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A Study on the Physicochemical Assessment of Salt Pan Water from the Cape Comorin Coast of Tamil Nadu

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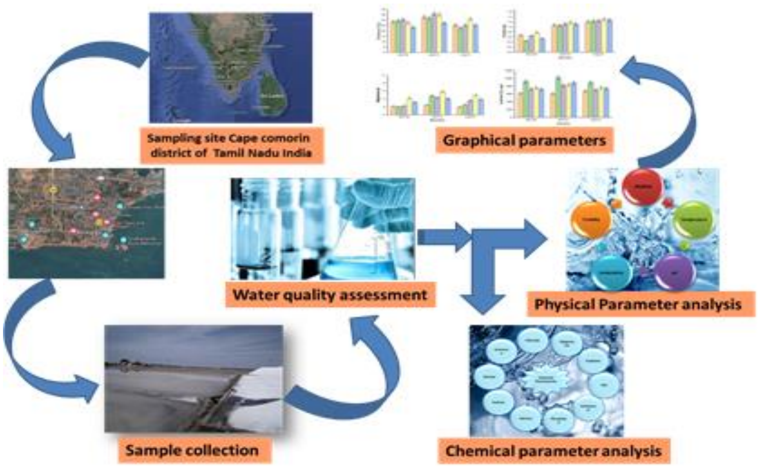
Keywords

Salt pan water, phytochemical parameters, alkalinity, conductivity, correlation coefficient, significant, estimation.

Abstract

Phytochemical components are a vital source of life for living things in marine habitats. The objective of the current inquiry is to evaluate the hydrogeochemical characteristics of samples of seawater and saltpan water. Samples were taken throughout the course of a year, from December 2020 to August 2021, at five selected sites in the Cape Comorin coastal region of the Kanyakumari district. Twenty physical and chemical characteristics of seawater and salt pan water have been the subject of a statistical analysis of the correlation coefficient study. Salinity, alkalinity, turbidity, temperature, pH, conductivity, sodium, calcium, magnesium, potassium, nitrate, TDS, phosphate, zinc, sulphate, and chloride are some of the characteristics. The findings show that the saltpan water sample contains higher levels of salinity, magnesium, chloride, suphate, and zinc than the seawater sample at different times of the year. The correlation coefficient statistical technique is great for accurately and reasonably forecasting the value of a significant parameter. The findings show a significant link between key variables in the Manakudi and Puthalam salt works. GraphPad Prism 9.4.1 was used to determine the relationship between the various physicochemical parameters using the data and the Karl-Pearson correlation coefficient.

Graphical Abstract



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1. Introduction

Salt plays an essential role in the world. The second-largest salt producer is in Tamil Nadu, India. The major production area for salt is around 600 acres, with an estimated annual production of 0.11 metric tonnes in the Kanyakumari district. The term "salt" refers to a mixture of diverse anionic and cataionic inorganic chemicals, among which sodium (Na+) and chloride (Cl-) are the most prevalent in a hypersaline environment (1). The ionic composition, pH, light intensity, oxygen content, salt content, and nutrient concentrations are all highly variable in hypersaline habitats, including salt marshes, salt pans, and salt lakes. That environment has been defined as having low species diversity and missing entire taxonomic groups due to seawater evaporation (2). In hypersaline habitats, surface extension and ecological relevance is both significant (3), and comprehension of the habitat's physicochemical analysis is crucial as it significantly influences the biological components. However, the levels that the majority of organisms (particularly eukaryotes) tolerate or require are often lower than 1%, which is lower than what is typically thought of as halophilic or halotolerant. The oceans and seas can be thought of as the largest habitats in the world, and the creatures that live there can survive or even require the salinity, which is generally constant (about 3.5%) and the mildly halophilic species, which is another way of saying "marine organisms" (4).

Several bacteria that were once classified as extremophiles are actually mild halophiles; in certain cases, varied behaviour is shown depending on the temperature of incubation or the nutrients provided. The acquisition of an internal osmotic pressure that is equal to that on the surface is perhaps the most important tactic. The environmental condition of physical and chemical parameters can affect microbes quantitatively and qualitatively. Studying the ecosystem and the creatures that live there requires research into their physical and chemical properties (5). In the second decade of the nineteenth century, early microbiologists developed an interest in hypersaline habitats. High inorganic salt levels are a harsh environment for the majority of bacteria, as seen by the frequent expiry of salt-cured hides and food (6).

The present study aims to evaluate physicochemical parameters of water samples from sea and saltern sources in the Kanyakumari district of Tamil Nadu. Analyse the effects of regular and periodic climate variation in various seasons on the physicochemical parameters induced by regular and periodic climate changes, and using the resulting data, analyse for correlations between the various physicochemical factors using the Karl-Pearson correlation coefficient by using GraphPad Prism 9.4.1.

2. Methodology

2.1 Study area

The sample sites are near Tamil Nadu's Cape comorin coast (8° 6' 6" N, 77° 28' 40" E). Manakudi, Latitude 8.09o Longitude 77.54o, Puthalam, Latitude 8.09o Longitude 77.48o, Thamaraikulam, Latitude 8.09o Longitude 77.48o, and Kovalam, Latitude 8.08o Longitude 77.52o Shown in Figure 1

2.2 Collection site

Seawater samples were collected from Kanyakumari's zero-point coastal region (site 1), and salt pan water samples were collected from Manakudi (site 2), Puthalam (site 3), Thamaraikulam (site 4), and Kovalam (site 5) at Cape Comorin. The samples were collected at tertiary intervals from December 2020 to August 2021 in sterile glass bottles. And the samples were brought in to the laboratory in an ice box, where they were analysed within 5 to 6 hours of collection.

2.3 Analysis of physical chemical parameters

The method followed by American Public Health Association (7) established standard procedures for the evaluation of the salt pan water. Temperature, pH, turbidity, salinity, alkalinity, total hardness, total dissolved solids (TDS), chloride, calcium, magnesium, sodium, potassium, sulphate, phosphate, and conductivity were among the physicochemical factors analysed. A thermometer was used to measure the temperatures of samples of seawater and salt pan water. Using a pH metre, the pH of samples of seawater and salt pan water

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was determined (ELICO L1–612). Using a nephelometer, the turbidity of samples of seawater and salt pan water was determined (Systronics Model 132). And using refractometer (Atago Model S/Mill-E) was used to measure the salinity of samples of seawater and salt pan water (8). Using the potentiometric titration method, the alkalinity of samples of seawater and salt pan water was determined. The EDTA titration method was used to measure the overall hardness of seawater. A TDS metre was used to measure the total dissolved solids in saltwater. The chloride content was calculated using the argent metric method. The EDTA titrimetric technique was used to determine the calcium concentration. In seawater and saltpan water, magnesium was computed as the difference between calcium as $CaCO_3$ and hardness. Using a flame-photometer, sodium and potassium contents were determined (Systronics Model 128). Using Bacl2, the turbid metric method was employed to determine the sulphate concentration. And using the stannous chloride method, the phosphate content of saltpan water samples was determined (9).

2.4 Statistical analysis

In statistical studies, the Karl-Pearson correlation coefficient is used to analyse the data and determine the correlation between and among different physical and chemical parameters by using GraphPad Prism 9.4.1.

3. Result and Discussion

The physicochemical parameters were analysed for various seasonal conditions from December 2020 to August 2021 and tabulated in Tables 1–5, with the physical parameter shown in Figure 1 and the chemical parameter shown in Figure 2, indicating a comparison of various parameters at different study sites. The water collected from five sites was observed as Seawater Sample Site 1, Manakudi Salt Pan Water Site 2, Puthalam Salt Pan Water Site 3, Thamaraikulam Salt Pan Water Site 4, and Kovalam Salt Pan Water Site 5.

