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# South Pacific Regional Environment Programme

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TOPIC REVIEW No. 25

BIRD CONSERVATION IN THE PACIFIC ISLANDS

International Council for Bird Preservation (ICBP)  
Study Report No. 7

South Pacific Commission  
Noumea, New Caledonia  
July 1985

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TOPIC REVIEW NO. 25  
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BIRD CONSERVATION IN THE PACIFIC ISLANDS

Rod Hay

(Jointly produced as SPREP Topic Review No. 25 and International Council for Bird Preservation (ICBP) Study Report No. 7)

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South Pacific Commission  
Noumea, New Caledonia  
July, 1985

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## P R E F A C E

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Twelve years ago, the United Nations Conference on the Human Environment (Stockholm, 5-16 June, 1972) adopted the Action Plan for the Human Environment, including the General Principles for Assessment and Control of Marine Pollution. In the light of the results of the Stockholm Conference, the United Nations General Assembly decided to establish the United Nations Environment Programme (UNEP) to "serve as a focal point for environmental action and coordination within the United Nations system" (General Assembly resolution XXVII of 15 December 1972). The organizations of the United Nations system were invited "to adopt the measures that may be required to undertake concerted and co-ordinated programmes with regard to international environmental problems", and the "intergovernmental and non-governmental organizations that have an interest in the field of the environment" were also invited "to lend their full support and collaboration to the United Nations with a view to achieving the largest possible degree of cooperation and co-ordination". Subsequently, the Governing Council of UNEP chose "Oceans" as one of the priority areas in which it would focus efforts to fulfil its catalytic and co-ordinating role.

The Regional Seas Programme was initiated by UNEP in 1974. Since then the Governing Council of UNEP has repeatedly endorsed a regional approach to the control of marine pollution and the management of marine and coastal resources and has requested the development of regional action plans.

The Regional Seas Programme at present includes eleven regions (1) and has over 120 coastal States participating in it. It is conceived as an action-oriented programme having concern not only for the consequences but also for the causes of environmental degradation and encompassing a comprehensive approach to combating environmental problems through the management of marine and coastal areas. Each regional action plan is formulated according to the needs of the region as perceived by the Governments concerned. It is designed to link assessment of the quality of the marine environment and the causes of its deterioration with activities for the management and development of the marine and coastal environment. The action plans promote the parallel development of regional legal agreements and of action-oriented programme activities (2).

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- (1) Mediterranean, Kuwait Action Plan Region, West and Central Africa, Wider Caribbean, East Asian Seas, South-East Pacific, South Pacific, Red Sea and Gulf of Aden, East Africa, South-West Atlantic and South Asian Seas.
  - (2) UNEP : Achievements and planned development of UNEP's Regional Seas Programme and comparable programmes sponsored by other bodies. UNEP Regional Seas Reports and Studies No. 1, UNEP, 1982.

The idea for a regional South Pacific Environment management programme came from the South Pacific Commission (SPC) in 1974. Consultations between SPC and UNEP led, in 1975, to the suggestion of organizing a South Pacific Conference on the Human Environment. The South Pacific Bureau for Economic Co-operation (SPEC) and the Economic and Social Commission for Asia and the Pacific (ESCAP) soon joined SPC's initiative and UNEP supported the development of what became known as the South Pacific Regional Environment Programme (SPREP) as part of its Regional Seas Programme.

A Co-ordinating Group, consisting of representatives from SPC, SPEC, ESCAP, and UNEP was established in 1980 to co-ordinate the preparations for the Conference.

The Conference on the Human Environment in the South Pacific was convened in Rarotonga (8-11 March, 1982). It adopted : the South Pacific Declaration on Natural Resources and Environment of the South Pacific Region ; and agreed on the administrative and financial arrangements needed to support the implementation of the Action Plan and on the workplan for the next phase of SPREP (3).

This report has been produced in accordance with the Action Plan by Dr. Rod Hay to whom the sponsors express their gratitude.

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- (3) SPC / SPEC / ESCAP / UNEP : Action Plan for Managing the Natural Resources and Environment of the South Pacific Region. UNEP Regional Seas Reports and Studies No. 29, UNEP, 1983.



## SUMMARY

This work is based on a review of published literature, communications with biologists in the region and visits to certain key areas. The aims are to look at the current status of knowledge of birds of the region and, focusing on those species most at risk and those habitats most in need of protection, to outline the projects that should be taken up by SPREP and ICBP and other funding organisations, and to assist with current research and issues.

Though the Pacific Islands do not generally each have a large complement of bird species, the degree of endemism is very high. Because of a number of factors common to island ecosystems and because of the degree of endemism, the number of species and subspecies is very high for such a land area. Habitat disturbance by human and natural agencies, predators, disease, hunting and competition from introduced species are all important.

The current state of nature conservation and those individuals and organisations involved are considered and a number of recommendations for future action are made. Amongst the specific projects recommended are the following:

1. General wildlife inventories in all areas, but particularly in Vanuatu, Western Samoa, and the outer islands of Fiji, Tonga, and French Polynesia.
2. Radio-tracking study and survey of the kagu (Rhynochetos jubatus) in New Caledonia.
3. Study of the habitat requirements of the tooth-billed pigeon (Diunculus strigirostris) in Western Samoa.
4. Population survey and breeding and predator study of the Tuamotu sandpiper (Prosobonia cancellatus) in French Polynesia..
5. Survey of the status and conservation needs of the Silktail (Lamprolia victoriae) on Vanua Levu and Taveuni in Fiji.
7. Studies towards conservation of other endemic species.
8. Protected areas for seabirds and landbirds.
9. Education projects, including producing a series of wildlife posters and other information material appropriate to each country of the region.

## R E S U M E

Le présent travail s'appuie sur une étude de la littérature publiée, sur des échanges avec des biologistes de la région et sur des missions dans certaines zones particulièrement importantes. Il se propose d'établir un bilan des connaissances actuelles sur l'avifaune de la région, en s'attachant aux espèces les plus menacées et aux habitats qui ont le plus besoin d'être protégés, de recenser les projets qui devraient retenir l'intérêt du PROE, du CIPO et d'autres organismes bailleurs de fonds; et d'apporter ainsi une aide aux recherches en cours et à la solution des problèmes en jeu.

Si, dans chaque île, le nombre d'espèces d'oiseaux est généralement limité, en revanche le degré d'endémisme est très élevé. Vu les nombreux éléments communs aux écosystèmes insulaires et le taux d'endémisme, le nombre d'espèces et sous-espèces est très élevé par rapport à l'ensemble de la superficie des terres. Les perturbations causées à l'habitat aviaire par l'action de l'homme ou d'agents naturels, les prédateurs, les maladies, la chasse et la concurrence d'autres espèces introduites, sont grosses de conséquences.

L'auteur étudie la situation du point de vue de la conservation, indique quelles sont les personnes et organisations compétentes et formule un certain nombre de recommandations concernant les actions à entreprendre. Il recommande notamment les travaux suivants :

1. Un recensement général de la faune et de la flore sauvages de toute la région, mais plus particulièrement de Vanuatu, du Samoa-Occidental, des îles périphériques de Fidji, de Tonga et de la Polynésie française.
  2. Une étude et un inventaire par dépistage radio du cagou (Rhynochetos jubatus) de Nouvelle-Calédonie.
  3. Une étude des besoins écologiques du pigeon à bec dentelé (Didunculus strigirostris) du Samoa-Occidental.
  4. Un recensement de la population de bécasseaux des Tuamotu (Prosobonia cancellatus), en Polynésie française, ainsi qu'une étude de la reproduction et des prédateurs de cet oiseau.
  5. Une étude de la situation et des besoins en matière de conservation du gobe-mouches (Lamprolia victoriana) à Vanua Levu et Taveuni, aux Iles Fidji.
  6. Une étude sur la sauvegarde d'autres espèces endémiques.
  7. La création des zones protégées destinées aux oiseaux de mer et de terre.
  8. Des projets à orientation pédagogique, notamment la réalisation d'une série d'affiches sur la faune et la flore sauvages et d'autres documents d'information adaptés à chaque pays de la région.
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## BIRD CONSERVATION IN THE PACIFIC ISLANDS

Rod Hay

## CHAPTER 1

## INTRODUCTION

## 1-1 BACKGROUND

The problems of bird conservation in the South-west Pacific are of a magnitude commensurate with the size of the area over which the Pacific Islands are scattered. The region considered here encompasses the nations and territories served by the South Pacific Commission, with the exception of Papua New Guinea, for which the International Council for Bird Preservation (ICBP) has a separate programme, and Norfolk Island.

. . . Furthermore, it concentrates on the southwestern portion of the region, largely because the islands where the United States influence has been strong, namely the Northern Marianas Islands, Guam, The Federated States of Micronesia, Palau, The Marshall Islands, Kiribati and American Samoa, have generally had a greater investment of faunal survey and other bird work than the rest of the Pacific. For example, the investigations conducted by the Pacific Ocean Biological Survey Program (POBSP) of the Smithsonian Institution during the 1960s (King, 1973) and subsequent surveys, particularly by or in conjunction with the U.S. Fish and Wildlife Service (e.g. Pratt et.al., 1980 for Palau; Engbring and Ramsay, 1981 for Guam; Amerson et.al., for American Samoa) are resulting in a greater store of information than is currently available for most of the other territories.

At its 18th World Conference in 1982, ICBP adopted, as a principal theme of its future activity, a strategy for protection of birds of the southwest Pacific (ICBP, 1983). A necessary preliminary to this work was the examination of all relevant data so that priorities for action could be set. ICBP's New Zealand representative, the Royal Forest and Bird Protection Society (RF&BPS), agreed to undertake this task, funding the principal researcher, and the whole project was incorporated into the South Pacific Regional Environment Programme (SPREP) which met travel costs from New Zealand to New Caledonia, Vanuatu, Fiji, Tonga, Western Samoa, Cook Islands and Hawaii. Accommodation was provided by the Zoology Department, University of Auckland.

The aim of the early phase of the work, therefore, is to examine recorded material on birds of the region, to canvass the local view of conservation requirements from official agencies, conservation organisations and interest groups, and to draw up a series of bird conservation proposals appropriate to the future work of SPREP, ICBP and other bodies.

## 1-2 THE PROBLEM

The serious plight of bird species in the region has been highlighted by Dahl (1984 a,b), who has calculated that there is, on average, one endangered bird species for every 90,000 human inhabitants in Oceania, a figure probably higher than in any other area of the world. In Australia, for example, the equivalent figure is 840,000. Even in New Zealand, acknowledged to have a poor record of extinctions and threatened species, the figure is one endangered species for every 116,500 inhabitants. The problem is further highlighted when land area is considered. In the Pacific islands there are more endangered species per unit land area than any other region of the world.

The plight of birds may be regarded as a small part of a wider conservation problem. Birds are generally conspicuous and motivate environmental concern probably more readily than any other biological group. Though this concern may be seen to be exclusive of more important problems, the focus on birds is well founded because it raises that concern and because conservation work on them brings benefits for the whole biota. Birds may be regarded as ecological indicators and their study inevitably leads to a broader environmental understanding.

## 1-3 SCOPE OF THIS REVIEW

The purposes of this review are several-fold. In order to plan rationally for a bird conservation programme, the problems of the whole region need to be considered together, so that urgent problems in remote areas are not missed in favour of those in well-known areas. A review of available information is necessary before priority species, areas and general issues can be selected. The general influences on bird survival are considered and those species and groups of species regarded as being at risk are reviewed. Leading from this, current requirements for action are proposed.

## 1-4 WHY PRESERVE RARE BIRDS?

The reasons behind concern for rare and endangered species warrant some discussion here. In his review of the natural history and conservation of threatened birds, Halliday (1978) proposed five main arguments which are considered here in a Pacific context (they are not necessarily listed in order of importance):

### 1-4-1 SCIENTIFIC

Islands may be considered as ecological laboratories whose size is small enough to allow scientific study of the effects of different environmental conditions. Groups of different islands often provide natural controlled experiments on the effects of different environmental conditions on the ecology and evolution of the biota. The study towards preservation of rare species provides an opportunity

to understand biological processes. Darwin's theory of evolution, for example, was stimulated into being by his study of the birds of the Galapagos Islands.

#### 1-4-2 ECOLOGICAL

This argument is similar to the scientific one, except that it stresses the role that species and groups of species may play in the functioning of ecosystems. Fruit pigeons, for example, are important dispersers of the seed of some forest trees and, where they are becoming rare as in French Polynesia, the regeneration cycle of the forest is being affected.

#### 1-4-3 ECONOMIC

The economic argument for preserving rare species is potentially a very powerful one, but is also fraught with risk. If it can be proven that the expense of protection brings an economic reward then there seems little reason not to proceed. Unfortunately, however, the economic benefits are usually remote and difficult to measure in cash terms. It is impossible, for example, to understand the benefit of maintaining a high species diversity with a view to the potential future use of some animals. There are, however, two areas in which the economic benefit can be gauged. Firstly, some birds, notably seabirds and landbirds such as pigeons, are traditional and often important sources of food. The conservation of these resources ensures the greatest possible long-term yield of food with obvious benefits to traditional and modern societies and economies. The second area of benefit is in tourism. The attraction of visitors to natural areas is growing rapidly but is not a resource yet adequately promoted by government and tourist interests.

#### 1-4-4 MORAL

A slightly more esoteric view of conservation is based on the fact that humans are merely one part of the world ecosystem. We do, however, have the power of determining whether or not another species survives. Recent history has shown that a burgeoning extinction rate is the result of human activity. The moral stance states that other animals have the same right to survive as we do and, because it is in our power to dictate whether other species lives or not, we have a moral obligation towards them.

#### 1-4-5 AESTHETIC

It is probably fair to state that while the most important imperatives for bird conservation are economic and ecological, the motivation behind many efforts, particularly in developed countries, is aesthetic. It is a valid argument nevertheless, particularly where the existence of protected natural areas and wildlife is seen to enhance the quality of life. Seen in the context of the money spent

on protecting human art, artifacts and treasures, the efforts made towards preserving "natural works of art" are relatively small. It is true, though, that this interest is relatively limited in the less developed countries of the region. Nevertheless, the aesthetic appeal of rare species can be well exploited in fund-raising efforts outside the region.

#### 1-5 ACKNOWLEDGEMENTS

Many people and organisations have contributed towards this study. Travel funds were made available by the South Pacific Regional Environment Programme and by the International Council for Bird Preservation in which I particularly wish to thank Dr Jeremy Carew-Reid and Dr Christoph Imboden. The work was carried out while under the employment of the Royal Forest and Bird Protection Society of New Zealand. Accommodation at the Zoology Department, University of Auckland was kindly provided by Professor E.C. Young and Dr Peter Jenkins.

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## CHAPTER 2

## THE AVIFAUNA OF THE SOUTH-WEST PACIFIC ISLANDS

## 2-1 INTRODUCTION

To fully describe the distribution, evolution, and status of the avifauna in an area of 25 million square kilometres, or about five per cent of the Earth's surface, is obviously beyond the scope of a review such as this. Relatively, the land area under consideration is not great at some 94,000 sq. km. (c.f. New Zealand's 270,000 sq.km. and Australia's nearly 7 million sq.km.). Its extreme biological importance, however, lies in its composition of a myriad of islands, atolls, rocks, and cays, most of which provide resting, feeding or breeding habitat for birds.

Two apparently contradictory features characterise the avifauna of the region. Firstly, in any one island the number of species of resident birds is very low when compared with an area within a continental land mass of similar size and range of habitats. Secondly, isolation has resulted in genetic separation and a consequent high rate of speciation between islands. Taken as a whole, therefore, the Pacific has a very wide variety of bird species for its land area, despite there being a small avifauna at any one site.

One of the determinants of bird speciation is the range of habitats available. The islands of the region may be classified into four main types according to their origins and present geomorphology:

1. Fragments of continental land-masses (e.g. New Caledonia and parts of Palau) on which may survive relic of an ancient avifauna isolated since the fragmentation of the southern super-continent, Gondwanaland. Because of their age, these islands tend to have a wider array of rock and soil types than the other types. This may be reflected in a higher biological diversity. New Caledonia, for example, has an extremely large number of plant species.

2. Volcanic islands. These range from young active volcanoes without a highly developed vegetation (e.g. Matthew and Hunter Islands, southeast of New Caledonia), through older and well-forested but sometimes still active volcanoes (e.g. Savaii, Western Samoa), to eroded volcanic remnants (e.g. Rarotonga, Cook Islands). The plains and valleys of these older volcanic islands are generally characterised by high soil fertility.

3. Atolls. Very low-lying islands of coral growing on the submerged stump of an old volcano. Atoll soil is generally poorly formed and of low fertility. Because of their uniformly low altitude and small size, they provide a low diversity of habitats and are more susceptible to the effects of catastrophes such as hurricanes. Without refugia, bird species are more likely to be completely eliminated during such events. Typically formed as rings of islets enclosing shallow lagoons, atolls are distributed across the Pacific

in the zone where water temperature allows for sufficient coral growth. The many atolls of the Tuamotu archipelago, the Marshall Islands and Tuvalu are typical.

4. Raised atolls. In certain areas, tectonic processes cause uplift of the sea floor and exposure of 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 are examples of raised atolls which, through time, have evolved into a relatively diverse series of habitats.

## 2-2 HISTORY OF ORNITHOLOGY IN THE PACIFIC

A distinction is made here between scientific and traditional ornithology because "discoveries" and "descriptions" of birds are generally regarded in purely European terms. This habit not only implies a scientific arrogance but can also result in the disregarding of important local information on the avifauna. There is no question that most bird species were "discovered" long before the museum collectors arrived on the scene.

The first European entry into the ornithology of Polynesia was during Captain James Cook's second voyage. Naturalists J.R. and G. Forster collected specimens and made notes in eastern Polynesia, Tonga and Niue. This was followed, in 1827, by the voyage of Dumont d'Urville, when naturalists Quoy and Gaimard visited Fiji and Tonga and collected some specimens of birds. The most extensive scientific exploration of the mid-1800's was that of the United States Exploring Expedition between 1838 and 1842, during which Tinian Ramsay Peale made a substantial collection of skins (Peale 1848).

Meanwhile, in Micronesia, the first notes of birds were made by Henry Wilson, a captain whose ship was stranded in Palau in 1783 (Baker 1951). In 1817 and 1818 Adelbert von Chamisso, naturalist with a Russian expedition, made a detailed exploration of the Marshall Islands and several areas of Western Micronesia. Quoy and Gaimard also explored the Marianas, during 1819 under Freycenet and in 1829 with d'Urville.

After this time, once European colonisation of the Pacific Islands was underway, resident collectors began to gather large numbers of birds for the museums of their home countries. In the second half of the 19th Century the firm, Godeffroy and Sons of Hamburg opened branches in a number of localities and organised collections of birds which were then despatched to a large repository in the Godeffroy Museum, Hamburg.

The most substantial contribution to the ornithology of the Pacific Islands this Century was the series of expeditions carried out over nearly 20 years from 1920 under the aegis of the Whitney South Seas Expedition and sponsored by Harry Payne Whitney. A high proportion of the islands in the region were visited and large series of bird skins

collected from most of them. These skins, deposited in the American Museum of Natural history, formed the basis for the scientific descriptions of many of the species and subspecies of birds and of our knowledge of distribution today. These descriptions were published as a long series of the American Museum Novitates, chiefly by Ernst Mayr and Dean Amadon, and formed the basis of Mayr's field guide "Birds of the Southwest Pacific" (Mayr 1945), surprisingly still one of the most comprehensive regional field guides.

World War II saw considerable disruption to the islands of the Pacific, particularly in Micronesia and Melanesia, but also saw the stationing of a number of ornithologists as coast watchers, e.g. in the Gilbert and Ellice Islands (Child, 1960) or as members of particular biological task forces, e.g. in Guam and other parts of Micronesia (Baker 1951). Much ornithological work resulted from this.

### 2.3 ORIGINS OF THE AVIFAUNA

For the purposes of this overview, the species are divided into three main groups, two of which assume the greatest importance in conservation. Landbirds are all those terrestrial, arboreal or freshwater forms which depend on the island ecosystems for feeding and breeding. Seabirds are all those species which leave their islands to feed in marine ecosystems. This excludes shore birds such as the reef heron Egretta sacra, which feed on marine organisms but do not venture offshore. The third group comprises the migratory species, mainly shorebirds, which breed elsewhere and winter in the Pacific.

The current distribution of the indigenous Pacific Island birds is the product of a wide array of biogeographical processes and represents colonisation and subsequent dispersal from a variety of sources. Obviously, the proximity of land-masses affects the ability of species to disperse between them. Also, the size of islands being colonised has a bearing on the ability of species to establish themselves successfully. These effects, observed in the Pacific, have given rise to a considerable body of biogeographic theory, notably that of Diamond (1970a and b, 1972, 1977), who sought to establish principles for the size of an island's avifauna based on size and proximity to other land masses.

Possible routes of colonisation are considered as follows:

1. Neotropical/Nearctic. With the exception of birds on the few island groups of the eastern Pacific (e.g. Galapagos, Easter), none of the landbirds of the South Pacific have an American origin. This is not surprising, considering the distance which such birds would have to cover in the face of unsuitable climatic conditions.

2. Palaeartic Region. None of the landbirds have a directly Palaeartic origin, though it is worth considering the occurrence of migratory shorebirds in the Pacific as the possible source of two sedentary species, the Tahiti (now extinct) and Tuamotu sandpipers Prosobonia leucoptera and P. cancellatus. A number of shorebirds, notably the Pacific golden plover Pluvialis

dominica, bristle-thighed curlew Numenius tahitiensis, wandering tattler Tringa incana and turnstone Arenaria interpres, regularly migrate from arctic breeding-grounds into the south Pacific. The unique record of a pair of turnstones nesting on a sand cay in New Caledonia far from their arctic nesting areas (Hannecart and Letocart 1980, F. Hannecart pers. comm.) may give a clue as to the origin of a sedentary shorebird such as the Tuamotu sandpiper breeding on remote atolls.

A number of Pacific landbirds are primarily of Palaearctic origin and their current distributions illustrate migration routes. The Micronesian islands closest to Asia, namely the Marianas and Palau show the greatest Asian influence, with species such as the yellow bittern Ixobrychus sinensis and the jungle nightjar of Palau Caprimulgus indicus probably originating in northeastern China via Japan. The short-eared owl Asio flammeus breeds in northern Europe and Asia but migrates south for the winter. One subspecies has become resident on Ponape in the Caroline Islands.

The distribution of the reed-warblers of the genus Acrocephalus provides an interesting example of dispersal and speciation. Again of Palaearctic origin, the genus comprises a large number of species through Europe, Asia and Africa. Two incursions into the Pacific are possible. Firstly, A. stentoreus is found from Africa to Australia, with one subspecies in the Solomons. Secondly, eight species and numerous subspecies are distributed in an arc from Micronesia across the north and east of Polynesia as follows:

SPECIES	DISTRIBUTION
<u>A. luscini</u>	- Micronesia
<u>A. rehsei</u>	- Kiribati
<u>A. kingii</u>	- Nihoa - Hawaiian Islands
<u>A. aequinoctialis</u>	- Christmas, Fanning Islands
<u>A. caffa</u>	- Society Islands
<u>A. atypha</u>	- Tuamotus
<u>A. mendanae</u>	- Marquesas
<u>A. vaughni</u>	- Pitcairn, Cook Islands

Present distribution probably marks out the route of colonisation of this group and it is unlikely that they ever reached or established on the islands of Polynesia and Melanesia where they do not occur today.

4. Asia. Because of a complex series of dispersals between the Australian and southeast Asian areas, it is more difficult to establish what species may have entered the Pacific from Malaysia, Indonesia or the Philippines. Baker (1951) suggests that the swiftlets (genus Collocalia), wood-swallows (Artamus), several of the rails and some other species arrived in Micronesia from the Philippine and Indonesian areas but some of these are probably of Australian origin. The jungle fowl Gallus gallus is clearly of southeast Asian origin but was brought into the Pacific during human colonisation.

5. Australian. Because the Australian region is a centre of radiation for a significant number of the world's bird species, it is hardly surprising that a majority of the Pacific Islands land and fresh-water species are traceable to that source. Groups clearly of Australian origin include the megapodes, fruit pigeons, kingfishers, woodswallows, weaver finches, white-eyes, cuckoo-shrikes and honeyeaters.

The honeyeaters (Meliphagidae) provide a striking example of dispersal and radiation of such a group. The 19 species in the island groups under discussion here occupy eight genera. The most numerous are the tiny red and black members of the genus Myzomela, a group widespread through northern Australia, New Guinea and Indonesia whose distribution in the Pacific is as follows:

SPECIES	DISTRIBUTION
<u>M. lafargei</u>	- Solomons
<u>M. eichhorni</u>	- Solomons
<u>M. melanocephala</u>	- Guadalcanal group - Solomons
<u>M. malaitae</u>	- Malaita - Solomons
<u>M. tristrami</u>	- San Cristobal - Solomons
<u>M. sanguinolenta</u>	- New Caledonia and widespread to west
<u>M. jugularis</u>	- Fiji and Rotuma
<u>M. cardinalis</u>	- eastern Solomons, Vanuatu, Santa Cruz, Loyalties, Palau, Carolines, Marianas, Samoa.

The distribution of the last species contrasts markedly with those preceding and it probably represents the most recent of multiple colonisations by the genus. The reasons for its disjunct distribution, absent from Fiji and Tonga, are not clear but may be related to competition from sympatric species already located in those areas. The three species in the genus Guadalcanaria are found in the Melanesian area, with one on Guadalcanal in the Solomons and one each in Vanuatu and New Caledonia. This genus is closely related to Meliphaga and Phylidonymis, both widespread genera in the Australian region. One species of the genus Foulehaio, the wattled honeyeater, is widespread through Fiji, Tonga, Samoa, and Wallis and Futuna while the only other (sometimes named as a separate genus, Xanthotis), is restricted to Kadavu Island, Fiji. The giant honeyeaters (genus Gymnomyza) also show a disjunct distribution, in this case possibly a relic of an ancient colonisation. Endemic species are found in New Caledonia, Fiji and Samoa. The final three genera are each represented by a single species in the Pacific. Lichmera incana in New Caledonia and Vanuatu is one of a genus widespread in Australia, New Guinea and Indonesia, while Meliarchus sclateri on San Cristobal in the Solomons and Cleptornis marchei on Saipan in the Marianas both constitute monotypic genera. The origins of these two species, particularly the latter, are not clear but they are probably relics of an ancient colonisation.

The distribution of the honeyeaters mirrors the general distribution of those species with an Australian origin, showing a complex of

widely dispersed and relic forms, decreasing in number on smaller islands and as they become more remote from their source.

6. New Zealand. Though most of New Zealand's avifauna are clearly either ancient endemics or of Australian origin, there has been a secondary radiation of some groups which have subsequently colonised other islands of the Pacific. Nestor parrots and Hemiphaga pigeons have dispersed to Norfolk and Lord Howe Islands, while Cyanoramphus parakeets occurred in Norfolk and the Society Islands. In addition, two cuckoos, the New Zealand long-tailed cuckoo Eudynamis taitensis and the shining cuckoo Chalcites lucidus, migrate from New Zealand into the eastern and western Pacific respectively.

7. Ancient endemics. Among the birds of the region are a few whose affinities are so obscure that their origins can only be surmised. The kagu Rhynochetos jubatus of New Caledonia is not clearly related to any other bird groups, though it does have similarities with the rails (worldwide) and the sunbittern family (South American) and the similarly enigmatic but extinct Aptornis of New Zealand. It is doubtless a relic of the period before New Caledonia became separated from the rest of the southern super-continent Gondwanaland. Other species, such as the silktail Lamprolia victoriae of Fiji and the tooth-billed pigeon Didunculus strigirostris of Samoa, have doubtless migrated to the islands across water but are of similarly obscure origin, representing a very early colonisation.

#### 2-4 DISTRIBUTION OF BIRDS

An obvious trend as one moves from west to east across the region is a reduction in the number of native species as their origins become more remote. Though land area (Table 2.1) and a variety of other factors are also important determinants of species numbers, the effect is quite clear when one considers islands of similar size distributed at different longitudes (Table 2.2). For example, notwithstanding the high recent rate of extinction there, there are only about twelve land and freshwater species on Tahiti compared with over forty on an island of similar size in the Solomons or Vanuatu, and an even greater number on islands of Papua New Guinea.

TABLE 2-1

## RELATIONSHIP BETWEEN LAND-AREA AND LAND BIRD SPECIES NUMBERS IN THE ISLANDS OF VANUATU

(from Diamond and Marshall 1977)

	Area (sq. km.)	Species no.
Santo	3937	50
Malekula	2034	45
Efate	877	43
Malo	176	41
Erromanga	898	40
Aoba	410	40
Epi	439	39
Ambrym	663	38
Pentecost	448	35
Gaua	332	36
Emae	33.1	35
Tanna	550	34
Maewo	263	34
Nguna	27.4	34
Vanua Lava	298	34
Tongoa	38.7	33
Aneityum	154	32
Mau	8.3	31
Paama	32.3	28
Lopevi	29.0	28
Ureparapara	49.2	26
Merelava	8.9	22
Futuna	11.0	20

TABLE 2-2

## RELATIVE LAND BIRD SPECIES NUMBERS ON SIX ISLANDS OF SIMILAR LAND AREA DISTRIBUTED ACROSS THE REGION

	Area (sq. km.)	Longitude (degrees)	Bird Species	Species/ sq. km.
Rennell	675	149E	36	.053
Efate	877	168E	43	.049
Lifou	1000	167E	40	.040
Taveuni	435	180	43	.096
Upolu	1100	172W	33	.030
Tahiti	1042	149W	12	.012

NB. Taveuni is close to the large land mass of Vanua Levu.

## 2-5 SEABIRDS

Because a small area of land serves vast area of ocean, seabird colonies tend to be found in dense and conspicuous clumps. They are thus a characteristic of the Pacific region, reaching extremely high abundance on some islands. They may be grouped into two main categories, inshore and oceanic feeders. The oceanic feeders consist mainly of members of the petrel (Procellariidae) and storm petrel (Hydrobatidae) families while the inshore feeders are tropic birds (Phaethontidae), frigate birds (Fregatidae), boobies (Sulidae) and terns (Laridae). Though some members of the albatross family (Diomedidae) and some gulls are visitors to the tropical Pacific, they are not significant elements of the avifauna.

Petrels and shearwaters abound in some islands, particularly those little disturbed by humans, their nesting burrows riddling suitable soil areas. That the distribution and numbers of these birds are poorly known is not surprising in view of the inaccessibility of much of their habitat. Three species in the region are known from only one or two specimens and most, though wide-ranging, are endemic to the tropical Pacific. Approximately 15 petrel and shearwater species and one storm petrel breed in the region, while others migrate in to feed.

Tropic birds are elegant, white, long-tailed birds which may also range far from land. Nesting in crevices and burrows, two species, the white-tailed and red-tailed, occur in the region.

The tropical members of the gannet family are known as boobies. Three species, the red-footed, brown and masked boobies breed in the tropical Pacific. The former species nests in trees and shrubs while the others are ground-nesters. The brown booby is probably the most abundant, though all three are widespread.

Another widespread tropical family, little differentiated across the world, is that of the frigate-birds. These large black and white birds are characterised by their long wings and forked tail and their habit of pursuing and robbing other seabirds for food. The males display at their nest-sites by inflating large red gular pouches. Two species occur widely in the Pacific; the greater Fregata minor and lesser frigate-birds F. ariel.

After the petrels and shearwaters, the greatest number of species of seabird in the Pacific are terns or noddies (family Laridae, subfamily Sterninae). Ranging in size from the large, robust crested tern Thalasseus bergii to the delicate little tern Sterna albifrons, there are 11 breeding species in five genera distributed widely across the Pacific. There are six species of sea-swallow (Sterna), some of which, e.g. the sooty tern, breed in immense colonies; one species each of Thalasseus, Procelsterna and Gygis; and two noddies (Anous).

The conservation of seabirds presents problems different to those of land birds. While some species must be protected because they are very rare, others occurring in large colonies are also vulnerable for



a variety of reasons (see Chapter 3). Because the long-term presence of humans appears to be inimical to the survival of many species, there is often a lack of information on their distribution, abundance and behaviour.

