


Plate 221. ***Dosinia erythraea*****, a-b. general view.**

***Dosinia* sp.1** (Plate 222 a-b)
Distribution: Muddy substrates near Failaka Island and in Kuwait Bay.

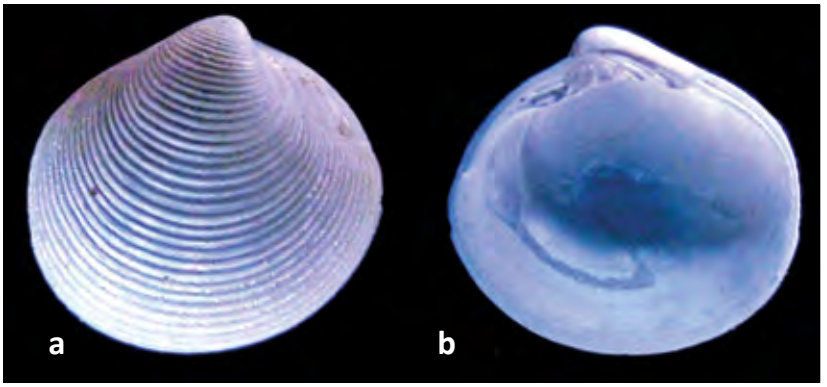


Plate 222. ***Dosinia* sp.1, a-b. general view.**

***Dosinia* sp.2** (Plate 223 a-b)
Distribution: Silty substrates in Kuwait Bay.

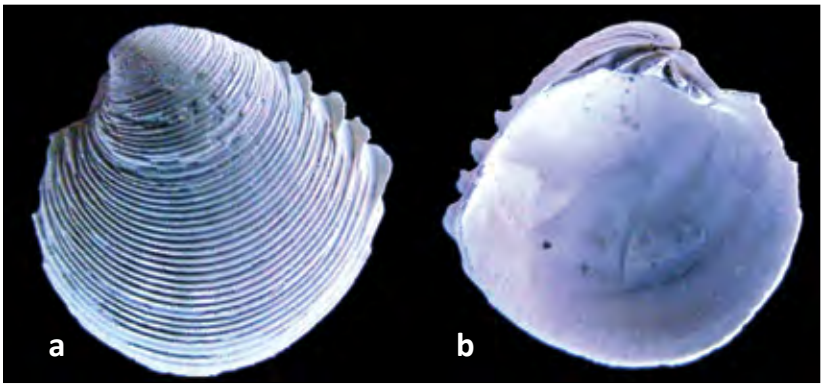


Plate 223. ***Dosinia* sp. 2, a-b. general view.**

Genus *Lioconcha*
Lioconcha ornata (Dillwyn, 1817) (Plate 224)
Distribution: Muddy and sandy substrates in Kuwait Bay.

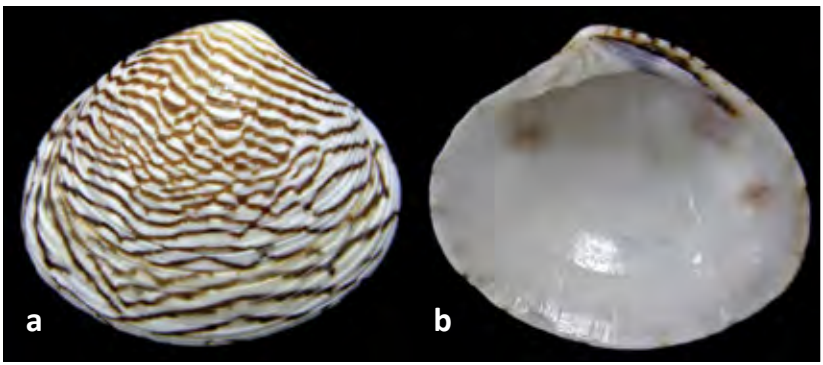


Plate 224. ***Lioconcha ornata*, a-b. general view.**

Genus *Marcia*

Marcia marmorata Lamarck, 1822 (Plate 225)

Distribution: Muddy and sandy substrates in Kuwait Bay.

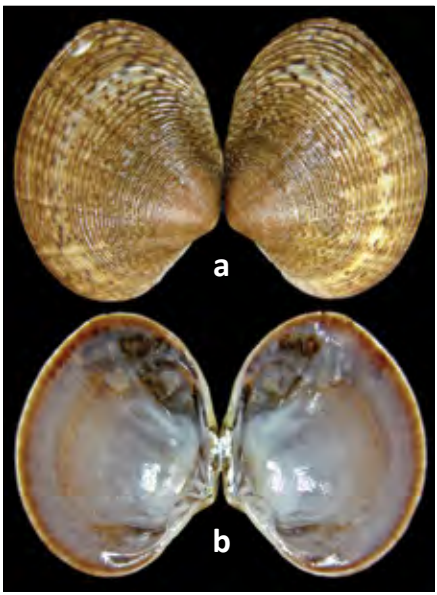


Plate 225. ***Marcia marmorata*****, a-b. general view.**

Marcia opima (Gmelin, 1791) (Plate 226)

Distribution: Muddy and sandy substrates in Kuwait Bay.

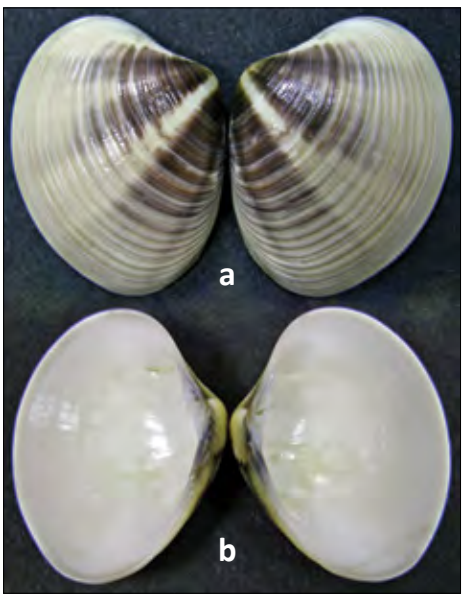


Plate 226. ***Marcia opima*****, a-b. general view.**

Genus *Paphia*
Paphia textile (Gmelin, 1791) (Plate 227 a-b)
Distribution: Intertidal zone of Ras Al-Zour.

***Paphia* sp. (juv.)** (Plate 228)
Distribution: Intertidal zone of Ras Al-Ardh.

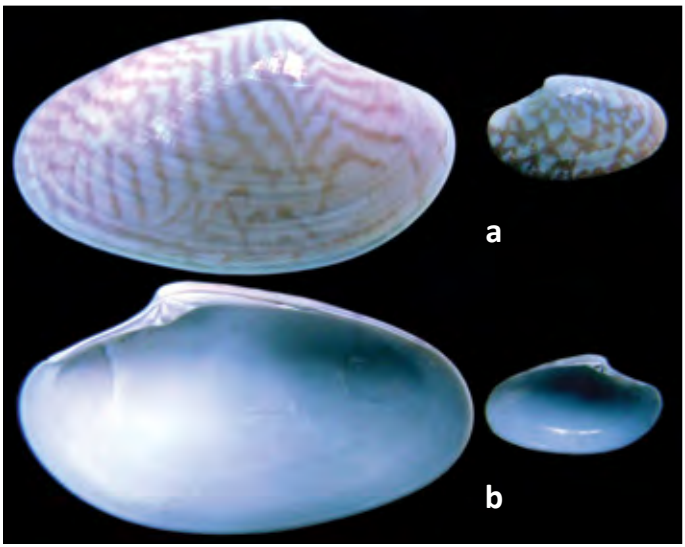


Plate 227. ***Paphia textile*****, a-b. general view.**

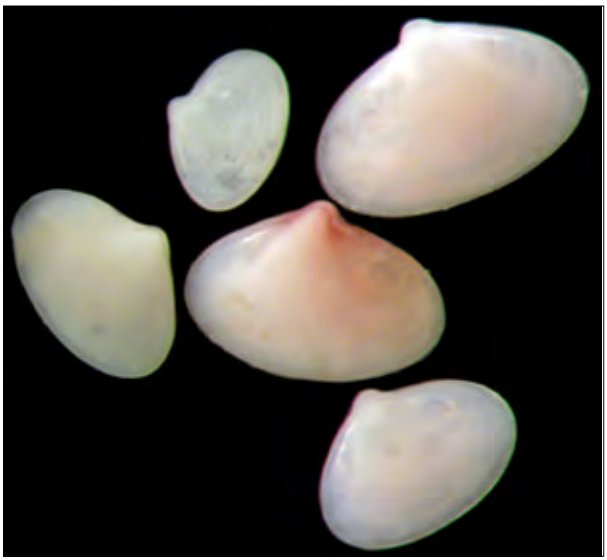


Plate 228. ***Paphia*** **sp. (juv.), general view.**

Genus *Protapes*

Protapes cor (G.B. Sowerby II, 1853) (Plate 229 a-b)

Distribution: Muddy and sandy substrates in Kuwait Bay.

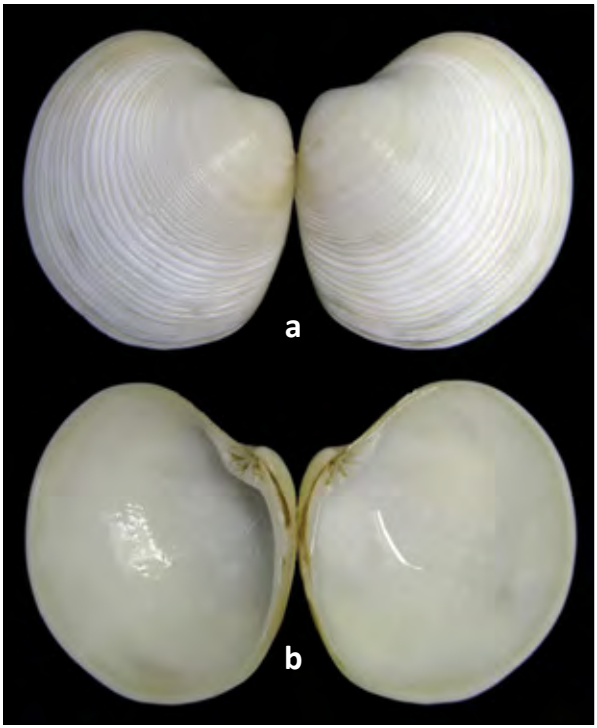


Plate 229. ***Protapes cor*****, a-b. general view.**

Protapes sinuosa (Lamarck, 1818) (Plate 230 a-b)

Distribution: Muddy and sandy substrates in Khor Al-Sabbiya.

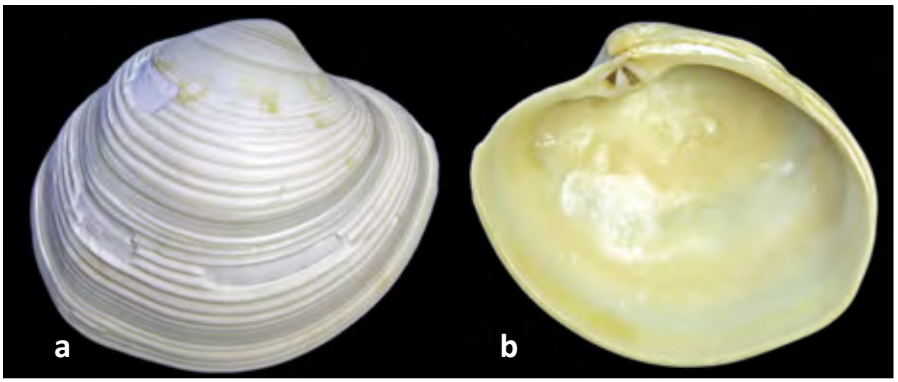


Plate 230. ***Protapes sinuosa*****, a-b.general view.**

Genus *Tapes*

Tapes bruguierei (Hanley, 1845) (Plate 231 a)

Distribution: Sandy substrates near Mahboula.

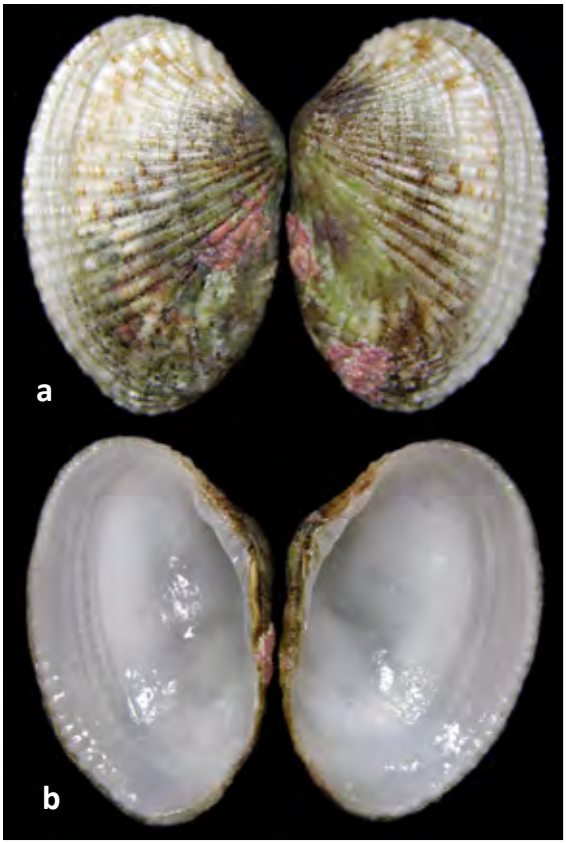


Plate 231. ***Tapes bruguierei*****, a-b. general view.**

Tapes sulcarius (Lamarck, 1818) (Plate 232 a)
Distribution: Sandy substrates near Mahboula.

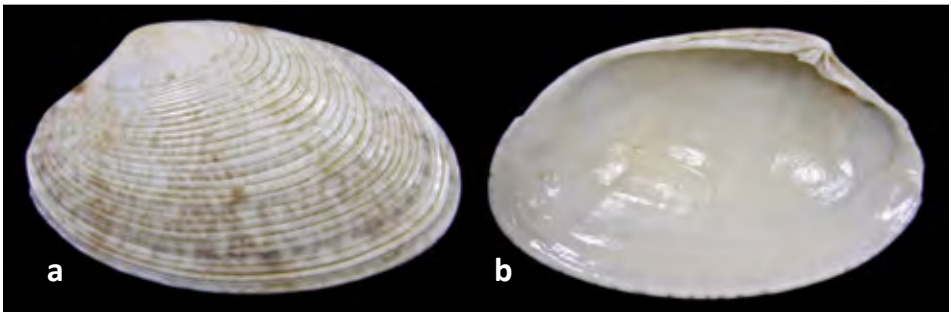


Plate 232. ***Tapes sulcarius*****, a-b. general view.**

Genus *Timoclea*
***Timoclea* sp.1 (juv.)** (Plate 233 a)
Distribution: Intertidal zone of Ras Al-Ardh and Muddy substrates between Ras Al-Ardh and Failaka Island.

***Timoclea* sp.2 (juv.)** (Plate 233 b)
Distribution: Muddy substrates around Failaka Island.

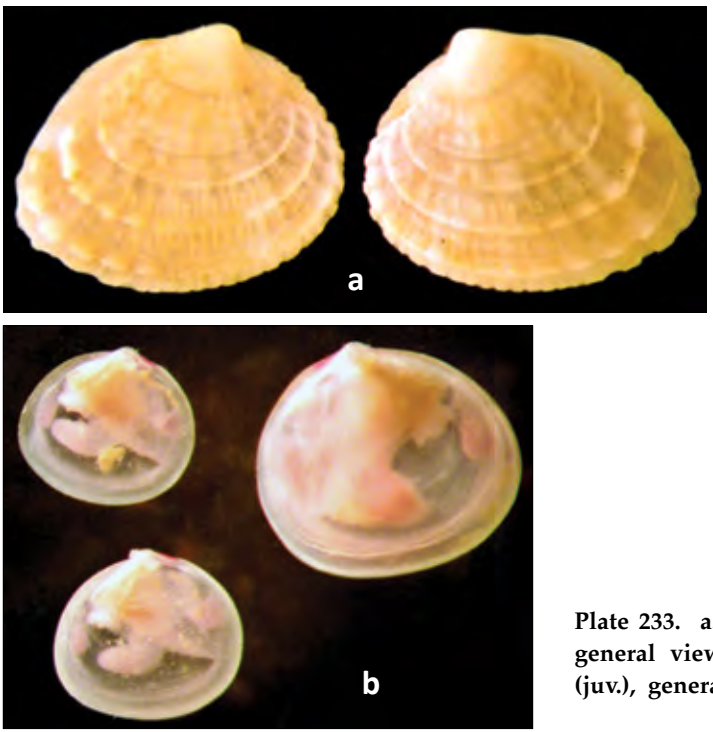


Plate 233. a. *Timoclea* sp.1 (juv.), general view; b. *Timoclea* sp.2 (juv.), general view.

Genus *Turtonia* Alder, 1848
Turtonia minuta (Fabricius, 1780)
Distribution: Muddy and silty substrates in Kuwait Bay.

***Turtonia* sp.**
Distribution: Muddy and silty substrates in Kuwait Bay.

Genus *Venerupis*
Venerupis rugosa (G.B. Sowerby II, 1854) (Plate 234 a-b)
Distribution: Sandy substrates in Ras Al-Julaiah.

Plate 234. *Venerupis rugosa*, a-b. general view.

Veneridae gen. sp. (Plate 235)
Distribution: Muddy and sandy substrates in Kuwait Bay.

Plate 235. Veneridae gen. sp., a-b. general view.

Family Trapezidae Lamy, 1920
Description: The few species of this family have boat-shaped or trapezional shells which are solid, sometimes coarsely ribbed, and have en external ligament situated behind the umbones. Below the ligament the hinge plate is narrowed. The cardinal teeth on each side are short but often very thick. The pallial sinus is usually poorly developed. Shells are mainly white but some are also purple inside.
Reference: Dance, 1992.

Genus *Trapezium*
Trapezium sublaevigatum (Lamarck, 1819) (Plate 236)
Distribution: Hard substrates from Khor Al-Sabbiya to Ras Al-Ardh.

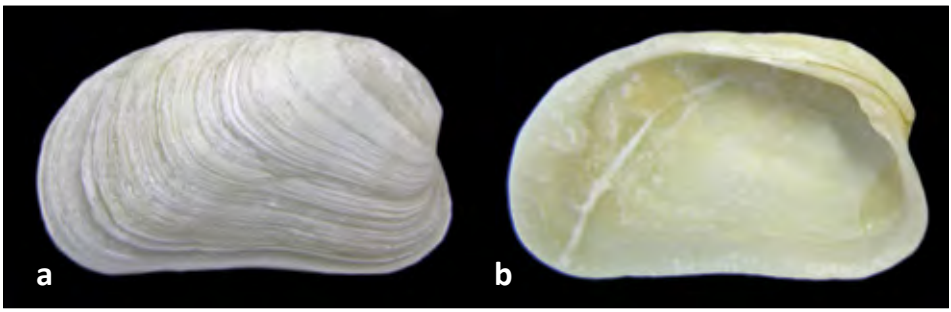


Plate 236. ***Trapezium sublaevigatum*****, a-b. general view.**

Family Solenidae Lamarck, 1809
Description: Shell elongate, straight and tubular, equivalve, inequilateral: umbones at anterior end. Gaping anteriorly and posteriorly. The anterior end either cut off squarely or slightly curved forward. Ligament external. One or two peg-like cardinal teeth in each valve; lateral teeth present or absent. Beaks terminal or nearly so. Adductor scars unequal, anterior typically elongate, posterior small. Pallial sinus present. Siphons fused; foot modified for rapid digging in sand or mud.
References: Hayward, 1990; Keen, 1971.

Genus *Solen*
Solen dactylus Cosel, 1989 (Plate 237 a-b)
Distribution: Burrows in sand or mud toward low tide in southern part of Khor Al-Sabbiya and along the northern coast of Kuwait Bay.

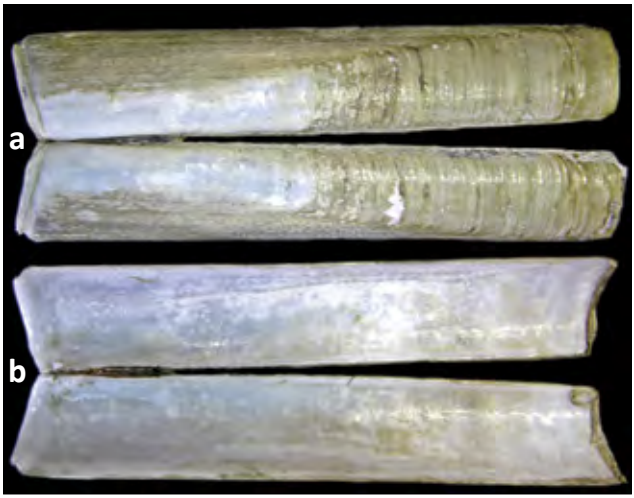


Plate 237. ***Solen dactylus*****, a-b. general view.**

Family Lucinidae Fleming, 1828
Description: The Lucinidae are predominantly lenticular or subovate in form and are burrowers into sand, gravel and mud. Anatomically they are quite distinct as they do not possess paired posterior siphons and the pallial line is always entire. The inhalant aperture is anterior and the contact with the surface is maintained by the finger-like foot which builds a mucus-lined tube. The anterior adductor muscle is usually elongate and this is reflected by the scar which is partly free from the pallial line. The ligament is mostly external but deeply sunken in some. Sculpture is primarily concentric, often with a secondary radial elements. The anterior adductor scar is relatively short. The hinge usually has two cardinal teeth and anterior and posterior laterals developed to various degrees. Hinge of adult mollusks of genus *Anodontia* has no teeth.
Reference: Bosch et al., 1995.

Genus *Anodontia*
Anodontia edentula (Linnaeus, 1758) (Plate 238 a-c)
Distribution: Muddy and sandy substrates in Kuwait Bay.

Plate 238. ***Anodontia edentula*****, a-c. general view.**

Subclass Pteriomorphia
Order Arcoida
Family Arcidae Lamarck, 1809
Description: Shell is thick and strong, tumid, oval, quadrate or irregular in outline; equivalve, inequilateral, umbones anterior to midline, widely separated. The shells of ark clams are often white or cream, but in certain species, the shell is striped with, tinted with, or completely colored with a rich brown. In life the shell of most species has a thick layer of brown periostracum covering the harder calcareous part of the shell. Ligament external, extending between umbones across a broad, grooved, diamond-shaped cardinal area. Hinge line straight, with a continuous series of identical teeth, alternating with sockets. Adductor muscle scars about equal. No pallial sinus.
Reference: Hayward et al., 1990.

Genus *Acar*
Acar abdita Oliver and Chesney, 1994 (Plate 239a-b)
Distribution: Intertidal zone from Ras-Al-Ardh to Ras Al-Zour, and Kubbar Island.

Acar plicata (Dillwyn, 1817) (Plate 240 a-b)
Distribution: Intertidal zone from Ras-Al-Ardh to Ras Al-Zour, and Kubbar Island.

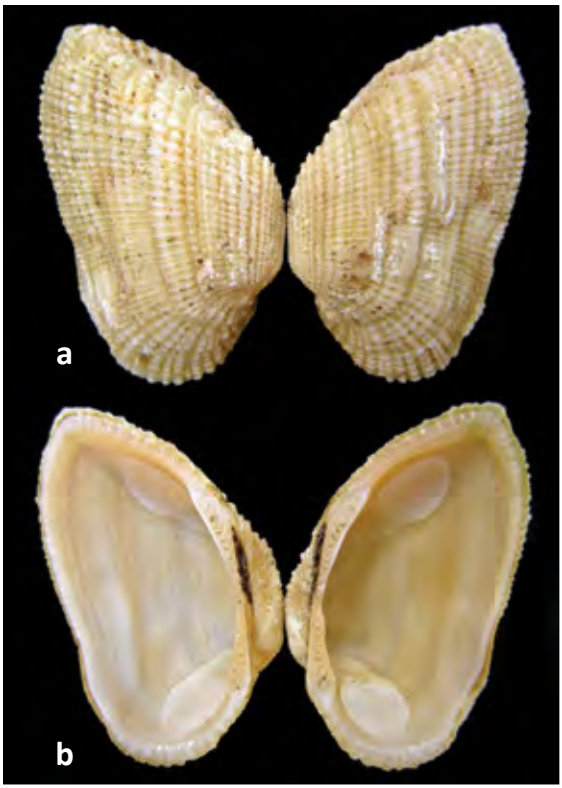


Plate 239. *Acar abdita*, a-b. general view.

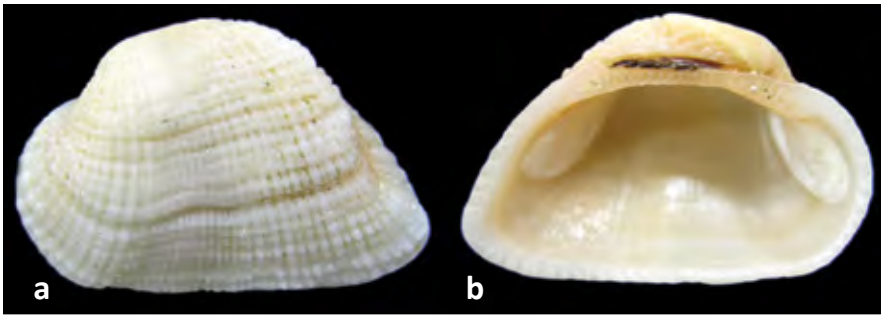


Plate 240. ***Acar plicata*****, a-b. general view.**

Genus ***Anadara***
Anadara ehrenbergi (Dunker, 1868) (Plate 241 a-b)
Distribution: Muddy and sandy substrates in Kuwait Bay.

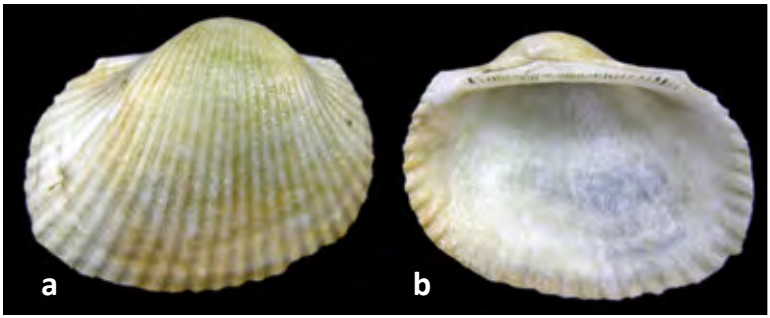


Plate 241. ***Anadara ehrenbergi*****, a-b. general view.**

Anadara erythraeonensis Philippi, 1851 (Plate 242 a-b)
Distribution: Sandy substrates near Mahboula.

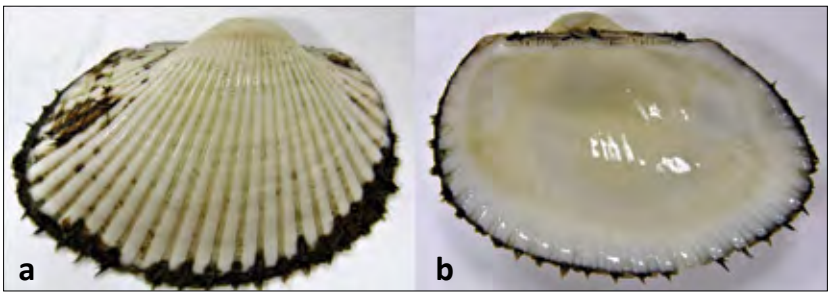


Plate 242. ***Anadara erythraeonensis*****, a-b. general view.**

***Anadara* sp. (juv.)** (Plate 243 a-b)
Distribution: Intertidal zone of Ras Al-Ardh and muddy substrates around Bubiyan Island.

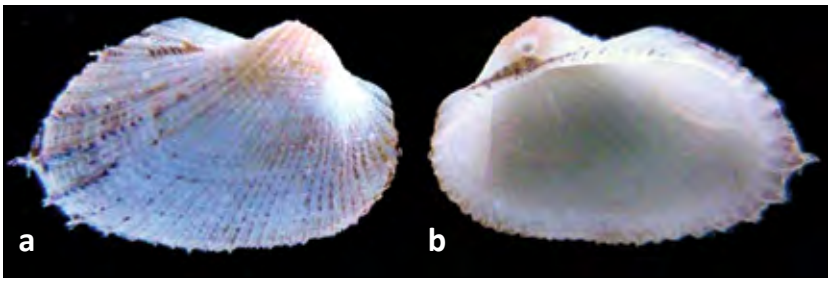


Plate 243. ***Anadara* sp. (juv.), a-b. general view.**

Genus *Arca*
***Arca* sp.**
Distribution: Muddy substrates between Bubiyan and Failaka Islands.

Genus *Barbatia*
Barbatia decussata (Sowerby I, 1833) (Plate 244 a-b)
Distribution: Muddy and sandy substrates in Kuwait Bay, and Kubbar Island.

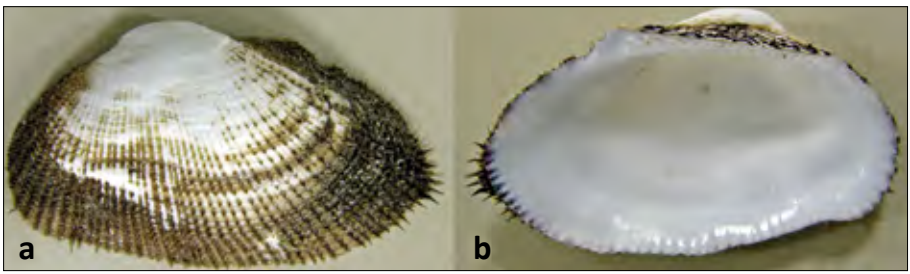


Plate 244. ***Barbatia decussata*, a-b. general view.**

Barbatia foliata (Forsskal, 1755) (Plate 245 a-b)
Distribution: Muddy and sandy substrates from Kuwait Bay to Ras Al-Zour, and also Kubbar Island.

Plate 245. ***Barbatia foliata*****, a-b. general view.**

Barbatia fusca (Bruguiere, 1789) (Plate 246 a-b)
Distribution: Intertidal zone of Ras Al-Zour.

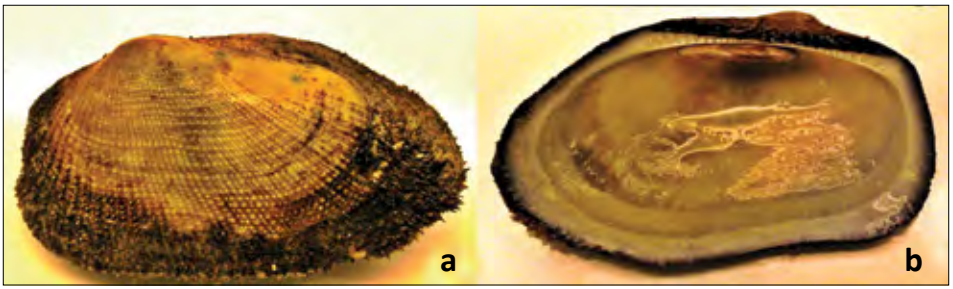


Plate 246. ***Barbatia fusca*****, a-b. general view.**

Barbatia setigera (Reeve, 1844) (Plate 247 a-b)
Distribution: Muddy and sandy substrates in Kuwait Bay, and also Kubbar Island.

Plate 247. ***Barbatia setigera*****, a-b. general view.**

***Barbatia* sp. (juv.)** (Plate 248 a-b)
Distribution: Muddy substrates in Khor Al-Sabbiya.

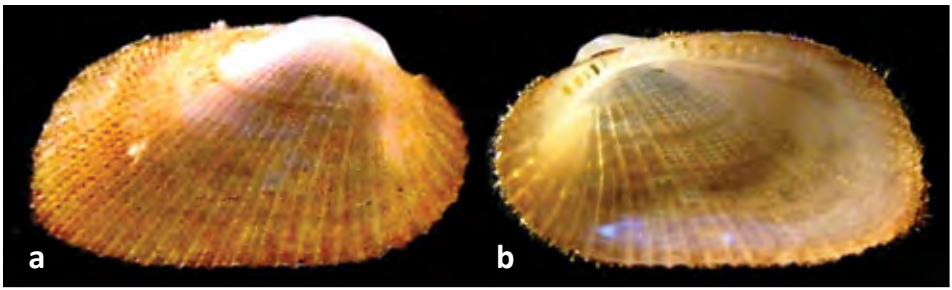


Plate 248. ***Barbatia* sp. (juv.), a-b. general view.**

Family Glycymerididae Newton, 1922
Description: Shell equivalve, hinge closed, solid, subequilateral, rounded, more or less circular to oval-subquadrate in outline; anterior side usually more evenly rounded than posterior one, which is often somewhat narrowed and angulated. Submedian orthogyrate, slightly prosogyrate or opisthogyrate umbones situated on top of a well-defined trigonal cardinal area which is deeply engraved by oblique or tent-shaped grooves and covered with a dark brown external ligament. External surface quite smooth, only striated radially and concentrically, or with radial ribs. Periostracum is thick and densely set with fine hair, or thin to almost absent. Hinge plate broad and strongly arched, bearing a series of teeth diverging outwards, which diminish in size medially and distally along the anterodorsal and postero-dorsal margins. Internal surface porcelaneous. Two subequal adductor muscle scars, their inner margin with a radial ridge always stronger at front of the posterior scar. Pallial line without a sinus. Internal margins crenulated. Filibranchiate type gills, with smooth branchial sheets. Siphons and byssus absent, the latter at least in the adult. Foot is large, hatchet-shaped, deeply grooved ventrally. Mantle widely opened, with compound marginal eyes covered by the periostracum. Shallow burrowers of soft bottoms, often containing a coarse fraction, slowly ploughing through the substrate with the anterior end foremost, and binding the sand with mucus from the foot. Filter-feeding species. Able to colonize habitats of low oxygen concentration thanks to the presence of the respiratory pigment haemoglobin in the blood.
Reference: Hayward, 1990.

