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RESEARCHARTICLE

DISCRIPTION AND IDENTIFICATION OF SOME SELECTED NEKTONIC AND BENTHIC ZOOPLAKTON INHABITING MARINE ECOSYSTEMS

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ABSTRACT

Zooplankton were collected from four marine ecosystems namely the North Sea (Helgoland - Germany), Banyuls-sur-Mer (Mediterranean sea - France), Abu Qir Bay (Mediterranean Sea- Egypt) and the northern estruarine harbour of the Arabian Gulf (Saudi Arabia). Collection tools used involved primarily the filtration of water by net, collecting the water in bottles/ water samplers or by pumps. Artificial heterologous inseminations on ascidians were tried in the laboratory and the larval stages have been described and identified. Collected zooplaktons were prepared for both macroscopic or / and scanning electron microscopy. All zooplankton were stained with Evans stain or Nile blue or Borax carmine to observe their internal structures since they are mostly transparent. Others were dissected with micro-needles and incised to ease their identification. Marine Species Identification Portal has been applied: http://species-identification.org/index.php//.Six species of Bryozoa were identified namely *Bugula neritina* (Linnaeus, 1758) and itsbarrel shapedlarva, *Electra crustulenta* (Pallas, 1766),*Bowerbankia gracilis* (Leidy, 1855) and its coronated larva, *Hippaliosina depressa* (Busk, 1854), *Nolella dilatata* (Marcus, 1940)and *Reptadeonella violacea* (Johnston, 1847). Two hydrozoan cnidarians were identified namely *Obelia geniculata* (Linnaeus, 1758) and *Pennaria disticha* (Goldfuss, 1820). Planula larva of Hydrozoa and the anthozoan *Actinodendron* sp. were collected from the Mediterranean sea. Two rotifers were identified namely *Paraseison annulatus* (Claus, 1876) and *Seison nebaliae* (Grube, 1861).The nematode *Anisakis simplex* and its third stage larva were extracted from the branchial chambers of ascidians whereas free nematode toothless larval stage has been collected from nekton. Four polychaetes were identified namely *Harmothoe* sp.,(scale worm), *Pomatocerous triqueter* (Linnaeus, 1758), *Nemidia lawrencii* (McIntosh, 1874) with synoneme *Nemidia torelli* and *Notomastus latericeus* (Sars, 1851). The copepod *Megacyclops viridis* (Jurine, 1820) and the gammarid *Gammaropsis* sp. with Naupli, zoaeaand megalopods were found in the nekton. The the isopod *Caecocassidias patagonica* (Kussakin, 1967) has been collected from the benthos. The scaphopod *Dentalium vulgare* (da Costa, 1778) and the bivalve *Microgloma turnerae* (Sanders and Allen,1973) were found in the benthos. Veliger and glochidia larvae were collected from the nekton. Two species of brittle star namely *Amphiura* sp and *Ophiomastix annulosa* were collected from the benthos. Echinoplutei with 8 arms were found in the nekton. Nine ascidian larvae were identified namely larvae of *Styela plicata* (Lesuaer, 1823), *Phallusia mammilata* (Cüvier 1815), *Corella parallelogramma* (Müller,1776), *Diplosoma migrans* (Menker und Ax. 1970), *Halocynthia roretzi* (Drasche), *Microcosmus claudicans* (Savigny,1816), *Molgula manhattensis* (Dekay, 1843), *Ascidiella aspersa* (Müller, 1776), and *Cnemidocarpa mollis* (Stimpson,1852). The abundance and distribution of all plankton studied varied considerably according to seasons and habitats. The findings of this work, the density of each genus or / and species in the four study localities and the presence or absence of a certain zooplankton in the different seasons of the year (faunal composition) will be statistically analyzed in another publication.

INTRODUCTION

Zooplankton are floating or bottom dweller organisms. The word "plankton" comes from a latin word meaning "drifters". This is what plankton do, drift as opposed to swim. For the most part nektonic zooplankton are microscopic and get around with the movement of the water currents (Able and Fahay, 1998; Horn, *et al*., 1999; Lazzari *et al*., 2010). They are also typically found at or near the surface of the water. There are several major classifications of plankton. Planktonic invertebrates live some point in their life cycle as members of the nekton (the swimmers) or the benthos (the bottom dwellers) (Calder and Boothe, 1977a; Van Dolah *et al*. 1979,1990,1991, 1994 and 1999).Community drifting zooplankton can be categorized according to size fractions

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into: picoplankton (0.2-2.0 µm, mainly heterotrophic bacteria), nanoplankton (2.0-20.0 µm, heterotrophic nanoflagellates), microplankton (20-200 µm, ciliates and a large part of rotifer species), mesozooplankton (0.2-20.0 mm, larger rotifers, mainly planktonic crustaceans), meroplanktonic larvae of some benthic invertebrates, etc.), and macrozooplankton (organisms larger than 20 mm: Cnidaria, Ctenophora, Chaetognatha, Mysidacea, Euphausiacea, Decapoda, Polychaeta and others) (Lenz, 2000).There are two major types of zooplankton: those that spend their entire lives as part of the plankton (called Holoplankton) and those that only spend a larval or reproductive stage as part of the plankton (called Meroplankton). Zooplaktons that live on the bottom are benthic and those floating freely in sea water are nektonic. Benthic invertebrate communities are generally separated into two major size classes. The meiofauna are organisms (metazoans plus foraminiferans) that typically range from 63 to 500 mm in size, and the macrofauna are all of the larger organisms greater than 500 mm in size. Both groups include species that are considered to be either epifauna because they reside primarily on the surface of the sediments and other substrata, or in fauna because they burrow or live beneath the surface of the sediment-water interface (Coull *et al*., 1977; Bell *et al*. 1978; Munn, 2004; Begon *et al*., 2006). Since there is a huge variety of benthic habitats, mud, sand, rocks, shallow, deep, there is a huge variety of benthic organisms. What they mostly have in common is that they don't swim, at least not much. Nearly every category of animal is included in the benthosCalder and Boothe (1977a, 1977b) and Calder *et al*. (1977). They are suspension feeders, filtering small food particules out of the water that passes through their pores. The term suspension feeder was introduced by Hunt (1925) to distinguish marine animals which feed on suspended particles from deposit feeders and carnivores. Jorgensen (1966) recognises two types of suspension feeding. Filters are used by animals such as sponges, tunicates and many crustaceans. "In other suspension feeders, the water with its content of suspended particles is not truly filtered, but is carried along surfaces capable of retaining particles that obtain contact with the surfaces.' Examples of such "non-filtering' suspension feeders are Entoprocta and Bryozoa. Bullivant (1968) has discussed feeding in lophophorates (bryozoans, phoronids and brachiopods); the method being described as impingement feeding by analogy with certain mechanical particle separators. It is suggested here that all suspension feeders may be better grouped according to the method they use to collect particles rather than the type of feeding organ they have (Brylawski and Miller, 2003). There are worms of every description, from microscopic to several meters. The benthos includes many of the molluscs. These all have soft bodies, many of which are protected by calcareous shells. These include the gastropods which is all the snails probably familiar to many people, the periwinkle snails in the marsh, the whelks and conchs on the beach. These animals go along grazing on algae. These animals are filter feeders. They suck in water, sieve out the good stuff, and spit the cleaned water back out. Some gastropods lack shells completely. The nudibranchs are an example. These are brightly coloured, rather large, sea slugs. They are much more interesting than standard garden variety slug, but they are close cousins. The cephalopods are the most advanced molluscs and include the octopus, squid, and cuttlefish. Only the octopus is really considered benthic. Other than the cuttlefish, these do not appear to have shells. In fact, both squid and octopi have a beak made of shell material. The echinoderms are another major group of benthic animals. Nektonic zooplankton are micronekton (size range, 0.02-I cm)as larvae of nematods, annelids, crustaceans, molluscs and echinodermsand macronekton(size range, 2-10 cm)like fishes (Murreland Lores, 2004 , Ahmad and Ashok, 2013). Nekton are those organisms that have developed powers of locomotion so that they are not at the mercy of prevailing sea currents or wind-induced water motion. Pelagic nekton usually have stream-lined shapes that make their propulsive efforts more effective. Most nekton are specialized invertebrates evolved the ability to swim (and hunt) actively in the water column. Cephalopods (squids, octopus, cuttlefish, nautilus) Arthropods (shrimp, prawns, some crabs). Mesopelagic nekton seldom exceed 10 cm, have large light-sensitive eyes, uniformly black Photophores and provided with light-producing organs. Abyssal pelagic have species-specific pattern of photophores, small with flabby, soft, nearly transparent flesh supported by weak exoskeleton. Zooplankton are distributed in any pelagic habitats in the sea, from coasts to offshore waters, and from the sea surface to the abyssal depths. Many of them are known to play important roles in marine ecosystems, including those in the food chain and matter transfer (Stickney *et al*., 1975; Bell and Coull 1978; Alheit and Scheibel 1982; Kennish 1986; Smith and Coull 1987; Coull 1990), but there are alsomany species whose distribution and ecologyare mostly unknown.Zooplankton are the favourite food of a great many marine animals so camouflaging themselves is a very important survival strategyVan Dolah *et al*. (1991, 1994, 1999) and Hyland *et al*. (1994, 1996, 1998). Developing effective camouflage when they live in clear, blue water is no easy matter. The best solution and the one most often used by members of the zooplankton is to be as transparent as possible or, in the case of many surface floating jellyfishes, blue. Crabs, and lobsters, are found among the zooplankton. Permanent plankton, or holoplankton, such as protozoa and copepods (an important food for larger animals), spend their lives as plankton. Temporary plankton, or meroplankton, such as young starfish, clams, worms, and other bottom-dwelling animals, live and feed as plankton until they leave to become adults in their proper habitats. Zooplankton are either herbivorous, feeding on phytoplankton, or carnivorous, feeding on other zooplankton. They themselves are fed upon by other zooplankton, fish, and even whales. Zooplankton is the vital transition between marineprimary production (phytoplankton) and large animals (fish) (Brylawski and Miller, 2003) .Zooplankton, like all plankton, exist in the epipelagic zone of the ocean or sea. It is possible for these creatures to move up and down in the water, (diel vertical migration). However, if the organism sinks too low, it will not be able to reach a suitable height, and will be washed out of the system. Murkin (1983) found higher numbers ofnekton with instands of emergent vegetation compared to open watersites in the early spring in the Delta Marsh, Manitoba. This was likely due to the habitat structure and food supply provided by the dead standing stems of the emergent vegetation. By midsummer, with the development of submersed vegetation and its associated structure and food supplies in open water areas, higher invertebrate levels were found outside the emergent vegetation stands. In addition, Bicknese (1987) andSuthers and Gee (1986) suggest that during midsummer, the warm water temperatures and shading within the emergent vegetation stands result in low dissolved oxygen levels. This would restrict the use of these areas by many invertebrate groups. Information on invertebrate abundance at the emergent vegetation--open water interface throughout the season would provide valuable insights into the role this unique habitat plays in the ecology of wetland invertebrates. The objective of the present study was to determine the distribution and abundance of nektonic and benthic invertebrates across the North Sea (Helgoland - Germany), Banyuls-sur-Mer (France) (Mediterranean sea), Abu Qir Bay (Mediterranean Sea) Egypt and the northern estruarine harbor of Arabian Gulf – Saudi Arabia. In general, there are many factors that play an important role in regulating the distribution and abundance of zooplankton communities. Since these biota represent an important food source for many other larger taxa, predation effects are often a major regulating factor. Competition, both among zooplankton within a species as well as among species, can also play a major role in limiting faunal abundances and distribution. These factors, when combined with the effects of various physicochemical factors such as salinity, temperature, dissolved oxygen, sediment grain size, depth of the redox (reducing) layer within the sediments, and distribution along the intertidal-subtidal depth gradient in estuarine environments, result in very complex spatial and temporal patterns in the structure of these assemblages. Readers interested in learning more about the effects of various biotic and physicochemical factors on zooplankton assemblage should review general texts on estuarine ecology, such as those published by Hynes (1970),Stickney *et al.* 1975, Kennish (1986), Mann and Lazier (1991), Ruttner (1974 & 1975a &b), Van Dolah *et al.* 1992, Valiela (1995), Levinton (1995) and Mann, (2000). Those interested in learning more about the life habits and distribution of the dominant macrofauna in estuaries should review general guides to marine and estuarine life, such as Ruppert and Fox (1988).

MATERIALS AND METHODS

Animals

Zooplankton were collected from four marine ecosystems. During my promotion for Ph. D. in Germany (1999 – 2000), many ascidian larvae were obtained in the laboratory through artificial heterologous inseminations. Different species of adult ascidians were collected in that time from the North Sea (Helgoland - Germany).Other ascidians were provided from the Mediterranean Sea in the year 2000 and transported alive to the Laboratoire Arago, Observatoire Oceanologique, Universite Pierre et Marine , Paris VI, Banylous sur Mer, France). These materials did not used before in any publication or in my doctoral thesis. Some plankton were collected from Banyuls-sur-Mer (France) (Mediterranean sea). During (2002 - 2010) planktons were collected seasonally from Abu Qir Bay (Mediterranean Sea) Egypt. During 2012 – 2014 planktons were collected from the northern estruarine harbour of the Arabian Gulf – Saudi Arabia. All planktons were transported alive in plastic aquaria containing well aerated sea water to the laboratory and placed in large glass aquaria containing well aerated sea water. Randomly selected adults of plank tonic communities were dissected in sea water. Sperm and eggs were sucked from gonoducts of collected ascidians and placed separately in suitable Petri dishes containing sea water and antibiotic. Artificial heterogonous insemination has been carried out and polyspermy has been avoided. The Fertilized eggs were washed and then grown at 20°C. The different embryonic stages were obtained according to the method of Hofmann *et al.* (2008) and Saad (2002). Hatched Larvae were then described and prepared for photomacroscopy or / and SEM study.

Methods of collection

The zooplankton collection involves primarily the filtration of water by net, collecting the water in bottles/ water samplers or by pumps. The sampling success would largely depend on the selection of a suitable gear; mesh size of netting material, time of collection, water depth of the study area and sampling strategy. The gear used keeping in view the objectives of the investigation (see Sameoto, *et al*. 2000, Merle, *et al*. 2002, Agnieszka, *et al*. 2012 for review). There are three main methods of zooplankton collection used, which are as follows:

Bottles / water samplers

This method was used mainly for collecting smaller forms or micro zooplankton. The water is collected at the sampling site in bottles or water samplers of 5 to 20litre capacity. The sterile bottles should be preferred. Surface water can be collected by scooping water into the bottle of suitable size. While collecting the water samples, there should be minimum disturbance of water to prevent avoidance reaction by plankton. The water samplers with closing mechanisms are commonly used for obtaining samples from the desired depths. Themicro zooplankton are then concentrated by allowing them to settle, centrifuging or fine filtration. The advantage of this method was that it is easy to operate and sampling depths are accurately known. The disadvantage is that the amount of water filtered is less. The macro zooplankton and rare forms are usually not collected by this method and so it is unsuitable for qualitative and quantitative estimations.

Pumps

The gear is normally used on board the vessel/boat. The sampling can also be carried out from a pier. In this method, the inlet pipe is lowered into the water and the outlet pipe is connected to a net of suitable mesh size. The net is particularly submerged in a tank of a known volume. This prevents damage to the organisms. The zooplankton is filtered through the net. A meter scale on the pump records the volume of water filtered. This method was used for quantitative estimation and to study the small scale distribution of plankton. The frictional resistance of the sampled water in the hose can cause turbulence; damaging the larger plankton especially the gelatinous forms, ctenophores and siphonophores etc. The advantage of the method is that the volume of the water pumped is known. Again the continuous sampling is possible. However, the sampling depth is limited to a few meters and it is difficult to obtain samples from deeper layers.

Nets

The most common method of zooplankton collection is by a net. The amount of water filtered is more and the gear is suitable both for qualitative and quantitative studies. The plankton nets used are of various sizes and types. The different nets can broadly be put into two categories, the open type used mainly for horizontal and oblique hauls and the closed nets with messengers for collecting vertical samples from desired depths. Despite minor variations, the plankton net is conical in shape and consists of ring (rigid/flexible and round/square), the filtering cone and the collecting bucket for collection of organisms. The collecting bucket should be strong and easy to remove from the net. The netting of the filtering coneis made of bolting silk, nylon or other synthetic material. The material should be durable with accurate and fixed pore size. The mesh should be square and aperture uniform. The mesh size of the netting material would influence the type of zooplankton collected by a net. The nets with finer mesh would capture smaller organisms, larval stages and eggs of plank tonic forms while those with coarse netting material are used for collecting bigger plankton and larvae. Sometimes combinations of nets with mesh of different pore sizes were used. There is a great variety of mesh available from the finest to the coarse pore sizes.

Macroscopic observation

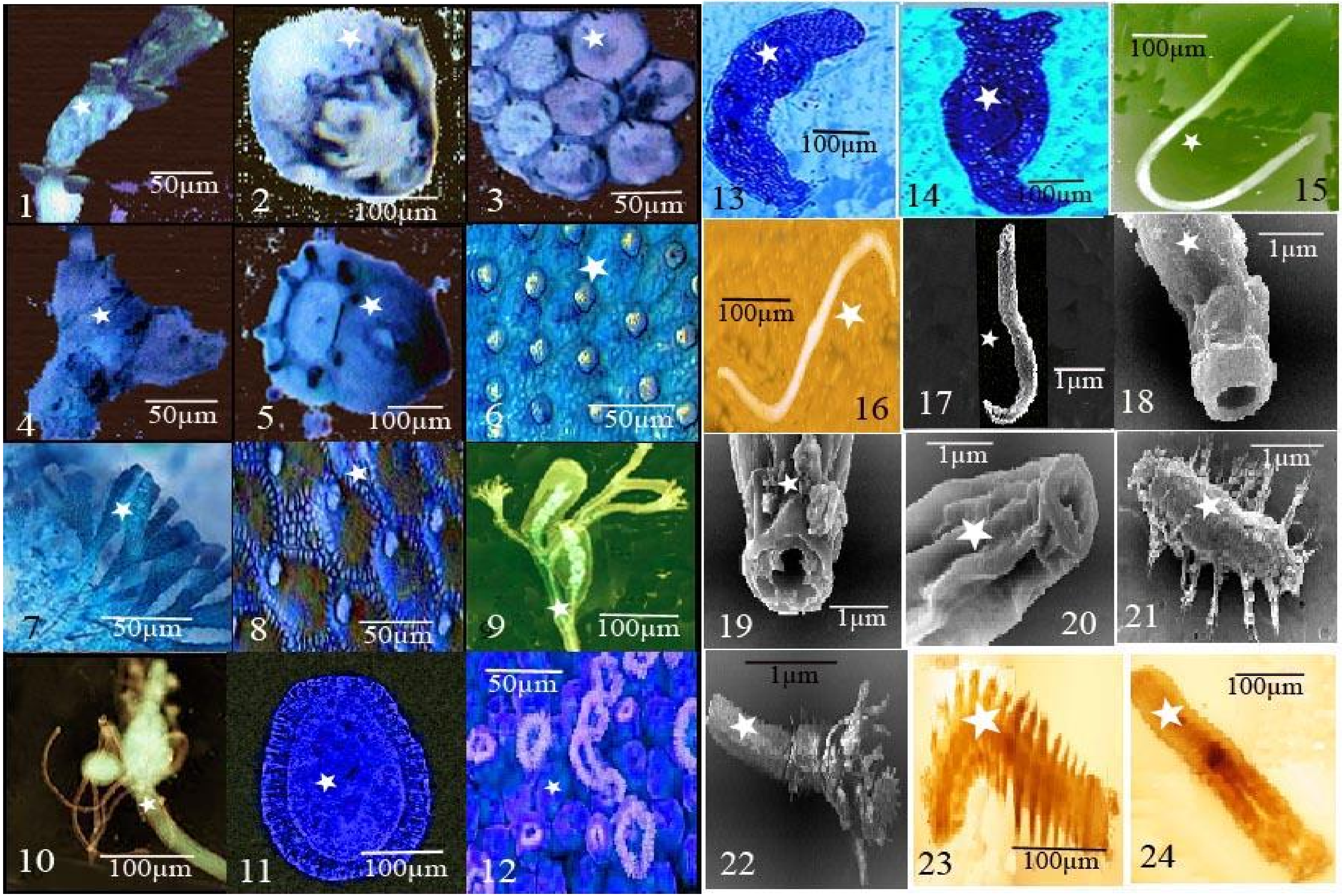
Plaktons were prepared for both macroscopic techniques or / and scanning electron microscopy. They were fixed for 24 hr in buffered 2.5% glutaraldehyde and post fixed for 30 min. in 1% osmium tetroxide. Washing was two times in 0.1 M phosphate buffer, followed by four times in 0.4 M glycerol and two times in PPTA (15 min.). Specimens with hard exoskeleton were washed many times in distilled water and subjected to dilute nitric acid for decalcification of exoskeleton or the cuticle. Specimens were fixed in neutral 10 % formalin or Bouin. Then washed in distilled water for 24 hrs, dehydration through ascending series of ethyl alcohol, alternated by another dehydration series of tertiary butyl alcohol (used as a softening agent). All zooplankton were stained with Evans stain or Nile blue or Borax carmine to observe its internal structures since they are mostly transparent. Samples were placed on glass slides with embedding mixture of PBS / glycerol / DABCO. Others were dissected with micro needles and incised longitudinally to ease its identification. Immediate viewing and photographing were performed under an Axiomicroscope (ZEISS-Axiophot). The description of almost all zooplankton was carried out on live stages under Axiomicroscope since they are minute, microscopic and transparent. Evan Blue stain was added to the live stages and described alive while movement. The photos did not clarify all described structures.

