
The effect of climate on the physical properties of water in the Najaf Sea

Lecturer. Ali. k. Gawad¹ and Assist.Prof. Dr. Zainab.W. Khadir²

^{1,2}University of Baghdad - College of Education / Ibn Rushd

ali.khazeal@uokerbala.edu.iq

zainab.a@ircoedu.uobaghdad.edu.iq

Abstract:

The results of the study showed that there is an effect of climatic elements on the physical properties of water in the study area, as the water temperature in the samples reached (9) °C as a minimum in a sample (5) during the month of January, while during the month of July it is clear that the degree The temperature of water samples reaches its peak, as it reached about (32.6) °C as a maximum in sample (12), while the electrical conductivity reached during the month of January at about (34.99) decimens / m as a minimum in sample (5), while the values reach their peak During the month of July, as it reached about (88.84) decimens / m as a maximum in a sample (12), while the values of turbidity in the water samples reached their peak during the month of January, as they reached a maximum of (64.64) NTU in a sample (5).) While it reaches its lowest value during the study period in the month of July, as it reached (22.16) NTU as a minimum in a sample (12), while the values of permeability reach its lowest value during the month of January with a limit of (14.14) cm as a minimum in a sample (12), but during the month of July, the permeability values reach their peak, reaching about (226.93) cm in sample (12) as a maximum.

The first topic

Introduction and theoretical framework

the introduction:

Climatic conditions affect the variation of chemical and physical properties in the Sea of Najaf, in terms of temperature, rain, relative humidity, and wind are all climatic factors that

affect that, and climate change is one of the most serious threats to natural ecosystems anywhere, whether they are environmental systems Water or terrestrial ecosystems, the relationship between climatic elements such as the relationship between solar radiation, temperature, wind, atmospheric pressure, relative humidity, rain and evaporation, which

leads to the creation of important environmental effects as in the case of dry and semi-arid environmental characteristics in the study area depending on the nature of their mutual relationship, Because it is a closed lake that has no other way out for the water entering it, it is exposed to the effects of the climate, especially in the summer, when high temperatures and evaporation increase, and electrical conductivity. In the past, flood waters flowed from the Euphrates River and dry valleys that flowed with water the desert plateau, which helps to mitigate the effects of climate change by refilling the water inside it and reducing the concentration of salt and elements, while a decrease in The water level in it and the exposure of the region to the influence of climatic conditions led to a change in the chemical, physical and biological characteristics of the aquatic environment of the Najaf Sea, and this contributed to a major role. In the destruction of the living environment of the Najaf Sea as a result of the impact of the climatic conditions that the study area is exposed to, the increase in the concentration of salts and heavy elements, which caused a change in the chemical, physical and biological characteristics

of the water, which led to the death of many organisms that were not suitable for these rapid environmental and climatic conditions, especially during Summer season due to high temperatures, low humidity and high evaporation rates, as living species suffered as a result of climatic conditions and their environmental repercussions, various environmental problems.

First: the problem of the study: –

The study problem can be formulated as follows ((What is the role of climate in affecting the physical properties of water in the Najaf Sea?))

Second: The hypothesis of the study: –

Since the main problem of the study was ((What is the role of climate in influencing the physical properties of water in the Sea of Najaf?)), a main hypothesis was set against the main problem represented by ((The climate has an effect on the physical properties of water in the Sea of Najaf))

Third: The aim of the study:

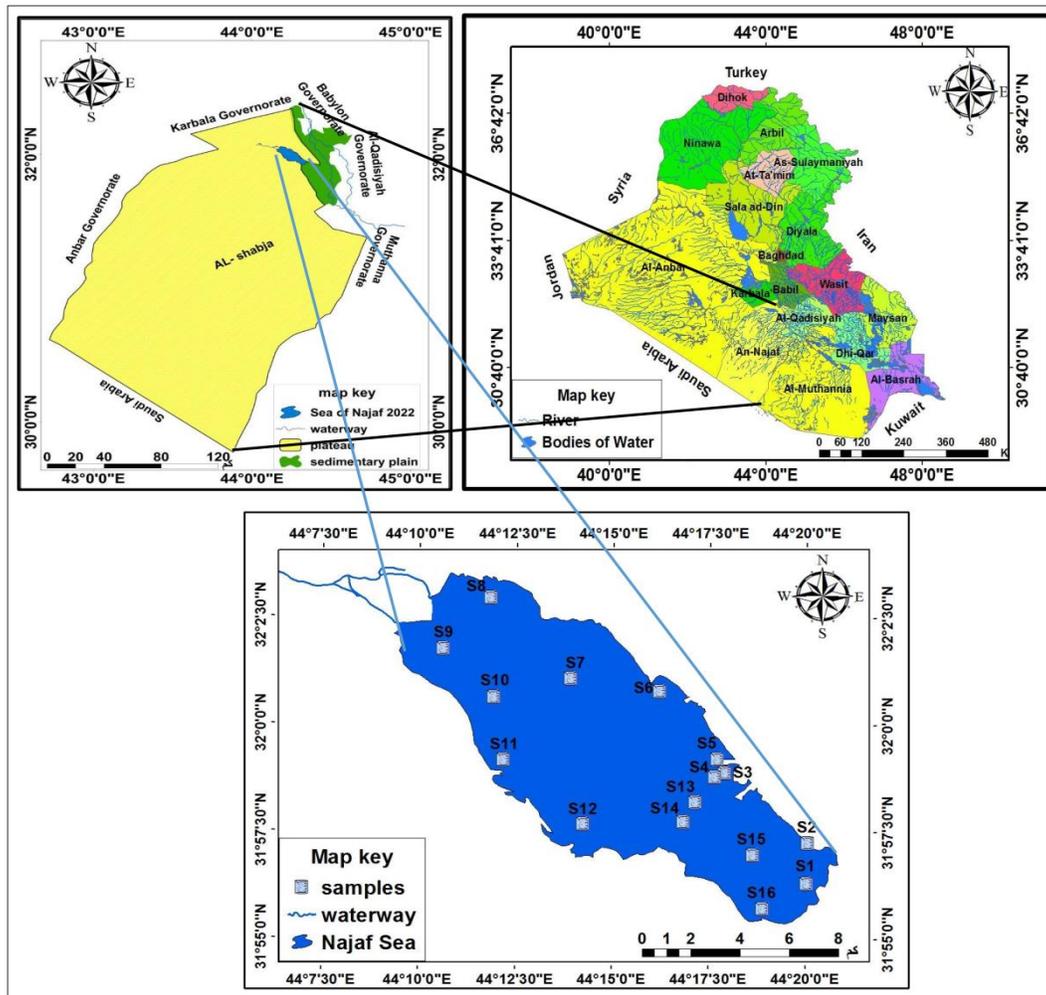
1- The study aims to identify the climatic characteristics in the study area and their relationship to the variation in the physical properties of the water in the Sea of Najaf, which affects the ecosystem in the Sea of Najaf.

2- Show the temporal and spatial variation of the physical characteristics in the study area.

3- Statement of the effect of the physical characteristics of water in the study area on aquatic organisms, by comparing the results of field and laboratory analyzes of water with Iraqi standards.

Map (1)

The astronomical and geographical location of the borders of the study area



Source / The researcher worked by relying on the satellite video captured from the Landsat 8 satellite on 2/17 2022 and software outputs (Arc GIs 10.8).

