



## Modification of the Water Quality Index (WQI) Process For Simple Calculation Using the Multi-Criteria Decision-Making (MCDM) Method: A Review

Naseem Akhtar<sup>1</sup>, M. I. Syakir<sup>1,2 \*,</sup> Mardiana Idayu Ahmad<sup>1</sup>, Khalid Umar<sup>3</sup>, Mohamad Shaiful Md Yusuff<sup>1</sup>, Mohd Talha Anees<sup>4</sup>, Abdul Qadir<sup>5</sup>, and Yazan Khalaf Ali Almanasir<sup>1</sup>

- <sup>1</sup> School of Industrial Technology, Division of Environmental Technology, Universiti Sains Malaysia, 11800 Gelugor, Pulau Pinang, Malaysia; naseemamu6@gmail.com (N.A.); mardianaidayu@usm.my (M.I.A.); shaifulyusuff@gmail.com (M.S.M.Y.); Almanasir@student.usm.my (Y.K.A.A.)
- <sup>2</sup> Centre for Global Sustainability Studies, Universiti Sains Malaysia, 11800 Gelugor, Pulau Pinang, Malaysia
- School of Chemical Sciences, Universiti Sains Malaysia, 11800 Gelugor, Pulau Pinang, Malaysia; khalidumar4@gmail.com
- <sup>4</sup> Department of Geology, Faculty of Science, University of Malaya, 50603 Petaling Jaya, Kuala Lumpur, Malaysia; talhaanees@um.edu.my
- <sup>5</sup> School of Physics, Universiti Sains Malaysia, 11800 Gelugor, Pulau Pinang, Malaysia; abdulqadiralig@gmail.com
- \* Corresponding author: misyakir@usm.my

**Table S1:** This shows the valuable information about a few common steps to use in WQI development for overall reviewed.

Indexing method	Parameters	Range	Classificati on	Sub-indices, weights, aggregation	Equation	Purpose and region of application
		95–100	Excellent		CWQI	
		80–94	Good		$-100 - \frac{\sqrt{F_1^2 + F_2^2 + F_3^2}}{F_1^2 + F_2^2 + F_3^2}$	
		60–79	Fair	-	1.732	
		45–59	Marginal		where F <sub>1</sub> (scope: the	
Canadian Council of Ministers of the Environme nt Water Quality Index (CCMEW QI) [12]	At least 4 parameters, maximum number of parameters is not specified	0–44	Poor	No sub-indices, no weights, no aggregation	above the guideline) is the number.of variables whose objectives are not met/total number. of variables ×100, F <sub>2</sub> (fre- quency: number of times by which the objectives are not met) is the num- ber. of failed tests/total number. of tests × 100, F <sub>3</sub> (denote amplitude: the amount by which the objectives are not met); (a) Excursion <sub>i</sub> = (failed test value <sub>i</sub> /objective <sub>j</sub> ) –1, (b) normalized sum of excursions (nse).	WQI was used by Horton for the weightings, and the scales of rating measures, in order to determine the relative significance in the water quality of each parameter.



					$= \sum_{i=1}^{n} excursion_{i}$ - no of test	
					and (c) $F_3=$	
					(nse/0.01nse+0.01)	
	_	0–3	Excellent	-	BCWQI	
	_	4–17	Good	_	$(F_1^2 + F_2^2 + (\frac{F_3}{2})^2)$	
British	At least 4	18–43	Fair	_	$=\frac{\sqrt{1-2}}{14E2}$	In 1970, the Brown's
Columbia	parameters,	44–59	Borderline	_	This index is similar to	
Water	maximum			No sub-indices,	the CWQI, where	WOI similar to Horton's
Quality	number of			no weights, no	parameters for water	index dependent on
Index	parameters is			aggregation	quality are calculated	weights to the individual
(BCWQI)	not	60–100	Poor		and their violation by	parameter.
[13,112]	specified				comparison to a	puluineteri
					prescribed limit is	
				No sub-indices, no weights, no aggregation $= \frac{\sqrt{F_1^2 + F_2^2 + (\frac{F_3}{3})^2}}{1.453}$ This index is similar to the CWQI, where parameters for water quality are calculated and their violation by comparison to a prescribed limit is identified. $V_1 = \frac{\sum P_i xC}{\sum P_i}$ The nse = $\frac{\sum_{i=1}^n SI_{i,k}xP_i}{\sum_{i=1}^n P_i}$ ag No sub-indices, no weights, no aggregation $V_2 = \frac{100 - \frac{\sqrt{V_1^2 + V_2^2}}{1.414}}{1.414}$ Where C = count factor for 1 or 0, P_i = relative weight, SI = subindex, i = an paramter order, k = order for each step. $WCI = \frac{1}{n} \sum_{i=1}^n \times \frac{C_i}{MAC_i}$ m where C_i is the parameter concentration, n is the q		
	_	91–100	Excellent	_	$V_{i} = \frac{\sum P_{i} x C}{\sum P_{i} x C}$	The article conducts the
	_	81–90	Very good	_	$\sum_{i=1}^{n} \sum_{i=1}^{n} P_{i}$	modified CWQI
	At least 4 parameters, maximum number of parameters is not specified	71–80	Good	- - No sub indices	$nse = \frac{\sum_{i=1}^{n} SI_{i,k} XP_i}{\sum_{i=1}^{n} P_i}$	aggregation that used the
Modified		51–70	Fair		$\Delta_{i=1}r_i$ nse	following amendment:
Canadian		21–50	Marginal		$v_2 = \frac{1}{0.005 \text{ nse} + 0.005}$	V1(Scope) shows that the
Water Quality Index (MCWQI) [120]		0–20	Poor	No sub-indices, no weights, no aggregation	MCWQI = 100 - $\frac{\sqrt{V_1^2 + V_2^2}}{1.414}$ where C = count factor for 1 or 0, P <sub>i</sub> = relative weight, SI = subindex, i = paramter order, k =	percentage of failed parameters is changed through parameter relative weights, and V2 (frequency and amplitude) is combined with fréquence and
		0.02	Voru door		order for each step.	
	-	0-0.2	Clean	-		Goskomgidromet
	-	0.2-1.0	Moderate	-	$1\sum^{n} C_{i}$	developed the WCI
		1–2	clean		$WCI = \frac{1}{n}\sum_{i=1}^{n} \times \frac{1}{MAC_i}$	method and is one of the
	-	2–4	Polluted	-	where $C_i$ is the	most widely used
Water	<sup>b</sup> parameters: _	4–6	Dirtv	- Equal woights	parameter	indicators for water
Contamina	NO <sub>2</sub> petroleum	6–10	Verv dirty	(sum of weights	concentration, n is the	quality evaluation. This
tion Index	products.			= 1)	no of indicators, and	measure is a typical
(WCI) [18]	ammonium ion	>10	Extremely dirty	-)	MAC: is the established value of the standard for the relevant type of water body.	additive coefficient which represents the mean above MAC in a relatively narrow number of individual components.
		0–24	Polluted			Based on measurements
0 "		25–49	Poor	-	$\sum P_i$	and subsequent
Overall	8 Parameters: -	50-74	Fair	Individual	$OIP = \sum \frac{1}{n}$	classification of
Index of	PH, DO, BOD, -	75–94	Good	sub-indices and	where Pi is the pollution	parameters for Indian
Pollution (OIP) [14]	TH, TDS, total _ coliform, As, F <sup>-</sup>	95–100	Excellent	equal weights	index and no of ith parameters	rivers, an OIP has been developed by Sargaonkar and Deshpande.