Scanning Electron Microscopy (SEM)

Samples of larvae were dried by means of the critical point method, mounted using carbon paste on an Al-stub and coated with gold up to a thickness of 400 Å in a sputter-coating unit (JFC-1100E). Observations of larvae morphology in the coded specimens were performed in a Jeol JSM-5300 scanning electron microscope operated between 15 and 20 KeV.

RESULTS

Bryozoa: (moss animals or sea mats), are tiny colonial animals that generally build stony skeletons of calcium carbonate. Most bryozoans are sessile and immobile, but a few colonies are able to creep about, and a few species of non-colonial bryozoans live and move about in the spaces between sand grains. The collected colonies were few millimeters in size, but the zooids that make up the colonies are tiny, usually less than a millimeter long. In each colony, different zooids assume different functions. Some zooids gather up the food for the colony (autozooids), others depend on them (heterozooids). Some zooids are devoted to strengthening the colony (kenozooids), and still others to cleaning the colony (vibracula). Each zooid secretes and lives inside a non-living case called a zooecium. These zooecia come in many different shapes and are interconnected in different ways depending on their shape. Species with simple rectangular box-like zooecia form mat like colonies, while other species with vase shaped zooecia build branching tree-like and fan-like colonies. The walls of these zooecia are strengthened with a variety of substances depending on species, normally this is either calcium carbonate, chitin or a mixture of both. Each zooecium has a hole at the top called an orifice through which the animal can extend its ring of tentacles or lophophore when it is feeding. In some species this orifice can be sealed shut by a sort of door called an operculum. The Bryozoans were formerly considered to contain two subgroups: the Ectoprocta and the Entoprocta, based on the similar bodyplans and mode of life of these two groups. Key to the different bryozoan genera collected (according to species identificationportal, (Van Couwelaar, 2015)* http://species-identification.org/index.php). Zooids erect, projecting vertically from the substratum with purple colour *Bugula neritina* (Linnaeus, 1758)⋆ (Fig. 1).Tan or straw coloured larva, eyespots visible, Purple coronate larva with reddish highlights. Barrel shaped, covered with longitudinal bands of cilia, furrow runs along one side of larva, semi-triangular darker colour bands present on sides of larva. Larva of *Bugula neritina* (Fig. 2). Shield-shaped zooecium, zooids are Circular or oval, vertical spines at margin of operculums do not point inward toward the zooids *Electra crustulenta* (Pallas, 1766)⋆ (Fig. 3).Tubular or tapering zooecium, zooid opaque light brown or orange-brown. Exposed tentacles iridescent purple. As specimens age they develop lateral stolens that give rise to additional zooids. Newly developing zooids appear as spheres near base of colony. Colouration translucent with medium brown highlights. Zooids with 8 tentacles. Lateral stolens often present. *Bowerbankia gracilis* (Leidy, 1855)⋆ (Fig. 4). No eyespots, flagella absent, larva barrel-shaped, light yellow coronate morphology. larva of *Bowerbankia gracilis* (Fig. 5). Colony encrusting, unilaminar, frontal wallthickly calcified, distinctly granular, with a series of marginalpores that usually continue proximally around the orifice. Orificeand operculum typically elongated, with a wide posterdelimited by minute, sharp condyles at each side; Adventitiousavicularia distolateral, single or paired (one at each side of the orifice). If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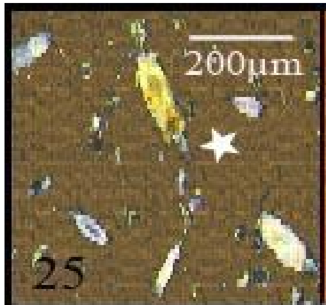
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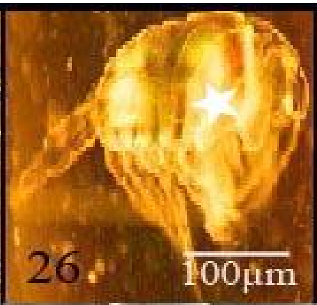
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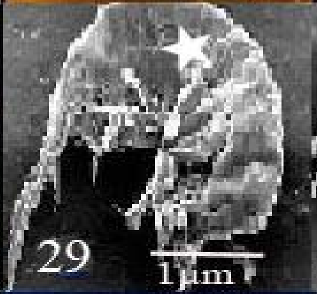
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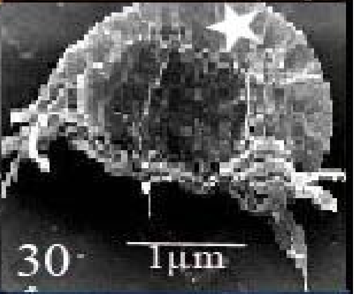
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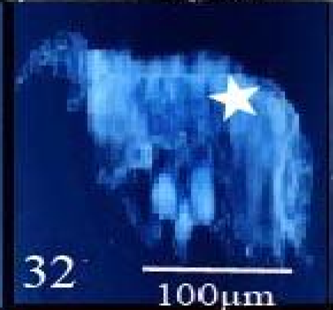
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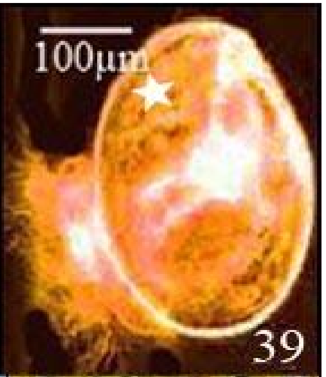
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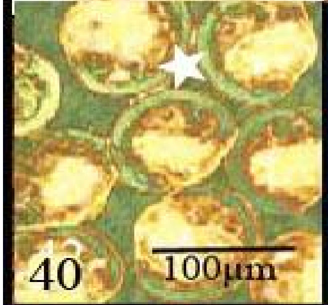
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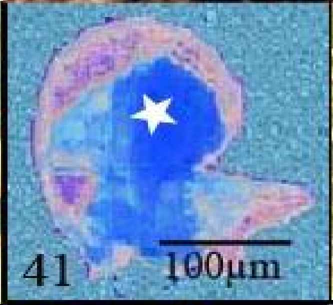
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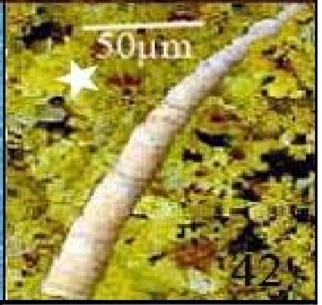
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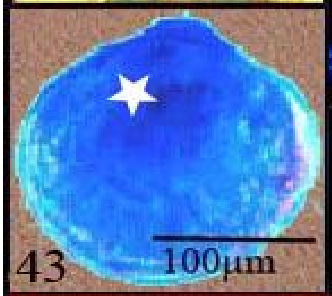
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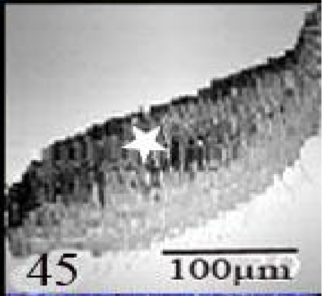
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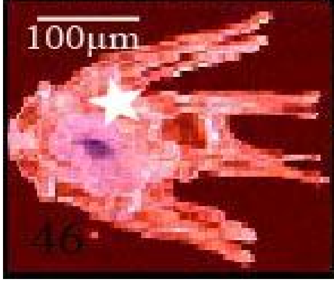
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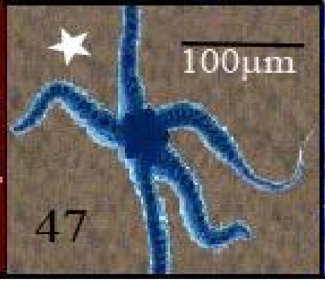
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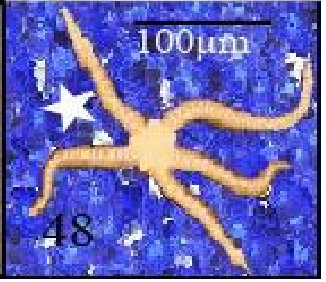
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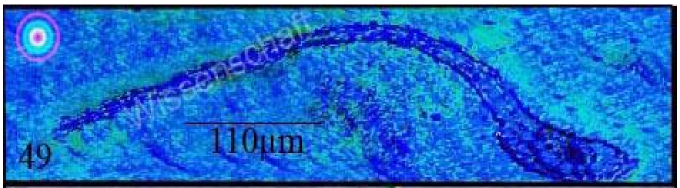

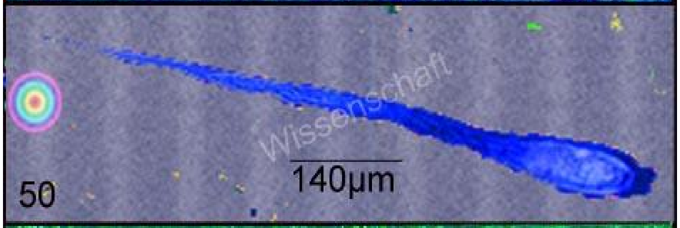

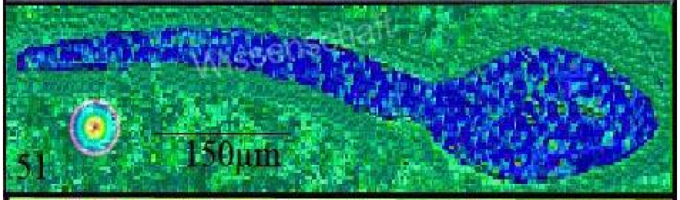

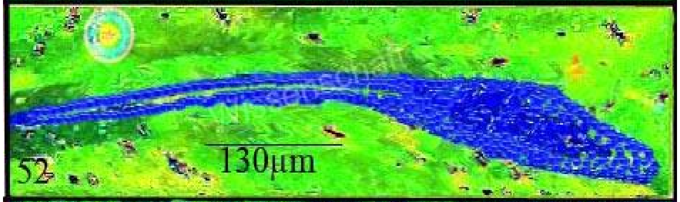

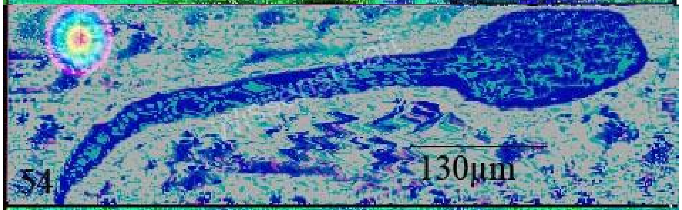

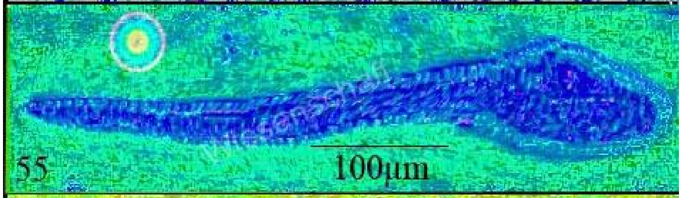

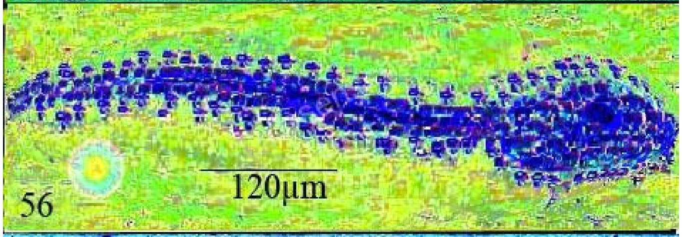

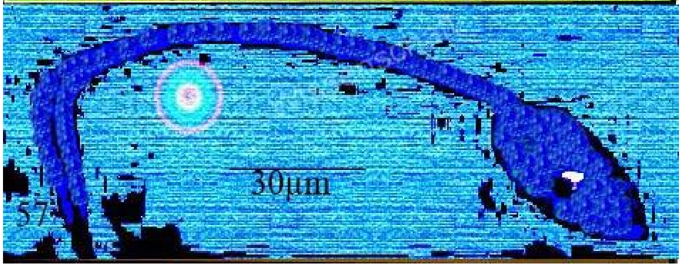

Fig. 1

Phase contrast photomacrograph of a part of the colony of *Bugula neritina* (Linnaeus, 1758). Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 2

Phase contrast photomacrograph of a larval stage of *Bugula neritina* (Linnaeus, 1758). Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 3

Phase contrast photomacrograph of a part of the colony of *Electra crustulenta* (Pallas, 1766). Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 4

Phase contrast photomacrograph of a part of the colony of *Bowerbankia gracilis* (Leidy, 1855). Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 5

Phase contrast photomacrograph of a larval stage of *Bowerbankia gracilis* (Leidy, 1855). Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer ,France andAbu Qir bay, Egypt).

Fig. 6

Phase contrast photomacrograph of a part of the colony of *Hippaliosina depressa* (Busk, 1854). Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 7

Phase contrast photomacrograph of a part of the colony of *Nolella dilatata*. Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 8

Phase contrast photomacrograph of a part of the colony of *Reptadeonella violacea* (Johnston, 1847). Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 9

Phase contrast photomacrograph of a part of the colony of *Obelia geniculata* (Linnaeus, 1758). Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt) and from the northern estruarine harbour of the Arabian Gulf – Saudi Arabia.

Fig. 10

Phase contrast photomacrograph of a single polymorphic zooid of *Pennaria disticha* (Goldfuss, 1820). Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt) and from the northern estruarine harbour of the Arabian Gulf – Saudi Arabia.

Fig. 11

Phase contrast photomacrograph of a part of the planula larva. Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 12

Phase contrast photomacrograph of the sea anemone *Actinodendron* sp. Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 13

Phase contrast photomacrograph of the rotifer*Paraseison annulatus* (Claus, 1876). Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 14

Phase contrast photomacrograph of the rotifer *Seison nebaliae* (Grube, 1861). Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 15

Phase contrast photomacrograph of the nematode *Anisakis simplex.* Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt), the North Sea (Helgoland - Germany) and from the northern estruarine harbour of the Arabian Gulf – Saudi Arabia.

Fig. 16

Phase contrast photomacrograph of the nematode*Anisakis simplex.* Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 17

SEM photomacrograph of the third stage larva of the nematode*Anisakis simplex.* Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt), the North Sea (Helgoland - Germany) and from the northern estruarine harbour of the Arabian Gulf – Saudi Arabia.

Fig. 18

SEM photomacrograph of the second stage larva of the nematode*Anisakis simplex.* Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt), the North Sea (Helgoland - Germany) and from the northern estruarine harbour of the Arabian Gulf – Saudi Arabia.

Fig. 19

SEM photomacrograph of the third stage larva of the nematode *Anisakis simplex*showinga trilobed lateral lips and a prominent V-shaped projecting boring tooth. Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt), the North Sea (Helgoland - Germany) and from the northern estruarine harbour of the Arabian Gulf – Saudi Arabia.

Fig. 20

SEM photomacrograph of the third stage larva of the nematode *Anisakis simplex* cuticle striation. Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt), the North Sea (Helgoland - Germany) and from the northern estruarine harbour of the Arabian Gulf – Saudi Arabia.

Fig. 21

Phase contrast photomacrograph of the polychaete *Harmothoe* sp., (scale worm), Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 22

Phase contrast photomacrograph of the polychaete *Pomatocerous triqueter* (Linnaeus, 1758), Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 23

Phase contrast photomacrograph of the polychaete *Nemidia lawrencii* (McIntosh, 1874) synoneme *Nemidia torelli*, Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France andAbu Qir bay, Egypt).

Fig. 24

Phase contrast photomacrograph of the polychaete *Notomastus latericeus* (Sars, 1851), Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 25

Phase contrast photomacrograph of the copepod *Megacyclops viridis* (Jurine, 1820), Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 26

Phase contrast photomacrograph of the male copepod *Megacyclops viridis* (Jurine, 1820), Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 27

Phase contrast photomacrograph of the brooding female copepod *Megacyclops viridis* (Jurine, 1820), Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 28

Phase contrast photomacrograph of the amphipod *Monocorophium acherisicum* (Costa, 1851). Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 29

SEM photomacrograph of the male amphipod *Monocorophium acherisicum* (Costa, 1851).. Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 30

SEM photomacrograph of the the female amphipod *Monocorophium acherisicum* (Costa, 1851).. Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 31

Phase contrast photomacrograph of the malecorophiide, *Monocorophium acherisicum* (Costa, 1851). Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 32

Phase contrast photomacrograph of the female corophiide, *Monocorophium acherisicum* (Costa, 1851). Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 33

Phase contrast photomacrograph of the male corophiide, *Monocorophium acherisicum* (Costa, 1851). Showing uropod 1 attached at invaginations laterally, lacking rim on urosome, male rostrum absent or minute, uropod 1 attached at invaginations laterally, lacking rim on urosome.Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 34

Phase contrast photomacrograph of the nauplius larva. Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 35

Phase contrast photomacrograph of the Zoea larva. Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 36

Phase contrast photomacrograph of the Megalopod larva. Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 37

Phase contrast photomacrograph of the isopod*Caecocassidias patagonica* (Kussakin, 1967). Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 38

Phase contrast photomacrograph of the striped Nudibranch *Armina* SP. Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 39

Phase contrast photomacrograph of the veliger larva with high magnification. Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 40

Phase contrast photomacrograph of the veliger larva with low magnification. Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 41

Phase contrast photomacrograph of the Glochidia larva. Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 42

Phase contrast photomacrograph of the shell of *Dentalium vulgare* (da Costa, 1778). Specimens were collected from the northern estruarine harbour of the Arabian Gulf – Saudi Arabia.

Fig. 43

Phase contrast photomacrograph of the bivalve *Microgloma tumidula* (Monterosato, 1880). Specimens were collected fromthe Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt) and the northern estruarine harbour of the Arabian Gulf – Saudi Arabia.

Fig. 44

Phase contrast photomacrograph of the sea cucumber *Polycheira rufescens*. Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 45

Phase contrast photomacrograph of the sea cucumber *Chiridota heheva*. Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 46

Phase contrast photomacrograph of the echinopluteus larva with 8 arms. Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France).

Fig. 47

Phase contrast photomacrograph of the echinoderm *Amphiura*sp. Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France).

Fig. 48

Phase contrast photomacrograph of the echinoderm *Ophiomastix annulosa*. Specimens were collected fromthe Mediterranean Sea (Banyuls-sur-Mer, France).

Fig. 49

Phase contrast photomacrograph of the long tailed larva of *Styela plicata*. Specimens were collected from the Mediterranean Sea (Abu Qir bay, Egypt).

Fig. 50

Phase contrast photomacrograph of the long tailed larva of*Phallusia mammilata*. Specimens were collected the Mediterranean the North Sea (Helgol and - Germany).

Fig. 51

Phase contrast photomacrograph of the long tailed larva of *Corella parallelogramma*. Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France). The North Sea (Helgoland - Germany).

Fig. 52

Phase contrast photomacrograph of the long tailed larva of *Diplosoma migrans*. Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France - Abu Qir Bay, Egypt). The North Sea (Helgoland - Germany) and the northern estruarine harbour of the Arabian Gulf – Saudi Arabia.

Fig. 53

Phase contrast photomacrograph of the long tailed larva of*Halocynthia roretzi*. Specimens were collected from the Mediterranean Sea (Abu Qir Bay, Egypt).

Fig. 54

Phase contrast photomacrograph of the long tailed larva of *Microcosmus claudicans*. Specimens were collected from the Mediterranean Sea (Abu Qir Bay, Egypt).

Fig. 55

Phase contrast photomacrograph of the long tailed larva of *Molgula manhattensis*. Specimens were collected from the Mediterranean Sea (Abu Qir Bay, Egypt) and and the northern estruarine harbour of the Arabian Gulf – Saudi Arabia.

Fig. 56

Phase contrast photomacrograph of the long tailed larva of *Ascidiella aspersa*. Specimens were collected fromthe Mediterranean Sea (Banyuls-sur-Mer, France - Abu Qir Bay, Egypt).

Fig. 57

Phase contrast photomacrograph of the long tailed larva of*Cnemidocarpa mollis*. Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France - Abu Qir Bay, Egypt) and the northern estruarine harbour of the Arabian Gulf – Saudi Arabia.

