

Using Bottom Marine Sediments as Environmental Indicator State of (Tolmaitha – Toukra) Region at Eastern North Coast of Libya

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Abstract

Original Research Article

This study was carried out on sediment samples collected from the region extended between Tolmaitha and Toukra towns at (Libya) North eastern coast. The study aimed to use the marine sediment as indicator pollution of the studied area. Different heavy metals of (Fe, Mn, Zn, Cu, pb, Cd, Co and Cr) beside the organic matter (O.M), Total phosphorus (T.P) and total nitrogen (T.N) were determined. The results showed variations in concentrations of total phosphorus (T.P) contents and ranged between (0.0037-0.319 ppm) and (0.007-0.240 ppm) during winter and summer seasons, respectively. The total nitrogen contents were fluctuated in the ranges of (0.0017-0.370 ppm) and (0.014 – 710ppm) during winter and summer seasons, respectively. Also the results showed that the organic matter (O.M) values were ranged between (0.072-0.720%) and (0.097-0.502%) during winter and summer seasons, respectively. The contents of heavy metals in sediment samples during summer season were ranged as follows:(16.5 –398.1 µg/g), (10.436 – 33.879 µg/g), (13.8 – 287.6 µg/g), (0.78 – 31.56 µg/g), (1.34 – 46.72 µg/g), (2.36 – 128.76 µg/g), (9.15 – 28.16 µg/g), (2.17 – 323.41 µg/g) , for Fe, Mn, Zn, Cu, Pb, Cd, Co, and Cr, respectively. The results showed high values of calcium in the studied sediment samples compared to the potassium and sodium contents. The results of the studied gave indication that area under investigated contain high values of heavy metals, total phosphorus and total nitrogen, this is mainly attribute to the human activities at the studied locations.

Keywords: sediment samples, Marine Sediments, Tolmaitha and Toukra towns, pollution.

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INTRODUCTION

Libya is an African nation lining the Mediterranean Sea, Its shore stretches out over 1,810 km with significant parts that are still in generally excellent normal condition, Despite the fact that oil investigation and exploitation, fisheries adrift and urbanization of the coast are the main human activities, numerous others exist in the Libyan waterfront zone, (Fauzi et al., 2001). The Mediterranean climate is one of the most extravagant and simultaneously generally helpless on the planet a faltering 80% of its contamination comes from land based sources fast urbanization along with expanding and unreasonable waterfront the travel industry improvements is causing huge natural and medical conditions the greater part the major metropolitan regions don't wastewater therapy plants and a large portion of the wastewater they produce is released in to the ocean (Michael, 2010). Contamination of the

waterfront water typically disrupts different water uses, refined bivalves are by and large raised in regions that are frequently thickly populated and are delicate to weighty contamination from human activities, microorganisms communicated by human countenances are most generally involved and the release of sewage dirtied by human and creature microbes into the ocean addresses the primary wellspring of bacterial pollution, each microbe present in seawater might be caught and gathered in the tissues of the bivalves thus addresses a potential wellbeing hazard, the way that most of metropolitan populaces rely upon seaside surface waters which are normally utilized for sewage removal, somehow, makes water contamination the important issue that requires sound administration practices to contain impacts, the review is created to make an evaluation to assess what is going on and give precise

data on the water quality (Subramani and Mangaiyarkarasi, 2014).

Meaning of Marine contamination: The term marine contamination was characterized by Joined Country working gathering called "Gathering of Master on Logical Parts of Marine natural Security (GESAMP)", characterized it as "Contamination implies presentation by man, straightforwardly or in a roundabout way of substances or energy into the marine climate (counting estuaries) bringing about such pernicious impacts as damage to living assets, risks to human wellbeing, impediment to marine exercises including fishing, weakness of value for utilization of seawater and decrease of conveniences" (Langston, 1990). **Wellsprings of Marin Pollution:** Oil is released in to the ocean in different structures as unrefined petroleum and as discrete parts, a large portion of the oil divisions are biodegradable, oil and its portions are utilized in different ways from family necessities to cars and ventures, the spilled oil more obliteration in the marine climate .Typically the metals having the nuclear weight more than twenty is considered as weighty metals, the term " weighty metals" is utilized to indicate components with explicit weight higher than those of Iron (Fe) and principally Lead (Pb), Copper (Cu), Cadmium (Disc) and Chromium (Cr)and Manganese (Mn) and (Zn) and (Co) (Davis *et al.*, 2003).

Pesticides: Pesticides are poisons (synthetic mixtures) utilized in horticultural ranch to kill the undesirable pets creatures joining the developed plants, A pesticide is any substance or combination of substances planned for forestalling, obliterating, repulsing , or relieving any irritation, vermin can be bugs, mice and different animals, undesirable plants (weeds), growths, or microorganisms like microbes and infections , However frequently misjudged to allude just to bug sprays, (Djomo *et al.*, 2006). **Radioactive Materials:** (Djomo *et al.*, 2006). **Supplements:** The supplements are for the most part of nitrogen, phosphorus and silicates, supplements are utilized by plants and creatures in a convoluted cycle, got back to the climate and afterward reused, they are fundamental for the development of marine essential makers like phytoplankton, kelp and ocean grass (Dowling and Sheehan, 2006).

Impact of Contaminations on Marine Creatures: Poisons go into to the seas are for the most part weakened, but the organic entities living in the seas will generally pack the toxins into their body different systems, similar to adsorption, assimilation, ingestion and so on, the convergence of toxin increments with higher trophic levels, i.e., from essential makers to the tertiary consumer, the edge furthest reaches of organic

entities to the toxin fixation increment with expanding trophic levels, different method of contamination transport in organic entities incorporates bio concentration, bioaccumulation and bio magnifications, (Funk, 2001).This study was carried out to evaluate the heavy metal contents of marine sediment at some locations of Libya coast.

MATERIALS AND METHODS

Description of the Studied Area

The area of study reaches out along the shore line of Tolmitha - Tukra locations around long distance of 40 km. Tolmitha, Ptolemais is by and large known as Ptolemais, it is situated at the wonderful region between the Green Mountain and the ocean, around 30 km west of Almerj city. It was established as port to serve Almerj, after it turned into a bustling business community during the 6th century BC, with merchandise showing up from the close by ports, for example, Alexandria port in Egypt, well as to trade the principal produce of the district, similar to sulphium, honey, spread and grains. Tukra, (Taucheira) is a town situated on the shore of Almerj Region, is the old second archeological town, established by the Greeks in Libya during the last quarter of the seventh century found 60 km east of the city of Benghazi. The city was previously known as Taucheira and Arsinoë and contains numerous landmarks which are dismissed by authorities in the Libyan government. The areas of this study region displayed in Figure (1) and Table (1).

