Diversity of Molluscan communities in Kondakarla Freshwater Lake, Visakhapatnam, Andhra Pradesh

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ABSTRACT

Background: Kondakarla Lake is the second largest natural freshwater lake in Andhra Pradesh, India located at a distance of 42 km from Visakhapatnam. The molluscan faunal diversity was investigated during the study period from July 2012 to June 2014. The study aimed to keep records mainly on the taxonomy, distribution, status, and conservation need of the different species.

Methods: Samples were collected with the help of local people by using Peterson’s grab sampler, Surber and D-Frame. The collected samples were washed and preserved in plastic screw cap bottles and preserved in 70 - 80% ethyl alcohol and in 5% formalin solution.

Results: Altogether 14 species of these 28.57% of class Bivalvia and 71.429% of Gastropoda were recorded at four selected stations. Order Mesogastropoda dominant with 2 families which contributed to 50% of the total population followed by Trigoinoida and Bsommatophora each contributed to 25%. The number and Percentage composition of Population Status were recorded during the study period. The recorded range of various diversity indexes were noted at different seasons.

Conclusion: Kondakarla freshwater lake consisting of 28.571% of class Bivalvia and 71.429% of gastropoda was recorded at four stations during the study period. The Population Status was 07.143% abundant, 57.143% species were common, 21.429% species were moderate and 14.286% species were rare in the total catch.

Key-words: Bivalvia, Diversity Index, Gastropoda, Population Status, Mollusca

INTRODUCTION

The Indian freshwater community is a rich diversity of molluscs, representing 212 species belonging to 21 families, 164 species were recorded from rivers and streams [1]. Approximately 5,000 species of freshwater snails were inhabitant lakes, ponds, and streams worldwide [2]. Freshwater mussels are soft-bodied animals that are usually producing an external skeleton is composed of a limy material or calcium carbonate, which serves both protective and supportive purposes. Freshwater molluscs grouped into two main classes i.e. Bivalves, and Gastropods. These are found in a wide range of freshwater habitats and have varied life history strategies, with lifespan that vary from species to species three months i.e. pea clams, 120 years for pearl mussels. They find their highest levels of endemism and diversity in ancient lakes, large river basins, and artesian basins and all of these habitats can be found within the Eastern Mediterranean region [3]. The freshwater snails are bioindicators and play a crucial role in the natural ecosystem. They are saprophytic animals and purify water bodies as they consume algae, zooplankton, diatoms, and organic waste. They provide food for many kinds of animals such as fish, birds and also for human beings and they are part of food webs [4,5].
Being mollusks are significant to humans throughout history as food source, tools, jewelry, and even pets. The present study aimed to keep records mainly on the taxonomy, distribution, status, and conservation need of the different species found at Kondakarla freshwater lake.

MATERIALS AND METHODS

Study area- Kondakarla Lake is the second largest natural fresh water lake in Andhra Pradesh located at a distance of 42 km from Visakhapatnam and 7 km from Anakapalle. It is located north-east of Kondakarla village, lies between latitudes 17°35’30″ and 17°36’02″ N, and longitudes 82°59’27″ and 83°1’0″ E. Samplings were done between 6.30 am and 11.30 am on every bimonthly and analyzed in department of Environmental sciences laboratory, Andhra University. Four stations were selected for the present study to the collection of Molluscs during the period June 2012 to May 2014. They are (Station I- Kakarapalli (E), Station II- Kondakarla Bird sanctuary (W), Station III- Vadrapalli (N), Station IV- Avasomavaram (S) (Fig. 1).

Collection, Preservation, and Identification- Molluscans were collected from each sampling site with the help of local people by using the boat, nylon scoop net, gloves, Peterson’s grab sampler, Surber and D-Frame. The Specimens were assembled to use hand-picking and scoop method, and collected samples were washed and preserved in plastic screw cap bottles and preserved in 70 - 80% ethyl alcohol and in 5% formalin solution. Diversity was estimated by counting the total number of species per square meter for each sample. The specimens were categorized and identified on the basis of characteristics of the shell such as shape, size, color, and ornamentation of coiled shell. Other characteristics include whorls as rounded, angular, keel over including shape, length and number of the spire, aperture as sinistral/dextral, opercula (trap door) absence/presence and their shape.

