

Evaluation of Physico-chemical Parameters and Molluscan Diversity of Kanher Reservoir

Rekha N. Kadam*¹, I. F. Pailwan² and R. G. Patil³

¹ P. G. Department of Zoology, Lal Bahaddur Shastri College, Satara - 415 002, Maharashtra, India

² Kisanveer Mahavidhyalay, Wai, Satara - 412 803, Maharashtra, India

³ Research Director Department of Zoology Lal Bahaddur Shastri College, Satara - 415 002, Maharashtra, India

Abstract

Present study and aim of this problem is to evaluate, the physico-chemical parameters of water and molluscan diversity of Dhom reservoir was studied during 2020. Mollusca play important role in ecosystem functioning, pollution indicator, medicinal value, economical value and nutritious food source. During present investigation totally 11 molluscan species belonging to four orders and five families of molluscan species were observed in the Dhom reservoir. The species observed under class Bivalveia, order Trigoinea were, *Parreysia corrugata*, *Parreysia favidens*, *Lamellidens corrianus*, *Lamellidens marginalis*, *Corbicula regularis* and *Tarebia lineata*. The species observed under class Gastropoda, order Basommatophora were, *Lymnaea stagnalis*, *Lymnaea luteola* and *Melanoides tuberculata*. The order with Sorbeochoncha only single species was observed *Melanoides tuberculata*. The order with Mesogastropoda also only single species was observed *Bellamya bengalensis*. The results were discussed on the bases of physico-chemical analysis of water and molluscan diversity indices.

Key words: Dhom reservoir, Physico-chemical parameters, Molluscan diversity

Globally about 5,000 species of fresh water molluscs are studied, out of which 217 species comprising 150 are gastropods and 67 species are bivalves have been stated from freshwater ecosystem of India. In our India, Western Ghats is considered to be an exclusive biodiversity hotspot for molluscan species. In which 77 species of freshwater molluscs recorded alone in this area [1]. Mollusk are important biotic component of aquatic ecosystem and play major role in decomposition, bio filtration, pollution indicator, food source for fishes, humans and birds [2]. Molluscs are very sensitive to change in aquatic environment of biotic and abiotic factors so they are considered ecosystem freshwater engineers [3]. India has 49 endemic species, out of which only 6 freshwater mollusk are found endemic to Maharashtra [1]. Molluscs are very sensitive to change in climatic condition of water so they are considered to be bio-indicator of aquatic pollution [4]. Some freshwater molluscan species are vectors and intermediate host for transmission of many diseases in animals and humans [5]. Molluscan community play very crucial role in aquatic ecosystem by many ways like energy flow, food source, biological indicator. But nowadays they became decline due pollution as well as human activities [6]. Some species of molluscs are host for various diseases: *Melanoides tuberculata*

is the host for nematode diseases like Paragonimiasis, Echinostomiasis, Heterophyiasis. *Indoplanorbis exustus* is the host for Cercarial Dermatitis, Echinostomiasis, Amphistomiasis nematode disease [1].

Present study and aim of this problem is to evaluate the physico-chemical parameters in relation to the molluscan fauna of Dhom reservoir of Satara district. Healthy and pollution free aquatic ecosystem is essential for all living things. Water analysis is very important to understand the quality of water because the life of all living things depends on the quality of water. Aquatic pollution affects the aquatic life directly or indirectly. Pollution alters the natural environmental condition resulted into an impact on diversity and distribution of aquatic ecosystem in the natural reservoirs. With the help of physico-chemical and biological study we can understand the quality of water.

For conservation of aquatic ecosystem, regular and updated study is very important because this type of record is useful for government agencies for implementation of the various types of programs, projects, rules and regulations. With the help of such records government can use new techniques to maintain or to conserve the aquatic ecosystems. Scientific record on physicochemical parameters and their impact on the

Received: 07 Nov 2022; Revised accepted: 27 Dec 2022; Published online: 12 Jan 2023

Correspondence to: Rekha N. Kadam, P. G. Department of Zoology, Lal Bahaddur Shastri College Satara - 415 002, Maharashtra, India, Tel: +91 8888330960; E-mail: sankalpabacus7844@gmail.com

Citation: Kadam RN, Pailwan IF, Patil RG. 2023. Evaluation of physico-chemical parameters and molluscan diversity of Kanher reservoir. *Res. Jr. Agril Sci.* 14(1): 90-94.

aquatic organisms especially Molluscs of the reservoir ecosystem is significant to understand the sensitivity, diversity, distribution and interaction with increased or decreased value of a particular parameters.