## 2-6 SHOREBIRDS

As already referred to in section 2-3, there is only one resident breeding shorebird, the Tuamotu sandpiper, though large numbers of others migrate from northern, mainly arctic regions following breeding. While the retention of winter habitat for migratory shorebirds is an important element of the bird conservation programme for any region, none of the species except the sandpiper will be discussed in detail here. Some habitat conservation requirements will be covered in Chapter Five, however. It must be pointed out that any country which provides winter habitat for a significant number of individuals of a species of shorebird has an international obligation to protect that habitat. In the Pacific, two or three species occur in significant numbers, the Turnstone Arenaria interpres, wandering tattler Tringa incana and the bristle-thighed curlew Numenius tahitiensis and the retention of suitable shoreline feeding and roosting habitat is important.

## 2-7 LOCAL ATTITUDES TO BIRDS AND THEIR PROTECTION

The tropical Pacific encompasses a vast complex of islands, human populations and cultures, and a full analysis of local attitudes to wildlife conservation is a subject beyond the scope of this review. Nevertheless, it is pertinent to the discussions that follow and to the achievability of conservation proposals to make some comments on attitudes to birds, their uses and abuses, and the likely response to protection.

### 2-7-1 BIRDS AS A FOOD RESOURCE

Throughout the Pacific, wild birds have formed a source of protein for traditional cultures. Though, in many cases, the husbanding of the resources has been promoted through enforcement of traditional tapus, Pre-European cultures have also been responsible for the elimination of a number of species. The distributions of food species such as the megapodes, for example, clearly constitute the remnants of once much more widely distributed groups. King (1973) has analysed the islands of the central Pacific and concluded that islands inhabited by humans tended to have less individuals and species of seabirds than those which didn't. It is a fair assumption that wherever birds are used a food resource, it is extremely difficult to manage that food resource in the absence of good data on its population dynamics and habitat requirements, particularly where a growing human population stretches its capacity.

The birds traditionally used as food vary from region to region but particularly include the eggs and young of surface nesting seabirds,

pigeons, the jungle fowl and megapodes. Small forest birds seldom appear to be taken. On atolls, seabird colonies are often confined to remote islets where they are not readily disturbed. Terns, noddies and boobies are frequently exploited, as are the eggs and nestlings of petrels, where accessible. By contrast, on some high islands where petrels also occur commonly, e.g. Gau Island, Fiji (D. Watling pers.comm.), the local inhabitants show no interest in them. Pigeons are a traditional food source in many regions, and their hunting is now resulting in over-exploitation in some, particularly in eastern Polynesia. The reasons for this are a combination of growing human populations, shrinking habitat and the use of non-traditional hunting methods. Firearms are dramatically more efficient at killing pigeons than rocks, spears and nooses. Jungle fowl were introduced into the Pacific by humans and have shown a remarkable resilience in the face of exploitation. Megapodes, whose eggs provide an important protein source in some areas are still surviving where human population has not expanded dramatically, e.g. Niuafu'ou Island, Tonga.

If the role of birds as a traditional source of food is acknowledged then conservation programmes for those species are likely to receive greater local and official support in the countries concerned.

#### 2-7-2 BIRDS AS PETS

While caged birds are not common in Pacific culture, young boobies are sometimes captured and kept as pets while there is evidence (Du Pont 1976) that Polynesians may have moved some species of parrot from island to island, either deliberately to create new wild populations or through the escape of caged individuals. The Pacific lorikeet Vini peruviana occurs in the Society and Tuamotu Islands and also on Aitutaki in the Cook group, where it may have been liberated in pre-European times. Similarly, it has been suggested that the red-breasted musk parrot Prosopelia tabuensis may have been introduced from Gau Island, Fiji to 'Eua and Tongatapu in Tonga.

#### 2-7-3 ATTITUDES TO NATURE CONSERVATION

It is clear from discussions with officials and local people in a number of areas (personal contacts in Vanuatu, Fiji, Tonga, Western Samoa and the Cook Islands) that the attitude towards nature conservation and the protection of birds is generally very positive. Appreciation of the role of indigenous ecosystems in soil conservation, food supply and tourism is growing and will hopefully help advance the cause of habitat protection locally.

Unfortunately a number of problems count against this. With few exceptions, the educational material available to local people (to schools particularly) is either non-existent or inappropriate to local needs. A scientific guide to the birds of a region, complete with descriptions of museum specimens and research results is generally of little interest to a person seeking to learn more about the behaviour, role and significance of the birds around them. Some attempts have been made (e.g. Muse and Muse 1982) to incorporate local lore as well

as local names into bird guides but there is still a clear need for documentation of customary knowledge and the production of appropriate educational material. The regional or world significance of a bird species is often poorly appreciated. A species which is abundant on a small island may not seem to be at risk to someone who does not travel from that island regularly, even if it occurs nowhere else.

Where human population is growing at a rate faster than the land can sustain it, nature conservation often takes a back seat to the need to clear more areas for agriculture. The pressure on a reserve is understandable if all around agricultural land is exhausted. This problem illustrates fundamental difficulties with planning and further points out the need for appropriate material for conservation education. The following chapter discusses this in more detail.

## CHAPTER 3

## THREATS TO BIRD SURVIVAL IN THE PACIFIC ISLANDS

## 3-1 INTRODUCTION

Of the 217 species or races of bird known to have become extinct over the last two centuries, 200 were either island inhabitants or occurred in some similar insular habitat (Halliday 1978). What, therefore, are the features which tend to predispose island bird species to a greater risk of extinction than those on larger land masses? An analysis of the situation in the Pacific highlights the following characteristics:

## 3-2 CHARACTERISTICS OF RARE SPECIES

## 3-2-1 NATURAL RARITY

Some species, particularly those at the top of food chains, never naturally reach high densities even where conditions are ideal. Thus, for example, island forms of the peregrine falcon (Falco peregrinus) figure prominently in the rare bird lists, vulnerable forms being found in the Bismarck Archipelago, Vanuatu, New Caledonia, The Loyalty Islands, Fiji and Samoa. A slight reduction either in habitat area, food availability or reproductive output of such a species may cause the population to dip below the critical level of viability.

Birds other than raptors, particularly territorial species, may also be unable to reach high densities. Therefore a species like the tooth-billed pigeon Didunculus strigirostris is only found in large tracts of forest in Samoa and cannot maintain sufficient numbers to retain viability in smaller remnants. This restriction has obvious implications in reserve planning.

## 3-2-2 INSULARITY

In other cases, insular species occur commonly in certain areas but are prevented from reaching high numbers not only because of restricted availability of habitat but also because of an inability to colonise new areas. This is because of remoteness and frequently also because of lack of mobility of the insular bird. The tendency towards flightlessness found in many island species obviously limits their capability of recolonisation.

The malau, or Niuafou'ou megapode (Megapodius pritchardii), for example, is endemic to Niuafou'ou Island in Tonga, where it relies on hot volcanic ash to incubate its eggs. Though these eggs are exploited for food by local residents, the population of several hundred birds probably saturates its restricted habitat. While not immediately endangered (and not appearing in the Red Data Book), its lack of a safe refuge and inability to disperse to new islands render

the malau potentially vulnerable to over-exploitation and to changes to its habitat.

### 3-2-3 COLONIALITY

Because a very small land area serves a vast area of productive ocean, huge numbers of seabirds may congregate on tiny islands in the Pacific. This dense and conspicuous clumping of colonial seabirds may lead to their greater vulnerability through human exploitation and apparently minor habitat disturbance. Ironically, some of the most abundant species are vulnerable locally because of both human and natural causes. Certain species, especially ground nesters and burrowing petrels and shearwaters, are usually first to suffer from such habitat changes (King 1973).

Densely clumped colonies are also susceptible to natural disturbances such as cyclones or the effects of changes in the circulation of oceanic water. For example, the extended occurrence of the El Nino ocean current in 1982 and 1983 led to the temporary disappearance of several million birds from Christmas Island (Boffey 1983).

### 3-2-4 LACK OF ADAPTATION TO PREDATORS

A feature of bird species of small islands, particularly in this region, is their evolution in the absence of predators. Because avian predators naturally occur in smaller numbers than their prey, there is often not enough space on an island for a viable predator population to be maintained. In addition, the inability of mammalian predators to disperse over water has kept them from oceanic islands. Because of this, subsequent introductions of such animals can have a devastating effect, as has been well documented in New Zealand and Hawaii (Atkinson 1977, King 1984). In the Pacific Islands the only rodent to have become widely dispersed in pre-European times was the Polynesian rat Rattus exulans. Though its effect on the pre-human avifauna of Polynesia is not well understood, there is evidence of an impact on some species (Kepler 1967). The spread of the two rats from Europe, R. rattus and R. norvegicus probably had a more dramatic effect. In addition to that of rodents, the impact of a number of other predators illustrates the vulnerability of birds on islands. Cats, dogs, pigs, mongoose, snakes, monitor lizards and owls have all been implicated in either threats of or actual extinctions (see 3-3-6).

### 3-2-5 SPECIALISED BEHAVIOUR OR HABITAT REQUIREMENTS

A frequent feature of island avifaunas is the occurrence of birds of specialised habits and form. The remarkable radiation of finches on the Galapagos Islands that inspired Darwin in the formulation of his theory of natural selection is also seen in bird groups in other archipelagoes. The reasons for the departure of a species' form and behaviour from those of its parent stock are complex. Among them is firstly the founder effect, where the complement of genetic material

making up the founding population does not necessarily reflect the full complement of the parent stock. Secondly the species is likely to change as it evolves into a new environment. The nett result of those two effects is a rapid rate of change in the colonising population.

This change does not necessarily mean that specialisation is bound to occur, as some so-called "supertramp species" become generalists in the relatively competition-free species-poor island environment (Diamond 1974). There is no doubt, however, that the radiation of forms that has occurred in some groups is a reflection of specialisation in new habitats. On some islands, the results of successive waves of colonists from the same parental source is reflected in the present complement of related species. For example, Norfolk Island is inhabited by three species of white-eye. The Norfolk white-eye Zosterops albogularis is the earliest colonist and is endangered, confined to the least man-modified forest remnant on the island. The next earliest colonist is another endemic species, the slender-billed white eye Z. tenuirostris, which is more common but still restricted to forest and scrub. The final species is a classic "supertramp", the grey-backed white-eye Z. lateralis, which thrives in a wide range of habitats and is dispersed over a large area of the southwest Pacific. In this example, the most specialised species are at the greatest risk of extinction because of their inability to adapt to a substantially altered environment. This is a feature of a large number of endangered birds around the world.

### 3-3 CURRENT RISKS TO BIRDS IN THE PACIFIC

#### 3-3-1 AGRICULTURE

While slash and burn farming is viable and sustainable at a low level, it ceases to be so in areas where human population has increased above a critical level. This is occurring in many places, as exemplified by 'Eua Island in Tonga, where "api" gardening is reducing the forest area at a rate faster than it is able to regenerate (pers.obs.).

Ironically, the creation of a nature reserve may increase that land's attractiveness to traditional farmers. Firstly, access to potential gardening areas may be enhanced by a park development and secondly, the amount "unused" land available for farming decreases as time goes on. For example, illegal incursion into O Le Pupu Pu'e National Park in Western Samoa is a growing problem (K. Poai pers.comm.).

The pattern of agricultural development has been different in different areas but generally the lowlands have been first to be modified. In Rarotonga, for example, the entire coastal strip consists of a human-induced ecosystem of plantations, gardens and residential areas with few native trees, while large areas of steeplands and higher altitude habitats remain virgin. The greatest amount of forest clearance for agriculture has occurred where the soil fertility is highest, generally on the alluvial flats of volcanic islands.

### 3-3-2 FORESTRY

Forestry development is rapidly proceeding in a number of island groups and is taking a number of forms. On some islands, timber extraction is occurring with little apparent attempt to integrate any representative reserve structure. For example, on San Cristobal in the Solomons, the home of six endemic bird species, a recently signed contract gives a United States based logging company the timber rights over the entire island (Anon. 1983b). This contract requires a small amount of local timber processing but most is exported as logs. The Solomon Islands government is then responsible for the restoration of the logged ecosystem. Elsewhere in the Solomons, Unilever Ltd. has secured the timber rights in a number of islands and substantial areas have been cleared despite the protests of traditional inhabitants (Scobie 1982).

Some forestry development is apparently taking place in a more carefully planned fashion, but even this is still occurring without an input of wildlife conservation requirements. Though relatively large areas of forest still exist in the Samoan islands, a New Zealand Government funded forestry development at the western end of Savaii Island is removing wildlife habitat, including that of three rare endemic bird species, the Samoan white-eye Zosterops samoensis, the mao Gymnomyza samoensis and the enigmatic tooth-billed pigeon Didunculus strigirostris. This is occurring without adequate knowledge of the distribution, numbers or habitat requirements of these species. Problems with this type of development were highlighted in September, 1983, when fire swept through the area, destroying most of the plantations (8,000 hectares) and further primary forest.

Ironically, the success of forest conservation movements in developed countries on the Pacific rim, particularly in Australia, New Zealand and North America, has placed increased pressure on the island nations for their timber. Large forestry companies are finding it easier and cheaper to exploit the resource in countries where environmental forestry policies are not well developed or enforced.

Opportunities for concurrent wildlife survey and research have generally been missed where forest surveys for timber trees have already been carried out.

### 3-3-3 HUMAN SETTLEMENT

A recent proposal by an American millionaire to settle on Henderson Island and clear the forest to raise cattle was seriously considered by the British authorities as a solution to the problems of isolation of the nearby Pitcairn Islanders (Hay 1983) but was turned down on environmental grounds after strong protests from many quarters (Serpell et.al. 1983) in a campaign reminiscent of that which secured Aldabra Island as a scientific reserve in the Indian Ocean. On account of its lack of disturbance and presence of a richly endemic biota (including two species and two subspecies of birds), the island

is now under consideration as a World Heritage Site. An important feature of this controversy was that the attraction of the island to the potential settler was its uninhabited and pristine state. Ironically, however, the publicity which surrounded this man's venture meant that environmental lobbyists were able to mobilize forces to oppose it. In contrast, the settlement of many areas takes place without fanfare and thus without the same opportunity for environmental factors to be considered by the interest groups and authorities.

It is possible to classify the degree of disturbance that an island has had by examining its complement of breeding seabirds. Generally, the presence of shearwaters, petrels and storm petrels denotes the least disturbed ones, while ground-nesting tropicbirds, terns, boobies and frigates are more resilient and are found on some populated islands. The least disturbance-prone are the tree-nesting boobies, frigates and noddies (King 1973). In the presence of a human population, the species complement is generally less than in uninhabited islands. In densely populated areas like the Tokelau Islands, for example, the only common breeding seabirds are the black and brown Noddies (Anous tenuirostris and A. stolidus) and the sooty and white terns (Sterna fuscata), tree-nesters (Thompson and Hackman 1968) which survive despite being exploited for food. In the Pitcairn group, the effect of human occupation is graphically illustrated in a comparison between the four islands. Of 14 seabirds recorded as breeding in the group, all occur on Henderson, 12 on the small atolls, Oeno and Ducie, while only two remain on Pitcairn, the only island with permanent human habitation (Williams 1960, Fosberg et.al. 1983, Serpell et.al. 1983). It is clear that Pitcairn had an abundant seabird fauna before settlement and its demise is attributable to that settlement. A number of the missing species visit the island regularly but fail to recolonise.

### 3-3-4 TOURISM

Tourists provide an important source of revenue to many of the islands in a way in which, with sensitive development, natural values need not necessarily be compromised. Unfortunately, however, tourist facilities are regularly built with little regard for the environment. For example, seabird colonies in the Mamanucas in northern Fiji are currently being bulldozed to make way for hotel construction (F. Clunie pers.comm.), while entrepreneurs who have a wish to retain wildlife often have little understanding of what is required. One developer in Fiji saw the presence of forest birds at the island resort that he was developing west of Lautoka to be a tourist attraction, but was adamant that the vegetation had to be cleared away to create the park-like surroundings appropriate to the tourists' perceived wishes. That developer had a benevolent attitude towards wildlife but failed to understand the basic habitat requirements of the species that he was seeking to retain. The appropriate information being made available to the developer may have led to a compromise in the plans to allow for some pristine habitat to be incorporated into the project.



There is little exploitation of the apparent potential for natural history tourism except in the marine environment where a small number of marine reserves (e.g. Palolo Deep in Western Samoa, and a range of reserves in Tonga and New Caledonia) have become important attractions. Close to centres of population, reserves such as Colo-i-Suva in Fiji and Mt. Vaiea in Western Samoa receive many visitors but the tourist potential of larger, more remote forest areas is little tapped.

If tourism is to be developed in a sensitive way, there are potential benefits both commercially and environmentally. What is required is study of the tourist potential of terrestrial ecosystems then a program of information and education for tourist operators.

### 3-3-5 LAND OWNERSHIP

Traditional or village ownership of land presents a problem to those attempting to secure the protection of tracts of wildlife habitat through either private or government ownership. In most countries of the Pacific, the opportunities to freehold land for reserve purposes are both limited and inappropriate to local conditions.

In Fiji, for example, the difficulty of obtaining reserves under the "Matiqali" system of land ownership is illustrated by the following example. One of a series of reserve proposals made by the National Trust for Fiji is for the protection of a small (120 ha.) representative sample of *dakua* (*Agathis vitiensis*) forest near the trans-insular highway on Vanua Levu. To obtain the lease of this area, the Trust must pay a lease of \$F50,000 in lieu of timber royalties that would otherwise come from the land (Keith-Reid 1983). Under the terms of the lease, the Matiqli owners could cancel at any time. This apparently insecure arrangement may be the only way of obtaining any example of virgin *dakua* forest as a reserve in Fiji (R. Mercer pers.comm.).

The systems of land ownership and control in the Pacific are many and varied, but generally land to be preserved must be leased or retained in local ownership. In Vanuatu, for example, all land remains in traditional ownership, and, where timber companies offer a substantial return for logging rights, that offer may need to be matched by the proponents of a forest reserve. Of a number of reserves recommended for Western Samoa (Holloway and Floyd 1975), the only large one to have come into being is O Le Pupu Pu'e National Park which was Government land (having been taken from German control), therefore no payment had to be made. The other proposed reserves are mainly under village ownership and to protect them would require a substantial payout of royalties.

Unfortunately, the current pattern of land tenure is often an uncomfortable hybrid between traditional and European systems, and it has been suggested that restoration of customary systems of land management may be the best approach to future planning (Dahl 1984). Study of traditional tenure is urgently needed so that the best means of environmental protection within that framework may be assessed.

## 3-3-6 PREDATORS

While eradication efforts may be successful in some cases, the spread of mammalian predators, particularly rat species, can be expected to continue. Despite the devastating effects of rats on birds of New Zealand and other regions, however, the suggestion has been made (Atkinson 1984) that birds on tropical oceanic islands are less susceptible to invasions because of prior adaptation to the considerable predatory influence of land crabs. If so, then it means that islands should not be "written off" as wildlife refuges when rats arrive, as has happened with some New Zealand islands. Notwithstanding this, some species, e.g. the Tuamotu sandpiper Prosobonia cancellatus, are clearly at risk through the spread of the ship rat.

In Fiji, in 1873, the mongoose Herpestes auropunctatus was introduced to Vanua Levu and Viti Levu to control rats in cane plantations (Watling 1982). Whether the liberation had the desired result is unclear, but it did have a devastating effect on the ground birds of those islands, causing the virtual or complete extinction of seven species, including hardy and otherwise widespread ones such as the jungle fowl Gallus gallus, the purple swamphen Porphyrio porphyrio and the banded rail Rallus philippensis. Mongoose liberations have had similar effects on the remnants of the Hawaiian avifauna.

A further example of the effect of predator introductions is the legacy of military occupation of a number of the central Pacific islands. Cats brought in as pets or in attempts to control rats have become feral and have had dramatic effects on the breeding of seabirds (King 1973) but may be controlled or even eliminated from quite large islands with sufficient effort and application as has occurred on Jarvis Island in the Line group (Rauzon 1983) and Little Barrier Island in New Zealand (Veitch 1980). The current efforts of a SPREP/New Zealand Wildlife Service project to control cats on Christmas Island in Kiribati is a recognition of the likely success of cat control.

Not all introduced predator problems involve mammals. In Guam, the brown tree snake Boiga irregularis was introduced in 1947. It is now distributed over much of the island, particularly in the south, whence most indigenous birds have disappeared (Engbring and Ramsey 1981). The snake reaches a large size and is known to feed on birds and their eggs (Savidge 1984). Another reptile, the monitor lizard Varanus indicus, has been introduced to some Micronesian islands as an agent of rat control but this has been unsuccessful, and the lizards prey on ground birds (Uchida 1967). The same author reported on the liberation of Japanese weasels Mustela sibirica to control rats in the Ryukyu Islands. Further liberations of mustelids could have dramatic effects on wild birds, though their impact is not predictable (see King 1984).

In the Marquesas Islands an introduced owl, Bubo virginianus,

has been implicated in the disappearance of the local fruit dove Ptilinopus mercierii.

### 3-3-7 COMPETITION WITH INTRODUCED BIRDS

Though competition with introduced species has been suggested as a cause of the decline of some native birds, the idea is very difficult to examine and test. A large number of species have been introduced and some of them have become abundant. The Indian myna Acridotheres tristis and jungle myna A. fuscus are widespread through eastern Melanesia and Polynesia and have been implicated in the disappearance of birds from a number of areas. On Rarotonga for example, mynas reach extremely high densities in cultivated and populated areas and suggestions have been made that they compete for food and nest-sites with native species (Turbott 1977). Turbott examined the question in some detail and concluded that competition was not currently an important factor, as mynas were not common in the forested interior of the island where the native species were found. This pattern appears to be repeated on other islands where mynas and other common introduced birds occur (e.g. red-vented bulbul Pycnonotus cafer in Fiji), and supports the contention of Diamond and Veitch (1981) that introduced birds generally survive best where the habitat has already been modified to the detriment of indigenous species.

Despite general evidence to the contrary, there are some cases in which competition may be a real factor, particularly for resources such as nest sites. The disappearance of the Norfolk Island parakeet Cyanorhamphus novaezelandiae cooki may be partly the result of intense competition from the abundant introduced rosella Platycercus elegans (Schodde et.al. 1983).

### 3-3-8 AVIAN DISEASE

The role of disease in reducing or eliminating birds on islands in tropical areas is poorly known, though its potential may have been dramatic. In Hawaii, the most quoted example, the complete loss of some endemic species and the restriction of others to certain areas has been attributed to the spread of avian malaria and other diseases by mosquitoes (Warner 1968). If it is the cause, then disease has accounted for some 41 species of extinct or critically rare birds. Because the Hawaiian Islands and many of the islands featuring in this review share features of topography, climate, history and vegetation, the hypothesis of disease and its implications need to be given careful consideration.

When Cook visited Hawaii in 1778, native birds were spread over the islands at all altitudes. When the night mosquito was accidentally introduced to Maui in 1826 it is believed to have brought with it diseases including bird pox and bird malaria, both fatal to species without immunity. As the mosquito spread through the islands, indigenous birds died out rapidly and became restricted to high altitude forests where the mosquitoes did not survive. Currently,

with few exceptions, native Hawaiian forest birds are confined to altitudes above 600 metres. There are a handful isolated populations at low altitude, such as one of the Hawaiian thrush Phaeornis obscurus in one area of the island of Hawaii (C.A. Kepler pers.comm.). This is taken as evidence that there is resistance in some species, though most do not show this characteristic.

A recently completed survey of the forest birds of Hawaii by the U.S. Fish and Wildlife Service has confirmed the negative correlation between mosquito density and bird presence, and this provides compelling evidence of the role of disease (C.A. Kepler pers.comm.). Notwithstanding this, the hypothesis requires further examination, as other factors have probably contributed to the loss of the indigenous birds. The lowlands of Hawaii have been extensively deforested both in pre and post-European times and have suffered the introductions of predators such as rats and the mongoose (Atkinson 1977). Whether predators have a differential effect at different altitudes is not clear but they are certainly widely distributed. A direct study of the role of disease planned by the U.S. Fish and Wildlife Service will have important implications, not only in Hawaii but also in other areas where disease may be a problem.

The relatively sudden disappearance of indigenous birds from Guam is a likely result of diseases introduced with a number of recently arrived mosquito species (Engbring and Ramsey 1981). The large military base on Guam was an important staging post for flights to and from South-east Asia during the Vietnam war and a number of the mosquitoes are believed to come from there. The introduction of the black francolin Francolinus francolinus in 1961 coincided with the beginning of the decline of native birds and it has been suggested (Savidge 1984) that it acted as a reservoir for disease.

The Society Islands have also been suggested as an area where mosquito-borne avian malaria has affected the native birds (Holyoak 1973b, 1973c) but this has not been examined in detail. The malaria-bearing mosquitoes have apparently not spread to the Marquesas Islands. Other areas (e.g. Rarotonga) have had introductions of mosquitoes which have not shown signs of affecting the native birds.

While it may be very difficult to study disease in wild bird populations, it is clearly a factor which needs further investigation and work in Hawaii will hopefully illuminate its role. Beyond the need for research, however, disease control would be a difficult proposition should it be necessary. The import of mosquitoes into new areas should be avoided through fumigation of aircraft travelling between islands.

### 3-3-9 HUNTING

Birds provide traditional food sources over most of the Pacific. It has been thought that traditional attitudes to resources and the hunting methods used prior to European arrival in the region meant that over-exploitation was rare. Recent analyses (Pernetta and Hill 1984), however, suggest that this was not so, as borne out by the

distribution of birds on islands that have been occupied by traditional societies and little modified otherwise (Thompson and Hackman 1968).

Whatever the early pattern of "population management" it is clear that hunting is threatening some species today, particularly where populations have been reduced by other factors. Pigeons such as Ducula galeata in the Marquesas are particularly vulnerable.

While laws exist to protect some species in the Trust Territory of the Pacific Islands, New Caledonia and French Polynesia, the resources available for enforcement are usually too meager for them to be effective. In French Polynesia, for example, legislation outlawing the hunting of all native birds is probably counter-productive as it is not enforced and is more likely to alienate the local population than lead to an understanding of the need for conservation.

There needs to be acknowledgement of the role of hunting in traditional societies and, where possible, the laws governing the taking of native birds should reflect an adequate scientific knowledge of the level of exploitation which the populations can sustain. Combined with this is the need for an education programme to protect exploited species.

Two further forms of hunting are of importance, live capture of birds for sale and the taking of scientific specimens. Illegal trade in wild birds is a large problem in some parts of the world, particularly in Australia and Central and South America, but little of this exploitation has been reported in the Pacific Islands. A lack of information does not mean that no trade occurs. On the contrary, at least one sub-species, the Ouvea horned parakeet Eunymphicus cornutus ouveaensis, is at risk due to collecting (King 1981, Y. Letocart pers.comm.) as high prices are paid for such a rare bird. Elsewhere, musk parrots (genus Prosopeia) are kept as pets and some trade occurs. It is important that countries in the region who are not signatories to the CITES agreement on trade in rare and endangered wildlife seek to ratify that convention.

The age during which scientific collectors scooped the last specimens of endangered species have theoretically passed. However, it is a relatively short time since expeditions sought out possible new species in the region. The Whitney South Sea Expedition, for example, spent up to ten years collecting birds for the American Museum of Natural History. On some islands those collections were large, and often of species unknown to the collectors. The effects that these collections were having on the populations could not be assessed. In American Samoa some 1300 specimens of birds of all species have found their way into museums, and about 1000 of those originated from the Whitney Expedition (Banks 1984). There is still pressure on some birds, one collector from a well known scientific institution having suggested in 1983 to the Cook Islands authorities that a small collection of Rarotonga flycatchers would not seriously affect the population of 20-30 individuals. Such a disregard for the welfare of rare species does little to credit otherwise reputable institutions.

### 3-3-10 POLLUTION AND POISONING

Pollution by domestic waste is probably the most widespread environmental problem of the Pacific region (Dahl 1984). Though no specific studies of its effects on birds have been carried out, it may be fairly assumed that pollution, particularly of inshore waters, would be detrimental to the majority of seabird colonies. One of the effects of urbanization is to increase the load of domestic waste on local water supplies, thereby placing natural communities in jeopardy. Few cases of industrial or agricultural pollution and its effects on birds have been investigated, though pesticides banned elsewhere in the world are still in widespread use in the Pacific.

One hypothesis advanced to explain the disappearance of birds from Guam was that it was a result of the intensive use of DDT and other pesticides. Subsequent investigations have indicated that these are not a factor presently, though they may have effected some populations in the past (Savidge 1984).

A more dramatic source of pollution is the radioactivity arising from nuclear weapons testing. Though atmospheric explosions at Christmas Island, Bikini, Enewetak and Mururoa probably affected local bird populations, current evidence suggests that the effects were not long-lasting. Christmas Island, site of tests in the 1950s, is home to vast numbers of seabirds today. Enewetak Atoll saw a large number of tests up to 1960 and a large but apparently dwindling seabird population occurred there in the late 1960s (Carpenter et.al. 1968). Despite reports of birds surviving tests, the effects on them of radioactivity remain essentially unstudied.

### 3-3-11 NATURAL DISASTERS

Clearly the Pacific avifauna has evolved in an environment which regularly suffers the effects of natural catastrophes. Islands appear and disappear through earthquakes and volcanic eruptions, cyclones sweep parts of the area and the eccentricities of ocean currents can remove critical seabird food supplies. Though little, if anything, can be done about these events, their effects combine with human influences to place birds under greater stress than they would normally bear. If a bird population is restricted to small areas by human activities, then its ability to cope with natural disasters is obviously lessened. Thus, for example, a logged forest on the Nadrau Plateau in Fiji is a less suitable reserve than a virgin one because of the greater likelihood of windthrow of residual trees during cyclones.

The dramatic failure of breeding of seabirds on Christmas Island during the persistent "El Nino" phenomenon of 1982-3 (Boffey 1983) was less of a disaster for the fact that all species are common in the region and were able to recolonise once conditions were suitable again. Species already made rare would obviously be less capable of surviving this sort of phenomenon.

### 3-3-12 INFORMATION.

One of the greatest problems facing those charged with making conservation recommendations is the paucity of detailed information on birds of the region. Many islands have not been surveyed since the 1920s, when the Whitney South Seas Expedition collected specimens, while others have not been examined at all. New records result regularly from visits to even relatively well recorded sites while new species and subspecies have been found in the last ten years (Holyoak 1974b, Hadden 1981, Watling 1982).

For example, one species recorded by the Whitney expedition in Fiji was the versicolour flycatcher (Myrornis versicolor), which only occurred on Ongea Levu Island in the Lau group. The continued existence of that bird has not been confirmed since, though there is little reason to assume that the habitat has changed markedly. This island, and a multitude of others have not had bird surveys done in recent years.

The greatest gaps in our knowledge are from the remote areas of the larger islands, particularly in the Solomons, Vanuatu, parts of Fiji and Western Samoa, and from the extensive archipelagos. The Kingdom of Tonga, Fiji and the Tuamotus each have a large number of small islands and atolls which have not been surveyed. Atolls present a particular problem because the individual islets often offer a variety of habitat characteristics as a result of vegetation, predator distribution, size, etc.

### 3-3-13 EDUCATION AND PUBLIC INTEREST

The success of wildlife conservation programmes often depends on the amount of public sympathy for the issues. That sympathy may be translated into material support, political lobbying or individual action. In western countries, sympathy can be aroused through use of the printed media, film and television. Generally, in Pacific countries those avenues are extremely limited and a lack of awareness has therefore hampered the efforts of those who are interested and involved to mobilize support for nature conservation causes. The organisations that do exist, such as l'Association pour la Sauvegarde de la Nature Neo-Caledonienne and the Vanuatu Natural Sciences Society, comprise mainly expatriot Europeans, despite the efforts of the latter to publish a multi-lingual journal.

