CHEMICAL DETERMINATIONS IN SEA WATER TAKEN FROM THE BASINS FOR KEEPING SEA-BIRDS

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CHEMICAL DETERMINATIONS IN SEA WATER TAKEN FROM THE BASINS FOR KEEPING SEA-BIRDS

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CONTENTS

I. Introduction

During the period October 1972 - July 1973 in two basins inhabited by ca. 20 guillemots *(Uria aalge)* each (SWENNEN, 1977), regularly sub-surface water samples were taken for the analysis of ammonia, nitrite, nitrate and orthophosphate. Water samples were analyzed, after filtration over 0.45 μ cellulose-acetate filters, by automated procedures of the methods described by STRICKLAND & PARSONS (1972).

The water introduced in the basins is Dutch coastal water (29.0 - 30.0 $^{o}/oo$ S). After the introduction of this sea water (100 m^3 per basin) it is circulated in closed system over a sand-bed filter. Pump-capacity is ca. 20 m^3/hour. Volume changes in the basins caused by evaporation or precipitation were corrected by introduction of Dutch coastal water or discarding of basin water. After 30-50 days the enriched sea water was discarded completely and 100 m^3 of new Dutch coastal water was introduced into the system.

Besides analysis of the above mentioned nutrients occasionally determinations of oxygen saturation, temperature and salinity over the whole water column were done. With a proper functioning of the pump no stratification with respect to salinity, temperature and oxygen could be detected.

The guillemots which were in a nutritional balance, were fed on fish (*Clupea sprattus, Ammodytes tobianus, Gadus esmarkii, Gadus merlangus*).
For computations 2.5% N and 0.3% P (in % of fresh matter) was used, according to VINOGRADOV.

II. Results

Figs 1 to 5 show the nutrients enrichment as a function of time in the basins at different periods. The enrichment with dissolved nitrogen and phosphorus compounds is caused by oxidation of food-rests and excretion products of the guillemots.

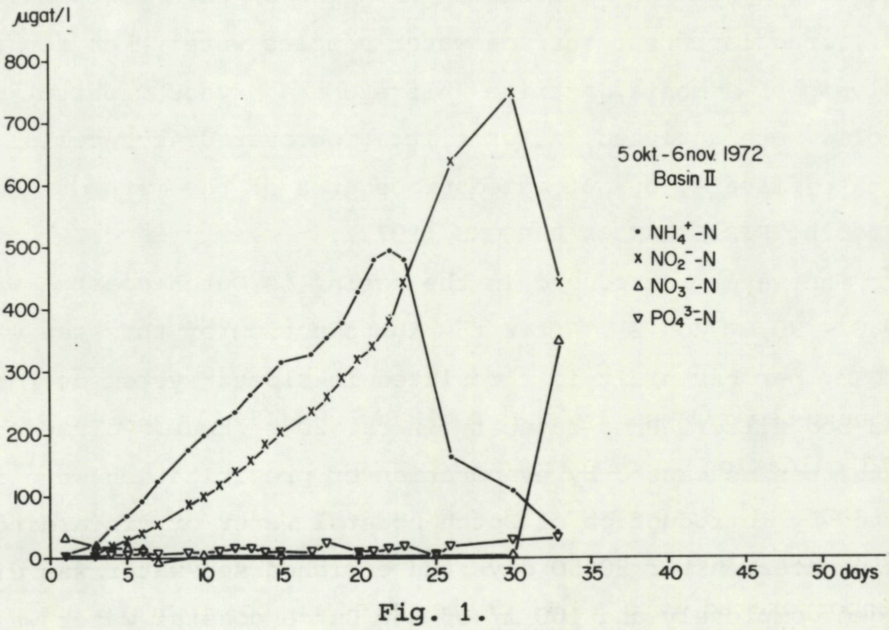

Fig. 1.

