AIRO JOURNALS
Peer Reviewed Multidisciplinary International
ISSN:2320-3714
Volume:3 Issue: 1
July 2024
Impact Factor: 10.2
Subject: Chemistry

AN EXHAUSTIVE EXAMINATION OF THE MODELS, METHODS, HISTORIES, AND VIEWPOINTS RELATED TO WATER QUALITY INDEXES (WQIs)

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Abstract

This study provides a detailed analysis of Water Quality Indexes (WQIs), tracing their historical development and evolution from simple aggregative models to sophisticated approaches using multivariate analysis and machine learning. It explores data collection, normalization, weighing, and aggregation methods, highlighting their advantages and disadvantages. The research also explores the influence of technology and environmental challenges on WQI creation. The review seeks to clarify WQIs' intricacies and provide future directions for improving environmental monitoring and public health.

Keywords: *Water Quality Indexes (WQIs), Water, Models, Techniques, Water Quality Ground Water.*

1. INTRODUCTION

One essential natural resource for human survival is water, supporting various activities and well-being. Surface and groundwater sources are crucial, but access remains a major obstacle, with over 1.1 billion people lacking clean water [1]. By 2025, over two-thirds of nations will face water-related issues [2].

Figure 1: Water Quality Indexes [3]

Water quality can deteriorate due to factors like social and economic growth, human activities, climate changes, and hydrological variations [4]. The accumulation of pollutants in surface water might result from these conditions, lowering the quality of the water. Maintaining water resources requires effective management [5].

Water quality is evaluated by tracking changes in its synthetic, organic, and physical components, which can be manipulated by natural and artificial cycles [6]. Water Quality Indexes (WQIs) are an effective method for representing water quality, reducing complex indices to a single value between 0 and 100 [7].

This study aims to explore various models, systems, histories, and perspectives related to water quality indexes (WQIs) [8]. It will examine various water quality lists used globally for assessment and discuss their advantages and disadvantages [9]. The study will also explore the intricacies of water quality evaluation, their historical roots, mechanical mechanisms, and various perspectives. The review will also propose future directions for working on WQIs in water resources management [10].

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2. WATER QUALITY INDEX

The Water Quality Index (WQI) is a device used to evaluate water quality, making it easier to reveal information and crucial for natural observation, policymaking, and public communication due to its straightforward and effective estimation [11].

- **Historical Perspective of WQIs**

In the 1960s, the World Quality Index (WQI) was created to evaluate water quality by integrating various criteria into a single score [12]. Over time, it has evolved with advanced statistical and computational techniques for improved reliability and accuracy [13].

- **Models Used in WQIs**

WQIs are calculated using various models with unique methodologies and applications, with the most common models being [14]:

1. **Arithmetic Mean Method**: WQIs are calculated using various models with unique methodologies and applications, with the most common models being.
2. **Geometric Mean Method**: This method emphasizes lower values, making it more sensitive to poor water quality, and is particularly useful in identifying potential health risks in water bodies.
3. **Weighted Sum Method**: The approach assigns weights to various water quality parameters, resulting in a more complex and representative WQI index.

- **Historical Evolution and Key Milestones**

The World Quality Index (WQI) was made during the 1960s to assess water quality by coordinating different rules into a solitary score [15]. Over time, it has evolved with advanced statistical and computational techniques for improved reliability and accuracy [16].

- **Phases of WQI development**

The World Quality Index (WQI) was made during the 1960s to assess water quality by coordinating different measures into a solitary score [17]. Over time, it has evolved with advanced statistical and computational techniques for improved reliability and accuracy [18].

- Early Conceptualization

The mid-20th century saw the development of Water Quality Indexes (WQI), initially focusing on basic factors like pH, dissolved oxygen, and turbidity. These early indexes provided a basic overview of water quality but lacked depth to capture complex biological and chemical interactions.

- Refinement and Expansion

The second phase of environmental science saw the refinement and expansion of WQIs, with advanced statistical methods and a wider range of parameters introduced. This led to the invention of weighted arithmetic indexes like WAWQI, allowing for fairer evaluations of water quality. Advancements in processing power enabled multivariate statistical methods for complex datasets.

