



Seasonal distribution of six newly recorded marine polychaetes from Karachi Coast

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Abstract: Polychaetes are one of the most abundant group of macrobenthos at tropical beaches and considered as important tools to monitor physical health of intertidal systems. A total of 96 sediment samples were collected in duplicate from four stations at Sandspit and Hawksbay beach during 2013-2014. At each station 2 replicate quadrates of 0.25 m² were excavated up to a depth of 10 cm and the collected sand was immediately sieved by using 0.5 mm mesh sieve. Six polychaete species *Cossuracoasta*, *Magelonacincta*, *Ophelinacyllindrica*, *O. norvegica*, *Glycerolongipinnis* and *Glycindeoligodon* are recorded for the first time from coastal sediments of Karachi coast. Highest abundance of polychaeteworms were recorded during northeast monsoon season.

Keywords: Benthic, Polychaetes, Sandy beaches, Karachi Coast.

1. INTRODUCTION

Ecosystem which illustrate the living coastal boundary of seas is dynamically a sandy beach ecosystem (McLachlan and Brown, 2006) which makes upto 31 % of global coastline (Luijendijk *et al.*, 2018). Sandy shores are considered one of the most extended coastal environments worldwide (Lercari and Defeo, 2003) having ecological, economic, recreational and cultural importance. Macro faunal abundance and diversity in rapidly changing sandy habitats depends on substrate stability and the presence of organic detritus (Jenderedjian, 2007; Farooq and Arshad, 2010). There are multiple factors which control faunal assemblages at sandy beaches such as, beach profile, sediment characteristics, physicochemical properties of sea water, inter and intra specific competition among species and seasonal variations (Arshad and Farooq, 2018).

Macrofaunal communities of sandy beaches are well adjusted to rapidly changing, three dimensional and highly dynamic environment. They exhibit notable adaptations in their physiology, morphology and behavior according to this unsteady coastal ecosystem (McLachlan and Brown, 2006). That is why macrofaunal communities have become a valued component of sandy beach environments and suggested for environmental health assessments (Gonçalves *et al.*, 2013; Arshad *et al.*, 2017)

Polychaetes are one of the most abundant group of macrobenthos at tropical beaches (Musale and Desai, 2011) exhibit notable adaptations in their physiology, morphology and behavior according to rapidly changing coastal ecosystem with cosmopolitan distribution.

Polychaetes are not only a dominant living component of sandy habitats but due to their limited mobility and capability to stay in polluted environments makes them important for scientific community to evaluate physical health of sandy beaches.

Polychaetes has been reported to be the most abundant group of macrobenthos in a number of studies in Indian Ocean (Ganesh and Raman, 2007; Joydas and Damodaran 2009) and also other parts of world (Madhupratap *et al.*, 2001; Probert *et al.*, 2001; Ellingsen and Gray, 2002). Polychaete fauna of Pakistan coast has been studied by Bindra (1927), Fauval (1953), Hasan (1960), Habib and Mustaqim (1988), Siddiqui and Mustaqim (1988), Mustaqim (1997), Mustaqim (2000) and Rasheed and Mustaqim (2003). This study add six species recorded first time from intertidal area of two sandy beaches of Karachi coast.

2. MATERIAL AND METHODS

The coast line of Pakistan stretches from the Iranian border, along the Makran coast of Balochistan and Karachi coast of Sindh to Sir Creek on the Indian border. The total length of coastline is about 1046 Km or 527 nautical miles. Sandspit is 14.5 km long barrier bar which connects the rocky head end of Manora with the main land and at places it is less than 305 m wide. Hawksbay is situated 20 km south west of Karachi (Fig. 1). It is accessible through Mauripur Road (formerly Hawkes Bay Road) or the Mubarak Goth Road from Karachi. It is a sandy beach with crystal blue water and brown coloured sand texture. Two stations were marked at each studied site namely S1, S2, H1 and H2.

