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Which Oceanic Islands merit World Heritage Status ?

A short feasibility study for IUCN—The World Conservation Union

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Introduction

This report is written at the request of Jim Thorsell, IUCN, to consider the question of how to decide which oceanic islands merit World Heritage Status.

I presented a shorter and earlier version of this paper to the Workshop on Critical Issues for Protected Areas, at the IUCN General Assembly of IUCN, in November-December 1991. This provided a valuable opportunity to hear comments and suggestions, which I have tried to incorporate.

This present version was written after a visit to WCMC and ICBP in January 1991. I would like to take this opportunity of thanking most warmly Nigel Collar (ICBP), Mark Collins (WCMC-Habitats Unit), Steve Davis (IUCN), Jerry Harrison (WCMC-PADU), Tim Johnson (ICBP), Alison Stattersfield (ICBP) and Sue Wells (freelance consultant) for their help and advice over this project. Without their help, in particular help from PADU, I would not have been able to write this report.

This study is on oceanic islands. I have omitted islands over 100,000 sq. km in size, notably Cuba, Madagascar and New Guinea, and also those that are parts of large land-masses, e.g. Sulawesi and Palawan. Offshore islands are omitted, as are those of the Mediterranean Sea. Less emphasis is put on the islands of the Southern Ocean than elsewhere, since CNPPA already has an excellent account on them (Clark and Dingwall, 1985).

Let me add a note of caution. This report is the result of a consultancy of only a few days, although I did spend longer on it than that. It does not, and is not designed to, give the answer on how to decide which islands meet World Heritage criteria. The tables are for illustration, not application, and are designed to show the form of more precise tables that could be compiled by suitable experts. Although the report may point in the right direction, lack of time means that some of the ideas may be a little "raw and undigested", and so may benefit from further discussion and debate before taking further.

Executive Summary

The report makes a number of proposals for discussion and further study on the question of how to decide which oceanic islands merit inscription on the Natural List of the World Heritage Convention. It suggest a conceptual framework for ways to rank islands in order of priority for protection under the Convention.

The starting point for the study is the four criteria for inscription of Natural Sites in the Operational Guidelines. In general these are found to be difficult to understand and lacking in precision and clarity. The report argues that biological diversity, the most threatened feature of islands, is not given enought weight and that Criterion (iv), on the presence of threatened species, is not fully appropriate to the Convention. It suggests, therefore, that Criterion (iv) be replaced by one on biological diversity, emphasizing diversity at species level.

The report then discusses how to measure biological diversity on islands. It does not favour the approach of a single numerical count or ranking of conservation value, but suggests that a number of tables could be compiled, ranking islands in order of importance for prominent features one by one. Those chosen for initial study are endemic birds, endemic plants, breeding grounds for marine vertebrates and coral reefs. These are discussed and provisional tables of rankings outlined for the first two. Centres of Diversity studies, such as in birds and plants, also provide useful guidance.

The existing 10 island sites on the World Heritage List are then evaluated in the light of these proposed criteria. All but a possible two sites—Scandola (Corsica) and Vallée de Mai (Seychelles)—clearly qualify, in some case overwhelmingly so.

Information sources on the natural features of islands are briefly described, from the World Conservation Monitoring Centre, the IUCN/WWF Project on Centres of Plant Diversity, the IUCN Islands Database and ICBP. In particular the IUCN Islands Database is evaluated.

A short list of key published works on islands for use in World Heritage matters is provided.

Recommendations for Future Action

This study outlines a number of paths that can be taken. I am, however, lothe to recommend further study alone. There is always a danger of erecting an academic superstructure which becomes steadily less useful as it grows in size. The subject of nature conservation is littered with studies, some of them very fine, that are never used.

Instead, I propose that IUCN, in partnership with Unesco, put emphasis on the process rather than on the production of a final report. To do this, I recommend that IUCN:

1. Does not try to "solve" the question in one consultancy or report, but rather works away at the main issue, builds up the various studies needed and evaluates the situation as it progresses;
2. Combines further work on this topic with:
   a) Any discussions on the future of the Convention, especially on the Guidelines for site criteria, in the light of its 20th Anniversary (1992) and the perception at the IUCN Protected Areas Workshop in Perth that changes were needed both to the Guidelines and to the range of sites covered;
   b) The day-to-day work of evaluating islands proposed for inclusion by Member States.

After discussion of this report by knowledgeable and interested parties, I suggest a longer consultancy than the present one be considered to take the work forward. This would take a broader view than this short study, covering features of islands other than biological diversity, which is emphasized here.

Ideally the same person should undertake the consultancy, participate to some extent in IUCN's contribution to any work on the Operational Guidelines, and contribute to evaluating any island sites that are nominated. S/he would also start identifying prime island sites for inscription, helping governments put forward their nominations and maybe even preparing project submissions to aid agencies for technical assistance on certain sites.

The following studies could be commissioned from experts, with more to follow later:

- A report listing and analysing all endemic and threatened birds on oceanic islands, and giving various tables of priority rankings;
- A report listing islands that are important sites for seabirds;
- A desk study on coral reefs on and around oceanic islands, proposing ways of assessing their global importance, with examples of reefs of high, medium and low importance;

- Further work on island endemic plants, to refine and extend the tables outlined here.

These individual studies need not be lengthy ones, since in most cases the data are available. But to achieve lasting conservation, the whole exercise should continue over several years, moving from desk study to actually promoting the inscription of the prime sites identified.

