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## Assessment of Molluscs as Indicator of Water Quality

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### ABSTRACT

*Mollusc species of three reservoirs Panshet, Khadakwasla and Ujjani reservoirs were studied. Good number of mollusc species were found in Ujjani reservoir comparatively. A Physicochemical study of three reservoirs was related with the abundance of molluscs. Presence of molluscs were due to alkaline nature, more calcium content and salts with high BOD, COD Nutrients, plant population of Ujjani reservoir located in downstream which had relatively more dissolved salts than Panshet and Khadakwasla reservoir located in the upstream with less human pressures showed less number of molluscs.*

**Keywords:** Molluscs, Ujjani reservoir, Alkalinity, Calcium, BOD, COD, Nutrients.

### I INTRODUCTION

Panshet Dam, Khadakwasla Dam and Ujjani Dams are situated in Bhima basin, Maharashtra. Panshet and Khadakwasla Dam/ Reservoirs are situated upstream whereas Ujjani Reservoir is in the downstream. The catchment area of Panshet dam and Khadakwasla are approx. 120 sq.km is surrounded by Hills which are extension of the main ridge of western ghats and rise to a height of 1200 m to 1300 m where Ambhi river and Mutha river are unpolluted as the catchment area is having good forest cover and comparatively less urbanization and industrialization.

Ujjani Reservoir is the terminal water body in the Upper Bhima River Basin. Its huge catchment area of 14850 sq. km is having more than 90 % urban, rural, industrial and agricultural activities which affects in its water quality day to day. Mula-Mutha tributary of Bhima River from Pune city carry discharges of more than 40 sewage lines and joins Bhima river at Paragon. There are more than 86% of untreated wastewaters discharged into the tributaries of Bhima river from the fast growing cities – Pune and Pimpri Chinchwad having combined population more than 6 million. Dam or Reservoir Project details are given in table 1.

**(a) Molluscs and Water Quality:** Molluscs are filter feeders hence they take in suspended materials from water, making water clear but they decrease the phytoplankton biomass. Mollusc abundance was observed extensively in Ujjani reservoir.



Molluscs are of immense importance from ecological point of view. They even have beneficial both economically and medicinally (Wosu, 2003). They have been important to humans since historic times as a source of food, jewellery, tools and even pets. Fresh water molluscs play significant role in public and veterinary health (Supian and Ikhwanuddin, 2002). Some fresh water snails are vectors of diseases of humans and livestock, serve as the intermediate hosts for a number of infections such as helminth diseases caused by trematodes (Abd El-Malek, 1958; Dazo et al., 1966; Barbosa and Barbosa, 1994; Brown, 1994; Karimi et al., 2004; Cañete et al., 2004; Kazibwe et al., 2006; Mostafa, 2009). The ecology of these organisms is considered to be affected by environmental factors like physico-chemical parameters (Garg et al., 2009), availability of food, competition, predator-prey interactions (Williams, 1970; Harman, 1972; McMahan et al., 1974; Lassen, 1975; Ofiozie, 1999), substrate architecture (Kershner and Lodge, 1990) and macrophytes (Bronmark, 1985; Costil and Clement, 1996; Ofiozie, 1999).

As molluscs are common components of the benthic communities, understanding their role in the aquatic ecosystems and their contribution to biomass production is deficient (Supian and Ikhwanuddin, 2002).

**(b) Study area:** Three reservoirs of Bhima Basin, Panshet and Khadakwasla at the upstream and Ujjani a terminal reservoir at the downstream.



**Fig 1 : Location of Panshet, Khadakwasla and Ujjani Reservoir**

Panshet Reservoir and Khadakwasla Reservoirs are located in pristine environment, and their catchment area drains almost nil sewage whereas

Ujjani Reservoir drains more than 86 % of untreated sewage and domestic from its huge catchment ha city Rivers Mula-Mutha and Bhima.