The data revealed that the physical parameters of temperature at the sampling sites for salt pan water ranged between 25 and 41 °C, and seawater ranged from 21 to 37 °C (10-12). The highest temperature range for both samples was in April 2021, followed by 30-32°C in August 2021 at both sites (Figure 2, Tables 1–5). Thus, the pH of seawater and salt pan samples at sites 1 and 3 ranged between 7 and 8. (Figure 2, Tables 1–5). It is evident from the results that the pH of seawater and salt pan water was slightly alkaline in the months of April and December 2021, while they were found to be neutral in August 2021. The pH of the salt pan water sample was more alkaline than the seawater (13, 14). The turbidity ranged from 18 to 22 NTU maximum values at sites 2 and 3 (Figure 2 and Tables 1-5). Turbidity was higher in April 2021, followed by December 2021 and August 2021. The site 3 sample was found to be more turbid when compared to others. The results indicate that alkalinity, sulphate, and chloride were increased in sites 2 and 3, ranging between 1500 and 2489 mg/l (Figure 2, Tables 1–5,). Alkalinity was higher in saltpan water when compared to seawater (15). The hardness of the water sample ranged between 10 and 39 g/l at both sites 2 and 3 (Figure 2, Tables 1–5). The total hardness was higher in salt pan water as compared to seawater. (16)

The chemical parameters of the water samples showed that the chloride content of the water ranged between 25 and 33 g/l at the maximum values at site 3 (Figure 2, Tables 1–5). The chloride content of salt pan water was higher than that of seawater. Calcium content varied from 1.6 to 8 g/l, with maximum values at sites 2 and 3 (Figure 2, Tables 1–5). It is thus evident that the calcium content was higher in salt pan water as compared to seawater. Magnesium content ranged from 2.5 to 5.8 g/l at maximum values at sites 3 and 4 (Figure 2, Tables 1–5). The results suggested that the content of magnesium was higher in saltpan water than in seawater in April 2021. Sundararaj *et al.* (15) reported the calcium content was always higher than the magnesium. Sodium content varied from 3.5 to 8.5 g/kg, with maximum values at site 3 (Figure 3, Tables 1–5). As a result, the sodium content of saltpan water was higher than that of seawater. The potassium content varied between 3.0 and 7.2 g/kg maximum values at site 1 (Figure 3, Tables 1–5). Thus, seawater possessed a higher content of potassium as compared to salt pan water. The conductivity of the water sample nearby the collected salt was found to be 93µS/cm higher at

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sites 3 and 4 (Figure 3, Tables 1–5). The nitrogen content of water samples was highest (32 ppm) at site 5, whereas the iron content was higher at sites 2 and 3 (4.6 and 5 ppm). The maximum iron content was 0.16 to 1.12 mg/l at sites 2, 3, and 5. Sulphate content in the sediments ranged from 610 to 1.028 mg/l, with maximum values at site 2 (Figure 3, Tables 1–5). TDS values at site 4 ranged from 42 to 64 g/l (Figure 3, Tables 1–5). Thus, from the above results, TDS were higher in saltpan water than in seawater samples, the same result observed by Muduli Bipra Prasanna (17). Thus, the content of sulphate recorded was higher in saltpan water than in seawater. The phosphorus content of the water ranged between 0.15 and 0.36 mg/l, with the highest values at site 2 (Figure 3, Tables 1–5,). This agreement correlates with the findings (18-20)

3.1 Correlation of physicochemical parameters in sea water and saltpan water samples: Statistical Analysis

The correlation coefficient is estimated by using a mathematical model for water quality analysis to describe the relationship between dependent and independent variables (21). In this study, the relationship between the water quality parameters and each data point was determined and calculated by

$$R = n \frac{\sum(KiFi - \sum Ki \sum Fi}{[n\sum xi2-(\sum xi)2][[n\sum yi2-(\sum Fi)2]]}$$

Where x and y values represent the x-variables of five different water quality parameters. N is the number of data points.

The Karl Pearson correlation coefficient matrix is used in this statistical study to predict relationships among more variables (22) and to measure the significance of water quality parameters (23). A direct correlation exists when an increase or decrease in the value of one parameter is associated with a corresponding value of another parameter. Tables 6 show the correlation between various physical and chemical parameters of seawater at Cape Comorin (Site 1) zero point. The findings showed that most of the measures investigated, with the exception of salt, had a strong positive connection with the alkalinity of the water. And total dissolved solids, sodium, and ammonia also showed a significant positive correlation with all of the parameters, with the exception of alkalinity, which showed a significant negative correlation with all of the parameters examined above, with the exception of alkalinity, which showed a significant negative correlation. Temperature, pH, hardness, chloride, sulphate, nitrate, fluoride, turbidity, potassium, nitrate, and tidy's all had a significant positive correlation with all of the parameters tested (Table 6). And the site 2 temperature of the saltpan water at Manakudi (Table 7) showed a positive correlation with most of the parameters, except nitrate. And the parameters of pH, alkalinity, total dissolved oxygen, sodium, chloride, and iron showed a positive correlation with all parameters except ammonia, nitrate, ammonia, fluoride, phosphate, and magnesium, which also showed a negative correlation. And chloride, potassium, and alkalinity, they showed a positive and significant correlation with the rest of the parameters. Table 8 indicates a correlation between the physicochemical parameters of saltpan water at Puthalam (Site 3). The chloride in saltpan water showed a positive and significant correlation with all of the parameters examined, except sodium and phosphate. And Temperature, pH, turbidity, alkalinity, conductivity, and hardness, total dissolved solids, TDS, iron, calcium, potassium, sulphate, and phosphate individually exhibited a significant positive correlation with all the parameters, whereas sodium showed a significant negative correlation with chloride. And Thamaraikulam (site 4) and Kovalam (site 5) salt pan water (Table 9 and Table 10), With the exception of temperature and hardness, calcium and magnesium, pH and calcium, and calcium and chloride, alkalinity, chloride, potassium, and sulphate, all the metrics individually had a strong positive correlation with each other (Table 10). This correlation coefficient value lies between +1 and -1. Previously published findings on correlation analyses of salt and seawater in aquatic bodies (24, 25). However, the present study of the correlation between the various physicochemical factors is related to the hypersaline environment. As a result, the current study can provide crucial data about the correlation between salt pan physicochemical properties and extremophile microbial components.

4. Conclusion

The physicochemical characteristics are most important for many processes that take place both in biotic and abiotic environments. Three domains have been interconnected with extreme environments: Archaea, Bacteria, and Eukarya. They are now recognised as inhabitants living in both non-extreme and extreme conditions; they are important constituents of the microbial biota in hypersaline environments with salinities ranging from 1.7M to 4.3M. The two most prominent groups are halophilic bacteria and archaea. In the current investigation, to determine and estimate the physicochemical parameters of salt pan and seawater samples, they were sourced from coastal saltpan sites at Puthalam, Manakudi, Kovalam, and Tamaraikulam under various seasonal conditions. The production of organic matter for direct use by organisms found in that particular environment depends on the concentrations of nutrients and trace elements and the energy conversion levels from phase to phase. Physicochemical parameters such as temperature, pH, salinity, hardness, alkalinity, and other chemical parameters like calcium, magnesium nitrate, sulphate, potassium, and phosphate were also determined. These factors play a major and significant role in a saltpan and seawater ecosystem. The detailed study of abiotic determinants is critical because changes in environmental conditions influence the physicochemical process of salt production as well as the growth of biological organisms. The significance between various factors was established by using the Karl-Pearson coefficient method to statistically analyse the data for correlation. We come to the conclusion that all the characteristics are significantly connected, with Puthalam and Manakudi salt works showing particularly strong correlations when compared to the various parameters, which have probably not been attempts for halophillic archaea to inhabit the hypersaline environments.

