Some ecological characteristics and ichthyofauna of surrounding Sammaliah Island, Abu Dhabi, UAE

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Abstract

Some physical and chemical characteristics and ichthyofauna of waters surrounding Sammaliah Island, Abu Dhabi, United Arab Emirates were described from June 2004 to May 2005. A total of 14 parameters including air and water temperatures, transparency, pH, salinity, alkalinity, chloride, calcium, magnesium, sodium, potassium, sulphate and nitrate were analyzed. Results revealed that the salinity of water was normally over 48‰ and attained 59.9‰ during July, while water temperature changed from 21°C in February to 33.3°C in July. Chloride, sodium, sulphate, magnesium, calcium and potassium comprised 95.3% of sea salts of the Island waters. The number of ichthyofauna caught from the study region was 49, belonging to 37 genus and 28 families. Carangidae was the more diverse family, including 3 genera and 4 species, followed by Haemulidae represented by 2 genera and 4 species.

Introduction

The Arabian Gulf is a shallow semi-enclosed marginal subtropical sea surrounded by a large, arid land mass, having a water surface area of 239.00 km² which extends for nearly 1000 km from Shatt Al-Arab River in the northwest to Strait of Hormuz in the southeast and mean depth of about 35 m, with a maximum depth of 100 m at Strait of Hormuz (Emery, 1956; Reynolds, 1993). Previous estimates of the annual mean discharge of the Shatt-Al-Arab River varied from 35 to 45 km³/yr (Saad, 1978; Reynolds, 1993). These values were reduced since 1990s due to dams and reservoirs constructed on the Euphrates and Tigris by Turkey, Iran, Syria and Iraq. The shallowness of the Arabian Gulf water leads to the formation of a very high

saline and dense water, surface salinity average 37-40‰ in the central part, 40-50‰ in the shallow parts of United Arab Emirates and 60-70‰ in remote lagoons and bays (Simmonds and Lamboeuf, 1981). High salinity levels are driven by strong evaporation, which exceeds combined rainfall and freshwater inputs by over a factor of ten (Sheppard, 1993). Despite the extreme environmental conditions, a wide variety of marine life is found in the Gulf, including sea turtles, marine birds, dugongs, whales, dolphins and over 500 fish species, many of these animals are endemic and heavily dependent on the Gulf environment (UNEP, 1999).

United Arab Emirates has two separate coastlines. By far the longest, at over 700 km, excluding islands, faces in a north to north-westerly direction into the southern Arabian Gulf whilst the other, much shorter, coast, approximately 70 km long, faces eastwards into the Gulf of Oman. The differences in climate, in the physical and chemical characteristics of the coastal waters, and in the surfaces available for colonization by marine life along the two coasts have led to assemblages of marine organisms that are somewhat different, although both are of Indian Ocean origin (George and John, 2005). Abu Dhabi Emirate lies on a T-shaped island jutting into the Arabian Gulf at 24°27'N, 54°23'E from the central western coast. Abu Dhabi has a mainland coast that includes reefs and numerous lagoons, creeks, bays, and peninsula extending from the Dubai emirate border at Ra's Ghantoot, west to the Saudi Arabian border at Ghuweifat. The offshore waters are generally shallow and as a result there are numerous offshore islands, ranging from dramatic salt dome formations to small sandy shoals, Al-Sammaliah Island is one of them (Siddiqui *et al*., 2009).

The oceanographic environment in the northern and southern parts of Arabian Gulf was extensively investigated by many authors (Sugden, 1963; Simmonds and Lamboeuf, 1981; Hunter, 1986; John *et al.,* 1990; Reynolds, 1993; Sheppard, 1993; Evans, 1995; George and John, 2005; Loughland, 2009; Alainachi and Alobaidy, 2010).

All fish species found in Arabian Gulf originally penetrated from the Indian Ocean through the Gulf of Oman and Straits of Hormuz. Although high levels of endemism have been suggested, in fact, only a very low number of species exist solely within the Gulf (Beech *et al.,* 2005). Several systematic works have been published to describe fish fauna of the Arabian Gulf (Regan, 1905; Blegvad, 1944; Whits and Barwani, 1971; FAO, 1981a, b; Al-Daham, 1982; Relyea, 1981; Kuronoma and Abe, 1986; Carpenter *et al.*, 1997; Jennings, 2005). Plenty of useful check-lists have been done in this field in some coasts of the Gulf countries (Khalaf, 1961; Mahdi, 1962, Kuronoma and Abe, 1972; Al-Kholy and Soloviov, 1978; Al-Sedfy, 1982;

Sivasubramaniam and Ibrahim, 1982; Dames and Moore, 1983; McCain *et al*., 1984; Al-Baharna, 1986; Randall, 1995; Mohamed *et al.,* 2001).

