International Journal of Engineering Applied Sciences and Technology, 2022
Vol. 7, Issue 5, ISSN No. 2455-2143, Pages 214-217
Published Online September 2022 in IJEAST (http://www.ijeast.com)

SHAPING AND EVALUATION OF PHYSICAL PARAMETERS FOR FARWA LAGOON - LIBYA

Asadeq A. D. Zaid
Department of Environment Science
Faculty of Science, Sabratha University, Libya

Amena H. Abdusslam Abugoufa
Department of Physics
Faculty of Science, Sabratha University, Libya

Fauzi Abdulslam Salih
Higher Institute of Marin Sciences Techniques
Sabratha, Libya

Abstract— **Farwa complex suffers the effect of pollution, temperature change and the high evaporation process. These effects include but are not limited to physical changes like water properties and the island's shape over time, as results of wave motion and direction. The only study that related to this issue was reported by (M. GERGES & A. DURGHAM, 1982) as part of the UNESCO mission. Their study concluded the results of high salinities, approaching 42 % in winter, 43 % in spring, and 44.5. %. in summer, and 43 %. in autumn, are most probably obtained through the evaporation process. Here we expressed our work by InSite examination and satellite image to evaluate these physical parameters. Results reported that TDS dropped from 11203 ppm at 27.7 C to 10430 ppm at 29.2 C and the daily average DO was between 3.0 mg/L and 3.7 mg/L. in addition, the value as inflow needs to be increased by extending the bath or the waterway at least 40 m wide and 3 m deep to let more water come thru it. This engineering proposal will raise the water level inside the lagoon as well as, expend the aquatic life in the area.**

Keywords— **Island, Farwa Lagoon, temperature, salinity, DO, pH, water depth**

I. INTRODUCTION

Due to the unique environment and the location, Farwa Island and Lagoon were the attraction of many researchers from different countries. Some studies were carried out by scientific expeditions from Europe especially Italy during the 1930s. The earliest studies of Farwa date back to the beginning of the last century (SCORDIA, 1937, cited in PERGENT ET AL., 2002), It is also threatened due to the Oil pollution and other land-based sources (LAURENT ETAL., 1998). The survey was divided into three phases from 1995 to 1999; this survey was conducted under the supervision of the Environment General Authority (EGA, Libya). In addition, for our part, we carried out the study and the investigation to evaluate the physical parameters of the lagoon to continue (M. GERGES & A. DURGHAM, 1982) work and start a reference for future research.

II. GENERAL DESCRIPTION OF THE AREA

Farwa Lagoon and Island is located in the north-west of the Libyan coast (11°54’45” E, 33°05’33” N), north Abu- Kamash which is almost 150 km west of Tripoli at the border area between Libya and Tunisia (fig. 1). The lagoon is covering an area of approximately 32 km² (13 km long and 2.5 km wide on average). The depth of the water is varying from 0.5 m to 4 m. Island (sand bar), an elongated sand bar extending from east to west for 11km and which is 0.5–1km wide (AZAFZAF ET AL., 2005; ETAYEB AND ESSGHAIER, 2007). There is a blocked opening at the eastern end of the sand bar; it was replaced by an artificial opening in 1995 about 3 km west of the natural one. As a result, the eastern region of the lagoon is characterized by shallow depths and a high degree of confinement..

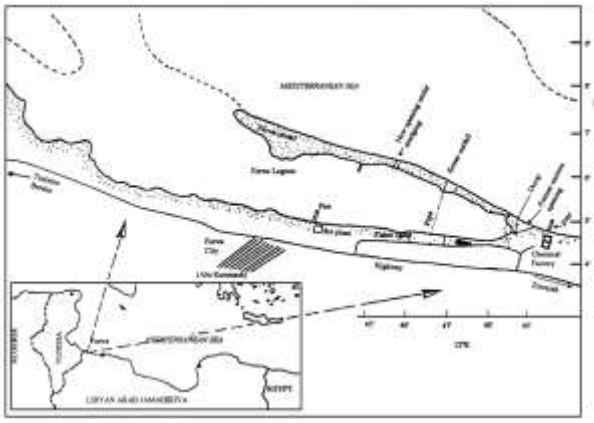

Fig. 1. Showing the location of Farwa complex

International Journal of Engineering Applied Sciences and Technology, 2022
Vol. 7, Issue 5, ISSN No. 2455-2143, Pages 214-217
Published Online September 2022 in IJEAST (http://www.ijeast.com)

The rest of the Lagoon is dominated by three benthic macrophyte species, namely the marine phanerogams Cymodocea nodosa (Asch, 1870), Posidonia oceanica and the alga Caulerpa prolifera (Lamouroux, 1809; PERGENT ET AL, 2002). At the far western part of the Island, there are accumulations of Posidonia and other seagrass.