Genus *Glycymeris*
Glycymeris livida (Reeve, 1843) (Plate 249 a-b)
Distribution: Sandy substrates near Mahboula.

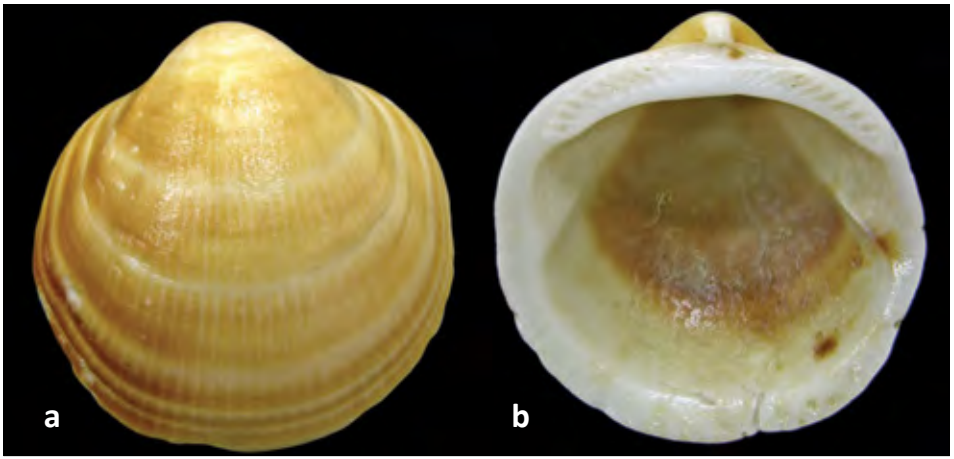


Plate 249. ***Glycymeris livida*****, a-b. general view.**

Glycymeris pectunculus (Linnaeus, 1758) (Plate 250 a-b)
Distribution: Intertidal zone from Mahboula to Ras Al-Zour.

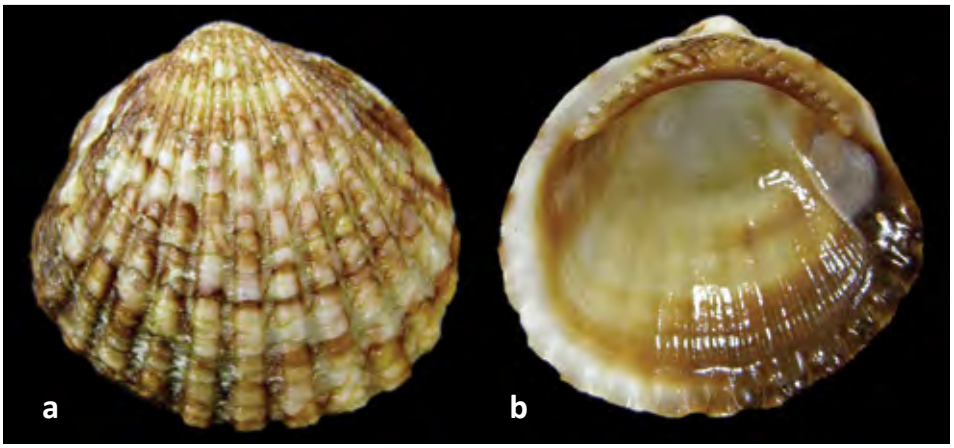


Plate 250. ***Glycymeris pectunculus*****, a-b. general view.**

Family Noetiidae Stewart, 1930
Description: Shell solid, equivalve, subtrigonal, trapezoidal to elliptical in shape, generally inequilateral and longer than high. Umbones often opisthogyrate, set apart from dorsal margin by a trigonal cardinal area. Ligament is external, stretching across the cardinal area, with oblique grooves and transverse striations. Outer surface with radial sculpture. Periostracum conspicuous, generally pilose. Hinge elongate, straightish to slightly arched, with numerous small transverse teeth which somewhat increase in size towards anterior and posterior ends. Interior of shell is porcelaneous. Two subequal adductor muscle scars, with a ridge or a shelf present along the inner margin of one or both scars. Pallial line without a sinus. Internal margins of valves smooth or crenulated. Gills of filibranchiate type. Foot is stout, grooved, often byssiferous. Mantle widely opened, with marginal eyes covered by periostracum. Maximum shell length 10 cm, commonly to 6 cm. Noetiidae usually live on sandy to muddy bottoms offshore, from depths between 5 and 252 m; most commonly found between 15 and 150 m.
Reference: Hayward, 1990.

Genus *Didimacar*
Didimacar tenebrica (Reeve 1824) (juv.) (Plate 251 a-b)
Distribution: Muddy substrates in Kuwait Bay.

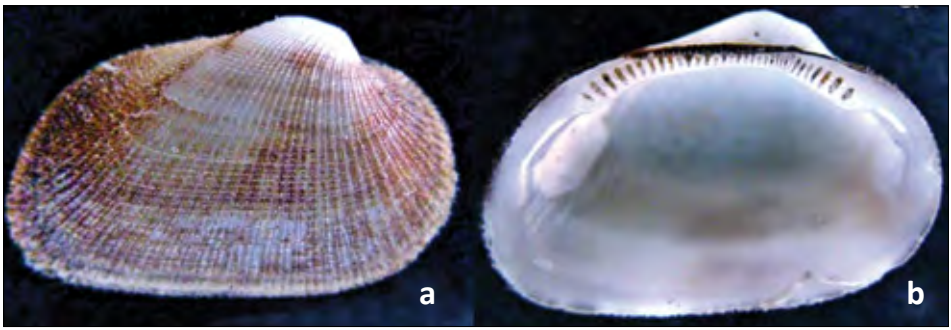


Plate 251. *Didimacar tenebrica*, a-b. general view.

Order Mytiloida
Family Mytilidae Rafinesque, 1815
Description: Shell of Mytilidae is elongate, equivalve; inequilateral, beaks at anterior end, terminal or subterminal; rarely almost equilateral. Periostracum is usually conspicuous, typically darker than shell, with or without spines. Hinge line without teeth, rarely with small crenulations, continuous with shell margin. Ligament is internal, or external in a narrow groove and inconspicuous. Adductor muscle scars unequal, anterior muscle scar reduced. No pallial sinus. Attached by a diffuse, fibrous byssus. Species in the family Mytilidae are found worldwide, but they are more abundant in colder seas, where they often form uninterrupted beds on rocky shores in the intertidal zone and the shallow subtidal. Mytilids include the well-known edible sea mussels.
Reference: Hayward, 1990.

Genus *Brachidontes*
Brachidontes variabilis (Krauss, 1848) (Plate 252 a-b)
Distribution: Hard substrates from Kuwait Bay to Fahaheel.

Plate 252. *Brachidontes variabilis*, a-b. general view.

Genus *Gregariella*
Gregariella simplicifilis Barnard, 1964 (juv.) (Plate 253)
Distribution: Intertidal zone of Ras Al-Ardh.

Plate 253. *Gregariella simplicifilis* (juv.), general view.

Genus *Lithophaga*
Lithophaga robusta (Jousseaume MS in Lamy, 1919) (Plate 254)
Distribution: Intertidal zone of Ras Al-Zour.

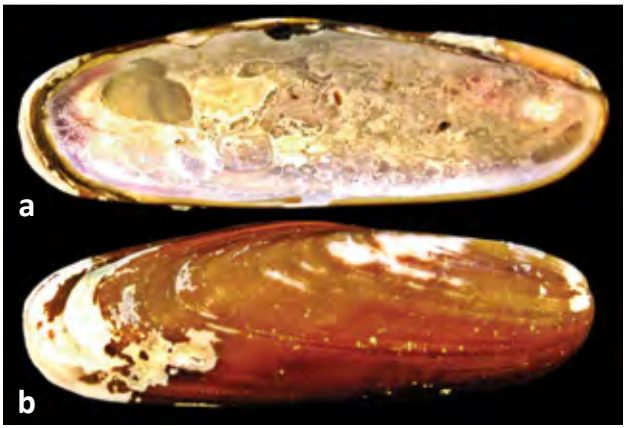


Plate 254. *Lithophaga robusta*, general view.

Genus *Musculista*
Musculista senhousia (Benson in Cantor, 1842) (Plate 255)
Distribution: Muddy substrates in Khor Al-Sabbiya.

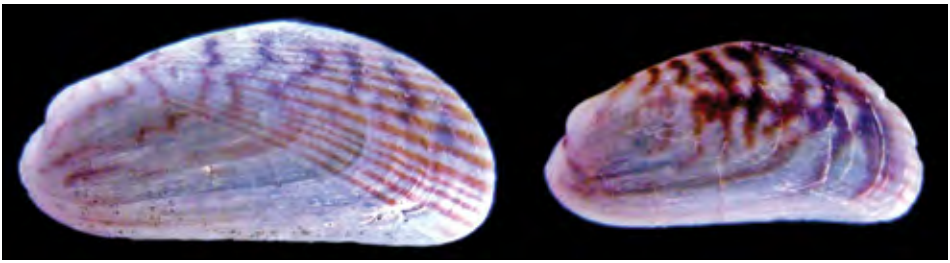


Plate 255. *Musculista senhousia*, general view.

Order Pectinoida
Family Pectinidae Rafinesque, 1815
Description: Shell thick and strong, typically oval or circular, occasionally irregular and distorted, usually with bold, radiating ribs. Equivalve or inequivalve, one valve often flat or less concave than the other. Hinge line straight, produced as short, projecting auricles or ears on each side of the umbones. Equilateral, or inequilateral with anterior ears longer than posterior ones. Hinge line without teeth, although occasionally infolded along its edge to form articulating surfaces. Ligament internal, in a well-marked chondrophore. One adductor scar only. Most Pectinidae have radial ribs and concentric ridges, although a few are smooth. The ctenolium is a key feature that separates Pectinidae from all other families. *Reference*: Hayward, 1990.

Genus *Chlamys*
Chlamys livida (Lamarck, 1819) (Plate 256 a-b)
Distribution: Sandy substrates from Ras Al-Ardh to Ras Al-Zour, and also Kubbar Island.

Plate 256. *Chlamys livida*, a-b. general view.

Family Spondylidae Gray, 1826
Description: Spiny oyster shells are very variable in shape and sculpture and are difficult to identify. Nearly all eastern Arabian shells have a reddish inner margin with beige coloring around the hinge; externally, if not worn, the sculpture is of flattened spines.
Reference: Bosch et al., 1995

Genus *Spondylus*
Spondylus marisrubri Röding, 1798 (Plate 257 a-b)
Distribution: Sandy substrates from Ras Al-Ardh to Ras Al-Zour, and also Kubbar Island.

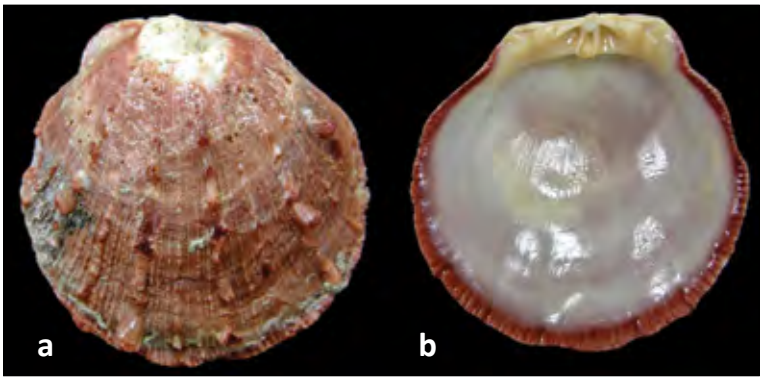


Plate 257. ***Spondylus marisrubri*****, a-b. general view.**

Spondylus variegatus Schreibers, 1793 (Plate 258 a-b)
Distribution: Kubbar Island.

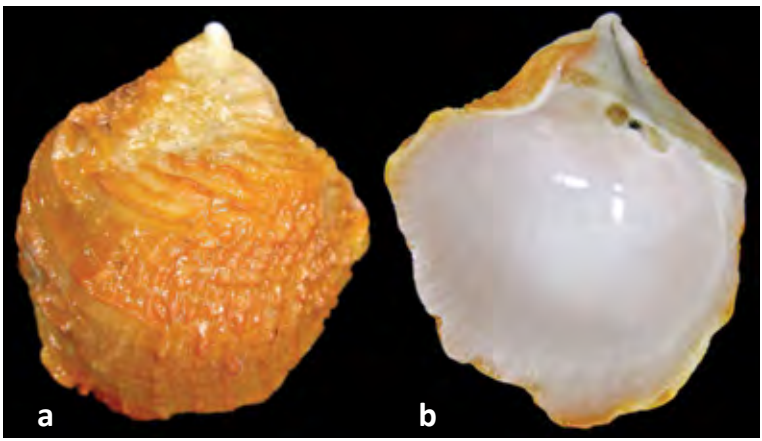


Plate 258. ***Spondylus variegatus*****, a-b. general view.**

Order Nuculanoida
Family Yoldiidae Habe, 1977
Description: The shells of Yoldiidae are mostly solid, triangular or oval in outline, with numerous small projecting teeth along the hinge plate. Shells are equivalve; difficult to identify. Animals live offshore, burrowing into the soft sea-bottom.
Reference: Tebble, 1966.

Genus *Yoldia*
Yoldia tropica Melvill, 1897 (Plate 259 a-c)
Distribution: Muddy substrates between Ras Al-Ardh and Failaka Island.

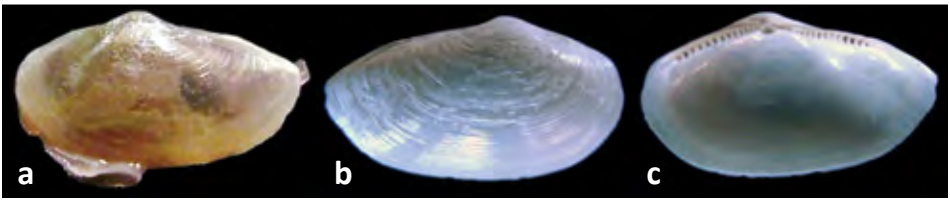


Plate 259. *Yoldia tropica*, a-c. general view.

Family Nuculidae Gray, 1824
Description: The shells of Nuculidae are subtriangular or oval in outline, smooth, tumid, equivalve, inequilateral, with umbones well to posterior of midline. Hinge line with taxodont teeth in two distinct series, anterior more numerous than posterior. Ligament is internal, in an elliptical chondrophore, below and just in front of beaks. Adductor muscle scars about equal; pallial line faint, without a sinus.
Reference: Hayward, 1990.

Genus *Nucula*
Nucula inconspicua H.Adams, 1871
Distribution: Muddy and silty substrates in Kuwait Bay.

***Nucula* sp.** (Plate 260 a-c)
Distribution: Muddy substrates in Kuwait Bay and between Bubiyan and Failaka Islands.

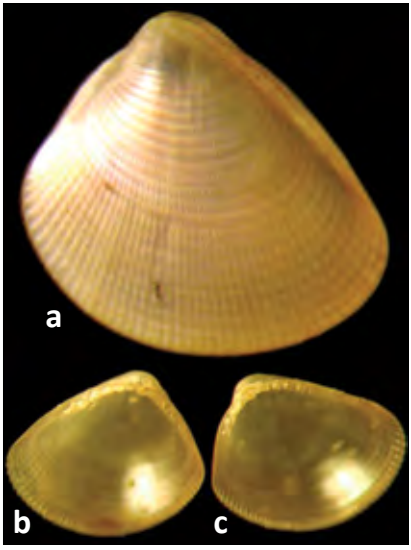


Plate 260. *Nucula* sp., a-c. general view.

Genus *Nuculoma*

Nuculoma layardii A. Adams, 1856 (juv.) (Plate 261 a-b)

Distribution: Intertidal zone of Ras Al-Ardh, muddy substrates between Ras Al-Ardh and Failaka Island and between Bubiyan and Failaka Islands.

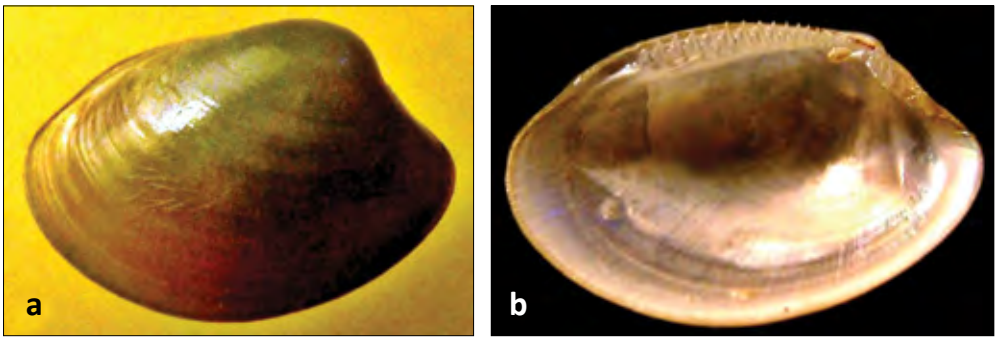


Plate 261. *Nuculoma layardii*, a-b. general view.

Family Ostreidae Rafinesque, 1815

Description: The shells of Ostreidae are thick, rugose; inequivalve, left (lower) valve convex, often forming a deep bowl and frequently overlapping the right valve, usually cemented to the substratum when small, right valve flat or slightly concave. Inequilateral, umbones anterior to midline. Juveniles with small taxodont teeth on each side of the umbones, absent in adults. Ligament is internal, thick; inner surface nacreous, with a single adductor scar, elliptical, distinct, and often recessed. The Ostreidae, or true oysters, are the food oysters of commerce worldwide. Reproductive behavior in the oyster is remarkable in that both oviparous (egg bearing) and larviparous (larvae bearing) species are found. The larviparous species, of which *Ostrea edulis* is typical, show a life history of alternating sex changes in the same individual, whereas the oviparous species, e.g., *O. virginica*, or *O. gigas*, are essentially hermaphroditic and may produce either predominantly male or predominantly female gametes depending on environmental temperature and nutrient availability.

Reference: Hayward, 1990.

Genus *Ostrea*

***Ostrea* sp.** (Plate 262 a-c)

Distribution: Hard substrates in Khor Al-Sabbiya and Kuwait Bay. The coastal rocks in middle part of the Khor consist only of valves of *Ostrea* sp. (Plate 252 a). Separate valves and aggregates of shells of oysters dominate along the shore line in this area (Plate 252 b).

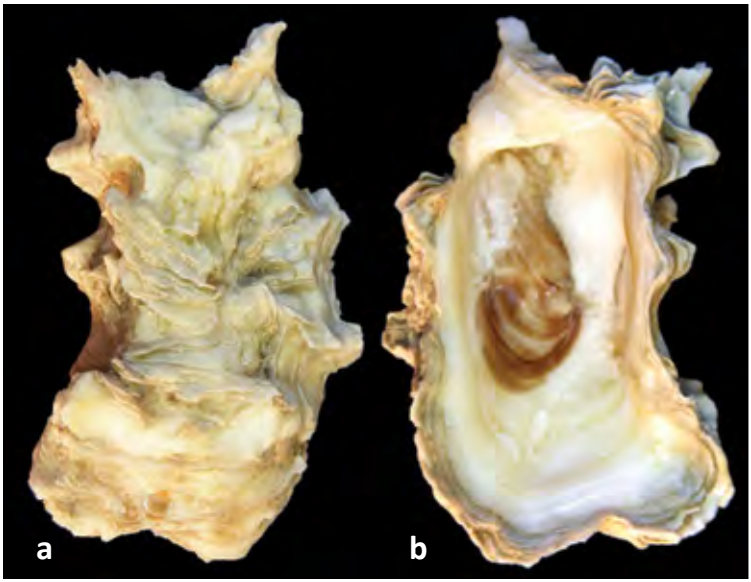
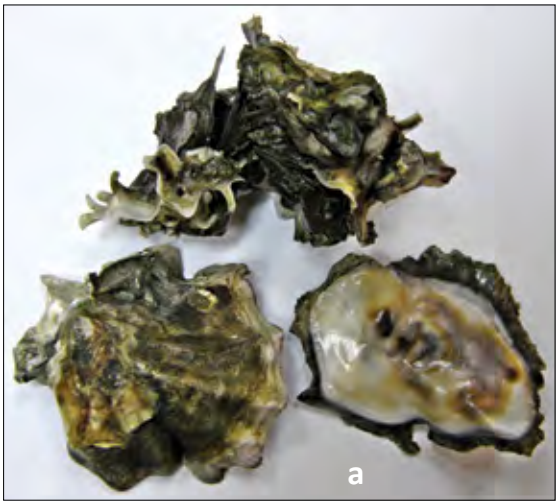


Plate 262. *Ostrea* **sp., a-b. general view; c. coastal rocks consisting of valves of** *Ostrea* **sp. in the middle part of Khor Al-Sabbiya.**

Genus *Saccostrea*
Saccostrea cucullata (Born, 1778) (Plate 263 a-b)
Distribution: Hard substrates in Ras Al-Ardh.



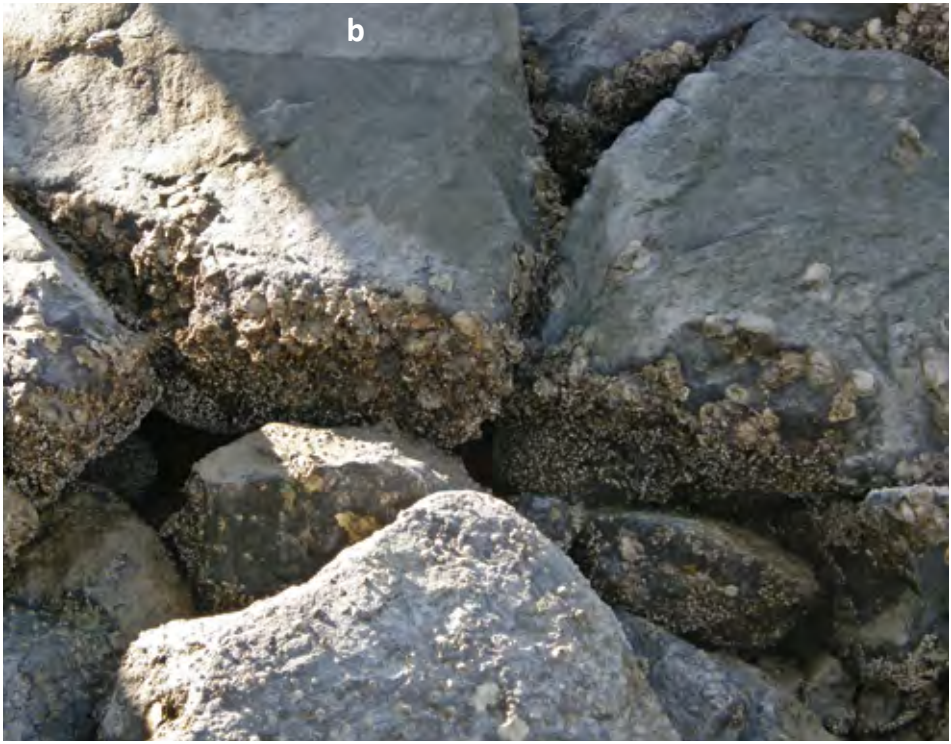


Plate 263. a. *Saccostrea cucullata*, general view; b. coastal rocks in Ras Al-Ardh covered with *S. cucullata*.

Family Malleidae Lamarck, 1819
Description: The shells of most of Malleidae are T-shaped, with the hinge at the top of the T, and with the byssus emrging from the hinge. An oblique ligament holds the hinge. The shell is partially nacreous. There is a single, large adductor muscle. The exhalant current exits at the hinge. Most hammer oysters live in tropical, coralline areas.
Reference: Hayward, 1990.

Genus *Malvifundus*
Malvifundus normalis (Lamarck, 1819) (Plate 264)
Distribution: Intertidal zone of Ras Al-Zour.

Plate 264. ***Malvifundus normalis*****, general view.**

Family Pinnidae Leach, 1819
Description: The shells of Pinnidae are equivalve, inequilateral, triangular, gaping posteriorly and along antero-ventral margin. Numerous close-packed ridges, beneath umbones at anterior end of shell, but no hinge teeth. Anterior adductor scar is small, close to the umbones; posterior larger, close to the middle of shell.
Reference: Hayward, 1990.

Genus *Pinna*
Pinna bicolor Gmelin, 1791 (Plate 265 a-b)
Distribution: Subtidal zone of Ras Al-Zour.

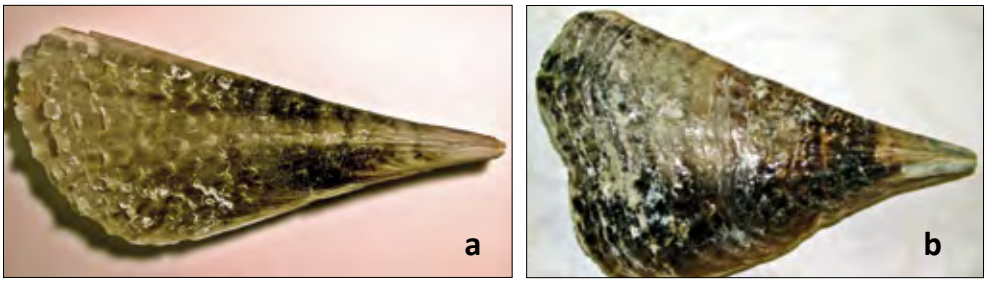


Plate 265. ***Pinna bicolor*****, a-b. general view.**

Family Pteriidae Gray, 1847
Description: Pteriidae (pearl oysters) is a family of medium-sized to large saltwater clams. The shells are very inequivalve, the right valve with an opening under its wings for the passage of a byssus (threadlike anchor). Found generally on rocks, sea fans, and other firm objects. Some of the species in this family are important economically as the source of saltwater pearls.
Reference: Hayward, 1990.

Genus *Pinctada*
Pinctada margarinifera (Linnaeus, 1758) (Plate 266 a-b)
Distribution: Hard substrates in subtidal zone from Ras Al-Ardh to Ras Al-Zour.

Pinctada radiata (Leach, 1814) (Plate 267 a-b)
Distribution: Hard substrates in subtidal zone of Ras Al-Zour.

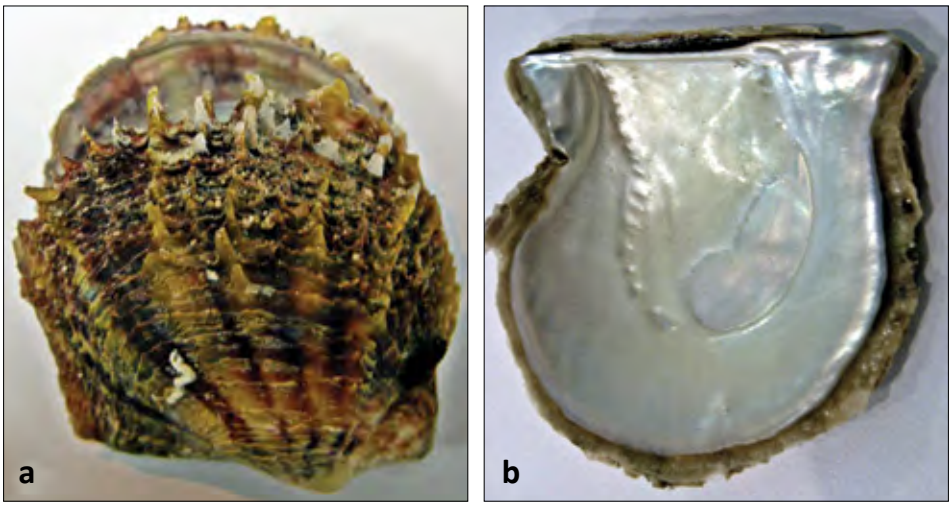


Plate 266. a-b. *Pinctada margarinifera*, general view.

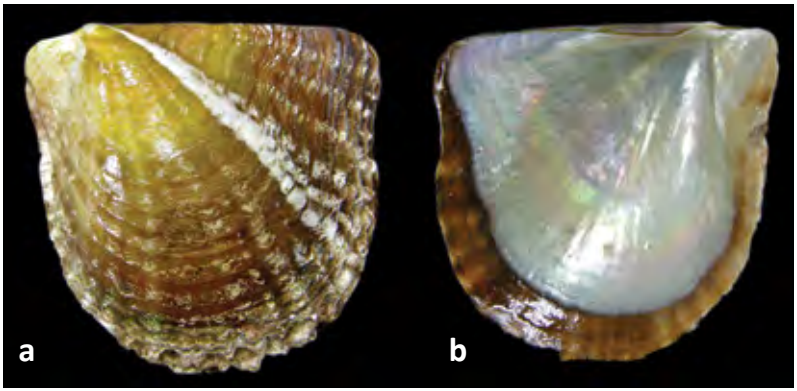


Plate 267. a-b. *Pinctada radiata*, general view.

Class SCAPHOPODA
Order Gadilida
Family Gadilidae Stoliczka, 1868
Description: The shells of Gadilidae are minute to moderate sized, commonly smooth and porcellaneous and rarely sculptured with longitudinal or annular markings. The maximum diameter of the shell is either at the anterior (oral) opening or very near to it.
Reference: Jones and Baxter, 1987.

Genus *Cadulus*
Cadulus euloides Melvill and Standen, 1901 (Plate 268 a-b)
Distribution: Intertidal zone from Ras Al-Ardh to Ras Al-Zour.

Plate 268. *Cadulus euloides*, a-b. general view.

Order Dentaliida
Family Dentaliidae Children, 1834
Description: Shells medium to large and with a weak to pronounced curvature. The maximum diameter is at the anterior aperture. Sculpturing consists of 4-20 rather smooth, slightly sculptured ribs, with or without secondary ribs bearing striations or transverse lines. The apex is simple with a superficial notch on the concave side or with a deep fissure on the concave as well as the convex side. The shell is oval, circular or subpolygonal in section. The central radula-tooth has an entire cutting edge and is smooth and rather arched. The lateral tooth is strong and the marginal teeth are curved.
Reference: Jones and Baxter, 1987.

Genus *Dentalium*
Dentalium octangulatum Donovan, 1803 (Plate 269)
Distribution: Muddy and sandy substrates in Kuwait Bay.

Plate 269. *Dentalium octangulatum*, general view.

Genus *Tesseracme*
Tesseracme quadrangularis (Sowerby in Broderip and Sowerby, 1832) (Plate 270 a-b)
Distribution: Muddy and silty substrates between Ras Al-Ardh and Failaka Island, in Kuwait Bay and between Bubiyan and Failaka Islands.

Plate 270. *Tesseracme quadrangularis*, a-b. general view.

Phylum ARTHROPODA
Subphylum CRUSTACEA
Class MAXILLOPODA
Infraclass Cirripedia
Order Sessilia

Sessilia is an order of barnacles, comprising the barnacles without stalks, or acorn barnacles. They form a monophyletic group and are probably derived from stalked barnacles. The animal is protected by a calcareous shell, formed by calcifications within the walls of the first three cephalic segments. The animal is placed within the shell, head downwards, and is fixed to the center of a shelly or membranous plate, which closes the lower aperture of the shell, and which is termed the "basis." The "basis" is fixed by its outer surface to some foreign object, and is sometimes compact, sometimes porous. Above the basis rises a limpet-shaped, conical, or cylindrical shell, which is open at the top, but is capable of being completely closed by a pyramidal lid or "operculum." Both the shell itself and the operculum are composed of calcareous plates usually differing from one another in shape, and distinguished by special names. Within the shell the animal is fixed, head downwards. The thoracic segments, six in number, bear six pairs of limbs, each of which consists of a jointed protopodite and a much-segmented exopodite and endopodite, both of which are bristled, and constitute the so-called "cirri," from which the name of the sub-class is derived. These twenty-four cirri - "the glass hand" of the Balanus - are in incessant action, being protruded from the opening of the shell, and again retracted within it, constantly producing currents of water, and thus bringing food to the animal. There are no specialised respiratory organs in the family of the Balanidae.

The final larval stage of barnacles is the cypris larva (Plate 271 a). Metamorphosis into a cyprid usually follows five or six planktotrophic nauplius stages and the time that the cypris of Sessilia spends in the plankton is few days. During this part of the life cycle, the cypris searches for a place to settle. It explores surfaces with modified antennules; once the cypris has found a potentially suitable area, it attaches using its attachment antenna (A.a. in Plate 271 a) and a secreted glycoproteinous substance.

Reference: Nicholson, 2006.

Family Balanidae Leach, 1814

Description: Sessile, without a peduncle; scuta and terga (forming the operculum) provided with depressor muscles; the rest of the valves immovably united together. Body, formed of six thoracic segments, generally furnished with six pairs of limbs; abdomen rudimentary, but often bearing caudal appendages.

Reference: Nicholson, 2006.

Genus *Balanus*

Balanus amphitrite Darwin, 1854 (Plate 271 a-b)

Distribution: Hard substrates from Shuwaikh to Ras Al-Zour.

***Balanus* sp.**

Distribution: Hard substrates from Shuwaikh to Ras Al-Ardh.

Plate 271. ***Balanus amphitrite,*** **a. cypris larva; b. adult stage.**
A.a. – attachment antenna.

Genus ***Euraphia***
Euraphia withersi (Pilsbry, 1916) (Plate 272)
Distribution: Hard substrates in Doha Port, Kuwait Bay.

Plate 272. Colony of ***Euraphia withersi*** **on the rock in Doha Port.**

Genus *Megabalanus* Hoek, 1913
Megabalanus tintinnabulum (Linnaeus, 1758) (Plate 273)
Distribution: Hard substrates in Khor Al-Sabbiya and Kuwait Bay.

