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## KONDAKARLA LAKE, ANDHRA PRADESH — A TAXOECOLOGICAL PROFILE

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### INTRODUCTION

Kondakarla 'ava', a freshwater lake, located north-east of Kondakarla village, lies between latitudes 17°35'30" and 17°36'02" N, and longitudes 82°01'0" E, *Ca.* 18 Kms from Anakpalle, Visakhapatnam District, was taken up for detailed limnological investigations, including observations on its plankton diversity.

The 'ava' has been focus of attention in past through studies on Aquatic productivity (Seshavatharam, 1982), Phytoplankton production (Murthy & Sehavatharam, 1988) decomposition studies on macrophytes (Seshavatharam, 1989), Protozoan fauna associated with macrophytes (Jayaraju and Kalavathi, 1986) besides detailed limnological studies (Seshavatharam and Chandramohan 1978-1982, Unpublished). The other academic endeavors include Vijaya Kumari, 1996), Sankara Rao (1982), Ratna Rao (1984) and Venu (1981) (Unpublished).

### MATERIAL AND METHODS

The water spread area of the lake is about 6.5 km. The shape of the lake can best be described as irregular resembling a many pronged rhizome. It roughly measures *Ca.* 3 km in North-South direction and about 2.5 kms in the East-West direction. The lake has a relatively small catchment area, *Ca.* 20 km. It is also mostly fed by hill stream and supply channel from river Sarada. The Munagapaka channel in Munagapaka mandal, serve as inlet for inflows into the 'ava' form the Sarada river. An outlet, permitting outflow of surplus water into the Bay of Bengal.

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Several small villages exist surrounding the 'ava' on the south-western side. The village skirting the 'ava' is Kondakarla and therefore it draws its name. The surrounding topography – minor hills and hillocks provide shelter to the lake by way of little wind action in its surface. The air water inter phase is normally placid with little water movement. The altitude range of these hills lie between 100–300 meters (Seshavathram, 1982). The lake is surrounded by undulating plains of sandy to loamy soils save the north-western flank where the river-built plain and sandy-silting loam soil of Sarada river abuts it.

There are extensively cultivated marginal areas of the lake with lush green paddy and sugar cane fields, besides small villages all around lake's fringes. As a result the lake receives significant inputs – surface run off from field around, besides allochthonous material, rendering it fertile, rich with luxuriant growth of aquatic macrophytes both within the lake and extensive swampy margins all around. In fact, the extensive weeds and rampant reeds have assumed nuisance proportion, hindering fish culture and inland navigation. The lake is also 'home' to winged visitors and is a feeding, breeding habitat to 'migratory birds' besides residential avifauna.

Taxonomic treaties (Pennak, 1989; and Thorp and Cooch, 1991) including Indian literature (Michael and Sharma, 1988; and Battish, 1992, Cook, 1996) were used as desk manuals for identification of zooplankton as well as aquatic plants.

The 'ava' (Telugu), or currently wetland, was limnologically surveyed using indigenous country 'boats', in reality hollow logs of palm tree-trunk, that serve as substitutes for traditional boats. The wetland is accessible by road from Kondakarla village and surveys/sampling for limnological investigations were initiated from the macrophyte-choked shallow waters around the village. The country boats were slowly towed from shallow, littoral regions to waters off or around Haripalem Village and measurements of subsurface water temperature, pH, conductivity *etc* made besides measurements of Sacchi Disc Transparency or visibility ( $Z_s$ , m) and depth (using lead weight). Samples for netzooplankton (using towing plankton net No.25 Nylon Bolt with a 100 ml PVC bottle tied at its extreme end) for qualitative studies, were collected from each sampling site. An Indianised version of Kemerler-Type lake water/lake plankton from desired depth at each sampling points were carried back (Hyderabad) for analysis of different forms of Phosphorous (P) and Nitrogen (N) and other ions-Silica, Sulphate *etc*.