Fourth: Study Methodology: –

In order to achieve the objectives of the study, the researcher followed the quantitative analysis approach using Pearson's correlation coefficient, regression coefficient, interpretation coefficient, and t tests to find the statistical relationship between the independent variable (climatic elements) and the dependent variable (physical properties of the sea of Najaf).

Fifth: Justifications for the study:

1– The lack of climatic studies concerned with finding the relationship between climatic characteristics and the physical properties of water.

2– The biodiversity in the study area and its impact on the climatic characteristics that can change the physical properties of the water and thus its incompatibility with its environmental requirements, especially since the study area is located within the semi-desert climate.

Sixth: The boundaries of the study area:

Geographical location:

It is geographically located in the Najaf Governorate in central Iraq and extends longitudinally from the north of the city of Najaf to the southwest of the city of Al-Hirah, which is formed from the deposits of the Tigris and Euphrates rivers. It varies in width, as its width

from the southeast is (16) km², while it shrinks in the middle to reach (10) km², and its total area is (435) km², that is, its depth reaches (10) meters above sea level. Najaf between latitudes (31.30–32.10) north, and longitudes (43.30–44.30) east, as shown in map (1). While the climatic data were from the year (1990–2022), i.e. for a period of 32 years, either objectively, as it is represented by a study of the effect on the physical properties of water in the Najaf Sea.

Seventh: How it works:

In order to find out the effect on the physical properties of water in the Sea of Najaf, the daily rates represented in the following climatic elements (the amount of solar radiation, temperature, atmospheric pressure, wind, relative humidity, evaporation and precipitation) were used for the year 2022, in addition to the field study by taking samples of water samples from sea water Najaf during the month of January, which represents the winter season, the month of March, which represents the spring season, July, which represents the summer season, and the month of October, which represents the autumn season, with a balance for each month, and conducting laboratory analysis of the physical properties of water

samples taken from the sea of Najaf, represented in (water temperature and conductivity electricity, turbidity and light transmittance) and comparing the results of the analysis with the Iraqi standards of the Iraqi Ministry of Environment to see the extent of their conformity with these standards.

Eighth: Research Structure:

The study included three sections, as the first section represents the introduction and the theoretical framework of the research, which included the main research problem and its hypothesis, the research objective, the research methodology, the limits of the research, the importance of the study, the justification for the research, the method of work and the structure of the research. Statistics between the elements of climate and the physical characteristics of the water of the Sea of Najaf, as well as the conclusions reached by the study, proposals, and a list of sources and references.

The second topic

Physical and chemical properties of the sea of Najaf

This research includes knowledge of the physical properties of the water of the Najaf Sea and its temporal and spatial variation through

the monthly variations of water samples taken from the Najaf Sea during the month of January dated 1/8/2022, the month of April dated 4/13/2022 and the month of July dated 5/11/2022 And the month of October on 7/11/2022, which occurs in these characteristics and compared with water quality specifications to know the extent of their impact on living organisms, and this appears through the results of laboratory tests of surface samples of sea of Najaf water samples, which number (16) samples,

1- Water temperature:

It is clear from Table (1) and Map (2) that the water temperature in the surface samples reaches its lowest degree during the study period in January, as it ranged between (9) °C as a minimum in sample (5) and up to (11.2) (12) °C as a maximum in a sample (12), while during the month of April it is clear that the water temperature ranged between (16.8) °C as a minimum in a sample (5), while a maximum of (18.4) °C was recorded in a sample (12).

As for during the month of July, it is clear that the temperature of surface water samples reaches its peak, as the temperature of surface water samples ranged between (29.4) °C as a

minimum in a sample (5) and up to (32.6) °C as a maximum in a sample (12) However, during the month of October, the water temperature ranged in surface water samples between (18.7) °C as a minimum in sample (5) and up to (20.6) °C as a maximum in sample (12),

The reason for the variation in the temperature of surface water samples during the months of the study period is due to the temperature display during the year. During the month of January, in which the lowest amount of solar

radiation and air temperature are recorded, which leads to recording the lowest water temperature in the study area during the months of the study period, after which the amount of solar radiation and temperature begin to rise gradually during the month of April and this coincides with the gradual rise in the water temperature In the study area from the beginning of the semester until its end, through the summer months, as it reaches its peak during the summer months during the study period, especially during the month of July.

Table (1)

Water temperature in °C for surface water samples in the Najaf Sea for the year (2022)

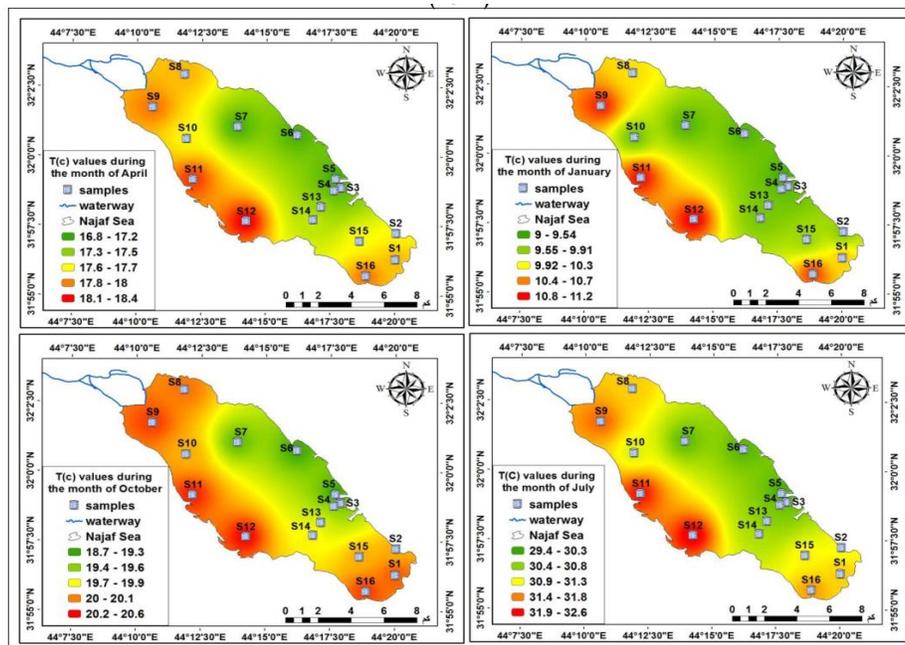
sample	January	April	July	October
S1	10.3	17.8	31.2	20.3
S2	9.5	17.6	30.9	20
S3	9.3	17	29.8	19.2
S4	9.3	17	30	19.4
S5	9	16.8	29.4	18.7
S6	9.2	16.9	29.7	18.9
S7	9.2	16.9	29.8	19.1
S8	10.2	17.8	31.2	20.2
S9	11	18	31.8	20.4
S10	9.4	17.6	30.7	20
S11	11.1	18.2	32.3	20.5
S12	11.2	18.4	32.6	20.6
S13	9.4	17.2	30.1	19.6
S14	9.4	17.4	30.4	19.8
S15	9.6	17.6	31	20
S16	10.9	18	31.5	20.4

Source // (1) The researcher worked based on the field study.

In addition, the thermal mixing process throughout the fall season is necessary to replenish the oxygen dissolved in the water, which leads to a decrease in the level of oxygen in the warm surface water layer, compared to the benthic and cold samples, where the oxygen is more, while the opposite occurs during the winter and spring seasons, as the decrease The amount of solar radiation and the air temperature reduces the temperature of the surface layer of water that is vulnerable to climatic influences, while the bottom water remains warmer, and this has an effect on the

amount of dissolved oxygen in the water, as the solubility of oxygen increases whenever the water temperature is low. Low water temperature leads to a decrease in the concentration of some elements that affect aquatic organisms, and low temperatures lead to reduced respiration and oxygen consumption, which reduces the amount of dangerous chemicals that reach body tissues and enter the circulatory system. However, the decrease in temperature below the minimum acceptable level for aquatic species leads to the cessation of their growth and metabolic activity.

