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Water Quality Index of Fresh Water Streams Feeding Wular Lake in Kashmir Himalaya- India

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ABSTRACT- This study aimed to analyze the impact of water quality on living beings especially on aquatic life and those who use it for drinking purposes. The preliminary analysis of the data showed that water quality indexes are rising year to year in wular lake. Further, the analysis showed that the water quality parameters are more effective to aquatic life ,because the aquatic life needs more water for living.The main areas which are polluting the water are industries,using of fertilizer and pesticides also use of chemicals in paints. Similarly, the waste water of villages and towns is less effecting in increasing the water indexes as compared to the industrial waste water.The main pollutants are dying industries,use of unwanted medicines in plants are causing sevier problems in water. During construction usage of oils also cause these problems in increasing the water quality parameters. The water of the lakes are getting effected due to these wastes , because the wular lake is the main fresh water lake in Kashmir india. Maximum people of valley are using it in drinking purposes. They are getting effected by this unclen water. Due to this the chest prolems are created due to which the water of wular lake had became the main problem causing agent in population. Results are showing the bad effect on population and aquatic life,because the aqualtic species are indirectlt effectin on humans. By eating fishes and nuts of wular lake. Based on these results, we conclude that reduction in water quality parameters is a major concern because day by day the industries are increasing the waste and it is directly effective in increasing the parameters , government should to take immidate steps to save this fresh water lake. As a result, the government should devise strategies to reduce harmful water quality parameters which are causing main effect to living population. Environmental protection is a long process requiring ongoing planning, government regulations, and public and industrial participation. To decrease these parameters everyone should be involved in this matter, it is abig concern future generation.

KEYWORDS- Water Quality Index, How To Overcome From This Problem, Decreasing Agents, Main Causicative Agents.

I. INTRODUCTION

Over the last few decades, researchers have focused their efforts on the relationship between water quality parameters and the negative effects on the living world. Many countries are confronted with significant issues, some are facing the higher issues because the use of modern techenology is the main culprit for the changes in the environment. The government is taking different measures to overcome this issue but the changing the standard of living society is directly responsible for these problems. Rising the issue of water pollution is the threat to living world. In developed countries the main issue of water quality is big concern.hence pollution is inextricably tied to economic development and growth. Environmental degradation has been identified as a significant issue in the process of economic development and growth. Because pollution has a direct impact on human life and the environment. Pollution clearly has a heinous impact on human health, resource depletion, and natural disasters. The major forms of pollution include air pollution, land degradation, soil contamination, water pollution, and noise pollution, whereas the source of pollution in the atmosphere involves the burning of fuels that generate house and industrial energy, depletion of vehicle consumption of petrol, diesel oil, waste gas, dirt, and heat. The main environmental pollutants are sulphur dioxide, nitrogen dioxide, and particulate matter. Different pollutants are the most significant in changing of water quality parameters. The pollutants like industrial wastes, fertilisers and pesticides are the main causicative agents. The parameters are changing in faster rate. We are unable to tackle to solve this problem. If the government cannot take measure steps to overcome this problem it will not only effect on living world but indirectly it will effect on economic development, it will decrese the production of country. In india the problem is in alaraming rate because all the water bodies are getting effected by these pollutants. In this context, this study aims to look into the impacts of bad water quality index, how to tackle to solve ths problem. What are the immidate measures to overcome from this problem which is increasing day by day. The data of different years is showing how much the parameters has changed what are the effects Caused by the water that has unidentified water quality parameters. The bad areas which ae gthe main agents effecting the water quality. The maximum water bodies in our country are getting effected by this deadly problem.

