

Henderson Island

World Heritage Site

Management Plan **2004–2009**

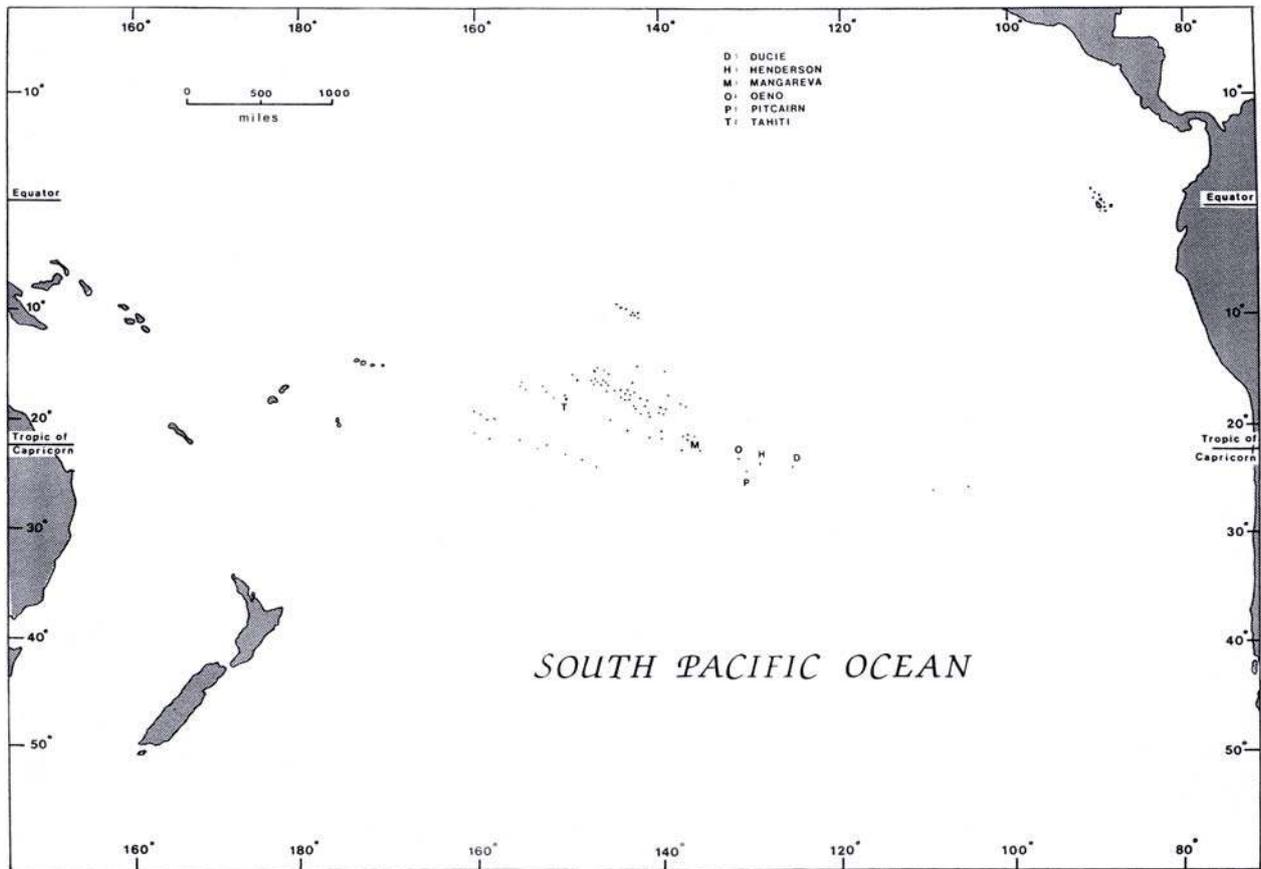
Conserving a unique site



M de L Brooke, I Hepburn
and RJ Trevelyan



Foreign &
Commonwealth Office
London



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World Heritage Site

Management Plan *2004 - 2009*

M. de L. Brooke, I. Hepburn and R.J. Trevelyan

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This management plan is available to interested persons for a small charge to cover costs.

Copies are available via the Pitcairn Island Administration, PO Box 105696, Auckland, New Zealand. admin@pitcairn.gov.pn It is also available on the website of the UK Overseas Territories Conservation Forum: www.ukotcf.org

Foreword

**The Rt Hon Jack Straw MP, Secretary of State for Foreign and Commonwealth Affairs
and The Rt Hon Tessa Jowell MP, Secretary of State for Culture, Media and Sport.**

We are delighted to present this Management Plan for the Henderson Island World Heritage Site.

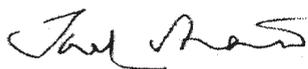
Henderson Island, one of the Pitcairn Islands in the central South Pacific, is an exceptionally undisturbed raised coral island. The island's geology, combining indicators of sea level change and corals dating back over half a million years, provides a unique opportunity for documenting climate change. Its animals and plants include many unique species, and its archaeological interest, deriving from a long period of Polynesian occupation, is high. Isolation has undoubtedly been an important reason why the island has retained so much that is special, but, as more places become accessible to more people, there is no guarantee that Henderson's isolation will continue to provide adequate long-term protection - hence the need for this Management Plan.

The Site is immensely beautiful as anyone lucky enough to land on its beaches will attest. This Management Plan will provide the framework within which sympathetic tourist visits can take place and will also ensure that the Pitcairn Islanders' tradition of utilising timber for the carving of curios can continue for generations to come, by promoting sustainable management of the resource.

This Management Plan also sets out important challenges to the Pitcairners to contribute to the sustainable management of Henderson Island, to the scientific community to put knowledge gleaned from studies on Henderson towards the conservation of other, more damaged Pacific islands, and to the tourism industry to ensure that its visits to Henderson do not compromise the outstanding beauty and importance of this island.

The British Government is accountable to UNESCO and the wider international community for the future conservation and presentation of this important site. It is a responsibility we take seriously. This Management Plan has been developed in close co-operation with many organisations - some within Government Departments and some beyond - together with the Pitcairn Islanders and other private individuals. All have shared a profound interest in the Site. The Plan aims to ensure that the conservation and management of the Site is undertaken in a sensitive and appropriate manner. It highlights the key issues affecting the Site both now and in the future, and outlines how these will be addressed.

We are extremely grateful to all those bodies and individuals who have worked so hard to produce this Plan, in particular the Pitcairn Island Council and the UK Overseas Territories Conservation Forum. We feel sure that this document will prove to be an invaluable management tool to all those involved in the ongoing presentation and conservation of this very special place.



JACK STRAW



TESSA JOWELL

Acknowledgements

Preparation of this management plan for Henderson Island has been possible only with the willing - and indeed enthusiastic - assistance of many individuals and organizations. The listing that follows is inevitably selective, and the contribution of those not named has been barely less important than that of those who are. Thank you to everyone.

A major fraction of the information described in the Plan derives from the work of the Sir Peter Scott Commemorative Expedition to the Pitcairn Islands. We would like to highlight the role of the UK Co-ordinators, Tom Spencer and Tim Benton, and of those whose maritime expertise ensured that fieldwork on Henderson was safe and worthwhile, Graham Wragg, owner of the research vessel *Te Manu*, Alve Henricson and Neal Oppen. However, all members of the Expedition freely gave of their time and knowledge. The Expedition's major sponsors were: The Royal Society, International Council for Bird Preservation (British Section), British Ornithologists' Union, J.A. Shirley and UNESCO. The Linnean Society was instrumental in providing a forum for discussion of results and ensuring the Expedition's findings were published.

Sara Oldfield played an important role in getting Henderson designated a UNESCO World Heritage site and establishing the UK Overseas Territories Conservation Forum. In later years, the Forum, chaired by Mike Pienkowski, has continued to highlight the biological importance of the Overseas Territories, including the Pitcairn Islands.

Prompted by Bonnie Vittery, the Joint Nature Conservation Committee made possible Ian Hepburn's visit to the Pitcairn Islands, and drafting of this Management Plan. Its subsequent completion by Michael Brooke and Rosie Trevelyan was enormously helped by financial support from the Foreign and Commonwealth Office, London, and the keen co-operation of staff in the Overseas Territories and Environment Policy Departments. In New Zealand, two Pitcairn Commissioners, Garth Harraway and Leon Salt, have been unfailingly supportive.

Particularly perceptive comments on drafts of the Plan were received from Vin Fleming (JNCC), Matthew Forbes (British High Commission, Wellington), Geoff Hilton and Sarah Sanders (RSPB) and Steve Waldren (Trinity College, Dublin).

On Pitcairn, special thanks are due to Jay, Carol, Mavis and Meralda Warren and their families for friendship, accommodation, and food, all supplied in abundance over many years. Tom Christian and his colleagues at the Pitcairn Island Meteorological Station kindly allowed free access to meteorological record files. Above all, the warmth and hospitality of the Pitcairn Islanders have made our visits to their Islands thoroughly enjoyable and productive.

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1. Summary

Henderson Island is uninhabited and one of four islands in the UK Overseas Territory of the Pitcairn Islands. In 1988 it was designated a World Heritage Site by UNESCO.

Although utilised both by Polynesians in the past and by present-day Pitcairn Islanders, Henderson Island remains in a largely pristine condition and is a unique Pacific example of an undisturbed raised coral island. It is home to 71 vascular plant species, over 300 molluscs, at least 180 insects, four endemic landbirds and major seabird colonies. It is also of supreme archaeological interest because of a period of Polynesian occupation lasting at least 600 years. Consequently Henderson Island is a resource of unique conservation and scientific research significance.

This management plan sets guidelines for human activities in order to conserve Henderson Island's indigenous biota and natural environment to the greatest degree possible.

Principal management objectives for Henderson Island are:

These objectives do not affect any current use of Henderson Island by Pitcairn Islanders. It is intended that well-managed access to the island continues to be allowed for Pitcairners and responsible tourism. This management plan has been produced in conjunction with the Pitcairn Island Council with support from the Foreign and Commonwealth Office, London. It consists of two key sections; a description and resource inventory, and management policies with guidelines for management. Appendices include species lists, copies of relevant legislation, as well as visitor guidelines and application and reporting forms for visitors.

Implementation of the Plan rests with a Management Committee reporting to the Pitcairn Islands Council. Copies of the plan are available on the web (www.ukotcf.org) and in paper form from the Pitcairn Islands Administration.

Address:

Pitcairn Administration, PO Box 105696
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- a) To protect the intact status of the island's geology, ecology and of its component flora and fauna - in particular threatened and endemic species, thus conserving the genetic differences between island populations, and the unique genetic contribution of Henderson Island to global diversity.
- b) To ensure that stocks of the timber species (miro and tou) are adequate to meet the needs of Pitcairners on a sustainable basis.
- c) To minimise interference with natural processes and the destruction or degradation of natural and archaeological features through human actions. This includes preventing the introduction of non-native animals, plants and other organisms or their propagules.
- d) To ensure the island's archaeological features remain available for visitors and scientific study.
- e) To ensure tourist visits to the island cause no long-term damage and are beneficial to the Pitcairn Islanders.
- f) To promote an awareness, through education and research, of the intrinsic value and significance of Henderson Island and its biota.

2. Statement of Significance

Henderson Island is an exceptionally remote island, over 3000 miles from the nearest continent and over 1000 miles from the nearest international airport. Much of its perimeter is guarded by vertical 30m limestone cliffs, but there are three beaches of intense beauty behind fringing coral reefs which are among the south-easternmost of the Pacific.

The island's isolation and difficulty of landing have contributed to its outstanding ecological integrity and interest. Despite a period of Polynesian occupation, Henderson is a unique exemplar of a large raised coral island unblemished by European occupation. Similar raised coral islands elsewhere in the tropics have been degraded by phosphate mining, military use and human occupation but the central plateau of Henderson supports an almost unique mosaic of limestone forest communities. The lack of invasive non-native plants is remarkable in a global context. Now Henderson is home to a suite of unique species including scores of invertebrates, nine endemic vascular plants and four endemic landbird species. One of the few flightless rail species to survive the human colonisation of the Pacific thrives on Henderson. Seabirds are abundant, finding rare nesting habitat in the immensity of the ocean, and the bulk of the world population of one species, the Henderson petrel, nests on the island.

Geologically, Henderson is a raised coral atoll characterised by a fossil lagoon surrounded by intricately eroded karst surfaces. Corals dating back over half a million years remain in situ and provide an exceptional opportunity for exploring the relationships between tectonic uplift (caused by the loading of the Earth's crust by neighbouring Pitcairn), sea-level fluctuation and climate change over hundreds of thousands of years.

This known record of island emergence provides a remarkable backdrop to the patterns and processes of plant and animal evolution seen on Henderson which is almost the last island in a long chain stretching back to south-east Asia along which plants and animals have dispersed over evolutionary time.

The past Polynesian occupation of Henderson is represented by archaeological artefacts, showing how the island, despite its isolation, is culturally connected to the wider world. This connection continues to this day as the Pitcairn Islanders, maintaining a unique lifestyle, voyage across the ocean to harvest certain hardwoods from Henderson. Today Henderson is of universal importance for its geological interest, its undisturbed ecology and its ability to refresh those lucky enough to cross seas of extraordinary clarity to land on its barely trodden beaches.

3. Introduction

Henderson Island in central South Pacific is one of the world's least disturbed raised coral islands. It has a remarkable fossil lagoon preserved at its centre and supports a rare example of low limestone woodland. Despite several centuries of Polynesian occupation and the extinction of various species during that occupation, the ecology of the island has remained largely intact. For example Henderson is home to an endemic flightless rail, one of the five Pacific islands to retain a flightless rail out of the several hundred formerly so blessed. The number of alien species is unusually low, especially for an island of Henderson's size. In short, Henderson Island is one of the world's irreplaceable treasures.

