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Polychaetes from Suez Gulf (Gabel El Zeit), Egypt

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ABSTRACT

Samples were collected twice Autumn 2018 and Winter 2019, from nine stations were chosen to collect bottom fauna to cover the area of study around sewage pipeline of an oil company in Gable El Zeit, Gulf of Suez. The bottom fauna of the study area consist of 8 taxonomic groups of invertebrate. These groups are Foraminifera, Nematoda, Polychaeta, Bivalvia, Gastropoda, Cumacea, Isopoda and Amphipoda. Due to the importance of macro invertebrate in bio monitoring environmental studies. This study are considered as a step to study bottom fauna present in this area around the sewage Pipeline for an oil company in Gable El Zeit area, as an environmental assessment of this part, with focusing on the polychaete group. The results came out that the stations far away from the drainage pipe are better than nearby also results of some invertebrate groups such as foraminifera, mollusks, polychaetes answer all questions and detected which can used as biomarker of hydrocarbon contamination.

INTRODUCTION

Macrofauna forms the dominant biomass in marine sediment and play an important role in ecosystem processes such as secondary production, nutrient recycling and pollutant metabolism. There are many Oil industries in Suez Gulf, which required great Protection Agency; its control is usually present, Oil considered the most important hydrocarbon contaminant in marine environment (Head et al., 2006). Oil, chemicals and wastes release from Pipelines, due to equipment failure, oil processes, human error or damage. The value of damage depends on where it occurs and how long it remains and impacted environment. Transportation of oil production effect on marine fauna (Dargay and Gately, 2010). Bio monitoring environmental studies used to detect the accumulation of chemicals in marine waters and organisms (Abbes, 2003). Bio monitoring of environment depends on bio indicators species or groups used to determine the presence or absent of contaminants (Chase et al., 2013). Polychaetes show remarkable abundance, species richness and functional diversity in marine benthic communities of both soft and hard bottoms (Musco, 2012). They play key role in ecosystem functioning and in the estimation of diversity and dynamics of benthic communities (Papageorgiou et al., 2006), used as biomarkers due to its capability to accumulate chemicals and hydrocarbons (Mouneyrac et al., 2010, Lucan-Bouché,1999).

Assessing environmental health, as a biological criterion for water quality and in biomonitoring studies (Mikac et al., 2011). They important for the stability of communities of bottom fauna (Fauchald, 1977), Many studies in Suez Gulf reported by Por (1978); Safriel & Lipkin (1975); Ben-Eliahu (1972), Amoureux and Fishelson (1978), El-Komi (1997) and El-Komi & Beltagy (1997), El Komi and Emara (2008), El-Komi et al., (2002) studied the distribution of the macro benthos assemblages in the shallow intertidal zone along the western coast of the Gulf of Suez, Egypt.

Hargrave and Thiel (1983) mentioned that Contamination by petroleum hydrocarbons from oil spills and oil refineries effect on the biology and physiology of benthic organisms which live on bottom (Massara Paletto et al., 2008). Making loss in diversity, richness and abundance of benthic organisms (Yu et al. 2013; Seo et al., 2014). So this study are considered as a step to study bottom fauna present in this area around the sewage Pipeline for one of oil company in Gable El zaat area, as an environmental assessment of this part, with focusing on the polychaete group.

METHOD AND MATERIAL

Samples were collected twice Autumn 2018 and Winter 2019, from nine stations were chosen to collect bottom fauna to cover the area around an Oil Company (Gable El Zeit, Gulf of Suez) sewage Pipeline (Fig.1). Samples were collected by using Van Veen grab (25x25cm). In the laboratory samples were washed through 0.2 mm mesh sieve for small polychaetes and 0.5 mm for the rest of fauna, and then fixed with a 70% ethyl alcohol solution, materials were sorted under a stereomicroscope, then species identified to species level. The photographs of the some species were taken by a digital camera attached to stereo and compound microscopes. The biological diversity coefficient (Shannon-Fenner) was calculated in different stations by applying the following equation (Deshmukh, 1986):

$$H = - \Sigma (ni / N) \ln (ni / N)$$

Also ANOVA test used to detect significant variation between stations, also species abundance was subjected to the cluster analysis for similarity between stations.