		76–100	Excellent			The water quality	
	7	51–75	Good	-	n n	assessment of the Vistula	
	7 parameters	26-50	Marginal	-	WQI = $\sqrt{\frac{\sum_{i=1}^{n} 1}{\sum_{i=1}^{n} 1}}$	basin in Poland using	
	BOD,		0	The reat of the	$\sqrt{\frac{2}{1}} = 1 \frac{x_i^2}{x_i^2}$	WQI and comparing the	
Dojlido Index [101]	ammonia, COD, Cl, DO, dissolved oxygen, BOD, SS, phosphates	0–25	Unsuitable	square harmonic mean	where n is the number of indices taken into account, and x <sub>i</sub> is the unit index of parameter i.	f results of water analysis with permissible values of parameters given for three classes, according to the Disposition of Minister of Environment.	
	8 parameters:	Phase 1	Suitability			WOI has been used for	
Contact Recreation Index (NZ Recreation Index) [114]	FC, color, dissolved inorganic nitrogen, dissolved reactive phosphorus, five-day BOD, pH, turbidity, and visual clarity	Phase 2	Unsuitabilit y	Minimum operator, It was done graphically with phases	$WQI = \prod_{i=1}^{n} W_i Q_i$ where Qi is the rating value of the parameter and Wi is the weighting factors.	contact recreation in freshwaters in New Zealand. Ideally, indicators of recreational water quality are microorganisms or chemical compounds that can be quantitatively associated with swimming and health hazards.	
	8 parameters:	100–75	Excellent	_		Hallock (2002) gave	
	DO, FC, pH, T,	74–50	Good	_	[WQI	information about the	
	total nitrogen,	49–25	Fair	_	$= a + b_1(paramter)$	creation of a WOI for the	
Hallock [83]	total phosphorus, turbidity, and total suspended sediments	25–0	Unsuitable	Additive	+ $b_2(parameter)^2$ ] where a is the subindices and $b_1$ - $b_2$ is the weights of parameters.	Freshwater monitoring unit of the Washington State Department of Ecology based partly on the NSF Index.	
		91–100	Excellent		ſ		
	•	76–90	Good	-	WOI		
	·	51-75	Fair	-			
	•	26-50	Marginal	-	L /		
Hanh Water Quality Index (Hanh's WQI) [119]	11 Parameters: ammonium nitrogen, COD, BOD, DO, orthophosphate , total coliform (TC), SS, T, turbidity, and toxicity	1–25	Poor	Parameters are directly taken as sub-indices using the permissible limits of water standards, Additive, and multiplicative functions	$= \left(1\right)^{n}$ $/5 \prod_{i=1}^{n} C_{i} \left[\sum_{i=1}^{5} Q_{i} 1\right]^{1/3}$ $/2 \sum_{j=1}^{2} Q_{j} \times Q_{k} \right]^{1/3}$ where C <sub>i</sub> is the coefficients addressing the sub-indexes, Q <sub>i</sub> , Q <sub>j</sub> , Q <sub>k</sub> is the sub-indices of organic and nutrients, particulates, and bacteria, respectively	Hanh (Hanh et al., 2011) proposed a method to investigate spatial and temporal variation in surface water quality in Vietnam and also applied to toxic substances that led to water pollution, in particular for organic and nutrients, particulates, and bacteria, respectively.	

	9 parameters:	40	Good		WOI	
	FC, pH, BOD,	20-40	Average	_		WQI has been applied for
Kaurish Index [115]	total nitrates, total solids, T, turbidity, conductivity, and phosphates	0–20	Poor	Additive	<ul> <li>= (P<sub>1</sub> × P<sub>2</sub> × P<sub>3</sub> P<sub>N</sub>)<sup>n</sup> where P is the water quality parameters and (1,2,3, N is the number of ith parameters).</li> </ul>	the determination of surface water quality of the City of Greensboro, Mecklenburg County.
		>7.9	Good			
		7.9–3.4	Average	_	WQI	Schiff and Benoit have
Schiff Index [116	7 parameters: TDS, SS, FC, nitrate, phosphate, chloride, and sulfate	<3.4	Poor	Modified additive	$= 10 - \left(\frac{10}{7}\right)$ $\times \sum_{i=1}^{n} \left(\frac{P_i}{P_{max}}\right)$ Where $P_i$ is the average of the ith parameter, and $P_{max}$ is the highest value of the parameter	described the use of WQI modified in a study of the watershed near New Haven, Connecticut, to indicate the levels of urban-derived non-point source (NPS) pollution.
River Status Index or Lius Index [11]	13 Parameters: DO, BOD, ammonia nitrogen, FC, turbidity, SS, T, Cd, Pb, Cr, Cu, Zn. Scaling only for DO because every parameter has	6.5	Good	Parameters are directly taken as sub-indices using the permissible limits of water standards. Used additive and multiplicative functions	$\begin{bmatrix} TWQI \\ = C_T C_{pH} C_{tox} \left[ \left( \sum_{i=1}^{3} I_i W_i \right) \right] \\ \times \left( \sum_{j=1}^{2} I_j W_j \right) \\ \times \left( \sum_{k=1}^{1} I_k \right) \end{bmatrix}^{1/3} \\ where Ii denotes the subindex values for the "organics" Ij represents the subindex values for the subindex values for the "particulates" Ik is the measurement of fecal coliform.$	A better overall index of water quality in Taiwan and its application in the Keya River is proposed by analyzing the behavior and limitations of traditional methods for quality assessment. Numeric quality scales are developed for each parameter to measure improvements in quality
	a different rank	4.5–6.5	Low pollute d			and to communicate results to others comprehensively.
		2.0–4.5	ate pollute d			
	-	2	Gross pollute d			
	5 parameters: DO, FC.	3	Very good WQ	I		The new index was applied to the Big Lost
Said [64]	turbidity, specific	3–2	$\frac{O}{Accept} = \log \frac{O}{Accept}$	$g\left[\frac{1}{(3.8)^{\text{TP}}(15)^{\text{FC/10}}}\right]$	$(DO)^{1.5}$ $(DO)^{0.00}(Turb)^{0.15} + 0.14(SC)^{0.5}$	River Watershed in Idaho, and the results

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conductivity,		where this is a specific linear function, DO is	gave a quantitative
and total	2.0	margi dissolved oxygen, turb is turbidity, TP is the	picture of the water
phosphates	2–0	nal total phosphorus, FC is the fecal coliform, SC is	quality situation.
(TP)		the specific conductivity	

**Table 2.** shows the valuable information about four common steps to used in WQI development for overall reviewed, since the 1960s.