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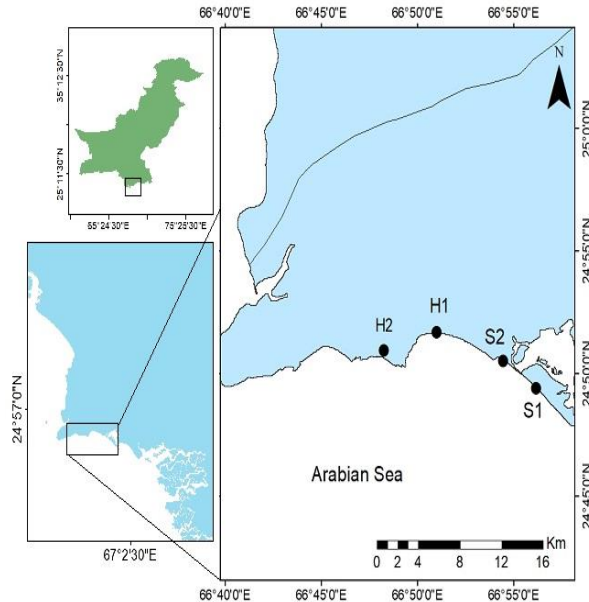


Fig. 1. Schematic positions of study stations (S1, S2, H1 and H2) at Karachi coast, Pakistan.

A total of 96 samples were collected in duplicate, from all stations (S1, S2, H1 and H2) 48 from each site. Samples were collected in pre-Monsoon (March and April), Southwest Monsoon (May - September), Post Monsoon (October) and Northeast Monsoon (November - February) period. In the text PRMS stands for pre monsoon, SWMS for southwest monsoon, PSMS for post monsoon and NEMS for northeast monsoon. The sampling was done along a vertical transect at High Tide Mark (HT) and Low Tide Mark (LT). At each station 2 replicate quadrates of 0.25 m² were excavated up to a depth of 10 cm and the collected sand was immediately sieved by using 0.5 mm mesh sieve. Polychaete worms were collected in separate plastic bottles, narcotized and preserved in 70% alcohol (Russell, 1963). In the laboratory, samples were analyzed using a binocular microscope and identified by Fauval, 1957; Fauchald, 1977; Böggemann, 2002 and Böggemann, 2005.

2. RESULTS AND DISCUSSION

A total of six species belonged to four orders of class Polychaeta were recorded for the first time from the coastal areas of Pakistan (Fig. 2-7).

Systematics

Class Polychaeta Grub, 1850 (Bristle worms)

Family Cossuridae Day 1963

Genus Cossura Webster & Benedict, 1887

Cossuracoasta Kitamori, 1960

Description

Preserved specimens appear pale to dusky in alcohol measured 12 to 15 mm in length with 98 to 106 segments. Long, cylindrical body pointed from both

ends. First two segments without appendages. Lacks parapodia and the setae arise laterally from the body wall (Fig. 2a). A long, tubular tentacle arise from the middle dorsal part of the third chaetigerous segment, measures 8 to 12mm. Two types of chaetae present, pre acicular chaetae barred transversely. Chaetae of first three segments longer and coarser which reduce in thickness in successive segments. Two types of post acicular chaetae, majority are long, smooth, slender capillary and a few are shorter with finely serrated flattened blades (Fig. 2b). Parapodial acicula projected slightly and recurved. Prostomium is conical with two nuchal organs, lacking eye spots. Pygidium present with three long anal cirri (Fig. 2c).

Remarks and Distribution

Recorded from low tidal mark from both sites. Middorsal tentacle varied in size in three specimens from the standard length described by Kitamori (1960) where it was between 7-8 mm. Recorded from Greece, Mediterranean Sea, Indian Ocean, European Marine waters.

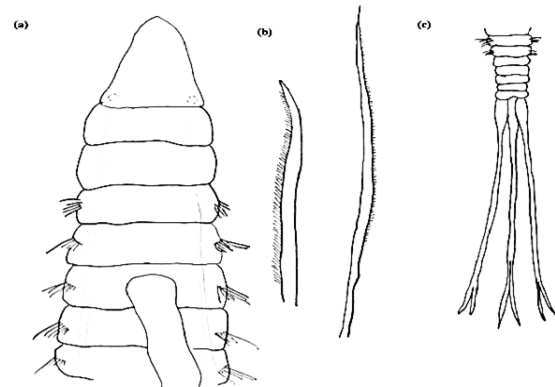


Fig. 2. *Cossuracoasta* (a) anterior portion of the habitus. (b) Short and long capillary seta. (c) Pygidium with three anal cirri.

