NOTES

A NOTE ON CHEMICAL STRATIFICATION AND BLOOMING OF *CERATIUM* SP. IN A MAN-MADE LAKE

OCCURRENCE of water blooms in polluted or eutrophic waters in inland is well known (among others see Ganapati 1960 in India and Mackonthun *et al.* 1967 in USA). Likewise 'Swarming' phenomenon due to some dinophycean plankton in the sea is also periodically reported (Prescott 1960).

In freshwaters, high densities of dinophyceans are only rarely reported. For instance, occurrence of *Ceratium hirundinella* as an exclusive bloom in a cold-water upland lake has been reported (Ganapati 1957, and Sreenivasan 1964).

While making a limnological survey of an artificial hydroelectric reservoir, Pilloor Dam, the occurrence of a dense 'bloom' of *Ceratium hirundinella* was noticed between 0.5 m. and 2 m.—a patch of dirty green water. This is a very narrow but deep reservoir with a maximum area about 250 ha. and a volume of 44.4 million m^3. It is situated at 1200 ft. above sea level. In Table I, the depthwise variation in some chemical constituents are recorded for 27th October 1969.

TABLE I

Hydrological conditions of Pilloor Reservoir on 27.10.1969
(All constituents in mg./L except pH)

Depth m.	..	0	1	2	5	10	20	25
Temperature °C	..	26.0	25.9	24.7	24.0	24.0	23.4	23.4
Free CO_2	..	nil	nil	2.0	4.2	3.4	4.1	4.0
pH alkalinity	..	10.0	7.0	nil	nil	nil	nil	nil
M.O. alkalinity	..	15	23	36	30	36	28	36
pH	..	8.6	8.6	6.9	6.6	6.7	6.7	6.7
DO	..	8.8	8.6	5.6	5.5	4.0	5.4	4.6

On this day the gross primary production was 4.35 g O_2/m^3/ day and at 2.0 m. compensation depth was reached. The plankton volume was only 0.001 cc/L at the surface and the numbers of *Ceratium hirundinella* were just 1000 numbers/L. It was accompanied by zooplankters such as *Cyclops, Brachionus plicatils, Centropyxis* sp., and *Nauplii* (25,000/L). At 1 m. depth, the plankton volume ('settled') was 0.8 cc/L and this had 2 million cells of *Ceratium* per L accompanied by zooplankters. At 2.0 m. depth the plankton (settled) volume was 0.4 cc/L and *Ceratium* numbered 960,000 Nos/L. At this depth, were recorded green algae such as *Cosmarium, Staurastrum* (*Desmidiaceae*), *Pediastrum* and *Scenedesmus* in lesser numbers with zooplankters like *Bosmina, Daphnia, Cyclops, Diaptomus* and *nauplii*. All these were in the middle (limnetic zone) of the lake. In the littoral also *Ceratium hirundinella* occurred—4,80,000 cells/L.

When the limnological data in Table I are examined, certain interesting features are evident. Thermal discontinuity was striking between 1 and 2 m. depths. Upto

1 m. depth free CO_2 was absent and phenolphthalein alkalinity was present. The steep drop in pH from 8.6 to 6.9 i.e 1.7 units within 1 m. is a noteworthy feature, in fact strikingly so. The dissolved oxygen also dropped from 8.6 to 5.6 mg/L. Palmer and Ingram (1955) consider *Ceratium hirundinella* as 'Oxygen producing' algal flagallate. Due to algal photosynthesis, utilisation of free CO_2 from the surface and removal from bicarbonate has resulted in the presence of carbonate alkalinity at 0 m. and 1m. depths with corresponding reduction in methyl orange alkalinity. This was responsible for the steep shift in pH also. The coincidence of the compensation depth being at 2 m. completed the picture.

The water quality-low alkalinity, hardness (28 PPM), chloride (4 PPM) electrical conductivity (60 μ mho/cm) absence of phosphate, nitrate etc. makes it out to be an oligotrophic water. But the organic matter as indicated by oxygen absorbed value (PV) of 2.3 mg/L is moderately high. This may be due to dissolved organic matter produced by the blooms of algae. The swarming of *Ceratium* upto 2 m. depth is evidently responsible for the biochemical stratification noted. Hutchinson (1967) thinks that *Ceratium hirundinella* appears to be a cold water form characteristic of mesotrophic waters. He cited data to show that it exists in water containing over 20 mg/L of calcium and pH over 7. But all these are not supported by our data.

According to Sladecek (1965) and Kolkwitz and Marsson (1908) *Ceratium* sp. are indicators of oligo saprobity. Further observations to elucidate the saprobic and trophic status of this group of algae will be reported in due course.

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