Assessing the Impact of Water Quality Parameters on Fish Farming and Agriculture in Bagh River Deori District, Maharashtra (India)

Chiranjeev Pandey[1],KiranlataDamle[1], Sanjay Thiske[1],Majid Ali[2], Gurprit Singh Bhatia[2], Akhilesh Yadav[2] , Karuna Rawte[2], Gagan Singh Guru*[2]

Department of Zoology[1,2]
Government Digvijay Autonomous Postgraduate College, Rajnandgaon Chhattisgarh (India), 491441

ORCID -0009-0008-5667-6268

chiranjeev717@gmail.com[1] gagansingh89660@gmail.com[2]

***Corresponding Author:** Gagan Singh Guru
gagansingh89660@gmail.com

Abstract

The Bagh River is positioned on Sirpur Reservoir. This rivulet divides the adjacent border areas of the two states Maharashtra and Chhattisgarh. Bagh River is not only a border river; it is also proving to be perfect from the point of view of drinking water and agriculture. Fish ranching on this river is basically based on conventional methods, in the past years it has supplied water for irrigation and drinking water to two states, the selected place for companion study has been selected around the dam which is similar to the one that occurs in nature. To determine the sudden change, chemical and physical factors are used for water testing, such as TDS (Total Dissolve Solid), pH, DO (Dissolve Oxygen), Turbidity, Conductivity, BOD (Biological Oxygen Demand), etc., impurities. Efforts to remove this will prove beneficial not only for the present time but also for the future of fish farming and drinking water and will also reveal the path to increase the production capacity of fish farming. In the entire selected area that has been identified around the dam, this limit can be reduced as per the study, eliminating the need for excessive testing of water quality and purity for drinking purposes. Considering the past as the basis of this river, the present and future are envisioned for fisheries, agriculture and drinking water; we can try to calculate the figures to be considered according to the security of this overall area.

Keywords: Water quality, Sirpur, Cage culture, Bagh River, Agriculture, Fisheries, Maharashtra, Fish Ranching.

Introduction

The zenith of the present seems to be getting lost in the darkness of the future, in which the struggle of the fishes is also unforgettable. The rural people here know its usefulness in the traditional way, but are moving away from the livelihood. It will have to be made a means of livelihood of the people, so that people's lives can be easily spent. People will have to gradually depend on it [6]. Various federal governments have launched their capacity in this area, but this dam is limited by that capacity. Now it is far away. It supplies the drink as per the need of the people, dividing the adjacent border of two states [13]. The water in the dam is born from the forested hills and rivers of Chhattisgarh and is nourished by the anchal of Maharashtra and Madhya Pradesh [14]. Fish of different species are found in this dam, which are carnivorous, omnivorous and vegetarian. Which by living in its habitat is enhancing the beauty of this place [3]? The weather here remains changeable, there is some cold in monsoon and hot environment is seen after monsoon, the potential of this area is so much that it can be used commercially [27]. Fish farming can be done by using cage colour and various new techniques to increase the yield [15]. Along with fish farming, pilgrimage should be promoted [28]. People will get support in fishing in this area from the government, but the BOD and COD in the water here become relatively less during the monsoon, but the monsoon. There is an increase in these after fish farming also causes pollution in water [8]. Fish ranching at Sirpur Reservoir offers a promising avenue for addressing the socio-economic challenges faced by the local community. By providing alternative livelihood opportunities, it can contribute to poverty alleviation and income generation [16). The cultivation of fish can supplement the income of farmers, particularly during the lean agricultural season, enhancing their resilience to economic fluctuations. Moreover, fish ranching has the potential to improve food security by providing a sustainable source of protein for the local population [6]. Fish is a nutrient-rich food, essential for human health and development, and increasing its availability can contribute to the

overall well-being of the community. While fish ranching holds immense promise, it is not without its challenges. Issues such as water quality fluctuations, overfishing, habitat degradation, and the introduction of invasive species can hinder the success of this endeavour [29]. Effective management strategies are essential to mitigate these risks and ensure the long-term sustainability of the fish population. On the other hand, fish ranching also presents a host of opportunities [5]. Advances in aquaculture technology, coupled with the growing demand for fish pr**o**ducts, create a favourable environment for the development of this sector. By adopting sustainable practices and investing in research and development, it is possible to maximize the benefits of fish ranching while minimizing its impact on the environment [11].

