THE INFLUENCE OF PENGUIN EXCREMENT ON PHYTOPLANKTON PRODUCTION DURING SHORT-TERM INCUBATION IN THE ROSS SEA, ANTARCTICA

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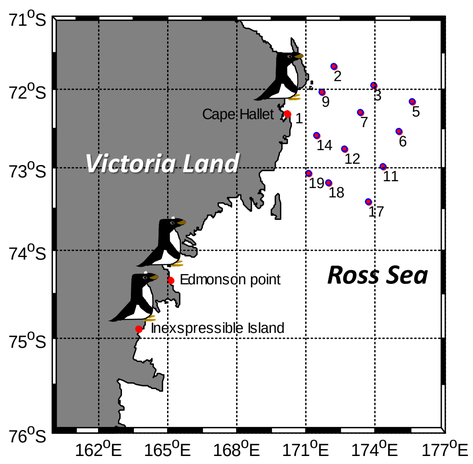

Fig. 1. Study area.

Abstract

Penguin rookeries in Antarctic coastal areas linked to marine ecosystems since their excretion has bio-available micronutrients and macronutrients for phytoplankton and potentially enhanced phytoplankton productivity and microbiota diversity. Penguin excrement samples were derived from three penguin rookeries (Cape Hallet; Cape, Edmonson point; Ep, and Inexpressible Island; Inex). To investigate the impact of penguin excretion, we conducted excrement-enrichment ^{13}C and ^{15}N dual-labelled phytoplankton incubation experiments with seawater samples collected from near the each penguin rookery in the Ross Sea, Antarctica. Specific carbon and nitrate uptake rates in control were higher than those of treatment during short-term incubation (4 hours), while the opposite was observed for specific ammonium uptake. These responses indicate that nitrate production by natural phytoplankton was regulated and inhibited by high ammonium concentrations from penguin excrement in the Ross Sea.

Materials and Methods

Penguin excretion-enrichment experiments

In situ incubation → short-term (4 hours).

- *Phytoplankton biomass (particulate organic carbon and nitrogen; POC and PON)*
- *Major inorganic nutrients (nitrate + nitrite, phosphate, ammonium, and silicate)*
- *Carbon and nitrogen uptake rates (nitrate and ammonium) of phytoplankton*

Fig. 2. Schematic view of the experiment method.

The aims of this study

1) To estimate response of phytoplankton (carbon and nitrogen uptake rates) on penguin excretion fertilization, using natural phytoplankton communities in the Antarctic marine ecosystem

2) To assess potential implications of penguin excretion fertilization in carbon and nitrogen cycling (to assess the role of penguin in ammonium regeneration).

Preliminary results

Table. 1. Concentration of stock solution.

	Stock solution con. (μM)		
	Ep	**Inex**	**Cape**
Phosphate	144.5	265.0	365.5
Nitrite + nitrate	107.5	4.6	1.8
Ammonium	906.1	839.3	883.6
Silicate	307.8	0.0	0.0

- The rate of carbon uptake in the other samples tended to decrease with the addition of more abundant excretion, but the Ep sample showed an exceptionally increasing trend (Fig. 3a).
- However, the specific carbon uptake except for phytoplankton biomass (particulate organic matter; POC) show higher value than treatments (Fig. 3b).
- The ammonium uptake rates in control were lower than those of treatments, whereas vice versa in nitrate uptake rate (Fig. 3c).
- The specific nitrogen uptake except for phytoplankton biomass (particulate organic matter; PON) also showed similar trend (Fig. 3d).

The carbon and nitrogen uptake were influenced by excretion enrichment. Especially, nitrate production was regulated and inhibited by high ammonium concentrations.

