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Temperature variability and distribution of fish along the Suez Gulf, Red Sea as a reason of climate change

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ABSTRACT

In the past decade, it has become evident that the entire global climate is warming, a phenomenon which has widespread impacts on biodiversity. Recently, many modeling studies estimated climate-mediated turning in species composition resulted from the integration of local species damage and invasions from other locations. The Suez Gulf is one of the wealthiest fishing regions of the Red Sea in the Egyptian sector. It has unique marine resources rich with natural biodiversity. Recently, it was noted that the Suez Gulf suffers from many pollutants. The various impacts of pollutants on aquatic biodiversity were studied. Observations data associated with the high-quality analysis offered by NASA POWER Project service and climate models outputs were used in describing the regional climate patterns for the historical period and under climate change conditions in both short and "long-term" prediction for the study area. In addition, the climate data were used as an input in the derived regression equation to assess its impact on fish abundance. Results indicated that there are small variations between the air and surface temperature compared to the differences between the air and water temperatures during the period 1982–2020, and the change in temperature for air, surface, and water has a similar pattern. Of the eleven fish families showing direct relation between temperature variation and distribution, Caragidae, Scombridae Kawakawa, Clupeidae Sardine and Mugilidae Mullet were the most prominent. Moreover, there are other controlling parameters affecting the change in the number of fishes in the total catch all over the year and all over the study period other than the temperature itself such as Gulf width, water depth, and fishing activities.

INTRODUCTION

Aquatic biodiversity is essential for the future sustainability of marine resources, especially commercial fisheries. The high degree of genetic diversity in different fish populations can protect them from various environmental stressors such as climate change and pollution, in addition, to the spread of related diseases in their environment **(Hilborn *et al*., 2003)**. Climate change has great impacts on marine systems through hydrographical changes, including variable weather patterns which threaten food production, increased risk of catastrophic floods, and rising sea levels **(Alharbi and Csala 2021)**. Moreover, some human activities affect species distribution such as; habitat degradation, aquaculture, and shipping. Climate change may promote the ability of some alien species to transfer to new ecosystems while affecting native species by disturbing the local dynamic equilibrium **(Pyke *et al*., 2008)**. To the range that resource availability permits, species are subjected to track warming climate and then relocate their distributions to other higher latitudes. Pole-wards range changes were observed in different regions and also various taxa **(Hellmann *et al*., 2008)**.

Recently, it can be said that climate change is already produced noticeable effects on aquatic biodiversity. Projected future changes are likely to perform changes in species distribution and ecosystems, and overall biodiversity loss **(Khalil *et al*., 2022)**. Marine fish are among the taxa which are changing their allocation the fastest due to climate change **(Lenoir *et al*., 2020)**, often strolling by hundreds of kilometres / decade **(Campana *et al*., 2020; Champion *et al*., 2021)**. Rapid distribution of fishes poleward is modifying the ecology of estuarine and marine systems **(Coni *et al*., 2022)** with different consequences for ecosystem services **(Pinsky *et al*., 2021)**.

With the rising global warming of oceans as a result of climate change, many aquatic organisms face great challenges that accommodate such changes by relocating their distribution poleward, proceeding with their phonology **(Poloczanska *et al*., 2013)**. While some parts of oceans warm gradually, others represent high fluctuations such as heatwaves and so enhancing more impacts on biodiversity **(Alley *et al*., 2003)**. As an example; the effects of climate change and heat waves on seagrass in addition to other organisms in the Mediterranean Sea **(MEA, 2019; Sharma *et al*., 2008)**. Estuaries could cause loss of breeding spots, disruption of the marine environment and the associated creatures, disturbance in circulation models which impact the conservation of some native species, elevated hypoxia and storm strength **(Roessig *et al*., 2004; Alharbi and Csala 2021)**.

To evaluate an increasing water temperature, long time series of water and air temperature data is required. However, the majority of observed water temperature data are not continuous measurements, but rather are taken at specific times **(Jordà *et al*., 2012)**. Consequently, because they are not synchronized with air temperature measurements, it is not possible to accurately interpret how changes in the water temperature of a given water body relate to climate change. Therefore, predicting and understanding water temperature are desired goals, and models of different types and complexities have been proposed ranging from simple regression models to more complex process-based numerical one-dimensional **(Marbà *et al*., 2015)** and three-dimensional models.

MATERIALS AND METHODS

Data: In the analysis of temperature extremes over the Suez Gulf, datasets of the daily maximum and minimum temperatures for the period 1982–2020 were used. Daily maximum highest and lowest temperature data in °C are quality-controlled for the whole period from 1982 to 2020. However, the original downloaded and being used MERRA2 data files contain the Earth's Skin Temperature (C), the temperature at 2m, wind speed (m s^{-1}) at both 10m and 50m, precipitation (mm day^{-1}), relative humidity (%) at 2m, dew point (°C) at 2m, sunrise time (h:m:s), transit (noon) time (h:m:s), sunset time (h:m:s), day-length (Hours), recorded each day at the station, these files were obtained from "https://power.larc.nasa.gov/data-access-viewer/" with data grid resolution 0.5 x 0.5 Degree recorded Daily Averaged Data.

The data processed contains only: Air Temp. (°C), Surface Temp. (°C), Water Temp. (°C), Max Temp. (°C), Min Temp. (°C), and Seasons. These data were used to detect the extremes and temporal variation in each parameter in the study area.

Collected data for fish

The most dominant fish species were collected and identified based on morphological and morphometric characteristics. The fishing statistics were collected from GAFRAD statistics books **(GAFRD, 1995-2018)**.