RESULTS

The macrofauna of the study area was represented by 116 species belonging to 8 taxonomic groups of invertebrate (Table1). These groups are Foraminifera, Nematoda, Polychaeta, Bivalvia, Gastropoda, Cumacea, Isopoda and Amphipoda.

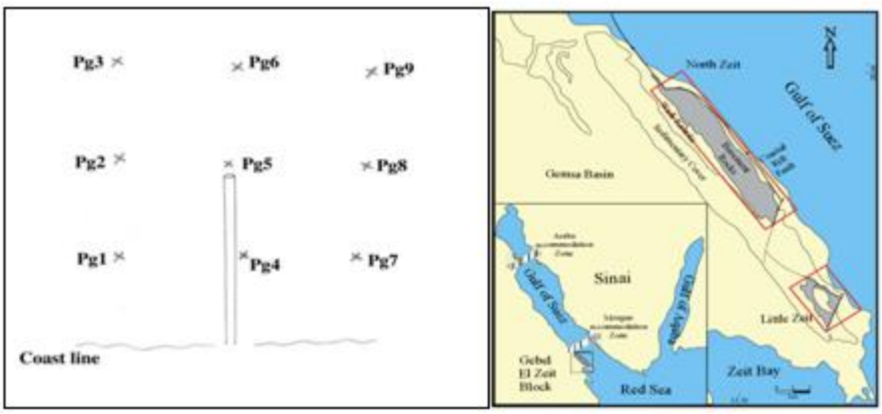

Fig. 1: A general outline of the locations of sampling stations of the bottom fauna of the study area and map of Suez Gulf showing the location of Petro Gulf Company in Gable El Zaat.

Table 1: Shows the number of ind./m² and number of specie in each site in the study area.