MATERIALS AND METHODS

Dhom reservoir in Satara district, Maharashtra were selected for molluscan and limnological study. Dhom reservoirs are an earth fill and gravity reservoir. Dhom reservoir is constructed in 1978 near Dhom village of Wai tehsil, Maharashtra, India. It is located about 8 km west to Wai town and about 42 km west to Satara city. Wai is the historical tehsil of Satara district which is located on Krishna River.

Table 1 Details of Dhom reservoir

Type of dam	Earth fill gravity
Height	160 Ft.
Length	8,130 Ft.
Volume	1,520 Cu Mi.
Impounds	Krishna River
Reservoir capacity	79,400 Cu Mi.
Surface area	964 Sq Mile.
Type of gate	Circular
No. of gate	5

The samples were collected monthly at morning from 09:00 am to 11 am in 5 liter capacity plastic cans for the year 2020. Then samples brought into laboratory for physico-

chemical analysis. The physico-chemical parameters were analyzed by standard methods [7-8] such as temperature of water was measured by mercury rod thermometer. The reading was taken for 2 to 3 times until a constant reading was attended. The value of pH was measured by digital pH meter. At sampling station. Turbidity of water was recorded at sampling station with the help of sacchi disc method and total dissolved solids (TDS) by Bach's Gravetric method [7]. Dissolved oxygen (DO) estimated by Wrinkler's iodometric method [7]. Biological Oxygen Demand (BOD) by Wrinklers method and Alkalinity by Acidometric method [8]. Rest of the parameters such as total hardness, phosphates, nitrates, chlorides and free carbon dioxide estimated by titration methods [7].

Molluscs were collected by various methods such as hand picking, sieving by using sieve (pore size 0.425 mm), hand net and forceps etc. macro-organisms collected from substratum, on stone surface, among the vegetation, silt and sediments. Molluscs were collected at early in the morning with the help of collecting equipment's. After collection, all organisms were washed and cleaned under running tap water by using sieve, excess debris and mud was removed by using brush. Absorbent tissue was used to remove excess water and moisture. The well cleaned specimens were identified by comparing their characters under lens or microscope with standard literature. Identification was done by using the hand lens, Fluorescent microscope (Dexuxe), Projection microscope SP-16 and standard identification keys such as Records of the Zoological Survey of India, Zoological Survey of India Faunal Diversity [1]. The specimen diversity indices was calculated by Past 3.22 application.

Table 2 Seasonal fluctuation in physico-chemical parameters of Dhom reservoir during year 2020

Parameters	Stations	Summer	Rainy	Winter	Minimum Value	Maximum value	Average
Temperature (°C)	I	25.23	23.65	23.98	23.65	25.23	24.28
	II	24.80	23.20	24.35	23.20	24.80	24.12
	III	24.90	23.06	24.10	23.06	24.90	24.02
	IV	24.40	22.76	24.31	22.76	24.40	23.82
pH	I	6.83	6.52	6.98	6.52	6.98	6.78
	II	7.29	6.86	7.02	6.86	7.29	7.05
	III	6.87	6.49	6.76	6.49	6.87	6.71
	IV	6.83	6.52	6.97	6.52	6.97	6.77
Turbidity (NTU)	I	1.25	1.50	1.00	1.00	1.50	1.25
	II	1.50	1.25	1.75	1.25	1.75	1.50
	III	1.43	0.80	1.38	0.80	1.43	1.20
	IV	1.38	1.30	1.50	1.30	1.50	1.39
Total dissolved solids (mg/l)	I	370.50	500.00	455.00	370.50	500.00	441.83
	II	412.72	556.25	450.00	412.72	556.25	472.99
	III	318.47	435.00	473.75	318.47	473.75	409.07
	IV	379.50	480.00	380.00	379.50	480.00	413.17
DO (mg/l)	I	5.32	5.88	6.28	5.32	6.28	5.82
	II	4.45	6.00	6.37	4.45	6.37	5.60
	III	4.46	5.90	6.45	4.46	6.45	5.60
	IV	4.46	5.95	6.41	4.46	6.41	5.61
BOD (mg/l)	I	12.82	7.56	12.98	7.56	12.98	11.12
	II	12.86	7.51	12.91	7.51	12.91	11.09
	III	12.86	7.44	12.88	7.44	12.88	11.06
	IV	12.88	7.52	12.87	7.52	12.88	11.09
Alkalinity (mg/l)	I	50.99	30.59	49.40	30.59	50.99	43.66
	II	50.91	30.68	49.38	30.68	50.91	43.65
	III	50.82	30.57	49.46	30.57	50.82	43.62
	IV	50.86	30.50	49.24	30.50	50.86	43.53
Hardness (mg/l)	I	74.37	53.90	67.01	53.90	74.37	65.09
	II	74.26	54.02	67.09	54.02	74.26	65.12
	III	74.19	53.95	67.19	53.95	74.19	65.11
	IV	74.32	54.05	66.97	54.05	74.32	65.11