Map (2) Monthly values of water temperature (m) in surface water samples in the Najaf Sea for the year (2022)



Source/researcher's work

(1) Based on the satellite image for the year 2022 from the Landsat 7 satellite and the outputs of the Arc GIS program (10.5).

(2) Table (1).

2- Electrical Connection E.C:

It is an important factor in knowing the total amount of salts present in the water, as it is compared to the quality of irrigation water based on international classifications. The electrical conductivity expresses the percentages of the

total dissolved salts in the water, its high indicates the high percentages of salts in the water⁽¹⁾, which is the ability of (noun) of the water to conduct electricity at a temperature of (25) and the increase of salts either by natural action such as the nature of the water and the ground ground, Or by industrial action, such as the drainage of industrial or sewage water on natural water bodies⁽²⁾.

Table (2) Electrical conductivity values of decimeters/m in surface water samples in Sea al-Najaf for the year (2022)

sample	January	April	July	October
S1	51.99	60.72	78.24	71.21
S2	48.44	56.56	72.87	66.33
S3	41.15	48.05	61.89	56.34
S4	43.84	51.2	65.97	60.04
S5	34.99	40.87	52.63	47.92
S6	36.77	42.94	55.31	50.35
S7	38.95	45.49	58.59	53.34
S8	49.53	57.85	74.52	67.84
S9	54.63	63.81	82.21	74.82
S10	47.11	55.02	70.89	64.52
S11	57.25	66.85	86.15	78.4
S12	59.04	68.94	88.84	80.86
S13	44.75	52.27	67.33	61.29
S14	46.07	53.8	69.31	63.09
S15	48.87	57.07	73.53	66.93
S16	53.5	62.48	80.51	73.27

¹⁾(Nibras Abbas Yas, Rock structures and their impact on increasing salt concentrations in the Euphrates River, irrigating Al-Kifl - Al-Shamiya (an applied study using GIS&RS technology, Al-Ustadh Journal for Humanities and Social Sciences, Volume (58), Issue (3), September 2019, p. 240.

²⁾(Najla Ajil Muhammad, Evaluation of the Tigris River Water for Different Uses near Al-Muthanna Bridge in the City of Baghdad for the period (2013-2015), Al-Ustad Journal for Humanities and Social Sciences, Volume (58), Issue (3), September 2019, p. 119.

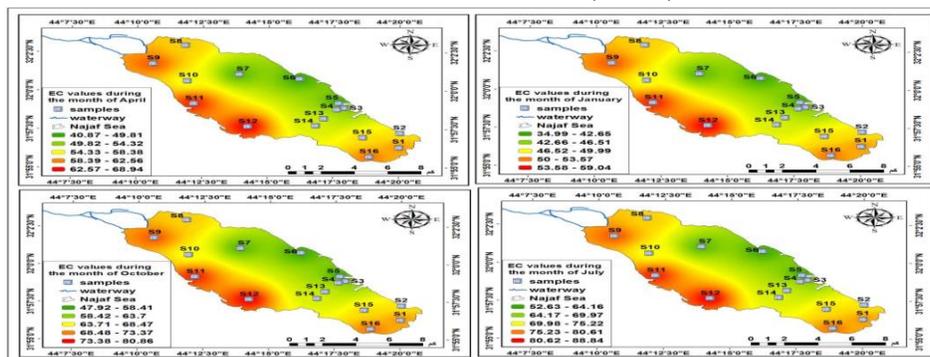
Source // (1) Results of laboratory analyzes of surface and benthic water samples of the Najaf Sea in the Public Health Laboratory.

(2) The field study dated 1/8/2022, 4/13/2022, 7/11/2022 and 10/11/2022.

Through table (2) and map (3), it is clear that the electrical connection during January reaches its lowest level, as it ranged between (34.99) decimens/m as a minimum in a sample (5) and up to (59.04) decimens/m as a maximum in a sample (12), and the reason for the decrease in the values of electrical conductivity in surface water samples during the month of January is due to the decrease in the rate of solar radiation, which leads to a decrease in air temperature, which is responsible for the decrease in the value of electrical conductivity to its lowest value in the month of January in water samples

surface in the Najaf Sea, and the rainfall leads to a rise in the water level of the Najaf Sea and as a result reduces the amount of total dissolved solids in the water, which results in a decrease in electrical conductivity, and based on Table (3) the water can be classified as water quality during the month of January In terms of electrical conductivity, according to the Food and Agriculture Organization of the International, where it is clear that the surface water samples (3, 4, 5, 6, 7, 13) had very high salinity and the quality of the groundwater was very salty. As for the samples (1, 2, 8, 9, 10, 11, 12, 14, 15, 16) Its water is a brine solution, and it is a type of sea water.

Map (3) Monthly values of electrical conductivity (decimeters/m) in surface water samples in Najaf Sea for the year (2022)



Source/researcher's work

(1) Based on the satellite image for the year 2022 from the Landsat 7 satellite and the outputs of the Aric GIS program (10.5).

(2) Table (2).

, While it is evident from Table (2) and Map (3) that the values begin to rise gradually during the month of April, as it reached about (40.87) decimens / m in sample (5), while it reached about (68.94) decimens / m as a maximum in Sample (12), and based on Table (3), the water

can be classified as water quality during the month of April in terms of electrical conductivity according to the Food and Agriculture Organization of the International, where it is clear that the surface water samples (5,6) were very salinity and the quality of the groundwater is very salty, While the samples (1, 2, 3, 4, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16) are within the category of brine water and its quality is sea water.

Table (3)

Classification of water in terms of electrical conductivity, according to the Food and Agriculture Organization of the International 2006⁽³⁾

class water	Electrical connection Decismens / m	water type
Not salty water	less than 0,7	Drinking and irrigation water
a little salty	2 - 0,7	Irrigation Water
moderate salinity	10 - 2	Primary drainage water and groundwater
high salinity	25 - 10	Secondary drainage water and groundwater
Very high salinity	45 - 25	Very salty groundwater
saline solution	more than 45	sea water

It also appears from Table (2) and Map (3) that the values reach their peak during the month of

July, as they reached a maximum of (88.84) decimens/m in sample (12), while their lowest

⁽³⁾FAO.Corporate Document Repository, water Quality for Agriculture 3.Infiltration Problems, 2006, <http://www.fao.org/DOCREP/OO3/T0234E04.htm>.

value reached about (52.63) decimens/m. In sample (5), the reason for reaching the electrical conductivity values to their maximum value during the month of July is due to an increase in the amount of solar radiation, which leads to an increase in air and water temperature, a decrease in relative humidity, and an increase in evaporation, which leads to an increase in the electrical conductivity values during this period. The month for surface water samples in the Najaf Sea, and with the decrease in the values of atmospheric pressure increases the wind speed that reaches its peak in the month of July, which causes dust storms and increases the amount of dust and salts suspended in the air, which increases the amount of dust deposited in the study area In addition to the lack of rain during the summer, it leads to a decrease in the water level in the Najaf Sea, and thus increases the values of total dissolved salts, and thus an increase in the electrical conductivity values.

Based on table (3), water can be classified as water quality during the month of July in terms of electrical conductivity, according to the Food and Agriculture Organization of the

International, where it is clear that all surface and benthic water samples were within the category of water with brine and its quality was sea water during the summer months.

