

# Are reefs fertilized by seabirds?

Anne Lorrain, Fanny Houllbrèque, Francesca Benzoni, Laura Tremblay-Boyer, Christophe Menkès, Claude E. Payri and Éric Vidal



Chesterfield Islands: sooty terns nest in large colonies. © IRD/E. Vidal

Reef building corals create thriving ecosystems in the middle of vast oceanic deserts. They structure habitats for tens of thousands of species of fish, crustaceans, mollusks and other marine species. Some species of seabird may travel long distances across oceans to forage, but they all meet on coral reef islets to breed. Recent research has found unexpected interactions between these seabirds and reef building corals, showing that corals partly use the nitrogen released by seabird excrement (LORRAIN *et al.*, 2017).

Seabirds nest on coral reef islets during a few months each year, which leads to the accumulation of large quantities of fecal material, known as guano. Guano is recognized as a significant source of nitrogen

and phosphate and has been used since ancient times as a natural fertilizer. Accumulations of guano from seabirds nesting on the shore fertilize terrestrial ecosystems and could also impact coral reef ecosystems locally.

Using stable nitrogen isotopic markers it is possible to trace the nitrogen derived from guano up the marine food web. The analysis of water and coral samples has demonstrated the presence of guano-derived nitrogen in both the lagoon waters and the living tissues of corals collected in the proximity of islets. The local nitrogen enrichment of lagoon waters can occur by direct surface run-off of the guano accumulated on islets, percolation into the sediments (with