A. An Over View of Water Quality Parameters and its Deadly Effects

India is the country which is more in this deadly problem, because the industries are not well planned and are directly sending the polluted water into the lakes and rivers. In india more than 80% water is contaminated which is the big concern for the society. It will not only effect the present generation but the future generation will be the

most effective. So it it the duty of everyone to tackle how this problem can be minimized. During the year 1990 to 1999 the 30% water was contaminated, but today it is three times higher than that, so we are in dangerious phase of life. Not only surface water is polluted but the ground water had also became unfit for drinking purposes. Due to increase in trench system the space between tubewells and trenches has decreased so it is also the causicative agent of pollution of ground water. Increase in polythene bags because the polythene bags are non-biodegredable and they are made of harmful chemicals and causing pollution in water bodies. The aquatic life has decreased by harmful parameters. Excessive quantites present in water bodies are carcogenic and deadly disease causing easiy agents. Due to these parameters the aquatic life has maximum effected because they are uanable to reproduce. By this problem different diseases are present now in living population like cholera, diahorrea, blue baby syndrome which are caused directly by these parameters. India is a big country , also the population is increasing and in second number, so it means due to this the pollution is also more as compared to other countries. If government cannot take immidate steps the pollution will cause more deadly problems in the human population.

B. An Overview of Water and its Measure Pollution Causing Agents

Almost 80% of India's surface water is polluted and an alarming percentage of ground water reserves are contaminated by various organic and inorganic pollutants. Water quality is effected by various sources ,which are classified as point ,nonpoint and transboundry sources. Due to rapid industrialization ,urbanization ,and population expansion in India have created a number of environmental problems ,water pollution being the major one .This has led to deterioration in both the quality and quantity of surface and ground water. Thereby affecting the net availability of water for consumptive use.

Between the years of 2001 and 2012 ,3245 hectares of lakes dissipated in the city of Hyderabad. The water recedes by nine feet a year on average in southern new delhi. Around 70% of waste water goes untreated and each day , more than 40 million liters of waste water flows directly into Indian lakes ,rivers and oceans. Eventually, contaminated water also enters the ground water. Because of this, proper waste management and sewage pollution cannot occur ,upsetting the irrigation system .The crops are not able to grow . By this around 38 million Indians are suffering from water born diseases like typhoid ,cholera and hepatitis every year.

C. Rationale of the Study

Water quality index have become a serious global issue in recent years. The global societal cost water quality parametrers are becoming too much unbalanced over changing time. It will cause serious problems to the future generation not only water of streams is getting effected but the potential and purity of ground water is also getting effected. Every year as the industries are in rising potential the unbalanced ecosystem is also getting created. It is the prime concern how to overcome from this problem, which major steps should be taken to over come from this problem. The aquatic life is detoriated day by day.Maximum aquatic species have extencted. The water born diseases has increased. Due to this the taste of water also changes, it becomes sour in taste. The health issues are the main problems of water quality parameters. It is the prime concern to understand the water quality in order to protect our health, and also the health of an ecosystem. Those, of course are the main reasons we are interested in water quality, so that we make sure our drinking water is safe and we are not damaging the environment.

D. Objectives of the Study

The objectives of the study are as follows;

- To analyze the trends in water quality parametres in wular lakeIndia.
- To analyze the impact of water quality parameters on living world, especially human population and aquatic life.

E. Hypothesis of the Study

The hypothesis of the study is as follows;

- The water quality parameters should have to remain static with changing time period.
- Due to water quality parameters, there would be neutral effect on living population

II. LITERATURE REVIEW

Salim Aijaz [1] analyzed the water quality of wular lake by using different methods During his research the main analysis was on the water quality parameters .He used the data of global water quality index parameters ,find how much the parameters had changed in normal way .Due to usage of pesticides they are the main pollutants of changing the water quality parameters .

Bhat et al [2] examined the water quality parameters and find the causes how they are changing day by day .What are the main causes for areas which cause the change in the parameters. Mainly the industries are increasing day by day, also by using pesticides the quality of water is getting changed which is the prime concern in future It will cause the bad effect on the living population, so we have to remain focus on these areas.

Rashid et al [3] During his research the quality of the water was some how changed due to the over usage of pesticides , waste materials and many more harmful chemicals .The study was about to find the water quality of the lake to compare with global water quality index .

Ali MB [4] During his research he examined the physicochemical characteristics and pollution level of water by using different chemicals in industries.

The changes in water quality was different at different sites when they where doing testing.

