Journal of Genetic and Environmental Resources Conservation, 2022, 10(1):20-28.
www.gercj.com Print ISSN: 2306-8663, Online ISSN: 2306 – 8280

Monitoring some physical and chemical properties of water in the eastern Al-Haweza marsh using satellite imagery and geographic information systems

Hussain Zaydan Ali[1]*, Amer M. Hussin[2] and Jasib S. Al-Marsumi[3]
[1]Al-Esraa University College, [2]Belad Al-Rafidain University College and [3]Iraqi Association of Marshes Survive and Development, Iraq.
***Corresponding author: hussain.zaydan@esraa.edu.iq**
Received: September 17th 2021; Accepted: November 19th 2021

Abstract

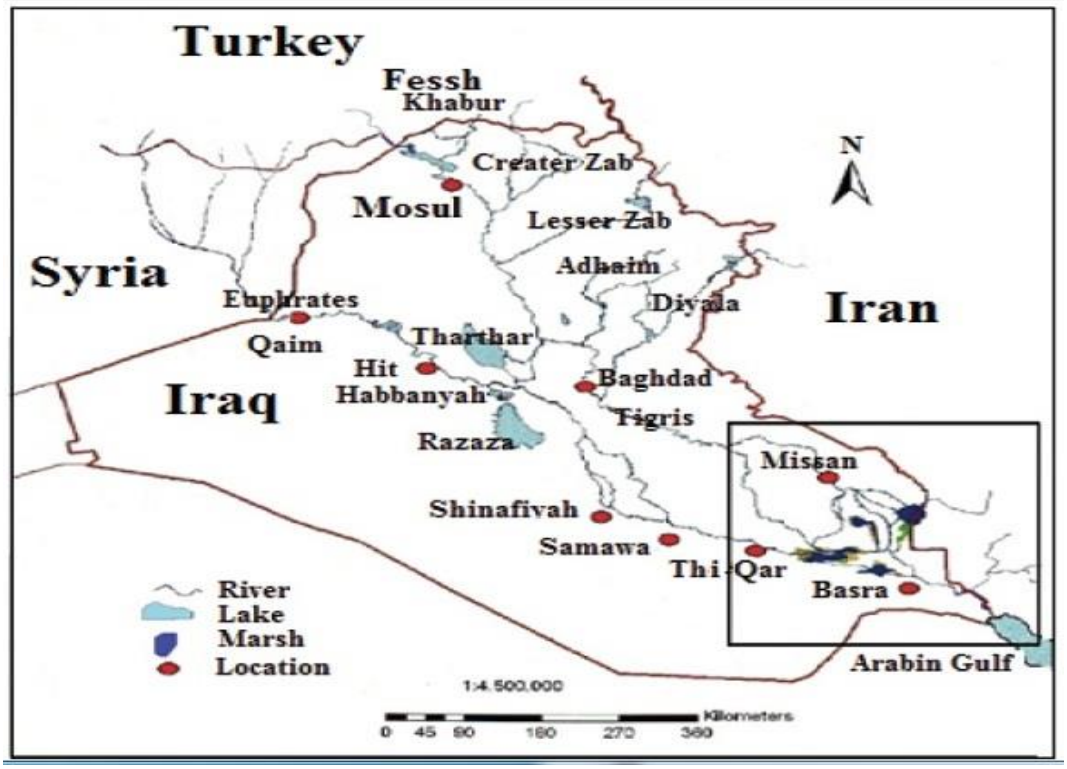
The Iraqi marshes environments had dramatic changed during the recent years. So, it's essential to study the environmental assessment impact on Iraqi marshes. The environmental quality is greatly focused on water because of its importance in maintaining the human health and health of the ecosystem. The study is aimed to determine the some physical and chemical parameters of water bodies and detect the environmental changes in the study area. 19 samples were collected from the study area from June to October 2017. Parameters include hydrogen number (pH), total dissolve solids (TDS), turbidity and electrical conductivity (EC). The study area is Al-Haweza marsh, includes Am Al-Naaj, Al-Audhem and Al-Sauda.This paper discusses the application of GIS specifically in monitoring water quality parameters. GIS provides effective tools in monitoring of water quality parameters aid with in situ measurement data. Geostatistics is one of the most advanced techniques in GIS for interpolation of water quality; it is essentially useful in protection, management and preservation of water quality. In this analysis, Kriging method is used for predicting spatial distribution of various parameters.