Declaration

Ethical Approval

Not applicable for ethical approval for this study.

Conflict of interest

Authors declare no conflict of interest.

Credit Authorship Contribution Statement

Conceptualization, design of experiments: A.B, R.G., for sample collection, data analysis, sample processing, and original draft writing: A.B.; data analysis, supervision, project administration, Data validation, edit and writing manuscript: R.G.; the manuscript has been read and approved for publication by all authors.

Funding

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Date availability statement

The essential data supporting the reported results are contained in this study. All other data are available on request from the corresponding authors.

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Figures Ligand

Figure 1: Sampling collection Site of Kanayakumari district

Figure 2: Physical Parameters of Salt pan water and Seawater samples a: Alkalinity; b, Turbidity; c, Hardness; d, Temperature; e, pH

Figure 3: Chemical Parameters of Salt pan water and Seawater samples a: Chloride; b, Fluoride; c, Magnesium; d, Sulphate; e, Dissolved solids; f, Ammonia; g, Phosphate; h, Iron; I, Calcium; j, Sodium; k, Potassium; l, Nitrate.

Tables Ligand

Table 1: Physicochemical Parameters of Seawater from Zero Point at Kanyakumari (Site 1)

Table 2: Physicochemical parameters of water sample from salt pans at Manakudi (Site 2)

Table 3: Physicochemical parameters of water from salt pans origin at Puthalam (Site 3)

Table 4: Physicochemical parameters of water from salt pans at Thamaraikulam (Site 4)

Table 5: Physicochemical parameters of water from salt pans at Kovalam (Site 5)

Table 6: Correlation coefficient among various physicochemical parameters of Sea water (Site 1)

Table 7: Correlation coefficient among various physicochemical parameters of Manakudi (Site 2)

Table 8: Correlation coefficient among various physicochemical parameters of Puthalam (Site 3)

Table 9: Correlation coefficient among various physicochemical parameters of Thamaraikulam (Site 4)

Table 10: Correlation coefficient among various physicochemical parameters of Kovalam (Site 5)

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Figure 1: Sampling collection Site of Kanyakumari district

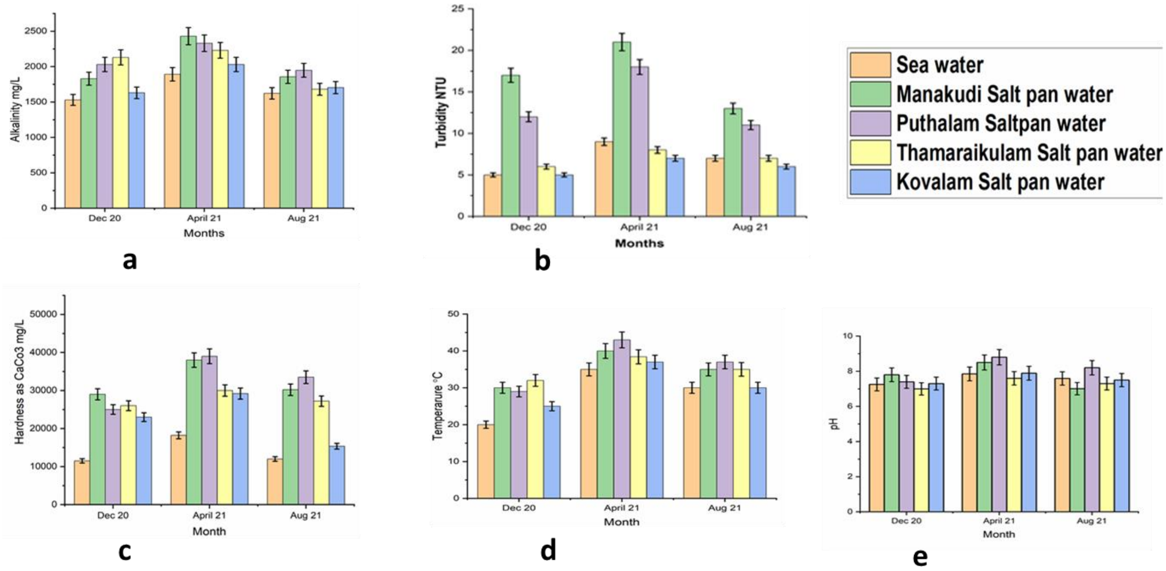
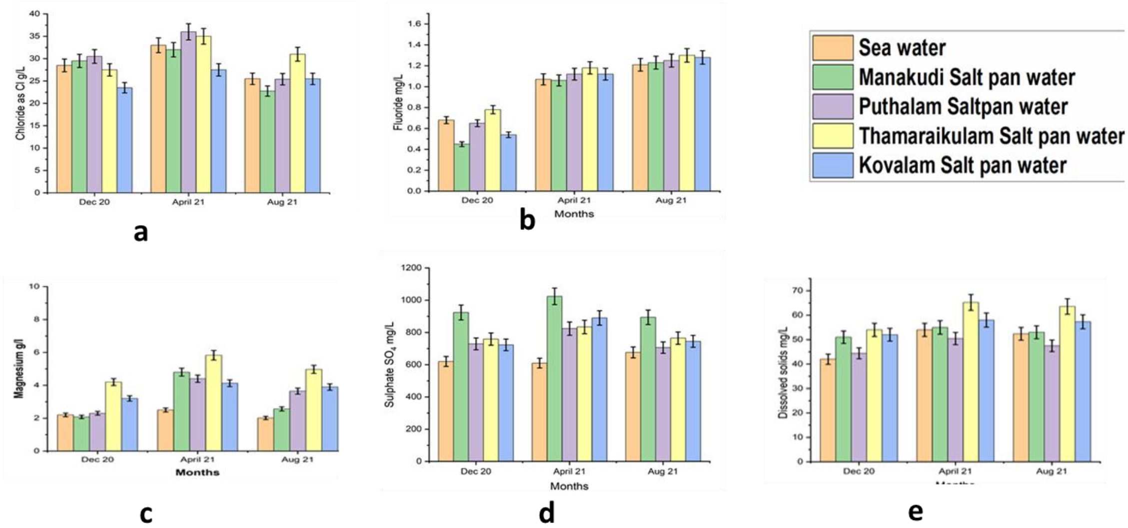


Figure 2: Physical Parameters of Salt pan water and Seawater samples a: Alkalinity; b, Turbidity; c, Hardness; d, Temperature; e, pH