Sofi AH [5] He has done the research on different streams at sonmarg Kashmir for finding the water quality index. The quality of water was different at different sites. The water quality has changed.

Kesharwani S [6] The determination of water quality index (WQI) of pond finded by the researcher thet how much change has gone in the water. Because by using pesticides in agriculture land, what are the impacts on living world.

M. R. D. Kundangar[7] During his research on Dal lake in Kashmir the quality of water lake has changed and how this water is effecting on phytoplanktons and other living population. The life of terrestrial living things has effected.

Yasir[8] By doing the practical on water quality on hokersar lake the quality of water has effected due to the industries ,by using water and drained into wular lake. The water of the lake has totally effected.
M. A. Khan [9] The Chemical usage in industries are effecting in the water quality of dal lake during the practical the water quality has changed which is directly effecting on living population.
A. R. Yousuf [10] The quality of himalyan water streams has been changing day by day due to excessive use of pesticide. The water quality has changed drastically by excessive use due to which quality has changed. During practical the water quality has changed.
Even some researchers utilizing a similar methodology, the outcomes are mixed. This could be due to differences in the variables used, the transformations used, the sample period, and/or the panel of nations examined. However, it will be interesting to analyze the relationship between water quality parameters and ill effects of thes parameters on living world

III. RESEARCH METHODOLOGY AND DATA SOURCES

A. Sources of Data

Secondary sources have been used for collecting the data for the present study. The secondary data have been utilized to examine the main sources of pollutants which are increasing the water quality parameters in wular lake in jammu and Kashmir, India and to investigate the impact of these parameters on human life and aquatic life.The data for the present study have been extracted from the following sources.

- Books and journals.
- World Development Indicators.

B. Coverage of Study

To achieve the objectives of the present study, secondary sources of data have been obtained for the period 2008-2016to 2017-2020.

C. Methods Used for Analyzing and Interpreting Data

After gathering the necessary data from testing of water samples, which were obtaine from different sites of wular lake. After that different methods were used for testing of water samples to find different parameters of water quality index. Like titration method is used.
Six water quality index parameters were considered for calculation (Tiwari and Manzoor ,1988; Mohantan and Patra 2000 ;Kesharwani et al,2004; Padmanabha and Belagalli, 2005 ; Ashok k pandith ,Sayar Yaseen and Javid ahmad shah 2015)
Water quality index method used is(Brown etal.,1972)
Step. 1 $\frac{1}{\frac{1}{S1}+\frac{1}{S2}+\frac{1}{S3}+\frac{1}{S4}+\cdots+\frac{1}{Sn}}$
Water Quality index (WQI) =∑ QiWi
Wn=K/Sn
Where,
Wi = water index.
Qi = Quality index
QpH = (VpH-7)/(8.5-7)*100

Table 1: Location of four sampling sites around the Wular lake

Site	Sampling Site Elevation	Latitude E	Longitude N
1	Ajas 1657m	74.6782	34.3335
II	Tujar nallah 1743m	74.4010	34.3779
II	Garoora 1643m	74.6744	34.3676
IV	Nadihall 1578m	74.66	34.39

D. Independent and Dependent Variables

In this study, the independent variable used is water quality indexand dependent variabl is living population.

E. Limitation of the Study

The study's drawback is that it only finds the water quality parameters of wular lake but the lakes are everywhere in india some are fresh water and some are unfit for drinking purposes, we should have to find all the parameters of water quality,some are missing in the research paper.

IV. DATA ANALYSIS AND RESULTS

The data of different parameters of different locations.
Data of water quality parameters were obtained during testing of different water samples obtained from different sites namely Ajas, Tujar nallah, Nadihall and Garoora. These samples were collected from these sites, after that testing were done to obtained results for final calculation of water quality index. The main motive of that water quality index that, can this water be fit for drinking purposes or unfit.The below table 2 shows the different sites.