On the other hand, our knowledge on the oceanographic characteristics and fish community structure of the shallow waters surrounding Sammaliah Island, adjacent to sabkha-related habitats is still scarce and fragmentary. Therefore, present study attempts to describe recent trend in the main physical and chemical characteristics and fish fauna in water surrounding the Island, and to project the effect of future development on water-related resources of the Island**.**

Materials and Methods

Study area

Sammaliah Island lies a isolated island, covers an area of about 14 km² and situated about 12 km northeast of Abu Dhabi City in the Arabian Gulf (Fig. 1) at 24º 26`10”-24º 28’ 56” North and 54º 29’ 22”-54º 34’ 12” East (Issa, 2009). The name Sammaliah itself is derived from the Arabic word for worn-out nets that fishermen would leave on the island, after fishing season. The Island is being developed as a heritage and environmental education facility and has had large areas of artificial intertidal wetlands developed, which have been extensively planted with mangroves (Siddiqui *et al.,* 2009).

Among exotic wildlife that inhabits the island are ostriches, emus, lizards, gazelles and more wildfowl. The Island has had large areas of artificial intertidal wetlands developed, which have been extensively planted with mangroves. The island is home to one of the world's largest artificial mangrove plantations, covering some 8km², which is being protected. Its geomorphology is characterized by a flat desert surface with small artificial sandy hills and dispersed coastal sabkha (salt flats) especially in the low lands along the shoreline. The soils are sandy in texture, with total surface soluble salts reaching 31.5%, giving a white color to the soils of the Island (Salam *et al.*, 2006). The haram, *Zygophyllum qatarense*, a salt-tolerant plant occurs naturally in sand plains between low dunes and offshore islands in Abu Dhabi Emirate and is common vegetation in Sammaliah Island, but completely invaded by the bottlebrush crystallized material (Siddiqui *et al.,* 2009).

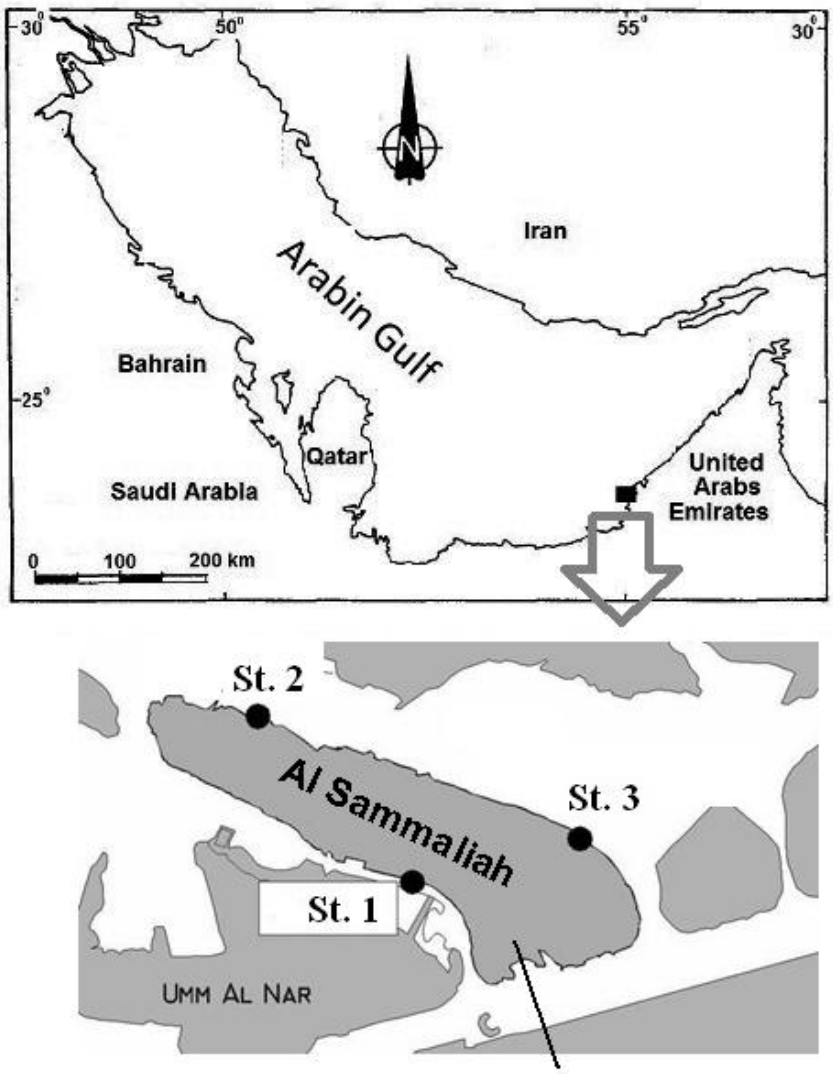

Fig. 1. Sampling stations on Sammaliah Island, Abu Dhabi

Water and Fish Sampling

Water samples were collected monthly from three stations in coastal waters of Sammaliah Island (Fig. 1), in the morning (9.00-10.00 am) from June 2004 to May 2005. Water and air temperatures were measured instantaneously using simple thermometer (0.1°C), and water transparency was measured by Secchi disk, while water samples for laboratory analyses were collected by black plastic bottles and kept frozen.

