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Composition, distribution and density of zooplankton in Randenigala reservoir, Sri Lanka.

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Abstract

Randenigala is a hill country reservoir, constructed for hydroelectric power generation and irigation in 1982. Present paper deals with species composition distribution and density of zooplankton in the reservoir based on studies carried out from May to October 1992.

Twenty-four species of zooplankton were recorded from the reservoir, out of which 12 species were rotifera, 8 species were cladocera and four species were copepoda. Copepoda density was the highest throughout the investigation.

The total copepod population consisted mainly of 34% of calanoid species, 6.7% of cyclopid species, 48.3% nauplii stages and 10.8% copepodid stages.

Keretella tropica and Trichocera species formed more than half of the rotifers. The next abundant species were the *Brachionus fulcatus, Filina opaliensis and Brachious caudatus. Asplanchopus and Lecane* were very rare.

Out of the eight species of cladocera, *Ceriodaphnia* species was the dominant group contributing more than 69% to the total Cladoceran community.

When the vertical distribution of zooplankton is concerned, the average highest density of zooplankton was Observed above 10m depth and highest numbers were generally recorded at surface waters. The densities were low bellow 10m reaching lowest density in the hypolimnetic region.

Key words: Tropical reservoir, Zooplankton, Copepoda Rotifer, Cladocera, Man-made lakes, Tropical Limnology.

1 Introduction

Randenigala reservoir (7^{0}8'-7^0, 7'N&80^0 49' E) was constructed by damming river Mahaweli in 1982 for hydroelectric power generation & irrigation.

It is often subjected to water level fluctuations due to usage of water for power generation.

Basic morphometric features of Randenegala reservoir are summarized as Surface Area at full supply level (f s l) = 25.5 km^2, Volume (at f s l) = 860 x 10^6 m^3, Shoreline = 74 Km mean depth 36.6 m Maximum length = 1.6 km & maximum width = 1.21 km & altitude 232- 303m above mean sea level. Morphology of the reservoir is given in Fig 1.

Most studies on freshwater zooplakton have been carried out in temperate countries, (Burgis & Telvin 1979, Bestsill Robert K et al 1994) In Sri Lanka, most work has been conducted on the plankton communities of ancient low land reservoirs (Fernando 1980 a- 1980 b, & Fernando & De Silva 1984 Fernando & Rajapakse 1983 b Duncun 1983), Dumont et al 1983).

Detailed research work exists on the newly built upland reservoirs, Piyasiri & Jayakody 1991, Piyasiri 1992, Pathmalal & Piyasiri 1995, De silva 1994, Chandrananda & Piyasiri 1992 a & 1992b, & De Silva 1994.)

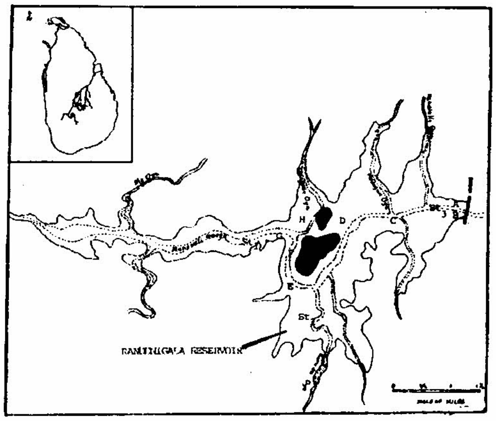
Objective of the persent paper was to investigate species composition, density & distribution of zooplankton of Randenigala reservoir

2. Materials and Methds

For determination of vertical distribution of zooplankton, major station 3 near the dam was selected as the sampling location where water level remains at a considerably higher level even during the drought season. To determine species composition, samples were collected horizontally by drawing the closing type plankton net at different sub stations A-B at monthly intervals. (Fig 1)

Investigations on horizontal distribution of zooplankton were done by filtering water for period of one minute over the surface horizontally through the net as the boat was moving over the surface. Collected samples were preserved in 5% buffered formaline (Lincoln and Sheals 1971) and further analysis was done in the laboratory under the light microscope using Sedwich-Rafter counting chamber.