As shown in Table (2) and Map (3), the values of the electrical connection begin to gradually decrease, reaching its lowest value during the month of October, at a rate of (47.92) decimens/m in a sample (5) and up to (80.86) decimens/m as a maximum in a sample. (12).

Based on table (3), the water quality can be classified in terms of electrical conductivity according to the Food and Agriculture Organization of the International, where it is clear that all surface and benthic water samples during the month of October were brine, which is among the types of sea water.

And when comparing the results of the analyzes of the electrical conductivity values with the maximum limits of permissible elements for the quality of water suitable for the Iraqi water environment shown in Table (4), it becomes clear that all surface and benthic samples exceeded the permissible limits during the study period.

Table (4) Local determinants of the physical properties of water⁽⁴⁾

Element	The chemical symbol	Unit of measure	The maximum limits of items allowed
electrical connection	Ec	Decismens / m	0.4
Turbidity	Tur	NTU	18- 10NTU

3– Turbidity (NTU):

Turbidity is related to the percentage of suspended matter in the water, which consists of particles of silt and a mixture of solid materials that may be (organic, mineral, microorganisms)⁽⁵⁾, and it appears from Table (5) and Map (4) that the turbidity values in surface water samples reach to its peak during the month of January, as the values ranged between (41.2) NTU as a minimum in sample (12) and up to (64.64) NTU as a maximum in sample (5), the gradual decrease in the values of climatic elements, especially solar radiation, temperature and wind speed And the high relative humidity and the low amount of evaporation, as its low values decrease the

concentration of dissolved salts and heavy elements, and with progress during the winter season, it is noted from Table (5) that the turbidity values reach their peak during the study period, as this is proportional to the increase in the numbers of phytoplankton (diatoms) During the month of January, as the decrease in the water temperature during the winter season is considered one of the environmental requirements that it needs for growth, and the increase in the amount of rain falling in the dry valleys and the runoff of these valleys towards the Najaf Sea and the sediment it carries with it lead to the turbidity of the water and thus increase the values of Akkara during this chapter.

⁴(Republic of Iraq, Ministry of Health, Environmental Legislations, Rivers Protection System from Pollution, No. (25), for the year (1967), Department of Environmental Protection and Improvement, 1998, p. 14.

⁵(Ali Abd al-Wahhab Majeed Muhammad, Environmental Assessment of Indicators of Pollution of Liquefaction Water and Household Reservoirs in the Regions of (Mansour - New Baghdad), Al-Ustadh Journal of Human and Social Sciences, Volume (61), Issue (1) for the year 2022 AD, p. 369.

Table (5) Turbidity NTU values for surface water samples in the Najaf Sea for the year (2022)

sample	January	April	July	October
S1	47.84	33.92	24.16	27.68
S2	48.4	34.96	24.48	28.8
S3	53.84	36.8	25.84	31.36
S4	53.28	36.4	25.6	31.2
S5	64.64	37.52	27.2	32
S6	64	37.12	26.96	31.68
S7	54.4	36.8	26.64	31.52
S8	47.92	34.56	24.24	27.92
S9	42	31.52	22.64	27.36
S10	48.8	34.96	24.72	29.12
S11	41.6	31.2	22.4	27.2
S12	41.2	30.88	22.16	26.88
S13	52.48	36.08	25.04	29.76
S14	51.92	35.28	24.8	29.44
S15	48.32	34.64	24.4	28.56
S16	47.44	33.6	23.92	27.44

Source / work of the researcher by accreditation

(1) Results of laboratory analyzes of surface and benthic water samples of the Najaf Sea in the Public Health Laboratory.

(2) The field study dated 1/8/2022, 4/13/2022, 7/11/2022 and 10/11/2022.

And when comparing the results of the analysis of surface water samples in the Sea of Najaf

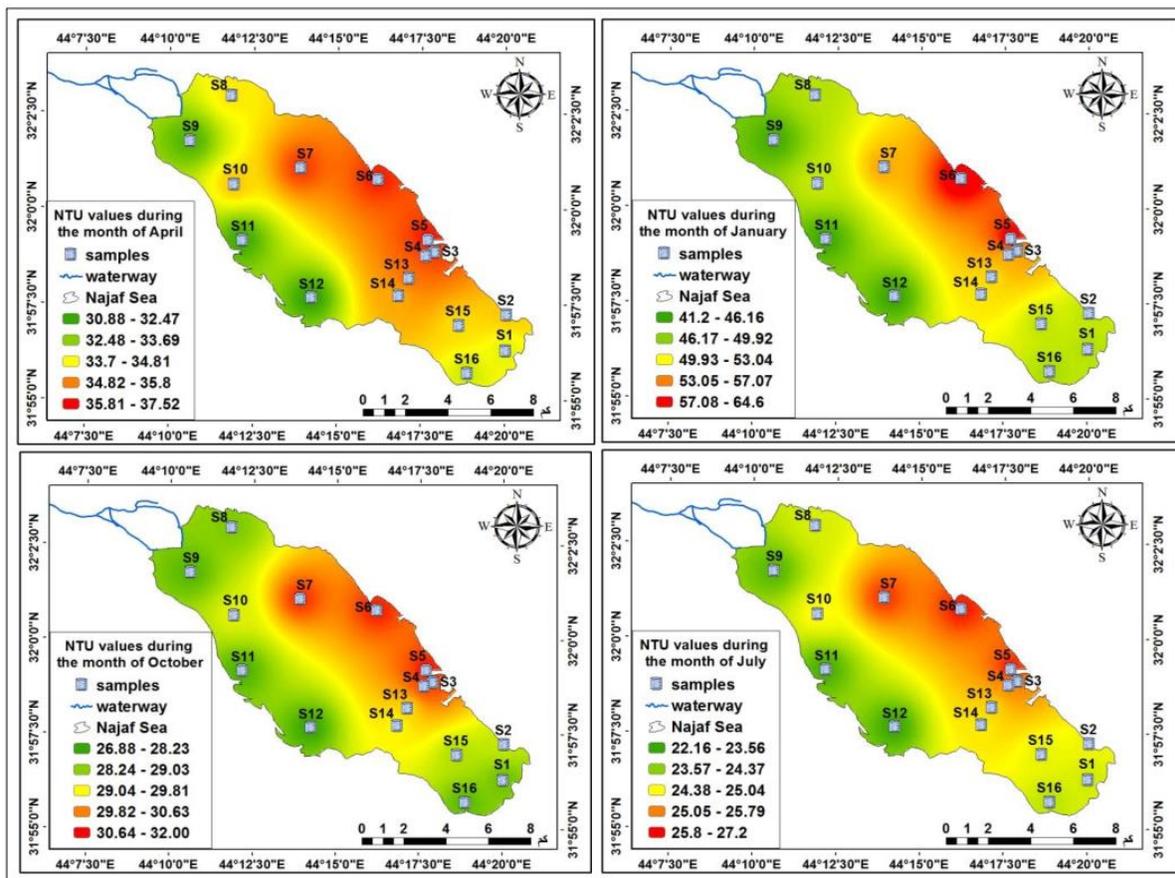
with the maximum limits of permissible elements for the quality of water suitable for the Iraqi water environment, which are shown in Table (4), it turns out that all samples exceeded the maximum permissible limits.

table (6)

Classification of water in terms of turbidity according to Minu Gupta Bhowon and et al⁽⁶⁾

water quality	Turbidity value NTU
clear	less than 5
dark	5-50
completely opaque	over 50

Map (4) Monthly Turbidity Values (NTU) in Surface Water Samples in Najaf Sea for the Year (2022)



Source/researcher's work

⁽⁶⁾Fondriest Environmental, Inc. "Turbidity, Total Suspended Solids and Water Clarity." Fundamentals of Environmental Measurements. 13 Jun. 2014.

