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Nutrient Balance and Biomass/Productivity Interrelations in the Coastal Lagoon Lake Burullus, Egypt

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The Nile delta lakes are proximate reservoirs for the Nile water flowing to the Mediterranean. Taking Lake Burullus as a model, in this study we tried to estimate the amount of nutrient input to the water system and analyze their probable impact on lake productivity.

Lake Burullus is located between the Nile River branches, connected to the Mediterranean through Bz. El-Burullus. The lake area is 420 Km^2 of which 370 Km^2 are open water; the average depth is 1.25 m. The lake receives $3.6x10^6 m^3$ of fresh and brackish water/y of which $2.2x10^9 m^3$/y is discharged to the Mediterranean. The islands divide the lake into four zones of different ecological conditions.

Water samples were collected during February 1987 - March 1988 from different zones and drains for determination of nitrogen, phosphorus and chlorophyll a (Strickland&Parsons, 1972) as well as primary productivity (Steeman-Nielsen, 1952).

Lake Burullus is considered a mesotrophic lake (average chlorophyll a 6.6 mg/m^3) specially when compared with Lake Manzalah (average 21 mg/m^3) (Hamza, 1985). The area receiving >80% of drain water reaching the lake recorded the maximum chlorophyll a average (10.8±14.1 mg/m^3). The same zone attained the maximum average productivity (0.23 g C/m^2. d) and contributes to about 1/3 the annual phytoplankton production of the lake i.e. 102,024 tons C/y.

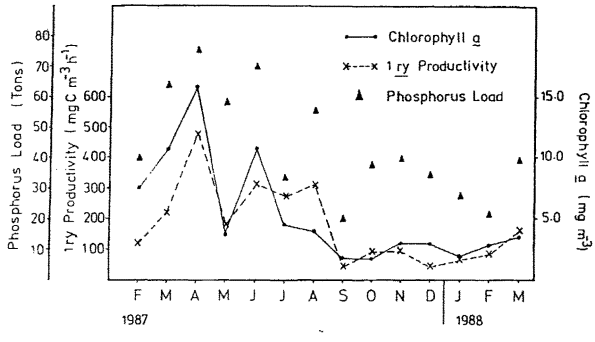

Figure 1 Biomass and productivity response to phosphorus load in Lake Burullus.

The question "what limits the lake productivity" is interesting to speculate. The fact that the lake don't receive any sewage disposal from heavily urban areas limits the phosphorus input to agricultural activities through the use of fertilizers. Mean-while, the dominant phytoplankton group inhabiting the lake are capable for nitrogen atmospheric fixation.

Table 1. Balance sheet for phosphorus and nitrogen in Lake Burullus.

ELEMENT	TOTAL* INFLOW (Tons/y)	OUTFLOW (Tons/y)	TOTAL GAIN (Tons/y)	DISSOLVED IN LAKE WATER (Tons/y)	SEDIMENTED OR UPTAKE (Tons/y)	PHYTO-** PLANKTON UPTAKE (Tons/y)	SEDIMENTED (Tons/y)
P	558	94	464	23.6	228	30	198
N	2318	291	2027	1416	611	238	373

* Rain water contributes 10 Kg P/y and 36 Kg N/y.
** Abdel-Moati (unpublished data).

Table 1 shows the dynamical balance of nitrogen and phosphorus in Lake Burullus. The wind driven circulation in the lake is set in a condition that the bulk nutrient derived to the lake flows northeast to the outlet. About 60% of inflowing water carrying 94 and 291 tons of N and P/y are conveyed to the Mediterranean i.e. 17% and 12% of N & P discharged, respectively. Only 42 and 61% of the total inflowing load of N and P are distributed throughout the water column. The annual phytoplankton consumption of N and P (in situ experiments) was 30 and 238 tons, hence sedimented P and N account for 35 and 16% of inflow. The increase of the lake water level over pumped drain water leads to sedimentation of nutrient bearing particles at discharge sites a process which controls the amount of phosphorus reaching the lake and prevent the lake from reaching its optimum production capacity. The short residence time of lake water (about 38 days) prevents the in-lake accumulation of organic derived material and continuously disturbs the lake equilibrium.

Direct relations not only occur between nutrient loading and lake-nutrient concentrations but also with the biomass and production levels. Figure 1 showed that biomass and production correspond to variations in phosphorus load in Lake Burullus.

REFERENCES

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