Species/ stations	PG1	PG2	PG3	PG4	PG5	PG6	PG7	PG8	PG9
Nematoda spp.	560	288	512	80	1856	304	256	624	64
Polychates	0	0	0	0	0	0	0	0	0
Aglaophamus dibranchis (Grube, 1877)	0	16	0	0	0	16	0	16	16
Aglaophamus lyrochaeta (Fauvel, 1902)	0	16	0	0	0	0	0	0	0
Amphicteis gunneri (M. Sars, 1835)	32	0	0	0	0	0	0	0	0
Ampharete acutifrons (Grube, 1860)	0	0	0	0	0	16	0	16	272
Aonides oxycephala (Sars, 1862)	0	32	0	0	32	32	0	0	32
Arichlidon reyssi (Katzmann, Laubier & Ramos, 1974)	0	0	0	0	0	0	0	0	16
Arichlidon watsonae Cruz-Gómez & Bastida-Zavala, 2018	0	0	0	0	32	0	0	0	16
Aricidea (Acmira) cerrutii Laubier, 1966	16	0	0	0	0	32	0	16	16
Aricidea (Aricidea) capensis bansei Laubier & Ramos, 1974	32	48	0	0	0	0	16	0	96
Aricidea (Stnelzovia) suecica Eliason, 1920	0	0	0	0	0	0	16	0	32
Armandia casuarina Moreira & Parapar, 2017	32	0	0	0	0	0	0	0	32
Aphelochaeta filiformis (Keferstein, 1862)	0	32	0	0	0	0	0	0	0
Brania furcelligera (Augener, 1913)	16	32	0	0	0	0	0	0	48
Capitella capitata (Fabricius, 1780)	0	0	16	0	0	0	0	0	0
Ceratonereis mirabilis Kinberg, 1865	0	32	0	0	0	0	0	0	0
Chone filicaudata Southern, 1914	32	0	0	0	0	16	0	16	32
Chrysopetalum occidentale Johnson, 1897.	0	0	0	0	0	0	32	16	0
Cirriformia capensis (Schmarda, 1861) .	0	32	0	0	0	0	0	0	0
Cirriformia tentaculata (Montagu, 1808)	0	0	16	0	0	0	0	16	0
Protocirrineris chrysoderma (Claparède, 1868)	0	0	0	0	0	0	0	16	0
Cossura longocirrata Webster & Benedict, 1887.	0	0	48	0	0	0	0	0	0
Diopatra neapolitana Delle Chiaje, 1841	16	0	0	0	0	0	0	0	0
Diplocirrus capensis Day, 1961 .	0	0	0	0	0	0	0	32	16
Euclymene lombricoides (Quatrefages, 1866).	0	16	0		0	0	16	0	0
Euclymene oerstedii (Claparède, 1863)	0	16	0	0	0	16	0	0	0
Euclymene mossambica (Day, 1957)	0	16	0	0	0	0	0	0	0
Eunice vittata (Delle Chiaje, 1828)	16	32	0	0	0	0	0	0	0
Exogone dispar (Webster, 1879)	32	16	0	0	0	0	0	0	16
Exogone homosetosa Hartmann-Schröder, 1965	16	0	0	0	0	0	32	0	0
Exogone simplex Hartmann-Schröder, 1960.	16	0	0	0	0	0	0	0	16
Fabricinuda mossambica (Day, 1957).	0	16	48	48	16	32	0	192	32
Goniada asiatica Hartman, 1976.	0	16	0	0	0	16	0	0	32
Glycera brevicirris Grube, 1870.	16	0	0	0	16	0	0	0	0
Glycera sphyrabrancha Schmarda,1861	0	0	0	0	0	16	0	0	32
Hesionides arenaria Friedrich, 1937.	0	0	0	0	0	0	16	0	0
Hesione splendida Lamarck, 1818.	16	0	0	0	0	0	0	0	32
Hesionura elongata (Southern, 1914).	16	16	16	0	0	0	48	0	0
Heteromastus filiformis (Claparède, 1864) .	0	32	16	0	0	0	0	16	0
Hydroides elegans (Haswell, 1883).	0	32	0	0	0	0	0	0	0
Hypereteone foliosa (Quatrefages, 1865) .	16	0	0	0	0	0	0	0	0
Hypereteone heteropoda (Hartman, 1951).	0	0	0	0	32	0	0	0	0
Hypsicomus capensis Day, 1961.	32	0	0	0	0	0	0	0	0
Isolda pulchella Müller in Grube, 1858.	0	0	0	0	0	0	0	32	0
Kirkegaardia annulosa (Hartman, 1965)	0	16	0	0	0	0	0	0	16
Leiochone tenuis Day, 1957 mald.	0	16	0	0	0	0	0	0	0
Lumbrineris cruzensis Hartman, 1944.	32	16	0	0	0	0	96	48	96
Lumbrineris latreilli Audouin & Milne Edwards, 1834	16	0	0	0	0	0	16	0	0
Lumbrineris coccinea (Renier, 1804)	0	0	0	0	0	0	0	32	0
Lumbrineriopsis paradoxa (Saint-Joseph, 1888)	16	0	0	0	0	0	32	16	0
Magelona mirabilis (Johnston, 1865)	0	0	0	0	0	0	0	0	32
Mediomastus fragilis Rasmussen, 1973.	0	0	0	0	0	0	0	0	32
Micronephthys sphaerocirrata (Wesenberg-Lund, 1949)	0	48	32	0	0	16	0	0	16
Micronereides capensis Day, 1963.	0	0	0	0	0	16	0	32	0
Neanthes acuminata (Ehlers, 1868).	0	0	0	0	0	0	0	16	16
Nereimyra punctata (Müller, 1788).	0	0	0	0	0	0	0	0	16
Nephtys longosetosa Örsted, 1842	0	0	0	0	0	0	0	0	32
Nephtys paradoxa Malm, 1874.	32	16	32	0	0	0	0	0	0
Notomastus latericeus Sars, 1851.	48	32	0	0	0	0	0	32	0
Notomastus mossambicus (Thomassin, 1970).	16	0	0	0	0	32	0	0	0
Owenia fusiformis Delle Chiaje, 1844.	0	0	0	0	32	0	0	0	16
Onuphis eremita oculata Hartman,1951.	0	0	0	0	0	0	0	0	32
Opisthodonta morena Langerhans,1879	16	0	0	0	0	0	0	0	0
Oxydromus obscurus (Verrill, 1873).	32	0	0	0	0	0	0	0	16