This was recognised in 1988 when the island was designated a World Heritage Site by UNESCO. Specifically, Henderson met the following world heritage criteria:-

- contain[ing] superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance.
- contain[ing] the most important and significant natural habitats for *in-situ* conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation.

The purpose of this Management Plan is to provide the framework to aid those with responsibility for Henderson, to help them ensure that the island continues to meet those criteria in perpetuity, thus delighting present and future generations. Indeed the need for such a Management Plan was recognised at the time of World Heritage designation. Then UNESCO reported the request by the Bureau of the World Heritage Committee for a description of the marine boundaries of the nominated site, and that the Bureau "encouraged":

- a) work with the Pitcairn Islanders to ensure on-site protection;
- b) review of the legal status of the island and considerations for upgrading it to a nature reserve and preparing a management plan for the site;
- c) considerations for strengthening the protection of the site through more involvement within the framework of the South Pacific Regional Environment

Programme and the Convention on the Protection of Natural Resources in the South Pacific and the Convention on the Conservation of Nature in the South Pacific" (UNESCO 1988).

This Plan is the culmination of discussions with the Islanders who will have a key role in ensuring on-site protection. It can therefore be considered a response to (a) and part of (b) of the Bureau's encouragement.

The Plan is a document that has been agreed among relevant parties. Notable input has been received from the Pitcairn Island Council, from the UK Government (Foreign and Commonwealth Office, Joint Nature Conservation Committee), from the Governor of Pitcairn and the Commissioner for Pitcairn (both based in New Zealand) and from UK NGOs co-ordinated via the UK Overseas Territories Conservation Forum. That said, Henderson's circumstances may change in the light of developments in the wider Pitcairn Islands and beyond, and accordingly the Management Plan makes provision for revision (see section 6.9). In that sense, the Plan is not an immutable document.

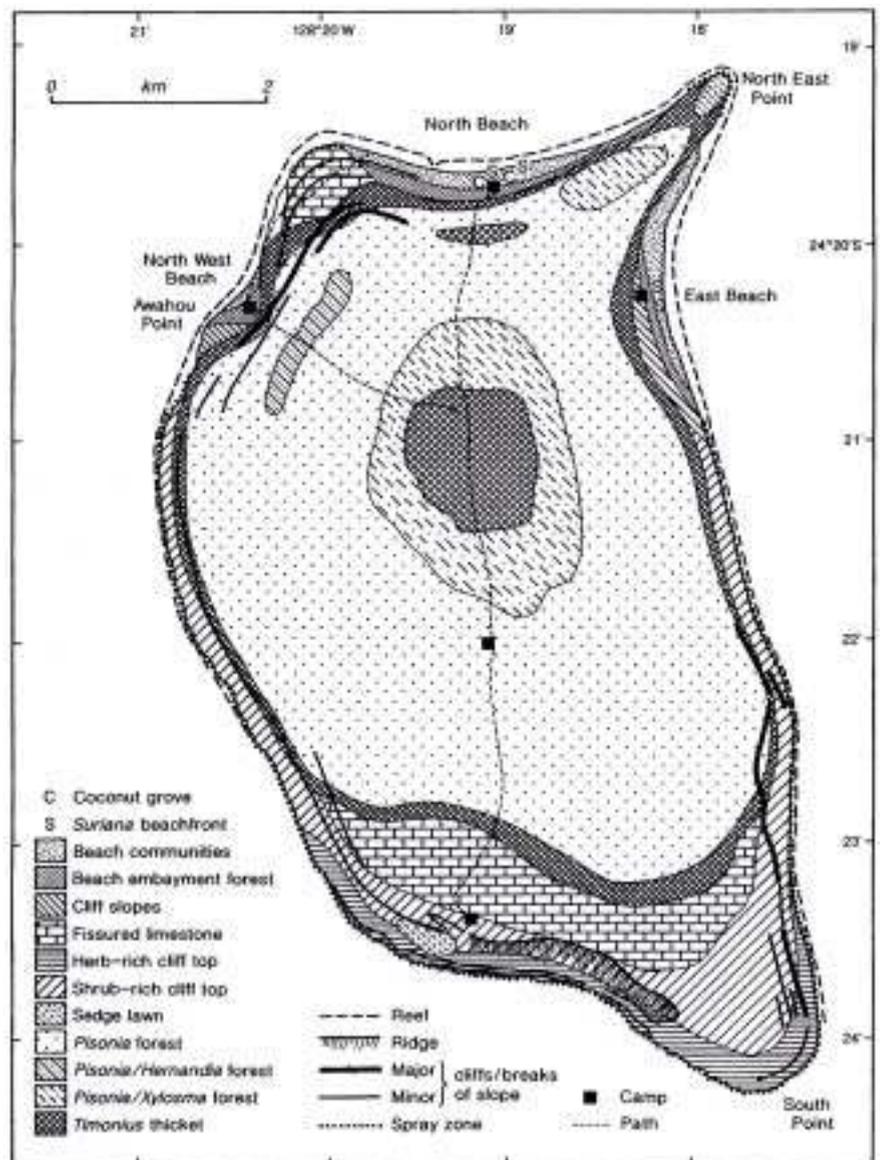
The Plan was drafted by Ian Hepburn in the immediate aftermath of the 1991-1992 Sir Peter Scott Commemorative Expedition to the Pitcairn Islands. Although drafts circulated in the early 1990s, an agreed document did not emerge until 2003. Then, Michael Brooke and Rosie Trevelyan returned to Pitcairn to discuss outstanding issues, and the present Plan results from those discussions.

The broad structure of the Plan follows a now standard approach, adopted, for example, in the Management Plan published recently for Inaccessible Island (Ryan and Glass 2001), a South Atlantic site with many similarities – difficult of access, uninhabited – to Henderson. The document incorporates, firstly (Chapter 3), a description of the administrative framework that currently applies to Henderson Island. Chapter 4 provides extensive factual information on the biological and physical attributes of Henderson gleaned from various sources but especially from the findings of the Sir Peter Scott Expedition. This major international expedition involved some 20 senior scientists plus field assistants over 15 months (January 1991 to March 1992), with the

specific objective of increasing our biological, archaeological and geological knowledge of Henderson. In 1995 the Expedition's findings were published in the Biological Journal of the Linnean Society. The Volume (no. 56, also published by Academic Press) is the most complete compendium available of our knowledge of Henderson. Such knowledge serves to underpin the island's conservation management. Despite its isolation, Henderson has been used by people in the past, and will be used in the future: these uses are discussed in Chapter 5. Next (Chapter 6), the Plan identifies the key management goals which must be met if the natural heritage values of

the island are to be maintained. This leads naturally to the recommended management of Henderson Island, addressed through a series of management objectives, each designed to achieve the fundamental goals of the protection of global biological diversity and sustainable resource use. Each management objective is supported by a series of specific measures intended to meet the stated objectives, plus an outline timetable for projects to be undertaken in the short- to medium-term to implement this plan. This chapter therefore represents the nuts-and-bolts of management.

Henderson Island outline showing topography and major vegetation communities (reproduced courtesy of the Linnean Society). Note that the paths and camps utilised in 1991-1992 have now disappeared.



4. The Administrative Framework of Henderson Island

Henderson Island is Crown Land within the Pitcairn Islands group, an Overseas Territory of the United Kingdom. It is subject to the Lands Court Ordinance (Revised Edition of the Laws 2001), Part VII of which gives to the Governor responsibility for possession, occupation and transference of the lands of the islands. The Wellington-based British High Commissioner to New Zealand holds the office of Governor of Pitcairn.

While the Governor holds most formal powers, much day-to-day administration of the islands' affairs is devolved to a Commissioner based at the Pitcairn Islands Administration office in Auckland.

The Island Council is responsible for the local government and administration of internal affairs within the Pitcairn Islands, including decisions on when to visit any of the other islands in the Pitcairn group. The Council comprises the Island Mayor (elected every three years), the Island Secretary, Chairman of Internal Affairs Committee, four elected officers (elected annually), and two advisers - one of whom is appointed by the Governor and one by the elected members. There is also a Conservation and Quarantine Officer whose remit includes Henderson Island.

Access to Henderson requires a licence issued by the Governor (through the Pitcairn Island Administration office) in consultation with the Island Council.

Nature conservation legislation

The following international conventions relevant to nature conservation and environmental protection have been extended to the Pitcairn Islands.

- Vienna Convention on Substances that deplete the Ozone Layer
- Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter

- Convention for the Protection of the Natural Resources and Environment of the South Pacific Region
- Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar)
- Convention on the International Trade in Endangered Species of Wild Fauna and Flora (CITES)
- Convention concerning the Protection of the World Cultural and Natural Heritage (World Heritage)
- Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)

Wildlife is protected by Part IV of the Local Government Regulations, which incorporates provisions to implement the Bonn Convention; Part III of the Regulations incorporates the provisions of CITES (see Annex IV). Administrative responsibility for these regulations is borne by the Governor and Island Council.

In 1987 Henderson Island was nominated by the UK Government for inclusion in the World Heritage List on the basis of its unique and outstanding biological features. The submission highlighted the following characteristics of Henderson:

- (i) the site demonstrates the dynamics of island evolution and natural selection in a near pristine environment;
- (ii) it is the only example of a raised coral atoll with its ecology virtually intact; and
- (iii) it is a location for endemic species and for populations of more widespread species under intense threat elsewhere (Oldfield 1987).

On 1 January 1989 Henderson Island was inscribed into the World Heritage List under the 1972 Convention concerning the Protection of the World Cultural and Natural Heritage.

5. Henderson Island - A description of its physical and biological features

Location and climate

The Pitcairn Islands - comprising Pitcairn Island (the only inhabited island of the group), Henderson Island (the largest), and the two atolls Ducie and Oeno - lie at the eastern end of the Tuamotu chain in the South Pacific Ocean and are the most south-easterly islands of the Pacific tectonic plate and Indo-Pacific province. The islands are very remote, with closest large land masses (New Zealand and the Peruvian coast of South America) roughly equidistant at about 4,800km away.

Henderson Island is located at 2422'S,12820'W. Pitcairn is about 200km WSW of Henderson, Ducie 360km E and Oeno 200km NW. Henderson is 9.6km long by 5.1km wide with a total area of approximately 37km² (Oldfield 1987).

A weather station was established in February 1991 by the 1991-92 scientific expedition on the coastal cliffs approximately 30m above the North Beach (base) camp. This provided the first continuous meteorological records for Henderson, and the results are summarised by Spencer (1995). The recording period, from February 1991 to January 1992, was influenced by a quasi-periodic re-organisation of the Pacific oceanic atmospheric system, known as the El Niño southern oscillation (ENSO: Spencer 1995). However, comparisons between meteorological data for Henderson and Pitcairn Islands during this 12-month period with average conditions during the previous decade (Table 1) indicate the extent to which the recording year differed from a 'normal' year on Henderson.

In the absence of prior meteorological records the annual rainfall total was estimated at 1500mm based on the island's location within the Southeast Trade belt (Fosberg *et al.* 1983). During the 12 months February 1991 to January 1992 the total rainfall recorded on Henderson was 1623mm; Pitcairn recorded 2171mm during this same period. Both islands followed a similar rainfall pattern throughout the 12 months (i.e. when rainfall increased from one month to the next on Henderson it increased on Pitcairn also, and vice versa). There is no readily discernible seasonal pattern to the rainfall. Pitcairn annual rainfall for the last decade averaged

1884mm (range 1232-2578mm). These data indicate that Pitcairn receives roughly 50% more rain than Henderson - presumably due to orographic effects on Pitcairn, and that in 1991-92 Pitcairn had about 15% more rain than the annual average for the previous decade.

During the 12-month recording period average monthly maximum temperatures on Henderson ranged from 29.6°C (February) to 24.2°C (June); average minimum temperatures ranged from 22.2 °C (February) to 15.7°C (June). The pattern on Pitcairn was similar, with maximum temperatures ranging from 25.1°C in February to 19.4°C in June) and minimum temperatures ranging from a high in March (20.6°C) to a low in June (16.1°C). The data follow the expected seasonal pattern with higher average temperatures in the austral summer months. Average maximum temperatures on Henderson are consistently some 4-5 deg C higher than on Pitcairn. This difference is probably largely due to the different heights of the recording stations; 30m a.s.l. on Henderson, 264m on Pitcairn.

Average minimum temperatures follow the same general pattern but with smaller differences (in the region of 1-2 deg C) and one reversal (Pitcairn average minimum was higher than that of Henderson in June). The monthly average maximum temperatures on Pitcairn during 1991-92 are low compared with the mean for the previous decade, but most fall within the range for the period 1979-90 (June and July are the only exceptions). A similar, though less marked, pattern is discernible for the monthly average minimum temperatures.

It appears that the Pitcairn Islands experienced cooler and wetter than average weather during 1991-92, possibly linked with the effect of ENSO. Taking this into account, it seems reasonable to suggest from the meteorological records available that in general Henderson has a drier, warmer climate than Pitcairn. The usual annual rainfall is probably in the region of 1300-1500mm with normal daytime temperatures ranging from around 28-30°C in summer to 24-26°C in winter, and coldest night-time temperatures rarely below 15-17°C.