Table 2: Different water quality parameters

Parameters	Site 1	Site 2	Site 3	Site 4
pH	7.99	9.3	8.1	8.2
Turbidity	3.45	3.55	3.98	3.61
Alkalinity	164	165	159	163
Calcium	85	87	88	88.9
Flouride	0.06	0.04	0.05	0.07
Total dissolved solids	459	456	454	458
Hardness	285	286	283	284
Magnesium	47	45	43	44

The above data got after the samples of different locations were collected from wular lake. Then after collection the samples were used for finding water quality parameters in laboratory by different methods like titreometric etc. After that water quality index will be finded for the main purpose of this project that is, is this water fit for drinking purposes or not, that is the main objective of this project because the water quality of wular lake is decreasing day by day.

A. Data Analysis and Results

The data is obtained by taking water samples at different sites of wular lake, different streams are feeding to the wular lake. The water of wular lake is getting polluted day by day due to increase in pollution in the valley, which is neighbouring to the wular lake. The streams are polluted due to municipal wastes, due to industrial pollution and, any other problems like using of fertilisers in the agriculture fields. The water is getting polluted due to these wastes.

On this way different sites were choosen for water samples namely Ajas, Tujar Nallah,Nadihall and Garoora for practical purposes.In table 3 the following parameters are mentioned.

Table 3: Methods used for finding these parameters

Variables	Units	Analytical methods
pH	Ph unit	pH meter
Alkalinity	mg/l	Titrimetric
Turbidity	NTU	Nepheloturbidity method
Calcium	mg/l	Titrimetric
Total dissolved solids	mg/l	Electrometric method
Hardness	mg/l	Titrimetric method
Magnesium		Titrimetric method

These above methods were used during practical purposes for finding the parameters of water of different sites obtained from wular lake.

During practical purpose, when we were finding the water quality parameters of different sites ,fist we have selected the Ajas site in below table 4 after that we have selected the site Tujar nallah in table number 3b after this, we ha e selected site Garoora in table number 3c and last site Nadihall site in table 4d. So these sites were selected for finding water quality parameters of these four given sites for different purposes

B. Water Quality Index for Site 1a, Ajas

Table 4: Water Quality Index for 1a, Ajas Site

Site 1									
Parameters	BIS Standards(S	1/Sn	K=1/(∑1/S	Wi=K/S		Mean Conc.Value (V	Vn/Sn	Vn/Sn*100=Qr	WnQn
pH	8.5	0.1176	1.3746471	0.16172	DEAL VALUE(Vo	7.9	0.6	60	9.7034
Turbidity	5	0.2	1.3746471	0.27493	0	3.45	0.69	69	18.97
Alkalinity	200	0.005	1.3746471	0.00687	0	164	0.82	82	0.5636
Calcium	75	0.0133	1.3746471	0.01833	0	85	1.13333	113.3333333	2.0772
Flouride	1	1	1.3746471	1.37465	0	0.06	0.06	6	8.2479
Hardness	300	0.0033	1.3746471	0.00458	0	285	0.95	95	0.4353
TDS	500	0.002	1.3746471	0.00275	0	459	0.918	91.8	0.2524
Magnesium	30	0.0333	1.3746471	0.04582	0	47	1.56667	156.6666667	7.1787
ater quality index ,WiQi=47.428		1.3746							47.429

C. Water Quality Index for Site 2b.Tujar Nallah

The site second of the wular lake is taken for the practical purposes. The water quality parameters of this site has been finded by different methods.the water quality of site second has shown different results. In below table all water quality parameters has been finded, the Tujar nallah site in table 2b has shown the results.

Table 5: Water Quality Index for Site 2b.Tujar Nallah

Parameters	BIS Standards(Sn)	1/Sn	K=1/(∑1/Sn	Wi=K/S	IDEAL VALUE(Vo	Mean Conc. Value (Vn	Vn/Sn	Vn/Sn*100=Qn	WnQn
Ph	8.5	0.11765	1.37464706	0.161723	7	8.3	0.86	86	13.9082
Turbidity	5	0.2	1.37464706	0.274929	0	3.55	0.71	71	19.52
Alkalinity	200	0.005	1.37464706	0.006873	0	165	0.825	82.5	0.56704
Calcium	75	0.01333	1.37464706	0.018329	0	87	1.16	116	2.12612
Flouride	1	1	1.37464706	1.374647	0	0.04	0.04	4	5.49859
Hardness	300	0.00333	1.37464706	0.004582	0	286	0.953333	95.33333333	0.43683
TDS	500	0.002	1.37464706	0.002749	0	456	0.912	91.2	0.25074
Magnesium	30	0.03333	1.37464706	0.045822	0	45	1.5	150	6.87324
ater quality index ∑WiQi=49.180		1.37465							49.1807