Table 1: The area of study locations

Location (No)	Station
1	Ardano-Tukra
2	Tukra D
3	Botraba D
4	Tolmitha 1
5	Tolmitha D3
6	Tukra west
7	Botraba-Ardano
8	Botraba
9	Tukra west
11	Ardano D
11	Tolmitha 2
12	Tolmitha-Botraba
13	Tolmitha D2
14	Ardano-Tukra D
15	Tukra
16	Tolmitha-Botraba D
17	Tolmitha 3
18	Ardano
19	Tolmitha D1
21	Botraba-Ardano D

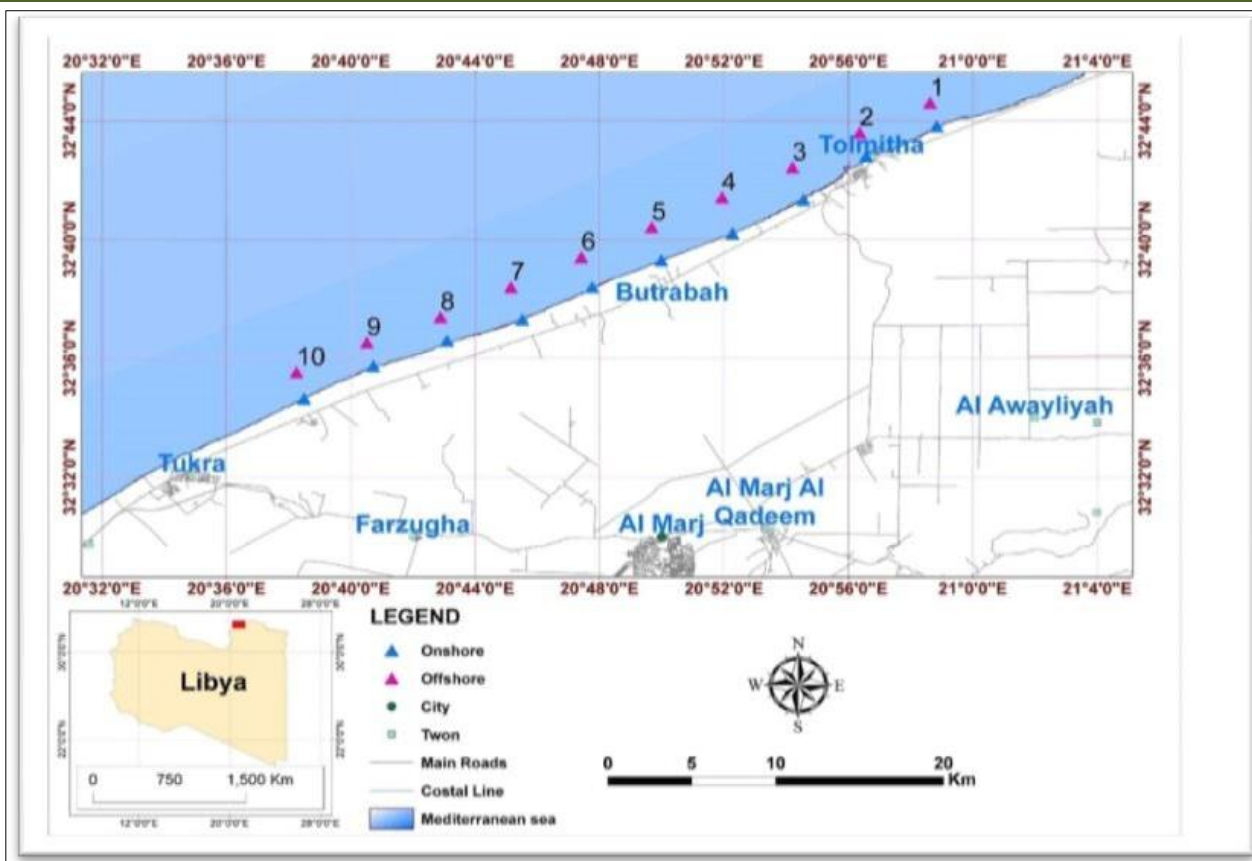


Figure 1: The stations of the studied area

Sediment Samples

Twenty surface sediment samples were collected during summer (2020) and Winter (2021) from (Tolmitha and Toukra) coast, the examples were kept in polyethylene packs, washed with refined water and dried at 85 °C in a broiler, then crushed in agate mortar, then, at that point, moved to the lab for examination.

Organic Matter

The natural carbon in the still up in the air by the accompanying procedure: 10 ml of chromic corrosive ($K_2Cr_2O_7 + H_2SO_4$) was added to 0.3 g of a finely powdered of sediment sample was warmed up to 85 °C for 15 minutes in an electric broiler. The cylinder was taken out from the warming and cooled by plunging in a virus water. The samples were transferred into 250 ml measuring flask (100 ml), then small amount of diphenylamine was added, and titrated against 0.2 N ferrous ammonium sulfate arrangement. The contents of organic matter were calculated by method described by (Hamad and Mojahid, 2010) & Hamad, 2006).

Total Phosphorus

About 0.5 g of the dry sediment sample was designed by a combination of 2 ml concentrated nitric acid and 2 ml perchloric acid. After that the samples were cooled, then filtrated and transferred into 250 ml volumetric flask, the molybdate method was used for estimate phosphorus contents (Hasan, 2006).

Total Nitrogen

The contents of total nitrogen were estimated by Nesler method (Hasan, 2006).

Minerals: (Sodium, potassium and calcium):

Sodium, potassium and Calcium concentration were estimated by utilizing a flame photometer type (JENWAY-CLINICAL PEP7).

Heavy Metals

Iron, manganese, zinc, cadmium, cobalt, lead, copper, were estimated during summer in sediment samples. 0.5 g of samples was designed by HNO_3 , the samples were cooled at room temperature. Then filtered by filter paper (0.45 μm). After filtration the examples were transferred into 100 ml, then the volume was completed by Distilled water (Hasan, 2008 & Nabil *et al.*, 2018) (Hamad and Mojahid, 2010) & Hamad, 2006). The concentrations of metals were measured by spectrophotometer (AAS), Perkin-Elmer (Model 2380).

Statistical Programs

Two different programs (Excel and R) were used to estimate the \pm SD, Average and correlation coefficient of the obtained data.

RESULTS AND DISCUSSION

Total Phosphorus

Phosphorus helps into the marine climate through sources especially farming manures, pesticides

and so, right on track and non-point sources, for example, treated and untreated sewage effluents starting from families and enterprises (Avale's *et al.*, 2006). Subsequently, observing of phosphorus content in the water and dregs is fundamental for control and stay away from eutrophication of the seaside oceanic climate, Momentum wealth of phosphorus in the earth outside is around 0.12%, notwithstanding, practically all the phosphorus on the earth crust is found as minerals including apatite (chloro and floro), vivianite, wavellite and phosphorite, the sorption of phosphate on silt has significant impacts ontransport, corruption and extreme destiny of phosphorus in marine environments (Frossard *et al.*, 2000; Ramanathan *et al.*, 2008). Phosphorus fractionation in the residue can give important data on the beginning of phosphorus, the level of contamination from anthropogenic exercises, the bioavailability and furthermore the entombment and digenesis of phosphorus in the silt (Schenau and De lange, 2001). The significance of the impact of dregs on the marine environment relies upon the synthetic type of phosphorus

in which this component is joined (Avile's and Niell, 2005).