## RESULTS AND DISCUSSION

### WATER QUALITY :

During the period of study, the air temperature ranged between 23–32°C and water temperature from 22–31. No definite pattern was noticed between these two factors. pH values ranged between 6.9 and 8.9, the maximum (8.9) was noticed in monsoon at Kondakarla village (may be due to the inflows of domestic sewage into the water body) and minimum (6.9) was

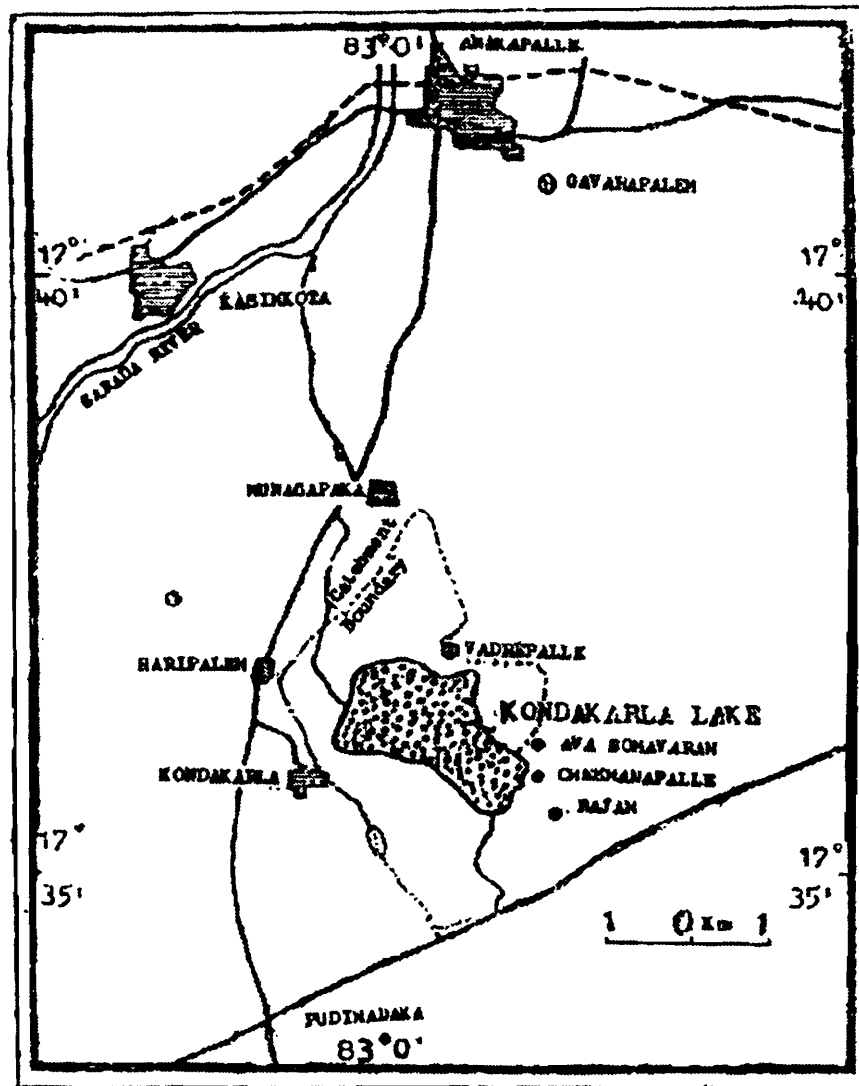
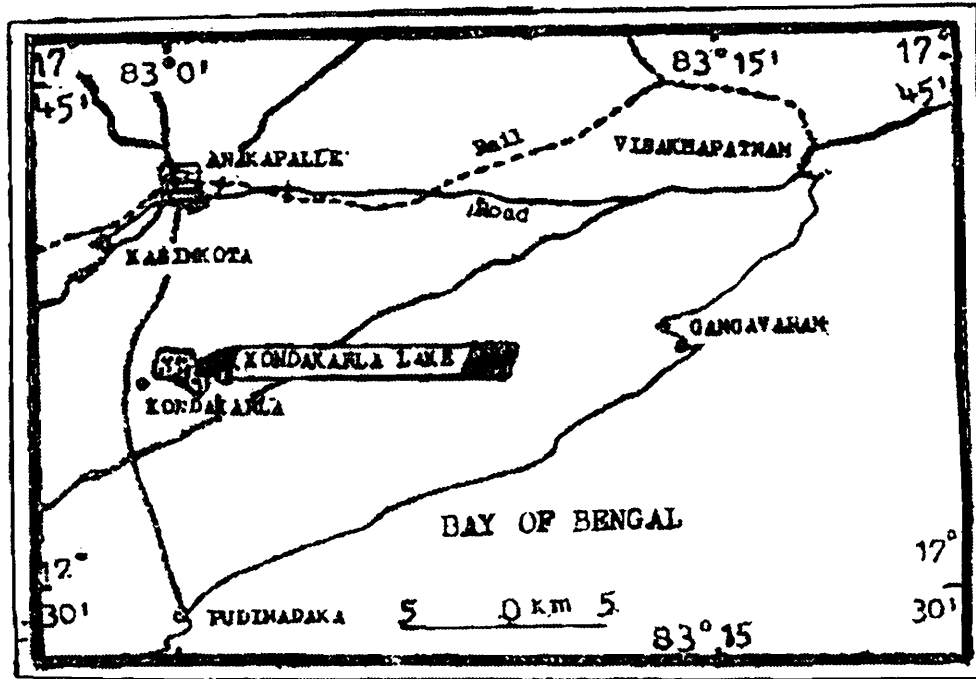
**Table 1. : PHYSICO CHEMICAL PARAMETERS OF KONDAKARLA LAKE**