- Standardization and Policy Integration

The third stage of development aimed to incorporate WQI into environmental policy frameworks and standardize them, adopting standardized WQIs by organizations like WHO and EPA. Area-specific indices were created to address unique regulatory requirements and environmental conditions.

- Modern Innovations

The World Quality Index (WQI) is a 21st-century tool that uses advanced technology and techniques to monitor water quality in real-time. It incorporates sensor technology and remote sensing, allowing WQIs to react to environmental changes. Machine learning and artificial intelligence are used to analyse large datasets, identify patterns, and forecast potential changes. As technology advances, WQIs become more important in environmental monitoring, policy-making, and public awareness, making them a crucial component of global efforts to conserve and manage water resources.

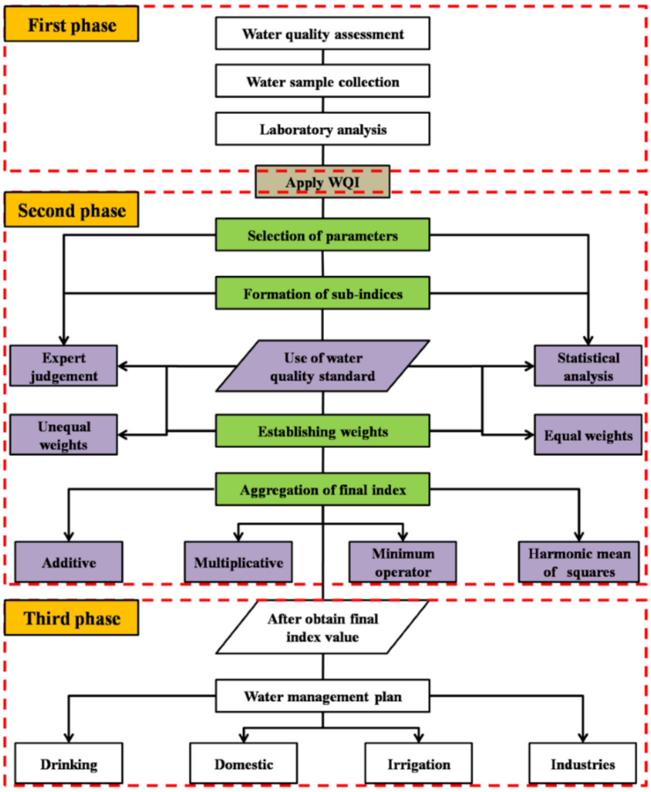

Figure 2: Phases of WQI development [19]

3. EVOLUTION OF WQI RESEARCH

The Water Quality File (WQI) study, developed in the 1960s, has significantly improved water quality management. It aims to create a uniform framework for assessing water quality by consolidating various variables into a single mathematical score, making complex information more accessible [20].

During the 1970s and 1980s, WQI research expanded to include physical, chemical, and biological indexes. Researchers adjusted WQIs for individual water bodies and intended uses, including drinking water, recreational water, and aquatic ecosystems [21]. Region-specific health quality indexes were developed to consider local environmental conditions and pollution sources [22].

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The 1990s and 2000s saw significant advancements in computational technology and geographic information systems (GIS), influencing the development of Water Quality Index

ISSN:2320-3714
Volume:3 Issue: 1
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(WQI) research [23]. The integration of remote sensing data and spatial analysis methodologies was necessary for evaluating water quality on larger spatial scales and in dynamic environments. Multi-rules choice analysis (MCDA) was introduced to guide comprehensive assessments of water quality [24]. The focus has shifted to contemporary water quality issues, such as toxins, environmental change impacts, and sustainable water management. Participatory methodologies and AI are being used to develop more adaptable WQIs. The development of WQI research reflects the growing complexity of water quality problems and the need for more comprehensive and adaptive tools [25].