The convergences of all out phosphorous substance in the residue were changed between: (0.0037-0.319 ppm) and (0.007 - 0.240ppm) during winter and summer seasons, separately, Table (2). The high qualities are most likely because of the extraordinary measures of manures remembering phosphate for the effluents of sewage, notwithstanding the homegrown, sewage, farming and modern effluents. The phosphorous mixtures are basically exist as broken up substances. These are removed from the arrangement and used for taking care of by various living beings which up on death, fall and collect on the base. These lead to an increment the phosphorous substance in residue until delivered again into arrangement by the activity of microbes (Avile's and Niell, 2005). The correlation coefficient matrix showed that phosphorus is positively correlated ($r = 0.15, 0.06, 0.06, 0.25, 0.34,$ and 0.31) with (Co, Pb, Zn, N, F, and Cu). Figure (2).

Table 2: Concentrations of total phosphorus content in the sediment samples during winter and summer

Seasons Locations	Winter (ppm)	Summer (ppm)
1	2.2442	2.222
2	2.2242	2.245
3	2.2448	2.221
4	2.442	2.612
5	2.261	2.661
6	2.266	2.244
7	2.441	2.241
8	2.442	2.212
9	2.282	2.216
10	2.242	2.245
11	2.212	2.241
12	2.2444	2.242
13	2.442	2.244
14	2.282	2.268
15	2.448	2.241
16	2.468	2.245
17	2.425	2.241
18	2.222	2.266
19	2.412	2.264
20	2.466	2.244
Average	2.212	2.212
SD±	2.282	2.221

Total Nitrogen

Anthropogenic N enters the waterfront marine climate due to two fundamental people's exercises the ignition of natural make a difference to deliver energy (counting biomass, coal, oil, and flammable gas) and the creation and con-sumption of food (Galloway *et al.*, 2002). Nitrogen contamination and the issue of expanding environmental CO₂ are connected, however the decision of fuel and further developing innovation can change the connection in significant ways (Galloway and Cowling, 2002). Since the oxidized barometrical N shows up as nitric corrosive in downpour, N

contamination and lake and woodland fermentation are additionally connected. Since fuel burning places receptive or naturally accessible N into the air, that N can undoubtedly travel huge spans before it is kept ashore and water. This implies that N can be stored on waterfront watershed and seaside marine waters from sources a long way from the coast and beyond the watershed depleting to drift. The centralizations of all out Nitrogen content in the dregs were vacillated between: (0.0017 - 0.370 ppm) and (0.014 - 0.710 ppm), during winter and summer seasons, separately, Table (3). The lower upsides of TN might be ascribed to the surprising

expansion in standing harvest of autotrophic creatures. The amount of phytoplankton arrived at the level which expanded the pace of uptake (Meybeck *et al.*, 1988) & (Hamad, 2006).

The correlation coefficient matrix showed that Nitrogen is positively correlated ($r= 0.06, 0.56, 0.25,$ and 0.28) with (Co, F, P, and Cu) Figure (3).

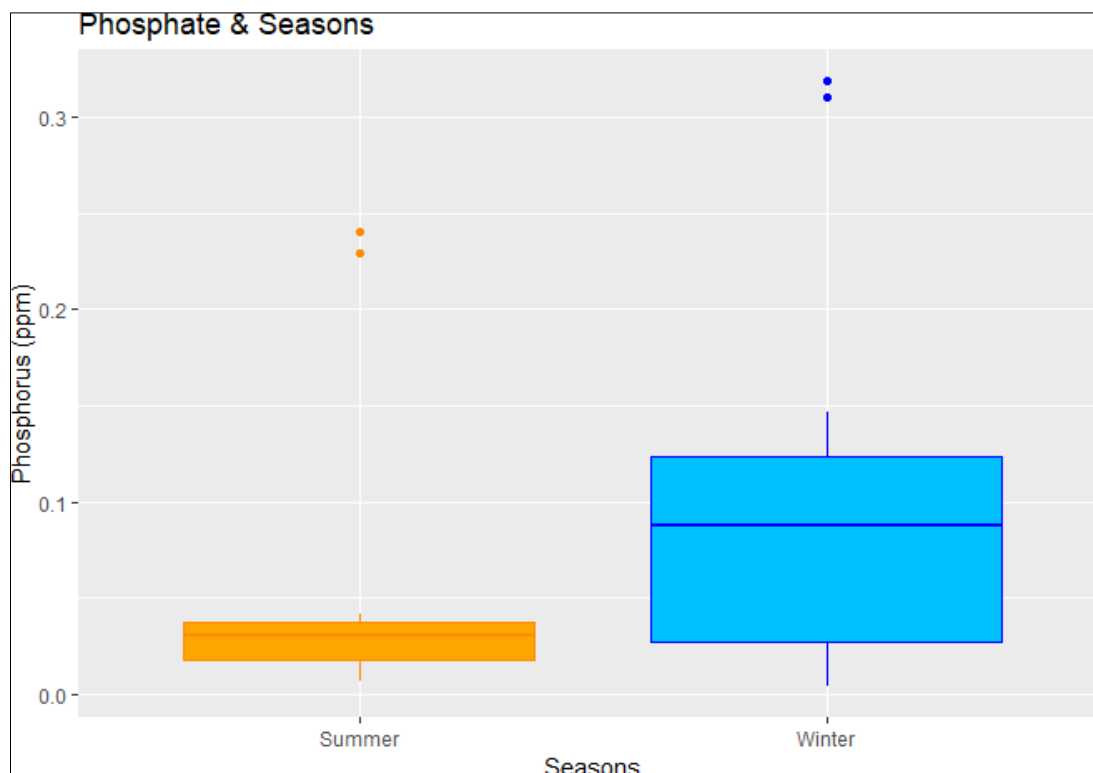


Figure 2: Grouped box plot illustrates the total phosphorus values in the sediments during winter and summer

Table 3: Concentrations of total Nitrogen content in the sediment samples during winter and summer

Seasons Locations	Winter (ppm)	Summer (ppm)
1	2.2241	2.444
2	2.2242	2.665
3	2.2212	2.611
4	2.624	2.622
5	2.612	2.551
6	2.214	2.442
7	2.442	2.241
8	2.2422	2.248
9	2.444	2.482
10	2.222	2.422
11	2.445	2.422
12	2.222	2.252
13	2.484	2.226
14	2.425	2.242
15	2.444	2.125
16	2.224	2.441
17	2.215	2.262
18	2.488	2.2421
19	2.422	2.248
20	2.442	2.426
Average	2.415	2.645
SD±	2.442	2.414