Table 1 - Rainfall and temperature data from Henderson and Pitcairn Islands

(a) February 1991- January 1992 data for Henderson (Hend) and Pitcairn (Pitc)

	Temperature (°C)				Rainfall total (mm)	
	mean maximum		mean minimum		Hend	Pitc
	Hend	Pitc	Hend	Pitc		
February	29.6	25.1	22.2	20.5	175.8	274.7
March	29.2	24.8	21.4	20.6	65.3	193.2
April	28.4	23.3	21.3	19.6	198.4	116.7
May	26.8	21.7	19.3	18.1	243.4	167.1
June	24.2	19.4	15.7	16.1	48.3	116.7
July	24.8	19.8	16.9	16.3	123.2	136.3
August	25.3	20.2	19.0	16.9	39.1	98.0
September	24.5	20.3	16.6	16.2	180.9	327.4
October	25.8	21.1	19.2	17.7	84.2	222.2
November	27.6	23.0	20.1	18.6	37.5	38.1
December	28.1	23.6	20.8	19.4	207.4	242.0
January	28.3	23.5	21.0	20.1	123.1	233.1

(b) Pitcairn 1979-90 averages and range. Ten years' data since 1987 and 1988 data not available.

	Temperature (°C)		Rainfall (mm)
	mean maximum	mean minimum	
January	26.1(24.0-27.9)	21.0(19.5-21.7)	86.0 (4.5-174.7)
February	26.5(25.0-27.0)	21.4(20.4-22.2)	116.3 (34.9-248.6)
March	26.0(24.5-26.7)	21.5(20.2-22.0)	175.0 (67.3-319.9)
April	24.8(23.3-25.7)	20.5(19.5-21.3)	105.5 (35.2-197.6)
May	23.0(21.8-24.6)	19.1(19.5-21.3)	140.3 (44.9-320.6)
June	22.0(20.7-23.3)	17.8(16.6-18.4)	187.1 (79.0-398.8)
July	21.5(20.2-27.0)	17.1(16.5-17.8)	148.5 (34.8-260.8)
August	20.7(18.9-22.2)	16.6(15.7-17.8)	163.3 (18.7-314.3)
September	21.2(20.2-23.0)	16.8(15.5-18.8)	136.4 (57.3-350.3)
October	22.1(21.1-23.7)	17.5(15.6-19.0)	144.3 (25.6-540.8)
November	22.8(21.7-23.7)	18.7(17.7-19.9)	164.9 (51.6-253.4)
December	24.1(22.7-25.5)	19.8(18.7-20.8)	241.7 (49.2-588.9)

Sources: Sir Peter Scott Commemorative Expedition to the Pitcairn Islands, 1991-1992, and Pitcairn Island Meteorological Station.

Geology, landforms and hydrology

The original volcanic island forming the atoll basement of Henderson may be around 13 million years old (Spencer & Paulay 1989, Spencer 1995). The initial phase of volcanic island building at nearby Pitcairn occurred around 0.8 to 0.9 million years ago (Blake 1995). The weight of this new volcanic island caused the crust beneath Pitcairn to be depressed, with uplift c. 200km from the load, a process known as lithospheric flexure. Uplift at Henderson caused the former sealevel atoll to be raised above sealevel to form a fossil

raised reef and a dry, fossil lagoon.

This process (which is still continuing at a rate of 0.1mm/yr) has caused this coral atoll to be elevated to a maximum of 33.5m a.s.l. The island has been emergent for about 380,000 years (Blake 1995), and this may be the timescale over which endemic terrestrial taxa have evolved.

The central plateau of the island forms a slight, dish-shaped depression (the fossil lagoon floor). The island is characterised by eroded karst surfaces, and is extremely rugged with areas of steep-sided pits, frequently 2-3m deep and reported to reach 3-7m deep. There are areas of jagged limestone pinnacles.

Caves occurring in the cliffs above the beaches were used extensively for shelter and habitation by the ancient Polynesian inhabitants of Henderson.

Henderson's geology, combining indicators of sea level change and corals dating back to



Plate 1.
Vertical limestone cliffs, rising 30m from the Pacific Ocean, surround the greater part of Henderson.

Within the interior, there are also open areas of coarse coral rubble with poor soil development and fossil patch reefs with corals still in their growth position.

Henderson is surrounded by vertical cliffs rising up to 30m. Marine erosion at the exposed southern end of Henderson has contributed to the formation of arches in the sea-cliffs (one measured at 24m a.s.l.) and a 'blow-hole' about 100m inland from the cliff edge.

The process of uplift has not been continuous and is reflected in several reef terraces preserved in the eastern, northern and north-western embayments. During periods of little uplift, wave action has eroded caves into the base of the sea cliffs, and, when uplift resumed, these caves, too, have been elevated.

at least 630,000 years ago, provides a unique opportunity for documenting climate change in the second half of the Pleistocene and therefore testing possible drivers of climatic cycles (e.g. Milankovitch cycles: Stirling *et al.* 2001).

Fringing reefs, averaging 50-100m offshore, occur around about a half of the island and protect the principal beaches, the 2km North and East Beaches and the small North-west Beach. Access to the island is normally via a passage in the reef in the middle of the North Beach. However it is also possible to land on the North-west Beach.

There is no fringing reef either between South Point and the North-west Beach or around the extreme north-east point where the cliffs are most severely undercut.



The reef lagoon is, in general, poorly developed, although there is an isolated, deep lagoonal depression within the reef at the northern end of East Beach which appears to harbour a full complement of reef fish species recorded at the reef edge.

Surface fresh water occurs only as drippings in caves, a few very small fresh to brackish pools at the South End (which appear to be rain-fed and become increasingly saline through evaporation and salt-spray), and small amounts of rainwater trapped in vegetation such as at the base of *Asplenium* leaves. One cave drip was measured in March 1991 at 4.5 litres/day, and another in January 1992 at 4.8 litres/day (unpublished observations of the Sir Peter Scott Commemorative Expedition to the Pitcairn Islands).

Fresh (or brackish) springs have been located at the North Beach and North-west Beach below high water level. A reported spring of unknown flow and permanence below the

high tide level at the north end of the island (Oldfield 1987) was not relocated by the 1991-92 expedition. However members of the expedition did locate a probable freshwater spring below low water level at the North-west Beach.

There is no readily available source of groundwater close to the surface. A pit excavated to a depth of 3m behind the beach crest on North Beach by the 1991-92 expedition failed to reach a water table.

The tidal range in the Gambier Islands (French Polynesia; c. 750km from Henderson) is 0.7-0.8m. Henderson has a semi-diurnal tidal cycle and probably a similar tidal range to the Gambiers, although sea state and atmospheric pressure can have a significant effect on sea levels regardless of tide. During strong onshore winds, low pressure and heavy swell, waves may breach the beach-crest; high pressure combined with spring tides depresses sea levels such that the fringing coral reef is exposed.

Plate 2.

The cliffs of Henderson, here near the North-west Point, are pocked by caves at various levels. Most were cut out at sea-level and then rose upwards as the entire island rose.

Plate 3.

Wave activity continues to undercut Henderson's cliffs.



Soils are generally poorly developed. The best organic loams up to 25cm in depth, with patches of well-developed humus layers, occur on the plateau around the rim of the fossil lagoon. Silty loams occur between limestone ridges at the South-west point. Beach-back woodland soils are derived from coral sand with organic material incorporated.

The poorest soils are in the centre of the island, developed on fossil lagoon reef patches and comprising a creamy, clay-like material between coral fragments. Surface sand deposits are rare on the plateau. All soils examined by the 1991-92 expedition were slightly on the alkaline side of neutral, in the range pH 7-8 (unpublished observations of the Sir Peter Scott Commemorative Expedition to the Pitcairn Islands).

Archaeological studies have identified Polynesian gardening sites on the eastern fringes of the plateau and at the cliff top above the North Beach. These sites are associated with charcoal, suggesting there was substantial burning of the plateau in the past (Weisler 1995).

Biological features

Main habitat types

Most of the surface of Henderson is densely vegetated with tangled scrub and scrub-forest, which averages around 4-7m in height and is virtually impenetrable over much of the island.

Taller tree species include *Cocos nucifera*, *Guettarda speciosa* and *Pandanus tectorius*; smaller trees include *Celtis pacifica* and *Pisonia grandis* (which is the predominant species of plateau woodland and scrub communities) and the endemics *Santalum hendersonense* and *Myrsine hosakae*.

The cliffs are only sparsely vegetated while the steep slopes are covered in ferns or dense herbs. Where there is heavy exposure to salt spray near the South Point, the vegetation is much more open.

Within that broad framework six major vegetation communities were distinguished by Waldren *et al.* (1995a) on the basis of surveys undertaken in 1991.

These are:-

- A. Beach-front communities of herbaceous and shrubby species.
The community is restricted to beaches of the northern part of the island.
- B. Embayment forests comprising tall forests 8-12m high occurring between the dune and cliff communities of the three main beaches.
- C. Open limestone scrub on dissected plateau limestone and thickly vegetated cliff slopes.
- D. Cliff and ledge communities on slopes too steep for open limestone scrub.
- E. Exposed cliff top communities, at the north-east point and near the south end where exposure to salt spray is high.
- F. Plateau forests, covering much of the elevated plateau and fossil lagoon.

The species characteristic of these communities are given in Table 2.

Table 2 — Main plant communities of Henderson Island and their principal species (after Waldren *et al.* 1995a)

A. Beach-front communities	<i>Scaevola taccada</i> , <i>Heliotropium candidum</i> , <i>Suriana maritima</i> (on sand)/ <i>Pemphis acidula</i> (on rock) and <i>Argusia argentea</i>
B. Embayment forest	<i>Cordia subcordata</i> , <i>Thespesia populnea</i> (not on East Beach), <i>Celtis pacifica</i> , <i>Pandanus tectorius</i> , <i>Pisonia grandis</i>
C. Open limestone scrub	<i>Phymatosorus scolopendrium</i> , <i>Timonius polygamus</i> , <i>Eugenia reinwardtiana</i> , <i>Nephrolepis hirsutula</i>
D. Cliff communities	<i>Heliotropium anomalum</i>
E. Exposed cliff top communities (low)	<i>Eugenia reinwardtiana</i> , <i>Chamaesyce sparrmannii</i>
F. Plateau forest communities	variable abundance of different species with species-rich areas on better soils including <i>Pisonia grandis</i> , <i>Nesoluma st-johnianum</i> , <i>Celtis pacifica</i> as dominants; drier, poorer soils have more <i>Xylosma suaveolens</i> ; <i>Pandanus</i> groves are common.

Of these communities, the beach-back embayment forests have been most influenced by introduced species. Coconut *Cocos nucifera* was introduced by Polynesians as early as the 12th century, although the existing coconut groves on the North Beach and North-West Beach were planted by Pitcairners early in the 20th century. Tou *Cordia subcordata* is probably a Polynesian introduction: it is found only behind the North and East Beaches. Rosewood or miro *Thespesia populnea* is also a Polynesian introduction, restricted to the North Beach and North-west Beach woodlands, which has become vitally important to the Pitcairn economy through its harvesting and use by the Pitcairners as a material from which curios are carved. Miro has probably replaced *Celtis/Glochidion* in the beach-back forest, although native ferns continue to thrive here. In some areas (e.g. North Beach) heavy cutting is thought to have resulted in miro being replaced by *Pandanus*, possibly through a combination of the dense *Pandanus* litter preventing miro seeds from gaining sufficient light for germination and shading or physical damage to seedlings by the large, heavy *Pandanus* leaves.



Plate 4.

Pandanus trees dominate some areas fringing and behind the North Beach. Their shade and heavy leaves may be a factor inhibiting growth of the saplings of the prized carving wood, miro *Thespesia populnea*.

Compared to the beach-back communities, the plateau is more intact ecologically. The forest and scrub woodland, pinnacle limestone and open coral rubble areas have been less influenced by the Polynesian occupation of Henderson. Apart from irregular and minimal disturbance by survey expeditions, whose main influence is to cut trails and open up some areas of the canopy, ecological processes on the plateau continue without interference.

Plate 5.

The tree *Hernandia stokesii* is confined on Henderson to the area with the most fiercely pinnacled limestone, about 1 km south-east of the North-west Beach. The species has an interesting distribution, being only found elsewhere on the island of Rapa, some 1600 km to the west of Henderson.



Table 3 - Vascular plants introduced by humans to Henderson Island (based on Waldren *et al.* 1995a, 1999, Weisler 1995)

Species	Introducing agent	Function
<i>Achyranthese aspera</i> var. <i>pubescens</i>	Polynesians	Adventive.
<i>Aleurites mollucana</i> [1]	Polynesians	Light.
<i>Caesalpinia bonduc</i>	Polynesians	Beads?, adventive?
<i>Cocos nucifera</i>	Polynesians; Pitcairners	Food & drink, medicinal, clothing, construction.
<i>Cordia subcordata</i>	Polynesians	Timber, medicinal, ornament?
<i>Cordyline fruticosa</i>	Polynesians	Food, religious & cultural use.
<i>Hedyotis romanoffiense</i>	1991-92 Expedition	Accidentally introduced from Oeno: First seen in 1997.
<i>Lycopersicon esculentum</i>	Pitcairners	Food, never persisting long.
<i>Pandanus tectorius</i>	Polynesians?; native?	Food, construction, medicinal.
<i>Passiflora maliformis</i>	Pitcairners?	Adventive?
<i>Setaria verticillata</i> [2]	Pitcairners?; Operation Raleigh?	Adventive.
<i>Solanum americanum</i>	Polynesians	Adventive
<i>Thespesia populnea</i>	Polynesians	Timber, medicinal, ornament?
<i>Thuarea involuta</i>	Polynesians?; native?	Adventive?

Notes

[1] probably extinct; encountered previously but not during the 1987 Smithsonian Expedition (Fosberg *et al.* 1989), nor located during 1991-92 expedition (Florence *et al.* 1995); shell fragment found on North Beach in 1997.

[2] all specimens seen during 1991-1992 were destroyed.

In addition, the following have been recorded only from (sub-) fossil material, though it is not known whether the plants were grown by the Polynesians *in situ* or whether they were derived from material transported to Henderson by Polynesians: *Barringtonia asiatica*, *Cyrtosperma chamissonis*, *Hibiscus tiliaceus*, *Musa* sp.