Family Magelonidae Cunningham & Ramage, 1888

Genus *Magelona* Müller, 1858; Emended Fiege et al. (2000)

Magelonacincta Ehler, 1908

Description

Appear cream white in colour in alcohol measures 14 mm for approximately 56 chaetigers. A stout species, 1-8 chaetigers have similar notopodia (Fig. 3a), low triangular notopodial prechaetal ridges confluent with slender triangular postchaetal lamellae, terminating in pointed tips (Fig. 3b). From thorax, postchaetal lamellae decrease in size, appear lateral in position from 5 chaetiger. Chaetiger 8 have longer notopodial lamellae than preceding chaetigers (Fig. 3c). Lateral, leaf like, pointed lamellae on abdominal chaetigers, approximately of same size in both rami; postchaetal expansions are not clear. Prostomium subtriangular, as

long as wide, anterior margin smooth with rudimentary horns, two longitudinal dorsal muscular ridges, diverging anteriorly and extends upto the prostomium. Proboscis is oval and ridged longitudinally (**Fig. 3d**). Palps arise ventrolaterally from prostomium, reaching upto chaetiger 17.

Remarks and Distribution

In one specimen everted proboscis, appeared oval and ridged inferiorly. Distally expanded neuropodial ventral lobes decreased in size in first 5 chaetigers and increasing from 6-8 chaetigers. Recorded from European waters, Scotland and Indian Ocean.

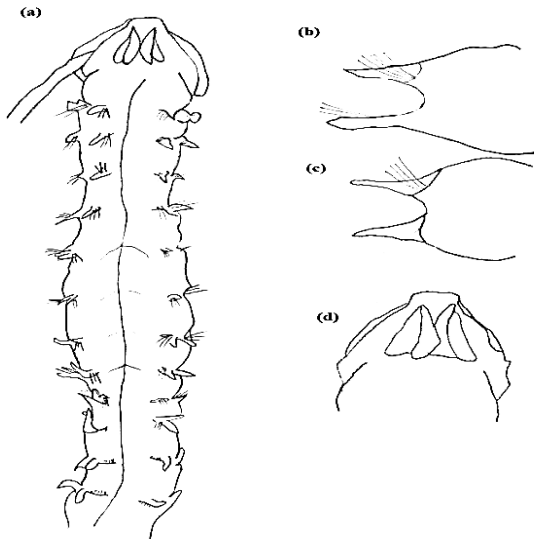


Fig. 3. (a) *Megilonacincta* dorsal view of anterior region. (b) Anterior view of chaetiger 1 (c). Anterior view of chaetiger 8. (d) Dorsal view of prostomium.

Family Ophelidae Malmgren, 1867

Genus *Ophelina* Örsted, 1843

Ophelinacylindricaudata Hansen, 1878

Description

Alive worms are white to off white in color while pale yellow in alcohol. Long worm like body with a continuous ventral groove and 28-30 body segments (**Fig. 4a**). Upto 19 mm long for 34 segments. Parapodia provided with prechaetal lobes. Neuropodial chaete smaller than notopodial ones.

Cirriformous gills present from chaetiger 2 to 7-11, then rudimentary or absent in middle region and present again in 1st 3-8 segments. Conical prostomium without secondary annulation. A thin median process present at tip of prostomium with two nuchal slits, eyes are absent (**Fig 4b**). Pygidium is longer than wide, cylindrical tube broadened with median dorsal lamella and medioventral cirrus (**Fig. 4c**).

Remarks and Distribution

Branchiae in middle third of the body were recorded as reported by Parapar and Moreira (2008) in material from the Iberian Peninsula and Uebelacker (1984) found the same character in specimens from the Gulf of Mexico. However this character was not observed in our specimens. This indicates the presence of closely related species with coinciding distribution areas. Recorded from Indian Ocean, Coast of Norway, Northern sea of Pacific and Atlantic Ocean.

O. norvegica Støp-Bowitz, 1945

Description

Preserved samples appear pale or yellowish in colour. Elongated body with secondary annulations (**Fig. 5a**), upto 52 mm for 61 chaetigers. Parapodia bears short prechaetal lamellae and ventral cirri except anterior 2-3 parapodia where the structures are long. Neuropodial chaetae shorter than notopodial one. Cirriform gills present in all segments except 1 and last 4 chaetigers. Gills on anterior segments are shorter than of those on posterior segments (**Fig. 5b**). Conical Prostomium provided with 2 large nuchal organs and a small middle process at tip. Eyes absent. funnel-shaped pygidial tube as long as wide, distinguished with the presence of 25 rings. A long cirrus coming out of pygidial funnel.