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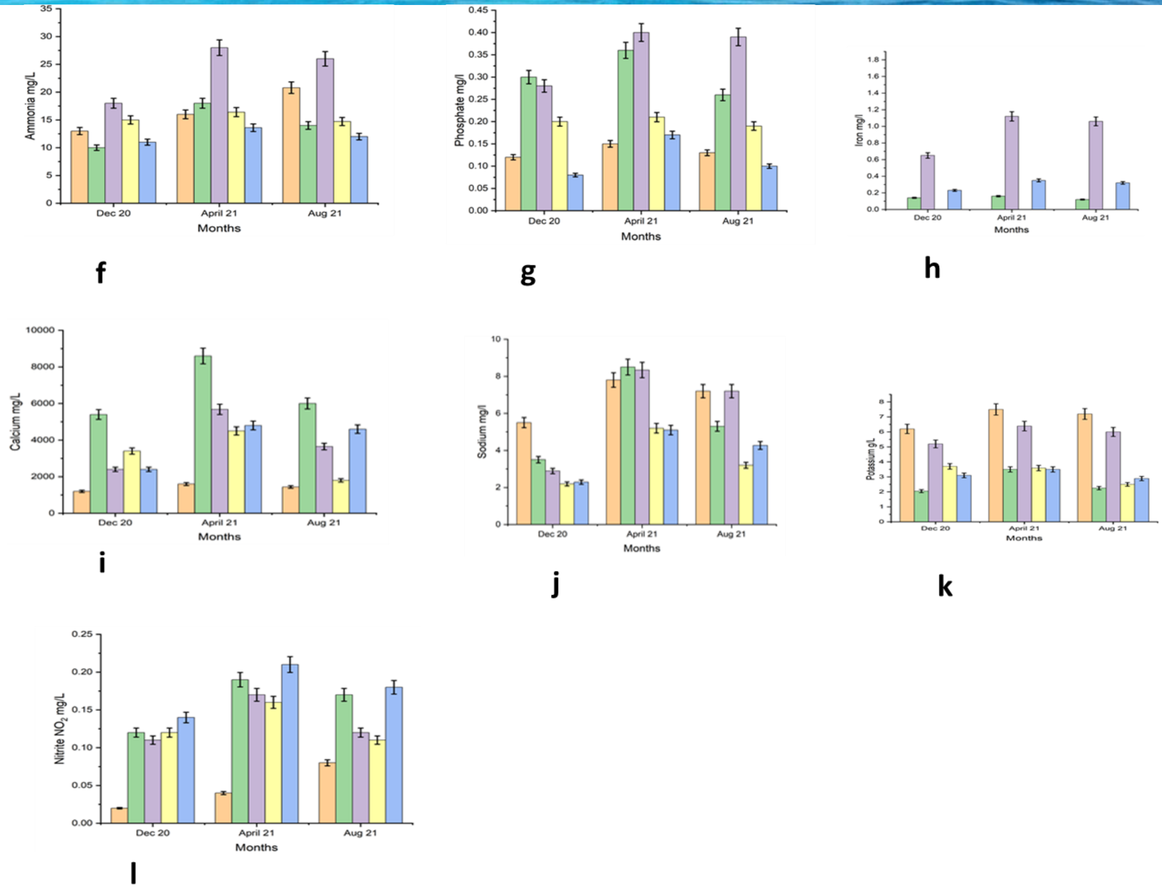

Figure 3: Chemical Parameters of Salt pan water and Seawater samples a: Chloride; b, Fluoride; c, Magnesium; d, Sulphate; e, Dissolved solids; f, Ammonia; g, Phosphate; h, Iron; I, Calcium; j, Sodium; k, Potassium; l, Nitrate.

Physicochemical Parameters of Site 1	Dec-2020	Apr-2021	Aug-2021
Appearance	Clear	Clear	Clear
Colour	Colourless	Colourless	Colourless
Odour	None	None	None
Temperature	20±1.00	35±1.75	30±1.50
pH	7.25±0.362	7.85±0.392	7.59±0.379
Total Hardness as CaCo3 g/L	11.5±0.575	18.2±0.91	12±0.6
Total Alkalinity mg/L	1530±76.5	1892±94.6	1623±81.15
Chloride as Cl g/L	28.5±1.425	31±1.65	25.5±1.275
Sulphate as SO4 mg/L	620±31	610±30.5	676±33.8
Nitrate as NO3 mg/L	1.5±0.075	3.1±0.155	2±0.1
Fluoride as F mg/L	0.68 ±0.034	1.07±0.053	1.21±0.060
Turbidity NTU	5±0.25	9±0.45	7±0.35

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Total dissolved Solids g/L	42±2.1	54±2.7	52.378±2.618
Conductivity µS/cm	74000	80000	77029
Calcium g/L	1.2±0.060	1.600±0.080	1.440±0.072
Magnesium mg/L	2.2±0.11	2.5±0.125	2.016±0.10
Sodium mg/L	5.500±0.275	7.800±0.39	7.200±0.36
Potassium mg/L	6.2±0.31	7.5±0.375	7.2±0.36
Ammonia mg/L	13±0.65	16±0.8	20.8±1.04
Nitrite as NO2 mg/L	0.02±0.001	0.04±0.002	0.08±0.004
Total Phosphate as PO4 mg/L	0.12±0.006	0.15±0.0075	0.13±0.0065
Iron mg/L	-	-	-

±SD - The values represent mean of triplicates. SD: Standard deviation

Table 1: Physicochemical Parameters of Seawater from Zero Point at Kanyakumari

Physicochemical Parameters of Site 2	**Dec-2020**	**Apr-2021**	**Aug-2021**
Appearance	Clear	Clear	Clear
Colour	Colourless	Colourless	Colourless
Odour	None	None	None
Temperature	30±1.50	40±2.00	35±2.15
pH	7.8±0.39	8.5±0.425	7.01±0.35
Total Hardness as CaCo3 g/L	29±1.45	38±1.9	30.2±1.51
Total Alkalinity mg/L	1830±91.5	2430±121.5	1856±92.8
Chloride as Cl g/L	29.5±1.475	32±1.6	22.75±1.137
Sulphate as SO4 mg/L	924±46.2	1.024±51.2	894±44.7
Nitrate as NO3 mg/L	2.1±0.105	3.4±0.17	3±0.15
Fluoride as F mg/L	0.45±0.022	1.06±0.053	1.23±0.061
Turbidity NTU	17±0.85	21±1.05	7±0.65
Total dissolved Solids g/L	51±2.55	55±2.75	53.02±2.651
Conductivity µS/cm	7280	8340	7797
Calcium g/L	5.4±0.27	8.600±0.430	6000±0.300
Magnesium mg/L	2.08±0.104	4.8±0.24	2.568±0.128
Sodium mg/L	3.500±0.175	8.500±0.425	5.300±0.265
Potassium mg/L	2.05±0.1025	3.5±0.175	2.25±0.112
Ammonia mg/L	10±0.5	18±0.9	14±0.7
Nitrite as NO2 mg/L	0.12±0.006	0.19±0.0095	0.17±0.0085
Total Phosphate as PO4 mg/L	0.3±0.015	0.36±0.018	0.26±0.013
Iron mg/L	0.14±0.007	0.16±0.008	0.12±0.006

±SD - The values represent mean of triplicates. SD: Standard deviation

Table 2: Physicochemical parameters of water sample from salt pans at Manakudi (Site 2)

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Physicochemical Parameters of Site 3	Dec-2020	Apr-2021	Aug-2021
Appearance	Clear	Clear	Clear
Colour	Colourless	Colourless	Colourless
Odour	None	None	None
Temperature	29±1.45	41±2.15	37±1.85
pH	7.40±0.37	8.8±0.44	8.2±0.41
Total Hardness as CaCo3 g/L	25±1.25	39±1.95	33.5±1.67
Total Alkalinity mg/L	2030±101.5	2330±116.5	1948±97.4
Chloride as Cl g/L	30.5±1.525	32±1.8	25.4±1.27
Sulphate as SO_4 mg/L	729±36.45	824±41.2	706±35.3
Nitrate as NO_3 mg/L	1.4±0.07	2.6±0.13	2.3±0.115
Fluoride as F mg/L	0.65±0.0325	1.12±0.056	1.25±0.0625
Turbidity NTU	12±0.6	18±0.9	11±0.55
Total dissolved Solids g/L	44.4±2.22	50.45±2.522	47.47±2.373
Conductivity µS/cm	74320	93451	67500
Calcium g/L	2.4±0.120	5.68±0.284	3.65±0.1825
Magnesium mg/L	4.2±0.21	5.732±0.2916	4.970±0.2485
Sodium mg/L	2.890±0.1445	8.340±0.412	7.200±0.36
Potassium mg/L	5.2±0.26	6.39±0.319	6±0.3
Ammonia mg/L	18±0.9	28±1.4	26±1.3
Nitrite as NO_2 mg/L	0.11±0.0055	0.17±0.0085	0.12±0.006
Total Phosphate as PO4 mg/L	0.28±0.014	0.4±0.02	0.39±0.0195
Iron mg/L	0.65±0.0325	1.12±0.056	1.06±0.053