Fishes were caught from coastal water of Sammaliah Island during the same period using three fishing methods; hooks and lines and traps (Karkoors) were used fife days a week, while cast net (10m diameter with a 10mm mesh) used weekly. Fishes carried to fish laboratory of the Island for identification adopting the taxonomic keys of Fischer and Blanchi (1984), Al-Baharna (1986), Kuronuma and Abe (1986) and Carpenter *et al*. (1997).

Variables analyzed in the Agricultural Research Laboratory, Abu Dhabi included: pH, salinity, cations (calcium, magnesium, sodium and potassium), anions (carbonate, bicarbonate, phosphorus and chloride) and nitrate. pH was measured by pH meter and salinity was determined by measuring the electrical conductivity of the samples using digital conductivity meter and converted to salinity, using standard tables. Cations were measured colorimetrically using Inductively Coupled Plasma. Anions were measured by titration following the standard procedures of APHA (1998). Nitrate content was measured by using Ultra Violet Spectrophotometer.

The spatial variation between stations in hydrographical variables was tested using analysis of variance (ANOVA). The correlation coefficients between different environmental parameters were calculated (n= 12, $P \leq 0.05$), the correlation coefficient is significant at $r \geq 0.505$. All statistical computations were made using SPSS software (version 11, 2001) statistical package.

Results

Table (1) summarizes mean values of air and water temperatures, transparency, pH, salinity, calcium, magnesium, sodium, potassium, carbonate, bicarbonate, chloride, sulphate and nitrate of the three stations in coastal waters of Sammaliah Island during study period. The results of analysis of variance are also shown. Measurements of these parameters were near identical between three stations and F-tests expressed no significant differences between these stations (Table, 1). However, the data from the three stations were pooled in order to study monthly variations in the physical and chemical characteristics of coastal waters of the Island.

Air and water temperatures

Monthly variations in the average values of air and water temperatures are shown in Fig. (2). The lowest values were 20°C and 21°C in February for air and water temperatures respectively, while the highest one was 40°C for air temperature in August and 33.3°C for water temperature in July. The trend in water temperature closely followed the monthly trend of air temperature.

Transparency

Monthly fluctuation in Secchi disk readings is given in Fig. (2). The readings ranged from 247cm in January to 437cm in April. Despite no significant variations were found between stations, but station 3 was clearer and its readings ranged from 260 cm in January to 540 cm in August.

Salinity

Salinity of Sammaliah Island water was above 48‰ and station 3 recorded the highest value of salinity (59.9‰) in July. Monthly variations in the average salinity are given in figure 3, where values ranged from 49.7‰ in January to 57.7‰ in July.

Chloride

Chloride contents were slightly fluctuate throughout the year and varied from 24.4 g/l in August to 27.6 g/l in July (Fig. 3).

Table 1: Descriptive statistics of the physical-chemical variables of Sammaliah Island waters, UAE

Variable	Stations 1	2	3	Range	F value**
Air Temp. (°C)	28.42 ± 4.38 *	28.08 ± 4.34 *	28.0 ± 4.39 *	20-40	0.006
Water Temp.(°C)	29.58 ± 5.65	29.83 ± 5.80	29.67± 6.11	21-34	0.031
Transparency(cm)	300 ± 55.92	332 ± 76.82	326 ± 75.50	205-540	0.697
pH	8.00 ± 0.085	8.02 ± 0.058	8.03 ± 0.065	7.8-8.1	0.673
Salinity ‰	53.18 ± 2.61	51.82 ± 2.36	53.05 ± 2.50	48-59.9	1.091
Chloride (g/l)	26.56 ± 1.32	26.12 ± 1.335	26.16 ± 1.365	22.8-28.1	0.398
Sodium (g/l)	17.02 ± 3.005	16.39 ± 2.724	17.06 ± 3.566	12.2-24.5	0.172
Alkalinity (mg/l)					
Carbonate	25.0 ± 11.87	24.2 ± 10.02	25.0 ± 10.30	0-40	0.024
Bicarbonate	66.67 ± 27.55	70.33 ± 28.27	65.92 ± 25.25	34-132	0.092
Nitrate (mg/l)	4.75 ± 1.22	4.58 ± 0.90	4.83 ± 1.03	3-7	0.174
Sulfate (g/l)	4.15 ± 0.242	4.02 ± 0.279	4.14 ± 0.257	3.53-4.51	1.057
Calcium (g/l)	0.56 ± 0.118	0.52 ± 0.071	0.56 ± 0.069	0.41-0.84	0.796
Magnesium (g/l)	1.80 ± 0.312	1.73± 0.290	1.85 ± 0.372	0.96-2.59	0.424
Potassium (g/l)	0.60 ± 0.088	0.57± 0.103	0.58 ± 0.104	0.45-0.81	0.333