Remarks and Distribution

Recorded from sandy habitat of Sandspit beach during Post monsoon season only, associated with very fine sediments. Pygidial cirri were recorded from one specimen only where it was damaged in rest of the samples. Recorded from Northeast Atlantic, Norwegian coast, Swedish coasts and Indian Ocean.

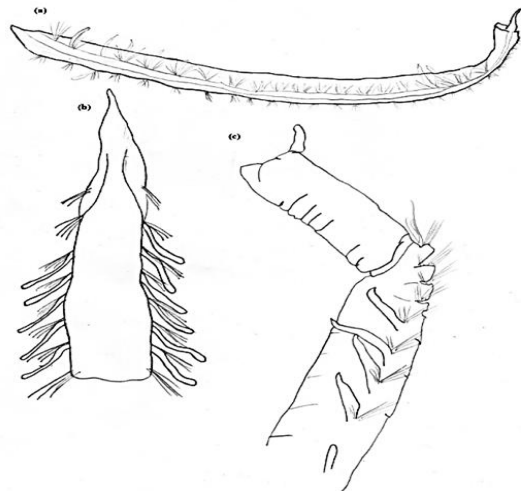


Fig. 4. (a) *Ophelinacylindricaudata* habitus lateral view. (b) Anterior part of the habitus. (c) Posterior part of the habitus.

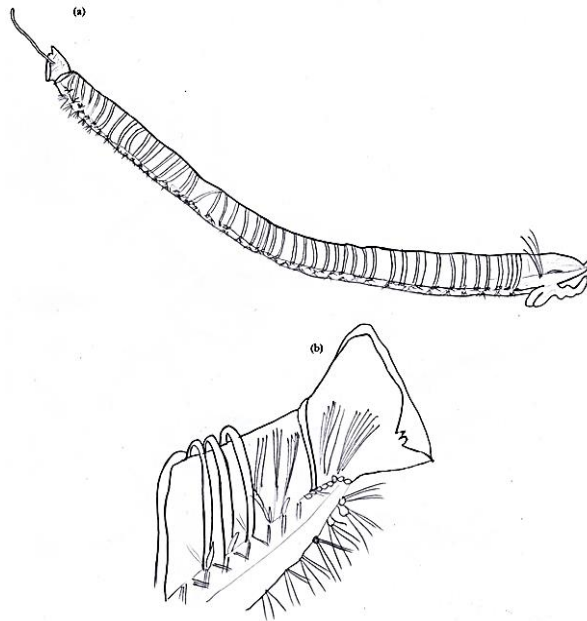


Fig. 5. (a) *Ophelinanorvegica* lateral view.
(b) Posterior part of the sp.

Family Glyceridae Grube, 1850

Genus *Glycera* Savigny 1818

Glyceralongipinnis Grube, 1878

Description

Appear white to off white in color in 70% alcohol. First two parapodia uniramous (Fig. 6a,b) and following parapodia are biramous (Fig 6c, d), each ramus provided with 2 cirriform, prechaetal, subequal ligules and a postchaetal rounded lobe. Branchial filaments are simple, longer than prechaetal ligules and starts from dorsal surface of chaetiger 20-22. Prostomium pointed. Two kinds of pharyngeal papillae: long and cylindrical papillae is mostly without rings (Fig. 6e), other is stout and rounded. Jaw is supported with two long slender limbs, which are united at base (Fig. 6f).

Remarks and Distribution

The holotype of *Glyceralongipinnis* Grube, 1878 referred to *Glycerasphyrabrancha* Schmarda, 1861 by Boggemann (2002). The specimens were recorded from low tidal marks from both sites. In 3 specimens branchial filaments at chaetiger 20 were smaller in size than of those present on successive chaetigers. Rest of the specimens agrees well with previous descriptions from Indian Ocean. Recorded from Indian Ocean, North-West and South-East Atlantic Ocean, West, East Pacific Ocean, Gulf of Mexico, Caribbean Sea, Thailand, Bay of Bengal and Phillipine Islands.