Farwa Island has a Mediterranean Sea climate. The mean annual temperature is 20ºC and the mean annual rainfall reaches 185 mm, that an average of the precipitation between 1990 to 2020. Generally, the area has sunny days most of the year.

The complex has a collection of sand dunes, trees, mudflats, marshes, drying salt lakes, and beaches. These different conditions provide a good habitat for many plant and animal species (Etayeb, 2002; EGA-RAC/SPA, 2012; Isemmann et al., 2016). Farwa Island is affected by wind speeds and currents ranging in different seasons, the current rotation path may create a kind of vortices in the northern part, especially in the relatively deep areas. It has been observed that the speed of the current in the eastern part of the lake is higher than in the western part at the entrance. The current average of the year is between 7- 40 cm/sec in the summer and 15 – 60 cm/sec in the spring season (Gerges & Durgham,1983 Marine Research Centre, 1982).

III. AIMS OF THE STUDY

The aims of this study are to identify the physiochemical properties, and the reformation of the lagoon to interpret its development Farwa complex. This study uses Landsat Images and physiochemical parameters of the water to evaluate the effect of these changes on aquatic organisms in the Farwa lagoon.

IV. METHODOLOGY

In this research we focused on investigating and evaluating the physical parameters of the Farwa lagoon. The investigation starts with the on-site measurement using the classic method as we used SensoDirect 150 device. This portable device is used to estimate the physiochemical parameters (pH, TDS, DO, and T). TDS is Total Dissolved Solids (ppm), normalized to 25C (based on a 2% per degree difference from 25 C). Do is the dissolved oxygen.

In addition, seven locations have been marked as sample locations as shown in image 2. These points' locations we measured using a small boat and some help from our friends at "Farwa Island Protection Organization". Individual sensors are calibrated before each sampling trip, using procedures outlined in the SensoDirect technical manual. DO and pH standards are prepared by Analytical Quality Control Laboratory to ISO 9001 requirements. PH sensor calibrated using a standard solution (pH buffer solutions).

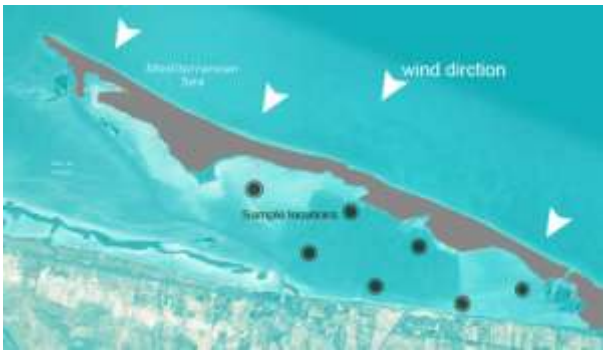

Fig. 2. Showing sample locations at the site of study

Selected seven points (Image 2), to dedicate salinity, pH, Do, T, and depth, which are located at the surface water in the Farwa lagoon.

The second part of this study is to inspect the opening (waterway) on the east side of the sand bar of Farwa Island. Thus, we did a site investigation and took notes about the length, width and flow rate of the water through the waterway. Presented data are based upon a detailed physiographic coastal barrier using Landsat Images and surface water measurements to determine the physiochemical properties of water in Farwa.

V. RESULTS AND DISCUSSION

Important physical parameters of water (especially seawater) are influenced by temperature, pH, salinity and dissolved oxygen. The total dissolved solids (TDS) are frequently used as water quality parameters. Therefore, we established the relation between all parameters we measured to demonstrate the link between these parameters. We measured the site of Farwa bank as it has a small and narrow recharging zone in the east end and the main inflow comes from the west end.

Moreover, we found that the depth of the lagoon ranged between 0.5 m on the east side and gradually increased to 4.0 m on the west side of the lagoon.