Indexing	Parameters	Range	Classificatio n	Sub-indices and weights	Equation	Purpose and region of application
		<100	Excellent			WQI was used
		100-150	Good	A rating scale		by Horton for the
		150-250	Poor	of Horton	$[W_1S_1 + W_2S_2 \dots W_nS_n]$	weightings and
Horton Water Quality Index (HWQI) [8]	8 Parameters: Alkalinity, DO, pH, EC, T, Cl-, alkalinity, coliforms	>250	Unsuitable	and unequal weights (1 to 4) and arith- metic weighted mean func- tion	$= \frac{1}{W_1 + W_2 + W_2} + \frac{1}{W_1 + W_2} + \frac{1}{W_1} + \frac{1}{W_2} + \frac{1}{W_1} + \frac{1}{W_1$	the scales of rating measures in order to determine the relative significance in the water quality of each parameter.
	11 Parameters	0–25	Excellent	_		In 1970 the
National	T rol EC DO	26–50	Good	- Cub indices	n	Brown's group
Sanitation	1, pn, rC, DO,	51–75	Poor	- Sub-Indices	NSEWOI – $\sum_{n=1}^{n} W \times 0$	also established a
Foundation	NO <sup>2</sup> BOD	76–100	Very poor	- useu Standard	$V_{i} = \sum_{i=1}^{N} W_{i} \times Q_{i}$	new WQI similar
Water Quality Index (NSFWQI) [9]	NO3 <sup>-</sup> , BOD, - total phosphates, pesticides, toxic metal	> 100	Unsuitable	<ul> <li>Standard, Sum of weight is 1 and additive</li> </ul>	where Q <sub>i</sub> is the sub-index of it parameter, W <sub>i</sub> is the weight associated with ith parameters	to Horton's index dependent on weights to the individual
		00 100	<b>F</b> 11 (			parameter.
	-	90-100	Excellent	-		The OWQI is a
	-	85-89	Good	-		single number
		80-85	Fair			that represents
		60–79	Poor			water quality,
Oregon Water Quality Index (OWQI) [15]	8 Parameters: DO, pH, FC, BOD, total phosphorus, NO3 <sup>-</sup> + ammonia, T	0–59	Unsuitable	Sub-indices used Standard, Sum of weight is 1 and additive (1st version)	$OWQI = \sqrt{\frac{n}{\sum_{i=1}^{n} \frac{1}{SI^{2}}}}$ where n = subindices number, SI = subindex of ith parameter.	taking into consideration 8 water quality parameters. The original OWQI was developed according to the NSFWQI in which the parameter selection was carried out by the Delphi method.
	26 Parameters:	91–100	Excellent	Sub-indices		The Bascarón
Bascarón Wa-	pH, BOD, TC,	61–90	Good	used	$BWOI = \frac{\sum P_i \times C_i}{\sum P_i \times C_i}$	index is designed
ter Quality In-	color, SO <sub>4</sub> , oil	31–60	Fair	Standard,	$\sum P_i$	specifically for
dex (BWOI)	and grease,	16–30	Poor	Sum of	where C <sub>i</sub> is the sub-index value	Spain by
[90]	NO <sub>3</sub> , Cl, EC,			weight is 1	and Pi is the relative weight of	Bascarón (1979).
L- ~ J	Mg, P, NO2, turbidity, Ca,	0–15	Very poor	and modified additive	each parameter.	This index has been included in

VedPrakashi

Water Quality DO, FC, pH,

4 parameters:

64–100

50–63

	permanganate,					many reports, in
	and apparent					particular in
	aspect					Latin America,
						India, and New
						Zealand.
	-	90–100	Excellent	<u>.</u>		In 1976 that
	-	80–89	Good			general WQI was
	-	70–79	Fair	-		developed and
	_	40–69	Tolerable			improved by the
	_	30–39	Low polluted	<u>.</u>		Scottish Research
Scottish	10 Parameters:	20–29	Polluted	Sub-indices	$1 \sum_{n=1}^{n} $	Department
Research	DO, BOD, TO,			used	$SWQI = \frac{100}{100} \sum (W_i \times Q_i)^2$	(SRDD) Index,
Development	N, P, SS, T, EC,			Standard,	i=1	which was
Department	ecsheria coli,			Sum of	meremeter W is the weight	designed by the
(SRDD) [10]	free and saline			weight is 1	parameter, with the werght	SRDD
(01(2)2)[10]	ammonia	0_19	Piggery	and additive	associated with full parameters	Development
		0-17	waste			Division based
						on the phases
						comparable to
						those in the NSF
						WQI.
	_	90–100	Excellent	-		Bhargava
	_	65–89	Good	<u>.</u>		approach has
	4 four various groups: heavy	35–64	Acceptable	Sub-indices	- n - <u>1</u>	been used in
		11–34	Polluted		$\mathbf{D}$	several nations
	metals,			used	$BMWQI = \left[ \prod_{i} \prod_{j} (P_i) \right] \times 100$	and it is simple
Bhargava	coliform			Standard,	where fi (Pi) for each variable	to use the curves
Method Water	organisms,			Sum of	the sensitivity function, such as	of sensitivity
Quality Index	physical			weight is 1	the impact of the associated	functions that
(BMWQI) [16]	parameters,	0 10	Severe water	and modified	variable weight concentration	have a value of
	organic and	0-10	quality	multiplicativ	of the activity $(0-1)$ and n the	between zeros to
	inorganic			e	number of variables.	one to manage
	parameters					relative
						parameters for
						different use.
	_	81–100	Excellent			The MWQI is the
	_	60–80	Low polluted	_		WQI calculation
						method
						developed by the
	6 paramotors:			Sub-indices	$MWQI = 0.22 SI_{DO} + 0.19 SI_{BOD}$	Department of
Malaysia Water Quality Index (MWQI) [17]				used	$+ 0.16 \text{ SI}_{\text{COD}}$	Environment
				Standard,	$+ 0.15 \text{ SI}_{AN}$	Malaysia. This
	со <i>D</i> , 55, рп,	0.50	Dellar 1	Sum of	+ 0.16 SI <sub>SS</sub>	method has been
		0-59	Polluted	weight is 1	$+ 0.12SI_{pH}$	successfully
	nitrogen (AN)			and additive	Where SI is the sub-index	applied to
						measure water
						quality for 462
						rivers in
						Malaysia.

No polluted Sub-indices

used

Low polluted

n

GWQI =

 $\sum W_i \times l_i$ 

The GWQI index

has been

Index (VedPrakashi's	BOD	38–49	Medium polluted	Standard, Sum of	where Wis the unit weight of the ith parameter, and lis the	developed to assess the overall
index) [7]		37–0	High polluted	weight is 1 and additive	sub-index function of the ith parameter.	water quality profile of the Ganga River. It was based on the NSFWQI and also had a weighted multiplication type with minor variations in weights, which indicated that the water quality standards were complied with for various categories of uses provided by the Central Water Pollution Board, India
	12 parameters:	0–40	Not			Dinius is a
	T NO <sup>2</sup> pH	40.50	Doubtful	Sub-indices		WOI method that
	hardnoss	50.80	Treatmont	Jused	n	is used for six
	color	50-60	Minor		$DWQI = \sum_{i} W_i \times l_i$	water categories
Dinius Water	alkalinity	80–90	nurification	Sum of	$\overline{i=1}$	usage such as
Quality Index	coliform form.		pumication	weight is 1	the ith parameter and his the	drinking water
(DWQI) [109]	specific			and	sub-index function of the ith	supply,
	conductivity,		Not	multiplicativ	narameter	domestic, fish,
	and	90–100	purification	e means	parameter.	shellfish,
I	Escherichia coli		1			agriculture, and
	count					industry.
		87.5–100	Clean			A water quality
	-	70-87.5	Good	_		index was
	-	54–70	Marginal	_		developed for
	-	37.5–54	pollution	_		integrating the
						combined impact
	9 Parameters,			Sub-indices	$\sum_{n=1}^{n} \sum_{i=1}^{n} \sum_{j=1}^{n} \sum_{i=1}^{n} \sum_{i=1}^{n} \sum_{i=1}^{n} \sum_{i$	of various
Anzali Water	COD, DO,			Used Standard	$AWQI = \sum_{i=1}^{N} W_i \times Q_i$	physical,
Quality Index	animonia,			Sum of	where Q <sub>i</sub> is the sub-index of the	biological
(AWQI) [110]	nhosnhate nH		Uich	woight is 1	ith parameter, Wi is the weight	narameters
1	T. TSS. and EC	>37.5	nollution	and additive	associated with ith parameters.	studied at 18
	_, 100, and 10		Pollution			different
						locations in the
						area and some
						watercourses
						within the basin