Family Goniadidae Kinberg, 1866

Genus *Goniada* Audouin & Milne-Edward, 1833

Glycindeoligodon Southern, 1921

Description

Alive worms are yellowish green in colour but dark brown in 70% alcohol, 20 mm long with upto 123 chaetigers. 19-20 uniramous parapodia in anterior region, each with long prechaetal lobe at chaetigerous lobe, a rounded postchaetal lobe, a broad dorsal cirrus and a thick, short ventral cirrus. Subsequent parapodia are biramous provided with notopodial lobe incompletely fused with dorsal cirrus. Neuropodial lobes are lamellar in middle chaetigers reducing posteriorly. Notochaetae stout, simple, hooked at tip and with pointed terminal hood. Neurochaetae composed of spinigers with fine serrated blades. Prostomium annulated, chevrons absent.

Remarks and Distribution

The specimens recorded from low tide mark from both sites during PRMS only. The present specimens agrees well with previous descriptions from Indian Ocean. Endemic in East coast of India, Hooghly estuary, Kakinanda bay, Bay of Bengal, Vellar estuary Madras.

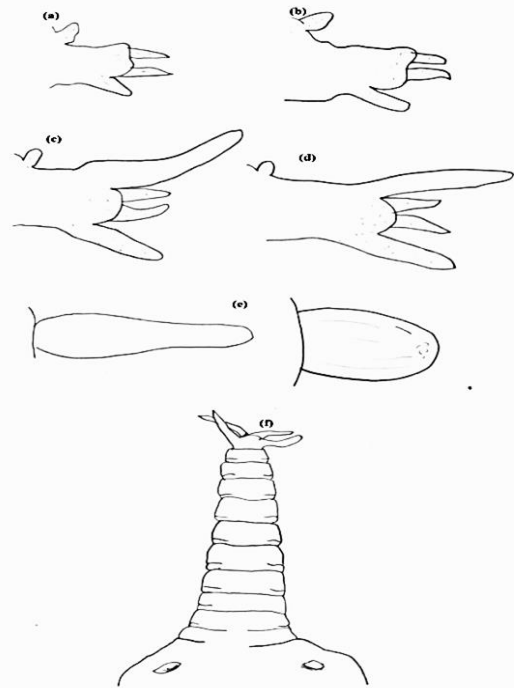


Fig. 6. (a). *Glyceralongipinnis*. (a, b) Uniramous parapodia anterior to posterior view. (c, d) Biramous parapodia anterior to posterior view. (e) Dorsal view of Proboscoidal papillae. (f) Anterior portion of prostomium

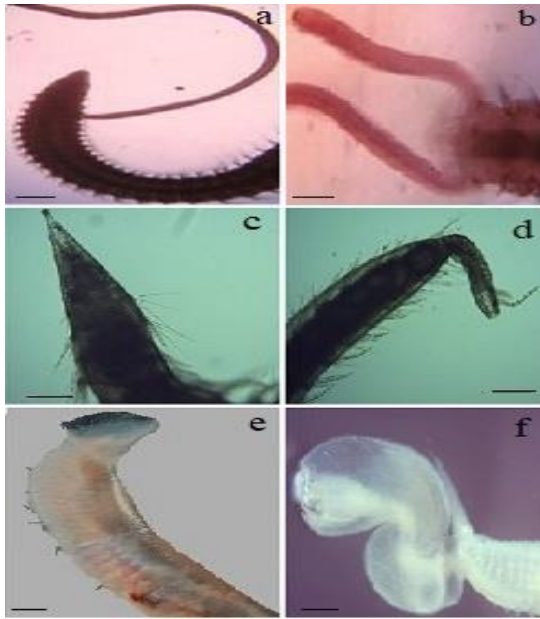


Fig. 7. *Cossuracoasta* (a); *Magelonacincta* (b); *Ophelinacylindrica* prostomium (c), pygidium (d); *O. norvegica* (e); *Glyceralongipinnis* (f).

Seasonal abundance of polychaete worms

Cossuracoasta was recorded from both sites during POMS and NEMS, *Magelonacincta* and *Ophelinacylindrica* during PRMS and NEMS, *O. norvegica* during POMS, *Glyceralongipinnis* during PRMS, SWMS and NEMS and *Glycindeoligodon* in PRMS only (Tab. 1, Fig. 8).