Keywords: Al-Haweza marsh, Water quality, GIS.

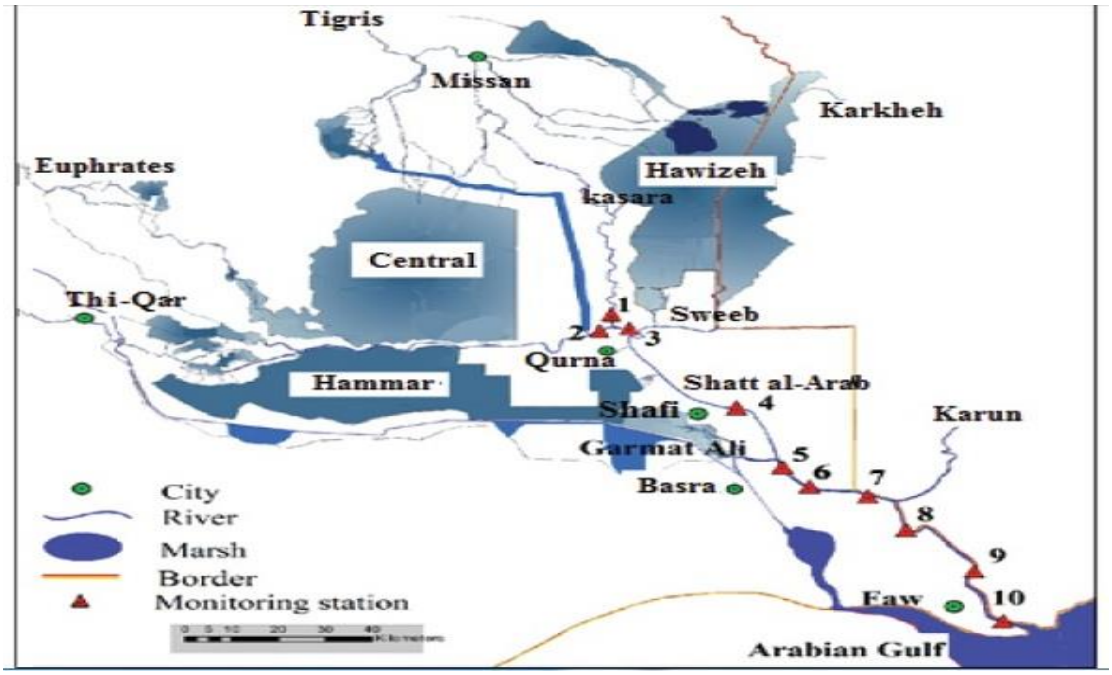
Introduction

The Iraqi southern marshes are delimited to the west by Nasiriyah, Amarah to the northeast, and Basrah to the south by three important southern cities: Nasiriyah, Amarah, and Basrah. The Iraqi wetlands are known as the Garden of Eden. Their large expanse of open water ranges from 15,000 to 20,000 square kilometers, and includes both permanent and seasonal marshes. The Al-Hammar, Central, and Western areas are the three primary areas, as indicated in Figure (1) and (2).

It is situated near the confluence of the Tigris and Euphrates rivers. Because of their huge area, the diversity of their aquatic flora, and their isolation from other analogous systems, such wetlands in the southern region of Iraq serve a critical role in maintaining biodiversity in the Middle East. The Marshes provide several benefits, including a diverse flora and fauna, animal grazing grounds, fish and other wildlife breeding areas. Marshes are also used as rice fields and cultivation zones for a variety of other crops. Marshes are important ecosystems that are influenced by and influenced by a variety of natural factors and human activities. They are important as fish and invertebrate incubators, as well as habitat for migratory birds. Marshes must be conserved and their health improved whenever possible, as this is critical for the surrounding ecosystem and for the people who live in this part of Iraq in particular. Transportation, fishing, rice cultivation, and bird hunting were all major human activities and enterprises for the residents of the southern wetlands and their surrounding settlements, as shown in Figures (3),(4),(5), and (6).