Few minute characteristics such as the size and shape of apex, suture deepness, low, the shape, position, size of umbilicus and columellar, Imperforated and perforated, the outer covering (periostracum), pigment, patterning (ribbed and striated), eye and tentacle position were also studied this course of work. The mathematical expression of Shannon- Wiener Index (H), Simpson Index, Menhinick Index, Buzas and Gibson’s Index, and evenness was calculated by using online calculator. The present study revealed, the occurrence of fourteen species belongs to two classes, three orders, four families and ten genera. List of molluscan fauna including their Class, order, family, genus, species and IUCN status were recorded in the present investigation was given in Table 1.
Total 28.57% of class Bivalvia and 71.42% of gastropoda was recorded at four stations during the study period. The listed species are Lamellidens corrianus, Lamellidens marginalis, Parreysia favidens, Parreysia corrugate, Bellamya bengalensis, Bellamya dissimilis, Thiara (Melanoides) tuberculata, Tarebia granifera, Tarebia granifera, Bithynia pulchella, Pila globosa, Lymnaea acuminata, Gyraulus convexiusculus and Indoplanorbis exustus.

Table 1: List of molluscs and their class, order, family, genus, species, population status and IUCN status at Kondakarla Lake

| Taxa                          | Population Status | IUCN 2018-1 |
|-------------------------------|-------------------|-------------|
| **Class: Bivalvia**           |                   |             |
| **Order: Trigoinoida**        |                   |             |
| Family– Unionida               |                   |             |
| Lamellidens corrianus         | C                 | LC          |
| Lamellidens marginalis        | C                 | LC          |
| Parreysia favidens            | M                 | LC          |
| Parreysia corrugata           | C                 | LC          |
| **Class: Gastropoda**         |                   |             |
| **Order: Mesogastropoda**     |                   |             |
| Family– Viviparida             |                   |             |
| Bellamya bengalensis          | M                 | LC          |
| Bellamya dissimilis           | M                 | LC          |
| Family– Thiarida              |                   |             |
| Thiara rudis                  | R                 | LC          |
| Thiara (Melanoides) tuberculata| C               | LC          |
| Tarebia granifera             | R                 | LC          |
| Bithynia pulchella            | C                 | LC          |
| Pila globosa                  | C                 | LC          |
| **Order: Bsommatophora**      |                   |             |
| Family– Planorbida             |                   |             |
| Lymnaea acuminata             | C                 | LC          |
| Gyraulus convexiusculus       | C                 | LC          |
| Indoplanorbis exustus         | A                 | LC          |

LC- Least concern; A= Abundant (76-100%); C = Common (51-75%); M = Moderate (26-50%); R = Rare (1-25%) of the total catch

In the present investigation, the number and percentage composition of families, genera, and species under different orders are shown in Table 2 and Fig 2, 3, 4. Order Mesogastropoda dominant with 2 families which contributed to 50% of the total population followed by Trigoinoida and Bsommatophora each with one, which contributed to 25%. Recorded orders Mesogastropoda dominant with 5 genera which contributed to 50% of the total population followed by Trigoinoida with 3, which contributed to 28.57% and Bsommatophora with 2 contributed to 21.43%.
Table 2: The number and percent composition of families, genera and species of Molluscans under various orders

| S. No. | Order          | Families (%) in an order | Genera (%) in an order | Species (%) in an order |
|--------|----------------|--------------------------|------------------------|------------------------|
| 1      | Trigoinoida    | 25                       | 20                     | 28.57                  |
| 2      | Mesogastropoda | 50                       | 50                     | 50                     |
| 3      | Bsommatophora  | 25                       | 30                     | 21.43                  |

Fig. 2: Percentage of families in an order

Fig. 3: Percentage of genera in an order

Fig. 4: Percentage of species in an order

In the present study, the number and percent composition of genera and species under various families were represented in Table 3 and Fig. 5 & Fig. 6. The generic composition of Molluscans belonging to different families shows that ten genera were recognized. The highest genera under Thiaridae contributed to 4, which contributed to 40% followed by Planorbidae with 3 contributed to 30%, Unionidae with 2 contributed to 20% and Viviparidae with one, which contributed to 10%.

Table 3: Number and percent composition of genera and species under various families

| S. No. | Families     | Genera in a family (%) | Species in a family (%) |
|--------|--------------|------------------------|------------------------|
| 1      | Unionida     | 20                     | 28.57                  |
| 2      | Viviparida   | 10                     | 14.29                  |
| 3      | Thiarida     | 40                     | 35.71                  |
| 4      | Planorbida   | 30                     | 21.43                  |
The number and percentage composition of population status is one species were abundant, which contributed to 7.14%, 08 species were common, which contributed to 57.14%, three species moderate which contributed to 21.43% and two species rare, which contributed to 14.29% in the total population (Table 4, Fig. 7). According to IUCN [24] all 14 species of both classes were Least Concern (LC) Table 1. On an average of various diversities, indexes were analyzed during the study period from July 2012 to June 2014. The recorded range of Shannon’s Index (H), Simpson Index, Menhinick Index, Buzas, and Gibson’s Index of class Bivalvia was 1.30 - 0.18 and gastropoda is 2.21 – 0.11. The calculate range in various orders i.e. Trigoinoida was 1.36 – 0.18, Mesogastropoda was 01.83 – 0.16, Bsommatophora was 1.09 - 0.32. Evenness is nearly similar in all classes and orders Table 5, Fig. 8 & Fig. 9.