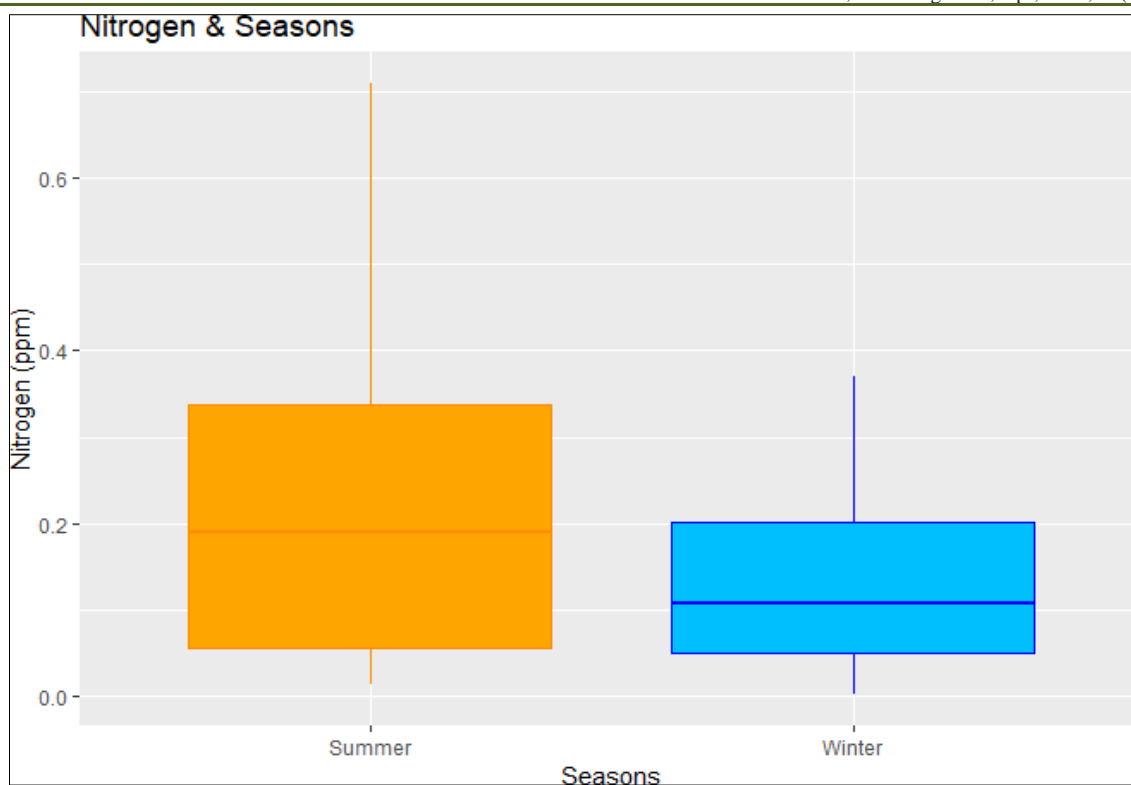


Figure 3: Grouped box plot illustrates the Total Nitrogen values in the sediments during winter and summer

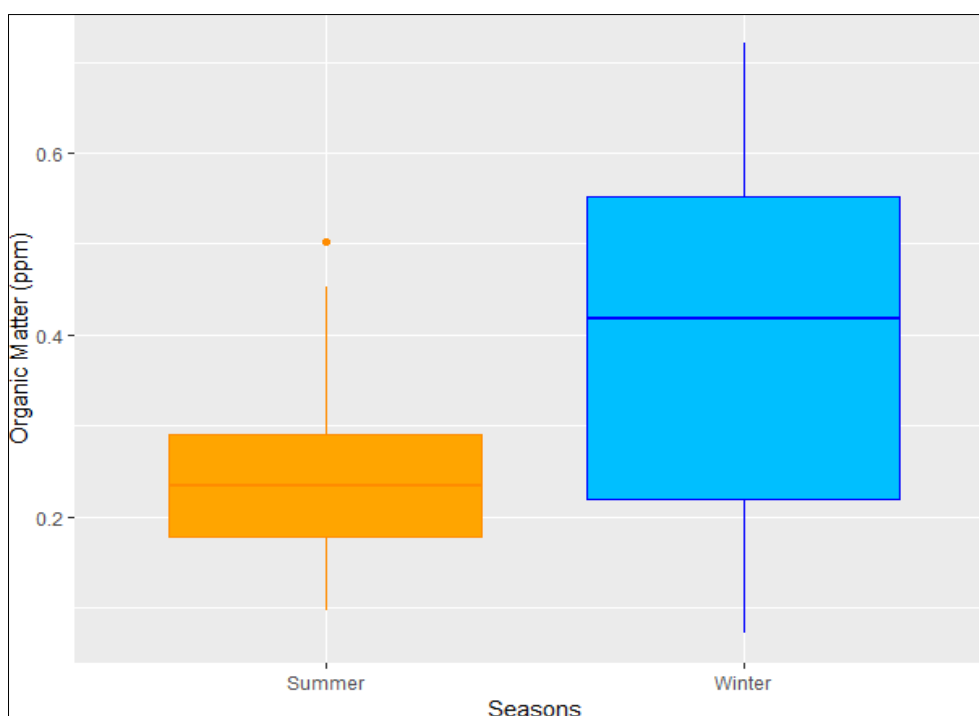
Organic Matter

Broken up natural matter (OM) in the ocean is one of the biggest repositories of natural matter on the world's surface (others remember soil natural matter and plant biomass for land), holding roughly as much carbon as is accessible in barometrical carbon dioxide (Hedges, 1992). Essential creation is a definitive wellspring of natural matter in the ocean, yet living biomass shapes under 1% of complete natural carbon in seawater, while over 90% of natural carbon happens as non-living DOC. As opposed to the natural repositories ashore, the cycles by which DOM has been framed are indistinct, and genuine sources and the compound idea of DOM are not notable. DOM has different capabilities and assumes significant parts in substance, natural and, surprisingly, physical oceanography, for instance, DOM associates with follow metals or radionuclide's and controls their elements, it fills the microbial circle, produces gases (CO and CO₂) and supplements with natural and photochemical responses, retains and quenches light, and influences satellite pictures etc, the earthly contribution of DOM is additionally a significant point in the worldwide carbon spending plan as well as carbon elements in waterfront conditions (Hamad and Mojahid, 2010) & Hamad, 2006). In this audit, in any case, we center around late advances in how we might interpret

the elements and substance portrayal of maritime DOM. Elements of DOM in the climate are not portrayed. The concentrations of organic matter content in the sediments were fluctuated between (0.072% - 0.720%), and (0.097% - 0.502%), during winter and summer season, respectively, Table (4). Aggregation of natural matter in silt is impacted by the size of the bowl, the wide of the mainland stage, the lootom relief, and other morphological elements. Physical (temperature, light, oxygen) and natural qualities (rivalry among species, propagation) are basic variables in the foundation and upkeep of the species possessing a residue (El-Sokary *et al.*, 1988). The quantative appropriation of natural matter substance in the silt relies primarily upon certain variables: The allocthonous natural burden going into the waters with sewage and modern squanders. The allocthonous natural creation of the sediments. The deterioration of organic matter and Particle arrangement of the sediments. The correlation coefficient matrix showed that positively correlated with (Ca, K, Na, Co, Mn, and N), ($r = 0.33, 0.34, 0.72, 0.13, 0.24$ and 0.01) respectively, Figure (4). However, the positive relationships kept between natural matter and most metals in the dregs, is presumably because of the natural matter related with silt particles. This is to a great extent liable for the capacity of silt to adsorb the metals.