Method:

Study the historical regional climate variability and trends at different timescales in the study area, based on the latest high-resolution climate reanalysis produced data (MERRA2) which offers hourly data on many atmospheric and land parameters together with estimates of the uncertainty. Investigations and analyses of the extreme temperatures of the air along with the ground surface and sea surface temperatures were carried out for the historical period, by using some selected indices and indicators of extremes (Table 1).

Using regression analysis for Sea Surface Temperature (SST) with Air Temperature (AT) based on the buoy data (available from JMA), the relationship can be expressed as:

$AT = 0.98 \cdot SST + 1.45$ … with a regression coefficient (r) = 0.98.

- To minimize the error caused by different regression equations for SST and AT in the summer ($AT = 1.01 \cdot SST - 0.66$) and winter seasons ($AT = 1.27 \cdot SST - 9.61$. (Y. S. Kim et al., 2004)

Study Area:

Gulf of Suez (Fig. 1) with "Latitude: 29° 58' 25.36" N; Longitude: 32° 31' 34.57" E" is the Red Sea's north-western arm, and is located east-side of Sinai Peninsula at the top north-east of Egypt. The Suez Canal links the Gulf of Suez to the Mediterranean Sea, and it is an important international shipping route. The length of the Gulf of Suez is about

314 km, from its top to its end at the city and its width varies from 19 to 32 km., its average depth is 40 m., and the maximum depth in certain areas is 70 m. There are four fishing harbors along the Gulf of Suez; Salakhana, Ataka, Ras Gharib, and El-Tor, respectively from the north toward the south, while the Ataka fishing harbor is considered the largest one having the largest number of operated fishing vessels at the Suez Gulf. It may be considered subtropical including huge seasonal variations **(Osman, 2016)**. Water temperature differs from 18 °C in winter to 28 °C in summer and its salinity exceeds 42% near its mouth **(Abdelmongy and El-Moselhy, 2015)**.

Fig. 1: Gulf of Suez

Data Analysis: All-climate indices were calculated using the RClimDex **(Zhang and Yang, 2004)** that is developed by Zhang and Yang. RClimDex generally calculates a total of 27 climatic indices, including for example temperature and precipitation indices, of which only 11 indices are computed using only temperature data.

Table 1: List of Extreme Indices Recommended by The Expert Team on Climate Change Detection and Indices (ETCCDI) Used in This Study

Absolute Indices			
Index	Indicator name	Definition	Unit
TXx	Maximum of maximum temperatures	The monthly maximum value of daily maximum	°C
TNx	Maximum of minimum temperatures	The monthly maximum value of the daily minimum	°C
TXn	Minimum of maximum temperatures	The monthly minimum value of daily maximum	°C
TNn	Minimum of minimum temperatures	The monthly minimum value of the daily minimum	°C
DTR	Diurnal temperature range	The difference between the maximum and minimum temperature	°C
Relative Indices			
Index	Indicator name	Definition	Unit
TX90p	Warm days	Percentage of days when TX>90th percentile	Days
TX95p	Very warm days	Percentage of days when TX>95th percentile	Days
TX99p	Extreme warm days	Percentage of days when TX>99th percentile	Days
TN90p	Warm nights	Percentage of days when TN>90th percentile	Days
TN90p	Very warm nights	Percentage of days when TN>90th percentile	Days
TN90p	Extreme warm nights	Percentage of days when TN>90th percentile	Days
TX10p	Cold days	Percentage of days when TX<10th percentile	Days
TN10p	Cold nights	Percentage of days when TN<10th percentile	Days

RESULTS

- **Temperature Extremes:**

Through analyzing the temperature ‘unusually hot days’ and ‘unusually cold days’ have been identified. The definition of these extremes is based on comparing the daily value with the 90th and 10th percentiles of the statistical distribution of the values recorded from 1/1/1982 to 31/3/2021, after this detection of the temperature extremes based on the daily data, years were compared by the means of the total number of extremes they contain.

Table 2: Temperature of Hot and Cold Days Vs Temperature of Hot and Cold Nights

Description	Percentile	Threshold Value (°C)
Hot days	90%	36.08
Very Hot days	95%	37.14
Extreme Hot days	99%	39.19
Cold days	10%	17.54
Hot Nights	90%	21.35
Very Hot Nights	95%	22.21
Extreme Hot Nights	99%	23.69
Cold Nights	10%	7.26

The recorded temperature of hot days and hot nights for the study area are above 36.08 ℃ and 21.35 ℃ respectively, while the temperature of the very hot days and nights are 37.14 ℃ and 22.21 ℃ respectively, and the extreme case for the temperature in the hot days and nights are 39.19 ℃ and 23.69 ℃ respectively, while the recorded temperature of cold days and cold nights are 17.54 ℃ and 7.26 ℃ respectively.

Using the threshold values deduced by the previous definition for the Hot and Cold days and nights presented in Table (2) the number of these days and nights are listed in Table (3), applying the statistical analysis methods it is found that there are 695 hot days most of them are in the Summer (June and July), also there are 571 days considered as very hot days and most of them are also in the Summer, and 144 extremely hot days mostly in the summer and some in the spring, while there are 1431 days with cold temperature below the selected threshold for the study, nearly all of them in the winter and some in the spring and few in the autumn. Speaking of the nights, there are 704 hot nights and most of them in the summer and some in the autumn, also there are 566 very hot nights most of them are also in the summer with some nights in the autumn, and 142 extremely hot nights mostly in the summer, while the last record is the cold nights with a count of 1428 nights mostly in the winter and few in the spring.

