

limestone to form "makatea" islands or raised atolls. While soils, particularly on the younger islands, are generally of low fertility, the range of topographies and altitudes means that a greater range of microhabitats develops. Niue Island (at 259 sq.km., the largest raised atoll in the world) and Henderson Island of the Pitcairn group are examples of raised atolls which, through time, have evolved into a relatively diverse series of habitats.

The birds of the Pacific are divided into three broad categories: resident land birds, locally breeding marine species and migratory shore birds.

A number of shorebird species such as the bristle-thighed curlew and the wandering tattler breed in the high arctic but are found around rocky shores and reef platforms during the northern winter. The unique record of a turnstone nest on a small coral islet in New Caledonia may give a clue to the origins of the one sedentary shorebird of the region, the Tuamotu sandpiper.

Most of the land birds have reached the South Pacific by island-hopping from either Asia or Australia. For example, the reed-warblers (genus *Acrocephalus*) are native to Europe and Asia and are spread in an arc across the Solomons, Micronesia and north-eastern Polynesia. The honeyeater family has spread northeastwards from its origin in Australia.

New Zealand is the source of a number of birds such as the kaka and N.Z. pigeon in Lord Howe and Norfolk Islands, and the kakariki in Norfolk, New Caledonia and the Society Islands.

There are a few species whose lineage is so ancient that they are either relatives of the Gondwanaland avifauna or migrated into the region in a past too distant to allow us to trace their relatives. The cagou in New Caledonia is not closely related to any other bird family though it may have connections with the extinct *Aptornis* of New Zealand. In Samoa, the enigmatic tooth-billed pigeon is unlike any other pigeon living, and the reasons for its survival there are not clear.

Are island birds at any greater risk than those of mainlands? Potentially yes, since small land areas mean small populations and remoteness makes it difficult to recolonise an island if the population is wiped out. What then are some of the problems facing Pacific island birds and their habitats?

- Modern and traditional agriculture is encroaching increasingly on natural habitats, particularly where the human population is growing rapidly, as is happening in the Kingdom of Tonga. There, every male reaching the age of majority has a traditional right to several acres of land for gardening. The land area is already insufficient to sustain this, with the result that slash-and-burn farming proceeds at a rate greater than that of the capacity of the forest to regenerate abandoned sites.

- The abundance and accessibility of cheap timber is drawing logging companies from all over the world to the larger Pacific Islands. The logging method is often little more than "timber mining".

Even if the concept of sustained yield harvest were a management objective, it has little basis for becoming a reality in these poorly understood tropical forests. For example, timber rights to the whole of San Cristobal Island in the Solomons have recently been given to an American company. An operation that benefits the Solomons little is being carried out with scant regard for the habitat of a large number of bird species, including six endemics. Almost nowhere in the area is even a representative reserve system an integral part of a forestry programme.

- Human settlement of uninhabited regions threatens some important islands. Only recently was the threat posed by an American millionaire and his cattle-ranching plans on Henderson Island averted. This saved, for the time being, one of the least modified and important "islands for science" in the region.

- Tourism can be a double-edged sword. While a potentially low-impact form of industry, it is not often planned with the appropriate sensitivity to the natural environment. In Fiji, for example, seabird colonies are now being bulldozed to make way for hotels so that tourists can get away from it all to a "South Sea Island Paradise". Islands are being cleared of vegetation to create the park-like environment perceived as being attractive to visitors.

- Just as introduced predators have devastated the avifaunas of New Zealand and Hawaii, they may be poised to do so in other areas of the Pacific. Fortunately, though some species such as the endangered Tuamotu Sandpiper are certainly rat susceptible, most terrestrial birds have not fallen victim to these rodents. The mongoose, however, introduced to Fiji to control rats in cane plantations, has almost destroyed the ground birds of Viti Levu and Vanua Levu.

- Avian disease has been frequently invoked as a reason for the elimination of most indigenous Hawaiian forest birds from low altitude areas. Difficult to study in wild bird populations, mosquito-borne diseases are clearly in need of investigation, particularly in the Society Islands and Guam, where dramatic bird losses may be related to their introduction.

- Hunting represents a threat, particularly to rare and localised species such as the pigeons of eastern Polynesia. Evidence from sub-fossil records suggests that a large number of species, including the Marquesas pigeon — now confined to Nuku Hiva — were once much more widespread. Polynesian as well as European settlement has taken its toll.

Scientific collecting is not immune from criticism as academic as well as conservation interest focusses in the region. Though widespread, conspicuous and characteristic of the whole Pacific, colonial seabirds are in urgent need of conservation in some areas. Because of their abundance, nesting boobies, noddies, frigates and petrels are an attractive food source, so much so that islands which have been

The core habitat of the only surviving population in Tonga of the red-breasted musk parrot, *Prosopiea tabuensis*, will possibly be protected by Tonga's proposed 'Eua National Park. Photo: Paddy Ryan

Inset: The Samoan broadbill on a Hoya vine. Photo: Mark Bellingham

inhabited longest now have few seabird species.

- Natural disasters such as the havoc wrought on Christmas Island's seabirds by the extended El Nino phenomenon in 1982-3 are, of course, unavoidable. Nevertheless, the likely occurrence of phenomena such as hurricanes and volcanic eruptions highlights the danger of restricting bird populations to small isolated remnants of habitat. A dramatic example is that the entire population of the Malau or Niuafo'ou Megapode is restricted to one Tongan island that is currently showing symptoms of an imminent eruption.

- In many areas, the traditional system of land tenure renders the establishment of reserves a complex task, requiring the approval of a multitude of owners as well as that of the Government. Conservation agencies need a detailed knowledge of traditional patterns of land ownership and management when planning and negotiating for protected natural areas.

- Perhaps the most fundamental and pressing problem concerning birds of the region is a lack of information. It is very difficult to make conservation recommendations when there is little or no information on the species or the area one is seeking to protect. For example, our entire knowledge of the Versicolor Flycatcher *Myzornis versicolor* of Ogea Levu in Fiji comes from specimens collected in the 1920s. So far as is known, no one has looked for the species since then, even though the island is relatively accessible. Remote areas of the larger Pacific Islands, particularly the Solomons, Vanuatu, parts of Fiji and Western Samoa, are poorly known, as are the extensive archipelagos of Tonga, the Tuamotus, and much of Micronesia. Even in Hawaii, where bird-watchers abound, a species new to science and new to all human experience was discovered as late as 1973. The po'ouli, a small Hawaiian honeycreeper was discovered in rainforest of Maui by a group of students. Wildlife surveys of key areas are urgently required. Lack of information is not only a problem for scientists and decision makers but also for inhabitants of the region. In many cases traditional knowledge has been lost or buried in westernisation and not been replaced. Educational material designed to nurture a new respect for wildlife is urgently needed.