* Mean ± standard deviation,

** $F_{0.05\,(2,\,33)} = 3.316$

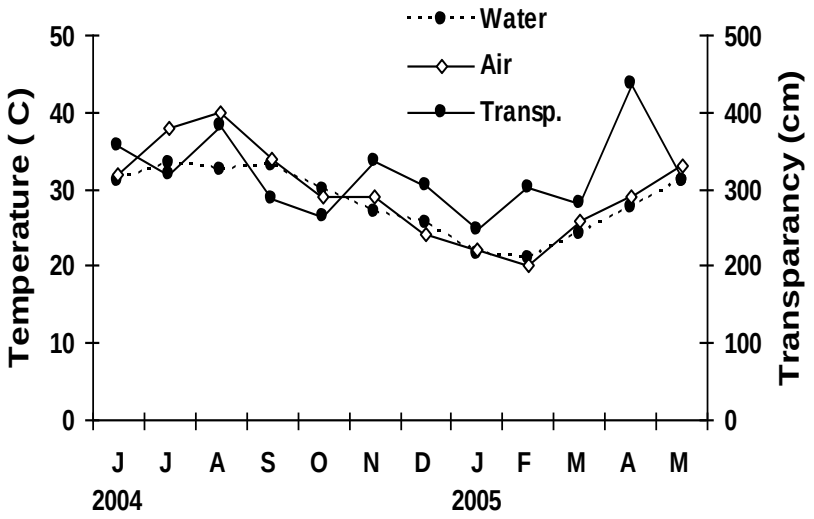

Fig. 2. Monthly mean values of air and water temperatures and transparency.

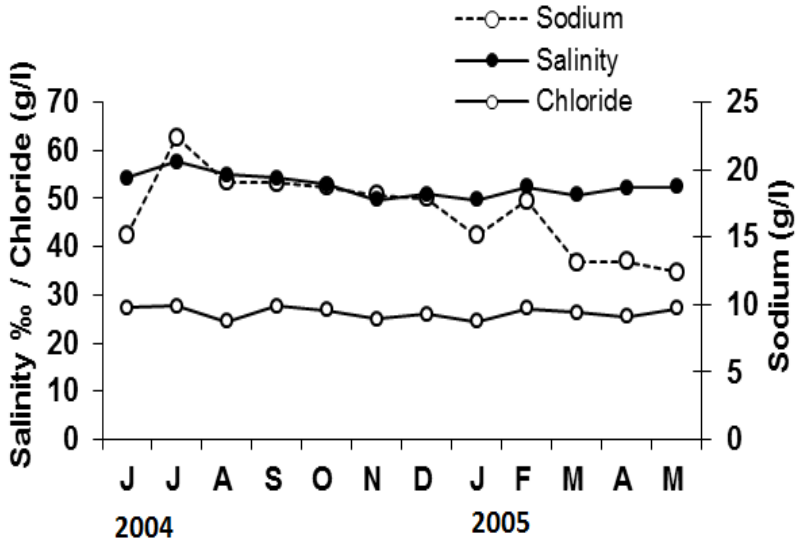

Fig. 3. Monthly mean values of salinity, chloride and sodium

Sodium

Monthly variations in the average values of Na are shown in Fig. (3). The lowest value was 12.4 g/l in May, while the highest one was 22.4 g/l in July.

pH

Generally, pH values were always on the alkaline side of neutrality and were relatively stable across months (Fig. 4). Values ranged from 7.9 in July to 8.1 in June, February and April.

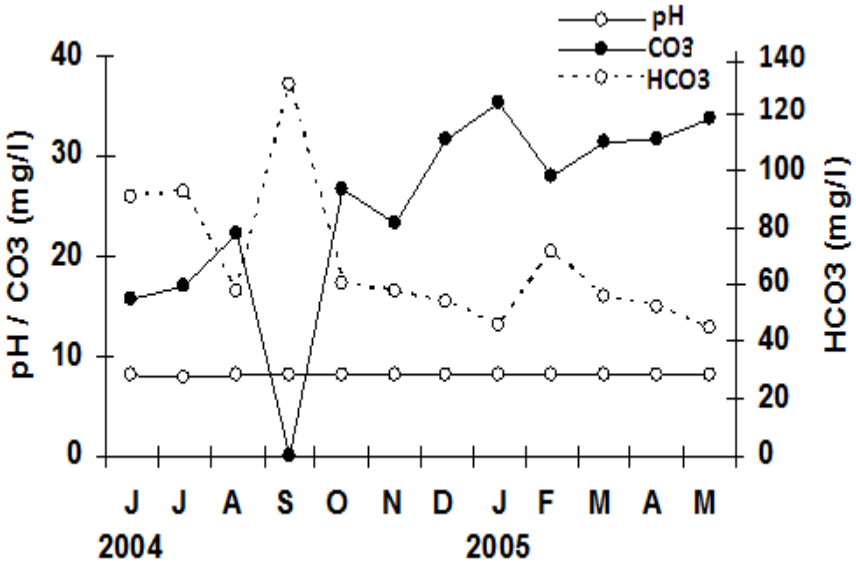

Fig. 4. Monthly mean values of pH, CO_3 and HCO_3

Carbonates and bicarbonates

Monthly average values of CO_3 and HCO_3 showed wide and reversely fluctuation during the course of one annual cycle (Fig. 4). The values of CO_3 varied from nil in September to 35.3 mg/l in January, while values of HCO_3 ranged from 44.7 mg/l in May to 130 mg/l in September.