±SD - The values represent mean of triplicates. SD: Standard deviation

Table 3: Physicochemical parameters of water from salt pans origin at Puthalam (Site 3)

Physicochemical Parameters of Site 4	Dec-2020	Apr-2021	Aug-2021
Appearance	Clear	Clear	Clear
Colour	Colourless	Colourless	Colourless
Odour	None	None	None
Temperature	32±1.60	38.4±1.92	37±1.75
pH	7±0.35	7.6±0.38	7.3±0.365
Total Hardness as CaCo3g/L	26±1.15	30±1.5	15.2±1.36
Total Alkalinity mg/L	2130±106.5	2230±111.5	1680±84
Chloride as Cl g/L	27.5±1.375	35±1.75	31±1.55
Sulphate as SO_4 mg/L	759±37.95	834±41.7	765±38.32
Nitrate as NO_3 mg/L	3±0.15	5±0.25	4.3±0.21
Fluoride as F mg/L	0.78±0.039	1.18±0.059	1.3±0.065
Turbidity NTU	6±0.3	8±0.4	7±0.35

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Total dissolved Solids g/L	54±2.7	65.23±3.261	63.546±3.177
Conductivity µS/cm	72000	82000	69808
Calcium g/L	3.4±0.170	4.5±0.225	2.8±0.14
Magnesium mg/L	3.2±0.16	5.832±0.2916	4.97±0.2485
Sodium mg/L	2.190±0.1095	5.2±0.26	3.200±0.16
Potassium mg/L	3.7±0.185	3.59±0.1795	2.5±0.125
Ammonia mg/L	15±0.75	16.4±0.82	14.72±0.736
Nitrite as NO_2 mg/L	0.12±0.006	0.16±0.008	0.11±0.0055
Total Phosphate as PO_4 mg/L	0.2±0.01	0.21±0.0105	0.19±0.0095
Iron mg/L	-	-	-

±SD - The values represent mean of triplicates. SD: Standard deviation

Table 4: Physicochemical parameters of water from salt pans at Thamaraikulam (Site 4)

Physicochemical Parameters of Site 5	Dec-2020	Apr-2021	Aug-2021
Appearance	Clear	Clear	Clear
Colour	Colourless	Colourless	Colourless
Odour	None	None	None
Temperature	25	37	30
pH	7.3±0.365	7.89±0.89	7.5±0.375
Total Hardness as $CaCo_3$ g/L	23±1.3	29.2±1.46	15.5±0.767
Total Alkalinity mg/L	1630±81.5	2030±101.5	1704±85.2
Chloride as Cl g/L	23.5±1.175	27.5±1.375	25.47±1.273
Sulphate as SO_4 mg/L	723±36.15	890±44.5	745±37.25
Nitrate as NO_3 mg/L	1.5±0.075	2±0.1	1.25±0.062
Fluoride as F mg/L	0.54±0.027	1.12±0.056	1.28±0.064
Turbidity NTU	5±0.25	7±0.35	6±0.3
Total dissolved Solids g/L	52±2.6	58±2.9	57.317±2.865
Conductivity µS/cm	64280	84289	78230
Calcium g/L	2.400±0.120	4.800±0.240	4.600±0.230
Magnesium mg/L	3.2±0.16	4.128±0.2064	3.896±0.1948
Sodium mg/L	2.290±0.1145	5.100±0.255	4.270±0.2135
Potassium mg/L	3.1±0.155	3.5±0.175	2.89±0.144
Ammonia mg/L	11±0.55	13.6±0.68	12±0.6
Nitrite as NO_2 mg/L	0.14±0.007	0.21±0.0105	0.18±0.009
Total Phosphate as PO_4 mg/L	0.08±0.004	0.17±0.0085	0.1±0.005
Iron mg/L	0.23±0.0115	0.35±0.0175	0.32±0.016

±SD - The values represent mean of triplicates. SD: Standard deviation

Table 5: Physicochemical parameters of water from salt pans at Kovalam (Site 5)

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Physicochemical Parameters of Site 1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Temperature	1	0.988*	0.912*	0.0156*	0.961*	0.963*	0.920*	0.982*	0.500*	0.997*	0.999*	0.997*	0.454*	0.988*	0.619*	0.954*	0.987*	0.929*
pH	0.988*	1	0.964*	0.169*	0.992*	0.910*	0.969*	0.999*	0.627*	0.973*	0.994*	0.996*	0.585*	0.952*	0.732*	0.897*	1.000*	0.975*
Total Hardness as CaCo3 mg/L	0.912*	0.964*	1	0.425*	0.990*	0.767*	1.000*	0.973*	0.812*	0.877*	0.928*	0.940*	0.780*	0.837*	0.887*	0.747*	0.965*	0.999*
Total Alkalinity mg/L	0.0156*	0.169*	0.425*	1	0.290*	-0.255*	0.407*	0.204*	0.874*	-0.062*	0.0582*	0.0906*	0.898*	-0.140*	0.795*	-0.285*	0.174*	0.386*
Chloride as	0.961*	0.992*	0.990*	0.290*	1	0.851*	0.992*	0.996*	0.719*	0.937*	0.972*	0.979*	0.681*	0.907*	0.811*	0.835*	0.993*	0.995*

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Cl mg/L																		
Sulphate as SO_4 mg/L	0.963*	0.910*	0.767*	-0.255*	0.851*	1	0.779*	0.894*	0.247*	0.981*	0.950*	0.940*	0.196*	0.993*	0.383*	1.000*	0.907*	0.794*
Nitrate as NO_3 mg/L	0.920*	0.969*	1.000*	0.407*	0.992*	0.779*	1	0.977*	0.800*	0.886	0.936*	0.947*	0.767*	0.848*	0.877*	0.76*	0.97*	1.000*
Fluride as F mg/L	0.982*	0.999*	0.973*	0.204*	0.996*	0.894*	0.977*	1	0.655*	0.964*	0.989*	0.993*	0.614*	0.941*	0.756*	0.880*	1.000*	0.982*
Turbidity NTU	0.500*	0.627*	0.812*	0.874*	0.719*	0.247*	0.800*	0.655*	1	0.431*	0.536*	0.564*	0.999*	0.359*	0.99*	0.218*	0.631*	0.786*
Total dissolved Solids mg/	0.997*	0.973*	0.877*	-0.0622*	0.937*	0.981*	0.886*	0.964*	0.431*	1	0.993*	0.988*	0.383*	0.997*	0.556*	0.975*	0.972*	0.897*

