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Shearwaters at Rottnest

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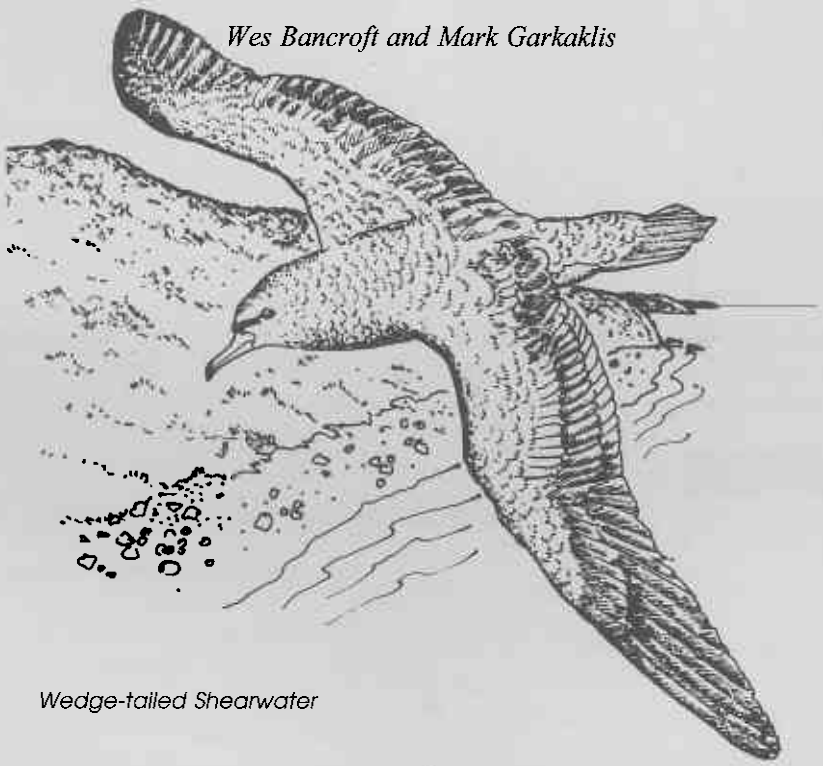

Wedge-tailed Shearwater

IT is dusk on the western coast of Rottnest Island. The summer daylight is fading and it's blowing a gale. On the horizon, out to sea, the silhouettes of hundreds of birds rapidly rise and drop from view, as they glide over the ocean's contours. While the whipping of the sand- and salt-spray makes it difficult to watch them for long, it is clear that these birds are masters of the wind. They're shearwaters, and they're coming home.

Every night, from mid-August until late April, flocks of Wedge-tailed Shearwaters descend on their nesting colonies on the south-western headlands of Rottnest Island. Having spent the day fishing at sea, diving and pursuing their prey to depths of 10 m, they return to their nests under the cover of night. But unlike many birds that are familiar to us, the shearwaters, often known as muttonbirds, don't build stick-cup nests in trees, or even scrapes on the ground. These birds are burrowers, and they're really good at what they do.

Their nesting burrows are dug by both birds in the monogamous pairs, and may reach depths in excess of 1.5 m below the soil surface, and lengths beyond 4 m. Burrows are 20 cm high by 27 cm wide and, more often than not, curve to the left. On average, the birds shift some 82 kg of soil from their burrow. All this can be done from scratch in six days. No mean feat, considering the equivalent would be two 70 kg humans shifting almost 15 tonnes of soil between them!

So why all the effort? Not surprisingly, there is method to this digging madness. Each year, pairs raise only a single offspring, and it is thought that by keeping the chicks in burrows they reduce the chance of the young being taken by aerial predators. On Rottnest Island, up to 20 Osprey (also known as Fish Eagles) patrol the cliffs, beaches and ocean throughout the daylight hours. With their chicks safely below ground, parents need not worry about the Osprey and can spend all day out at sea collecting dinner for them instead.

The life of the burrow-bound shearwater chick is, however, a lonely one. After spending three months digging or clearing burrows (birds will regularly reuse the same burrow year after year), an adult pair will incubate their single egg from late November. As soon as the chick hatches in mid-January it is left alone, by day, in the burrow. Both parents tend the chick, and at least one of them will return every one to four nights to deliver a meal of fish and squid. Even when the parents

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do return, they don't spend long with their chick in the burrow, often preferring to sit on the surface and wait for dawn. The adults depart well before sunrise, so that they can be at their preferred feeding ground and ready to fish at first light.