Plate 273. ***Megabalanus tintinnabulum*****, general view.**

***Megabalanus* sp.** (Plate 274)
Distribution: Hard substrates on Qaruh Island.

Plate 274. ***Megabalanus* sp., general view.**

Class MALACOSTRACA

Order Amphipoda

Amphipods typically have a shrimp-like body, flattened from side to side. Unlike many crustaceans, they have no carapace over the thorax, which is not visibly divided from the abdomen in most species. The head has two well-developed antennae, and, in most cases, a pair of compound eyes. Some deepwater species have their eyes divided into upper and lower portions, so that they effectively have four eyes in total. Most amphipods have eight pairs of thoracic limbs. The first pair is fused at the base, and modified to act as mouthparts. The second and third pairs, or gnathopods, are enlarged and include pincer-like structures used to help gather food, while the remaining pairs are essentially unmodified. While similar patterns of thoracic limbs are found in other crustaceans, the arrangement of the six pairs of abdominal limbs is unique to the group. The first three pairs are pleopods, adapted for swimming, while the other three are uropods.

Suborder Gammaridea

Family Ampeliscidae Costa, 1857

Description: Urosomites 2-3 coalesced. Pereopods 5- alike but pereopod 7 of distinct structure, article 2 with distinct, usually broad posteroventral lobe, article 2 of pereopods 5-6 rhomboid or diamond shaped and poorly lobed. Eyes when present composed of internal pigment masses served by 2-4 external cuticular lenses. Accessory flagellum is absent. Article 4 of pereopods elongate, article 6 much shorter than 4 and article 5 much shorter than 6, these pereopods glandular. Head is very large. Gnathopods are feeble. Uropod 3 biramous. Telson is laminar.

Genus *Ampelisca* Krøyer, 1842

Description: Flagella of antennae 1-2 with 5 or more articles. Article 3 of maxilliped palp unproduced. Article 2 of pereopod 7 with posterior margin oblique and article expanding ventrally, rarely parallel to anterior margin, anterior margin of posteroventral lobe near junction with article 2 not setose. Telson much longer than broad, cleft much more than half its length.

***Ampelisca* sp.** (Plate 275 a-d)

Distribution: Muddy and silty substrates around Failaka Island, in Kuwait Bay and in Khor Al-Sabbiya.

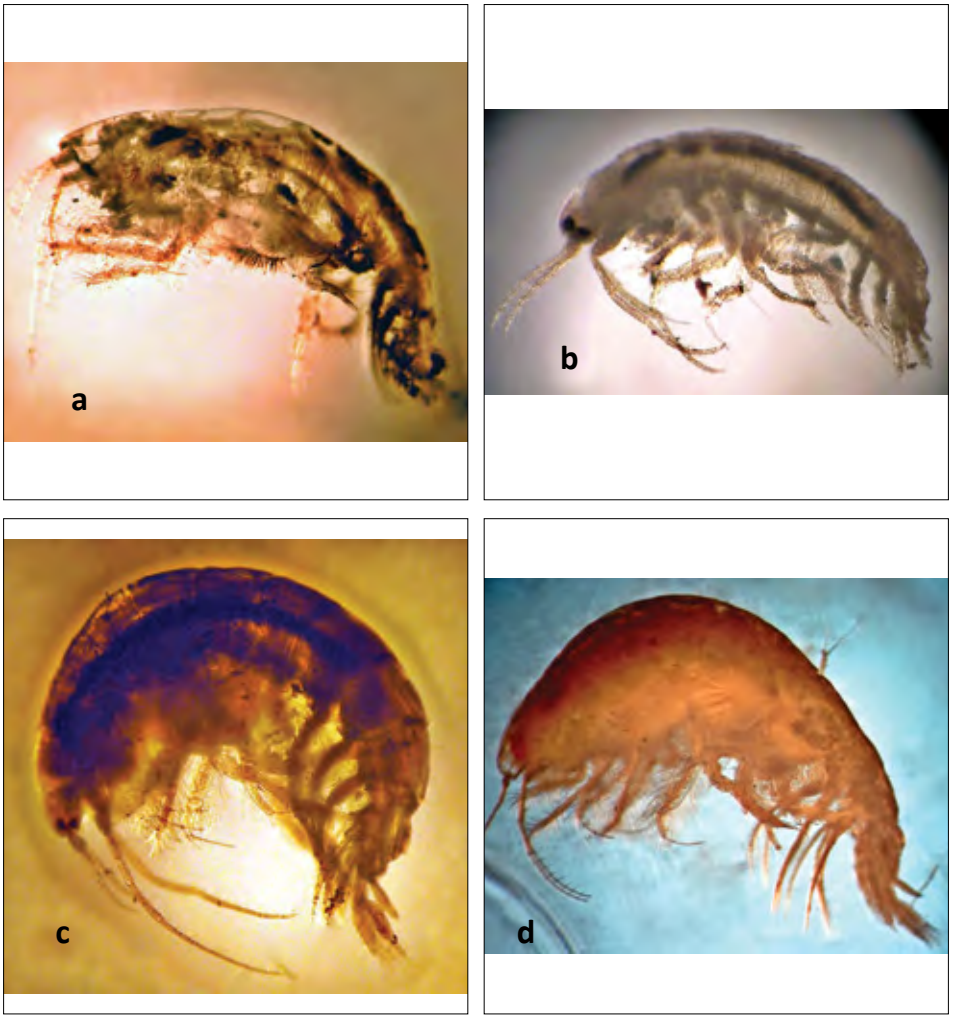


Plate 275. ***Ampelisca*** **sp., a-d. general view.**

Genus *Byblis* Boeck, 1871
Description: Flagella of antennae 1-2 with 5 or more articles. Article 3 of maxillipedal palp unproduced. Article 2 of pereopod 7 with posterior margin oblique and article expanding ventrally and strongly extended, anterior margin of posteroventral lobe near junction with article 2 setose. Telson varying from rarely as long as to usually shorter than broad, cleft or incised less than half its length.

***Byblis* sp.** (Plate 276)
Distribution: Kuwait's marine environment.

Plate 276. *Byblis* sp., general view.

Family Ampithoidae Stebbing, 1899
Description: Corophioid either with outer lobes of lower lip notched or with inner ramus of uropod 3 as short as (shortened) outer ramus and broad, pad-like and apically setose, or outer ramus of uropod 3 with 1-2 large articulate apical spines divergent from axis of ramus.

Genus *Ampithoe* Leach, 1814
Description: Body laterally compressed, smooth normal, urosomites free, urosomite 1 ordinary. Rosrum short, ocular lobes short, blunt, antennal sinus weak I moderate. Eyes ordinary. Antennae of various lengths often subequal or 1 longer than 2, both slender or antenna 2 stout; peduncular article 3 of antenna 1 mn shorter than 1, articles 2-3 longest, accessory flagellum absent. Antenna 2 peduncular article 3 short, peduncle often stout in male. Epistome unproduced anteriorly Labrum subrounded, entire. Mandible normal, pallp strong, article 3 rarely semi-falciform, usually rectolinear or clavate, article 3 longer than 2. Labium with notched outer lobes, with well-developed inner lobes, mandibular lobes long, blunt. Inner plate of maxilla 1 is triangular, with one apical seta, outer plate with 7 spines, palp 2-articulate. Outer plates of maxilla 2 rather broad, inner plate with weakly mediofacial row of setae. Inner plate of maxilliped with distal spines, outer plate normal, exceeds apex on palp article 2, with spines on medial margin, palp with 4 articles, article 2 short, article 3 unlobed, article 4 short with medium nail and setae. Coxae

relatively long, weakly overlapping, progressively but slightly elongate from 1 to 4, coxa 1 dilated, produced forward, coxa 2 larger than 1, often dilated, coxa 4 longer than coxa 1, unlobed, coxa; 5 as long as 4, coxae 6-7 much smaller than anterior coxae.
Gnathopods 1-2 weakly diverse, gnathopod 2 slightly to greatly larger than 1, gnathopod 1 (weakly) subchelate, article 5 as long as or shorter than 6, poorly lobed, propodus expanded, palm oblique. Gnathopod 2 enlarged, subchelate, with article 2 only distally dilated, with article I 4 often extended distally along posterior margin of article 5, article 5 shorter than 6, lobed, article 6 dilated, sometimes with false chela, dactyl ordinary.
Pereopods 3-4 normal, similar, with slender or weakly inflated article 2, article 4 dilated, dactyls short. Pereopods 5-7 similar to each other, progressively longer, occasionally prehensile, pereopod 5 shorter than and different from pereopods 6-7, with broader article 2, pereopods 6-7 with narrower unlobed article 2, dactyl of pereopods 5-7 short, curved.
Sternal processes of thorax absent. Coxal gills present on segments 2-6. Pleopods normal. Epimeron 3 not bisinuate. Uropods 1-2 biramous, normal, rami slightly unequal, much shorter than (1) or as long as (2) peduncle, peduncle of uropods 1-2 with obsolescent or without ventrodistal process, when present strongly blunted. Uropod 3 stout and conspicuous but short, biramous, both rami very short, peduncle longer than rami, outer ramus recurved apically, with 2 distal hook-spines, inner ramus often longer than outer ramus, broad and pad-like and apically setose. Telson entire, as broad as long, ovate, semi-circular or pentagonal, with hooked apical cusps, these occasionally enlarged.

***Ampithoe* sp.** (Plate 277)
Distribution: Intertidal zone of Ras Al-Ardh.

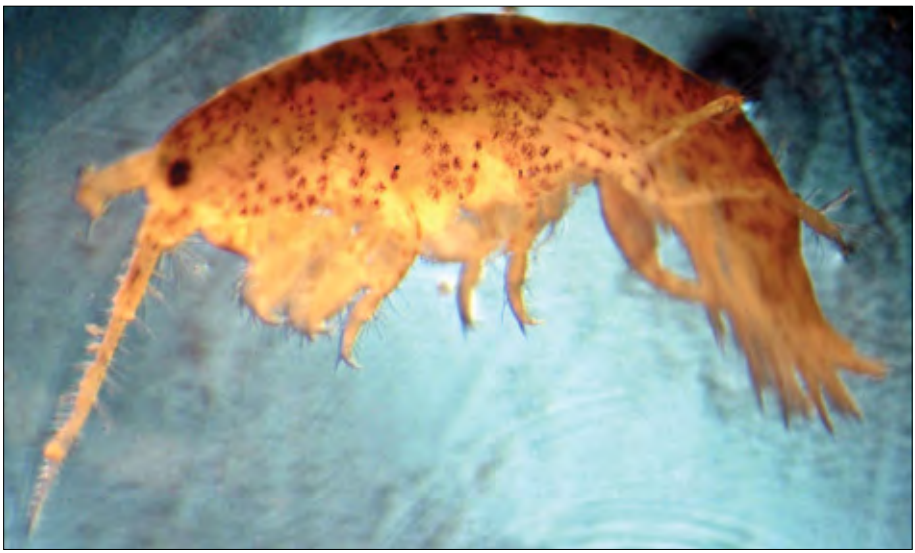


Plate 277. ***Ampithoe* sp., general view.**

Genus *Cymadusa* Savigny, 1816

Description: Body laterally compressed, smooth, normal, urosomites free, urosomite 1 ordinary. Rostrum is short, ocular lobes obsolescent, blunt, antennal sinus weak. Eyes ordinary. Antennae nearly subequal, 1 longer than 2, 1 slender, antenna 2 slightly stout; peduncular article 3 of antenna 1 shorter than 1, articles 1 -2 longest, accessory flagellum 1 to 2-articulate or scalelike. Antenna 2 peduncular article 3 short, peduncle slightly stout in male. Epistome unproduced anteriorly I Labrum subrounded, entire. Mandible normal, palpi strong, article 3 rectolinear or weakly clavate, article 3 as long as 2. Labium with weakly (type) notched outer lobes, with well-developed inner lobes, mandibular lobes long, blunt. Inner plate of maxilla 1 is short, with a row of medial setae, outer plate with 9 spines, palp 2-articulate. Outer plates of maxilla 2 broad or not, inner narrow, inner plate with mediofacial row of setae. Inner plate of I maxilliped with distal spines, outer plate long, reaching apex of palp article 2, with spines on medial margin, palp with 4 articles, article 2 short, article 3 unlobed, article 4 long, with medium nail. Coxae ordinary to long, strongly overlapping, progressively elongate from 1 to 4, coxa 1 dilated, produced forward, coxa 4 longer than coxa 1, not lobed, coxa 5 as long as 4, coxae 6-7 much smaller than anterior coxae.

Gnathopods 1-2 weakly diverse; densely setose gnathopod 2 larger than 1, gnathopod 1 in male weakly subchelate, article 5 longer than 6, poorly or broadly lobed, article 6 slightly expanded, palm oblique. Gnathopod 2 enlarged, subchelate, with article 2 not dilated, very setose, with article 4 enlarged, extended along posterior margin of article 5, weakly merochelate, article 5 shorter than 6, more slender than 6, lobed, article 6 dilated, sometimes with false chela, dactyl ordinary.

Pereopods 3-4 normal, similar, with slender article 2, article 4 dilated, dactyls short. Pereopods 5-7 similar to each other, progressively longer, scarcely prehensile, pereopod 5 shorter and different from pereopods 6-7, with broader article 2, pereopods 6-7 with narrower unlobed article 2, dactyl of pereopods 5-7 short, curved.

Sternal processes of thorax absent. Coxal gills [undescribed, present on segments 2-6]. Pleopods normal. Epimeron 3 bisinuate. Uropods 1-2 biramous, normal, stout, rami slightly unequal, much shorter (1) or longer (2) than peduncle, peduncle of uropods 1-2 with ventrodistal process, that of uropod 2 smaller to obsolescent. Uropod 3 of ordinary length, biramous, both rami short, peduncle longer than rami, outer ramus with 2 distal hook-spines, inner ramus longer than outer ramus, broad, pad-like and apically setose. Telson entire, short, broader than long, pentagonal with 2 hooked apical cusps.

***Cymadusa* sp.**

Distribution: Intertidal zone of Ras Al-Ardh.

Family Cyproideidae Barnard, 1974
Description: Coxae 3-4 immensely broadened, with contiguous margins abutting or when weakly overlapping fitting together along rabbeted acclivities; coxae 1-2 very small, coxa 2 mostly hidden by coxa 3. Peduncle of uropod 3 elongate. Telson entire.

Genus *Cyproidea* Haswell, 1880
Description: Mandible with 3-articulate palp. Palp of maxilla 1 1-articulate. Gnathopod 1 large, subchelate, weakly carpochelate. Propodus large, palm very oblique; gnathopod 2 large, subchelate, fully carpochelate, propodus small, palm almost transverse. Article 2 of pereopods 5-7 rectolinear. Urosomite 1 not elongate, not dorsally keeled; uropod 3 vaulting over telson. Telson short, reaching middle of peduncle on uropod 3.
Article 2 of antenna 1 dorsally crested and apically toothed. Mandibular molar is medium to small, poorly or not triturative. Mandibular lobes of lower lip obsolescent (type) or not. Inner plate of maxilla 1 of medium size (type) to very small, outer plate with 6-8 main spines. Outer plate of maxilliped feeble. Pleonite 3 unproduced posterodorsally. Inner and outer rami of uropods 1-3 extending subequally.

***Cyproidea* sp.** (Plate 278)
Distribution: Kuwait's marine environment.

Plate 278. *Cyproidea* sp., general view.

Family Corophiidae Dana, 1849
Description: Accessory flagellum variable, often absent; urosome visibly depressed; urosomal segment 2 subequal to segment 1 in length; telson entire; pereopods often glandular.

Genus *Corophium* Latreille, 1806
Description: Body cylindrical, depressed, smooth urosomites free, or 1-3 coalesced but marked ventrally by sutures, 3 not coalesced with telson; urosomite ordinary. Rostrum short to long, thorn-like, ocular lobes short to moderate, often produced forward, pointed or blunt; antennal sinus deep. Eyes small. Antennae of various lengths, 1 shorter than 2, 1 slender, antennal stout; peduncular article 3 of antenna 1 shorter than 1. Article 1 longer or equal 2; accessory flagellum vestigial or absent. Antenna 2 gland cone usually spur-like, peduncular article 3 short, peduncle stouter in male but very stout in both sexes, article 4 massive, 5 less massive, both sculptured and spinose, less strongly so in female, flagellum very short, 2-articulated. Epistome 1 unproduced anteriorly. Labrum subrounded, entire or deeply incised. Mandible normal, palp weak, very slender, with 2-3 articles, article 1 usually missing, article 3 rectolinear, shorter than or as long as 2, attached to 2 usually in geniculate fashion, article 2 often produced apically. Labium with entire outer lobes, with well-developed inner lobes, mandibular lobes short, blunt. Inner plate of maxilla 1 triangular, short to vestigial, without setae, outer plate with 7 spines, palp 2-articulate. Plates of maxilla 2 ordinary to narrow, diverse or not, inner plate with mediofacial row of setae barely submarginal or with only mediomarginal setae. Inner plate of maxilliped normal or often reduced, slender, pointed, with distal setae, outer plate long, reaching apex of palp article 2, with spines or setae only on medial margin, palp with 4 articles, article 2 long, article 3 unlobed, article 4 short, with long nail and setae.

Coxae very small, short, discontiguous, of various sizes and shapes, progressively shorter from 1 to 4, coxa 1 dilated, produced forward, coxa 2 short, coxa 4 shorter than coxa 1, not lobed, coxa 5 as long as 4, coxae 6-7 barely smaller than anterior coxae. Gnathopods 1-2 diverse, of subequal size, small, both with linear articles, densely setose, gnathopod 2 slightly larger than 1, gnathopod 1 in male subchelate, article 5 long, linear, unlobed, palm short and transverse or oblique, Gnathopod 2 simple, linear, with article 4 enlarged, inflated, heavily setose, incipiently merochelate, grossly extended and fused distally along posterior margin of article 5, article 5 shorter than 6, unlobed, article 6 narrow, more slender than article 5, dactyl ordinary.

Pereopods 3-4 abnormal, longer than gnathopods, similar, with slightly inflated article 2, article 4 dilated, article 5 tiny, dactyls long. Pereopods 5-6 much shorter than and different from pereopod 7, with narrower article 2, tiny reniform article 5 with facial spination, pereopods 5-7 with narrow, setose, unlobed article 2, pereopods 6-7 with differently pointing dactyl; articles 4-6 of pereopod 7 elongate, dactyl of pereopods 5-7 short, curved, without accessory spine on outer margin. Sternal processes of thorax absent. Coxal gills present on segments 3-6. Pleopods with dilated peduncle. Epimeron 3 bisinuate or not.

Uropods 1-2 biramous, normal, stout, rami slightly unequal or equal, on uropod 1 much shorter, on uropod 2 longer than peduncle, peduncle without ventrodistal process. Uropod 3 very short, uniramous, peduncle usually shorter than ramus, very short, peduncle not dilated medially, single ramus 1-articulate, foliaceous or narrow, obtuse distally, broad and pad-like and marginally setose. Telson entire, short, broader than long, ovate or heart-shaped or pentagonal, lacking major armaments.

***Corophium* sp.** (Plate 279)
Distribution: Intertidal zone of Ras Al-Ardh.

Plate 279. *Corophium* sp., general view.

Genus *Siphonoecetes* Krøyer, 1845

Description: Body cylindrical, depressed, smooth, urosomites 1-2 free, 3 not coalesced with telson. Rostrum short, thorn-like, pointed or blunt, lacking subrostral projection, ocular lobes elongate, produced forward, blunt. Antennal sinus is deep. Eyes are weak. Antenna 1 much shorter than 2, 1 slender, antenna 2 stout; peduncular article 3 of antenna 1 slightly shorter than 1, article 2 longest, accessory flagellum absent. Antenna 2 peduncular segment 3 elongate, peduncle stout in male, flagellum with 1 long, 1 shorter and 2 tiny articles. Epistome unproduced anteriorly. Labrum subrounded, entire or weakly incised. Mandible normal, palp strong but very slender, with only 2 articles, article 2 tiny. Labrum with entire outer lobes, with well-developed inner lobes, mandibular lobes long, weakly pointed. Inner plate of maxilla 1 vestigial, lacking setae, outer plate with 6 spines, palp 2-articulate. Plates of maxilla 2 ordinary, inner plate with or without mediofacial row of setae, otherwise with mediomarginal setae. Inner plate of maxilliped with distal spines, outer plate normal, not exceeding apex of palp article 2, with spines on medial margin, palp with 4 articles, article 2 long, article 3 unlobed, article 4 very short, with long nail and setae.

Coxae small, relatively short, discontiguous, of various sizes and shapes, progressively shortened from 1 to 4, coxa 1 not dilated, occasionally produced forward, coxa 2 larger than 1, weakly produced or not, coxa 4 not lobed, coxa 5 nearly as long as 4, coxa 7 smaller than anterior coxae; coxae 3-4 with dentate margin and stout pectinate setae. Gnathopods 1-2 are diverse, small, first occasionally with linear articles, gnathopod 1 slightly longer than 2, gnathopod 1 in male poorly subchelate, article 5 longer than 6, unlobed. Gnathopod 2 slightly enlarged, weakly subchelate or simple, with article 2 dilated, very spinose, article 5 shorter than 6, lobed, more slender than article 5; dactyl long.

Pereopods 3-4 alike, unusual, with inflated article 2, article 4 dilated, dactyls long. Pereopods 5-7 dissimilar to each other, with weakly expanded article 2. Pereopods 5-6 then 7 progressively longer; pereopods 5-6 shorter than and different from pereopod 7, with broader, anteriorly lobed article 2, with short and reniform article 5 like pereopods 3-4, pereopod 7 with broad unlobed heavily setose article 2, articles 4-6 slender, dactyls of pereopods 5-7 short, geniculate, with accessory tooth. Coxal gills present on segments 3-6. Pleopods with dilated peduncle. Epimeron 3 not bisinuate.

Uropods 1-2 are biramous, stout, rami slightly unequal, much shorter than peduncle, inner ramus much shorter than outer; peduncle of uropod 1 without ventrodistal process. Uropod 3 small, single ramus shorter than peduncle, obtuse and setose distally, peduncle dilated medially, armed with several long apical pectinate setae or not. Telson entire, short, broader than long, ovate or softly triangular, with 2 apical patches of hooks.

***Siphonoecetes* sp.** (Plate 280)
Distribution: Muddy substrates in Khor Al-Sabbiya.

Plate 280. *Siphonoecetes* sp., general view.

Family Isaeidae Dana, 1855
Description: Body smooth. Coxae usually deep, rarely shallow, often ventrally setose; coxae 2-5 often largest; coxa 4 not excavate behind; coxa 5 with deep anterior lobe. Rostrum generally absent; head strongly recessed at insertion of A2; eye lobes often extended, sometimes bearing eyes on proximal or distal portion. Antennae subequal in length or A2 longer; antennae elongate, slender, primary flagellum often shorter than peduncles, frequently setose; A2 never sexually dimorphic, accessory flagellum variable. Labrum ventral margin weakly excavate or notched, epistome often strongly produced, acute. Labium with distinct inner lobes, mandibular processes never attenuated. Mandible molar strong; palp slender, 3-articulate, article 3 generally spatulate, terminally setose. Mxl inner plate small with 1 to several apical setae, outer plate generally with 10 spines, palp large. Mx2 with inner and outer plates well developed. Mxp plates strong. Gn2 subchelate, sexually dimorphic, always enlarged in male and generally larger than Gnl. P3-4 basis usually not expanded; dactyli with gland ducts. P5-7 elongate; P7 slightly longer than P6. Pleopod peduncles normal. Ul-2 slender; Ul peduncle rarely with distoventral spine-like process, rami generally subequal. U3 sometimes projecting beyond Ul-2, peduncle often elongate, inner ramus tending to reduction, sometimes absent; terminal spines of rami simple. Telson short, thick, fleshy, entire, sometimes with dorsolateral crests. Coxal branchiae sac-like on pereon segs 2-6. Oostegites large, laminar, smallest on seg 5.

Genus *Cheiriphotis* Walker, 1904

Description: Body laterally compressed, smooth, normal; urosomites free, urosomite 1 ordinary. Rostrum short, ocular lobes short, pointed, antennal sinus weak to deep. Eyes small. Antennae of medium length, nearly subequal, both slender, peduncular article 3 of antenna 1 shorter than 1, articles 1-2 longest, accessory flagellum pluriarticulate. Antenna 2 peduncular article 3 short**,** flagellum often short. Epistome unproduced anteriorly. Labrum incised. Mandible normal, palp strong, slender, article 3 rectolinear or clavate, article 3 scarcely shorter than 2. Labium with entire outer lobes, with well-developed inner lobes, mandibular lobes short, pointed. Inner plate of maxilla 1 triangular, large, with a row of medial setae, outer plate with 9 spines, palp 2-articulate. Plates of maxilla 2 ordinary, inner plate with mediofacial row of setae. Inner plate of maxilliped with distal spines, outer plate normal, not reaching apex of palp article 2, with spines on medial margin, palp with 4 articles, article 2 long, article 3 unlobed, article 4 long, stubby, with long nail and setae.

Coxae small, relatively short, weakly overlapping, of various sizes and shapes, progressively elongate from 2 4, spiniform, coxa 1 dilated, produced forward, coxa 2 shorter than 1, broad, coxa 4 not longer than coxa 1, not lobed, coxa 5 as long as 4, coxae 6-7 smaller than anterior coxae. Gnathopods 1-2 diverse; gnathopod 2 greatly larger than 1, gnathopod 1 in male subchelate, article 5 long, unlobed, longer than 6. Gnathopod 2 enlarged, subchelate, with article 2 slightly dilated, with article 4 enlarged, extended distally along posterior margin of article 5, article 5 shorter than 6, very short, often seemingly absent or fused to article 4, lobed, article 6 greatly dilated, sometimes with false chela or processes on posteroproximal margin, dactyl long. Pereopods similar, with inflated article 2, article 4 dilated, dactyls short. Pereopods 5-7 similar to each other, progressively longer, pereopod 5 much shorter than pereopod 7, pereopods 5-7 with broad, lobed, setose article 2, dactyl of pereopods 5-7 curved, medium. Sternal processes of thorax absent. Coxal gills [undescribed, present on segments 2-6]. Pleopods normal. Epimeron 3 is bisinuate. Uropods 1-2 biramous, stout, rami subequal, much shorter than peduncle, peduncle of uropods 1-2 without ventrodistal process. Uropod 3 small, very short, uni- or biramous, both rami very short, almost spine-like, peduncle plate-like, longer than rami but very short, often dilated medially (when inner ramus absent), outer ramus with small article 2 or spine, inner ramus scale-like, shorter than outer ramus or lost in adults. Telson entire, short, broader than long, semicircular, pointed apically, with 2 hooked apical cusps.

***Cheiriphotis* sp.** (Plate 281)

Distribution: Muddy substrates between Bubiyan and Failaka Islands and in Khor Al-Sabbiya.

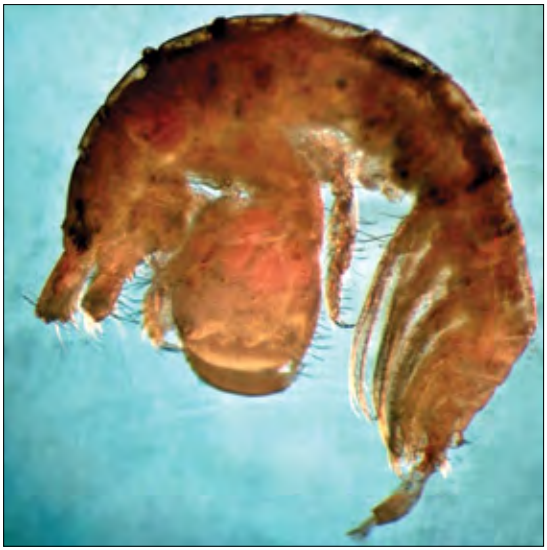


Plate 281. ***Cheiriphotis*** **sp., general view.**

Genus ***Microphotis*** Ruffo, 1952
Description: Similar to *Photis*, but main flagellar articles of antennae 1-2 very few; coxae short, coxa 1 dilated, produced forward; article 5 of gnathopod 2 poorly lobed; article 6 of pereopods 3-4 with only 2 locking setae on posterior margin, no other armaments; dactyl of pereopods 5-7 geniculate but dactyl of pereopod 5 lacking tooth; peduncle of uropod 1 with ventrodistal process; uropod 3 small, uniramous, single ramus shorter than peduncle, 1-articulate, peduncle also short.

Microphotis blachei (Plate 282)
Distribution: Muddy substrates near Failaka Island.

Isaeidae gen .sp.
Distribution: Muddy and silty substrates in Kuwait Bay.

Plate 282. ***Microphotis blachei*****, general view.**

Family Ischyroceridae Stebbing, 1899

Description: Lateral cephalic lobes moderately to strongly produced, subocular margin often deeply excavate. Al-2 subequal or A2 larger, accessory flagellum reduced or absent. Labrum ventral margin rounded or weakly excavate, epistome produced anteriorly; labium with mandibular projection of outer plate generally rounded or subacute; mandibular palp 3-articulate, art 2 the longest, art 3 truncate; Mxl inner plate small with reduction of setae often to 0 or 1; Mx2 inner plate posterior margin setiferous. Coxa 4 not excavate posteriorly. Gn2 in male larger than Gnl, sometimes carpochelate. P3-4 glandular. U3 rarely projecting beyond Ul-2, biramous or uniramous, peduncle strong, rami shorter than peduncle, outer ramus uncinate, with hooked teeth at apex.

Genus Ericthonius Milne-Edwards, 1830

Description: Body subcylindrical, slightly depressed, smooth, urosomites free, urosomite 1 ordinary. Rostrum short, ocular lobes short, pointed, antennal sinus deep. (Head as long as pereonites 1-2 together). Eyes are medium to large, weak or absent. Antennae long, subequal, both slender, peduncular article 3 of antenna 1 longer than 1, articles 2-3 longest, accessory flagellum vestigial or absent. Antenna 2 peduncular article 3 scarcely elongate. Epistome produced anteriorly. Labrum subrounded, entire. Mandible normal, palp strong, article 3 clavate, shorter than 2. Labium with entire outer lobes, with well-developed inner lobes, mandibular lobes long, pointed. Inner plate of maxilla 1 triangular, with a row of medial setae, outer plate with 7 spines, palp 2-articulate. Plates of maxilla 2 ordinary, inner plate with mediofacial row of setae. Inner plate of maxilliped with distal spines, outer plate short, reaching halfway to apex of palp article 2, with spines on medial margin, palp with 4 articles, article 2 long, article 3 unlobed, article 4 short, with long setae.

Coxae very small, short, weakly contiguous or not, of various sizes and shapes, not progressively elongate from 1 to 4, coxa 1 not dilated, not produced forward, coxa 2 larger than 1, coxa 4 not longer than coxa 1, not lobed, coxa 5 longer than 4, coxae 6-7 not much smaller than anterior coxae. Gnathopods 1-2 diverse, gnathopod 2 greatly larger than 1, gnathopod 1 in male subchelate, article 5 longer than 6, lobed. Gnathopod 2 enlarged, weakly subchelate, linear, carpochelate in male, with article 2 not dilated, article 4 extended along posterior margin of article 5, with process on posterodistal margin, dactyl long.

Pereopods 3-4 similar, with inflated article 2, article 4 dilated, dactyls short. Pereopods 5-7 similar to each other, progressively longer, pereopod 5 shorter than pereopods 6-7, pereopods 5-7 with medium-narrow almost lobed article 2, pereopods 6-7 with longer curved dactyl, dactyl of pereopod 5 almost geniculate, without accessory spine on outer margin. Sternal processes of thorax absent. Coxal gills present on segments 2-6. Pleopods normal. Epimeron 3 not bisinuate. Uropods 1-2 biramous, normal (see Variables), rami slightly unequal, shorter than peduncle, peduncle of uropods 1-9 without ventrodistal process. Uropod 3 small uniramous, single ramus short, recurved apically, will distal hooks, peduncle elongate, longer than ramus. Telson entire, short, reduced, broader than long, rectangular, emarginate apically, covered with hooks.

***Ericthonius* sp.** (Plate 283)

Distribution: Muddy substrates between Bubiyan and Failaka Islands.

Plate 283. ***Ericthonius*** **sp., general view.**

Family Lysianassidae Dana, 1849
Description: Article 3 of gnathopod 2 elongate, remainder of appendage forming mitten apically; peduncle of antenna 1 short and stout, articles 2-3 much shorter than 1 and partly telescoped basally.

Genus ***Orchomene*** Boeck, 1871
Description: Mouthparts forming quadrate bundle. Labrum and epistome typically differentially produced, prominent, separate, usually epistome slightly to strongly dominant in size and projection, blunt. Incisor ordinary; molar weakly triturative or simple, medium to small, occasionally conicolaminate or subconical, setulose, palp attached strongly proximal to molar. Inner plate of maxilla weakly (2) setose; palp 2-articulate, large. Inner and outer plates of maxilliped well developed, palp slightly exceeding outer plate, dactyl well developed. Coxa 1 large and visible, not tapering. Gnathopod 1 subchelate, palm oblique to transverse, articles 5 and 6 subequal, or 5 shorter than 6, dactyl medium; article 6 of gnathopod shorter than article 5, ordinary, propodus minutely subchelate. Inner ramus of uropod 2 without notch. Uropod 3 ordinary, peduncle ordinary, inner ramus slightly shortened, outer ramus 2-articulate. Telson ordinary, weakly to deeply (type) cleft or emarginate or entire.

Orchomene **sp.** (Plate 284)
Distribution: Kuwait's marine environment.

Plate 284. ***Orchomene sp.*****, general view.**

Family Melitidae Bousfield, 1973

Description: Head free, not coalesced with peraeonite 1; exposed; as long as deep, or longer than deep; anteroventral margin notched (not complete), anteroventral corner rounded or subquadrate or hooked; rostrum present or absent, short; eyes present, well developed or obsolescent, or absent; not coalesced; 1 pair; not bulging. Body laterally compressed; cuticle smooth.