Only about 15% of the flora is introduced. *Pandanus* palms are scattered throughout the island and amount to about 15% of the vegetation cover. Their origin is uncertain and this species may well be composed of both native and introduced stock (seeds arriving through long-distance sea dispersal, and plants brought by Polynesian settlers). The oil-rich *Pandanus* leaves were used for house thatch, matting, etc; aerial roots and fruits were eaten in times of food shortage (a “famine food”). The introduced candlenut *Aleurites moluccana* has not been collected since 1924 and is presumed extinct on Henderson (Table 3). Other introduced plants and, where relevant, their probable uses are indicated in Table 3.

The 71 species of vascular plant recorded on Henderson are listed in Annex I. This flora, derived from the west (Kingston & Waldren, 2003), includes nine taxa endemic to Henderson and one endemic to the Pitcairn group (occurring on Henderson and Pitcairn only) and a number of species which are rare or restricted within the island (Table 4).

These species are those of greatest conservation concern. The 1991-92 expedition recorded four species new to Henderson, and also collected 21 lichen species, most of which were new to Henderson since, previously, only five species had been recorded (Florence *et al.* 1995).

It appears that most of the plateau vegetation has never been cleared (but see comment above concerning Polynesian gardens). Exceptions are a few patches cleared in the north and north-west for guano surveys early in the twentieth century, clearances in the northern third of the island for a network of lines associated with an airstrip survey during World War II, and plateau clearances in 1966 for helicopter landings during another airstrip survey.

Since that time, a southbound path was cut by ‘Operation Raleigh’ in 1986. The path extended about one kilometre from the North Beach. The network of paths was extended during the 1991-1992 (Benton & Spencer 1995), but the paths had virtually vanished by 2000.

Table 4 - Globally threatened flowering plants occurring on Henderson Island, based on Florence *et al.* (1995) and Waldren *et al.* (1995b)

Taxon	Distribution	Status on Henderson
<i>Allophyllus rhomboidalis</i>	SE Polynesia	Occasional
<i>Alyxia fosbergii</i>	Henderson endemic	Common
<i>Bidens hendersonensis</i> var. <i>hendersonensis</i>	Henderson endemic	Locally common
<i>Chamaesyce sparmannii</i>	Pitcairn, Henderson and Marotiri Rocks only	Frequent on coast
<i>Geniostoma hendersonense</i>	Henderson endemic	Locally common
<i>Hernandia stokesii</i>	Rapa, Henderson	Locally common
<i>Ixora fragrans</i>	Henderson endemic (?)	Common
<i>Meryta brachypoda</i>	South-central Pacific	Rare
<i>Myrsine hosakae</i>	Henderson endemic	Uncommon
<i>Nesoluma st-johnianum</i>	Henderson endemic	Frequent
<i>Peperomia rhomboidea</i>	Henderson endemic	Frequent
<i>Pittosporum arborescens</i>	Pacific Islands	Very rare
<i>Santalum insulare</i> var. <i>hendersonense</i>	Endemic variety	Fairly common
<i>Sesbania coccinea</i>	Eastern Pacific	Possibly extinct
<i>Xylosma suaveolens</i> var. <i>haroldii</i>	Endemic variety (possibly also Pitcairn)	Common/Frequent

In addition, the following endemic taxa, currently not recognized as taxonomically distinct, have been described from Henderson: *Cyclophyllum barbatum* forma. *calcicola*, *Bidens hendersonensis* var. *spathulata*

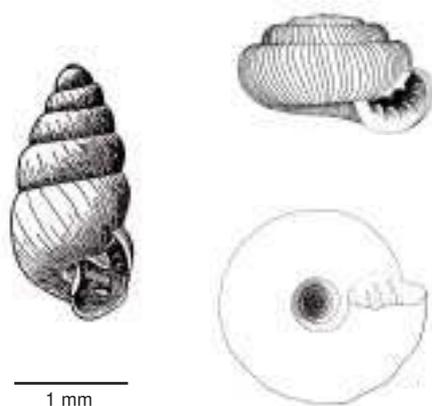
Animals - species, populations and relationship to main habitats

Invertebrates

Until the 1991-1992 Expedition, only a few groups of invertebrates had received the attention of scientists visiting Henderson. The Expedition's collections greatly expanded our knowledge of invertebrate groups, but it is likely that species inventories from most groups remain far from complete. The following account therefore sketches points of interest while indicating the approximate number of species and degree of endemism within certain groups.

There are only about 180 species of insect on Henderson, of which about 20% may be endemic (Benton 1995). Reflecting their strong flying abilities, moths and flies comprise over 50% of the known insect fauna. Over 100 species of non-flying terrestrial arthropods have now been recorded, with indications that the levels of endemism are high (Benton & Lehtinen 1995). All groups of arthropods are overwhelmingly derived from the west, from Polynesia rather than from South America to the east.

The snails *Tubuaia hendersoni* (L) and *Minidonta hendersoni* (two on R) are two of roughly eight living snail species that are endemic to Henderson.



Sixteen species of land snail currently occur on Henderson: about half the taxa are endemic (Preece 1995a). A further six species formerly occurred on the island. They are represented in sub-fossil deposits but then disappeared around 400-900 yr BP. The timing of the disappearance strongly suggests that their demise was caused by the Polynesian occupation, but the precise causes have not been established (Preece 1998).

With some exceptions detailed below marine inshore invertebrates have not been well studied. Available information was collated by Paulay (1989). Widespread species such as slate-pencil urchins *Heterocentrotus trigonarius* and crayfish *Panulirus* sp. are present, and the latter are harvested for local use when the Pitcairners visit. Among the better-studied groups are corals (Pandolfi 1995) and molluscs (Preece 1995b). Preece documented 426 marine mollusc species from the wider Pitcairn Islands, and 305 from Henderson. He estimated that the total fauna might be around 700 species, the overwhelming majority derived from the west. In contrast to the terrestrial fauna, endemism is low, under 2%.

Vertebrates

As is true of the marine invertebrates, the fish species occurring at Henderson tend to be a subset of those occurring further west in Polynesia. Irving (1995) noted 183 fish species from 49 families. Neither species richness nor endemism are particularly high. Annex III provides a list of fish species recorded around the reef.

One species of gecko (*Lepidodactylus lugubris*) and three species of skink (*Cryptoblepharus poecilopleurus*, *Emoia cyanura*, *Lipinia noctua*) have been recorded from Henderson (Gill 1993). All are most likely Polynesian introductions.

Green Turtles *Chelonia mydas* nest on East Beach. The main nesting season is around January-March. Observations in 1991-1992 suggested about 10 females may be using the Island. While this is a low number in global terms, it is a total that represents about 1% of the French Polynesian population (Brooke 1995a).

Henderson Island is of global significance for its four endemic landbird species and for its large populations of seabirds. Of particular importance among the seabirds is the Henderson Petrel. Formerly considered the dark morph of the Herald Petrel, the taxon was given specific status by Brooke & Rowe (1996) on the basis of data gathered during 1991-1992. Henderson Island is the global headquarters of this Endangered species.

The general distribution and populations of breeding seabirds on Henderson is shown in Table 7.



Plate 6.

The breeding season of Green Turtles *Chelonia mydas* on Henderson is mostly January-March. The East Beach is favoured for nesting.

Table 7 - Henderson seabird population estimates (pairs) and distribution. Information from Brooke (1995b, c). The Henderson population as a percentage of the world population is coded as follows: * ≤ 1 , ** 1-10, ***15+. The Henderson Petrel is Endangered, Murphy's Petrel Near-threatened (BirdLife International 2000).

Species	Population estimate	Distribution on Henderson
Murphy's Petrel <i>Pterodroma ultima</i>	2500*	Mainly beach and cliff on East Beach and North Beach and low scrub at south end
Kermadec Petrel <i>P. neglecta</i>	10,000***	On plateau, usually within 500m of coast; rarely at sea level
Herald Petrel <i>P. heraldica</i>	11,100***	Throughout plateau
Henderson Petrel <i>P. heraldica</i>	16,000***	Throughout plateau
Red-tailed Tropicbird <i>Phaethon rubricauda</i>	200-300*	Mostly close to cliff top; especially at South End
Masked Booby <i>Sula dactylatra</i>	50-60*	North and East beaches only
Red-footed Booby <i>S. sula</i>	100-200*	Generally scattered through plateau forest
Great Frigatebird <i>Fregata minor</i>	c. 100-200*	Generally scattered through plateau forest
Fairy Tern <i>Gygis alba</i>	?thousands, perhaps 10,000**	Throughout the island
Blue-grey Noddy <i>Procelsterna caerulea</i>	breeding not confirmed, but suspected; perhaps 10 pairs probably confined to North beach cliffs	
Brown Noddy <i>Anous stolidus</i>	c. 100*	More or less open areas of plateau
Black Noddy <i>A. minutus</i>	10s*	More or less open areas of plateau

Plate 7.

Polynesian rats *Rattus exulans* have been present on Henderson for at least 700 years. Their impact on the breeding success of the surface-nesting gadfly petrels is severe.



Of great concern is the fact that, during 1991-1992, breeding success of all four *Pterodroma* species was low, under 20% and indeed close to zero for Murphy's Petrel (Brooke 1995b). Observations suggested that this low success was due to predation by Pacific rats *Rattus exulans*, introduced by the Polynesians, on small chicks. If this one year's outcome was typical of most other years, and further research in 2003 suggested it was, then the future of petrels on Henderson and, most worryingly, of the Henderson Petrel is in jeopardy. A research priority is to establish whether rat predation is always high.

All waders (or shorebirds) recorded are migrants from the northern hemisphere. Small numbers of Wandering Tattlers *Heteroscelus incanus* and Sanderlings *Calidris alba* are found on the beaches of Henderson. Pacific Golden *Pluvialis fulva* and Grey Plovers *P. squatarola* have also been recorded. The most numerous wader is the Bristle-thighed Curlew *Numenius tahitiensis*. This species uses all three beaches and is a migrant from Alaska with a northern winter (i.e. austral summer) population of around 40-50 birds, most of which arrive in early September and depart in April, leaving a non-breeding population of no more than ten birds on the island. Since the world population of this Vulnerable curlew is only about 10,000 (BirdLife International 2000), the Henderson population is about 0.5% of the total.

Henderson's endemic land birds

Henderson Island is of the highest ornithological importance, not only for the seabirds discussed above but also for its landbirds. All four breeding landbird species are endemic to the island and classified as Vulnerable by BirdLife International (2000).

Of pre-eminent interest is the flightless Henderson Crake *Porzana atra*, one of only about five species of flightless rail remaining extant on Pacific islands. Its former generic name, *Nesophylax*, translates as 'the black guardian of the island' (Serpell *et al.* 1983). Population estimates for this species, known to the Pitcairners as 'chicken-bird', were 3240 individuals in 1987 and, perhaps using a more reliable technique, 6200 in 1991 (Graves 1992, Jones *et al.* 1995). While some eggs may be lost to the Pacific rats present on Henderson, the crakes are very aggressive towards the rats, and have co-existed with them for some 800 years. There is no immediate concern for the crake, provided other predators do not reach Henderson.

The Henderson Fruit-dove *Ptilinopus insularis* is an endemic representative of a widespread Pacific genus. Its diet includes most fruit species available on the island, but the watery *Procris pedunculata* is especially important. Population estimates in 1987 and 1991/92 were 3420 and 3140 individuals respectively (Brooke & Jones 1995).

The Henderson Reed-warbler *Acrocephalus taiti*, formerly considered conspecific with the Pitcairn Reed-warbler *A. vaughani*, has been the subject of a detailed single-season breeding study which established that about one-third of breeding territories were occupied not by pairs but by trios. Such trios, either two male/one female or one male/two females, were of birds unrelated to each other. Population estimates in 1987 and in 1991/92 were 10,800 and 9,500 individuals respectively (Graves 1992, Brooke & Hartley 1995).

The scarcest of the landbirds is the Henderson Lorikeet *Vini stephensi* which feeds on nectar, pollen, fruit and also arthropods (Trevelyan 1995). No nest has ever been found. Worldwide, it is the only species of *Vini* living in habitats relatively little altered by man. A population estimate in 1987 was 720-1820 individuals (Graves 1992).

While the present-day avifauna is of global importance, the past avifauna was richer still. This is indicated by major studies of the sub-fossil bird bones by Steadman & Olson (1984), Schubel & Steadman (1989), Wragg & Weisler (1994), and Wragg (1995). These studies have consistently revealed that seabirds, especially

Pterodroma petrels, were a major source of food for Polynesians. Since the present petrel populations would be difficult to harvest because the birds are so scattered across the plateau, it is plausible that former populations were larger by one or two orders of magnitude. Moreover, three or four seabird species are sufficiently common in sub-fossil deposits to suggest they formerly bred on Henderson, but are now extinct there, although not globally (Wragg 1995).

and three pigeon species, all apparently endemic to Henderson, became extinct as a result of the Polynesian impact. In addition the Pacific Swallow *Hirundo tahitica* was locally extirpated. Of the extant landbirds, the warbler is known from pre-occupation deposits, but the other three species make their first appearance at the boundary layer between pre-occupation deposits and younger deposits showing anthropogenic influence (Wragg 1995).

A similar picture of Polynesian impact emerges from studies of landbird bones. One sandpiper



6. Human Use of Henderson - Past, Present and Future

Prehistoric Use of Henderson

Archaeological surveys have established that Polynesian occupation of Henderson extended over a period of about 800-900 years from about the late 8th to early 17th centuries (Weisler 1995). The Polynesian sites appear to be concentrated in rock shelters, caves in coastal cliffs and beach areas fringing the northern part of Henderson. Although the less hospitable plateau and southern coastline of the island have yet to be fully explored, it is clear these areas were less heavily utilised. Over 20 major sites have been located, and up to 100 Polynesians could have lived on the island.

that use of Henderson was most intensive during certain parts of the year, for instance during the turtle nesting season. In the later part of the occupation period, from around 1450 AD, contact between the islands apparently ceased, and this probably contributed to the eventual demise of the population. It is apparently a coincidence that the Polynesian occupation ceased just before the first European, Captain Quiros sailing from Peru with a fleet of three ships, 'discovered' Henderson in 1606.