Fig 1 Sampling locations in Randenigala reservoir



Each Plankton sample was diluted upto 100ml and was taken as the initial volume for counting. Then the plankton was enumerated by pipeting random sub samples from each bottle. 1%- 100% of zooplankton were counted depending on the density of zooplankton in the sample.

3. Results

Species composition of zooplankton

Of the 24 species of zooplankton recorded, 12 species were Rotifera, 8 species were Cladocera with their nymph stages and ephippia and 4 species were copepoda with their eggs, egg bearing calanoids and cyclopoid species (Table 1).

Table 1 Zooplankton species recorded from Randanigala reservoir.

Rotifera		
Asplanchnopus sp.		*Tricocera similis*
Brachionus caudatus		*Tricocera* sp.
Brachionus fulcatus		*Lecane luna*
Brachionus havanensis		*Lecane ungulata*
Brachionus leydigli		*Filinia opaliensis*
Kertlla Tropica		*Filinia longista*
Cladoera		
Chydorous sp.		*Ceriodaphnia* sp.
Diapanasoma modigliani		*Ceriodaphnia cornuta*
Bosmina longirostris		*Daphnia lumbhotzi*
Bosmina deitersi		*Bosmina* sp.
Copeoda		
Calanoid	*Phyllodiaptomus annae*	
	Tropodiaptomus astralis	
Cyclopid	*Messocyclops leukarti*	
	Thermocyclops crassue	

Seasonal fluctuations of Major plankton types

Fig. 2a illustrates the seasonal fluctuation of different zooplankton types in the reservoir. Out of the four groups of zooplankton, Copepoda density was the highest throughout the investigation and their eggs, rotifera and cladoceran species occurred in lower densities compared to the copepoda. When the overall mean density of rotifera and cladocera was concerned, their densities were almost uniform throughout the investigation period. The naupli population was dominant of copepods and represented large numbers at each sampling time and this may be either due to dilution effect. The next abundant type was rotifera and then the cladocera.

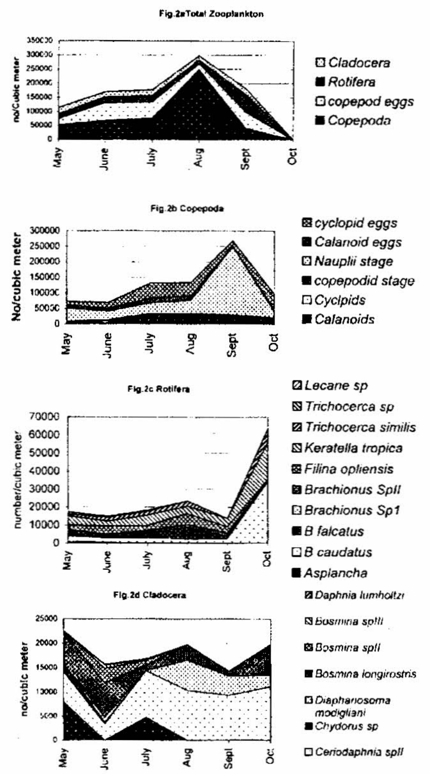


Fig 2a - 2d : Fluctuation of different zooplankton types in Randenigala reservoir during the study period.

Copepoda

The Copepod in Randenigala reservoir during the study period consisted of 34% of calanoid species, 6.65% of cycopida species, 48.32% of naupli stages and 10.8% of copepodid stages. Fig 2b illustrates fluctuation of copepoda during the investigation period.

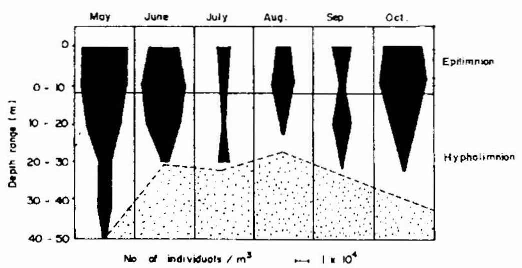
There was a striking increase in naupli stages, cyclopids and calanoid numbers from August to September. The peaks rapidly dropped from September to October. Densities of eggs of both calanoids and cyclopids increased from June to August and considerable rapid decline of copepod eggs were recorded in September. During this period, nauplii contributed mainly to zooplankton popuations. However, copepodids, calanoids and cyclopids represented at low densities and free eggs. naupli and copepodid stages were found throughout the year indicating continuous reproduction during the study period.