Table 4: Concentrations of organic matter % in the sediments samples during winter and summer

Seasons Locations	Winter (%)	Summer (%)
1	2.422	2.644
2	2.244	2.125
3	2.622	2.428
4	2.248	2.481
5	2.226	2.212
6	2.544	2.125
7	2.422	2.614
8	2.662	2.428
9	2.248	2.526
10	2.141	2.662
11	2.562	2.662
12	2.142	2.651
13	2.422	2.426
14	2.245	2.651
15	2.262	2.154
16	2.542	2.614
17	2.416	2.662
18	2.148	2.614
19	2.641	2.426
20	2.421	2.442
Average	2.142	2.62
SD±	2.622	2.444

**Figure 4: Grouped box plot illustrates the organic matter values in the sediments during winter and summer**

Major Cations: The main cations contained in natural water are Ca^{2+} , Na^+ , Mg^{2+} and K^+ .

Calcium (Ca^{2+}):

Calcium is one of the significant components in seawater. It is basic for the development of various organic designs, including the skeletons and shells of green growth, and other invertebrates, carbonate, then again, capabilities as skeleton component of corals and

different spineless creatures, as cushion framework as well as supplement for algae, in nature variety of the calcium fixation is generally extremely low and because of an adjustment of saltiness brought about by for example changes of temperature or convergence from rivers, in reefs, calcification responses of organic entities affect the calcium focus because of the huge volume of the encompassing ocean water (Brockmann and Janse, 2008). The values of calcium concentrations in the area

under study were ranged between (102-43 ppm) and (44-70 ppm), respectively, during winter and summer seasons, Table (5). The high qualities might be because of biogenic beginning, where creatures residing in the water promptly dynamic calcium to shape their skeletal system. In this way, when these life forms passed on, their skeletons start to rot (Saad, 1987). The correlation coefficient matrix showed that, calcium is positively

correlated ($r= 0.33, 0.51, 0.42, 0.39,$ and 0.31) with (OM, K, Na, Pb, and Mn), respectively, Figure (5). Generally, the adjustment of calcium content, might be credited to a few factors, for example, the biometrical combination of mollusks, coralline, green growth, echinoids, foraminifera tests, carbonate petetiods and the precipitation of $CaCO_3$ from the water segment (Jahnke and Jahnke, 2004).

Table 5: Concentration of major cations Ca^{2+} in the sediment samples during winter and summer

Seasons Locations	Winter (ppm)	Summer (ppm)
1	51	22
2	426	28
3	14	56
4	25	58
5	28	56
6	14	18
7	22	56
8	24	26
9	82	22
10	15	22
11	25	52
12	52	54
13	54	54
14	51	11
15	84	22
16	25	25
17	22	24
18	21	28
19	22	54
20	84	54
Average	28	58
SD±	45	8.2

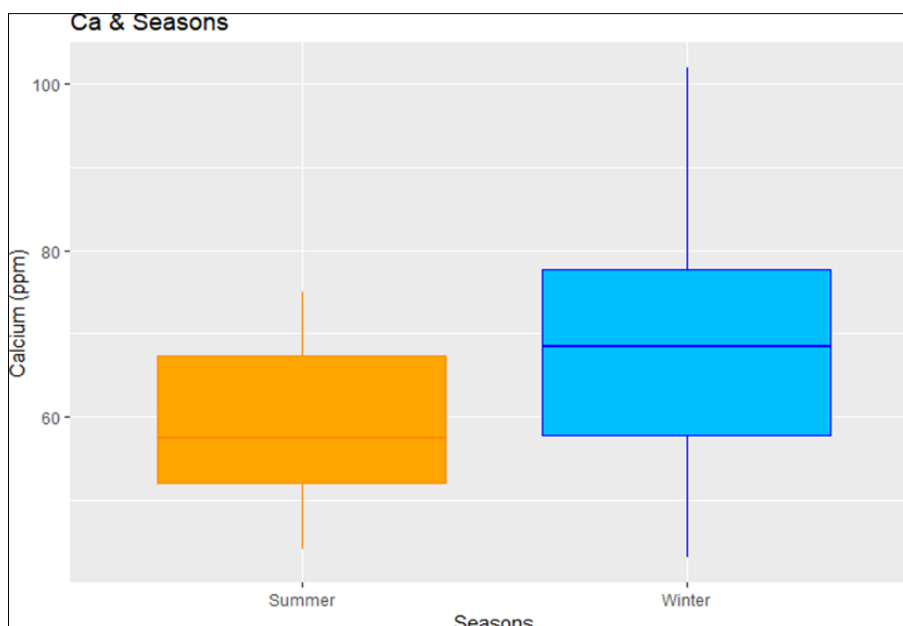


Figure 5: Grouped box plot illustrates the Ca^{2+} values in the sediments during winter and summer

Sodium and Potassium (Na^+ & K^+)

The sodium in salting its ionized structure is a decidedly charged cation. The ionized chloride frames a

bigger, adversely charged anion, the size distinction among Na^+ and Cl^- works with accomplishing a very much pressed salt crystal, because of both the compound

properties of salt and the synthetic properties of water, salt disintegrates quickly in water, separating into isolated sodium and chloride ions, in the event that the substance properties of salt were unique, NaCl wouldn't be equipped for doing capabilities in the body are vital forever (Bergman, 2010). The upsides of sodium fixations nearby under study were gone between: (45 - 109 ppm), and (52 - 118 ppm), individually, during winter and summer seasons, Table (6). The high sodium

contents in marine residue might be ascribed to the capacity of specific life forms to focus sodium (Riley and Skirrow, 1995). The correlation coefficient matrix showed that sodium is positively correlated ($r=0.72, .042, 0.74,$ and 0.1) with (OM, Ca, K, and Co), Figure (6). The positive correlation coefficient of sodium with OM, Ca, K, and Co, pointed to the distribution of both elements in the sediments may depend and each another, (Mamdouh *et al.*, 2010).