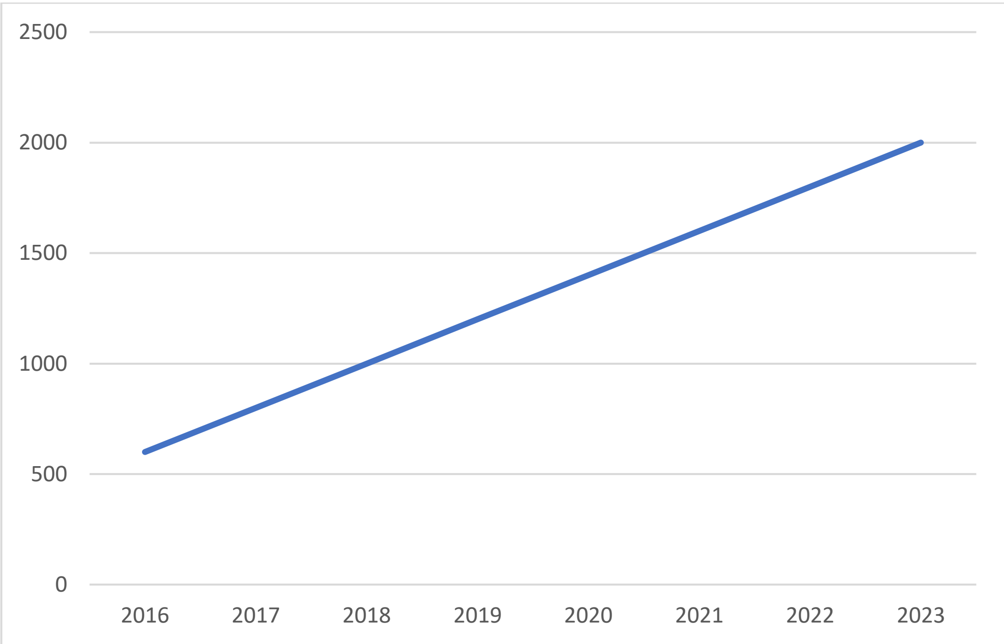

Figure 3: Water Quality Index (WQI) Research Over the Years [26]

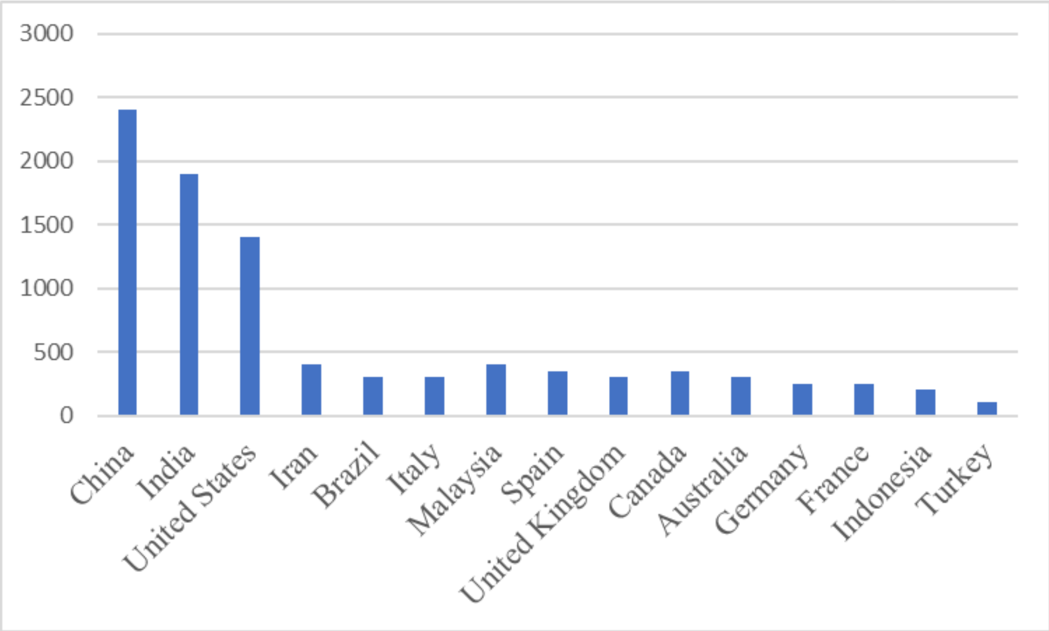

Figure 4: Water Quality Index (WQI) Research by Country/Region [27]

4. DIFERENT METHODS FOR WQI DETERMINATION

The Water Quality Index (WQI) is resolved utilizing different techniques, including the Weighted Arithmetic Index, NSFWQI, CCMEWQI, and OWQI [28]. The Weighted Arithmetic Index method is a simple and flexible approach that involves weighing water quality characteristics like nutrients, heavy metals, pH, turbidity, and dissolved oxygen. This method allows for the inclusion of a wide range of criteria and weightings based on the specific water body and research goals [29].