Study Area: It is situated between the (Northing = 21°04'37.8"N; Easting = 80°28'24.2"E) latter two states. 40% of it falls in Chhattisgarh and 60% in Maharashtra [From, Figure 01]. This dam is spread over 32.970 square kilometres, which keeps water throughout the year [9]. Generally, different types of seasons are seen here, which can be divided into four months [From, Figure 01]. Comparatively, the average temperature, rainfall and wind speed here is twenty four degrees Celsius, Two hundred fifty millimetres, twenty kilometres per hour, according to [10]. There are no fish farms far and wide in this area; people fish here only according to the weather [30]. They cast nets through which the people here earn their living [17].The present study has been adjusted for physical and chemical analysis on dam water to determine pre-monsoon and post-monsoon (October 2023 to March 2024) from fish culture point of view [7].

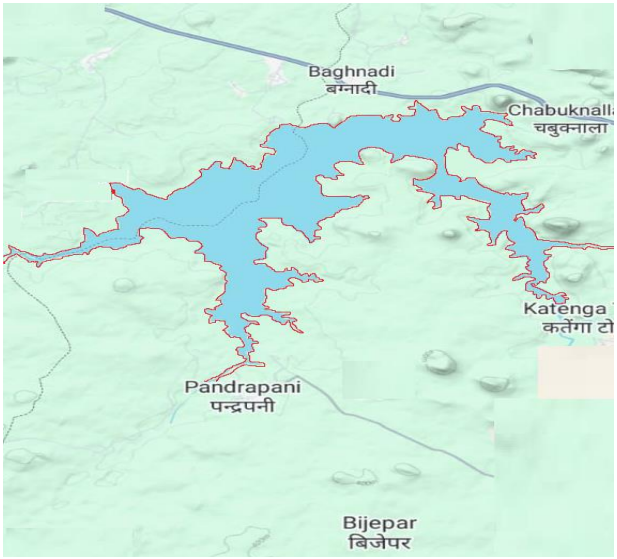


***Figure 01*: Study Area [32].**

Materials and Methods: This dam is built on the border with Chhattisgarh towards the west, which passes through the south and moves towards the north-west [19].is no fish ranching in this area. On the basis of the survey, we have taken into account the water Physico - chemical factors [23]. Work has been done on this such as Temperature, Turbidity, Chlorine, Dissolve Oxygen, Biological Oxygen Demand (BOD), Total Dissolve Solid (TDS), Salinity, and Conductance etc. [20]. We have selected the water from the entry and exit route of the dam as samples, which seem to be collected from the upper surface for sampling [12]. There are 100 to 150 villages around the dam where construction of ponds is seen extensively [18]. People are inclined towards fish farming in a timely and traditional manner [21]. These monitoring points are protected according to the use of (Global Positioning System) GPS [31]. It is tested by the Maharashtra government for drinking purpose for big cities; we are done according to [1] and [22].

***Table 01:*Fish Found in Sirpur Reservoir**

SN.	**Scientific Name**	**Order**	**Local Name**	**Fin Formula**	**Feeding Habit**	**100%of productivity for abundance**
1.	*Labeo rohita*	Cypriniforms	Rohu	D. 16 (3/13); P. 17; V.9; A. 7; (2/5); C. 19; L. 1. 40- -41 ; L.tr. 6½ – 7½ /9; Barbels 1 pair.	Herbivorous	*22.3%*