Paucibranchia conferta (Moore, 1911).	0	0	0	0	0	0	0	0	16
Parexogone hebes (Webster & Benedict, 1884)	0	0	16	0	0	0	0	0	0
Pholoe minuta (Fabricius, 1780).	0	0	0	0	0	16	0	16	32
Phyllodoce groenlandica Örsted, 1842	0	32	0	0	0	0	0	0	0
Pionosyllis heterochaetosa San Martín & Hutchings, 2006.	0	0	0	0	16	0	0	0	0
Podarkeopsis capensis (Day, 1963)	0	0	0	0	16	0	0	0	0
Poecilochaetus spinulosus Mackie,1990	0	0	0	0	0	0	0	0	32
Prionospio cirrifera Wirén, 1883.	32	0	0	0	0	16	32	48	16
Prionospio ehlersi Fauvel, 1928.	112	64	32	0	0	16	32	48	48
Prionospio heterobranchia Moore, 1907	0	0	16	0	16	0	32	16	32
Prionospio saccifera Mackie & Hartley, 1990	0	16	0	0	16	0	0	0	0
Prionospio steenstrupi Malmgren, 1867	0	0	16	0	0	0	0	0	0
Pista unibranchiata Day,1963	0	0	0	0	0	0	0	0	16
Protocirrineris chrysoderma (Claparède, 1868)	0	0	0	0	0	0	0	0	16
Prosphaerosyllis campoy (San Martín, Acero, Contonente & Gomez, 1982)	16	0	16	0	0	0	0	0	32
Sabella fusca Johnston, 1836	16	16	16	0	0	16	32	48	16
Psamathe fusca Johnston, 1836	0	16	0	0	0	0	32	32	0
Scolelepis (Scolelepis) squamata (O.F. Muller, 1806)	16	0	0	0	0	0	32	16	0
Schistomeringos rudolphi (Delle Chiaje, 1828)	16	0	0	0	0	0	0	0	0
Sigambra tentaculata (Treadwell, 1941)	0	0	0	0	0	0	0	0	16
Sige bifoliata (Moore, 1909).	0	16	0	0	0	0	0	16	0
Sphaerosyllis annulata Nogueira, San Martín & Fukuda, 2004	0	0	0	0	0	0	0	48	0
Sphaerosyllis pirifera Claparède, 1868	0	0	32	0	0	0	0	0	0
Sphaerosyllis parabulbosa San Martín & López, 2002.	32	0	0	0	0	0	0	0	32
Sthenelais boa (Johnston, 1833).	0	0	0	0		0	0	16	0
Streptosyllis aequiseta Hartmann-Schröder, 1981.	16	0	32	0	0	16	0	0	32
Streptosyllis bidentata Southern, 1914.	0	0	48	0	0	0	0	0	32
Syllis caeca (Katzmann, 1973)	0	0	0	0	0	0	0	32	32
Syllis garciai (Campoy, 1982).	16	0	48	0	0	0	0	0	48
Timarete punctata (Grube, 1859).	0	0	0	0	0	0	0	16	0
Westheidesyllis corallicola (Ding & Westheide, 1997).	16	0	0	0	0	16	0	16	96
Gastropoda	0	0	0	0	0	0	0	0	0
***Acteocina* simplex**	16	0	0	0	0	0	0	0	0
***Laevidentalium* sp**	16	0	0	0	0	0	0	0	0
Viriola corrugata	0	0	0	16	0	0	0	0	0
Vexillum sp.	0	16	0	0	0	0	0	0	0
Casmaria sp.	16	0	0	0	0	0	0	0	0
Bivalvia	0	0	0	0	0	0	0	0	0
Moerella lactea	16	0	0	0	0	0	0	0	0
***Cardium* sp.**	16	0	0	0	0	0	0	0	0
***Pseudometis* sp.**	0	32	0	0	0	0	0	0	0
Cardiolucina semperiana	0	0	16	0	0	0	0	32	0
Tellidora lamellosa	0	0	0	0	0	0	0	16	0
Cumacea	0	0	0	0	0	0	0	0	0
***Distylis* sp**	16	0	0	0	0	0	0	0	0
***Iphinoe* sp**	16	0	0	0	0	0	0	32	0
Isopoda	0	0	0	0	0	0	0	0	0
***Mesanthura* sp**	0	16	0	0	0	0	0	0	0
Amphipoda	0	0	0	0	0	0	0	0	0
***Apocorophium* sp.**	16	0	0	0	0	0	0	0	0
***Lysianassa* sp.**	16	0	0	0	0	0	0	16	16
Lembos teleporus	16	0	0	0	0	0	0	16	0
Amphilochus neapolitanus	0	0	0	0	0	0	0	48	0
Ampelisca excavat	0	0	32	0	0	0	0	0	16
Leucothoe bannwarthi (Schellenberg, 1928)	0	0	0	0	0	0	0	16	0
Erichthonius brasiliensis (Dana). Delagoa Bay	0	0	0	0	0	0	0	32	16
Ostracoda sp.	64	0	32	0	64	0	0	0	0
Total number of individuals /m²	1632	1104	1088	144	2160	656	768	1760	1776
Total number of species	46	35	21	3	13	19	17	39	51
Diversity index	2.051	2.075	1.84	0.28	0.98	1.775	1.74	2.185	3.1

