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Assessment and Comparison of Surface Water Quality (Hydro Chemical) in Urban & Semi Urban Environment: A Case Study of Chennai and Cuddalore Districts

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Abstract

Water is one of the most valuable resources for humanity. Yet, securing safe drinking water has become a growing challenge for many people worldwide, particularly in developing and underdeveloped nations. Human activities and inadequate industrial waste management have worsened water pollution, leading to deteriorated water quality. Environmentalists and public health professionals struggle to combat the spread of infectious agents through contaminated drinking water in these regions, where millions of individuals rely on unsafe water sources. This article will compare the drinking water quality between Chennai district and Cuddalore district. Hydro-chemical data for groundwater in these districts has been collected from the State Ground and Surface Water Resource Data Centre in Chennai, Tamil Nadu, India, covering the years 2012 to 2022. The data was analyzed using statistical software MS-Excel 2013 and represented with maps and diagrams created using ArcGIS 10.8 where necessary. The Water Quality Index (WQI) technique was employed to combine and summarize various parameters measured from individual samples, as it is the most accepted method for assessing drinking water quality. Parameters such as Sulphate, Chlorine, Magnesium, Calcium, and Total Dissolved Substances have declined in both Cuddalore and Chennai districts from 2012 to 2022. Fluorine and Nitrate levels improved in Cuddalore but worsened in Chennai over the same period. The pH levels showed improvement in both districts from 2012 to 2022. The comparison reveals that the drinking water quality in both districts has deteriorated during the study period.

Keywords: Water Chemical Parameters, Water Quality Index, Chennai & Cuddalore Districts

Introduction

Water is the most precious commodity for humans. However, obtaining clean drinking water has become an increasing challenge for many around the globe, especially for developing and underdeveloped countries. Water pollution, due to human activity and poor industrial waste management, has exasperated poor water quality. Environmentalists and public health professionals face challenges in their battle against the exposure to infectious agents via drinking water in developing countries, where millions of people consume water that is contaminated. Individual's health and hygiene is largely dependent on adequate availability of safe drinking water, access to improved sanitation and better hygienic practices. Water and sanitation-related diseases, despite being preventable, still remains one of the most significant child health problems worldwide and reasons for malnutrition. Water in natural get impurities from the surrounding environment. Impurities formed from exchange and dissolution reactions in the soil, such as organic/inorganic matter and solid or dissolved living organisms [1-3]. Groundwater may be considered as one of the most precious and one of the basic requirements for human existence and the survival of mankind providing him the luxuries and comforts in addition to fulfilling his basic necessities of life and also for industrial and agricultural development thus being a very important constituent of our eco-system [4-6]. Given the emergence of population growth and its consequences, rapid urbanization, intense industrial and agricultural activities with all

the emissions and waste, toxins and excess chemicals occur in the environment, altering the properties of the air, soil and water The ground water are susceptible to various pollutants depending on physical processes and anthropogenic activities Drinking water must be free from the main types of contaminants and water pollutants (Onda et al, 2012) [7-10]. Water quality has been identified as an issue in most developing countries due to the large- scale agricultural activities and presence of industries. These in addition to poor or lack of water treatment facilities along with exposes water sources to contamination. Exposure profiles, health risks, and water quality reliability issues vary widely across populations, geographically and by contaminant Regular drinking water quality monitoring is essential to prevent an excessive amount of contamination Geographic Information Systems (GIS) play an important role in understanding and managing water resources and in the study of their pollution, which together with hydrogeochemical analysis, can be important tools in the exploitation of this natural resource. This article will focus on the comparison of drinking water quality among Chennai district and Cuddalore districts [11-13].

Study Area

Cuddalore District is one of the districts of the south Indian state of Tamil Nadu. The total Geographical area of the district is 3678 sq. Km with coastlines of 68 km. The District lies between 11°9'0.982"N to 11°54'12.735"N latitude and 78°52'38.242"E to 79°48'44.403"E longitude. Cuddalore a fast-growing industrial town and Headquarters of the Cuddalore Taluk and District. It is located at the estuary of river Gedilam and Pennaiyar with Bay of Bengal.

Totally there are 32 Firkas, 2 Townships, 13 Blocks, 16 Town Panchayats and 899 Revenue Villages in Cuddalore district shown in the Figure 1(a).