Figure(1): Iraq Map.



Figure(2): The Mesopotamian marshlands.

Figure(3): A suitable means used by peoples.

Figure(4): Human activities in marshes.

Figure(5): Water buffalo in the marshes.

Figure(6): Birds migration.

Major industries such as the paper and cardboard industry, milling, and a few other small-scale local enterprises, as well as tourism, are all reliant on healthy marshes in nearby cities and towns. Many species of aquatic plants, fish, and water fowl call this enormous marshes home. Buffalo farming, fishing, hunting, rice cultivation, and mat weaving are the main occupations in the marshes. Water buffalo offer milk, butter, yoghurt, meat, and excrement; they graze in the reed beds for most of the year, but in the winter they are tethered on platforms and fed sliced rooster flesh. Fishing is allowed in all of the wetlands. The wetlands of Mesopotamia serve as a crucially essential refuge for ducks during periods of unusually harsh weather further north, in addition to providing typical wintering habitat. Large numbers of birds may be compelled to migrate further south during harsh winters when numerous wetlands in eastern Turkey and the Caspian Region freeze over (CRIM, 2007; UNEP, 2006; UNEP, 2001).

The studied area lies in Al-Haweza marsh as shown in Figure (7). Water is essential for life; its quality is of great importance for mankind and it is linked directly with human welfare. The physical parameters present in the water play a significant role in classifying and assessing the water quality. The natural water analysis for physical properties is very important for public health studies. Hence there is a need and concern over the protection and management of drinking water quality. A detailed presentation of water quality studies can be found in (Al-Imarah, and Jawad, 1994; Al-Moussawi, 1989; WHO, 1992; WHO, 2004; WHO, 2008).

Geostatistics is one of the most advanced techniques for interpolation of groundwater quality; it is essentially useful in protection, management and preservation of ground water quality. In this analysis, inverse distance weighting method is used for predicting spatial distribution of various physical parameters[9], Maps showing the spatial distribution of water quality index is developed using GIS (Al-Jabberi, 2010). Water Samples were collected from 19 different locations during June to October 2017. We analyzed the samples for Total dissolved solids, Electrical Conductivity, pH, and Turbidity.

Figure(7): The studied area.

Materials and Methods

Geographical Information system (GIS) is used to handle digital spatial data. GIS is designed to do many functions such as capturing, storing, manipulating, analyzing, and displaying spatial data or georeferenced data. GIS is necessary to map water quality parameters. GIS environment can accept different types of data and analyze them (Burrough and McDonnell, 1998; Chang, 2014). The purpose of this research is to study the spatial variations in the parameters of water. To obtain the base map we used ArcGIS 10.2.2 software for the study area. For spatial reference of the output map we used WGS 1984 (Geographic Coordinate System). Then IDW was used to interpolate the parameters. The function of interpolation is to find the value of each parameter at un-sampled location from the measurement to produce continuous surfaces (Foda et al., 1984; Cressie, 1991). A detailed presentation of geostatistical theories can be found in (Isaaks and Srivastava, 1989; Goovaerts, 2000).

Results and Discussion

Spatial continuous surfaces can be considered important in management of environment and also decision making. When we collect environmental data in field surveys they are always point sources. The environmental managers need these data to be continuous instead of points in the study area. The scientists also prefer continuous data in the region for the sake of interpretations.

[1] Turbidity can be considered as a measure of particles that are suspended in water. The organic matter particles Algae and suspended sediment make the water turbid. Due to diffusion of sunlight by suspended particles the available light is reduced, which is an important parameter for the process of algal photosynthesis.

The temperature of the water is also increased by the presence of suspended particles. If the water is not clear then it can reduce penetration of sunlight, which used by plants for photosynthesis. When the levels of light become too low, this will stop the process of photosynthesis and accordingly the plants will die. Turbidity of Am Al-Naaj and Al-Audhem are shown in Figure 8 and 9.