Plate 8.

The intensity of the Polynesian occupation of Henderson, an occupation lasting over 600 years, was revealed by archaeological work masterminded by Marshall Weisler, now of the University of Otago, and undertaken during the 1991-1992 Expedition.



Polynesians were responsible for introducing a number of plants to Henderson (see Table 3) and probably the Pacific Rat. In the quest for food they exploited both marine animals (reef fish, sea turtles, crabs, lobster and shellfish) and terrestrial species, in particular seabirds and the endemic landbirds. As discussed above, they may have been a major agency in the extirpation of some bird species from Henderson.

In the early part of the occupation period, contact was maintained with Pitcairn, evidenced by the use of materials not available on Henderson itself. It is therefore possible

Historic and Current Use of Henderson

Although Henderson Island was discovered by Europeans in the early 17th century, it was not until two centuries later that the island was named, after Capt. James Henderson of the *Hercules* who called on 17 January 1819. Only in 1838 was the Pitcairn group formally possessed for the British Crown. Subsequent visits by Europeans to Henderson have been infrequent and irregular, largely due to the difficult landing conditions which prevail much of the time and the lack of a secure water supply on the island.

A series of survey expeditions to Henderson have been made with a view to exploiting various resources, including phosphate mining (visits in 1881, 1900, 1907, 1908 and 1912 - none of which found phosphate in commercial quantities), the construction of an airstrip for strategic purposes (surveys by the British forces in 1944, and USNS Sunnyvale hydrographic survey ship in 1966) and personal use of a prospective resident - that of Mr. Ratliff in 1981 (Winchester 1985).

Scientific investigations - mostly in the form of plant and animal collections - have been made both independently and alongside early phosphate surveys since Capt. F.W. Beechey's visit in HMS *Blossom* in 1825. The first substantial biological study was in 1912 (by James Banks, D.R. Tait and J.R. Jamieson during a phosphate survey) and further visits for biological studies occurred in 1922 (Whitney South Seas Expedition), and 1934 (Mangarevan Expedition). Biological and other scientific studies were conducted during 1986 Operation Raleigh and 1987 Smithsonian Expeditions. These visits were mostly of short duration and based on the North and North-west beaches. Because of the difficulty of penetrating the interior of the plateau their work was concentrated on the northern and north-western fringes of Henderson. Certainly nothing has approached the scale and extent of investigation of contemporary ecology, biology and historical ecology and archaeology of Henderson Island achieved during the 1991-92 Sir Peter Scott Commemorative Expedition, when approximately 70 scientist-months covering a wide range of earth and life science disciplines focused on the island.

The first visit by Pitcairners to Henderson was in 1843, and two further visits were made in 1851. These were little more than reconnaissance visits and were only possible because of the chance availability of a vessel for the journey. Since the advent of long-boats on Pitcairn it has been possible for regular journeys to be made to Henderson to harvest the favoured miro and tou woods for carving. From the late 1930s occasional trips were made to cut wood, but only since the arrival of the tough, aluminium-hulled long-boats (Tin in 1983 and Tub in 1987) to replace earlier boats of wooden construction have regular

trips to Henderson been possible. Pitcairners usually visit Henderson once a year, but occasionally pay up to three visits in a year when weather conditions are particularly favourable. These visits, normally accompanied by the Pitcairn Conservation Officer, potentially allow management activity.

Reef fish, crayfish and coconuts are exploited by both Pitcairners and expeditions temporarily resident on Henderson. Marine fish are caught in small quantities by these groups and passing (non-commercial) vessels. The UK Government has previously leased fishing rights within Pitcairn waters to Japanese fishery interests under a 3-year licence (in the late 1980s). Pitcairners report frequent incidents of illegal commercial fishing by Korean, Taiwanese and other fishing vessels within the 200-mile exclusive economic zone.

Forest exploitation

Forest exploitation merits a separate section since the introduced hardwoods miro and tou are prized by Pitcairners for hand-carved curios, and are the main resource exploited from Henderson. Wood carving is important to the Pitcairn economy, and is likely to remain so, and the harvest of this wood is the main reason for any visit to Henderson by the Pitcairners.



Plate 9.

The carving woods harvested on Henderson are crafted into saleable curios by Pitcairners such as Jay Warren.

The main employment of the small Pitcairn workforce is in local government and community service sectors. While all Pitcairners between school-leaving and

retirement ages are engaged in paid employment, the income can be low (about NZ\$150 per month for part-time work). Supplementary income is essential for the islanders to acquire any goods or services from outside Pitcairn. Wood carvings (or curios) are the main source of supplementary income. The chief outlet is direct sale to visitors, and especially to cruise ship passengers, although some mail order sales are achieved despite intervals of months between ships visiting Pitcairn.

Both miro and tou grow on Henderson only in the beach-back woodlands (tou in East Beach and North Beach woodlands and miro in North Beach and North-west Beach woodlands). Miro is also grown in plantations on Pitcairn (see below), where tou is rare.

Landing conditions are difficult and access to the favoured North and North-west Beaches is not always possible. Prevailing weather conditions place a greater restriction on visitors landing at Henderson than any other mechanism.

The island is an attractive landing point for passing yachts, most of which arrive from the east, either from Rapa Nui or the Galapagos, and therefore they call at Henderson before making contact with Pitcairn. This creates difficulties in providing them with information prior to their visits. Henderson also remains a specific target for smaller cruise ships carrying passengers on South Pacific cultural and natural history voyages. Such cruise ship visits are likely to continue and perhaps increase in the foreseeable future.

Plate 10.

Only once or twice a year does Henderson receive any significant influx of people, in this case passengers from the *World Discoverer* arriving for a day visit.



Irregular and small-scale use of Henderson

As Henderson is uninhabited there are no means of maintaining an accurate record of *ad hoc* visitors landing from the yachts and larger vessels passing through Pitcairn waters. In theory all visitors require landing permission to be granted by the Pitcairn Administration, but the remote location makes policing such a regulation impossible unless Pitcairners or other sanctioned visitors happen to be present.

The 1991-92 scientific expedition noted 11 vessels stopping at Henderson during the ten months from February to November 1991. Approximately 140 people landed on Henderson from nine of these vessels. Most of the visitors (c. 100 people) landed from the 'World Discoverer' tourist ship carrying passengers on its regular (annual) South Pacific natural heritage voyage. All those who landed on Henderson, with the exception of some of the yacht crews (about 18 people),

would have landed on the island regardless of the presence of the expedition members. The Pitcairners suggest that the frequency of such landings in the decade since 1992 has remained roughly the same.

The concern with all visitors is that they will introduce alien species, remove archaeological artefacts, and mis-use the Pitcairners' carving resources. The concern grows with the number of visitors. Measures to minimise visitor impact are discussed in Chapter 7 (section 7.4) and listed in the visitors' code of conduct (Annex VII).

Future resource use

There is no quantitative information on either the extent or the rate of use of any of Henderson Island's resources which are currently exploited. Observations as early as the 1950s (Williams 1960) suggested that miro (and perhaps tou) were being harvested at an unsustainable rate. This problem may have been exacerbated in the late 1980s and early 1990s as chain-saws replaced axes and the frequency of visits increased. However recent years have seen the frequency of visits drop below one a year.

The demand for these prized carving woods is unlikely to diminish. The sale of curios is likely to continue to be an important source of income for Pitcairn families, unless an alternative source of supplementary income is developed. The most frequently suggested source is an improved infrastructure, permitting an increased number of homestay tourists on Pitcairn. Such tourists might well wish to buy carvings, and therefore demand for the wood resource would not actually decline.

Miro from plantations on Pitcairn is generally regarded by the Pitcairners as being an inferior quality wood. It lacks the colour and grain of Henderson miro - possibly resulting from the different growing conditions and climate at the two locations (richer soil and wetter climate of Pitcairn compared with the nutrient-poor sandy soils of the Henderson beach-back areas and lower rainfall of this island). Thus the Henderson miro will remain a preferred carving material for Pitcairners.

Management should therefore be designed to foster sustainable use of Henderson's woods. Observations during the 1991-92 scientific expedition indicated that there remains a considerable number of cut stumps from large miro trees - some of which show signs of coppice-like regeneration - but few saplings and apparently very poor survival of seedlings under the dense *Pandanus* and coconut canopy.



Other uses may be made of Henderson. Specialist natural history and natural heritage tourism is an expanding sector of the tourist trade. A focus on globally important and unique areas - including World Heritage Sites - is likely to be a feature of this sector of the trade in future. Demands by tour ships similar to *World Discoverer* to visit to Henderson Island may well increase as this specialist market expands.

The UK Government would be interested in selling licences to fish within Pitcairn waters. No licensed commercial fishing occurs at present. Illegal fishing is suspected by the Pitcairners to occur, and no means exist to police effectively either this or any legally granted rights to fish within Pitcairn waters generally or close to Henderson specifically.

Henderson provides a remarkable opportunity to study a number of natural science and archaeological topics, including species turnover and the impact of man on species extirpations. There are likely to be specialist scientific visits in the future.

Plate 11.

An old tou tree *Cordia subcordata* has several times been cut by the Pitcairners for carving wood, but this tree continues to sprout new stems which, in due time, can be harvested anew.

7. Henderson Management goals and objectives

The conservation importance of Henderson Island is derived from the near-pristine state of its ecology, as is recognised in the World Heritage Designation. Its intactness results from its isolation, which, in combination with the difficulty of landing, difficult terrain over much of the plateau, poor soils, lack of surface water, and absence of mineral resources (e.g. economic phosphate deposits) has not attracted major human settlement. Thus ecological processes have continued on Henderson with very limited human influence. The environment is exceptionally good for the preservation of archaeological material which allows a picture of prehistory of the island to be constructed, both in terms of human occupation and faunal turnover and the influence of Polynesians on the species composition of Henderson.

The principal management goals for Henderson Island are:

- a) to protect the intact status of the island's geology and ecology and of its component flora and fauna - in particular threatened and endemic species, thus conserving the genetic differences between island populations, and the unique genetic contribution of Henderson Island to global diversity.
- b) to ensure that stocks of the timber species (miro and tou) are adequate to meet the needs of Pitcairners on a sustainable basis.
- c) to minimise interference with natural processes and the destruction or degradation of natural and archaeological features through human actions.
- d) to prevent the further introduction of non-native species and to control or eradicate those alien species established on the island which pose a threat to native wildlife.
- e) to ensure the island's archaeological features are preserved for scientific study and for viewing by visitors.
- f) to ensure tourist visits to the island cause no damage and are beneficial to the Pitcairn Islanders.
- g) to promote an awareness, through education and research, of the intrinsic value and significance of Henderson Island and its biota.

7.1 Management

Objective:

To provide a management structure to protect the biological importance of Henderson and ensure any exploitation of its resources is regulated.

Implementation measures:

- Establish a Management Committee comprising the following members:-
 - The Pitcairn Conservation Officer and one other representative of the Pitcairn Island Council
 - The Commissioner for Pitcairn and a representative appointed by the Governor
 - A representative of the Foreign and Commonwealth Office, London, and from the UK Joint Nature Conservation Committee
 - Two independent environmental scientists nominated by the UK Overseas Territories Conservation Forum.
- This Committee will be responsible for implementing the Management Plan. This task will include seeking necessary funding. *Inter alia*, the Committee will meet electronically at least twice a year and pass its recommendations to the Pitcairn Island Council for endorsement. Council and the Governor will retain right of veto.
- The chair may be any one of the above group and will be elected by the Committee. It will be the chair's responsibility to instigate meetings and to ensure that approved recommendations are acted upon.
- The constitution and authority of the Committee, together with its powers and duties, should be established in binding legal form by ordinance of the Governor or regulations of the Island Council.
- The Committee will review and, where appropriate, improve by bye-laws the legal framework protecting Henderson Island.

7.2 Alien fauna and flora

Alien organisms are those that occur outside their natural range as a result (wholly or in part) of human activities. The introduction of alien species has had a devastating impact on other oceanic islands. This is of particular relevance to the plateau communities and to species vulnerable to the introduction of alien species.

Objectives:

a) To prevent the introduction of new species to Henderson Island and b) to control or eradicate, where necessary and feasible, alien species that are already at Henderson Island. Species known to pose the greatest threat to Henderson or other island ecosystems should receive the highest priority for action.

Implementation measures:

- No new species of fauna or flora shall be introduced to Henderson Island.
- Identify priorities for the control or eradication of alien species based upon their known or perceived threat to native wildlife.
- The Henderson Management Committee should seek funding for Islanders (or other persons) to identify and eradicate newly arrived or localised species before they have had a chance to spread widely on the island.
- Ensure through bye-laws that all visitors follow the visitor's code (Annex VII) that includes specific instructions guarding against introductions. The visitors' code must be distributed to cruise ship operators, yacht crews visiting Pitcairn and other sanctioned visitors to Henderson and publicised in yachting publications and the Pitcairn Government website.

7.3 Miro and tou**Objective:**

The use of Henderson miro and tou for carvings is a significant source of supplementary income to the Pitcairn Islanders and it is therefore a priority to ensure that stocks are adequate to meet the needs of the Islanders on a sustainable basis. At present visits to Henderson by Pitcairners leave little or no time for management activities.