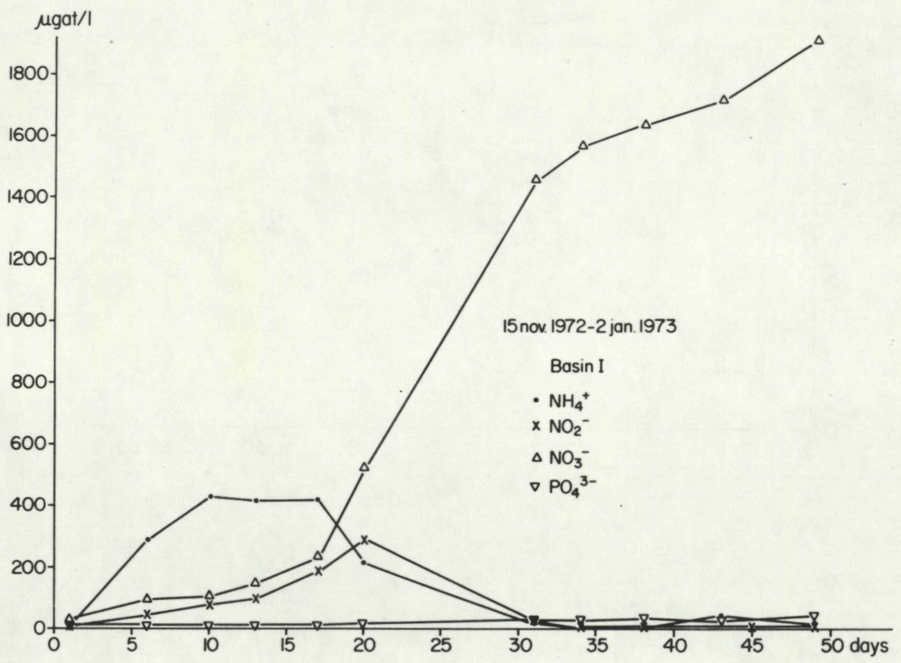

Fig. 2.

In Fig. 1 and more or less also in Fig. 2 the intermediate in the oxidation process of organic N and ammonia, nitrite, accumulates at a certain time. The high concentration of nitrite in Fig. 1, reaching a maximum 30 days after the start of the experiment should be noted. Especially in closed-water systems, inhabited by fishes, accumulation of the very toxic nitrite, that forms the non-oxygen binding methaemoglobin with haemoglobin, should be avoided.

In Figs 3 to 5 the oxidation of N compounds does not occur via accumulation of nitrite. Probably the oxidation capacity of the sand-bed filters by that time had been built up, so that rapid oxidation to nitrate could occur.

Especially in Fig. 5 it can be seen, that besides mineralization of N and P also a part of the nitrate and orthophosphate is incorporated into algal cells, keeping the nitrate and

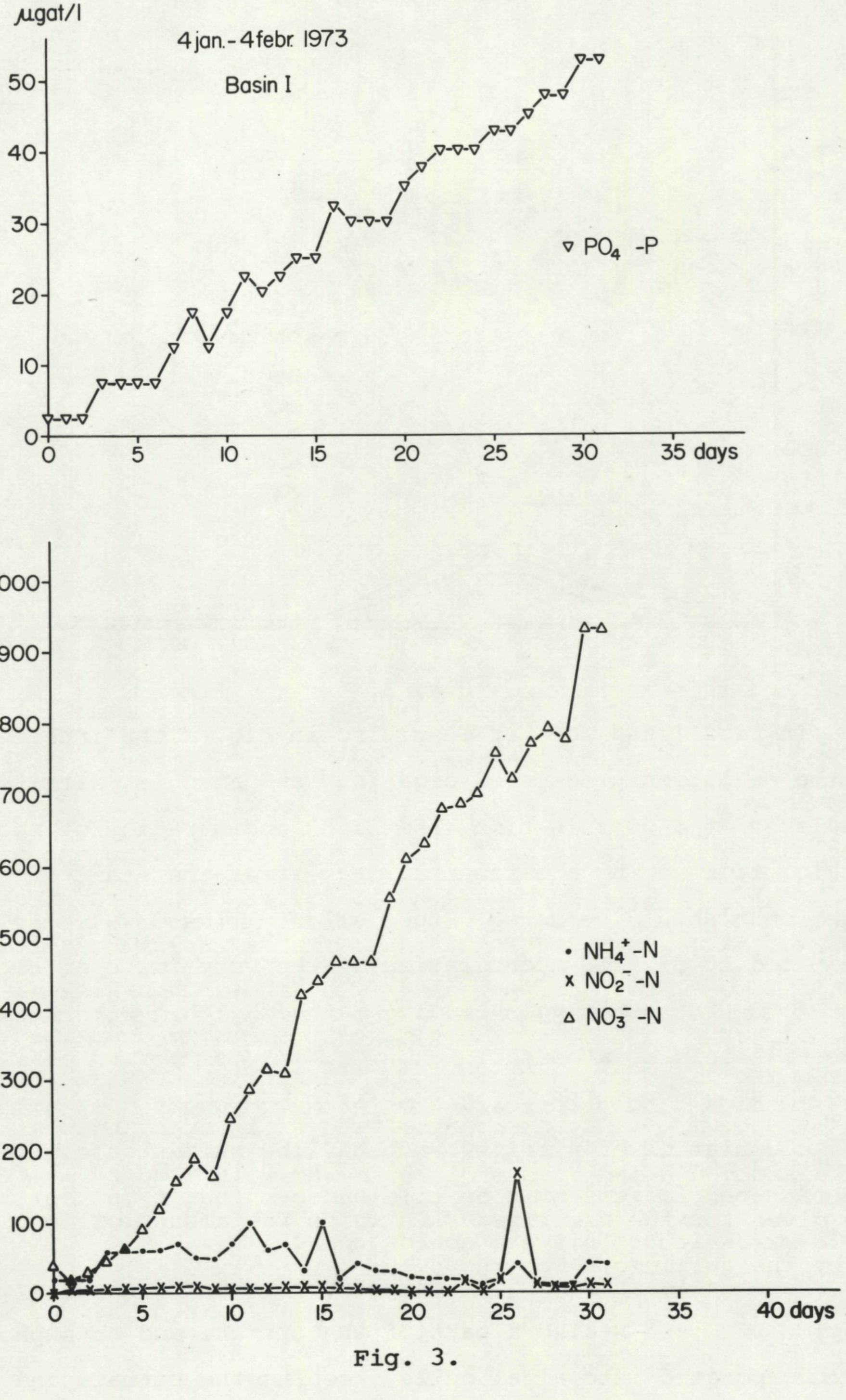
µgat/l
4 jan. - 4 febr. 1973
Basin I
▽ PO4 -P
35 days
• NH4+ -N
x NO2- -N
△ NO3- -N
40 days