Table 4: The number and percentage composition of Population Status in the total population

| Population Status | A (76 - 100%) | C (51 - 75%) | M (26 - 50%) | R (1 - 25%) |
|-------------------|---------------|--------------|--------------|-------------|
| Number of species | 01            | 08           | 03           | 02          |
| Composition (%)   | 7.14          | 57.14        | 21.43        | 14.29       |

A=Abundant, C= Common, M= Moderate, R= Rare
Table 5: Average diversity indexes from July 2012 to June 2014 in Kondakarla Ava Lake

| Diversity Index       | Class       | Orders                  |
|-----------------------|-------------|-------------------------|
|                       | Bivalvia    | Gastropoda              | Trigoinoida | Mesogastropoda | Bsommatophora |
| Shannon's Index (H)   | 1.36        | 2.21                    | 1.36        | 1.83           | 1.09          |
| Evenness E=H/Hmax     | 0.98        | 0.96                    | 0.98        | 0.94           | 0.99          |
| Simpson Index         | 0.18        | 0.11                    | 0.18        | 0.16           | 0.32          |
| Menhinick Index       | 1.27        | 1.10                    | 1.27        | 0.99           | 0.52          |
| Maralef Richness Index| 1.30        | 2.04                    | 1.30        | 1.53           | 0.57          |
| Buzas and Gibson's Index| 0.98      | 0.91                    | 0.98        | 0.89           | 0.99          |

Fig. 8: Diversity Index in different classes

Fig. 9: Diversity Index in different orders
DISCUSSION
The similar observations were made reported by Subba [16] was identified ten freshwater molluscs, nine species belonging to six families viz. Planorbidae, Viviaeridae, Pilidae, Lymnaeidae and Thiareidae of class Gastropoda and one species is of family Amblemidae of the class Bivalvia. Seba Roy and Gupta [17] reported a total of 16 molluscan taxa belonging to 2 classes, viz., Gastropoda, and Bivalvia, 4 orders, 5 families and 9 genera were recorded from 12 different sites, of the 16 species, 5 gastropods and 2 bivalves were recorded in a few sites only and appeared to be sensitive to anthropogenic disturbances. Raina et al. [18] recorded 17 species and identified from nine families in Sip River is a tributary of River Narmada. The documentation of bivalve as a whole during the period of study was less dominant as compared to Gastropoda. Similar reports were observed by Khade and Mane [19] studied the diversity of bivalve and gastropod Molluscs from mangrove habitat, rocky substrata, sandy beach, and muddy habitat was studied. The 22% bivalves while 78% gastropods were recorded. Erkan et al. [20] reported the freshwater mussel fauna of Turkey has hitherto received little attention. Five native mussel species belonging to 3 genera were encountered in surveys: Anodonta cygnea, A. anatina, Unio pictorum, U. crassus, and Dreissena polymorpha. In addition, an invasive species from Asia, A. woodiana, was recorded in the region for the first time. Pir et al. [21] investigated on the distribution of molluscs in Narmada River, where as Biju et al. [22] recorded on molluscs collected from the Bharathapuzha River, Kerala [23] noted on a collection of freshwater Molluscs from Lahore.

In this present study, the number and percentage composition of families, genera, and species under different orders similarities were identified by various investigators. Burdi et al. [25] noted a total of four genera including seven species of pelecypods were identified where Parreysia (Radiatula) wyngangensis was found most dominant. Pelecypod populations were fairly good and more or less same numbers of individuals were recorded. Negi and Mamgain [26] were reported to assess the benthic macro-invertebrates from the Tons river, is to be inversely correlated with the maximum diversity of benthos at the upstream site (H’ 0.204) during the winter season while it was recorded minimum during the rainy season at all the sites. Maximum diversity is reported during the winter season at all the sites. Kakar et al. [27] reported species diversity indices of freshwater in different sites of Balochistan province, Kumar and Vyas [28] investigated on diversity index of molluscan communities in Narmada River.

CONCLUSIONS
Kondakara freshwater lake consisting of 28.57% of class Bivalvia and 71.42% of Gastropoda was recorded at four stations during the study period. The Population Status is 07.14% abundant, 57.14% species were common, 21.42% species were moderate and 14.28% species were rare in the total catch. This study concluded that the presence of diversified Molluscan community indicated that the lake is a good potential bioindicator. Further investigations on habitat wise preferences with life cycles of mollusc fauna could provide insights into their conservation and an important food resource to migratory birds of the Kondakaral Lake.

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