The Importance of Oceanic Islands in Conservation

Islands have in general been neglected by conservationists, especially at international level. Islands, especially tropical and subtropical ones, have very rich endemic floras and faunas. These tend to be under threat, because of a combination of the small natural ranges of the species, the great pressures on land for development and tourism, and the depredations of invasive introduced plants and animals.

As a result islands contain high numbers of threatened species; in fact one in three of all known threatened plants occur on islands. The World Heritage Convention can play a vital role in reducing the threat to these species though ensuring key areas where populations of them grow or live are protected.

It is encouraging to see some new initiatives on islands—for example WWF are now funding plant-saving projects on a range of island groups, IUCN is working with the Caribbean Conservation Foundation on an islands strategy for the Caribbean islands, and WWF is initiating a Pacific programme, the first in its history.

Yet so far the World Heritage Convention has not been much applied to the challenges of island conservation and only a handful of islands have been inscribed on the list. As Thorsell (1989) says, apart from Australia and New Zealand, the Convention has not yet found broad acceptance by the small island nations of the Pacific. The only study I could find on islands and World Heritage is a paper by Molloy and Dingwall (1990). (This is a very useful study and I will return to it later).

The low profile of World Heritage in island conservation is a pity and should be redressed, as the Convention has a very special role to play. In many ways, it could be a valid successor to the Islands for Science Programme of IBP in the 1960s. In fact the Convention is particularly appropriate for protecting small islands with unique natural history.

The Operational Guidelines for the Convention

The starting point for any study on World Heritage must be the Operational Guidelines for implementing the Convention. These set out the criteria under which a Natural Site may be inscribed under the Convention. The sites must:

"(i) be outstanding examples representing the major stages of the earth's evolutionary history; or

(ii) be outstanding examples representing significant ongoing geological processes, biological evolution and man's interaction with his natural environment; as distinct from the periods of the earth's development, this focuses upon ongoing processes in the development of communities of plants and animals, landforms and marine areas and fresh water bodies; or

(iii) contain superlative natural phenomena, formations or features, for instance, outstanding examples of the most important ecosystems, areas of exceptional beauty or exceptional combinations of natural and cultural elements; or

(iv) contain the most important and significant natural habitats where threatened species of animals or plants of outstanding value from the point of view of science or conservation still survive."

Overlighting all these criteria is the concept of *Uniqueness*—expressed in the Guidelines as "of outstanding universal value".

In addition to satisfying one or more of these criteria, sites have to satisfy a number of conditions that relate to their *integrity*, which includes the degree of protection afforded.

Discussion of the Guidelines

In general I find the guidelines difficult to understand and lacking in precision and clarity. I suspect that this reflects a more fundamental difficulty in defining the purpose of the Convention. As Nigel Collar put it to me, using phrases like "gems", "nature's pearls" and "universal value" may indicate a lack of intellectual rigour on what the Convention is intended to cover. This is not to criticise those who prepared the Guidelines or those who administer them, rather to highlight a difficulty that I feel may not always be fully appreciated.

That said, we have to accept that judgement on these (and any other) criteria will ultimately be subjective. How could we assess natural beauty, for example, in any other way ? And in my view political factors should be considered too, so as to give some weight to including sites from as wide a range of Member States as possible. It is quite valid to search for objectivity, but we should accept that it is an

ultimate goal that can never be reached. This need not hinder us. We should not forget that the Cultural Sites must be judged almost entirely on subjective grounds—how else, for example, could one compare the French cathedrals of Chartres, Cluny and Notre-Dame ?

I have two specific comments on the guidelines:

a) They do not give enough weight to biological diversity. Features of natural beauty, features of geology and the earth's evolution, etc., may be important, but none of them are remotely as threatened as biological diversity. Yet biological diversity is not specifically mentioned. (The emphasis in Criterion (ii) is on the process of evolution, rather than its products.)

b) The fourth criterion, on threatened species, is not appropriate in my view. There are two reasons for this:

- I do not believe that the drafters of the Convention believed its role was to safeguard the numerous small, single-species reserves that are needed to conserve the tens of thousands of threatened species around the world. Also it would be invidious to decide which threatened species were of "universal value"—a herpetologist, arachnologist and botanist would have quite different views!
- The islands with the most threatened species are the most degraded ones, and so least fit the criterion of integrity. Consider two examples: Lord Howe Island, north east of Sydney, consists of more or less intact lowland evergreen rainforest of outstanding biological value—of the 74 endemic plants, only 2 are Endangered, principally because most of the forest is intact and protected. Yet at the other extreme, Rodrigues island (east of Mauritius) has an equally rich endemic flora, yet its forests are devastated and reduced to tiny relict patches. Of the 49 endemic taxa of plants that have been recorded—and there are undoubtedly more that became extinct before botanists first visited the island—eight are Extinct and 22 Endangered (Strahm, 1989). Rodrigues has far more threatened species, yet Lord Howe is far more suitable for World Heritage Status.

I suggest that the way around this dilemma is to amend Criterion (iv) into a measure of biological diversity. Although ecosystem diversity and gene diversity may be covered also, the main thrust should be on species diversity, in particular to "catch" a high number of species not protected elsewhere. For the rest of this report I focus on the criterion of biological diversity.

Ways of Measuring Biological Diversity on Islands

The Centres of Biological Diversity concept seems ideal for World Heritage. Under this concept, biologists take advantage of the fact that the diversity of wild species

is distributed very unevenly over the earth. They identify those places which, if protected, would conserve a disproportionate proportion of the biota concerned. Such projects are being done for birds and plants (described below).