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paired, one sometimes larger than the other. Remarks: The original description of this species was published by Busk (1854)*.This bryozoanis *Hippaliosina depressa* (Busk, 1854)* (Fig. 6).Figure 7 is *Nolella dilatata* defined according to (Marcus, 1940: Harmelin, 1968 Hondt, 1983: Hayward, 1985: Zabala and Maluquer, 1988). Primary and secondary orifices semicircular; peristome very short. Frontal shield finely granular, with a round spiramen in a depression in the centre of the zooid; marginal pores arranged in a single series, closely spaced. A small frontal adventitious avicularium, placed proximally to the secondary, calcified orifice; rostrum triangular, acute, directed distally. Accessory second discontinuous row of areolae can develop all around the avicularium and the ascopore. This bryozoan is *Reptadeonella violacea* (Johnston, 1847) (Fig. 8) defined according (Hayward and Ryland, 1999: Hayward and McKinney, 2002).

Cnidarians (Hydrozoa): The hydroid form is usually colonial, with multiple polyps connected by tubelike hydrocauli. The hollow cavity in the middle of the polyp extends into the associated hydrocaulus, so that all the zooids of the colony are intimately connected. Where the hydrocaulus runs along the substrate, it form a horizontal root-like stolon that anchors the colony to the bottom. The colonies are generally small, no more than a few centimeters across. The hydrocaulus is usually surrounded by a sheath of chitin and proteins called the perisarc. The majority of polyps are specialized for feeding. These have a more or less cylindrical body with a terminal mouth on a raised protuberance called the hypostome, surrounded by a number of tentacles. The polyp contains a central cavity, in which initial digestion takes place. Partially digested food may then be passed into the hydrocaulus for distribution around the colony and completion of the digestion process. Unlike some other cnidarian groups, the lining of the central cavity lacks stinging nematocysts, which are found only on the tentacles and outer surface. All colonial hydrozoans also include some polyps specialized for reproduction. These lack tentacles and contain numerous buds from which the medusoid stage of the lifecycle is produced. The arrangement and type of these reproductive polyps varies considerably between different groups.

Key to the two hydrozoan genera collected (according to species identification portal, (Van Couwelaar M. (2015)*http://species-identification. org/index.php**)**

Family Campanulariidae Johnston, 1837
Subfamily Obeliinae Haeckel, 1879*Obelia geniculata* (Linnaeus, 1758) (Fig. 9) is readily distinguishable from other members of this genus by the structure of its stem. It forms a series of internodes that are zig-zag in their arrangement, and it is jointed at each bend. There are several annulations after each joint. Just below each joint the internodes are thickened on alternate sides, forming a 'shelf' for the support of ringed pedicels which in turn, support the hydrothecae. The hydrothecae are obconical in shape and have a smooth outer margin. The gonothecae are shaped like a grecian urn, and are also borne on ringed pedicels. (see Boero *et al*., 1996, Govindarajan *et al*. 2005 for review).Family Pennariidae McCrady, 1859*. Hydroid colony pinnate, occasionally bushy, stem monosiphonic, giving rise alternately from opposite sides to two series of hydrocladia; hydrocaulus and hydrocladia with terminal hydranths (monopodial); hydranths on short pedicels on upper side of the hydrocladia; hydranths pear-shaped; tentacles of two types: in distal half of hydranth more or less capitate tentacles in one oral whorl and more in indistinct whorls below, on lower par of hydranth one aboral whorl of semifiliform to slightly capitate aboral tentacles; gonophores developing above aboral tentacles, eumedusoids, liberated or not. Medusa a simple eumedusoid; manubrium not extending beyond umbrella margin; gonads completely surrounding manubrium; four radial canals; four permanently rudimentary tentacles, usually reduced to mere bulbs, without ocelli. The hydroid is restricted bathymetrically to shallow waters (0–29 m) (Fraser 1944). *Pennaria disticha*(Goldfuss, 1820)* (Fig. 10), common name christmas treehydroid.*Pennaria disticha* is in the Genus *Pennaria* and Family Pennariidae, the Suborder Capitata. It can be further characterized as in the Order Anthoathecata in the Subclass Hydroidolina. Conspicuous and erect hydroid colonies with terminal hydranths and pinnately-branched stems. Growth monopodial with main stem divided into internodes of varying length. Hydranths are borne at the end of the stem, hydrocladia and ramules. They are clavate with a whorl of filiform aboral tentacles and short irregularly scattered capitate tentacles. Gonophores borne between the sets of tentacles.

Planula larva: (Fig. 11) is the free-swimming, flattened, ciliated, bilaterally symmetriclarval form of various cnidarian species. Some groups of Nemerteans too produce larvae, which are very similar to the planula. The planula forms from the fertilized egg of a medusa, as the case in scyphozoans and some hydrozoans, or from a polyp, as in the case of anthozoans. Depending on the species, the planula either metamorphoses directly into a free-swimming, miniature version of the adult form (such as many open-sea scyphozoans), or navigates through the water until it reaches a hard substrate (many may prefer specific substrates) where it anchors and grows into a polyp (including all anthozoans with a planula stage, many coastal scyphozoans, and some hydrozoans). Planulae of the subphylum Medusozoa have no mouth or digestive tract and are unable to feed themselves, while those of Anthozoa can feed. Planula larvae swim with the aboral end (the end away from the mouth) in front.

Sea anemones are a group of marine-dwelling, predatory animals of the order Actiniaria. They are named for the anemone, a terrestrial flower. Sea anemones are classified in the class Anthozoa, subclass Hexacorallia. Anthozoa often have large polyps that allow for digestion of larger prey and also lack a medusa stage. As cnidarians, sea anemones are related to corals, jellyfish, tube-dwelling anemones, Structurally the sea anemone is known as a polyp. The body wall consists of an outer layer of epidermis and an inner layer of gastrodermis; between these two is a gelatinous, non-cellular layer known as the mesoglea. The body wall is organized into a muscular column with a top that has a mouth (the oral disc) and a bottom (the pedal disc) that holds onto the substratum. Within the column is a sac-like digestive cavity, called the coelenteron or gastro-vascular cavity, that has the mouth as its only opening. The coelenteron of sea anemones is divided into pie-shaped sections by muscular mesenteries, some of which attach both to the top (oral) and bottom (pedal) discs. There is no right or left side on a sea anemone; it has radial symmetry.

This sea anemone is *Actinodendron sp.* (Fig. 12) defined accordingspecies identification portal, (Van Couwelaar M. (2015)* http://species-identification.org/index.php.

Rotifera (wheel invertebrates): Seisonidae is a family of rotifers, found on the gills of marine crustaceans. Peculiar among rotifers, males and females are both present and equal in size. They have a large and elongate body with reduced corona. Body cylindrical or sack-shaped, covered with cuticle or lorica, usually <200 µm; head with ciliated corona. Only Seisonidea are exclusively marine. Morphologically, rotifers possess two main distinctive features: corona and mastax. The ciliated region at the apical end (head) of a rotifer is called the corona ("wheel organ"); it is used for locomotion and food gathering. In adults of some rotifer families, ciliation is reduced and the corona is replaced by a funnel or bowl-shaped structure (the infundibulum) at the bottom of which the mouth is located. Along the edge of the infundibulum of most species there is a series of long setae (bristles).The other universal characteristic of rotifers is a muscular pharynx, the mastax, possessing a complex set of hard jaws called trophi. Most rotifers are free living, they swim in the pelagial or crawl on substrata (bottom sediments, stems of macrophytes); however, many species live permanently attached to plants (the latter are called sessile rotifers). Very few rotifers are parasitic; the vast majority of rotifers are solitary but some (ca. 25 species) form colonies of various sizes (Wallace, 1987).Most rotifers are either obligatory parthenogenetic (the whole class of bdelloids) or produce males for a brief period, sometimes only a few days, each year or season (Nogrady *et al*., 1995). Male rotifers are usually strongly reduced in size and sometimes only slightly resembling the females of the same species. Identification of the two rotifer genera collected (according to species identification portal,(Van Couwelaar M. (2015)*,http://species-identification.org/index.php).Paraseison (Plate, 1887)**Paraseison annulatus* (Claus, 1876)* (Fig. 13)-ectoparasite of crustaceans. Seison (Grube, 1861) *Seison nebaliae* (Grube, 1861)* (Fig. 14).

Nematoda (Anisakidae): 3Lips, relatively small, inconspicuous, surrounded of mouth, with aprominent boring tooth.Tail rounded, length (0.088-0.579mm), with smallmucron. Mucron length (0.015-0.022mm).Worms were obtained from ascidiansbranchial chambers. The cuticle is thick,usually with distinct striations mainly at the anteriorand posterior body extremities (Figs. 15-20). A triangularoral opening is visible between trilobed laterallips; a prominent V-shaped projecting boringtooth is located ventrally to themouth. The excretory opening, seen by light microscopebelow the boring tooth on the ventralside. Rectangular to circular outlines of papillaecould be seen on each of the lateroventrallips. Adult *Anisakis simplex* is seen in (Figs. 15 - 16), third stage larva in (Fig. 17). A rounded toothless mouth of early larval stage obtained from the nekton is seen in (Fig. 18). A trilobed lateral lips and a prominent V-shaped projecting boring toothand cuticle striation are seen in (Figs. 19-20).This anisakid has beenidentified (according to Simonetta, et al. 2011; species identification portal, http://species-identification.org/index .php)

Annelida (Polychaeta): Errant polychaetes include actively crawling or swimming forms which may, however, also spend time in burrows or crevices, or under rocks on the seashore. Many are predators on small invertebrates; some are scavengers. In most the first few body segments bear sensory projections called cirri, while the remaining body segments bear conspicuous leglike appendages called parapodia. The parapodia, along with undulations of the body, propel the worm in crawling and swimming; parapodia are tipped with bundles of setae, usually made of chitin. Most errant polychaetes have well-developed head regions, which bear eyes, sensory tentacles, and a specialized organ, the nuchal organ, thought to detect chemicals. The anterior end of the gut often forms a protrusible structure, the proboscis, sometimes equipped with strong chitinous jaws and used in feeding. The setae of some polychaetesare composed of calcium carbonate rather than chitin and are hollow. These brittle setae are easily broken off and contain a toxin that produces a painful reaction in humans. In the scaleworms, a series of overlapping scales form a covering over the animal's upper surface.

Key to the polychaete genera collected (according to species identification portal, (Van Couwelaar M. (2015)* **http://species-identification. org/index.php)**

With 2 prostomialantennae (antennae are absent); pharynx, when everted, clearly consisting of 2 portions, with a pair of stout jaws on the distal portion and usually with conical teeth on one or more areas of both portions. Proximal unit of the prostomial palps is much larger than the distal unit. Figure 21is identified as *Harmothoe* sp.,(scale worm),young specimen, length ca. 800 µm. The long white tubes that look like squirted toothpaste are the tubes of the keel worm *Pomatocerous triqueter* (Linnaeus, 1758) (Fig 22 shows this tubeworm out of the tube). The tubes in cross section are said to resemble the shape of a ship's hull hence the comon name. It uses its tentacles to catch detritus (dead stuff) from the water. This tubeworm encrusts stones, rocks and shells, and the carapace of some species of decapods. They are predominantly sublittoral. The calcareous tube is white, smooth and irregularly curved with a single, median ridge that ends in a projection over the anterior opening. The operculum bears a shallow, dish-shaped plug (ampulla) which is often conical distally, and may have projections on the crown. The colouration of the body is bright but variable, and the crown of tentacles (radioles) are banded with various colours*Nemidia lawrencii* (McIntosh, 1874)* synoneme *Nemidia torelli* (Malmgren, 1866)*(Fig. 23) prostomium elongated, bilobed, with a peak on each lobe. 50 and more chaetigers, the posterior region without scales.Body long, 50 and more chaetigers. Prostomium elongated, bilobed, with a peak on each lobe, median and lateral antennae with small papillae, and a pair of papillate palps. Two pair of small eyes, anterior pair on line of greatest width of prostomium. Body with 15 pairs of scales, leaving the posterior region uncovered. Scales smooth, margins not fringed with papillae, without tubercules. Notopodial chaetae mostly filamentous with a long spinose part and capillary tips. Neuropodial chaetae with long spines on the swollen terminal part and long, straight unidentate tips. Pygidium with dorsal anus and a pair of anal cirri. *Notomastus latericeus* (Sars, 1851) (Fig 24), body long, cylindrical, very fragile, lacking any appendages, 150 segments. Prostomium short, conical with an eversible sac-like pharynx. Thorax with 12 segments. First segment without chaetae, following 11 segments with capillary chaetae only. Posterior body with hooded hooks, dorsally and ventrally. Genital hooks absent.

Pygidium terminates in a membranous flap, without cirri.Up to 300 mm for 150 segments.

Copepoda (oar-feet Entomostraca) are the most common zooplanktonworldwide. They are an integral part ofthe food web as both predator and prey. Cyclopidae - Genus: Megacyclops(Kiefer, 1927). The hitherto used keys (Kiefer, 1960;Dussart, 1969; Einsle, 1975), give the following distinctions:- Furcal branches (length:width) 3,5 to 4,5seta 1: seta 4 . . . . . .greater than 2 , seta 1: length furca . . . . . greater than 1body length 1,2 to 3 mm. *Megacyclops viridis*(Jurine, 1820) (Figs 25-27).This copepod has beenidentified (according to species identification portal, http://species-identification.org/index.php)

Amphipoda (Gammaridae): are the most abundant and familiar suborder of the order Amphipoda. They represent a very diverse group of organisms with a worldwiderange (Barnard and Karaman1991). Amphipods are characterized by three traits; 1) the absence of a carapace, 2) thefirst thoracic segment being fused to the head, and 3) the abdomen being divided into twoparts each with three segments. Gammaridean amphipods are usually laterallycompressed. Most are benthic but there are some planktonic species. The "typical"gammaridean has large coxal plates, a large abdomen with six pairs of appendages, and relatively small compound eyes. There is divergence from the typical body plan, making gammarids a broad and diverse group with respect to morphology. Figure 28- 30 show *Gammaropsis* sp. Isaeidae (Liljeborg, 1855)⋆. Male antennae 2 not stout and enlarged (Figs. 28 - 30).Brooding female missing some pereopods and one of the second antennae (Fig. 30).Accessory flagellum 3 or more articulate; article 3 of antenna 1 equal to or longer thanarticle 1; gnathopods subchelate; uropod 3 biramous, rami equal to each other, variable inlength, generally equal to or longer than peduncle (Barnard, 1969).Male antennae 2 stout and enlarged, lacking accessory flagellum; Urosome visiblydepressed/flattened, Corophiidae, *Monocorophium acherisicum* (Costa, 1851)⋆. A. Male rostrum absent or minute; Uropod 1 attached at invaginations laterally, lacking rim on urosome , male rostrum absent or minute, uropod 1 attached at invaginations laterally, lacking rim on urosome (Figs.31-33).The megalopod is the final larvalstage of a crab. During thisstage, the abdomen is extended. The abdomen is foldedunder the body as an adult (Fig. 31).This amphipods have beenidentified (according to species identification portal,(Van Couwelaar M. (2015)*http://species-identification.org/ index. php). Nauplius larva is shown in (Fig. 34), zoaea larva (Fig. 35) The zoea is a larval stage of a crab or shrimp. Zoea have two large spines that are used for protection and flotation and megalopod larva (Fig. 36).

Isopoda: Sphaeromatidae (Latreille, 1825)* are small, fast swimming isopods found in the estuarine and marine habitats. They are sometimes known as "pillbugs" because of their ability to roll up into a pill-sized ball when threatened. They are shorter and more compact. Mouthparts: Mandible, maxillule and maxilla unmodified. Maxilliped with palpunmodified, lobes bearing setae, but endite greatly expanded with proximalflaps and lobes. Brood pouch: 5 pairs of oostegites arising from pereonites 1, 2, 3, 4 and 5. Brood held in marsupium thus formed. Pockets and internal pouches absent. Fig 37 *Caecocassidias patagonica* (Keller *et al.,* 1967; Kussakin, 1967).This isopod has beenidentified (according to species identification portal, http://species-identification. org/index. php).

Sea slugs are any of various highly colorful marine gastropods of the suborder Nudibranchia, lacking a shell and gills but having fringelike projections that serve as respiratory organs. Also called nudibranch. Or Any of various other marine gastropods that lack a shell or have a reduced shell. Nudibranchs, meaning "naked gills" consist of soft-bodied sea slugs and are members of the class Gastropoda. The majority of the colorful opisthobranchs that are seen belong to the suborder Nudibranchia. Nudibranchs can be found anywhere in marine habitat, to tidal pools, to coral reefs, but are most diverse in tropical waters. Nudibranchs have an irregular shape that can be thick or flattened and long or short and can range anywhere from 0.635 centimeters to 60.96 centimeters. The average lifespan of a nudibranch can vary anywhere from weeks to one year, based on the abundance of food available to them. Nudibranchs are carnivores and use their radula, a band of curved teeth, to scrape or tear food particles. They feed on species such as hydroids, sea anemones, corals, sponges and fish eggs. Each species of nudibranch usually specializes on one specific sessile animal on which to feed. Nudibranchs move or "crawl" by ciliary action or the muscular action of its foot, a flat and broad muscle that clings to rocks, corals, sponges and other surfaces. Although separated into four different groups, the two most common groups of nudibranchs are the aeolidida (aeolids) and the doridoidea (dorids). Doridoidea is the largest group of nudibranchs and is comprised of many different variations of body types. Aeolidida are the second largest subgroup of nudibranchs and show a more consistent elongated shape. Nudibranchs have both male and female sex organs, making them hermaphrodites. Although hermaphroditic, self-fertilization does not occur. Only when the reproductive pores of two nudibranchs line up, neck to neck, can fertilization ensue. Nudibranchs have obtained different defenses in order to escape predation; chemical defenses are obtained from their prey by ingestion, and are then incorporated into nudibranch tissues. The bright colors and patterns of nudibranchs serve as a warning signal to predators of their chemical defenses. Alternatively, the coloration of nudibranchs could also be a camouflage mechanism, allowing them to blend in to various substrates. The only genus of slugs collected is the striped Nudibranch *Armina* SP. (Cooper, 1963)⋆ (Fig. 38). This slug is collected from Abu Qir bay Egypt for the first time. This sea slug has beenidentified (according to species identification portal, (Van Couwelaar M. (2015)* (http://species-identification.org/index.php).

Veligerlarvais a free-swimming larval stage of a mollusk. Veligers have the beginnings of a foot, shell, and mantle. The veliger larvae of gastropods are suspension feeders. Long cilia form a band along the smooth or lobed velum in these larvae, while recessed beneath this band is a groove lined with cilia which leads to the mouth (Yonge, 1926; Lebour, 1931; Werner, 1955; Thompson, 1959) (Figs. 39 - 40). Glochidia larva(Fig. 41) form has hooks, which enable it to attach itself to gills of a marine host species for a period before it detaches and falls to the substrate and takes on the typical form of a juvenile bivalve. Since the host is active and free-swimming, this process helps distribute the bivalve species to potential areas of habitat that it could not reach any other way.

Scaphopoda: The Scaphopods appear to occupy a position intermediate between the Gastropoda and the Lamellibranchiata: the presence of a univalve shell, a buccal mass with a radula and the nature of the nervous system are characteristic of the gastropods while the digging foot, lack of cephalisation, fused mantle which is open at both ends and bilateral symmetry are typical of bivalves. Family Siphonodentaliidae Simroth, 1895⋆. Shell 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. Source: Jones and Baxter (1987).The following subtaxa of this family occur in the Arabian Gulf:Genus *Cadulus* (Philippi, 1844) (Source: Jones and Baxter, 1987). Shell small to moderate, arcuate and with the maximum diameter near the middle or between the median portion and the oral aperture. The aperture generally constricted and never the region of maximum diameter. Shell surface smooth, rarely sculptured with longitudinal striae or minute annular rings. Apical orifice simple or with 2-4 notches, orifice often constricted with a ledge within the opening. Shell texture vitreous and transparent/translucent. Foot vermiform with a pedal disc but no filament. The following species has been collected from the benthos of the Arabian Gulf:Family Dentaliidae. The mantle is entirely within the shell. The foot extends from the larger end of the shell, and is used to burrow through the substrate. They position their head down in the substrate, with the apical end of the shell (at the rear of the animal's body) projecting up into the water. The shells are conical and curved in a plan spiral way, and they are usually whitish in color. Because of these characteristics, the shell somewhat resembles a miniature elephant's tusk. They are hollow and open at both ends; the opening at the larger end is the main or anterior aperture of the shell. The smaller opening is known as the apical aperture. Genus *Dentalium* (Linnaeus, 1758)⋆. Shell thick; with a few marked, oblique, concentric growth lines or ridges: gently tapered towards posterior end, less curved than Dentalium entalis. Posterior portion of shell with fine, closely spaced, longitudinal striations. Anterior aperture circular; posterior end obliquely truncate, aperture circular with smooth rim, occluded by septum, with central pipe bearing a circular orifice. The animal is of similar shape as its shell, with a rudimentary eyeless head, which is covered by the mantle as in the bivalves. The foot is long, pointed, and bilobed, and projects from the large end of the shell. The radula within the buccal mass is broad and oval, with only 5 teeth in a row. *Dentalium vulgare* (da Costa, 1778)⋆ (Fig. 42).This scaphopod has been identified (according to species identification portal, http://species-identification.org/index.php).