						during the past
						five years by the
						Bureau of
						Reclamation of
						Anzali Wetland.
		100-80	Excellent	_		Fuzzy Logic (FL)
		80–60	Good			has helped
		60–40	Moderate			researchers to
		40–20	Poor			induce user
						information and
						experience to
						address the
						complexity and
						ambiguity
						involved in
					$f(\mathbf{x}; \mathbf{z}, \mathbf{b}, \mathbf{c}, \mathbf{d})$	evaluating
						natural systems
					$= \max\left(\min\left(\frac{a-x}{a}, 1, \frac{a-x}{a}\right), 0\right)$	ever since its
					(a-b d-c)	introduction by
Fuzzy-based					$FWQI = \frac{\int d\mu(z) ddz}{\int \mu(z) z dz}$	Zadeh. Fuzzy
water quality				Using fuzzy logic	where FWQI is the fuzzy-based water quality index value	Logic maps input
index (Fuzzy	No guidelines					' to output using
Index) [102]		0–20	Unacceptable	0	(between 0 and 100) and a b c	the Fuzzy
					and d are membership function	' Inferencing
					parameters and z is the	System (FIS)
					independent variable of the	which combines
					output fuzzy set in each rule.	FL and
					, i i i i i i i i i i i i i i i i i i i	knowledge of
						experts through
						four main
						components,
						fuggification
						fuzzification,
						informed
						interence,
						defuzzification
		100-80	Extreme			Smith developed
		80-60	Good			an index for four
		60-40	suitable			purposes of
		40_20	Unsuitable	Sub-indices		water such as
		40-20	Olisultable	used	[T	fish spawning.
Smith's Water	7 Parameters:			Standard,		water supply.
Ouality Index	SS, turbidity,			Sum of	$= \sum \min(I_{sub1}, I_{sub2}, \dots \dots I_{subn})$	general. and
(SWOI) [69]	do, t, bod,			weight is 1	where Imin equals the lowest	bathing. The
(	FC, ammonia	20-0	Total	and	value of the subindex.	development of
		20 0	unsuitable	minimum		this index was
				operator		related to the
						recommendation
						of the water

						quality standards for New Zealand water legislation
	14 parameters:	<26	Excellent	Sub-indices		Tiwari and
	pH, EC, TDS,	26-50	Good	_ used	-	Mishra have
	TH, Ca, Mg,	51-75	Medium	Standard,	$TMWQI = Antilog \sum W_n logq_n$	been proposed a
Tiwari and	Na, K, Cl, F,	76-100	Poor	Sum of	where $q_n$ is the quality class	logarithmic WQI
Mishra WQI	nitrates,			weight is 1,	for the nth variable, and $W_n$ is	method for the
(11/1//QI)[108]	carbonates,	> 100	T.T.,	and	the relative weight of the nth	assessment of the
	bicarbonates,	>100	Unsuitable	logarithmic	parameters.	quality of major
	sulfates			aggregations	i	Indian rivers.
	-	0–50	Unsuitable	_		Wepener
	-	51–59	Fair	_		developed the ATWQI to
						evaluate the
						health of aquatic
						ecosystems.
A	12 Parameters:			Sub-indices	$1 \left(1\sum^{n}\right)^{2}$	Because a wide
Aquatic	DO, pH,			used	$ATWQI = \frac{100}{100} \left( \frac{1}{n} \sum_{i=1}^{n} q_i \right)$	range of fish
Ouality Index	E. Zn Mn Cr		Suitable	Sum of	where $a_i$ is the quality of the ith	toxicity
(ATWOI) [112]	Cu Ph Ni and	60–100		weight is 1	parameter.	available the
(1111) (112)	potassium			and additive	1	toxic health
						indicators of the
						aquatic
						ecosystem are
						the impacts of
						distinct water
						quality on fish.
	-	91–100	Excellent	_		The Simplified is
	-	71–91	Good	_		used by the
	-	51-70	Medium	_	$CAWQI = SI_{temp}(SI_{TOC} + SI_{SS} + SI_{DO} + SI_{EC})$	water agency in
	-	26–50	Poor	- Sub-indices		Catalan. This is
Catalan Water	5 Parameters			used	ith parameters, temp, TOC, SS	correlation
Agency Water	T. DO. TOC.			Standard,	DO, and EC are the	between DO.
Quality Index	SS, EC			Sum of	temperature, total organic	TOC, SS, and EC
(CAWQI) [117]		0–25	Very poor	weight is 1	carbon, suspended solids,	with a weight
			5 1	and additive	dissolved solids, and electric	vector of 0.30,
					conductivity, respectively.	0.25, 0.25, and
						0.20,
						respectively.
	12 Parameters: -	95–100	Excellent	_	n	Under the water
	Cd, cyanide,	75–94	Good	- Sub-indices	$UWQI = \sum W_i \times l_i$	quality standards
Universal	Hg, Selenium, -	50-74	Fair	– used	$\sum_{i=1}^{n} m_i \times n_i$	defined by the
Water Quality	As, F,	26–49	Marginal	– Standard,	where <i>Wi</i> is the weight for the	European
Index (UWQI)	Nitrate-N, DO,			Sum of	ith parameter and <i>li</i> is the	Communities
[116]	BOD, T	0 - 25	Poor	weight is 1	sub-index for the lth	the Turkish
	phosphorus,		1 001	and additive	Parameter.	water pollution
	pH, and TC					control

						regulations and
						other scientific
						details, UWQI
						was developed
						by Boyacioglu.
		0–25	Excellent			The WA-WQI
	-	25-50	Good	-		method
Weighted	-	51–75	Poor	Sub-indices		categorized the
Arithmetic		75–100	Very Poor	used	$\sum_{i=1}^{n} l_i W_i$	quality of water
Water Quality	2 parameters:		5	Standard,	$AW - WQI = \frac{1}{\sum_{i=1}^{n} W_i}$	as per purity
Index Method	pH, DO main			Sum of	Where li is the quality rating,	using the most
(AW-WQI)		>100	Unquitable	weight is 1	Wi is the unit weight.	frequently
[104]		>100	Unsuitable	and additive		calculated
						variables of
						water quality.
		71–100	Good	_		WQI has been
	9 parameters:	51–70	Fair	_		applied to all the
	DO, ammonia.	31–50	Marginal	_	$1\left(\sum^{n}\right)^{2}$	data for an
	pH, BOD, Cl,				$WQI = \frac{1}{100} \left( \sum Q_i W_i \right)$	annual or longer
House Index	total coliform,			Additive	$\frac{1}{1}$	time series as a
[89]	total				Wi is the unit weight and n is	means of
	phosphorus,	10–30	unsuitable		the number of parameters	detecting cycles
	nitrates, and T				the number of parameters.	and trends in
						river water
		75 100	Encellent			quality
	-	75-100	Excellent	-		Four separate
	-	25 40	Good	-		hoop used in the
	9 parameters:	25-49	Poor	-		water quality
	BOD DO			Sub-indicos		assessment of
	corrosion			used		Dalmatia waters
Dalmatian	coefficient			Standard	$WOI = \frac{WQE}{WQE}$	in southern
Water Quality	mineralization.			Sum of	WQE <sub>MAC</sub>	Croatia: an
Index	protein N. T.			weight is 1	where WQE is the water	arithmetic index.
(Dalmatian	total coliform.	0–24	Unsuitable	and	quality evaluation, MAC is the	arithmetic
Index) [60]	total nitrate,	0 =1	Chistilitatie	multiplicativ	maximum admissible limit.	modified index,
	and total			e		geometric
	phosphorus					modified index,
						and
						Solway-modified
						index.
	9 parameters:	75–100	Excellent	_		The sim of this
	COD, FC,	50-74	Good			method was to
	detergents,	25–49	Poor	Sub-indices	<b>T</b> n	astablished a
Almeida Water	nitrates,			used	RWQI = $[Q_i^{W_i}]$	new RWOI as a
Quality Index	Escherichia			Standard,	Where Oi is the rating value of	tool to ensure the
(Almeida's	coli,			Sum of	parameter i and Wi are the	health of
Index) [96]	enterococci,	0–24	Unsuitable	weight is 1	weighting factors ( $\Sigma W = 1$ ).	swimmers and to
	nitrates,			and additive		make practical
	phosphate, pH,					decisions.
	and total					