Table one showed the total number of individuals and number of species also the diversity of organisms in each station. There are many types of foraminifera shells with great numbers are recorded in most station but became less in number in station number four and five, also great numbers of nematodes are present are counted in all stations, maximum number were recorded in station PG5 (1856 ind./m²), while less number are present in stations PG4 and PG9 (80, 64 ind./m² respectively). Mollusks represented by 10 species five Gastropods and five Bivalve (Table1), Cumacea two species *Distylis* sp. and *Iphinoe* sp., Isopoda one species *Mesanthura* sp. recorded in PG2, seven Amphipoda species are represented but with less number of individuals in most station except stations PG8, PG1 and PG9, they are *Apocorophium* sp, *Lysianassa* sp, *Lembos teleporus*, *Amphilochus neapolitanus*, *Ampelisca excavat, Leucothoe bannwarthi*, *Erichthonius brasiliensis*.

Great total number of individuals recorded at station PG5 (2160 ind./m²) due to the presence of great number of nematode (1856 ind./m²), it share by 19% of the total number of individuals recorded during this study, stations number 4, 6 and 7 shared by 1%, 6% and 7% from the total number of organisms respectively (Fig. 2).

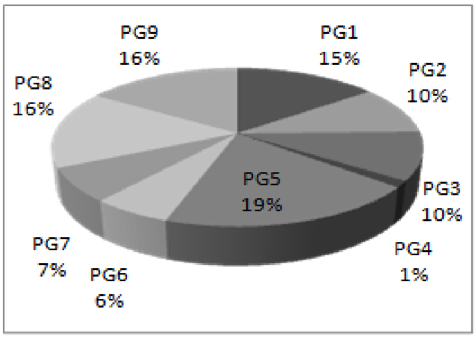

Fig. 2: Shows the percent of total number of individuals of organisms for all fauna in each station at the study area.

Polychaetes was the most diversified group represented by (94 species) belonging to 28 families and 70 genera with total number of individuals 5808 ind./m², average polychaete abundance was high at station PG9 and low at station PG4 (48 ind./m²). ANOVA test showed insignificant variation between stations (P< 0.05) and detected that maximum abundance of polychaetes was at station PG9 (1648 ind./m²) and the least one at station PG4 (48 ind./m²) (Tables 3 & 4). Thirty three polychaete species dominant in the study area, their abundance together contributed 43.251% from the total polychaetes fauna (Table 2).

Table 2: Dominant polychaete species at sampling station during the present study.

Dominant polychaete species	PG1	PG1	PG1	PG1	PG1	PG1	PG1	PG1	PG1	%
Fabricinuda mossambica (Day, 1957).	0	16	48	48	16	32	0	192	32	6.65
Streptosyllis aequiseta Hartmann-Schröder, 1981.	16	0	32	0	0	16	0	0	32	1.63
Sabella fusca Johnston, 1836	16	16	16	0	0	16	32	48	16	2.76
Prionospio ehlersi Fauvel, 1928.	112	64	32	0	0	16	32	48	48	6.06
Ampharete acutifrons (Grube, 1860)	0	0	0	0	0	16	0	16	272	5.24
Prionospio cirrifera Wirén, 1883.	32	0	0	0	0	16	32	48	16	2.47
Westheidesyllis corallicola (Ding & Westheide, 1997).	16	0	0	0	0	16	0	16	96	2.47
Prionospio heterobranchia Moore, 1907	0	0	16	0	16	0	32	16	32	1.91
Micronephthys sphaerocirrata (Wesenberg-Lund, 1949)	0	48	32	0	0	16	0	0	16	1.91
Aricidea (Aricidea) capensis bansei Laubier & Ramos, 1974	32	48	0	0	0	0	16	0	96	3.31
Aonides oxycephala (Sars, 1862)		32	0	0	32	32	0	0	32	2.20
Lumbrineris cruzensis Hartman, 1944.	32	16	0	0	0	0	96	48	96	4.96
Hesionura elongata (Southern, 1914).	16	16	16	0	0	0	48	0	0	1.63