D. Water Quality Index for Site 3c,Garoora

The site second of the wular lake is taken for the practical purposes. The water quality parameters of this site has been finded by different methods.the water quality of site second has shown different results. In below table 6 all water quality parameters has been finded, the Garoora site and the results.

Table 6: Water Quality Index for Site 3c, Garoora

Parameters	BIS Standards(Sn)	1/Sn	K=1/(∑1/Sn	Wi=K/Sn	IDEAL VALUE(Vo	Mean Conc. Value (Vn	Vn/Sn	Vn/Sn*100=Qn	WnQn
Ph	8.5	0.11765	1.37464706	0.161723	7	8.1	0.733	73.3	11.8543
Turbidity	5	0.2	1.37464706	0.274929	0	4.12	0.824	82.4	22.6542
Alkalinity	200	0.005	1.37464706	0.006873	0	159	0.795	79.5	0.54642
Calcium	75	0.01333	1.37464706	0.018329	0	89	1.186667	118.6666667	2.175
Flouride	1	1	1.37464706	1.374647	0	0.05	0.05	5	6.87324
Hardness	300	0.00333	1.37464706	0.004582	0	283	0.943333	94.33333333	0.43225
TDS	500	0.002	1.37464706	0.002749	0	454	0.908	90.8	0.24964
Magnesium	30	0.03333	1.37464706	0.045822	0	43	1.433333	143.3333333	6.56776
Water quality index ∑WiQi=51.5825		1.37465							51.3528

E. Water Quality Index for Site 4, Nadihall

The site second of the wular lake is taken for the practical purposes. The water quality parameters of this site has been finded by different methods.the water quality of site second has shown different results. In below table 7, all water quality parameters has been finded, the Nadihall, site and the results.

Table 7: Water Quality Index for Site 4, *Nadihall*

Parameters	BIS Standards(Sn)	1/Sn	K=1/(∑1/Sn	Wi=K/Sn	IDEAL VALUE(Vo)	Mean Conc. Value (Vn)	Vn/Sn	Vn/Sn*100=Qn	WnQn
Ph	8.5	0.11765	1.37464706	0.161723	7	8.2	0.8	80	12.9379
Turbidity	5	0.2	1.37464706	0.274929	0	3.6	0.72	72	19.7949
Alkalinity	200	0.005	1.37464706	0.006873	0	163	0.815	81.5	0.56017
Calcium	75	0.01333	1.37464706	0.018329	0	88.9	1.185333	118.5333333	2.17255
Flouride	1	1	1.37464706	1.374647	0	0.07	0.07	7	9.62253
Hardness	300	0.00333	1.37464706	0.004582	0	285	0.95	95	0.4353
TDS	500	0.002	1.37464706	0.002749	0	458	0.916	91.6	0.25184
Magnesium	30	0.03333	1.37464706	0.045822	0	45	1.5	150	6.87324
Water quality index ∑WiQi=52.648		1.37465							52.6484

After finding the water quality parameters ofv these four sites. The grap was drawn to know how the water quality of wular lake is changing year by year ,which is big concern for present and future generation. In this line graph, the below figure 1 is showing the change of water quality parameters. The below figure 1 is showing exact the change in waterquality parameters of wular lake feeded by different strems. So the below graph shows these parameters of different trends.