Rotifera

The next abundant group of zooplankton was the rotifera. They formed 25.9% of total zooplankton in the samples. Fig 2c illustrates the seasonal flucation of rotifera population during the investigation period. *Keretella tropica* and *Tricocera* species formed more than half of the rotifers. The next abundant species were *Brachionus fulcatus, Filina opaliansis and Brachionus caudatus.* However other species such as *Asplanchopus* sp. and *Lecane* sp. were very rare and observed only occasionally.

Peak abundance of *K tropica* and *B caudatus* occurred in May and October. The highest plankton pulses of *F opeliensis* were recorded in June and August whereas their population densities were lower in May, July and October. Population density of *B fulcatus* slightly increased between June and August and rapidly dropped from August to October.

Fig. 3a Cladocera - Bosmina longirostris



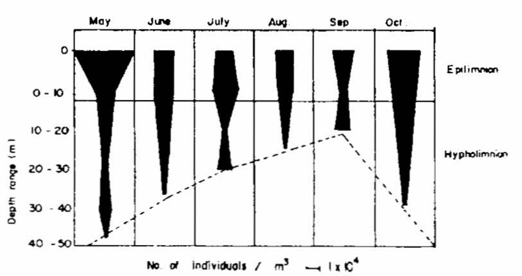


Fig 3b Rotifera Brachionus fulcatus

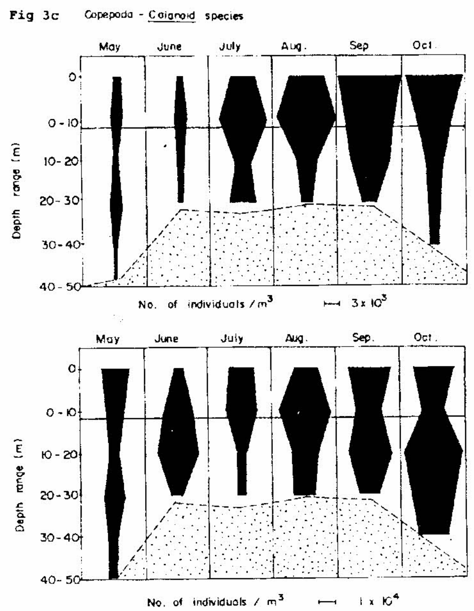


Fig-3a - 3d : Vertical migration patterns of different zooplankton types along the vertical profile of Randenigala erservoir.

Cladocera

Fig 2b illustrates the seasonal fluctuation of cladocera populations in Randenigala reservoir during the investigation priod. Out of eight species, of cladocera, *Ceriodaphnia* species was the dominant type in the reservoir. However *Ceriodaphnia cornuta* indicated dominance and they contributed more than 69% to the total cladoceran community. *C cornuta* population increased from August to September. *D aspinosum* and Ceriodaphnia species rapidly increased from May to August whereas declined in September. High density of *B longirostris* was observed in May and October. In between this period, *Bosmina longirostris* population decreased considerably.

Vertical Migration

Fig. 3a, 3b, 3c, and 3d illustrate the vertical profile of zooplankton densities of selected species of rotifera, cladocera and copepoda during the investigation period. The densities of zooplankton were high above 10m depth and highest numbers were generally recorded at surface waters. Of the four genera of zooplankton with an exception of cyclopid copepods (Fig. 3d) densities of all other 3 groups decreased with depth None of these zooplankton groups reached zero density at any depth. During the investigation period, epilimnetic region of the rservoir was upto about 5.5-6.5m and most of the zooplankton showed their maximum population densities in the epilimnetic region. The lowest density was recorded in the hypolimnion, which was below the thermocline of the reservoir.