The snag, of course, is that they identify only a small number of sites, around 200 worldwide in the case of plants. Only a very few of these will be islands. Our policy should be that all these 200 sites should eventually be on the World Heritage List, but many other sites should also be on the List, some for other features but some for plants as well. Nor does the Centres of Diversity report help when Unesco receives a nomination from an island that was not selected as one of these *crème de la crème* sites. So we still need other systems from which we can make some measure of the conservation value of individual islands.

One way of doing this would be by some form of numerical count, on the lines of the tables ranking "conservation importance" in Arthur Dahl's *Review of the Protected Areas System in Oceania* (1986). Ingenious though this is, my initial inclination is not to follow this route. The difficulty with it is that it hides the element of subjectivity in a set of fixed assumptions that compares the importance of say, human impact, with species richness in numerical terms. It is also important to remember that for World Heritage we do not need the level of precision that it implies. To evaluate a nomination from Tahiti, we do not need to know that Tahiti is Nº 11 in the ranking of Pacific Islands; all we need to know is that it is in the top, say, 25 than in the bottom, say, 100.

Rather, I would prefer a system of determining a number of measures of the biological richness of islands based on their various features, and considering each of them separately. In this way, comparisons from one island to another can be made unambiguously. The weighting given to one factor over another can then be assessed differently in different cases, rather than be implicit in the process. For each feature, we could develop some examples of important islands in each class, with a ranking where the information allows.

I would suggest initially the following measures of biological diversity of oceanic islands:

- Endemic birds;
- Endemic plants;
- Coral reefs;
- As breeding grounds for marine vertebrates.

At first sight these may seem a little crude and arbitrary. But in each case they are measurable, as I show below, on a system that is intellectually rigorous and that compares like with like. Also, they are simple, and in most cases the necessary rankings can be prepared reasonably easily from existing data.

Of course other groups of organisms could be used as well. Endemic reptiles and land-snails would be two possibilities. However, few oceanic islands have endemic mammals, and the invertebrates are rarely well known enough to be used for comparative purposes. But the advantage of this general approach is that tables and

rankings can be done for other groups later, without upsetting the work already done.

(Late in the study a suggestion was made that sites for migratory species, notably birds, should be considered too, and this could be taken up later on.)

One point that should be considered is the degree of taxonomic distinction of the endemic taxa concerned. This is relevant in the case of the World Heritage Convention because taxa like endemic plant families (Lactoridaceae on Juan Fernández, for example) are arguably of greater "outstanding universal value" than, say, one of hundreds of endemic species of pandan trees (screw pines) or sea-lavenders, both of which are only told apart from related species by very small differences. Any further study should take up this aspect, which is not further discussed here.

Whereas the first two features refer principally to the land, the second two refer to the sea. The marine sites may in fact be more difficult to assess, as in marine systems the number of species is not a good indicator of biodiversity value.

These approaches are now considered in more detail. The first two are investigated with sample rankings, the others are just outlined as hypotheses.

1. Endemic Birds

It is an astonishing fact that although fewer than one fifth of the world's bird species are restricted to islands, over 90% of bird extinctions during historic times have occurred on islands (Johnson and Stattersfield, 1990). Moreover, of the birds presently threatened on islands, over 90% are confined to one political unit (i.e. are endemics) (*ibid.*). Thus, if the World Heritage Convention is to contribute to saving the biological diversity of the world's birds, the number of island endemic birds that a World Heritage site has would be a good criterion.

Table 1 lists oceanic islands in declining order of endemic birds. I should stress that this is a very preliminary table, compiled from the appendix of Johnson & Stattersfield (1990). Its intention is to give a flavour of what a more detailed analysis by qualified ornithologists could provide.

Yet even so, it gives a clear message. Just as with plants, the diversity of endemic birds is spread very unevenly around the world. Taking advantage of this, those implementing the World Heritage Convention could, for example, decide as a rule of thumb that:

- If an island site had more than 3 endemic birds, it would be worthy of World Heritage status on that ground alone;
- If an island site had 2 - 3 endemic birds, it would provide a strong supporting argument to inscription under other criteria;
- If an island site had one endemic bird, it would lend only weak support to inscription under other criteria.

As mentioned above, this table is an illustration. To prepare a table for regular use, it would be necessary to provide a more careful and detailed analysis, in particular:

- Finding a way to discount to some extent the counts of those endemic birds that are on more than one island group—in the table they are counted for each island group on which they occur. Maybe one could multiply the count for each bird (i.e. 1) by a rough percentage of the extent of the bird's range on that island, i.e. if only 10% of an endemic bird's range was on Lord Howe Island, that bird would only have scored 0.1 (not 1 as before) in the endemic bird ranking for Lord Howe Island.