Bivalvia: Shell Structure: Minute,1-1.2 mm. relatively solid. Equivalve: Equivalent. Equilateral: Slightly in equilateral, beaks situated to the posterior of midline, app. 40-45% of total length from posterior end. Tumidity: Tumid. Outline: Oval, anteriorly extended; height of shell approximately 80% of the length; dorsal margin straight, very short posteriorly, longer anteriorly; posterior margin gently rounded, anterior margin extended and more strongly rounded; ventral margin rounded, lunule and escutcheon absent; umbo not prominent, projecting slightly above the dorsal margin, prodissoconch conspicuous. Sculpture: Very fine, regular concentric lines, increasing in prominence towards the ventral margin; also very faint radial lines. Margin: Smooth. Ligament: Internal, amphidetic, oval, sat in a simple resilifer below the beaks. Hinge: Taxodont: hinge relatively strong with 3 large, blunt, chevron-shaped teeth either side of the ligament. Pallial Musculature: Indistinct. Periostracum: Glossy, very pale straw coloured. Colour: Translucent white. Additional Characters: Elongated coils along the dorsum on both sides of the body.*Microgloma tumidula* (Monterosato, 1880)⋆(Fig. 43). Nuculanoidea : Nuculanidae Tebble name: n/a Smith & Heppell name: *Microgloma turnerae* (Sanders and Allen, 1973).This bivalve has beenidentified (according to species identification portal, (Van Couwelaar M. (2015)*http://species-identification.org/index.php).

Echinodermata (Holothuroidea): Sea cucumbers are echinoderms from the class Holothuroidea. They are marine animals with a leathery skin and an elongated body containing a single, branched gonad. Sea cucumbers are found on the sea floor worldwide. Sea cucumbers serve a useful role in the marine ecosystem as they help recycle nutrients, breaking down detritus and other organic matter after which bacteria can continue the degradation process. Like all echinoderms, sea cucumbers have an endoskeleton just below the skin, calcified structures that are usually reduced to isolated microscopic ossicles (or sclerietes) joined by connective tissue. In some species these can sometimes be enlarged to flattened plates, forming an armour. In pelagic species such as Pelagothuria natatrix (Order Elasipodida, family Pelagothuriidae), the skeleton is absent and there is no calcareous ring. The sea cucumbers are named for their resemblance to the vegetable cucumber.Subphylum:Echinozoa / Class: Holothuroidea / Subclass:podacea/ Order:Apodida/ Family Chiridotidae Östergren, 1898. These sea cucumbers are vagile holothurians with an elongated shape (up to 3 meters for Synapta maculata), worm or snake-like. Their shape is adapted for burrowing through the sediment, sometimes in a fashion similar to earthworms. Their mouth is surrounded with 10-25 pinnate or peltate tentacles. The absence of tube feet gives the order its name, Apodida meaning without feet : they move by crawling on the sediment, hence they need flat bottoms with few current. Members of this order have a circum-oral ring and tentacles, but do not have tube feet or radial canals. They also lack the complex respiratory trees found in other sea cucumbers, and respire and excrete nitrogenous waste through their skin.

Figure44 has been identified as *Polycheira rufescens*.Class: Holothuroidea / Order: Apodida / Suborder: Synaptina Family:Chiridotidae Östergren, 1898⋆. Members of this family have 10, 12, or 18 pelto-digitate tentacles (bearing 3-10 digits on each side). They lack podia, radial canals and respiratory tree. The soft body wall is supported by ossicles which are generally wheel-shaped with six spokes. Some species have hook-shaped or rod-shaped ossicles or spiny sigmoid bodies Figure 45 has been identified as *Chiridota heheva*. These two holothuroideans has been identified (according to species identification portal, http://species-identification.org/index. php).

Echinopluteus with 8 arms: has bilateral symmetry; transparent; calcareous skeleton and spines; spines simple or fenestrated; skeleton is birefringent (the decomposition of a ray of light, passing through the skeleton and being split into two rays). Skeleton becomes visible in glowing rainbow colours that change as the swimming larva changes its orientation to the light (Fig. 46).

Echinodermata (Ophiuridea Gray, 1840): like many echinodermsexhibit pentaradial symmetry. Brittle stars have five arms that join together at a central body disk. The arms are clearly delineated from the central body disk, and in this way brittle stars can be distinguished from starfish (starfish arms blend with the central body disk such that it is not easy to delineate where the arm ends and the central body disk begins).Brittle stars move using a water vascular system and tube feet. Their arms can move side to side but not up and down (if they are bent up or down they break, hence the name brittle star). Figure 47 is identified as *Amphiura*sp. with a maximum span of app. 1 inch (2.5 cm). Figure48 is identified as brittle star *Ophiomastix annulosa*, for sale at the Kölle Zoo pet super store in Heilbronn, can be seen even during daylight hours. These echinoderms have beenidentified (according to species identification portal, (Van Couwelaar M. (2015)*,http://species-identification.org/index.php).

ASCIDIAN LARVAE (Identification of the ascidian larvae studied has been carried out according to (Millar,1970 & 1971and Van Couwelaar, 2015 - Marine Species Identification Portal : Class Ascidiacea: http://species-identification. org/index.php). *Styela plicata*Lesuaer, 1823(Fig. 49)No cells interspersed about the body and tail………………… *Styela plicata*. Medium sized (9.2 mm), snake-like larva. Body merges directly with tail; overall aspect of larva snake-like. Single large, round ocellus present. Numerousstructures visible near ocellus and appear as bands of pigments at different depths. Body darkly pigmented, including tail. Tail very muscular. *Phallusia mammilata* (Cüvier 1815)⋆ (Fig. 50)Presence of spots – Body covered with iridescent spots…. *Phallusia mammilata*. Medium sized larva (1.27 mm) covered with blue-gray iridescent spots. Ocellus and statolith present. Occasionally, tips of three adhesive papillae visible as small protrusions at front of body; often, papillae not visible. Stalks of papillae rarely visible. Lobes visible in body (digestive structures of developing zooid). Center-most lobe dark orange. Two flanking lobes lighter yellow-orange. Tail very light orange.*Corella parallelogramma* (Müller,1776)⋆(Fig. 51). A frill of small finger-like projections around the equator of the body...... *Corella parallelogramma*. Very large larva (3.02 mm) with bulbous body. No eyespots or statoliths visible. Frill composed of numerous finger-like projections runs around equator of body. Portion of body anterior to frill transparent. Pigmented cone-like structure visible in the center of body. Several adhesive papillae located on anterior portion of body. Portion of the body posterior to the frill contains numerous pigmented structures. Colouration bright orange to deep red. The changing morphology of Botrylloides larvae makes it easy to determine how close a larva is to settlement. The frill of the larva acts much like the legs of a lunar lander. In newly released larvae the frill encircles the equator of the body. As the larva gets closer to settlement, the finger-like projections of the frill begin to extend and the anterior portion of the body retracts. When settlement is imminent, the fingers project beyond the end of the body and look much like the fingers of a grasping hand. Upon attachment to the substratum, the fingers form the outer margin of the juvenile Botrylloides colony.

Diplosoma migrans (Menker und Ax. 1970)(Fig. 52). Lateral ampullae absent……… ………............ *Diplosoma migrans*. Large larva (1.29 mm) with bulbous, transparent body. Ocellus and statolith present, however,close together and often appear as single spot at low magnification. Three large adhesive papillae; papillaedo not project beyond margin of body. Stalks run from adhesive papillae to lobe-like organs in center of larva.Scattered granular spots visible in body. Tail opaque light orange-brown. Coloration of central lobes.*Halocynthia roretzi* (Drasche)(Fig. 53). Presence of Lateral Ampullae – Six additional structures resembling adhesive papillae (lateral ampullae) present in a second row behind three anterior adhesive papillae…………………………..……..... *Halocynthia roretzi* Medium to large larvae (1.24 - 1.560 mm). Ocellus and statolith present. Body transparentwith very few spots. Three adhesive papillae on anterior side of body; papillae do not project beyond bodymargin. Lateral ampullae present in second row behind adhesive papillaeand project from coloured mass in center of body. Dark yellow lobes in body (digestive structures of developingzooid). Overall colouration yellowish. Lateral ampullae and posterior region of central mass light yellow. *Microcosmus claudicans* (Savigny,1816)⋆(Fig. 54)

Morphology of Adhesive Papillae – Adhesive papillae project well beyond the body……………………………..…........... *Microcosmus claudicans*.Medium sized larva (1.14 mm). Well developed adhesive glands on anterior portion of body that project wellbeyond body. Anterior portion of bodytransparent; posterior portion pigmented. Body can range in shape from round to oval. Ocellus present, but visiblefrom only one side and difficult to detect; The tailopaque or translucent white. Most visible feature three lines running most of the length of juvenile (endostyle and sides of brachialbasket). Brachial basket iridescent pink-purple; endostyle more opaque and covered with spots. *Molgula manhattensis* (Dekay, 1843)⋆ (Fig. 55). Body Shape – Body rounded and bulbous with the pigmented portion being fully enclosed by a transparent capsule…..………. *Molgula manhattensis*. Larvae: Small larva (0.50 mm)with bulbous body. Well developed capsule fully encloses body. Because capsule fairly thick, smooth, and uniform, the larva has theappearance of wearing a space helmet. Ocellus present near the center of the body. Downward pointing adhesive papillaepresent on anterior portion of body; papillae enclosed within capsule and do not protrude beyond margin of the body. Tail usually sticks out directly behind larva with little bending. *Ascidiella aspersa* (Müller, 1776)⋆ (Fig. 56)Body squarish…………..…......... *Ascidiella aspersa*. Small larva (0.90mm) with squarish body. From side, body squarish and uniformly pigmented. Ocellus and statolith present; both spherical and App. equal in size.

Often ocellus and statolith appear located in distinct the cerebral vesicle. Three large adhesive papillae project well beyond the body. Posterior portion of body appears flat. Cells may beinterspersed about body and tail. Tail somewhat short relative to body. Outer cuticle of tail appears wavy. *Cnemidocarpa mollis* (Stimpson, 1852) (Fig.57). Numerous cells interspersed about the body and tail such that larva appears to be decaying or falling apart, Body Shape Body oval or seed-shaped…. *Cnemidocarpa mollis*. Narrow larva (0.04 mm) with dark, granular appearance and cells interspersed about body and tail. Body oval or seed shaped. Cells interspersed about the body and tail giving appearance that larva is sloughing cells or decaying. Adhesive papillae located on anteriorside of body. Papillae downwardly directed, project beyond the margin of the body, and appear glove-like. Largeocellus and smaller statolith present; both often visible. Colouration dark tan. Larvae move awkwardly. When held in glass dish, many larvae remain motionless on bottom. Swimming appears to be inefficient; a great deal of side-side thrashing motion occurs with little forward progress. The abundance and distribution of all plankton studied varied considerably according to seasons and habitats. The findings of this work, the density of each genus or / and species in the four study localities and the presence or absence of a certain zooplankton in the different seasons of the year (faunal composition)will be statistically analyzed in another publication.

DISCUSSION

Organisms that live in marine habitats face certain challenges that their terrestrial counterparts do not. One of the obvious differences is the motion of the fluid medium, which presents opportunities and drawbacks that are unique to animals that live suspended in the water column. Among the benefits this lifestyle offers are enhanced dispersal of the population, which may be achieved at a relatively low energy cost, the resultant high gene flow among dispersed populations, and the ability to readily expand into new habitats. Marine organisms with limited swimming ability relative to the strength of ambient currents are said to be plank tonic. Although the diverse assemblages of zooplankton in marine and estuarine habitats are all subjected to the vagaries of the water in which they reside, they do not all respond similarly to the forces that cause the water to move. By using selective behavior in response to various physical cues, even plank tonic organisms can exert some influence on the ultimate outcome of their transport (Epifanio 1988). Thus, by responding to salinity cues, some planktonic species may be distributed only within restricted zones in coastal waters, such as the low-salinity regions of estuaries, while others with may reside only in coastal waters and the high-salinity reaches near the estuary mouth. Another important aspect of zooplankton behavior is the periodic vertical migration exhibited by many copepods (Steele and Henderson 1998). The daily vertical migration of many plank tonic organisms may be influenced by the abundance of both food items and predators, as well as other environmental cues such as light, salinity, and temperature. In addition to locating food and avoiding predators, zooplankton may benefit from the changes in their bioenergetics that result from metabolic rates that differ on either side of the thermo cline (McLaren 1963) in stratified waters. Avent *et al.* (1998) recently provided evidence that a common species of the estuarine copepod genus *Acartia* exhibits an endogenous vertical migration with a period that coincides with the semi-diurnal tide. Abundance of zooplankton across a marine ecosystem is influenced by a combination of factors. Water temperature can affect growth rate and reproduction in marine invertebrates (Vijverberg 1977, 1980,1989, Savage 1982, Townsend *et al.* 1983 & 2001).Water is a very good thermal conductor(Cole 1979); therefore, differences in water temperature would likely equilibrate quickly. As a result, water temperature probably had little effect on invertebrate distribution and abundance across the interface. Many marine invertebrates cannot withstand low levels of dissolved oxygen and respond by moving or reducing their metabolic activities (Augenfeld 1967; Jorgensen 1980). Death may result if conditions persist. One benefit of habitats with low oxygen levels isreduced predation by fish and invertebrate predators that cannot tolerate such conditions (Bennett and Streams 1986, Suthers and Gee 1986). Suthers and Gee (1986) found that yellow perch avoided the cattail stands and moved into open water once oxygen levelsdropped in early July. As cladocerans are a major foodsource of yellow perch in the Delta Marsh (Suthers and Gee 1986), their movements and those of other fish may be responsible for this observed change in thecladoceran distribution across the interface. The presence of vegetation and the associated structure is important in providing refuge from predators (Bennett and Streams 1986). Rabe and Gibson (1984) also found cladocerans in higher levels in vegetated areas compared to open-water sites, suggesting that the vegetation provides protection from ambushing predators. The effect of overall habitat structure may not be as important as the low oxygen levels reducing access by fish and other predators to the cattail stand. The role of detritus in the distribution and abundance of wetland invertebrates requires more study. Peaks in invertebrate numbers did not occur at the open water-emergent vegetation interface during any of the sample periods in this study. The high invertebrate abundance and diversity commonly observed in interspersed wetland habitats seems to be related more to the mixture of habitat types than the actual amount of interface present. The total zooplankton abundance reflected quite well the seasonal variation of the copepods population for example. Indeed, the copepods dominated at all study sites throughout the year. A decrease was observed only during the summer due to the higher abundance of copepod predator, such as Siphonophoraand Hydromedusae (Azeiteiro, 1999; Vieira *et al.*, 2003). The results also agree with findings in other areas, which showed that copepods usually constitute the main taxa (Calbet *et al.*, 2001; Dalal and Goswami, 2001; Fernańdez dePuelles *et al.*, 2003; Gaudy, *et al.* 2003). From the quantitative point of view, the most representative axon was *Acartia tonsa*, which is typical forestuarine environments and may reach very highabundances in waters containing high concentrationof particulate organic matter (Fernandez, *et al.* 2003 a & b, Tackx *et al.*, 2004; Murrel and Lores, 2004). *A. tonsa* is currentlydominant in the inner areas of the southern branchwhere the eutrophication is still more severe (Pardal *et al.*, 2004).Concerning biodiversity, heterogeneity valuesproved to be high in summer at downstream sampling stations because of the great contributionof marine species that invaded the estuary. The decrease in heterogeneity verified for the southern branch and mouth, especially at lowtide, during autumn was not due to a decrease in the number of species but a dominance of the estuarine species *A. tonsa* whose reproductionperiod is in September. A similar pattern was also found in the Seine estuary (Mouny and Dauvin, 2002). In the northern branch the observed decrease in heterogeneity during the summer period was due to the higher abundance of decapods larvae. Many planktonic larvae, one ofthe most important components of the meroplankton, showed a clear seasonal trend related to temperature (Gilabert, 2001).In addition, this work represents the first description of the zooplankton community ofthe northern estuarine beach of the Arabian Gulf and its comparison with the other three study localities.

Studies of zooplankton communities and their distribution patterns in the estuarine ecosystem is lacking, but a substantial amount of research has been conducted on this faunal groups in open seas. The dominant zooplankton taxa found in shallow creek and vegetated marsh habitats were nematodes and copepods (Coull *et al*. 1977, Bell *et al*., 1978, Fernandez and Molinero, 2007, Fernandez and Molinero, 2007). Other taxa commonly found at lower densities include some species of polychaetes, ostracods, oligochaetes, turbellarians, bivalves and other miscellaneous taxa (Bell 1982, Bell and Woodin 1984, Kennish 1986). Several of these species may include life stages that are meiofaunal in size only as juveniles, whereas other species remain as meiofauna throughout their entire life cycle. In shallow water salt marsh and tidal creek habitats of the North Inlet estuary, Coull *et al*. (1979) documented clear distribution patterns among the meiobenthic copepod species sampled. Species that were primarily restricted to subtidal habitats included *Halectinosoma winonae* and *Pseudobradya pulchella*, both of which are considered to be epibenthic species. *Nannopus palustris* occurred only on the mudflats and low marsh and is well adapted to low dissolved oxygen environments. Species found in the intertidal zone of the salt marsh flats included *Diarthrodes aegideus*, which was abundant only during the winter and spring months, *Pseudostenhelia wellsi* and *Robertsonia propinqua*, which were limited to the lower marsh zone, and *Nitocra lacustris* and *Schizopera knabeni*, which were limited to the high marsh flats. Species found across the entire subtidal-intertidal gradient included *Microarthridium littorale, Halicyclops coulli*, and *Enhydrosoma propinquum* (Coull *et al*., 1979). Long-term studies of shallow water meiofaunal assemblages at North Inlet have documented substantial seasonal and annual variability in the abundance, and to a lesser extent, the composition of the meiofauna (Coull and Bell 1979, Coull and Dudley 1985). Meiofaunal assemblages at a sub tidal muddy station were dominated by nematodes throughout most of a 63-month study period, with greatest densities observed during the spring and summer months (Coull and Bell 1979). Copepod assemblages at North Inl*et al*so showed distinct seasonal changes at a muddy site, but seasonal effects were less pronounced at a sandy station. Data on deeper-water meiofaunal assemblages in southeastern estuaries are lacking, but those assemblages are likely to include many of the same subtidal and widely distributed species noted above. Meiofaunal organisms play an important role in the estuarine food web complex since they consume bacteria, other microfauna and flora, and detritus, and they are, in turn, consumed by many larger macrofaunal invertebrates and juvenile finfish (Stickney *et al*. 1975, Bell and Coull 1978, Alheit and Scheibel 1982, Kennish 1986, Smith and Coull 1987, Coull 1990). Their densities can be quite high (2.6 x 107 individuals/m2) and standing crop dry weight biomass can average about 1-2 g/m2 (Coull and Bell 1979). This, combined with their short life cycle and high turnover rates in the sediments, make the meiofauna an extremely important contributor to the total carbon production of estuarine bottom habitats. The abundance and distribution of all plankton studied varied considerably according to seasons and habitats. The findings of this work, the density of each genus or / and species in the four study localities and the presence or absence of a certain zooplankton in the different seasons of the year (faunal composition)will be statistically analyzed in another publication.