2.	*Catla catla*	Cypriniforms	Catla	D.18-19 (3/15-16); P. 19; V.9; A. 8(3/5); C. 19; L.1. 43; L.tr. 7(1/2) - 6(1/2).	Herbivorous	*20%*
3.	*Cirrihinus mrigala*	Cypriniforms	Mrigal	D. 16(3/13); P. 18; V. 9; A.8(2/6); C. 15; L. 1. 42-44; L.tr. 6(1/2). Barbels 1paire	Herbivorous	*10%*
4.	*Wallago attu*	Cypriniforms	Padhina	D. 5; P.1/14; V. 10; A.86 (4/82); C.17; Barbels 2 pairs	Herbivorous	*9%*
5.	*Salmostoma bacalia*	Clupeiforms	Sarangi	D.15-17 (3/12-14); P.14-16; V.6-7;A. 40-41; (2/38-39); C.17; Lr. 44 - 45; L.tr. 12-13	Carnivorous predatory	*8.3%*
6.	*Oreochromis mosambica*	Perciforms	Tilapia	D. 11 (3/8); P.13 – 15; V.9; A.8 (3/5); C. 19; L.1. 26 – 27; L.tr. 5½ - 6/6½	Omnivorous	*22.8%*
7.	*Mystus tengara*	Bagridae	Tegna	D.8(1/7);P.8(1/7);V.6;A. 9(3/6);C.17; Barbles four pairs	Omnivorous	*14%*
8.	*Channa punctatus*	Channidae	Ghunda	D.51;P.18;V.5;A.32;C.15;L.I.65;L.tr.51/2/12	Carnivorous predatory	*6%*
9.	*Clarias batrachas*	Claridae	Magur	D.65;P.9(1/8);V.6;A.47; C.17; Barbles four pairs	Omnivorous	*8.3%*
10.	*Labeo boga*	Cyprinidae	Lohia	D.8(1/7);V.8(1/7);A.14(2/12);L.I.110; L.tr.28-33/16-28	Herbivores	*3%*
11.	*Labeocalbasu*	Cyprinidae	Kalbaz	D.11(3/8);P.15;V.9;A.8(2/6);C.19;L.I.23; L.tr.41/2/4/1/2	Herbivores	4.33%
12.	*Puntius sophore*	Cyprinidae	Kotri	D.9(2/7);P.12;V.9;A.15; C.19;L.I.43;L.tr.12/10	Herbivores	*4%*
13.	*Pangasius pangasius*	Pangasiidae	Pangas	D.1/7;P1;1/12;P2,6;29	Omnivores	5.1%
14.	*Chana gachua*	Channidae	Khoksi	D.51;P.18;V.5;A.32;C.15;L.I.65;L.tr.51/2/12	Carnivorous predatory	*10.3%*
15.	*Notopterus chitala*	Notopteridae	Patola	D.8(1/7);P.17;V.6;A.100 ;C.19;L.I.200; L.rt.25/50	Carnivorous predatory	*7%*

Table 02: **Physico – Chemical parameter analysis of fish ranching in Sirpur Reservoir.**

Seasons	**Monsoon**			**Post monsoon**			**APHA**	**USEPA**	**FAO**
Parameters	**Oct 2023**	**Nov 2023**	**Dec 2023**	**Jan 2023**	**Feb 2023**	**Mar 2023**			
Colour	Dark Green	Dark Green	Light Green	Light Green	Light White	Light Green	-	-	-
Temperature ° C	22	25	23	24	28	34	25°C-30°C	25°C-30°C	25°C-30°C
Turbidity (NTU)	0.19	0.12	0.16	0.18	0.10	0.11	**b	< 30	30
Total Dissolve Solid(ppm)	200	250	300	260	310	410		< 450	**b
Chlorine (mg/litr)	30	31	33.5	32.2	29.2	26.6	-	-	-
DO (mg/litr.)	7	10	9	10	16	18	>20	< 40	>30
BOD (mg/litr.)	6.2	6.5	6.7	5.6	5.3	5.2	3-20	10	-
COD (mg/litr.)	6.9	5.3	6.6	4.5	2.6	3.2	-	-	-
Salinity (ppt)	6.2	8.3	8.3	10	11.1	12.2	-	-	-
EC (pS)	175	120	100	120	90	80	-	>200	>220
Conductance (mS)	5	3	2	6	8	10	**b	< 0.75	-

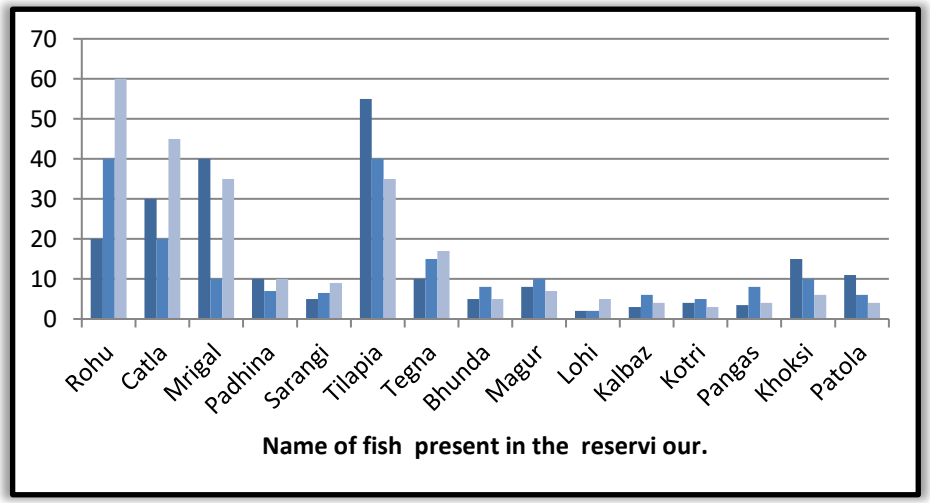
pH	7.2	7.5	7.9	8	8.3	8.6	5.9-8.2	-	6.0-8.5
Total Alkanity (mg/litr.)	50	62	71	80	83	90	-	-	-