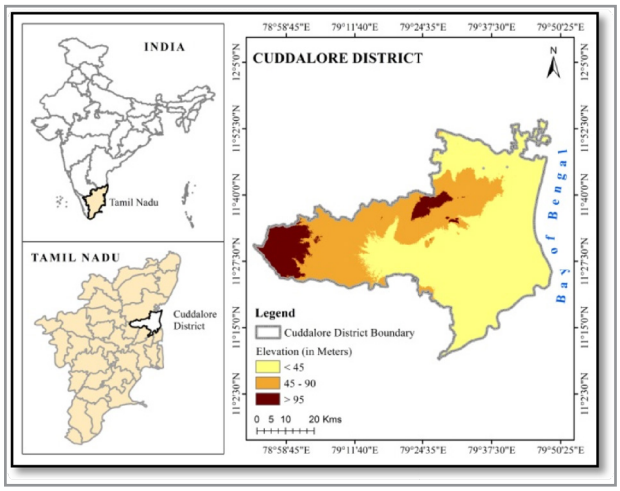

Figure 1 (a): Cuddalore District

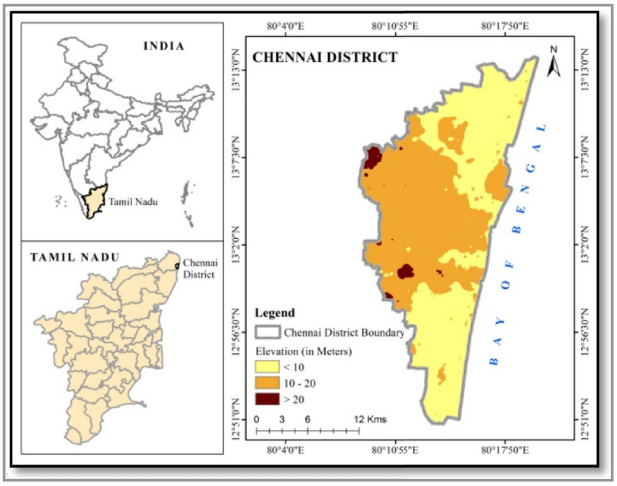

Figure 1(b): Chennai District

Chennai, as the capital of the state of Tamil Nadu, houses the state executive. The city has an area of 426 km². Chennai is the 4th most populated city; the 6th most densely inhabited city in India and the 31st biggest urban in the world. The areal extent of the city possesses the rank of 27out of 640 cities of India. It is known as the 'Gateway to South India' and well-connected globally. Chennai is located in the northeast of Tamil Nadu, on the east coast, next to the Bay of Bengal. It lies between the 12° 09'N and 13° 09' N latitudes and 80° 0'12' 'E and 80° 0' 19" shown in the Figure 1(b). It extends for 25.6 km along the coast of the bay, from Thiruvanmiyur in the south to Thiruvottiyur in the north.

Data and Methodology

The Hydro chemical data for the ground water for the Chennai district and Cud alore district has been obtained for 20 years from 10 to 2022 from the State Ground and Surface Water Resource data centre, Chennai, Tamil Nadu, India. The obtained data has been analyzed using statistical software MS-Excel 2013. The data has been represented with the help of maps and diagrams wherever necessary. Maps and diagrams have been prepared using ArcGIS 10.8. The water quality index (WQI) technique has been used to combine and summarize various parameters measured from individual sample since it is the most acceptable way to examine the water quality for drinking purposes. This technique is thought to have the greatest impact on human health among the several water quality metrics. The calculation of WQI can be broken down into the following four easy steps. As a result of each parameter's contribution to quality, weights are assigned to each one in the first phase on a sliding scale from 5 to 1, with 5 being the most essential and 1 being the least.

Relative Weight (Wi)
It is calculated using following equation

$$W_i = \frac{w_i}{\sum_{i=1}^{n} w_i}$$

Where,
wi = weight of each individual parameter n = number of parameters.

The second step is that calculating quality rating scale (qi), The quality rating scale for each parameter in each sample is determined by dividing the concentration of each parameter by its respective standard (Si) given by WHO multiplied by 100

$$q_i = \frac{C_i}{S_i} * 100$$

Ci = Concentration of individual parameter (mg/l)
Si = Maximum allowable limit for individual parameters (mg/l)

The third step is to find the sub-index (SI) and WQI using the following equation,

$$SI_I = q_i * W_i$$

$$WQI = \sum_{i=1}^{n} SI_i$$

Where,
SIi = Sub index of individual parameters
qi = quality rating scale of individual parameters Wi = Relative weight of individual parameters
n = number of parameters

Water Quality Parameters

Sulphate

Acceptable range of Sulphate is 87 percent in the year 2012 has reduced to 79.83 percent in the year 2022 in Cuddalore district similarly acceptable range of Sulphate in Chennai district has reduced from 96.83 percent in 2012 to 93.38 percent in the year 2022. Permissible range of Sulphate in Cuddalore district has reduced from 12.10 percent in the year 2012 to 11.57 percent in the year 2022 whereas permissible range of Sulphate in Chennai district has increased from 2.59 percent of the total geographical area in the year 2012 to 4.45 percent of the total geographical area in the year 2022. Not Suitable range of Sulphate that is water has more than 400 mg/l of Sulphate has been increased spatially both in Chennai district as well as Cuddalore district. From 0 percent of total geographical area in the year 2012 to 8.60 percent in the year 2022 in Cuddalore district. Similarly, not suitable range has increased in Chennai district from 0.58 percent of total geographical area in the year 2012 to 2.17 percent of total geographical area in the year 2022 shown in the Table 1. During the year 2012, entire Cuddalore district the sulphate in ground water is in acceptable limit shown in the Figure 2. In the year 2022, the entire district is acceptable limit of sulphate in the ground water except on the south eastern parts of the Cuddalore district shown in the Figure 2. Acceptable limit of sulphate can be seen on entire study area except on eastern side Chennai district during the year 2012 (Figure 3). In the year 2022, the entire Chennai district is acceptable limit of sulphate in the ground water except on the south eastern parts of the Chennai district shown in the Figure 3.

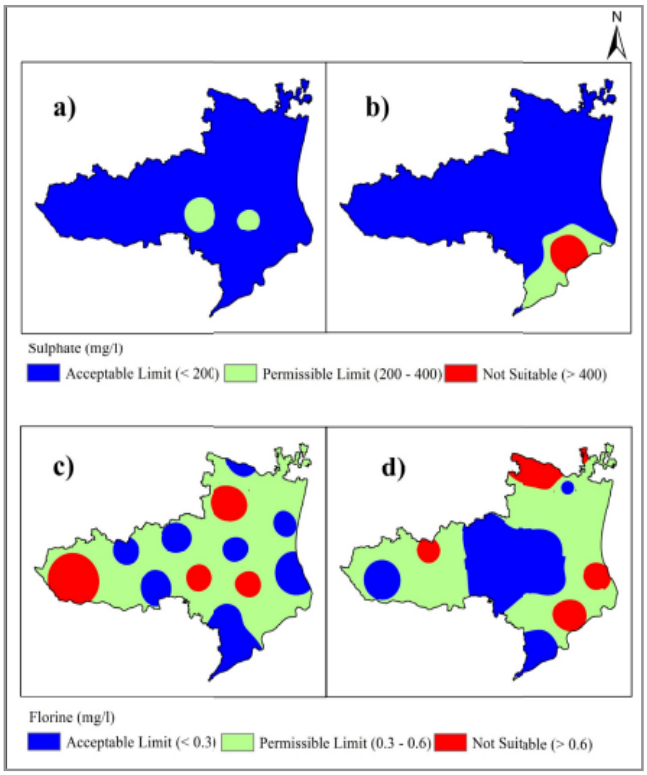

Figure 2: Spatial Distribution of Chemical parameter in Cuddalore District (a) Sulphate - 2012 (b) Sulphate – 2022 (c) Florine – 2012 (d) Florine - 2022