(1) Based on the satellite image for the year 2022 from the Landsat 7 satellite and the outputs of the Arc GIS program (10.5).

(2) Table (5).

and they can be classified according to Table (6), where it is clear that The surface samples (3, 4, 5, 6, 7, 13, 14) were completely dark during January, while the rest of the surface and benthic samples during January were dark , As for the month of April, it is shown in Table (5) and the map. (4) The turbidity values start with a gradual decrease, as the values ranged between (30.88) NTU as a minimum in sample (12), while it reached a maximum in sample (5) as it reached about (37.52) NTU.

And when comparing the results of the analysis of surface water samples in the Sea of Najaf with the maximum limits of permissible elements for the quality of water suitable for the Iraqi water environment, which are shown in Table (4), as it turns out that all samples exceeded the maximum permissible limits, and surface and benthic water samples can be classified according to Table (6). Where it is clear that all the samples during the months of April were dark, as shown by Table (5) and Map (3) that the turbidity values in surface water samples reach their lowest value during the study period

in July, as they ranged between (22.16).) NTU as a minimum in a sample (12) and up to (27.2) NTU as a maximum in a sample (5), and the reason for the decrease in turbidity values during the month of July is due to the high amount of solar radiation, the increase in air and water temperature, the decrease in atmospheric pressure, the increase in wind speed, and the decrease in relative humidity Increasing the amount of evaporation and lack of precipitation. These climatic conditions change the physical and chemical properties of water, such as increasing electrical conductivity and total dissolved salts, which leads to many organisms such as zooplankton and phytoplankton within the water column. The turbidity values decreased to their lowest value during the month of July, and when comparing the results of the analysis of surface and benthic water samples in the Sea of Najaf with the maximum limits of permissible elements for the quality of water suitable for the Iraqi water environment, which are shown in Table (4), as it turns out that all samples exceeded the maximum limits allowed In July, surface and benthic water samples can be classified based on table (6), where it is clear that all samples during July were dark, as shown in table (5) and map (4)

that the turbidity values in surface water samples during the month of October. The first ranged between (26.88) NTU as a minimum in a sample (12) and up to (32) NTU as a maximum in a sample (5), and when comparing the results of the analysis of surface and benthic water samples in the Najaf Sea with the maximum limits of the permissible elements for the quality of water suitable for the Iraqi water environment and shown in table (4), as it appears that all samples exceeded the maximum permissible limits, and the water quality can be classified according to turbidity values based on table (6), where it is clear that all surface and bottom samples were dark during the month of October.

4- Light waste (sacchi disk):

It is clear from Table (7) and Map (5) that the permeability values reach their lowest value during the month of January, as they ranged between (14.14) cm as a minimum in sample (12) and up to (119.07) cm as a maximum in sample (5).), and the reason for the decrease in the values of sacchi during the month of January is due to the decrease in the amount of solar radiation, the actual brightness, and the abundance of cloudiness. Large, which makes

the sky distinguished by its purity most days of the year, which in turn leads to the passage of the highest amounts of solar radiation and its arrival to the surface of the earth (), and the low temperature of the air and thus the water provides a suitable environment for the growth of diatoms in copious numbers that spread in the upper surface layer of water for their need. To the light in carrying out the process of photosynthesis and the production of chlorophyll, and that the rain falls during the winter over the neighboring lands and dry valleys works to transfer sediment and alluvial materials to the Sea of Najaf, and they spread within the water column, and this leads to a decrease in the permeability values, and the permeability values can be classified. During the month of January, according to table (8), where it is clear that the samples (1, 2, 8, 10, 14, 15, 16) plankton became more abundant and the water quality poor during the month of January. As for the samples (9, 11, 12) There were a lot of plankton and a lot of organic matter (fertilizer) and the risk of low oxygen in the morning during the month of January, (3, 4, 7, 13) the amount of plankton was ideal, and for the sample (5, 6) the water was very clear and suitable for

fertilization The roots of the plants will begin to grow and the fish may become exhausted due to the decrease in oxygen. As for during the month of April, it is clear from Table (7) and Map (5) that the permeability values gradually rise, as it ranged between (19.2) cm as a minimum in a sample (12). And up to (163.18) cm as a maximum in sample (5), and the permeability values can be classified during the months of the spring season based on Table (8) where it is clear that the samples (1, 2, 4, 8, 10, 13, 14,

15, 16) The amount of plankton was ideal, while the samples (9, 11) plankton became more abundant and the water quality poor during the spring months, while the sample (12) contained a lot of plankton and a lot of organic matter (fertilizer) and a lower risk Oxygen was added in the morning during the months of the spring season. As for the samples (3, 5, 6, 7), the water was very clear and suitable for fertilization.

Table (7) Light transmittance values (sacchi disc) cm of surface water samples in the Najaf Sea for the year (2022)

sample	January	April	July	October
S1	25.31	34.33	48.23	31.54
S2	27.53	37.36	52.48	34.3
S3	33.49	45.34	63.82	41.74
S4	31.25	42.42	59.57	38.95
S5	119.07	163.18	226.93	148.35
S6	49.11	66.54	93.61	61.19
S7	35.72	48.95	68.07	44.5
S8	25.85	35.34	48.62	32.47
S9	18.6	25.26	35.47	23.19
S10	28.27	38.39	53.9	35.23
S11	17.99	25.25	35.46	23.17
S12	14.14	19.2	26.95	17.62
S13	30.23	42.39	58.65	38.94
S14	29.76	40.76	56.73	37.09
S15	26.05	35.36	49.64	32.48
S16	23.82	32.33	45.38	29.67

Source // The researcher worked based on the field study on 1/8/2022, 4/13/2022, 7/11/2022 and 10/11/2022.

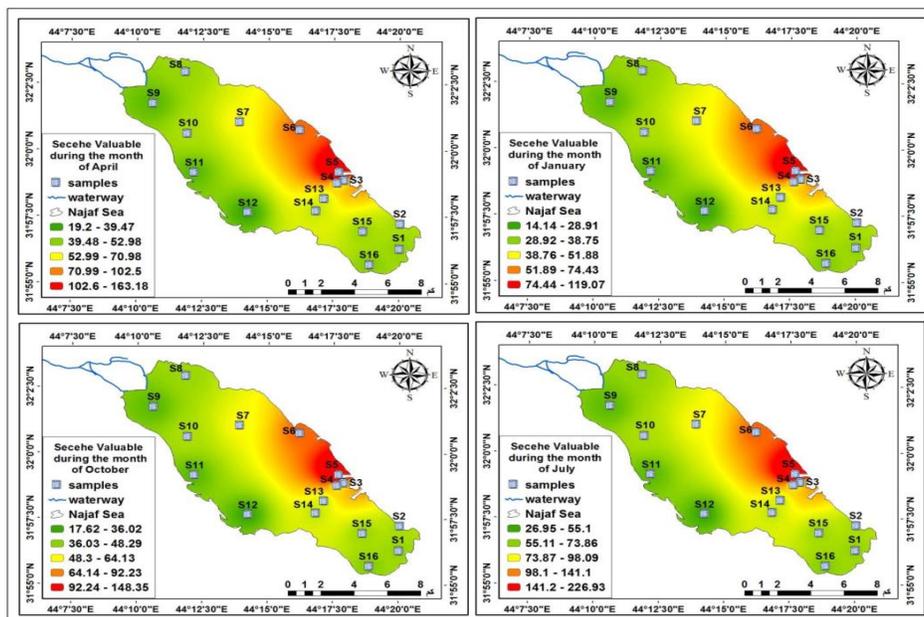
Table (8)