Result and Discussion:

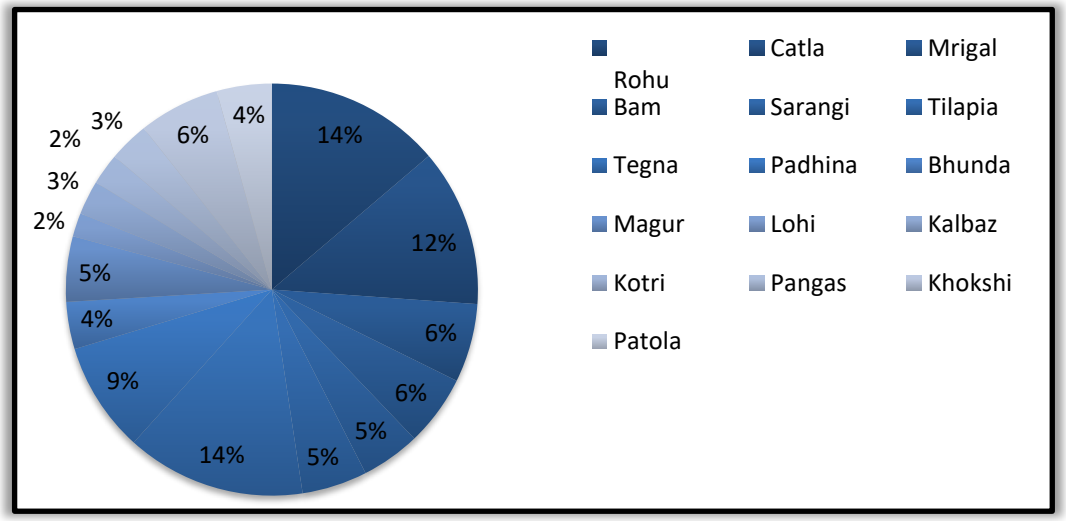
According to Table 02, its temperature keeps changing according to the weather. During the study, its temperature was low during monsoon which was 22°C, 25°C, 23°C from October to December, After monsoon the temperature increases, from January to March it is - 24°C, 28°C, 34°C which is beneficial for the fish from the point of view of adaptation [*Labeo rohita (*Rohu)] and [*Labeo calbasu (*Kalbaz)][From, Table 02]. In the months of October and January, turbidity increases to 0.19 NTU and 0.18 NTU, but in November, December, February and March, turbidity becomes normal to 0.12 NTU, 0.16 NTU, 0.10 NTU, 0.11 NTU, as a result of which turbidity is seen in the water.Total dissolved solids are very less during monsoon 200 ppm, 250ppm, 300ppm but after monsoon it increases relatively to 260ppm, 310ppm, 410ppm [From, Table 02]. Its quantity increases in the months of October and December to 30 mg/litre., 33.5mg/litr but after the end of monsoon[*Labeoboga (*Lohia)], [*Clarias batrachas (*Magur)] and [*Colisafasciatus (*Gourami)], a change is seen in it, from January to March, 32.2mg/litr to 26.6 mg/litr Dissolved Oxygen is seen in the month of October to December, 7mg/litr, 9mg/litrbut From January to March, its quantity increases to 10 mg/litre, 18mg/litre due to which the transpiration of water decreases. The amount of chemical oxygen demand in the water here is not normal, which is 6.9mg/litre at the beginning of monsoon[*Channa punctatus (*Ghunda)] [*Mystus tengara (*Tegna)][*Oreochromis mosambica (*Tilapia)][*Ilishamotius (*Sarangi)]. 2.2litr. to 6.6mg/litr. After monsoon, 4.5 mg/litr to 3.2 mg/litr is used. On this, the increase in salinity factor is more. After monsoon, 10 mg/litr to 12.2 mg/litr [From, Table 02], which is suitable for some fishes [*Amphipnous cuhia (*Bam)] [*Wallago attu (*Padhina)] [*Cirrihinus mrigala (*Mrigal)] and [*Catla catla (*Catla)][From, Table 01]. It can be harmful but it is seen so widely in this place that it does not have much impact but it will have to be reduced for commercial fish ranching [From, Graph 01, 02 *and* 03] [8].