Table 3: Summary Count of Hot and Cold Days and Nights All Over the Study Period (1982-2020)

Years (1982 - 2020)	
No. of Hot Days	720
No. of Very Hot Days	571
No. of Extreme Hot Days	144
No. of Cold Days	1426
No. of Hot Nights	704
No. of Very Hot Nights	574
No. of Extreme Hot Nights	147
No. of Cold Nights	1425

From the data in Fig (2) and table (4) below the number of recorded hot days are 720 days with hot nights count of (704 nights), while the number of very hot days is 571 days and for the very hot nights is 574 nights. Meanwhile, the counts of extreme cases for both hot days and cold nights are 144 days and 147 nights respectively, while the counts of cold days vs cold nights are 1426 days and 1425 nights respectively. From which it is clear that almost all the days and nights are having the same pattern in the recorded extremes (i.e. the day with extremely hot temperature accompanied with a night with extremely hot temperature)

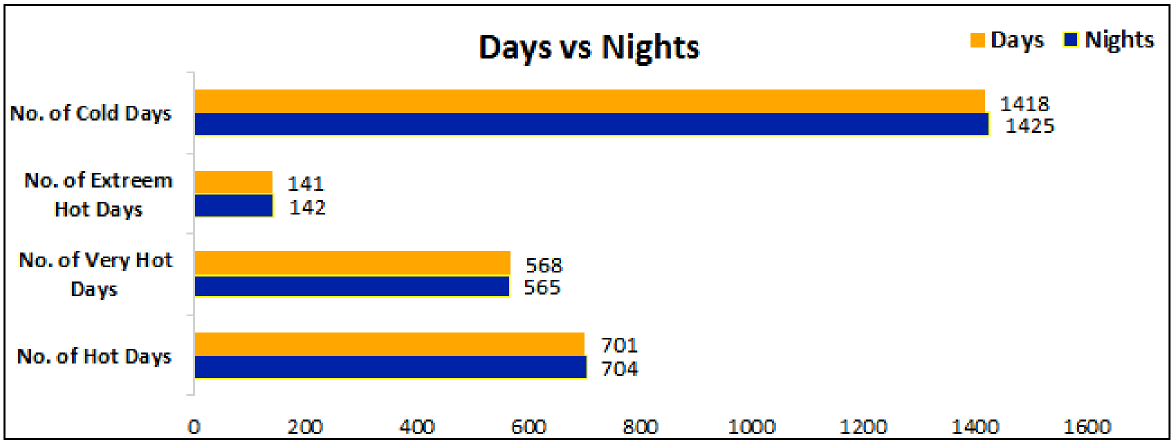


Fig. 2: Count of Hot and Cold Days and Nights

Table 4: Number of Hot and Cold Day in Comparison to Number of Hot and Cold Nights

	No. of Hot Days	No. of very Hot Days	No. of Extreme Hot Days	No. of Cold Days
Days	701	568	141	1418
Night	704	565	142	1425

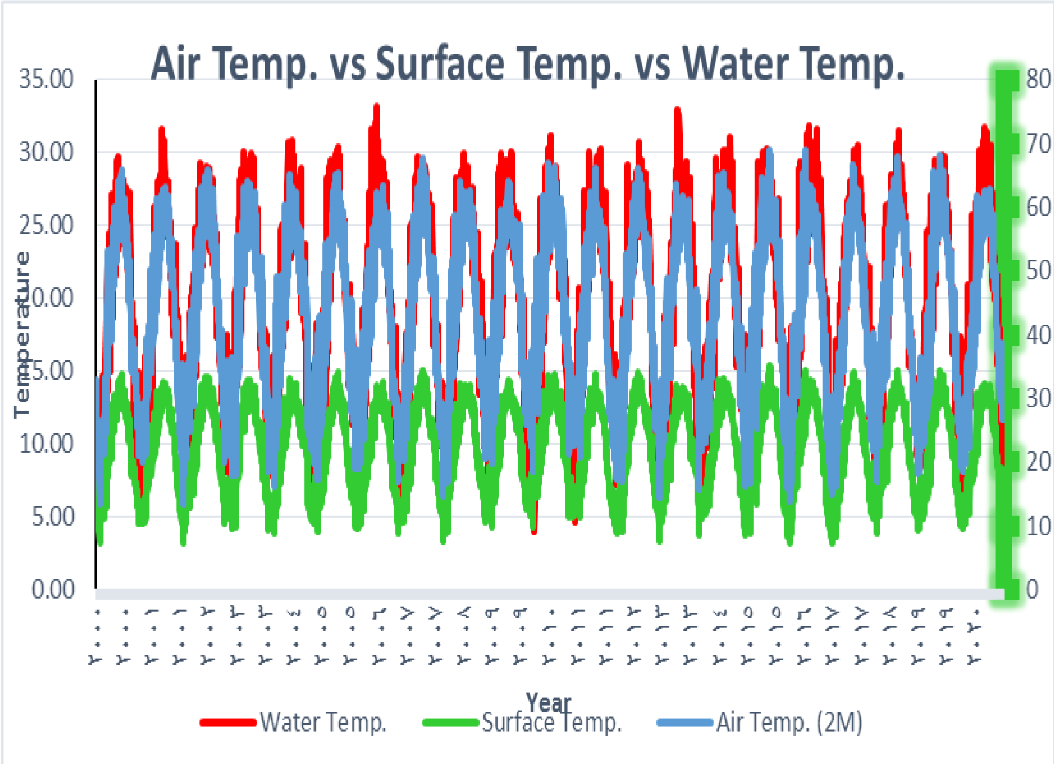


Fig. 3: Air Temp. vs Surface Temp. vs Water Temp

Table (5) shows the detailed identification of each of the relative indices for each year over the study period from 1982 to 2020, and the highlighted cells are the maximum and minimum counts. Figure (3) shows the relation between air, surface, and air temperatures and it is obvious that the air and surface temperature differences are slightly very small, compared to the differences between the air and water temperatures, also it is clear that the change in the temperature for the air, surface and the water is having the same pattern.