S. No.	Parameter	Cheemanapalle			Avasomavaram			Rajam			Centre Point			Kond Village			Vadrepalle			Haripalem		
		S	M	W	S	M	W	S	M	W	S	M	W	S	M	W	S	M	W	S	M	W
1	Temp. (Air) C	32	31	23	32	-	25.5	32	31	26	32	31	26.5	31	31	23	32	31	28	32	31	29
2	Temp. (Water) C	29	29	22.5	29	-	24	29	29	24	29	31	24	29	29	22	29	30	25	29	30	25
3	pH	7.5	8.5	7.5	7.2	-	7.5	7.4	8.5	7.5	6.9	8.5	7.5	7.3	8.9	7.0	7.2	8.5	7.0	7.1	8.5	8.0
4	E. Cond.	840	1340	780	730	-	630	810	860	540	810	860	540	560	960	830	430	1090	510	960	1720	830
5	Turbidity (NTU)	6	60	8	540	-	6	5	50	8	5	50	8	5	50	8	20	10	8	4	60	8
6	Dis. Oxygen mg. lr	7.6	8.2	3.2	7.2	-	5.8	7.9	12.2	6.6	7.9	12.2	6.6	2.4	5.6	3.0	2.8	9.2	6.0	3.4	9.8	5.0
7	Carbonates "		70	9	35	-	80	45	20	NIL	45	20	NIL	NIL	NIL	NIL	45	60	NIL	NIL	20	NIL
		71	0	NIL																		
8	Bicarbonates "	190	185	295	200	-	135	155	255	230	155	255	230	430	290	300	235	210	180	280	315	350
9	Free Co2 "	NIL	NIL	NIL	NIL	-	NIL	NIL	NIL	NIL	NIL	4.8	9.0	6.0	4.0	NIL	NIL	1.6	0.6	NIL	8.0	
10	Chloride "	149	170	110	142	-	80	142	175	75	142	175	75	184	210	70	156	145	55	160	185	70
11	Total Hardness "	140	80	165	125	-	155	135	210	155	135	210	155	185	430	200	120	280	150	175	295	270
12	Calcium "	46	17	48	38	-	40	40	34	42	40	34	42	59	92	61	40	52	40	36	50	59
13	Magnesium "	7	10	12	9	-	15	10	31	13	10	31	13	11	51	13	6	38	13	22	38	32
14	Nitrate-N	1	2	2	1	-	2	1	1	2	1	1	2	1	4	3	1	3	3	1	5	3
15	Amm. Nitrogen "	NIL	NIL	NIL	NIL	-	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL
16	Total Nitrogen "	NIL	NIL	NIL	NIL	-	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL
17	Phosphorous "	NIL	15	10	Traces	-	15	NIL	10	NIL	Trace	5	5	NIL	5	10	Traces	40	5	Traces	10	10
18	Silica "	30	40	25	25	-	20	25	35	25	30	25	20	25	30	25	20	30	20	25	35	25
19	Sulphates "	10	250	40	10	-	10	10	260	40	15	240	10	70	190	40	10	300	10	25	220	40