Fig. 3.

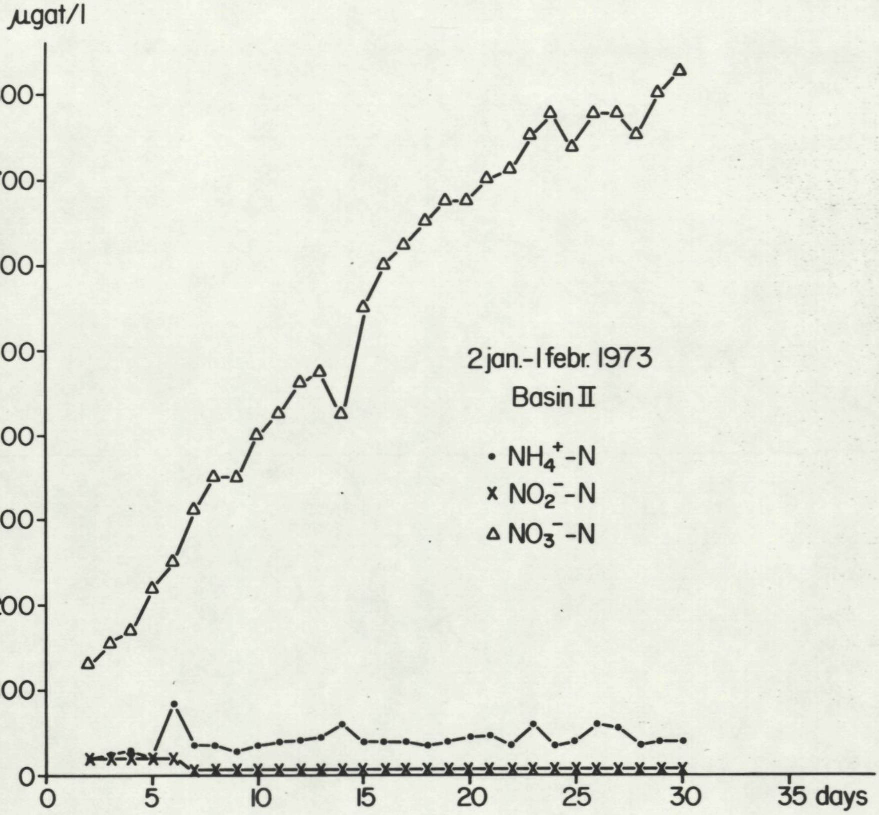

Fig. 4.

phosphate concentrations at a constant level at the end of the experiment. As a consequence the mineralization percentages of Table I are underestimations. In fact, the massive algal blooms form the main reason for total refreshment of the basins.

In Table I, the amount of N and P introduced as food, the enrichment related to the initial concentration of dissolved N and (NH_4^+ + NO_2^- + NO_3^-) and dissolved P (as orthophosphate) and the dissolved N and P as % of the N and P introduced as food, are given for the experiments in which the amount of food taken up by the guillemots was known.