Implementation measures:

- Harvesting of miro and tou to be restricted to residents of Pitcairn Island who have the responsibility to ensure their harvesting operations are sustainable. This is currently done through limiting the visits to Henderson as well as by a type of rationing.
- Funds should be sought to investigate what management, if any, is required to ensure that future stocks will be adequate in the event of increased offtake from current levels.
- Forestry operations are likely to include coppicing, re-forestation, and monitoring of regeneration experiments. These would be carried out either through a salaried position for a Pitcairner or a Henderson ranger (section 7.4).



Plate 12.

Miro and tou from Henderson are often turned into attractive carvings of fish and dolphins.

7.4 Tourism

Objective:

To ensure that tourism on Henderson Island is sustainable, non-damaging and contributes revenue to the Pitcairn economy and the management of the Island.

Implementation measures:

- To establish a new ordinance or bye-law to enable effective enforcement of the visitors' code of conduct.
- All visitors must follow the code of conduct, restrictions on landings and prohibitions concerning introductions and removal of material from Henderson (Annex VII).
- A Pitcairn Islander may accompany visiting ships as a guide paid through funds (additional to the Henderson landing fee) levied by the ship. This will be particularly feasible for ships that pass Pitcairn on both legs of the journey to and from Henderson.
- Information boards to be erected (funding permitting) at the North and North-west Beaches to cover the eventuality that unaccompanied visitors are not aware of the visitors' code of conduct.
- Consideration should be given (by the Management Committee) to the to the eventual establishment of a ranger post on Henderson, funding and logistics permitting, and subject to Pitcairn Island Council support. The ranger may either be from Pitcairn (where it will be a government post) or from elsewhere. The ranger would be responsible for enforcing the visitors' code of conduct (Annex VII) as well as implementing management activities of *miro* and *tou* (section 7.3). Facilities for the ranger will be designed to minimise the impact on the environment.

7.5 Turtle nesting beaches and the reef

Objective:

East Beach is an important nesting ground for Green Turtles, a globally threatened species. A priority of this plan is to ensure that East Beach continues to be a suitable turtle nesting habitat.

Implementation measures:

- No activities that would degrade East Beach

as a suitable nesting habitat for Green Turtles. This is particularly important during the turtle nesting season (January-March). Landing recommendations are specified in the visitors code (Annex VII).

- Prohibit blasting or widening of reef passages in any part of Henderson Island.

7.6 Monitoring and research

Objective:

Environmental monitoring is an essential means of providing feedback on the success of management objectives as well as making recommendations for revisions to management plans. In addition, research activities that generate knowledge pertinent to the environmental management of Henderson and of the functioning of Pacific Island ecosystems are encouraged.

7.6.1 Monitoring

Implementation measures:

- *Ad hoc* records of alien plants or animals should be reported to the Management Committee. This is likely to be by Islanders visiting Henderson for *miro* and *tou* harvesting and other regular visitors to Pitcairn and Henderson.
- Develop, in collaboration with the Islanders, a prioritised monitoring programme for both native species of conservation importance and alien species likely to pose a threat to the former.

7.6.2 Research

Implementation measures:

- Scientific expeditions to Henderson should submit a research proposal to the Pitcairn Islands Administration for forwarding to the Management Committee. If the proposal is accepted, personnel must pay a research fee in line with charges levied elsewhere. Collaborative projects with the Islanders should be encouraged.
- Geological or biological materials or Polynesian artefacts may only be removed from Henderson with a licence granted by the Pitcairn Islands Administration which must be sanctioned by the Management Committee.

- Expeditions are encouraged to focus on issues important to the long-term monitoring and management of Henderson Island, such as the impact of alien species, for example the effect of rats on the breeding success of seabirds.
- Scientific expeditions visiting Henderson should have relevant expertise, demonstrate environmental responsibility and follow the visitors' code of conduct.
- A report must be submitted to the Pitcairn Islands Administration within three months of leaving the island, as an interim before the final report.
- Deposit specimens in museums or other public institutions at the end of the study, and ensure that accession details are reported in scientific papers arising.
- Any financial or non-monetary benefits accruing from the use of genetic resources permitted to be removed from Henderson shall be shared between the Pitcairn Island Council and the expedition as determined by the Management Committee.

7.7 Extinctions, *ex situ* conservation and translocation

Objectives:

The overall objective is to conserve the genetic differences between island populations, and the unique genetic contribution of Henderson Island endemics to global diversity. If extinction on Henderson results (wholly or in part) from human activities or introduced species, the population should be re-established on Henderson Island as soon as possible (assuming there exists a viable *ex situ* source).

Implementation measures:

- The Management Committee may grant permission to capture suitable individuals for *ex situ* conservation in an appropriate zoological or botanical garden given compelling scientific evidence that the species faces extinction. Such action should be contingent on a plan for re-establishing the population once the proximal cause for its extinction has been resolved.
- Removal of individuals for scientific purposes should only be done where there is no demonstrable impact on the future survival of the species.

7.8 Education

Objectives:

All visitors to Henderson should be made aware of the conservation and cultural importance of the island. Because of the remoteness of Henderson Island, only a relatively small number of people will be able to visit it. Accordingly an awareness should be developed in the broader community.

Implementation measures:

- The management plan is designed to provide sufficient information for visitors to understand the reasoning behind the visitors' code of conduct and other regulations.
- Key sections of the plan should be made readily available to tour companies and the yachting community. A means of achieving this would be via leaflets available at such departure points as Rapa Nui and Mangareva.
- Information boards should be considered (funding permitting) to cover the eventuality that unaccompanied visitors are not aware of the visitors' code of conduct.
- Researchers visiting the island are encouraged to produce popular articles to inform the broader public of Henderson Island's remarkable geology, unique flora and fauna, and its global conservation and cultural status.

7.9 Revision of management plan

Objectives:

Progress against management goals should be reviewed every five years, and revisions of the management plan instituted to ensure it remains relevant. Revisions may take place at shorter intervals if deemed necessary.

Implementation measures:

- This should be instigated by the Management Committee and, when approved by the Pitcairn Island Council and Governor, submitted to the Foreign and Commonwealth Office, London for forwarding to UNESCO.
- The overall management strategy should be open to modification in the light of changes in conditions on Henderson or improved knowledge about the Island.
- Should a Pitcairn development plan emerge in the future, the Henderson Management Committee should have the opportunity to assess its impact on Henderson.

8. Management Plan Targets

The following are priority activities of the management plan. All have been foreshadowed and their rationale explained in earlier chapters of the plan.

- Appoint members of the Management Committee (section 7.1).
- Draft modification to Ordinances to afford Henderson Island appropriate conservation status and empower the Management Committee to take appropriate decisions – including, for example, establishing bye-laws giving force to the Visitors' Code - to ensure the natural and cultural importance of the island is maintained.
- Investigate feasibility of a ranger on Henderson.
- Write funding proposals for
 - establishing a ranger post on the island (subject to feasibility study above)
 - developing visitor guides and notice boards to be erected on North Beach outlining visitors' code of conduct and educational information
 - completing preparation of multi-lingual visitor leaflets for distribution at departure points such as Rapa Nui and Mangareva
 - establishing new economically advantageous posts for Pitcairners to undertake forestry operations and monitor regeneration experiments (in absence of a ranger on island).
- agree on priority species list for monitoring programme. The list is likely to include further research on the impacts of rats on gadfly petrels, an assessment of the status of other alien species, and a population census of certain threatened plant species.
- agree on broad areas that should be a priority for scientific research.

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Annexes

Annex I. Systematic list of vascular plants recorded on Henderson Island (based on Florence *et al.* 1995).

Pteridophyta

Aspleniaceae

- Asplenium polyodon* G. Forster
- Asplenium nidus* L.
- Asplenium obtusatum* G. Forster

Davalliaceae

- Davallia solida* Sw.
- Nephrolepis hirsutula* (Forst. f.) Presl.
- Nephrolepis biserrata* (Swartz) Schott

Polypodiaceae

- Phymatosorus scolopendria* (N.L. Burm)
- Pichi-Serm.
- Pyrrosia serpens* (Forts. f.) Ching

Psilotaceae

- Psilotum nudum* (L.) Beauv.

Monocotyledonae

Poaceae

- Setaria verticillata* (L.) Beauv.
- Thuarea involuta* (Forst. f.) R. and S.
- Lepturus repens* (Forst. f.) R.Br.

Cyperaceae

- Fimbristylis cymosa* R. Br.

Agavaceae

- Cordyline fruticosa* (L.) Chev.

Liliaceae

- Dianella ensifolia* var. *gambierensis* F.Br.

Pandanaceae

- Pandanus tectorius* Parkinson

Arecaceae

- Cocos nucifera* L.

Dicotyledonae

Aizoaceae

- Sesuvium portulacastrum* L.

Amaranthaceae

- Achyranthes aspera* var. *pubescens* (Moq.) Townsend

Apocyanaceae

- Alyxia fosbergii* Florence

Araliaceae

- Mertya brachypoda* Harms

Asteraceae

- Bidens hendersonensis* var. *hendersonensis* Sherff
- Senecio stokesii* F. Br.

Boraginaceae

- Cordia subcordata* Lam.
- Heliotropium anomalum* var. *argenteum* A. Gray

- Argusia argentea* (L. f.) H. Heine

Brassicaceae

- Lepidium bidentatum* Mont

Capparidaceae

- Capparis cordifolia* Lamarck

Convolvulaceae

- Ipomoea macrantha* R. and S.
- Operculina turpethum* (L.) S. Manso

Euphorbiaceae

- Aleurites moluccana* (L.) Willd.
- Chamaesyce sparrmannii* (Boiss.)
- Hurusawa
- Glochidion pitcairnense* (F. Br.) St John

Flacourtiaceae

- Xylosma suaveolens* ssp. *haroldii*
- Sleumer

Goodeniaceae

- Scaevola sericea* Vahl

Hernandiaceae

- Hernandia stokesii* (F.Br.) Kubitzki

Lauraceae

- Cassytha filiformis* L.

Leguminaceae

- Caesalpinia bonduc* (L.) Roxb.
- Senna glanduligera* (St. John) A.C. Smith
- Sesbania coccinea* (L.f.) Poir.
- Canavalia rosea* (Sw.) A.P. DC.

Loganiaceae

- Geniostoma hendersonense* St John

Lythraceae

- Pemphis acidula* Forst

Malvaceae

- Thespesia populnea* (L.) Sol. ex Correa

Myrsinaceae

- Myrsine hosakae* St John

Myrtaceae

- Eugenia reinwartiana* (Blume) A.P. DC.

Nyctaginaceae

- Boerhavia tetrandra* Forst. f.
- Pisonia grandis* R. Br.

Passifloraceae

- Passiflora maliformis* L.

Piperaceae

- Peperomia rhomboidea* Hook. & Arn.

Pittosporaceae

- Pittosporum arborescens* Rich. ex Gray

Portulacaceae

- Portulaca lutea* Sol. ex Forst. f.

Rubiaceae	<i>Guettarda speciosa</i> L.	Solanaceae	<i>Lycium sandwicense</i> (A. Gray)
	<i>Cyclophyllum barbatum</i> (G. Forster) N.		<i>Solanum americanum</i> P. Miller
Halle & Florence	<i>Hedyotis romanzoffiensis</i> (Cham. & Schlecht.) Fosberg	Surianaceae	<i>Suriana maritima</i> L.
	<i>Psydrax odorata</i> (Forst. f.)	Tiliaceae	<i>Triumfetta procumbens</i> Forst. f.
	<i>Ixora fragrans</i> (H. & A.) Forst. f.	Ulmaceae	<i>Celtis pacifica</i> Planch.
	<i>Morinda myrtifolia</i> A. Gray.	Urticaceae	<i>Procris pedunculata</i> (Forst.) Wedd. var. <i>pedunculata</i>
	<i>Timonius polygamus</i> (Forst.) Robins.	Verbenaceae	<i>Premna serratifolia</i> L.
Santalaceae	<i>Santalum insulare</i> var. <i>hendersonense</i> (Skottsberg) Fosberg & Sacht	Viscaceae	<i>Korthalsella rubescens</i> (Tiegh.) Lecomte
Sapindaceae	<i>Allophylus rhomboidalis</i> (Neaud) Radlkofer		<i>Korthalsella platycaula</i> (Tiegh.) Engler
Sapotaceae	<i>Nesoluma st-johnianum</i> Lam. and Meeuse		

Annex II. List of key references to invertebrates collected on Henderson.

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Plate 13. Coconut crabs *Birgus latros* are scarce on Henderson Island.

Annex III. Systematic list of vertebrates recorded on Henderson Island. Fishes based on Irving *et al.* (1995) and Randall (1999), reptiles on Gill (1993), birds on Williams (1960), Bourne & David (1983) and Brooke (1995c). Species known only from sub-fossil deposits are not listed.