S-Summer

M-Monsoon

W-Winter




 MANDAL HEAD  
 QUARTERS


 LAKE


 VILLAGES

found at Centre Point in summer. Electric Conductivity ranged between 430 and 1720 micro siemens/cm and Turbidity values found between 4 and 540 N.T.U. Dissolved Oxygen was noticed between 0.8 and 16.2 mg/litre and both the values were found Centre Point in winter and monsoon respectively. Carbonate values in the ecosystem were absent in all the seasons at Kondakarla village spot and partially in other places. This parameter ranged from 20 to 90 mg/litre and no specific pattern is noticed. Bicarbonates were observed in the range from 120 to 430 mg/litre. The lower and higher values were found in summer at Centre Point and Kondakarla village respectively. Accumulation of large quantities of bicarbonates during summer may be due to liberation of Carbon-di-oxide in the process of decomposition of bottom sediments with resultant conversion of insoluble carbonates to bicarbonates. Free carbon-di-oxide was found ranged between 0.4 and 9.0 mg/litre and this factor also has not shown any specific pattern. Occurrence of its maximum value (9.0) in summer may be due to increased decomposition of dead organic matter with the rise in temperature. Chloride quantities were observed from 45 to 210mg/Lit in the present investigation. During summer it was around 150 in almost all the spots of the water body. Comparatively, its maximum values were found in monsoon. Both the maximum (430) and minimum (80) values of Total Hardness were found in monsoon seasons at Kondakarla village and Chemanapalle respectively. The values of Calcium and Magnesium were found ranged between 17–92 and 6–51 mg/lit. respectively. Nitrate values in the lake waters ranged between 1 and 5 mg/litre. Mostly lower value (1) had been noticed in summers and higher ones (5) in monsoon. These values are far below the maximum permissible limits for drinking water (50). Ammonia nitrogen and Total nitrogen values were totally absent in the ecosystem. Phosphates were found absent and as traces in summer. The maximum value (40) was noticed in monsoon at Vadrepalle which may be attributed to letting in the agricultural run off into the water body. The value of silicates were found ranged from 20 to 40 mg/litre. The values of sulphates were noticed between 10 and 300 mg/litre. In summer, the values were found less and the higher values were in monsoon. The maximum value (300) was found in monsoon at Vadrepalle, the reason may be attributed to heavy load of domestic sewage from the surrounding colonies into the lake.

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**Table 1. :** List of different types of aquatic plants observed in Kondakarla Lake.

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**I. Wetland Plants attached to substratum**

**A) Emergent forms**

Family JUNACEAE

1. *Typha aungustata* Bory and Chaub
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Family CYPERACEAE

2. *Cyperus* sp.\*
  3. *Elacocharis* sp.
-

## Family POLYGONACEAE

4. *Polygonum glaberrimum* Willd.
- 

## Family CONVULVACEAE

5. *Ipomoea fistulosa* Martius ex Choisy  
6. *Ipomoea* sp.
- 

**B) Floating leaved Macrophytes**

## Family APONOGETONACEAE

1. *Aponogeton crispum* Thumb\*\*  
(= *A. echinatum* Ruxburgh)
- 

## Family NYMPHACEAE

2. *Nymphaea nouchali* Burm
- 

## Family MENYANTHACEAE

3. *Nymphoides indicum* (Linnaeus) O. Kuntze  
4. *Ipomoea aquatica* Forsk  
(*I. reptans* auct. Ind. non Linnaeus)
- 

## Family FEBACEAE

5. *Neptunia oleracea* Lour
- 

## Family ONAGRACEAE

6. *Ludwigia adscendens* (L.) H. Hora  
(= *Jussiaea repens* Linnaeus)
- 

**C) Submerged macrophytes**

## Family HYDROCHARITACEAE

1. *Hydrilla verticillata* (Linnaeus fil.) Royle  
2. *Ottelia alismoides* (Linnaeus) Pers.
- 

## Family NAJADACEAE

3. *Najas graminea* Del.
- 

## Family FABACEAE

- Neptunia oleracea* Lour  
4. *Chara vulgaris* Linnaeus
-

## Family AMARANTHACEAE

*Alternanthera sessilis* (Linnaeus) R. Broron\*\*\*

ex A. P. de. Condolle

(A. *triandra* Lamarck, *Achyranthes prostrata* D. Don)

## Family PONTEDERIACEA

*Eichornia crassipes* (Martius) Solus Lauback**II. Free floating macrophytes**

## Family SALVINIACEAE

1. *Salvinia* sp. (*molesta* Mitchell) cf.\*\*\*\*

## Family AZOLLACEAE

2. *Azolla filiculoides* am.

## Family LEMNAEAE Duckweeds

3. *Lemna acuinotrallis* Welwitsch  
(= *Lemna perpusilla* Torrey auct Ind.)