Table 5: Detailed Count of Hot and Cold Days and Nights All Over the Study Period (1982-2020)

Year	Hot days	Very Hot Days	Ext. Hot Days	Cold Days	Hot Nights	Very Hot Nights	Ext Hot Nights	cold Nights
1982	14	8	0	54	8	6	0	54
1983	12	6	2	62	6	6	1	70
1984	15	6	1	39	5	3	0	42
1985	12	13	1	37	10	11	0	42
1986	16	7	2	39	7	11	3	38
1987	7	21	2	39	4	13	4	42
1988	25	27	13	46	32	23	5	35
1989	20	8	1	61	13	5	0	59
1990	17	9	0	42	7	6	0	42
1991	18	9	2	48	18	11	2	38
1992	18	9	3	76	14	5	0	74
1993	24	13	3	41	17	12	0	61
1994	19	12	0	35	26	5	2	33
1995	17	15	4	40	16	7	4	33
1996	20	19	3	24	10	10	4	21
1997	11	13	3	36	11	7	1	39
1998	27	27	7	30	15	24	7	27
1999	13	19	0	15	22	11	2	26
2000	21	14	8	50	11	11	3	59
2001	20	27	1	29	26	16	3	26
2002	18	18	14	27	19	18	9	36
2003	24	12	2	31	26	8	1	35
2004	10	16	4	38	9	7	1	31
2005	16	15	3	39	18	14	3	37
2006	12	15	1	36	12	16	1	35
2007	12	17	10	30	19	10	10	29
2008	35	19	2	39	22	20	4	40
2009	19	12	1	13	19	16	6	22
2010	23	25	6	11	16	36	13	10
2011	17	9	1	26	11	10	1	13
2012	12	21	3	50	18	26	11	53
2013	17	2	4	26	22	11	0	28
2014	14	14	5	12	30	15	3	11
2015	20	21	6	34	31	22	19	29
2016	22	19	8	42	42	22	3	39
2017	25	15	4	39	17	32	6	40
2018	23	7	4	22	37	31	4	12
2019	23	15	7	34	34	27	8	34
2020	32	17	3	34	24	30	3	30

Table 6: Average monthly Fish Amount during (2000-2018)

Month	Temp. ℃	Fish (Ton)
Jan	10.38	2960.88
Feb	10.96	2273.81
Mar	13.70	2027.5
Apr	18.60	1813.88
May	22.54	1094.19
Jun	25.46	202.813
Jul	27.05	140.5
Aug	26.87	31.5625
Sep	24.55	950.875
Oct	21.06	3861.31
Nov	16.33	4232.19
Dec	11.96	3419.06

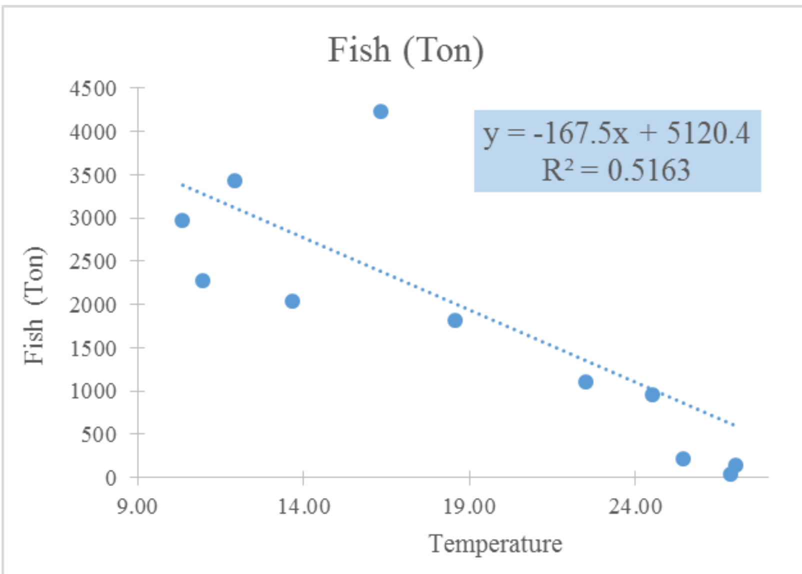


Fig. 4: Average monthly Fish Amount during (2000-2018)