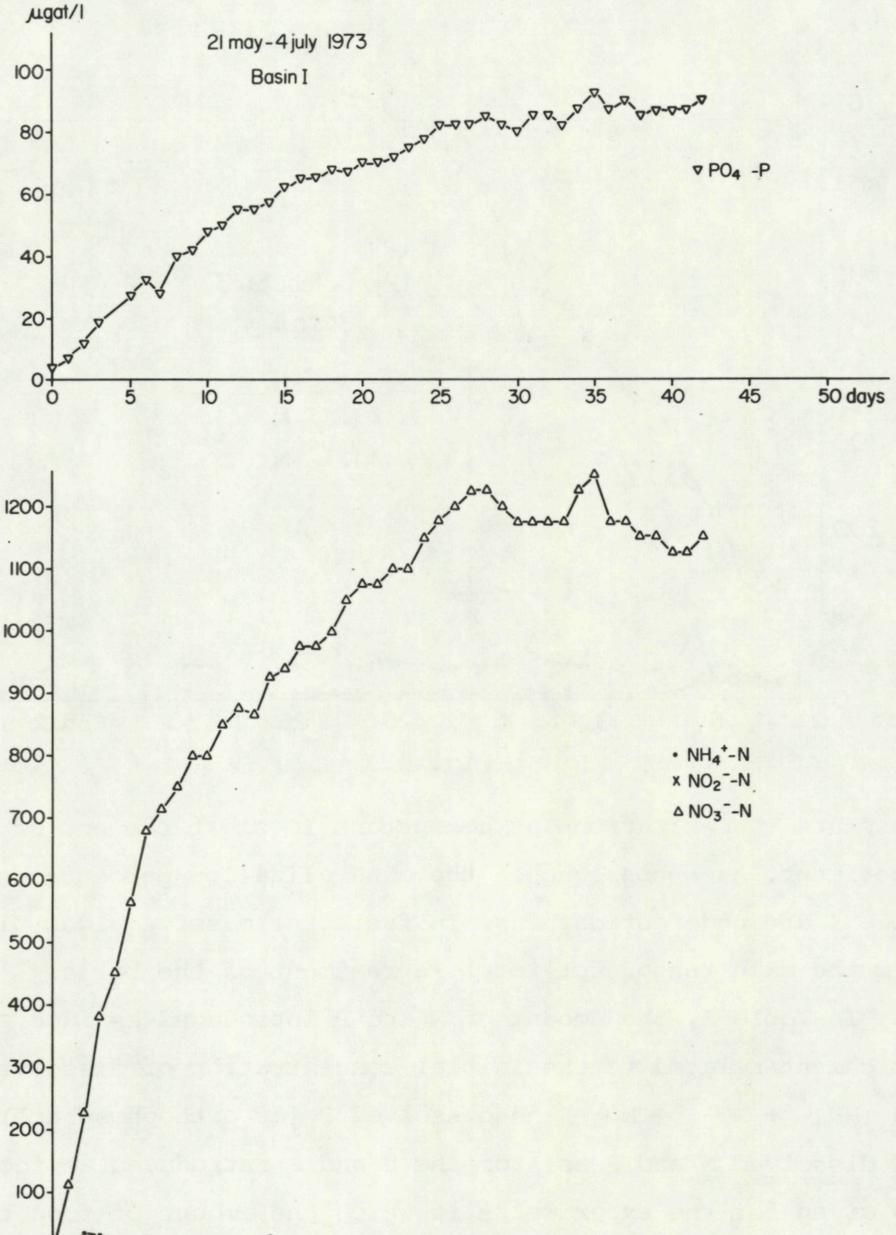
µgat/l
21 may - 4 july 1973
Basin I
▽ PO4 -P
• NH4+-N
x NO2−-N
△ NO3−-N
0
20
40
60
80
100
200
300
400
500
600
700
800
900
1000
1100
1200
0 5 10 15 20 25 30 35 40 45 50 days

Fig. 5.

Table I.

Nitrogen and phosphorus added as food to the two basins during the course of the experiments and the enrichment and mineralization occurring over that time.

Fig.	Basin	Days	Added as food		Enriched		Mineralized	
			N (g)	P (g)	N (×)	P (×)	N (%)	P (%)
1	II	33	3050	366	20.9	17.5	36.8	28.6
2	I	51	3964	476	54.1	47.7	68.4	26.5
3	I	33	2323	279	15.6	15.3	56.5	42.6
4	II	30	1892	-	13.7	-	61.0	-
5	I	45	4871	585	48.9	24.6	33.3	47.1

III. Conclusions

In closed-system water basins, inhabited by guilletmots, fed on fish, the originally present Dutch coastal water (ca. 30 $^{o}/oo$ S) was enriched with respect to dissolved N and P ca. 10-50 times in 30-50 days, without significant harmfull effects. By using high pumping capacities and biologically active sand-beds filters 40-60% of the nitrogen introduced as food and 20-40% of P is mineralized in 30-50 days.

IV. Literature

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