4.1.National sanitation foundation (NSFWQI)

The National Sanitation Foundation's Water Quality Index (NSFWQI) is a broadly involved device for evaluating and dispersing data about water quality. Made during the 1970s, it comprises of nine key elements, including Broke up Oxygen (DO), pH, Biochemical Oxygen Interest (Body), temperature change, complete phosphate and nitrate levels, turbidity, and all out solids. Higher DO values indicate higher quality water, while high pH levels negatively impact contaminant solubility and aquatic life. High BOD indicates low DO and high organic pollution. Temperature change affects metabolic rates and species diversity, while high phosphate and nitrate levels can lead to eutrophication and health problems [30]. The ultimate score on the index can range from 0 to 100, with qualitative descriptions used to make understanding easier.

Table 1: Water Quality Index (WQI) score into different qualitative descriptors [31].

WQI Score Range	Qualitative Descriptor
90-100	Excellent
80-90	Good
60-80	Medium
30-60	Bad
0-30	Very Bad

4.2. Canadian council of ministers of the environment water quality index (CCMEWQI)

The Canadian Council of Ministers of the Environment Water Quality Index (CCME WQI) is a device utilized in Canada to survey and impart surface water quality information. It offers a solitary benefit that gathers various water quality models into a straightforward index score, working with understanding and evaluation of water quality across different settings and time spans. The CCME WQI thinks about physical, compound, and organic qualities of water, including pH, broke up oxygen, biochemical oxygen interest, all out suspended solids, and foreign substances like supplements and weighty metals. Sub-records are appointed to each water quality measurement, featuring regions where water quality might be debased. The last score is resolved utilizing a weighted arithmetic mean or other suitable strategy [32].

- Interpretation of CCME WQI Scores:

Table 2: Water Quality Based on The CCMEWQI [33]

Class	WQI Value Range	Water Quality Description
I	76–100	Great water quality is protected by near absolute absence of danger. The environment is about exactly as it would be in nature.
II	66–75	A minor danger is warded off by good water quality. Situations rarely diverge from average values.
III	51–65	Alright Although occasionally threatened, the quality of the water is normally safe. Situations can occasionally diverge from average values.
IV	41–50	Not good (marginal) Water quality is frequently at risk. The conditions often diverge from average levels
V	0–40	Extremely Negative (Deficient) Water quality is almost never safe. Typically, the conditions differ from average levels.

4.3.Oregon water quality index (OWQI)

The Oregon Water Quality Index (OWQI) is a US technique for evaluating water quality in Oregon, taking into account factors like temperature, broke down oxygen levels, pH balance, conductivity, turbidity, complete nitrogen, all out phosphorus, and waste coliform microorganisms, deciding water reasonableness for drinking and oceanic territory support [34].

- Calculation and Interpretation

The OWQI measures water quality by determining the significance of each parameter and applying weights. Data from monitoring stations is normalized for fair comparisons across water bodies and periods. The weighted scores are aggregated, resulting in a score ranging from 0 to 100, with higher scores indicating better water quality [35].

Table 3: As Per the OWQI Index, Water Index [36]

Numerical Value Range	Condition	Colour
90–100	Excellent	Blue
85–90	Good	Green
80–85	Medium	Yellow
50–75	Bad	Orange
10–40	Very Bad	Red

The Original Water Quality Index (OWQI) categorizes water quality into levels like excellent, good, fair, bad, and extremely poor, aiding public, environmental agencies, and policymakers in understanding water health. However, it has limitations such as weighting methodologies and omission of certain contaminants. Despite its usefulness, OWQI is often used in conjunction with other assessments for comprehensive water management and conservation activities [37].