Unfortunately there is a serious lack of expertise in the region, with the occasional exception of expatriots who seldom remain for long. Traditional knowledge and respect for wildlife has dwindled under years of colonial rule and western influence but has not been replaced by the "aesthetic" attitude, particularly to birds, which helps guarantee the success of conservation movements in wealthier nations. The challenge to wildlife managers, therefore, is to raise public awareness in a way appropriate to local society and its channels of communication. This involves an understanding of the traditional relationship to wildlife and a fostering of that knowledge. For

example, the effects of hunting on populations of exploited species need to be understood so that the sustainable level of that hunting can be communicated to the exploiters as well as in law. Sympathy is unlikely to arise from anti-hunting laws that have no apparent relevance to the abundance of a traditional food source. Similarly the concept of reserves as sanctuaries for exploited wildlife so that their populations may be sustained needs to be communicated further.



## CHAPTER 4

## THREATENED SPECIES

## 4-1 INTRODUCTION

The species of the region considered most at risk are listed as follows. Further work will undoubtedly highlight others in need of attention and hopefully allow others to be removed from the list. Though threatened species are an important focus of a bird conservation programme, work on them must be complementary to work to preserve bird habitat generally.

## 4-2 FAMILY PROCELLARIIDAE - PETRELS AND SHEARWATERS

Because of their wide-ranging habits, this group of seabirds may be expected to figure less prominently in the endangered bird lists than some of the groups which follow. Indeed, there are only seventeen forms of the entire Procellariiform order at risk world-wide. However, 16 of those are petrels or shearwaters and two occur in the region under consideration here (King, 1981).

A look at the features of the breeding habitat of the family reveals the following elements:

1. Breeding habitat within reach of an adequate pelagic food supply. Though most species are migratory and can range over many square kilometres of ocean, it is clear that nesting sites must be available close to feeding grounds during the breeding season.

2. Suitable nest sites. As most species nest in burrows or ground cavities, an adequate supply of friable soil or creviced rock is necessary. These need to be close to cliffs, climbable trees or other high points from which the birds can launch themselves seawards.

3. Absence of predators. Their ground-nesting habit renders most species vulnerable to the effects of predators. There is abundant evidence of the impact of mammalian predators, especially in the restriction of some once widespread species to small predator-free islands. The colonization of Jarvis Island in the Line group by cats, for example, led to the elimination of petrels there (Rauzon, 1983).

It is clear, therefore, that petrels and shearwaters readily suffer the effects of habitat disturbance. This is borne out by the analysis of King (1973), in which petrels, shearwaters and storm petrels were seen to be first to disappear from central Pacific islands colonized by humans and predatory mammals. Though only two species are listed as endangered, more widespread forms are undergoing reduction in numbers and compression of range. The active conservation of seabirds is a difficult proposition in the absence of an adequate reserve network. While predator control is an important management tool in some areas, e.g. Jarvis Island and Christmas Island, and the suitability of some habitats may thereby be restored or enhanced, the survival of these birds depends mainly on the identification and protection of key breeding areas. Basic information on the

distribution of colonies is much less available for seabirds than for most other groups. The breeding distribution of seabirds in Fiji, for example, is poorly known (F.G. Clunie pers. comm.) because of the large number of islands difficult of access and the small number of observers. The reasons for this lack of knowledge are clear when it is considered that seabirds tend to be most abundant on the remotest islands and members of the Procellariidae are usually only active on land after dark.

The two endangered species illustrate the paucity of knowledge that is available for seabirds in the area.

4-2-1 FIJI PETREL (MACGILLIVRAY'S PETREL) - Pterodroma  
(Pseudobulweria), macgillivrayi

This petrel was described from a single specimen collected in 1855 on Gau Island in Fiji by an officer of the HMS Herald. It is a small, wholly dark species probably related to the northern Pacific genus Bulweria (M.J. Imber pers. comm.)

Despite searches of the island in 1924 by the Whitney South Seas Expedition, by J.B. Smart in 1971 (King 1981) and by T.G. Lovegrove in 1982 (pers. comm.) there was no confirmation of the species' existence until 1984, though small dark petrels had been glimpsed at sea in the vicinity. After several exploratory visits to Gau in 1983 and 1984, Dr Dick Watling attracted a single Fiji petrel into his spotlight on the island's summit on April 29, 1984, thus making the first confirmed sighting in almost 130 years (D. Watling pers. comm.). These expeditions, supported by ICBP and by the Central Manufacturing Company of Fiji, were successful not only in rediscovering the petrel but also in providing information on other birds not previously recorded from the island. In addition, the interest aroused locally and further afield served an important conservation education role. The searches were carried out with the close involvement of Gau Island residents and illustrate the vital need for the cooperation and interest of local people in such work.

Prospects for the Fiji petrel cannot be assessed until more is known of the status and distribution of the population. While Gau island has ship rats and cats in its forests, there may be insufficient food for cats in the presumed nesting area near the summit and the absence of feral pigs removes a potential source of disturbance found on many other Fijian islands. Survival until the present time of what was probably never a common species suggests that its prospects could be good but obviously more information is required.

The priorities now are to locate the nesting areas and to try and make an estimate of numbers. This will involve further searches on Gau Island but also the investigation of likely areas on other high islands. Consideration should be given to the use of radio transmitters on birds to locate nesting areas. The current Red Data Book status of indeterminate should remain until more information is available.

4-2-2 BECK'S PETREL - Pterodroma rostrata becki

While it is generally regarded as a subspecies of the larger, wide-ranging Tahiti petrel, some authors (Hadden 1981) give Beck's petrel full species status. Described from two specimens taken during the Whitney South Seas Expedition (Murphy 1928), it reveals even less of its nesting area than the preceding species; both individuals were taken at sea. The first was caught north of Buka in the North Solomons while the second came from northwest of Rendova in the Solomons so it is assumed that it nests in that group (Bourne 1968).

In the absence of further sightings of this bird it is not possible to make conservation recommendations beyond stating the need for survey of potential nesting areas. Research on the distribution of birds in the Solomon Islands in general is urgently required and it is particularly important to canvass local knowledge of the occurrence of birds such as this. There have been reports (Bourne 1968) of birds which nest in burrows on some of the large islands and these need to be followed up. The indeterminate status of Beck's petrel should remain until more information is available.

## 4-3 FAMILY ANATIDAE - DABBING DUCKS

4-3-1 MARIANAS MALLARD - Anas oustaleti

While there is some argument over the taxonomic status of the Marianas mallard, it is clear that it is at least a form endemic to the Marianas Islands. It has been regarded as the result of a past hybridisation between the mallard, A. platyrhynchos and the Australian grey duck, A. superciliosa (King 1981).

Though uncommon, it was seen regularly on the islands of Saipan, Tinian and Guam in the first half of this century. The duck underwent a marked decline after 1940, particularly on Guam where the impact of military occupation probably caused increased hunting pressure and habitat disturbance. Recently, it has only occurred at Lake Susupe and in a mangrove area north of Garapan on Saipan (Anon. 1983a) but there have been no sightings since those reported by Pratt et.al. (1979).

Captive breeding efforts have so far been unsuccessful, and recently promulgated regulations by the Department of Fish and Wildlife banning hunting and by the Coastal Resources Management Office protecting wetlands may have come too late. Captive propagation is the most appropriate management technique and probably the last individuals have been taken into captivity in Hawaii (Schallenberger 1979).

## 4-4 FAMILY FALCONIDAE - FALCONS, CARACARAS

4-4-1 PEREGRINE FALCON Falco peregrinus

An almost cosmopolitan species, the peregrine falcon has undergone a dramatic reduction in numbers over most of its range during the latter

part of this century. The major cause of this has been contamination of the environment by chlorinated hydrocarbons used as pesticides. These induce the production of thin-shelled eggs which break in the nest. Peregrines occurring in Vanuatu, New Caledonia, the Loyalty Islands, Fiji and Western Samoa are all probably of the subspecies *F. p. nesiotis*, while isolated records from Palau and Yap are probably of the Siberian race (Mayr, 1945).

Because they are wide ranging, these falcons are not necessarily endangered even where occurring in low densities, but experience with the closely related *F. novaeseelandiae* (N. Fox, pers. comm.) suggests that some island races may be more at risk than mainland ones. In that species the only form suffering significant egg shell thinning is the one found on the remote subantarctic Auckland Islands. While living far from sources of chlorinated hydrocarbons, these falcons ingest higher levels than their mainland counterparts which live closer to the sources, because the compounds become concentrated as they move up the food chains. Auckland Island falcons feed mainly on seabirds which are at the head of long marine food chains while the mainland ones feed on landbirds, many of them herbivores or primary carnivores. Though the feeding habits of *F. p. nesiotis* are not well known, Clunie (1976) has detailed the prey of birds around Suva, Fiji, reporting a diet of forest birds and flying foxes in one case and feral pigeons and seabirds in another. Little is known of nesting habits because the birds are not abundant in any area.

In view of its natural rarity and of a lack of detailed information on the species in the area under consideration, it is not possible to make detailed conservation recommendations. A priority, nevertheless, is to attempt to gather local information and traditional knowledge on the distribution and habits of such species.

#### 4-5 FAMILY MEGAPODIIDAE - MEGAPODES

Restricted to the Australo-Pacific region, this family comprises 12 species in six genera, of which *Megapodius* is the largest. Megapodes are characterised by their habit of using independent sources of heat for incubating their eggs. While most use rotting vegetation or warm sand, some choose areas of volcanic activity to provide the appropriate incubation temperature. Because the large eggs tend to be laid in certain traditional areas or conspicuous sites, they have often been exploited for food. While megapode populations can clearly withstand a degree of exploitation, the potential for over-use grows with increased human pressure in some areas.

##### 4-5-1 MARIANAS MEGAPODE - *Megapodius laperouse*

The nominate race of *M. laperouse* previously ranged through all the Marianas Islands but has since disappeared from the larger southern ones (Saipan, Tinian, Guam and Rota) (Baker 1951). Falanruw (1975) summarised their distribution in the early 1970s when he

recorded them on all other islands of the group except Farallon de Medinilla, which had not been adequately surveyed. The record from Uracas is significant in that the island is a young volcanic one with little vegetation. Probable nest tunnels were found there in steep areas of cinders.

The main factors influencing the decline of this bird are habitat disturbance by humans and goats, the taking of eggs and the depredations of pigs and monitor lizards, which are common on some of the islands.

The megapode is protected under the US Endangered Species Act of 1973 and the TTPI Endangered Species Act of 1975, though there is provision for the taking of eggs by indigenous inhabitants. It is not known, however, what yield the bird population can sustain. The International Biological Programme has recommended the reservation of Uracas, Maug, Guguan and Farallon de Medinilla as islands for international scientific supervision (Douglas 1968). Maug and Sariguan have already been recognised as reserves and Ascuncion is proposed (Dahl 1980) but Farallon de Medinilla has been used recently as a bombing range by the US military.

The best prospects for survival of this subspecies appear to lie in the maintenance of reserves, the prevention of the spread of browsing mammals and predators to undisturbed islands and an understanding of the level of egg removal that the populations can sustain. Given the setting aside of adequate reserve areas, the population should sustain itself. It is encouraging that some birds may have recently recolonized Saipan (Pratt and Bruner 1978). Given adequate population information it may be possible to remove it from the endangered species lists.

#### 4-5-2 PALAU MEGAPODE - Megapodius laperouse senex

This subspecies is also classified in the Red Data Book as rare. It is found in a variety of habitats, foraging in leaf litter and soil in the forest but is generally restricted to coralline islands. Nests have been found in different substrates, ranging from sand to vegetable matter and occasionally in coral rubble (Pratt et.al. 1980).

While early estimates of numbers put the total population at less than a hundred birds (Baker 1951), the more recent surveys of Pratt et.al. suggest that the sub-species is not in serious trouble. It was regarded as being rare or uncommon on Babelthuap, Arakabesan and Koror but still common on Urukthapel, Eil Malk, Peleliu and Angaur. High densities were found on a part of the Kayangel atoll.

The Palau megapode is protected under US and TTPI law but it is still commonly exploited for eggs. Despite this exploitation it survives in good numbers and should be considered for removal from the endangered species lists provided adequate reserves can be created in areas such as Kayangel and on the main islands.

4-5-3 MALAU (Niuafu'ou megapode) - Megapodius pritchardii

This endemic species is the most remote of all the megapodes from parental stock. Because of the remoteness of Niuafu'ou from the rest of the Tongan archipelago the species remains poorly known. Like some races of Megapodius freycenit in the Solomons, the malau uses hot volcanic ash in which to incubate its eggs. This behaviour restricts its nesting areas to those in loose soil close to volcanic vents, either under forest or in open ash.

Observations in 1969 summarised by Weir (1973) suggested a population of over two thousand birds and close to the carrying capacity of the island but this was regarded as an overestimate after a survey by D.V. Todd in 1976 in which he counted between 200 and 400 birds (Watling 1982). It is possible, though unlikely, that the population had decreased in that time.

The major pressure on the ability of the malau population to maintain itself is the taking of eggs by local inhabitants, despite the banning of this activity under Tongan law. As with the Marianas megapode, it is not clear what level of exploitation the species can withstand. It would be counter-productive to enforce a ban on a traditional activity which doesn't necessarily threaten the species, but more information is required. It is not clear what threat to the status of the malau is a recently inaugurated air link between Niuafu'ou and the main island of Tongatapu but any build-up of human population pressure could result in over-exploitation.

In 1968 an attempt was made to start a second population of malau by transferring six adult and three immature birds to Tafahi Island (Watling 1982) but this was unsuccessful either because insufficient birds were used or because the habitat was unsuitable. Tafahi is fairly densely settled and probably has insufficient areas of warm soil. By contrast, the island of Late is not currently populated, is seldom visited and probably has suitable habitat. A proposal has been made to transfer malau to that island (D. Rinke pers. comm.) and this should receive priority. In view of a low, albeit dense population of this species, it should be accorded vulnerable status in the Red Data Book, in which it doesn't currently figure.

## 4-6 FAMILY RALLIDAE - RAILS

4-6-1 GUAM RAIL - Rallus owstoni

Endemic to the island of Guam, this rail is secretive and flightless. Until the late 1960s it was regarded as abundant (Perez 1968) but by the late 1970s the population had decreased dramatically (Jenkins 1979) and the species was absent from the southern half of the island.

Survival prospects for the Guam rail are enhanced by its broad habitat range; it is found in primary and secondary forest, scrub and agricultural areas. A survey carried out by the US Fish and Wildlife Service and Guam Aquatic and Wildlife Resource Division in 1981 estimated the minimum total population to be 2,329 birds (Engbring and

Ramsay 1981), a surprising result in view of the complete absence of records during an earlier survey (Ralph and Sakai, 1979). While this appears to be a high number, it represents at least a two fold reduction in density over two years in some of the areas surveyed. Clearly a serious decline was still underway at that time. Subsequently, following a further decline, the species has been placed on the US Federal Endangered Species List (Savidge, 1984), the most recent estimate of numbers being less than 100 individuals (Anon. 1984). Education and law enforcement programmes are being stepped up along with further investigations of the causes of the decline.

#### 4-6-2 SAN CRISTOBAL MOUNTAIN RAIL Pareudiastes sylvestris

Known originally from one specimen taken at 600 metres on San Cristobal Island by the Whitney South Seas Expedition (Mayr, 1933a), this species is large and flightless. Though other specimens have not been taken, one sighting was made near Wuranakumau during the Oxford University Expedition in 1953 (Cain and Galbraith 1956) and it was regarded as common in the area by local inhabitants.

No specific measures have been taken towards the species' protection but information is urgently required in view of recent moves towards exploitation of San Cristobal's timber reserves. The island has six unique bird species (J.M. Diamond undated) including the rail and thus must be accorded a high priority. A United States Company, Howell Enterprises, has acquired timber rights for all of San Cristobal and will probably clear 80,000 hectares (Anon 1983b). This operation will have a heavy impact on wildlife communities and there appears to be little planning for reserves.

A survey of the indigenous wildlife of San Cristobal is urgently required in order to assess the status of the rail and to make specific reserve proposals.

#### 4-6-3 SAMOAN WOOD RAIL (Puna'e) Pareudiastes pacificus

This species is known only from a few specimens taken on Savaii Island last century and has been regarded as extinct (Watling 1982). Consequently, little is known of its habits beyond early accounts that it displayed aberrant habits such as nesting in burrows (possibly in confusion with petrels). Its inclusion here is on the basis of the unconfirmed sighting of a large rail fitting the description of this species by K. Poai high on Savaii in August 1984 (M. Bellingham pers. comm.).

Clearly, the only possible step now towards conservation of this endemic species is to incorporate searches for it into more general wildlife surveys proposed for Western Samoa. Despite being accessible and often visited, the Western Samoan forests remain poorly surveyed for birds.

4-6-4 HENDERSON ISLAND RAIL (Chicken bird) Nesophylax  
ater

Restricted to Henderson Island in Pitcairn group, this rail is a close relative of the widespread genus Porzana. It was first described as belonging to that genus by North (1908) but was subsequently given the status of monotypic genus by Murphy (1934) following collections by Beck and Quayle of the Whitney South Seas Expedition. Subsequently, the species has been placed with Nesophylax by Williams (1960) and Bourne and David (1983) but with Porzana by Fosberg et.al. (1983). While the level of endemism of this bird is debatable, it certainly is different enough to warrant special treatment.

While regarded as common by the authors quoted and not listed in the Red Data Book, the Henderson Island Rail is included here because it is a flightless endemic species that has recently been potentially at risk through development of its habitat.

Henderson Island is a 37 sq.km. raised coral island which has been uninhabited since at least 1600, though there is evidence of Polynesian settlement before that time (Fosberg et.al. 1983). The only mammals present are kiore Rattus exulans and these obviously pose no threat to the continued survival of the rail. The bird is very tame and has been reported as sneaking up on visitors from behind as it forages in the litter for insects or molluscs (Bourne and David 1983). While its nest has never been described, it is clear that it would be at considerable risk from the introduction of predators.

The island's importance as a reserve was highlighted in 1982 and 1983 when a proposal by a millionaire to settle there was considered seriously by the British authorities. The development would have included clearance of forest in order to graze cattle, the building of an airfield and the introduction of other farm stock. This request was rejected on environmental and technical grounds by the authorities but it illustrates the pressure that regionally and globally important ecosystems can be placed under if they do not receive official recognition.

Though not endangered, the Henderson Island rail should be considered for vulnerable status in the Red Data Book because of its endemism and restricted distribution. Expeditions to Henderson Island are planned and these should include attempts to assess the population of this and other bird species.

4-6-4 BARRED-WING RAIL (Sasa) Nesoclopeus poecilopterus

This is a large, drab coloured rail that has been recorded only from 12 specimens taken from the islands of Viti Levu and Ovalau in Fiji last century. There have been unconfirmed sightings of large rails made more recently on Taveuni (Blackburn 1971) and on the Nadrau Plateau on Viti Levu (Holyoak 1973) but the species must be close to



extinction, if not already extinct.

Though it may have been rare before their introduction (Watling 1982), the presence of mongoose must be considered an important factor in the rail's decline. Once common ground-dwelling birds such as the banded rail Rallus philippensis, purple swamphen Porphyrio porphyrio and jungle fowl Gallus gallus have disappeared from Viti Levu and Vanua Levu as a result of mongoose predation and this species is regarded as being similarly vulnerable.

There are no specific proposals for conservation of the barred-wing rail but support for general wildlife surveys of the main islands of Fiji may result in more information on the species (F. Clunie pers.comm.). It is particularly important to canvass local knowledge of species such as this. Of paramount importance is the prohibition of mongoose releases on further islands.

#### 4-7 FAMILY RHYNOCHETIDAE - KAGU

##### 4-7-1 KAGU Rhynchetos jubatus

The single species in this family is confined to the main island of New Caledonia, La Grande Terre. Though recent sub-fossil discoveries on Isle des Pins suggest a broader distribution in the past, the kagu has no close relatives anywhere in the world, with the possible exception of the enigmatic but extinct Aptornis of New Zealand. It thus comprises an endemic family of very uncertain affinities but perhaps with some connection with the herons and the rails or the sunbittern and the jacanas (families Eurypigidae and Jacanidae) (Thibault 1976). For these reasons Ernst Mayr proclaimed it as one of the most peculiar birds of the South West Pacific region (Mayr, 1945).

While they are large (adults weigh approximately one kilogram and stand up to half a metre tall), kagus are very rarely seen in the wild, being identified usually by their brief bouts of dawn calling or as the occasional prey of over-zealous pig dogs. Restricted now to certain isolated parts and with numbers uncertain (they are very difficult to census), the species suffers a variety of threats. Kagus are found only in undisturbed forest in the wetter regions of La Grande Terre. An estimated 500-1000 individuals are scattered over the wetter regions of the Grande Terre (Beland 1975, Letocart 1984), with populations known in Riviere Bleue, Foret de la Thy, Dent de St. Vincent, Col des Rousettes, Mt. Cantaloupai, Massif de Tchingou, Poindimie (Jeggo 1979), les Monts Koghis (Vuilleumier and Gochfield 1976) and other smaller sites.

Dogs used for pig hunting are known to catch adult kagus, wild cats are equally dangerous and pigs, known to prey on adult petrels, probably also compete for Placostylus snails and other invertebrate kagu food. The ship rat, Rattus rattus is also common in New Caledonian forests and is a likely predator of eggs and chicks of the ground-nesting kagu. Despite these predators, the species has survived until now, so perhaps the greatest threat is the continual erosion of available habitat. During the nickel boom

between 1970 and 1980, open-cast mining affected large areas of the country and this has consorted with an increased human population pressure and accessibility to place the species under further stress.

The kagu is subject to important conservation work currently (Letocart 1984). Firstly, the establishment of a network of territorial parks and botanical reserves is some assurance that habitat remains. Much of this is dangerously accessible to hunters, but at least one area, le Parc Territorial de la Riviere Bleue, contains several thousand hectares of kagu habitat and is remote enough to allow greater protection. Even there, however, the building of a hydro village in the middle of the park has recently been narrowly averted (A.L. Dahl, pers. comm.). The second approach to conservation of the species is a captive breeding programme. The Service des Eaux et Forets and the Societe d'Ornithologie Neo-Caledonienne have established large aviaries in the Parc Forestier near Noumea where several pairs of kagu are kept. Remarkably, the birds become very tame and approachable when in captivity and successful nesting there has resulted in the raising of nearly twenty juveniles since the programme began in the late 1970's. This result is in marked contrast to the complete failure of attempts to breed this species in zoos elsewhere in the world.

The ultimate aim of the captive breeding programme is to supplement the wild population with mature birds, capable of looking after themselves. Responsible for much of this operation is Yves Letocart, ranger responsible for the Riviere Bleue park, who has constructed a large "pre-release hostel" in the park, where captive-reared birds practise fending for themselves before liberation.

While these birds may be an important supplement to a dwindling wild population, it is important to know something of their chances of survival. For a species which is difficult to observe as this one, radio-tracking of individuals may provide the only reliable data. With this in mind, Messrs Letocart and F. Hannecart toured New Zealand in 1983, hosted by Royal Forest and Bird Protection Society, NZ Wildlife Service, NZ Forest Service, Department of Scientific and Industrial Research and the Department of Lands and Survey to study radio-tracking and wildlife survey techniques, and general aspects of nature conservation.

If the kagu is to continue to survive, then more accurate information is needed on the size and distribution of the population and the factors affecting it. Support is urgently needed to carry out this work and some assistance will be required with the radio tracking study that has already been planned.

## 4-8 FAMILY SCOLOPACIDAE - SNIPES, WOODCOCKS AND SANDPIPERS

4-8-1 TUAMOTU SANDPIPER (KIVI-KIVI) Prosobonia cancellatus

Among the discoveries made during Cook's forays into the Pacific were two species of shorebird resident on Tahiti and Christmas Island. Following some taxonomic shuffling (Zusi and Jehl, 1970), these have been placed with the true wading birds or Scolopacidae, a family of mainly migratory species which breed almost exclusively in the Northern Hemisphere and include familiar birds like Godwits, Knots and Curlews. Sedentary species breeding south of the equator, such as this and the subantarctic Snipe (Coenocorypha spp.) are thus of considerable biological interest. Apart from one record of a turnstone Arenaria interpres breeding on a coral cay of New Caledonia (F. Hannecart pers.comm.), these are the only breeding species of shorebird in the region.

The Tahiti Sandpiper Prosobonia leucoptera is only known from three specimens collected in 1744 on Tahiti and Eimeo in the Society group, and is represented today by a single mounted specimen to be seen in the Rijksmuseum von Natuurlijke Historie in Leiden in the Netherlands. Its distribution during Cook's day appears to have been limited and its extinction, due to causes unknown, was very swift.

Cook's third expedition included a stop at Christmas Island, 2000 kilometres to the north, and saw the discovery of the type specimen of Aechmorrhynchus cancellatus, the Tuamotu Sandpiper, now regarded as also belonging to the genus Prosobonia. In contrast to the Tahiti Sandpiper, this species was widespread, though ironically, it has never again been found on Christmas Island. The species was recorded by the United States Exploring Expedition in 1839 on Raraka and Pukapuka but little was noted of its natural history.

In the 1920s, the Whitney South Sea Expedition travelled through the Tuamotu Archipelago and surrounding islands, and field naturalists Quayle and Beck collected or reported sandpipers from at least 16 atolls, though they were already extinct on others by then (Holyoak and Thibault 1984). In keeping with the then current attitude of "collect before it disappears", the expedition accounted for about 60 individuals during the course of its wanderings, and the skins of these are to be found in the American Museum of Natural History.

While such depredations may not have necessarily affected the species' chance of survival, it is clear that similar collecting today could have disastrous consequences. Recent records are limited to the islands of Marutea au Sua and Maturei-Vavao, where they are probably breeding (Lacan and Mougin, 1974), Pinaki and Nukutavake (King, 1981), and the sighting of a single bird on Rangiroa (Holyoak, 1973a). There are no recent records of breeding and no detailed studies of the species have been carried out.

The little that is known about the ecology of these birds has been summarised by Bruner (1972). Known locally as the "Kivi-kivi", they are tiny birds measuring only 16-17 centimetres in length. Less

strikingly marked than the Taiti species, they exhibit two colour-phases; a dark form with a dark brown head and upper back and underparts heavily streaked with brown on a light buff background, and a light form with similar markings but much paler in tone. Both forms have a light streak over the eye and brown tail and wings.

Found all over the atolls on which they occur, kivi-kivis actively pursue a diet consisting mainly of insects. Ants, wasps, crickets and beetles have been identified along with some seashore invertebrates (Holyoak and Thibault 1984). Like so many species which have evolved in the absence of ground predators, they are exceedingly tame, as evidenced by reports of them being caught by hand. It is during breeding that these birds' vulnerability to predators becomes obvious. The nest is a loose structure of twigs and grass gathered in a depression in the sand amongst coral rubble and, like other shorebirds, the chicks remain on the ground for a period of weeks until they can fly.

The spread of human influence across the Pacific has been accompanied by a following of rats, cats and dogs that birds such as these had not been exposed to previously. Therefore, while kivi-kivi may occasionally be hunted by humans (Lacan and Mougin 1974), the depredations of cats and rats are probably a major cause of the decline.

The key requirements for the species conservation are firstly, for information, then secondly for the appropriate action based on that information. The plan for its conservation focuses on the following elements:

1. A survey of the following atolls to determine whether the species has survived since the reports of the 1920's: Fakareva, Kauehi, Taenga, Katu, Tuanake, Hiti, Tepoko, Vanavana, Tenararo, Vahanga, Tenarunga and Maria.
2. A study of breeding and habitat requirements on Marutea au Sud, Maturei-Vavao or Nukutavake.
3. Analysis of land use and predator distribution to determine feasibility of reserve establishment, e.g. on Maturei-Vavao.

Because successful conservation in these areas depends heavily on the good will of the local people, it is essential that education work is carried out hand in hand with any research. Restriction of access to cats, dogs and rats other than Rattus exulans would appear to be likely requirements. Other conservation measures such as translocation and captive breeding would have to be considered carefully in the light of research results and local acceptability.

#### 4-9 FAMILY COLUMBIDAE - PIGEONS

Despite the fact that they are, as a rule, highly edible to humans and other predators, pigeons constitute a widespread and highly successful family. Of worldwide distribution, they have evolved into a variety

of forms and sizes ranging from the tiny diamond doves to the very large crowned pigeons. There is no taxonomic distinction implied in the terms pigeon and dove, rather they generally refer to large and small forms respectively. There are about 285 species world-wide but the Australian region appears to have the richest pigeon fauna (Frith 1982). The generally wide-ranging habits and often colourful plumage of these birds has meant that pigeons form a conspicuous feature of the avifauna.

While compelling reasons exist for the conservation of pigeons for their own sake, the importance of the role of one group in the functioning of the ecosystems in which they live must also be considered. Fruit pigeons consume a wide variety of fruits and may disperse the seeds of those over considerable distances. Some large-fruited trees probably rely on pigeons for dispersal and maintenance, particularly on an island such as Karotonga, where two of the six landbirds are pigeons and the other species do not eat large fruits. The distribution of some trees currently can only be explained in terms of the previous existence of a now-extinct pigeon species. In addition to studies of dispersal, experiments currently underway in New Zealand will assess the hypothesis that passage through a pigeon gut enhances seed germination (M.W. Clout pers.comm.).

Of 53 species which occur in the region being considered here, 12 figure in the Red Data Book. This illustrates the fact that the profusion of tropical islands in the Pacific has promoted a radiation of forms which, as small isolated populations, have become vulnerable to sudden changes in their habitat. While some, e.g. the Radaak and Truk Micronesian pigeons, are subspecies of more widespread species, others, e.g. the tooth-billed pigeon and the cloven-feathered dove, represent monotypic endemic genera. Pigeons, particularly fruit eating species, form a very significant element of the rare bird fauna of the Pacific.

#### 4-9-1 PALAU NICOBAR PIGEON Caloenas nicobarica pelewensis

The Nicobar pigeon constitutes a group of very obscure origins. Goodwin (1983) regards it as being most closely related to the ground doves or quail pigeons (Gallicolumba), but clearly it has evolved separately since very early times. It is a heavy bodied bird with long wings and legs and a curious mantle of long feathers hanging from the neck. Its bill is heavy, a likely adaptation to a ground feeding habit, its diet consisting of seeds, fruits and some invertebrates. Unlike fruit pigeons but like many other pigeons, it appears to digest the seed as well as the flesh of fruits. It is a colonial nester with an exceptionally long fledging period; both characteristics render it vulnerable to habitat disturbance.

The nominate race of the Nicobar pigeon is widely distributed and is not at risk. It is apparently restricted to the smaller wooded islands near to major land masses from the Nicobar Islands east to the Solomons and including Indonesia, Borneo, the Philippines and New

Guinea. In contrast, the Palau race, which is smaller, is restricted to that archipelago and is classified in the Red Data Book as endangered.

While Baker (1951) considered the subspecies to be "on the road to extinction", recent observations (Pratt et al. 1980) suggest that there may have been a slight recovery. While the species is very secretive and difficult to observe, low numbers were observed on Eil Malak, Urukthapel and Peleliu and small flocks on Koror and the islands in Iwayama Bay. It has also been recorded from Arakabesan, Babelthuap and Ngeroneu (Baker 1951).

Most Nicobar pigeons appear to be found on small forested islands adjacent to larger land masses. It is not clear whether this is a result of disturbance to populations on the larger islands or reflects an actual habitat preference. The main problem facing these birds currently is continued hunting pressure, despite their listing and protection as endangered species under Trust Territory and US Federal law. While this hunting pressure may have eased since the Second World War, strict enforcement of the current ban is necessary. The Palau Nicobar pigeon should remain listed as endangered until its status is known to be more secure.

#### 4-9-2 TOOTH-BILLED PIGEON (Manume'a, Didunculus strigirostris)

The origins of the manume'a are quite obscure as it has no clear relationships with any other members of the pigeon family. Its endemism is highlighted by the suggestion by some authors (see Watling 1982) that it deserves classification in a family of its own within the order Columbiformes. Also suggested is a relationship with the enigmatic but extinct dodo of Mauritius. While it is unlikely that the taxonomic question will be resolved easily, it is certain that this species is highly endemic and of ancient origin. As with many of the species in the region, this scientific question should not take precedence over the need to ensure the bird's survival.