Figure (8): Turbidity of Am Al-Naaj.

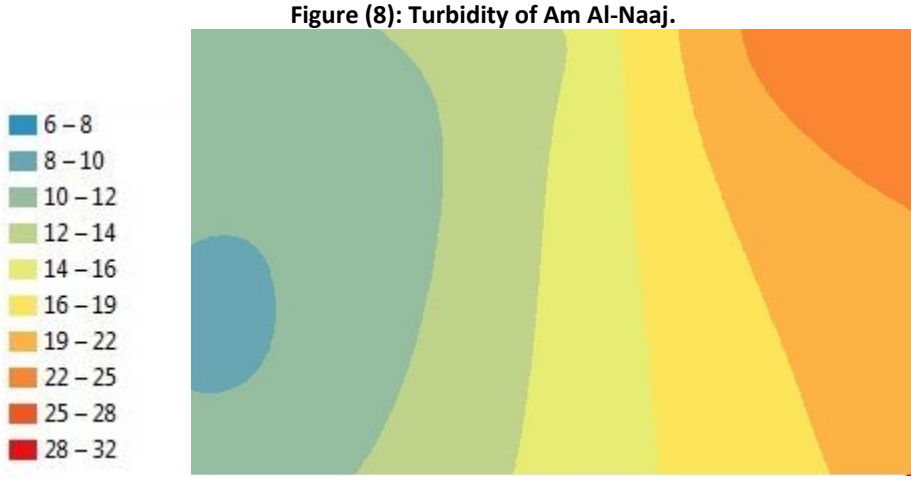


Figure (9): Turbidity of Al-Audhem.

[2] PH is algorithmic scale to judge whether the water is acidic or basic (alkaline). The aquatic organisms can live usually in pH range between 6 and 8. pH value depends on the concentration of H^+ and OH^- ions. Distilled water is a neutral solution and having a value of 7. While acidic solution has a value PH less than 7. The basic solution on the other hand has pH greater than 7. pH is very important parameters, because organisms are sensitive to changes of pH. When pH is very high or very low, then most of aquatic organisms are affected and those values will be unsuitable for them. Drinking water has values of pH between 6.5 and 8.0 at 25°C (80° F). pH of Am Al-Naaj and Al-Audhem are shown in Figure 10 and 11. The value of pH for stream, river, or other water bodies will change depending on many parameters such as bedrock, type of soil and any contaminants in their path.

Figure (10): pH of Am Al-Naaj.

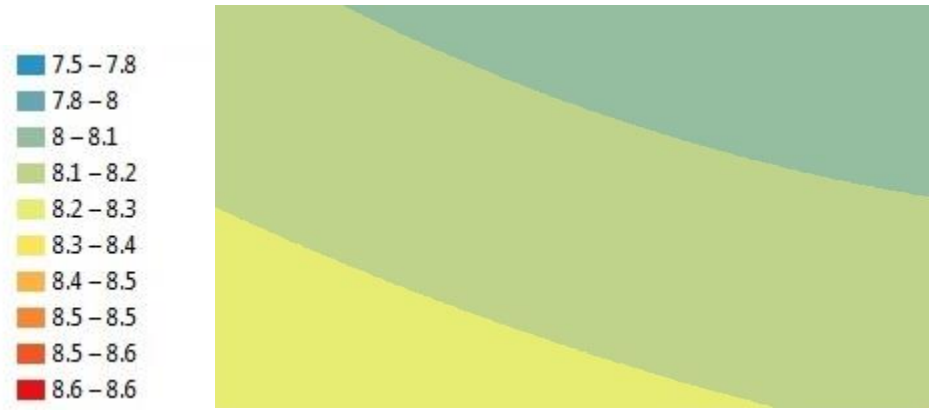


Figure (11): pH of Al-Audhem.