Nitrates

Monthly variations in the average values of NO_3 were presented in figure 5. It ranged from 3.0 mg/l in March and April to 6.0 mg/l in August and September.

Sulfate

Figure 5 showed monthly variations in the values of SO_4, where it varied from 3.76 g/l in August and January to 4.49 g/l in July.

Calcium, Magnesium and Potassium

Monthly variations in the average values of Ca, Mg and K are presented in figure 6. The values of Ca varied from 0.47 g/l in December and March to 0.69 g/l in June,

while the values of Mg ranged from 0.98 g/l in February to 2.17 g/l in June. The values of K ranged from 0.47 g/l in November to 0.73 g/l in March and May.

Pearson correlation coefficients between all physical-chemical characteristics of coastal waters of the Island during study period have been calculated. The results revealed that among all environmental variables correlation, only ten were positive significantly correlations and four were negative significantly correlations (Fig. 7). The highest significant positive correlations were detected between air and water temperatures ($r = 0.939$, $P \leq 0.05$), followed by air and water temperatures and salinity ($r = 0.763, 0.761$, $P \leq 0.05$), and between Na and CO_3 ($r = 0.760$, $P \leq 0.05$), while the highest significant negative correlation was between HCO_3 and CO_3 ($r = -0.952$, $P \leq 0.05$).

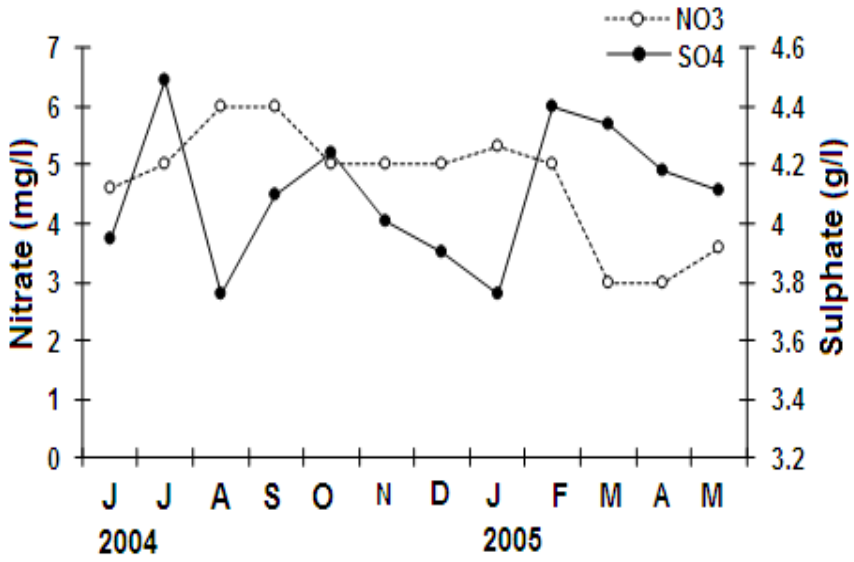

Fig. 5. Monthly mean values of Nitrate and Sulphate

Ichthyofuna

A total of 49 fish species belonging to 37 genus and 28 families were recorded from coast water of Sammaliah Island during study period (Table 2). Thirteen families were represented by more than one species. Carangidae was the more diverse family, including 3 genera and 4 species, followed by Haemulidae represented by 2 genera and 4 species. Lethrinidae, Lutjanidae, Sparidae and Terapontidae represented by 3 species for each one. Seven families represented by two species namely, Belonidae, Clupeidae, Gerreidae, Mugilidae, Mullidae, Nemipteridae and Sphyraenidae, the rest by a single species.