**Table 1:**  
**Project details of the Reservoirs under study.**

S.No.	Official name	Panshet Dam	Khadakwasla Dam	Ujjani Dam
1	Location	Velhe Pune District	Khadakwasla Village	Ujjani, Solapur istrict
2	Coordinates	18°23'15"N 73°36'46"E	18°26'30"N 73°46'5"E	18°04'26"N 75°07'12"E
3	Opening date	1972	1964	1980
4	Height	63.56 m	31.79 meter	56.4 m
5	Length	1,039 m	1939 meters	2,534 m
6	Volume	4,190 km <sup>3</sup>	85.91 MCM	3,320,000 m <sup>3</sup>
7	Impounds	Ambi river	Mutha River	Bhima River
8	Catchment area	120 sq.km	200 sq.Km	14,850 Sq. km
9	Surface area	65 sq.Km	14.8 Sq.Km	337 Sq.Km

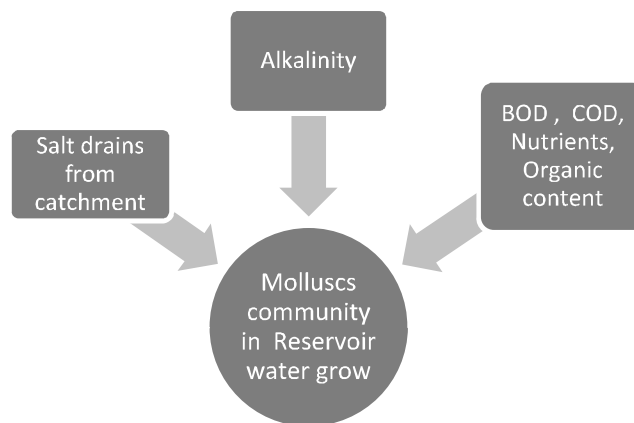
**Table 2:**  
**Comparative differences in Catchment area of Three Reservoirs**

S.No.	Catchment Land	Panshet Reservoir	Khadakwasla REservoir	Ujjani Reservoir
1	Forest Cover	Approx 40%	Approx 10%	No Forest cover
2	Agricultural	Approx 30 %	Approx 20 %	Approx 10 %
3	Industrial	< 1 %	< 3 %	> 80%
4	Urban	< 1 %	< 10 %	> 90%
5	Population	< 10 %	< 30 %	> 80%

(c) **Flowdiagram** : Figure 2, below shows molluscs needed more salts for their life cycle. Their shell needs calcium for its build up,

which they can absorb well in alkaline waters. More organic content was indicated by high BOD and COD.





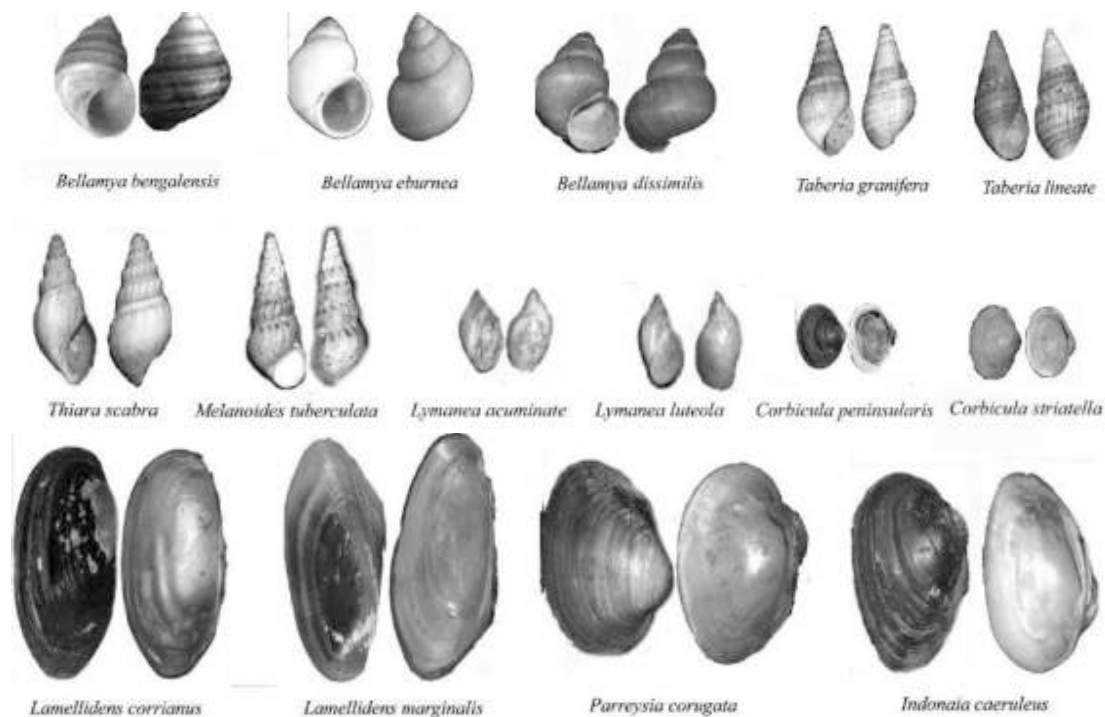
**Fig. 2: Molluscs as Indicators of Water Quality**