Table 6: Concentrations of major cations Na⁺ in the sediment samples during winter and summer

Seasons Locations	Winter (ppm)	Summer (ppm)
1	15	81
2	52	12
3	55	51
4	22	28
5	84	56
6	51	15
7	422	24
8	14	24
9	24	448
10	55	24
11	21	14
12	22	422
13	21	24
14	22	51
15	421	15
16	12	21
17	84	21
18	425	25
19	28	25
20	82	51
Average	25	22
SD±	41	48

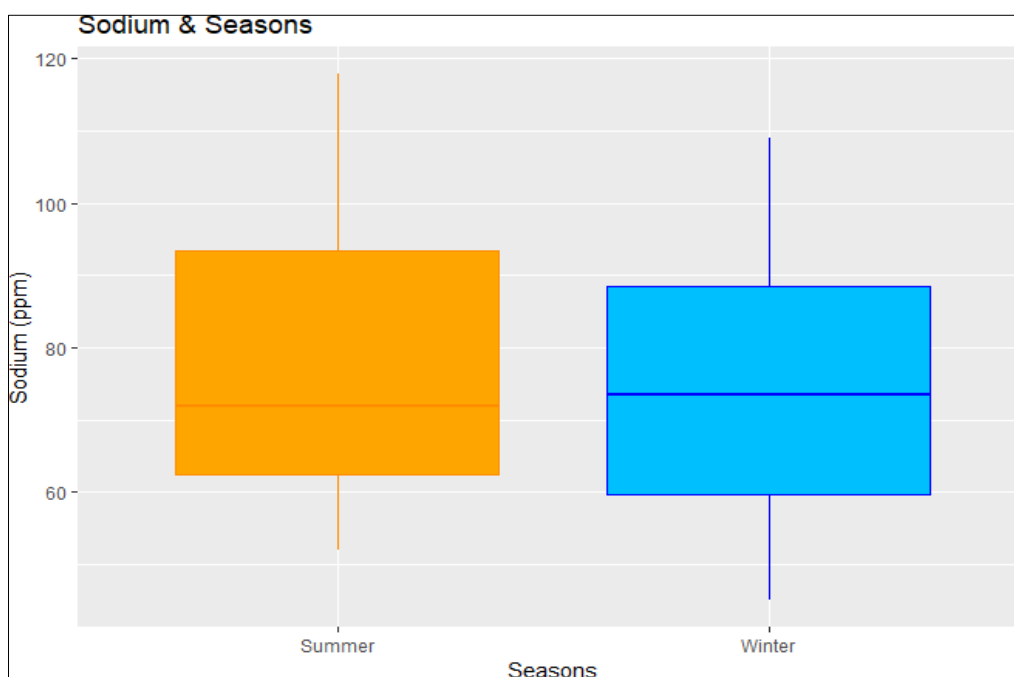


Figure 6: Grouped box plot illustrates the Na⁺ values in the sediments during winter and summer

Potassium (k⁺)

Potassium, with regards to the size of its substance in the World's outside and the dissolvability of its mixtures, is basically the same as sodium, nonetheless, it happens in lower fixations in surface waters as it has powerless transitory ability, this is because of its dynamic support in organic cycles, for example ingestion by living plants and miniature life forms. The values of potassium concentrations in the area under study, were ranged between: (46 -113 ppm), and (42-50 ppm) respectively, during winter and summer season, Table (7). The correlation coefficient matrix potassium is positively correlated (r = 0.34 ,0.51, 0.74,

0.23, 0.14, and 0.03) with (OM, Ca, Na, Co, Pb, and Mn) , Figure (7). In the geochemical cycle, Na⁺ and K⁺ tend to be isolated during enduring and statement processes (Chester, 1965). Though, volcanic rocks contain generally equivalent measures of Na⁺ and K⁺. In remote ocean dregs, Na⁺ and K⁺ are fundamentally situated in mud, yet might be likewise available in other mineral stages, like antacid feldspars. In light of the practically complete shortfall of such minerals in the residue of the area, almost certainly, Na⁺ and K⁺ are available as discrete mineral stages or might be related with the significant mineral parts (for example carbonate minerals).

Table 7: Concentration of major cations K⁺ in the sediment samples during winter and summer

Seasons Locations	Winter (ppm)	Summer (ppm)
1	14	16
2	22	44
3	22	62
4	444	64
5	52	42
6	24	62
7	12	62
8	12	64
9	84	46
10	426	65
11	81	46
12	54	52
13	424	64
14	54	66
15	21	42
16	444	41
17	18	61
18	52	46
19	84	65
20	426	61
Average	21.8	48.4
SD±	64.82	8.26

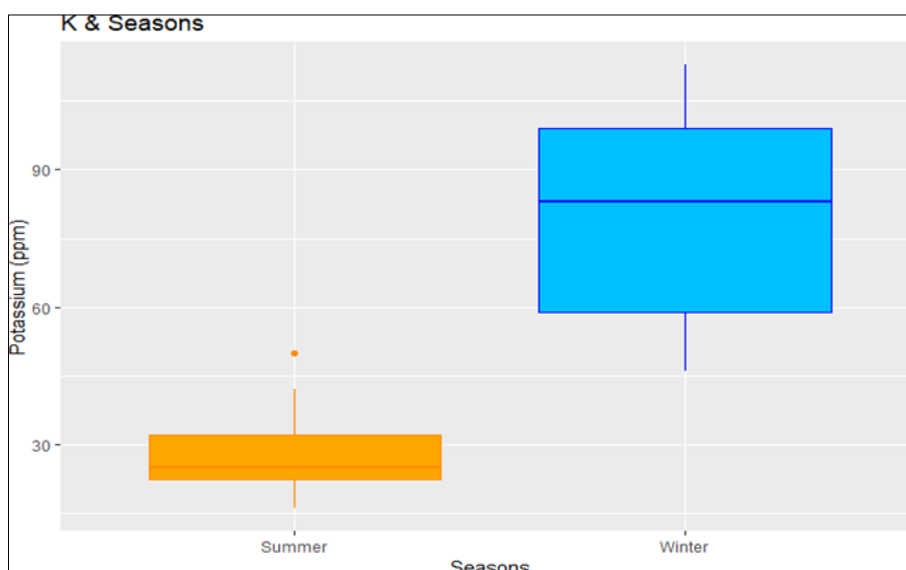


Figure 7: Grouped box plot illustrates the Potassium ions values in the sediments during winter and summer

Heavy Metals

Iron:

Iron is a bountiful component in marine sedimentary frameworks. It is conveyed to these frameworks by riverine transport of earthly soil-determined material, as chilly and icy mass boated rock garbage, as airborne residue, and from submarine volcanic exhalations. Underneath the residue surface (under a couple of millimeters in natural rich dregs), sans oxygen (anoxic) conditions win because of the utilization of all suitable oxygen by life forms processing natural carbon. Under these circumstances, the decrease of ferric iron to ferrous iron [Fe (II)] is interceded by microscopic organisms that can live without any oxygen (the supposed anaerobes). This cycle results the grouping of Fe (III) in residue which directs compound pathways; it is likewise the nature, and consequently bioavailability, of the iron oxides present. (Kiven and Joe, 2011). The convergences of Fe in the dregs during summer were varied between (16.5-398.1ppm) separately, Table (12). The lower content Fe in the silt might be credited to: dregs goes about as a significant sink for poisons in the oceanic climate where the suspended residue particles settle the adsorbed contaminations to be eliminated from the water segment (Seitzinger, 1991). The Fe content in the sediments is positively correlated with (Zn, N, P, Cu and Cd) ($r = 0, 0.56, 0.34, 0.29, \text{ and } 0.01$) ($r = \text{Ca, K, Co, Pb, Cd, and Cr}$).