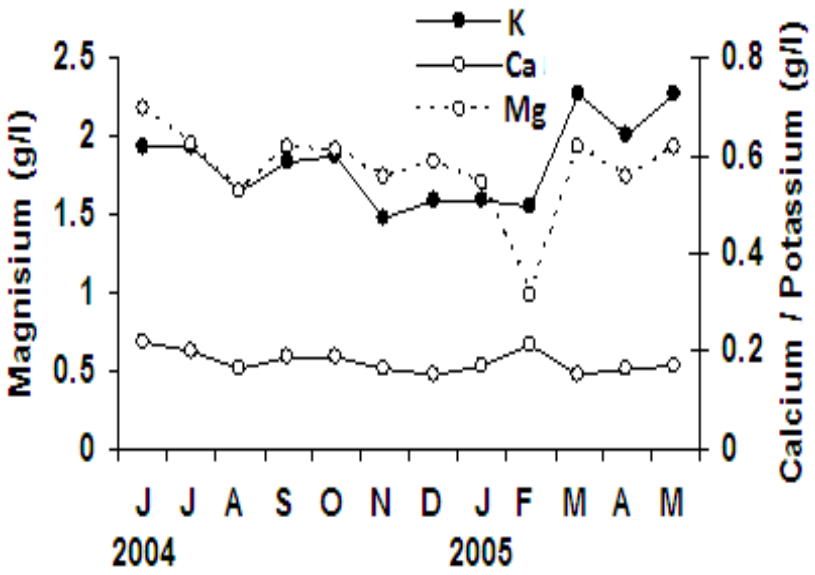

Fig. 6. Monthly mean values of Ca, Mg and K

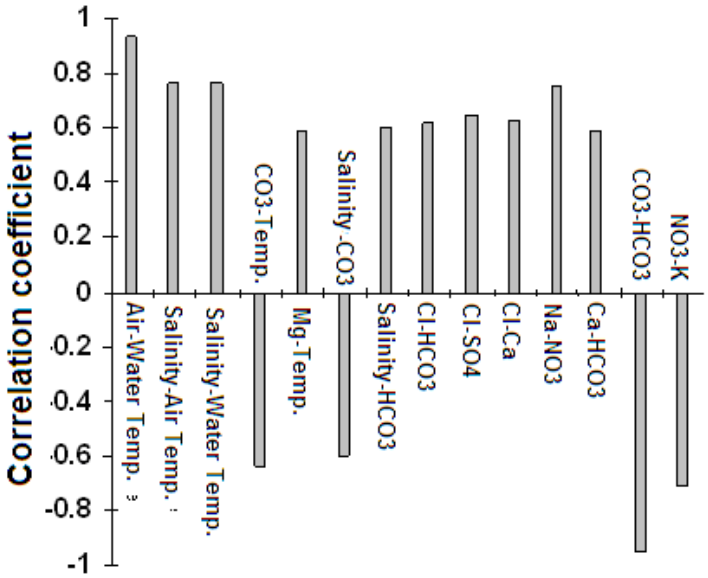

Fig. 7. Significant Pearson correlation coefficients between the variables

Discussion

In general, the shallowness of southwestern Arabian Gulf water, the dominant water circulation pattern which is counter-clockwise, the prevailing north-westerly wind and hot weather when air temperatures can reach 50°C lead to the formation of a very high saline and dense water, with maximum salinities as high as 57‰ along the southern coast (Sheppard, 1993). Water of normal oceanic salinity enters the Gulf through the surface waters of the Strait of Hormuz, moves northwards along the Iranian coast, turns southward along the western coast and exits along the bottom of the Strait as dense hypersaline water (Emery, 1956; Simmonds and Lamboeuf, 1981; Hunter 1986; John *et al.*, 1990; Reynolds, 1993, Sheppard, 1993; Evans, 1995; Richlen, *et al*., 2010). Typical mass transport by the outflow from the Arabian Gulf has been estimated to be about 34.5 x109 m^3/day, which is larger than that reported by other studies (Bidokhti and Ezam, 2008).

Table 2. Annotated check-list of the fishes recorded in waters surroundingSammaliah Island (June 2004 to May 2005)