**II METHODOLOGY**

(a) **Mollusc Collection** Molluscs were sampled using a D-frame net with approximately 30 x 20 cm in border area of 2m<sup>2</sup>. Three replicate samples were taken at each site. The collected specimens were kept in plastic containers. Then the animals were preserved in 7% alcohol for further study. Dead specimens with dry shells were also collected samples were brought to laboratory. In the laboratory, samples were washed in two sieves (2 and 0.5 mm mesh) and sorted and identified. It was

done from 5 locations in each of the three reservoirs. Tables 1-3 shows seasonal variation of molluscs.

(b) **Water Sample Collection** - Surface water from sampling locations were collected in well labeled cleaned polyethylene bottles rinsed by deionized & reservoir water. Analysis of physicochemical parameters is done as per APHA (2005), Standard Methods for the Examination of Water and Waste Water, 21<sup>st</sup> edition, American Public Health Association, Washington, DC., USA.



**Fig. 3 : Images of Mollusc species from Reservoirs**

Mollusc sp were collected and counted from every 100 sq ft area in five locations of three reservoirs, Panshet, Khadakwasla and Ujjani during three

seasons. During summer season heaps of snails were found dead on the bank of Ujjani reservoir.

**Table 3**  
**Mollusc abundance in Monsoon for 3 reservoirs**

S.No.	Molluscs sp	Panshet	Khadakwasla	Ujjani
	Molluscs sp			
1	<i>Bellamaya bengalensis</i>	-	++	++++
2	<i>Bellamya eburnea</i>	-	+++	++++
3	<i>Bellamya dissimilis</i>	+	++	++++
4	<i>Tuberia granifera</i>	++	+++	++++
5	<i>Tuberia lineate</i>	++	+++	++++
6	<i>Thiara scabra</i>	++	+	++++
7	<i>Melanoides tuberculata</i>	-	++	++++
8	<i>Lymanea acuminate</i>	+	++	++++
9	<i>Corbicula peninsularis</i>	+	+++	++++
10	<i>Corbicula striatella</i>	++	+++	++++
11	<i>Lamellidens corrianus</i>	-	+++	++++
12	<i>Pareysia curvugata</i>	-	++++	++++
13	<i>Lamellidens marginalis</i>	++	++++	++++
14	<i>Indonaia caerules</i>	++	+++	++++

+++++) Most Abundance; (+++) Less Abundance; (++) Present; (-) Absent;