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RESEARCHARTICLE

DISCRIPTION AND IDENTIFICATION OF SOME SELECTED NEKTONIC AND BENTHIC ZOOPLAKTON INHABITING MARINE ECOSYSTEMS

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ABSTRACT

Zooplankton were collected from four marine ecosystems namely the North Sea (Helgoland - Germany), Banyuls-sur-Mer (Mediterranean sea - France), Abu Qir Bay (Mediterranean Sea- Egypt) and the northern estruarine harbour of the Arabian Gulf (Saudi Arabia). Collection tools used involved primarily the filtration of water by net, collecting the water in bottles/ water samplers or by pumps. Artificial heterologous inseminations on ascidians were tried in the laboratory and the larval stages have been described and identified. Collected zooplaktons were prepared for both macroscopic or / and scanning electron microscopy. All zooplankton were stained with Evans stain or Nile blue or Borax carmine to observe their internal structures since they are mostly transparent. Others were dissected with micro-needles and incised to ease their identification. Marine Species Identification Portal has been applied: http://species-identification.org/index.php//.Six species of Bryozoa were identified namely *Bugula neritina* (Linnaeus, 1758) and itsbarrel shapedlarva, *Electra crustulenta* (Pallas, 1766),*Bowerbankia gracilis* (Leidy, 1855) and its coronated larva, *Hippaliosina depressa* (Busk, 1854), *Nolella dilatata* (Marcus, 1940)and *Reptadeonella violacea* (Johnston, 1847). Two hydrozoan cnidarians were identified namely *Obelia geniculata* (Linnaeus, 1758) and *Pennaria disticha* (Goldfuss, 1820). Planula larva of Hydrozoa and the anthozoan *Actinodendron* sp. were collected from the Mediterranean sea. Two rotifers were identified namely *Paraseison annulatus* (Claus, 1876) and *Seison nebaliae* (Grube, 1861).The nematode *Anisakis simplex* and its third stage larva were extracted from the branchial chambers of ascidians whereas free nematode toothless larval stage has been collected from nekton. Four polychaetes were identified namely *Harmothoe* sp.,(scale worm), *Pomatocerous triqueter* (Linnaeus, 1758), *Nemidia lawrencii* (McIntosh, 1874) with synoneme *Nemidia torelli* and *Notomastus latericeus* (Sars, 1851). The copepod *Megacyclops viridis* (Jurine, 1820) and the gammarid *Gammaropsis* sp. with Naupli, zoaeaand megalopods were found in the nekton. The the isopod *Caecocassidias patagonica* (Kussakin, 1967) has been collected from the benthos. The scaphopod *Dentalium vulgare* (da Costa, 1778) and the bivalve *Microgloma turnerae* (Sanders and Allen,1973) were found in the benthos. Veliger and glochidia larvae were collected from the nekton. Two species of brittle star namely *Amphiura* sp and *Ophiomastix annulosa* were collected from the benthos. Echinoplutei with 8 arms were found in the nekton. Nine ascidian larvae were identified namely larvae of *Styela plicata* (Lesuaer, 1823), *Phallusia mammilata* (Cüvier 1815), *Corella parallelogramma* (Müller,1776), *Diplosoma migrans* (Menker und Ax. 1970), *Halocynthia roretzi* (Drasche), *Microcosmus claudicans* (Savigny,1816), *Molgula manhattensis* (Dekay, 1843), *Ascidiella aspersa* (Müller, 1776), and *Cnemidocarpa mollis* (Stimpson,1852). The abundance and distribution of all plankton studied varied considerably according to seasons and habitats. The findings of this work, the density of each genus or / and species in the four study localities and the presence or absence of a certain zooplankton in the different seasons of the year (faunal composition) will be statistically analyzed in another publication.

INTRODUCTION

Zooplankton are floating or bottom dweller organisms. The word "plankton" comes from a latin word meaning "drifters". This is what plankton do, drift as opposed to swim. For the most part nektonic zooplankton are microscopic and get around with the movement of the water currents (Able and Fahay, 1998; Horn, *et al*., 1999; Lazzari *et al*., 2010). They are also typically found at or near the surface of the water. There are several major classifications of plankton. Planktonic invertebrates live some point in their life cycle as members of the nekton (the swimmers) or the benthos (the bottom dwellers) (Calder and Boothe, 1977a; Van Dolah *et al*. 1979,1990,1991, 1994 and 1999).Community drifting zooplankton can be categorized according to size fractions

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into: picoplankton (0.2-2.0 μm, mainly heterotrophic bacteria), nanoplankton (2.0-20.0 μm, heterotrophic nanoflagellates), microplankton (20-200 μm, ciliates and a large part of rotifer species), mesozooplankton (0.2-20.0 mm, larger rotifers, mainly planktonic crustaceans), meroplanktonic larvae of some benthic invertebrates, etc.), and macrozooplankton (organisms larger than 20 mm: Cnidaria, Ctenophora, Chaetognatha, Mysidacea, Euphausiacea, Decapoda, Polychaeta and others) (Lenz, 2000).There are two major types of zooplankton: those that spend their entire lives as part of the plankton (called Holoplankton) and those that only spend a larval or reproductive stage as part of the plankton (called Meroplankton). Zooplaktons that live on the bottom are benthic and those floating freely in sea water are nektonic. Benthic invertebrate communities are generally separated into two major size classes. The meiofauna are organisms (metazoans plus foraminiferans) that typically range from 63 to 500 mm in size, and the macrofauna are all of the larger organisms greater than 500 mm in size. Both groups include species that are considered to be either epifauna because they reside primarily on the surface of the sediments and other substrata, or in fauna because they burrow or live beneath the surface of the sediment-water interface (Coull *et al*., 1977; Bell *et al*. 1978; Munn, 2004; Begon *et al*., 2006). Since there is a huge variety of benthic habitats, mud, sand, rocks, shallow, deep, there is a huge variety of benthic organisms. What they mostly have in common is that they don't swim, at least not much. Nearly every category of animal is included in the benthosCalder and Boothe (1977a, 1977b) and Calder *et al*. (1977). They are suspension feeders, filtering small food particules out of the water that passes through their pores. The term suspension feeder was introduced by Hunt (1925) to distinguish marine animals which feed on suspended particles from deposit feeders and carnivores. Jorgensen (1966) recognises two types of suspension feeding. Filters are used by animals such as sponges, tunicates and many crustaceans. “In other suspension feeders, the water with its content of suspended particles is not truly filtered, but is carried along surfaces capable of retaining particles that obtain contact with the surfaces.’ Examples of such “non-filtering’ suspension feeders are Entoprocta and Bryozoa. Bullivant (1968) has discussed feeding in lophophorates (bryozoans, phoronids and brachiopods); the method being described as impingement feeding by analogy with certain mechanical particle separators. It is suggested here that all suspension feeders may be better grouped according to the method they use to collect particles rather than the type of feeding organ they have (Brylawski and Miller, 2003). There are worms of every description, from microscopic to several meters. The benthos includes many of the molluscs. These all have soft bodies, many of which are protected by calcareous shells. These include the gastropods which is all the snails probably familiar to many people, the periwinkle snails in the marsh, the whelks and conchs on the beach. These animals go along grazing on algae. These animals are filter feeders. They suck in water, sieve out the good stuff, and spit the cleaned water back out. Some gastropods lack shells completely. The nudibranchs are an example. These are brightly coloured, rather large, sea slugs. They are much more interesting than standard garden variety slug, but they are close cousins. The cephalopods are the most advanced molluscs and include the octopus, squid, and cuttlefish. Only the octopus is really considered benthic. Other than the cuttlefish, these do not appear to have shells. In fact, both squid and octopi have a beak made of shell material. The echinoderms are another major group of benthic animals. Nektonic zooplankton are micronekton (size range, 0.02-I cm)as larvae of nematods, annelids, crustaceans, molluscs and echinodermsand macronekton(size range, 2-10 cm)like fishes (Murreland Lores, 2004 , Ahmad and Ashok, 2013). Nekton are those organisms that have developed powers of locomotion so that they are not at the mercy of prevailing sea currents or wind-induced water motion. Pelagic nekton usually have stream-lined shapes that make their propulsive efforts more effective. Most nekton are specialized invertebrates evolved the ability to swim (and hunt) actively in the water column. Cephalopods (squids, octopus, cuttlefish, nautilus) Arthropods (shrimp, prawns, some crabs). Mesopelagic nekton seldom exceed 10 cm, have large light-sensitive eyes, uniformly black Photophores and provided with light-producing organs. Abyssal pelagic have species-specific pattern of photophores, small with flabby, soft, nearly transparent flesh supported by weak exoskeleton. Zooplankton are distributed in any pelagic habitats in the sea, from coasts to offshore waters, and from the sea surface to the abyssal depths. Many of them are known to play important roles in marine ecosystems, including those in the food chain and matter transfer (Stickney *et al*., 1975; Bell and Coull 1978; Alheit and Scheibel 1982; Kennish 1986; Smith and Coull 1987; Coull 1990), but there are alsomany species whose distribution and ecologyare mostly unknown.Zooplankton are the favourite food of a great many marine animals so camouflaging themselves is a very important survival strategyVan Dolah *et al*. (1991, 1994, 1999) and Hyland *et al*. (1994, 1996, 1998). Developing effective camouflage when they live in clear, blue water is no easy matter. The best solution and the one most often used by members of the zooplankton is to be as transparent as possible or, in the case of many surface floating jellyfishes, blue. Crabs, and lobsters, are found among the zooplankton. Permanent plankton, or holoplankton, such as protozoa and copepods (an important food for larger animals), spend their lives as plankton. Temporary plankton, or meroplankton, such as young starfish, clams, worms, and other bottom-dwelling animals, live and feed as plankton until they leave to become adults in their proper habitats. Zooplankton are either herbivorous, feeding on phytoplankton, or carnivorous, feeding on other zooplankton. They themselves are fed upon by other zooplankton, fish, and even whales. Zooplankton is the vital transition between marineprimary production (phytoplankton) and large animals (fish) (Brylawski and Miller, 2003) .Zooplankton, like all plankton, exist in the epipelagic zone of the ocean or sea. It is possible for these creatures to move up and down in the water, (diel vertical migration). However, if the organism sinks too low, it will not be able to reach a suitable height, and will be washed out of the system. Murkin (1983) found higher numbers ofnekton with instands of emergent vegetation compared to open watersites in the early spring in the Delta Marsh, Manitoba. This was likely due to the habitat structure and food supply provided by the dead standing stems of the emergent vegetation. By midsummer, with the development of submersed vegetation and its associated structure and food supplies in open water areas, higher invertebrate levels were found outside the emergent vegetation stands. In addition, Bicknese (1987) andSuthers and Gee (1986) suggest that during midsummer, the warm water temperatures and shading within the emergent vegetation stands result in low dissolved oxygen levels. This would restrict the use of these areas by many invertebrate groups. Information on invertebrate abundance at the emergent vegetation--open water interface throughout the season would provide valuable insights into the role this unique habitat plays in the ecology of wetland invertebrates. The objective of the present study was to determine the distribution and abundance of nektonic and benthic invertebrates across the North Sea (Helgoland - Germany), Banyuls-sur-Mer (France) (Mediterranean sea), Abu Qir Bay (Mediterranean Sea) Egypt and the northern estruarine harbor of Arabian Gulf – Saudi Arabia. In general, there are many factors that play an important role in regulating the distribution and abundance of zooplankton communities. Since these biota represent an important food source for many other larger taxa, predation effects are often a major regulating factor. Competition, both among zooplankton within a species as well as among species, can also play a major role in limiting faunal abundances and distribution. These factors, when combined with the effects of various physicochemical factors such as salinity, temperature, dissolved oxygen, sediment grain size, depth of the redox (reducing) layer within the sediments, and distribution along the intertidal-subtidal depth gradient in estuarine environments, result in very complex spatial and temporal patterns in the structure of these assemblages. Readers interested in learning more about the effects of various biotic and physicochemical factors on zooplankton assemblage should review general texts on estuarine ecology, such as those published by Hynes (1970),Stickney *et al.* 1975, Kennish (1986), Mann and Lazier (1991), Ruttner (1974 & 1975a &b), Van Dolah *et al.* 1992, Valiela (1995), Levinton (1995) and Mann, (2000). Those interested in learning more about the life habits and distribution of the dominant macrofauna in estuaries should review general guides to marine and estuarine life, such as Ruppert and Fox (1988).

MATERIALS AND METHODS

Animals

Zooplankton were collected from four marine ecosystems. During my promotion for Ph. D. in Germany (1999 – 2000), many ascidian larvae were obtained in the laboratory through artificial heterologous inseminations. Different species of adult ascidians were collected in that time from the North Sea (Helgoland - Germany).Other ascidians were provided from the Mediterranean Sea in the year 2000 and transported alive to the Laboratoire Arago, Observatoire Oceanologique, Universite Pierre et Marine , Paris VI, Banylous sur Mer, France). These materials did not used before in any publication or in my doctoral thesis. Some plankton were collected from Banyuls-sur-Mer (France) (Mediterranean sea). During (2002 - 2010) planktons were collected seasonally from Abu Qir Bay (Mediterranean Sea) Egypt. During 2012 – 2014 planktons were collected from the northern estruarine harbour of the Arabian Gulf – Saudi Arabia. All planktons were transported alive in plastic aquaria containing well aerated sea water to the laboratory and placed in large glass aquaria containing well aerated sea water. Randomly selected adults of plank tonic communities were dissected in sea water. Sperm and eggs were sucked from gonoducts of collected ascidians and placed separately in suitable Petri dishes containing sea water and antibiotic. Artificial heterogonous insemination has been carried out and polyspermy has been avoided. The Fertilized eggs were washed and then grown at 20°C. The different embryonic stages were obtained according to the method of Hofmann *et al.* (2008) and Saad (2002). Hatched Larvae were then described and prepared for photomacroscopy or / and SEM study.

Methods of collection

The zooplankton collection involves primarily the filtration of water by net, collecting the water in bottles/ water samplers or by pumps. The sampling success would largely depend on the selection of a suitable gear; mesh size of netting material, time of collection, water depth of the study area and sampling strategy. The gear used keeping in view the objectives of the investigation (see Sameoto, *et al*. 2000, Merle, *et al*. 2002, Agnieszka, *et al*. 2012 for review). There are three main methods of zooplankton collection used, which are as follows:

Bottles / water samplers

This method was used mainly for collecting smaller forms or micro zooplankton. The water is collected at the sampling site in bottles or water samplers of 5 to 20litre capacity. The sterile bottles should be preferred. Surface water can be collected by scooping water into the bottle of suitable size. While collecting the water samples, there should be minimum disturbance of water to prevent avoidance reaction by plankton. The water samplers with closing mechanisms are commonly used for obtaining samples from the desired depths. Themicro zooplankton are then concentrated by allowing them to settle, centrifuging or fine filtration. The advantage of this method was that it is easy to operate and sampling depths are accurately known. The disadvantage is that the amount of water filtered is less. The macro zooplankton and rare forms are usually not collected by this method and so it is unsuitable for qualitative and quantitative estimations.

Pumps

The gear is normally used on board the vessel/boat. The sampling can also be carried out from a pier. In this method, the inlet pipe is lowered into the water and the outlet pipe is connected to a net of suitable mesh size. The net is particularly submerged in a tank of a known volume. This prevents damage to the organisms. The zooplankton is filtered through the net. A meter scale on the pump records the volume of water filtered. This method was used for quantitative estimation and to study the small scale distribution of plankton. The frictional resistance of the sampled water in the hose can cause turbulence; damaging the larger plankton especially the gelatinous forms, ctenophores and siphonophores etc. The advantage of the method is that the volume of the water pumped is known. Again the continuous sampling is possible. However, the sampling depth is limited to a few meters and it is difficult to obtain samples from deeper layers.

Nets

The most common method of zooplankton collection is by a net. The amount of water filtered is more and the gear is suitable both for qualitative and quantitative studies. The plankton nets used are of various sizes and types. The different nets can broadly be put into two categories, the open type used mainly for horizontal and oblique hauls and the closed nets with messengers for collecting vertical samples from desired depths. Despite minor variations, the plankton net is conical in shape and consists of ring (rigid/flexible and round/square), the filtering cone and the collecting bucket for collection of organisms. The collecting bucket should be strong and easy to remove from the net. The netting of the filtering coneis made of bolting silk, nylon or other synthetic material. The material should be durable with accurate and fixed pore size. The mesh should be square and aperture uniform. The mesh size of the netting material would influence the type of zooplankton collected by a net. The nets with finer mesh would capture smaller organisms, larval stages and eggs of plank tonic forms while those with coarse netting material are used for collecting bigger plankton and larvae. Sometimes combinations of nets with mesh of different pore sizes were used. There is a great variety of mesh available from the finest to the coarse pore sizes.

Macroscopic observation

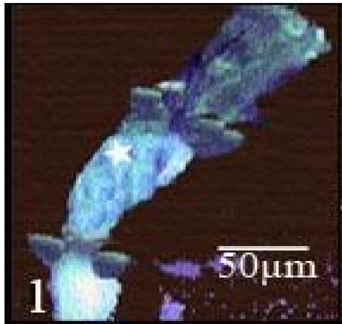
Plaktons were prepared for both macroscopic techniques or / and scanning electron microscopy. They were fixed for 24 hr in buffered 2.5% glutaraldehyde and post fixed for 30 min. in 1% osmium tetroxide. Washing was two times in 0.1 M phosphate buffer, followed by four times in 0.4 M glycerol and two times in PPTA (15 min.). Specimens with hard exoskeleton were washed many times in distilled water and subjected to dilute nitric acid for decalcification of exoskeleton or the cuticle. Specimens were fixed in neutral 10 % formalin or Bouin. Then washed in distilled water for 24 hrs, dehydration through ascending series of ethyl alcohol, alternated by another dehydration series of tertiary butyl alcohol (used as a softening agent). All zooplankton were stained with Evans stain or Nile blue or Borax carmine to observe its internal structures since they are mostly transparent. Samples were placed on glass slides with embedding mixture of PBS / glycerol / DABCO. Others were dissected with micro needles and incised longitudinally to ease its identification. Immediate viewing and photographing were performed under an Axiomicroscope (ZEISS-Axiophot). The description of almost all zooplankton was carried out on live stages under Axiomicroscope since they are minute, microscopic and transparent. Evan Blue stain was added to the live stages and described alive while movement. The photos did not clarify all described structures.

Scanning Electron Microscopy (SEM)

Samples of larvae were dried by means of the critical point method, mounted using carbon paste on an Al-stub and coated with gold up to a thickness of 400 Å in a sputter-coating unit (JFC-1100E). Observations of larvae morphology in the coded specimens were performed in a Jeol JSM-5300 scanning electron microscope operated between 15 and 20 KeV.