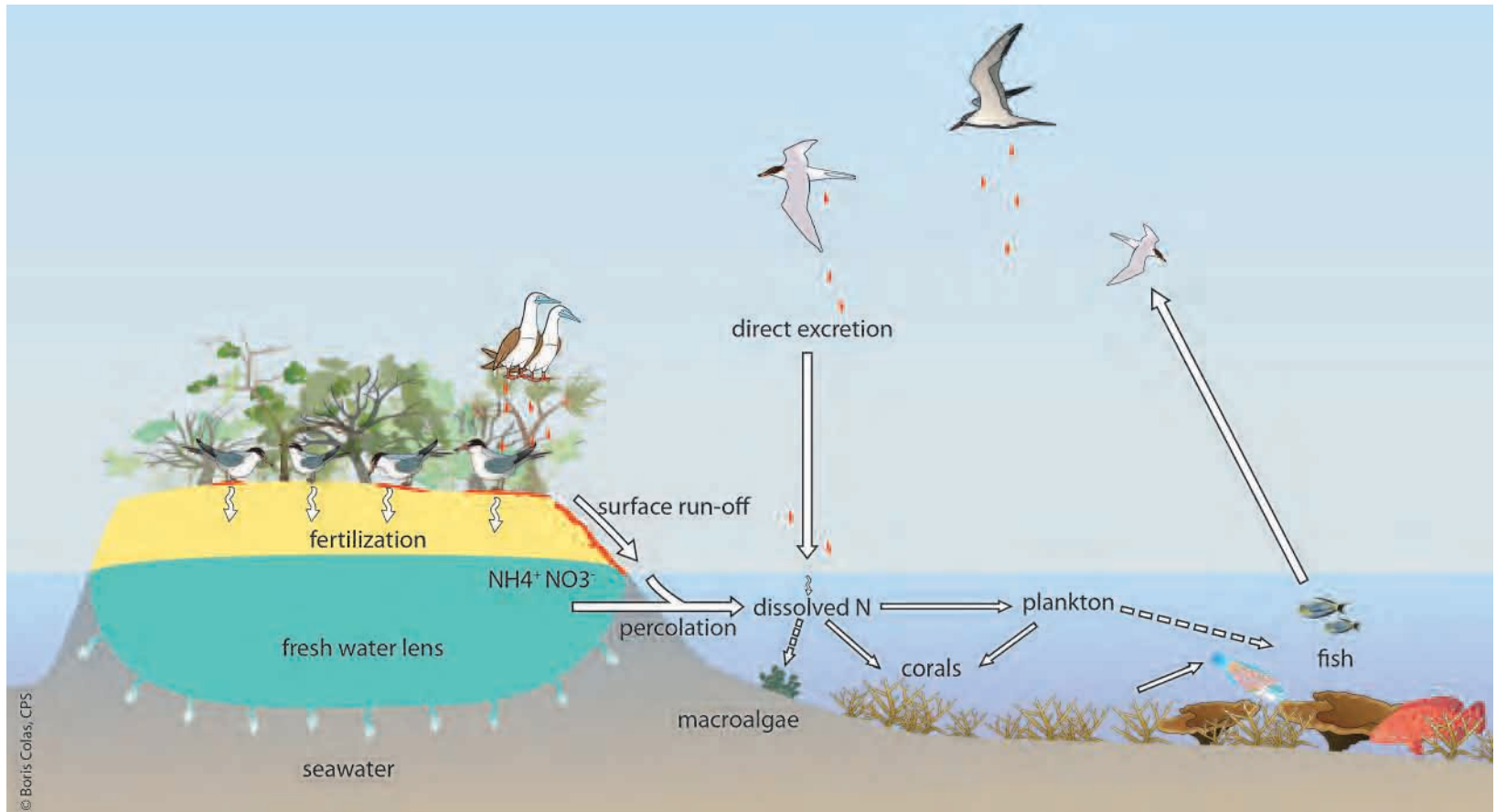


Figure 1: Schematic diagram of the guano-derived nitrogen inputs into a coral reef ecosystem. Adapted from LORRAIN *et al.*, 2017

precipitations) and resurgence at sea, or the direct excretion of feces into the water during seabirds' foraging trips (Fig. 1). Several hypotheses exist, or coexist, regarding the mechanisms behind the corals uptake of guano-derived nitrogen. One theory is that nitrogen can be used by plankton which in turn is ingested by corals. Alternatively, a dissolved form of nitrogen could be directly assimilated by corals and zooxanthellae (coral symbiotic microalgae).

## Reference

LORRAIN A. *et al.*, 2017 Seabirds supply nitrogen to reef-building corals on remote Pacific islets. *Scientific Report*, 7 : 3721.



Breeding black noddies providing huge amounts of guano, Chesterfield Reefs © E Vidal/IRD

# New Caledonia World of corals

*Scientific direction: Claude E. Payri*

*IRD Editions*

*French National Research Institute for Sustainable Development, Marseilles, 2018*

*Editions Solaris*

Translation: Lydiane Mattio  
Editorial coordination: Claude E. Payri  
Page and cover layout : Pierre-Alain Pantz - Editions Solaris  
Printing: Winson Press, Singapour

### Cover illustrations

Cover page 1 (from top to bottom):

Bay of Upi, Isle of Pines. © P.-A. Pantz

Coral biodiversity of Larégnère reef. © IRD/S. Andréfouët

Cover page 4 (from left to right):

Loading of a mikwaa net on a decked pirogue at Pwadèwia, St. Joseph Bay,  
Isle of Pines, 2017. © M. Juncker

Clown fish eggs. © G. Boussarie

Incubation of coral colonies in benthic chambers. © CNRS/E. Amice

Flying Red-footed booby (*Sula sula*). © M. Juncker

The law of 1st July 1992 (intellectual property code, first part), under paragraphs 2 and 3 of article L122-5, only authorizes, on the one hand, "copies and reproductions strictly reserved for the private use of the copyist and not destined for collective use," and, on the other hand, analyses and short quotations for the purpose of example and illustration, therefore "any representation or complete or partial reproduction, made without the approval of the author or the entitled parties or the legal claimant, is prohibited (paragraph 1 of article L. 122-4). Such representation or reproduction, by any means whatsoever, would therefore constitute an infringement punishable by the penalties provided for in Title III of the aforementioned law.

© IRD/SOLARIS 2018

ISBN : 978-2-7099-2677-5

Recommended citation:

Payri, C.E. (dir.), 2018 – New Caledonia: world of corals. IRD Editions/Solaris, Marseilles/Nouméa, 288 pp.