Table 1

Index of islands in declining order of threatened island endemic birds: a provisional count

Hawaiian Is.	26	Fiji	3	Bioko	1
Solomon Is.	14	Juan Fernandez Is.	3	Bonin Is.	1
Mauritius	9	Madeira	3	Cocos I.	1
Sao Tomé & Principe	8	Micronesia	3	Crozet Is.	1
Seychelles	8	Nicobar Is.	3	Desventurados Is.	1
Marquesas Is.	7	Northern Marianas	3	Grenada	1
Chatham Is.	6	Taiwan	3	Guadalupe I.	1
Revillagigedos Is.	6	Antipodes Is.	2	Kerguelen Is.	1
Cook Is.	5	Campbell I.	2	Kiribati	1
Dominican Republic	5	Cape Verde Is.	2	Leeward Is.	1
Galápagos Is	5	Cayman Is.	2	Lord Howe I.	1
New Caledonia	5	Dominica	2	Mayotte	1
Society Is.	5	Henderson I.	2	Montserrat	1
Sri Lanka	5	Jamaica	2	Nauru	1
Tristan da Cunha	5	Martinique	2	Norfolk I.	1
Tuamotu Arch.	5	Okinawa	2	Prince Edward I.	1
Canary Is.	4	Palau	2	St Helena	1
Guam	4	Réunion	2	Snares I.	1
Haiti	4	St Vincent	2	Socotra	1
Puerto Rico	4	Tubuai Is.	2	Swan Is.	1
St Lucia	4	Vanuatu	2	Tonga	1
Andaman Is.	3	Amsterdam I.	1	Torishima	1
Auckland Is.	3	Ascension I.	1	Virgin Is.	1
Christmas I.	3	Bahamas	1	Western Samoa	1
Comoros	3	Bermuda	1		

Source: Appendix 1, List of threatened and extinct island endemic birds, in Johnson, T.H. and Stattersfield, A.J. (1990), A global review of island endemic birds, *Ibis* 132: 167-180.

- Finding a way to distinguish between species and subspecies, so as to give the latter less weight, and maybe also even making judgements on taxa of disputed rank.
- Bringing the geographical system used into line with whatever system is adopted. (The tables on endemic plants use slightly different geographical units.)

2. Endemic Plants

Endemic plants are in some senses an even better criterion, because:

- There is a much greater range, from none to many thousands of species on some islands. This gives a higher accuracy to any ranking and also greatly reduces the need to remove from the counts the occasional endemic species that may not be fully distinct.
- Plant diversity is a good indicator of overall biological diversity, since plants provide the habitats for many other forms of life.
- We know the number of endemic plants for virtually all islands in the world to a relatively high degree of accuracy, so comparisons can be made.

Tables 2 and 3 provide information on island plant endemics, drawn from the Threatened Plants Unit database and their book *Plants in Danger: What do we know ?* The first table is of threatened species. This has limited uses on its own, because a low score could mean that a threatened plant list had not been compiled (as with most Caribbean islands, for example) or alternatively that the flora was not in danger. Some amplification is therefore needed.

More useful is the second table, which gives the most up-to-date figure (in about 1985) on the number of endemic species of vascular plants (pteridophytes, gymnosperms, angiosperms). Although a number of qualifications are added, shown by footnotes, resolving them is unlikely to change the ranking greatly. The number of endemic plants varies from 1 to 2474, a massive range.

Thus one could say that:

- If an island site had more than 50 endemic plants, it would be worthy of World Heritage status on that ground alone;
- If an island site had 5 - 50 endemic plants, it would provide a strong supporting argument to inscription under other criteria;
- If an island site had 1-4 endemic plants, it would lend only weak support to inscription under other criteria.

It may be that these limits are set too high, as the number of islands near the top of the list that could be World Heritage Sites in their entirety is very small. And within a group of islands, such as the Canaries, the plants tend to be in a range of different habitats and on individual islands, not all clustered together in one place. Further study and some practical use of the criterion would be needed. For

Table 2

Threatened Plant Records for Oceanic Islands

Island	*Endemic*				*Non-endemic*				*Total*
	E	*V*	*R*	*I*	*E*	*V*	*R*	*I*	
Atlantic Islands									
Azores		5	18	6		1	2		32
Canary Is.	125	130	143	7	2	17	3	1	428
Cape Verde Is.						1			1
Madeira	16	30	39		3	17	6		111
Principe			1						1
Salvage Is.	2	1	1		1	2	2	1	10
Caribbean Islands									
Antigua/Barbuda	1								1
Bahamas				21			1		22
Barbados			1						1
Bermuda	4	1	6						11
Br. Virgin Is.				1					1
Dominica	4	4	13	30			3	8	62
Dominican Rep.	3		3	35		1		4	46
Grenada		1	1					1	3
Guadeloupe	1	3				1	3	6	14
Haiti	2	1	2					4	9
Hispaniola			2					1	3
Jamaica		2	5				1		8
Martinique	2	3				1	2	4	12
Montserrat								1	1
Puerto Rico	2	2	1	67		3		8	83
St Lucia							1	2	3
St Vincent				2				2	4
Trinidad/Tobago			1			2	1		4
Turks & Caicos							1		1
U.S. Virgin Is.				4		1		5	10
Indian Ocean									
Aldabra			1			1			2
Andamans	3		4		1		1		9
Christmas I.	2	2	8	2					14