[3] Total Dissolved Solids: The dissolved solids are considered important components for ecosystems that are to be healthy for aquatic culture. The nutrients like nitrates and phosphates, and also salts that are dissolved in water, such as sodium chloride, all participate to this parameter. The solids in streams and in lakes are in the form of suspended and dissolved matter. Silt, and decayed plant matter and the effluent from treatment of sewage contribute to suspended solids. The difference between suspended solids and dissolved solids is that the former cannot pass through a filter, whereas dissolved solids will pass through the filter. In freshwater the dissolved solids include salts that are contributing to yield ions such as Na+, Ca2+, Mg2+,HCO3-, SO42-, or Cl-. The aquatic life is affected when the level of TDS is high. There is a relation between TDS and electrical conductivity (EC), both parameters are directly proportional. TDS of Am Al-Naaj and Al-Audhem are shown in Figure 12 and 13.

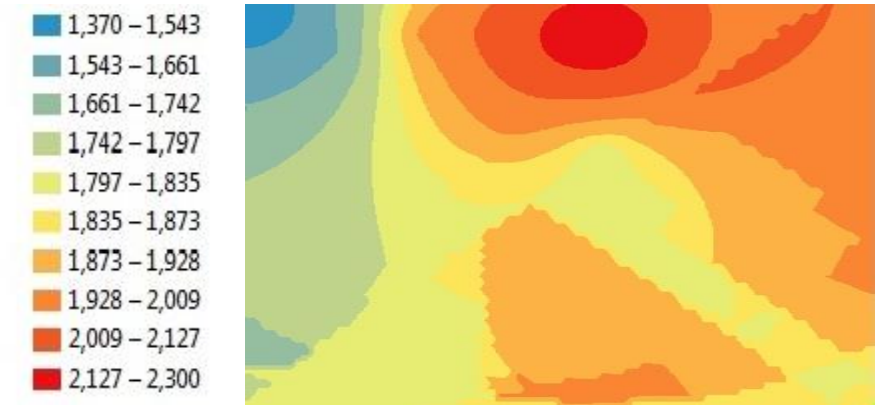


Figure (12): TDS of Am Al-Naaj.

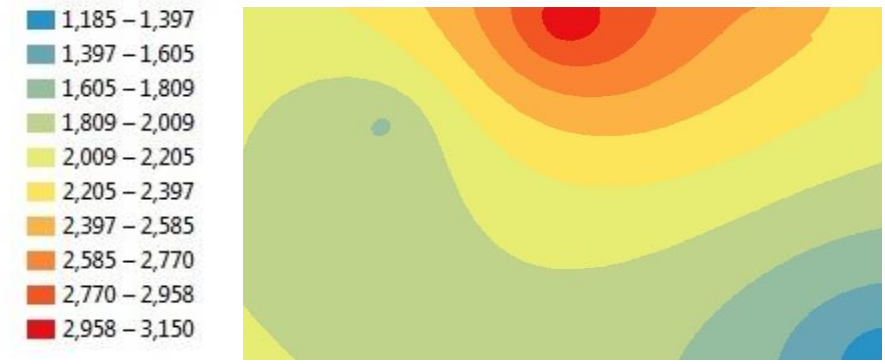


Figure (13): TDS of Al-Audhem.

[4] Conductivity: The ability to pass an electric current in water and its related to the presence of anions and cations. There is a direct relation between conductivity and temperature. We usually measure conductivity at 25 degrees Celsius. Conductivity is measured in micro Siemens per centimeter. EC of Am Al-Naaj, and Al-Audhem are shown in Figure 14 and 15. The capacity of ions is measured by electrical conductivity meters. When ranges are small, the measurements of EC are in mS/cm and µS/cm (WHO, 2008).