## Family POACEAE (GRAMINAE)

4. *Echinochloa stagnina* (Retz.)  
5. *Pseudoraphis spinescens* (R. Br.) Vickery

## Family LENTIBULARIACEAE

6. *Utricularia aureo* Loureiro  
(= *Utricularia flexuosa* Venl)  
7. *U.stellaris* Linnaeus fil.

## Family ARACEAE

8. *Pistia stratiotes* Linnaeus\*1. Seshavatharam, 1982 records *Scirpus articulatus* Linn. According to Cook, 1996 *Scirpus* strictly is Restricted P. 181 to Himalayas, and not down South in Peninsular India.

\*\*2. Exclusive to South India/Sri Lanka (Cook,1996).

\*\*\*3. Essentially terrestrial, wetland sp. often partly floating, partly submerging.

\*\*\*\*4. Seshavatharam, 1982 reports *S. auriculata* Cook, 199 records *C. cucullata* Roxburgh and *S. molesta* Mitchell from Peninsular India, excluding *S. nataris* (Linn.) restricted to Himalayas.

**Table 3. :** Systematic list of different genera/species and sub-species of major zooplankter groups from littoral and limnetic regions in Kondakarla lake.

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**ROTIFERA**

Order BDELLOIDEA

Family PHILODINIDAE Bryce

Genus *Philodina* (Ehbg., 1980)

*Philodina citrina* (Ehbg., 1832)

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Order FLOSCULARIACEA

Family FILINIDAE

Genus *Filinia* Boryde St. Vincent, 1824

*Filinia longiseta* (Ehrenberg, 1834)

*F. opoliensis* (Zacharias, 1898)

*F. terminalis* (Plate, 1886)

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Family TERSTUDINELLIDAE

Genus *Testudinella* Bory de st. Vincent, 1826

*Testudinella patina* (Hermann, 1783)

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Order PLOIMIDA

Family ASPLANCHNIDAE

Genus *Asplanchna* Gosse, 1850

*Asplanchna intermedia* Hudson, 1886

*Asplanchnopus* sp.

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Family BRANCHIONIDAE

Genus *Brachionus* Pallas, 1776

*Brachionus falcatus* Zacharias, 1898

*B. falcatus* var. *lyratus* Lammerman, 1908

*B. forficula* Wierzesker, 1891

*B. forficula* f. *typica urawensis* Sudzuki, 1965

*B. calyciflorus* Pallas, 1766

*B. calyciflorus* var. *dorcas* (Gosse, 1851)

*B. angularis* Gosse, 1851

*B. caudatus* Barrois and Daday, 1894



- B. caudatus personatus* Ahlstrom, 1940  
*B. quadridentatus* (Hermann, 1783)  
*B. quadridentatus f. cluniorbicularis* (Skorikov, 1879)  
*B. quadridentatus f. metheni* (Barrois & Daddy, 1894)  
*B. patulus* (O. F. Muller, 1786)  
*B. patulus macranthus*

Genus *Keratella* Bory de st. Vincent, 1822

- K. cochlearis* Gosse, 1851  
*K. procurva* (Thorpe, 1891)  
*K. quadrata* (Muller, 1786)  
*K. tropica* (Apstein, 1907)

Genus *Platylas* Haring, 1914

- P. quadricornis* Ehrb. 1882  
*Notholca striata* (Muller, 1786)

Genus *Anuraeopsis* Lauterborn, 1900

- A. navicula* Rousselet, 1892

## Family COLURELLIDAE

## Sub family COLURINAE

Genus *Lepadella* Bory de st. Vincent, 1826

- Lepadella acuminata* (Ehrb. 1834)  
*L. heterostyla* (Murray, 1917)  
*L. patella* (Muller, 1786)

Genus *Colurella* Bory de st. Vincent, 1826

- Colurella obtusa* (Gosse, 1886)

## Family LECANIDAE

Genus *Lecane* Nitzsh, 1827

- Lecane papuana* (Murray, 1913)  
*L. curvicorins* Murray, 1913  
*L. luna* (Muller, 1776)

Genus *Monostyla* Ehrenberg, 1830

- Monostyla hamata* (Stokes, 1896)  
*M. quadridentata* (Ehrenberg, 1832)

*M. obtusa* (Murray, 1913)

*M. lunaris* (Ehrenberg, 1832)

*M. bulla* (Gosse, 1851)

*M. clostocerca* (Schmarda, 1859)