Manganese

Seawater Mn happens in many structures, among which the bioavailable broke down structure which is accessible for fuse in living beings and marine particles (Sarmiento and Gruber, 2006). However long there is oxygen in the dregs, the natural carbon is demineralized by involving this oxygen as an electron acceptor. This interaction produces CO₂ that motions out of the dregs. When oxygen is generally drained, nitrate is utilized as an oxidizer, delivering both N₂ and CO₂ this is called denitrification. Around a similar time, Mn decrease happens, changing MnO₂ over completely to broke down Mn (II) that motions out of the dregs into base waters (Pakhomova *et al.*, 2007; Middag *et al.*, 2011). The centralization of Mn contents in the dregs of the area under study were ranged between (10.436-33.879 ppm) separately, during summer, Table (12). The variable Mn content in the various locales of studies might be credited to the idea of silt, basically grain size. Where the mud dregs are improved in manganese. The correlation coefficient matrix of the Mn in the sediments showed positively correlated with (OM, Ca, K, Co, Pb, Cd, and Cr), ($r=0.24, 0.31, 0.03, 0.15, 0.37, 0.16, \text{ and } 0.11$).

Zinc

Zinc (Zn) is an extremely normal natural toxin; its presence might be compromising the water biological climate. Subsequently, much examination exertion has been coordinated toward the dispersion of Zn in water climate. Anthropogenic exercises including civil

wastewater releases, coal-consuming power plants; fabricating processes including metals; and barometrical aftermath are the significant wellspring of Zn contamination (Pertsemli and Voutsas, 2007). Zn has low dissolvability in fluid arrangement; it is effectively adsorbed on water-borne suspended particles. After a progression of regular cycles, the water-borne Zn at long last gathers in the silt, and the amount of Zn contained in the residue mirror the level of contamination for the water body (Chen *et al.*, 2007). The convergence of Zn content in the residue of the area under study were varied between (13.8-287.6ppm) separately, during summer, Table (12). The most elevated zinc fixation might be contributing the increment rate if zinc sedimentation, sedimentation of zinc in preferred exclusively under anaerobic condition where zinc is encouraged. The Zn content is decidedly connected with (P, and Cu) ($r= 0.06 \text{ and } 0.19$). These relations are ascribed to adsorption of zinc by hydrous iron and manganese oxides. The size of adsorption increment with pH.

Copper

Copper is a pervasive component in the world's covering, from which it is moved by enduring to waterfront residue. Copper is amassed in dregs along with its autochthonous ocean source because of microscopic fish sedimentation. In spite of the fact that copper is a fundamental micronutrient for living organic entities. It can become harmful to marine life when its fixation expansions in the environmental elements. Hence, copper has been utilized as an algacide and molluscicide in water (Schiff *et al.*, 2004) and it is a part of antifouling paint for transport bottoms. The average wellspring of copper in marine climate defilement is modern releases and environmental affidavit. Fungicides, wood additives and boat (Wolanski, 2006). Copper present in the water and silt can be amassed by benthic creatures, causing, for instance, decreased breath rates and disabled development in mussels, mollusks and other shellfish. The grouping of Cu contents in the residue of the area under study were vacillated between (0.78-31.56ppm) separately, during summer, Table (12). As a rule, the expansion in copper content in the dregs might be credited to the expulsion of copper from the water section intervened by the root of the tiny fish or because of adsorption on the suspended matter or the complexation with natural matter passing on the water body to the silt (Nather and Lim, 1991). The Cu content is positively correlated with (Zn, N, Fe, P, and Cd) ($r= 0.19, 0.28, 0.29, 0.31 \text{ and } 0.1$).

Lead

Lead can enter a waterway from various sea-going, air and earthbound courses. Around half of climatic lead in the climate starts from normal sources. Normal wellsprings of lead incorporate enduring of soil, woods fires and volcanoes. Wellsprings of lead that come from human movement incorporate the release of ammo, leaded fuel in light airplane and the burning of coal and wood, as well as different cycles in metal

creation and assembling. Lead can likewise straightforwardly enter sea-going conditions from metropolitan sources including family utilizes, squander the board and sewage treatment plants (Vercaigne *et al.*, 2011). Lead can move starting with one spot then onto the next in streams as solvent buildings and particles. The vehicle is to a great extent constrained by the trading of lead with residue and the nature and size of particles. In surface waters, normal home seasons of organic particles containing lead have been assessed at two to five years (UNEP, 2010). Regular cycles tend to remove lead from the water and store it in dregs where its accessibility to present hurtful impacts to amphibian organic entities is extremely low (Thornton *et al.*, 2001). Silt structure a sink for lead in freshwater and saltwater conditions, with long home time and restricted portability. When gotten comfortable dregs, lead ties or responds with other compound species and is changed over into structures that are generally insoluble -, for example, adsorption onto iron and manganese containing minerals and mud minerals, or in anoxic districts close to the residue/water interface, by transformation to lead sulfide. The concentration of Pb contents in the residue of the area under study were changed between (1.34 - 46.72 ppm) separately, during summer, Table (13). The high qualities because of the impact of various horticultural squanders enhanced the dregs with suspended natural matter, humic acids secure a huge part of Pb trouble from the overlying water through suspended particles The Pb content is positively correlated with (Ca, K, Co, Mn, and P) ($r=0.39, 0.14, 0.11, 0.37$ and 0.06).

Cadmium

Cadmium (Compact disc) is a superfluous, unsafe follow weighty metal for marine organic entities, and its contaminating impacts and poisonousness to organic entities on a worldwide scale are difficult issues (e.g., Satarug *et al.*, 2003). Anthropogenic poisons, for example, weighty metals released into the tropical and sub-tropical seaside locales by waterway release and groundwater, are as of now getting impressive consideration because of their capability to harm coral reefs and their aggregate harm to the biological system (Ramos *et al.*, 2004; Fabricius, 2005). Rural movement is a potential wellspring of Compact disc (from phosphate compost utilized in horticultural fields) that enters the waterfront marine environment (Mamdouh *et al.*, 2012). The concentration of Cd contents in the sediment of the area under study were fluctuated between (2.36-128.76ppm) respectively, during summer, Table (13). The high content of Cd is mainly attributed to the agricultural effluents. The Cd content is positively correlated with (Mn, Fe, and Cu) ($r=0.16, 0.01$ and 0.1).