**Table 4**  
**Mollusc abundance in Winter for 3 reservoirs**

S.No.	Molluscs sp	Panshet	Khadakwasla	Ujjani
	Molluscs sp			
1	<i>Bellamaya bengalensis</i>	-	+++	++++
2	<i>Bellamya eburnea</i>	++	+++	++++
3	<i>Bellamya dissimilis</i>	+	++	++++
4	<i>Tuberia granifera</i>	++	+++	++++
5	<i>Tuberia lineate</i>	++	+	++++
6	<i>Thiara scabra</i>	-	+++	++++
7	<i>Melanoides tuberculata</i>	++	+++	++++
8	<i>Lymanea acuminate</i>	++	+++	++++
9	<i>Corbicula peninsularis</i>	-	-	++++
10	<i>Corbicula striatella</i>	++	+++	++++
11	<i>Lamellidens corrianus</i>	++	+++	++++
12	<i>Pareysia curvugata</i>	-	+++	++++
13	<i>Lamellidens marginalis</i>	-	+++	++++
14	<i>Indonaia caerules</i>	++	+++	++++

(+++++) Most Abundance; (+++) Less Abundance; (++) Present; (-) Absent;

**Table 5**  
**Molluscs abundance in summer for three Reservoirs**

S.No.	Molluscs sp	Panshet	Khadakwasla	Ujjani
	Molluscs sp			
1	Bellamaya bengalensis	-	++	+++++
2	Bellamya eburnea	++	+	+++++
3	Bellamya dissimilis	-	++	+++++
4	Tuberia granifera	++	+++	+++++
5	Tuberia lineate	+	+	+++++
6	Thiara scabra	++	+++	+++++
7	Melanoides tuberculata	-	+	+++++
8	Lymanca acuminata	+	+++	+++++
9	Corbicula peninsularis	++	+++	+++++
10	Corbicula striaetella	++	+++	+++++
11	Lamellidens corrianus	-	+++	+++++
12	Pareysia curvugata	-	+++	+++++
13	Lamellidens marginalis	-	+++	+++++
14	Indonata caerules	++	+++	+++++

(+++++) Most Abundance; (+++) Less Abundance; (++) Present; (-) Absent;

**Table 6 :**  
**Physicochemical parameters of three Reservoirs (Average Values)**

S.No	Parameter	Parameter	Objective	Panshet	Khadakwasla	Ujjani
1	pH	-	8.5	8.4	8.4	7.4
2	EC	µS/cm	300	78	88	169
3	DO	mg/l	5	8	7	5
4	BOD	mg/l	2	1	2	120
5	COD	mg/l	10	5	6	74
6	Na+	mg/l	250	3	7	63
7	K+	mg/l	12	0.8	0.6	24
8	Ca++	mg/l	75	7.6	6.9	58
9	Mg++	mg/l	200	7.8	6.8	6.8
10	TH	mg/l	300	66	67	126
11	HCO3-	mg/l	200	0	2.5	162
12	CO3=	mg/l	200	0	3.1	172
13	TALK	mg/l	300	0.77	6.5	268
14	Cl-	mg/l	250	8.5	6.7	74
15	SO4=	mg/l	150	7.8	6.8	74
16	NO3-N	mg/l	45	6.9	8.1	0.83
17	PO4-P	mg/l	0.1	0.69	0.8	0.81
18	SiO2	mg/l	50	6.6	8.3	82
19	Fe	mg/l	0.3	0.83	0.78	0.69
20	TDS	mg/l	500	79	104	178

### III RESULTS

Ujjani reservoir shows most abundance of molluscs. Unlike Ujjani reservoir Panshet and Khadkwasla reservoirs show less abundance and

sometimes scanty presence of molluscs. This is shown in Figure 4. While counting the number of mollusc (+++++) abundance were given more than 25 for each (+) and (-) would indicate absence of molluscs.