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L																		
Conductivity µS/cm	0.999*	0.994*	0.928*	0.0582*	0.972*	0.950*	0.936*	0.989*	0.536*	0.993*	1	0.999*	0.491*	0.980*	0.652*	0.94*	0.993*	0.944*
Calcium mg/L	0.997*	0.997*	0.940*	0.0906*	0.979*	0.940*	0.947*	0.993*	0.564*	0.988*	0.999*	1	0.519*	0.973*	0.676*	0.929*	0.996*	0.954*
Megnesium mg/L	0.454*	0.585*	0.780*	0.898*	0.681*	0.196*	0.767*	0.614*	0.999*	0.383*	0.491*	0.519*	1	0.31*	0.981*	0.166*	0.590*	0.752*
Sodium mg/L	0.988*	0.952*	0.837*	-0.14*	0.907*	0.993*	0.848*	0.941*	0.359*	0.997*	0.980*	0.973*	0.310*	1	0.489*	0.989*	0.951*	0.860*
Pottassium mg/L	0.619*	0.732*	0.887*	0.795*	0.811*	0.383*	0.877*	0.756*	0.990*	0.556*	0.652*	0.676*	0.981*	0.489*	1	0.355*	0.736*	0.866*
Ammonia mg/L	0.954*	0.897*	0.747*	-0.285*	0.835*	1.000*	0.760*	0.880*	0.218*	0.975*	0.940*	0.929*	0.166*	0.989*	0.355*	1	0.894*	0.775*
Nitrite as NO2 mg/	0.987*	1.000*	0.965*	0.174*	0.993*	0.907*	0.970*	1.000*	0.631*	0.972*	0.993*	0.996*	0.590*	0.951*	0.736*	0.894*	1	0.976*

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L																		
Total Phosphateas PO4 mg/L	0.929*	0.975*	0.999*	0.386*	0.995*	0.794*	1.000*	0.982*	0.786*	0.897*	0.944*	0.954*	0.752*	0.86*	0.866*	0.775*	0.976*	1

*Correlation is significant at the 0.05 level (2-tailed). **Correlation is significant at the 0.01 level (2-tailed)

Table 6: Correlation coefficient among various physical and chemical parameters of Sea water (Site 1)

Physicochemical Parameters of Site 2	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	20
Temperature	**1**	0.470*	0.726*	0.489*	0.151*	0.735*	0.976*	0.966*	0.596*	0.357*	0.769*	0.941*	0.987*	0.305*	0.0426*	0.844*	-0.327*	0.703*	0.500*
pH	0.470*	**1**	0.948*	1.000*	0.944*	0.944*	0.267*	0.224*	0.989*	0.992*	0.925*	0.741*	0.321*	0.984*	0.902*	-0.0777*	0.681*	0.989*	0.999*
Total Hardnessas CaCo3 mg/L	0.726*	0.948*	**1**	0.955*	0.789*	1.000**	0.56*	0.522*	0.985*	0.902*	0.998*	0.916*	0.605*	0.876*	0.718*	0.244*	0.412*	0.985*	0.959*
Total Alkalinity mg/L	0.489*	1.000*	0.955*	**1**	0.936*	0.951*	0.288*	0.245*	0.992*	0.989*	0.933*	0.756*	0.341*	0.980*	0.892*	-0.0556*	0.664*	0.992*	1.000**
Chloride as Clmg/L	0.151*	0.944*	0.789*	0.936*	**1**	0.782*	-0.0668*	-0.111*	0.884*	0.977*	0.748*	0.478*	-0.0108*	0.987*	0.994*	-0.403*	0.885*	0.884*	0.932*
Sulphate as SO4mg/L	0.735*	0.944*	1.000**	0.951*	0.782*	**1**	0.570*	0.533*	0.983*	0.896*	0.999*	0.921*	0.615*	0.87*	0.709*	0.256*	0.401*	0.983*	0.955*
Nitrate as NO3mg/L	0.976*	0.267*	0.560*	0.288*	-0.0668*	0.570*	**1**	0.999*	0.408*	0.146*	0.613*	0.845*	0.998*	0.0917*	-0.175*	0.940*	-0.524*	0.408*	0.300*
Fluride as F mg/L	0.966*	0.224*	0.522*	0.245*	-0.111*	0.533*	0.999*	**1**	0.367*	0.102*	0.577*	0.820*	0.995*	0.0472*	-0.219*	0.954*	-0.562*	0.367*	0.257*
Turbidity NTU	0.596*	0.989*	0.985*	0.992*	0.884*	0.983*	0.408*	0.367*	**1**	0.963*	0.972*	0.833*	0.458*	0.947*	0.828*	0.072*	0.564*	0.990*	0.993*
Total dissolved Solids mg/L	0.357*	0.992*	0.902*	0.989*	0.977*	0.890*	0.146*	0.102*	0.963*	**1**	0.871*	0.653*	0.201*	0.998*	0.948*	-0.200*	0.766*	0.915*	0.987*
Conductivity µS/cm	0.769*	0.925*	0.998*	0.933*	0.748*	0.999*	0.613*	0.577*	0.972*	0.871*	**1**	0.94*	0.656*	0.843*	0.671*	0.306*	0.352*	0.995*	0.938*
Calcium mg/L	0.941*	0.741*	0.916*	0.756*	0.478*	0.921*	0.845*	0.820*	0.833*	0.653*	0.940*	**1**	0.873*	0.610*	0.379*	0.612*	0.0128*	0.903*	0.764*
Megnesium mg/L	0.987*	0.321*	0.605*	0.341*	-0.0108*	0.615*	0.998*	0.995*	0.458*	0.201*	0.656*	0.873*	**1**	0.147*	-0.120*	0.919*	-0.476*	0.579*	0.353*
Sodium mg/L	0.305*	0.984*	0.876*	0.980*	0.987*	0.870*	0.0917*	0.0472*	0.947*	0.998*	0.843*	0.610*	0.147*	**1**	0.964*	-0.253*	0.800*	0.892*	0.977*
Pottassium mg/L	0.0426*	0.902*	0.718*	0.892*	0.994*	0.709*	-0.175*	-0.219*	0.828*	0.948*	0.671*	0.379*	-0.120*	0.964*	**1**	-0.500*	0.930*	0.74*	0.887*
Ammonia mg/L	0.844*	-0.0777*	0.244*	-0.0556*	-0.403*	0.256*	0.94*	0.954*	0.072*	-0.200*	0.306*	0.612*	0.919*	-0.253*	-0.500*	**1**	-0.783*	0.212*	-0.0429*
Nitrite as NO2 mg/L	-0.327*	0.681*	0.412*	0.664*	0.885*	0.401*	-0.524*	-0.562*	0.564*	0.766*	0.352*	0.0128*	-0.476*	0.800*	0.930*	-0.783*	**1**	0.441*	0.655*
Total Phosphateas PO4 mg/L	0.703*	0.958*	0.999*	0.964*	0.809*	0.999*	0.533*	0.494*	0.990*	0.915*	0.995*	0.903*	0.579*	0.892*	0.740*	0.212*	0.441*	**1**	0.967*
Iron mg/L	0.500*	0.999*	0.959*	1.000**	0.932*	0.955*	0.300*	0.257*	0.993*	0.987*	0.938*	0.764*	0.353*	0.977*	0.887*	-0.0429*	0.655*	0.967*	1

*Correlation is significant at the 0.05 level (2-tailed). **Correlation is significant at the 0.01 level (2-tailed)

Table 7: Correlation coefficient among various physical and chemical parameters of Manakudi (Site 2)