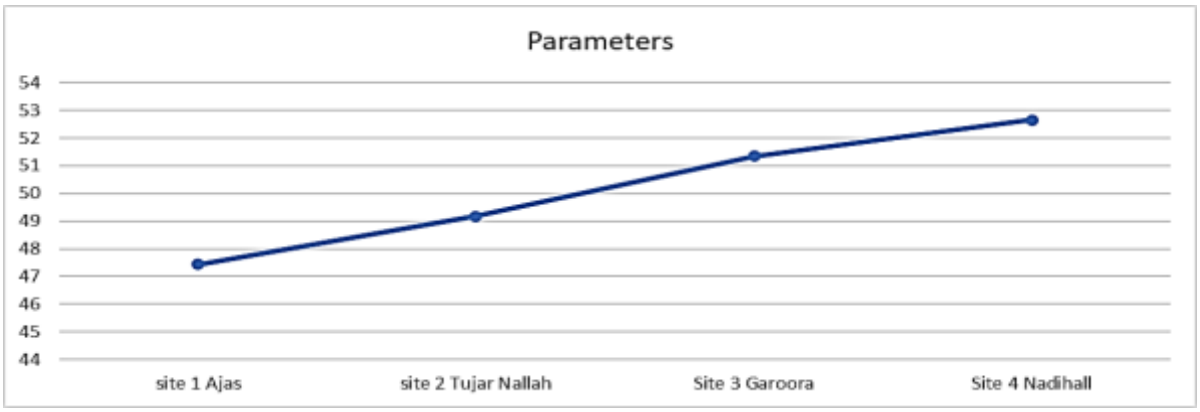

Figure 1: Graph of water quality parameters of all the 4 sites

The below table 8 shows the water quality parameters of different years from 2013 to 20219. How much the quality of water has changed from time to time all the results are shown in the figure 2 is also drawn against these parameters.

Table 8: Water quality index graph of different years

YEARS	Water quality index (WiQi)
2013	45.43
2014	46.68
2015	47.21
2016	47.67
2017	48.21
2018	48.34
2019	49.18
2021	51.36
2022	52.65

Now after the finding water quality parameters of present year and after that these parameters were compared with previous years. The above table number 8, is showing the water quality parameters of different years from 2013 to 2018 after that to 2022. Now the graph is made for all the water quality parameters given in figure 2.

Figure 2: Graph of water quality parameters from(2012 to 2016)

Table 9 shows the standard quality of water quality parameters, which range is good and which ios haramfull for living beings. This below table 9 shows the levels of different paraeters when it becomes haramfull fof humans and other living creatures.

Table 9: Standard water quality parameters

Water Quality Index	Water Quality Status
0-25	Excellent
26-50	Good
51-75	Poor
76-100	Very poor
>100	Unfit for Consumption

The above table 9 is showing, the quality parameters of water from poor to good quality. If the quality goes on decreasing or increasing.

V. CONCLUSION

From the observations, it may be concluded that among three streams, the water quality of all the streams is slightly polluted based on water quality index. The study revealed that these streams are experiencing initial stage of anthropogenic stress pollution and needs fast attention of aquatic ecologists. Further, the results of the study could be helpful in the management of the lake for its water quality, fisheries and restoration. The data obtained could also form baseline and reference point while assessing further changes that might be caused by nature or man in the lake.

After all the water quality parameters were obtained by different laboratory methods, then after that water quality index is obtained from that water parameters.

All the water quality index parametrs of different sites show different results but overall the water of wular lake is somehow fit for drinking purposes. In some places the quality of water has found poor but can be used for drinking purposes.

The water quality of wular lake feeded by different streams show variation in results from year to year that means the quality of water of this fresh water lake is getting polluted day by day. This is the prime concern to save this asias fresh water lake by taking different measures for saving this fresh water lake. The quality of water is mainy effected by chemical pollutants like calcium, acids driven out from industries is the main cause of its pollution. Due to open deffication the germs are also effecting to the water of the lake. So in overall the quality of water of wular lake has been too much changed due to pollutants. To save the future the wular should be saved because it is the main water body of not only Kashmir but whole India.

The wular lake is also the biggest and largest wet land in jammu and Kashmir, it is lagest fish producing lake in jammau and Kashmir.

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