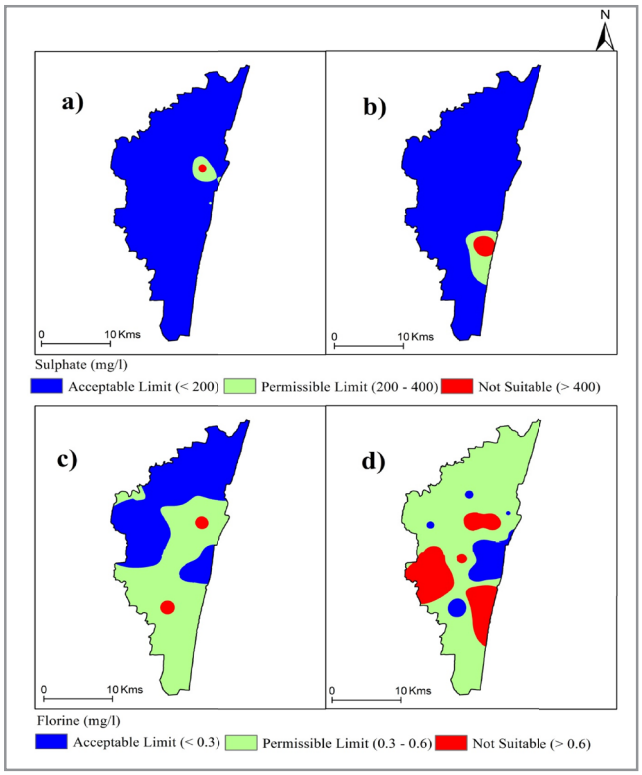

Figure 3: Spatial Distribution of Chemical parameter in Chennai District (a) Sulphate - 2012 (b) Sulphate – 2022 (c) Florine – 2012 (d) Florine - 2022

Table 1: Comparison of Sulphate in Cuddalore and Chennai district

Suitability	Range (in mg/l)	2012		2022	
		Cuddalore	Chennai	Cuddalore	Chennai
Acceptable	<200	87.90	96.83	79.83	93.38
Permissible	200 - 400	12.10	2.59	11.57	4.45
Not Suitable	>400	0.00	0.58	8.60	2.17
Total		100.00	100.00	100.00	100.00

Fluorine

In the Cuddalore district, the acceptable range of Fluorine has increased from 24.12 percent in 2012 to 33.58 percent in 2022. Conversely, in the Chennai district, the acceptable range of Fluorine has decreased from 46.71 percent in 2012 to 9.03 percent in 2022. In Cuddalore district, the permissible range of Fluorine has decreased from 58.23 percent in 2012 to 51.68 percent in 2022, while in Chennai district, it has increased from 51.42 percent of the total geographical area in 2012 to 71.70 percent of the total geographical area in 2022. The amount of Fluorine in water that is outside of the suitable range that is above 0.6 mg/l—has decreased spatially in the Cuddalore but has increased spatially in Chennai districts. In the Cuddalore district, the percentage of total geographical area decreased from 17.65 percent in 2012 to 14.74 percent in 2022. Comparably, in Chennai district, the unsuitable range has grown from 1.87 percent of the entire area in 2012 to 19.27 percent of the total area in 2022 shown in the Table 2. Acceptable limit of fluoride has decreased can be seen on some parts of central, southern and western region whereas western parts of the district with not suitable condition of fluoride during 2012 shown in the Figure 2. The acceptable limit of fluoride in the year 2022 can be seen on the central region whereas not suitable condition can be seen on the north and south eastern parts of the district shown in the Figure 2. With respect to Fluoride in the year 2012, the acceptable limit is on west and north parts of the Chennai district (Figure 3). Acceptable limit of fluoride has decreased can be seen on some parts of central and eastern region whereas western and south eastern parts of the Chennai district with not suitable condition of fluoride during 2022 shown in the Figure 3.

Table 2: Comparison of Fluorine in Cuddalore and Chennai district

Suitability	Range (in mg/l)	2012		2022	
		Cuddalore	Chennai	Cuddalore	Chennai
Acceptable	<0.3	24.12	46.71	33.58	9.03
Permissible	0.3-0.6	58.23	51.42	51.68	71.70
Not Suitable	>0.6	17.65	1.87	14.74	19.27
Total		100.00	100.00	100.00	100.00

Chlorine

The acceptable range of Chlorine in the Cuddalore district has decreased from 69.79 percent in 2012 to 49.07 percent in 2022. On the other hand, the acceptable range of Chlorine in the Chennai has dropped from 73.09 percent in 2012 to 62.50 percent in 2022. The permissible range of Chlorine in Cuddalore district increased from 24.51 percent in 2012 to 39.85 percent in 2022, whereas in Chennai district it grew from 26.91 percent in 2012 to 30.43 percent in 2022 of the whole geographical area. In the districts of Cuddalore, the amount of Chlorine in water that is not suitable range—above 1000 mg/l—has increased spatially in Cuddalore as well as Chennai. The district of Cuddalore has increased in its percentage of total geographical area from 5.69 percent in 2012 to 11.08 percent in 2022. In contrast, as Table 3 illustrates, the range in Chennai district increased from 0 percent of the total area in 2012 to 7.08 percent of the total area in 2022. Not suitable condition almost reduced during 2012 whereas acceptable limit has increase and spread over central, southern, eastern and northern parts of the Cuddalore district shown in the Figure 4. In the year 2022, acceptable limit has decreased into permissible limit and not suitable conditions prevailing on south eastern parts of the Cuddalore district shown in the Figure 4. North eastern parts of the district are permissible limit during 2002 whereas acceptable limit is on central and southern parts of the Chennai district (Figure 5). In the year 2022, acceptable limit has decreased into permissible limit and not suitable conditions prevailing on south eastern parts of the Chennai district shown in the Figure 5.