$ \begin{array}{c c c c c c c c c c c c c c c c c c c $							
No parameter $\frac{91-100}{17-0}$ $\frac{15-90}{18-0}$ $15-90$		coliform					
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $		No parameter	91–100	Excellent	Sub-indices used		The latest index is proposed by Harkin's, based on the nonparametric <sup>i</sup> ranking method of Kendall's multivariate.
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		guidelines: any	71–90	Good			
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		number of	51–70	Medium		$\sum_{n}^{n} (R_{in} - R_{ic})^2$	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		parameters	26–50	Bad	Standard,	WQI = $\sum_{i=1}^{\infty} \frac{var_i}{var_i}$ where R <sub>in</sub> is the rank of ith	
Harkins Index Harkins Index Harki		may be used to compute the	0–25		Sum of weight is 1		
$ \begin{bmatrix} 105 \end{bmatrix} & depending \\ up on the intended \\ ultimate use and or \\ objective of the \\ evaluation \\ \hline 12 parameters \\ evaluation \\ \hline 13 parameters \\ COD, DO, \\ BOD, Fe, Mn, \\ COD, DO, \\ BOD, Fe, Mn, \\ COD, DO, \\ contract contract \\ contract contract \\ c$	Harkins Index	WQI value		Very bad	and	compared values of the	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	[105]	depending			Statistical	parameter R <sub>ic</sub> is the control value of the ith parameter, var <sub>i</sub> is the rank variance of ith parameter.	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $		upon the			procedures through Multivariate		
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $		intended					
and or objective of the evaluationKendall's statisticand or objective of the evaluationStatistic13 parameters:0-1Excellent ammonia, 1-2Acceptable Sub-indices usedCOD, DO, DOD, 2-4Low polluted Sub-indices usedPrati Index [68]In parameters:In parameters:9-10Excellent Sub-indices usedIn parameters:95-100Excellent 55-94Good the targinal curvesWQI = $\prod_{i=1}^{n} q_i w_i$ where $q_i$ is the quality rating, wis is the unit weight, and n is the number of parameters.95-100Excellent 57-94Good 26-49Sub-indices with rating curvesRoss Water Quality Index (Ross WQI) [106]4 parameters: $\frac{95-100}{26-49}$ Sub-indices usedRoss Water (106)4 parameters: $\frac{95-100}{26-49}$ Sub-indices usedRoss Water [106]4 parameters: $\frac{95-100}{26-49}$ Sub-indices usedRoss Water [106]4 parameters: $\frac{95-100}{26-49}$ Sub-indices usedRoss Water [106]13 parameters $\frac{80-91}{26-49}$ Sub-indices usedStoner Index [70]momonia $\frac{55-58}{26-54}$ Poor Very poorStoner Index [70]substance [		ultimate use					
objective of the evaluationstatistic13 parameters: ammonia, COD, DO, nitrates, pH,0-1Excellent ammonia, 2-4Low pollutedPrati Index [68]Sb, alkylbenzene sulfonates, chlorine, carbon chloroform4-8PollutedSub-indices used Standard, yollutedWQI = $\prod_{i=1}^{n} q_i v_i$ where $q_i$ is the quality rating, wit is the unit weight, and n is the number of parameters.In particular, because of the use as a source of urban waterRoss Water Quality Index (Ross WQI) [106]4 parameters: 26-4950-500Excellent 75-94Sub-indices weight is 1 and additiveSub-indices with rating curvesWQI = $\sum_{i=1}^{n} W_i \times Q_i$ ith parameter, Wi is the weight associated with ith parameters.WQI as been experiseRoss Water Quality Index (Ross WQI) [106]4 parameters: 50-5450-51Excellent 72-79Sub-indices opinion, AdditiveWQI = $\sum_{i=1}^{n} W_i \times Q_i$ where Qi is the sub-index of the determination of water of surface water.13 parameters (for water [70]13 parameters supply): CL, color, Cu, substance [MBAS], sulfate, Zn, pH, phenols, Fe, and titrate-nitrogeSub-indices sued sustanceWQI (A) = $\sum_{i=1}^{n} (QF)_i(RF)_i$ the value of jith type parameters.WQI was developed to where WQI (A) is the WQI for two specific uses and additive13 parameters substance50-54Very poor suffate, Zn, pH, phenols, Fe, and50-54Very poor suffate, Zn, pH, phenols, Fe, andSub-indices such as public to sub andard, <b< td=""><td></td><td>and or</td><td>Kendall's</td></b<>		and or			Kendall's		
evaluation13 parameters: ammonia (COD, DO, BOD, Fe, Mn, nitrates, pH, elastylbenzene sulfonates, chloriof (hloroform0-1Excellent acceptable used standard, Sum of weight is 1 and additiveIn particular, because of the use as a source of urban waterPrati Index [68]85 S5, alkylbenzene sulfonates, chloriof chloroform8Polluted standard, Sum of weight is 1 and additiveSub-indices used standard, Sum of weight is 1 and additiveWQI = $\prod_{i=1}^{n} q_i w_i$ where $q_i$ is the quality rating, where $q_i$ is the unit weight, and n is the number of parameters.Ross Water Quality Index (Ross WQI) [106]4 parameters: $\frac{75-94}$ Sub-indices Good $\frac{50-74}$ Sub-indices with rating curvesWQI = $\prod_{i=1}^{n} w_i \times q_i$ water Quality index water.WQI has been estated for the number of parameters.Ross Water Quality Index (Ross WQI) [106]4 parameters: $\frac{50-74}$ Sub-indices (Good $\frac{50-74}$ Sub-indices with rating curvesWQI = $\sum_{i=1}^{n} W_i \times Q_i$ water QU (A) is the weight water.WQI has been estated with ith parameters.13 parameters (for water (for water (for water substance [70]Sub-indices substance methylene attice introge, F, FC, and nitrate-nitrogeSub-indices sue ad substanceWQI = $\sum_{i=1}^{n} (QF)_i(RF)_1$ where WQI (A) is the WQI for wise the number of parameters.10BOD and SS50-54 substanceSub-indices sue additiveWQI = $\sum_{i=1}^{n} T_i$ 11Substance (MBAS], su		objective of the			statistic		
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $		evaluation					
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $		13 parameters:	0–1	Excellent	_		In particular,
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $		ammonia,	1–2	Acceptable	_		because of the use as a source of urban water supply, Prati et
$ \begin{array}{c} BOD, Fe, Mn, \\ nitrates, pH, \\ sulfonates, \\ chromotes, \\ ch$		COD, DO,	2–4	Low polluted	<u>.</u>		
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $		BOD, Fe, Mn,	4–8	Polluted	Sub-indices	<b>Tn</b>	
Prati Index [68]SS, alkylbenzene sulfonates, chlorine, carbon chloroformSS, alkylbenzene sulfonates, chlorine, carbon 		nitrates, pH,			used	$WQI = \prod_{i} q_i^{w_i}$	
$ \begin{array}{c} \text{Number [of ]} \\ \text{alkylbenzene} \\ \text{sulfonates,} \\ \text{chlorine,} \\ \text{carbon} \\ \text{chloroform} \\ \text{extract} \\ \hline \\ \text{Carbon} \\ \text{chloroform} \\ \text{extract} \\ \hline \\ \text{Ross Water} \\ \text{Quality Index} \\ \text{(Ross WQI)} \\ [106] \\ [106] \\ [106] \\ \hline \\ \text{BOD and SS} \\ \hline \\ \text{More attract} \\ \hline \\ \begin{array}{c} \frac{95-100}{50-74} \\ \frac{50-74}{Fair} \\ \frac{26-49}{Good} \\ \frac{50-74}{Fair} \\ \frac{26-49}{Good} \\ \frac{50-74}{Fair} \\ \frac{26-49}{Good} \\ \frac{50-74}{Carbon} \\ \frac{26-49}{Carbon} \\ \frac{27-79}{Cood} \\ \frac{27-79}{Cood} \\ \frac{27-79}{Cood} \\ \frac{27-79}{Cood} \\ \frac{27-79}{Carbon} \\ 27-79$	Prati Index [68]	SS,			Standard, Sum of weight is 1 and additive	where q <sub>i</sub> is the quality rating, wi is the unit weight, and n is the number of parameters.	al. evaluated the
sulfonates, chornicel, set chlorine, chornicel, and biological parameters. Chornicel, and biological parameters. Chornicel, and biological parameters of natural water resources. Ross Water Quality Index ammonia nitrogen, DO, [106] BOD and SS 0-25 Poor 13 parameters. Stoner Index [70] Stoner Index [70] Substance [MBAS], sulfate, Zn, pH, phenols, Fe, and nitrate-nitroge [70] Stoner Index [70] Substance [MBAS], sulfate, Zn, pH, phenols, Fe, and nitrate-nitroge [70] Stoner Index [70] Stoner Index [70] Stoner Index [70] Substance [MBAS], sulfate, Zn, pH, phenols, Fe, and nitrate-nitroge [70] Stoner Index [70] Stoner Index [70] Substance [MBAS], sulfate, Zn, pH, phenols, Fe, and nitrate-nitroge [70] Stoner Index [70] Stoner Index [70] Substance [70] Substance [70] Substance [70] Substance [70] Substance [70] Substance [70] Sub-indices and additive attrace [70] Substance [70	11441 11460 [00]	' alkylbenzene					physical,
chlorine, carbon chloroform extract parameters of natural water resources. Ross Water 4 parameters: ammonia nitrogen, DO, [106] BOD and SS (0-25 Poor 106] Poor 26-49 Marginal 26-49 Marginal 26-49 Marginal 25-58 Poor 25 P		sulfonates,	>8	Heavy polluted			chemical, and
$\begin{array}{c} \mbox{carbon} \\ \mbox{chloroform} \\ \mbox{extract} \\ \mbox{extract} \\ \mbox{Ross Water} \\ \mbox{Quality Index} \\ \mbox{(Ross WQI)} \\ \mbox{[106]} \\ \mbox{BOD and SS} \\ \mbox{Mol} \\ \mbox{[106]} \\ \mbox{BOD and SS} \\ \mbox{BOD and SS} \\ \mbox{BOD and SS} \\ \mbox{Introgen, DO, } \\ \mbox{BOD and SS} \\ \mbox{Introgen, PO, } \\ \mbox{BOD and SS} \\ \mbox{Introgen, PI, FC, } \\ \mbox{Stoner Index} \\ \mbox{[70]} \\ \mbox{Storage and } \\ \mbox{Ross WQI} \\ \mbox{Introgen, F, FC, } \\ \mbox{Introde active blue } \\ \mbox{Substance} \\ \mbox{Introde and Additive} \\ \mbox{Intrade active blue } \\ \mbox{Substance} \\ \mbox{Intrade and } \\ \mbox{Substance} \\ \mbox{Intrade and } \\ \mbox{Substance} \\ \mbox{Intrade active blue } \\ \mbox{Introde active blue } \\ \mbox{Intrade active blue } $		chlorine,	. 0				biological
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		carbon					parameters of
extractresources.resources.Ross Water Quality Index (Ross WQI) $4$ parameters: $\frac{95-100}{75-94}$ Good $50-74$ Fair $26-49$ Marginal $26-49$ Marginal $30-25$ PoorSub-indices opinion, AdditiveWQI = $\sum_{i=1}^{n} W_i \times Q_i$ ith parameter, $W_i$ is the weight associated with ith parameters. Water of surface water.Image: Water of surface expert's opinion, AdditiveImage: Water of surface expert's 		chloroform					natural water
Ross Water Quality Index (Ross WQI)4 parameters: ammonia nitrogen, DO, BOD and SS $\overline{75-94}$ Good $\overline{26-49}$ Good Fair Curveswith rating curvesWQI = $\sum_{i=1}^{n} W_i \times Q_i$ is the sub-induces of the developed by where Q_i is the sub-index of the expert's opinion, AdditiveWQI has been established for the determination of water of surface water.106]BOD and SS $0-25$ Pooropinion, Additive $WQI = \sum_{i=1}^{n} W_i \times Q_i$ He established for the determination of water of surface water.106]BOD and SS $0-25$ Pooropinion, Additive $WQI = \sum_{i=1}^{n} W_i \times Q_i$ WQI has been established for the determination of water of surface water.13 parameters (for water color, Cu, attive blue [70] $80-91$ Excellent $72-79$ $Good$ $WQI = \sum_{i=1}^{n} (QF)_i (RF)_i$ WQI was developed to assess waters for two specific uses specific use A, n is the number of parameters, $(QF)_i$ is the and additive aggregationWQI (A) is the WQI for specific use A, n is the number of parameters, $(QF)_i$ is the type of quality function, $(RF)_i$ is the ranking factor and $T_j$ is the value of jth type parameters.WQI = $\sum_{i=1}^{n} W_i \times Q_i$ STORET index was developed107nitrate-nitroge0GoodHaving three sub-indicesWQI = $\sum_{i=1}^{n} W_i \times Q_i$ STORET index was developed		extract	05 100	E 11 (			resources.
Ross Water Quality Index (Ross WQI)4 parameters: ammonia $\frac{75-94}{50-74}$ Good Fair Curveswith rating curves $WQI = \sum_{i=1}^{n} W_i \times Q_i$ ith parameter, $W_i$ is the sub-index of the determination of water of surface water.[106]BOD and SS BOD and SS $0-25$ Poor $0-25$ Poor $0-25$ Poor $0-25$ <		4 parameters: - ammonia -	95-100	Excellent	with rating	$WQI = \sum_{i=1}^{n} W_i \times Q_i$ where Q <sub>i</sub> is the sub-index of the ith parameter, W <sub>i</sub> is the weight associated with ith parameters.	WQI has been
Quality Index (Ross WQI)ammonia nitrogen, DO, [106] $30-74$ rarFair rar curvescurves 	Ross Water		75-94	Good			established for
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Quality Index		30-74	Fair			the
$\begin{bmatrix} 106 \end{bmatrix} & BOD and SS & 0-25 & Poor & opinion, \\ Additive & associated with ith parameter, W_i is the weight & water of surface water. \\ \\ \hline Mathematical Mathem$	(Ross WQI)	nitrogen, DO, -	26-49	Marginai	evpert's		e determination of water of surface water.
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	[106]	BOD and SS	0–25	Poor	opinion		
13 parameters80-91Excellent(for water72-79Goodsupply): Cl,65-71Faircolor, Cu,59-64Marginalammonia55-58Poornitrogen, F, FC,methyleneactive bluesubstance[70](MBAS],sulfate, Zn, pH,50-54phenols, Fe,andandintrate-nitrogestorage andNo specified0GoodHatrige and0GoodHaving threeRetrieval oflist of(10)Low pollutedsubstance0substanceStorage andNNo specified0GoodHaving threeRetrieval ofUse of parametersNStorage andNo specifiedStorage andNo specified0GoodGoodHaving threeWQI = $\sum_{i=1}^{n} (W_i \times Q_i)$ Storage andNo specifiedStorage andNo specifiedN0Storage andNo specifiedN0 <td< td=""><td></td><td>Additive</td></td<>					Additive		
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		13 parameters	80–91	Excellent	-		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		(for water	72–79	Good			
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		supply): Cl,	65–71	Fair		$WQI(A) = \sum (QF)_I (RF)_I$	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		color, Cu,	59–64	Marginal		[ <u>i=1</u>	
Stoner Index [70]nitrogen, F, FC, methylene active blue substance [MBAS], sulfate, Zn, pH, 		ammonia	55–58	Poor	Sub-indices	$\sum_{n=1}^{n}$	WQI was
Stoner Index [70]methylene active blue substance [MBAS], sulfate, Zn, pH, phenols, Fe, and nitrate-nitrogeStandard, substance (MBAS], sulfate, Zn, pH, phenols, Fe, and nitrate-nitrogeStandard, sum of weight is 1 $j=1$ J sum of where WQI (A) is the WQI for specific use A, n is the number of parameters, $(QF)_I$ is the type of quality function, $(RF)_I$ is the ranking factor and $T_j$ is the value of jth parameters.such as public water supply and irrigation.Storage and Retrieval ofNo specified list of $0$ (-1)-(-10) Low polluted sub-indicesMaximum product stonageWQI = $\sum_{i=1}^{n} W_i \times Q_i$ STORET index was developed	Stoner Index [70]	nitrogen, F, FC,			used	$+\sum_{j=1}^{j} T_{j}$	developed to
$\begin{bmatrix} [70] \\ active blue \\ substance \\ [MBAS], \\ sulfate, Zn, pH, \\ phenols, Fe, \\ and \\ nitrate-nitroge \\ Retrieval of \\ Retrieval of \\ Betrieval of \\ \end{bmatrix} = \begin{bmatrix} active blue \\ substance \\ [MBAS], \\ 50-54 \\ Very poor \\ and additive \\ and additive \\ and additive \\ and additive \\ argregation \\ argregation \\ argregation \\ the value of jth type \\ parameters. \\ WQI = \sum_{i=1}^{n} W_i \times Q_i \\ WQI = \sum_{i=1}^{n} W_i \times Q_i \\ Water supply \\ substance \\ such as public \\ water supply \\ and irrigation. \\ STORET index \\ was developed \\ was developed \\ \end{bmatrix}$		methylene		Very poor	Standard, Sum of weight is 1 and additive aggregation	where WQI (A) is the WQI for t specific use A n is the number	assess waters for two specific uses
substance [MBAS], sulfate, Zn, pH, phenols, Fe, and nitrate-nitroge n Storage and Retrieval of list of $0$ $Cood$ $1$ $Very poor and T_{j} is the ranking factor and T_{j} is the ranking factor and T_{j} is the value of jth type parameters.NStorage and No specified 0 Cood Having three Retrieval of list of (-1)-(-10) Low polluted sub-indices WQI = \sum_{i=1}^{n} W_i \times Q_i STORET index was developed$		active blue					
$[MBAS], \\ sulfate, Zn, pH, \\ phenols, Fe, \\ and \\ nitrate-nitroge \\ Retrieval of \\ Retrieval of \\ [MBAS], \\ 50-54 \\ Very poor \\ 50-54 \\ Very poor \\ and \\ sub-indices \\ Very poor \\ aggregation \\ aggregation \\ is the ranking factor and T_j is the water supply and irrigation. \\ is the ranking factor and T_j is the value of jth type parameters. \\ No specified \\ (-1)-(-10) Low polluted sub-indices \\ WQI = \sum_{i=1}^{n} W_i \times Q_i \\ WQI = \sum_{i=1}^{n} W_i \times Q_i \\ Was developed$		substance	50–54			of parameters $(QE)$ is the	such as public
surface, Zn, pH, and irrigation type of quarty function, (Ar ) i and irrigation. phenols, Fe, is the ranking factor and $T_j$ is the value of jth type parameters. n Storage and No specified 0 Good Having three Retrieval of list of (-1)-(-10) Low polluted sub-indices $WQI = \sum_{i=1}^{n} W_i \times Q_i$ STORET index was developed		[MBAS],				type of quality function $(PF)$	water supply
$\begin{array}{c} \text{is the function and } r_{j} \text{ is the value of jth type} \\ \text{nitrate-nitroge} \\ \text{Storage and No specified} \\ \text{Retrieval of list of} \\ \hline (-1)-(-10) \text{ Low polluted sub-indices} \\ \hline WQI = \sum_{i=1}^{n} W_{i} \times Q_{i} \\ \hline Was developed \\ \hline W$		suitate, Zn, pH,				is the ranking factor and T. is	and irrigation.
$\frac{n}{1}$ $\frac{n}{1}$ $\frac{n}{1}$ $\frac{n}{1}$ $\frac{n}{1}$ $\frac{n}{1}$ $\frac{1}{1}$ $\frac{1}{1}$ $\frac{n}{1}$ $\frac{1}{1}$ $\frac{1}$		pnenois, Fe,				the value of ith type	
nStorage and Retrieval of0Good (-1)-(-10) Low polluted sub-indicesWQI = $\sum_{i=1}^{n} W_i \times Q_i$ STORET index was developed		anu				parameters	
Storage and No specified $0$ Good Having three Retrieval of list of $(-1)-(-10)$ Low polluted sub-indices $WQI = \sum_{i=1}^{n} W_i \times Q_i$ STORET index was developed		nuale-nitroge				Faranciers.	
Retrieval of list of $(-1)-(-10)$ Low polluted sub-indices $WQI = \sum W_i \times Q_i$ was developed	Storage and	II No specified	0	Cood	Having three	<u>n</u>	STOPET : day
$\mathbf{W}$	Retrieval of	list of	(_1)_(_10	U ow polluted	sub-indicee	$WQI = \sum W_i \times Q_i$	was developed