RESULTS

Bryozoa: (moss animals or sea mats), are tiny colonial animals that generally build stony skeletons of calcium carbonate. Most bryozoans are sessile and immobile, but a few colonies are able to creep about, and a few species of non-colonial bryozoans live and move about in the spaces between sand grains. The collected colonies were few millimeters in size, but the zooids that make up the colonies are tiny, usually less than a millimeter long. In each colony, different zooids assume different functions. Some zooids gather up the food for the colony (autozooids), others depend on them (heterozooids). Some zooids are devoted to strengthening the colony (kenozooids), and still others to cleaning the colony (vibracula). Each zooid secretes and lives inside a non-living case called a zooecium. These zooecia come in many different shapes and are interconnected in different ways depending on their shape. Species with simple rectangular box-like zooecia form mat like colonies, while other species with vase shaped zooecia build branching tree-like and fan-like colonies. The walls of these zooecia are strengthened with a variety of substances depending on species, normally this is either calcium carbonate, chitin or a mixture of both. Each zooecium has a hole at the top called an orifice through which the animal can extend its ring of tentacles or lophophore when it is feeding. In some species this orifice can be sealed shut by a sort of door called an operculum. The Bryozoans were formerly considered to contain two subgroups: the Ectoprocta and the Entoprocta, based on the similar bodyplans and mode of life of these two groups. Key to the different bryozoan genera collected (according to species identificationportal, (Van Couwelaar, 2015)* http://species-identification. org/index.php). Zooids erect, projecting vertically from the substratum with purple colour *Bugula neritina* (Linnaeus, 1758)⋆ (Fig. 1).Tan or straw coloured larva, eyespots visible, Purple coronate larva with reddish highlights. Barrel shaped, covered with longitudinal bands of cilia, furrow runs along one side of larva, semi-triangular darker colour bands present on sides of larva. Larva of *Bugula neritina* (Fig. 2). Shield-shaped zooecium, zooids are Circular or oval, vertical spines at margin of operculums do not point inward toward the zooids *Electra crustulenta* (Pallas, 1766)⋆ (Fig. 3).Tubular or tapering zooecium, zooid opaque light brown or orange-brown. Exposed tentacles iridescent purple. As specimens age they develop lateral stolens that give rise to additional zooids. Newly developing zooids appear as spheres near base of colony. Colouration translucent with medium brown highlights. Zooids with 8 tentacles. Lateral stolens often present. *Bowerbankia gracilis* (Leidy, 1855)⋆ (Fig. 4). No eyespots, flagella absent, larva barrel-shaped, light yellow coronate morphology. larva of *Bowerbankia gracilis* (Fig. 5). Colony encrusting, unilaminar, frontal wallthickly calcified, distinctly granular, with a series of marginalpores that usually continue proximally around the orifice. Orificeand operculum typically elongated, with a wide posterdelimited by minute, sharp condyles at each side; Adventitiousavicularia distolateral, single or paired (one at each side of the orifice). If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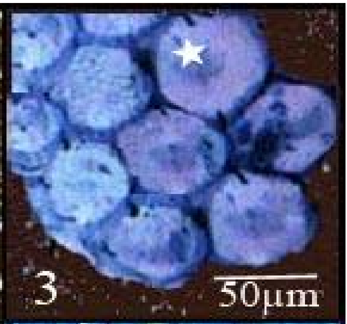
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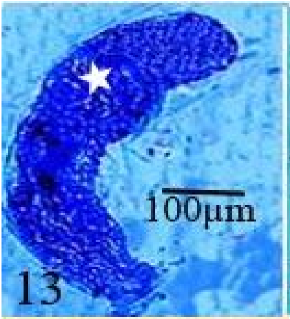
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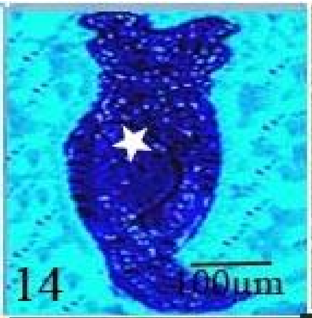
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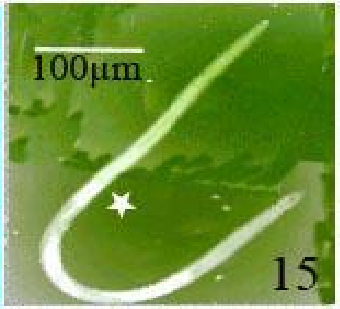
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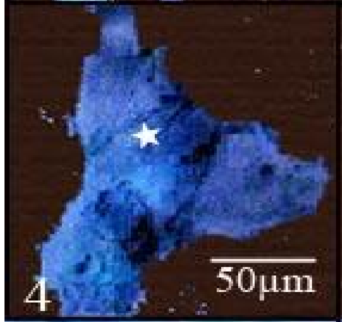
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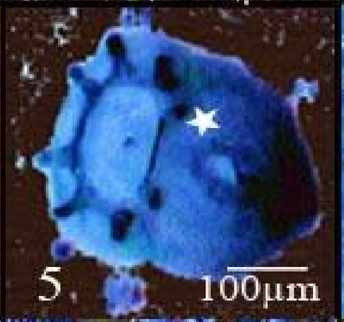
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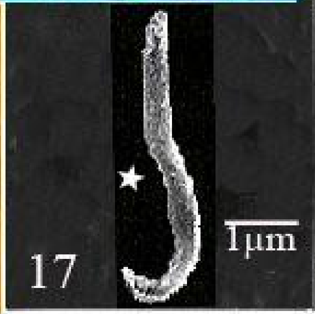
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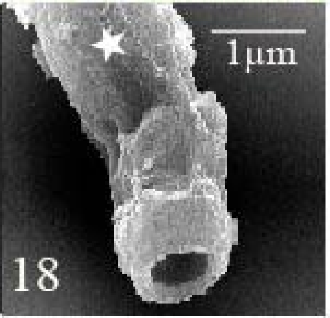
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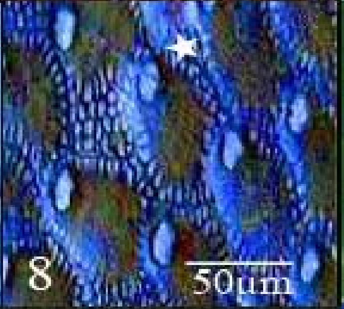
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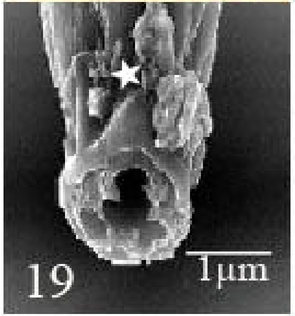
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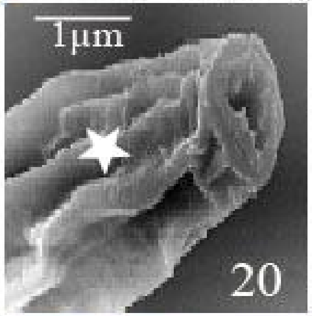
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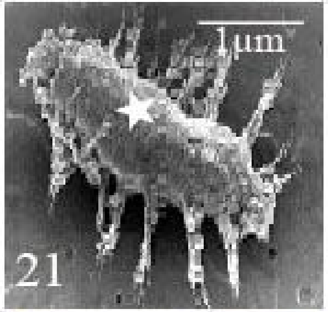
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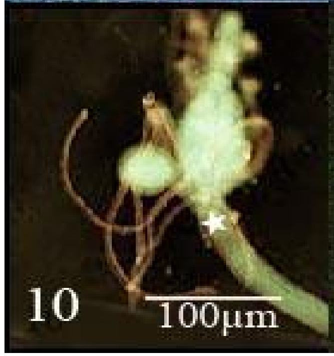
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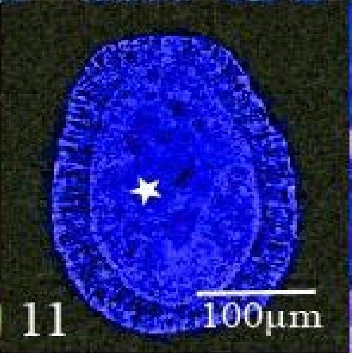
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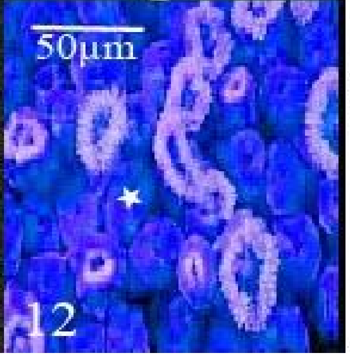
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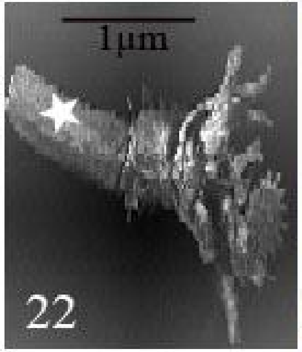
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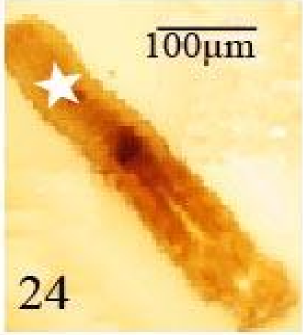
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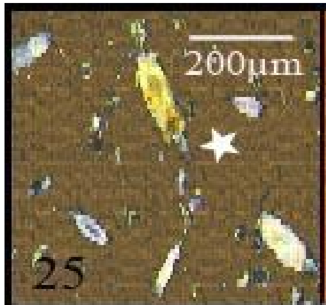
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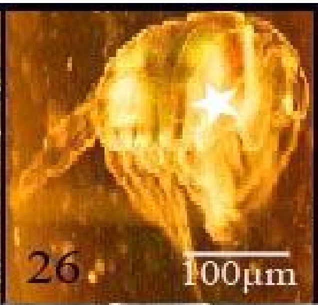
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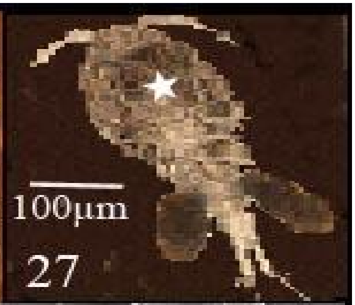
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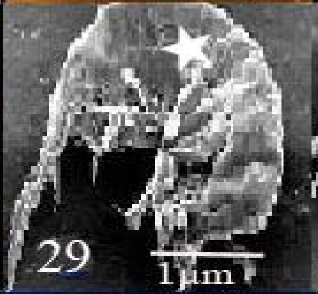
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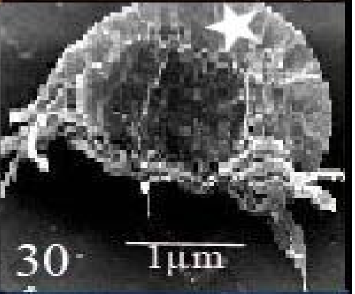
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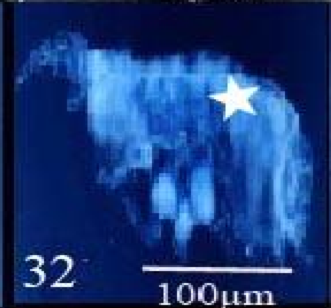
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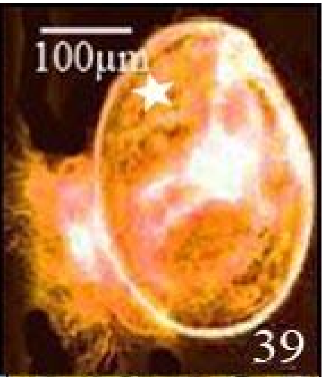
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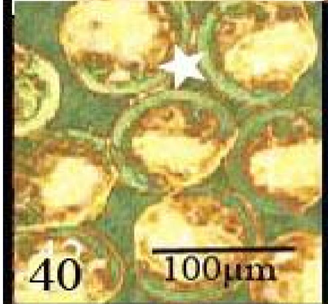
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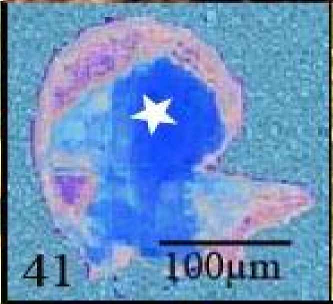
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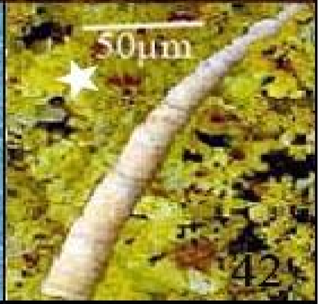
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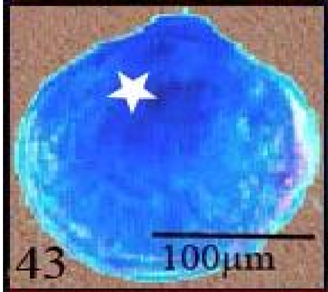
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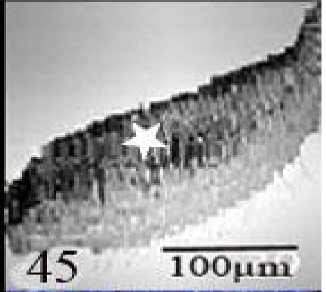
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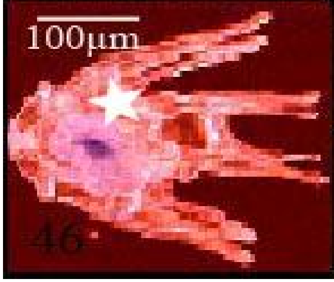
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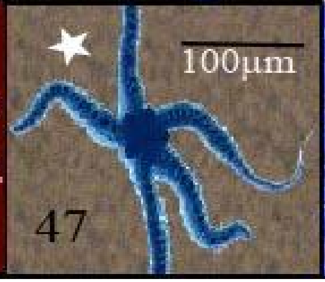
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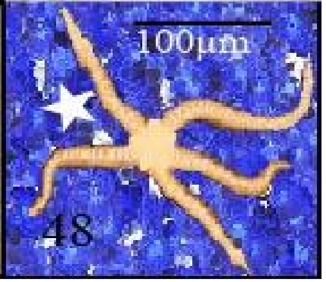
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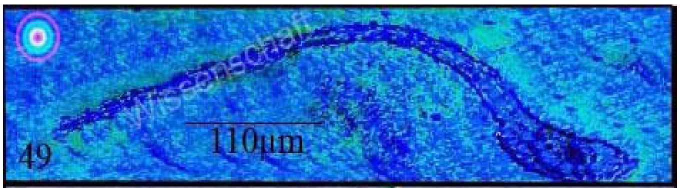

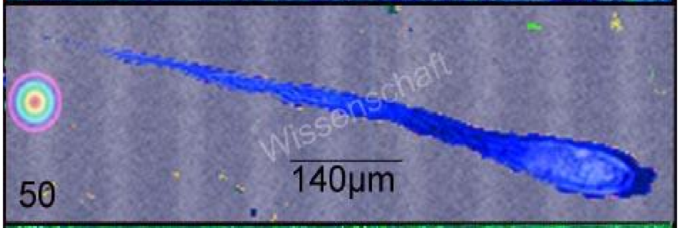

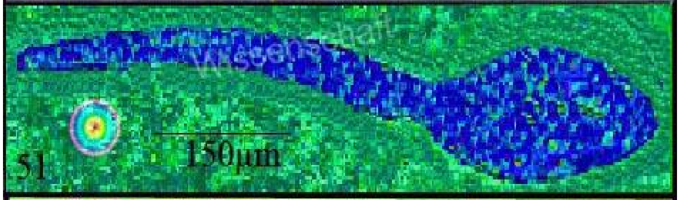

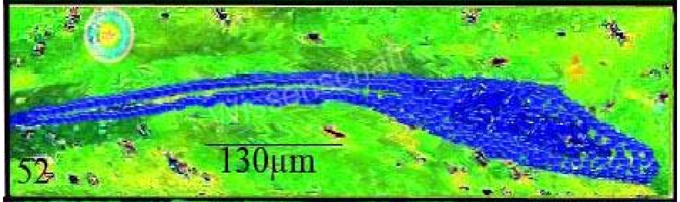

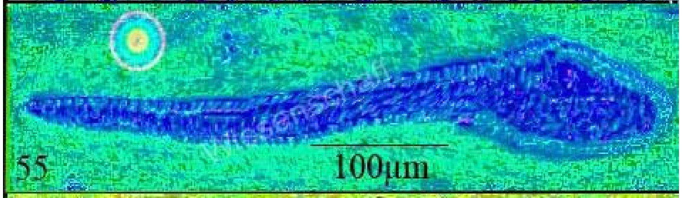

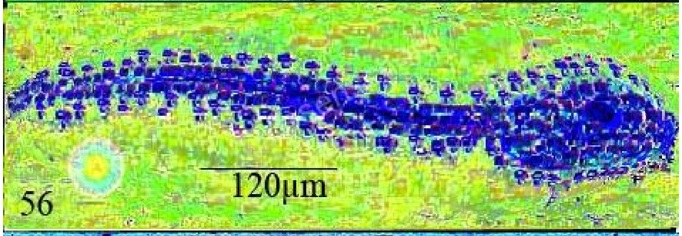

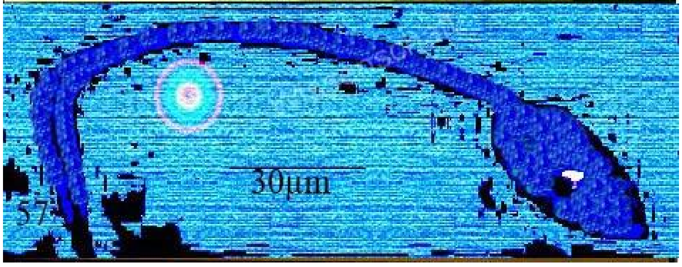

Fig. 1
Phase contrast photomacrograph of a part of the colony of *Bugula neritina* (Linnaeus, 1758). Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 2
Phase contrast photomacrograph of a larval stage of *Bugula neritina* (Linnaeus, 1758). Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 3
Phase contrast photomacrograph of a part of the colony of *Electra crustulenta* (Pallas, 1766). Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 4
Phase contrast photomacrograph of a part of the colony of *Bowerbankia gracilis* (Leidy, 1855). Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 5
Phase contrast photomacrograph of a larval stage of *Bowerbankia gracilis* (Leidy, 1855). Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer ,France andAbu Qir bay, Egypt).

Fig. 6
Phase contrast photomacrograph of a part of the colony of *Hippaliosina depressa* (Busk, 1854). Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 7
Phase contrast photomacrograph of a part of the colony of *Nolella dilatata*. Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 8
Phase contrast photomacrograph of a part of the colony of *Reptadeonella violacea* (Johnston, 1847). Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 9
Phase contrast photomacrograph of a part of the colony of *Obelia geniculata* (Linnaeus, 1758). Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt) and from the northern estruarine harbour of the Arabian Gulf – Saudi Arabia.

Fig. 10
Phase contrast photomacrograph of a single polymorphic zooid of *Pennaria disticha* (Goldfuss, 1820). Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt) and from the northern estruarine harbour of the Arabian Gulf – Saudi Arabia.

Fig. 11
Phase contrast photomacrograph of a part of the planula larva. Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 12
Phase contrast photomacrograph of the sea anemone *Actinodendron* sp. Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 13

Phase contrast photomacrograph of the rotifer*Paraseison annulatus* (Claus, 1876). Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 14

Phase contrast photomacrograph of the rotifer *Seison nebaliae* (Grube, 1861). Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 15

Phase contrast photomacrograph of the nematode *Anisakis simplex.* Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt), the North Sea (Helgoland - Germany) and from the northern estruarine harbour of the Arabian Gulf – Saudi Arabia.

Fig. 16

Phase contrast photomacrograph of the nematode*Anisakis simplex.* Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 17

SEM photomacrograph of the third stage larva of the nematode*Anisakis simplex.* Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt), the North Sea (Helgoland - Germany) and from the northern estruarine harbour of the Arabian Gulf – Saudi Arabia.

Fig. 18

SEM photomacrograph of the second stage larva of the nematode*Anisakis simplex.* Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt), the North Sea (Helgoland - Germany) and from the northern estruarine harbour of the Arabian Gulf – Saudi Arabia.

Fig. 19

SEM photomacrograph of the third stage larva of the nematode *Anisakis simplex*showinga trilobed lateral lips and a prominent V-shaped projecting boring tooth. Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt), the North Sea (Helgoland - Germany) and from the northern estruarine harbour of the Arabian Gulf – Saudi Arabia.

Fig. 20

SEM photomacrograph of the third stage larva of the nematode *Anisakis simplex* cuticle striation. Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt), the North Sea (Helgoland - Germany) and from the northern estruarine harbour of the Arabian Gulf – Saudi Arabia.

Fig. 21

Phase contrast photomacrograph of the polychaete *Harmothoe* sp., (scale worm), Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 22

Phase contrast photomacrograph of the polychaete *Pomatocerous triqueter* (Linnaeus, 1758), Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 23

Phase contrast photomacrograph of the polychaete *Nemidia lawrencii* (McIntosh, 1874) synoneme *Nemidia torelli*, Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France andAbu Qir bay, Egypt).

Fig. 24

Phase contrast photomacrograph of the polychaete *Notomastus latericeus* (Sars, 1851), Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 25

Phase contrast photomacrograph of the copepod *Megacyclops viridis* (Jurine, 1820), Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 26

Phase contrast photomacrograph of the male copepod *Megacyclops viridis* (Jurine, 1820), Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 27

Phase contrast photomacrograph of the brooding female copepod *Megacyclops viridis* (Jurine, 1820), Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 28

Phase contrast photomacrograph of the amphipod *Monocorophium acherisicum* (Costa, 1851). Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 29

SEM photomacrograph of the male amphipod *Monocorophium acherisicum* (Costa, 1851).. Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 30

SEM photomacrograph of the the female amphipod *Monocorophium acherisicum* (Costa, 1851).. Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 31

Phase contrast photomacrograph of the malecorophiide, *Monocorophium acherisicum* (Costa, 1851). Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 32

Phase contrast photomacrograph of the female corophiide, *Monocorophium acherisicum* (Costa, 1851). Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 33

Phase contrast photomacrograph of the male corophiide, *Monocorophium acherisicum* (Costa, 1851). Showing uropod 1 attached at invaginations laterally, lacking rim on urosome, male rostrum absent or minute, uropod 1 attached at invaginations laterally, lacking rim on urosome.Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 34
Phase contrast photomacrograph of the nauplius larva. Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 35
Phase contrast photomacrograph of the Zoea larva. Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 36
Phase contrast photomacrograph of the Megalopod larva. Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 37
Phase contrast photomacrograph of the isopod*Caecocassidias patagonica* (Kussakin, 1967). Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 38
Phase contrast photomacrograph of the striped Nudibranch *Armina* SP. Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 39
Phase contrast photomacrograph of the veliger larva with high magnification. Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 40
Phase contrast photomacrograph of the veliger larva with low magnification. Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 41
Phase contrast photomacrograph of the Glochidia larva. Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 42
Phase contrast photomacrograph of the shell of *Dentalium vulgare* (da Costa, 1778). Specimens were collected from the northern estruarine harbour of the Arabian Gulf – Saudi Arabia.

Fig. 43
Phase contrast photomacrograph of the bivalve *Microgloma tumidula* (Monterosato, 1880). Specimens were collected fromthe Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt) and the northern estruarine harbour of the Arabian Gulf – Saudi Arabia.

Fig. 44
Phase contrast photomacrograph of the sea cucumber *Polycheira rufescens*. Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 45
Phase contrast photomacrograph of the sea cucumber *Chiridota heheva*. Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France and Abu Qir bay, Egypt).

Fig. 46
Phase contrast photomacrograph of the echinopluteus larva with 8 arms. Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France).

Fig. 47
Phase contrast photomacrograph of the echinoderm *Amphiura*sp. Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France).

Fig. 48
Phase contrast photomacrograph of the echinoderm *Ophiomastix annulosa*. Specimens were collected fromthe Mediterranean Sea (Banyuls-sur-Mer, France).

Fig. 49
Phase contrast photomacrograph of the long tailed larva of *Styela plicata*. Specimens were collected from the Mediterranean Sea (Abu Qir bay, Egypt).

Fig. 50
Phase contrast photomacrograph of the long tailed larva of*Phallusia mammilata*. Specimens were collected the Mediterranean the North Sea (Helgol and - Germany).

Fig. 51
Phase contrast photomacrograph of the long tailed larva of *Corella parallelogramma*. Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France). The North Sea (Helgoland - Germany).