Class: Elasmobranchii	<i>Cephalopholis urodeta</i>
Carcharhinidae (requiem sharks)	<i>Epinephelus fasciatus</i>
<i>Carcharhinus amblyrhinchos</i>	<i>Epinephelus hexagonatus</i>
<i>Carcharhinus melanopterus</i>	<i>Epinephelus lanceolatus</i>
<i>Triaenodon obesus</i>	<i>Epinephelus merra</i>
Class: Actinopterygii	<i>Epinephelus socialis</i>
Moringuidae (worm eels)	<i>Epinephelus spilotoceps</i>
<i>Moringua ferruginea</i>	<i>Epinephelus tuamotuensis</i>
Muraenidae (moray eels)	<i>Epinephelus tauvina</i>
<i>Anarchias cf. cantonensis</i>	<i>Pseudanthias</i> spp.
<i>Enchelynassa canina</i>	<i>Pseudanthias ventralis ventralis</i>
<i>Gymnothorax eurostus</i>	<i>Variola louti</i>
<i>Gymnothorax javanicus</i>	Cirrhitidae (hawkfishes)
<i>Gymnothorax meleagris</i>	<i>Amblycirrhitus wilhelmi</i>
<i>Uropterygius</i> sp.	<i>Cirrhitops hubbardi</i>
<i>Uropterygius macrocephalus</i>	<i>Cirrhitus pinnulatus</i>
<i>Uropterygius xanthopterus</i>	<i>Paracirrhitus arcatus</i>
Opichthidae (snake eels)	<i>Paracirrhitus forsteri</i>
<i>Muraenichthys laticaudata</i>	<i>Paracirrhitus hemisticus</i>
Synodontidae (lizardfishes)	Apogonidae (cardinalfishes)
<i>Saurida gracilis</i>	<i>Apogon</i> spp.
Hemirhamphidae (half beaks)	<i>Apogon crassiceps</i>
<i>Euleptorhamphus viridis</i>	Kuhliidae (flagtails)
<i>Hyporhamphus acutus acutus</i>	<i>Kuhlia marginata</i>
Belonidae (needlefishes)	Priacanthidae (bigeyes)
<i>Platybelone argalus platyura</i>	<i>Heteropriacanthus cruentatus</i>
<i>Tylosaurus crocodilus crocodilus</i>	Carangidae (jacks)
Exocoetidae (flyingfishes)	<i>Carangoides ferdau</i>
<i>Exocoetus obtusirostris</i>	<i>Carangoides orthogrammus</i>
Holocentridae (squirrelfishes & soldierfishes)	<i>Caranx ignobilis</i>
<i>Myripristis berndti</i>	<i>Caranx lugubris</i>
<i>Neoniphon sammara</i>	<i>Caranx melampygus</i>
<i>Sargocentron diadema</i>	<i>Pseudocaranx dentex</i>
<i>Sargocentron punctatissimum</i>	<i>Seriola lelandi</i>
<i>Sargocentron spiniferum</i>	Coryphenidae (dolphinfishes)
<i>Sargocentron tieri</i>	<i>Coryphaena hippurus</i>
<i>Sargocentron megalops</i>	Lutjanidae (snappers)
Fistulariidae (cornetfishes)	<i>Aphareus furca</i>
<i>Fistularia commersonii</i>	<i>Lutjanus bohar</i>
Scorpaenidae (scorpionfishes)	<i>Lutjanus kasmira</i>
<i>Pterois antennata</i>	Caesionidae (fusiliers)
<i>Pterois volitans</i>	<i>Pterocaesio tile</i>
<i>Scorpaenopsis</i> sp.	Lethrinidae (emperors)
<i>Sebastapistes mauritiana</i>	<i>Gnathodentex aurolineatus</i>
<i>Sebastapistes tinkhami</i>	<i>Monotaxis grandoculis</i>
Caracanthidae (orbicular velvetfishes)	<i>Lethrinus olivaceus</i>
<i>Caracanthus unipinna</i>	Mullidae (goatfishes)
Serranidae (groupers & seabasses)	<i>Mulloidichthys flavolineatus</i>
<i>Cephalopholis argus</i>	<i>Mulloidichthys vanicolensis</i>
	<i>Parupeneus bifasciatus</i>
	<i>Parupeneus cyclostomus</i>

-
- Parupeneus trifasciatus*
- Pempheridae (sweepers)
Pempheris otaitensis
- Kyphosidae (sea chubbs)
Kyphosus bigibbus
- Ephippididae (spadefishes)
Platax sp.
- Chaetodontidae (butterflyfishes)
Chaetodon auriga
Chaetodon flavirostris
Chaetodon lunula
Chaetodon mertensii
Chaetodon ornatissimus
Chaetodon pelewensis
Chaetodon quadrimaculatus
Chaetodon reticulatus
Chaetodon unimaculatus
Forcipiger longirostris
Forcipiger flavissimus
Heniochus monoceros
- Pomacanthidae (angelfishes)
Centropyge loriculus
Centropyge hotumatua
Centropyge flavissimus
Genicanthus spinus
Genicanthus watanabei
Pomacanthus imperator
- Pomacentridae (damselfishes)
Chromis agilis
Chromis bami
Chromis pamae
Chrysiptera galba
Dascyllus flavicaudus
Plectroglyphidodon imparripennis
Plectroglyphidodon - johnstonianus
Plectroglyphidodon leucozona
Plectroglyphidodon phoenixensis
Pomachromis fuscidorsalis
Stegastes emeryi
Stegastes fasciolatus
- Labridae (wrasses)
Anampses caeruleopunctatus
Bodianus anthioides
Bodianus axillaris
Bodianus bilunulatus
Cheilinus undulatus
Corys aygula
Gomphosus varius
Hemigymnus fasciatus
Labroides dimidiatus
Labroides rubrolabiatus
Oxycheilinus sp.
Oxycheilinus unifasciatus
Pseudocheilinus sp.
- Pseudocheilinus citrinus*
Pseudocheilinus octotaenia
Pseudocheilinus tetrataenia
Thalassoma heiseri
Thalassoma lutescens
Thalassoma purpureum
Thalassoma trilobatum
Xyrichtys pavo
- Scaridae (parrotfishes)
Chlorurus microrhinos
Scarus forsteri
Scarus longipinnis
- Tripterygiidae (triplefins)
Enneapterygius ornatus
- Creediidae (sand burrowers)
Limnichthys donaldsoni
- Mugilidae (mulletts)
Neomyxus leuciscus
- Sphyraenidae (barracudas)
Sphyraena helleri
- Blenniidae (blennies)
Alticus sp.
Blenniella gibbifrons
Cirripectes alboapicalis
Cirripectes quagga
Cirripectes variolosus
Entomacrodus caudofasciatus
Entomacrodus niuafoouensis
Entomacrodus rofeni
Entomacrodus sealei
Entomacrodus striatus
Exallias brevei
Plagiotremus tapeinosoma
Rhabdoblennius rhabdotrachelus
Stanulus seychellensis
- Gobiesocidae (clingfishes)
Pherallodus indicus
- Microdesmidae (wormfishes and dartfishes)
Nemateleostris magnifica
- Gobiidae (gobies)
Eviota saipanensis
Gobiodon sp.
Trimmatom eoiotops
- Acanthuridae (surgeonfishes)
Acanthurus achilles
Acanthurus guttatus
Acanthurus leucopareius
Acanthurus nigrofuscus
Acanthurus nigroris
Acanthurus nubilis
Acanthurus thompsoni
Acanthurus trigostegus
Ctenochaetus hawaiiensis
Ctenochaetus striatus
Ctenochaetus strigosus

<i>Naso brevirostris</i>	<i>Rhinecanthus rectangulus</i>
<i>Naso caesius</i>	<i>Rhinecanthus lanula</i>
<i>Naso hexacanthus</i>	<i>Sufflamen bursa</i>
<i>Naso unicornis</i>	<i>Sufflamen fraenatus</i>
<i>Zebrasoma scopes</i>	Monacanthidae (filefishes)
<i>Zebrasoma veliferum</i>	<i>Aluterus scriptus</i>
Zanclidae (moorish idols)	<i>Cantherhines dumerilii</i>
<i>Zanclus cornutus</i>	<i>Cantherhines pardalis</i>
Trichiuridae (sandeels)	Tetraodontidae (puffers)
<i>Benthodesmus</i> sp.	<i>Arothron meleagris</i>
Scombridae (tunas)	Ostraciidae (trunkfishes)
<i>Gymnosarda unicolor</i>	<i>Ostacion meleagris</i>
Bothidae (lefteye flounders)	Diodontidae (porcupinefishes)
<i>Bothus mancus</i>	<i>Diodon holocanthus</i>
Balistidae (triggerfishes)	Molidae (sunfishes)
<i>Balistoides viridescens</i>	<i>Ranzania laevis</i>
<i>Rhinecanthus aculeatus</i>	



Plate 14. The superbly camouflaged left-handed flounder *Bothus mancus* is common inside the reef, when it can be seen!

Class: Reptilia

Lepidodactylus lugubris
Cryptoblepharus poecilopleurus
Emoia cyanura
Lipinia noctua
Chelone mydas

Class: Aves

Procellariidae (petrels)

Macronectes giganteus
Pterodroma lessonii
Pterodroma alba
Pterodroma ultima
Pterodroma neglecta
Pterodroma heraldica
Pterodroma atrata
Puffinus pacificus
Puffinus nativitatis

Hydrobatidae (storm petrels)

Pelagodroma marina

Sulidae (boobies)

Sula dactylatra
Sula sula
Sula leucogaster?

Phaethontidae (tropicbirds)

Phaethon rubricauda
Phaethon lepturus?

Fregatidae (frigatebirds)

Fregata minor

Ardeidae (herons)

Egretta sacra

Falconidae (falcons)

Falco peregrinus

Rallidae (rails)

Porzana atra

Charadriidae (plovers)

Pluvialis fulva
Pluvialis squatarola

Scolopacidae (sandpipers)

Numenius tahitiensis
Heteroscelus incanus
Calidris alba

Sternidae (terns & noddies)

Sterna fuscata
Procelsterna cerulea
Anous stolidus
Anous minutus
Gygis alba leucopes

Columbidae (doves)

Ptilinopus insularis

Psittacidae (parrots)

Vini stepheni

Sylviidae (warblers)

Acrocephalus taiti

Class: Mammalia

Muridae

Rattus exulans

Balaenopteridae

Megaptera novaeangliae

Annex IV. Reproduced below are the regulations concerning Plant and Animal Quarantine (Part III) and Wildlife (Part IV: Section C) from the 2001 edition of the Pitcairn Local Government regulations. Both are of relevance to Henderson conservation. Note that ‘the Islands’ means all four islands of the Pitcairn group, and therefore includes Henderson.

Part III – Plant and Animal Quarantine

1. For the purposes of this Part of the Regulations, “the Washington Convention” means the Convention on International Trade in Endangered Species of Wild Fauna and Flora made at Washington on the 3rd day of March 1973, and includes all amendments from time to time made to the Appendices thereto in accordance with the provisions of that Convention.

2. Reference in this Part of these Regulations to species of wild fauna and flora referred to in the Appendices in the Washington Convention shall, where the Appendices so apply, be deemed to include reference to recognisable parts and derivatives thereof.

3. No plants or animals shall be imported into, or exported from, any of the Islands without a permit from the Council: provided that –
(a) plant seeds, fruit, vegetables and sawn timber, other than any of the species referred to in the Appendices to the Washington Convention, may be imported from any place outside the tropics without such a permit; and
(b) plants and animals, other than any of the species referred to in the Appendices to the Washington Convention, may be exported from the Islands without such a permit.

4. Every application for a permit to import or export any plants or animals shall be made to the Quarantine Officer who shall forward the same to the Council together with his recommendations as to whether a permit should be granted or not.

5. Permits shall not be granted –
(a) for the importation of any plants from any place within the tropics;
(b) for the importation or exportation of any of the species of plants or animals referred to in the Appendices to the Washington Convention; or
(c) for the importation of any animals, without the prior approval of the Governor and shall be subject to such conditions as the Governor may direct.

6. Permits for the importation of any plants shall be subject to the condition that such plants are accompanied by a certificate from the appropriate authority of the country from which such plants are imported that such plants are free from disease or pests.

7. No plants or animals imported into or exported from the Islands or any of them shall, without prior approval of the Quarantine Officer, be landed at or loaded from any place other than Bounty Bay, Pitcairn Island.

8. No plants or animals for which a permit is required under the provisions of these Regulations shall be landed on or loaded from any of the Islands until they have first been inspected by the Quarantine Officer and all certificates and permits required by the provisions of these Regulations to accompany them or to be held in relation thereto have been produced to him for his inspection. Penalty: \$100 or 40 days’ imprisonment.

9. No person shall import or export any plants or animals into or from any other Islands in contravention of the provisions of these Regulations. Penalty: \$100 or 40 days’ imprisonment.

10. Irrespective of any penalty which may be imposed under the provisions of the last two preceding regulations, the Quarantine Officer may confiscate and destroy, or otherwise dispose of in such manner as the Council may direct, any plants or animals imported into or exported from any of the Islands in contravention of these Regulations or which on inspection are found to be subject to any disease or infestation by any pest.

Part IV – Animals and Wild Life C - Wild Life (Note to readers: the text below is a strict copy of the regulations, including some quirky uses of Latin binomials.)

1. No person shall, kill, take or in any way molest any wild bird or take eggs of any wild bird except in accordance with the provisions of these regulations. Penalty: \$50.
2. The provisions of the last preceding regulation shall not apply to the Hawk (*Fregeta minor*) or its eggs, except during the months of August to December inclusive, or to the Noddy (*Anous stolidus pileatus*) or its eggs, except during the months August to January inclusive.
3. Notwithstanding the provisions of the last two preceding regulations, the Council may appoint a committee of its members, to be known as the Wild Bird Protection Committee, which committee shall have the authority to declare that all or any of the following birds or their eggs, namely –
 - All species of Petrel (*Pterodroma*);
 - All species of Noddy (*Anous stolidus pileatus*);
 - All species of Booby (*Sula*);
 - Bosum Bird (*Phaeton rubricauda* subsp.);
 - The Hawk (*Fregeta minor*),may be killed or taken on Oeno Island, and may –
 - (a) limit the numbers of all such birds or their eggs that may be killed or taken by any one person;
 - (b) restrict the times during which any such birds or their eggs may be killed or taken; or
 - (c) restrict the areas within which any such birds or their eggs may be killed or taken.
4. The Council may, with the prior approval of the Governor, wholly or partially exempt any person or persons from any of the provisions of the last three preceding regulations.
5. No person shall take, hunt, fish, capture, harass or intentionally kill, or attempt to take, to take, hunt, fish, capture, harass or kill, any member of the following species –

blue whale (*balaenoptera masculus*)
humpback whale (*megaptera novaeangliae*)
right whale (*eubalaena glacialis*)
short-tailed albatross (*diomedea albatrus*)
cahow (*pterodroma cahow*)
dark-rumped petrel (*pterodroma phaeopygia*)
green sea turtle and related species (*cheloniidae*)
leather back sea turtle (*dermochelys coriacea*)
hawksbill turtle (*eretmochelys imbricata*)
loggerhead turtle (*caretta caretta*)
Ridley turtle (*lepidochalys olivacea*)
Penalty: \$50.