Restricted to the two main islands of western Samoa, Upolu and Savaii, the manume'a is of vulnerable status. Recent searches on both islands confirm a clear preference for undisturbed primary forest habitat. A tendency to be found at high altitude may reflect the distribution of this habitat. While Lovegrove (1984) located a relatively healthy population at the western end of Savaii in 1982, that forest has been subsequently cleared as part of the exotic reforestation programme based at Asau (M. Bellingham and A. Davis pers. comm.). The pressure on undisturbed forest habitat through development for forestry is likely to continue in Western Samoa and this brings a risk, particularly on the drier western ends of the islands, of forest destruction by fire. In September, 1983 a large area of plantation, and logged and primary forest was lost in a blaze that proved very difficult to control in the dry basalt terrain. Subsequently, to meet the shortfall, further indigenous wood has been sought to maintain supply to the Asau sawmill.

Human demographic pressure represents an additional threat to the survival of this species, both through hunting and garden clearance. Pigeons are hunted generally (K. Viliamu, pers. comm.) and manume'a are undoubtedly taken. While the species may be able to sustain light hunting pressure, human population increase and increased availability of firearms are likely to lead to pressure which it may not be able to withstand.

While little is known of the species' breeding biology or of its vulnerability to predation by cats or rats, the suggestion has been made (King 1981) that a population of manume'a should be established on a cat-free island, namely Nu'ula in the Aleipata group at the eastern end of Upolu. Unfortunately, the small area (25 hectares) of Nu'ula render it unsuitable as a reserve for this species. Fruit-eating pigeons generally require large forest areas to sustain them year-round (M.N. Clout pers. comm.) and 25 hectares is unlikely to support more than a few even if the habitat is suitable.

Of the two major requirements for the manume'a's survival, the first, the provision of adequate forest reserves, has been partly, though not yet adequately met. O Le Pupu Pu'e National Park comprises 3000 hectares of forest running from the southern coast of Upolu to the crest of the central range. While surveys to assess bird numbers have not been fully carried out, the park probably provides habitat for a number of manume'a. Further reserves are necessary, particularly on Savaii.

The botanical and regional basis for a current plan for reserves in Western Samoa (Holloway and Floyd 1975) has been thoroughly researched but there is a lack of detailed information on the status and distribution of any of the vertebrate wildlife. The second main requirement is therefore for studies of the distribution and abundance of bird species and the habitat requirements of the manume'a.

#### 4-9-3 CLOVEN-FEATHERED DOVE (Pigeon vert) Drepanoptila nolosericea

Though belonging to a monotypic genus, the cloven-feathered dove is a close relative of the widespread genus Ptilinopus (Goodwin 1983). It is a medium-sized pigeon of striking colouration and patterning. The general colour is green with black and silver, transverse stripes on the lower back and tail and a green-yellow breast patch. They feed on and sometimes flock in large numbers to banyan and araliau trees (Hannecart and Letocart 1980).

The species was regarded as very rare by Warner (1947, in 1944 and 1945, but more recent surveys have indicated a healthier population. The results of a survey carried out by the Societe Calédonienne d'Ornithologie in 1974 (Beland 1975b) showed that it had an irregular distribution on the Grande Terre, with the greatest abundance on the eastern side of the island and in the forested hills. It is not found commonly in the largest forest reserve, Parc Territorial de la Riviere Bleue (Y. Letocart pers. comm.) but is still relatively common in other areas (Hannecart and Letocart, 1980) e.g. Col d'Amieu (pers.

obs.). Though it has also been recorded from Isle de Pins, it has not been seen there recently (Beland 1975b).

The major factors affecting the ability of the cloven-feathered dove to survive are probably habitat clearance and hunting. While the boom of the 1960s has slowed in pace, large areas of New Caledonia are still being opened to exploitation. While the pigeon is protected by law, it is still widely hunted; 44 out of 67 observers distributed across the Grande Terre reported hunting in their regions (Beland 1976) in 1974.

The cloven-feathered dove's vulnerable Red Data Book status should remain while it is still hunted and until adequate reserves can be created in its habitat. The creation of further secure reserves in other parts of New Caledonia depends heavily on the successful resolution of land ownership issues and the cooperation of Kanak and other inhabitants. This depends, in turn, on an adequate conservation education programme.

#### 4-9-4 TRUK MICRONESIAN PIGEON Ducula oceanica teraokai

The Micronesian pigeon is a close relative of the widespread Pacific pigeon (D. pacifica). The species is split into five races dispersed through most of southern Micronesia (Mayr 1945). This race was once distributed throughout the high islands of Truk but underwent severe hunting pressure during World War Two when an American blockade of the islands resulted in food shortages for the resident Japanese (King 1981).

Currently the pigeon is possibly in low numbers on Toi Island and other islands but more information will be available following surveys being carried out by the U.S. Fish and Wildlife Service (J. Emyring pers.comm.). None were seen during a brief survey of Moen Island in 1977 (Ralph and Sakai 1979). The species is protected under the U.S. Trust Territories Endangered Species Act.

#### 4-9-5 RADAK MICRONESIAN PIGEON Ducula oceanica ratakensis

Closely similar to the preceding race, the Radak Micronesian pigeon is recorded only from two atolls of the Radak chain of the Marshall Islands, Arno and Wotje. Though little is known of its distribution on Wotje, the pigeon has apparently disappeared from some of the suitably vegetated islands of Arno Atoll (King 1981).

Though it is probably hunted, the reasons for the decline of this race are not clearly understood. Disappearance from Ine Island, Arno may be related to the introduction there of Rattus rattus, but the effects of rats are not known. More information is required on the status of the Radak pigeon, particularly on Wotje atoll.



4-9-6 MARQUESAS PIGEON (Upe) Ducula galeata

A large species, the Marquesas pigeon feeds on the large ripe fruit of species such as Fagraea and Terminalia, swallowing them whole and dispersing the seeds. It also eats the smaller fruit of Ficus, Cordia and Eugenia and the introduced guava (Holyoak and Thibault 1984).

Now found only on Nuku Hiva, this pigeon is restricted to the valleys of Haatepuna, Hatineu and Taipi. There are conflicting accounts of its population, Bruner (1972) having estimated 45-50 while Holyoak (1975) thought that there were 75-105 in 1972. None were seen by Montgomery et al. (1980) but in a brief search in 1982, M. Fowler (pers.comm.) saw only six individuals. The distribution of trees such as Fagraea, whose fruit are probably not dispersed in any other way, suggests that the species was once more widespread.

Though protected by law, D. galeata is hunted and eaten, and its apparent population decline is probably related to over exploitation as well as habitat degradation. Enforcement of a hunting ban is required in addition to a full population survey and protection of existing habitat.

4-9-7 SOCIETY ISLANDS PIGEON (Rupe) Ducula aurorae

While some authors consider this as a distinct species (Goodwin 1983), others (Holyoak and Thibault 1984) regard it to be a subspecies of the widespread D. pacifica. It has similar habits to other members of the genus, feeding on a variety of large and small fruits. The current distribution, on Makatea in the Tuamotus and on Tahiti is probably a relic of a once more widespread range, though the only other record is from Moorea last century.

The population on Tahiti in 1975 comprised merely 10-12 individuals restricted to the Papenoo Valley (Holyoak and Thibault 1984), an area threatened with deforestation through heavy over-grazing (Holyoak 1973b). On Makatea the population is more secure, around 500 individuals having been estimated as being present (Thibault and Thibault 1975). Phosphate extraction on that island has recently finished (King 1981) and, with the human population declining, survival prospects for the pigeon appear reasonable.

Unless the reserve in Papenoo Valley is secured against grazing, and a hunting ban on this species is enforced, extinction on Tahiti is a probability. A further survey of Makatea is required to assess the status there. The translocation of Makatea birds to other secure areas could be considered as a future management tool.

4-9-8 NOTOU (Giant imperial pigeon) Ducula goliath

This is one of the largest fruit pigeons, weighing up to a kilogram. It feeds on a range of fruiting species but is particularly known to take large ones such as those of some Pandanus (Y. Letocart

pers.comm.). Though once found on the Isle des Pins, it is apparently now absent from there (King 1981). On la Grande Terre the nodou is restricted to undisturbed rain forest with a wide range of food species. It is quite common in some isolated areas such as Parc Territorial de la Riviere Bleue in the southeast of the island (pers. obs.) but is absent from other apparently suitable habitat.

Though the pigeon is protected for most of the year, there is a hunting season during the weekends between 15 March and 15 April (ASNNC 1980). While this season is short, there is evidence of overhunting even during the closed period. Given sufficient habitat in reserves such as Haute Yate and Riviere Bleue the species should survive, though little is known of its biology.

Enforcement of hunting laws and a census and distribution studies are required. The vulnerable status should remain in the Red Data Book until more information on status is available.

#### 4-9-9 SOCIETY ISLANDS GROUND DOVE Gallicolumba erythroptera

The old-world quail doves or ground doves comprise 18 species distributed across the Pacific from Indonesia to French Polynesia (Goodwin 1983). They are small long-legged pigeons which spend much of their time on or near the ground feeding on fallen seeds or berries. Two species, both in French Polynesia, are recorded in the Red Data Book.

The Society Islands ground dove is a forest dweller which was once found throughout the Society and Tuamotu Islands. Its ground habits have apparently resulted in its extirpation by cats and rats over much of its range and it is now found only in several small islands in the Tuamotus. The subspecies G. e. erythroptera was found to be common by the Whitney South Seas Expedition on Vanavana, Tenararo, Tenarunga and Maturei-Vavao but has only been recently recorded from Maturei-Vavao (Lacan and Mougin 1974). A second subspecies, G. e. pectoralis apparently occurred on Tikehau, Fakarava, Katiu, Tuanake, Hiti, Tahanea, Makeno and Hao (Holyoak and Thibault 1984) but it has not been recorded recently.

It is vital that Maturei-Vavao remain free of Rattus rattus and other predators if this species is to survive. Further searches of other islands of the Tuamotus are required.

#### 4-9-10 MARQUESAS GROUND-DOVE Gallicolumba rubescens

This species lives on the ground under trees on some of the dry-zone islands of the Marquesas. Like the Society Islands ground dove, it is susceptible to predation by introduced cats and rats and is now confined to the predator-free islands of Hatutu and Fatuhuku.

A survey in 1975 resulted in a count of 200-250 birds on Hatutu, while on Fatuhuku its status is unclear (Holyoak and Thibault 1984).

Despite the reserve status of Hatutu, this species is very vulnerable to the possibility of a predator liberation. There are requirements for a survey of Fatuhuku, though its small size means that few ground doves could live there, and an investigation of other islands as possible sites for translocation of the species. Though its Red Data Book Status is indeterminate, given current knowledge it should be reclassified as vulnerable or endangered.

#### 4-9-11 MARIANAS FRUIT-DOVE Ptilinopus roseicapillus

The genus Ptilinopus constitutes a remarkable radiation of some 47 species distributed from Southeast Asia across the Pacific to Pitcairn. Among them are some of the world's most brightly coloured birds. All species are believed to be primarily frugivorous, though they probably also feed on buds and foliage and some take invertebrates (Goodwin 1983). Despite the large number of endemic species in the genus, a relatively small proportion is believed to be at risk and only two appear in the Red Data Book. In addition to the species discussed here, P. insularis from Henderson Island should also be regarded as potentially at risk.

The Marianas fruit dove is endemic to the Islands of Guam, Saipan, Tinian, Rota and Aguijan. It feeds in the upper canopy, is highly cryptic and is hence difficult to observe, but gives a penetrating and distinctive call and is thus easy to census. Because it has been decreasing in range and population since 1945 (King 1981) it warrants its vulnerable status in the Red Data Book. Pratt et al. (1979) noted a marked decline in Guam between 1976 and 1978! A recent survey on Guam (Engbring and Ramsay 1981) resulted in an estimate of 241 individuals, mainly concentrated in the northwest of the island in native forest. This count represents a decline which, if mirrored on the other islands, would place the species seriously at risk. The 1977 survey by Ralph and Sakai (1979) suggests that this species is common on Rota and uncommon on Saipan and Jenkins (1983) records their occurrence on Aguijan and Saipan. Though the avifauna on the rest of the North Marianas hasn't suffered to the degree of that on Guam, clearance of forest habitat is still cause for concern.

#### 4-9-12 RAPA FRUIT DOVE (Koko) Ptilinopus huttoni

Confined to the 22 sq.km. island of Rapa in the Austral group, this dove is at risk mainly because of the deforestation of its habitat induced by land clearance and by the unrestricted grazing of 5000 goats and 500 cattle (Paulay 1982). Erosion is a serious problem as already large areas of the island have become bare. Surprisingly, in contrast to tradition in many other Polynesian Islands, the doves are apparently not hunted, hence are tame and relatively common in the remaining forest.

The Red Data Book Status should remain as rare, though the species is obviously vulnerable to further habitat loss. There is an urgent need on Rapa for the protection of a forest reserve from clearance and grazing.

4-9-13 MARQUESAS FRUIT DOVE (Kuku) Ptilinopus mercierii

Two subspecies of this dove, P. m. tristrami and P. m. mercierii, were described, the former from Hiva Oa and the latter from Nuku Hiva Island. Despite vague reports from other islands, the species seems to have been limited to the above two. Though Bruner (1972) accorded the species common status on Nuku Hiva, it was apparently extinct there before 1922 (Holyoak and Thibault 1984). Though there are remote possibilities of finding this subspecies alive, it is probably already extinct. The reduction in numbers of the Hiva Oa subspecies has been attributed to the introduction to that island of the great horned owl Bubo virginianus. The dove was reported recently from the island (Montgomery et al. 1980). The species should be looked for in the course of other surveys on those islands.

## 4-10 FAMILY PSITTACIDAE - PARROTS

Parrots constitute a conspicuous element of the rare bird fauna in those parts of the world where the family is found. While they are generally affected by the problems such as loss of habitat, predators, etc. that confront other rare bird groups, parrots also face pressure from collectors. Because of their colourful appearance, comic behaviour, apparent intelligence and ability at vocal mimicry, parrots are in heavy demand world-wide as pets. This has led to a highly organised and profitable trade in which the laws of supply and demand inflate the prices that collectors will pay for rare species. The result is a persecution of endangered parrots which may prove fatal for many species. Though captive breeding is a relatively easy proposition, it does not lessen the pressure on wild populations. Indeed, it probably increases the demand for new stock.

Most tropical species are forest inhabitants and are therefore vulnerable to logging and forest clearance. Notwithstanding the pressures on parrots, however, there are only four entries for the Pacific Islands.

4-10-1 NORFOLK ISLAND PARAKEET Cyanorhamphus  
novaezelandiae cooki

Cyanorhamphus is a genus of small parrots found mainly in the New Zealand region. Some have radiated beyond New Zealand and two extinct species C. zealandicus and C. uiiatanus, were found during Cook's voyages to the Society Islands (Holyoak and Thibault 1984). C. novaezelandiae exhibits the greatest radiation within a species, forms being found in New Caledonia, Kermadecs, Norfolk, New Zealand, Chathams and Antipodes; and extinct ones from Lord Howe and Macquarie Islands.

On Norfolk Island the subspecies is a relatively large billed parakeet that spends at least some of its time feeding on the cones of

Araucaria (Schodde et al. (1983). Recent surveys have estimated the upper limit to the population as 28 to 30 birds, though there may have been as few as 17, concentrated almost exclusively in the 474 ha. Mount Pitt Reserve (Forshaw 1980, 1981).

The low density of parakeets in a relatively large reserve (13-14% of the island's area) illustrates that other factors additional to habitat loss may have contributed to the decline of this subspecies, and these were considered by Forshaw. Circumstantial evidence points to a loss of some species from Norfolk Island as a result of competition with others that have been introduced. The introduction of the crimson rosella Platycercus elegans has probably meant competition for food (their ecological niches are very similar) and, along with the European starling Sturnus vulgaris, for nest sites.

Though a large population of parakeets may be able to withstand a certain amount of predation, chance occurrences place a small population at greater risk. Ship rats and cats are very common on the island.

Disease has often been suggested as a reason for the extinction or rarity of wild bird species, but the direct evidence of this has been understandably difficult to obtain. On Norfolk Island in 1976, however, a disease outbreak was detected in the rosella population and it is possible that this also affected the parakeets.

While the protection of remaining indigenous vegetation is important, the most practical conservation measure - suggested by Forshaw - is to attempt to establish a population elsewhere, probably on the well-forested Lord Howe Island where the local subspecies is extinct, probably because of early over-exploitation. Control of rosellas to avert competition has been suggested but this is unlikely to have the support of local residents (Forshaw 1980).

#### 4-10-2 OUEVA HORNED PARAKEET Eunymphicus cornutus uvaensis

The horned parakeets are endemic to New Caledonia, one subspecies being uncommon but relatively widespread on the Grande Terre, while this one is confined to Ouvea, the smallest of the inhabited Loyalty Islands where it inhabits mature forest.

In 1939 the population was estimated at approximately 1000 birds (Warner 1947) but clearly there has been a reduction since that time in the face of habitat clearance and hunting. An estimate of numbers in its range between Cap Rossel and Cap Escarpe was 200 birds in 1974 (King 1981).

While habitat reduction has probably been an important factor in the past, the greatest threat to the parakeet is live capture for export. Because of its rarity, it has acquired a high value to collectors. Birds are captured by islanders who conceal nooses inside hollowed-out papaya fruit (Y. Letocart pers.comm.). They are then sold for up to

\$A50.00 to exporters who are able to realise many times that figure on international markets. Though the species is protected by law and is listed in Appendix 2 of the 1973 Convention on International Trade in Endangered Species of Flora and Fauna, there are extreme difficulties in enforcing the regulations on Ouvea.

Attempts have been made to introduce the subspecies to other islands in the Loyalties but these have so far failed (King 1981). A captive population in the Parc Forestier near Noumea could form the basis of further attempts to liberate the subspecies elsewhere but there is an urgent need for effective conservation on Ouvea and policing of regulations concerning capture and trade.

#### 4-10-3 TAHITI LORIKEET Vini peruviana

The genus Vini constitutes five species of lory distributed from Samoa and Tonga in the west to Henderson Island in the east. All five are of restricted distribution and their ranges generally are shrinking. For example, V. australis, once common throughout the Tongan and Samoan Islands, has disappeared from all but Niuafo'ou in Tonga, though it is still common in Samoa. It is not rare enough for inclusion in the Red Data Book, but its status and that of the other species should be monitored.

The Tahiti lorikeet once occurred throughout the Society Islands and Tuamotus but now only survives on some of the Tuamotus, two of the Societies and Aitutaki in the Cook Islands, where it was apparently introduced by Polynesians. The total population is probably several hundred birds (King 1981). That and its apparent preference for coconut groves suggest that this species is not immediately at risk. However, the spread of mosquitoes to islands of the area may bring the risk of avian disease (Holyoak 1973b). Its rare status should be maintained and the results of investigations into avian disease should be monitored.

#### 4-10-4 ULTRAMARINE LORIKEET Vini ultramarina

Like the preceding species, the ultramarine lorikeet has a reduced range, being found now on only three of the Marquesas Islands where it once occurred. It is widely distributed on Uapou, where the population in 1975 was estimated at 250-350 pairs, but less common on Nukuhiva and Uahuka, where it was introduced several decades ago (Holyoak 1975). Unlike V. peruviana, this species appears to favour montane forest, though it does frequent banana plantations seasonally and Montgomery et.al. (1980) observed them in coastal areas.

The size of the current population confirms the species' rare status. Because the Marquesas Islands are generally under threat of deforestation and over-grazing, protection of habitat is urgently needed along with enforcement of a ban on hunting. The suggestion that avian malaria may be a problem (Holyoak 1974a), requires further investigation.

## 4-11 FAMILY ALCEDINIDAE - KINGFISHERS

4-11-1 GUAM MICRONESIAN KINGFISHER HALCYON CINNAMOMINA  
CINNAMOMINA

The Guam kingfisher is an endemic subspecies, the two other (non-endangered) forms of the species being found on Palau and Ponape. A forest-dweller, it feeds on a variety of small animals.

It is not easy to assess the current status of this bird. While its range has shrunk by 60% since the 1950s, population estimates made recently suggested a population in excess of three thousand individuals (Engbring and Ramsey, 1982), a ten-fold increase on an estimate of 150 pairs made in 1975. Ralph and Sakai (1979) found the kingfisher to be not uncommon in 1977. Much of the difference in estimates may be attributable to differences in survey technique, and Engbring and Ramsey do not deny the kingfisher's vulnerability given the overall reduction in bird numbers on Guam.

While the situation on Guam for most indigenous bird species appears to be unstable (Savidge 1984), the status accorded the kingfisher by the Red Data Book should be kept under review. Pratt et al. (1979) concluded that the kingfisher was one of the species least affected by the factors causing the decline of the other Guam birds. A vulnerable status is probably most appropriate for the Red Data Book.

## 4-12 FAMILY STRIGIDAE - OWLS

4-12-1 PONAPE SHORT-EARED OWL Asio flammeus ponapensis

The short-eared owl is distributed across much of the Holarctic, South America, West Indies, Galapagos and Ponape. This subspecies is thus of interest because of its isolation from other areas where the owl occurs. It is restricted to the 335 sq.km. Ponape Island and, in keeping with most owl species, naturally occurs in low density.

While many of the rare species of the region are suffering the effects of deforestation, the owl's habit of hunting over open country and clearings renders it less vulnerable to that influence. The population is very low, however, two dozen having been counted in 1930 (Baker 1951) and about 50 in 1956 (Marshall 1962), with only single individuals being seen in 1975 (King 1981) and 1977 (Ralph and Sakai 1979). Feeding studies by Marshall indicate that the main prey is the Polynesian rat Rattus exulans, with lizards and the ship rat R. rattus as secondary items.

In the light of indications that the owl is surviving in modified habitats and feeding on introduced rodents, it should be regarded as rare but probably not endangered. The difficulty of adequately surveying for a nocturnal or semi-nocturnal species is acknowledged, however, and more information is required on the current status of the subspecies.

4-12-2 NORFOLK BOOBOOK OWL Ninox novaeseelandiae  
undulata

One form of a species widespread through the Australasian region, the Norfolk Island boobook owl is a small owl which feeds on a range of vertebrate and invertebrate prey. Despite the fact that other subspecies (e.g. N. n. novaeseelandiae in New Zealand) have thrived in man-modified environments, this one is now regarded as seriously endangered.

During the most recent survey of the birds of Norfolk Island the boobook owl was found in only 2% of the 34 sq.km. land area. The causes of its rarity are not known and there is little information on its ecology. Norfolk Island is substantially modified and the survival of a number of species depends on the protection of remnant forest areas such as the Mt. Pitt reserve.

4-13 FAMILY MUSCICAPIDAE

This family is probably numerically the largest of any in the world, including the Pacific species of thrushes, warblers, flycatchers, monarchs, fantails and whistlers. Of thirteen subfamilies, eight are represented in the Red Data Book, three of those having species in the Pacific Islands.

SUBFAMILY TURDINAE - THRUSHES AND CHATS

4-13-1 GREY-HEADED BLACKBIRD (Island Thrush) Turdus  
poliocephalus poliocephalus

The genus Turdus comprises 61 species world-wide but only one occurs naturally in the Pacific islands (The extinct T. ulietensis from Raiatea is usually placed in the genus Zoothera). Fifty forms of island thrush have been described distributed from Christmas Island (Indian Ocean) east through Indonesia and Melanesia to Samoa. It is a tribute to the resilience and adaptability of this species that only one subspecies is considered endangered. However, three are already extinct - T. p. vinitinctus on Lord Howe Island, T. p. pritzbueri on Lifu Island and T. p. mareensis - and the New Caledonian subspecies is presently confined to one offshore island.

The 34 sq. km. of Norfolk Island has been largely cleared of forest and this has restricted the grey-headed blackbird to the 405 ha. Mt Pitt Reserve where its numbers are critically low. Individuals were seen in 1968 and 1975 but none were seen during a recent survey, and the thrush is now regarded as seriously endangered (Schoode et.al. 1983). Predation by introduced rats and cats has probably contributed to the decline, but competition with the highly successful introduced European blackbird T. merula could have had an important effect.



## SUBFAMILY SYLVIINAE - OLD WORLD WARBLERS

4-13-2 POLYNESIAN WARBLER Acrocephalus caffer

This genus of reed-warblers includes some 31 species whose distribution represents colonisation from Europe and Asia across the northern and central Pacific south to Eastern Polynesia. Though found in Australia and the Solomons, and in the western Hawaiian Islands and parts of Micronesia, they are absent from much of Melanesia and central Polynesia. In eastern Polynesia they have undergone an extensive radiation of forms and this has resulted in a fair amount of taxonomic confusion. The latest resolution of the group in this region is that of Holyoak and Thibault (1984) and their scheme is followed here. Four species are recognised in the eastern Pacific, A. aequinoctialis (Christmas Island), A. caffer (Societies, Marquesas, Tuamotus), A. vaughni (Pitcairn) and A. kerearako (southern Cooks). It is of value to examine the status of all the subspecies as they provide a useful insight into the influences affecting landbirds in the region.

The following table summarises the status of all subspecies of A. caffer.

Subspecies	Distribution	Status
<u>caffer</u>	Tahiti	restricted
<u>longirostris</u>	Moorea	endangered
<u>garetti</u>	Huahine	extinct
<u>postremus</u>	Hatutu	rare
<u>aquilonis</u>	Eiao	endangered
<u>percenis</u>	Nuku Hiva	common
<u>laae</u>	Ua Huka	abundant
<u>dido</u>	Ua Pou	abundant
<u>mendanae</u>	Hiva Oa and Tahuatu	common
<u>consobrinus</u>	Mohotani	uncommon
<u>fatuhivae</u>	Fatu Hiva	common
<u>musae</u>	Raiatea	extinct
<u>atyphus</u>	Northwest Tuamotus	widespread
<u>eremus</u>	Makatea	common
<u>niauensis</u>	Niau	common
<u>palmarum</u>	Anaa	frequent
<u>flavidus</u>	Nupuka	extinct?
<u>ravus</u>	South Tuamotus	widespread

1. EIAO POLYNESIAN WARBLER A. c. aquilonis

Eiao Island (50 sq.km.) is severely eroded and deforested due to over-grazing by feral sheep and pigs. Despite being proclaimed a reserve in 1971 (Decker 1973) it has since been the site of military activity and considered as a site for nuclear weapons testing (King 1981).

The warbler was discovered in 1922 during the Whitney South Seas

Expedition but little was known of it subsequently until a report of a restricted number in bush remnants on the central plateau of the island in the late 1960s and early 1970s (Holyoak and Thibault 1984).

Its survival depends on survival of vegetation on this island. This depends in turn on its restoration to protected status and the removal of feral mammals.

## 2. HATUTU POLYNESIAN WARBLER *A. c. postremus*

Hatutu (Hatutaa) Island (18 sq.km.) has a special place in nature conservation in the Marquesas Islands, being probably the least altered of the group. The fact that it has no permanent water has meant that it has not been an attractive place for the introduction of grazing stock or human habitation (Decker 1973). Consequently, the vegetation is intact and the only introduced mammal is the Polynesian rat. Despite this, the numbers were estimated to be 30-50 pairs restricted to certain areas in 1975 (Holyoak and Thibault 1984).

Military activity on nearby Eiao Island constitutes the greatest threat to this and other birds on the island despite its protected status recognized in 1971 (Decker 1973). It is vital that Hatutu's importance continues to be recognized.

## 3. MOOREA POLYNESIAN WARBLER *A. c. longirostris*

Found only on Moorea, this subspecies is regarded as being close to extinction (Holyoak and Thibault 1984). It was already considered as scarce in 1921 by the collectors of the Whitney South Seas Expedition and only two pairs were found in the interior of the island in 1973. The possibility has been suggested that avian malaria carried by introduced mosquitoes caused the decline of this bird (King 1981).

A census of the population of the warbler and an investigation of the role of avian malaria are needed.

## 4-13-3 NIGHTINGALE REED WARBLER *Acrocephalus luscini*

Distributed through the Marianas, Carolines and on Nauru, this species does not appear to be seriously endangered. It is, however, listed as endangered on the TTPI list for the islands of Guam, where it is already extinct, Saipan, Truk and Ponape.

Reed warblers were found by Ralph and Sakai (1979) to be uncommon on Saipan and Truk but more recent surveys (J. Engbring pers.comm.) should provide more detailed information.

4-13-4. LONG-LEGGED WARBLER Trichocichla rufa

Constituting a genus endemic to Fiji, this species is known from only a few specimens and a handful of sightings. T.r. rufa is thought to be confined to the damp southeastern side of Viti Levu but is known recently only from unconfirmed sightings. T.r. cluniei was discovered in 1974 (Kinsky 1975) in the Delanacau mountains of Vanua Levu, where two birds were seen.

The species has clearly been very rare for some time, though the reasons for that rarity are unknown. It is possible that the mongoose Herpestes auropunctatus, introduced in 1873, has been responsible for the demise of this, as it has been for a number of ground-dwellers. It is not possible to prove this without more information on the warbler but it is thought to live and feed in the lower storeys of the forest (Watling 1982).

Adequate wildlife surveys have not been carried out over much of Fiji (F.Clunie pers.comm.) and more research on the numbers and distribution of most species is required. The warbler is probably a secretive species and could be easily missed by casual observers. Should a population of T. rufa be found then a study of its status is needed, with a view to possible transfer to a predator-free island. The Red Data Book status of this bird should be revised to indeterminate until more information is available.

## SUBFAMILY MONARCHINAE - MONARCHS

Though some authors place this group with the Muscicapinae or Old World Flycatchers, this account follows that of King (1981) in placing it on its own. The subfamily is spread across the Indian and Pacific Oceans and is represented by a large number of genera.

4-13-5 Silktail Lamprolia victoriae

Regarded by Mayr (1945) as "one of the most puzzling birds of the world", the relationships of this Fijian species are very obscure. While some authors (Cottrell 1966 and Heather 1977) suggest that it is a relative of the Riflebirds and Birds of Paradise (Paradisaeidae), others place it with the Sylviidae (Walters 1980). The most recently accepted interpretation is that of Olsen (1980), who places the silktail in the Monarchinae. Whatever the correct view it is clear that the silktail is of ancient origin and its limited distribution gives it high priority for protection.

Of the two subspecies, L.v. victoriae is endemic to Taveuni, where it is common in intact moist forest. This restricts it to the unpopulated and wet southeast of the island and to forest above 500m. Most observers (Heather 1977) note the species to be common there and there seems little cause for concern about its status. In contrast, L.v. kleinschmidti has a very restricted distribution and an apparently small population. R. Mercer (pers.comm.) has seen it only on the Natewa Peninsula of Vanua Levu and Heather (1977) recorded it from a small number of sites there. Subsequent studies by N. Langham

(pers.comm.) suggest that it is limited to a few areas of forest on the southern side of the peninsula. Unlike the Taveuni subspecies it appears to be restricted to low altitude forest, little of which remains intact in the area. The total population was estimated at considerably less than a hundred birds.

Currently the Vanua Levu silktail is endangered, hence qualifies for a listing in the Red Data Book. The major threat is probably habitat modification and loss through logging of dakua (Agathis vitiensis) and other timber species. There are no prospects for reserves in the area (A small reserve proposed by the National Trust for Fiji on the transinsular highway is out of the silktail range). An urgent study of the status and ecology of this subspecies is required so that adequate reserve proposals can be made. Consideration should be given to the prospects for establishment of a population on another island, though the opportunities for this appear to be limited.