Observation

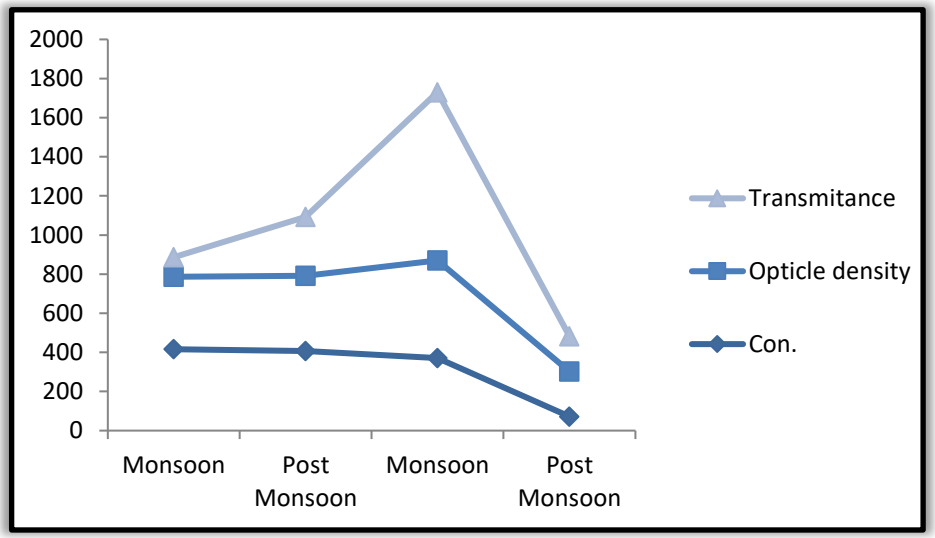
When after complete assessment in Sirpur Dam it is found that there is a decline in the productivity of fish during monsoon due to increase in TDS, chlorine content and weather also does not remain stable due to which is (Catla, Mrigal, Pangas, Khokshi, Kotri,Patola etc.), many fish die [From, Graph 04].Due to this, some fish species like - But on the other hand, as soon as the monsoon goes [From, Graph 02], there is an increase in the productivity of fishes because at this time their condition becomes more clean due to which the fishes get adequate adaptation and also get adequate nutrition [4]. Fish ranching at Sirpur Reservoir has the potential to fulfill multiple purposes, contributing to food security, income generation, and environmental sustainability [24]. However, careful planning and management are necessary to address potential challenges and ensure the long-term viability of this practice [From, Graph 03] [25]. By promoting responsible aquaculture practices and balancing various needs [From, Graph 01], fish ranching at Sirpur can be a valuable asset for the local community and environment [26] [From, Graph 04].



Graph 01: Some fishes are present in the Reservoir.



Graph 02: Fish present in study area.



Values for concentration, optical density and transmittance.

Graph 03: Spectrophotometer data analysis.

Conclusion: The above data shows that there is no contaminant in the water of this dam which can pollute the water. The salinity in this area has to be reduced and the fish species in the stocked area have to be conserved and produced on a large scale [From, Graph 02]. This can be done in a convenient way due to which the polluting elements will also be removed. At present this water is not very bad but considering the near future, it is necessary to conserve these fishes which are listed in IUCN so that the productivity can increase [From, Graph 04]. Can increase and can support people's livelihood. Fish ranching can significantly increase fish production in the reservoir. Stocking the reservoir with commercially valuable fish species can provide a reliable source of income for local fishermen and contribute to food security in the region [From, Graph 01]. Careful selection of fish species that thrive in the reservoir's specific conditions and responsible stocking practices are crucial for long-term sustainability. This can empower local communities, particularly those dependent on traditional fishing practices, and provide a stable source of income. Training programs in sustainable fish ranching techniques can further enhance the skills and knowledge of local fishers. Fish play a vital role in maintaining a healthy aquatic ecosystem. Stocking the reservoir with native fish species that have a balanced predator-prey relationship can help control invasive species and maintain biodiversity [From, Graph 01 *and* 02]. Additionally, fish can contribute to improved water quality by consuming algae and other organic matter.