Water Quality	parameters,	(-11)-(-3	Highly	for physical,	where $Q_i$ is the sub-index of the	and has been
Data (STORET)	Parameters are	0)	polluted	chemical, and	ith parameter, Wi is the weight	used to assess
Index [107]	categorized			biological.	associated with ith parameters.	the status of sur-
	into 3 classes		Hona	Additive		face water bodies
	(physical,	≥(−30)	nelluted			in Indonesia.
	chemical, and		ponuted			
	biological)					
		1.0	Excellent			The geometric
		1.0-0.8	Good	_		mean of the
		0.5-0.8	Satisfactory	-		quality of each
		0.2-0.5	Poor	-		variable
				-		represented by a
			unacceptable	Sub-indices	5 N - 7 ( N - )	number (ranging
	10 parameters:			used	$WOI = \left  \prod_{i=1}^{n} \int_{a_i}^{a_i} (\mathbf{p}) \right  \times \left( \sum_{i=1}^{n} \right)$	from 0 to 1) took
	coliform count,			Standard,	$vvQi = \left  \prod_{i} \prod_{j} (P_i) \right  \times \left( \sum_{i} a_i \right)$	Walski & Parker
	color, grease,			Sum of	where $P_i$ is the value of the ith	(1974) to be
Walski and	nutrients,			weight is 1	parameter, $\int_{\cdot}^{a_i}(P_i)$ is the	named
Parker [104]	odour, pH, SS,			and,	sensitivity function for ith	"sensitivity
	T, toxicity, and	0.01-0.2		Modified	variable, at is the weight of	function". They
	turbidity			multiplicativ	parameters.	proposed
				e		different curves
						and formulas for
						the sensitivity
						functions of the
						measured
						concentrations.
		95–100	Excellent			WQI has been
	15 parameters: ammonia, Ca, Cl, EC, TH, Mg, Mn,	75–94	Good			developed for
		50-74	Fair	_		the Vaal Water
		26–49	Marginal	Sub-indices V used wher Standard, coefficie Sum of presen weight is 1 for the and additive the		Management
		0–25	Poor		$VWQI = \sum_{i=1}^{n} W_i l_i$ where W <sub>i</sub> is the weighted coefficient for the <i>ith</i> parameter presented, <i>Ii</i> s the sub-index for the <i>ith</i> parameter and n is the total number of parameters.	Area (VWMA) in
						South Africa,
Vaal Water	nitrate, pH,					which is founded
Quality Index	sulfate, total alkalinity, turbidity, chlorophyll 665, and orthophosphat e					on scope,
(Vaal WQI)						frequency and
[120]						amplitude of
						explanatory
						variables
						differing from
						the targeted
						values and/or
						guidelines.
Wanda Water Quality Index	7 parameters: pH, EC, BOD, FC, T,	0–25	Poor	Sub-indices used Standard,	$WQI = \frac{1}{100} \left( \sum_{i=1}^{n} q_i w_i \right)^2$	WQI has been
		26–50	Fair			used for the
		51–70	Average			investigationof
		71–90	Good			the water quality
(Wanda's	turbidity, and	91–94	Very good	Sum of	where q <sub>i</sub> is the quality rating,	index ratings of
Index) [121]	nutrients	95–100	Excellent	weight is 1	wi is the unit weight, and n is	water in the
Index) [121]	(nitrogen and phosphorus)			and modified the number of p	the number of parameters.	Mpumalanga
				additive		and North West
						provinces, South