Antenna 1 subequal to antenna 2, or longer than antenna 2; peduncle with sparse robust and slender setae; 3-articulate; peduncular article 1 shorter than article 2, or subequal to article 2, or longer than article 2; antenna 1 article 2 longer than article 3; peduncular articles 1-2 not geniculate; accessory flagellum present; antenna 1 callynophore absent. Antenna 2 present; short, or medium length; articles not folded in zigzag fashion; without hook-like process; flagellum shorter than peduncle; 5 or more articulate; not clavate; calceoli absent.

Mouthparts well developed. Mandible incisor dentate; lacinia mobilis present on both sides; accessory setal row without distal tuft; molar present, medium, triturative or non-triturative; palp present. Maxilla 1 present; inner plate present, strongly setose along medial margin; palp present, not clavate, 2 -articulate. Maxilla 2 inner plate present; outer plate present. Maxilliped inner and outer plates well developed or reduced, palps present, well developed or reduced; inner plates well developed, separate; outer plates present, large or small; palp 4-articulate, article 3 without rugosities. Labium is smooth. Peraeonites 1-7 separate; complete; sternal gills absent; pleurae absent.

Coxae 1-7 well developed, none fused with peraeonites. Coxae 1-4 longer than broad or broader than long, overlapping, coxae not acuminate. Coxae 1-3 not successively smaller, none vestigial. Coxae 2-4 none immensely broadened.

Gnathopod 1 not sexually dimorphic; smaller (or weaker) than gnathopod 2, or subequal to gnathopod 2; subequal to coxa 2; gnathopod 1 merus and carpus not rotated; gnathopod 1 carpus/propodus not cantilevered; subequal to propodus, or longer than propodus; gnathopod 1 not produced along posterior margin of propodus; dactylus large. Gnathopod 2 sexually dimorphic; subchelate; coxa subequal to but not hidden by coxa 3; ischium short; merus not fused along posterior margin of carpus or produced away from it; carpus/propodus not cantilevered, carpus short, shorter than propodus, slightly produced along posterior margin of propodus or not produced along posterior margin of propodus.

Peraeopods heteropodous (3-4 directed posteriorly, 5-7 directed anteriorly), none prehensile. Peraeopod 3 well developed. Peraeopod 4 well developed. 3-4 not glandular; 3-7 without hooded dactyli, 3-7 propodi without distal spurs. Coxa well developed, longer than broad; carpus subequal to propodus, not produced; dactylus well developed. Coxa subequal to coxa 3 or larger than coxa 3, not acuminate, with well developed posteroventral lobe or with small posterior lobe or without posteroventral lobe; carpus not produced. Peraeopods 5-7 with few robust or slender setae; dactyli without slender or robust setae. Peraeopod 5 well developed; shorter than peraeopod 6; coxa smaller than coxa 4, without posterior lobe; basis expanded, with posteroventral lobe or without posteroventral lobe; merus/carpus free; carpus linear; with a few subterminal setae. Peraeopod 6 subequal in length to peraeopod 7; merus/carpus free; dactylus with a few subterminal setae. Peraeopod 7 with 6-7 well developed articles; longer than peraeopod 5; similar in structure to peraeopod 6; with 7 articles; basis expanded, without dense slender setae; dactylus with a few subterminal setae. Pleonites 1-3 with transverse dorsal serrations or without transverse dorsal serrations, without dorsal carina; without slender or robust dorsal setae. Epimera 1-3 present. Epimeron 1 well developed. Epimeron 2 setose, or without setae.

Urosome not dorsoventrally flattened; urosomites 1 to 3 free; urosomite 1 longer than urosomite 2, or much longer than urosomite 2; urosome urosomite 1 bicarinate, or urosomites not carinate; urosomites 1-2 without transverse dorsal serrations. Uropods 1-2 apices of rami with robust setae. Uropods 1-3 radically dissimilar in structure and size, or similar in structure and size. Uropod 1 peduncle without long plumose setae, with 1 or 2 basofacial robust setae, without ventromedial spur. Uropod 2 well developed; without ventromedial spur, without dorsal flange; inner ramus subequal to outer ramus, or longer than outer ramus. Uropod 3 not sexually dimorphic; peduncle short; outer ramus longer than peduncle, 1-articulate or 2-articulate, without recurved spines. Telson laminar; deeply cleft; longer than broad, or as long as broad; apical robust setae present.
Reference: Lowry and Springthorpe, 2001.

Genus *Ceradocus* Costa, 1853
Description: Accessory flagellum 3- or more articulate; lower lip with inner lobes; inner plate of maxilla 1 densely setose medially, of maxilla 2 moderately to strongly setose madially; gnathopods normal; uropod 3 exceeding uropod 1, rami equal, lanceolate, broad or slender, outer 1-articulate; telson deeply cleft; palp article 3 of mandible half as long as article 2 (*Metaceradocus, Elasmopoides*), article 3 of palp with medial process or spines or cusp.

***Ceradocus* sp.** (Plate 285)
Distribution: Kuwait's marine environment.

Plate 285. *Ceradocus* sp., general view.

Genus *Eriopisa* Stebbing, 1890
***Eriopisa* sp.**
Distribution: Muddy and silty substrates in Kuwait Bay.

Genus *Melita* Leach, 1814
Description: Body smooth or with dorsal teeth. Eyes present or absent. Al peduncle long, accessory flagellum with 1 or several arts. A2 shorter than Al. Coxae moderately long. Labrum entire, labium with inner lobes. Mandibular palp 3-articulate, art 3 not falciform. Mxl inner plate conical or triangular, outer plate with 7-9 spines, palp 2-articulate, usually dissimilar. Mx2 plates narrow, inner plate without medial row of setae. Mxp well developed, palp 4-articulate. Gnl small, subchelate, propodus in some species anterodistally produced. Gn2 large, subchelate. P3-7 normal. Ul-2 normal. U3 with inner ramus scale-like. Telson cleft nearly to base, lobes acuminate.

***Melita* sp.**
Distribution: Muddy substrates around Failaka Island and in Kuwait Bay.

Melitidae gen. sp.
Distribution: Muddy and silty substrates in Kuwait Bay.

Family Oedicerotidae Liljeborg, 1865
Description: Pereopods 5-6 equally short, pereopod 7 immensely elongate and of different shape than pereopods 5-6; pereopods weakly fossorial; head large, eyes when present dorsally appressed or fused together; telson short, entire or emarginate; apices of rami on uropods 1-2 naked or bearing immersed nails, no subapical spines.

Genus *Perioculodes* Sars, 1895
Description: Cutting edge of mandible projecting and well toothed; molar small, lacking ridges, conical, with apical spines, palp article 3 shorter than 2. Inner lobes of lower lip fused or separated by incision. Gnathopods similar to one another, slender, carpus with sharp strong posterior lobe projecting distalwards and guarding propodus; palm of both gnathopods oblique. Uropod 2 fully reaching end of rami on uropod 3. Uropod 3 well developed.

Perioculodes aequimanus (Korssman, 1880) (Plate 286)
Distribution: Muddy substrates near Failaka Island.

***Perioculodes* sp.**
Distribution: Muddy substrates near Failaka Island and intertidal zone of Ras Al-Ardh.

Plate 286. ***Perioculodes aequimanus*, general view.**

Genus *Synchelidium* Sars, 1895
***Synchelidium* sp.**
Distribution: Muddy and silty substrates in Kuwait Bay.

Genus *Sinoediceros* Shen, 1995
Sinoediceros homopalmatus Shen, 1955
Distribution: Muddy and silty substrates in Kuwait Bay.

Family Platyischnopidae Barnard and Drummond, 1979
Description: Rostrum strong, cylindrical, with subapical ventral retrorse process, cheek poorly developed. Antenna 1 of haustorius form or urothoe form (typical), flagella elongate. Antenna 2 of urothoe form, article 5 slightly to strongly shorter and slightly narrower than article 4, latter without major facial armament, ventral margin with 1 kind of armament, either setae or glassy spines, flagellum often greatly elongate in male and antenna 2 bearing calceoli. Prebuccal complex massive, upper lip dominant, epistome scarcely evident. Mandibles bearing short, broad, phoxocephalid-like incisors with 3 main teeth or stubby modifications thereof, 1 of these widely disjunct; laciniae mobiles present on both sides, alike or not, rakers moderately numerous and serrate, molar of medium size, not triturative, bearing spinules, lacking accessory chopper; palp 3-articulate, article 3 lacking outer setae, all spines concentrated on apical bevel. Lower lip with discrete inner lobes, mandibular extensions of outer lobes well developed. Maxilla 1 with 1-articulate palp, inner plate with fewer than 5 setae. Maxilla 2 ordinary or outer plate enlarged, inner plate with poorly developed oblique facial row of setae. Maxillipeds with unexpanded bases, poorly enlarged plates, outer spinose; palp 4-articulate, article 2 wide but not differentially expanded, article 4 unguiform, with or without nail. No baler lobes on any maxillae or maxillipeds.
Coxae variable but coxa 4 strongly dominant and posterodorsally excavate, thus with posteriorly directed lobe, coxa 3 rectangular, or ventrally narrow, coxae 1-2 of various dimensions. Coxal gills on segments 2-6, 3-7 or 2-7; brood plates slender. Gnathopods feeble or slightly enlarged, alike or not, carpus more or less elongate, propodus elongate or not, strongly or weakly chelate. Article 5 of pereopods 3-4 narrow, with sparse posterior spination; dactyls of pereopods 3-7 well developed or pereopod 5 weakly of haustorius form, articles 2, 4, occasionally 5, expanded, articles 4-5 with weakly developed facial spination; pereopods 6-7 more or less alike but pereopod 7 larger, article 2 usually of modified phoxocephalid form, article 4 of pereopods 6-7 expanded; no pereopod with underslung articulation.
Pleopod 2 not inferior. Peduncles of pleopods much longer than wide, coupling hooks of haustorius kind; inner rami as long as outer (or very nearly), bearing multiple clothespin spines with small inner barbs. Epimeron 1 well developed; epimeron 2 often dominant in size. Urosomites ordinary. Rami of uropods 1-2 styliform or rodlike, spinose; uropod 3 of phoxocephalid form but inner ramus very small to moderate in size, article 2 of outer ramus small to greatly elongate, apices of rami poorly setose. Telson variable, cleft to entire. Sexual dimorphism occurring on antenna 2 and uropod 3.

Genus *Platyischnopus* Stebbing, 1888
Description: Head bearing apical rostral process between antennae. Article 2 of antenna 1 exceeding 1.4 times as long as article 1. Mandibular rakers absent; setae on palp article 2 absent. Coxae 1-3 very short, diverse; coxa 3 distally tapering; posterior lobe of coxa 4 not tapering. Article 5 of gnathopods 1-2 much longer than article 6, gnathopods chelate. Article 5 of pereopod 7 with sharp cusp. Pereonite 3 dorsally naked. Telson lacking lateral brush of setae.

Platyischnopus herdmani Walker, 1904 (Plate 287)
Distribution: Intertidal zone of Ras Al-Zour.

Plate 287. *Platyischnopus herdmani*, general view.

Family Urothoidae Bousfield, 1978
Description: Rostrum weak, head short, ventral cheek strongly developed and projecting ventrally. Antenna 1 of urothoe form, articles 1 -3 elongate, geniculate, flagella short. Antenna 2 of urothoe form, article 4 scarcely expanded, with spines either absent or in seriate ranks, all spines on article 4 apicad, no disjunct spine group basad, ventral margin with 2 kinds of setae, elongate plumes, and smaller penicillates, ventral glassy spines poorly developed or absent, article 5 slightly shorter and narrower than article 4, flagellum variable, usually short in female but in male often greatly elongate as in *Bathyporeia* or phoxocephalids, and flagellum, plus part of peduncle, often furnished with calceoli. Prebuccal complex massive, epistome scarcely distinct, upper lip dominant. Mandibles bearing stubby, poorly toothed incisors; laciniae mobiles, though occasionally vestigial, present on both sides and unlike each other, rakers poorly developed to absent; molar large to medium, minutely fuzzy, almost non-triturative, lacking significant accessory chopper; palp 3-articulate, article 3 rounded apically, setae dominantly apical, with outer setae, setae simple. Lower lip with discrete inner lobes, mandibular extensions of outer lobes well developed. Maxilla 1 with 2-articulate palp, inner plate with fewer than 6 setae. Maxilla 2 ordinary, inner plate with well to poorly developed medial to submarginal row of setae. Maxillipeds with unexpanded bases, normally enlarged plates, outer spinose; palp 4-articulate, article 2 expanded or nasiform, article 4 unguiform to clavate, usually setose, apical nail usually poorly developed. No baler lobes on any maxillae or maxillipeds.

Coxae variable, either of ordinary gammarid form, or coxa 1 very small, or coxa 3 dominant and/or bearing posteroventral lobe, plus other variations. Coxal gills on segments 2-5 or 2-6; brood plates slender. Gnathopods feeble, grossly alike in proportions, carpi elongate, but otherwise highly variable in degrees of palmar development and chelateness, article 3 short. Article 5 of pereopods 3-4 broad, slightly expanded, not deeply lobate, with thick posterior spines; dactyls of pereopods 3-5 well developed, those of pereopods 6-7 variable but usually well developed; pereopod 5 of haustorius form, articles 2, 4, and 5 expanded, articles 4-5 with extensive facial rows of spines in primitive members but declining in derived taxa; pereopods 6-7 alike, or pereopod 7 developed in phoxocephalid fashion, with article 2 broadly expanded and posteroventrally lobate, remainder of articles thin, whole appendage somewhat shortened in comparison to pereopod 6.
Pleopod 2 apparently not inferior; peduncles of pleopods slightly to significantly wider than long, coupling hooks paired on each pleopod; inner rami usually inferior, usually not bearing clothespin hooks (only several species in 2 genera examined). Epimeron 1 strongly developed; epimeron 3 dominant in size and usually in setation. Urosomites ordinary. Rami of uropods 1-2 styliform and spinose or naked or rami absent; peduncles usually only spinose, but 1 genus with linguiform and setose peduncles lacking rami; uropod 3 of ordinary haustorioid-phoxocephalid kind, outer ramus dominant, 2-articulate, peduncle short, flat, expanded; rami poorly setose apically. Telson variable. Antenna 2 with strong sexual dimorphism in several taxa.

Genus *Urothoe* Dana, 1852
Description: Pereopod 7 not of phoxocephalid form, thus article 2 not shield-like (but often large and ovate) and rest of leg not slender and short combined. Uropods 1-2 with rami. Uropod 3 long and slender. Telson ordinary, deeply cleft.

Urothoe grimaldii Chevreux, 1895
Distribution: Intertidal zone of Ras Al-Zour.

***Urothoe* sp.** (Plate 288)
Distribution: Muddy substrates in Khor Al-Sabbiya and intertidal zone of Ras Al-Ardh.

Plate 288. *Urothoe* sp., general view.

Suborder Caprellidea

Family Pariambidae Laubitz, 1993

Description: Head partially or completely coalesced with peraeonite 1; exposed; as long as deep, or longer than deep; rostrum present or absent, short; eyes present, well developed or obsolescent; not coalesced; 1 pair; not bulging. Body cylindrical; cuticle smooth, or processiferous.

Antenna 1 longer than antenna 2; peduncle with sparse robust and slender setae; 3-articulate; peduncular article 1 shorter than article 2, or subequal to article 2; antenna 1 article 2 longer than article 3; peduncular articles 1--2 not geniculate; accessory flagellum absent; antenna 1 callynophore absent. Antenna 2 present; short; articles not folded in zigzag fashion; without hook-like process; flagellum shorter than peduncle; less than 5-articulate; not clavate; calceoli absent.

Mouthparts well developed. Mandible incisor dentate; lacinia mobilis present on both sides; accessory setal row without distal tuft; molar present, medium, triturative; palp present or absent. Maxilla 1 present; inner plate absent; palp present, not clavate, 2 -articulate. Maxilla 2 inner plate present; outer plate present. Maxilliped inner and outer plates well developed or reduced, palps present, well developed or reduced; inner plates well developed or reduced, separate; outer plates present, small; palp 4-articulate, article 3 without rugosities. Labium smooth.

Peraeon. Peraeonites 1-7 separate; complete; sternal gills absent; pleurae absent.

Coxae 1-7 vestigial or absent, none fused with peraeonites. Coxae not acuminate. Coxae 1-3 not successively smaller, none vestigial. Coxae 2--4 none immensely broadened.

Gnathopod 1 not sexually dimorphic; smaller (or weaker) than gnathopod 2; gnathopod 1 merus and carpus not rotated; gnathopod 1 carpus/propodus not cantilevered; shorter than propodus; gnathopod 1 not produced along posterior margin of propodus; dactylus large. Gnathopod 2 not sexually dimorphic; subchelate; ischium short; merus not fused along posterior margin of carpus or produced away from it; carpus/propodus not cantilevered, carpus short or elongate, shorter than propodus or subequal to propodus, not produced along posterior margin of propodus.

Peraeopods 3-5 greatly reduced, 6-7 directed anteriorly, some or all prehensile. Peraeopod 3 greatly reduced, some articles absent. Peraeopod 4 greatly reduced or absent. Peraeopods 5-7 with few robust or slender setae; dactyli without slender or robust setae. Peraeopod 5 well developed, or greatly reduced, or reduced; shorter than peraeopod 6, or subequal in length to peraeopod 6; basis linear, subrectangular, without posteroventral lobe; merus/carpus free; carpus linear; setae absent. Peraeopod 6 subequal in length to peraeopod 7; merus/carpus free; dactylus without setae. Peraeopod 7 with 6-7 well developed articles; subequal to peraeopod 5; similar in structure to peraeopod 6; with 7 articles; basis linear, without dense slender setae; dactylus without setae.

Pleon. Pleonites 1-3 without transverse dorsal serrations, without dorsal carina; without slender or robust dorsal setae. Epimera 1-3 absent.

Urosome dorsoventrally flattened; urosomites 1 to 3 coalesced; urosomites 1-2 without transverse dorsal serrations. Uropods 1-3 reduced to one vestigial pair. Uropod 2 absent.

Genus *Deutella* Mayer, 1890
Description: Flagellum of antenna 2 with two articles, swimming setae absent. Mandibular palp three-articulate; setal formula for distal article 1-x-1; molar present. Outer lobe of maxilliped longer than inner lobe. Pereopod 5 with six articles. Male abdomen with pair of appendages and pair of setose lobes.

***Deutella* sp.** (Plate 289 a-b)
Distribution: Kuwait's marine environment.

Plate 289. *Deutella* sp., a. female; b. male.

Family Photidae Dall, 1895
Description: Head, lateral lobes often slightly produced. Side plates variable in depth and relative size, 2nd not unfrequently the largest, 4th with hind margin not excavate. Antenna 1 often subequal to antenna 2, sometimes longer; accessory flagellum varied from obsolete to long. Mandibular process of lower lip not acutely produced, 3rd joint of mandibular palp usually not longer than 2nd, inner plate of maxilla 1 with a variable number of setae. Gnathopods 1 and 2 either subchelate or simple, but gnathopod 1 not the larger, and sexual difference chiefly affecting gnathopod 2. Peraeopods 1 and 2 granular. Peraeopods 4 and 5 longer than the rest. Uropods 1 and 2 biramous. Uropod 3 biramous except in Microprotopus. Telson simple.
Reference: Stebbing, 1906.

Genus *Photis* Krøyer, 1842
***Photis* sp.**
Distribution: Muddy and silty substrates in Kuwait Bay.

Order Tanaidacea

Family Apseudidae Leach, 1814

Description: Body shape semicylindrical, dorsoventrally flattened, or cylindrical. Head, eye present, or lobes only without visual elements. Antennule (antenna 1) biramous. Antenna (antenna 2), with more than 6 articles; squama present. Mouthparts well developed, functional in both sexes. Mandible, palp present, comprised of three articles; lacina mobilis on both right and left mandible; setal row present; molar broad. Labium with one pair of lobes, articulated. Maxillule (maxilla 1), with two endites; palp biarticulated, palp with more than two setae. Maxilla (maxilla 2) well developed. Maxilliped, coxa present; basis not fused; endites not fused, narrower than basis. Epignath large, reniform, with two unevenly sized articles.

Pereonite 1 not reduced, at least three times wider than pereopod basis diameter. Cheliped, attachment via coxa, or directly to ventral cephalothorax surface; exopod present; carpus with few or no long plumose setae. Pereopods 1 to 3, coxae present. Pereopod 1, without plumose setae on distal articles; coxa extended into acute spine; ischium present; dactylus short, curved. Pereopod 4 as long as pereopods 5 and 6, dactylus not reduced. Pereopods 4 to 6, coxa present; dactylus and terminal seta not fused. Marsupium formed by four pairs of oostegites, or five pairs of oostegites.

Pleon with five developed pleonites. Pleopods biramous; male pleopods well developed; female pleopods well developed. Uropods present; protopod without curved spiniform process; endopod with more than six articles; exopod with more than two articles.

Reference: Lowry and Springthorpe, 2001.

Genus *Apseudes* Leach, 1814

***Apseudes* sp.** (Plate 290 a-b)

Distribution: Kuwait's marine environment.

Plate 290. ***Apseudes*** **sp. a. female; b. male.**

Genus ***Apseudopsis*** Norman, 1899
Apseudopsis **sp.**
Distribution: Muddy and silty substrates in Kuwait Bay.

Apseudidae gen. sp. (Plate 291)
Distribution: Kuwait's marine environment.

Plate 291. Apseudidae gen. sp., general view.

Order Isopoda

Family Anthuridae Leach, 1814

Description: Body shape without loss or gross modification of appendages on one side of the body; in dorsal view without peduncular articles of antenna 1 or 2 contiguous with coxal margins.

Head not capable of lateral rotation (laterally encompassed, abutting or fused to pereonite 1). Antenna 1 inserting on head anteriorly and/or dorsally to antenna 2, minute or well developed; not as follows: reduced to 2 articles with second article expanded and scalloped. Antenna 2 well developed; flagellum of fewer than 10 articles, shorter than peduncle. Mouthparts not forming suctorial cone or proboscis; not produced anteriorly. Mandible not projecting anteriorly and together forceps-like; compact, with weakly-toothed transverse incisor; palp present. Maxilliped palp broad (c. twice as long as wide), with 5 free articles or with 2 or more articles fused; endite reaching palp article 3 or absent or obsolete.

Pereonites 6-7 pereonite 7 distinct dorsally, free. Pereonite 7 wider than long, much shorter than pereonite 6 (body 10-15 times as long as wide, females and juveniles rarely more elongate). Pereopods 6-7 pairs readily apparent; 1-3 or 1-7 not prehensile. Pereopod 1 propodal palm without proximal tooth (palm more or less continuous with that of carpus). Pereopods 2-3 carpus not or weakly produced posterodistally; propodus with posterodistal robust seta only. Pereopods 4-7 propodus with posterodistal robust seta only. Pereopods 5-7 without flattened setose articles andor dactyls modified or absent. Pereopod 7 propodus anterodistal serrate setae absent.

Pleonites 1-5 fused; together 2 times as long as wide (or less). Pleonites 4-5 without plumose setae on pleonal epimera or posterior borders. Pleopods 5 pairs present; with pleopod 1 exopod opercular alone. Pleopod 2 of males not consisting of an enlarged peduncle with a geniculate endopod and a small muscular exopod. Pleotelson statocysts paired. Uropods positioned proximally on pleotelson; distinct from pleopods, not forming operculum over pleopodal chamber (although may be folded ventrally below pleotelson). Peduncle not forming an elongate clavate article with rami reduced or absent. Endopod not claw-like (acute and recurved) andor posteroventral in position. Exopod folded dorsally over pleotelson.

Reference: Reference: Lowry, 1999.

Genus *Apanthura* Stebbing, 1900

Apanthura sandalensis Stebbing, 1900 (Plate 292)

Distribution: Muddy substrates of Khor Al-Sabbiya.

Plate 292. *Apanthura sandalensis*, general view.

Family Arcturidae Dana, 1849

Description: Body shape without loss or gross modification of appendages on one side of the body; in dorsal view without peduncular articles of antenna 1 or 2 contiguous with coxal margins; in lateral view flexed between pereonites 4 and 5, or strongly geniculate between pereonites 4 and 5, or straight, more or less flattened or semicylindrical. Body surface smooth or slightly sculptured, or variously spinose or rugose. Head not capable of lateral rotation; fused to pereonite 1. Eyes well developed, or reduced or lost. Antenna 1 inserting on head anteriorly and/or dorsally to antenna 2, minute or well developed; not as follows: reduced to 2 articles with second article expanded and scalloped. Antenna 2 well developed; flagellum of 2-3 articles plus distal claw. Mouthparts not forming suctorial cone or proboscis; with pereopod 1 enclosed in lateral view by lateral plates of head and pereonite 1. Mandible not projecting anteriorly and together forceps-like; palp absent. Pereonite 4 at least 1.5 times as long as pereonite 3. Pereonites 6-7 pereonite 7 distinct dorsally, free. Coxae extending ventrally and laterally to overhang the coxa-basis articulation of the pereopods, or not extending ventrally and laterally to overhang the coxa-basis articulation of the pereopods; 2-7 obsolete, bases of pereopods exposed, or 2-7 obsolete and with expanded marginal tergites. Oostegites 1-4 functional, 5 absent, or 1-5 functional (Arcturus only); 1-4 not supported by mesial coxal lobes. Pereopods 6-7 pairs readily apparent; 1-3 or 1-7 not prehensile; gnathopod elongated, differentiated from ambulatory 5-7; without dense fur of fine setae in males. Pereopod 1 dactylus evenly curved along anterior margin, evenly tapering. Pereopods 2-4 with paired long setae along posterior margins evenly and well developed; 2-4 dactylus prominent, unguis short. Pereopod 4 similar to pereopod 3. Pereopods 5-7 without flattened setose articles andor dactyls modified or absent. Penes fused as a single penial plate; penial plate apically simple or barely slit. Pleonites and pleotelson with pleonites 1-5 and pleotelson fused. Pleopods 5 pairs present. Pleopod 1 peduncle longer than peduncle on pleopods 2-5; marginal setae on rami longer than, or equal to, length of rami; exopod of males laminar, lateral excavation present. Pleopod 2 of males not consisting of an enlarged peduncle with a geniculate endopod and a small muscular exopod; appendix masculina about as long as endopod or longer, basally as wide or wider than endopod. Pleotelson without dorsolateral ridges ending in mediodorsal posterior spine. Uropods positioned proximally on pleotelson; folded ventrally below pleotelson, forming operculum enclosing pleopodal chamber. Peduncle not forming an elongate clavate article with rami reduced or absent. Endopod not claw-like (acute and recurved) andor posteroventral in position. Exopod not folded dorsally over pleotelson, tapering, with terminal setae only, more than half as long as endopod or very short, bearing a single prominent robust seta (endopod also with robust apical seta).

Reference: Keable et al., 2002.

Arcturidae gen. sp.

Distribution: Muddy and silty substrates in Kuwait Bay.

Family Gnathiidae Leach, 1814
Description: Rostrum present or absent; eyes sessile or stalked or absent; compound, visual elements present; ocular scale absent; naupliar eyes absent. Antennules (antenna 1) uniramous; peduncle and flagellum distinct; exopod reduced, vestigial or absent; statocyst absent. Antennae (antenna 2) uniramous; exopod multiarticulate. Mouthparts modified to form suctorial cone, or not highly modified. Mandible uniramous, or absent. Maxillipeds, 2 pairs; second pair forming an operculum which covers the mouthparts (pylopod). Thorax. Carapace absent. Thorax and abdomen differentiated. Peraeopods (legs) 5 pairs; uniramous; non-phyllopodous; differentiated (some prehensile); pylopod present. Peraeopod 1 (leg 1) simple. Peraeopod 2 (leg 2) simple. Peraeopod 3 (leg 3) simple. Abdomen with 5 somites. Epimera present. Pleopods present; well developed, broad and flat. Uropods well developed, 1 pair, positioned ventrolaterally; rami present, exopod without diaresis; endopod without statocyst. Telson fused to pleon (pleotelson).
Reference: Lowry, 1999.

Genus *Gnathia* Leach, 1814
***Gnathia* sp.** (Plate 293)
Distribution: Muddy and silty substrates near Failaka Island, in Kuwait Bay, in Khor Al-Sabbiya and intertidal zone of Ras Al-Ardh.

Isopoda gen. sp.
Distribution: Muddy and silty substrates near Failaka Island, in Kuwait Bay, between Bubiyan and Failaka Islands and intertidal zone of Ras Al-Zour.

Plate 293. *Gnathia* sp., general view.

Order Cumacea

Family Bodotriidae Scott, 1901

Description: No free telson. Uropod inner ramus one or two-articulate. Male pleopods: 5 pairs, occasionally 3, 2, or no pairs, with process on the outer edge of the inner ramus. Pleural folds nearly always present on the abdomen of the male. Number of free thoracic somites frequently reduced. Exopods on maxillipeds and at least pereopod 1, but may occur on pereopods in the following combinations: in the male, 4 or 1, occasionally 2 or 3 fully developed pairs, 1 + 2 rudimentary, 2 + 2 rudimentary, or 3 + 1 rudimentary; in the female, 3 or 1, occasionally 2 fully developed pairs, 3 + 1 rudimentary, 2 + 2 rudimentary, 2 + 1 rudimentary, or 1 + 2 rudimentary. Mandible naviculoid, with large section dorsal to molar. Branchial apparatus without gill plates or supports. Comprises three subfamiles: Bodotriinae: with exopods only on first pair of pereopods; male with five pairs of pleopods. Vaunthompsoniinae: with exopods on pereopods beyond the first pair; male with five pairs of pleopods. Mancocumatinae: with exopods on pereopods beyond the first pair; male with no, two, or three pairs of pleopods.

Reference: Lowry and Springthorpe, 2001.

Genus *Bodotria* Goodsir, 1843

***Bodotria* sp.** (Plate 294)

Distribution: Muddy substrates near Failaka Island.

Plate 294. ***Bodotria* sp.**, general view.

Genus *Cumopsis* G.O. Sars, 1865
***Cumopsis* sp.** (Plate 295)
Distribution: Muddy substrates in Kuwait Bay and intertidal zone of Ras Al-Zour.

Plate 295. *Cumopsis* sp., general view.

Genus *Cyclaspis* Sars, 1865
***Cyclaspis* sp.** (Plate 296)
Distribution: Muddy substrates near Failaka Island, between Bubiyan and Failaka Islands and in Khor Al-Sabbiya.

Plate 296. *Cyclaspis* sp., general view.

Genus *Eocuma* Marcusen, 1894
Eocuma affine Calman, 1904 (Plate 297)
Distribution: Muddy substrates between Bubiyan and Failaka Islands.

Plate 297. *Eocuma affine*, general view.

Eocuma rosae Corbera and Galil, 2007 (Plate 298)
Distribution: Kuwait's marine environment.

Plate 298. *Eocuma rosae*, general view.

***Eocuma* sp.** (Plate 299)
Distribution: Muddy substrates near Failaka Island and between Bubiyan and Failaka Islands.

Plate 299. *Eocuma* sp., general view.

Genus *Iphinoe* Bate, 1856
Iphinoe maeotica Sowinskyi, 1893 (Plate 300)
Distribution: Muddy substrates near Failaka Island.

***Iphinoe* sp.**
Distribution: Muddy and silty substrates near Failaka Island and in Kuwait Bay.

Plate 300. *Iphinoe maeotica*, general view.

Family Nannastacidae Bate, 1866
Description: No free telson. Uropod inner ramus uniarticulate. Male pleopods absent. Number free thoracic somites rarely reduced. Exopods on maxillipeds and the following combinations of pereopods: in the male, 1-4, rarely 1-3 or 1-2; in the female, 1-2, rarely 1-3, absent from all, or absent from third maxillipeds and present on pereopods 1-2. Mandible naviculoid or with various degrees of reduction of the section dorsal to the molar. Branchial apparatus without gill plates, with or without gill supports.
Reference: Lowry and Springthorpe, 2001.

Genus *Campylaspis* G.O. Sars, 1865
***Campylaspis* sp.** (Plate 301)
Distribution: Muddy substrates near Failaka Island.

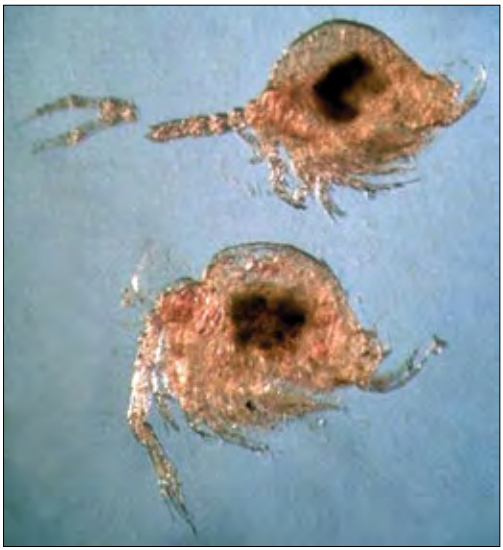


Plate 301. *Campylaspis* sp., general view.

Genus *Cumella* G.O. Sars, 1865
***Cumella* sp.** (Plate 302)
Distribution: Muddy substrates near Failaka Island and intertidal zone of Ras Al-Zour.

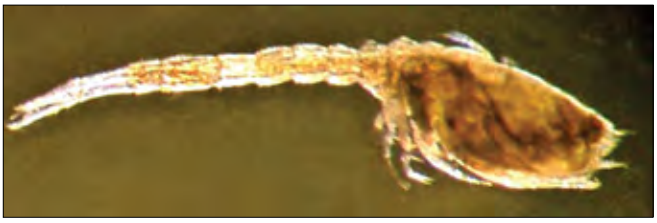


Plate 302. *Cumella* sp., general view.