Phosphates (mg/l)	I	0.02	0.03	0.05	0.02	0.05	0.03
	II	0.02	0.03	0.03	0.02	0.03	0.02
	III	0.02	0.03	0.03	0.02	0.03	0.03
	IV	0.01	0.03	0.04	0.01	0.04	0.03
Nitrates (mg/l)	I	13.96	12.29	13.10	12.29	13.96	13.12
	II	13.93	12.29	13.11	12.29	13.93	13.11
	III	13.93	12.18	13.12	12.18	13.93	13.07
	IV	13.94	12.32	13.10	12.32	13.94	13.12
Chlorides (mg/l)	I	29.08	27.65	24.62	24.62	29.08	27.12
	II	29.07	27.59	31.32	27.59	31.32	29.32
	III	29.05	27.68	31.38	27.68	31.38	29.37
	IV	28.99	27.64	31.42	27.64	31.42	29.35
Free CO ₂ (mg/l)	I	8.11	5.49	8.52	5.49	8.52	7.37
	II	8.10	5.58	8.39	5.58	8.39	7.35
	III	8.09	5.64	8.42	5.64	8.42	7.38
	IV	8.07	5.64	8.40	5.64	8.40	7.37

RESULTS AND DISCUSSION

The physico-chemical parameters such as temperature, pH, turbidity, total dissolved solids, dissolved oxygen, biological oxygen demand, alkalinity, total hardness, phosphate, nitrate, chloride and free carbon dioxide were

observed at permissible limits. Monthly fluctuations was observed in above physico-chemical parameters because of various factors such as pollution, climate change and seasons, photosynthetic activities of aquatic plants and animals. Similar types of results about physico-chemical analysis observed by different scientists such as [9-16].

Table 2 Molluscan species occurred at study stations

Phylum	Class	Order	Family	Genus and Species
Mollusca	Bivalveia	Trigoinoida	Uninoidae	<i>Parreysia corrugata</i>
Mollusca	Bivalveia	Trigoinoida	Uninoidae	<i>Parreysia favidens</i>
Mollusca	Bivalveia	Trigoinoida	Uninoidae	<i>Lamellidens corrianus</i>
Mollusca	Bivalveia	Trigoinoida	Uninoidae	<i>Lamellidens marginalis</i>
Mollusca	Bivalveia	Trigoinoida	Uninoidae	<i>Corbicula regularis</i>
Mollusca	Bivalveia	Trigoinoida	Uninoidae	<i>Tarebia lineata</i>
Mollusca	Gastropoda	Basommatophora	Lymnaeidae	<i>Lymnaea stagnalis</i>
Mollusca	Gastropoda	Basommatophora	Lymnaeidae	<i>Lymnaea luteola</i>
Mollusca	Gastropoda	Sorbeochoncha	Tharidae	<i>Melanoidus tuberculata</i>
Mollusca	Gastropoda	Basommatophora	Planorbidae	<i>Indoplanorbis exustus</i>
Mollusca	Gastropoda	Architaenioglossa	Viviparidae	<i>Bellamyia bengalensis</i>

