



CHRIS JONES

# seabird saviours

Tropical seabirds affect coral reefs

Although the oceans make up 70 per cent of the world's surface, only three per cent of bird species make their living at sea. One reason why seabirds are much less diverse than terrestrial species is the requirement to return to land to breed. Although seabirds are the most mobile organisms on earth, their ability to fully exploit marine ecosystems is limited to some extent by the distribution of oceanic islands. Seabirds breed in colonies for a variety of reasons, but their colonies

above Large seabird colonies, such as this Sooty Tern colony, import nutrients that impact the surrounding reef habitats as well as terrestrial ecosystems.

are especially large in areas where there are few islands.

The high densities of seabirds breeding on islands play a key role in shaping the islands' terrestrial ecology. In addition to their physical impacts through trampling and/or nest construction, seabirds import marine nutrients through their faeces (and, to a lesser extent, feathers and carcasses), with knock-on effects for the plants and animals found on islands. Some of the best-studied examples are in the Gulf of Mexico, where Gary Polis and his colleagues showed that islands with seabird colonies had plants with a higher nutrient content, as well as greater abundances of invertebrates, than similar islands lacking seabirds.

Nutrient imports by seabirds also affect inshore marine communities on islands. In the 1980s, research by Phil Hockey, Alison Bosman and George Branch revealed the complex web of interactions that results from nutrient runoff from guano islands off the west coast of South Africa. Similarly, Anne Treasure recently modelled the impact on coastal communities of the hundreds of tonnes of nitrogen and phosphorus excreted each year by seabirds at South Africa's Prince Edward Islands.

Now Nicholas Graham and his colleagues have shown the importance of tropical seabird colonies on coral reef ecosystems in the Indian Ocean (*Nature* 559: 250-253).

Biologists have often wondered why coral reefs are among the most diverse and productive habitats on earth, even though they occur in largely nutrient-poor tropical oceans. Graham et al. suggest that seabirds provide part of the answer. Their study took advantage of an unfortunate natural experiment created by the introduction of rats to some islands in the Chagos Archipelago in the Indian Ocean, about 500 kilometres south of the Maldives. Rats are efficient predators of seabird eggs and chicks, and even kill adults of smaller species. As a result, islands with rats have virtually no breeding seabirds compared to rat-free islands. This results in the nutrient content of soils on rat-free islands

being 250 times higher than islands with rats, with knock-on effects for the islands' plants and animals.

The study showed that these differences extend to adjacent coral reef communities, with algae, sponges and reef fish all benefiting from nutrient inputs from seabirds. Reef fish are more abundant and grow faster at islands with seabird colonies. Importantly, the researchers found that two key ecological processes critical for coral reef health are enhanced at islands with seabirds: grazing pressure is three times greater and the removal of dead coral by parrotfish is almost four times greater. Both processes promote coral settlement and are crucial to allow reefs to recover

following coral die-backs, such as the large-scale coral bleaching that occurred in the area in 2016.

Parrotfish feeding also creates sand, which is important for maintaining the low-lying atolls. Thus seabirds indirectly assist in sustaining their own breeding sites – an increasingly important function as climate change drives sea levels higher. The study concludes that rodent eradications should be prioritised as a conservation tool not only to bolster threatened seabird populations and restore the delicate terrestrial island ecosystems, but also to promote the conservation of coral reefs, which are home to so much marine biodiversity.

PETER RYAN



CHRIS OOSTHUIZEN/BRITISH ECOLOGICAL SOCIETY

# stand out

Dr Chris Oosthuizen of the University of Pretoria's Department of Zoology and Entomology recently won the British Ecological Society's annual photography competition, *Capturing Ecology*.

The independent judging panel comprised six eminent ecologists and award-winning wildlife photographers. Oosthuizen, a postdoctoral fellow at

the department's Mammal Research Institute, was chosen as the overall winner with his image of a lone adult King Penguin standing among a crowd of chicks on the remote subantarctic Marion Island, which is part of the Prince Edward Islands.

'Photography is a key science engagement tool that can convey important

conservation messages,' says Oosthuizen. 'Although the global population of King Penguins is large, populations inhabiting islands around the Antarctic face an uncertain future. Many seabirds are more endangered than elephants and rhinos, and deserve the same attention that these conservation icons receive,' he says.