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Family MYTILINIDAE

Genus *Mytilina* Bory de st. Vincent, 1826

*Mytilina ventralis* Ehrenberg, 1832

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Family TRICHOCERCA

Genus *Trichocerca* Lamarck, 1801

*Trichocerca longiseta* (Sehran, K. 1802)

*T. ratus* (Muller, 1776)

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Family TRICHOTRIIDAE

Genus *Trichotria*

*Trichotria tetractis* (Ehrb. 1832)

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### CLADOCERA

Family SIDDIAE Baird, 1830

Genus *Diaphanosoma* Fischer, 1850

*Diaphanosoma sarsi* Richard, 1895

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Family DAPHNIDAE Straus, 1820

Genus *Ceriodaphnia* Dana, 1853

*Ceriodaphnia cornuta* Sars 1885

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Family MOINIDAE Goulden, 1968

Genus *Moina* Baird, 1850

*Moina brachiata* (Jurine, 1820)

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Family BOSMINIDAE Sars, 1965

Genus *Bosminopsis* Richard, 1895

*Bosminopsis deitersi* (Richard, 1895)

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Family MACROTHRICIDAE Norman & Brady, 1867

Genus *Macrothrix* Baird, 1843

*Macrothrix Spinosa* King, 1853

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Family CHYDORIDAE Stebbing, 1902

Subfamily CHYDORINAE

Genus *Chydorus* Leach, 1816

*Chydorus reticulatus* Daddy, 1898

*C. parvus* (Daday, 1898)

Genus *Dunhevedia* King, 1853

*Dunhevedia serrata* Daday, 1898

Subfamily ALONINAE Frey, 1967

Genus *Alona* Baird, 1843 emend Smirnov, 1971

*Alona davidi davidi* Richard, 1895a

*A. davidi punctata* (Daday, 1895)

*A. rectangula rectangula* Sars, 1862a

*A. rectangula rechari* (Stingelin, 1895)

Genus *Dadaya* Sars, 1901

*Dadaya macrops* (Daday, 1898)

Genus *Biapertura* Smirnov, 1971

*Biapertura karua* (King, 1853)

Subclass COPEPODA

Order CALANOIDA Sars, 1903

Family DIAPTOMIDAE Baird, 1850

Subfamily DIAPTOMIDAE Kiefer, 1932

Genus *Heliodiaptomus* Kiefer, 1932

*Heliodiaptomus viduus*

*Heliodiaptomus* sp.

Genus *Phyllodiaptomus* Kiefer, 19368

*Phyllodiaptomus* sp. 88/8

(Plus) Nauplius (N'-N6) Copepodid (1-L6) Stages

Suborder CYCLOPOIDA

Family CYCLOPOIDA Dana, 1853

Genus *Mesocyclops* Claus, 1893

*Mesocyclops leuckarti* (Clause, 1857)

*M. varicans* Sars, 1863

(Plus) Nauplius (N'-N6)/Copepodid (C'-C6) stages

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Subfamily EUCYCLOPINAЕ Kiefer, 1929

Genus *Eucyclops* Claus, 1893

Class OSTRACODA (Latreille, 1802)

Subclass PODOCOPA (Muller, 1894)

Order PODOCOPSDIA Sars, 1866

Super Family CYPRIDIDAE Baird, 1854

Genus *Cypris* O. F. Muller, 1776

*Cypris* sp.

Genus *Stenocypris* Sars, 1889

*Stenocypris major* (Baird, 1859)

*S. malcomsoni* Brady, 1886

Genus *Strandesia* Stauhlmann, 1888

*Strandesia elongata* Hartmann, 1964

Genus *Centrocypris* Vavra, 1895

*Centrocypris* sp.

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## SUMMARY

Kondakarla 'ava' a 600 ha. perennial freshwater wetland, is a relatively less known, non-descript lake, despite its good taxonomic potential from view point of diversity and distribution of zooplankton elements, besides overall wetland biodiversity. Observations on the lake dimensions, ambient lake water quality, its trophic status *vis-à-vis* plant nutrients, general/composition and ecology of the zooplankton community and macrophytes have been incorporated. In all, > 71 species under five major zooplankton – groups – Rotifera (44 sp), Cladocera (14 sp), Copepoda (5 sp.) Ostracoda (5 sp) and others (1 sp.) were identified. While Copepods predominate, rotifers and cladoceran fauna exhibit rich diversity, in their overall species content, in this primarily Oligotrophic lake type.

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