Polychaete assemblages make up a dominant component of sandy beach environment and used widely as indicator organisms for coastal health management (Surugiu, 2005; Dean, 2008). The most dominant polychaetes recorded during this study belonged to family glyceride. However, only one first record *Glyceralongipinnis* reported from this family where it was present with the most dominant *Glycera alba*. A total of four species of genus *Glycera* have been reported earlier from coastal waters of Pakistan (Mustaqim, 1997; Kazmi and Naushaba, 2013) other than *G. longipinnis*. Glycerids are reported to be detritivores, feeding on faecal pellets and recorded in high densities from organically rich environments (Inglis and Kross, 2000). Kazmi and Naushaba (2013) has included two *Cossura* species and one *Ophelina* species in the checklist of marine worms of Pakistan which were previously reported from intertidal areas of Pakistan coast. However both of these families were not included in the checklist of marine polychaetes of Pakistan developed by Mustaqim (1997). *Magelonapapillicornis* and *M. cornuta* have been reported earlier by Kazmi and Naushaba (2013) but *M. cincta* have recorded for the first time during this study. Joydas and Damodaran (2009) reported *Magelonacincta* from sandy as well as muddy substrata from Indian Ocean. In the present study *Magelonacincta* reported during NEMS where very fine sand was the dominant factor. This illustrate that even if many species are naturally accompanying a sedimentary habitat, their distributions are not always restricted to that environment only (Joydas and Damodaran 2009).

Tab. 1: Polychaete species recorded from Sandspit and Hawksbay during monsoon 2013-2014. (PRMS = pre monsoon, SWMS = Southwest monsoon, PSMS = post monsoon and NEMS = Northeast monsoon).

S. No.	Species	PRMS		SWMS		POMS		NEMS		Total
		S	H	S	H	S	H	S	H	
1	<i>Cossuracoasta</i>	0	0	0	0	1	2	1	2	6
2	<i>Magelonacincta</i>	1	0	0	0	0	0	1	2	4
3	<i>Ophelinacylindrica</i>	5	5	0	0	0	0	0	3	13
4	<i>Ophelinanorvegica</i>	0	0	0	0	4	1	0	0	5
5	<i>Glyceralongipinnis</i>	1	0	0	1	0	0	2	2	6
6	<i>Glycindeoligodon</i>	4	1	0	0	0	0	0	0	5
	Total	11	6	0	1	2	2	4	9	39

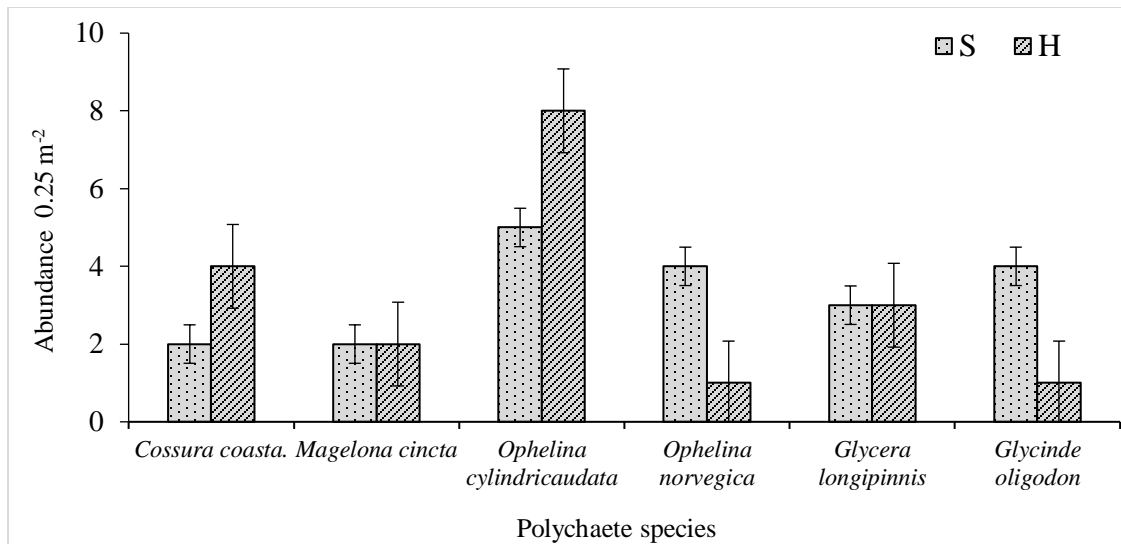


Fig. 8. Comparataive abundance of polychaete species at Hawksbay and Sandspit beach of Karachi coast.

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