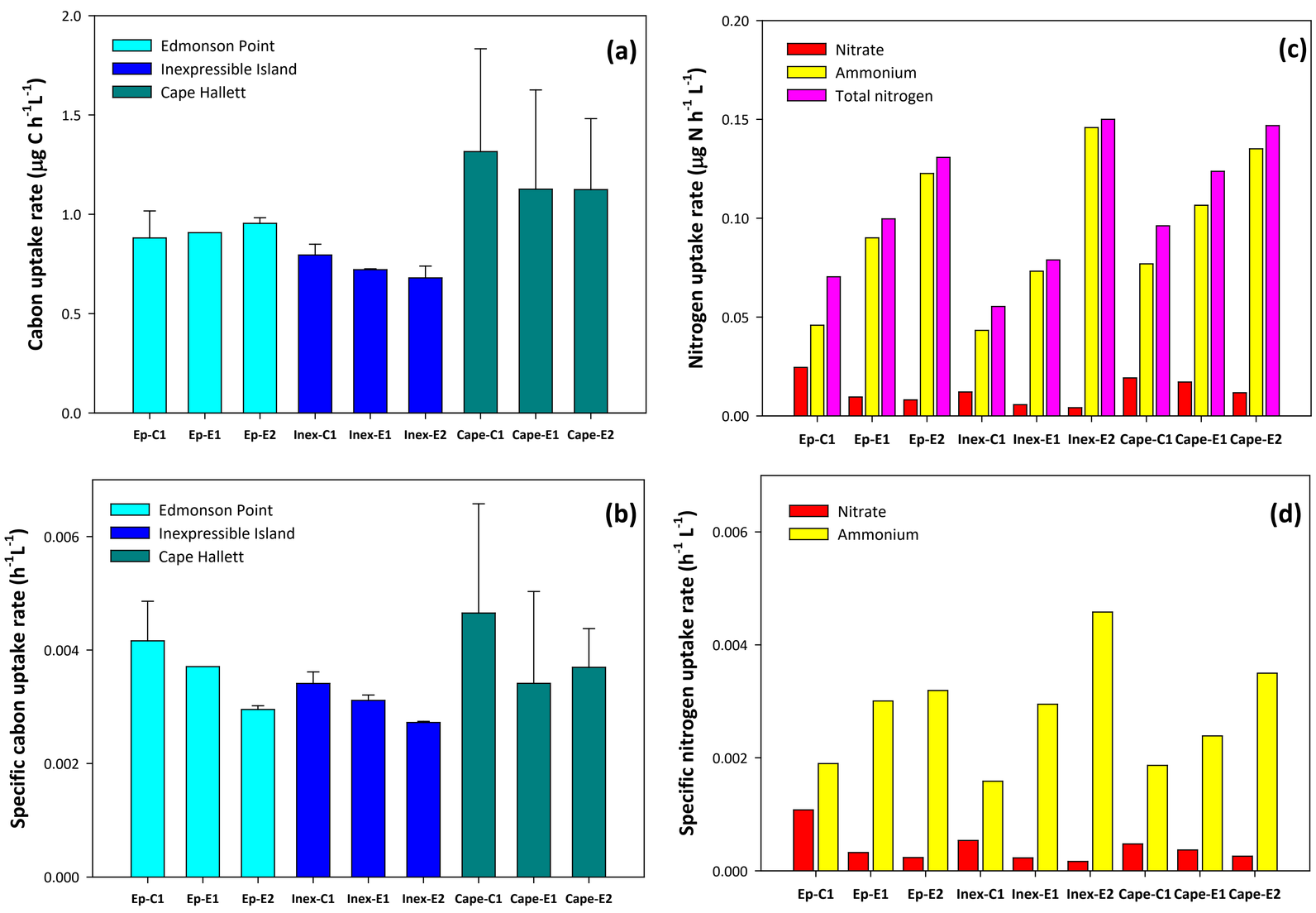

Fig. 3. Absolute and specific for carbon (a and b) and nitrogen (c and d) uptake rate during short-term incubation.

Acknowledgment

We thank the captain, officers, and crew of the R/V Araon for their valuable assistance at field work. This study was supported by Ministry of Oceans and Fisheries (MOF) and undertaken part of "Ecosystem Structure and Function of Marine Protected Area (MPA) in Antarctica; 20170336)".