Table 3: Comparison of Chlorine in Cuddalore and Chennai district

Suitability	Range (in mg/l)	2012		2022	
		Cuddalore	Chennai	Cuddalore	Chennai
Acceptable	<250	69.79	73.09	49.07	62.50
Permissible	250 - 1000	24.51	26.91	39.85	30.43
Not Suitable	>1000	5.69	0.00	11.08	7.08
Total		100.00		100.00	100.00

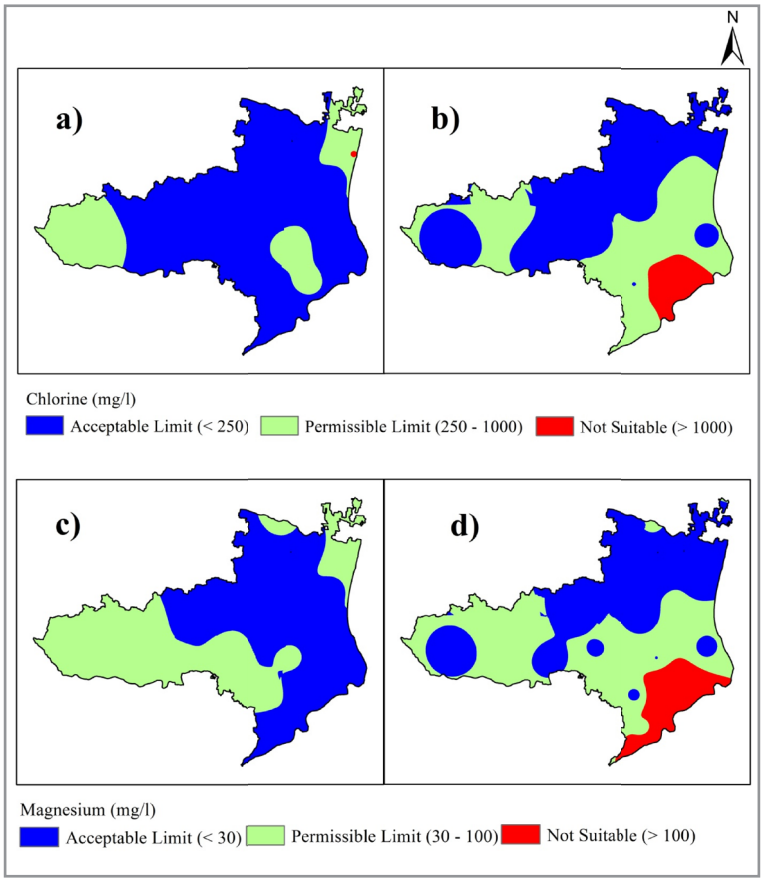

Figure 4: Spatial Distribution of Chemical parameter in Cuddalore District (a) Chlorine - 2012 (b) Chlorine – 2022 (c) Magnesium– 2012 (d) Magnesium - 2022

Magnesium

Acceptable range of Magnesium is 55.06 percent in the year 2012 has reduced to 42.16 percent in the year 2022 in Cuddalore district similarly acceptable range of Magnesium in Chennai district has increased from 37.95 percent in 2012 to 54.05 percent in the year 2022. Permissible range of Magnesium in Cuddalore district has reduced from 44.94 percent in the year 2012 to 43.52 percent in the year 2022 whereas permissible range of Magnesium in Chennai district has greatly reduced from 62.05 percent of the total geographical area in the year 2012 to 35.46 percent of the total geographical area in the year 2022. Not Suitable range of Magnesium that is water has more than 100 mg/l of Magnesium has been increased spatially both in Chennai district as well as Cuddalore district. From 0 percent of total geographical area in the year 2012 to 14.32 percent in the year 2022 in Cuddalore district. Similarly, not suitable range has increased in Chennai district from 0 percent of total geographical area in the year 2012 to 10.49 percent of total geographical area in the year 2022 shown in the Table 4. Condition of the magnesium has increased by majority of the north, western and southern parts of the Cuddalore district are in acceptable limit during the year 2012 shown in the Figure 4. In the year 2022, the condition of magnesium has decreased by increasing the not suitable condition of ground water on south and south eastern parts of the district whereas acceptable limit can be seen on the north and north eastern parts of the Cuddalore district (Figure 4). Acceptable limit of magnesium in the year 2012 can been seen on the western, and central parts of Chennai district (Figure 5). Condition of the magnesium has increased by majority of the north western and eastern parts of the district comes under acceptable limit, not suitable condition of ground water on south eastern parts of the Chennai district during the year 2022 shown in the Figure 5.