Table 3: Analysis of Variance (ANOVA)

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Factor	8	18928	2366.0	8.19	0.000
Error	846	244467	289.0		

Total	854	263394

Table 4: Represented the means

Factor	N	Mean	StDev	95% CI
PG1	95	8.93	15.95	(5.50; 12.35)
PG2	95	7.92	13.58	(4.49; 11.34)
PG3	95	5.22	12.23	(1.80; 8.64)
PG4	95	0.505	4.925	(-2.918; 3.928)
PG5	95	2.358	7.369	(-1.065; 5.781)
PG6	95	3.705	8.236	(0.282; 7.128)
PG7	95	5.39	14.31	(1.97; 8.81)
PG8	95	9.77	23.26	(6.35; 13.19)
PG9	95	17.35	33.47	(13.92; 20.77)

The average abundance of *Fabricinuda mossambica* range (16-192 ind./m²), *Prionospio ehlersi* range (16-112 ind./m²) and *Ampharete acutifrons* range (16-272 ind./m²) species. This study revealed that family Spionidae (7 species) and Syllidae (16 species) with the highest number of individuals (848 and 978 ind./m² respectively), shared by 14% and 17%, followed by family Sabellidae shared by 12% from the total polychaetes individuals and the rest families with less percent (Fig.7). Polychaetes are representative in all stations, with an average 81% of the total number of species and 53% from the total number of individuals followed by nematode, which represented by 41% from the total number of individuals of total fauna. While the rest of groups showed less percent (Figs. 3, 4).

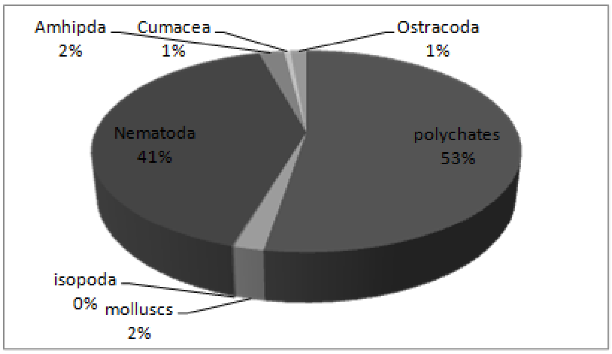

Fig. 3: Shows the percent of total number of individuals for each group of fauna in the study area.

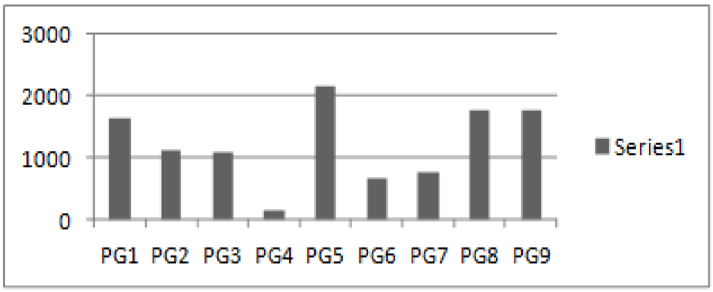

Fig. 4: Shows the total number of inds./m² in each station at the area of study.

Stations PG9 are the most diverse station (51 species), also 46 species recorded at station PG1. PG4 with the least number of species (3 species).
Table (1), Fig. (5). indicates an increase in the number of species in the areas fare from the source of drainage.