Family	Scientific Name	Common Name
Carangidae	*Carangoides bajad*	Orange spotted trevally
=	*Gnathanodon speciosus*	Golden trevally
=	*Scomberoides commersonnianus*	Talang queenfish
=	*Trachinotus blochii*	Snubnose pompano
Haemulidae	*Plectorhinchus flavomaculatus*	Lemon sweetlip
=	*Plectorhinchus schotaf*	Minstrel sweetlip
=	*Plectorhinchus sordidus*	Sordid rybberlips
=	*Pomadasys stridens*	Striped piggy
Lethrinidae	*Lethrinus lentjan*	Redspot emperor
=	*Lethrinus mahsena*	Mahsena emperor
=	*Lethrinus nebulosus*	Spangled emperor
Lutjanidae	*Lutjanus argentimaculatus*	Mangrove red snapper
=	*Lutjanus ehrenbergi*	Blackspot snapper
=	*Lutjanus quinquelineatus*	Five-lined snapper
Sparidae	*Acanthopagrus bifasciatus*	Twobar seabream
=	*Acanthopagrus latus*	Yellowfin seabream
=	*Rhabdosargus sarba*	Goldlined seabream
Terapontidae	*Pelates quadrilineatus*	Fourlined terapon
=	*Therapon jarbua*	Jarbua terapon
=	*Therapon puta*	Smallscalled terapon
Belonidae	*Strongylura leiura*	Banded needlefish
=	*Tylosurus crocodilus*	Hound needlefish
Clupeidae	*Amblygaster sirm*	Spotted sardinella
=	*Sardinella longiceps*	Indian oil sardine
Gerreidae	*Gerres acinances*	Longtail silver-biddy
=	*Gerres oyena*	Common silver-biddy
Mugilidae	*Liza macrolepis*	Largescale mullet
=	*Valamugil seheli*	Blue-spot mullet
Mullidae	*Upeneus sulphureus*	Sulphur goatfish
=	*Upeneus tragula*	Freckled goatfish
Nemipteridae	*Scolopsis ghanam*	Arabian monocle bream
=	*Scolopsis taeniatus*	Black-streaked monocle bream
Sphyraenidae	*Sphyraena pulnamiae*	Chevron barracuda
=	*Sphyraena jello*	Pickhandle barracuda
Atherinidae	*Atherinomorus lacunosus*	Hardyhead silverside
Chanidae	*Chanos chanos*	Milkfish
Cyprinodontidae	*Aphanius dispar*	Arabian barred killifish
Gobiidae	*Amblygobius albimaculatus*	Butterfly goby
Hemirhamphidae	*Hemirhamphus archipelagicus*	Jumping halfpeak
Monacanthidae	*Paramonacanthus japonicus*	Hairfinned leatherjacket
Monodactylidae	*Monodactylus argenteus*	Silver moony
Platycephalidae	*Platycephalus indicus*	Bartail flathead
Plotosidae	*Plotosus lineatus*	Striped eel catfish
Pomacanthidae	*Pomacanthus maculosus*	Yellow-marked butterflyfish
Pomacentridae	*Abdefduf saxatilli*	Sergeant major
Serranidae	*Epinephelus malabaricus*	Malabar grouper
Siganidae	*Siganus canaliculatus*	White-spotted spine foot
Sillaginidae	*Sillago sihama*	Silver sillago
Soleidae	*Pardachirus marmoratus*	Finless sole

One of the most striking features of the oceanographic conditions of waters surrounding Sammaliah Island was found to be the extremely saline and thermal conditions. The salinity trend in this region may be related to water circulation and to the high evaporation. Also the results of Pearson correlation coefficients between the variables revealed that the highest significant correlations were found between air and water temperatures and salinity of the coastal water of Island.

Salam *et al.* (2006) stated that Sammaliah Island is characterized by its hyper arid climate, the mean annual rainfall is less than 50 mm/year, while the mean monthly temperature is above 30°C. The coastal waters of the Emirates are generally vertically well-mixed and turbid. This is due to sinking of the surface water as a result of its increased density and wave action caused by the north-westerly wind and the often strong summer daytime winds which result from temperature differences between water and the nearby landmass. Continuous sunlight, particularly in the summer months, warms the water surface, causing evaporation levels to increase (150 mm/year). The combinations of wind, solar energy, very low annual rainfall and the effect of freshwater run-off on coastal waters is usually negligible may lead to very high evaporation levels, especially in shallower and lagoon areas (Brown, 1986; George and John, 2005; Alainachi and Alobaidy, 2010).

Typically, seawater has a salinity of 35‰ and only six elements and compounds (chlorine, sodium, sulphate, magnesium, calcium and potassium) comprise about 99% of sea salts (Stewart, 2006). However, despite the annual mean water salinity of the coastal water of the Island was high (52.6‰), the same six major elements (ions) formed only 95.3% compared with other waters (Table 3). There is retracted in the ions of chloride and sodium compare with some other waters, and there is increased in

Table 3: Main ions composition of different regions compared to Sammaliah Island waters

Variables	Sammaliah Island		Arabian Gulf (Al-Jubail) *		Typical Seawater +		Arabian Gulf (Kuwait) **		Red Sea (Jeddah) **	
	g/l	%	g/l	%	g/l	%	g/l	%	g/l	%
Chloride	26.3	50.4	24.09	55.00	19.35	55.02	23.00	51.11	22.22	54.20
Sodium	16.8	32.2	13.44	30.68	10.77	30.66	15.85	35.22	14.26	34.78
Sulphate	4.1	7.9	3.38	7.72	2.71	7.71	3.20	7.11	3.08	7.51
Calcium	0.6	1.1	0.51	1.16	0.41	1.17	1.77	3.93	0.74	1.80
Magnesium	1.8	3.4	1.62	3.70	1.29	3.65	0.50	1.11	0.23	0.56
Potassium	0.6	1.1	0.48	1.10	0.40	1.13	0.46	1.02	0.21	0.51
Salinity ‰	52.2		43.8		35.0		45.0		41.0	
%		96.2		99.36		99.34		99.5		99.36

* Malik, *et al.* (1999),
\+ Thurman and Burton (2001)
** Magazine - Water Condition & purification, January 2005.

the ion of sulphate, this may be due to existence of gypsum with other minerals from evaporation in the coast. Siddiqui *et. al.* (2009) stated that continuous sea water intrusion and evaporation under hyper arid conditions lead the crystallization over the vegetation, and ultimately over a period of time the entire vegetation was invaded with bottlebrush gypsum overgrowth. Issa (2009) mentioned that the increase vegetation cover found around Sammaliah Island is mostly attributed to the increase in mangrove planted areas alone with an aerial increase from 2.256 km² in 1999 to 3.568 km² in 2005, an increase of 58.2% in seven years.