#### POMAREA FLYCATCHERS

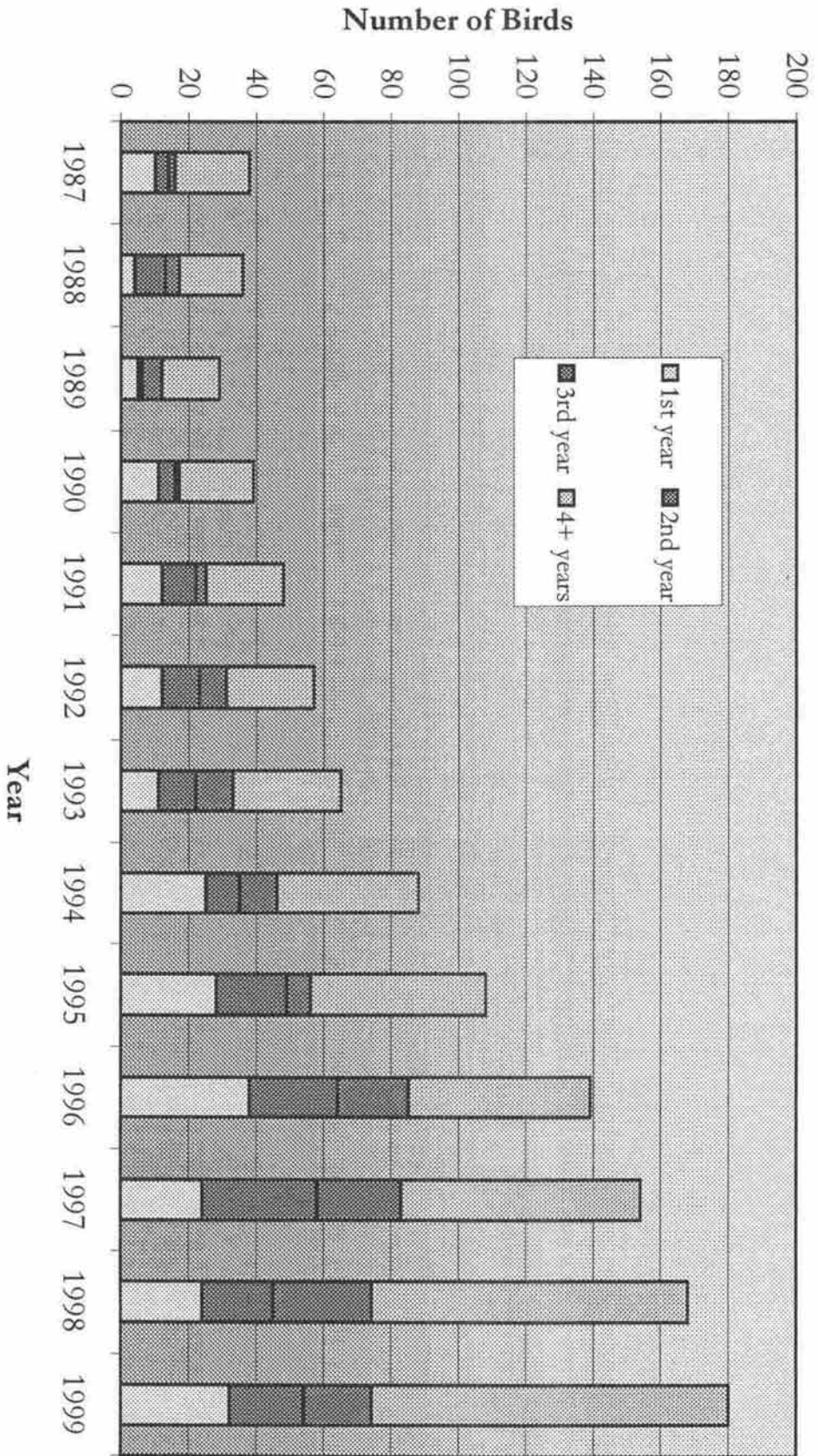
The genus Pomarea has undergone a radiation of forms in eastern Polynesia similar to that of Acrocephalus but its route of colonisation appears to have been different, as related genera occur right across Melanesia and Polynesia.

All species are small, insectivorous birds whose territorial habits and chattering calls render them relatively easy to locate and census when present.

The following genus summary illustrates the status of all species and sub-species (data from Holyoak and Thibault 1984). Of the six species and twelve forms, a high proportion are either extinct or at risk.

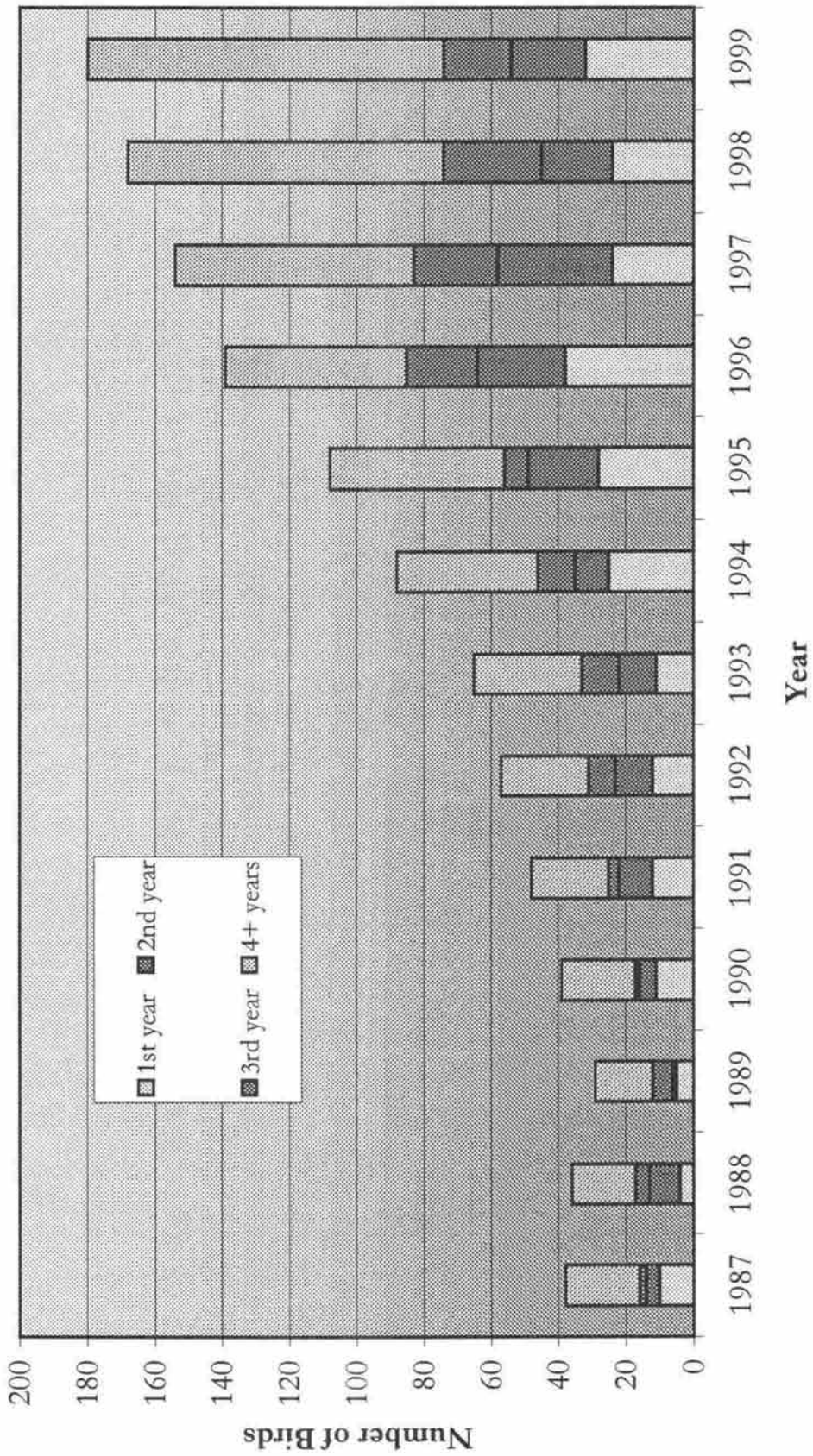
Form	Distribution	Status
<u>dimidiata</u>	Rarotonga	20-30
<u>pomarea</u>	Maupiti	extinct
<u>nigra</u>		
<u>n. nigra</u>	Tahiti	100-500
<u>n. tabuensis</u>	Tongatapu (Tonga)	extinct
<u>n. pomarea</u>	Maupiti	extinct
<u>iphis</u>		
<u>i. iphis</u>	Ua Huku	common
<u>i. fluxa</u>	Eiao	endangered
<u>mendozae</u>		
<u>m. mendozae</u>	Hiva Oa and Tahuata	endangered
<u>m. motanensis</u>	Mohotani	500-700
<u>m. mira</u>	Ua Pou	300-400
<u>m. nukuhivae</u>	Nuku Hiva	extinct
<u>whitneyi</u>	Fatu Hiva	common

# Kakerori Population Change





# Kakerori Population Change







4-13-6 RAROTONGA FLYCATCHER (Kakerori) Pomarea dimidiata

The rarest of the native landbirds of the Cook Islands is undoubtedly the kakerori, which is restricted to the forested interior of Rarotonga. The species has been rare for at least this century, as evidenced by the comparative lack of success of European collectors, who only accounted for ten between 1871 and 1923. There are two colour-phases, one a dark grey and light grey, and the other a vivid ginger. Despite the illustrations in du Pont (1975), these phases may not relate to sex or age.

A series of surveys in 1973 by David Holyoak resulted in sightings of five birds, two in a southern catchment near Te Kou and three in the Tupapa Valley in the north (Holyoak and Trubaut 1984). Subsequently, in 1981, following the possible sighting of one bird by B. Brown near the peak of Te Rua Manga, a six week survey of a large area of the island by several members of the Ornithological Society of New Zealand resulted in no birds being seen at all (T.G. Lovegrove pers.comm.). A definite sighting was made, however, in August 1982 by E. Cameron (pers.comm.). This bird was seen at approximately 300 metres altitude in dense forest in an area where J. Hosking, a local resident, had regularly seen them. The sighting was repeated in October 1983 by E.G. Turbott, when he and Hosking saw a flycatcher at the same locality (E.G. Turbott, pers.comm.).

Knowledge of the species was greatly increased in December, 1983 when David Todd, an ornithologist associated with ICBP, carried out a private survey over much of Rarotonga. He located at least 21 birds and two nests, the first ever recorded. The birds were concentrated mainly in the upper reaches of the southern catchments, with the greatest number in the Totokoitu Valley (D. Todd pers.comm.). By chance, the areas searched by Todd and the New Zealand party two years earlier were complementary, with little overlap in coverage. Currently, therefore, the flycatcher is known to exist in small numbers in specific areas of Rarotonga, the most important locality being the Totokoitu Valley.

The cause of its rarity is not clear, particularly as little is known of its breeding biology, but the influence of European rats may be important. Rattus norvegicus was introduced during the 1800s and R. rattus has probably been present for a similar period (Atkinson 1984). Suggestions have also been made (C.J. Ralph pers.comm.) that the habitat requirements are very specific and the vegetation may be limiting distribution. Though the interior of Rarotonga is well forested, a government proposal to create Lucaena plantations to feed a power plant could threaten the habitat.

Currently some investigations are being carried out in the Totokoitu catchment by a local biologist, Gerald McCormack, who is accumulating some important data. As part of this programme, 8 kakerori have been colour-banded and it is hoped that they will form the basis of a more intensive study.

The kakerori's chances of survival should be enhanced by the following

## actions:

1. Reservation of an adequate area of forest free from disturbance through timber-cutting, clearance or other undue human activity. A reserve centred on the Taipara and totokoitu catchments appears most suitable, though extensions should be considered depending on results of further surveys. The establishment of such a reserve would be compatible with a current Government proposal for a large water supply scheme for Rarotonga. The restrictions that should apply to a water-supply catchment should benefit the wildlife of that reserve, providing there was no substantial habitat disturbance associated with the construction of water intakes, etc.
2. A further survey in areas not already searched. There are some valleys that have not already been covered and some of these may contain kakerori. An analysis of vegetation would be an important component of such a study.
3. A study of habitat requirements. This is a longer term project which may involve research on feeding and breeding over one or two seasons. The best means by which this study can be carried out is probably through funding a scholarship for research at doctoral or post-doctoral level. Such a scholarship should provide a living wage for two seasons and facilities for analysis at a suitable University such as Auckland.

Currently classified as vulnerable in the Red Data Book, the kakerori warrants a reclassification as endangered.

4-13-7 EIAO FLYCATCHER Pomarea iphis fluxa

Endemic to the island of Eiao in the Marquesas, this subspecies has undergone a serious reduction in range and numbers since 48 specimens were collected by the Whitney South Seas Expedition in 1922. It was not seen during a brief visit in 1975 (Holyoak and Thibault 1984) but may still survive in remnant areas of forest, as flycatchers were reported by Montgomery, et.al. (1980) in 1977.

Eiao is seriously deforested and eroded as a result of over-grazing by sheep and pigs and will continue to deteriorate unless these animals are controlled (Decker 1973). Though created a reserve in 1971, Eiao has since been the site of military activity and was proposed as a site for nuclear weapons testing. Given its recognition as an important ecosystem and habitat for several endemic forms of bird, it is important that it be managed for reserve purposes. Survival of the flycatcher depends on control or removal of feral grazing mammals and subsequent reafforestation. A survey to determine the status of the subspecies is urgently required.

4-13-8 HIVA OA FLYCATCHER Pomarea mendozae mendozae

Once occurring on Hiva Oa and Tahuata, this subspecies is now extinct on the 52 sq.km. latter island and is in critically low numbers on the

former. This decline has occurred since the 1920s when the Whitney South Seas Expedition collected a large series of specimens. In 1929 Fisher and Wetmore (1931) saw none on Hiva Oa, but it survived at least until 1975 when a single female was observed on the ridge between Puamau and Ootua (Holyoak and Thibault 1984). The latest record of this bird is that of Montgomery et.al. (1980), who saw several in July 1977. Despite several weeks of searching by the former expedition, though, none were found on Tahuata and it is regarded as extinct there.

Like *P. dimidiata*, this species appears to favour wooded valleys. A current restriction to higher altitude is probably the result of clearance and over-grazing lower down. Survival of these birds probably depends on the management of adequate reserves. This must involve the control of feral mammals and the fencing of lowland forest remnants. More information on the status and distribution of the species is also required.

4-13-9 UAPOU FLYCATCHER Pomarea mendozae mira

Endemic to Uapou Island in the Marquesas, this subspecies is believed to have decreased in range and population since its discovery in 1921-22 by the Whitney South Seas Expedition. Fisher (Fisher and Wetmore 1931) did not find it in 1929, suggesting that it had disappeared from the coastal region, but an estimate of 300-400 birds was made in 1971 and 1975 (Holyoak and Thibault 1984). The population was concentrated in the region above 550m. altitude, the densest population being in the Hohoi Valley.

Like most of the Marquesas Islands, Uapou has been largely deforested, woodland now comprising 15% whereas it once covered 90% of the land area. This, combined with the effects of feral stock, is placing most forest wildlife at risk. Though action for this bird may not appear urgent, the creation of secure forest reserves, particularly in the Hohoi Valley, is vital.

4-13-10 NUKUHIVA FLYCATCHER Pomarea mendozae nukuhivae

While many specimens of this flycatcher were taken on Nuku Hiva Island in the 19th Century, it was regarded as rare by the collectors for the Whitney South Seas Expedition in the 1920s and was not found in 192 and 1975, despite thorough searches (Holyoak and Thibault 1984).

In 1922 the subspecies was confined to wooded valleys at the western end of the island and it is most likely to be located there if it still exists. Given excessive grazing by goats and cattle, however, it is unlikely that adequate habitat remains. If not relocated by a future survey, this bird should be classified as extinct.

4-13-11 TAHITI FLYCATCHER Pomarea nigra nigra

Once thought to be close to extinction (King 1981), this species (the

other two subspecies are extinct) was rediscovered in small numbers on the slopes of Mount Marau in the northwest of Tahiti during the 1970s (Holyoak and Thibault 1977).

As with other threatened Pomarea species, the Tahiti flycatcher apparently favoured low altitude forests before extensive grazing and clearance removed much of that habitat. Their current distribution is thus a relict of a much broader earlier one.

The relative accessibility of the Tahiti flycatcher renders it a very suitable species for an intensive study of habitat requirements. Information gathered during this and the similar study recommended for the Rarotonga flycatcher would be of value in conservation work on all Pomarea species.

#### 4-13-12 TRUK MONARCH Metabolus rugensis

Endemic to the Truk Group, Caroline Islands, this monarch constitutes a monotypic genus. It has been recorded from a number of the islands of Truk but recent records are restricted to Moen, Uman, Uoot, and Tol, where it has been described as rare (King 1981). There is some evidence of a recovery following extreme rarity during World War II and it is possible that disturbance to the island's ecosystems associated with that period may have caused the decline.

Surveys of the island are currently underway (J. Engbring pers. comm.) and the results of these will help indicate what action is necessary to ensure the survival of the genus. Like other monarchs already discussed, Metabolus is an active, vocal bird whose population should be readily censused.

#### 4-13-13 VERSICOLOR FLYCATCHER Mayrornis versicolor

Three species comprise this genus of small flycatchers found in Fiji and the Santa Cruz Islands. While M. lessoni is widely distributed in the Fijian Islands, M. schistaceus and M. versicolor are each restricted to a single island (Mayr, 1945). The former is found on Vanikoro Island, where its status is probably secure, while the latter was described by Mayr (1933b) from specimens collected on Ogea Levu Island in the Lau Group, Fiji during the Whitney South Seas Expedition in 1924.

The versicolor flycatcher differs from its relatives by having a rufous breast. Little is known of its habits, though it is probably confined to indigenous forest. Ogea Levu is little modified, most of its 13 sq. km. being forested and the human inhabitants living on the coastal fringe. Since the Whitney Expedition there have been no ornithological visits to Ogea Levu (D. Watling pers. comm.), so nothing is known of the species' current status or of its possible interactions with the sympatric M. lessoni.

In view of its restricted distribution and the possibility of future exploitation of its forest habitat, the species probably warrants

indeterminate status in the Red Data Book. Certainly its status requires investigation. A proposal for a survey of Ogea Levu has been made by D. Watling.

4-13-14 GUAM FLYCATCHER Myiagra freyceniti

Once abundant in all habitats of Guam except the southern savannahs, this species had apparently begun to decline during World War II (Baker 1951) and is now restricted to the mature forest of the northern limestone cliff area. Pratt et al. (1979) noted a marked decline between 1976 and 1978 and, from the results of surveys by Jenkins (1983), it is now regarded as being seriously in danger of extinction.

The most important feature of any conservation work on this species is protection of its habitat in the northern cliff and plateau habitats. This area is the responsibility of the U.S. armed forces.

4-14 FAMILY ZOSTEROPIDAE - WHITE-EYES

Small, yellowish-green and white birds with a ring of white feathers around the eye, white-eyes range through tropical and sub-tropical regions of the Old World. The family includes some 87 species (Walters 1980), 65 of which are in the genus Zosterops. While most species are not at risk and some, like Z. lateralis are remarkably widespread and abundant, five Pacific species or subspecies are recorded in the Red Data Book.

4-14-1 PONAPE GREATER WHITE-EYE Rukia longirostra

The genus Rukia comprises three white-eyes, each endemic to one Micronesian island or island group. Though there is some controversy over the taxonomy of this group (Pratt et al. 1980), it is agreed that they constitute species quite distinct from other white-eyes. Generally, they are large and have a superficial resemblance to the reed-warblers of the genus Acrocephalus. Two species are classified as rare or endangered while the other one, on Yap, appears relatively secure (Pratt et al. 1977). A fourth species, on Palau, was previously regarded as a member of this genus (Mayr 1967) but is now placed in the monotypic Megazosterops (Pratt et al. 1980).

The Ponape greater white-eye is one of the largest species. It is endemic to the 334 sq.km. island of Ponape, where it is restricted to forest above 500m. altitude. Little is known of its distribution there, as few have ever been recorded (King 1981). The most recent records are of several seen in 1975 in mountain forest and two seen during a brief survey in 1977 (Ralph and Sakai 1979).

Though the species is protected under Trust Territory law, its forest habitat is at risk of clearance. More information on the numbers and distribution is urgently needed and it is hoped that surveys currently planned by the U.S. Fish and Wildlife Service will provide it.

4-14-2 TRUK GREATER WHITE-EYE Rukia ruki

The second of the endangered species of Rukia is found only on the largest island of the Truk group, Tol Island (34 sq.km.). Its distribution there appears to be limited to a tiny (12 ha.) area of montane rain forest around the summit of Mt. Winibot where three individuals were seen in 1975 (King 1981). Though this and other remnants have been recommended as reserves (Douglas 1969, Dahl 1980), they are not yet secure.

The causes of the white-eye's rarity are not clear, though habitat loss is undoubtedly important.

If it still survives, this species is in a very precarious position and urgent conservation measures are required. The results of a recent survey by the U.S. Fish and Wildlife Service will help to indicate what is necessary. The species may be a suitable candidate for translocation to another island.

4-14-3 WHITE-BREASTED WHITE-EYE Zosterops albogularis

Endemic to the 35 sq.km. Norfolk Island, this white-eye is, like several of the other Norfolk species, confined to the 405 ha. area of Mt. Pitt Reserve, the only forest remnant on the island. This species represents the first of three colonisations of Norfolk Island by white-eyes, the most recent being by the widespread Z. lateralis, which survives well in open habitat.

A 1962 estimate of less than 50 birds (King 1981) was probably optimistic as few had been seen during surveys aimed uniquely at that species. During the most recent survey (Schoode et.al. 1983) they were found to be very rare in the reserve and thus warrant a seriously endangered status. While habitat loss is probably the main cause of the decline, it is possible that habitat loss and competition with the other species may have been important.

4-14-4 ROTA BRIDLED WHITE-EYE Zosterops conspicillata rotensis

Restricted to the island of Rota in the North Marianas, this is one of the six sub-species of bridled white-eye. The others are dispersed through the Marianas, Palau and the Carolines and are not currently endangered, the Guam sub-species is very restricted in range and is potentially at risk (Pratt et.al 1979, Jenkins 1983).

In 1976 this white-eye was restricted to upland areas of Pandanus woodland where clearance for agriculture was reducing the amount of habitat. In 1977 it was found to be moderately common (Ralph and Sakai 1979). The reasons for the restriction in range are not clear, but competition with the introduced black drongo Dicrurus macrocercus has been suggested (King 1981).

The current indeterminate status of this white-eye should be retained in the absence of more detailed information and the Guam sub-species should be added to the vulnerable list.

4-14-5 GIZO WHITE-EYE Zosterops luteirostris  
luteirostris

One of two subspecies, the Gizo white-eye is restricted to the 35 sq.km. island of Gizo in the central Solomon Islands. Though once abundant (Murphy 1929), it is now endangered as a result of logging and clearance on the island.

In the absence of an adequate forest reserve, the prospects for survival are not good. Proposals for reserves (J.M. Diamond pers.comm, Dahl 1980) have not been taken up. Further investigation on Gizo are needed to determine the status of the white-eye and to assess the possibilities for protection on the island or liberation elsewhere.

4-18 FAMILY ESTRILDIDAE - WAXBILLS

This family of finches is distributed across the tropical Old World from Africa, through Asia, to Australia and the western Pacific. They are small seed-eaters with short, stout pointed bills and often bright colours. One genus, Erythrura, is found in the Pacific Islands, and there are two forms listed in the Red Data Book.

4-18-1 PALAU BLUE-FACED PARROT FINCH Erythrura trichroa  
pelewensis

The blue-faced parrot-finch is a very widespread species, subspecies being found in Celebes, the Moluccas, New Guinea and adjacent islands, the Bismarcks, northeastern Australia, Palau, the Carolines, Solomons, Vanuatu and New Caledonia. The single type specimen of the Palau subspecies was collected early this century on Babelthuap and none were seen thereafter until six were observed on eastern Arakabesan in 1976. Further individuals were seen on Babelthuap and on small islands south of Urukthapel in 1978 and subsequently they were discovered in small numbers on most of the small rock islands in that area (Pratt et.al. 1980).

The species is relatively inconspicuous despite its bright blue, green and red colouration and is difficult to census. There is some evidence of nomadism on Palau (Pratt et.al. 1980) and this would confound attempts to obtain an accurate assessment of numbers. Nevertheless, it is in low numbers and its indeterminate Red Data Book status should be reviewed to rare. It is on the official Trust Territory list of endangered species and hence protected.

4-18-2 PINK-BILLED PARROTFINCH Erythrura kleinshmidtii

Possibly the most aberrant member of the genus (Mayr 1945), the pink-billed parrotfinch is relatively large, with a very heavy pale-pink bill. It is confined to Viti Levu, Fiji, where its distribution appears to be fairly restricted.

Though it has always been considered as rare (King 1981), recent sightings suggest that it is more common and widespread than previously thought (F. Clunie pers. comm.). Known from the Nadrau Plateau (Clunie and Perks 1972) and in lowland rain forest at Nailagosakelo Creek close to Suva (Clunie 1973), the species favours undisturbed indigenous forest but has also been found in locos plantations in the wet zone. It is a relatively inconspicuous bird despite its colourful appearance and is most frequently found amongst mixed-species flocks of insectivorous birds.

While substantial areas of indigenous Fijian forest remain, this species is probably secure. However, despite a major plan for a parks and reserves system having been produced by the Fiji National Trust, few have been created and logging and clearance are occurring at a high rate.

## 4-16 FAMILY STURNIDAE - STARLINGS

Almost ubiquitous in the Old world, the starling family comprises 110 species, one of which may be the most abundant of all birds, the European starling, Sturnus vulgaris. The Sturnidae are represented in the Indo-Pacific by 22 species in the genus Aplonis. These are medium-sized passerines of dark and often glossy colour with a bright yellow or brown coloured iris. They are active and capable fliers, feed on a wide variety of foods and nest in holes or cavities.

Some islands show the results of multiple invasions by Aplonis stock. For example, the Samoan islands are populated by an endemic species, the fua A. atrifusca and three subspecies of the widespread miti vao or Polynesian starling A. tabuensis.

The Red Data Book lists two species as being at risk. In addition, two species, A. corvina from Kusaie in the Carolines and A. mavornata from Raiatea in the Societies, are already extinct. A further species, the Rarotonga starling, is added to the endangered list here.

4-16-1 PONAPE MOUNTAIN STARLING Aplonis pelzelni

Restricted to the mountain forest of Ponape in the eastern Carolines, this species has decreased in abundance and range since 59 specimens were collected in 1932 (Baker 1951). A small number (1-4) was seen in 1975 during a brief survey (King 1981), but the island has not been adequately surveyed.



The reasons for the decline are not clear, but it has been suggested (Greenway 1958) that this species may be susceptible to the predation by rats that probably caused the extinction of the Kusaie starling.

The species is protected under U.S. and trust territory law but until more is known of its status, appropriate conservation recommendations apart from habitat protection cannot be made.

#### 4-16-2 SANTO MOUNTAIN STARLING Aplonis santovestris

Restricted to cloud forest above 1000m. on Espiritu Santo, Vanuatu, this species is rare and localised (King 1981). The centres of its population are probably the Tabwemassana Massif and Mount Wataimasan but little information on its distribution is available. A major expedition in 1971 failed to locate any but three pairs have been seen subsequently (King 1981).

The reasons for the species' restriction are not clear as the habitat in this region is little disturbed. In view of that and of the relative security of high altitude areas on Espiritu Santo, there is little cause for immediate concern (R. Pickering, pers.comm.) but its status in the Red Data Book should remain as rare.

The lack of information available for this species illustrates the need for adequate surveys of the status of indigenous wildlife in Vanuatu.

#### 4-16-3 RAROTONGA STARLING Aplonis cinerascens

Endemic to the 66 sq.km. Rarotonga in the Cook Islands, this starling was described by Hartlaub and Finsch (1871). It is restricted to the forested interior of the island, where it is distributed evenly.

While being regarded as abundant early this century (Wilson 1907) and still frequent in 1973 (Holyoak and Thibault 1984), the species does not appear to be common currently (T. Lovegrove pers.comm, G. McCormack pers.comm., pers.obs.). While an estimate of 100 birds may be pessimistic, the species was found nowhere to be abundant in 1984.

The introduced Indian myna Acridotheres tristis has been suggested as competing for food and nest-sites with the indigenous species in Rarotonga. However, the myna is abundant in the cultivated coastal strip where the starling is not found and is uncommon in the indigenous forest. Differences in habitat preference probably ameliorate any possible competition. Snip rats are common in the forest, as are cats, and these mammals may be affecting the starlings.

A study of the status and ecology of the Rarotonga is required and may be carried out in conjunction with the more urgent study of the Rarotonga flycatcher.

## 4-17 FAMILY ARTAMIDAE - WOOD SWALLOWS

small family of ten species in the genus Artamus, the wood swallows are aerial foragers generally larger than true swallows. Their distribution centres on the Indonesian-Australian region and only one species occurs in the Pacific Islands.

4-17-1 PALAU WHITE-BREASTED WOOD SWALLOW Artamus leucorhynchus pelewensis

The white-breasted wood swallow is perhaps that most widespread and abundant species in the genus. Ten subspecies are found from the Andaman Islands in the Indian Ocean, through Indonesia to Palau, Fiji and northern Australia. They are conspicuous birds with striking black and white plumage and a habit of hawking insects over open country.

The Palau subspecies is the only one believed to be at risk. It has been collected on the islands of Babelthuap and Angaur and seen rarely on most of the others of the group (Baker 1951) but may now be restricted to the remote upland savannahs of Babelthuap (397 sq. km.) (Pratt et.al. 1980). The reasons for its rarity are not clear, though this type of habitat is restricted in area. The population was estimated in 1978 at several hundred birds but there has not been an accurate census carried out.

The wood swallow is on the Trust Territory Endangered Species List and is protected by law.

## 4-18 FAMILY CORVIDAE - CROWS

Surprisingly, only two of the 111 species of crow and jay around the world are believed to be at risk (though two from New Zealand have long been extinct). Both endangered species, the 'alala or Hawaiian crow, and the Marianas crow are Pacific Island forms.

4-18-1 MARIANAS CROW Corvus kubaryi

Endemic to the islands of Rota and Guam, the Marianas crow has never apparently been common, though it was distributed over most of Guam during the 1940s and 1950s (Baker 1951). It is an omnivorous species, forest dwelling, and is regarded as unusually tame (Engbring and Ramsey 1981).

Despite an endangered classification in the Red Data Book, the crow was one of the most frequently detected species on Guam during the most recent survey of Engbring and Ramsey. This is partly due to the fact that it is mobile, and conspicuous when calling. The estimate for the Guam population in 1981 was 357 birds, concentrated in the northern quarter of the island. This represents a substantial reduction in range since the 1950s. Despite this, the population may have increased in the last few years (Engbring and Ramsey 1981, Pratt et.al. 1979). On Rota, Ralph and Sakai (1979) found a density of

crows similar to that on Guam .

While an apparent increase in the crow population is encouraging, the status of the Guam avifauna in general is precarious for reasons that are not yet fully understood. The species is listed in the Guam Endangered Species List and is thus protected by law. Its endangered species classification in the Red Data Book should remain in view of the recent crash in numbers of Guam birds as a whole. Though Rota hasn't suffered the same loss of birds as Guam, its forest area is only half as large.

## CHAPTER 5

## A. REGIONAL REVIEW OF WILDLIFE PROTECTION

## 5-1 INTRODUCTION

Though the foregoing chapters paint a fairly bleak picture of wildlife protection in the Pacific Islands, there are officials and amateurs currently working in the area and legislation for them to work under. This chapter seeks to review briefly the present framework of wildlife conservation activity in the Pacific Islands under a number of categories. Firstly, the legislation under which wildlife and wildlife habitat may be protected is looked at, as are some other laws affecting conservation. The work of agencies and individuals is also discussed. Finally, a review of outstanding wildlife localities is presented. Selection of these areas is based on information from a variety of sources and their listing must be regarded as preliminary. A comprehensive listing of areas of outstanding significance to birds will depend on a large series of ground surveys yet to be carried out.

## 5-2 CONSERVATION LEGISLATION

Four categories of legislation affecting the conservation of birds are looked at in each country or territory:

1. General environmental policies.
2. Wildlife protection laws.
3. Statutes for protected natural areas and the system of land tenure under which they may operate.
4. International conventions.