Table 4: Comparison of Magnesium in Cuddalore and Chennai district

Suitability	Range (in mg/l)	2012		2022	
		Cuddalore	Chennai	Cuddalore	Chennai
Acceptable	<30	55.06	37.95	42.16	54.05
Permissible	30 - 100	44.94	62.05	43.52	35.46
Not Suitable	>100	0.00	0.00	14.32	10.49
Total		100.00	100.00	100.00	100.00

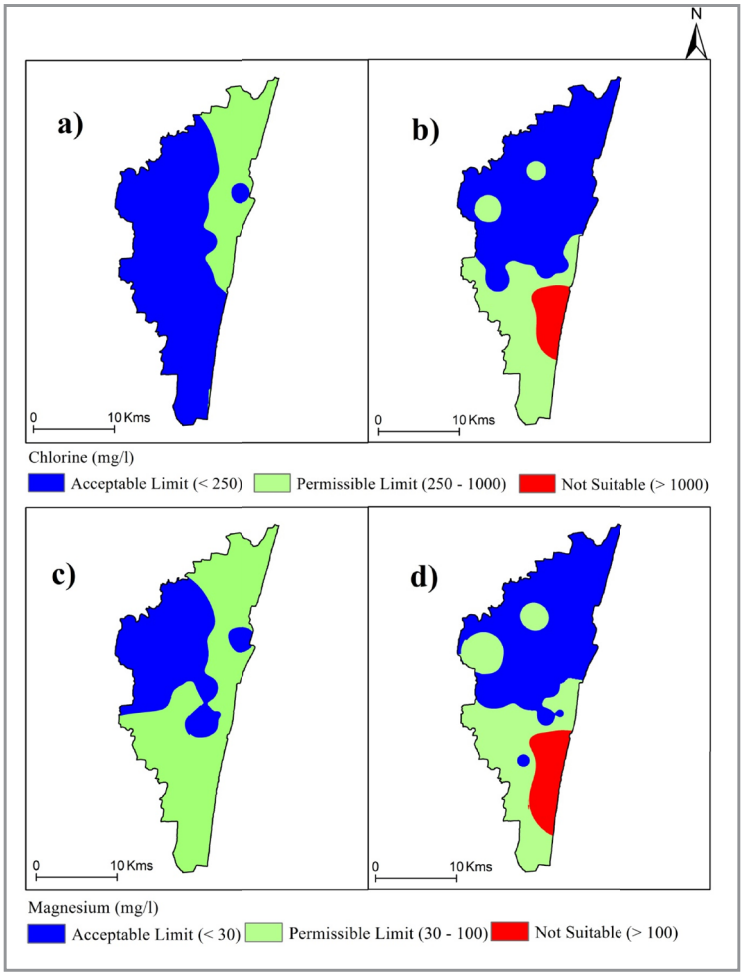

Figure 5: Spatial Distribution of Chemical parameter in Chennai District (a) Chlorine - 2012 (b) Chlorine – 2022 (c) Magnesium– 2012 (d) Magnesium - 2022

pH

Acceptable range of pH is 72.56 percent in the year 2012 has increased to 93.14 percent in the year 2022 in Cuddalore district similarly acceptable range of pH in Chennai district has increased from 61.06 percent in 2012 to 96.80 percent in the year 2022. Not Suitable range of pH that is water has more than 8.5 of pH has been decreased spatially both in Chennai district as well as Cuddalore district. From 27.44 percent of total geographical area in the year 2012 to 6.86 percent in the year 2022 in Cuddalore district. Similarly, not suitable range has decreased in Chennai district from 38.93 percent of total geographical area in the year 2012 to 3.19 percent of total geographical area in the year 2022 shown in the Table 6. Not suitable condition of pH has reduced in the year 2012 can be seen only on western and few parts of east whereas north, central, south and north eastern parts of the Cuddalore district are acceptable limit of ph (Figure 6). In the year 2022, the entire Cuddalore district is acceptable limit of pH except few parts on the eastern parts are not suitable condition shown in the Figure 6. Non-suitable limit of pH in the district can be seen on the north and western parts whereas remaining parts of the Chennai district are acceptable condition during 2012 shown in the Figure 7. In the year 2022, the entire Chennai district is acceptable limit of pH except few parts on the central parts are not suitable condition shown in the Figure 7.

Table 5: Comparison of pH in Cuddalore and Chennai district

Suitability	Range	2012		2022	
		Cuddalore	Chennai	Cuddalore	Chennai
Acceptable	6.5 - 8.5	72.56	61.06	93.14	96.80
Not suitable	> 8.5	27.44	38.93	6.86	3.19
Total		100	100	100	100

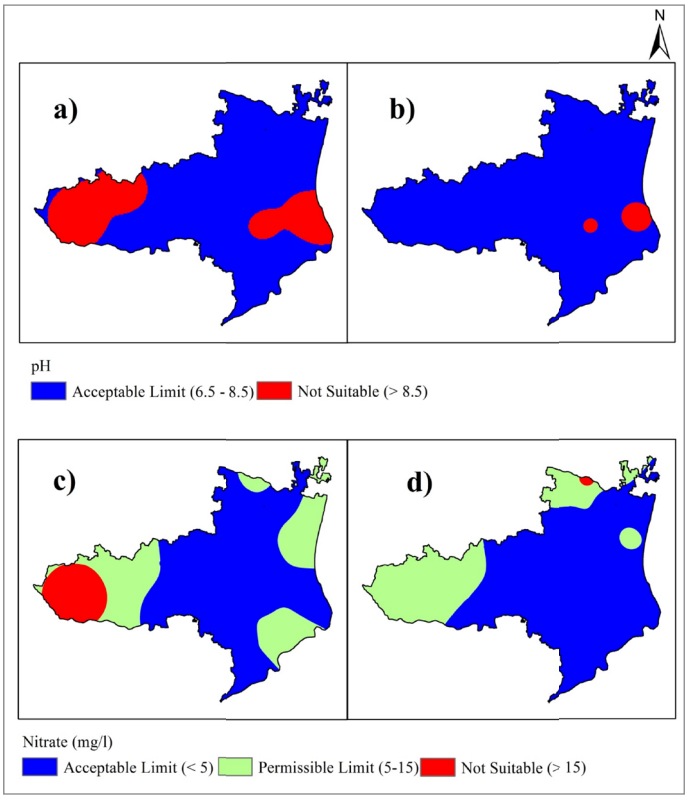

Figure 6: Spatial Distribution of Chemical parameter in Cuddalore District (a) pH - 2012 (b) pH – 2022 (c) Nitrate – 2012 (d) Nitrate - 2022