Island	*Endemic*				*Non-endemic*				*Total*
	E	*V*	*R*	*I*	*E*	*V*	*R*	*I*	
Comoros				3					3
Mauritius	84	42	52	4	11	17	9	6	225
Nicobar	2		5		1		1		9
Réunion	14	11	21	5	10	15	8	5	89
Rodrigues	23	7	11		6	6	2		55
Seychelles	23	10	2	37	1				73
Socotra	84	17	29	1					131
Sri Lanka	17	5	12	19		1			54
Pacific Ocean									
American Samoa			2				3	1	6
Caroline Is.	1		1	1					3
Fiji	1	3	15	6					25
Galápagos Is.	12	10	96	9					127
Gambier Is.	1								1
Guadelupe			1						1
Guam	3			1	4			4	12
Hawaiian Is.	725	38	64	815					1642
Henderson I.				2					2
Juan Fernández	51	33	10	1					95
Mariana Is.	1								1
Marquesas Is.	18	13	7	22				1	61
New Caledonia	15	24	107	22					168
North Marianas					4			4	8
Oeno Atoll				1					1
Ogasawara-Shoto	35		35	1	3		6	1	81
Ryukyu Is.	1					1			2
Society Is.				2				1	3
Solomon Is.						2	1		3
Taiwan	3	22	51	5	1	5	5	1	93
Tuamotu Is.								1	1
Volcano Is.					3		5	1	9
Western Samoa			7	1			3	1	12
Australia and New Zealand									
Chatham Is.	6	4	6			4	1	1	22
Kermadec Is.	5		2				2		9
Lord Howe I.	2	10	60	3		3			78
Norfolk I.	12	29		1		3			45

Island	*Endemic*				*Non-endemic*				*Total*
	E	*V*	*R*	*I*	*E*	*V*	*R*	*I*	
South Atlantic Islands									
Antipodes Is.			1			1	3		5
Ascension I.	5		4					1	10
Auckland Is.			1			1	5		7
Campbell I.			1						1
Falkland Is.	1		3						4
Macquarie I.		1	1						2
St Helena	23		17					2	42
Trindade								1	1
Tristan da Cunha			6	11				1	18

Key: E—Endangered; V—Vulnerable, R—Rare, I—Indeterminate.

Notes: Islands with no recorded threatened plants are omitted.

Threatened status is global, i.e. a species threatened on the island but not threatened elsewhere would not be included.

Extinct species omitted; Ex/E species treated as E, V/R species as V, E/R species as E.

Source: Threatened Plants Unit printout, 16 August 1988.

Table 3

Oceanic Islands in declining order of endemic plant species

Island	*Nº Endemic plants*	*Date of Information*	*Footnotes*
New Caledonia	2474	1984	1
Hispaniola	1800	1984	1, 6
Hawaii	900-950	1986	1
Jamaica	911	1982, 1984	2
Sri Lanka	907	1982, 1983	
Taiwan	894	1979	2
Fiji	700	1984	2
Canaries	593	1990	3, 8
Caroline Is.	293	1979, 1982	3, 4

Island	*Nº Endemic plants*	*Date of Information*	*Footnotes*
Puerto Rico	234	1982	
Galápagos	229	1978	1, 9
Andamans & Nicobars	225	1977, 1984	1
Socotra	215	1970s	
Trinidad and Tobago	215	1981	1
Réunion	176	1980	2
Mauritius	172	1980s	
Ogasawara-Gunto	152	1978	
Vanuatu	150	1975	
Tubuai	140	1984	1, 2
Comoros	136	1917	
Madeira	131	1980s	
Bahamas	121	1982	1, 2
Juan Fernández	118	1980s	3
Sao Tomé	108	1944	
Marquesas Is.	103	1980s	3
Cape Verde	92	1979	1
Seychelles	90	1979	7
Marianas	81	1979, 1982	3, 4
Lord Howe I.	74	1983	
Azores	55	1980s	
St Helena	50	1984	
Rodrigues	49	1989	3, 10
Norfolk I.	48	1968	1
Aldabra	43	1980	3
Chatham Is.	35-40	1984	1
Principe	35	1944	
American Samoa	27	1982	
U.S. Virgin Is.	27	1974	1
Tuamotu Arch.	20	1931-5	2, 3
Netherlands Antilles	7-19	?	
Cayman Is.	18	1984	1
Tristan da Cunha	17	1981	3
Falkland Is.	16	1968	
Bermuda	15	1981	
Christmas I. (Australia)	15	1984	1
Coco, Isla da	15	1966	2
St Vincent	12	1893	
Ascension I.	11	1980	
Gambier	11	1974	1
Tonga	11	1959	3
Henderson	10	1983	3

Island	*Nº Endemic plants*	*Date of Information*	*Footnotes*
Heard I.	8	1975	1
Salvage Is.	8	1980	3
Auckland Is.	6	1985	1
Barbados	6	1984	
Dominica	6	1984	
Antigua/Barbuda	5	1938	1, 2
Easter I.	5	1920	
Maldives	5	1961	11
Wallice & Futuna	5	1977	1
Campbell Is.	3	1961	1
Macdonald Is.	3	1975	1
Macquarie I.	3	1960	1
Aleutian Is.	"a few"	1960	
Antipodes Is.	1	1981	1
Kerguelen Is.	1	1975	1
Marion & Prince Edward Is.	1	1982	
Nauru	1	?	

Notes: All figures are from *Plants in Danger* unless otherwise cited in footnotes. Plant-rich islands for which figures are not available include Guadeloupe, Martinique and Guam.

Footnotes:
1. Omits ferns
2. Estimated from a given percentage of endemism
3. Includes subspecies and varieties
4. Omits monocotyledons
5. Includes Turks & Caicos Is., which should be treated separately.
6. Covers Haiti and Dominican Republic.
7. Omits coralline islands, which are listed under Aldabra
8. From database of Jardín Botánico "Viera da Clavijo", Las Palmas
9. Updated from the date given.
10. Strahm, W. (1989). *Plant Red Data Book for Rodrigues.* IUCN/Koeltz.
11. Likely to be dubious species.

example, islands that most agree would be worthy of World Heritage, such as Round Island and Henderson Island, with about 5 and 10 endemics respectively, would only be in the second category. Yet these two do have other very strong reasons for nomination, and both have endemic fauna as well. And the plant-rich islands already inscribed come through with a considerable margin (see below).