References:

1. APHA (1998) Standard Methods for the Examination of Water and Wastewater. 20th Edition, American Public Health Association, American Water Works Association and Water Environmental Federation, Washington DC. DOI:10.4236/ojepi.2022.124035

2. A Review on Heavy Metal Ions and Containing Dyes Removal Through Graphene Oxide-Based Adsorption Strategies for Textile doi.org/10.1002/tcr.202000153 Wastewater Treatment https://doi.org/10.1002/tcr.202000153
3. Arur, Anand and Krishanan, P. (2019). Assessing the water spread area available for fish culture and fish production potential in inland lentic water bodies using remote sensing: A case study from Chhattisgarh State, India \\ https://doi.org/10.1016/j.rsase.2019.100273
4. Banjare, GokulRam Sahu, Bharat Lal (2019)Fluoride Contamination of Groundwater and Toxicities in Dongargaon Block, Chhattisgarh, India. DOI 10.1007/s12403-016-0229-3
5. Castany, G., Marce, A., Margat, J., Moussu, H., Vuillaume, Y., &Evin, J. (1974). An environmental isotope study of the groundwater regime in large aquifers. International Atomic Energy Agency (IAEA): IAEA. ISSN 0074 – 1884
6. Dębowski, M.; Zieliński, M.; Kazimierowicz, J.; Kujawska, N.; Talbierz, S. Microalgae Cultivation Technologies as an Opportunity for Bioenergetic System Development—Advantages and Limitations. *Sustainability* **2020**, *12*, 9980. [Google Scholar] [CrossRef]
7. Fayyadh,A.S.; Hussien,B.M.; Al-Hamdani, M.M.; Salim,S.A.; Mukhlef,H.N and Maher,A.A. (2016). Hydrologic System of Euphrates River (Spatial Analysis) between Al-Qaem and Falluja. Iraqi Bulletin of Geology and Mining. 2: 1-12. doi.org/10.1016/j.biopha.2017.10.134
8. FAO. (2016). Food and Agriculture Organization of the United Nations. The State of World Fisheries and Aquaculture: Contributing to food security and nutrition for all. Rome. 200 pp. ISBN 978-92-5-109185-2
9. Gagan Singh Guru: 14. Islam MR, MM Haque, and MM Rahman, 2017. Strength and Weakness of Existing Traceability System of Seafood Production in Bangladesh. Progressive Agriculture, 28: 160-162
10. Sifa, L., & Senlin, X. (1995). *Culture and capture of fish in Chinese reservoirs*. IDRC, Ottawa, ON, CA.Kumar, Trilok, Mishra, Dr. Sonal, Thiske,Sanjay, Ali, Majid, Bhatia,Gurprit Singh, Pande, Chiranjeev (2018). THE CLIMATE IMPERATIVE: UNDERSTANDING THE IMPACTS AND SOLUTIONS OF CLIMATE CHANGE. (2018). *JOURNAL OF CRITICAL REVIEWS*, *7*(19). https://doi.org/10.53555/jcr.07.19.1453
11. Hossain M Z (1999), "A Socio-economic Study of Pond Fish Production in Some Selected Areas in Noakhali District", M.S. Thesis, Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh.
12. Pandey, C & Mishra A (2024), Assessing The Heavy Metal Contamination On Tissue Of Fish Channa Striata (Bloch) And Its Consequent Impact On Blood Composition From River Kharun, Chhattisgarh (India).Gis Science Journal, 11 (07), 856-867
13. Islam M S, Murshed S M M, Moniruzzaman M and Baree M A (2002), "Rice-cum Fish Farming in Selected Areas of Mymensingh District", Online J. Biol. Sci., Vol. 2, No. 10, pp. 715-718.
14. Islam S, 2010. Use of Selected Polyculture Practices by the fish Farmers of MelandahaUpazila under Jamalpur Districts. M.S. (Ag. Ext. Ed.) Thesis, Department of Agricultural Extension Education, Bangladesh Agricultural University, Mymensingh, Bangladesh.
15. Jahan H, I Parvez, and ASM Kibria, 2018. Current Aquaculture Practices in Dinajpur District: Special Emphasis on Fish Feeds. International Journal of Fisheries and Aquatic Research, 3(1): 35-42.
16. Kothari CR, 2004. Research Methodology: Methods and Techniques (2nd. ed.) New Age International (p) Limited.
17. Köppen, W. (1936) Das geographische System der Klimate. Handbuch der Klimatologie (ed. by W. Köppen and R. Geiger), Vol 1 PartDOI:10.1007/s00704-020-03190-8
18. Mazid MA, 2002. Development of Fisheries in Bangladesh, Plan and Strategies for Income Generation and Poverty Alleviation. 176 Dhaka: NasimaMazid, 74 A/2, Kallyanpur Main Road.
19. Mia MS, F Yeasmin, SM Moniruzzaman, MFH Kafi, MI Miah, and MS Haq, 2015. Socio-economic Condition of the Fishers‟ Community of Meghna River of Ashuganjupazila in Brahmanbaria district, Bangladesh. International Journal of Natural and Social Sciences, 2: 42-
20. Mischke CC, 2012. Aquaculture Pond Fertilization: Impacts of Nutrient Input on Production. Wiley Blackwell, Ames, IA, USA.
21. Mohan CV, 2007. Seed Quality in Freshwater Fish Production. pp. 499–517. In: M.G. BondadReantaso (ed.). Assessment of Freshwater Fish Seed Resources for Sustainable Aquaculture. FAO Fisheries Technical Paper. No. 501. Rome, FAO. 2007. 628p.
22. Mabunay, L., (2008). "Gender Roles in Women's Lives: A Study of Fishing Households in a Central Philippine Community", PhD. Dissertation, s.l.: McGill University, Montreal, Canada.
23. Machina, H. Namonje-Kapembwa, T., and Kasoma, A.C., (2018). Youth Employment in Zambia: What Opportunities Does Agriculture Offer? Indaba Agricultural Policy Research Institute (IAPRI) Lusaka, Zambia Downloadable at: http://www.iapri.org.zm/ and http://www.aec.msu.edu/fs2/zambia/index.htm.
24. Murray, U. &Sayasane, K., 2015. Socio-economic and gender issues in the UNDP/FAO Provincial Aquaculture Development Project. , Bangkok: The Food and Agriculture Organization of The United Nations.
25. Quddus M A, Rahman M S and Moniruzzaman M (2000), "Socio-economic Conditions of the pond owners of Demra, Dhaka", Bangladesh J. Fish. Res.,Vol. 4, No. 2, pp. 203-207.
26. Rashed MAR, 2018. Use of Best Management Practices (BMPs) by the Farmers of SavarUpazila of Bangladesh. M.S. (AEIS) Thesis, Department of Agricultural Extension and Information System, SherE-Bangla Agricultural University, Dhaka.