For all their time alone, the chicks do get fed well. At the end of the season they can weigh more than one and a half times as much as an adult bird. There is a catch, though. In late April the adult birds choose not to return to the colonies at all. They leave the chick, alone again, to use its reserves of fat to complete the last of its growth and juvenile moult, before leaving the colony to join the rest of the population at sea for the winter.

Immature birds will spend three or four years at sea before they will begin to breed. Often the young birds will return to the site from which they fledged, and in the case of Rottnest Island, the colonies have been expanding in size and in number. The number of burrows on the island has nearly doubled in the last decade, with some 11 700 burrows now spread across six discrete colonies. The first recording of Wedge-tailed Shearwater nesting on Rottnest Island was of a single active burrow made in 1889. By the mid-1950s there were over 500 burrows, and more than 2500 in 1982. One colony increased 23-fold in burrow number in this period. Growth of this magnitude has to almost certainly have been driven by immigration of birds from other areas, rather than just the return of Rottnest-bred birds.

Why the increase in population? One might think that, like us, once the shearwaters found the beauty of Rottnest Island, they could not get enough, and made sure that all their friends and relatives paid the island a visit. In some sense this is true, but not just for the shearwaters. Many other seabird species of tropical origin have expanded their breeding range into southwestern Australia, including the Red-tailed Tropicbird, Bridled Tern, Roseate Tern, Common Noddy and Sooty Tern. While we are only just beginning to think that we understand, it appears that these expansions are correlated with an increase in the frequency of El Nino-Southern Oscillation (ENSO). The impacts of ENSO on weather patterns (and farming) are well known, but its effects on organisms are less well understood (although probably no less important). We do know that ENSO alters oceanographic factors that, in turn, probably affect the availability of food. It is thought that when times became tough in northern waters, the breeding seabirds may have followed their food resources southward. Once in the south, the birds found Rottnest, and it wasn't long before the romantic West End sunsets had large numbers of shearwaters nesting on its cliff tops.

As a consequence of the expanding shearwater colonies, the amount of soil displaced by the birds has also increased. Soil

Wedge-tailed Shearwater (ph: W. Bancroft)

Shearwater colony on Rottnest, the white dots are the spoil-piles at the mouth of the burrows. (ph: W. Bancroft)

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displacement, turnover and modification can have vast-ranging effects on the ecosystem. Studies elsewhere in the world have shown that digging and burrowing (termed biopedturbation) can alter soil nutrient regimes and the physical properties of soil. Flow-on effects have been increases or decreases in plant biodiversity, altered plant community composition, and, while not well studied, changes in the animal species (or their abundance) present. Terrestrial animal species may also benefit from the physical habitat alteration by burrowers. The creation of a burrow may provide shelter for animals that would otherwise go without. The habitat is so valuable for some species of reptiles, such as the Tiger Snake on islands in the Bass Straight, that they have evolved to co-habit burrows with the owners (Short-tailed Shearwaters in the snake's case). This process of non-trophic (food-related), non-competitive species interaction has only recently been formalised by ecologists, who have termed it 'ecosystem engineering'.

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The question that interested us was, 'In light of the expanding colonies and soil disturbance by shearwaters on Rottnest, are the birds ecosystem engineers?' The answer to this is certainly 'yes', and we are investigating the magnitude of any effects that the birds may be having on the ecosystem. While we are still working through the data and preparing publications, it has become clear that almost all characters that we have measured (including soil bulk density, soil water repellency, soil nutrient content, plant biodiversity, plant productivity and animal biodiversity) strongly differ between the shearwater colonies and adjacent heathland. There is no doubt in our minds that the shearwaters are playing a major role in structuring components of the island ecosystem. We will continue to investigate.

So now the wind has dropped, and the first rays of sun are painting the western end of Rottnest with its light. The adult shearwaters are hunting well beyond the horizon, and their chicks sit quietly underground. Were it not for webbed footprints on piles of soil, the activities of the previous night, and the fascinating life that these birds lead, may never have been suspected.

Wes Bancroft is a PhD student from the School of Animal Biology at UWA, investigating the role of Wedge-tailed Shearwaters on Rottnest Island as ecosystem engineers, and their modulation of ecosystem function. He would be happy to answer questions or hear your stories about these birds, and can be contacted by phone: 9380 1493 or email: wes@cyllene.uwa.edu.au

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