Information in this review is taken from Dahl (1980), SPREP (1981), and VeVenkatesh and Va'ai (1981).

## 5-2-1 AMERICAN SAMOA

The Economic Development, Quality of Life and Coastal Zone Management Plans seek to govern the type of development that may be carried out in the territory of American Samoa, and these contain provision for protected areas. The results of a number of resource and land-use surveys are incorporated into the Coastal Atlas, compiled under the Coastal Zone Management Plan.

American Samoan Government laws are supplemented by United States Federal laws, including the Endangered Species Act. At the present time there are no listings of birds from the territory so no specific protection applies.

The Coastal Zone Management Plan and the Territorial Comprehensive Outdoor Recreation Plan 1980-85 provide for a system of parks, forest and nature reserves. There are seven National Landmarks and three Conservation Zones declared under the Parks and Recreation Bill 1980.

Ninety percent of the land is under customary Samoan ownership, the rest being shared between freehold and individual Samoan tenure. Protection of large areas in reserves would have to be arranged through lease from the customary owners.

No international conventions have been entered into by the American Samoan Government but the US Federal government is a signatory to the Convention on the International Trade in Endangered Species (CITES) and other agreements which may have application in the territory.

#### 5-2-2 THE COOK ISLANDS

The first National Development Plan for the Cook Islands is a complex attempt to define the development goals of a scattered group of islands that are vastly differing in physical, social and biological character. The Planning Advisory Committee seeks to balance resource conservation and environmental protection with development.

There is no specific legislation protecting indigenous birds, though some are endangered. Ironically, the only bird species to receive statutory protection has been the myna, introduced in an unsuccessful attempt to control insect pests and now occurring in extreme abundance, particularly on Rarotonga where it has been blamed for the demise of other species. That protection has not been enforced recently when a bounty was placed on them but this was not at all successful in reducing their numbers.

The Conservation Act 1975 provides for the establishment of a Director of Conservation and theoretically provides a framework for the establishment of reserves, but there is no specific legislation arising from it. However, the uninhabited atoll of Suvarrow has been designated an International Maritime Park, thereby providing refuge for a large and important seabird fauna. Traditional conservation legislation operates effectively in some areas, particularly in the outer islands where the Raui concept can restrict access to and use of important zones. Almost the entire land area is under Maori ownership, though it may be leased to other users.

#### 5-2-3 FIJI

The 8th Development Plan (1981-85) emphasises natural resource based development "consistent with the maintenance of a healthy environment". It is acknowledged that a series of natural resource surveys will need to be carried out if this development is to proceed rationally. The Town Planning Act provides for "... the conservation of the natural beauties of the area including lakes and other inland waters, banks of rivers, foreshores of harbours and other parts of the sea, hill slopes and summits and valleys."

Legislation for the protection of endangered species is not adequate and is currently under review. It is probable that the new laws will provide marginally greater protection for some species but comprehensive protection of native birds is unlikely to result.

Designation and management of reserves is possible under a variety of agencies. The Native Land Trust Board administers land on behalf of customary Fijian owners and can proclaim Native Reserves under the Native Land Trust Act. The Ministry of Agriculture and Fisheries administers the Land Conservation Act which was established "... to make provision for the conservation and improvement of the land and water resources of Fiji." In consultation with the Native Lands Trust Board, the Minister of Forests may declare under the Forests Act 1953 "... any land, not being reserved forest or alienated land, to be a protected forest." The main body responsible for the establishment of parks and reserves in Fiji is the National Trust for Fiji (administered by the Ministry of Works and Communication), which is responsible for the National Parks and Reserves Bill 1970. This bill provides for the "... preservation and protection of the natural environment including unspoilt landscape, reefs and waters, indigenous flora and fauna including native organisms, habitats and ecological systems, features of scenic, historic or archaeological interest or any other scientific interest." Despite a comprehensive plan for a reserve system having been prepared jointly by the National Trust, the International Union for Conservation of Nature and World Wildlife Fund, the National Trust has a very small staff and an extremely limited budget. Eighty percent of land is under communal "Matiqali" ownership with approximately ten percent freehold and the remainder under state control.

Fiji is signatory to the International Plant Protection Convention, Plant Protection Agreement for the South-East Asia and Pacific Region and to the Convention on the Conservation of Nature in the South Pacific.

#### 5-2-4 FRENCH POLYNESIA

At present there is no overall environmental plan for these islands, despite the need for an environmental policy being implicit in the Eighth Economic and Social Development Plan.

The hunting and destruction of all species of birds is prohibited by a decree enacted in 1967. The broad scope of this decree may count against its effectiveness and it appears to be seldom enforced. In recognition of problems caused by past introductions (over 30 bird species), conditions were laid down in 1977 and 1978 restricting the importation of live animals.

Though various Forestry Regulations control wood felling, clearing and bush-fires, there is no specific legislation providing for the establishment of a reserve network though some (e.g. Eiao) have been declared by decree. Eighty-five percent of the land is in Polynesian ownership, though a large proportion of this in the Society Group is leased to Chinese. It is possible for French citizens to purchase land and people of other nationalities may do so with difficulty.

## 5-2-5 GUAM

Guam has a very comprehensive series of plans for aquatic, terrestrial and social development. Explicit in all these is a commitment to maintaining a high quality of air, water and land beneficial to plants and wildlife.

The Endangered and Threatened Species Act, Plants and Animals and Agriculture Codes, and Game and Fish Laws all have a bearing on the protection of bird species, and there is a comprehensive list of endangered species registered under the Act. Some of these are also included in the US Federal List and receive protection under Federal law.

The Department of Land Management, the Guam Environmental Protection Agency, the Department of Parks and Recreation, the Department of Agriculture and the U.S. Armed Forces all have some input into the possible creation and administration of reserves and wildlife refuges. These may be designated under Government Codes on Conservation, Parks and Monuments, Historic Preservation laws and Parks and Recreation rules. One third of the land is under direct control of the United States Federal Government while a third each are owned by the Government of Guam and small private holdings.

The US Government is signatory to the CITES Treaty on trade in endangered wildlife.

## 5-2-6 KIRIBATI

The National Development Plan of Kiribati seeks to "... protect the environment from pollution and irresponsible commercial depredation." Government Policies seek the acceptance of a need for conservation of wildlife and natural areas.

Under the Wildlife Conservation Ordinance 1971 any bird may be declared a protected species and its hunting or killing prohibited.

Under the above legislation any area may be declared a wildlife sanctuary and access to parts of that area prohibited. In addition, the Prohibited Areas Ordinance 1957 provides for the closing to the public of any area of land or territorial water. Water supply reserves may also be designated under the Public Utilities Ordinance 1977. Most of the land is in small hereditary holdings though some is controlled by missions. The difficulty of land negotiations is shown by the large amount of litigation before the courts however.

## 5-2-7 NEW CALEDONIA

The forestry and mining policies of the territory embrace a commitment to establishing a network of representative botanical and faunal reserves. Currently, some 60,00 ha. of reserves have been gazetted.

Listed endangered birds and seabirds are completely protected and hunting of most others is controlled. These laws do not adequately protect some rare birds such as the kagu and Ouvaea horned parakeet.

Decree 405 of 1910 lays down restrictions prohibiting deforestation of certain sites and decree 54-1110 of 1954 proscribes mining in certain protection zones. Nature reserves can be established under the forest or the mining policy. All land was originally taken over by the State when France assumed control, and they then allocated areas to different groups. Melanesians control a growing proportion, presently around 400,000 hectares, while non-Melanesian rural land comprises some 300,000 hectares. Smaller areas are in mission or company control while the Government is still responsible for large areas, including the reserve network. It is assumed that a similar reserve administration will apply under the projected independence of New Caledonia from France.

New Caledonia has accepted the Convention on the Conservation of Nature in the South Pacific and is party to the CITES agreement on trade in endangered wildlife.

#### 5-2-8 NIUE

The National Development Plan (NNDP 1990-1985) emphasises socio-economic development and social services and does not specify protection of the biological environment, though it is recognised in one Chapter.

There is no listing of endangered species but there is a season for the taking of pigeons and bats under the Wildlife Ordinance 1972.

The role of traditional law is very strong in the management of Niue Island affairs. Therefore, despite a lack of Government legislation under which reserves may be created, tapu forest areas, particularly at Huvalu, are secure at this stage. Niueans and the Government own all the land and no alienation is permitted, though the Government may lease areas for up to 60 years.

#### 5-2-9 PITCAIRN ISLANDS

Because of its small size, Pitcairn does not have a specific body of law covering environmental issues. All land is under family ownership and theoretically may be bought and sold, though this never occurs. The legal status of the islands of Oeno, Ducie and Henderson is not clear, though as Pitcairn Protectorates they are assumed to be British Crown Land.

Pitcairn is party to the CITES international agreement on trade in endangered wildlife. Henderson Island is under consideration as a World Heritage Site under the World Heritage Convention which Great Britain has recently ratified.



## 5-2-10 SOLOMON ISLANDS

The current Five-year Development Plan includes the following policy points relevant to the conservation of wildlife and its habitat:

- development opportunities to be set in the context of environmental opportunities and constraints, resource availability and sustainability;
- comprehensive and integrated natural resource management a high-priority national interest;
- establishment of an appropriate system of controls to protect environment, resources and people;
- application or adaptation of suitable custom conservation practices to modern development needs;
- a National Conservation Strategy.

The Wild Birds Protection Act 1914/30 stipulates protection for some indigenous birds and imposes seasons on the hunting of others but is little enforced. Specific protections for rare and endangered species are required.

The National Parks Act 1954 provides for the establishment of designated protected natural areas, and the Forests and Timber Act 1969/77 includes environmental provisions such as the declaring of a "controlled forest". The Town and Country Planning Act 1979 gives the Planning Board the power to zone areas for preservation. Of the 29,785 sq. km. land area, 88 percent is in customary tenure while the remaining 12 percent is alienated, half to Solomon Islanders and half to outsiders, with some leased to companies and missions.

## 5-2-11 TOKELAU

Because of the dependence of a dense population on a limited area of atoll, most of Tokelau's conservation policies relate to protection of the human environment. Tree planting is one of the aims of a compulsory annual conservation week.

There is no endangered species protection legislation.

Reserve laws do not exist, though there is a restriction placed on the rights of foreign vessels to land on the atolls. All the land is under family ownership.

Tokelau is not, of itself, party to international environmental agreements as the New Zealand acts for the country at the international level.

## 5-2-12 KINGDOM OF TONGA

Economic and social policies are embodied in the Kingdom's Five Year Development Plan. This seeks to develop Tonga's natural resources in a sustainable fashion and to minimize environmental damage. All development projects are subject to environmental impact surveys supervised by the Office for National Parks and Reserves and the Department of Lands and Survey.

The Birds and Fish Preservation Act allows for the complete protection of some named species and of controlled hunting for others. In practice, this lends protection to very few birds (the introduced feral rock pigeon has been a recipient of protection) and it is acknowledged that the act needs updating.

The above Act also makes some provision for protected areas, as do the Parks and Reserves Act 1976 and the Forest Act. Under these acts, however, there is only one small terrestrial reserve, on Tongatapu. The Eastern side of 'Eua Island, long proposed for National Park status, remains unprotected. All land is Crown controlled but large estates are divided amongst the Nobles. Every Tongan male, on reaching the age of 16, is entitled to an allocation of three ha. of rural land and a small town plot. This places great pressure on land as in many areas demand is outstripping availability. Alienation of land is not permitted. Of 747 sq. km. land area, 66 percent is given over to allotments while the remainder is divided between Government, Tongan, foreign and church leases, Nobles' land and Government land. The small existing reserves are Government property.

## 5-2-13 TRUST TERRITORY OF THE PACIFIC ISLANDS

Embodying the Federated States of Micronesia, the North Marianas Islands, and the Republics of Palau and the Marshall Islands, these countries are treated together here as each is still in the process of achieving independence from United States trusteeship. Nature conservation legislation is generally unchanged from that of the TTPI.

The Trust Territory Environmental Quality Protection Act 1972 states a "public policy" which seeks to "maintain land quality ... and to the greatest degree practicable prevent injury to plant and animal life". This policy and its statutes are administered by the Trust Territory Environmental Protection Board.

The Endangered Species Act 1975 gives authority to the Chief Conservationist to establish a broad range of programmes aimed at protecting designated endangered species.

The above Act also contains provision for the acquisition and management of land or aquatic habitat for the conservation of resident species. The Land Use Planning Act 1972 gives authority to the various states to establish land-use zoning laws. Land ownership is complex but generally, in contrast to Polynesian and Melanesian islands, there is a considerable amount of public land, much of it a

legacy of earlier control by German and Japanese governments.

U.S. Federal laws applying to the states of the TTPI include the Endangered Species Act and the Fish and Wildlife Coordination Act (in which the US Department of the Interior provides technical assistance for the management of wildlife resources). The National Environmental Policy Act requires that all federally funded development proposals be subject to an Environmental Impact Assessment.

#### 5-2-14 TUVALU

The Tuvalu Development Plan acknowledges the need to protect the environment from unnecessary exploitation and recognises a traditional dependency on wildlife and the need to conserve stocks.

There is specific Wildlife Conservation legislation protecting most seabirds but this dates from early Gilbert and Ellice Island Wildlife Ordinances and is seldom enforced.

The above legislation contains the power to create wildlife sanctuaries, as does that concerning Prohibited Areas. There is no legislation, however, allowing for the protection of vegetation types. Most land is owned in small family holdings.

#### 5-2-15 VANUATU

Environmental policy is enshrined in article 7(d) of the country's Constitution:

- "Every person has the following fundamental duties to himself and his descendants and to others:

(d) to protect Vanuatu and to safeguard the national wealth, resources and environment in the interests of the present generation and of future generations".

The Joint Wild Life and Bird Protection Regulation No. 5 of 1967 protects certain bird species by seasonal prohibition of hunting, particularly of pigeons, and by regulating export and banning hunting at night. Fourteen species, including both of those listed in the Red Data Book, are fully protected. Most of the pigeons, two ducks and the megapode are subject to a closed hunting season between 1 September and 31 May and restricted to a limit bag of ten of each species during the rest of the year.

The Joint Forestry Regulation No. 30 1964 provides the authority to declare forest reserves. Tree-felling in forest areas is generally subject to regulation and deforestation cannot proceed without a permit. Legislation for national parks and reserves is being considered and a number of suitable sites have been identified. All land is under indigenous custom ownership though leases may be negotiated with the owners.

## 5-2-16 WALLIS AND FUTUNA

These islands have no specific conservation policy or laws though there are traditional restraints on the taking of wildlife species. International agreements entered into by France presumably also apply to Wallis and Futuna.

## 5-2-17 WESTERN SAMOA

Environmental policy is embodied in the Five Year Plan which recognizes environmental problems and the need for conservation. There are conservation policies concerning forestry, agriculture and national parks. There is no legislation covering endangered species or bird protection. The need for this is recognized and an Animal Bill is under consideration.

Habitat protection is possible under the Forestry Act 1967, the National Parks and Reserves Act 1974 and the Land Ordinance 1959. O Le Pupu Pu'e National Park and five reserves have been established under the National Parks and Reserves Act. Eighty percent of the land is in custom ownership while the remaining 20 percent is divided between the Government and freehold. The creation of O Le Pupu Pu'e National Park was facilitated because that land was already owned by the Government, having already been alienated by the German Government when it was in control early this Century. The creation of further parks will probably involve lease negotiations with local owners.

Western Samoa was the first country signatory to the Convention for the Conservation of Nature in the South Pacific 1976.

## 5-3 BIRD CONSERVATION ACTIVITY IN THE PACIFIC

### 5-3-1 RESEARCH

Despite being poorly endowed with conservation biologists, the Pacific Ocean area has attracted outside attention for a long period. This attention has come from scientific institutions, amateur groups and interested individuals. For example, the American Museum of Natural History was responsible for the Whitney South Seas Expedition, which constituted the most thorough ornithological exploration seen in the Pacific. The Smithsonian Institution sponsored the Pacific Ocean Biological Survey Programme (POBSP) which, in the 1960s, resulted in considerable data on seabirds of the central Pacific. In addition numerous other studies have been sponsored by those and other scientific institutions around the world. Notable have been ORSTOM (France), the Paris Museum of Natural History, Australian National Museum, Sydney Museum, National Museum of New Zealand, Auckland Museum, the Yamashina Institute of Ornithology (Japan), the Universities of Chicago and Kansas and others, the Bernice P. Bishop Museum (Hawaii), the University of Hawaii and Brigham Young University (Hawaii). Much work has also originated from the members of study groups such as the Royal Australian Ornithologists' Union,

Ornithological Society, of New Zealand, Hawaii Audubon Society and Pacific Seabird Group.

### 5-3-2 CONSERVATION

The following organisations and individuals are making or have recently made a significant contribution to ornithology and specifically towards bird conservation:

The International Council for Bird Preservation has recently supported some in the region, notably the search by D. Watling for the Fiji petrel on Gau Island and seabird surveys of the Lau Group currently being carried out by F. Clunie of the Fiji Museum, and is considering support for bird surveys in the Solomons.

SPREP is currently active in the fields of general nature conservation, education and the study of traditional knowledge of nature conservation. Besides supporting the research for this document, they are also assisting the Kiribati Wildlife Conservation Unit.

The World Wildlife Fund, International Union for the Conservation of Nature and Natural Resources and United Nations Environment Programme have all been involved in some projects in the region but further work will undoubtedly depend on the reliable identification of worthwhile projects.

The United States Fish and Wildlife Service is responsible for wildlife surveys of American Samoa, the Trust Territory of the Pacific Islands (the Republics of Palau and the Marshall Islands, Federated States of Micronesia, Commonwealth of the North Marianas) and Guam. The Micronesian surveys are being carried out by the Service in conjunction with local authorities, while the most recent one in American Samoa was contracted to Environmental Consultants Inc., the ornithology being the responsibility of A.B. Amerson Jr.

The U.S. Forest Service has carried out a small amount of survey work in Micronesia. Dr C.J. Ralph of the Service has also visited Rarotonga and other islands and advised on bird conservation in a private capacity.

The Australian Parks and Wildlife Service is responsible for work on the rare species of Norfolk Island.

The New Zealand Wildlife Service has recently been involved, through SPREP, in the cat control programme on Christmas Island. A willingness has been expressed to be involved in more work of this nature but this is at present inhibited by inadequate staff levels (R.T. Adams pers.comm.).

The New Zealand Department of Lands and Survey has sponsored conservation work in the Pacific, including the establishment and initial management of O Le Pupū Pu'e National Park in Western Samoa.

The New Zealand Forest Service has assisted with forestry plans and operations in a number of areas, notably in Tonga and Western Samoa, where plans for forest industries included the setting aside of representative reserves. New Zealand aid is still sought and given for forestry work.

### 5-3-3 LOCAL GROUPS

There are no nature conservation groups in Kiribati but a recent report on behalf of the Kiribati Government by Dr Martin Garnett included the results of some surveys of bird distribution and numbers. The Wildlife Conservation Unit, Kiritimati is a Government and Aid funded body responsible for protection of the bird reserve on Christmas Island. This group is also supported by SPREP.

The Solomon Islands do not have a conservation or natural history study group, though the Australian Rainforests conservation group has been carrying out a study of forest conservation of the islands (see Scobie, 1982). Recent ornithological work has been carried out by Dr Jared M. Diamond, who has prepared "A proposed forest reserve system and conservation strategy for the Solomon Islands". This proposes a network of reserves of the size and shape designed to protect the maximum number of forest bird species.

In Vanuatu, the Vanuatu Natural Science Society seeks to foster knowledge and appreciation of indigenous wildlife. Their journal "Naika" is published in English, French and Bislama and includes material such as a compilation of custom attitudes to conservation in various parts of the country, and a number of articles on birds by R.E. Pickering.

In New Caledonia, there are two private organisations in addition to the official agencies which have some involvement with bird conservation. The Office de la Recherche Scientifique et Technique Outre-mer (ORSTOM) has carried out some bird work but does not currently have an ornithologist in the Territory.

Until 1984, the Service des Eaux et Forêts has been responsible for the management of the biological reserves but this function has now been separated from forestry and is part of the work of Circonscription Industriel et Développement Economique Rural Sud. The territory's only professional ornithologist, M. Yves Letocart, is employed by CIDER-Sud. M. Letocart has collaborated with another local ornithologist, M. Francis Hannecart, on a two volume guide to the birds of the region.

The Association pour la Sauvegarde de la Nature Neo-Caledonienne is a private organisation dedicated to nature conservation in the region. The association produces an annual journal "Nature Caledonienne" which covers a wide range of environmental issues and is active in the

fields of education and lobbying. Its founder and secretary, M. Jean-Louis d'Auzon is responsible for much of its success.

The Societe Ornithologique Neo-Caledonienne, though primarily involved in work with caged birds, has been responsible with Service des Eaux et Forets in establishing the successful kagu breeding enclosures at Parc Forestier in Noumea.

In Fiji the Department of Forestry is responsible for some habitat protection and conservation education through its education officer, Mrs Asenaca Ravuvu.

The National Trust for Fiji has a statutory role in furnishing Fiji with a parks and reserves system but is limited financially, having one full time executive officer, Mr Birandra E. Singh. The Chairman of the Trust, Mr Robin Mercer, is the author of a guide to some of the common birds of Fiji.

The Fiji Museum, through its Director, Mr Fergus Clunie, has made a major contribution to recent ornithological study in Fiji. Fergus Clunie is the author of many papers and articles on birds and his planned work on distribution should have a vital bearing on future conservation work there.

Author of a recent book on the birds of Fiji, Tonga and Samoa, Dr Dick Watling has been recently resident in Fiji. His activities in bird conservation include the successful search for the Fiji petrel and a proposed survey for the versicolor flycatcher.

In Tonga, official agencies with an involvement in nature conservation include the Department of Agriculture, Fisheries and Forests, and the Parks and Reserves Section of the Department of Lands and Survey. There are no local private wildlife study or conservation groups, though there are some individuals, notably Mr Deiter Renke, who has been studying red-breasted musk parrots on 'Eua, who have been involved in some bird work.

In Western Samoa, the Parks and Reserves section of the Ministry of Agriculture and Forests is the main wildlife conservation agency. Ranger in charge of this section is Mr Kalati Poai, whose main responsibility is the management of O Le Pupu Pu'e National Park. There is a small natural history study group comprised mainly of expatriate Europeans.

The Cook Islands do not have any private groups involved in natural history conservation but the Department of Education is sponsoring Science Advisor, Mr Gerald McCormack, who is preparing a series of natural history guides, including one on birds, appropriate for local use. He is also accumulating a considerable amount of information on birds of the islands and local knowledge of them. A guide to the birds of the Cook Islands has already been prepared on behalf of the

Cook Islands Library and Museum Society by Mr David Holyoak (Holyoak 1980).

The overall supervision of conservation activity in the Cook Islands is the responsibility of Mr Tony Utanga, Secretary for Internal Affairs.

In French Polynesia there is an ORSTOM research office but there is no current ornithological work. Recent work carried out by D.T. Holyoak and J.-C. Thibault has culminated in the publication of "Birds of Eastern Polynesia" published by the Paris Museum of Natural History.

A Tahiti based conservation group, Te Ora Natura, focuses its activity on a range of environmental issues in the area, some of which involve conservation of bird habitat.

A number of other groups and individuals from outside French Polynesia are making a significant contribution there, notably David Holyoak and J.-C. Thibault, Philip Bruner of Brigham Young University, Hawaii, Steve Montgomery of the University of Hawaii, Mark Fowler and others.

#### 5-4 BIRD HABITATS OF REGIONAL SIGNIFICANCE

##### 5-4-1 INTRODUCTION

The biogeographic classifications of the Pacific adopted by Dahl (1980) are followed here as they provide the best basis for assessing the international biological significance of the sites in each country. Those areas under protection are indicated along with those requiring protection. In each of Dahl's Provinces important landbird and seabird sites are documented where known. It must be emphasised that this list is not an exhaustive compilation of all bird habitats, but a series of representative sites whose protection could most realistically benefit bird conservation in the Pacific.

The establishment of a network of reserves is central to the aims of bird conservation, and must be a major aim of the bird survey work recommended above. The recently gazetted O Le Pupu-Pu'e National Park in Western Samoa is an example of what is needed to preserve a representative range of habitats. The success of such a park depends largely on the use made of it by locals and visitors, so promotion of the concept is necessary.

##### 5-4-2 REGION III SOLOMON ISLANDS.

Of 26 the terrestrial biomes recognized by Dahl, there are small reserves representing six. The largest area under any protection is the 6,080 ha. Queen Elizabeth National Park on Guadalcanal but much of its area is degraded because of clearing and burning for gardens and through logging. A small area of controlled forest on Kolombangara accounts for protection of examples of four biomes and this completes the area under protected status. Diversity of birds and the level of endemism are both very high, with 40 endemic species out of a total



avifauna of 126 species.

There are no regionally significant seabird colonies in the Solomons but the habitat of Beck's petrel and Heinroth's shearwater will probably require protection if located in the region.

Further terrestrial reserves are required in the face of heavy logging pressure on some of the islands. Particularly important are large forest reserves on Guadalcanal, San Cristobal, Choiseul and Santa Isabel. Further forest reserves recommended by Diamond (undated) are on Rennell (five species and ten subspecies of bird endemic), Kolombangara, Malaita, New Georgia, Rendova, Tetepare, Ranongga, Gizo, Uki Ni Masi and Oema (pigeon colonies). San Cristobal has six endemic birds, one of them rare and another possibly extinct. Of all the Solomons this one should probably receive the highest priority. The distribution of all forest species is poorly known and survey work is urgent.

#### 5-4-3 REGION IV - NEW CALEDONIA, LOYALTY ISLANDS

While only seven of the 22 biomes of this region are represented in reserves, they constitute one of the most comprehensive reserve networks in the southwest Pacific islands.

The New Caledonian reserves are of several types, as follows:

STATUS	NAME	AREA (ha.)	
Total Nature Reserve	Montagne des Sources	5,870	
Territorial Parks	Riviere Bleue	9,000	
	Tny	1,050	
Special Marine Reserve	Yves Merlet	22,925	
Wildlife Sanctuaries	Haute Yate	4,300	
	Lepredour Island	560	
	Pam Island	450	
	Aoupinie	5,420	
	Botanical Reserves	Mont Mou	675
		Mont Panie	5,080
		Mont Humboldt	1,600
	South (7 areas)	4,508	

In addition, 20,678 ha. of "forest reserves" supervised by the Department of Waters and Forests are areas where hunting and other forest use is controlled. Further to this are nearly 200,000 ha. of mining reserves in which mining is prohibited.

The largest seabird colonies are those on the outer edges of this Province, namely at the Chesterfield Islands in the west and on Matthew, Hunter and Walpole islands to the southeast. The former is an atoll formation with extensive reefs, lagoon and coral cays. As such, it enjoys a degree of natural protection. It warrants status as either a territorial or international park, however, as it has probably the largest seabird populations in the Coral Sea. Matthew,

Hunter and Walpole are, in contrast, small islands, the former two volcanic (Matthew is still active, and the latter raised limestone). Being remote from land and uninhabited, they are all important seabird rookeries. Potential reserve status for Matthew and Hunter is jeopardised by an ownership dispute between the governments of France and Vanuatu. French military occupation of Hunter Island may be affecting its seabird population.

Closer to the mainland, the barrier reef islands in the Yves Merlet Marine Reserve include representative colonies of some of the more common species of seabird and rookeries for the osprey Pandion haliaetus (T.G. Lovegrove pers.comm.). On la Grande Terre, there are colonies of petrels and shearwaters (Pterodroma rostrata, Puffinus gavia and P. l'herminieri) breeding at high altitude. These need to be identified to determine further requirements for protection.

The adequacy of the terrestrial reserves for conserving the indigenous birds of the region is affected by the apparently disjunct distribution of some species such as the kagu and the pigeon vert, and by the accessibility to hunters. Perhaps the most important area under protection is that included in Parc Territorial de la Riviere Bleue et la Riviere Blanche, some 16,500 ha. of forest and serpentine vegetation. This area, in the southeast of the territory, includes some of the most extensive and important habitat for the kagu and other forest dwelling endemic birds such as the notou. It is also under relatively little pressure from Melanesian land claims (Y. Letocart pers.comm.). These claims and moves towards independence may place some of the areas, particularly forest reserves such as Col d'Amieu, in doubt as to their protected status. Negotiation of protected status that is acceptable to Melanesian land owners is needed, particularly on the Loyalty Islands where there are no reserves to protect the endemic species and subspecies of bird.

On the Loyalty Islands and the Isle of Pines there are no reserves except for the 848 ha. Oro Peninsula on the Isle of Pines, an area subject to rights of customary use. In view of the number of endemic species and subspecies of birds present, there is some urgency for establishment of suitable sanctuaries on Ouvea, Lifou and Mare. A recent proposal for a wood-fired power station on Mare would have required much of the area currently forested under plantation for fuel species.

Yande Island to the northwest of la Grande Terre is a small coastal island with one village on which was recently discovered perhaps the last population of the New Caledonian island thrush, Turdus poliocephalus xanthopus, now probably extinct on the mainland (de Naurois 1982). Subspecies from Mare and Lifou are also extinct.

#### 5-4-4 PROVINCE V - VANUATU - SANTA CRUZ

This Province has not been well surveyed for seabirds. There are, however, few atolls and a consequent lack of large rookeries as in the Solomons Province. The Reef Islands have been proposed as reserves

(Dahl 1980) and, as such, would secure rookeries on the only atoll in Vanuatu. There are breeding colonies of shearwaters in the inland of some of the large islands, e.g. Tanna and Anatom, and these probably contain Audubon's shearwater Puffinus l'herminieri. The distribution of seabirds on the small islands of the Province is poorly known and survey work would be welcomed. A seabird rookery on Fatutaka is worthy of protection.

Of 21 terrestrial biomes in these islands identified by Dahl (1980), none have been given any specific reserve status. Representative reserves in each of the major forest types would provide the best basis for bird protection. Particularly important are lowland areas. Though much of the lowlands of Vanuatu and Santa Cruz have been logged there are suitable areas for protection, particularly in the Santa Cruz Islands and on Erromango where logging is taking place presently and in some areas of Espiritu Santo where clearance for agriculture is occurring. The islands of Vanikoro and Ndende are urgently in need of survey for suitable forest and bird reserves. In addition to lowland areas, the high altitude cloud forest of Espiritu Santo should be reserved for the Santo mountain starling and other bird species. Duck Lake, Efate has been proposed as a reserve for freshwater and forest birds.

#### 5-4-5 PROVINCE VI - NORFOLK - LORD HOWE - KERMADEC

Of these sub-tropical islands, only Norfolk is discussed here. Lord Howe and the Kermadecs are Australian and New Zealand territory respectively and are each already subject to intensive bird conservation programmes.

For its land area, Norfolk presents some of the most urgent bird conservation problems in the Pacific, with the Norfolk Island parakeet, boobook owl, gray-headed blackbird and white-breasted silvereye all endangered.

Philip Island has been proposed as a reserve but is so severely devegetated and eroded that its value is minimal. Nepean Island, a small stack, is free of the rabbits which destroyed the Philip Island vegetation and probably free of predators, hence would be a suitable reserve for the protection of a variety of seabirds, particularly petrels and shearwaters.

The survival of the landbirds of Norfolk depends on the protection and health of the remaining large indigenous forest stand, a 120ha. reserve around Mount Pitt and Mount Bates. Though reserved, this area suffers from stock grazing and requires fencing.

#### 5-4-6 PROVINCE VII - FIJI

The Fijian Province consists of a very large number of islands of all geological types, ranging from tiny atolls to the large and diverse islands of Vanua Levu and Viti Levu. Of 27 terrestrial biomes

identified by Dahl, there are reserves in six in Fiji. These reserves range from the small (20 ha.) Vunimoli montane rainforest reserve on Vanua Levu to the 4,000 ha. Ravilevu reserve on the southeastern side of Taveuni. The status of these reserves varies and the areas best for nature protection are generally those unsuitable for logging or agriculture.