Order Mysida

Family Mysidae Haworth, 1825

Description: Carapace large, last 2 or 3 thoracic somites exposed dorsally. Rostrum obtuse. Eyes normally developed. Antenna (antenna 2) scale with apical suture, outer margin smooth, without setae, with terminal spine. Labrum produced anteriorly. Mandible lacinia mobilis well developed, spine row absent (in genus Gastrosaccus) or spine row present between lacinia mobilis and molar process, molar process well developed. First maxilliped exopod well developed (and in Anchialina the first maxilliped bears a small claw). Second thoracopod developed as a maxilliped (and in Gastrosaccus supports a small claw), exopod well developed. Third-eigth thoracopods endopod with distinct carpus and propodus (e.g. Anchialina) or endopod with fused carpus and propodus (tarsus) (e.g. Gastrosaccus), carpopropodus segmentation increases posteriorly (Gastrosaccus), propodus segmentation increases posteriorly (Anchialina). Branchiae on thoracopods are absent. Marsupium composed of two pairs of oostegites, or composed of three pairs of oostegites.

Abdomen pleural plates absent, or female pleural plate 1 well developed, partially covering marsupium; 6-th and 7-th abdominal somites fused. First pair biramous, or endopod reduced (in Anchialina); second pair biramous; third pair exopod elongated (in some Gastrosaccus species the endopod is reduced or fused to the exopod); 4-th pair biramous; 5-th pair biramous. Female pleopods: first pleopod biramous, remaining reduced (reduced to uniramous unsegmented plates). Uropod endopod inner margin with robust setae, statocyst present; exopod complete, outer margin with robust setae. Telson apex cleft.

Reference: Meland, 2002.

Genus *Gastrosaccus* Norman, 1868

***Gastrosaccus* sp.** (Plate 303)

Distribution: Intertidal zone of Ras Al-Zour.

Plate 303. *Gastrosaccus* sp., general view.

Order Decapoda
Infraorder Caridea
Family Alpheidae Rafinesque, 1815
Description: Common name: Pistol shrimps, Snapping shrimps. Alpheidae is a family of caridean snapping shrimp characterized by having asymmetrical claws, the larger of which is typically capable of producing a loud snapping sound. Other common names of these species include pistol shrimp or alpheid shrimp. The family is diverse, and is worldwide in distribution, consisting of about 600 species within 38 or more genera.
Most snapping shrimp dig burrows and are common inhabitants of coral reefs, submerged seagrass flats, and oyster reefs. Some pistol shrimp species share burrows with goby fishes in a symbiotic relationship. The burrow is built and tended by the pistol shrimp, and the goby provides protection by watching out for danger. When both are out of the burrow, the shrimp maintains contact with the goby using its antenna. The goby, having the better vision, alerts the shrimp of danger using a characteristic tail movement, and then both retreat into the safety of the shared burrow. So far, this association has been observed in species that inhabit coral reef habitats. Social behavior has been discovered in the genus
The shrimp snaps a specialized claw shut to create a cavitation bubble that generates acoustic pressures of up to 80 kPa at a distance of 4 cm from the claw. The pressure is strong enough to kill small fish and shatter glass. It corresponds to a zero to peak pressure level of 218 decibels relative to one micropascal (dB re 1 μPa), equivalent to a zero to peak source level of 190 dB re 1 μPa at the standard reference distance of 1 m. The duration of the click is less than 1 millisecond. The snap can also produce sonoluminescence from the collapsing cavitation bubble. As it collapses, the cavitation bubble reaches temperatures of over 5,000 K (4,726.85 degrees Celsius). In comparison, the surface temperature of the sun is estimated to be around 5,778 K. The light is of lower intensity than the light produced by typical sonoluminescence and is not visible to the naked eye. It is most likely a by-product of the shock wave with no biological significance. However, it was the first known instance of an animal producing light by this effect. It has subsequently been discovered that another group of crustaceans, the mantis shrimp, contains species whose club-like forelimbs can strike so quickly and with such force as to induce sonoluminescent cavitation bubbles upon impact.
Reference: Australian Faunal Directory, 2010.

Genus *Alpheus* Weber, 1795
***Alpheus* sp.1** (Plate 304 a-c)
Distribution: Intertidal and subtidal zones of Ras Al-Julaiah.

Plate 304. ***Alpheus*** **sp.1, a. female, general view; b. male, general view; c. chela.**

Alpheus **sp. 2** (Plate 305)
Distribution: Intertidal and subtidal zones of Ras Al-Ardh.

Plate 305. ***Alpheus*** **sp. 2, general view.**

Genus *Athanas* Leach, 1814
***Athanas* sp.** (Plate 306)
Distribution: Muddy substrates in Kuwait Bay and between Bubiyan and Failaka Islands.

Plate 306. *Athanas* sp., general view.

Infraorder Achelata
Family Scyllaridae Latreille, 1825
Description: Common name: Slipper lobsters. Scyllaridae have six segments in their heads and eight segments in the thorax, which are collectively covered in a thick carapace. The six segments of the abdomen each bear a pair of pleopods, while the thoracic appendages are either walking legs or maxillipeds. The head segments bear various mouthparts and two pairs of antennae. The first antennae, or antennules, are held on a long flexible stalk, and are used for sensing the environment. The second antennae are the slipper lobster's most conspicuous feature, as they are expanded and flattened into large plates that extend horizontally forward from the animal's head.
Reference: Lavalli and Spanier, 2007.

Genus Thenus Leach, 1815
Thenus orientalis (Lund, 1793) (Plate 307 a-b)
Distribution: Widespread in Indian Ocean. *T.orientalis* are inhabitants of in subtidal zone, only occasionally found in intertidal zone on sandy and muddy bottoms. Subject of commercial fisheries.

Plate 307. ***Thenus orientalis*****, a. dorsal view; b. ventral view.**

Infraorder Anomura
Family Hippidae Latreille, 1825
Description: Common name: Mole crabs. Hippids are relatively small, crab-like anomurans, commonly termed "mole" or "sand" crabs for their habit of burrowing into the substrate. Carapace ovate, more or less expanded laterally; rostrum reduced or absent; ocular peduncles short or long, cornea distinct. Third maxillipeds sub-operculiform with enlarged, broadened merus; without exopods. First pereiopods not subchelate; dactyli cylindrical or lamellate. Dactyli of second, third and fourth pereiopods flattened. Endopod and exopod of uropod long, lamellar. Telson strongly elongated, lanceolate, apically acute. Female with three pairs of pleopods on abdominal somites 2–4.
References: Miyake, 1978. From: Australian Faunal Directory, 2010.

Genus *Emerita* Scopoli, 1777
Emerita holthuisi Sankolli, 1965 (Plate 308 a-d)
Distribution: Burrowing in sand beaches, moves up and down the beach behind the surf. In Kuwait, it was observed in the intertidal zone of Ras Al-Julaiah.

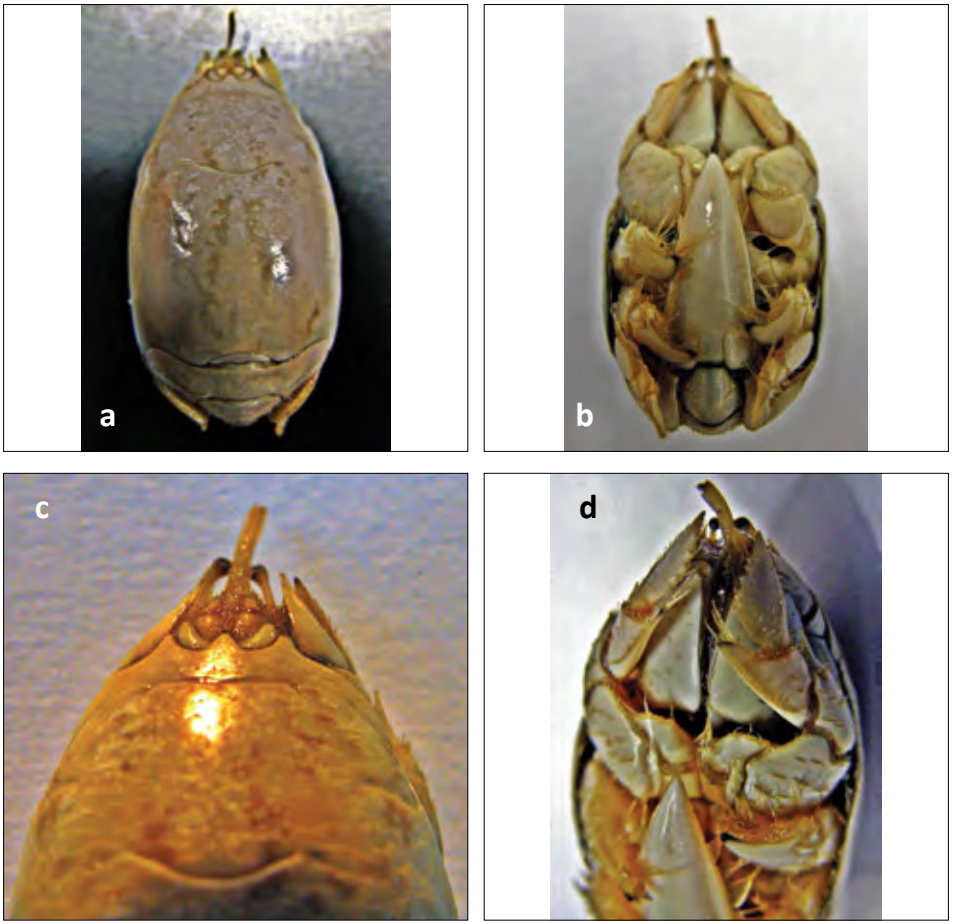


Plate 308. ***Emerita holthuisi*****, a. dorsal view; b. ventral view; c. frontal part, dorsal view; d. frontal part, ventro-lateral view.**

Family Diogenidae Ortmann, 1892

Description: Common name: Left-handed hermit crabs. Carapace cylindrical or subcylindrical, carapace longer than wide or as long as or wider than long; carapace with linea anomurica; outer orbital spines absent; rostrum reduced, or absent. Eye cornea well developed, or reduced; ocular acicles present. Antenna 1 flagellum biramous. Maxilliped 3 bases close together; crista dentata present; accessory tooth absent; dactylus simple.

Pereopod 1 chelate; cheliped left largest, or equal or subequal, or right largest. Pereopods 2 to 4 pereopods 2 and 3 similar, perepod 4 greatly reduced; 2-4 with basis and ischium fused; dactyli of pereopods 2 to 3 simple. Pereopod 3 about the same length as pereopod 2, or shorter than pereopod 2; pereopods 3 dactyli and propodi of right and left similar, or dactyli and propodi of right and left dissimilar. Pereopod 4 chelate. Sternum partially divided; sternite of pereopod 5 reduced, widely separated from preceding sternite; somite of pereopod 5 not fused with first abdominal somite.

Abdomen well developed, carried posteriorly or reduced, carried posteriorly, abdomen with distinct somites or with indistinct somites. Epimera (pleura) absent. Male pleopods 3-5 unpaired; none modified as gonopods, or pleopod 1 with one or both modified as gonopods, or pleopod 2 with one or both modified as gonopods, or pleopods 1 and 2 modified as gonopods. Male with single gonopore, or with indications of female gonopores; female with no sexual modifications, or with single gonopore, or with first pleopods paired and modified as gonopods, or with brood pouch developed. Uropods present, uropods positioned ventrolaterally, not forming tailfan; rami with propodal rasps. Telson present, entire.

Reference: Australian Faunal Directory, 2010.

Genus *Diogenes* Dana, 1851

***Diogenes* sp.** (Plate 309)

Distribution: Sandy and muddy substrates from Khor Al-Sabbiya to Al-Khiran.

Plate 309. *Diogenes* sp., general view.

Genus *Paguristes* Dana, 1851
***Paguristes* sp.** (Plate 310)
Distribution: Sandy and muddy substrates from Khor Al-Sabbiya to Al-Khiran.

Plate 310. *Paguristes* sp., general view.

Diogenidae gen. sp.1 (Plate 311 a-b)
Distribution: Sandy and muddy substrates from Khor Al-Sabbiya to Al-Khiran.

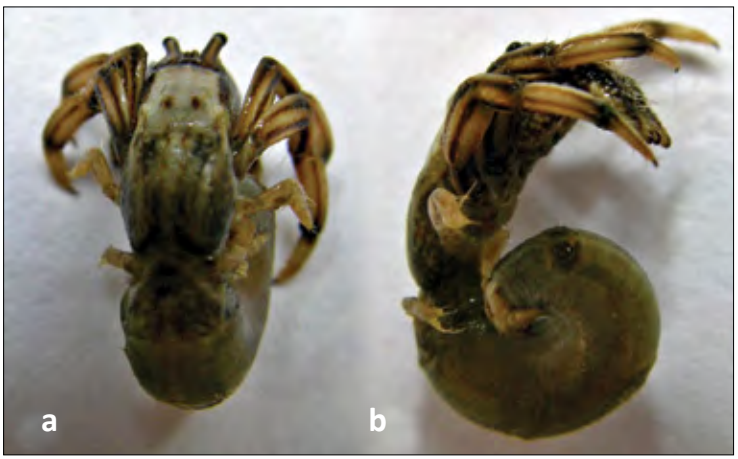


Plate 311. Diogenidae gen. sp.1, a-b. general view.

Diogenidae gen. sp. 2 (Plate 312 a-b)
Distribution: Kubbar Island.

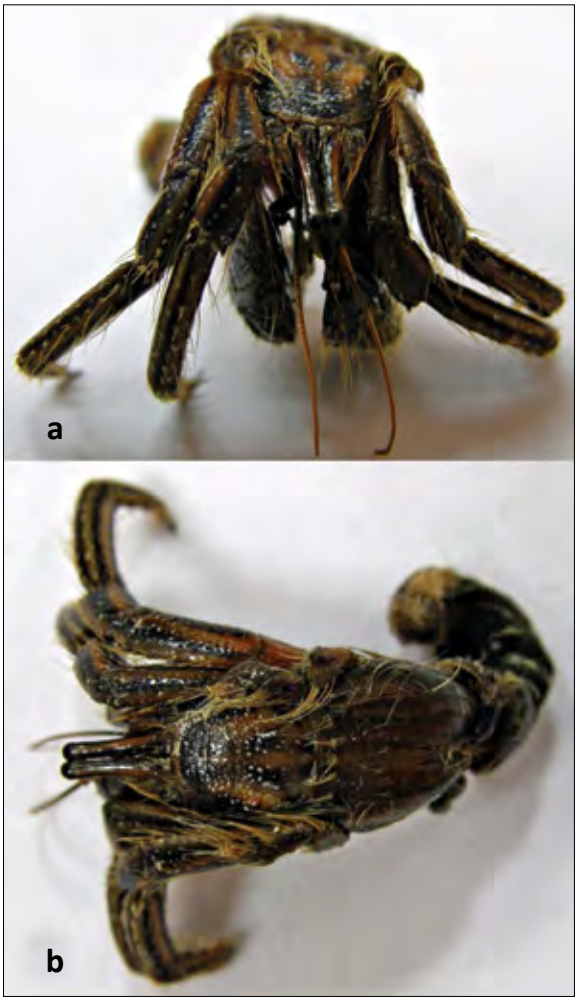


Plate 312. Diogenidae gen. sp. 2, a-b. general view.

Family Porcellanidae Haworth, 1825

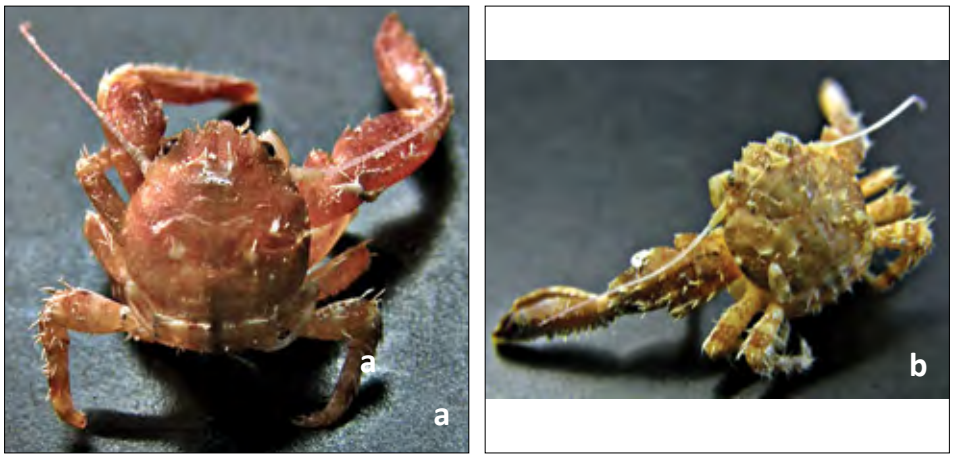
Description: Common name: Porclain crabs. Carapace dorsoventrally flattened, as long as or wider than long; with linea anomurica; outer orbital spines absent; rostrum reduced, or absent. Eye cornea well developed; ocular acicles absent. Antenna 1 flagellum reduced, vestigial or absent. Maxilliped 3 bases close together; crista dentata present; accessory tooth absent; dactylus simple. Pereopod 1 chelate; cheliped equal or subequal. Pereopods 2 to 4 pereopods 2 to 4 all of similar form; 2-4 with basis and ischium fused; dactyli of pereopods 2 to 3 simple. Pereopod 3 about the same length as pereopod 2; pereopods 3 dactyli and propodi of right and left similar. Pereopod 4 simple. Sternum partially divided; sternite of pereopod 5 reduced, contiguous with preceding sternite; somite of pereopod 5 not fused with first abdominal somite. Abdomen reduced, carried under thorax, abdomen with distinct somites. Epimera (pleura) absent. Male pleopods 3-5 absent. Uropods present, uropods positioned ventrolaterally, forming tailfan; rami unmodified. Telson present, divided into mulitple plates.

Reference: McLaughlin, et al., 2002.

Genus *Petrolisthes* Stimpson, 1858

Petrolisthes carinipes (Heller, 1861) (Plate 313 a-d)

Distribution: Underside of rocks in the subtidal zone of Ras Al-Ardh.



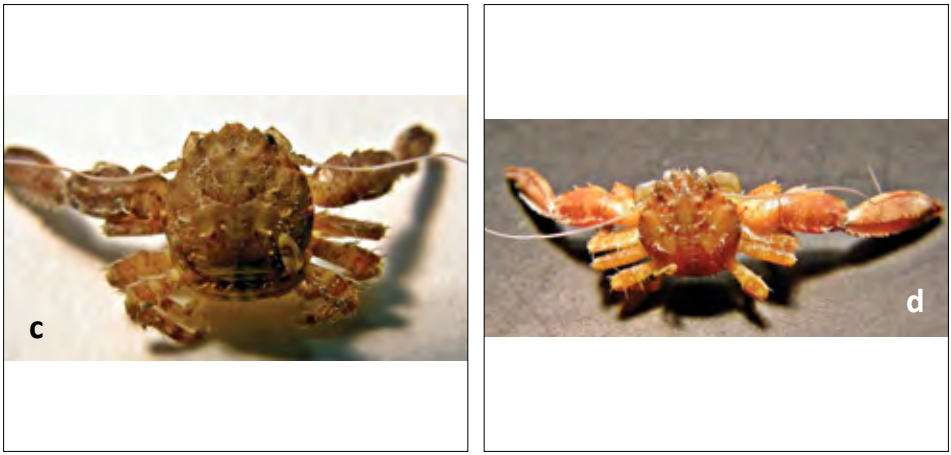


Plate 313. ***Petrolisthes carinipes*****, a-d. general view.**

Petrolisthes rufescens (Heller, 1861) (Plate 314 a-b)
Distribution: Underside of rocks in the subtidal zone of Ras Al-Ardh.

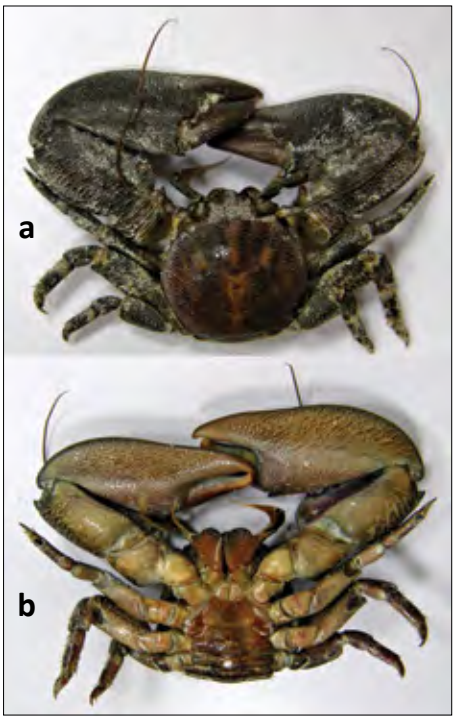


Plate 314. ***Petrolisthes rufescens*****, a-b. general view.**

Genus *Raphidopus* Stimpson, 1858
***Raphidopus* sp.** (Plate 315)
Distribution: Muddy substrates in Kuwait Bay and between Bubiyan and Failaka Islands.

Plate 315. *Raphidopus* sp., general view.

Infraorder Thalassinidea
Family Callianassidae Dana, 1852
Description: Common name: Ghost shrimps. Carapace elongate, slender, separated by cervical groove into long anterior (gastric) and short posterior (cardiac) region. Rostrum little developed, nearly always unspined. Without pleurobranchs. Ocular peduncles more or less dorsoventrally depressed, contiguous, cornea usually subdistal. Antennal scales reduced. First maxilliped with large foliaceous exopodite, nonflagellated, reduced endopodite and well-developed epipodite generally composed of anterior and posterior lobe; second often foliaceous exopodite and epipodite reduced or absent; third frequently without exopodite, endopodite pediform, subpediform or operculiform and epipodite reduced or absent. First legs chelate, usually unequal; second legs chelate; third simple; fourth simple or subcheliform; fifth subchelate or chelate. Pleopods 1 and 2 present in both sexes (except some males), 3-5 foliaceous, provided with appendix interna.
Reference: Dana, 1852. From: Marine Species Identification Portal, 2010.

Genus *Callianassa* Leach, 1814
***Callianassa* sp.** (Plate 316 a-c)
Distribution: Muddy substrates in Khor Al-Sabbiya.

Plate 316. ***Callianassa*** **sp., a. general view; b. pereopoda; c. uropod.**

Infraorder Brachyura

Family Camptandriidae Stimpson, 1858

Description: Carapace generally flattened, laterally oval to subquadrangular or subpentagonal; dorsal surface with regions poorly to well indicated, gastro-cardiac groove usually distinct; antenolateral margins usually toothed or lobed, but sometimes entire. Front more than half width of orbital margin. Buccal cavern broader than long; third maxilliped broad; merus as long as or longer than ischium. Chelipeds more or less equal, large in males weak in females; dactilus of males usually with a discrete, well-indicated, proximal tooth. Walking legs typically broad, varying from moderate in length to short and stout. Male abdomen with variable number of fused segments, sometimes fifth strongly constricted, such that stem of first gonopod visible externally. Male and female genital openings sternal. Male first gonopod with apex strongly recurved, more or less elaborately lobed, and often swollen; male second gonopod very short.

Reference: Manning and Holthuis, 1981. From: Australian Faunal Directory, 2010.

Genus *Tylodiplax* De Man, 1895

***Tylodiplax* sp.**

Distribution: Dig burrows on mudflats in Kuwait Bay.

Family Dotillidae Stimpson, 1858

Description: Carapace subglobose or quadrilateral; anterolateral margins with tooth or indentation behind exorbital angle. Front variable, from narrow to moderately broad. Interantennular septum broad; antennules folding lengthwise, subparallel or oblique. Eyestalks usually elongate. Buccal cavern sometimes greatly enlarged; third maxilliped broad, completely closing buccal cavern. Chelipeds are symmetrical or slightly asymmetrical in both sexes. Brush of long setae edging pouch leading into branchial cavity between bases of second and third periopods may be present, or completely lacking; abdomen with transverse brush of setae in some genera. Meri of some or all pereiopods often bearing a tympanum. Thoracic sternum broad posteriorly. Male genital opening sternal.

Reference: Barnes, 1967. From: Australian Faunal Directory, 2010.

Genus *Ilyoplax* Stimpson, 1858

***Ilyoplax* sp.** (Plate 317)

Distribution: Dig burrows on mudflats in Kuwait Bay.

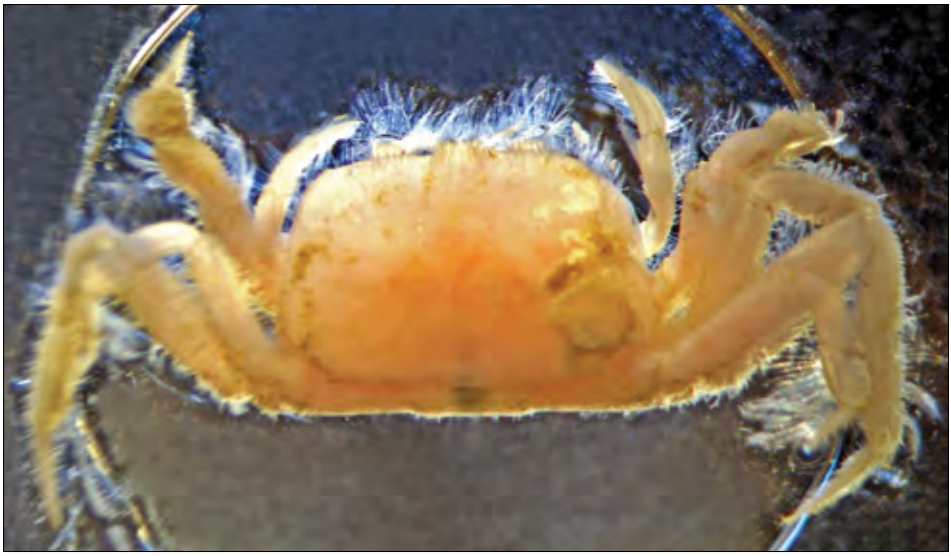


Plate 317. ***Ilyoplax*** **sp., general view.**

Family Grapsidae MacLeay, 1838
Description: Common name: Marsh crabs, Shore crabs, Talon crabs. Carapace typically quadrilateral to quadrate, sometimes subcircular, lateral margins may be straight or arched and more or less markedly convergent or divergent; body flattened to deep and swollen; dorsal surface smooth to granular, often naked but may be more or less densely covered with setae; carapace regions poorly to moderate well defined, often with strong gastro-cardiac groove and contiguous grooves. Anterolateral margin entire, or with one to several teeth or lobes and may or not be well demarcated from posterolateral margin; posterolateral regions sometimes bearing triangular facet. Front wide, much broader than orbits; exorbital angles sometimes forming greatest breadth of carapace. Interantennular septum very broad; division of orbit into two fossae is accented. Bucal cavern quadrate; third maxillipeds may meet when closed, but mostly leave distinct rhomboidal gap. Third maxilliped with exopod either slender or very board, usually with flagellum; palp articulating either at antero-external angle or at middle of anterior border of merus. Chelipeds usually stout and robust, subequal; sexes similar. Walking legs highly variable in shape and length; often flattened and bearing transverse circular terraces. Male abdomen usually with seven free segments, but segments 4-6 sometimes fused. Male and female genital openings sternal. Male first gonopod often with corncous tip or process more or less well developed; usually obscured by dense distal brush or long setae.
Reference: Davie, 2002.

Genus *Metopograpsus* H. Milne-Edwards, 1853
Metopograpsus messor (Forskål, 1775) (Plate 318)
Distribution: Ubiquitous, on or under rocks or weed on sandy and muddy, as well as rocky shores, usually above high water neaps. Registered from the Red Sea to Australia. Observed in Kuwait's marine environment.

Grapsidae gen. sp.
Distribution: Muddy substrates near Failaka Island.

Plate 318. *Metopograpsus messor*, general view.

Family Leucosiidae Samouelle, 1819
Description: Common name: Nut crabs, Pebble crabs, Purse crabs. Carapace subcircular, ovoid, pyriform or pentagonal; regions often not defined; smooth or armed, with spines and lobes. Eyes and orbits small. Frontal region narrowed and variously produced anteriorly. Antennules folding obliquely. Antennae small, sometimes obsolete. Maxillipeds 3 elongate, completely closing buccal cavern; palp arising from groove near mesial edge of concealed surface, hidden when maxillipeds closed; exopod broad. Afferent branchial channel opening at bases of maxilliped 3, running along side of buccal cavity, covered by exopod of maxilliped 3. Efferent branchial channel covered by lamellar process of maxilliped 1. Chelipeds symmetrical, robust and elongate. Walking legs with dactyli simple. Abdomen with some somites fused in both sexes. Female genital opening sternal; male opening coxal or sternal. Male gonopod 2 short.
Reference: Poore, 2004.

Genus *Philyra* Losina-Losinsky, 1961 accepted as *Phoxiphilyra* Stock, 1974
***Philyra* sp.** (Plate 319)
Distribution: Kuwait's marine environment.

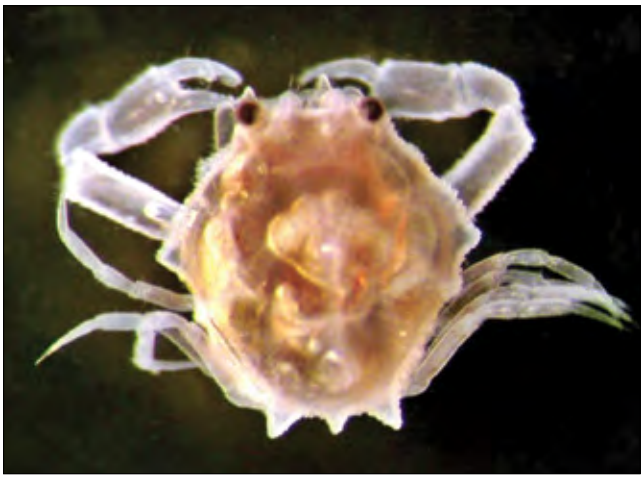


Plate 319. *Philyra* sp., general view.

Family Majidae Samouelle, 1819
Description: Carapace widest posteriorly, with well-developed branchial regions; typically pyriform (pear-shaped) or triangular, but also may be circular to sub-ovate; dorsal surface more or less convex, smooth to highly ornamented; hooked setae often present on carapace and legs. Front narrow, produced to form rostrum of varied form: typically two long, horn-like projections, more or less fused at base, but in extreme case may be a short, strongly deflexed flat plate. Orbits complete, poorly developed or absent. Basal segment of antenna well developed, usually fused with epistome, and often also with front. Epistome large, buccal cavity quadrate. Palp of third maxilliped articulated either at summit or at antero-internal angle of merus. Anterolateral margins of carapace often armed with well-developed spines. Legs often spiny and/or granular, often with stiff setae. Chelipeds highly mobile; may be long and massive, or greatly reduced and smaller than walking legs. Male and female abdomen of seven free segments, rarely some fused, sometimes segment 6 fused to telson, to form pleotelson. Female genital opening sternal; male openings coxal. G1 greatly exceeding G2 in length.
Reference: Australian Faunal Directory, 2010.

Majidae gen. sp.1
Distribution: Muddy substrates near Failaka Island.

Majidae gen. sp.2 (Plate 320)
Distribution: On seaweeds *Sargassum binderi* in the subtidal zone of Ras Al-Zour.

Plate 320. ***Majidae*** **gen. sp.2 with vesicles of** ***Sargassum binderi*****.**

Family Camptandriidae Stimpson, 1858

Description: Carapace rounded to subquadrangular. Dorsal surface with regions poorly or fully indicated. Antero-lateral margins entire, dentate or lobate. Buccal cavern broader than long. Third maxillipeds broad; merus as long as or longer than ischium; the last two articles slender. Chelipeds equal to subequal, more swollen in males; dactylus generally with a big proximal denticulated tooth. Ambulatory legs short, stout. Abdomen with variable fused segments, sometimes the fifth constricted. Female openings sternal. Male openings sternal. G1 generally strongly recurved, extremely characteristic.

Reference: Guinot and Bouchard, 1998.

Genus *Cleistostoma*

Cleistostoma dotilliformis Alcock, 1900 (Plate 321 a-b)

Distribution: Burrows in sandy and muddy substrates in the intertidal zone of Khor Al-Sabbiya.

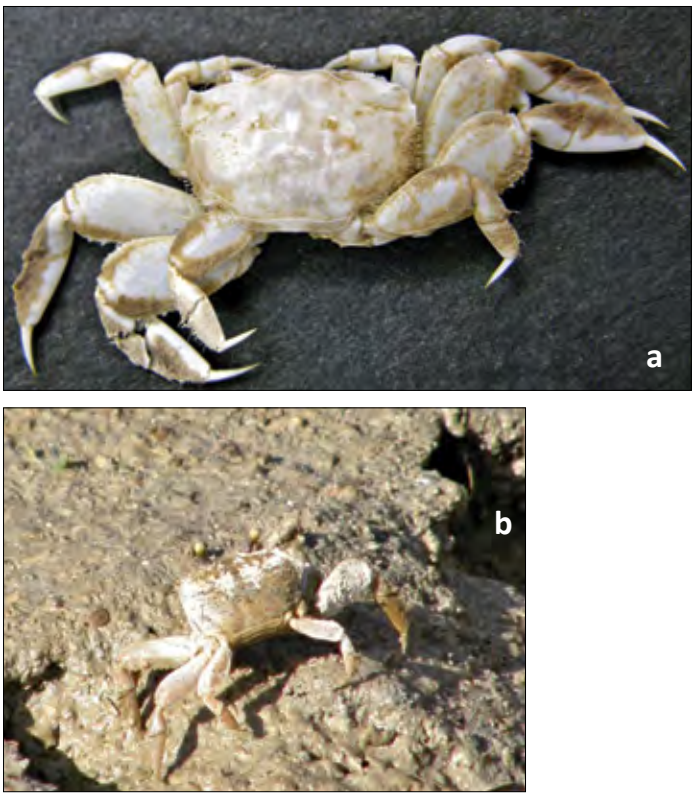


Plate 321. ***Cleistostoma dotilliformis*****, a. general view; b.** ***C. dotilliformis*** **near the borrow in Doha-West.**

Family Ocypodidae Rafinesque, 1815
Description: Common name: Fiddler crabs, Ghost crabs. Carapace quadrancular to pentagonal; deep and strongly vaulted, or flattened. Front narrow, often in form of deflexed lobe between bases of eyestalks. Orbits broad, occupying whole anterior margin of carapace each side of front. Eyestalks long. Maxillipeds 3 usually completely closing buccal cavern; sometimes leaving a gap but never rhomboidal; exopod slender and usually concealed; palp articulated at or near distolated angle of merus. Male abdomen is narrow, with all somites distinct. Often with hairy-edged pouch leading into branchial cavity between bases of walking legs 2 and 3 or 1 and 2.
Reference: Australian Faunal Directory, 2010.