6. Notwithstanding the provisions of Regulation 5, the Council may appoint a committee of its members, to be known as the Conservation of Migratory Species of Wild Animals Committee which shall have the power to authorise any person in a manner not inconsistent with the welfare of the species concerned and to the extent of such number of members of the species and the area and times within which such authorisation shall have effect, as shall be specified therein, to take, hunt, fish, capture, harass or kill any members of any species referred to in Regulation 5 –
 - (a) for scientific purposes;
 - (b) for the purpose of enhancing the propagation or survival of the species concerned;
 - (c) in order to accommodate the needs of traditional subsistence users of the species concerned; or
 - (d) as required by extraordinary circumstances,and where any such authorisation has been duly given by the Committee, the person to whom it has been given shall not by reason of any act committed in pursuance thereof be guilty of any offence under Regulation 5.

7. The Committee constituted under Regulation 6 shall be responsible for the implementation within the islands of the Convention on the Conservation of Migratory Species of Wild Animals as the same shall be applied to Pitcairn.

Annex V. Application for a permit to visit and/or conduct research on Henderson Island

Please furnish the following information as fully as possible and submit it to:
Pitcairn Administration, PO Box 105696, Auckland, New Zealand. Admin@pitcairn.gov.pn
Fax +64 9 366 0187. Fees are charged for permits to visit Henderson Island.

- Address and contact details, including e-mail
- Home institution/affiliation
- Reason for visiting Henderson - Research, Tourism, Education, or Other (specify)
- Dates and duration of proposed visit
- Number of people and their ages.
- Means of transport to the Island
- Proposed landing sites and areas to be visited on the Island

If the proposed visit is for research or education, please answer the following questions:

- What is the aim of the proposed research? Give broad objectives and relate them to past and current research.
- How will the products of the research be disseminated?
- What benefit will the proposed project have for the conservation management of Henderson Island (if any)?
- Could the project be conducted elsewhere? If so, justify your choice of Henderson Island.
- Outline your planned field work protocol
- If the project involves collection of samples that will be removed from the Island, specify the types and numbers of samples to be collected, and the collection method. Specify where the samples will be housed (e.g. museum) after completion of the project.
- Will the project require the erection of temporary structures (e.g. hides, markers)? Confirm that all such markers will be removed at the end of the project.
- Describe the safety measures designed to minimize the risk of accident during the project. Describe how personnel will be evacuated in the event of an accident.
- What funds are available for the project, and from what sources?

Declaration (repeat in full).

I (name) declare that the above information is complete and correct. I and other members of my party are in good health, and we accept that any loss or injury resulting from our visit to Henderson Island is not the responsibility of the Pitcairn Island Council or Pitcairn Islands Administration. Furthermore we understand that neither the Pitcairn Island Council nor the Pitcairn Islands Administration is under any obligation to come to our aid in any circumstances.

Should the Pitcairners come to our aid with our prior assent, then we undertake to re-imburse the costs, both immediate and consequential, that they have incurred. We are conversant with the objectives and regulations of the Henderson Island Management Plan and agree to abide by them fully.

Signed.....

Date.....

Witnessed.....

Date.....

Please attach the following:

1. Brief curriculum vitae, outlining experience relevant to visiting Henderson Island. Researchers should provide a list of recent relevant publications, film-makers a list of recent films produced.

Note: The above declaration, based on that appearing in the Inaccessible Management Plan (Ryan & Glass 2001), appears to the authors of the present Plan not to resolve entirely the issue of who might bear the costs of the rescue from Henderson by the Pitcairners of any visitors. Finding the wording that satisfactorily covers both the immediate and the consequential costs, without asking the visitors to sign a blank cheque, probably requires legal advice.

Annex VI. Reporting form for visit to the Henderson Island World Heritage Site

Henderson Island is home to plants and animals that are found nowhere else in the world. It is also of supreme archaeological interest because of a period of Polynesian occupation for at least 600 years. Consequently Henderson Island is a resource of unique conservation and scientific research significance. Visitors can play an important role in monitoring the status and health of the island, and are therefore requested to fill in and return a reporting form after their visit to:

Pitcairn Administration, PO Box 105696, Auckland, New Zealand Admin@pitcairn.gov.pn

Name:

Address and affiliation:

Email and/or fax:

Reason for visit to Henderson Island:

.....

Number of people in group: Dates of visit (from/to):

Type of vessel & capacity:

Landing site:

Did you see any other visitors during your stay? If so please give details (numbers of people, type of vessel, etc.:

.....

Did you see any evidence of turtle tracks or nesting?:

.....

Any comments on the state of the beach and beach back?:

.....

Was all waste material removed from the island? If not please give details:

.....

Any sightings of species of plants or animals that you think might have arrived recently and may be cause for conservation concern?

.....

.....

Any other notable sightings of plants or animals?

.....

.....

Please send, if possible, confirmatory digital photos of above sightings to the Pitcairn Islands Administration Office.

Any other comments:

.....

.....

.....

.....

.....

Annex VII. Code of conduct for visitors to Henderson Island

Introduction to Henderson Island:

Henderson Island is home to plants and animals that are found nowhere else in the world. It is also of supreme archaeological interest because of a period of Polynesian occupation for at least 600 years. Consequently Henderson Island is a resource of unique conservation and scientific research significance.

It is for these reasons that it was made a World Heritage Site in 1988. However, the Island is at constant risk from the accidental introduction of plants or animals that are not native to the island (so-called alien species). For example, if ship rats were to reach Henderson, then the unique flightless rail would almost certainly go extinct. But it is often the smaller things that are more difficult to control that also cause irreversible problems.

For example, a stray seed on a shoe or sock could introduce a new grass that could overrun Henderson's native vegetation. Similarly, a fungal spore or egg of a fruit fly could attack the native fruits or flowers that are so important to the Island's insect and bird communities (and might eventually spread to Pitcairn via other visitors). It is therefore very important that visitors follow these simple guidelines:

Code of conduct for visitors:

A landing fee is payable to the Office of the Governor of Pitcairn, Henderson, Ducie and Oeno Islands, in New Zealand. The fee is set by the Pitcairn Island Council and is payable on a per passenger basis. It contributes towards the management of this globally important place. However neither the Governor, nor the Council, nor its members can be responsible for any accidents, howsoever caused.

Flora and fauna are not to be disturbed, damaged, destroyed or removed. Polynesian artefacts should not be disturbed, damaged, destroyed or removed. No live plants or animals may be taken to the island. This provision includes small animals that, for example, may be infesting food or in soil attached to equipment.

All visitors must ensure clothing, stores, equipment and other accompanying materials are thoroughly cleaned to prevent seeds and other propagules reaching the island. Any storage containers and vessels landing on the island should be checked to ensure they are rodent-free.

Passengers bringing food or cut lunches ashore may not bring any fresh fruit. Honey, honey products, eggs and egg products are prohibited. Dried food stores should be pest free. All rubbish, including food waste and wrapping, is to be removed from the island (and not buried). Collecting of rock samples and fossil collecting is prohibited.

No evidence of the visit will remain after departure. No fires should be lit. Landing is to be on North Beach. If this is impossible due to weather conditions, then a landing on North-west Beach may take place. Landing on East Beach is prohibited except in emergency situations. Visitors should remain on the landing beach or in the beach-back environs.

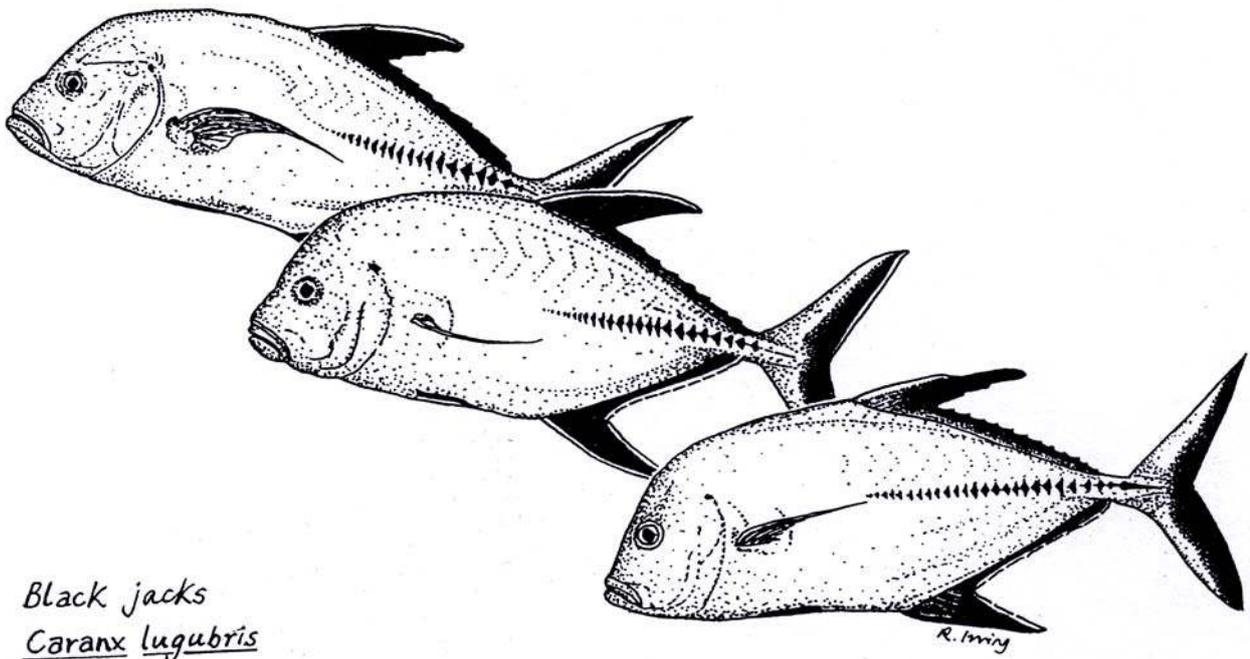
Visitors are encouraged to report sightings of alien animals (such as the ship rat) or plants to the Pitcairn Island Council.

Exclusion of liability

Pitcairn Island Landing and Residence Ordinance, Section 9.

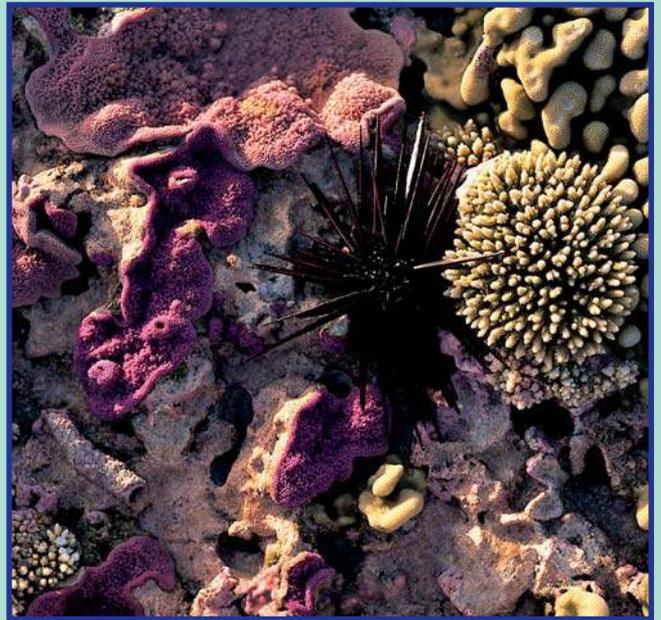
(1) Where any person who is landing or has landed in the Islands, whether in pursuant to any license or permit issued under this Ordinance or not, sustains any damage to loss of property or suffers personal injury or death by accident, there shall be no liability in law for compensation or damages arising directly or indirectly out of such damage, loss, injury or death notwithstanding any rule of law or enactment to the contrary, on the part of the Crown, the Governor, the Island Council or any member or members thereof, or any person by virtue of any statutory function or duty, or any other person acting in any function or capacity as servant, employee, agent or delegate of the Crown, the Governor or the Island Council.

(2) For the purpose of subsection (1), the period of landing in the islands shall be deemed to commence if landing by means of a Pitcairn Boat, at the moment of boarding it from another vessel; or if landing by other means, at the moment of stepping ashore and to end if departing by means of a Pitcairn boat, at the moment of leaving it to board another vessel; or if departing by other, at the moment of leaving the shore.



Black jacks
Caranx lugubris

Henderson Island, in the South Pacific, is home to many endemic plant and animal species, including the Henderson fruit dove. It also provides nesting sites for thousands of seabirds – among them, Murphy’s petrels. Although just south of the Tropic of Capricorn, the island is fringed with a coral reef and visited about once a year by Pitcairn islanders, who harvest hardwoods for their traditional carvings.



Henderson Island is Crown Land within the Pitcairn Islands group, an Overseas Territory of the United Kingdom. The Wellington-based British High Commissioner to New Zealand holds the office of Governor of Pitcairn. While the Governor holds most formal powers, much day-to-day administration of the islands' affairs is devolved to a Commissioner based at the Pitcairn Islands Administration Office in Auckland. Hence the involvement of the Foreign & Commonwealth Office, London, and the Pitcairn Islands Administration in the publication of this Plan.

Front cover image: East Beach, Henderson Island, by Michael Brooke
Above: all images by Michael Brooke