Table 3 Simpson 1-D of Dhom Reservoir

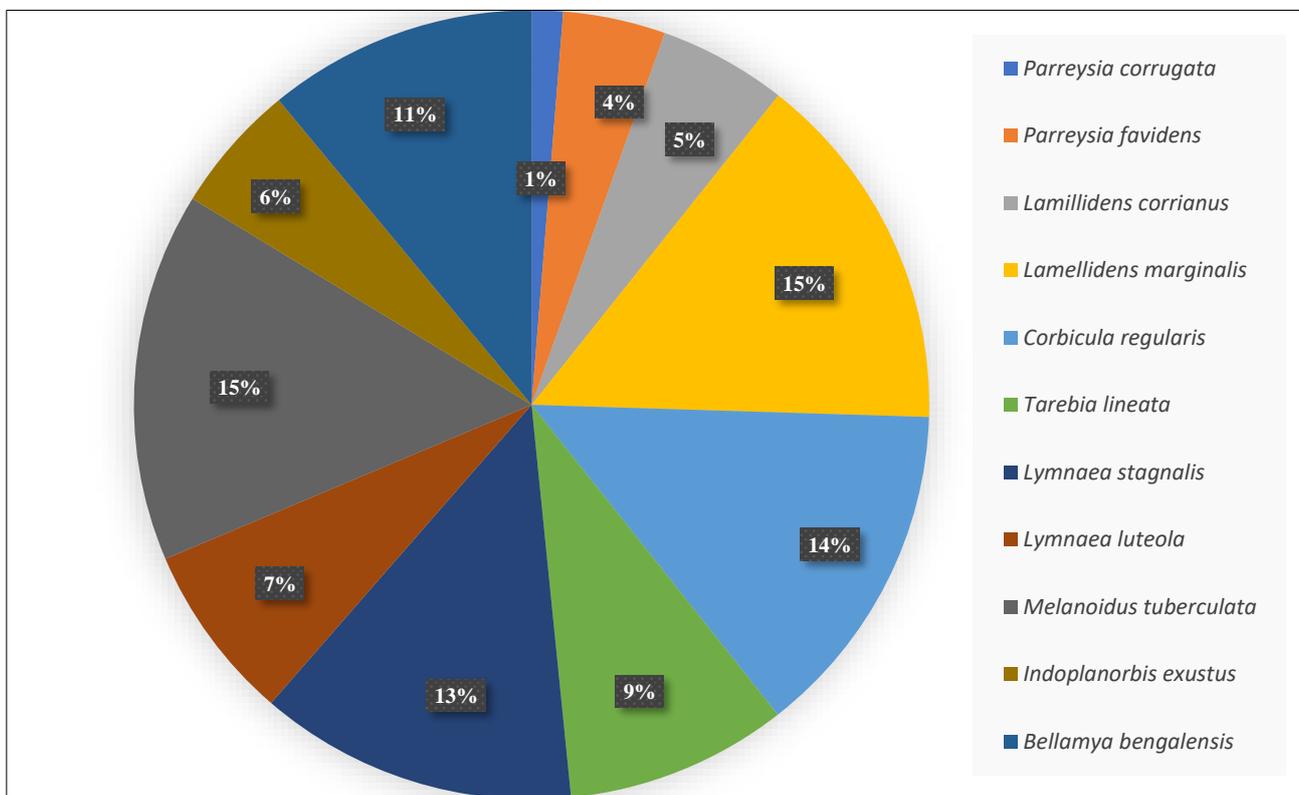
Name of species	Simpson_1-D of Dhom water reservoir
<i>Parreysia corrugata</i>	0.04353
<i>Parreysia favidens</i>	0.1427
<i>Lamellidens corrianus</i>	0.1785
<i>Lamellidens marginalis</i>	0.5075
<i>Corbicula regularis</i>	0.4749
<i>Tarebia lineata</i>	0.3094
<i>Lymnaea stagnalis</i>	0.4431
<i>Lymnaea luteola</i>	0.2482
<i>Melanoidus tuberculata</i>	0.5177
<i>Indoplanorbis exustus</i>	0.181
<i>Bellamyia bengalensis</i>	0.3751