Genus *Nanosesarma* Tweedie, 1950
Nanosesarma minutum (DeMann, 1887) (Plate 322 a-c)
Distribution: Extremely common in crevices and under rocks across the eulittorial zone. Widespread in the Indian Ocean. Observed in Kuwait's marine environment.

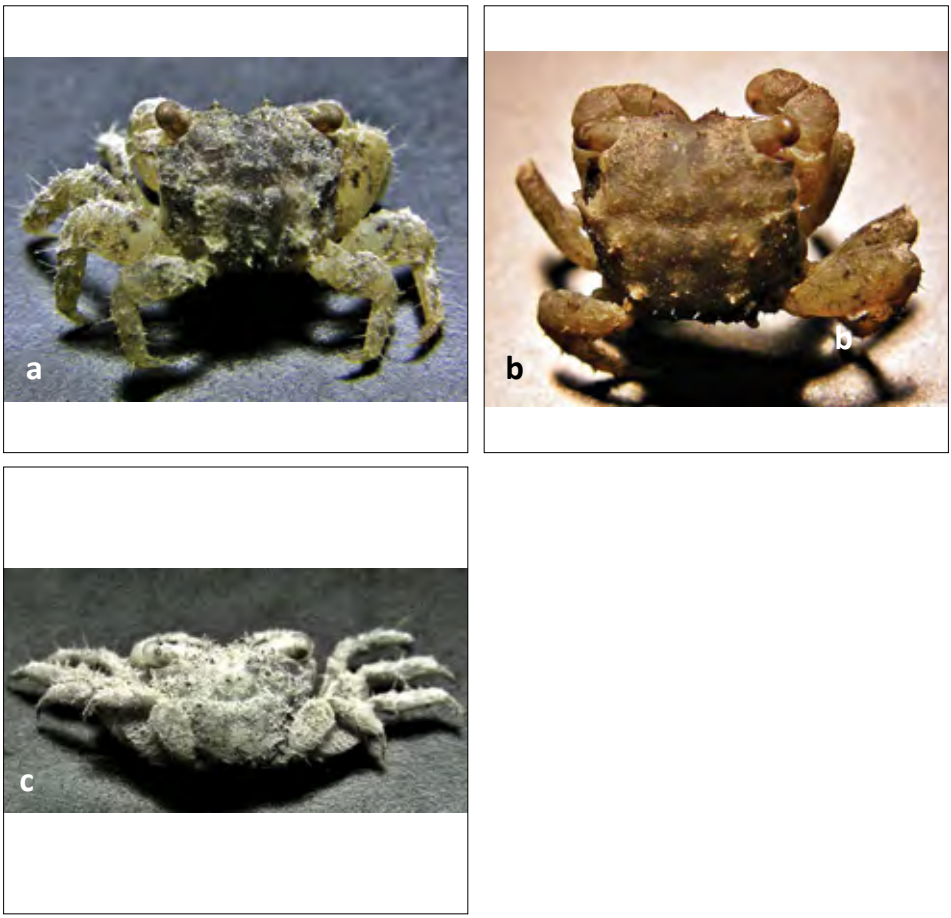


Plate 322. *Nanosesarma minutum*, a-c. general view.

Family Portunidae Rafinesque, 1815
Description: Common name: Swimming crabs. Carapace usually broader than long, and broadest between last pair of antero-lateral teeth, transversely hexagonal to transversely ovate. Regions of the carapace not well defined. Antero-lateral teeth varying from 5 to 9. Antennules and antennae short. Orbits broad. Eyes conspicuous. Buccal frame quadrate. Carpus of third maxillipeds articulated at inner dorsal margin of merus. Dactylus of P5 suboval or lanceolate, rarely styliform, and always dorso-ventrally flattened. P5 generally modified for swimming, with at least propodus and dactylus paddle-like. Male abdomen with segments 3-5 fused to varying degrees. Male openings coxal. Female openings sternal. Flattening of the fifth pair of legs into broad paddles is used for swimming This ability, together with their strong, sharp claws, allows many species to be fast and aggressive predators.
Reference: Marine Species Identification Portal, 2010.

Genus *Portunus* Weber, 1795
Portunus pelagicus (Linnaeus, 1758) (Plate 323 a-b)
Distribution: Widespread in the Indian Ocean. *P.pelagicus* is subtidal fast swimming predator, moving intertidally on a rising tide. Subject of commercial fisheries. Common in Kuwait's marine environment

Plate 323. *Portunus pelagicus*, general view. a. male; b. female.

Family Xanthidae MacLeay, 1838

Description: Common name: Mud crabs, Pebble crabs or Rubble crabs. Xanthidae is the largest crab family in terms of species richness, with 572 species in 133 genera divided among the thirteen subfamilies.

Carapace hexagonal, transversely hexagonal to transversely oval, sometimes subcircular; dorsal regions (areolation) generally, but not always, well defined; surface usually ridged or granular. Frontal margin more or less bilobed. Anterolateral margins generally with two to six teeth, spines, or lobes, sometimes weakly differentiated. Epistome with ridges that define efferent branchial canals absent or confined to the posterior part of the buccal cavity, not continuing on to meet the anterior buccal frame. Chelipeds with fingers pointed or spoon-tipped. Walking legs with or without a dactyl-propodal articulation formed by a rounded prolongation of propodal lateral margin sliding against and beneath a progecting button situated proximally on lateral margin of dactilus. Thoracic sternum relatively narrow. Male abdomen consisting of five movable segments with segments 3-5 fused (sutures may sometimes be more or less evident). Male genital openings coxal; female openings sternal. Male first gonopod slender, curved or sinouos, relatively simple apically, lacking complex lobes or folds; typically with long setae distally or subdistally; second gonopod short, less than 0.25 times length of first.

Reference: Poore, 2004.

Genus *Atergatis*

Atergatis integerrimus (Lamarck, 1818) (Plate 324 a-c)

Distribution: Qaruh Island.

Plate 324. ***Atergatis integerrimus*****, female, a-c. general view.**

Genus *Epixanthus*

Epixanthus frontalis (H. Milne-Edwards, 1834) (Plate 325 a-b)

Distribution: Kubbar Island.

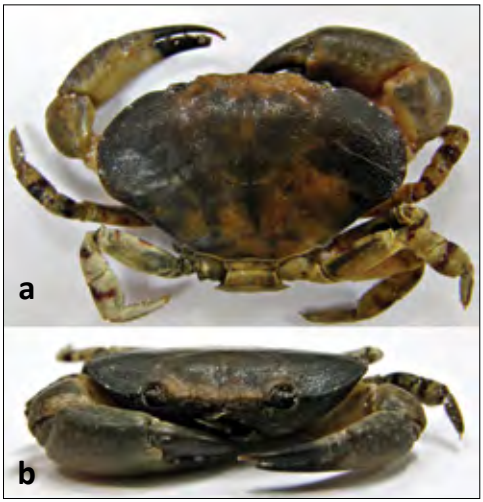


Plate 325. ***Epixanthus frontalis*****, a-b. general view.**

Genus *Eurycarcinus*

Eurycarcinus orientalis A. Milne-Edwards, 1867 (Plate 326 a-b)

Distribution: Burrows in sandy and muddy substrates in intertidal zone of Khor Al-Sabbiya.

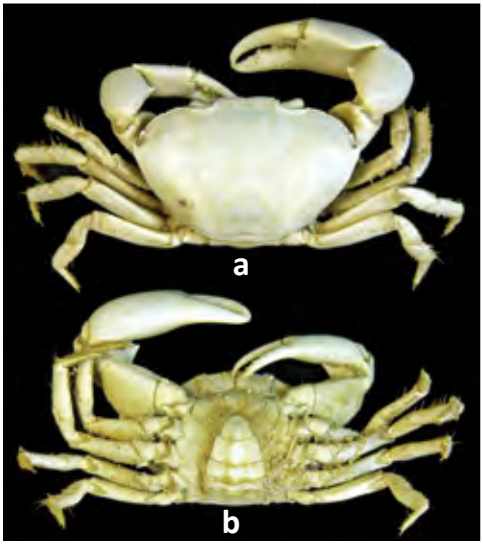


Plate 326. ***Eurycarcinus orientalis*****, a-b. general view.**

Genus *Medaeops*

Medaeops granulosus (Haswell, 1882) (Plate 327 a-b)

Distribution: Under the rocks in Kuwait Bay.

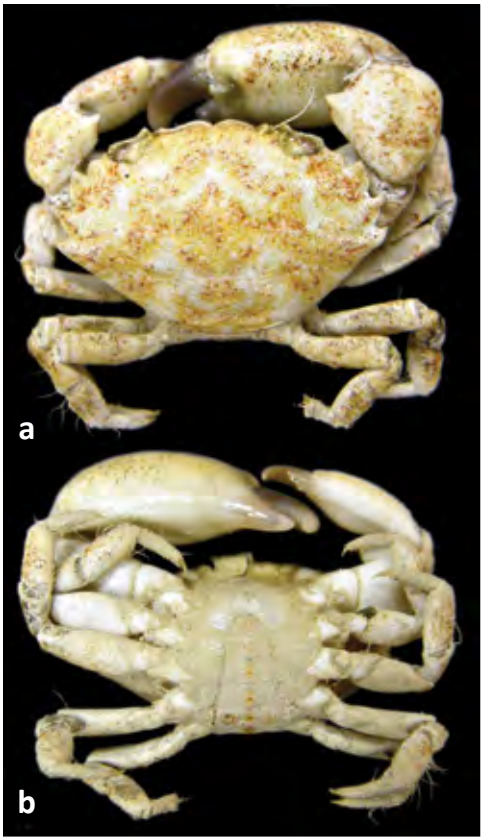


Plate 327. ***Medaeops granulosus*****, a-b. general view.**

Genus *Pilumnus* Leach, 1816
Pilumnus vespertilio Fabricius, 1793 (Plate 328 a-c)
Distribution: Lower shore amongst rocks and weeds. Widespread in Indo-Pacific.

Xanthidae gen. sp.
Distribution: Muddy substrates near Failaka Island and in Kuwait Bay.

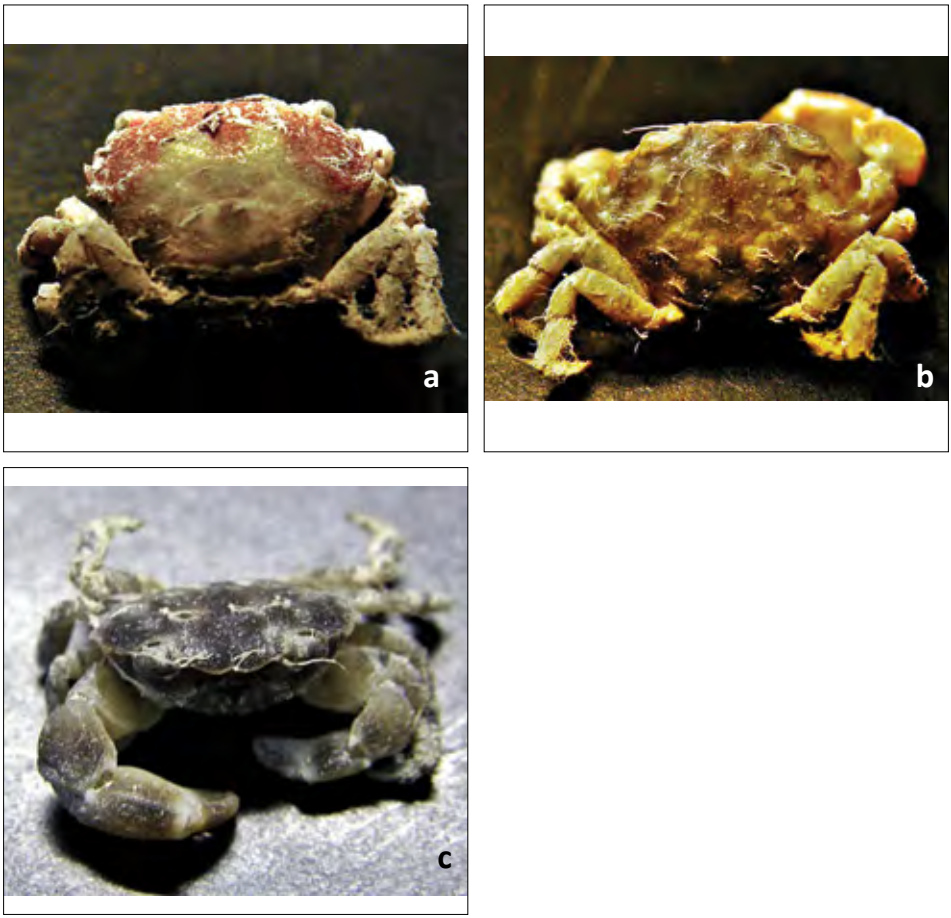


Plate 328. ***Pilumnus vespertilio*****, a-c. general view.**

Genus *Xantho*

Xantho (Leptodius) exaratus H. Milne-Edwards, 1834 (Plate 329)

Distribution: Under the rocks in Kuwait Bay.

Plate 329. *Xantho exaratus*, general view.

Family Macrophthalmidae Dana, 1851

Description: Carapace broader than long, usually quadrilateral, and not very deep. Dorsal surface flattish, sometimes rather vaulted, with the regions usually well defined; smooth at the middle but with a few granules in the branchial part. Antero-lateral margins either straight or slightly arched, entire, faintly or distinctly toothed. Front variable but never very broad. Interantennular septum very narrow. Antennules folding transversely; flagellum well developed. Eyestalks usually elongate; often remarkably long; not projected beyond antero-lateral angle. Upper orbital margin slightly oblique and finely crenulated, suborbital margin with two triangular lobes or oblique tubercles at distal end. Third maxillipeds not always meeting across the buccal cavern, but the gap never very wide; exopodite not, or not entirely, concealed, and with a flagellum. Chelipeds subequal. Third margins of merus of cheliped serrated; manus longer than the merus; inner surface hairy and with a spine. Ambulatory legs: between the bases of any of the legs no special recess or pouch; anterior pairs sometimes extremely broad and short. Third walking leg with a tuft of hair at manus and carpus. Carapace usually is pale grey in life.

Reference: Guinot and Bouchard, 1998.

Genus *Macrophtalmus*

Macrophtalmus (Venitus) dentipes Lucas, in Guérin Méneville, 1836 (Plate 330)

Distribution: Burrows in sandy and muddy substrates in intertidal zone of Khor Al-Sabbiya.

Plate 330. ***Macrophtalmus (Venitus) dentipes*****, female, general view.**

Macrophthalmus (Mareotis) depressus Rüppell, 1830 (Plate 331)
Distribution: Burrows in sandy and muddy substrates in the intertidal zone of Kuwait Bay.

Plate 331. ***Macrophthalmus (Mareotis) depressus*****, male, general view.**

Subphylum CHELICERATA
Class PYCNOGONIDA
Order Pantopoda

Description: Common name: Sea Spiders. Pantopods have long legs in contrast to a small body size. The number of walking legs is usually eight (four pairs), but species with five and six pairs exist. Because of their small size and slender body and legs, no respiratory system is necessary, with gases moving by diffusion. A proboscis allows them to suck nutrients from soft-bodied invertebrates, and their digestive tract has diverticula extending into the legs. Pycnogonids are so small that each of their tiny muscles consists of only one single cell, surrounded by connective tissue. The anterior region consists of the proboscis, which has fairly limited dorsoventral and lateral movement, and three to four appendages including the ovigers, which are used in caring for young and cleaning as well as courtship. In some species, the chelifores, palps and ovigers can be reduced or missing in adults. In those species that lack chelifores and palps, the proboscis is well developed and more mobile and flexible, often equipped with numerous sensory bristles and strong rasping ridges around the mouth. The last segment includes the anus and tubercle, which projects dorsally. Pantopods has up to two pairs of dorsally located simple eyes on its non-calcareous exoskeleton, though sometimes the eyes can be missing, especially among species living in the deep oceans. The abdomen does not have any appendages, and in most species it is reduced and almost vestigial. The organs of this chelicerate extend throughout many appendages because its body is too small to accommodate all of them alone.

From: Margulis and Chapman, 2009.

Family Ascorhynchidae Hoek, 1881
Genus *Ascorhynchus* Sars, 1878
***Ascorhynchus* sp.** (Plate 332)
Distribution: Kuwait's marine environment.

Family Phoxichilidiidae Sars, 1891
Description: Chelifores well developed, palps absent. Ovigerous legs have five to nine joints in males only.
Reference: Marine Species Identification Portal, 2010.

Genus *Phoxiphilyra* Stock, 1974
***Phoxiphilyra* sp.**
Distribution: Muddy and silty substrates in Kuwait Bay.

Plate 332. ***Ascorhynchus*** **sp., general view.**

Phylum ECHINODERMATA
Subphylum ASTEROZOA
Class OPHIUROIDEA
Order Ophiurida
Brittle-stars with distinct scales on arms and disc, but they may be concealed by grains or spines or naked skin. The side arm plates are large, not confined to the lower edge of the arms, and often joining in the dorsal and ventral mid-line. The arm spines are not directed downwards, more rarely partly transformed into hooks. The arms are unbranched and move mainly horizontally. The genital slits are long and narrow, extending from the mouth shield to the edge of the disc. Rarely each genital slit is divided into an inner and outer part, being coalesced in the middle. Only one madreporite present.

Family Amphiuridae Ljungman, 1867
Description: Commonl name: Long-armed burrowing brittle stars, burrowing brittle stars. Amphiuridae are generally small brittlestars with a generally distinctly scaled disc, sometimes with spines. There is a pair of infradental papillae on the apex of the jaw. The papillae on the sides of the jaw may be contiguous or not contiguous with the infradental papillae. There is a single series of square teeth, no tooth papillae. Inside the mouth edge there are two pairs of tube-feet. The arms are mostly very long, slender and flexible. The arm spines are short and outstanding. The genital organs are small and not in the shape of a single large mass at each bursal slit.
Reference: Marine Species Identification Portal.

Genus *Amphipholis* Thomas, 1966
Amphipholis squamata (Delle Chiaje, 1828) (Plate 333)
Distribution: Muddy substrates near Failaka Island and in Khor Al-Sabbiya.

Plate 333. *Amphipholis squamata*, general view.

Genus *Amphioplus* Verrill 1899
Amphioplus (Lymanella) hastatus (Ljungman, 1867)
Distribution: Muddy and silty substrates in Kuwait Bay.

***Amphioplus (Lymanella)* sp.** (Plate 334 a-b)
Distribution: Muddy substrates near Failaka Island and between Bubiyan and Failaka Islands.

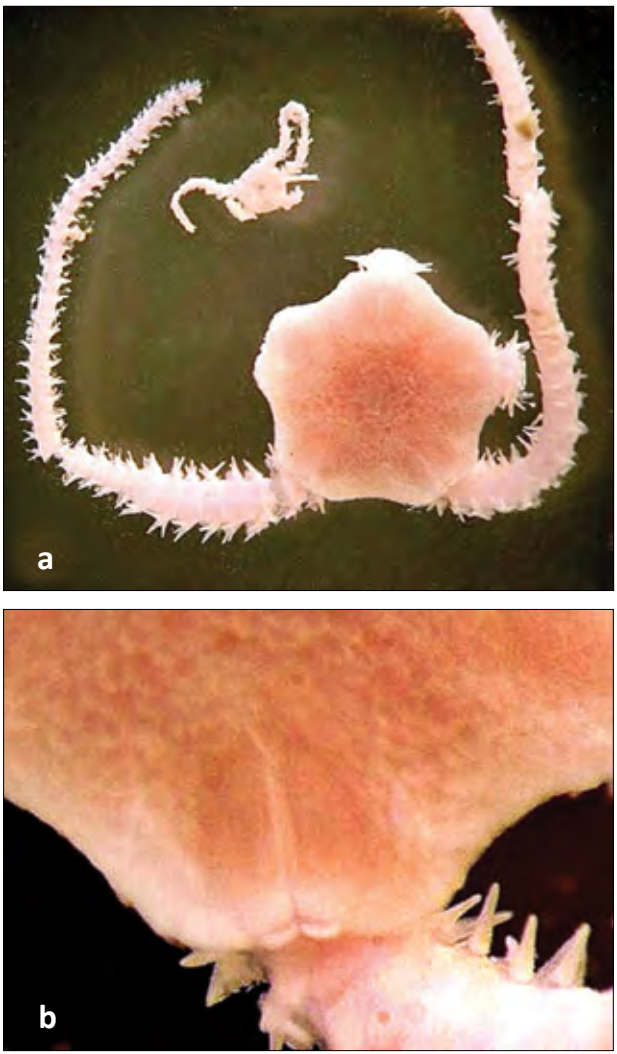


Plate 334. ***Amphioplus (Lymanella)* sp. a. general view; b. section of disc.**

Genus ***Amphiura*** Forbes 1843

Amphiura fasciata Mortensen, 1940 (Plate 335 a-c)

Distribution: Muddy substrates near Failaka Island and between Bubiyan and Failaka Islands.

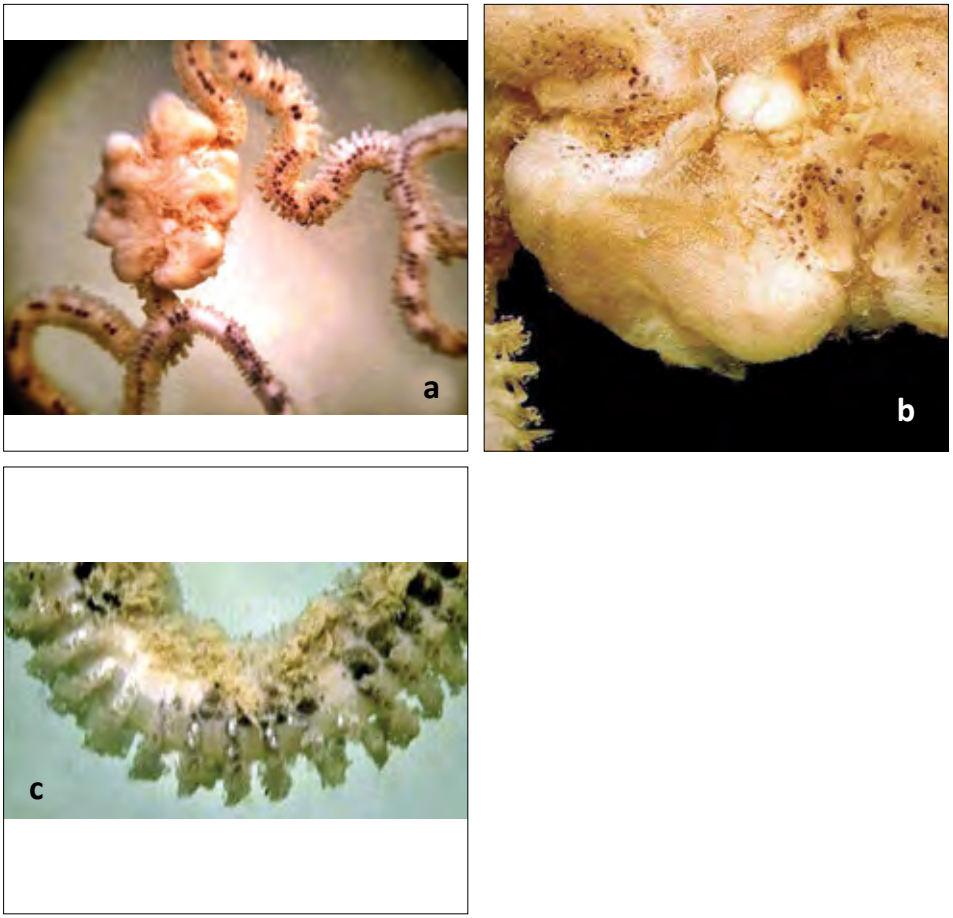


Plate 335. ***Amphiura fasciata*****. a. general view; b. section of disc; c. fragment of arm.**

Family Ophiotrichidae Ljungman, 1867
Description: Brittle-stars with well-developed scales, which may be more or less concealed by small spines or thorny stumps. The radial shields are large and conspicuous. Both the dorsal and ventral arm plates are well developed, the arm spines are erect and generally distinctly thorny. No mouth papillae, but a group of well-developed tooth papillae, and inside these a series of broad, strong teeth on the apex of the jaws. There is a second pair of tube-feet inside the mouth edge.

Genus *Macrophiothrix* H.L. Clark 1938
***Macrophiothrix* sp.**
Distribution: Muddy substrates near Failaka Island and between Bubiyan and Failaka Islands, in Kuwait Bay and the intertidal zone of Ras Al-Ardh.

Subphylum ECHINOZOA
Class ECHINOIDEA
Order Echinothuroida
Family Diadematidae Gray, 1855
Description: A family of large euechinoid echinoderms having crenulate tubercles and long spines. Test depressed; coronal plating rigid to slightly flexible especially adapically; apical disc relatively small; generally hemicyclic with posterior oculars insert; genital plates strongly projecting interradially. Periproctal plating well-developed peripherally; ambulacral plating trigeminate, with an enlarged element and two smaller demiplates. Pore-pairs uniserial; arranged into weak arcs. May become crowded adorally to form phyllodes; interambulacral plates usually with multiple subequal tubercles forming a row. If one, then adradial and interradial zones well developed and with secondary tubercles; sphaeridial pit close to every third pore-pair from peristome to apex; tubercles perforate and almost always crenulate; peristome small; buccal notches rounded, with associated tags. Perradial notch also present; spines verticillate and hollow or with sparse open mesh; larva with just two arms.
Reference: Smith, 2005.

Genus *Diadema* J.E. Gray, 1825
Diadema setosum (Leske, 1778) (Plate 336 a-b)
Distribution: Subtidal zone from Ras Al-Ardh to Ras Al-Zour, as well as Kubbar Island.

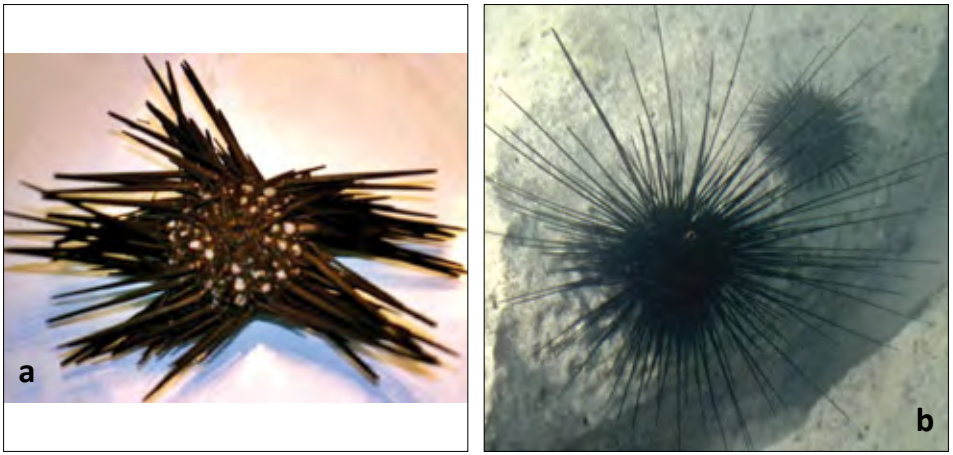


Plate 336. ***Diadema setosum*****, a. general view; b. sea urchins** ***D. setosum*** **and** ***Echinometra mathaei*** **on the rock in Ras Al-Ardh.**

Family Echinometridae Gray, 1825
Description: Echinometridae are primarily distinguished on their globiferous pedicellarial structure. Test is circular or ovate in outline; ambulacra trigeminate or polygenimate; buccal notches extremely feeble; single asymmetrical lateral tooth on narrow tubular blade of globiferous pedicellariae; echinopluteus with basket-like arrangement of spicules in early stage.
Reference: Smith, 2005.

Genus ***Echinometra*** Gray 1825
Echinometra mathaei (de Blainville, 1825) (Plate 337 a-b)
Distribution: Indian and West Pacific Ocean. In Kuwait waters, it was registered in the subtidal zone from Ras Al-Ardh to Ras Al-Zour.

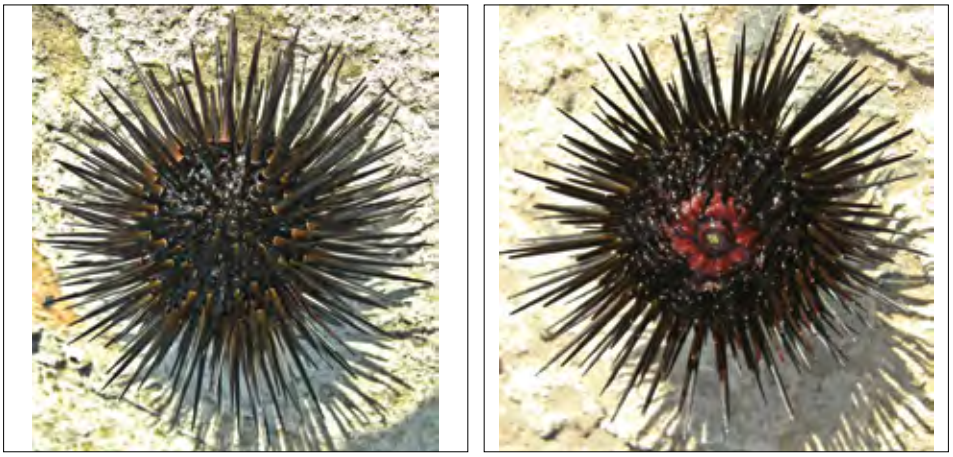


Plate 337. ***Echinometra mathaei*****, a-b. general view.**

Order Spatangoida
Family Brissidae Gray, 1855
Description: Distinguished from other Spatangoids by the short and wide labral plate that does not extend beyond the first ambulacral plate and by its relatively narrow and parallel-sided petals. Ethmolytic apical disc with genital plate 2 extending behind the posterior ocular plates; labral plate short and wide, not in contact with ambulacral plate 2; episternal plates tapering posteriorly; petals narrow and parallel-sided, without wide perradial zone; generally sunken; peripetalous and subanal fascioles present.
Reference: Smith, 2005.

Genus *Brissopsis* L. Agassiz, in L. Agassiz and Desor 1847
Brissopsis persica Mortensen, 1940 (Plate 338 a-b)
Distribution: Kuwait's marine environment.

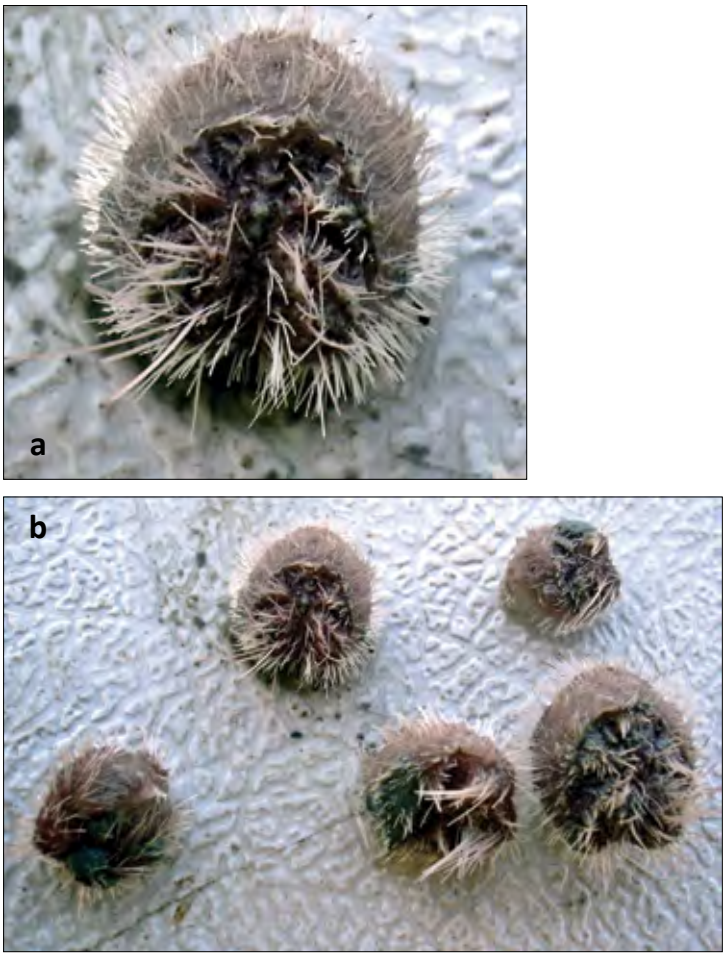
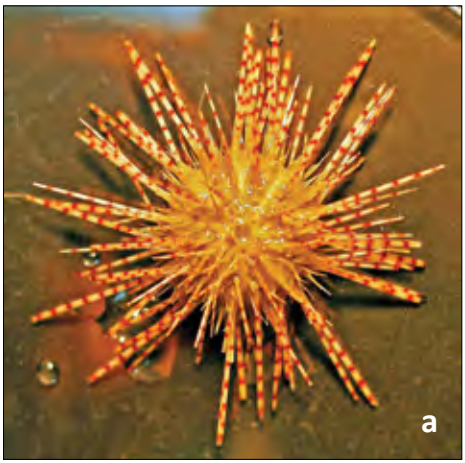


Plate 338. ***Brissopsis persica*****, a-b. general view.**

Order Temnopleuroida
Family Temnopleuridae Agassiz, 1872
Description: Sea urchins with apical disc relatively small and dicyclic. Periproct is subcircular with smooth edges (periproctal plates not indenting apical ring); ambulacra trigeminate, with echinid style compounding. Pore-pairs forming a simple adradial band which does not expand adorally. Primary tubercles in ambulacral and interambulacral zones are similar in size; imperforate and with or without crenulation; deep and sharp-edged pits at triple suture points at least in juveniles and usually throughout life; often large and prominent; peristome much larger than apical disc; buccal notches obsolete.
Reference: Smith, 2005.