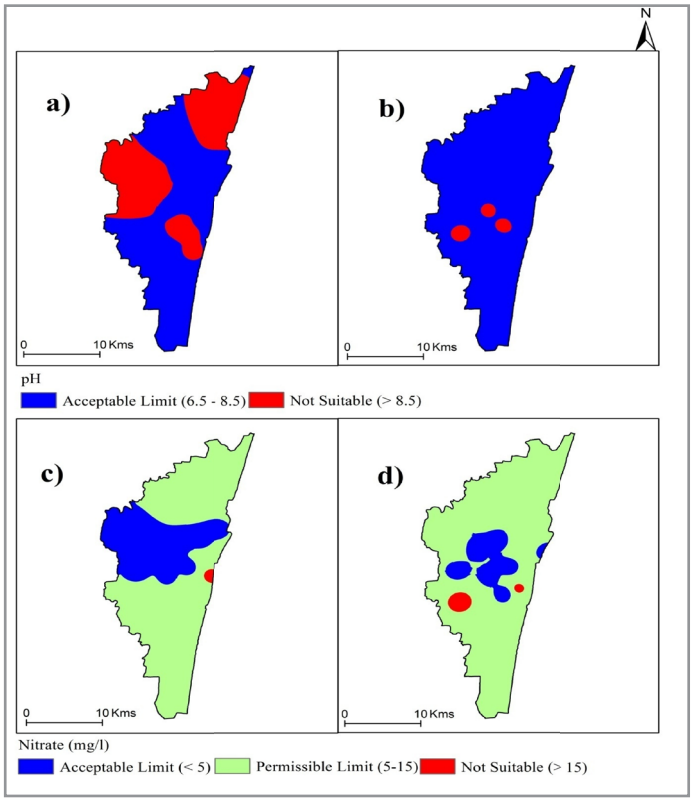

Figure 7: Spatial Distribution of Chemical parameter in Chennai District (a) pH - 2012 (b) pH – 2022 (c) Nitrate – 2012 (d) Nitrate - 2022

Nitrate

In the Cuddalore district, the acceptable range of Nitrate has increased from 57.90 percent in 2012 to 66.27 percent in 2022. Conversely, in the Chennai district, the acceptable range of Nitrate has decreased from 28.42 percent in 2012 to 12.20 percent in 2022. In Cuddalore district, the permissible range of Nitrate has decreased from 28.85 percent in 2012 to 27.86 percent in 2022, while in Chennai district, it has increased from 70.78 percent of the total geographical area in 2012 to 85.48 percent of the total geographical area in 2022. The amount of Nitrate in water that is outside of the suitable range that is above 15 mg/l—has decreased spatially in the Cuddalore but increased spatially in Chennai districts. In the Cuddalore district, the percentage of total geographical area increased from 13.25 percent in 2012 to 5.87 percent in 2022. Comparably, in Chennai district, the unsuitable range has grown from 0.80 percent of the entire area in 2012 to 2.32 percent of the total area in 2022 shown in the Table 6. In the year 2012, the acceptable limit has increased and spread over central, north, south and eastern parts of the Cuddalore district whereas western parts of the district with not suitable condition shown in the Figure 6. Condition of the nitrate in the year 2022 has improved and spread over central, north, south and western parts of the Cuddalore district whereas not suitable condition has been changed in permissible limit (Figure 6). Figure 7 shows that not suitable condition of nitrate is on the small portion on eastern part of the district whereas acceptable limit is on central and eastern parts of the Chennai district during the year 2012. Condition of the nitrate in the year 2022 has declined and spread over central and eastern parts of the Chennai district whereas not suitable condition has been located in the western (Figure 7).

Table 6: Comparison of Nitrate in Cuddalore and Chennai district

Suitability	Range (in mg/l)	2012	2012	2022	2022
		Cuddalore	Chennai	Cuddalore	Chennai
Acceptable	<5	57.90	28.42	66.27	12.20
Permissible	5-15	28.85	70.78	27.86	85.48
Not Suitable	>15	13.25	0.80	5.87	2.32
Total		100.00	100.00	100.00	100.00

Total Dissolved Substances

The acceptable range of Total Dissolved Substances in the Cuddalore district has increased from 15.94 percent in 2012 to 23.55 percent in 2022. On the other hand, the acceptable range of Total Dissolved Substances in the Chennai has dropped from 14.26 percent in 2012 to 5.47 percent in 2022. The permissible range

of Total Dissolved Substances in Cuddalore district decreased from 77.69 percent in 2012 to 64.70 percent in 2022, whereas in Chennai district it increased from 85.17 percent in 2012 to 86.13 percent in 2022 of the whole geographical area. In the districts of Cuddalore, the amount of Total Dissolved Substances in water that is not suitable range—above 2000 mg/l —has increased spatially in Cuddalore as well as Chennai. The district of Cuddalore has increased in its percentage of total geographical area from 6.38 percent in 2012 to 11.75 percent in 2022. In contrast, as Table 7 illustrates, the range in Chennai district increased from 0.55 percent of the total area in 2012 to 8.20 percent of the total area in 2022. not suitable category of TDS can be seen on north east where major parts of this category has reduced to permissible limit of TDS, acceptable limit can be seen on few parts of north, south and north eastern parts of the Cuddalore district during 2012 shown in the Figure 8. Not suitable category of TDS can be on south eastern parts of the district whereas north and north eastern parts of the Cuddalore district are comes under acceptable category shown in the Figure 8. Few parts on the eastern side of the Chennai district is Not suitable condition of TDS during the year 2012. The Acceptable limit of TDS can be seen on the west, few parts of north of the district (Figure 9). Not suitable category of TDS can be seen on south east, acceptable limit can be seen on few parts of central and eastern parts of the Chennai district during 2022 shown in the Figure 9.