4.4.Weighted arithmetic water quality index (WAWQI)

The Weighted Arithmetic Water Quality Index (WAWQI) is a mathematical marker that consolidates numerous water quality boundaries into a solitary measure. It works on information examination by allocating loads to factors in light of their significance in surveying water quality [38]. The WAWQI standardizes each parameter to a common range of 0 to 100, ensuring accurate integration. The process involves selecting key water quality metrics, sizing data, assigning weights, and calculating the weighted average. A higher score indicates better water quality, while a lower score indicates worse. The WAWQI is useful for stakeholders, including environmental regulators, policymakers, and researchers, to assess and compare water quality across locations or over time. However, it may be subject to subjectivity and lacks consideration for factors' interactions. Regular updates and adjustments to the WAWQI are necessary to ensure its relevance and accuracy in sustainable water management practices [39].

$$\text{WAWQI} = \sum_{i=1}^{n} (W_i \times Q_i)$$

where:

- Wi = Weight assigned to parameter i
- Qi = Normalized score of parameters i
- n = Total number of parameters

ISSN:2320-3714
Volume:3 Issue: 1
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Table 4: Numerous studies pertaining to Water Quality Indexes (WQIs) [40]

Authors	Construct Methods	Service Context	Key Findings
Roșca (2020) [41]	WAWQI	Glacial lakes, Rodnei mountains, Romania	Good quality water with a small amount of anthropogenic change. WQI stands for outstanding and superior quality. No pollution is shown by the heavy metal pollution index.
Nair et al. (2020) [42]	WAWQI	River basins of the Ithikkara and Kallada in Kerala, India	The majority of the water is graded as "excellent" during the monsoon and pre monsoon. Ion-parameter connections are investigated.
Teodorof L, et al. (2021) [43]	WAWQI & IWQI	Hilly terrain of Jammu Himalaya	Most spring samples are acceptable for household use and irrigation. Hazards associated with sodium and salinity in groundwater.
Udeshani et al. (2020) [44]	WAWQI	Monaragala, Sri Lanka	High levels of hardness, EC, TDS, Cl, and fluoride are caused by lithology, which affects groundwater quality. Very low groundwater quality is indicated by a WQI.
Betis et al. (2020) [45]	CCMEWQI	Quebec, Canada	Disparities between streams and water from harvested peatlands were observed. pH recommendations frequently disregarded in peatlands.
Cristable et al. (2020) [46]	NSFWQI	Saluran Tarum Barat, West Java	Medium water quality impacted by industrial, infrastructure, and agricultural activity.

En-nkhili et al. (2020) [47]	WWQI	Boudaroua Lake, Morocco	Good water quality impacted by agriculturally produced nitrogen compounds
Nong X et.al (2020) [48]	WWQI	Boudaroua Lake in the Moroccan Pre-Rif	Good water quality overall, but tainted by agricultural activities' organic nitrogen compounds, particularly following the first fall rains.

This table categorizes studies based on authors, the constructed methods (such as WAWQI, CCMEWQI, NSFWQI, etc.), the service context (geographical locations), and key findings related to water quality assessments.

5. CONCLUSION

Water quality indices (WQIs) are a diverse collection of models, methodologies, histories, and perspectives that help understand and control water quality [49]. The Weighted Arithmetic Water Quality Index (WAWQI) is a great representation, consolidating different logical disciplines to assess sea-going environments and drinking water wellbeing [50]. WQIs have evolved from simple aggregation methods to complex systems, considering intricate interactions between parameters. Despite challenges like weighting subjectivity and adaptation to environmental issues, WQIs remain vital tools for water resource protection and sustainable development.

REFERENCES

1. Uddin, M. G., Nash, S., & Olbert, A. I. (2021). A review of water quality index models and their use for assessing surface water quality. *Ecological Indicators*, *122*, 107218.
2. Patel, P. S., Pandya, D. M., & Shah, M. (2023). A systematic and comparative study of Water Quality Index (WQI) for groundwater quality analysis and assessment. *Environmental Science and Pollution Research*, *30*(19), 54303-54323.
3. Lukhabi, D. K., Mensah, P. K., Asare, N. K., Pulumuka-Kamanga, T., & Ouma, K. O. (2023). Adapted water quality indices: Limitations and potential for water quality monitoring in Africa. *Water*, *15*(9), 1736.