All the major seabird rookeries are yet to be identified, though a series of surveys currently being conducted by F. Clunie will provide detailed information for many of the islands of eastern Fiji, particularly those of the Lau group. Recent discoveries by D. Watling of the phoenix petrel and Mac'Gillivray's petrel breeding on the high island of Gau illustrate the amount still to be discovered about seabird distribution in the province. There are important rookeries on the Islands of Mambualau, Ogea Ndriki, Kamanabuli, Nukubasaqa, Nukutolu and Wailagilala (the site of a manned light-house) (J.A.F. Jenkins pers.comm.) and these would all be suitable as reserves. Petrels probably breed on many of the islands but there is a particularly important colony on the slopes of Mt Washington on the western end of Kadavu. Reservation of this area would encompass important forest bird habitat and provide Kadavu with its first protected area.

Forest reserves at all altitudes are urgently needed in Fiji in the face of extensive forest exploitation. The National Trust for Fiji has been able to secure one lowland (logged) reserve near Suva through a private donation from the Garrick estate and is in the process of securing a 110 ha. dakua reserve on the Transinsula Highway, Vanua Levu, but it does not have the resources to readily secure others. Protection of a large number of Fiji's birds depends on the retention of adequate habitat. Particularly important are endemic species such as the long-legged warbler, pink-billed parrot finch, red-throated lorikeet, Peale's pigeon, silktail, giant forest honeyeater and endemic species on Kadavu, Rotuma and Ogea Levu. Though the most important sites for these birds are not always known, reservation of the representative areas outlined in the Fiji National Trust Report on Parks and Reserves in Fiji would ensure safety for most of the more common species. More research is required on the distribution and status of the pink-billed parrotfinch, the Vanua Levu silktail and the versicolor flycatcher before the key sites for them can be protected. For the Vanua Levu silktail, however, it may be too late if critical areas along the Natewa Peninsula are logged.

#### 5-4-7 PROVINCE VIII - TONGA - NIUE

Of 13 types of terrestrial habitat, a reserve has been set aside in only one of them. On Niue, the limestone forest of the Huvalu tapu area is protected under customary law and there is a very small lowland forest reserve on Tongatapu. There is a clear requirement for additional reserves and Niue provides an example of the sort of protection which may be most appropriate.

There are no large seabird rookeries on Niue but a number on the Tongan islands. In the light of current knowledge, the most important

appear to include those on 'Ata and Nuku. Ata and some of the other southern islands have been unoccupied since last century when the King removed the populations to safety because of threats from slave-traders. 'Ata now contains an abundant seabird fauna (Douglas 1968, T.G. Lovegrove pers.comm.) and would be a suitable site for a national or international seabird reserve.

Niue is probably served by the Huvalu tapu forest but further forest reserves would assist in the conservation of the endemic subspecies of Polynesian triller on the island. Forest reserves are lacking in Tonga, though there has been a long-standing proposal to create a National Park on 'Eua. The eastern, limestone-terraced side of the island is particularly suitable as it contains a substantial area of relatively inaccessible and hence undisturbed rainforest. A forestry operation on the upper slopes of 'Eua would not interfere with the Park proposal and may enhance its protection. The success of this proposal would depend on resolution of local land-issues though, theoretically, the land in question is either government or Royal land.

Forest reserves are also recommended for Vava'u (endemic Tongan whistler), Tafahi, Niuatoputapu and Niuafo'ou (for the endemic megapode).

#### 5-4-8 PROVINCE IX - SAMOA, WALLIS AND FUTUNA

Of 32 types of terrestrial ecosystem identified by Dahl, 15 are represented in reserves, most of those in O Le Pupu Pu'e National Park in Western Samoa. Other important reserves are the Tusitala Historic and Nature Reserve in Western Samoa and the Rose Atoll National Wildlife Refuge in American Samoa.

Rose Atoll is a very important seabird breeding area under U.S. Federal protection. Other important seabird sites are on Swains and Ta'u Islands (American Samoa) and the Aleipata Islands (Western Samoa). The results of Amerson et.al's. (1982) surveys showed a very high diversity and large population of petrels and shearwaters on Ta'u. The island was recognised by Dahl as having National Park potential but, because of its importance to seabirds, it would probably be more suitable as a site for a wildlife refuge. Creation of such a status would have to be done with the wishes and cooperation of the local inhabitants. The Aleipata Islands, east of Upolu, have been recommended as tooth-billed pigeon sanctuaries (King 1981). While unsuitable for this purpose, Nu'utele is a candidate for Western Samoa's only seabird reserve.

O Le Pupu Pu'e National Park preserves a range of lowland and montane forest types and is consequently a key area in the Province for bird conservation. It protects populations of all the major forest species of Upolu, including the rare endemic tooth-billed pigeon and the mao. A similar reserve is required on Savaii in view of deforestation of the western end of the island. Of the UNDAT/IUCN survey reserve recommendations, it appears that one incorporating coastal forest at Tafua, southeast Savaii and the slopes of Mt Silisili to the summit

would preserve the greatest range of habitats. A coastal reserve is particularly important, as are examples of the high altitude habitats of the island. Such a reserve would assist in and may ensure the protection of species such as the Samoan white-eye, which is endemic to Savaii, the tooth-billed pigeon and mao, possibly the Samoan wood-rail if its existence is reconfirmed, and other endemic Samoan species. Planning for this and other reserves needs to include forest bird surveys. Further montane areas on Upolu suitable as bird reserves include Lakes Lanato'o and Olomaga, Tiavi, Kuipisia and Matautu.

There are no reserves on Wallis and Futuna but Alofi (near Futuna, is well wooded and uninhabited and would be a suitable reserve for the blue-crowned lory, which is shrinking markedly in range (Watling 1982). Futuna Island supports endemic subspecies of the white-collared kingfisher, Polynesian triller, and Fiji shrikebill, and the requirements for their protection need to be investigated.

#### 5-4-9 PROVINCE X - TUVALU, TOKELAU

This Province comprises a small number of inhabited atolls. The opportunities for bird conservation are not great as there are few sites with bird populations of significance. Child (1960) commented on the exploitation of seabirds in Tuvalu, indicating that populations were sparse because of that. There are, however, colonies of most of the common species of terns, noddies and boobies on relatively undisturbed islets. Funafuti, for example, has the following breeding species: black-naped, bridled, grey-backed, white and crested terns; and brown and black noddies. The investigation of suitable islets for seabird protection is a priority in Tuvalu and Tokelau.

The landbird fauna is very limited, and the opportunities for reservation of terrestrial vegetation are similarly so. There are no reserves currently.

#### 5-4-10 PROVINCE X - KIRIBATI, NAURU

This province, like the last, mainly comprises inhabited atolls, and includes western Kiribati, Nauru and Banaba (Ocean Island). Again the major bird groups are seabirds, which are not generally common, though they are important to local fishermen as indicators of fish schools (Child 1960). There are no reserves, though clearly some are desirable.

Seabirds occur on all the main islands but the only large colonies appear to be on some small islets, e.g. Kotabu and Naibini, Butaritari. These are planned as reserves (Dahl 1980) and could be supplemented by others on Tarawa. More investigation of the distribution and abundance of seabirds is required.

## 5-4-11 PROVINCE XII - MARIANA ISLANDS

The Commonwealth of the North Marianas and particularly Guam have severe bird conservation problems but also have local and U.S. agencies currently attempting their solution. For this reason they are not treated in detail here.

There are seabird colonies at some points on Guam and particularly on the northernmost of the Marianas. Maug and Sariguan are scheduled as wildlife reserves under the Commonwealth Constitution and the islands of Uracas, Gugan and Farallon de Medinilla were proposed as Islands for Science under the International Biological Programme (Douglas 1969). Farallon de Medinilla has since been used as a bombing range by the U.S. but may still be suitable as a seabird reserve.

Existing terrestrial reserves on Guam comprise approximately five percent of the territory but they are not likely to be adequate to protect the landbird fauna. Most of Guam's birds, including several endangered species, are restricted to the far north. A reserve centred on Ritidian Point could encompass much of the remaining occupied habitat.

Asuncion Island is a suitable site for a further reserve as it contains a healthy population of the Micronesian megapode. Forest reserves are required for the protection of endemic species on the inhabited islands of the North Marianas, particularly Saipan, Rota and Tinian.

## 5-4-12 PROVINCE XIII - CAROLINE ISLANDS

This is a very diverse Province comprising islands ranging from the continental remnants of Palau and Yap to volcanic islands such as Kosrae and Ponape, and some atoll formations. As such and because of a high bird species diversity, the conservation interest for the area is very high. Of 31 landbird species on Palau, five are endemic, while the figures for the Carolines are 28 and nine respectively. Eighteen species are listed by Dahl (1980) as endangered while 12 have been considered here. Once again, however, the area has been subject to considerable attention from ornithologists from the U.S.A. and consequently does not receive comprehensive treatment here.

The only reserves currently in the Province are the Ngerukewid Wildlife Reserve in Palau and possibly a small area around the summit of Mt Winibot on Tol, Truk.

Important seabird rookeries occur on the following islands (Baker 1951, Douglas 1969, Owen 1977, Dahl 1980): Gaferut, East and West Fayu, Oroluk and Pikelot.

Further terrestrial reserves have been recommended for high altitude areas of Ponape, Kosrae, Tol, Moen, Dublon, Fefan and Uman in the Truk group, and forest areas of Babeldoop (Palau) and Yap.

## 5-4-13 PROVINCE XIV - MARSHALL ISLANDS

This Province consists exclusively of atolls, hence with few exceptions the interest in bird conservation involves seabirds. Two of the most important rookeries are apparently protected in reserves on Pokak and Bikar. The former is one of the most important in the Pacific, providing habitat for 20 species of seabird, while the latter has had 18 recorded (Douglas 1969). Fourteen species are known to breed at each site, some of them abundantly (Fosberg 1966). Other atolls with large numbers of seabirds are Taka, Wake, Jemo, Wotho, Ujelang, Ujae and Kwajalein.

Reserves are proposed for Wotho, Taka and Jemo (Dahl 1980), and research is required to determine the status of the Radak Micronesian pigeon on Wotje and Arno to see what habitat protection is necessary there.

## 5-4-14 PROVINCE XV - PHOENIX, LINE, NORTHERN COOK ISLANDS

All islands in this Province are either atolls or raised atolls. They come under the jurisdiction of three different governments; Kiribati for the Phoenix and Line Islands; U.S.A. for Palmyra, Howland, Baker and Jarvis; Cook Islands for the Northern Cooks. Most are uninhabited. Of the eight terrestrial biomes reported by Dahl, only seabird colonies are represented in reserves. These are comprehensive, however, protecting some of the most important sites in the whole Pacific. In addition to several reserves on Christmas (Kiritimati), the islands of Birnie, McKean, Phoenix, Malden, Starbuck and Vostok are Kiribati Wildlife Sanctuaries, while Jarvis, Howland and Baker are U.S. National Wildlife Refuges and Suwarrow is protected by the Cook Islands government.

Canton is also an important seabird island but its present status is uncertain. Other islands presently unreserved but having substantial seabird populations are Hull, Sydney, Caroline, Flint, Fanning and Palmyra.

Because of the significance of these islands Dahl has suggested an international reserve for the Phoenix group. Such a proposal would increase the protection that the islands already have without compromising sovereignty. Palmyra is privately owned but apparently unoccupied and may be a suitable site for a reserve under an organisation such as the U.S. Nature Conservancy. The northern Cook Islands are not well studied for seabirds, though Motu Kotawa and Motu Ko on Pukapuka deserve protection. Recent work by G.V. McCormack (pers.comm.) will provide more information for this area.

On Tabueran Island, adequate areas of the habitat of the endemic Christmas Island warbler habitat still require protection.



## 5-4-15 PROVINCE XVI - COOK, AUSTRAL ISLANDS

A mixture of high volcanic islands, makatea islands and atolls, this province is scattered over a wide area of ocean and includes some remote islands in the Australs. There are currently no reserves though there are a number of important conservation areas.

Seabirds are found breeding on some of the reefs and shores, with tropic birds and petrels nesting in the interior of the high islands such as Rarotonga. Takutea is probably the most important seabird site.

A number of endemic species and subspecies of landbird are found in the region and, though only two are considered here as endangered, there is a need for habitat protection for all. The first requirement for the protection of the Rarotonga endemics, the flycatcher and starling, is the reservation of an adequate area of the forested interior of the island, particularly in the narrow valleys to the south. Three subspecies of the kingfisher Halcyon venerata are found on Mangaia, Mauke and Atiu (the Rarotonga subspecies is extinct), while an endemic swiftlet Collocalia sawtelli occurs on Atiu. On Rimatara in the Australs there is an endemic lorikeet Vini kuhlii and an endemic subspecies of the Pitcairn reed warbler Acrocephalus vaughni, while another subspecies of the latter is common on Mangaia. Two subspecies of the Rarotonga fruit-dove Ptilinopus rarotongensis are found on Rarotonga and Atiu respectively. Finally, Aitutaki is the stronghold for threatened Pacific lorikeet. Protected areas on all these islands should ensure the survival of the common endemics.

## 5-4-16 PROVINCE XVII - SOCIETY ISLANDS

This Province consists of high islands, atolls and raised atolls. Ornithologically, the Societies are perhaps one of the most devastated groups of islands in the whole Pacific. Of 22 resident landbird species, 16 were endemic but nine forms have become extinct in European times and several more are threatened. Though there are proposed reserves on Tahiti, Tetiaroa, Raiatea and Moorea, the amount of land protected as bird habitat is not adequate.

Seabirds breed on a number of the atolls and also in undisturbed high altitude areas on some of the volcanic islands such as Tahiti. Important rookeries are found on Tetiaroa, Tubai, Mopihaa, Fenuaura and Motuone and reserve proposals have been made for all except Motuone (Dahl 1980). High altitude reserves for the Tahiti petrel should also be considered.

The greatest bird conservation problem in the Province is with terrestrial species. Currently, of those still extant, four have been considered here, while a further two, the green heron Butorides striatus and the swiftlet Aerodramus leucocephalus are also in low enough numbers to warrant concern. On Tahiti, remnant forest areas are in vital need of protection from grazing and

clearing, particularly in the Papenoo Valley (Society Islands pigeon) and on the slopes of Mt Marau (Tahiti flycatcher). On Moorea, the Polynesian warbler is seriously endangered but its habitat requirements are not clearly known. Bird reserves have also been proposed for Raiatea and Maupiti for protection of some of the more common endemic species (Dahl 1980).

#### 5-4-17 PROVINCE XVIII - TUAMOTU ARCHIPELAGO

The Tuamotus consist of a vast archipelago of atolls and one raised limestone island, Makatea. Despite being atolls, they have a number of localised and endemic landbirds in addition to some important seabirds areas. The fauna remains poorly known generally, however.

The most important sites for seabirds identified by Dahl (1980) are on Pukapuka, Tekokoto, Kauehe, Apataki, Rangiroa, Tikei, Taiaro and Kaukura. In most cases, small uninhabited islets which are parts of larger atolls provide the best seabird habitat. Seven petrels and shearwaters, two tropic birds, three boobies, two frigate birds and seven terns and noddies breed on islands of the group. The creation of reserves for seabirds would have to be undertaken with the cooperation of local inhabitants who rely on them as a food source in some areas. They also rely on seabirds as fish school indicators so the need for conservation is accepted for that reason (SPREP 1981).

Of the landbirds of the Tuamotus only one species of songbird has been established long enough to have evolved into subspecies. The long-billed warbler Acrocephalus caffer has six subspecies in the group. All are common (though some are restricted to one atoll) except the Napuka warbler, which may be extinct. The Society Islands ground dove once occurred throughout the Societies and the Tuamotus, but is now endangered and is probably restricted to one subspecies on Maturei Vavao (Lacan and Mougis 1974). The Society Islands pigeon is now restricted to a tiny remnant on Tahiti but a more substantial population on Makatea. The Tahiti lorikeet has a similarly relict distribution but is more common, occurring on several atolls, including the large Rangiroa. Of international significance is the Tuamotu sandpiper, now possibly restricted to fewer than five atolls, having been recorded recently only from Marutea du Sud and Maturei Vavao and possibly from Pinaki and Nukutavake. Surveys of these islands are urgently required. The significance of Maturei Vavao is quite clear, however, and its protection must be a priority.

#### 5-4-18 PROVINCE XIX - MARQUESAS ISLANDS

Along with the Societies, this group of volcanic islands presents one of the most serious sets of problems of bird conservation in the south Pacific. Biogeographically, the Province is relatively isolated from its neighbours and most of its bird species and subspecies are endemic. Two of these are already extinct and a further ten are listed here as endangered.

There are seabird rookeries on a number of the smaller islands such as

Ilot de Sable and those around Uanuka and Uapou, and on the larger islands of Hatutu, Motuoa and Fatuuka. Ilot de Sable and Hatutu are designated as reserves, with Hatutu perhaps the most important one in the Province. Proposals have been made for further seabird reserves on Fatuhuku; Motu Papa and Epiti (Uanuka); Cirque de Honoï, Motu Mokohe and Motu Oa (Uapou). These should ensure adequate conservation for all the common species.

Nukuhiva Island has the last remnants of the Marquesas pigeon, the few individuals being restricted to the valleys of Haatepuna, Hatiheu and Taipi. Protection of this species from hunting and reservation and fencing of its habitat are very urgent requirements. Also on Nukuhiva are remnant populations of the Nukuhiva flycatcher and ultramarine lorikeet and possible but unlikely survivors of the Marquesas fruit dove and the Nukuhiva subspecies of the Marquesas flycatcher. Hivaoo Island also had a rare subspecies of the above flycatcher, and the status of the Marquesas fruit dove there is not clear as Bruner (1972) regarded it as common, while Holyoak and Thibault (1984) regarded it as extinct. The most important sites for protection on the island appear to be the undisturbed wooded valleys around Puamau and Ootua. On Uapou Island a further subspecies of the Marquesas flycatcher is at risk, the densest concentration being in the Hohoi Valley. This area is one of the few forested areas left on the island.

Two islands, Eiao and Hatutu, were set aside as reserves in 1971 and these are both very important sites. On Hatutu may be the only surviving population of the Marquesas ground dove, and also an endemic subspecies of the Polynesian warbler. The island is free of predators and feral browsing mammals. Eiao is, by contrast, seriously eroded as a result of grazing. It supports a remnant population of the allied flycatcher Pomarea iphis and an endangered subspecies of the Polynesian warbler. Survival of these birds depends on forest recovery following control of the feral stock.

All of the larger islands of the Marquesas are urgently in need of forest restoration and protection work if more extinctions are to be avoided.

#### 5-4-19 PROVINCE XX - PITCAIRN, GAMBIER ISLANDS, RAPA

This province consists of scattered high volcanic, makatea and atoll type islands. There are approximately 16 terrestrial habitat types but none of them are under formal protection. Of the four islands of the Pitcairn group, only one is inhabited. The other three are little modified and are consequently very important bird habitats. The Gambier Islands are, in contrast, highly modified by humans, chiefly through burning, and few areas are now of ornithological significance. Rapa is also inhabited, but some primary forest remains and Marotiri is free of human disturbance.

This is a very important province for seabirds because it is one of the few island groups extending into the subtropical south Pacific. There are a number of endemic forms including the white-bellied storm petrel Fregetta grallaria titans and a race of the little

shearwater Puffinus assimilis which breed around Rapa (Du Pont 1976). Ducie, Oeno and Henderson Islands, with at least 12 breeding species each, are particularly important, having already been proposed as Islands for Science (Douglas 1969). In the Gambiers, despite the extensive modification, some islands have seabirds, notably Manui (Akamaru Atoll) and Motu Teiku, which is still a hunting site for local inhabitants. Studies are needed of the protection and management of these birds. In the Rapa region there is a need for the protection of Marotiri and of the islets around Rapa itself.

For terrestrial birds, the most important problems are the protection of Henderson Island (4 endemic species and subspecies) and forest remnants on Rapa Island for the Rapa fruit dove Ptilinopus huttoni). The latter are in need of fencing from feral goats.

## CHAPTER 6

## BIRD CONSERVATION - STRATEGY FOR THE PACIFIC ISLANDS

## 6-1 INTRODUCTION

Wildlife conservation projects may be classified into the following categories:

1. Study - to determine the status and distribution of wildlife populations.
2. Planning - acquisition of reserves and promulgation of legislation.
3. Study - to determine the habitat requirements of important species.
4. Species action - projects aimed at rescuing individual species.
5. Education - to provide public information on wildlife of local, regional and international significance.
6. Education - to publicize the need for wildlife conservation and to promote the means by which it may be achieved.

Ideally, an action plan for wildlife protection should proceed in the steps outlined above, with the most important objective being the retention of habitat. Despite the possible role of captive breeding and other single species work, priority must be given to the principle of maintaining a habitat reserve sufficient for the survival of a full representation of the biota. To achieve this, reserves need to be of adequate size and integrity. Land-use in other areas should also be compatible with retaining as many of the natural features as possible. Ideally, therefore, the reserve plan should be based on a full knowledge of the ecosystems.

In many countries bird conservation work has proceeded past the inventory stage and a large number of species are sufficiently well studied to enable the appropriate action for protection to be taken where necessary. In the Pacific basin, however, the avifauna is generally poorly known, particularly in the south-west of the region, much of our knowledge of distribution coming from the studies carried out by the Whitney South Sea Expedition in the 1920s and 1930s. Without detailed knowledge it is difficult to make regionally balanced conservation plans. To create a reserve for a species without adequate knowledge of its habitat requirements may mean that that reserve fails to fulfil its purpose. Similarly, to create reserves for wildlife without knowledge of centres of population is to risk having a non-representative reserve system. Ideally, therefore, a wildlife conservation strategy should follow a course based on a

thorough base of biological information. This is the philosophy behind regionally based conservation strategies such as the Heritage Programs of the United States Nature Conservancy.

The first priority for bird conservation in this region, therefore, is to build an inventory of species' status and distribution. This is being achieved in some areas, particularly those where the United States has a strong interest, namely the Micronesian islands of the North Marianas, Guam, Palau, the Marshalls and the Carolines, and American Samoa. The US Fish and Wildlife Service is currently involved in a series of bird surveys covering those islands, the aim being to understand the pattern of vertebrate wildlife distribution in relation to vegetation and other habitat characteristics. For much of the rest of the region, however, coverage is relatively poor, particularly on the larger, forested islands and the extensive archipelagos of atolls. In the high islands of the Solomons, Vanuatu, Fiji, Tonga, western Samoa and French Polynesia particularly, there is an urgent need for wildlife and wildlife habitat inventories. Similarly, surveys are required of groups of smaller islands throughout the region, particularly in Kiribati, Tuvalu, Fiji, Tonga, and the Tuamotus, the main purpose there being an inventory of seabird colonies.

Reserve plans have been prepared for a number of the countries of the region, but their implementation has met with varying success. Of the protected area requirements noted by Dani (1980), only a small proportion have been recognized, and that recognition is not necessarily always formal. For example, Suvarrow Atoll is classified as a reserve by the Cook Islands Government but that classification is not necessarily binding.

For some species and in some areas, there is sufficient knowledge to take action on specific problems. Despite a general lack of knowledge of birds of the region, therefore, it is practical and complementary to single out certain species for special attention because of their endemism, rarity, and local or regional significance. The results of these projects are likely to reach beyond the species themselves in spin-off effects on other species in the same environments and in publicity for conservation in general. A featured species approach is therefore recommended in addition to the need for a thorough inventory.

Publicity is an essential feature of a bird conservation strategy for the region. Without public countenancing of the aims of a bird conservation programme, its chances of success are restricted. Therefore an education project is proposed, where possible, to operate through Non-Governmental conservation agencies and interest groups.

## 6-2 WILDLIFE SURVEYS

As already mentioned, one of the key requirements of the region is information on the distribution and numbers of both rare and common species of birds. Concern over this is regularly echoed by officials of the island governments, who would generally support properly

constituted wildlife surveys, providing that funding and expertise was available from outside. Ironically, land-use studies and forest assessments have been carried out over many areas, e.g. Vanuatu (Quentin 1982) and western Samoa, but the opportunity to include a wildlife input has not been taken up. A proposal is made, therefore, to establish a wildlife survey unit capable of responding to requests for basic faunal assessment.

The composition of the unit must be appropriate to the resources available and to the magnitude of the survey tasks planned. As a potential model, the composition of the Hawaii Forest Bird Survey teams is examined (Scott et al. 1981). There, the team comprised 25 personnel, though most were not involved full-time. A group of eight ornithologists working for four months of each year and five botanists working four to six months were supervised by one full-time senior scientist and one full-time field supervisor. In addition, a statistician, an administrative officer, two field assistants and a team of track markers etc. were employed for part of each year. This was a maximum staffing level for a programme which was spread over six years and covered virtually all of the extant forests of the Hawaiian Islands. The results were impressive, enabling the production of a series of recovery plans based on detailed knowledge of the distribution and density of the avifauna. It was this knowledge which attracted the interest and abilities of the US Nature Conservancy and other private and public organisations to work towards securing key areas for protection (Kepler and Scott, in press).

The methodology is particularly appropriate to the survey of islands with a variety of forest communities, as it enables accurate assessments to be made of the densities of rare and common species alike. The basic steps are as follows (from Scott et al. 1981):

1. Identify discrete units of study based on vegetational, topographical, or other appropriate features.
2. Prepare a series of transects with an even distance between them and with a randomized start point. These transects should run perpendicular to contours on steep land and to major habitat features (watercourses etc.) on flat land.
3. At fixed intervals along each transect, carry out a series of eight-minute bird counts using the variable circle count technique devised by Reynolds et al. (1980). This method relies on distance estimations, perhaps the most difficult aspect of the field work about which to be rigorous. The distance between each count station will depend on local conditions such as the diversity and abundance of the avifauna.
4. At each station an assessment is made of aspects of the vegetation relevant to the bird survey. Vegetation type, composition, phenological details, structure, vigour, impact of feral mammals etc. are all noted in a standardized form.
5. Training of observers is vital to the success of such a survey (C.A. Kepler pers.comm.). Two to three weeks at the start of

each season of the Hawaii Forest Bird Survey was taken up with training in visual and auditory identification of birds, distance estimation, and dual counting to reduce observer differences as much as possible. Basic botanical training must also be given.

The advantages of using as large a team as possible are obvious. Variability resulting from seasonal changes is reduced as much as possible, and the results of the survey are available sooner. With the team referred to above, 48 counting stations, or approximately 2000 hectares per day could be covered. Thus, for example, the entire area of O Le Pupu Pu'e National Park in Western Samoa could theoretically be covered in one to two days. However, consideration must be given to the availability, and cost of such a team and to the support that could be provided within each country.

The major advantages of a smaller team, however, are ease of organisation and mobility in countries where transport, equipment and accommodation are limited, and a greatly reduced cost.

The long-term objective, therefore, is to establish a wildlife survey team capable of responding to requests for inventory data in terrestrial ecosystems. The basic methodology of the Hawaii Forest Bird Surveys is recommended because of its proven use in tropical island environments and also because of the need for systematic comparisons between regions. This methodology, has been adapted and is currently in use in Micronesia and will also be used in a future survey of American Samoa. Close liaison with US Fish and Wildlife Service is recommended. A major difference here, however, is that the scale of the operation must be appropriate to the limited resources available. Therefore, the use of volunteer labour and a minimum sized team is recommended wherever possible.

#### PRIORITY AREAS

1. Fiji Islands - forest birds in the larger islands. The effects of logging urgently need to be studied. Landbirds and seabirds in the small islands.
2. Western Samoa - forest birds in the larger islands.
3. Vanuatu - landbirds and seabirds on all islands.
4. French Polynesia - landbirds in Marquesas and Societies. Landbirds and seabirds in Tuamotus and Australs.
5. Solomon Islands - landbirds and seabirds on all islands, particularly where forest exploitation is occurring.
6. New Caledonia - landbirds on la Grande Terre and Loyalties.
7. Tongan Islands - seabirds on small islands, particularly southern group.
8. Cook Islands - seabirds on all islands, landbirds in southern



group.

The first phase of this work is a pilot study in one area. The islands of Western Samoa are recommended for a variety of reasons. They comprise two large land masses, Upolu and Savaii, and a small number of smaller islands, all areas being relatively accessible. The Department of Forests and Agriculture has requested such a survey (I. Reti pers.comm.) and has offered local logistic support. The results of this survey will help in planning those in other areas.

## 6-2-1 A WILDLIFE SURVEY OF WESTERN SAMOA

### INTRODUCTION

Ten of the 33 land-birds of the Samoan Islands are endemic species, three of those figuring in the list of rare and endangered forms referred to in Chapter 3 and several others potentially threatened. Study of the literature available on birds in Western Samoa reveals a poor understanding of the distribution and abundance of native species. A parks and reserves plan has been prepared (Holloway and Floyd 1975) but this involved little information on bird distribution. The plan for O Le Pupu Pu'e National Park (Ollier et.al. 1979) includes a species list and some more detailed information on distribution within the park, but is incomplete. Pressures on indigenous ecosystems are growing, with an increasing human population demanding cropping and plantation land, and with the extensive forestry development on Savaii. Further plans for reserves need to be based on a knowledge on the distribution and abundance of wildlife, and that need is relatively urgent.

### PERSONNEL

The research team should consist of the following:

1. Senior scientist - responsible for the overall supervision of the survey, planning, project design, analysis and preparation of the final report. Duration of employment one full year.
2. Technical assistant - logistic organisation, planning, liaison, assistance with analysis and report preparation. Duration of employment six months.
3. Field staff - four biologists responsible for recording of field data, coding for analysis, etc. Field experience in bird observation necessary. One botanist to be included. These workers will probably be volunteers whose transport, food and accommodation expenses will be met by the project.
4. Local liaison - two or more people to assist locally with transport, accommodation, negotiations with landowners and guiding. Duration of employment three to four months. It has been suggested that the local Department of Agriculture and Forests will be able to employ these assistants (I. Reti pers. comm.).

Suitably qualified staff will need to be prepared to remain in the field under basic conditions.

## METHODOLOGY

The methodology will broadly follow that of the Hawaii Forest Bird Surveys (Scott et. al. 1981). A series of representative forest study areas will be chosen on the main islands. These will be surveyed using the variable circle count technique (Reynolds et.al. 1980). In addition to bird survey data, the vegetation will be sampled and records taken of other vertebrate wildlife (reptiles and mammals). The full survey will take eight weeks, with a further four weeks for training and organisation. The survey should be carried out in the dry season, the most suitable time probably being between August and November.

In addition to forest surveys, brief visits will be made to offshore islands, particularly the Aleipata Islands east of Upolu, and Apolima between Upolu and Savaii. Inventories of forest and seabirds on these islands will form an important part of the project. Some night work in likely petrel and shearwater breeding areas will also be necessary.

## FACILITIES FOR ANALYSIS

It is appropriate that the project be based in New Zealand as an offer of accommodation has been made with the New Zealand Wildlife Service (R.T. Adams - Director, pers.comm.) and interest has been shown by the Department of Scientific and Industrial Research (R.M. Sadleir, pers. comm.). Negotiations will have to be made for computing facilities, but the programs used by the US Fish and Wildlife Service should be appropriate for the analysis of the data from this project.

## FUNDING

Input from several sources should be sought, with SPREP and ICBP having overall supervision and audit but with requests going through ICBP to World Wildlife Fund and through SPREP to the New Zealand and Australian Foreign Aid Programmes. While it may be possible to attract qualified volunteer labour, the budget should allow for salaries for the full team plus air fares from Australia or New Zealand.

## 6-2-2 OTHER SURVEYS

From time to time requests come to ICBP for support on ad hoc bird surveys of certain areas. While these usually produce valuable data, as in the case of the Fiji seabird surveys currently being undertaken, it is considered more valuable that future surveys should adhere to a basic methodology. This would ensure that they would be repeatable and that different areas could be compared reliably. It is therefore recommended that a set of guidelines be prepared for island surveys

and surveys for rare species. These probably should follow broadly the methodology referred to above.

### 6-3 FEATURED SPECIES

A number of species have been selected for special attention because of their rarity and international significance. One of the factors used in assessing conservation priorities is the degree of endemism of the bird concerned. Of the forms referred to here, only one, the kagu, constitutes an endemic family while several others are endemic genera.