Table 7: Comparison of Total Dissolved Substances in Cuddalore and Chennai district

Suitability	Range (in mg/l)	2012	2022	2022	2022
		Cuddalore	Chennai	Cuddalore	Chennai
Acceptable	<500	15.94	14.26	23.55	5.47
Permissible	500 - 2000	77.69	85.17	64.70	86.31
Not Suitable	>2000	6.38	0.55	11.75	8.20
Total		100.00	100.00	100.00	100.00

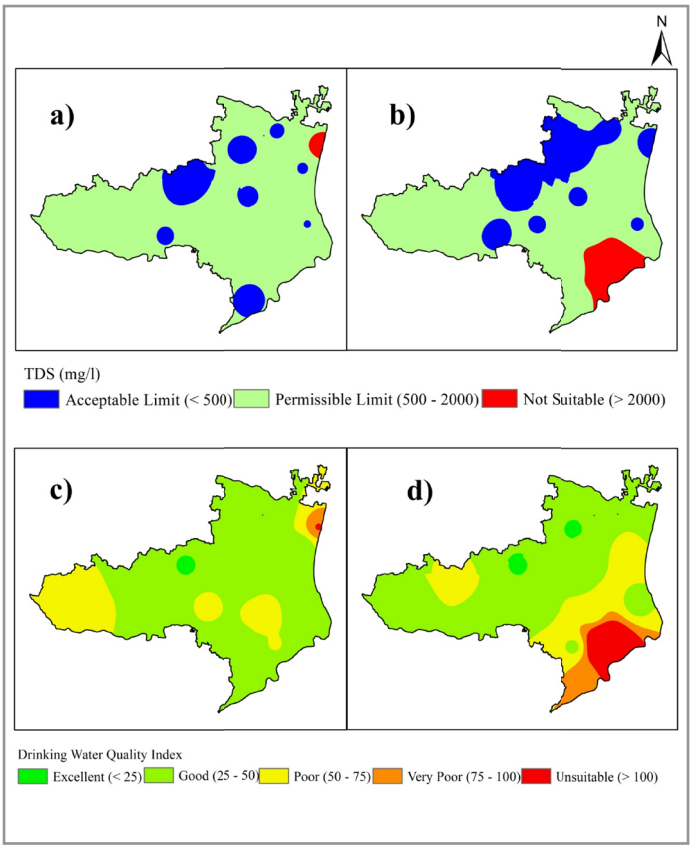

Figure 8: Spatial Distribution of Chemical parameter in Cuddalore District (a) TDS - 2012 (b) TDS – 2022 (c) Drinking Water Quality Index – 2012 (d) Drinking Water Quality Index - 2022

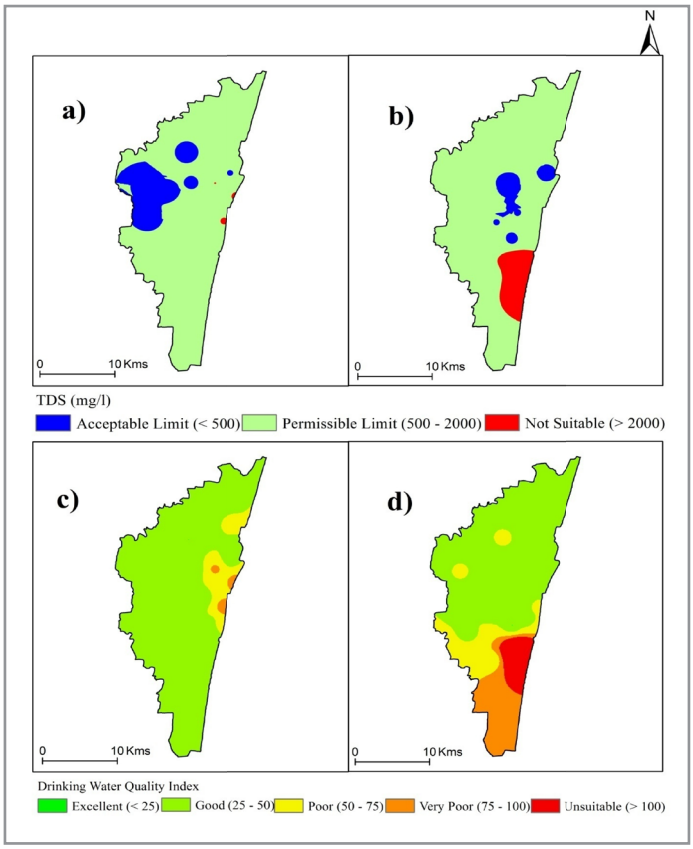

Figure 9: Spatial Distribution of Chemical parameter in Chennai District (a) TDS - 2012 (b) TDS – 2022 (c) Drinking Water Quality Index – 2012 (d) Drinking Water Quality Index - 2022

Drinking Water Quality Status

Excellent condition of the drinking water in Cuddalore district has slightly increased from 4.11 percent of the total geographical area in the year 2012 to 4.84 percent of the total area of Cuddalore district in the year 2022. Similarly, excellent condition of drinking water in Chennai district has slightly increased from 0