4. Moudou, M., El Hammoudani, Y., Haboubi, K., Achoukhi, I., El Boudammoussi, M., Faiz, H., ... & Dimane, F. (2024). Water quality indices (WQIs): An in-depth analysis and overview. In *E3S Web of Conferences* (Vol. 527, p. 02015). EDP Sciences.

5. Kumar, D., Kumar, R., Sharma, M., Awasthi, A., & Kumar, M. (2024). Global water quality indices: Development, implications, and limitations. *Total Environment Advances*, *9*, 200095.

6. Uddin, M. G. (2020). Development of a novel water quality index model using data. *Journal of King Saud University-Computer and Information Sciences*, *34,* 4773-4781.

7. Mogane, L. K., Masebe, T., Msagati, T. A., & Ncube, E. (2023). A comprehensive review of water quality indices for lotic and lentic ecosystems. *Environmental Monitoring and Assessment*, *195*(8), 926.

8. Keraga, A. S. (2019). Assessment and modeling of surface water quality dynamics in Awash River Basin, Ethiopia. *Addis Ababa Institute of Technology, School of Chemical and Bio Engineering*

9. Moeinzadeh, H., Yong, K. T., & Withana, A. (2024). A critical analysis of parameter choices in water quality assessment. *Water Research*, 121777

10. Johnston, N., Rolfe, J., & Flint, N. (2024). A systematic review of agricultural use water quality indices. *Environmental and Sustainability Indicators*, 100417.

11. Aguilar, J. A. P., Campo, J., Meneu, S. N., Gimeno-García, E., & Andreu, V. (2019). Analysis of existing water information for the applicability of water quality indices in the fluvial-littoral area of Turia and Jucar Rivers, Valencia, Spain. *Applied Geography*, *111*, 102062.

12. Guy-Baker, C. L. (2018). *Developing a TopoSWAT Model and Water Quality Index Framework for the Karst-Dominant Falling Water River Watershed* (Master's thesis, Tennessee Technological University).

13. Sajib, A. M., Diganta, M. T. M., Rahman, A., Dabrowski, T., Olbert, A. I., & Uddin, M. G. (2023). Developing a novel tool for assessing the groundwater incorporating water quality index and machine learning approach. *Groundwater for Sustainable Development*, *23*, 101049.

14. Alarcón, A. P. G., Elizondo, M. D. S. G., Vergara, I., Lagos, M. D., & Herrera, M. T. A. (2021). WATER QUALITY INDICES IN MÉXICO AND COLOMBIA.

EVOLUTION, CRITERIA AND CHALLENGES. *Ingeniería Investigación y Desarrollo: I2+ D*, *21*(2), 1-18.

15. Vân, Đ. T. B. *Modification of the Canadian Water Quality Index: Case Study Assessment of Groundwater Quality in Mekong Delta, Vietnam* (Doctoral dissertation, Dissertation, Darmstadt, Technische Universität Darmstadt, 2020).

16. Van Bich, D. T. (2020). Modification of the Canadian Water Quality Index: Case Study Assessment of Groundwater Quality in Mekong Delta, Vietnam.

17. Talukdar, P., Kumar, B., & Kulkarni, V. V. (2023). A review of water quality models and monitoring methods for capabilities of pollutant source identification, classification, and transport simulation. *Reviews in Environmental Science and Bio/Technology*, *22*(3), 653-677.

18. Singh, B., Sihag, P., Singh, V. P., Sepahvand, A., & Singh, K. (2021). Soft computing technique-based prediction of water quality index. *Water Supply*, *21*(8), 4015-4029.

19. Egbueri, J. C., & Agbasi, J. C. (2022). Combining data-intelligent algorithms for the assessment and predictive modeling of groundwater resources quality in parts of southeastern Nigeria. *Environmental Science and Pollution Research*, *29*(38), 57147-57171.

20. Machiwal, D., Cloutier, V., Güler, C., & Kazakis, N. (2018). A review of GIS-integrated statistical techniques for groundwater quality evaluation and protection. *Environmental Earth Sciences*, *77*(19), 681.

21. Islam, M. S., & Mostafa, M. G. (2022). Suitability of water quality index methods for assessing groundwater quality in the Ganges River basin area. *H2Open Journal*, *5*(2), 198-220.