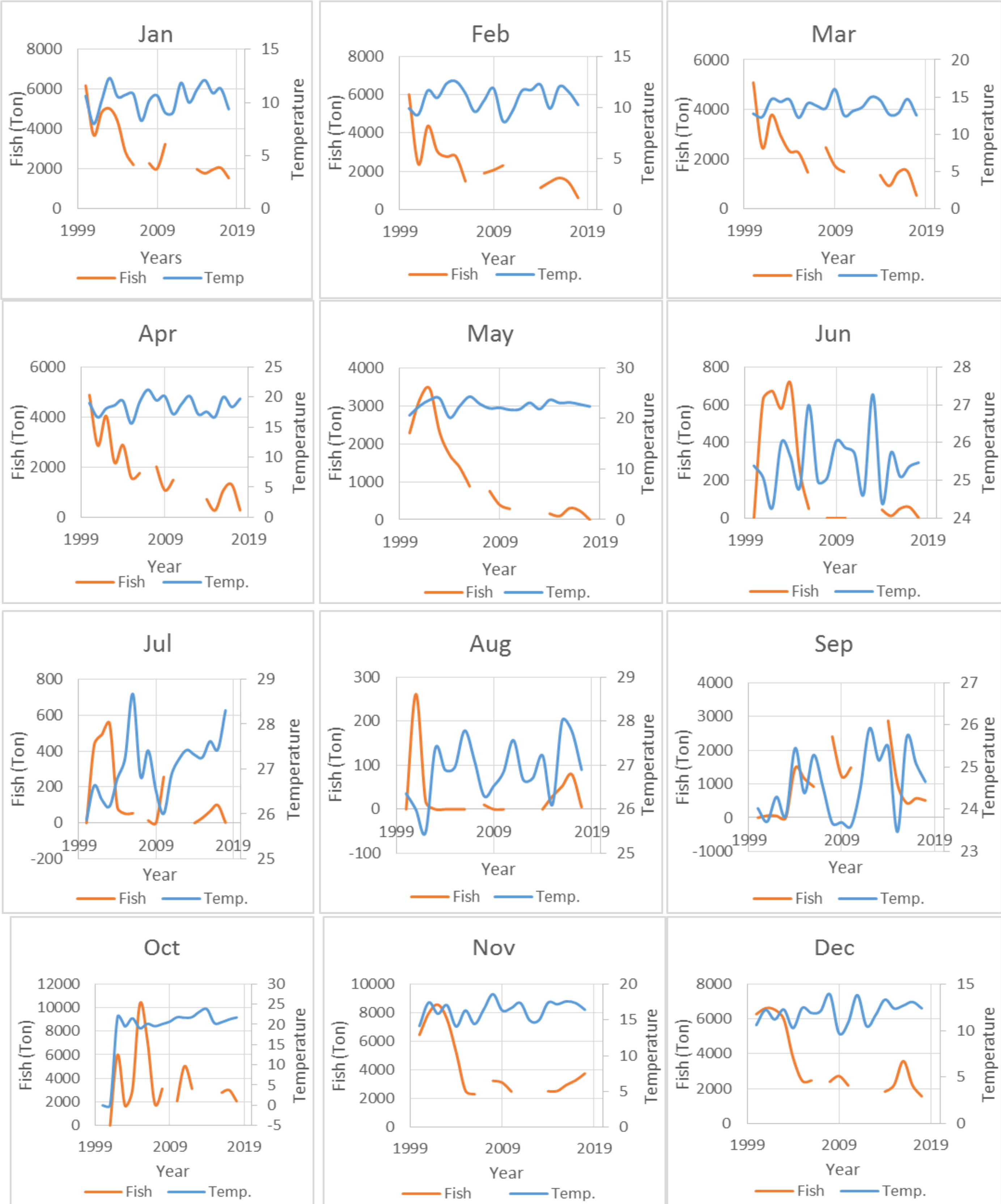
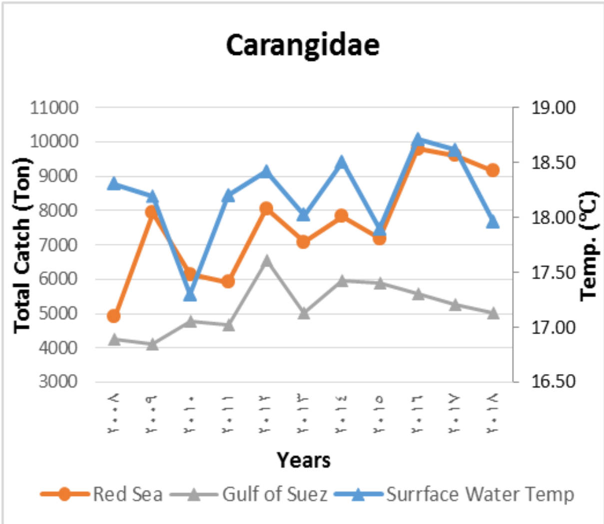
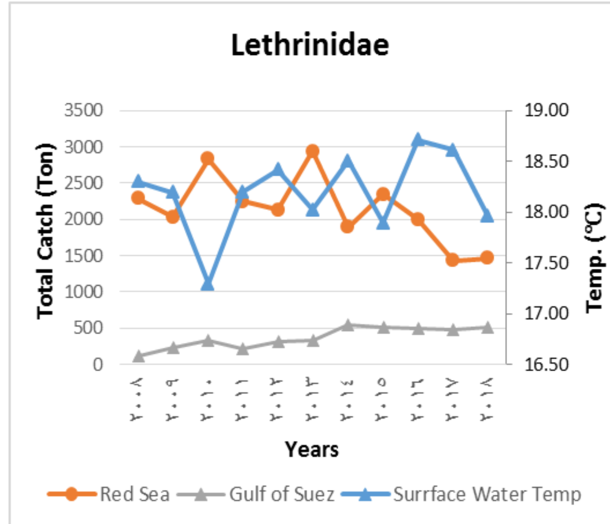


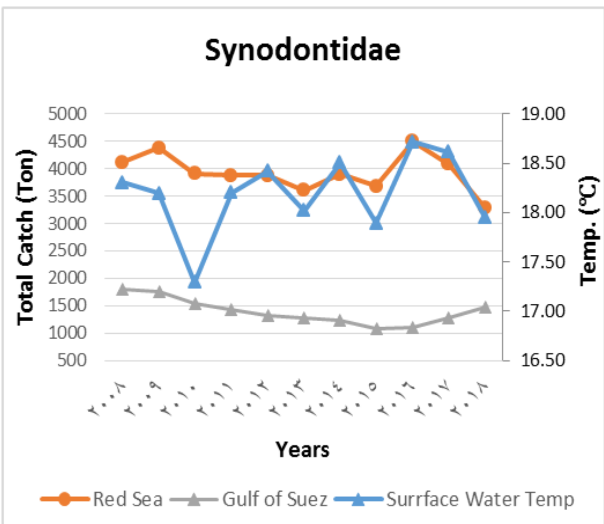
Fig. 5: Water Temperature vs Fish Amount (2000 – 2018) distribution over year monthsGulf of Suez