Cobalt

Cobalt is a bio-fundamental metal forever, framing among others, the focal cobalt - corrin complex of cobalam in (vitamin B12). Eukaryotes use Co essentially as cobalamin in, for instance, methionine amalgamation. Microorganisms and archaea furthermore

use cobalamin in catalysts for anaerobic digestion systems, including maturation, dehalogenation, and one carbon compound electron moves (Banerjee and Ragsdale, 2003). Cobalt focuses in present day seawater shift from 3 to 120 ppm (Saito and Moffett, 2002), with varieties reliant upon communications with different metals, biota and natural matter. Cobalt shows supplement like way of behaving with surface least focuses because of natural up take by phytoplankton (Saito *et al.*, 2010). The convergence of components in seawater mirrors a harmony among conveyance and expulsion of components by means of precipitation and adsorption processes to quantitatively decipher changes in the marine Co supply, as recorded by dregs stored under various redox conditions, we detail beneath evaluations of the transitions of broken up Co to seawater, and mass gathering rates (Blemish) for residue saved under oxic, anoxic and euxinic conditions (Mamdouh *et al.*, 2012). The centralization of Co contents in the silt of the area under study were varied between (9.15-28.16ppm) separately, during summer, Table (13). As a rule, the dissemination of cobalt relies upon the sewage effluents and the design of residue and dirt (Powers *et al.*, 2002). The Co content is positively correlated with (OM, K, Na, Pb, Mn, N, and P) ($r=0.13, 0.23, 0.1, 0.11, 0.15, 0.06$ and 0.15).

Chromium

In oceanic climate Chromium is found as Cr (III) and Cr (VI) as water solvent complex anions (Pourahmad *et al.*, 2005; Zalups and Koropatnick, 2000). Water defilements happen by barometrical contamination as significant source (Goyer and Clarkson, 2001). Chromium combination and metal creating industry or cooling towers (EPA, 1998), modern released into the water (electro painting and metal completing businesses) and overflow from metropolitan regions. Chromium is taken out from air by air aftermath and precipitations (Clarkson, 2001). Silt thought about an extreme sink for Cr in marine conditions however on the off chance that the biological circumstances are switched, the sink can turn into a source by providing Cr to the interstitial water and fundamental seawater. Chromium is adsorbed on the silt surface. Significant adsorbing surfaces in the marine silt are natural matter, oxides, hydroxides, carbonates, and dirt's (Pourahmad *et al.*, 2005). Adsorption of Cr by residue is saltiness subordinate; adsorb particle is most prominent at 0.1-1‰. The convergence of Cr contents in the residue of the area under study were varied between (2.17- 323.41ppm) separately, during summer, Table (13). Chromium is really adsorbed from seawater by hydrous oxides of manganese, nickel and cobalt. Under oxidizing conditions, chromium changed to chromium (VI) oxidation state, and brought about fractional misfortune from the dregs (Influence *et al.*, 2002). The Cr content is decidedly connected with (Mn) ($r=0.11$). The positive correlation between the concentrations between the studied metals could indicate the same or similar source input. The elementals association may signify that each

paired element has an identical source or common sink in the stream sediments (Nyangababo *et al.*, 2005). In most cases; however, there are no significant correlations among most of these heavy metals, suggesting that these metals are not associated with each other. Furthermore, these metals might have different anthropogenic and natural sources in sediments of the area of study.

Sediment Quality Guideline as Per United States Environmental Protection Agency (USEPA)

The chemical contamination in the sediments was evaluated by comparing with the sediment quality guideline proposed by USEPA. These criteria are shown in Table (8). The studied metals in all stations under investigation belong to polluted sediments, while some of sediment samples at some locations are considered as moderately polluted by the studied heavy metals while the most stations belong to heavily polluted by Cr and Cd.

Table 8: EPA guidelines for sediments (Concentration ppm)

Metal	Not polluted	Moderately Polluted	Heavily Polluted	Present Study
Co	-	-	> 6	9.15-28.16
Pb	< 40	40 -60	> 60	1.34 - 46.72
Mn	< 25	25 -50	> 50	10.436-33.87
Zn	< 25	25 -50	> 50	13.8- 287.6
Fe	< 25	25 -50	> 50	16.5 - 398.1
Cu	< 25	25 – 50	> 50	0.78 - 31.56
Cd	-	-	> 6	2.36 - 128.76
Cr	< 25	25-50	> 50	2.17 - 323.41

Table 9: Concentrations of studied heavy metals samples in the sediments during summer season

Season (Summer) Location	Iron (ppm)	Manganese (ppm)	Zinc (ppm)	Copper (ppm)
1	656.4	45.162	62.2	4.12
2	86.5	42.412	425.1	6.64
3	16.4	44.552	652.2	65.46
4	86.2	64.446	44.8	5.4
5	418.4	44.212	625.1	44.52
6	26.5	41.424	615.4	6.41
7	41.6	68.112	52.4	44.52
8	15.4	42.462	615.4	6.82
9	16	41.262	41.5	44.52
10	56.1	42.164	62.5	2.24
11	625.1	45.114	52.6	41.45
12	84.5	46.145	18.6	2.86
13	22.6	42.142	25.2	2.86
14	62.5	62.252	22.6	6.24
15	42.5	64.821	64.8	48.24
16	25.6	44.821	682.2	2.28
17	651.1	64.466	61.5	8.12
18	22.4	61.412	422.5	48.64
19	22.4	64.444	48.1	6.14
21	452.1	62.482	58.6	1.45
Average	118.960	101.442	126.305	19.946
±SD	237.633	10.491	266.333	21.805

Table 10: Concentrations of studied heavy metals samples in the sediments during summer seasons

Season (Summer) Location	Lead (ppm)	Cadmium (ppm)	Cobalt (ppm)	Chromium (ppm)
1	62.84	5.22	46.14	4.41
2	6.51	41.46	42.22	65.22
3	1.64	5.22	44.41	2.45
4	68.24	6.42	62.42	6.28
5	4.41	46.15	42.64	6.52
6	4.61	2.85	42.28	4.68
7	48.21	61.84	64.22	6.42
8	1.46	4.25	44.61	1.62

Season (Summer) Location	Lead (ppm)	Cadmium (ppm)	Cobalt (ppm)	Chromium (ppm)
9	4.22	48.14	41.62	64.21
10	12.26	2.68	41.41	2.82
11	1.52	6.81	45.51	1.46
12	6.84	4.52	68.42	1.24
13	5.26	48.45	42.68	1.46
14	2.24	2.14	48.41	4.86
15	2.68	61.14	42.15	1.26
16	48.24	8.26	64.42	52.24
17	4.21	2.12	66.41	6.41
18	42.25	52.56	42.45	1.52
19	2.24	42.24	1.45	464.14
21	4.62	468.22	48.46	1.26
Average	77.592	86.288	92.997	102.173
±SD	22.753	102.017	14.426	103.174

CONCLUSION

The results obtained in this which carried out on sediment samples collected from locations at eastern side of Libya coast recorded different variations for heavy metals, Total phosphorus and Total Nitrogen contents, these values are mainly due out lets or human activities.

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