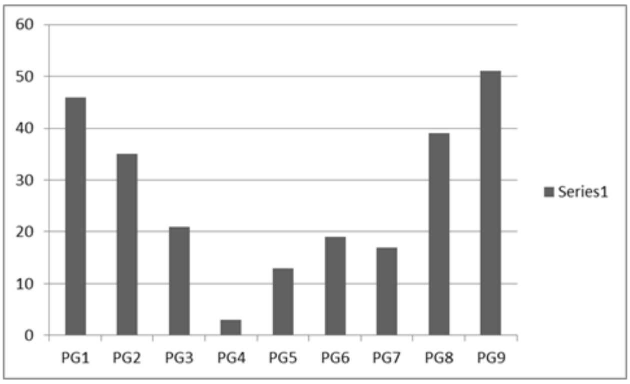

Fig. 5: Shows the total number of species in each station at the area of study.

The biological diversity coefficient (Shannon-Fennier) was calculated in different stations by applying the following equation (Deshmukh, 1986):

$H = - \Sigma (ni / N) \ln (ni / N)$

Where ni represents the number of species in each station, while N is the total number of all species in the same station. This coefficient indicates the degree of pollution in different stations and decreases its value as pollution increases.

The results showed that the highest values of the biological diversity parameters (3.1 and 2.185) are recorded in the stations PG9 and PG8 respectively. A relatively large value (2.05 and 2.075) also recorded in PG1and PG2 stations respectively while the lowest value was (0.28 and 0.98) are recorded in stations (PG4 and PG5), (Fig. 6).

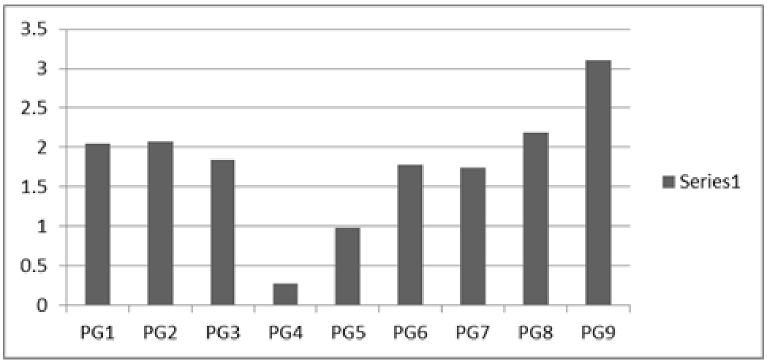

Fig. 6: Shows the biological diversity of each station of the study area.

The degree of contamination of water bodies was classified according to the value of biological diversity factor (Wiehm, 1972). It is assumed that the higher value of 3 indicates that this area is free of pollutants and that the value between 1 and 3 indicates that this area has a moderate percentage of pollution. A value of less than 1 indicates that this area has a high percentage of contaminants.

If this assumption is taken stations PG2 and PG9 are fare from the sources of pollutants. Station PG4 is the most polluted and has a high percentage of contaminants with a biodiversity value of 0.28. The lowest percentage of pollution is assumed to be located at stations PG2 and PG9 (Figure 6). So, these stations can be taken as references.

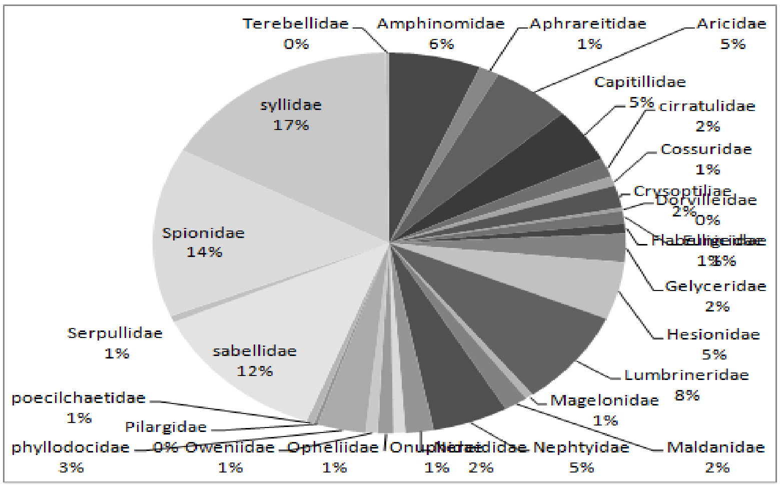

Fig. 7: Shows the percent of each family of polychaetes recorded in the study area.