Classification of water quality in terms of sacchi disc values for light transmittance ⁽⁷⁾

water quality	Sacchi disk value (depth/cm)
The water is very clear for fertilization and plant roots will start to grow and the fish can become stressed due to the low oxygen	أكثر من 60
Insufficient area of plankton in the water	60 – 45
The amount of plankton is perfect	45 - 30
Plankton is becoming more abundant and the water quality is poor	30 - 20
Lots of plankton, lots of organic matter (compost) and the risk of low oxygen in the morning	20 – 0

As for during the month of July, the permeability values reach their peak, as they ranged between (226.93) cm in a sample (12) as a maximum and up to (26.95) cm in a sample (5) as a minimum.

Map (5) Monthly values of light transmittance (sacchi disc) cm in surface water samples in Najaf Sea for the year (2022)



⁽⁷⁾(American People through the United States Agency for International Development (USAID) Rural Vulnerabilities and Ecosystem Stability , How to Use a Sechi Disk , Technical Bulletin (47), Cambodia Harvest , September 2012 , p. 2 .

Source/researcher's work

(1) Based on the satellite image for the year 2022 from the Landsat 7 satellite and the outputs of the Arc GIS program (10.5).

(2) Table (7).

The amount of solar radiation and the angle of incidence of solar radiation, which leads to an increase in the transmittance of light that penetrates the water layer, in addition to that it works to raise the temperature of the air and water, which leads to a decrease in the numbers of plankton and zooplankton, due to the inadequacy of the aquatic environment with its life requirements to increase the temperature and salinity. Classification of the permeability values during the summer months based on Table (8), where it turns out that the samples (1, 2, 4, 8, 10, 13, 14, 15, 16) had an insufficient amount of plankton in the water, while the samples (3, 5, 6, 7) The water was very clear and suitable for fertilization, and the roots of the plants would begin to grow and the fish could become exhausted due to the decrease in oxygen. As for the sample (12), the plankton became more abundant and the water quality was poor, as shown in Table (7). Map (5) shows that the permeability values ranged

during the month of October between (17.62) cm as a minimum. In a sample (12) with a maximum limit of (148.35) cm in a sample (5), the water quality can be classified during the month of October based on Table (63), as it is clear that the sample (12) contained a lot of plankton and a lot of organic matter (fertilizer) and the risk of low oxygen in the morning, while the samples (1, 2, 3, 4, 7, 8, 10, 13, 14, 15) the amount of plankton was ideal, while the samples (9, 11, 16) the plankton became more The abundance and quality of water is poor, while the sample (5,6) was very clear and suitable for fertilization, and the roots of the plants will begin to grow and the fish may become exhausted due to the low oxygen during the months of the autumn season.

The third topic

The statistical relationship between climate elements and the physical properties of the sea of Najaf

In order to show the qualitative variation of the water characteristics according to the different months of the year, it was necessary to clarify this variation using statistical methods to find out

its amount, as well as to clarify which climatic elements affect directly and others affect elements have the most influence, as some indirectly,

Table (9)

Daily averages of the climatic characteristics of the Najaf station for the year 2022

the month	solar radiation	temperature	wind	Relative humidity	Monthly total precipitation	evaporation
2022/1/8	124.44	12.61	1.71	57.91	13.8	2.50
2022/4/13	204.24	22.96	2.42	42.24	1.7	5.57
2022/7/11	210.46	35.72	3.06	28.07	0.0	10.27
2022/10/11	187.58	28.08	2.13	31.38	10.6	5.45

Republic of Iraq, Ministry of Transport and Communications, General Authority for Meteorology and Seismic Monitoring, Department of Climate and Water Significance, unpublished data, 2022.

and statistical methods show the direction of the influence of the climate element Some of them

have a positive effect, that is, they have a direct relationship that works to enhance the qualitative characteristics of the water, while others have a negative effect, and here their relationship is inverse, that is, they work to reduce the characteristics and hydrological characteristics of the water in the study area.

Table (10)

Average physical properties of water in the Najaf Sea for the year 2022

the month	water temperature	electrical connection	Turbidity	Light transmittance (sacchi disk)
2022/1/8	19.819	64.784	29.245	41.902
2022/4/13	9.875	47.305	50.505	33.512
2022/7/11	17.513	55.245	34.765	45.775
2022/10/11	30.775	71.174	24.7	63.969

The source is the researcher's work based on Table (1), (2), (5) and (7).

To find the statistical relationships between the climatic elements and the qualitative characteristics of the water in the Sea of Najaf,

the Pearson correlation coefficient was used to extract the strength of the correlation, and then the interpretation or determination coefficient

(R2) was used to interpret the effect of the dependent element on the dependent element. The daily rates of the solar radiation rate were used. And the average temperature, wind, relative humidity, precipitation and evaporation, which are shown in Table (9), for the day 8/1/2022, 13/4/2022, 11/7/2022 and 11/10/2022 and used as an independent factor (approved), which corresponds to the date of sampling Water from the Najaf Sea, and linking it with the monthly measurements of the physical properties of the water, which is considered a dependent variable and shown in Table (10).

1- The statistical relationship between the daily average of solar radiation (watts/m²) and the physical properties of the water in the Najaf Sea:

Table (11) shows the existence of a strong direct correlation with statistical significance, as the value of the correlation between the rate of solar radiation, temperature, electrical conductivity, and light transmittance reached the limits of (0.82), (0.78) and (0.79), respectively, and this indicates when the daily rate of radiation increases. The solar radiation will lead to an increase in the water temperature,

electrical conductivity and light transmittance, while the inverse correlation was very strong between the solar radiation rate and the turbidity, as its value reached (0.92), and this indicates that when the solar radiation rate increases, the turbidity will decrease, while the coefficient appears. The regression is that the daily rate of change in the physical properties of water is a result of the change in the daily rate of solar radiation, as the daily rate of solar radiation increases by 1 watt / m², the (water temperature) increases by (0.18 m), the electrical conductivity is (0.21) and the light transmittance is (0.26). This indicates a direct relationship between the daily rate of solar radiation, water temperature, electrical conductivity and light transmittance, while it appears from Table (11) that the regression coefficient was inverse between the daily rate of solar radiation and turbidity, as the regression value was (0.2). 6-) This indicates that whenever the rate of solar radiation increases by 1 watt / m², it will decrease the turbidity by (-0.26). The amount of the other change, amounting to (33%), is caused by other factors that change the water temperature, and so on

with regard to the rest of each of the electrical conductivity, turbidity.

Table (11) Statistical relationships between the daily average of solar radiation (watts/m²) and the physical properties of water in the Najaf Sea for the year 2022

physical properties	correlation coefficient	regression coefficient	Interpretation coefficient
water temperature	0.82	0.18	0.67
Electrical conductivity (Ec)	0.78	0.21	0.61
Turbidity (NTU)	-0.92	-0.26	0.85
Light transmittance	0.79	0.26	0.63

Source // The researcher worked based on Table (9) and (10).

and light transmittance, as the interpretation coefficient reached an amount of (61%, 85%, and 63%), respectively, this explains that the average The daily solar radiation affects the physical properties of the water and is associated with direct and inverse correlations, and this proves the validity of the researcher's hypothesis that the climate has an effect on the physical properties of the water in the Sea of Najaf.