One problem with Table 3 is that it covers only species confined to the area concerned, unlike Table 1, on birds. The islands of the Lesser Antilles are therefore ranked too low, because plant species on these islands tend to be endemic to two or three individual islands (e.g. a species might be endemic to St Vincent, Grenada and St Lucia, rather than to just one of them). Thus a way needs to be found to include such species in the rankings.

3. Breeding Grounds for Marine Vertebrates

Many animals that spend most of their life at sea come ashore on islands for breeding. Notable examples are seabirds and marine turtles. It would be worthwhile considering whether a series of tables for islands would be useful to give some measurement of conservation importance in this case.

I discussed the possibility of considering islands as nesting sites for seabirds with Tim Johnson and Alison Stattersfield of ICBP. They emphasized the importance of islands as seabird colonies and made the point that the islands with important seabird colonies were rarely the ones with the endemic birds. This makes the use of this criterion especially worthwhile. Also, one could argue that the great flocks of seabirds, such as the 52,000 gannets on St Kilda, are one of the wonders of nature. The numbers too are very large: South Georgia, an island with neither endemic plants nor endemic birds, supports 31 million pairs of 26 different seabird species.

Tim Johnson and Alison Stattersfield consider that a study could be done to list the important islands for seabirds and to find some way of ranking them. The ranking might not be numerical, but be comparative, putting the islands into groups of priority. This is because one would have to balance the population sizes of the birds with the number of species supported. In other words, South Georgia supporting 22 million Antarctic Primes should count for more than St Kilda supporting 52,000 gannets. How this could be done would need some thought by those knowledgeable in the subject.

Such a study would have to include both oceanic and offshore islands.

4. Coral Reefs

Coral reefs occur in 85 different tropical countries (Fitter, 1986), largely between latitudes 30°N and 30°S (Wells, 1988). They are some of the richest habitats known, both in terms of their diversity and their productivity. They also capture the public imagination in a way that other marine habitats, say sea-grass beds, would rarely do. Like tropical forests, diversity is their very essence; one might conserve a

sea-grass bed for one particular sea-cow, but one would, I suspect, rarely conserve a coral reef for one species alone. It is the whole indivisible set of species and their interactions that we seek to conserve.

An important point about coral reefs made by Sue Wells is that high diversity and high endemism rarely go together. For example, reefs in SE Asia are high in diversity but low in endemism, whereas reefs in Hawaii are low in diversity but have many endemics. Indeed, diversity is a more important feature than endemism in this habitat, and many reefs have similar assemblages of species. Conversely many of the species tend to have very large ranges. So, for coral reefs, "uniqueness" would be difficult to characterize.

Coral reefs are of course very important from an economic point of view and for the ecological processes they support. Sue Wells contends that *all* reefs should be managed to maintain their structure, not just a small percentage of them as "representative samples", as in so many terrestrial ecosystems. Nor are they neatly defined areas, and of course the commonest threats to them—pollution and siltation—come from elsewhere. For these and other reasons, the biosphere reserve concept is more suitable for coral reef conservation than the World Heritage Convention.

Nevertheless the presence of important reefs could well be an important feature in any island nomination for a World Heritage Site. It would also be possible to draw up some criteria for what constitutes an "exceptional" reef—features such as size, isolation, the extent to which it is pristine—come to mind as well as biological diversity and endemism. Such a range of factors points not to a ranking list of coral reefs, as with the endemic plants and birds, but rather a study that would nominate a number of criteria to use when judging a reef, and would outline examples of reefs that were near the top, the middle and the bottom of the range for each criterion. A synthesis from this could then suggest and describe a small number of reefs that would be particularly worthy of inscription under the World Heritage Convention. Sue Wells suggested the Chagos Archipelago reefs, for example (pers. comm., 1991).

Yet if coral reefs, why not other ecosystems on islands ? Mark Collins argued convincingly that as coral reefs only occur in the tropics, using them as a criterion would discount temperate marine habitats like salt marshes. He suggested instead that the key criterion should be the *number* of ecosystems and considered that a study to rank islands by this would be possible—but difficult. WCMC still has no single set of ecosystem classification that it is following. I have doubts on the value of this approach, feeling more that number of ecosystems is more appropriate as a criterion for biosphere reserves, with their emphasis on representativeness, rather than for World Heritage Areas, with their emphasis on uniqueness.

It may be that World Heritage should concentrate more on the uniqueness and rarity of individual vegetation types—this is certainly one of the most convincing arguments used in nominations. For example, a powerful argument for inscribing Garajonay was that it has some of the best intact laurel forests in the Canaries, an otherwise threatened vegetation type essentially confined to the Canaries and

Madeira. More thought and discussion is needed on the ecosystem approach. In the meantime, I still feel it is worthwhile taking the criterion of coral reefs forward, as they are very much a wonder of nature and will not be picked up in the assessment of islands under the other criteria proposed. Studies on other ecosystems on islands could always come later.