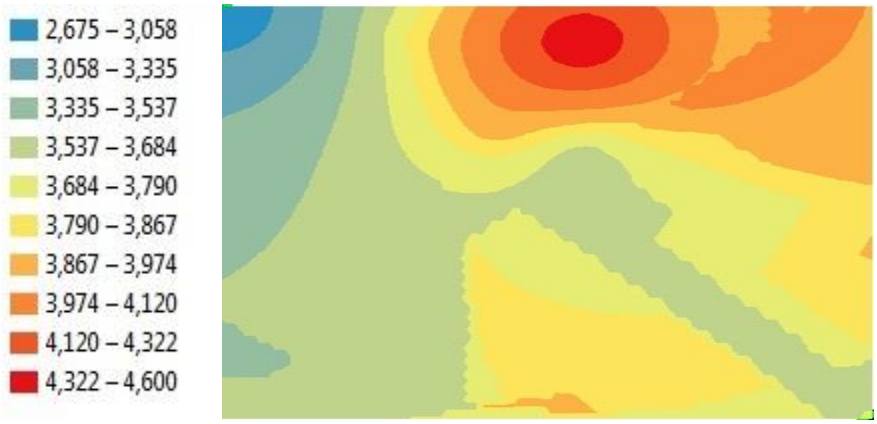


Figure (14): EC of Am Al-Naaj.

Figure (15): EC of Al-Audhem.

Conclusion

As previously noted in this study, the wetlands of southern Iraq play an important role in the preservation of biodiversity in the Middle East, owing to their huge size, diversity of aquatic vegetation, and isolation from other analogous systems. The area is a one-of-a-kind environment that provides a vital supply of habitat and food for local residents. Remote sensing data together with GPS and GIS technologies can be considered as a valuable tool when used for monitoring. The consultants and natural resource managers used these techniques to provide management plans for many applications of natural resources. The reason for monitoring water quality is to improve its quality. Usually in situ measurements are conducted to collect samples of water and analyze the samples in the laboratory. In this paper the parameters are assessed for spatial variations. Testing the water for agricultural, domestic, and drinking is essential. Different physical and chemical parameters are tested, and the selection of these parameters depends on the purpose of use.

References

Al-Imarah, F.J.M., and Jawad, H.M., (1994). Physiochemical parameters of southern Iraq water, Northwest Arabian Gulf. Marine mesopotamimica, V.9, No.1, pp.1-17.

Al-Jabberi, M.H. (2010). Sediment logical and environmental aspects of subsurface Basrah sediments –south Iraq. Mesopot. J. Mar. Sci., V.25, No.2, pp-67-78.

Al-Moussawi, S.N. (1989). Hydro chemical and particulate matter investigation of Khor Al-Zubair, NW of Arabian Gulf. Jour. Of Marine mesopotamica, V.4. No.1, pp-19-30. In Arabic.

Burrough, P.A. & R.A. McDonnell (1998). Principles of Geographical Information Systems. Oxford: Oxford University Press.

Chang, K. (2014). Introduction to Geographic Information Systems: McGraw-Hill Education.

Cressie, N.: Statistics for spatial data, Wiley, New York, 900 pp,1991.

CRIM (2007) Study the Rehabilitation of Al Huweizah Marsh Ecological System . Ministry of Water Resources, Center of Restoration of Iraqi Marshes, Baghdad, Vol .1 to 7.

Foda, M.A. ; Khala, F.I.; Al-Kadi, A.S. ,1985. Estimation of Dust Fallout rates in the Northern Arbian Gulf, pp.592-603.

Goovaerts, P. (2000). Geostatistical approaches for incorporating elevation into the spatial interpolationof rainfall, J. Hydrol., 228, 113–129.

Isaaks, E.H. and Srivastava, R.M., (1989). Applied Geostatistics. Oxford University Press, New York, 561 pp.

Myers, Donald E. 1994. "Spatial Interpolation: An Overview." Geoderma 62 (1-3): 17-28.

UNEP (2006). Iraqi Marshlands Observation System. UNEP Technical Report, 71 .

UNEP (2001). The Mesopotamian Marshlands: Demise of an Ecosystem. Early Warning and Assessment Technical Report,47.

WHO, World Health Organization. (1992). International Standards for Drinking Water. Geneva, Switzerland, 1992.

WHO, World Health Organization. (2004). Guidelines for Drinking-water Quality, 3rd Ed: Volume 1 – Recommendations. Geneva.

WHO, World Health Organization. (2008). Guidelines for drinking water, Vol. 1, Recommendations, Geneva, 3rd Ed., ISBN 9789241547611, 2008.