2- The statistical relationship between the average daily temperature (m) and the physical properties of the water in the Najaf Sea:

It can be seen from Table (12) that there is a very strong direct correlation with statistical significance, as the value of the correlation between the daily rate of air temperature, water

temperature, electrical conductivity, turbidity, and light transmittance is within (0.98), (0.99) and (0.90), and this indicates that Increasing the daily average of the air temperature will lead to an increase in the water temperature, electrical conductivity and light transmittance, while the inverse correlation was very strong between the daily average of the air temperature and turbidity, as the correlation value reached (-0.98), and this indicates that when the daily average of the air temperature increases It will work on a decrease in turbidity. As for the regression coefficient, it is clear from Table (12) that the daily rate of change in the physical properties of the water is a result of the change in the daily average of the air temperature, as whenever the daily average of the air temperature increases by 1 degree Celsius,

each of the water temperature increases by (0.87). m), electrical conductivity (1.01) and light transmittance (1.19), and this indicates a direct relationship between the rate of air temperature, water temperature, electrical conductivity and light transmittance, while the regression coefficient was inverse between the daily rate of degrees The value of the regression was (-1.13), and this indicates that there is an inverse relationship between the daily average of the air temperature and the turbidity. When the daily average of the air temperature increases by one degree Celsius, the turbidity decreases by (-0.42). The amount of change caused by the daily average of the air

temperature in the water temperature reached the limits of (95%), meaning that the amount of the other change, amounting to (5%), is caused by other factors that change the water temperature, and so on with regard to the rest of each of the electrical connection, turbidity and light transmittance, as it reached The interpretation coefficient is (97%, 96%, and 81%), respectively. This explains that the daily rate of air temperature affects the physical properties of water and is associated with direct and inverse correlations. This proves the validity of the researcher's hypothesis that climate has an impact on the physical properties of water in the sea. Najaf.

Table (12) Statistical relationships between the average daily temperature (°C) and the physical properties of water in the Najaf Sea for the year 2022

physical properties	correlation coefficient	regression coefficient	Interpretation coefficient
water temperature	0.98	0.87	0.95
Electrical conductivity (Ec)	0.99	1.07	0.97
Turbidity (NTU)	-0.98	-1.13	0.96
Light transmittance	0.90	1.19	0.81

Source // The researcher worked based on Table (9) and (10).

3- The statistical relationship between the average daily wind speed (m/s) and the physical properties of the water in the Najaf Sea:

It can be seen from Table (13) that there is a very strong direct correlation with statistical significance, as the value of the correlation between the daily rate of wind speed, water temperature and light transmittance was within

(0.95) and (0.90), while the correlation was strong between the daily rate of wind speed and connectivity. Electricity, as the correlation value reached around (0.82), this indicates that increasing the daily rate of wind speed will lead to an increase in water temperature, electrical

conductivity, and light transmittance, while the correlation was strong inverse between the daily rate of wind speed and turbidity, as the correlation value reached (-0.84), This indicates that when the daily rate of wind speed increases, turbidity will decrease.

Table (13) Statistical relationships between the average daily wind speed (m/s) and the physical properties of water in the Najaf Sea for the year 2022

physical properties	correlation coefficient	regression coefficient	Interpretation coefficient
water temperature	0.95	14.46	0.90
Electrical conductivity (Ec)	0.82	15.17	0.67
Turbidity (NTU)	-0.84	-16.58	0.70
Light transmittance	0.99	22.44	0.98

Source // The researcher worked based on Table (9) and (10).

As for the regression coefficient, it appears from Table (13) that the daily rate of change in the physical properties of the water is a result of the change in the daily rate of wind speed, as whenever the daily rate of wind speed increases by 1 meter/second, the water temperature increases by (14.46 m) and the electrical conductivity (15.17).) and light transmittance (22.44), and this indicates that there is a direct relationship between the daily rate of wind speed, water temperature, electrical conductivity, and light transmittance, while the regression coefficient was inverse between the daily rate of wind speed and turbidity, as the

regression value reached (-16.58), and this indicates There is an inverse relationship between the daily rate of wind speed and turbidity. When the daily rate of wind speed increases by 1 meter / sec, the turbidity decreases by (-16.58). As for the coefficient of interpretation, the amount of change caused by the daily rate of wind speed in the water temperature reached about (90%). That is, the amount of the other change, amounting to (10%), is caused by other factors that change the water temperature, and so on for the rest of each of the electrical connection, turbidity, and light transmittance, as the interpretation

coefficient amounted to (67%, 70%, and 98%), respectively. , This explains that the daily rate of wind speed affects the physical properties of water and is associated with direct and inverse correlations.

4– Statistical relationships between the daily average relative humidity (%) and the physical properties of water in theNajaf Sea:

It can be seen from Table (14) that there is a very strong inverse correlation with statistical significance, as the value of the correlation between the daily average of relative humidity, water temperature and electrical conductivity is

within (-0.90) and (-0.97), while the correlation was strong between the daily average of relative humidity And light transmittance, as the correlation value reached around (-0.78), this indicates that increasing the daily rate of relative humidity will lead to a decrease in water temperature, electrical conductivity, and light transmittance, while the direct correlation was very strong between the daily rate of wind speed and turbidity, as the correlation value reached (0.99).), and this indicates that when the daily rate of relative humidity increases, it will increase the turbidity.

Table (14) Statistical relationships between the daily average relative humidity (%) and the physical properties of water in the Najaf Sea for the year 2022

physical properties	correlation coefficient	regression coefficient	Interpretation coefficient
water temperature	-0.90	-0.58	0.81
Electrical conductivity (Ec)	-0.97	-0.76	0.95
Turbidity (NTU)	0.99	0.83	0.98
Light transmittance	-0.78	-0.74	0.61

Source // The researcher worked based on Table (9) and (10).

As for the regression coefficient, it appears from Table (14) that the daily rate of change in the physical properties of water is a result of the change in the daily rate of relative humidity, as the more the daily rate of relative humidity increases by 1%, the water temperature decreases by (-0.58 m) and the electrical

conductivity is (-0.76).) and light transmittance (-0.74), and this indicates an inverse relationship between the daily rate of relative humidity, water temperature, electrical conductivity, and light transmittance, while the regression coefficient was direct between the daily rate of relative humidity and turbidity, as

the regression value reached (0.83), and this indicates There is a positive relationship between the daily average relative humidity and turbidity. When the daily average relative humidity increases by 1%, the turbidity increases by (0.83). As for the coefficient of interpretation, the amount of change caused by the daily rate of relative humidity in the water temperature reached about (81%), meaning that the amount of the other change, amounting to (19%), is caused by other factors that change the water temperature, and so on with respect to the rest of each of the electrical connection, turbidity and permeability Light, as the interpretation coefficient was (95%, 98%, and 61%), respectively. This explains that the daily rate of relative humidity affects the physical properties of water and is associated with direct and inverse correlations, and this proves the validity of the researcher's hypothesis that climate has an impact on the physical properties of water. in the sea of Najaf.