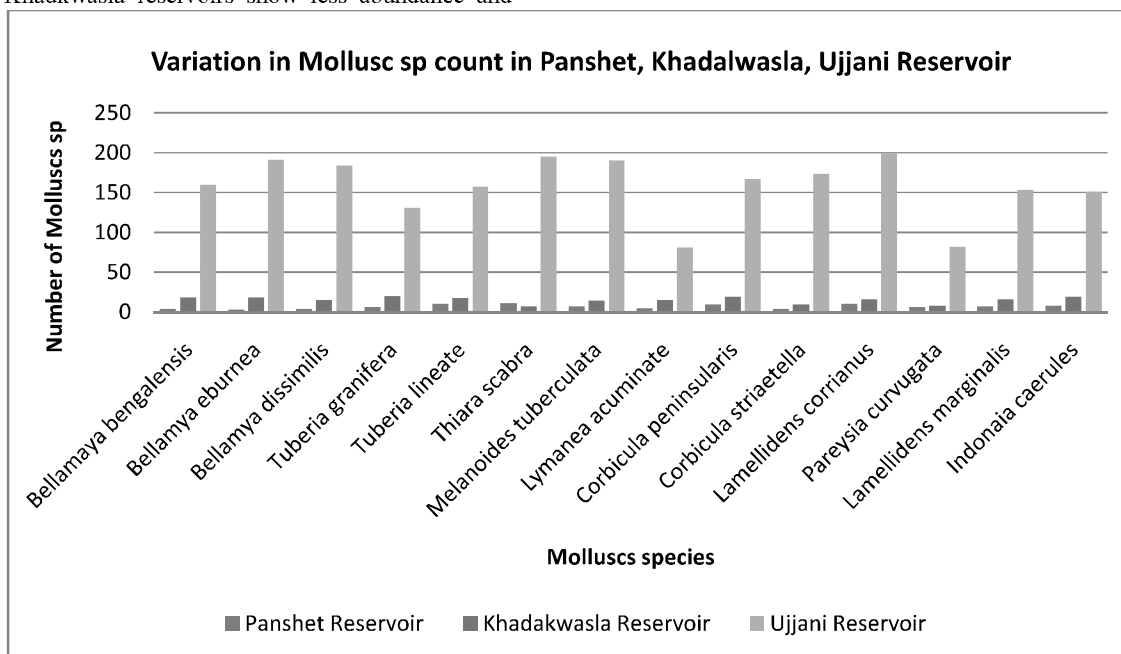


Fig. 4 : Variation of Molluscs species in Panshet, Khadakwala and Ujjani Reservoirs

### IV DISCUSSIONS

The study of relationship of abundance of molluscs to water quality parameters is depicted from abundance tables 3-5 and table 6 for physicochemical parameters for its comparative differences. Ujjani reservoir is having comparatively high salt content ranging from 100 to 500 mg/l, alkalinity more than 100 mg/l and Calcium content more than 50 mg/l with high BOD, COD and the nutrient content from its huge catchment area which is highly urbanized. The presence of aquatic plants in Ujjani reservoir makes home for molluscs and affects the dissolved oxygen concentration. Green plants release oxygen into the water during photosynthesis. Photosynthesis occurs during the day when the sun is out and ceases at night. Thus in Ujjani reservoir with significant populations of algae and other aquatic plants, the dissolved oxygen concentration may fluctuated daily, reaching its highest levels in the late afternoon.

Molluscs have a variety of different feeding mechanisms. The bivalve molluscs can filter-feed fine particles from water. Some of the single-shelled molluscs (limpets) possess a ribbon-shaped tongue or radula, covered with rasping teeth, which

enables them to scrape algae from the pebbles or hard bottom.

**(a) Significance of mollusc:**

The freshwater molluscs play a very important role in nature and help in assessment of ecological status of the water bodies. Being herbivores, they form the lower strata of aquatic trophic linkages and perform many other ecological activities. Hence, studies pertaining to their diversity, distribution and ecology become imperative. Bivalves intimately correlated with the physico-chemical regime of the reservoir. These species can be considered as bioindicators of pollution as they were found to respond prominently to nutrient inputs, discharge of sewage and excreta produced by animals and humans. A progressive increase in their number with increasing pollution load indicates that they possess great tolerance against the contaminants present in water and flourish well in their presence. Findings of the present work shall be utilized by future researchers and ecologists as supplementary information in public and veterinary health sciences, ecotoxicology, water quality assessment and river and reservoir management studies.



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