Fig. 52
Phase contrast photomacrograph of the long tailed larva of *Diplosoma migrans*. Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France - Abu Qir Bay, Egypt). The North Sea (Helgoland - Germany) and the northern estruarine harbour of the Arabian Gulf – Saudi Arabia.

Fig. 53
Phase contrast photomacrograph of the long tailed larva of*Halocynthia roretzi*. Specimens were collected from the Mediterranean Sea (Abu Qir Bay, Egypt).

Fig. 54
Phase contrast photomacrograph of the long tailed larva of *Microcosmus claudicans*. Specimens were collected from the Mediterranean Sea (Abu Qir Bay, Egypt).

Fig. 55
Phase contrast photomacrograph of the long tailed larva of *Molgula manhattensis*. Specimens were collected from the Mediterranean Sea (Abu Qir Bay, Egypt) and and the northern estruarine harbour of the Arabian Gulf – Saudi Arabia.

Fig. 56
Phase contrast photomacrograph of the long tailed larva of *Ascidiella aspersa*. Specimens were collected fromthe Mediterranean Sea (Banyuls-sur-Mer, France - Abu Qir Bay, Egypt).

Fig. 57
Phase contrast photomacrograph of the long tailed larva of*Cnemidocarpa mollis*. Specimens were collected from the Mediterranean Sea (Banyuls-sur-Mer, France - Abu Qir Bay, Egypt) and the northern estruarine harbour of the Arabian Gulf – Saudi Arabia.

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paired, one sometimes larger than the other. Remarks: The original description of this species was published by Busk (1854)*.This bryozoanis *Hippaliosina depressa* (Busk, 1854)* (Fig. 6).Figure 7 is *Nolella dilatata* defined according to (Marcus, 1940: Harmelin, 1968 Hondt, 1983: Hayward, 1985: Zabala and Maluquer, 1988). Primary and secondary orifices semicircular; peristome very short. Frontal shield finely granular, with a round spiramen in a depression in the centre of the zooid; marginal pores arranged in a single series, closely spaced. A small frontal adventitious avicularium, placed proximally to the secondary, calcified orifice; rostrum triangular, acute, directed distally. Accessory second discontinuous row of areolae can develop all around the avicularium and the ascopore. This bryozoan is *Reptadeonella violacea* (Johnston, 1847) (Fig. 8) defined according (Hayward and Ryland, 1999: Hayward and McKinney, 2002).

Cnidarians (Hydrozoa): The hydroid form is usually colonial, with multiple polyps connected by tubelike hydrocauli. The hollow cavity in the middle of the polyp extends into the associated hydrocaulus, so that all the zooids of the colony are intimately connected. Where the hydrocaulus runs along the substrate, it form a horizontal root-like stolon that anchors the colony to the bottom. The colonies are generally small, no more than a few centimeters across. The hydrocaulus is usually surrounded by a sheath of chitin and proteins called the perisarc. The majority of polyps are specialized for feeding. These have a more or less cylindrical body with a terminal mouth on a raised protuberance called the hypostome, surrounded by a number of tentacles. The polyp contains a central cavity, in which initial digestion takes place. Partially digested food may then be passed into the hydrocaulus for distribution around the colony and completion of the digestion process. Unlike some other cnidarian groups, the lining of the central cavity lacks stinging nematocysts, which are found only on the tentacles and outer surface. All colonial hydrozoans also include some polyps specialized for reproduction. These lack tentacles and contain numerous buds from which the medusoid stage of the lifecycle is produced. The arrangement and type of these reproductive polyps varies considerably between different groups.

Key to the two hydrozoan genera collected (according to species identification portal, (Van Couwelaar M. (2015)*http://species-identification. org/index.php**)**

Family Campanulariidae Johnston, 1837
Subfamily Obeliinae Haeckel, 1879*Obelia geniculata* (Linnaeus, 1758) (Fig. 9) is readily distinguishable from other members of this genus by the structure of its stem. It forms a series of internodes that are zig-zag in their arrangement, and it is jointed at each bend. There are several annulations after each joint. Just below each joint the internodes are thickened on alternate sides, forming a 'shelf' for the support of ringed pedicels which in turn, support the hydrothecae. The hydrothecae are obconical in shape and have a smooth outer margin. The gonothecae are shaped like a grecian urn, and are also borne on ringed pedicels. (see Boero *et al*., 1996, Govindarajan *et al*. 2005 for review).Family Pennariidae McCrady, 1859*. Hydroid colony pinnate, occasionally bushy, stem monosiphonic, giving rise alternately from opposite sides to two series of hydrocladia; hydrocaulus and hydrocladia with terminal hydranths (monopodial); hydranths on short pedicels on upper side of the hydrocladia; hydranths pear-shaped; tentacles of two types: in distal half of hydranth more or less capitate tentacles in one oral whorl and more in indistinct whorls below, on lower par of hydranth one aboral whorl of semifiliform to slightly capitate aboral tentacles; gonophores developing above aboral tentacles, eumedusoids, liberated or not. Medusa a simple eumedusoid; manubrium not extending beyond umbrella margin; gonads completely surrounding manubrium; four radial canals; four permanently rudimentary tentacles, usually reduced to mere bulbs, without ocelli. The hydroid is restricted bathymetrically to shallow waters (0–29 m) (Fraser 1944). *Pennaria disticha*(Goldfuss, 1820)* (Fig. 10), common name christmas treehydroid.*Pennaria disticha* is in the Genus *Pennaria* and Family Pennariidae, the Suborder Capitata. It can be further characterized as in the Order Anthoathecata in the Subclass Hydroidolina. Conspicuous and erect hydroid colonies with terminal hydranths and pinnately-branched stems. Growth monopodial with main stem divided into internodes of varying length. Hydranths are borne at the end of the stem, hydrocladia and ramules. They are clavate with a whorl of filiform aboral tentacles and short irregularly scattered capitate tentacles. Gonophores borne between the sets of tentacles.

Planula larva: (Fig. 11) is the free-swimming, flattened, ciliated, bilaterally symmetriclarval form of various cnidarian species. Some groups of Nemerteans too produce larvae, which are very similar to the planula. The planula forms from the fertilized egg of a medusa, as the case in scyphozoans and some hydrozoans, or from a polyp, as in the case of anthozoans. Depending on the species, the planula either metamorphoses directly into a free-swimming, miniature version of the adult form (such as many open-sea scyphozoans), or navigates through the water until it reaches a hard substrate (many may prefer specific substrates) where it anchors and grows into a polyp (including all anthozoans with a planula stage, many coastal scyphozoans, and some hydrozoans). Planulae of the subphylum Medusozoa have no mouth or digestive tract and are unable to feed themselves, while those of Anthozoa can feed. Planula larvae swim with the aboral end (the end away from the mouth) in front.

Sea anemones are a group of marine-dwelling, predatory animals of the order Actiniaria. They are named for the anemone, a terrestrial flower. Sea anemones are classified in the class Anthozoa, subclass Hexacorallia. Anthozoa often have large polyps that allow for digestion of larger prey and also lack a medusa stage. As cnidarians, sea anemones are related to corals, jellyfish, tube-dwelling anemones, Structurally the sea anemone is known as a polyp. The body wall consists of an outer layer of epidermis and an inner layer of gastrodermis; between these two is a gelatinous, non-cellular layer known as the mesoglea. The body wall is organized into a muscular column with a top that has a mouth (the oral disc) and a bottom (the pedal disc) that holds onto the substratum. Within the column is a sac-like digestive cavity, called the coelenteron or gastro-vascular cavity, that has the mouth as its only opening. The coelenteron of sea anemones is divided into pie-shaped sections by muscular mesenteries, some of which attach both to the top (oral) and bottom (pedal) discs. There is no right or left side on a sea anemone; it has radial symmetry.

This sea anemone is *Actinodendron sp.* (Fig. 12) defined accordingspecies identification portal, (Van Couwelaar M. (2015)* http://species-identification.org/index.php.

Rotifera (wheel invertebrates): Seisonidae is a family of rotifers, found on the gills of marine crustaceans. Peculiar among rotifers, males and females are both present and equal in size. They have a large and elongate body with reduced corona. Body cylindrical or sack-shaped, covered with cuticle or lorica, usually <200 µm; head with ciliated corona. Only Seisonidea are exclusively marine. Morphologically, rotifers possess two main distinctive features: corona and mastax. The ciliated region at the apical end (head) of a rotifer is called the corona ("wheel organ"); it is used for locomotion and food gathering. In adults of some rotifer families, ciliation is reduced and the corona is replaced by a funnel or bowl-shaped structure (the infundibulum) at the bottom of which the mouth is located. Along the edge of the infundibulum of most species there is a series of long setae (bristles).The other universal characteristic of rotifers is a muscular pharynx, the mastax, possessing a complex set of hard jaws called trophi. Most rotifers are free living, they swim in the pelagial or crawl on substrata (bottom sediments, stems of macrophytes); however, many species live permanently attached to plants (the latter are called sessile rotifers). Very few rotifers are parasitic; the vast majority of rotifers are solitary but some (ca. 25 species) form colonies of various sizes (Wallace, 1987).Most rotifers are either obligatory parthenogenetic (the whole class of bdelloids) or produce males for a brief period, sometimes only a few days, each year or season (Nogrady *et al*., 1995). Male rotifers are usually strongly reduced in size and sometimes only slightly resembling the females of the same species. Identification of the two rotifer genera collected (according to species identification portal,(Van Couwelaar M. (2015)*,http://species-identification.org/index.php).Paraseison (Plate, 1887)**Paraseison annulatus* (Claus, 1876)* (Fig. 13)- ectoparasite of crustaceans. Seison (Grube, 1861) *Seison nebaliae* (Grube, 1861)* (Fig. 14).

Nematoda (Anisakidae): 3Lips, relatively small, inconspicuous, surrounded of mouth, with aprominent boring tooth.Tail rounded, length (0.088-0.579mm), with smallmucron. Mucron length (0.015-0.022mm).Worms were obtained from ascidiansbranchial chambers. The cuticle is thick,usually with distinct striations mainly at the anteriorand posterior body extremities (Figs. 15-20). A triangularoral opening is visible between trilobed laterallips; a prominent V-shaped projecting boringtooth is located ventrally to themouth. The excretory opening, seen by light microscopebelow the boring tooth on the ventralside. Rectangular to circular outlines of papillaecould be seen on each of the lateroventrallips. Adult *Anisakis simplex* is seen in (Figs. 15 - 16), third stage larva in (Fig. 17). A rounded toothless mouth of early larval stage obtained from the nekton is seen in (Fig. 18). A trilobed lateral lips and a prominent V-shaped projecting boring toothand cuticle striation are seen in (Figs. 19-20).This anisakid has beenidentified (according to Simonetta, et al. 2011; species identification portal, http://species-identification.org/index .php)

Annelida (Polychaeta): Errant polychaetes include actively crawling or swimming forms which may, however, also spend time in burrows or crevices, or under rocks on the seashore. Many are predators on small invertebrates; some are scavengers. In most the first few body segments bear sensory projections called cirri, while the remaining body segments bear conspicuous leglike appendages called parapodia. The parapodia, along with undulations of the body, propel the worm in crawling and swimming; parapodia are tipped with bundles of setae, usually made of chitin. Most errant polychaetes have well-developed head regions, which bear eyes, sensory tentacles, and a specialized organ, the nuchal organ, thought to detect chemicals. The anterior end of the gut often forms a protrusible structure, the proboscis, sometimes equipped with strong chitinous jaws and used in feeding. The setae of some polychaetesare composed of calcium carbonate rather than chitin and are hollow. These brittle setae are easily broken off and contain a toxin that produces a painful reaction in humans. In the scaleworms, a series of overlapping scales form a covering over the animal's upper surface.

Key to the polychaete genera collected (according to species identification portal, (Van Couwelaar M. (2015)* **http://species-identification. org/index.php)**

With 2 prostomialantennae (antennae are absent); pharynx, when everted, clearly consisting of 2 portions, with a pair of stout jaws on the distal portion and usually with conical teeth on one or more areas of both portions. Proximal unit of the prostomial palps is much larger than the distal unit. Figure 21is identified as *Harmothoe* sp.,(scale worm),young specimen, length ca. 800 µm. The long white tubes that look like squirted toothpaste are the tubes of the keel worm *Pomatocerous triqueter* (Linnaeus, 1758) (Fig 22 shows this tubeworm out of the tube). The tubes in cross section are said to resemble the shape of a ship's hull hence the comon name. It uses its tentacles to catch detritus (dead stuff) from the water. This tubeworm encrusts stones, rocks and shells, and the carapace of some species of decapods. They are predominantly sublittoral. The calcareous tube is white, smooth and irregularly curved with a single, median ridge that ends in a projection over the anterior opening. The operculum bears a shallow, dish-shaped plug (ampulla) which is often conical distally, and may have projections on the crown. The colouration of the body is bright but variable, and the crown of tentacles (radioles) are banded with various colours*Nemidia lawrencii* (McIntosh, 1874)* synoneme *Nemidia torelli* (Malmgren, 1866)*(Fig. 23) prostomium elongated, bilobed, with a peak on each lobe. 50 and more chaetigers, the posterior region without scales.Body long, 50 and more chaetigers. Prostomium elongated, bilobed, with a peak on each lobe, median and lateral antennae with small papillae, and a pair of papillate palps. Two pair of small eyes, anterior pair on line of greatest width of prostomium. Body with 15 pairs of scales, leaving the posterior region uncovered. Scales smooth, margins not fringed with papillae, without tubercules. Notopodial chaetae mostly filamentous with a long spinose part and capillary tips. Neuropodial chaetae with long spines on the swollen terminal part and long, straight unidentate tips. Pygidium with dorsal anus and a pair of anal cirri. *Notomastus latericeus* (Sars, 1851) (Fig 24), body long, cylindrical, very fragile, lacking any appendages, 150 segments. Prostomium short, conical with an eversible sac-like pharynx. Thorax with 12 segments. First segment without chaetae, following 11 segments with capillary chaetae only. Posterior body with hooded hooks, dorsally and ventrally. Genital hooks absent.

Pygidium terminates in a membranous flap, without cirri.Up to 300 mm for 150 segments.

Copepoda (oar-feet Entomostraca) are the most common zooplanktonworldwide. They are an integral part ofthe food web as both predator and prey. Cyclopidae - Genus: Megacyclops(Kiefer, 1927). The hitherto used keys (Kiefer, 1960;Dussart, 1969; Einsle, 1975), give the following distinctions:- Furcal branches (length:width) 3,5 to 4,5seta 1: seta 4 . . . . . .greater than 2 , seta 1: length furca . . . . . greater than 1body length 1,2 to 3 mm. *Megacyclops viridis*(Jurine, 1820) (Figs 25-27).This copepod has beenidentified (according to species identification portal, http://species-identification.org/index.php)

Amphipoda (Gammaridae): are the most abundant and familiar suborder of the order Amphipoda. They represent a very diverse group of organisms with a worldwiderange (Barnard and Karaman1991). Amphipods are characterized by three traits; 1) the absence of a carapace, 2) thefirst thoracic segment being fused to the head, and 3) the abdomen being divided into twoparts each with three segments. Gammaridean amphipods are usually laterallycompressed. Most are benthic but there are some planktonic species. The "typical"gammaridean has large coxal plates, a large abdomen with six pairs of appendages, and relatively small compound eyes. There is divergence from the typical body plan, making gammarids a broad and diverse group with respect to morphology. Figure 28- 30 show *Gammaropsis* sp. Isaeidae (Liljeborg, 1855)⋆. Male antennae 2 not stout and enlarged (Figs. 28 - 30).Brooding female missing some pereopods and one of the second antennae (Fig. 30).Accessory flagellum 3 or more articulate; article 3 of antenna 1 equal to or longer thanarticle 1; gnathopods subchelate; uropod 3 biramous, rami equal to each other, variable inlength, generally equal to or longer than peduncle (Barnard, 1969).Male antennae 2 stout and enlarged, lacking accessory flagellum; Urosome visiblydepressed/flattened, Corophiidae, *Monocorophium acherisicum* (Costa, 1851)⋆. A. Male rostrum absent or minute; Uropod 1 attached at invaginations laterally, lacking rim on urosome , male rostrum absent or minute, uropod 1 attached at invaginations laterally, lacking rim on urosome (Figs.31-33).The megalopod is the final larvalstage of a crab. During thisstage, the abdomen is extended. The abdomen is foldedunder the body as an adult (Fig. 31).This amphipods have beenidentified (according to species identification portal,(Van Couwelaar M. (2015)*http://species-identification.org/ index. php). Nauplius larva is shown in (Fig. 34), zoaea larva (Fig. 35) The zoea is a larval stage of a crab or shrimp. Zoea have two large spines that are used for protection and flotation and megalopod larva (Fig. 36).

Isopoda: Sphaeromatidae (Latreille, 1825)* are small, fast swimming isopods found in the estuarine and marine habitats. They are sometimes known as "pillbugs" because of their ability to roll up into a pill-sized ball when threatened. They are shorter and more compact. Mouthparts: Mandible, maxillule and maxilla unmodified. Maxilliped with palpunmodified, lobes bearing setae, but endite greatly expanded with proximalflaps and lobes. Brood pouch: 5 pairs of oostegites arising from pereonites 1, 2, 3, 4 and 5. Brood held in marsupium thus formed. Pockets and internal pouches absent. Fig 37 *Caecocassidias patagonica* (Keller *et al.,* 1967; Kussakin, 1967).This isopod has beenidentified (according to species identification portal, http://species-identification. org/index. php).

Sea slugs are any of various highly colorful marine gastropods of the suborder Nudibranchia, lacking a shell and gills but having fringelike projections that serve as respiratory organs. Also called nudibranch. Or Any of various other marine gastropods that lack a shell or have a reduced shell. Nudibranchs, meaning "naked gills" consist of soft-bodied sea slugs and are members of the class Gastropoda. The majority of the colorful opisthobranchs that are seen belong to the suborder Nudibranchia. Nudibranchs can be found anywhere in marine habitat, to tidal pools, to coral reefs, but are most diverse in tropical waters. Nudibranchs have an irregular shape that can be thick or flattened and long or short and can range anywhere from 0.635 centimeters to 60.96 centimeters. The average lifespan of a nudibranch can vary anywhere from weeks to one year, based on the abundance of food available to them. Nudibranchs are carnivores and use their radula, a band of curved teeth, to scrape or tear food particles. They feed on species such as hydroids, sea anemones, corals, sponges and fish eggs. Each species of nudibranch usually specializes on one specific sessile animal on which to feed. Nudibranchs move or "crawl" by ciliary action or the muscular action of its foot, a flat and broad muscle that clings to rocks, corals, sponges and other surfaces. Although separated into four different groups, the two most common groups of nudibranchs are the aeolidida (aeolids) and the doridoidea (dorids). Doridoidea is the largest group of nudibranchs and is comprised of many different variations of body types. Aeolidida are the second largest subgroup of nudibranchs and show a more consistent elongated shape. Nudibranchs have both male and female sex organs, making them hermaphrodites. Although hermaphroditic, self-fertilization does not occur. Only when the reproductive pores of two nudibranchs line up, neck to neck, can fertilization ensue. Nudibranchs have obtained different defenses in order to escape predation; chemical defenses are obtained from their prey by ingestion, and are then incorporated into nudibranch tissues. The bright colors and patterns of nudibranchs serve as a warning signal to predators of their chemical defenses. Alternatively, the coloration of nudibranchs could also be a camouflage mechanism, allowing them to blend in to various substrates. The only genus of slugs collected is the striped Nudibranch *Armina* SP. (Cooper, 1963)⋆ (Fig. 38). This slug is collected from Abu Qir bay Egypt for the first time. This sea slug has beenidentified (according to species identification portal, (Van Couwelaar M. (2015)* (http://species-identification.org/index.php).

Veligerlarvais a free-swimming larval stage of a mollusk. Veligers have the beginnings of a foot, shell, and mantle. The veliger larvae of gastropods are suspension feeders. Long cilia form a band along the smooth or lobed velum in these larvae, while recessed beneath this band is a groove lined with cilia which leads to the mouth (Yonge, 1926; Lebour, 1931; Werner, 1955; Thompson, 1959) (Figs. 39 - 40). Glochidia larva(Fig. 41) form has hooks, which enable it to attach itself to gills of a marine host species for a period before it detaches and falls to the substrate and takes on the typical form of a juvenile bivalve. Since the host is active and free-swimming, this process helps distribute the bivalve species to potential areas of habitat that it could not reach any other way.