						Africa.
	11 parameters: DO, BOD,	90–100	Excellent	Sub-indices used		A water quality
		80-89	Good			indices in the
Doiningor		60–79	Average		n	form established
Water Ouality	turbidity, TS,	26–59	Fair		$WQI = \sum_{i=1}^{N} W_i Q_i$	and defined here
Index	nitrates,			Standard,	where $O_i$ is the quality rating.	IS gaining
(Deininger	phosphates,	0-25		Sum of	Wi is the unit weight, and n is	significant
Index) [76]	рН, Т, FC,		Poor	weight is 1	the number of parameters.	acceptance in the
	pesticides and	0-25		and additive	1	United States
	toxic elements					and other
						countries.
	11 parameters:	0–19	Worst	Sub-indices		WQI has been
Medeiros	T pH, TDS,	20–36	Bad	used	$\prod^n$	used for the
Water Quality	TSS, DO, BOD,	37–51	Regular	Standard,	$WQI = \prod_{i=1}^{n} q_i^{w_i}$	investigationof
Index	thermotolerant,	52–79	Good	Sum of	where qi is the quality rating,	the water quality
(Medeiros	FC, total			weight is 1	wi is the unit weight, and n is	of the Murucupi
WQI) [122]	nitrogen, total	80-100	Excellent	and	the number of parameters.	River in the
	phosphorus,			multiplicativ		industrial areas
		<f0< td=""><td>Encollogat</td><td>e</td><td></td><td>Di Fara, Drazii.</td></f0<>	Encollogat	e		Di Fara, Drazii.
	12 parameters	<00	Excellent	-		Physical-chemica
	turbidity T	101 200	Boom	Sub indicos		i parameters to
García-Ávila	EC, pH, TDS, TH, Ca, Mg, alkalinity, Cl, nitrates, sulfates, phosphates	201 200	Poor Verre De er	Sub-indices	$WQI = \sum_{i=n} SI_{i-n}$ where SI <sub>i</sub> is the sub-indices, $SI_i = q_i w_i$	assess and
Water Quality		201-300	Very Poor	Standard		analyze the
Index		>300	Inappropriate	Sum of weight is 1 and additive		drinking water in
(García-Ávila						the city of
Index) [123]						Azogues using
						the water quality
						index (WQI).
	17 parameters: T, SS, COD, DO, nitrate, total phosphate, detergent, phenol, Cl, Zn, Pb, mercury, and FC	100-90	Excellent	-		WJWQI
		90–75	Good			developed to
		75–50	Fair		replace the	
		50–25	Marginal	-	$AI = \prod_{i=1}^{n} Si^{w_i}$ where AI is the aggregated index; n is the number of sub-indices; w <sub>i</sub> is ith weight and Si is the ith sub-index.	currently used
				-		indices in West
				Sub-indices used Standard, Sum of		Java, Indonesia.
West Java Water Quality Index (WIWOI)						The application
						of WJWQI for the
						province of West
[124]				weight is 1		Java has been
[124]		25–5	Poor	and		revealed using
				geometric		monitoring data
						from 2001 to 2011
						to spatially and
						temporally assess
						the general status
·		0= 400				of water quality.
<b>D</b> • • • • •	17 parameters:	95-100	Excellent	Sub-indices		The purpose of
Drinking-Wate r Quality Index (DWQI)[88]	pH, EC, Na, Cl,	85-95	Good	used	$DWQI = \prod Si^{W_i}$	this study is to
	sultate,	75-85	Fair	Standard,	Si is the ith sub-index. n is the	evaluate the
	alkalinity, $IH$ ,	60-75	Marginal	Sum of	number of sub-indices. wijs	quality of the
	Ca, wig, re, r,	40-60	Poor	weight is I	,	uniking water in