Discussion

The Randenigala reservoir is often subjected to water level fluctuations during the study period depending on the rainfall & due to usage of water for hydroelectric power generation. These fluctuations intern influence the physico chemical & biological properties of the erservoir

The zooplankton found in Randenigala reservoir was typically tropical (Fernando and Rajapaksa 1983) and the number of cladocera and rotifera species were fewer than the copepoda species. Among the above zooplankton groups, the most abundant group recorded in Victoria and Kotmale reservoirs were copepoda (Piyasiri and Jayakody 1991, Chandrananda and Piyasiri 1993). They are the three major groups of zooplankton commonly found in limnetic region of Randenigala reservoir. Similar conditions were observed in water bodies like Parakrama Samudura (Duncan 1883a). According to Green (1972); Pejler (1977) ; and Fernando (1980a); cladocera is a limnetic zooplankton found in South East Asia. Similarly, the number of claboceran species has been recorded from other tropical countries such as Malayasia (Idris and Fernando 1981) and the Philippines (Manarial and Fernado 1981). This might be true for Randenigala, which is situated at the lowest altitude compared to the other hill counry reservoirs of the Mahaweli reservoir system.

The copepods found in the present investigation were mainly comprised of four species. Two of them are cyclopids; *Mesocyclops leukarti, Thermocyclops crassus* and two calanoids; *Phyllodiaptomus annae* and *Topodiaptomus australis.* These species were also recorded in Victoria (Piyasiri & Jayakody 1991, Chandrananda and Piyasiri 1993). According to Fernando (1980b) about four Copepod species species are dominant in the limnetic zooplankton.

The most abundant Rotifera species found in Randenigala were *Brachionus* species, Keretella tropica and Trichocera species. Green (1972) and Pejlre (1977) indicated that there was a negative relationship between density of rotifera and water level fluctuation. The total number of rotifera and their indivdual density fluctuated with the water level. When cladoceran density of the reservoir is concerned, *Ceriodaphnia* species was the most abundant genus in Randenigala reservoir, which belongs to family *Daphnidae.* This species was frequent and abundant in every fresh water habitat type (Rajapaksa and Fernando 1982) Chandrananda and Piyasiri 1993). The rare *Daphnia lumhonltzi found in Randenigala is* known to be widely distributed in Southern India and in Thailand (Gerrn 1972). *Chydorus* species was observed in the rainy season only. This may be due to hatching of cystic forms with dilution of water. *Bosmina* species was very common throughout the tropics.

Diaphanosoma aspinosum and *Diaphanosoma modigliani* were recorded in very low densities in the reservoir. Similar conditions were recordled in Victoria reservoir (Piyasiri & Jayakody 1991, Chanderananda and Piyasiri 1993).

The present investigation revealed that there was a nagetive relationship between copepoda density and water level fluctuation. When water level decreased, temperature of the water column was high and eggs were produced with resuced size. This may prevent perdation pressure

In August, 1992 the water level of the reservoir increased. Soon after the rain, total number of calanoid and cyclopid eggs rapidly dropped to low densities of 11×10^3 egg/m^3 and 3×10^3 egg/m^3 respectively (Fig 2b). At the same date, inverse relationship of naupli stages of copepods, copepodid stages, cyclopid and calanoid were observed. During this period water temperature was around 25^0 C. These varying thermal condition of the reservoir caused hatching of eggs of calanoids and cyclopids and produced large number of naupli stages. Sinilar condition have been reported in South East and recorded from tropical water bodies (Fernando 1980a & 1980b).

Both the larvae and adult zooplakton in all stations were high at the depth range 0m-10m and distributed throughout the water column. Vertical distribution pattern of zooplankton also varies according to light intensity of the sampling time. According to Piyasiri and Jayakody (1991) the zooplankton density was high at the surface to 15m depth and their density decreased with increasing depth. The upward migration of zooplankton which occurred during afternoon and downward migration performed during day time and concentrated near the bottom of the lake was observed in Kotmale (Chandrananda & Piyasiri 1993). The same pattern was recorded at Randenigala reservoir and copepoda were occupying the surface to 15m depth range and considerable densities of them occupy even the bottom layers.

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