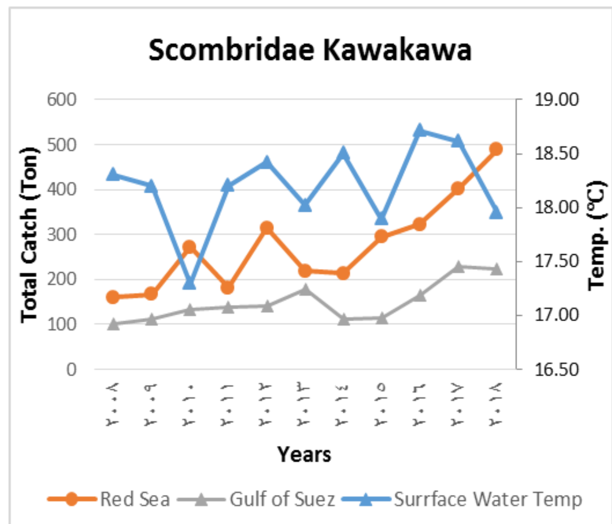
Table 7: Fish amounts distributed by fish type (2008 – 2018) in the Red Sea and Gulf of Suez

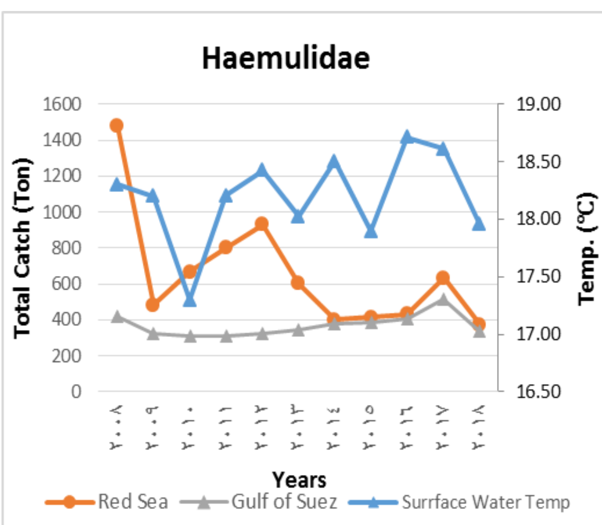
Fish name	Site	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Carangidae	Red Sea	4909	7932	6151	5913	8057	7092	7826	7196	9804	9613	9152
	Gulf of Suez	4256	4123	4786	4678	6543	5014	5970	5879	5567	5278	5033
Lethrinidae	Red Sea	2291	2038	2831	2246	2134	2938	1892	2347	2001	1431	1467
	Gulf of Suez	118	234	324	213	309	327	546	511	498	483	513
Synodontidae	Red Sea	4116	4381	3915	3884	3877	3605	3901	3679	4504	4085	3294
	Gulf of Suez	1810	1768	1543	1435	1332	1279	1234	1090	1112	1288	1473
Scombridae Kawakawa	Red Sea	160	167	272	182	315	219	213	295	323	402	489
	Gulf of Suez	102	111	132	139	141	179	112	115	165	230	224
Nemipteridae	Red Sea	3456	4135	2894	3393	3333	3239	2982	3162	2662	3289	3178
	Gulf of Suez	558	511	476	444	421	417	456	555	678	453	635
Scombridae Spanish Mackerel	Red Sea	181	174	349	225	174	161	233	362	289	170	124
	Gulf of Suez	32	30	29	29	24	23	23	120	118	29	41
Haemulidae	Red Sea	1476	484	667	799	929	601	400	415	431	633	373
	Gulf of Suez	417	323	311	309	324	342	378	388	403	514	335
Sparidae Boopsboops	Red Sea	1325	728	793	32	343	58	38	25	17	535	60
	Gulf of Suez	1325	545	509	2	211	58	38	25	17	535	60
Clupeidae Sardine	Red Sea	3281	7295	4701	4840	5328	4146	4587	5091	6888	7921	9499
	Gulf of Suez	3281	2567	2444	3213	4324	4146	4587	5091	6888	7921	8074
Engraulidae Anchovy	Red Sea	5336	4230	3775	1719	338	3058	3408	3110	3152	3339	3066
	Gulf of Suez	5336	4230	3775	1719	338	3058	3408	3110	3152	3339	3066
Mugilidae Mullet	Red Sea	1159	599	339	343	236	186	185	122	156	311	279
	Gulf of Suez	639	543	211	167	154	159	136	90	115	230	206

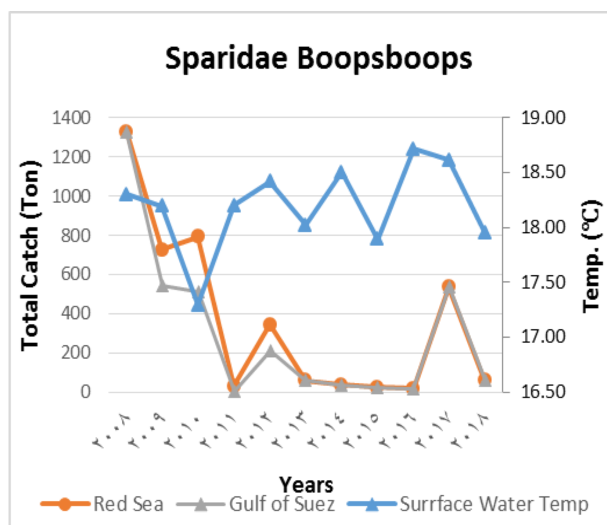

Carangidae
Total Catch (Ton)
Temp. (℃)
Years
Red Sea
Gulf of Suez
Surrface Water Temp