22. García-Avila, F., Loja-Suco, P., Siguenza-Jeton, C., Jiménez-Ordonez, M., Valdiviezo-Gonzales, L., Cabello-Torres, R., & Aviles-Anazco, A. (2023). Evaluation of the water quality of a high Andean Lake using different quantitative approaches. *Ecological Indicators*, *154*, 110924.

23. Hussein, E. E., Jat Baloch, M. Y., Nigar, A., Abualkhair, H. F., Aldawood, F. K., & Tageldin, E. (2023). Machine learning algorithms for predicting the water quality index. *Water*, *15*(20), 3540.

24. Singh, P. K., & Saxena, S. (2018). Towards developing a river health index. *Ecological Indicators*, *85*, 999-1011.

25. Sajib, A. M., Diganta, M. T. M., Moniruzzaman, M., Rahman, A., Dabrowski, T., Uddin, M. G., & Olbert, A. I. (2024). Assessing water quality of an ecologically critical urban canal incorporating machine learning approaches. *Ecological Informatics*, *80*, 102514.

26. Li, Y., Wang, X. K., Zhang, H. Y., Wang, J. Q., & Li, L. (2021). An integrated regional water quality assessment method considering interrelationships among monitoring indicators. *Environmental Monitoring and Assessment*, *193*, 1-20.

27. Pangaliyev, Y., Akbayeva, L., Mamytova, N., Shamshedenova, S., Onerkhan, G., & Mkilima, T. (2024). Assessment of Water Regime, Management and Quality Analysis Based on Water Quality Indices–A Case of Karaganda Region, Kazakhstan. *Polish Journal of Environmental Studies*, *33*(1), 781-801.

28. Betis, H., St-Hilaire, A., Fortin, C., & Duchesne, S. (2020). Development of a water quality index for watercourses downstream of harvested peatlands. *Water Quality Research Journal*, *55*(2), 119-131.

29. Hai, T., Ahmadianfar, I., Halder, B., Heddam, S., Al-Areeq, A. M., Demir, V., ... & Yaseen, Z. M. (2024). Surface water quality index forecasting using multivariate complementing approach reinforced with locally weighted linear regression model. *Environmental Science and Pollution Research*, 1-25.

30. Wibowo, M. A., Andarini, P., Kurniatama, D. V. P., & Humaira, N. G. (2024). Methods for Determining the Water Quality Index in Developing Asian Countries: A Review. *Ecological Engineering & Environmental Technology*, *25*.

31. Mogane, L. K., Masebe, T., Msagati, T. A., & Ncube, E. (2023). Water Quality Index Models for Lotic and Lentic Ecosystems-A Systematic Review.

32. Talal, M., Alamoodi, A. H., Albahri, O. S., Albahri, A. S., & Pamucar, D. (2023). Evaluation of remote sensing techniques-based water quality monitoring for sustainable hydrological applications: an integrated FWZIC-VIKOR modelling approach. *Environment, Development and Sustainability*, 1-45.

33. Pronk, T. E., Hofman-Caris, R. C. H. M., Vries, D., Kools, S. A. E., ter Laak, T. L., & Stroomberg, G. J. (2021). A water quality index for the removal requirement and purification treatment effort of micropollutants. *Water Supply*, *21*(1), 128-145.

34. Das, C. R., & Das, S. (2023). Assessment of surface water quality for drinking by combining three water quality indices with their usefulness: case of Damodar River in India. *Water, Air, & Soil Pollution*, *234*(5), 327.

35. Benoit, K. K., Séraphin, K. K., Félix, K. K., Charles, B. K., Martin, K. K., & Brou, D. (2020). Indices of water quality and pesticide monitoring survey in lake of Western Côte d'Ivoire and its human risk assessment. *Natural Resources*, *11*(2), 46-69.

36. Shams, M. Y., Elshewey, A. M., El-Kenawy, E. S. M., Ibrahim, A., Talaat, F. M., & Tarek, Z. (2024). Water quality prediction using machine learning models based on grid search method. *Multimedia Tools and Applications*, *83*(12), 35307-35334.