The total number of 11 taxa were recorded from all sampling stations during the study period (Table 2). The molluscan community was recorded by two classes, viz., Gastropoda and Bivalveia. Gastropod was represented by two orders viz., Mesogastropoda and Basommatophora; three families (Viviparidae, Tharidae and Planorbidae). The species observed under class Bivalveia, order Trigoinoida were, *Parreysia corrugata*, *Parreysia favidens*, *Lamellidens corrianus*, *Lamellidens marginalis*, *Corbicula regularis* and *Tarebia lineata*. The species observed under class Gastropoda, order Basommatophora were, *Lymnaea stagnalis*, *Lymnaea luteola* and *Melanoidus tuberculata*. The order with Sorbeochoncha only single species was observed *Melanoidus*

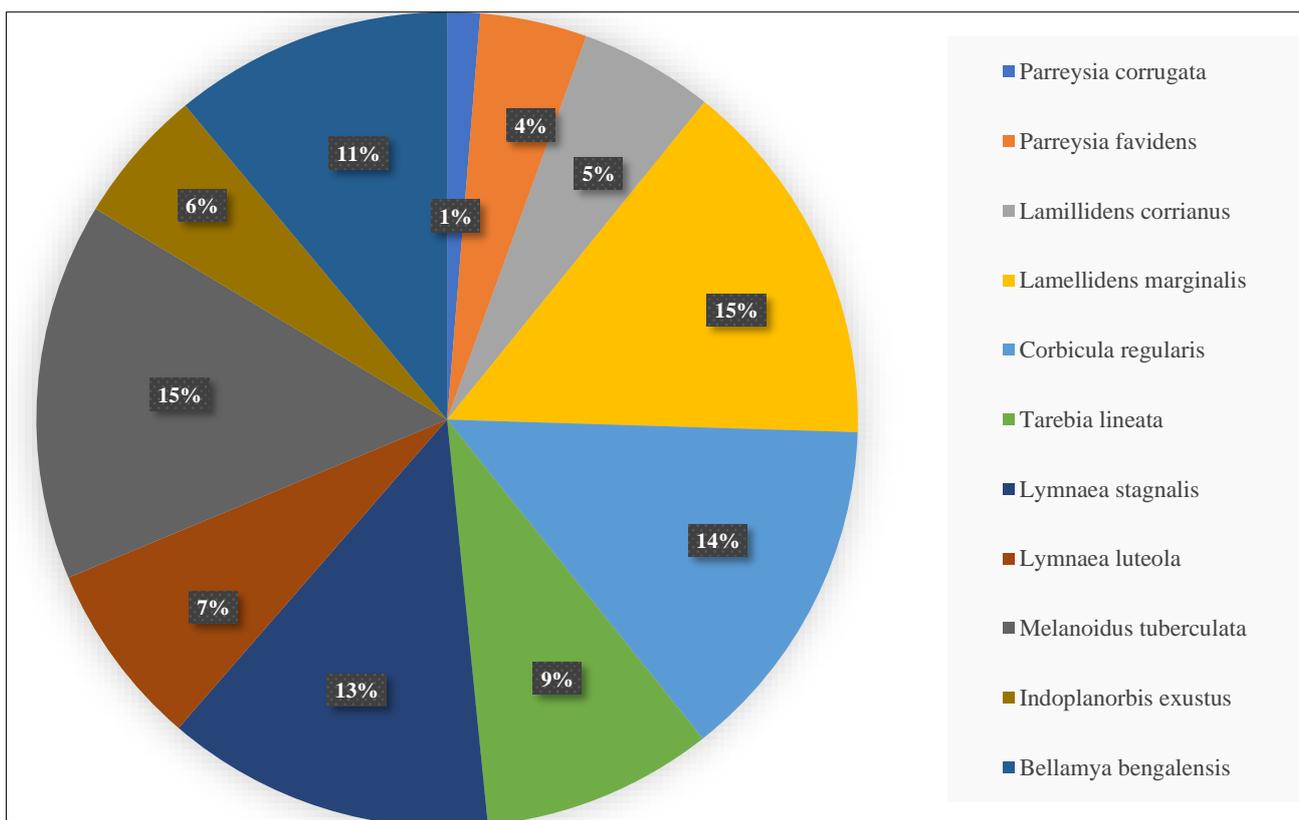
tuberculata. The order with Mesogastropoda also only single species was observed *Bellamyia bengalensis*. In the present investigation, the Simpson 1-D and Shannon H of Dhom reservoir for all species showed in (Table 3-4) and its percentage graph also showed in (Graph 2-3) respectively for the year 2020. Among the class Gastropod species, the percentage composition of *Lymnaea luteola* and *Indoplanorbis exustus* was high at Dhom reservoir with abundance of 22% for each species. Among the class Bivalveia species the percentage composition of *Parreysia corrugata* and *Corbicula regularis* was less in number at Dhom reservoir with only 1% for each species.