Lethrinidae
Total Catch (Ton)
Temp. (℃)
Years
Red Sea
Gulf of Suez
Surrface Water Temp


Synodontidae
Total Catch (Ton)
Temp. (℃)
Years
Red Sea
Gulf of Suez
Surrface Water Temp


Scombridae Kawakawa
Total Catch (Ton)
Temp. (℃)
Years
Red Sea
Gulf of Suez
Surrface Water Temp


Haemulidae
Total Catch (Ton)
Temp. (℃)
Years
Red Sea
Gulf of Suez
Surrface Water Temp


Sparidae Boopsboops
Total Catch (Ton)
Temp. (℃)
Years
Red Sea
Gulf of Suez
Surrface Water Temp

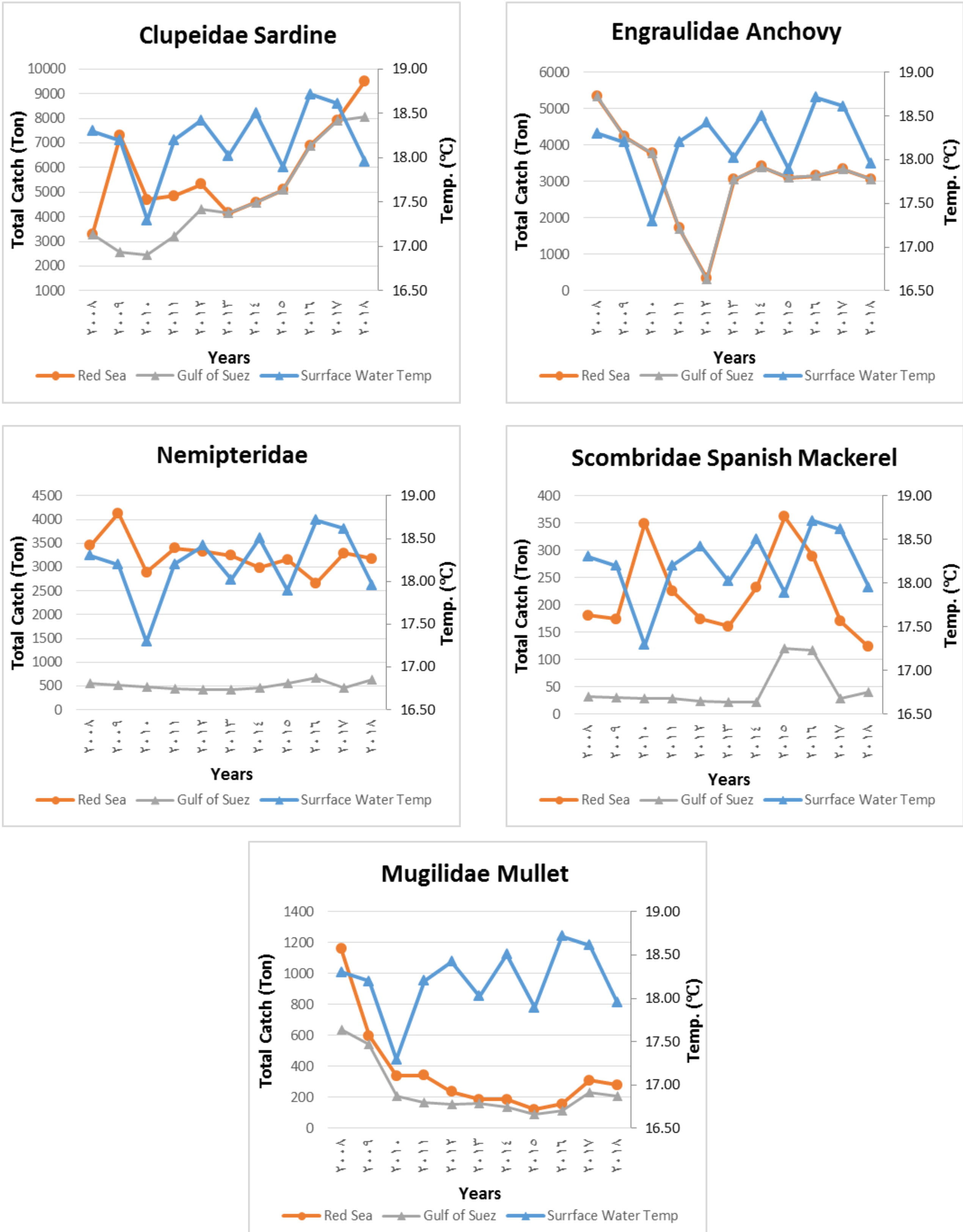


Fig. 6: Water Temperature vs Fish Amount (2008 – 2018) Distribution by Fish Type

DISCUSSION

Like many regions all around the world, Suez Gulf is predicted to experience an increase in temperature and drought conditions as a result of climate change, leading to altered fish species distributions. According to the available data in table (7) and Figure (6), it is notable that for the **Carangidae Fish**, the number of fish increases with the increase of temperature and decreases when the temperature decreases in both the Red Sea and Gulf of Suez. Except in certain periods as in (2008~2009) and (2015~2016) in which the amount of fish decreases with the increase of temperature and increases when the temperature decreases. While for the **Lethrinidae Fish**, the amount of fish decreases with the increase of temperature and increases when the temperature decreases in both the Red Sea and the Gulf of Suez. Except in certain periods as in (2008~2009) and (2016~2017) in which the amount of fish increases with the increase of temperature and decreases when the temperature decreases.