Comments on Other Criteria

Criteria (i) and (ii) are rather similar to each other. Some island groups—the Canaries, the Galápagos, Hawaii for example—show arguably the finest examples of adaptive radiation on earth, and to some extent this can be documented. There are also fascinating examples of co-evolution, such as the Hawaiian sunbirds with the curved bills that enable them to pollinate the endemic *Hibiscadelphus* plants, and it might be possible to document some of the more notable examples of these. But it would be hard to be objective or complete in doing so.

In considering the cases for inscribing various New Zealand islands, Molloy and Dingwall (1990) interpret Criterion (i) more in terms of geological evolution and Criterion (ii) more in terms of biological evolution. This is a good practical way to proceed, but, as I understand it, both criteria would theoretically cover both geological and biological evolution. Following this lead, I made a list of the arguments that Molloy and Dingwall make under each of the four criteria (Table 4). This is very instructive, though maybe a little unfair to analyse their paper in this way! This Table shows that the authors are very comprehensive in describing all the features of New Zealand islands that make them worthy of conservation, but that the Guidelines provide a less than adequate framework for presenting their case. Certainly their interpretation is rather different from mine, and this is a criticism not of them but of the Guidelines.

I don't yet have a formulation of how Criteria (i) and (ii) could be reworked but I suspect the answer will lie in not dividing by time (at present (i) refers to past evolution, (ii) mainly to ongoing evolution) but by sector, such as geology, human interaction, unique ecosystems, biological diversity, etc.

Criterion (iii)—the natural beauty criterion—is even harder to measure. How can one evaluate natural beauty in concrete terms? To do so is almost a contradiction in terms! We could look at the extent to which the place appeared in literature or art, but this would not be a reliable guide. Many novels have been set on islands, but all too often they are tales of shipwreck and treasure hunting, rather than expressions of natural beauty. Or, the islands may no longer exist, as with Atlantis!

Natural beauty aside, it would probably be more difficult to make studies of what islands best fit Criteria (i) and (ii) than for the criterion of biological diversity. It is certainly more outside the present range of this consultant, and for that reason alone not taken further in this short study.

Table 4

Rapid analysis of the arguments put forward by Molloy and Dingwall (1990) in considering the World Heritage Values of New Zealand Islands, arranged by the Operational Guidelines

Guideline 1: "Outstanding examples representing the major stages of the earth's evolutionary history"

- Whether near a tectonic boundary or not
- Earthquake activity, especially intensity of
- Geological origin
- Tectonic and geological integrity
- Marine life in surrounding waters

Guideline 2: "Be outstanding examples representing significant ongoing geological processes, biological evolution and man's interaction with his natural environment; as distinct from the periods of the earth's development, this focuses upon ongoing processes in the development of communities of plants and animals, landforms and marine areas and fresh water bodies"

- Biological evolution
- Centres of endemism, especially numbers of endemic species
- Integrity of biota, in part as a measure of whether ongoing evolution possible (e.g. because of lack of introducted predators)
- Differences of vegetation types from mainland ecosystems
- Degree of modification of the vegetation
- Links to previous biotas, now extinct (e.g. to "pre-Quaternary Antarctica")
- "Man's interaction with his environment"
  - Length of occupation
  - Presence of indigenous peoples
  - Sources of stone and other raw materials in historic times

Guideline 3: "Contain superlative natural phenomena, formations or features, for instance, outstanding examples of the most important ecosystems, areas of exceptional beauty or exceptional combinations of natural and cultural elements"

- Outstanding landscape features
- Physical features (e.g. jagged spires, lava dome, ancient volcano)
- High density of breeding seabirds and marine mammals

Guideline 4: "Contain the most important and significant natural habitats where threatened species of animals or plants of outstanding value from the point of view of science or conservation still survive"

- Includes presence of animals translocated from elsewhere for conservation purposes
- Taxonomic distinctiveness emphasised as a criterion for assessing "outstanding natural value".

Portions of Islands

One point to bear in mind is that for most island groups, it would not be practical to put the whole island on the World Heritage List. In many cases, IUCN and Unesco will be considering nominations for parts of islands.

A key question to ask here is the extent to which the part of the island covers the unique features and biological diversity of the island. Garajonay in the Canaries scores highly here—it contains some of the best laurel forest in the Canary Islands and laurel forest is by far the most species-rich vegetation type on the islands. Vallée de Mai in the Seychelles and Scandola in Corsica would score less well.

This distinction may also make it easier to consider and rank islands for inclusion in their entirety on the World Heritage List because there simply are not that many islands in the first rank biologically that are uninhabited. Most tend to be rather small—such as Henderson Island in the Pacific and Round Island in the Indian Ocean.

Brief Analysis of Existing World Heritage Island Sites

It is interesting to see how far the existing World Heritage Island Sites match up when considered on the criteria of biological diversity suggested above. For a complete picture, however, the analysis would need to include other features such as geology, interaction with man, natural beauty, etc.

So far the following oceanic islands have been inscribed on the World Heritage Convention in their entirety:

Aldabra With its numerous seabird colonies, some endemic birds and its marine turtle beaches, Aldabra scores highly on any measure of biological diversity. Perhaps most significant are its massive populations of Giant Turtles and the fact that it is one of the very few intact such islands in the world. The 43 plant endemics (of which many are reputed to be not very ancient or very distinct species) provide "a strong supporting argument". Combined together, these arguments make it clearly worthy of World Heritage Status.