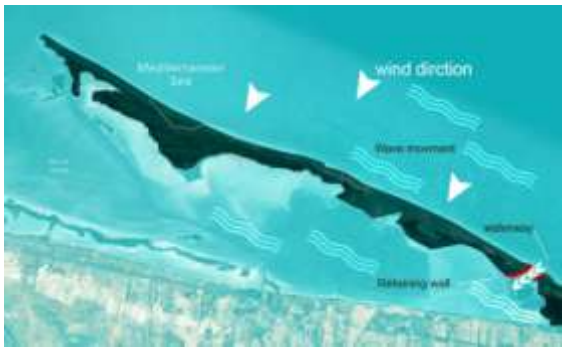

Fig. 3. Showing the wind direction and wav motion out and inside the lagoon

It concerns that the depth of the water related to the low recharging from the open sea. The picture on the side indicates

International Journal of Engineering Applied Sciences and Technology, 2022
Vol. 7, Issue 5, ISSN No. 2455-2143, Pages 214-217
Published Online September 2022 in IJEAST (http://www.ijeast.com)

to this issue as it is clear that the wave motion and the wind direction hit the area from the northeast which handle the reformation of the island shape over the time.
Moreover, the opening on the east side of the island is about 75 m long and 23 m wide, with a 0.5 m depth as clear in Images 4 a, b

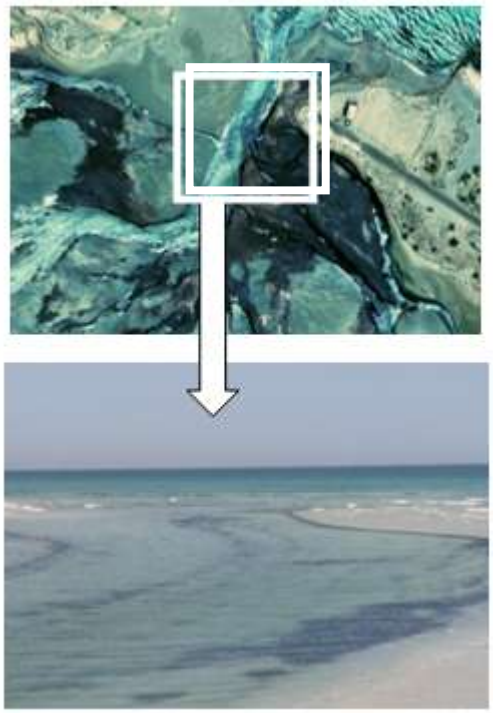

Fig. 4. Showing the wind direction and wav motion out and inside the lagoon (a) Original Satalite image (b) Land Image showing physical description of the waterway (Farwa lagoon)

Therefore, after finishing the physical inspection and coming to our parameters we measured in seven different locations. The table below shows these numbers.

Table -1 Experiment Result parameters measurements (Farwa lagoon)

Sample #	TDS (ppm)	DO (mg/L)	pH	T (Co)
1	10781.25	3.5	8.69	27.9
2	11015.62	3.6	7.37	27.7
3	11046.87	3.5	8.92	28.0
4	10578.12	3.7	7.70	29.0
5	10437.50	3.7	7.78	28.8
6	10906.25	3.1	8.65	29.2
7	11203.12	3.3	7.71	28.7

A. Temperature and TDS
The total dissolved solids (TDS) in the Farwa lagoon are influenced by temperature and the conductivity of ions in water depends on the temperature of the water. Ions move faster when the water is warm.

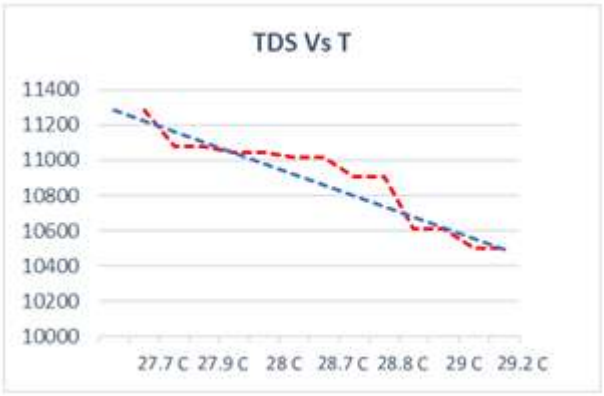

Fig. 5. TDS (ppm) vs T (Co) for seven different locations at the site of study

Temperature is also important because it has an effect on water chemistry and wave movement. The rate of chemical reactions generally increases at higher temperatures.