And for the **Synodontidae Fish**, the amount of fish increases with the increase of temperature and decreases when the temperature decreases in the Red Sea except in the period (2008~2009) the amount of fishes increases when the temperature decreases, while in the Gulf of Suez the amount of fishes decreases all the time and starts to increase by 2015 and keeps the increase till 2018. In addition, it takes a different path in the Gulf of Suez away from the temperature variability. For the **Scombridae Kawakawa Fish**, the amount of fish in both the Red Sea and the Gulf of Suez is not varying with the increase or decrease of the Temperature. While, for the **Nemipteridae Fish,** the amount of fish in the Red Sea decreases with the increase of temperature and increases when the temperature decreases. Except in certain periods as in (2010~2011), (2012~2013), and (2017~2018) in which the amount of fish increases with the increase of temperature and decreases when the temperature decreases. In addition to that, it takes a different path in the Gulf of Suez away from the temperature variability.

Temperature increase to some degree will compensate the considerable freshening of the water at the expense of evaporation from water surface. Intensively evaporating, such water bodies will bring a high part of salts into salt balance of the sea water (**Chernichko *et al*., 2022**).

Moreover, for the **Scombridae Spanish Mackerel Fish,** the amount of fish decreases with the increase of temperature and increases when the temperature decreases in the Red Sea. While for the Gulf of Suez, the change takes a different path in the Gulf of Suez away from the temperature variability. However, in certain periods as in (2008~2009) (2012~2014) and (2016~2018), the amount of fish increases with the increase of temperature and decreases when the temperature decreases in the Red Sea. Also, for the **Haemulidae Fish,** the amount of fish increases with the increase of temperature and decreases when the temperature decreases in the Red Sea except in the periods (2009~2010), (2013~2015), and (2016~2017) the amount of fishes increases when the temperature decreases, while for the Gulf of Suez, the change takes an increasing curve from 2009 to 2017 then the change takes a decreasing curve. For the **Sparidae Boopsboops Fish,** the amount of fish increases with the increase of temperature and decreases when the temperature decreases in the Red Sea and Gulf of Suez in the periods (2008~2009), (2011~2013), (2014~2015) and (2017~2018) and all the remaining periods the amount of fishes decreases with the increase of temperature and increases when the temperature decreases.

For the **Clupeidae Sardine Fish,** the amount of fish increases with the increase of temperature and decreases when the temperature decreases in the Red Sea and Gulf of Suez except in the periods (2008~2009), (2014~2015), and (2016~2018) the number of fish increases with the increase of temperature and decreases when the temperature decreases. And for the **Engraulidae Anchovy Fish,** the amount of fish increases with the increase of temperature and decreases when the temperature decreases in the Red Sea and Gulf of Suez except in the periods (2010~2012) and (2016~2017) the amount of fish increases with the decrease of temperature and decreases when the temperature increases. While for the **Mugilidae Mullet Fish,** the amount of fish increases with the increase of temperature and decreases when the temperature decreases in the Red Sea except in the periods (2011~2012), (2013~2014), and (2016~2017) the number of fish increases with the decrease of temperature and decreases when the temperature increases. And in the Gulf of Suez, shows the same behavior as the Red Sea Except in (2010~2011) the amount of fish decreases with the increase in temperature.

The detected fluctuations in fish distribution may be related to many parameters other than temperature changes: Three fishing methods are used in the Gulf and the Red Sea; trawl, purse-seine, and artisanal fisheries especially long and hand, and some of them are suspended during the closure season (from June to August or September). Therefore, the recorded numbers reveal the current fishing method only and not the real numbers in the Gulf. Another parameter that affects fish distribution is that at low temperatures, fish move to shallow areas in the Gulf for heating. So, some fish species are recorded in high numbers in some areas when compared to others. In agreement with our results, it is clear that global warming also integrates with other environmental efforts such as exploitation – land-use change – invasive species – pollution, and diseases **(Staudt *et al*., 2013)**. In many situations, such stressors have been the main drivers of biodiversity loss **(Master *et al*., 2009)** and will combine with climate change to impact the vulnerability of populations and species **(Barnosky *et al*., 2011; Mantyla-Pringle *et al.*, 2011)**.

Biodiversity is always one of the most difficult service which is amenable to research and prediction. At the same time, the climatic changes impact on significantly both biodiversity as a whole, its components, and the welfare (well-being) of the person, which he receives based on biodiversity **(Schippers et al., 2021 and Verma, 2021)**.

CONCLUSION

From the previous results, it is obvious that there are other controlling parameters for the change in the number of fishes in the total catch all over the year and all over the study period other than the temperature itself, and it can be listed in detail with another detailed long period study, but here in this study just a few of them will be mentioned such as:

- The dimensions of both the Red Sea and the Suez of Gulf are extremely different (Width and Depth).
- Fishing methods and the closure season.
- Maritime navigation, wave movement, and sea currents vary from sea to gulf.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This research was conducted in strict accordance with the guidelines of the Ethical Committee, National Research Centre, Egypt, on the care and use of animals for scientific purposes.

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AUTHOR CONTRIBUTIONS

Ali Wheida Mostafa El Nazer, Fagr Kh. Abdel-Gawad and Samah M. Bassem conceived the study, Ali Wheida, Mostafa El Nazer, Samah M. Bassem, Tarek A.Temraz, Zaki Z. Sharawy, conducted the study, A. A. Wheida, and Mostafa El Nazer analyzed the results. All authors reviewed the manuscript.

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