#### 6-2-1 ENDEMIC FAMILY - KAGU (Rhynocnetos jubatus,

In terms of endemism, the kagu is the most important bird of the whole region. Though its status as a territorial symbol has not protected it from threats to its survival, it should lend weight to the need for action.

#### STATUS

- Endangered. 500-1000 individuals restricted to la Grande Terre, New Caledonia (Letocart 1984). Disjunct and scattered distribution with populations known in Riviere Bleue, Foret de la Thy, Dent de St. Vincent, Col des Rousettes, Mt. Cantaloupai, Massif de Tchinguou, near Poindimie and in some smaller areas (Jeggio 1979). An incomplete survey of local records (Beland 1975) suggested the greatest numbers to be on the wetter north-eastern side of the island.

#### THREATS

- Dogs used by poachers hunting pigs in reserves such as Parc Territoriale de la Riviere Bleue.
- Predation by cats, rats and wild pigs
- Habitat lost to nickel mining and forestry.

#### CURRENT WORK

- A network of reserves has been established (Dani 1980) but some of these are difficult to protect.
- A captive breeding programme at Parc Forestier near Noumea has produced over twenty fledglings, some of which have been released into the wild (Letocart 1984).
- Cats and other predators are regularly poisoned along tracks in Parc Territorial de la Riviere Bleue (Letocart 1984).

#### FUTURE NEEDS

- Urgent need for survey of all suitable habitat on la Grande Terre in order to gather reliable data on status and distribution of the species. The methodology for this study must be assessed in the light of availability of personnel, but the minimum requirement is for a team of four field workers to sample a range of habitat types and geographical areas over a period of three months in spring. Estimate of kagu density in each area will be made by recording locations of calling birds during a dawn listening period. Census in intensive study area in Parc Territoriale de la Riviere Bleue will provide

indices for making estimates of overall population.

- Radio-tracking study of individual kagu. Being a ground bird that is extraordinarily difficult to observe directly, the kagu is an ideal subject for a telemetry study. Firstly, the fate of juveniles raised in captivity and released into the wild must urgently be determined. The success or otherwise of that programme has important implications not only for the kagu, but also for other bird conservation work which includes captive breeding as an element. It is proposed that a sample of captive-bred and wild kagu be fitted with transmitters in order to obtain relative survivorship and range data. Preliminaries to this work have already been carried out by M. Yves Letocart, Circonscription du Developpement de l'Economie Rurale Sud and it is likely that equipment will be available through that agency. One field worker in addition to M. Letocart will be required to carry out the research.

- The preparation of publicity material, posters etc. on the importance of the kagu internationally and the need for its protection. This work could possibly be carried out through cooperation with the Association pour la Sauvegarde de la Nature Neo-Caledonienne.

#### 6-3-2 ENDEMIC GENERA

##### 1. TOOTH-BILLED PIGEON (Didunculus strigirostris)

This pigeon is of ancient origin (Goodwin 1983), its closest relatives being too obscure to be agreed upon. Little is known of its habits or habitat requirements and the population has never been assessed.

#### STATUS

- Vulnerable. The population on Savaii is probably more abundant than that on Upolu (King 1981) but this has not been properly studied. It is restricted to undisturbed rain forest, particularly at high altitude.

#### THREATS

- Hunted legally. Estimated to constitute 8-10% of hunter's bags (King 1981). This species is likely to suffer the effects of overhunting in a diminishing forest reserve.  
 - Predation, not studied.  
 - Habitat loss, particularly at the western end of Savaii, where forest clearance is occurring to relatively high altitude.

#### CURRENT WORK

- Occasional surveys of small areas (T.G. Lovegrove, M. Bellingham, A. Davis pers.comm.).  
 - Hunting banned in O Le Pupu Pu'e National Park, Upolu.

#### FUTURE WORK

- Survey of suitable habitat on Savaii and Upolu to assess status of the species. This work should be carried out as part of a

larger survey of wildlife and wildlife habitats in western Samoa.

- A study of the habitat requirements of the species in O Le Pupu Pu'e National Park. A longer term study would provide data that may be used in an estimate of the maximum sustainable yield of the population to hunting. Habitat data would be used in a plan to supplement that of Holloway and Floyd (1975) with wildlife needs. The intensive study would be suitable either for one single scientist or as student research under the supervision of a scientist in New Zealand or Australia. The Director of Ecology Division, NZ Department of Scientific and Industrial Research has expressed an interest in involving his research team, which is currently carrying out work on pigeons, in studies of this species.

- Publicity material to supplement posters on Samoan wildlife currently available.

## 2. TUAMOTU SANDPIPER (KIVI-KIVI), Prosobonia cancellatus

This is the only member of the family Scolopaciidae endemic to the region.

### STATUS

- Confined to the Tuamotu islands. Collected or reported from at least 16 atolls in the 1920s, though they were already extinct on others by then (Holyoak and Thibault 1984). Recent records are limited to the islands of Marutea du Sud and Maturei-Vavao, where they are probably breeding (Lacan and Mougin, 1974), Pinaki and Nukutavake (King, 1981) and the sighting of a single bird on Rangiroa (Holyoak, 1973a). Other possible islands have not been surveyed. There are no recent records of breeding and no detailed studies of the species have been carried out.

### THREATS

- While kivi-kivi may occasionally be hunted by humans (Lacan and Mougin 1974) the depredations of cats and rats are probably a major cause of the decline.

### CURRENT WORK

- None known.

### FUTURE WORK

1. A survey of the following atolls to determine whether the species has survived since the reports of the 1920's:

Fakareva, Kaeahi, Taenga, Katiu, Tuanake, Hiti, Tepoko, Vanavana, Tenararo, Vahanga, Tenarunga and Maria.

2. A study of breeding and habitat requirements on Marutea du Sud, Maturei-Vavao or Nukutavake.

3. Analysis of land use and predator distribution to determine feasibility of reserve establishment, e.g. on Maturei-Vavao.

- Because successful conservation in these areas depends

heavily on the good will of the local people, it is essential that education work is carried out hand in hand with any research. Restriction of access to cats, dogs and rats other than Rattus exulans would appear to be likely requirements. Other conservation measures such as translocation and captive breeding would have to be considered carefully in the light of research results and local acceptability.

## 2. SILKTAIL (Lamprolia victoriae)

### STATUS

- Taveuni subspecies relatively common, Vanua Levu subspecies endangered and confined to coastal forest remnants on the Natewa Peninsula.

### THREATS

- Logging and clearance of habitat.
- Predation by mongoose, cats or rats?

### CURRENT WORK

- Recent survey on Vanua Levu by N. Langham.

### FUTURE WORK

- Further survey of the distribution and abundance of both subspecies.
- Study of the feeding behaviour and habitat requirements of both subspecies.
- Establishment of reserves in lowland forest remnants on Natewa Peninsula.

The first two projects are suitable for graduate research work. The Head of Department, School of Natural Resources, University of the South Pacific, has indicated a willingness to provide some facilities for a student enrolled in a graduate programme at another university. The Head of Zoology, University of Auckland has expressed an interest in accepting such a student for an MSc or PhD in that department.

## 6-3-3 ENDEMIC SPECIES

### 1. FIJI PETREL (Pseudobulweria macgillivrayi)

Rediscovered after being lost for 130 years, this petrel is still only known from two specimens.

### STATUS

- Not known, one bird caught at the summit of Gau Island in 1983. Breeding area not known but presumed to be at high altitude on Gau.

### THREATS

- Predation by cats likely.

## CURRENT WORK

- Recent surveys by D. Watling sponsored by Central Manufacturing Co. of Fiji and by ICBP resulted in discovery of recent specimen.
- Tracks cut and parts of island prepared for further searches.

## FUTURE WORK

- Further survey of likely breeding area required.
- Surveys of similar habitat on other high islands, e.g. Ovalau, in the region where the petrel may breed.
- Study of breeding success if population is located.

2. RAROTONGA FLYCATCHER (Pomarea dimidiata).

One of a radiation of Pomarea species in eastern Polynesia, the Rarotonga flycatcher is probably the most at risk.

## STATUS

- Known from a handful of sightings this century, the population is now thought to number about 30 individuals confined mainly to the bottoms of steep valleys in the south of the island.

## THREATS

- Rat or cat predation?
- Restricted to habitat type which is no longer abundant?

## CURRENT WORK

- Recent surveys have accurately established the status in most areas.
- Eight of a population of 16 birds have been colour-banded in one valley and these are being observed by G.V. McCormack.

## FUTURE WORK

- Reservation of an adequate area of forest free from disturbance through timber cutting, clearance or other undue human activity. A reserve centred on the Taipara and particularly the Totokoitu catchments appears to be the most suitable for the species at this stage though extensions to that would depend on the results of further surveys for the species. The establishment of such a reserve would be entirely compatible with the proposal stated recently by the Prime Minister, Sir Thomas Davis, to commence work on a large water supply scheme for Rarotonga. The sort of restrictions that would apply to entry and use of a water catchment reserve would benefit the wildlife of that reserve, providing that there was no substantial habitat disturbance associated with construction of water intakes, etc.

- A further survey for the species in areas not already searched. Though the coverage of Rarotonga so far has been thorough, there are valleys and portions of valleys that have not been searched. This needs to be done before a reliable population estimate can be made. Analysis of vegetation in areas where flycatchers do and do not occur would be an important component of such a survey.

- A study of habitat requirements. This is a longer term project which may involve research on feeding and breeding over one or two seasons. The best means by which this study can be carried out is still to be decided but, given sufficient funds, it is proposed that a scholarship be provided for a student at either a post-graduate or a post-doctoral level. This scholarship will provide a living wage for two seasons and facilities for analysis and write-up in New Zealand, probably at Auckland University. Subject to availability, local facilities at Totokoitu Research Station (Cook Islands Government/NZDSIR) could be used.

### 3. PIGEONS

The pigeons of French Polynesia constitute a group of birds which deserve particular attention because of their traditional importance for food, their likely role in seed dispersal of forest trees, and their rarity. The species most in need of work are the following:

- Marquesas pigeon (Ducula galeata)
- Society islands pigeon (Ducula aurorae)
- Society islands ground dove (Gallicolumba erythroptera)
- Marquesas ground dove (Gallicolumba rubescens)
- Marquesas fruit dove (Ptilinopus mercierii)
- Rapa fruit dove (Ptilinopus huttoni)

#### THREATS

- Habitat loss through clearance for farming and other development.
- Habitat degradation through browsing by feral stock.
- Over-exploitation by hunters.
- Avian disease.

#### CURRENT WORK

- Recent surveys of status of some species.
- Some reserves created, e.g. Hatutu and Eiao, though protection of natural areas inadequate.

#### FUTURE WORK

- Forest bird surveys of pigeon habitats.
- Census of endangered species.
- Research project on the ecology of fruit pigeons.
- Research project on the ecology of ground doves.
- Fencing and animal control in existing forest remnants and reserves.
- Effective control of illegal hunting of endangered species.

The establishment of a pigeon working group to plan and supervise research into the ecology and conservation of this group is recommended.



#### 6-4 PROTECTED AREAS

The establishment of a network of reserves is central to the aims of bird conservation, and must be a major aim of the bird survey work recommended above. The recently gazetted U Le Pupu-Pu'e National Park in Western Samoa is an example of what is needed to preserve a representative range of habitats. The success of such a park depends largely on the use made of it by locals and visitors, so promotion of the concept is necessary.

The survey of bird conservation areas reported in the previous chapter provides guidelines for the requirements of protected areas for birds in the Pacific Islands. Obviously, protection could take a number of forms, either under direct reservation by government as National or International Park or reserve, through purchase by a conservation agency or by a form of land use control in keeping with local custom. The third approach may be the most suitable in many areas of the Pacific.

#### 6-5 PUBLICITY AND EDUCATION

Conservation education is a large problem where mass media coverage is not an instant window into every home in the country. It is, however, one of the most important tasks confronting those working in the field of nature protection. It is important, therefore, to provide material which is appropriate to the needs of the people concerned. Implicit in every project should be the requirement to provide educational material for both local and international use. The following are two means by which this may be attempted.

##### 6-5-1 POSTERS

In view of the fact that, in many places, homes are decorated with such posters (travel, etc.) as are available, the production of a series of large coloured bird posters for each region is proposed. These would depict local birds accompanied by a brief conservation text. Posters of this nature have been produced by the Ministry of Agriculture and Forests in Western Samoa and by the Association pour la Sauvegarde de la Nature Neo-Caledonienne in New Caledonia and have been generally well received locally and in the tourist industry. Liaison with local interest groups such as the ASSNCC, the Vanuatu Natural Sciences Society, Fiji National Trust and Ia Ora te Natura in Tahiti is important for the production and distribution of this type of material.

##### 6-5-2 VIDEO

The popularity of video is increasing at a burgeoning rate in the Pacific region, taking over from cinema as a major form of passive entertainment. Serious consideration should be given to the commissioning of a series of videos on wildlife of local and regional significance. These would be available to those schools which have

suitable equipment but also through commercial video outlets, possibly at cheap rates of rental.

Possible subjects are seabirds and pigeons, groups of species with a traditional food significance, life histories of rare species such as kagu, and forest inhabitants. Television New Zealand's Natural History Unit is currently preparing a documentary on conservation in Fiji, and it is assumed that this will be available when finished.

## REFERENCES

- Amerson, A.B.Jr., W.A. Whistler and T.D. Schwaner. 1982. Wildlife and wildlife habitat of American Samoa. 2 Vols. Washington. United States Department of the Interior, Fish and Wildlife Service.
- Anon. 1983a. Marianas mallard. Coastal Views 5(2):6. Coastal Resources Management Office, Commonwealth of the North Marianas Islands.
- Anon. 1983b. Washington logger heads for the South Pacific. World Wood April, 1983:55.
- Anon. 1984. Guam rail: temporarily listed as endangered. *Elepaio* 45:21.
- ASSNC. 1980. Ces Animaux sont Menaces... Il Faut les Proteger. Notes to conservation poster. Noumea. Association pour la Sauvegarde de la Nature Neo-Caledonienne.
- Atkinson, I.A.E. 1977. A reassessment of factors, particularly Rattus rattus L., that influenced the decline of endemic forest birds in the Hawaiian Islands. *Pacific Science* 31:109-133.
- Atkinson, I.A.E. 1984. The spread of commensal species of Rattus to oceanic islands and their effects on island avifaunas. Paper read before 18th World Conference of ICBP, Cambridge, August 1982.
- Baker, R.H. 1951. The avifauna of Micronesia; its origin, evolution and distribution. University of Kansas Publications in Natural History 3(1): 359 pp.
- Banks, R.C. 1984. Bird specimens from American Samoa. *Pacific Science* 38: 150-169.
- Beland, P. 1975a. Enquete sur les oiseaux de Caledonie. Le kagu. *Nature Caledonienne* 8:31-34.
- Beland, P. 1975b. Enquete sur les oiseaux de Caledonie. Le pigeon vert - Le collier blanc. *Nature Caledonienne* 9:33-35.
- Blackburn, A. 1971. Some notes on Fijian birds. *Notornis* 18:147-174.
- Boffey, P.M. 1983. Birds are seen returning to Christmas Island. *New York Times*. August 22.
- Bourne, W.R.P. 1965. The missing petrels. *Bulletin of the British Ornithological Club* 85:97-105.
- Bourne, W.R.P. and A.C.F. David. 1983. Henderson Island, Central South Pacific, and its Birds. *Notornis* 30:233-243.

- Bruner, P.L. 1972. Field Guide to The Birds of French Polynesia. Pacific Science Information Centre. Bernice P. Bishop Museum. Honolulu. 135 pp.
- Cain, A.J. and I.C.J. Galbraith. 1956. Field notes on the birds of the Eastern Solomon Islands. *Ibis* 98:100-134, 262-295.
- Carpenter, M.L., W.B. Jackson and M.W. Fall. 1968. Bird populations at Eniwetok Atoll. *Micronesica* 4:296-307.
- Carter, J. (Ed.). 1984. Pacific Islands Yearbook. Fifteenth Edition. Sydney. Pacific Publications. 557 pp.
- Chila, P. 1960. Birds of the Gilbert and Ellice Island colony. *Atoll Research Bulletin* 74:1-38
- Clunie, F. 1973. Pink-billed parrot finches near Nailagoyakelo Creek, southern Viti Levu. *Notornis* 20:202-209.
- Clunie, F. 1976. A Fiji peregrine in an urban-marine environment. *Notornis* 23:8-28.
- Clunie F. and I. Perks. 1972. Note on the pink-billed parrot-finch of Fiji. *Notornis* 19:335-336.
- Cottrell, C.W. 1966. On a problem species Lamprolia victoriae. *Emu* 66:253-266.
- Dahl, A.L. 1980. Regional Ecosystems Survey of the South Pacific Area. Technical Paper No. 179. Noumea. South Pacific Commission. 99pp.
- Dahl, A.L. 1984. Oceania's most pressing environmental concerns. *Ambio* 13:296-301.
- Decker, B.G. 1973. Unique dry-island biota under official protection in northwest Marquesas Islands (Iles Marquises). *Biological Conservation* 5(1):66-67.
- Diamond, J.M. 1970a. Ecological consequences of island colonization by Southwest Pacific birds. 1. Types of niche shifts. *Proceedings of the National Academy of Science USA* 67:539-546.
- Diamond, J.M. 1970b. Ecological consequences of island colonization by Southwest Pacific birds. 2. The effects of species diversity on total population density. *Proceedings of the National Academy of Science USA* 67:1715-1721.
- Diamond, J.M. 1972. Biogeographic kinetics: estimation of relaxation times for avifaunas in the Southwest Pacific. *Proceedings of the National Academy of Science USA* 69:3199-3203.
- Diamond, J.M. 1974. Colonisation of exploded volcanic islands by birds: the supertramp strategy. *Science* 184:803-806.

- Diamond, J.M. 1977. Continental and insular speciation in Pacific landbirds. *Systematic Zoology* 26:263.
- Diamond, J.M. Undated. A Proposed Forest Reserve System and Conservation Strategy for the Solomon Islands. Unpublished report with the author.
- Diamond, J.M. and A.G. Marshall. 1977. Distributional ecology of New Hebridean birds: a species kaleidoscope. *Journal of Animal Ecology* 46:703-727.
- Diamond, J.M. and C.R. Veitch. 1981. Extinctions and introductions in the New Zealand avifauna: cause and effect? *Science* 211:499-501.
- Douglas, G. 1969. Checklist of Pacific oceanic islands. *Micronesica* 5(2):327-463.
- Du Pont, J.E. 1976. South Pacific Birds. Delaware Museum of Natural History Monograph Series No. 3. 218pp.
- Engbring, J. and F. Ramsey. Distribution and Abundance of the Forest Birds of Guam; Results of a 1981 Survey. Unpublished Report. U.S. Fish and Wildlife Service and Guam Aquatic and Wildlife Resources Division. 72pp.
- Falanruw, M.V.C. 1975. Distribution of the Micronesian megapode M. laperouse in the northern Mariana islands. *Micronesica* 11:149-150.
- Fisher, A.K. and A. Wetmore. 1931. Report on birds collected by the Pinchot Expedition of 1929 to the Caribbean and the Pacific. *Proceedings of the U.S. National Museum* 79(10):1-66.
- Forshaw, J.M. 1980. The Norfolk Island parakeet (Cyanoramphus novaezelandiae cooki) -- A threatened population: status and management options. Pp. 461-469 in: *Proceedings of the ICBP Parrot Working Group Meeting*. St. Lucia, 1980. R.F. Pasquier, editor. International Council for Bird Preservation Technical Publication No. 1. Washington. Smithsonian Institution.
- Forshaw, J.M. 1981. *Australian Parrots*. Lansdowne. Melbourne.
- Fosberg, F.R., M.-H. Sachet and D.R. Stoddart. 1983. Henderson Island (Southeastern Polynesia): summary of current knowledge. *Atoll Research Bulletin* 272. 47pp.
- Frith, H.J. 1982. *Pigeons and Doves of Australia*. Adelaide. Rigby. 304pp.
- Goodwin, D. 1983. *Pigeons and Doves of the World*. 3rd Edition. Ithaca. British Museum (Natural History) and Cornell University Press. 363 pp.

- Greenway, J.C. Extinct and Vanishing Birds of the World New York. Special Publication 13. American Committee for International Wildlife Protection.
- Haaden, D. 1981. Birds of the North Solomons. Wau Ecology Institute Handbook No. 8. Wau, Papua New Guinea. 107pp.
- Halliday, T. 1978. Vanishing Birds - Their Natural History and Conservation. New Zealand. Hutchinson. 296pp.
- Hannecart, F and Y. Letocart. 1980. Oiseaux de Nouvelle Calédonie et des Loyautés. Tome 1. Les Editions Cardinalis. 150pp.
- Hartlaub, G. and O. Finsch. 1871. On a collection of birds from Savai and Rarotonga islands in the Pacific. Proceedings of the Zoological Society of London (1871):28-29
- Hay, J.R. 1983. Conservationists oppose plan to develop island haven. New Zealand Herald. July 9, 1983.
- Heather, B.D. 1977. The Vanua Levu silktail (Lamprolia victoricae kleinschmiati). A preliminary look at its status and habits. Notornis 24:94-128.
- Holloway, C.W. and C.H. Floyd (UNDAT-IUCN). 1975. A National Parks system for Western Samoa.
- Holyoak, D.T. 1973a. Notes on the birds of Rangiroa, Tuamotu Archipelago, and the surrounding ocean. Bulletin of the British Ornithological Club 93: 26-32.
- Holyoak, D.T. 1973b. Endangered land-birds in French Polynesia. Biological Conservation 5(3):231-232.
- Holyoak, D.T. 1973c. Polyesian land-birds face H-bombs and malaria. New Scientist 57:288-290/
- Holyoak, D.T. 1974a. Les Oiseau des iles de la Societe. L'Oiseau et Rev. Fr. Orn. 44:i-27, 153-181.
- Holyoak, D.T. 1974b. Undescribed landbirds from the Cook Islands, Pacific Ocean. Bulletin of the British Ornithological Club 94:145-150.
- Holyoak, D.T. 1975. Les Oiseaux des Iles Marquises. L'Oiseau et Rev.Fr.Orn. 45:207-233, 341-366.
- Holyoak, D.T. 1980. Guide to Cook Island Birds. Cook Islands Library and Museum Society. 40pp.
- Holyoak, D.T. and J.-C. Thibault. 1977. Habitats, morphologie e tinteractions ecologiques des oiseaux insectivores de Polynesie Orientale. L'Oiseau et Rev. Fr. Orn. 47:115-147.

- Holyoak, D.T. and J.-C. Thibault. 1984. Contribution a l'etude des oiseaux de Polynesie Orientale. Memoires du Museum National d'Histoire Naturelle. Serie A - Zoologie. T. 127. 209pp.
- Jeggo, D. 1979. A preliminary survey report on the kagu Rhynochetos jubatus of New Caledonia. Jersey Wildlife Review 1979:20-28.
- Jenkins, J.M. 1979. Natural history of the Guam rail. Condor 81:404-408.
- Jenkins, J.M. 1983. The native forest birds of Guam. Ornithological Monographs 31.
- Keith-Reid, R. 1983. Save a dakuia for only \$50. Fiji Times, July 1983.
- Kepler, C.B. 1967. Polynesian rat predation on nesting Laysan Albatrosses and other Pacific seabirds. Auk 84:426-430.
- Kepler, C.B. In Press. Conservation of island ecosystems. ICBP Technical Bulletin.
- King, W.B. 1973. Conservation status of birds of central Pacific Islands. Wilson Bulletin 85:89-103.
- King, W.B. (Compiler) 1981. Endangered Birds of the world. The ICBP Red Data Book. Washington. Smithsonian Institution Press and ICBP.
- King, C.M. 1984. Immigrant killers - introduced predators and the conservation of birds in New Zealand. Auckland. Oxford University Press. 224pp.
- Kinsky, F.C. 1975. A new subspecies of the long-legged warbler Trichocichla rufa (Reichenow) from Vanua Levu, Fiji. Bulletin of the British Ornithological Club 95:98-101.
- Lacan, F. and J.-L. Mougin 1974. Les Oiseaux des Iles Gambier et de quelques orientaux de l'archipel des Tuamotu (Ocean Pacifique). L'Oiseau et R.F.O. 44: 192-280.
- Letocart, Y. 1984. Sauvegard du Cagou. Unpublished report. Paita. Circonscription du Developpement de l'Economie Rurale. 9pp.
- Lovegrove, T.G. 1984. The south west Pacific expedition aboard the yacht "Derwent" 1982. Forest and Bird 15(1):21-28.
- Marshall, J.T., Jr. 1962. Predation and natural selection. In T.I. Storer, ed., Pacific Island rat ecology. Bernice P. Bishop Museum Bulletin 225.
- Mayr, E. 1933a. Birds collected during the Whitney South Sea Expedition, XXII: Three new genera from Polynesia and Melanesia. American Museum Novitates 590.

- Mayr, E. 1933b. Birds collected during the Whitney South Sea Expedition, XXV. Notes on the genera Myadria and Mayrornis. American Museum Novitates 651:1-20.
- Mayr, E. 1945. Birds of the South-West Pacific New York. MacMillan. 316pp.
- Mayr, E. 1967. Zosteropidae (Indo-Australian taxa), pp. 289-236 In R.A. Paynter, Jr. (ed.), Check-list of Birds of the World. Vol.12.
- Montgomery, S.L., W.C. Gagne and B.H. Gagne. 1980. Notes on birdlife and nature conservation in the Marquesas and Society Islands. Elepaio 40(11):152-155.
- Murphy, R.C. 1924. Whitney Expedition 2. Notes on the Columbiidae, Rallidae, and Hydrobatidae from Polynesia. American Museum novitates 124:1-13.
- Murphy, R.C. 1928. Whitney Expedition 4. Notes on the Procellariidae and Hydrobatidae from the Pacific. American Museum Novitates 322:1-5.
- Murphy, R.C. 1929. Whitney Expedition 9. Zosteropidae from the Solomon Islands. American Museum Novitates 365:1-11.
- Muse, C. and S. Muse 1982. The Birds and Bird Lore of Samoa. Walla Walla, Washington. The Authors.
- de Naurois, R. 1982. Sur le statut passe et present des Merles (Turdus poliocephalus) de Nouvelle-Caledonie et les iles voisines. L'Oiseau et la Revue Francaise d'Ornithologie 52:153-170.
- North, A.J. 1908. On three apparently undescribed birds from Henderson or Elizabeth Island, Paumotu Group. Records of the Australian Museum 7(1):29-32.
- Ollier, C.D., W.A. Whistler and A.B. Amerson Jr. 1979. O Le Pupu-Pu'e National Park, Samoa. UNDAT. Suva.
- Olsen, S.L. 1980. Lamprolia as part of a South Pacific radiation of Monarchine Flycatchers. Notornis 27:8-10.
- Owen, R.P. 1977. A checklist of the birds of Micronesia. Micronesica 13:65-81.
- Paulay, G. 1982. Rapa Island and its weevils. Discovery 16(1):25-31.
- Peale, T.R. 1848. United States Exploring Expedition. Vol.8 Mammalia and Ornithology. Philadelphia. Sherman.



- Perez, S.G.A. 1968. Notes on the breeding season of Guam rails. *Micronesica* 4(1):133-135.
- Pernetta, J.C. and L Hill. 1984. Traditional use and conservation of resources in the Pacific basin. *Ambio* 3:359-364.
- Pratt, H.D., P.L. Bruner and D.G. Berrett. 1977. Ornithological observations on Yap, Western Caroline Islands. *Micronesica* 13:57-63.
- Pratt, H.D., and P.L. Bruner. 1978. Micronesian megapode rediscovered on Saipan. *Elepaio* 39:57-59.
- Pratt, H.D., P.L. Bruner and D.G. Berrett. 1979. America's unknown avifauna: the birds of the Mariana Islands. *American Birds* 33(3):227-235.
- Pratt, H.D., J. Engbring, P.L. Bruner and D.G. Berrett. 1980. Notes on the taxonomy, natural history, and status of the resident birds of Palau. *Condor* 82:117-131.
- Quantin, P. 1982. Vanuatu agronomic potential and land use map. Explanatory notes. URSTUM and Ministry of Land and Natural Resources, Republic of Vanuatu.
- Ralph, C.J. 1979. Forest bird and fruit bat populations and their conservation in Micronesia: notes on a survey. *Elepaio* 40(2):20-26.
- Rauzon, M.J. 1983. Feral cats of Jarvis island: Their Effects on Seabirds and their Eradication. Unpublished MSc thesis. Department of Geography, University of Hawaii.
- Reynolds, R.T., J.M. Scott and K.A. Nussbaum. 1980. A variable circular plot method for estimating bird numbers. *Condor* 28:309-313.
- Savage, J.A. 1984. Guam: paradise lost for wildlife. *Biological Conservation* 30: 305-317.
- Schallenberg, R.J. 1979. Last Marianas mallards now in Hawaii. *Elepaio* 40(2):28.
- Schoode, R., P. Fullagar and N. Hermes. 1983. A review of Norfolk Island birds: past and present. Australian National Parks and Wildlife Service Special Publication 8. 119pp.
- Scobie, P. 1982. Forest fight in the Solomons. *National Parks Journal* 26:13-15.
- Scott, J.M., J.D. Jacobi and F.L. Ramsey. 1981. Avian surveys of large geographical areas: a systematic approach. *Wildlife Society Bulletin* 9:190-200.

- Serpell, J., N. Collar, S. Davis and S. Wells. 1983. Submission to the Foreign and Commonwealth Office on the future conservation of Henderson Island in the Pitcairn group. WWF.-UK., IUCN., ICBP.
- South Pacific Regional Environment Programme. 1981. Country Reports 1980-1981. Noumea. New Caledonia.
- Thibault, J.-C. Le cayou dans la littérature. Unpublished manuscript with the author. 18pp.
- Thibault, B. and J.-C. Thibault. 1975. Liste des oiseaux de Polynésie orientale (Nouvelles acquisitions faunistiques). Oiseau Rev. Fr. Orn. 45:89-92.
- Thompson, M.C. and C.D. Hackman. 1968. Birds of the Tokelau Islands. Notornis 15:109-117.
- Turbott, E.G. 1977. Rarotonga birds, with notes on land-bird status. Notornis 24:149-157.
- Uchida, T. 1966. Observation on the monitor lizard, Varanus indicus (Daudin) as a rat control agent on Ifaluk, Western Caroline Islands. Micronesica 3:17-18.
- Veitch, C.R. 1980. The eradication of cats from Little Barrier Island. New Zealand Wildlife Service Internal Report. Wellington. Department of Internal Affairs.
- Venkatesh, S. and S. Va'ai. 1981. An Overview of Environmental protection Legislations in the South Pacific Countries. South Pacific regional Environment Programme, Topic Review 13. Noumea. South Pacific Commission. 29pp.
- Vuilleumier, F. and M. Gochfield. 1976. Notes sur l'avifaune de Nouvelle-Calédonie. Alauda 44:237-273.
- Walters, M. 1980. The Complete Birds of the World. Sydney. Reed. 340pp.
- Warner, D.W. 1947. The Ornithology of New Caledonia and the Loyalty Islands. Unpublished PhD thesis. Cornell University. New York. 228pp.
- Warner, R.E. 1968. The role of introduced diseases in the extinction of the endemic Hawaiian avifauna. Condor 70:101-120.
- Watling, D. 1982. The Birds of Fiji, Tonga and Samoa. Wellington. Millwood Press. 176pp.
- Weir, D. 1973. Status and habits of Megapodius pritchardii. Wilson Bulletin 85:79-82.
- Williams, G.R. 1960. The birds of Pitcairn Island. Ibis 102:58-70.

Wilson, S.B. 1907. Notes on birds from Tahiti and Society Group.  
*Ibis* 9(3):373-379.

Zusi, R.L. and J.R. Jehl Jr. 1972. The systematic relationships of  
Aechmorhynchus, Prosobonia and Phegornis  
(Charadriiformes: Charadrii). *Auk* 87: 760-780.

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