B. Temperature and TDS
Temperature drives the major physical and biological actions in the Farwa lagoon. The more the water temperature increases, the greater the biogeochemical activity influenced by the environmental intrinsic. Temperature also controls the dynamics of the life of various aquatic organisms that live in reservoirs area, though higher life forms, such as fish, insects, and other aquatic species all have a recommended temperature variety.

Fig. 6. DO vs T for seven different locations at the site of study

The surface water temperature is found to be in the range between 27.8 C0 and 29C0. The daily average DO between 3.0 mg/L and 3.7 mg/L. from the figure and after marketing all the points we got; it is clear that the Do is dropping by increasing the water temperature.
Moreover, points located close to the edge of the island have higher Do related to various aquatic organisms that live in the reservoirs area.

International Journal of Engineering Applied Sciences and Technology, 2022
Vol. 7, Issue 5, ISSN No. 2455-2143, Pages 214-217
Published Online September 2022 in IJEAST (http://www.ijeast.com)

VI. CONCLUSION

According to our and Other Studies, there exists microbiological activity in lagoon water. Microorganisms are capable to degrade TDS and their activity could be the reason for TDS concentration changes. During biological processes TDS can be consumed by microorganisms, too. Absolutely in such a case the value of the recharge water added to the lagoon is very low according to our investigation.
However, this value as inflow needs to be increased by extending the bath or the waterway at least 40 m wide and 3 m deep to let more water come thru it. This engineering proposal will raise the water level inside the lagoon as well as, expending the aquatic life inside the lagoon. The subject needs more information about the amount of recharge water coming from the waterway which means there is a need to study the water balance in this region.

VII. RECOMMENDATION

Over the years, some of the most common problems we've seen with Farwa Island is changing its shape over time. The wave keeps reformation the island. So, the island is getting longer and less wide, and that is related to the direction of the wind (seasonal).

- The first recommendation we would like to provide is to extend the waterway (trench) the let more water come thru and increase the flow rate into the lagoon.

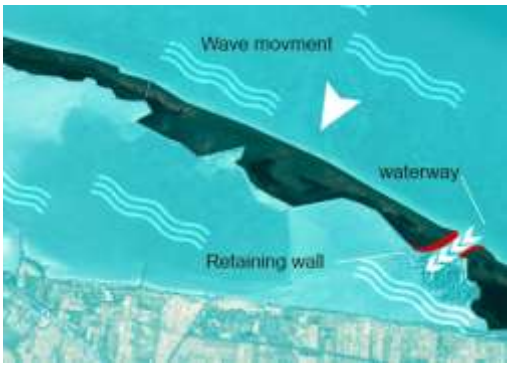

Fig. 7. showing waterway and the retaining wall that we have proposed

- Build retaining walls around the edge where the trench has been made. The retaining walls should be made with an engineering design to provide stability and a longer lifetime.

Fig. 8. showing Steal and concrete retaining wall as an example

VIII. REFERENCE

[1] A Poisson, (1980) Conductivity/salinity/temperature relationship of diluted and concentrated standard seawater, IEEE Journal of Oceanic Engineering, volume 5 Issue 1.

[2] Gerges, M.A. And A. Durgham, 1982 - A study of the physical environment and water circulation in Farwa Lagoon, Libya

[3] A Rietmanm M. L Kaplan & R. J Cava, (1985) Lithium ion-poly (ethylene oxide) complexes. I. Effect of anion on conductivity, Solid State Ionics, Volume 17, Issue 1, Pages 67-73

[4] https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps

[5] Salinity, pH and dissolved oxygen water quality data from the ADP marine exclusion zone, March 2012. Adelaide Desalination Project | Australian Water Quality.

[6] Samal N.R., Pierson D.C., Huang Y., Read J., Anandhi A., Owens E.M. 2012. Impact of climate change on Cannonsville reservoir thermal structure in the New York City Water Supply. Water Quality Research Journal, Canada 47: 389–405