5- Statistical relationships between precipitation (mm) and physical properties of water in the Najaf Sea:

It can be seen from Table (15) that there is a strong inverse correlation with statistical

significance, as the value of the correlation between the monthly total rainfall, water temperature and light transmittance was within the limits of (-0.76) and (-0.86), while the correlation was medium between the monthly total rainfall and the electrical conductivity, as The correlation value reached around (-0.58). This indicates that an increase in the monthly total rainfall will lead to a decrease in the water temperature, electrical conductivity and light transmittance, while the direct correlation was strong between the monthly total rainfall and turbidity, as the correlation value reached (0.70), and this indicates that at Increasing the monthly total of precipitation will increase the turbidity. As for the regression coefficient, it is clear from Table (15) that the daily rate of change in the physical properties of the water is a result of the change in the monthly total of precipitation, as whenever the monthly total of precipitation increases by 1 mm/L, the water temperature decreases by (-0.98 m), electrical conductivity (-0.91), and light transmittance (-1.65), which indicates an inverse relationship between the monthly total rainfall, water temperature, electrical conductivity, and light transmittance, while the regression coefficient

was direct between groups. The monthly time of rain and turbidity, as the value of the regression reached (1.16), and this indicates the existence of a direct relationship between the monthly total

of rain and turbidity. When the monthly total of rain increases by 1 mm / liter, the turbidity increases by (1.16).

Table (15) Statistical relationships between the daily total rainfall (mm) and the physical properties of water in the Najaf Sea for the year 2022

physical properties	correlation coefficient	regression coefficient	Interpretation coefficient
water temperature	-0.76	-0.98	0.58
Electrical conductivity (Ec)	-0.58	-0.91	0.34
Turbidity (NTU)	0.70	1.16	0.48
Light transmittance	-0.86	-1.65	0.75

Source // The researcher worked based on Table (9) and (10).

As for the coefficient of interpretation, the amount of change caused by the monthly total rainfall in the water temperature reached about (58%), meaning that the amount of the other change, amounting to (42%), is caused by other factors that change the water temperature, and so on with respect to the rest of each of the electrical connection, turbidity, and light transmittance. As the interpretation coefficient was (34%, 48%, and 75%), respectively, this explains that the monthly total rainfall affects the physical properties of water and is associated with direct and inverse correlations, and this proves the validity of the researcher's hypothesis that climate has an impact on the physical properties of water in the sea. Najaf.

6– Statistical relationships between the daily rate of evaporation (mm) and the physical properties of water in the Najaf Sea:

It can be seen from Table (16) that there is a very strong direct correlation with statistical significance, as the value of the correlation between the daily rate of evaporation, water temperature, electrical conductivity and light transmittance is within (0.99), (0.90) and (0.99). This indicates that the daily rate of evaporation increases. It will lead to an increase in water temperature, electrical conductivity, and light transmittance, while the correlation was strong inverse between the daily rate of evaporation and turbidity, as the correlation value reached (-0.88), and this indicates that

when the daily rate of evaporation increases, turbidity will decrease. As for the regression coefficient, it is shown in the table (15) The daily rate of change in the physical properties of water as a result of the change in the daily rate of evaporation, as the increase of 8.34 by 1 mm / liter increases each of the water temperature by (2.67 m), electrical conductivity (2.95) and light transmittance (3.97), and this indicates the presence of A direct relationship between the

daily rate of evaporation, water temperature, electrical conductivity and light transmittance, while the regression coefficient was inverse between the daily rate of evaporation and turbidity, as the regression value was (-3.07), and this indicates an inverse relationship between the daily rate of evaporation and For turbidity, when the monthly total rainfall increases by 1 mm / liter, the turbidity decreases by (-3.07).

Table (16) Statistical relationships between the daily rate of evaporation (mm) and the physical properties of water in the Najaf Sea for the year 2022

physical properties	correlation coefficient	regression coefficient	Interpretation coefficient
water temperature	0.99	2.67	0.98
Electrical conductivity (Ec)	0.90	2.95	0.82
Turbidity (NTU)	-0.88	-3.07	0.77
Light transmittance)	0.99	3.97	0.98

Source // The researcher worked based on Table (9) and (10).

As for the coefficient of interpretation, the amount of change caused by the daily rate of evaporation in the water temperature reached about (98%), meaning that the amount of the other change of (2%) is caused by Other factors change the water temperature, and so on with regard to the rest of each of the electrical conductivity, turbidity and light transmittance, as the interpretation coefficient reached an amount

of (82%, 77% and 98%), respectively, this explains that the daily rate of evaporation affects the physical properties of water and is associated with it With direct and inverse correlations, this proves the validity of the researcher's hypothesis that climate has an effect on the physical properties of water in the Najaf Sea.

Conclusions:

1- It appears from the results of the statistical analysis that there is a strong direct correlation with statistical significance, as the value of the correlation between the rate of solar radiation, temperature, electrical conductivity and light transmittance is around (0.82), (0.78) and (0.79), respectively, while the inverse correlation was strong There is a very significant difference between the rate of solar radiation and turbidity, as its value reached (0.92).

2- It is clear from the results of the research that there is a very strong direct correlation with statistical significance, as the value of the correlation between the daily rate of air temperature, water temperature, electrical conductivity, turbidity and light transmittance is within (0.98), (0.99) and (0.90), while the correlation was A very strong inverse between the average daily air temperature and turbidity, as the correlation value reached (-0.98).

3- It is noted that there is a very strong direct correlation with statistical significance, as the value of the correlation between the daily rate of wind speed, water temperature and light transmittance was within (0.95) and (0.90) while the correlation was strong between the

daily rate of wind speed and electrical conductivity as it reached The correlation value is around (0.82), while the correlation was strong inverse between the average daily wind speed and turbidity, as the correlation value reached (-0.84).

4- It turns out that there is a very strong inverse correlation with statistical significance, as the value of the correlation between the daily rate of relative humidity, water temperature and electrical conductivity is within the limits of (-0.90) and (-0.97), while the correlation was strong between the daily rate of relative humidity and light transmittance as The correlation value reached around (-0.78), while the direct correlation was very strong between the average daily wind speed and turbidity, as the correlation value reached (0.99).

5- It is clear that there is a strong inverse correlation with statistical significance, as the value of the correlation between the monthly total of rainfall, water temperature and light transmittance was within the limits of (-0.76) and (-0.86), while the correlation was medium between the monthly total of rainfall and the electrical conductivity, as the correlation value reached within (-0.58), while the direct

correlation was strong between the monthly total rainfall and turbidity, as the correlation value reached (0.70).

6- It is noted that there is a very strong direct correlation with statistical significance, as the value of the correlation between the daily rate of evaporation, water temperature, electrical conductivity and light transmittance is within (0.99), (0.90) and (0.99), while the correlation was strong inverse between the daily rate of evaporation And turbidity, where the correlation value reached (-0.88).

Recommendations:

1- The necessity of preserving the water harvest through the construction of dams to store water during the winter season in the western, southwestern and southeastern sides, as they contain many seasonal valleys that receive large amounts of rain during the winter season, and these dams are opened during the summer season to feed the Najaf Sea It compensates for the shortage of water as a result of its vulnerability to climatic elements, especially high temperature, low relative humidity, lack of precipitation, and increased evaporation.

2- Taking care of the biological diversity in the waters of the Najaf Sea, which contains many fish, birds, snails and crustaceans, and preventing the drainage of sewage into it because it destroys the ecosystem, especially since the low water level during the summer will increase the concentration of dissolved ions and heavy elements in the water, which constitutes Danger to aquatic life.

3- Eliminate the manifestations of desertification in the Sea al-Bahr region through planting green belts, which have an effect on preserving the water area in the Sea al-Bahr by reducing temperatures and the amount of evaporation and increasing the relative humidity.

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