Physicochemical Parameters of Site 3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	20
Temperature	**1**	0.994*	1.000**	0.793*	0.0284*	0.623*	0.982*	0.992*	0.434*	0.845*	0.565*	0.947*	0.992*	0.991*	0.662*	0.327*	0.836*	0.967*	0.824*
pH	0.994*	**1**	0.993*	0.854*	0.136*	0.703*	0.997*	1.000*	0.528*	0.897*	0.651*	0.976*	1.000**	0.971*	0.739*	0.427*	0.890*	0.934*	0.880*
Total Hardnessas CaCo3 mg/L	1.000**	0.993*	**1**	0.787*	0.0191*	0.615*	0.98*	0.991*	0.425*	0.840*	0.558*	0.944*	0.991*	0.992*	0.655*	0.319*	0.831*	0.969*	0.819*
Total Alkalinitymg/L	0.793*	0.854*	0.787*	**1**	0.632*	0.971*	0.894*	0.863*	0.893*	0.996*	0.951*	0.946*	0.861*	0.704*	0.982*	0.836*	0.997*	0.611*	0.999*
Chloride as Clmg/L	0.0284*	0.136*	0.0191*	0.632*	**1**	0.800*	0.217*	0.154*	0.913*	0.559*	0.841*	0.348*	0.150*	-0.105*	0.768*	0.954*	0.573*	-0.228*	0.590*
Sulphate asSO4 mg/L	0.623*	0.703*	0.615*	0.971*	0.800*	**1**	0.759*	0.716*	0.975*	0.945*	0.997*	0.841*	0.714*	0.513*	0.999*	0.943*	0.950*	0.402*	0.956*
Nitrate as NO3mg/L	0.982*	0.997*	0.980*	0.894*	0.217*	0.759*	**1**	0.998*	0.596*	0.931*	0.711*	0.991*	0.998*	0.948*	0.792*	0.500*	0.924*	0.901*	0.916*
Fluride as Fmg/L	0.992*	1.000*	0.991*	0.863*	0.154*	0.716*	0.998*	**1**	0.543*	0.905*	0.665*	0.980*	1.000*	0.966*	0.751*	0.444*	0.898*	0.927*	0.889*
Turbidity NTU	0.434*	0.528*	0.425*	0.893*	0.913*	0.975*	0.596*	0.543*	**1**	0.848*	0.988*	0.700*	0.541*	0.309*	0.962*	0.993*	0.857*	0.189*	0.868*
Total dissolvedSolids mg/L	0.845*	0.897*	0.840*	0.996*	0.559*	0.945*	0.931*	0.905*	0.848*	**1**	0.919*	0.972*	0.904*	0.766*	0.960*	0.782*	1.000*	0.680*	0.999*
ConductivityµS/cm	0.565*	0.651*	0.558*	0.951*	0.841*	0.997*	0.711*	0.665*	0.988*	0.919*	**1**	0.800*	0.662*	0.450*	0.992*	0.964*	0.925*	0.336*	0.933*
Calcium mg/L	0.947*	0.976*	0.944*	0.946*	0.348*	0.841*	0.991*	0.980*	0.7*	0.972*	0.800*	**1**	0.979*	0.896*	0.868*	0.613*	0.968*	0.834*	0.962*
Megnesiummg/L	0.992*	1.000*	0.991*	0.861*	0.150*	0.714*	0.998*	1.000*	0.541*	0.904*	0.662*	0.979*	**1**	0.967*	0.749*	0.440*	0.897*	0.928*	0.887*
Sodium mg/L	0.991*	0.971*	0.992*	0.704*	-0.105*	0.513*	0.948*	0.966*	0.309*	0.766	0.450*	0.896*	0.967*	**1**	0.556*	0.198*	0.755*	0.992*	0.741*
Pottassiummg/L	0.662*	0.739*	0.655*	0.982*	0.768*	0.999*	0.792*	0.751*	0.962*	0.960*	0.992*	0.868*	0.749*	0.556*	**1**	0.925*	0.965*	0.449*	0.970*
Ammonia mg/L	0.327*	0.427*	0.319*	0.836*	0.954*	0.943*	0.500*	0.444*	0.993*	0.782*	0.964*	0.613*	0.440*	0.198*	0.925*	**1**	0.792*	0.0751*	0.805*
Nitrite as NO2 mg/L	0.836*	0.890*	0.831*	0.997*	0.573*	0.950*	0.924*	0.898*	0.857*	1.000*	0.925*	0.968*	0.897*	0.755*	0.965*	0.792*	**1**	0.668*	1.000*
Total Phosphateas PO4 mg/L	0.967*	0.934*	0.969*	0.611*	-0.228*	0.402*	0.901*	0.927*	0.189*	0.680*	0.336*	0.834*	0.928*	0.992*	0.449*	0.0751*	0.668*	**1**	0.652*
Iron mg/L	0.824*	0.880*	0.819*	0.999*	0.590*	0.956*	0.916*	0.889*	0.868	0.999	0.933*	0.962*	0.887*	0.741*	0.970*	0.805*	1.000*	0.652*	1

*Correlation is significant at the 0.05 level (2-tailed). **Correlation is significant at the 0.01 level (2-tailed)

CODEN: JCLMC4

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Table 8: Correlation coefficient among various physical and chemical parameters of Puthalam (Site 3)

Physicochemical Parameters of Site 4	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Temperature	**1**	0.951*	0.394*	0.788*	0.902*	0.721*	0.859*	0.997*	0.951*	0.613*	0.947*	0.103*	0.761*	0.675*	0.124*	0.546*	0.669*	0.208*
pH	0.951*	**1**	0.658*	0.940*	0.991*	0.900*	0.975*	0.971*	0.945*	0.827*	1.000**	0.405*	0.924*	0.87*	0.424*	0.778*	0.866*	0.500*
Total Hardness as CaCo3 mg/L	0.394*	0.658*	**1**	0.876*	0.752*	0.921*	0.809*	0.458*	0.375*	0.968 *	0.669*	0.955*	0.896*	0.944*	0.961*	0.985*	0.947*	0.981*
Total Alkalinity mg/L	0.788*	0.940*	0.876*	**1**	0.977*	0.995*	0.992*	0.83*	0.775*	0.969*	0.945*	0.693*	0.999*	0.986*	0.708*	0.946*	0.985*	0.766*
Chloride as Clmg/L	0.902*	0.991*	0.752*	0.977*	**1**	0.950*	0.996*	0.931*	0.893*	0.894*	0.993*	0.522*	0.966*	0.927*	0.540*	0.854*	0.924*	0.610*
Sulphate as SO4 mg/L	0.721*	0.900*	0.921*	0.995*	0.950*	**1**	0.974*	0.769*	0.706*	0.989*	0.906*	0.763*	0.998*	0.998*	0.777*	0.974*	0.997*	0.828*
Nitrate as NO3mg/L	0.859*	0.975*	0.809*	0.992*	0.996*	0.974*	**1**	0.893*	0.848*	0.931*	0.978*	0.598*	0.986*	0.958*	0.615*	0.898*	0.955*	0.680*
Fluride as Fmg/L	0.997*	0.971*	0.458*	0.830*	0.931*	0.769*	0.893*	**1**	0.996*	0.668*	0.967*	0.174*	0.805*	0.726*	0.194*	0.604*	0.721*	0.277*
Turbidity NTU	1.000*	0.945*	0.375*	0.775*	0.893*	0.706*	0.848*	0.996*	**1**	0.596*	0.940*	0.0823*	0.747*	0.659*	0.103*	0.528*	0.654*	0.188*
Total dissolvedSolids mg/L	0.613*	0.827*	0.968*	0.969*	0.894*	0.989*	0.931*	0.668*	0.596*	**1**	0.835*	0.849*	0.979*	0.997*	0.860*	0.997*	0.997*	0.901*
ConductivityµS/cm	0.947*	1.000*	0.669*	0.945*	0.993*	0.906*	0.978*	0.967*	0.940*	0.835*	**1**	0.418*	0.929*	0.877*	0.437*	0.787*	0.873*	0.512*
Calcium mg/L	0.103*	0.405*	0.955*	0.693*	0.522*	0.763*	0.598*	0.174*	0.0823*	0.849*	0.418*	**1**	0.724*	0.803*	1.000*	0.890*	0.808*	0.994*
Megnesium mg/L	0.761*	0.924*	0.896*	0.999*	0.966*	0.998*	0.986*	0.805*	0.747*	0.979*	0.929*	0.724*	**1**	0.992*	0.738*	0.959*	0.991*	0.793*
Sodium mg/L	0.675*	0.870*	0.944*	0.986*	0.927*	0.998*	0.958*	0.726*	0.659*	0.997*	0.877*	0.803*	0.992*	**1**	0.816*	0.987*	1.000**	0.862*
Pottassiummg/L	0.124*	0.424*	0.961*	0.708*	0.540*	0.777*	0.615*	0.194*	0.103*	0.860*	0.437*	1.000*	0.738*	0.816*	**1**	0.899*	0.820*	0.996*
Ammonia mg/L	0.546*	0.778*	0.985*	0.946*	0.854*	0.974*	0.898*	0.604*	0.528*	0.997*	0.787*	0.890*	0.959*	0.987*	0.899*	**1**	0.988*	0.933*
Nitrite as NO2 mg/L	0.669*	0.866*	0.947*	0.985*	0.924*	0.997*	0.955*	0.721*	0.654*	0.997*	0.873*	0.808*	0.991*	1.000*	0.820*	0.988*	**1**	0.866*
Total Phosphateas PO4 mg/L	0.208*	0.500*	0.981*	0.766*	0.610*	0.828*	0.68*	0.277*	0.188*	0.901*	0.512*	0.994*	0.793*	0.862*	0.996*	0.933*	0.866*	**1**