	nitrate, Mn,			and	ith weight factor of ith	and around
	Zn, Pb, Cr and	40–0	Very poor	Geometric	parameter.	Mayiladuthurai
	Cu					taluk using
						DWQI.
		91–100	Excellent	_		This research
	_	71–90	Good	$\begin{array}{c c} \hline Good \\ \hline Regular \\ \hline Bad \\ \hline \\ WWQI \\ \hline \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ $	ſ	aims to was
	23 parameters:	51-70	Regular		WWQI	established a
	Turbidity, TSS,	26–50	Bad			Wastewater
	EC, TDS, Ca, Mg, Na, SAR,				$\sum_{n=1}^{N} \left( \left( \prod_{i=1}^{n} \right) \right)$	Quality Index
Mastowator					$= \sum \left( \left( \left  (SI_i)^{W_i} \right  W_j \right) \right)$	(WWQI) to
wastewater	Cl, pH, BOD,				$\frac{1}{i=1} \left( \left( \frac{1}{i=1} \right)_{j} \right)$	determine the
water quality	COD, nitrate,				where Wj is the relative weight	quality of
	Phosphate,				of the jth group; N is the	effluents from
[57]	boron, Mn, Cd,	10-25	Very bad	function	number of groups; and SI <sub>i</sub> ,	the North
	Cr, Pb, Ni, Fe,	5	5		Wi,and n are the sub-index	Wastewater
	total coliform,			value of the ith parameter, the	Treatment Plant	
	and FC				relative weight of the ith	(WWTP) of
					parameter	Isfahan for
						agriculture.