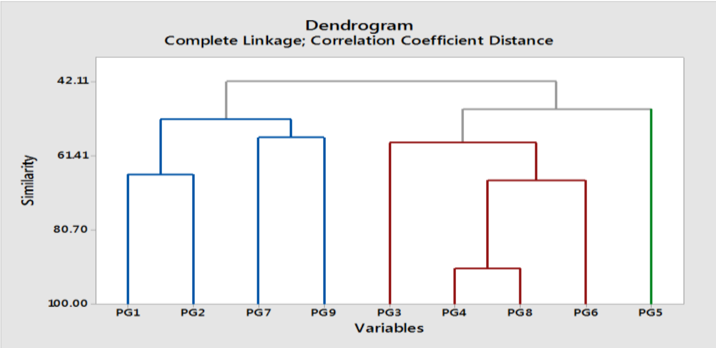

Fig. 8: Represented the Dendgram of similarity (Cluster analysis).

Species abundance was subjected to the cluster analysis (Fig. 8). It detected two groups, stations (PG3, PG4& PG6) clustered together with about 50% similarity (Group I) Station PG7 and PG9 with 55% beside PG1 and PG2 with about 65% similarity (Group II), The channel station (PG5) did not cluster with other stations.

DISCUSSION

Syllidae species are sensitive to pollution, such as *Streptosyllis aequiseta* which considered as dominant species in the study area but disappeared from the station near to the source of drainage, also family Nephtyidae represented by 5% from the total polychaetes are recorded in the station far away from the source of drainage.

The area of study was dominated by opportunistic species like spionidae sp. such as *Prionospio ehlersi*, Sabellidae sp. such as *Fabricinuda mossambica* and *Sabella fusca*., Sivadas et al. (2010) mentioned that the benthic community in an unstable environment is typically dominated by r-selected species, characterized by higher reproduction rate and genetic variation, and is therefore more stress tolerant such as Spionidae, Cirratulidae, Magelonidae and Cossuridae species, they are surface or subsurface feeders, and are established as pollution indicators (Grassle and Grassle , 1974).

The low diversity in the station near the source of drainage reflects the negative effect of increase organic contaminant. Present results agrees well with the maximum diversity is observed in stations fare away from the source PG9 and PG2, and PG1 which have moderate values of organic contaminant of oil. The presence of Capitellidae and Cirratulidae species indicated that the area suffer from oil pollution, this agrees with Holmer et al., (1997) and Seo et al., (2014), they mentioned that (Spionid, Cirratulids, Cossurids, Capitellids) are known to have remarkable tolerance of hydrocarbon and other pollutants that are toxic to most other fauna. Further, carnivorous species belonging to the family Glyceridae, Goniadidae, Eunicidae, Nereididae were recorded in low abundance this agree with these results where they share by only 1-2% from the total polychaetes recorded. Pearson and Rosenberg (1978) reported that Crustaceans, specially the amphipods show high sensitivity to pollution and disappear from highly polluted habitats, so in this study it shared by only 2% from total fauna and disappeared from all station near the source of oil release.

In general, there was a very low impact of the spills on Polychaetes, but high on amphipod crustaceans and mollusks. This detected by the presence of many empty shells of mollusks recorded during this study. This confirmed by Kalman et al. (2010), who mentioned that biomarkers are generally more sensitive to pollution factors than natural factors.

The general picture of the benthic biota in different stations indicates that the biological diversity coefficient is increased in only two stations (PG2, PG9), which means that they fare away from the source of the pollutants. There is also a relatively high value of the biodiversity factor in PG8 and PG1 stations, which indicates low pollution in these stations. The low values of the biological diversity factor in most other stations can be attributed to the environmental disturbance in the study area and its impact with petroleum organic pollutants and possibly other types of industrial pollutants. the presence of oil residues on the wall of the bottle samples after washing the samples, means that great amount of oil contaminated the area and effect on fauna especially samples of PG4, PG5 and PG6 stations with less number of species and total number of individuals.

The presence of large numbers of foraminifera’s shells, as well as dead mollusks and the less number of crustaceans (e.g. Amphipod and Isopoda) give a good evidence of increased negative toxicities of petroleum organic pollutants to benthos in the study area.

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