Scaphopoda: The Scaphopods appear to occupy a position intermediate between the Gastropoda and the Lamellibranchiata: the presence of a univalve shell, a buccal mass with a radula and the nature of the nervous system are characteristic of the gastropods while the digging foot, lack of cephalisation, fused mantle which is open at both ends and bilateral symmetry are typical of bivalves. Family Siphonodentaliidae Simroth, 1895⋆. Shell 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. Source: Jones and Baxter (1987).The following subtaxa of this family occur in the Arabian Gulf:Genus *Cadulus* (Philippi, 1844) (Source: Jones and Baxter, 1987). Shell small to moderate, arcuate and with the maximum diameter near the middle or between the median portion and the oral aperture. The aperture generally constricted and never the region of maximum diameter. Shell surface smooth, rarely sculptured with longitudinal striae or minute annular rings. Apical orifice simple or with 2-4 notches, orifice often constricted with a ledge within the opening. Shell texture vitreous and transparent/translucent. Foot vermiform with a pedal disc but no filament. The following species has been collected from the benthos of the Arabian Gulf:Family Dentaliidae. The mantle is entirely within the shell. The foot extends from the larger end of the shell, and is used to burrow through the substrate. They position their head down in the substrate, with the apical end of the shell (at the rear of the animal's body) projecting up into the water. The shells are conical and curved in a plan spiral way, and they are usually whitish in color. Because of these characteristics, the shell somewhat resembles a miniature elephant's tusk. They are hollow and open at both ends; the opening at the larger end is the main or anterior aperture of the shell. The smaller opening is known as the apical aperture. Genus *Dentalium* (Linnaeus, 1758)⋆. Shell thick; with a few marked, oblique, concentric growth lines or ridges: gently tapered towards posterior end, less curved than Dentalium entalis. Posterior portion of shell with fine, closely spaced, longitudinal striations. Anterior aperture circular; posterior end obliquely truncate, aperture circular with smooth rim, occluded by septum, with central pipe bearing a circular orifice. The animal is of similar shape as its shell, with a rudimentary eyeless head, which is covered by the mantle as in the bivalves. The foot is long, pointed, and bilobed, and projects from the large end of the shell. The radula within the buccal mass is broad and oval, with only 5 teeth in a row. *Dentalium vulgare* (da Costa, 1778)⋆ (Fig. 42).This scaphopod has been identified (according to species identification portal, http://species-identification.org/index.php).

Bivalvia: Shell Structure: Minute,1-1.2 mm. relatively solid. Equivalve: Equivalent. Equilateral: Slightly in equilateral, beaks situated to the posterior of midline, app. 40-45% of total length from posterior end. Tumidity: Tumid. Outline: Oval, anteriorly extended; height of shell approximately 80% of the length; dorsal margin straight, very short posteriorly, longer anteriorly; posterior margin gently rounded, anterior margin extended and more strongly rounded; ventral margin rounded, lunule and escutcheon absent; umbo not prominent, projecting slightly above the dorsal margin, prodissoconch conspicuous. Sculpture: Very fine, regular concentric lines, increasing in prominence towards the ventral margin; also very faint radial lines. Margin: Smooth. Ligament: Internal, amphidetic, oval, sat in a simple resilifer below the beaks. Hinge: Taxodont: hinge relatively strong with 3 large, blunt, chevron-shaped teeth either side of the ligament. Pallial Musculature: Indistinct. Periostracum: Glossy, very pale straw coloured. Colour: Translucent white. Additional Characters: Elongated coils along the dorsum on both sides of the body.*Microgloma tumidula* (Monterosato, 1880)⋆(Fig. 43). Nuculanoidea : Nuculanidae Tebble name: n/a Smith & Heppell name: *Microgloma turnerae* (Sanders and Allen, 1973).This bivalve has beenidentified (according to species identification portal, (Van Couwelaar M. (2015)*http://species-identification.org/index.php).

Echinodermata (Holothuroidea): Sea cucumbers are echinoderms from the class Holothuroidea. They are marine animals with a leathery skin and an elongated body containing a single, branched gonad. Sea cucumbers are found on the sea floor worldwide. Sea cucumbers serve a useful role in the marine ecosystem as they help recycle nutrients, breaking down detritus and other organic matter after which bacteria can continue the degradation process. Like all echinoderms, sea cucumbers have an endoskeleton just below the skin, calcified structures that are usually reduced to isolated microscopic ossicles (or sclerietes) joined by connective tissue. In some species these can sometimes be enlarged to flattened plates, forming an armour. In pelagic species such as Pelagothuria natatrix (Order Elasipodida, family Pelagothuriidae), the skeleton is absent and there is no calcareous ring. The sea cucumbers are named for their resemblance to the vegetable cucumber.Subphylum:Echinozoa / Class: Holothuroidea / Subclass:podacea/ Order:Apodida/ Family Chiridotidae Östergren, 1898. These sea cucumbers are vagile holothurians with an elongated shape (up to 3 meters for Synapta maculata), worm or snake-like. Their shape is adapted for burrowing through the sediment, sometimes in a fashion similar to earthworms. Their mouth is surrounded with 10-25 pinnate or peltate tentacles. The absence of tube feet gives the order its name, Apodida meaning without feet : they move by crawling on the sediment, hence they need flat bottoms with few current. Members of this order have a circum-oral ring and tentacles, but do not have tube feet or radial canals. They also lack the complex respiratory trees found in other sea cucumbers, and respire and excrete nitrogenous waste through their skin.

Figure44 has been identified as *Polycheira rufescens*.Class: Holothuroidea / Order: Apodida / Suborder: Synaptina Family:Chiridotidae Östergren, 1898⋆. Members of this family have 10, 12, or 18 pelto-digitate tentacles (bearing 3-10 digits on each side). They lack podia, radial canals and respiratory tree. The soft body wall is supported by ossicles which are generally wheel-shaped with six spokes. Some species have hook-shaped or rod-shaped ossicles or spiny sigmoid bodies Figure 45 has been identified as *Chiridota heheva*. These two holothuroideans has been identified (according to species identification portal, http://species-identification.org/index. php).

Echinopluteus with 8 arms: has bilateral symmetry; transparent; calcareous skeleton and spines; spines simple or fenestrated; skeleton is birefringent (the decomposition of a ray of light, passing through the skeleton and being split into two rays). Skeleton becomes visible in glowing rainbow colours that change as the swimming larva changes its orientation to the light (Fig. 46).

Echinodermata (Ophiuridea Gray, 1840): like many echinodermsexhibit pentaradial symmetry. Brittle stars have five arms that join together at a central body disk. The arms are clearly delineated from the central body disk, and in this way brittle stars can be distinguished from starfish (starfish arms blend with the central body disk such that it is not easy to delineate where the arm ends and the central body disk begins).Brittle stars move using a water vascular system and tube feet. Their arms can move side to side but not up and down (if they are bent up or down they break, hence the name brittle star). Figure 47 is identified as *Amphiura*sp. with a maximum span of app. 1 inch (2.5 cm). Figure48 is identified as brittle star *Ophiomastix annulosa*, for sale at the Kölle Zoo pet super store in Heilbronn, can be seen even during daylight hours. These echinoderms have beenidentified (according to species identification portal, (Van Couwelaar M. (2015)*,http://species-identification.org/index.php).

ASCIDIAN LARVAE (Identification of the ascidian larvae studied has been carried out according to (Millar,1970 & 1971and Van Couwelaar, 2015 - Marine Species Identification Portal : Class Ascidiacea: http://species-identification. org/index.php). *Styela plicata*Lesuaer, 1823(Fig. 49)No cells interspersed about the body and tail………………… *Styela plicata*. Medium sized (9.2 mm), snake-like larva. Body merges directly with tail; overall aspect of larva snake-like. Single large, round ocellus present. Numerousstructures visible near ocellus and appear as bands of pigments at different depths. Body darkly pigmented, including tail. Tail very muscular. *Phallusia mammilata* (Cüvier 1815)⋆ (Fig. 50)Presence of spots – Body covered with iridescent spots…. *Phallusia mammilata*. Medium sized larva (1.27 mm) covered with blue-gray iridescent spots. Ocellus and statolith present. Occasionally, tips of three adhesive papillae visible as small protrusions at front of body; often, papillae not visible. Stalks of papillae rarely visible. Lobes visible in body (digestive structures of developing zooid). Center-most lobe dark orange. Two flanking lobes lighter yellow-orange. Tail very light orange.*Corella parallelogramma* (Müller,1776)⋆(Fig. 51). A frill of small finger-like projections around the equator of the body...... *Corella parallelogramma*. Very large larva (3.02 mm) with bulbous body. No eyespots or statoliths visible. Frill composed of numerous finger-like projections runs around equator of body. Portion of body anterior to frill transparent. Pigmented cone-like structure visible in the center of body. Several adhesive papillae located on anterior portion of body. Portion of the body posterior to the frill contains numerous pigmented structures. Colouration bright orange to deep red. The changing morphology of Botrylloides larvae makes it easy to determine how close a larva is to settlement. The frill of the larva acts much like the legs of a lunar lander. In newly released larvae the frill encircles the equator of the body. As the larva gets closer to settlement, the finger-like projections of the frill begin to extend and the anterior portion of the body retracts. When settlement is imminent, the fingers project beyond the end of the body and look much like the fingers of a grasping hand. Upon attachment to the substratum, the fingers form the outer margin of the juvenile Botrylloides colony.

Diplosoma migrans (Menker und Ax. 1970)(Fig. 52). Lateral ampullae absent……… ……….............. *Diplosoma migrans*. Large larva (1.29 mm) with bulbous, transparent body. Ocellus and statolith present, however,close together and often appear as single spot at low magnification. Three large adhesive papillae; papillaedo not project beyond margin of body. Stalks run from adhesive papillae to lobe-like organs in center of larva.Scattered granular spots visible in body. Tail opaque light orange-brown. Coloration of central lobes.*Halocynthia roretzi* (Drasche)(Fig. 53). Presence of Lateral Ampullae – Six additional structures resembling adhesive papillae (lateral ampullae) present in a second row behind three anterior adhesive papillae………………………….……..... *Halocynthia roretzi* Medium to large larvae (1.24 - 1.560 mm). Ocellus and statolith present. Body transparentwith very few spots. Three adhesive papillae on anterior side of body; papillae do not project beyond bodymargin. Lateral ampullae present in second row behind adhesive papillaeand project from coloured mass in center of body. Dark yellow lobes in body (digestive structures of developingzooid). Overall colouration yellowish. Lateral ampullae and posterior region of central mass light yellow. *Microcosmus claudicans* (Savigny,1816)⋆(Fig. 54) Morphology of Adhesive Papillae – Adhesive papillae project well beyond the body……………………………..…........... *Microcosmus claudicans*.Medium sized larva (1.14 mm). Well developed adhesive glands on anterior portion of body that project wellbeyond body. Anterior portion of bodytransparent; posterior portion pigmented. Body can range in shape from round to oval. Ocellus present, but visiblefrom only one side and difficult to detect; The tailopaque or translucent white. Most visible feature three lines running most of the length of juvenile (endostyle and sides of brachialbasket). Brachial basket iridescent pink-purple; endostyle more opaque and covered with spots. *Molgula manhattensis* (Dekay, 1843)⋆ (Fig. 55). Body Shape – Body rounded and bulbous with the pigmented portion being fully enclosed by a transparent capsule…..………. *Molgula manhattensis*. Larvae: Small larva (0.50 mm)with bulbous body. Well developed capsule fully encloses body. Because capsule fairly thick, smooth, and uniform, the larva has theappearance of wearing a space helmet. Ocellus present near the center of the body. Downward pointing adhesive papillaepresent on anterior portion of body; papillae enclosed within capsule and do not protrude beyond margin of the body. Tail usually sticks out directly behind larva with little bending. *Ascidiella aspersa* (Müller, 1776)⋆ (Fig. 56)Body squarish…………..…......... *Ascidiella aspersa*. Small larva (0.90mm) with squarish body. From side, body squarish and uniformly pigmented. Ocellus and statolith present; both spherical and App. equal in size.

Often ocellus and statolith appear located in distinct the cerebral vesicle. Three large adhesive papillae project well beyond the body. Posterior portion of body appears flat. Cells may beinterspersed about body and tail. Tail somewhat short relative to body. Outer cuticle of tail appears wavy. *Cnemidocarpa mollis* (Stimpson, 1852) (Fig.57). Numerous cells interspersed about the body and tail such that larva appears to be decaying or falling apart, Body Shape Body oval or seed-shaped…. *Cnemidocarpa mollis*. Narrow larva (0.04 mm) with dark, granular appearance and cells interspersed about body and tail. Body oval or seed shaped. Cells interspersed about the body and tail giving appearance that larva is sloughing cells or decaying. Adhesive papillae located on anteriorside of body. Papillae downwardly directed, project beyond the margin of the body, and appear glove-like. Largeocellus and smaller statolith present; both often visible. Colouration dark tan. Larvae move awkwardly. When held in glass dish, many larvae remain motionless on bottom. Swimming appears to be inefficient; a great deal of side-side thrashing motion occurs with little forward progress. The abundance and distribution of all plankton studied varied considerably according to seasons and habitats. The findings of this work, the density of each genus or / and species in the four study localities and the presence or absence of a certain zooplankton in the different seasons of the year (faunal composition)will be statistically analyzed in another publication.

DISCUSSION

Organisms that live in marine habitats face certain challenges that their terrestrial counterparts do not. One of the obvious differences is the motion of the fluid medium, which presents opportunities and drawbacks that are unique to animals that live suspended in the water column. Among the benefits this lifestyle offers are enhanced dispersal of the population, which may be achieved at a relatively low energy cost, the resultant high gene flow among dispersed populations, and the ability to readily expand into new habitats. Marine organisms with limited swimming ability relative to the strength of ambient currents are said to be plank tonic. Although the diverse assemblages of zooplankton in marine and estuarine habitats are all subjected to the vagaries of the water in which they reside, they do not all respond similarly to the forces that cause the water to move. By using selective behavior in response to various physical cues, even plank tonic organisms can exert some influence on the ultimate outcome of their transport (Epifanio 1988). Thus, by responding to salinity cues, some planktonic species may be distributed only within restricted zones in coastal waters, such as the low-salinity regions of estuaries, while others with may reside only in coastal waters and the high-salinity reaches near the estuary mouth. Another important aspect of zooplankton behavior is the periodic vertical migration exhibited by many copepods (Steele and Henderson 1998). The daily vertical migration of many plank tonic organisms may be influenced by the abundance of both food items and predators, as well as other environmental cues such as light, salinity, and temperature. In addition to locating food and avoiding predators, zooplankton may benefit from the changes in their bioenergetics that result from metabolic rates that differ on either side of the thermo cline (McLaren 1963) in stratified waters. Avent *et al*. (1998) recently provided evidence that a common species of the estuarine copepod genus *Acartia* exhibits an endogenous vertical migration with a period that coincides with the semi-diurnal tide. Abundance of zooplankton across a marine ecosystem is influenced by a combination of factors. Water temperature can affect growth rate and reproduction in marine invertebrates (Vijverberg 1977, 1980,1989, Savage 1982, Townsend *et al*. 1983 & 2001).Water is a very good thermal conductor(Cole 1979); therefore, differences in water temperature would likely equilibrate quickly. As a result, water temperature probably had little effect on invertebrate distribution and abundance across the interface. Many marine invertebrates cannot withstand low levels of dissolved oxygen and respond by moving or reducing their metabolic activities (Augenfeld 1967; Jorgensen 1980). Death may result if conditions persist. One benefit of habitats with low oxygen levels isreduced predation by fish and invertebrate predators that cannot tolerate such conditions (Bennett and Streams 1986, Suthers and Gee 1986). Suthers and Gee (1986) found that yellow perch avoided the cattail stands and moved into open water once oxygen levelsdropped in early July. As cladocerans are a major foodsource of yellow perch in the Delta Marsh (Suthers and Gee 1986), their movements and those of other fish may be responsible for this observed change in thecladoceran distribution across the interface. The presence of vegetation and the associated structure is important in providing refuge from predators (Bennett and Streams 1986). Rabe and Gibson (1984) also found cladocerans in higher levels in vegetated areas compared to open-water sites, suggesting that the vegetation provides protection from ambushing predators. The effect of overall habitat structure may not be as important as the low oxygen levels reducing access by fish and other predators to the cattail stand. The role of detritus in the distribution and abundance of wetland invertebrates requires more study. Peaks in invertebrate numbers did not occur at the open water-emergent vegetation interface during any of the sample periods in this study. The high invertebrate abundance and diversity commonly observed in interspersed wetland habitats seems to be related more to the mixture of habitat types than the actual amount of interface present. The total zooplankton abundance reflected quite well the seasonal variation of the copepods population for example. Indeed, the copepods dominated at all study sites throughout the year. A decrease was observed only during the summer due to the higher abundance of copepod predator, such as Siphonophoraand Hydromedusae (Azeiteiro, 1999; Vieira *et al*., 2003). The results also agree with findings in other areas, which showed that copepods usually constitute the main taxa (Calbet *et al*., 2001; Dalal and Goswami, 2001; Ferna´ndez dePuelles *et al*., 2003; Gaudy, *et al*. 2003). From the quantitative point of view, the most representative axon was *Acartia tonsa*, which is typical forestuarine environments and may reach very highabundances in waters containing high concentrationof particulate organic matter (Fernandez, *et al*. 2003 a & b, Tackx *et al*., 2004; Murrel and Lores, 2004). *A. tonsa* is currentlydominant in the inner areas of the southern branchwhere the eutrophication is still more severe (Pardal *et al*., 2004).Concerning biodiversity, heterogeneity valuesproved to be high in summer at downstream sampling stations because of the great contributionof marine species that invaded the estuary. The decrease in heterogeneity verified for the southern branch and mouth, especially at lowtide, during autumn was not due to a decrease in the number of species but a dominance of the estuarine species *A. tonsa* whose reproductionperiod is in September. A similar pattern was also found in the Seine estuary (Mouny and Dauvin, 2002). In the northern branch the observed decrease in heterogeneity during the summer period was due to the higher abundance of decapods larvae. Many planktonic larvae, one ofthe most important components of the meroplankton, showed a clear seasonal trend related to temperature (Gilabert, 2001).In addition, this work represents the first description of the zooplankton community ofthe northern estuarine beach of the Arabian Gulf and its comparison with the other three study localities.

Studies of zooplankton communities and their distribution patterns in the estuarine ecosystem is lacking, but a substantial amount of research has been conducted on this faunal groups in open seas. The dominant zooplankton taxa found in shallow creek and vegetated marsh habitats were nematodes and copepods (Coull *et al*. 1977, Bell *et al*., 1978, Fernandez and Molinero, 2007, Fernandez and Molinero, 2007). Other taxa commonly found at lower densities include some species of polychaetes, ostracods, oligochaetes, turbellarians, bivalves and other miscellaneous taxa (Bell 1982, Bell and Woodin 1984, Kennish 1986). Several of these species may include life stages that are meiofaunal in size only as juveniles, whereas other species remain as meiofauna throughout their entire life cycle. In shallow water salt marsh and tidal creek habitats of the North Inlet estuary, Coull *et al*. (1979) documented clear distribution patterns among the meiobenthic copepod species sampled. Species that were primarily restricted to subtidal habitats included *Halectinosoma winonae* and *Pseudobradya pulchella*, both of which are considered to be epibenthic species. *Nannopus palustris* occurred only on the mudflats and low marsh and is well adapted to low dissolved oxygen environments. Species found in the intertidal zone of the salt marsh flats included *Diarthrodes aegideus*, which was abundant only during the winter and spring months, *Pseudostenhelia wellsi* and *Robertsonia propinqua*, which were limited to the lower marsh zone, and *Nitocra lacustris* and *Schizopera knabeni*, which were limited to the high marsh flats. Species found across the entire subtidal-intertidal gradient included *Microarthridium littorale, Halicyclops coulli*, and *Enhydrosoma propinquum* (Coull *et al*., 1979). Long-term studies of shallow water meiofaunal assemblages at North Inlet have documented substantial seasonal and annual variability in the abundance, and to a lesser extent, the composition of the meiofauna (Coull and Bell 1979, Coull and Dudley 1985). Meiofaunal assemblages at a sub tidal muddy station were dominated by nematodes throughout most of a 63-month study period, with greatest densities observed during the spring and summer months (Coull and Bell 1979). Copepod assemblages at North Inl*et al*so showed distinct seasonal changes at a muddy site, but seasonal effects were less pronounced at a sandy station. Data on deeper-water meiofaunal assemblages in southeastern estuaries are lacking, but those assemblages are likely to include many of the same subtidal and widely distributed species noted above. Meiofaunal organisms play an important role in the estuarine food web complex since they consume bacteria, other microfauna and flora, and detritus, and they are, in turn, consumed by many larger macrofaunal invertebrates and juvenile finfish (Stickney *et al*. 1975, Bell and Coull 1978, Alheit and Scheibel 1982, Kennish 1986, Smith and Coull 1987, Coull 1990). Their densities can be quite high (2.6 x 107 individuals/m2) and standing crop dry weight biomass can average about 1-2 g/m2 (Coull and Bell 1979). This, combined with their short life cycle and high turnover rates in the sediments, make the meiofauna an extremely important contributor to the total carbon production of estuarine bottom habitats. The abundance and distribution of all plankton studied varied considerably according to seasons and habitats. The findings of this work, the density of each genus or / and species in the four study localities and the presence or absence of a certain zooplankton in the different seasons of the year (faunal composition)will be statistically analyzed in another publication.

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