*Correlation is significant at the 0.05 level (2-tailed). **Correlation is significant at the 0.01 level (2-tailed)

CODEN: JCLMC4

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Table 9: Correlation coefficient among various physical and chemical parameters of Thamaraikulam (Site 4)

Physicochemical Parameters of Site 5	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	20
Temperature	**1**	0.987*	1.000**	0.984*	0.996*	0.954*	0.724*	0.972*	0.995*	0.998*	0.949*	0.855*	0.930*	0.965*	0.716*	0.999*	0.984*	0.977*	0.930*
pH	0.987*	**1**	0.988*	0.943*	0.997*	0.893*	0.604*	0.921*	0.998*	0.995*	0.987*	0.928*	0.977*	0.995*	0.594*	0.980*	1.000**	0.930*	0.977*
Total Hardnessas CaCo3 mg/L	1.000**	0.988*	**1**	0.983*	0.997*	0.952*	0.720*	0.970*	0.996*	0.998*	0.951*	0.859*	0.932*	0.966*	0.711*	0.999*	0.985*	0.976*	0.932*
Total Alkalinitymg/L	0.984*	0.943*	0.983*	**1**	0.965*	0.992*	0.835*	0.998*	0.963*	0.972*	0.879*	0.750*	0.850*	0.903*	0.828*	0.990*	0.937*	0.999*	0.850*
Chloride as Clmg/L	0.996*	0.997*	0.997*	0.965*	**1**	0.924*	0.661*	0.948*	1.000*	1.000*	0.973*	0.897*	0.958*	0.984*	0.652*	0.992*	0.996*	0.955*	0.958*
Sulphate asSO4 mg/L	0.954*	0.893*	0.952*	0.992*	0.924*	**1**	0.893*	0.952*	0.992*	0.924*	0.999*	0.921*	0.615*	0.87*	0.709*	0.256*	0.401*	0.983*	0.955*
Nitrate as NO3mg/L	0.724*	0.604*	0.720*	0.835*	0.661*	0.898*	**1**	0.866*	0.655*	0.680*	0.470*	0.262*	0.419*	0.517*	1.000*	0.749*	0.59*	0.854*	0.419*
Fluride as F mg/L	0.972*	0.921*	0.970*	0.998*	0.948*	0.998*	0.866*	**1**	0.945*	0.956*	0.849*	0.710*	0.817*	0.876*	0.860*	0.980*	0.915*	1.000*	0.817*
Turbidity NTU	0.995*	0.998*	0.996*	0.963*	1.000*	0.920*	0.655*	0.945*	**1**	0.999*	0.975*	0.901*	0.961*	0.986*	0.645*	0.991*	0.997*	0.952*	0.961*
Total dissolvedSolids mg/L	0.998*	0.995*	0.998*	0.972*	1.000*	0.933*	0.680*	0.956*	0.999*	**1**	0.967*	0.886*	0.951*	0.979*	0.671*	0.995*	0.993*	0.962*	0.951*
Conductivity μS/cm	0.949*	0.987*	0.951*	0.879*	0.973*	0.810*	0.470*	0.849*	0.975*	0.967*	**1**	0.975*	0.998*	0.999*	0.46*	0.937*	0.990*	0.861*	0.998*
Calcium mg/L	0.855*	0.928*	0.859*	0.750*	0.897*	0.660*	0.262*	0.710*	0.901*	0.886*	0.975*	**1**	0.986*	0.962*	0.25*	0.836*	0.934*	0.726*	0.986*
Megnesium mg/L	0.930*	0.977*	0.932*	0.850*	0.958*	0.776*	0.419*	0.817*	0.961*	0.951*	0.998*	0.986*	**1**	0.994*	0.408*	0.916*	0.980*	0.83*	0.983*
Sodium mg/L	0.965*	0.995*	0.966*	0.903*	0.984*	0.841*	0.517*	0.876*	0.986*	0.979*	0.999*	0.962*	0.994*	**1**	0.507*	0.954*	0.996*	0.887*	0.997*
Pottassium mg/L	0.716*	0.594*	0.711*	0.828*	0.652*	0.893*	1.000*	0.860*	0.645*	0.671*	0.460*	0.250*	0.408*	0.507*	**1**	0.741*	0.580*	0.848*	0.569*
Ammonia mg/L	0.999*	0.980*	0.999*	0.990*	0.992*	0.964*	0.749*	0.980*	0.991*	0.995*	0.937*	0.836*	0.916*	0.954*	0.741*	**1**	0.977*	0.984*	0.974*
Nitrite as NO2 mg/L	0.984*	1.000*	0.985*	0.937*	0.996*	0.885*	0.590*	0.915*	0.997*	0.993*	0.990*	0.934*	0.980*	0.996*	0.58*	0.977*	**1**	0.924*	1.000*
Total Phosphate asPO4 mg/L	0.977*	0.930*	0.976*	0.999*	0.955*	0.996*	0.854*	1.000*	0.952*	0.962*	0.861*	0.726*	0.830*	0.887*	0.848*	0.984*	0.924*	**1**	0.919*
Iron mg/L	0.93*	1.000*	0.983*	0.932*	0.995*	0.879*	0.579*	0.909*	0.995*	0.992*	0.992*	0.939*	0.983*	0.997*	0.569*	0.974*	1.000**	0.919	1

*Correlation is significant at the 0.05 level (2-tailed). **Correlation is significant at the 0.01 level (2-tailed)

Table 10: Correlation coefficient among various physical and chemical parameters of Kovalam (Site 5)

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