Table 4 Shannon_H of Dhom reservoir

Name of species	Simpson_1-D of Dhom water reservoir
<i>Parreysia corrugata</i>	0.04353
<i>Parreysia favidens</i>	0.1427
<i>Lamellidens corrianus</i>	0.1785
<i>Lamellidens marginalis</i>	0.5075
<i>Corbicula regularis</i>	0.4749
<i>Tarebia lineata</i>	0.3094
<i>Lymnaea stagnalis</i>	0.4431
<i>Lymnaea luteola</i>	0.2482
<i>Melanoidus tuberculata</i>	0.5177
<i>Indoplanorbis exustus</i>	0.181
<i>Bellamyia bengalensis</i>	0.3751



Simpson_1-D of Dhom water reservoir



Shannon_H of Dhom reservoir

Molluscs are most diverse and dominating invertebrate in fresh water ecosystem. The diversity of mollusca are depend on various factors like availability of food, temperature, pollution stress, habitat and nature of water [17]. In all over the world, there are 5000 species belonging to freshwater molluscs, of which 217 species were recorded from Indian freshwater ecosystem [1]. The diversity, richness and abundance of freshwater Mollusca have been recorded during the summer

season, because of decomposed organic matter settled down into the bottom and such condition take place in summer season [18]. Number of moluscans get increased and proliferate in summer season has been also reported by [19]. Some observations have been reported positive correlation between Mollusca and temperature by [20]. Freshwater Mollusca can be survived in low oxygen content water. Some parameters like hardness, alkalinity, nitrate and phosphate shows positive

correlation to Mollusca and play very crucial role in their growth, survival rate and proliferation. [21-22] stated that, the some species of mollusk can be survive in low pH (beyond 5 pH). [23] reported 13 molluscan species in Ramsagar reservoir India. [4] recalled 11 taxa of freshwater molluscs from class Gastropoda and Bivalvia representing 54.453 and 45.546% population of molluscs respectively.

CONCLUSION

From the study it can be concluded that the physico-chemical parameters of Dhom reservoir show average range in all parameters. There is no excessive value were recorded during study period. So, the water is suitable for aquatic animals, drinking, irrigation and agricultural purposes. During

study period 11 molluscan species were observed in the Dhom reservoir. The species observed under class Bivalveia are *Parreysia corrugata*, *Parreysia favidens*, *Lamillidens corrianus*, *Lamellidens marginalis*, *Corbicula regularis* and *Tarebia lineata*. The species observed under class Gastropoda are *Lymnaea stagnalis*, *Lymnaea luteola*, *Melanoidis tuberculata*, *Melanoidis tuberculata* and *Bellamya bengalensis*.

Acknowledgement

We are thankful to Principal, Lal Bahadur Shastri College, Satara and Head, Department of Zoology for providing facilities to perform laboratory work. We also extend our gratitude towards the Dhom reservoir office to carry out research work in Dhom reservoir of Satara district.