Genus *Temnopleurus* Agassiz 1841
Temnopleurus toreumaticus (Leske, 1778) (Plate 339 a-b)
Distribution: Muddy substrates in Kuwait Bay.



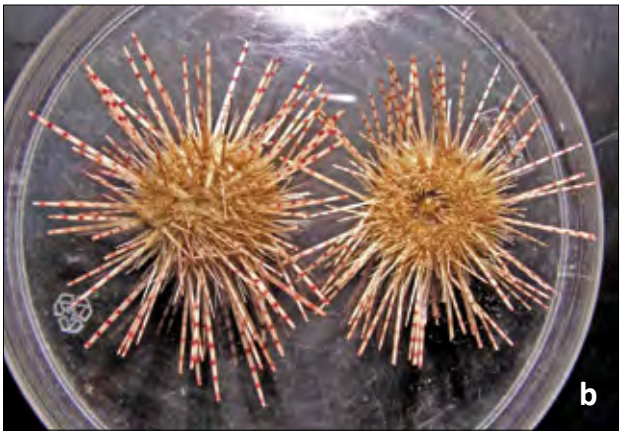


Plate 339. ***Temnopleurus toreumaticus*****, a-b. general view.**

Order Cidaroida
Family Cidaridae Gray, 1825
Description:. Interambulacra with single large primary tubercle that is perforate and, in the most basal members, basically non-crenulate (traces of crenulation may be present on adapical side of aboral tubercles); ambulacra simple throughout; tuberculation uniform; primary interambulacral tubercles surrounded by a differentiated ring of scrobicular tubercles; spines cylindrical to fusiform but never strongly clavate.
Reference: Smith, 2005.

Cidaridae gen. sp. (Plate 340)
Distribution: Coral reefs in Ras Al-Zour.

Plate 340. Cidaridae gen. sp., general view.

Order Clypeasteroida
Description: The Clypeasteroida includes a number of familiar sea urchin groups, including the sand dollars, sea biscuits and cake urchins. They are mainly shallow-water forms inhabiting sandy substrata. The sand dollars are mostly infaunal, living immediately underneath the sediment-water interface often in beach-face or shallow shoal settings. Clypeasteroids are unique in having large numbers of tiny tube feet and this has allowed them to harvest the small organic particles found amongst sand-sized grains. No other echinoid group has tube-feet of such minute proportions. Although all have a functioning lantern, the teeth are internal and are used solely for crushing and biting particles internally.
Reference: Smith, 2005.

Family Clypeasteridae L. Agassiz, 1872
Description: Clypeasteroids with internal buttressing in the form of concentric walls around the periphery with or without more central pillars. A pair of sunken and enclosed sphaeridia in each ambulacrum. Petals when well developed consisting of alternating primary plates and demiplates (apetalloid forms with simple ambulacral plating). Perignathic girdle of five pairs of ambulacral elements (auricles). Five gonopores in the apical disc. Peristome generally sunken, with surrounding infundibulum. Interambulacral plating on oral surface always disjunct.
Reference: Smith, 2005.

Genus *Clypeaster*
Clypeaster humilis (Leske, 1778) (Plate 341)
Distribution: Sandy substrates from Ras Al-Ardh to Ras Al-Zour.

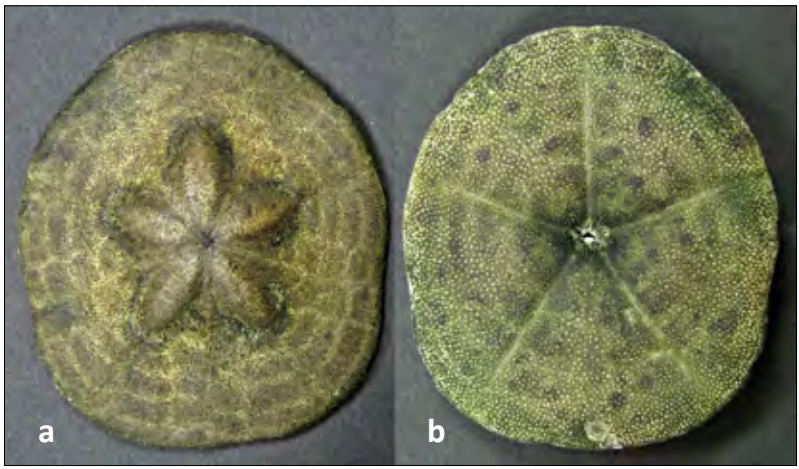


Plate 341. ***Clypeaster humilis*****, a. dorsal view; b. ventral view.**

Family Astriclypeidae Stefanini, 1912
Description: Clypeasteroids with internal buttressing present; variably developed; petaloid areas composed of simple primary plates throughout; perignathic girdle consisting of five interradial pegs. Lantern muscle attachment structures consisting of five fused interradial pegs; interambulacral plating biserial to apex. Complex internal buttresses forming microcanal system around periphery; four gonopores; ambulacral and interambulacral zones similar in width at ambitus; pores and tube-feet extending onto interambulacral zones; petals well-developed, closed or nearly closed distally; basicoronal circlet small, interambulacral elements pointed but not strongly projecting; posterior interambulacral zone disjunct adorally; periproct opening oral, associated with first pair of post-basicoronal interambulacral plates; perradial notches or lunules in some or all ambulacra; food grooves well developed, bifurcating at edge of basicoronal circlet and finely subdivided distally.
Reference: Smith, 2005.

Genus *Echinodiscus*
Echinodiscus auritus Leske, 1778 (Plate 342)
Distribution: Sandy substrates of Ras Al-Zour.

Plate 342. *Echinodiscus auritus*, general view.

Class HOLOTHUROIDEA
Order Aspidochirotida
Description:. The Aspidochirotida are the holothurians with 15-30 shield-shaped tentacles. Body wall usually thick; ossicles usually include tables. Respiratory trees present. Mesentery of posterior intestinal loop attached to right ventral interradius. Longitudinal muscles arranged into five double bands. Some species may reach a length of 1-2 m. The animals usually occur in exposed shallow-water environments.
Reference: Smith, 2005.

Family Holothuriidae Ludwig, 1894
Description:. The Holothuriidae contains a large assemblage of most diverse sea cucumbers falling into many sub-groups, but all having tables (though sometimes rare) among the spicules and a robust calcareous ring. Species size ranges from small to very large. They are usually sausage-shaped, with thin to thick body wall and diverse colour patterns. Some species lie exposed, though most are more or less fugitive below rocks or buried. Most are found on reef flats, lagoons or shallow slopes, but some prefer deeper regions, soft sediments, sea-grasses or coastal regions.
Reference: Smith, 2005.

Genus *Holothuria* Linnaeus, 1767
Holothuria (Halodeima) atra Jaeger, 1833 (Plate 343)
Distribution: Sandy substrates from Ras Al-Ardh to Ras Al-Zour.

Plate 343. *Holothuria (Halodeima) atra*, general view.

Holothuria (Thymiosycia) arenicola Semper, 1868. (Plate 344 a-b)
Distribution: Sandy substrates from Ras Al-Ardh to Ras Al-Zour.

Plate 344. ***Holothuria (Thymiosycia) arenicola*****, a. dorsal view; b. ventral view.**

Order Dendrochirotida
Description: Holothurians with 10-30 richly branched tentacles, and complex to simple calcareous ring. Body wall either firm with large ossicles or soft with reduced ossicles. The animals attach themselves to hard substrates or burrow into soft sediments. Prey is captured on the sticky tentacles, which are pushed into the mouth. Larvae, when present, are not planktonic but lecithotrophic.
Reference: Smith, 2005.

Family Phyllophoridae Oestergren, 1907
Description: Family Phyllophoridae contains of small to medium-sized dendrochirote sea cucumbers with more than ten tentacles in one to three rings. Typically, the outer tentacles are longer for feeding and the inner ones shorter for cleaning. Most occur below boulders or buried in the substrate.
Reference: Smith, 2005.

Genus *Ohshimella* Heding and Panning 1954
Ohshimella ehrenbergii (Selenka, 1868) (Plate 345)
Distribution: Muddy substrates between Bubiyan and Failaka Islands.

Plate 345. ***Ohshimella ehrenbergii*****, general view.**

Class ASTEROIDEA
Order Valvatida
Description: Starfish with generally inconspicuous marginal plates, not forming a vertical edge to the disc. The dorsal and oral side are covered with spines, mostly in groups on prominences from the plates, forming paxillae, more rarely isolated. Simple pedicellariae may occur. The papulae are mostly both on the dorsal and ventral side. The tube-feet are usually in two series and always provided with a sucking disc.
Reference: Smith, 2005.

Family Asterinidae Gray, 1840
Description:. Starfish with very short arms, giving the flattened body a pentagonal shape. The edge of the body is sharp and is formed of small indistinct marginal plates.
Reference: Smith, 2005.

Genus *Aquilonastra* O'Loughlin in O'Loughlin and Waters, 2004
Aquilonastra burtoni (Gray, 1840) (Plate 346 a-b)
Distribution: Sandy substrates from Ras Al-Ardh to Ras Al-Zour.

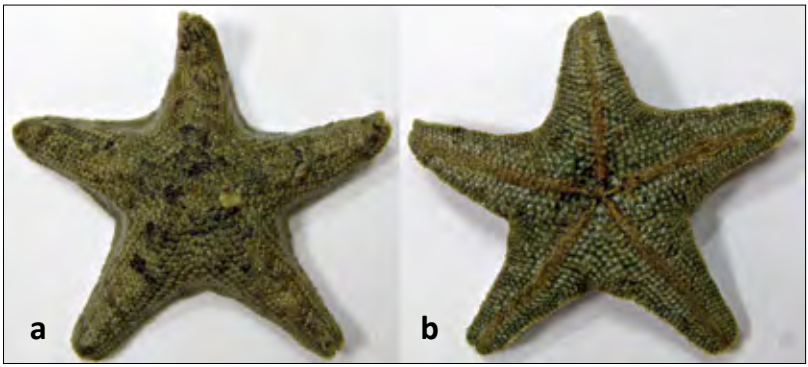


Plate 346. ***Aquilonastra burtoni*****, a. dorsal view; b. ventral view.**

Phylum HEMICHORDATA
Class ENTEROPNEUSTA
Acorn worms (Class Enteropneusta) are soft, round worms usually found in sand or mud. Their bodies are divided into three regions: an anterior proboscis, a collar, and a posterior trunk, which is usually the longest. The trunk may be subdivided into several regions. They have a straight gut, which starts at the anteroventral mouth which is found at the junction between the proboscis and the collar, and ends at the posterior tip of the trunk. Enteropneusts burrow by using the proboscis. This is elongated and thrust forward, then contracted longitudinally to form a bulge. This bulge is moved posteriorly to the base of the proboscis, pulling the animal forward. The collar and trunk move forward passively. Cilia on the surface of the proboscis and collar also move sand posteriorly.

Order Enteropneusta

Family Harrimaniidae Spengel, 1901

Description: Family Harrimaniidae has simple gonads, large, yolky eggs, and perihaemal cavities but has no synapticles in the gill bars, no hepatic caecum, and no tornaria larval stage. The hepatic region has no distinguishing external features like the hepatic sacculation of ptychoderids, but is recognised by its deep brown or green pigmentation and thick convoluted walls, which are visible through the semi-transparent epidermis. The trunk coelom is devoid of lateral septa, and the body wall is devoid of any circular musculature. The Harrimaniidae are considered to be the most primitive family in the class Enteropneusta.

Saccoglossus species have an elongate proboscis and a posterior fold of the collar, which slightly overlaps the trunk. In most *Saccoglossus* species the proboscis is cylindrical, tapered apically, grooved mid-dorsally and many times longer than the collar. The collar is sub-cylindrical, longer than broad in most species, as broad as long in some, but shorter in others, especially in preserved or contracted specimens. The longitudinal musculature of the proboscis is often concentrically arranged. The posterior oesophageal region is perforated by one or more pairs of pores, which lie in shallow diverging grooves on each side of the mid-dorsal line. Oesophageal pores are absent in the other genera. Spawning in some saccoglossids is known to be seasonal, epidemic, and temperature and tide related. Fertilisation is external; the buoyant eggs have being dispersed by tides. Development involves a planula-like lecithotrophic larva, with a short, partially planktonic, dispersal phase, then settlement and an exploratory benthic phase prior to assuming a burrowing habit.

References: Hyman, 1959; Australian Faunal Directory, 2010.

Genus *Saccoglossus* Schimkewitsch 1892

***Saccoglossus* sp.** (Plate 347)

Distribution: Muddy substrates between Bubiyan and Failaka Islands.

Plate 347. *Saccoglossus* sp., general view.

Phylum CHORDATA
Subphylum UROCHORDATA
Class ASCIDIACEA
Order Aplousobranchia
Family Polyclinidae Milne-Edwards, 1841
Description: Polyclinidae is one of the most diverse families of the Aplousobranchia. They have embedded zooids with 6-lobed or (occasionally) 8-lobed branchial apertures and smooth-rimmed atrial apertures, usually with a tongue from the upper rim of the opening or from the body wall anterior to the opening. Zooids may be arranged with their atrial openings into sometimes extensive branching cloacal canals or in circular systems around simple cloacal cavities. Colonies vary from small cushions to large irregular and sometimes lobed masses, or stalked heads, and many species have sand or other particles embedded in the test. Gonads are in a thread- or sac-like posterior abdomen with the testis follicles respectively serially arranged or bunched. The ovary is small and is anterior to the testis follicles. Fertilisation appears to occur in the atrial cavity or the distal end of the oviduct, where embryos are found at different stages of development. The gut loop is relatively short and the stomach is about halfway down the descending limb.
Reference: Berrill, 1950, from: Australian Faunal Directory, 2010.

Genus *Polyclinum* Savigny 1816
Polyclinum constellatum Savigny, 1816 (Plate 348)
Distribution: Widely distributed in warm waters throughout the world and recorded frequently in the Western Indian Ocean. In Kuwait it was found on hard substrates in the intertidal zone of Ras Al-Ardh.

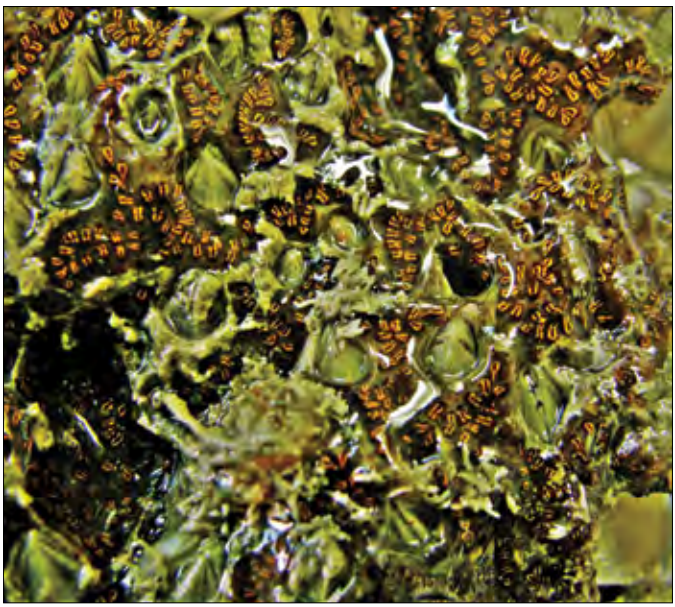


Plate 348. ***Polyclinum constellatum*****, colony.**

Order Phlebobranchia
Family Ascidiidae Herdman, 1882
Description: The family Ascidiidae contains solitary forms, usually with a relatively firm, inflexible, gelatinous, translucent test. The branchial sac is more or less flat, the branchial wall sometimes having minute undulations but usually lacking internal folds. The large gonads are enclosed in the gut loop and often spread over the inside of the gut, which is bent up in the left parietal body wall. The testis consists of branching follicles joined to a common vas deferens. The tubular ovary also branches. The vas deferens and thick ovarian tube are between two limbs of the gut loop, opening with the anus near the base of the atrial aperture. Body muscles usually form an irregular network over the right side of the body and anterior to the gut on the left, although they are inconspicuous over the gut. *Phallusia* species are large with thick, firm and translucent test. The ciliated pit, the primary opening of the neural duct (at the base of the branchial siphon), is one- to two-thirds of the body length distant from the neural gland (just anterior to the atrial siphon). This is an appreciable distance when individuals are up to 60 mm or more in length. The accessory openings of the neural duct into the atrial cavity (characteristic of this genus) may be associated with that long neural duct.
Reference: Kott, 1985.

Genus *Phallusia* Savigny 1816
Phallusia nigra Savigny, 1816 (Plate 349 a-b)
Distribution: East Mediterranean Sea, Red Sea, Arabian Gulf. In Kuwait waters, registered on hard substrates in the intertidal zone of Ras Al-Ardh.

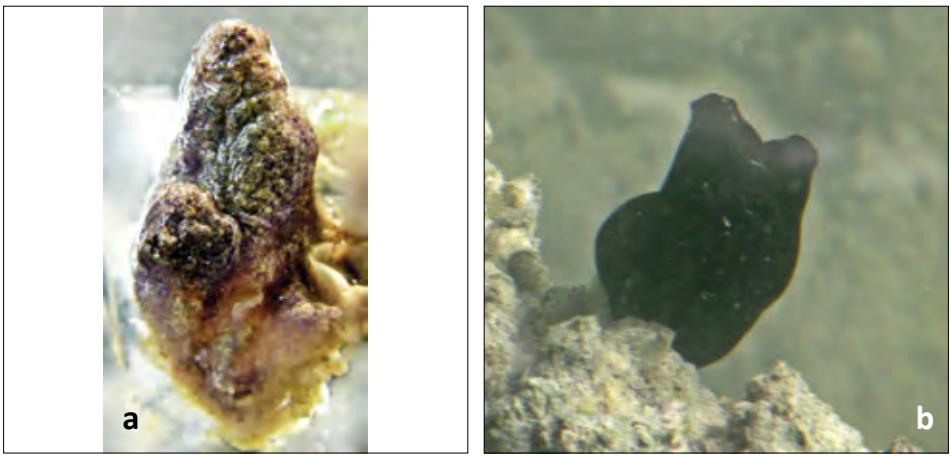


Plate 349. ***Phallusia nigra*****, a. general view of young specimen; b.** ***P. nigra*** **on the rock in Ras Al-Ardh.**

Subphylum CEPHALOCHORDATA
Class LEPTOCARDII
Order Amphioxiformes
Family Branchiostomidae

Description: Cephalochordates, also known as lancelets or acraniates, are small (‹50 mm) primitive chordates and are normally considered to be the sister group to the Vertebrata. They show little evidence of cephalisation, are elongate, pointed at both ends and laterally compressed. A fold of skin extends along the dorsal midline, around the tail and anteriorly along the posterior part of the ventral surface. This fold, which is enlarged posteriorly, forms a continuous dorsal, caudal and ventral fin. The notochord is homologous with the same structure in other chordates and consists of a series of cell discs or lamellae composed of muscle cells. A collagenous sheath surrounds the lamellae and by contraction of the muscles, a rigid axial skeleton can be produced. A hollow nerve cord is dorsal to the notochord. Cephalochordates will respond to light, tactile and chemical stimuli, however complex sense organs are absent. A single pigmented eye spot is found in some species. The animals are metamerically segmented with the muscles forming a series of myotomes. The gonads, which vary in number from 20–40 in different species, are easily discernible externally. The sexes are similar and fertilisation is external. Spawning typically occurs at sundown. The larvae, which are similar to the echinoderm tornaria larva, swim actively using cilia. They develop into the asymmetrical, pelagic, amphioxoides larvae before transformation and settlement. Cephalochordates are jawless, mucous filter-feeders similar to tunicates. Water is drawn in through the mouth, which is surrounded by buccal cirri, by ciliary action, then filtered through the gill slits and finally passes to the exterior through an atriopore. Only a single family, Branchiostomidae, is recognized, with two genera and about 23 species worldwide.

Reference: Australian Faunal Directory, 2010.

Genus *Branchiostoma (Amphioxus)* (Yarrell, 1836)
***Branchiostoma* sp.** (Plate 350 a-b)
Distribution: Intertidal zone of Ras Al-Ardh (Station 16).

Plate 350. ***Branchiostoma*** **sp., a. general view; b. oral end.**

Subphylum VERTEBRATA
Class ACTINOPTERYGII
Order Perciformes
Family Gobiidae
Subfamily Oxudercinae

Description: Mudskippers are currently included in the subfamily Oxudercinae (family Gobiidae). The combination of unique physiological and behavioral adaptations of the mudskippers, including pectoral fins that act as legs; the ability to breathe through their skins, and the digging of burrows to avoid drying make them able to survive for long periods on land. Mudskippers inhabit in tropical, subtropical and temperate intertidal soft-bottomed areas, particularly on mudflats and in mangrove forests.

Five species of mudskippers are reported in Kuwait's intertidal zone (Al-Yamani et al., 2004). During the current study, we registered and photographed only two species, *Periophthalmus waltoni* and *Boleophthalmus dussumieri.*

Genus *Periophthalmus*
Periophthalmus waltoni Koumans, 1941 (Plate 351 a-b)
Distribution: Tidal creeks of western coast of Khor Al-Sabbiya.

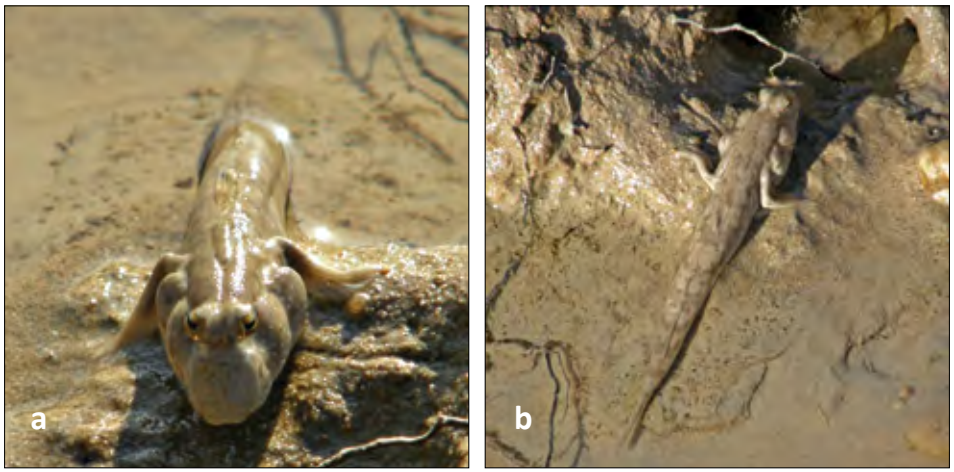


Plate 351. ***Periophthalmus waltoni*****, a. general view, b. mudskipper near its borrow.**

Genus *Boleophthalmus*
Boleophthalmus dussumieri Valenciennes, 1837 (Plate 352 a-b)
Distribution: Intertidal zone of Kuwait Bay.

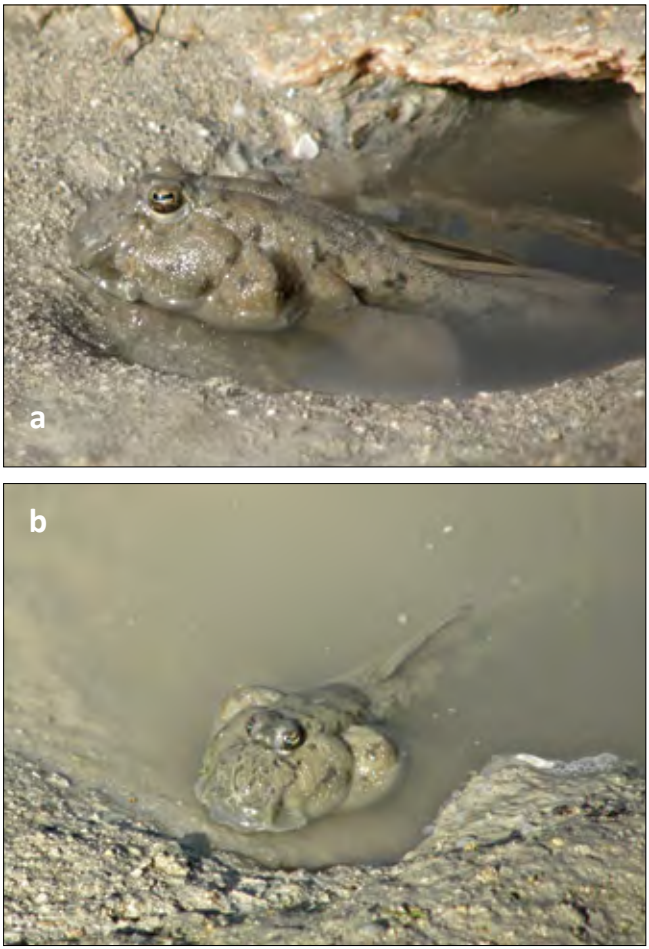


Plate 352. Mudskipper *Boleophtalmus dussumieri*, a-b. general view.

COMPARATIVE TABLE OF BENTHIC SPECIES FROM THE WATERS OF KUWAIT AND ROPME SEA

List of zoobenthos species encountered in Kuwait waters and ROPME (Regional Organization for the Protection of the Marine Environment) Sea.

This study (2004, 2009-2012) Kuwait waters	PAAC (2005) Kuwait waters *	ROPME Sea (2004-2005) **
CNIDARIA		
		Folliculinidae gen. sp.
		Virgularia sp.
	Edwardsiidae gen. sp.	Edwardsiidae gen. sp.
	Hydrozoa gen. sp.	
Obelia dichotoma		
Actiniaria gen. spp.	Actiniaria gen. spp.	
ECTOPROCTA		
Bugula neritina		
Schizoporella errata		
PHORONIDA		
Phoronis spp.	*Phoronis* spp.	
PROIFERA		
Porifera gen. spp.		Porifera gen. sp.
NEMATODA		
Nematoda gen. spp.	Nematoda gen. spp.	Nematoda gen. spp.
NEMERTEA		
Nemertea gen. spp.	Nemertea gen. spp.	Nemertea gen. spp.
ECHIURA		
Anelassorhynchus branchiorhynchus		
	Echiuroinea gen. spp.	
Ikeda pirotansis		
Listriolobus brevirostris		
SIPUNCULA		
		Aspidosiphon elegans
Apionsoma trichocephalus		
		Golfingia hespera
Phascolion convestitum		
		Phascolion robertsoni
Phascolion valdiviae var.sumatrense		
Phascolion spp.		
Sipuncula gen. sp.		Sipuncula gen. sp.
ANNELIDA		
		Aisychis disparidentata
		Amphiglena quadrioculatum
		Amphinomidae sp.
		Ancistrosyllis constricta
		Ancistrosyllis parva
		Ancistrosyllis rigida

This study (2004, 2009-2012) Kuwait waters	PAAC (2005) Kuwait waters *	ROPME Sea (2004-2005) **
Ancistrosyllis sp.		*Ancistrosyllis* sp.
		Aonides oxycephala
		Aphrodite sp.
		Arabella mutans
Aricidea longobranchiata		*Aricidea longobranchiata*
		Aricidea jeffreysi
Aricidea sp.	*Aricidea* sp.	*Aricidea* sp.
		Augneria sp.
	Amaeana trilobata	
	Anaitides maderiensis	
	Amandia leptocirrus	
Aglaophamus sp.		
		Amage bioculata
Amage sp.		
Ampharetidae gen. sp.		
Amphicteis sp.		
Ancistargis sp.		
Bhawania goodei		
Brada mamillata		
		Brada villosa
Branchiomma cingulata		
	Bookhoutia oligognatha	
		Brania sp.
Capitella capitata		
Capitella sp.	*Capitella spp.*	
Capitellidae gen. sp.	Capitellidae gen. sp.	
Capitomastus sp.		
		Caulleriella bioculatus
	Ceratonereis sp.	
	Ceratonereis erythraensis	
Chaetopterus sp.		
		Chone filicaudata
		Chone sp.
		Chrysopetalum (Paleanotus) ehlersi
	Cirratulidae gen. sp.	
		Cirratulus filiformis
Cirratulus sp.		
Cirriformia chrysoderma		
	Cirriformia semicincta	
Cirriphorous branchiatus		*Cirriphorous branchiatus*
Cirrophorus harpagoneus		
Cirrophorus sp.		
		Cossura coasta
	Cossura dayi	

This study (2004, 2009-2012) Kuwait waters	PAAC (2005) Kuwait waters *	ROPME Sea (2004-2005) **
Cossura laeviseta		
Dasybranchus sp.		*Dasybranchus* sp.
		Diopatra cuprea punctifera
Diopatra neapolitana		
		Diplocirrus capensis
Diplocirrus glaucus		
Dodecaceria sp.		
Dorvillea sp.		*Dorvillea* sp.
		Drilognathus sp.
	Drilonereis filum	*Drilonereis filum*
	Enchytraeidae gen. spp.	
		Eteone (Mysta) siphodonta
		Euchone capensis
Eteone ornata		
Euclymene annandalei		
Euclymene insecta		
		Euclymene luderitziana
Euclymene sp.		*Euclymene* sp.
		Eumida sanguinea
Eunice indica		*Eunice indica*
Eunice laticeps		
	Eunice siciliensis	
		Eunereis sp.
		Eusyllis sp.
		Exogone clavator
Exogone sp.	*Exogone* spp.	*Exogone* spp.
		Exogone verugera
	Fabricia sp.	
		Flabelligeridae gen. sp.
Flabelligera diplochaitos		
		Galathowenia sp.
	Galathowenia oculata	
		Glycera convoluta
	Glycera macintoshi	
Glycera rouxii		*Glycera rouxi*
Glycera tesselata		
Glycera tridactyla		
	Glycera sp.	
Glycera unicornis		
	Glycinde bonhourei	
		Glycinde capensis
Glycinde sp.		
		Goniada emerita
		Goniada maculata
Goniada sp.		

This study (2004, 2009-2012) Kuwait waters	PAAC (2005) Kuwait waters *	ROPME Sea (2004-2005) **
	Goniadidae spp. (juveniles)	
		Goniadella sp.
		Gyptis capensis
		Halosydna alleni
	Haplosyllis spongicola	
Harmothoe dictyophora		*Harmothoe dictyophora*
Harmothoe minuta		
Harmothoe sp.		
Hesionidae gen. sp.	Hesionidae gen. sp.	
Heteromastus filiformis		*Heteromastus filiformis*
	Heteromastus similes	
	Hirudinea sp.	
Hydroides heterocerus		
		Hydroides homocerous
		Isolda albula
	Jasminiera sp.	
		Kefersteinia cirrata
Lanice conchilega		
Laonice cirrata		*Laonice cirrata*
	Leocrates claparedil	
		Leocrates sp.
	Leonnates decipiens	
Leonnates indicus		
Leonnates persicus		*Leonnates persicus*
Lepidasthenia sp.		
Levinsenia gracilis	*Levinsenia gracilis*	
Levinsenia sp.		
	Lepidonotus tenuisetosus	
		Lepidonotus sp.
		Leptonereis sp.
		Loandalla sp.
Loimia medusa		*Loimia medusa*
	Lumbrineridae gen. sp.	
		Lumbrinereis bifilaris
		Lumbrinereis gracilis
Lumbrineris heteropoda		*Lumbrinereis heteropoda*
Lumbrineris impatiens		
Lumbrineris latreilli		*Lumbrinereis latreilli*
Lumbrineris sp.		*Lumbrinereis* spp.
Lysilla pambanensis		
		Magelona alleni
Magelona cornuta		*Magelona cornuta*
		Magelona cincta
	Magelona heteropoda	

This study (2004, 2009-2012) Kuwait waters	PAAC (2005) Kuwait waters *	ROPME Sea (2004-2005) **
		Magelona sp.
Maldane cristata		
Maldane sarsi		
Maldanidae gen. sp.		
		Marphysa macintoshi
	Marphysa sanguinea	
	Mediomastus caudatus	
		Mediomastus sp.
	Melinna palmata	*Melinna palmata*
Melinna sp.		
Melinnopsis sp.		
		Mesochaetopterus minutus
Micronephtys sp.		
		Microneries sp.
Micronephtys sphaerocirrata		*Micronephtys sphaerocirrata*
	Nephtyidae spp.	
		Nephtys lyrochaeta
		Nephtys paradox
Nephtys tulearensis		*Nephtys tulearensis*
	Nephtys sp.	
	Nereidae gen. spp.	
Nereis pelagica		
		Nereis persica
		Nerimyra sp.
Ninoe pulchra	*Ninoe pulchra*	
Notomastus latericeus		
		Notomastus sp.
	Odontosyllis sp.	
		Onuphis eremite
		Onuphis investigatoris
Onuphis sp.		
Ophelina acuminata		*Ophelina acuminata*
	Ophelina sp.	
Ophiodromus latifrons		
	Orbinia sp.	
Orbiniella sp.		
		Owenia fusiformis
	Paramphinome indica	
		Paradonides lyra
		Paralacydonia paradox
Paramphinome sp.		
		Paraonis gracilis gracilis
Paraonis sp.		
Paraprionospio pinnata	*Paraprionospio pinnata*	*Paraprionospio pinnata*
Parheteromastus tenuis		

This study (2004, 2009-2012) Kuwait waters	PAAC (2005) Kuwait waters *	ROPME Sea (2004-2005) **
Pectinaria antipoda		
		Pectinaria (Amphictene) crassa
		Pectinaria (Pectinaria) papillosa
	Perinereis nuntia	
	Perinereis vancaurica	
Pherusa (Stylaroides) plumosa		
		Phyllodoce castanae
	Phyllodoce dissotyla	*Phyllodoce dissotyla*
		Pilargis sp.
		Pista unibranchiata
	Phyllodoce maderiensis	
Phyllodocidae gen. sp.	Phyllodocidae gen. sp.	
Pista cristata		
	Podarkeopsis sp.	
		Poecilochaetus serpens
Poecilochaetus sp.		
		Polycirrus sp.
		Polydora (Pseudopolydora) antennata
	Polydora ciliata	*Polydora ciliata*
Polydora sp.	*Polydora* sp.	*Polydora* sp.
		Polynoinae gen. sp.
		Potamilla ehlersi
	Potamilla sp.	*Potamilla* sp.
	Polygordius lacteus	
	Polynoidae gen. sp.	
Pomatoleios kraussii	*Pomatoleios kraussii*	
Prionospio aucklandica		
Prionospio cirrifera		
		Prionospio ehlersi
		Prionospio malmgreni
		Prionospio queenslandica
		Prionospio sexoculata
		Prionospio steenstrupi
		Prionospio tridentate
	Prionospio sp.	*Prionospio* sp.
		Procerastea perrieri
		Protodorvillea egena
Protodorvillea sp.		
	Protodrilus spp.	
		Protomystides sp.
		Pseudoeurythoe hirsute
	Pseudopolydora antennata	
	Pseudopolydora kempi	
	Pseudopolydora prolifera	
Pseudopolydora sp.	*Pseudopolydora* sp.	