percent in the year 2012 to 0.20 percent of the total geographical area of Chennai district in the year 2022. Good condition of the drinking water has decreased from 66.72 percent in the year 2012 to 56.13 percent of total area in the year 2022 in Cuddalore district. Similarly, good condition of the drinking water has drastically decreased from 89.72 percent of the total geographical area of Chennai district in the year 2012 to 66.42 percent of the total geographical area in the year 2022. Poor status of drinking water has increased both Cuddalore as well as Chennai district. In Cuddalore district the poor condition of drinking water has decreased from 21.45 percent of the total geographical area in the year 2012 to 22.47 percent of the total area in the year 2022. Like a wise in Chennai district, poor condition of drinking water has increased from 8.82 percent of the total geographical area in the year 2012 to 13.12 percent of the total area in the year 2022. Very poor condition of drinking water has increased spatially in Cuddalore as well as Chennai district. In Cuddalore district it increased 4.26 percent in the year 2012 to 8.16 percent of the total area in the year 2022. Similarly, in Chennai district very poor condition of the drinking water has drastically increased from 1.46 percent of the total area in 2012 to 14.08 percent of the total geographical area in the year 2022. Unsuitable condition of the drinking water has drastically increased in Cuddalore district from 3.46 percent of geographical area in the year 2012 to 8.40 percent of the total area in the year 2022 shown in the Figure 10. In Chennai district, unsuitable condition was 0 percent in 2012 but has drastically increased to 6.18 percent of the total geographical area in the year 2022 shown in the Figure 11 Unsuitability and poor water area are spatially located on the north eastern parts of the district whereas poor water is spatially located on the western and central parts of the Cuddalore district during the year 2012 shown in the Figure 10. From the Figure 10, South eastern parts of the Cuddalore district has unsuitable drinking water whereas western, north and north eastern parts are covered with excellent to good suitability of water. From the Figure 11 the poor and very poor quality of water is in eastern side of the Chennai district, whereas remaining parts of the district comes under good suitability of drinking water in the year 2012. During 2022, Unsuitability and poor water area are spatially located on the south eastern parts of the Chennai district shown in the Fig-11.

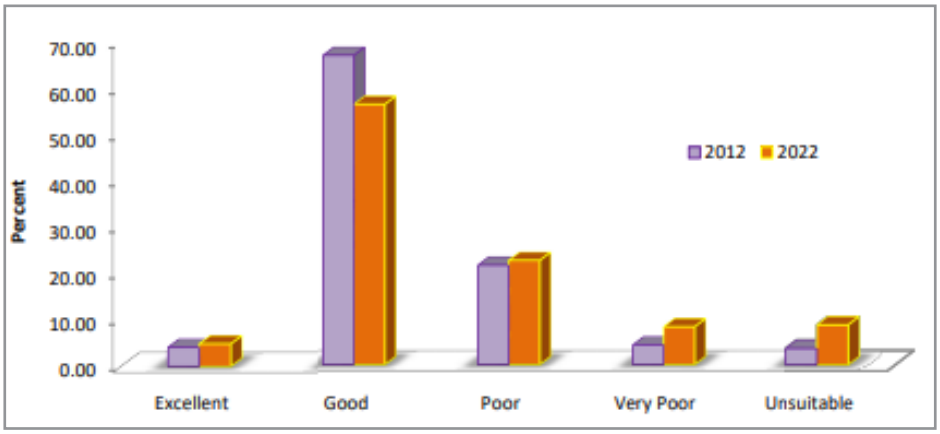

Figure 10: Comparison of suitability of Drinking water quality in Cuddalore –2012 & 2022

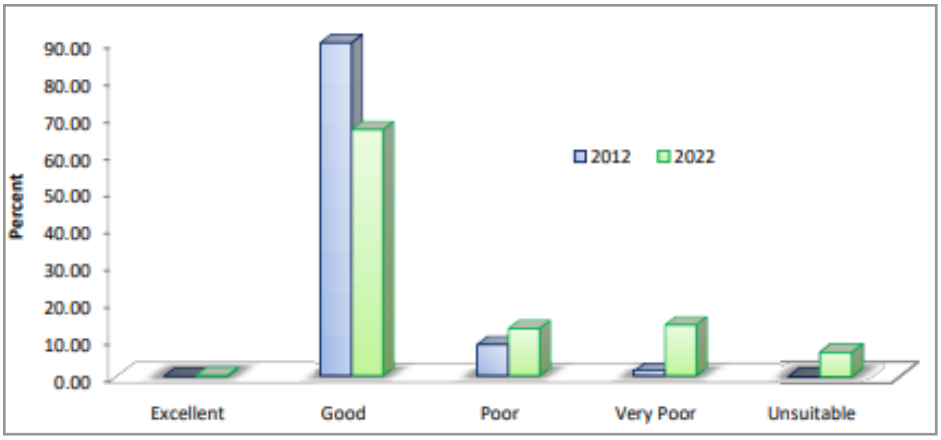

Figure 11: Comparison of suitability of Drinking water quality in Chennai –2012 & 2022

Conclusion

Water quality parameter such as Sulphate, Chlorine, Magnesium, and Total Dissolved Substances has deteriorated in Cuddalore as well as Chennai district from 2012 to 2022. Fluorine and Nitrate shown improvement in Cuddalore district but deteriorated in Chennai district from 2012 to 2022. pH has shown improvement from the year 2012 to 2022 in both the district. The comparison of the status of Drinking water in Cuddalore and

Chennai Districts reveals that condition of the drinking water quality has decreased during the study period. Suitable condition of the drinking water in Cuddalore district was 70.83 percent of total area has decreased to 60.97 percent in the year 2022. Unsuitable condition of the drinking water was 29.19 percent of the total geographical area in the year 2012 has increased to 39.03 percent of the total area of Cuddalore district in the year 2022. Area of suitable condition drinking water in Chennai district has decreased from 89.72 percent of total area in 2012 to 66.62 percent of the total area in 2022. Unsuitable condition of the drinking water in Chennai district was occupied only 10.28 percent of the total area in 2012 but it has increased to 33.38 percent of the total geographical area in the year 2022. The drinking water quality of Chennai district has decreased from the year 2012 to 2022. Status of drinking water quality of Cuddalore district has decreased from 2002 to 2012 but slightly increased in the year 2022. The overall status of the drinking water quality, Cuddalore district faces severe deterioration of water quality due to sea water intrusion especially after tsunami (2004) whereas water quality status is not affected much in Chennai.

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