LITERATURE CITED

1. Chandra K, Gopi KC, Rao DV, Valarmathi K, Alfred JRB. 2017. *Current Status of Freshwater Faunal Diversity in India*.
2. Weerakoon SN, Chandrasekara WU, Amarasinghe US. 2021. Diversity and distribution of freshwater molluscan fauna in reservoirs and headwater streams of the Kala Oya River basin in Sri Lanka. *Sri Lanka Journal of Aquatic Sciences* 26(2): 67.
3. Lathlean JA, McQuaid CD. 2017. Biogeographic variability in the value of mussel beds as ecosystem engineers on South African rocky shores. *Ecosystems* 20: 568-582.
4. Sharma KK, Bangotra K, Saini M. 2013. Diversity and distribution of Mollusca in relation to the physico-chemical profile of Gho-Manhasan stream, Jammu (J & K). *International Journal of Biodiversity and Conservation* 5(4): 240-249.
5. DEQ W, Mabidi A, Bird MS, Perissinotto R, Thorne RSJ, Williams WP, Station LIE, Epler JH, Ramakrishna Dey A, Subramanian KA, Sivaramakrishnan. 1992. Handbook on Indian freshwater molluscs. In: *State of Florida Department of Environmental Protection Division of Water Facilities Tallahassee* 12(3): .
6. Lopes-Lima M, Teixeira A, Froufe E, Lopes A, Varandas S, Sousa R. 2014. Biology and conservation of freshwater bivalves: Past, present and future perspectives. *Hydrobiologia* 735(1): 1-13.
7. APHA, AWWA, WPCF. 2005. Standard methods for examination of water and waste water, 21st Edition, *American Public Health Association*, New York.
8. Trivedy RK, Goel PK. 1986. Chemical and biological methods for water pollution studies. *Env. Publications*. pp 247.
9. Pawar SM, Sonawane SR. 2012. Water quality profile of kas reservoir of Satara District, Maharashtra, India. *Nature Environment and Pollution Technology* 11(1): 173-176.
10. Gaikwad VD, Padule AR, More RB. 2021. Study of physicochemical parameters of Uttarmand reservoir in Patan tahsil, district Satara (M.S.). 9(7): 2019-2021.
11. Gujar MP, Patil RG, Suryavanshi SK, Rajebhonsale MS. 2015. Evaluation of physicochemical factors of river Koyana in district Satara (Maharashtra-India). *International Journal of Researches in Biosciences, Agriculture and Technology* 3(2): 111-113.
12. Bandral M, Gupta K. 2013. A survey on physico-chemical parameters in relation to abundance / distribution of fresh water Crab (*Paratelphusa masoniana*) in GH0 Manhasan Stream of Jammu Region, India. *Research Journal of Animal, Veterinary and Fishery Sciences* 1(9): 1-6.
13. Swain S, Sawant PB, Chadha NK, Chhandaprajnadasini EM, Katare M. 2020. Significance of water pH and hardness on fish biological processes: A review. *International Journal of Chemical Studies* 8(4): 830-837.
14. Mushahida-Al-Noor S, Kamruzzaman S. 2013. Spatial and temporal variations in physical and chemical parameters in water of Rupsha River and relationship with Edaphic Factors in Khulna South Western Bangladesh. *International Journal of Science and Research* 2(1): 460-467.
15. Belokda W, Damsiri Z, Natij L, Khalil K. 2020. *Assessment of physico-chemical parameters of freshwater in the Sidi Abderrahmane reservoir, Safi, Morocco*. *African Journal of Aquatic Science* 45(3): 259-268.
16. Salvai A, Grabic J, Josimov-dundjerski J, Zemunac R, Antonic N, Savic R, Blagojevi B. 2022. Trend analysis of water quality parameters in the middle part of the Danube flow in Serbia. *Ecological Chemistry and Engineering* 29(1): 51-63.
17. Montagnac V, Guyondet T, Comeau L, Tremblay R. 2020. Physiological differences between wild and cultured bivalves in Prince Edward Island, Canada. *Aquatic Living Resources* 33(8): 1-11.
18. Michael RG. 1968. Studies on bottom fauna in a tropical freshwater pond. *Hydrobiol.* 31: 203-230.
19. Bath KS, Kaur H, Dhillon SS. 1999. Correlation of Molluscs with Physico-chemical factors at Harike Reservoir (Punjab). *Indian Jr. Environ. Sci.* 3: 159-163.
20. Malhotra YR, Sharma KK, Thakial MR. 1996. Ecology of macroinvertebrates from a fish pond. *Proceedings of National Academy of Science India* 66: 53-59.
21. Wright JF, Furse M, Armitage P. 1994. Use of macroinvertebrate communities to detect environmental stress in running waters. *Water Quality and Stress Indicators in Marine and Freshwater Systems: Linking Levels of Organization* 4: 15-34.
22. Rosenberg DM, Resh VH. 1993. Introduction to fresh water biomonitoring and benthic macroinvertebrates. In: Chapman and Hall, New York. pp 1-9.
23. Garg RK, Rao RJ, Saksena DN. 2009. Correlation of molluscan diversity with physico-chemical characteristics of water of Ramsagar reservoir, India. *Int. Jr. Biodivers Conservation* 1(6): 202-207.