37. Valdiviezo Gonzales, L. G., García-Avila, F., Loja-Suco, P., Siguenza-Jeton, C., Jiménez-Ordoñez, M., Valdiviezo-Gonzales, L., ... & Aviles-Añazco, A. (2023). Evaluation of the water quality of a high Andean lake using different quantitative approaches.

38. Liu, Y., & Li, L. (2023). Multiple Evaluations of the Spatial and Temporal Characteristics of Surface Water Quality in the Typical Area of the Yangtze River Delta of China Using the Water Quality Index and Multivariate Statistical Analysis: A Case Study in Shengzhou City. *International Journal of Environmental Research and Public Health*, *20*(4), 2883.

39. Ghaemi, Z., & Noshadi, M. (2022). Surface water quality analysis using multivariate statistical techniques: a case study of Fars Province rivers, Iran. *Environmental Monitoring and Assessment*, *194*(3), 178.

40. Lukhabi, D. K., Mensah, P. K., Asare, N. K., Pulumuka-Kamanga, T., & Ouma, K. O. (2023). Adapted Water Quality Indices: Limitations and Potential for Water Quality Monitoring in Africa. Water 2023, 15, 1736.

41. Roșca OM (2020) Impact of anthropogenic activities on water quality parameters of glacial lakes from Rodnei mountains, Romania. Environ Res 182:109136. https://doi.org/ 10.1016/j.envres.2020.109136

42. Nair HC, Joseph A, Padmakumari Gopinathan V (2020) Hydrochemistry of tropical springs using multivariate statistical analysis in Ithikkara and Kallada river basins, Kerala, India. Sustain Water Resour Manag 6:1–21. https://doi.org/10.1007/s40899-020-00363-1

43. Teodorof L, Ene A, Burada A, Despina C, Seceleanu-Odor D, Trifanov C, Ibram O, Bratfanof E, Tudor MI, Tudor M, Cernisencu I, Georgescu LP, Iticescu C (2021) Integrated assessment of surface water quality in Danube River Chilia branch. Appl Sci 11:9172. https://doi.org/10.3390/ app11199172

44. Udeshani WAC, Dissanayake HMKP, Gunatilake SK, Chandrajith R (2020) Assessment of groundwater quality using water quality index (WQI): a case study of a hard rock terrain in Sri Lanka. Groundw Sustain Dev 11:100421. https://doi.org/10.1016/j.gsd.2020.100421

45. Betis H, St-Hilaire A, Fortin C, Duchesne S (2020) Development of a water quality index for watercourses downstream of harvested peatlands. Water Qual Res J 55:119–131. https://doi.org/10.2166/wqrj.2020.007

46. Cristable RM, Nurdin E, Wardhana W (2020) Water quality analysis of Saluran Tarum Barat, West Java, based on National Sanitation Foundation-Water Quality Index (NSF-WQI). IOP Conf Ser: Earth Environ Sci 481:012068. https://doi.org/10.1088/1755-1315/481/1/ 012068

47. En-nkhili H, Najy M, Etebaai I, Talbi FZ, El Kharrim K, Belghyti D (2020) Application of water quality index for the assessment of Boudaroua lake in the Moroccan pre-rif. Conference GEOIT4W-2020: 1–5. https://doi.org/10. 1145/3399205.3399248

48. Nong X, Shao D, Zhong H, Liang J (2020) Evaluation of water quality in the South-to-North Water diversion project of China using the water quality index (WQI) method. Water Res 178:115781. https://doi.org/10.1016/j.watres. 2020.115781

49. Hai, T., Ahmadianfar, I., Halder, B., Heddam, S., Al-Areeq, A. M., Demir, V., ... & Yaseen, Z. M. (2024). Surface water quality index forecasting using multivariate complementing approach reinforced with locally weighted linear regression model. Environmental Science and Pollution Research, 1-25.

50. Benoit, K. K., Séraphin, K. K., Félix, K. K., Charles, B. K., Martin, K. K., & Brou, D. (2020). Indices of water quality and pesticide monitoring survey in lake of Western Côte d'Ivoire and its human risk assessment. Natural Resources, 11(2), 46-69.

AIRO JOURNALS
Peer Reviewed
Multidisciplinary
International

ISSN:2320-3714
Volume:3 Issue: 1
July 2024
Impact Factor: 10.2
Subject: Chemistry

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