This study (2004, 2009-2012) Kuwait waters	PAAC (2005) Kuwait waters *	ROPME Sea (2004-2005) **
Rashgua rubrocincta		
Rhodine sp.		*Rhodine* sp.
Sabellidae gen. sp.	Sabellidae gen. sp.	
		Sabellaria spinulosa var. alcoki
	Sacrocirrus spp.	
Samythopsis grubei		
	Scolelepis squamata	
	Scolelepis sp.	
	Scoletoma sp.	
Schistomeringos incerta		
		Schistomeringos neglecta
Schistomeringos sp.		
Scoloplos chevalieri		*Scoloplos chevalieri*
Scoloplos sp.		
		Sclerocheilus minutis
		Scolelepis indica
Sigambra tentaculata	*Sigambra tentaculata*	
		Sphaerodorum sp.
		Sphaerosyllis capensis
Sphaerosyllis sp.		*Sphaerosyllis* sp.
		Spiofilicornis sp.
		Spiochaetopterus vitrarius
Spiochaetopterus sp.		
Spionidae gen. sp.		Spionidae gen. sp.
		Spiophanes bombyx
		Spiophanes kroeyeri
		Spiophanes japonicum
Spirobranchus tetraceros		
Sternaspis scutata	*Sternaspis scutata*	*Sternaspis scutata*
		Sthenolepis japonicus
Syllidae gen. sp.	Syllidae gen. spp.	Syllidae gen. sp.
Syllis cornuta		*Syllis cornuta*
	Syllis gracills	*Syllis gracilis*
		Syllis spongicola
		Syllis sp.
	Syneimis albini	
Tauberia sp.		
		Terbella ehrenbergi
	Terebella sp.	
Terebellidae gen. sp.		Terbellidae gen. sp.
Terebellides sp.		
Terebellides stroemi		*Terbellides stroemi*
		Thalenessa djiboutiensis
		Tharyx filibranchiata

This study (2004, 2009-2012) Kuwait waters	PAAC (2005) Kuwait waters *	ROPME Sea (2004-2005) **
		Tharyx marioni
Tharyx multifilis		
Tharyx sp.	*Tharyx* sp.	*Tharyx* sp.
Trichobranchus sp.		*Trichobranchus* sp.
	Tylonereis bobrawlenskyi	
Typosyllis cornuta		
		Vermiliopsis acanthophora
Oligochaeta spp.	Oligochaeta spp.	Oligochaeta spp.
BRACHIOPODA		
Lingula sp.		*Lingula* sp.
MOLLUSCA		
Acar abdita		
Acar plicata		
Acteon sp.		
Amiantis umbonella	*Amiantis umbonella*	
Amphilepida faba		*Amphilepida faba*
Amphilepida peilei		
Amphilepida sp.	*Amphilepida* sp.	
Anadara ehrenbergi		
Anadara erythraeonensis		
Anadara sp.		
Ancilla castanea		*Ancilla castanea*
Anodontia edentula		
Arca sp.		
	Arcoidea gen. spp.	
Architectonica sp.		*Architectonica* sp.
Architectonicidae gen. sp.		
Asaphis violascens		
		Atactodea gen. sp.
		Atys cylindricus
Atys pellyi		
Atys sp.		
Barbatia decussata		*Barbatia decussata*
Barbatia foliata		
Barbatia fusca		
Barbatia setigera		
Barbatia sp.		
Bassina calophylla		
	Barleeia sp.	
		Bellucina sempriana
Bittium sp.		
Brachiodontes variabilis	*Brachiodontes variabilis*	
		Buccinidae gen. sp.
Bulla ampulla		

This study (2004, 2009-2012) Kuwait waters	PAAC (2005) Kuwait waters *	ROPME Sea (2004-2005) **
Cadulus euloides		
Caecum sp.		
Callista florida	*Callista florida*	
Calyptraea pellucida	*Calyptraea pellucida*	*Calyptraea pellucida*
Calyptraea sp.		*Calyptraea* sp.
Cantharus wagneri		
Cardiidae gen. sp.		
Carditella sp.		
Cardites sp.		
		Cardita sp.
Cardites bicolor		
Casmaria ponderosa		
Cellana rota		
Cerithidea cingulata	*Cerithidea cingulata*	
Cerithium scabridum	*Cerithium scabridum*	
Cerithidium cerithinum		
Cerithiidae gen. sp.		
Cerithiopsis sp.		
Cerithium caeruleum		
Circe intermedia		
	Circenita callipyga	
Chama brassica		
Chama reflexa		
Chama sp.		
		Chition lamyi
		Chitonidae gen. sp.
Chlamys livida		
Chrysallida spp.		
Clanculus pharaonius		
Clypeomorus bifasciatus	*Clypeomorus bifasciatus*	
Conus sp.		
Corbula sulculosa	*Corbula sulculosa*	
Corbula taitensis		
Costellaria sp.		
Costellariidae gen. sp.		
Crepidula walshi		
Cronia konkanensis		
	Curvemysella peculiaris	
Curvimysella sp.		
Cuthona albocrusta		
Cylichna collyra		
Cylichna cylindracea		
Cylichna sp.		
	Cyclostrema sp.	
Cymatium sp.		

This study (2004, 2009-2012) Kuwait waters	PAAC (2005) Kuwait waters *	ROPME Sea (2004-2005) **
Cypraea grayana		
Cypraea lamarckii		
Cypraea lentiginosa		
Cypraea pulchra		
Cypraea (Erosaria) turdus		
Dentalium octangulatum		
		Dentalium politum
Didimacar tenebrica		
Diodora funiculata		
Diodora ruppellii		
Diplodonta sp.		
		Donax paxillus
Donax sp.		
Dosinia alta		
	Dosinia ceylonica	
Dosinia erythraea	*Dosinia erythraea*	
Dosinia sp.		
	Dosiniinae gen. sp.	
Doto kya		
Echinolittorina arabica		
Ellobium sp.		
Epitonium sp.		
Ervilia sp.		
Ethminolia degregorii		
Eubranchus misakiensis		
Euchelus asper	*Euchelus asper*	
		Eulima bilineata
		Eulimella sp.
		Eulimidae gen. sp.
Flabellina amabilis		
		Frigidocardium exasperatum
Fulvia fragile		
		Fulvia papyracea
Fusinus arabicus		
	Galeommatoidea gen. sp.	Galeommatoidea gen. sp.
Gari maculosa		
Gari sp.		*Gari* sp.
		Gastrochaena sp.
Gibberula mazagonica	*Gibberula mazagonica*	
		Gibberula sp.
Glossaulax didyma		
Glycyremis livida		
Glycymeris pectunculus		
Granulina oodes		
Gregariella simplicifilis		

This study (2004, 2009-2012) Kuwait waters	PAAC (2005) Kuwait waters *	ROPME Sea (2004-2005) **
Haminoea vitrea	*Haminoea vitrea*	
		Heliacus variegatus
Heliacus sp.		
Hexaplex kuesterianus		
	Hiatella sp.	
Hiatula ruppelliana		
	Hiatula sp.	
Hypermastus epiphanes		
Ischnochiton yerburyi		
		Kellia cycladiformis
Kellia sp.		
	Lanternula anatina	
	Lanternula erythraensis	
	Lanternula spp.	
	Leiosolenus tripartitus	
Leucotina gratiosa	*Leucotina gratiosa*	
		Limaria fragilis
		Limposis multistriata
Lioconcha ornata		
Lithophaga robusta		
		Loripes clausus
Loripes sp.		
Loxoglypta rhomboides		
Lunella coronata	*Lunella coronata*	
Mactra lilacea		
Mactrinula sp.		
Malvifundus normalis		
Marikellia sp.		
Marcia marmorata	*Marcia flammea/marmorata*	
Marcia opima		
	Margenellidae gen. sp.	
Melanella cumingi		
Melanella sp.		
Mitrella blanda	*Mitrella blanda*	
		Modiolus philippinarum
		Modiolus sp.
Monilea chiliarches		
Monodonta nebulosa		
Murex scoloplax		
	Muricoidea gen. sp.	
		Musculista perfragilis
Musculista senhousia		
		Musculus cumingiana
	Mytiloidea gen. spp.	
Nassarius albescens		

This study (2004, 2009-2012) Kuwait waters	PAAC (2005) Kuwait waters *	ROPME Sea (2004-2005) **
Nassarius concinnus		
Nassarius emilyae		
Nassarius frederici		
Nassarius marmoreus		
Nassarius persicus	*Nassarius persicus*	
Nassarius sp.		
		Natica lineata
		Natica pomatiella
		Natica sp.
Nerita sp.		
Neverita didyma		
	Noetiella chesneyi	
Nucula inconspicua		*Nucula inconspicua*
Nucula sp.		
		Nuculana sp.
Nuculoma layardii	*Nuculoma layardii*	
Nudibranhia g.sp.		
Odostomia eutropia		
Odostomia sp.		*Odostomia* sp.
	Odostomiinae gen. sp.	
Omalogyra japonica		
Omalogyra sp.		
Onchidium peroni		
	Osilinus kotschyi	
Ostrea spp.		
	Ostreoidea gen. sp.	
Paphia sp.		
Paphia textile		
		Pectinidae gen. sp.
Periploma indicum		
Peronia peronii		
Pinctada margarinifera		
Pinctada radiata		
	Pillucina fischeriana	
Pinna bicolor		*Pinna bicolor*
Placida daguilarensis		
Planaxis sulcatus		
	Polypiacophora gen. sp.	
Potamides conicus		
Priotrochus obscurus		
Protapes cor	*Protapes cor*	
Protapes sinuosa		
	Protapes sp.	
Pseudodaphnella daedala		
Pseudonoba alphesiboei		

This study (2004, 2009-2012) Kuwait waters	PAAC (2005) Kuwait waters *	ROPME Sea (2004-2005) **
Pseudonoba columen		
	Pseudonoba sp.	
		Pteria sp.
Pupa affinis		
Pyramidella sp.		
Pyramidellidae gen. sp.	Pyramidellidae gen. sp.	
Rapana rapiformis		
Rapana venoza		
		Retusa tarutana
		Retusa truncatula
Retusa sp.		
Rhinoclavis kochi		
Ringicula propinquans		
		Rissoina clathrata
Rissoina sp.		*Rissoina* sp.
	Rissooidea gen. sp.	
Saccostrea cucullata		
Scabricola desetangsii		
Scintilla sp.		*Scintilla* sp.
Serpulorbis variabilis		
Siphonaria belcheri		
Siphonaria savignui		
Solen dactylus	*Solen dactylus*	
	Solenoidea gen. spp.	
Soletellina rosea		
Splendrillia sp.		
Spondylus marisubri		
Spondylus variegatus		
Stomatella auricula		
Strombus decorus		*Strombus decorus*
Strombus persicus		
Syndesmya sp.		
Syrnola aclys		
Syrnola brunnea		
Syrnola sp.		
Tapes bruguierei	*Tapes bruguierei*	
Tapes sulcarius		*Tapes sulcarius*
Tellina arsinoensis	*Tellina arsinoensis*	
Tellina donacina		
		Tellina (Arcopella) isseli
Tellina methoria		
		Tellina (Exotica) triradiata
Tellina sp.	*Tellina* sp.	*Tellina* sp.
	Tellinidae gen. spp.	Tellinidae gen. spp.
	Tellinoidea gen. sp.	

This study (2004, 2009-2012) Kuwait waters	PAAC (2005) Kuwait waters *	ROPME Sea (2004-2005) **
		Tellina (Pinguitellina) pinguis
Tellina valtonis		
Tellina vernalis		*Tellina vernalis*
Terebra sp.		
Terebellum terebellum		
Terebridae gen. sp.		
Tesseracme quadrapicalis		
Thaisella lacera		
Thaisella tissoti		
Thais savignyi		
	Thraciacea gen. spp.	
	Thracia sp.	
Theora cadabra	*Theora cadabra*	
Tibia insulaechorab		
		Timoclea macfadyeni
Timoclea spp.		
Tonnidae gen. sp.(juv).		
Tornatina inconspicua		
Tornatina persiana		
Tornatina sp.	*Tornatina* sp.	
Trachycardium assimile		
Trachycardium lacunosum		
Trachycardium rubicundum		
Trapezium sublaevigatum	*Trapezium sublaevigatum*	
	Trichotropidae gen. sp.	
Tricolia sp.		
Trochus erithreus		
Trochus fultoni		
Turbonilla icela		
Turbonilla linjaica		
		Turbonilla sp.
Turbo radiatus		
Turridae gen. sp.		
Turtonia minuta		
Turtonia sp.		
Umbonium vestiarum	*Umbonium vestiarium*	
Vanicoro sp.		
Veneridae gen. sp.	Veneridae gen. spp.	
Venerupis rugosa		
Vexillum (Costellaria) diaconalis		
Vexillum (Pusia) osiridis		
		Vitreolina sp.
	Voorwindia tiberiana	
Yoldia tropica		
Zafra selasphora		

This study (2004, 2009-2012) Kuwait waters	PAAC (2005) Kuwait waters *	ROPME Sea (2004-2005) **
	ARTHROPODA	
Alpheus spp.		*Alpheus* sp.
	Alpheidae gen. sp.	
		Amakusantura sp.
Ampelisca sp.		*Ampelisca* spp.
	Ampeliscidae gen. spp.	
	Amphipoda gen. sp.	
Ampithoe sp.		
		Anatanis gracilis
		Aoridae gen. sp.
Apanthura sandalensis	*Apanthura sandaiensis*	
		Apseuda spp.
Apseudes sp.		
Apseudopsis sp.		
Apseudidae gen. sp.		
		Arcturella brevipes
Arcturidae gen. sp.		
Athanas sp.		
		Atelecyclidae kraussia
Atergatis integerrimus		
Balanus amphitrite		
Balanus sp.	*Balanus* spp.	
		Bodotria siamensis
Bodotria sp.		
		Birubius sp.
Byblis sp.	*Byblis* sp.	
		Calappidae gen. sp.
Callianassa sp.		*Callianassa* sp.
Campylaspis sp.		*Campylaspis* sp.
Ceradocus sp.		
	Cirolanidae gen. sp.	
	Cheiriphotis megacheles	
Cheiriphotis sp.		
		Chthamalus sp.
Cleistostoma dotilliformis	*Cleistostoma dotilliformis*	
	Cleistostoma kuwaitense	
	Copepoda gen. spp.	
Corophium sp.		*Corophium* sp.
	Cumacea gen. spp.	
		Cumella hispida
Cumella sp.		*Cumella* sp.
Cumopsis sp.		
		Cyclaspis cingulata
Cyclaspis sp.		

This study (2004, 2009-2012) Kuwait waters	PAAC (2005) Kuwait waters *	ROPME Sea (2004-2005) **
Cyclopoida gen. sp.		
Cymadusa sp.		
		Cymodoce richardsoniae
Cyproidea sp.		
Deutella sp.		
	Diogenes avarus	
	Diogenes costatus	
Diogenes sp.		
Diogenidae gen. spp.		Diogenidae gen. sp.
	Dotilla blandfordi	
		Ebalia sp.
Emerita holthuisi		
Eocuma affine		*Eocuma affine*
		Eocuma lata
		Eocuma producta
Eocuma rosae		
Eocuma sp.		*Eocuma* sp.
Eriopisa sp.	*Eriopisa* sp.	
	Eurydice sp.	
Epixanthus frontalis		
Ericthonius sp.		*Ericthonius* sp.
		Eriopisella schellensis
Euraphia withersi		
Eurycarcinus orientalis		
		Eurydice arabica
	Gammaropsis sp.	*Gammaropsis* sp.
Gastrosaccus sp.		
		Gnathia rhinobates
Gnathia sp.	*Gnathia* spp.	*Gnathia* spp.
	Grandideriella sp.	
Grapsidae gen. sp.		
		Harpiosquilla harpax
		Heterocuma andamani
		Hippolytidae gen. sp.
	Hyale sp.	
		Idunella sp.
	Ilyoplax stevensi	
Ilyoplax sp.		
		Inachus sp.
Iphinoe maeotica		
		Iphinoe stebbingi
Iphinoe sp.		
Isaeidae gen. sp		
Isopoda gen. sp.	Isopoda gen. spp.	
		Lembos sp.

This study (2004, 2009-2012) Kuwait waters	PAAC (2005) Kuwait waters *	ROPME Sea (2004-2005) **
		Lepidepecreum sp.
		Leptocheirus sp.
		Leptostylis sp.
	Leucosiidae gen. sp.	
Macrophthalmus dentipes	*Macrophthalmus dentipes*	
Macrophthalmus depressus	*Macrophthalmus depressus*	
	Macrophthalmus laevis	
	Macrophthalmus latreilli	
	Macrophthalmus spp.	
		Maera hirondellei
	Maera grossimana	
Majidae gen. spp.		Majidae gen. sp.
		Makrokylindrus sp.
Medaeops granulosus		
Megabalanus tintinnabulum		
Megabalanus sp.		
Melita sp.		*Melita* sp.
Melitidae gen. sp.		
		Microdeutopus anomalus
		Micropanope rufopunctata
Metopograpsus messor		
Microphotis blachei		
	Mysidacea gen. sp.	
Nanosesarma minutum	*Nanosesarma minutum*	
		Nebalia capensis
	Ocypodidae gen. spp.	Ocypodidae gen. spp.
	Oedicerotidae gen. sp.	
Orchomene sp.		
Ostracoda gen. spp.	Ostracoda gen. spp.	Ostracoda gen. spp.
Paguristes sp.		
	Paracleistostoma arabicum	
	Parasesarma plicatum	
		Pasiphaeidae gen. sp.
Perioculodes aequimanus		
		Perioculoides longicornis
Perioculodes sp.		
Petrolisthes carinipes		*Petrolisthes carinipes*
Petrolisthes rufescens		
Philyra sp.		
		Phitisca marina
		Photis longicaudata
Photis sp.		
	Phoxocephalidae gen. sp.	
Phoxiphilyra sp.		
	Pilumnidae gen. sp.	

This study (2004, 2009-2012) Kuwait waters	PAAC (2005) Kuwait waters *	ROPME Sea (2004-2005) **
	Pilumnopeus vanquelini	
Pilumnus vespertilio		
	Pinnotheres sp.	
Platyischnopus herdmani		
	Podoceros brasiliensis	
Porcellanidae gen. sp.		
Portunus pelagicus		
		Procera edulis
		Procera sp.
Raphidopus sp.		
Sinoediceros homopalmatus		
Siphonoecetes sp.	*Siphonoecetes* sp.	
		Sophrosyne sp.
	Sphaeromatidae gen. sp.	
		Sympodomma incertum
	Synalpheus sp.	
Synchelidium sp.		
	Tanaidacea gen. spp.	
Thenus orientalis		
	Tylodiplax indica	
Tylodiplax sp.		
		Typhocarcinodes sp.
		Typhotanais sp.
	Uca sindensis	
	Uca spp.	
Urothoe grimaldii		
		Urothoe pulchella
	Urothoe spinidigitus	
Urothoe sp.	*Urothoe* sp.	
Xantho exaratus		
Xanthidae gen. sp.		
ECHINODERMATA		
Amphioplus (Lymanella) hastatus		
Amphioplus (Lymanella) sp.		
Amphipholis squamata		
Amphiura fasciata		
		Amphiuridae gen. sp.
Aquilonastra burtoni		
Ascorhynchus sp.		
		Aterina sp.
Brissopsis persica		
Cidaridae gen. sp.		
Clypeaster humilis		
Diadema setosum		
		Echinoidae gen. sp.

This study (2004, 2009-2012) Kuwait waters	PAAC (2005) Kuwait waters *	ROPME Sea (2004-2005) **
Echinodiscus auritus		
Echinometra mathaei		
Holothuria arenicola		
Holothuria atra		
		Labidoplax sp.
Macrophiothrix sp.		
Ohshimella ehrenbergii		
		Ophiura sp.
	Ophiurida gen. spp.	
		Synaptidae gen. sp.
Temnopleurus toreumaticus		
HEMICHORDATA		
Saccoglossus sp.		
CHORDATA		
Polyclinum constellatum		
Phallusia nigra		
	Tunicata gen. sp.	Tunicata gen. spp.
Branchiostoma sp.		

* PAAC 2005 – Grey Literature (Kuwait Waters), with permission from PAAC management, 2006.

** ROPME – Status of Marine Environment Report – SOMER, 2004-2005 (ROPME Sea: Arabian Gulf, Sea of Oman, NW Arabian Sea).

REFERENCES

Al-Rifaie, K.; Al-Yamani, F.; Lennox, A.; Boltachova, N.; Revkov, N.; Grintsov, V.; Kolesnikova, E. and Murina, V. 2012. Macrozoobenthos Community Structure during Four Seasons in Kuwait Bay. *International Journal of Oceans and Oceanography (IJOO)*, Vol.6, No.1, pp. 45-67.

Al-Yamani, F.; Bishop J.; Al-Husaini M.; Al-Ghadban, A.N.; Behbehani, M.; Rao, S.; Khan, N.; Salman, M.; Abdel Jawad, M.; Al-Attar, M.; Al-Rifaie, K.; Al-Ghunaim, A.; Ismail, W.; Lennox, A; and Al-Tabtibaie, M. 2001. A Strategic Plan for Sustainable Utilization of Kuwait's Marine Environment. Kuwait Foundation for the Advancement of Sciences, Kuwait, 40 pp.

Al-Yamani, F.Y.; J. Bishop; E. Ramadhan; M. Al-Husaini; and F.N. Al-Ghadban. 2004. Oceanographic Atlas of Kuwait's Waters. Publ. Kuwait Institute for Scientific Research, 203 pp.

Al-Yamani, F.; Boltachova, N.; Revkov, N.; Makarov, M.; Grintsov, V.; Kolesnikova, E; and Murina, V. 2009. Winter species composition, diversity and abundance of zoobenthos in Kuwait's waters, *Arabian Gulf. Zookeys* **31**, pp. 17–38 (doi: 10.3897/zookeys.31.74).

Al-Zamel, A.Z., M.A. Al-Sarawi, S.R. Khader, I.A. Al-Rifaiy. 2009. Environmental Monitoring and Assessment 149(1-4):395-409.

Australian Faunal Directory. Department of the Environment, Water, Heritage and the Arts, 2010, Canberra, Australia. Available from: http://www.environment.gov.au/biodiversity/index.html.

Barnes, R.S.K. 1967. The Macrophthalminae of Australasia; with a review of the evolution and morphological diversity of the type genus Macrophthalmus (Crustacea: Brachyura). *Transactions of the Zoological Society of London*, **31**(2), pp. 195–262.

Berrill, N.J. 1950. The Tunicata. Ray Society Publications 133, 354 pp.

Beechey, D. 2009. The Seashells of New South Wales. Available from: http://seashellsofnsw.org.au/index.htm.

Bosch, T.D., Dance, S.P., Moolenbeek, R.G.; Oliver, G.P. 1995. Seashells of Eastern Arabia. Motivate Publishing, Dubai, London, 296 pp.

Bu-Olayan, A.H., and B.V. Thomas. 2005. Validating species diversity of benthic organisms to trace metal pollution in Kuwait Bay, off the Arabian Gulf. Applied Ecology and Environmental Research 3(2): 93-100.

Cornelius, P.F.S. 1995. North-west European thecate hydroids and their medusae. Part 2. Sertulariidae to Campanulariidae. Synopses of the British Fauna, New Series 50, 386 pp.

Cowles, D. 2002-2006. Key to Invertebrates Found at or near the Rosario Beach Marine Laboratory (Walla Walla University) Fidalgo Island, Anacortes, WA. Available from: http://www.wallawalla.edu/academics/departments/biology/rosario/inverts/index.html.

Crustacea.net. An Interactive Information Retrieval System for Crustaceans of the World. Australian Museum, 2009. Available from: http://crustacea.net/intro.htm.

Dana, J.D., 1852. Conspectus Crustaceorum quae in Orbis Terrarum circumnavigatione, Carolo Wilkes e Classe Reipublicas Foederatae Duce, lexit et descripsit. *Proceedings Academy natural Sciences, Philadelphia*, **6**, pp. 6-28, 73-86.

Dance, S.P. 1992. Shells Eyewitness Handbook. Dorling Kindersley, London, 256 pp.

Dayrat, B. 2009. Review of the current knowledge of the systematics of Onchidiidae (Mollusca: Gastropoda: Pulmonata) with a checklist of nominal species. *Zootaxa* 2068, pp. 1–26.

Edmonds, S.J. 2000. Phylum Sipuncula. In: Polychaetes and Allies: The Southern Synthesis. Fauna of Australia Vol. 4 Polychaeta, Myzostomida, Pogonophora, Echiura, Sipuncula. (ed. Beesley, P.L., Ross, G.J.B. and Glasby, C.J.).Melbourne, CSIRO Publishing, pp. 375-400.

Emig, C.C. 1982. The biology of Phoronida. *Advances in marine Biology*, **19**, pp. 1-89.

Emig, C.C. 2003. Proof that *Lingula* (Brachiopoda) is not a living-fossil, and emended diagnoses of the Family Lingulidae. Carnets de Géologie/Notebooks on Geology, Letter 2003/01, (CG2003_L01_CCE)

Emig, C.C. Alvarez, F. and Bitner, M.A. 2011. Brachiopoda world database. Available from: http://www.marinespecies.org/brachiopoda.

Gardiner, J.; Townsend, Y. and Varvell, P. 2004. A Field Guide of Intertidal Habitats of Kuwait. Ecology and Environment, Inc., Kuwait, 79 pp.

Guinot, D. and Bouchard, J.-M. 1998. Evolution of the abdominal holding systems of brachyuran crabs (Crustacea, Decapoda, Brachyura). Zoosystema, 20(4), pp. 613-694.

Hayward, P.J. 1990. Mollusca II: Bivalvia and Cephalopoda. In: The Marine Fauna of the British Isles and North-West Europe. (ed. Hayward P.J. and Ryland J.S.). Clarendon Press, Oxford, pp. 731-793.

Hayward, P.J.; Wigham, G.D. and Yonow, N. 1990. Mollusca I: Polyplacophora, Scaphopoda, and Gastropoda. In: The Marine Fauna of the British Isles and North-West Europe. (ed. P.J. Hayward and J.S. Ryland). Clarendon Press, Oxford, pp. 628-730.

Hoagland, K.E. 1977. Systematic Review of the fossil and recent Crepidula and discussion of evolution of the Calyptraeidae. *Malacologica*, **16**(2), pp. 353-420.

Houbrick, R.S. 1992. Monograph of the genus Cerithium Bruguiere in the Indo-Pacific (Cerithiidae: Prosobranchia). *Smithsonian Contributions to Zoology*, **510**, pp. 1-211.

Hyman, L.H. 1959. The Invertebrates: Smaller Coelomic Groups. McGraw-Hill Book Co., New York. pp. 72-155.

Jones, D.A. 1986. A field guide to the sea shores of Kuwait and the Arabian Gulf. Dorset, Blandford Press, 192 pp.

Jones, A.M. and J.M. Baxter, 1987. Molluscs: Caudofoveata, Solenogastres, Polyplacophora and Scaphopoda. Synopses of the British fauna (NS), 123 pp.

Keable, S.J.; Poore, G.C.B.; and Wilson, G.D.F. 2002. Australian Isopoda: Families. Version: 2 October 2002. Available from: http://crustacea.net.

Keen, M.A. 1971. Sea shells of tropical west America: marine mollusks from Baja California to Peru, Stanford University Press, 1064 pp.

Kisseleva M.I. 1968. Développement du benthos dans les mers du bassin méditerranéen. *Rapp. Comm. int. Mer Médit.*, **19**(2), pp. 103–105.

Kott, P. 1985. The Australian Ascidiacea. *Memoirs of the Queensland Museum*, **23**, pp. 1–440.

Lavalli, K.L. and Spanier, E. 2007. Introduction to the Biology and Fisheries of Slipper Lobsters. In: The Biology and Fisheries of the Slipper Lobster. Crustacean Issues, volume 17. CRC Press, pp. 3–24.

Lowry, J.K. 1999. Crustacea, the Higher Taxa: Description, Identification, and Information Retrieval. Version: 2 October 1999. Available from: http://crustacea.net.

Lowry, J.K. and Springthorpe, R.T. 2001. Amphipoda: Families. Version 1: 2 September 2001. Available from: http://crustacea.net.

Manning, R.B. and Holthuis, L.B. 1981. West African Brachyuran Crabs (Crustacea: Decapoda). *Smithsonian Contributions to Zoology*, **306**(i–xii), pp. 1–379.

Margalef, R. 1958. Information theory in ecology. *General Systems*, **3**, pp. 36–71.

Meland, K. 2002. Mysidacea: Families, Subfamilies and Tribes. Version 1: 2 October 2000. . Available from: http://crustacea.net.

McLaughlin, P.; Ahyong, S.; and Lowry, J.K. 2002. Anomura: Families. Version: 2 October 2002. Available from: http://crustacea.net.

Miyake, S. 1978. The Crustacea Anomura of Sagami Bay. Tokyo : Biological Laboratory Imperial Household, 200 pp.

Mohammad, M.B.B. 1970. A new species of the genus *Prionospio* (Annelida: Polychaeta). *Hydrobiologia*, **36**(1), pp. 23–26.

Mohammad, M.B.B. 1971. Intertidal polychaetes from Kuwait, Arabian Gulf with descriptions of three new species. *Journal of Zoology*, **163**, pp. 285–303.

Mohammad, M.B.B. 1973. New species and records of polychaete annelids from Kuwait, Arabian Gulf. *Zoological Journal of the Linnean Society*, **52**, pp.23–44.

Mohammad, M.B.B. 1980. Polychaete annelids from Kuwaitian islands, Arabian Gulf with descriptions of four new species. *Zoological Journal of the Linnean Society*, **69**, pp. 31–42.

Nicholson, H.A. 2006. A Manual of Zoology for the Use of Students. with a General Introduction on the Principles of Zoology. Scholarly Publishing Office, University of Michigan Library, 692 pp.

Pielou, E.C. 1966. The mesurements of diversity in diff erent types of biological collections *Journal of Theoretical Biology*, **13**, pp. 131–144.

Pleijel, F. and Rouse, G.W. 2004. Hesionidae. http://tolweb.org/Hesionidae/22789/2004.04.13. In: The Tree of Life Web Project, 1995-2005. Available from: http://tolweb.org.

Poppe, G.T. and Goto, Y. 1991. European Seashells. Vol. I. Wiesbaden/Verlag Christa Hemmen, 352 pp.

Rouse, G.W. and Pleijel, F. 2001. Polychaetes. Oxford University Press, Oxford. 354 pp.

Schander, C., van Aartsen, J.J. and Corgan, J.C. 1999. Families and genera of the Pyramidelloidea (Mollusca: Gastropoda). *Bollettino Malacologico* **34**(9-12), pp. 145–166.

Sedgwick, A., Lister, J.J. and Shipley, A.E. 1898. A Student's Text-book of Zoology: Protozoa to Chaetognatha. 619 pp.

Shannon, C.E. and Weaver, W. 1963. The mathematical theory of communication. Urbana, University of Illinois Press, 125 pp.

Simpson, E.H. 1949. Measurement of diversity. *Nature*, **163**, pp. 688.

Smith, A.B. (editor) 2005. The Echinoid Directory. World Wide Web electronic publication. Available from: http://www.nhm.ac.uk/research-curation/projects/echinoid-directory/index.

Stebbing, T. R. 1906. Amphipoda. I. Gammaridea. Das Tierreich, 21, Berlin, 806 pp.

Stephensen, K. 1945. The Brachyura of the Iranian Gulf with an Appendix: The male pleopod of the Brachyura. In: Danish Scientific Investigations in Iran, Part 4. Copenhagen, E. Munksgaard, pp. 57-237.

Tebble, N. 1966. British Bivalve Seashells. Trustees of The British Museum (Natural history). London, 212 pp.

Thompson, T.E. 1988. Molluscs: Benthic Opisthobranchs (Mollusca: Gastropoda). Synopses of the British fauna (NS), 356 pp.

Tokinova, R.P., Utevsky, S.Yu., Shurova, N.M., Murina G.-V.V. and Chernyshev, A.V. 2008. Biota of the Russian Waters of the Sea of Japan Vol. 6. Polyclad Turbellarians, Leeches, Oligochaetes, and Echiurans. Vladivostok. 293 pp.

Wesenberg-Lund, E. 1949. Polychaetes of the Iranian Gulf. In: Danish scientific investigations in Iran, 4, pp. 247–400.

Wilson, R.S.; Hutchings, P.A. and Glasby, C.J. (eds). 2003. Polychaetes: An Interactive Identification Guide. CSIRO Publishing, Melbourne. Available from: http://researchdata.museum.vic.gov.au/polychaetes/index.htm

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