27. Toppo N, 2016. Quality Assessment of Some Farm Made Fish Feeds of Muktagacha and Phulpurupazila in Mymensingh district. MS Thesis, Department of Aquaculture, Bangladesh Agricultural University, Mymensingh, Bangladesh.
28. Tacon,A.G.J and Halwart,M. (2007). Cage aquaculture: a global overview. In: Cage aquaculture - Regional reviews and global overview. Halwart, M.; Soto, D. and Arthur, J. R. (Eds.): 1-16. FAO Fisheries Technical Paper. No. 498, Rome, FAO, 241 p. DOI:10.1080/23308249.2014.987209
29. Thakur, Ankit (2018) of status of the fishery cooperatives, SHGs and fishermen groups in Baster of Chhattisgarh P –ISSN: 2349-8234
30. Yi Y, Phuong DR, Phu TQ, Lin CK, Diana S. Environmental Impacts of cage culture for Catfish in Hongngu, Vietnam. In: Harris, R., Courter, I., Egna, H. (Eds.), Twenty-First Annual Report. Aquaculture CRSP, Oregon State University, Corvallis, Oregon.2004; 157-168. DOI:10.13140/2.1.3089.7280
31. Google Map (2024) https://www.google.com/maps/@20.9780764,80.8433137,13z?entry=ttu&g_ep=EgoyMDI0MDkxNi4wIKXMDSoASAFQAw%3D%3D