A total of 49 fish species belong to 28 families were recorded from coast water of Sammaliah Island during the study period. Dipper and Woodward (1989) mentioned that the number of species in the southern Gulf is low in number. Fouda (1995) reported 47 fish species during a monitoring survey of nine khawrs (coastal lagoons) of varying salinity in the Dhofar province of Oman. Zajonz *et al.* (2002) reported seven fish species in Sabkha-related aquatic habitats included Clupeidae (*Sardinella sindensis*), Cyprinodontidae (*Lebias dispar dispar*), Sparidae (*Argyrops spinifer*), Serranidae (*Epinephelus coioides*), Terapontidae (*Terapon jarbua*), Gerreidae (*Gerres oyena*) and Mugilidae (*Liza subviridis*). All these families were presented in Sammaliah waters.

There are some variations in the number of fish families recorded from the different parts of the Arabian Gulf and this depends on the habitat of sampling, reflecting the heterogeneous nature of the environment (Roberts, 1986). Arabian Gulf possesses a variety of habitats: open waters, estuary, coral reefs, seagrass beds, islands, mangroves, khors, extensive intertidal flats, saltmarsh and sabkha. Relyea (1981) counted sixty six families from the inshore areas of the Arabian Gulf, Sivasubremaniem and Ibrshim (1982) reported fifty four families from Qatar waters, Al-Bahama (1986) recorded eighty four families from Bahraini water, Kuronoms and Abe (1986) counted one hundred and one families from the entire Gulf region, Carpenter *et al.* (1997) recorded 118 families with 539 species from the Gulf region, Siddeek *et al.* (1999) reported over 350 commercial demersal fish species in the Arabian Sea, Gulf of Oman and Arabian Gulf, Mohamed *et al.* (2001) recorded 124 species belong to 60 families from northwest Arabian Gulf, Beech (2004) prepared a list of 105 species belonged to 45 families from different marine habitats of Abu Dhabi, and Beech *et al.* (2005) mentioned a total of 587 species from 78 families had been identified in the two coasts of United Arab Emirates.

The intense activities of the urbanization may have changed some important conditions for fish occurrence, such as the food availability, niches present, and conditions for

feeding, for reproduction or for shelter against eventual predators and created poor hydrographic conditions. Brook and Dawoud (2005) stated that the rapid and significant urbanization along the coastlines has meant that risks to the marine and coastal areas now include pollution (from municipal, industrial, agricultural sources etc.), coastal erosion and other effects such as from engineering projects, oil spills, dredging and pollution due to shipping and so on.

Seawater desalination constitutes an important source for water supply to the population bordering the Arabian Gulf and this was discharged into the Gulf, the seawater desalination discharge will increase the salinities of Arabian Gulf by some extra 2.24‰ in the year 2050 (Bashitialshaaer *et al*., 2011). Lattemann and Höpner (2008) stated that the largest number of desalination plants can be found in Arabian Gulf with a total seawater desalination capacity of approximately 11 million m^3/day, which means a little less than half (45%) of the worldwide daily production and the main producers in the Gulf region are the United Arab Emirates, 26% of the worldwide seawater desalination capacity.

Acknowledgments

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بعض الخصائص البيئية وأنواع أسماك المياه المحيطة بجزيرة السمالية، أبو ظبي، الإمارات العربية المتحدة

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المستخلص

درست بعض الصفات الفيزيائية والكيميائية وأنواع أسماك المياه المحيطة بجزيرة السمالية، أبو ظبي، الإمارات العربية المتحدة للفترة من حزيران 2004 إلى آيار 2005. شمل القياس درجة حرارة الهواء والماء ونفاذية الضوء و pH والملوحة والقاعدية (كاربونات و بيكربونات) والكلوريد والكالسيوم والمغنيسيوم والصوديوم والبوتاسيوم والكبريتات والنترات. أظهرت النتائج ارتفاع ملوحة الماء أكثر من 48 جزء بالألف وتصل إلى 59.9 جزء بالألف خلال تموز، بينما تراوحت درجة حرارة الماء بين 21°م خلال شباط إلى 33.3°م خلال تموز. شكل الكلورايد والصوديوم والكبريتات والمغنيسيوم والكالسيوم والبوتاسيوم نسبة 95.3% من أملاح المياه المحيطة بالجزيرة. بلغ عدد أنواع الأسماك المصادة من منطقة الدراسة 49 نوع تعود لـ 37 جنس و 28 عائلة. كانت عائلة الحمام **Carangidae** اكثر العوائل تنوعا وشملت ثلاث اجناس واربعة انواع، تليها عائلة **Haemulidae** والتي تمثلت بجنسين واربعة انواع من الاسماك.