Galápagos Islands These famous islands could be accepted because of their 229 plant endemics or their 5 bird endemics. But these features clearly understate their importance. The Galápagos is one of the best, if not the best, "laboratory of evolution", demonstrating remarkable co-evolution between plants and animals. Other features include the marine mammals in its waters, the breeding grounds for one marine turtle and the cultural heritage.

Lord Howe Island Again its 74 endemic plants would qualify it on their own. But just as important is that it is one of the very few oceanic islands in the world with a forest vegetation of endemic species still largely intact. This has given it an exceptional range of ecosystems and makes it a very special example of how many other islands would have been before man destroyed their vegetation.

Henderson Island With 10 plant endemics and four endemic landbirds, Henderson would qualify for inclusion. Just as important is the fact that Henderson is said to be the best remaining intact raised coral atoll in the world. It is, in fact, the epitome of the kind of small uninhabited island that should be on World Heritage.

The following have been inscribed in their entirety but can barely be described as oceanic:

Great Barrier Reef The world's longest stretch of coral reef, with over 1500 species of fish, 400 species of coral, 4000 species of molluscs, 242 species of birds, and many threatened marine mammals. Great Barrier Reef would clearly be at or near the top of any world list of coral reefs for inscription.

St Kilda With 25% of the world population of gannet, the largest British colony of fulmar and about half Britain's population of puffin, St Kilda will score highly in any ranking of islands as seabird colonies. Its cultural heritage is also significant. Described by Julian Huxley as "the most majestic sea rock in existence" (Stac Lee), its landscape and beauty would also score highly. For these reasons, I feel its inclusion is well justified, though its case is not so overwhelming as the islands listed above. We should, however, accept that temperate islands have far less species diversity than subtropical or tropical ones, and should therefore qualify without the dazzling numbers of species found on many tropical islands.

Parts of the following islands have been inscribed:

Canary Islands: Garajonay, Gomera Its main feature is some of the best intact laurel forests in the Canary Islands. Laurel forests are a very remarkable type of moist forest and contain the highest proportion of endemic species of any vegetation type in the Canaries. The PADU sheet mentions 450 flora species of which 34 are endemic to Gomera and 8 to the Park itself. I would assume that the number of Canarian plant endemics present is well over 50, probably over 100, so fulfilling the endemic plant criterion for inscription. The Park has 2 bird endemics also.

Corsica: Scandola Without more data, it is not possible to analyse this inscription objectively, but on first assessment it would not seem to meet the criteria. The PADU data sheet mentions one threatened plant species, though there may be more —Corsica has 31 endemic plants overall, 16 of which are threatened, and a further 12 threatened non-endemic plants. The vegetation seems typical of the Mediterranean basin, and not therefore unique to Scandola or Corsica. The birds include two threatened species, one of which, the Peregrine Falcon, is very widespread. It is encouraging to note that the area is now returning to natural vegetation, but that alone would not qualify it for World Heritage Status.

Hawaii: Volcanoes It is well known that Hawaii has one of the highest rates of endemism in the world. According to PADU, Hawaii Volcanoes has 41 plants that are candidates for Endangered status, and an additional 40 species considered to be rare, out of 374 native species. As endemism in Hawaiian plants is over 90%, even allowing for the fact that botanists have greatly reduced the number of species on Hawaii (revisions of difficult taxonomic groups have shown many taxa with different names to be identical or near-identical), there must be at least 100-200 plant endemics in the Park. There also appear to be over 10 endemic birds, an astonishing total. On these grounds alone, Hawaii Volcanoes is clearly worthy of inscription, let alone its scenic interest and vegetational diversity.

Seychelles: Vallée de Mai, Praslin A tiny site of 18 hectares, within the Praslin National Park, this is very different from the other island sites inscribed on the List. It is the famous site of the extraordinary palm, the Coco de Mer (*Lodoicea maldivica.*) Indications are from the account in the Afrotropical Realm Directory that there are a few other endemic species present, but certainly not a substantial proportion of the 90 Seychelles plant endemics. There is a rich fauna but it is not clear how significant the Reserve is to the populations of the species concerned. I suspect that a more rigorous examination would show that the Vallée de Mai did not meet the criteria outlined above.

I am indebted to PADU for their excellent datasheets on these sites, without which I would not have been able to make this brief analysis.

Data Sources on Islands

Over the years there have been a many attempts to catgorize islands and prepare data sets on them, ranging from Gina Douglas's landmark IBP listing in 1969 to the Islands Directory today. In the time available I could not make a consistent review of the data about islands but I do list some of the more relevent activities. There will also, of course, be extensive datasets on islands and their biota in national museums, zoos and botanic gardens, in regional conservation organizations like SPREP and the Caribbean Conservation Organization, and, not least, on the islands themselves! I should also add that this analysis is confined to data sets in the UK.

1. World Conservation Monitoring Centre (WCMC)

The Protected Areas Data Unit has:

- A database of information on 24,000 protected areas;
- 4000 detailed sheets, including ones on all World Heritage areas, biosphere reserves and most large protected areas around the world.

Information from this unit is consistent, usually up-to-date and easily available from a knowledgeable staff.

Also taking an area-based approach, the new Habitats Unit has prepared some very impressive GIS maps, an acclaimed popular book on rainforests and have three major works on tropical forests in Asia, Africa and Latin America in the later stages of preparation. Their work to plot the forests of SE Asia (divided into six classes) includes islands of the Pacific east to Fiji. In one major project, they are mapping all "managed areas" in the tropics—this term includes production forests and Forest Reserves (areas reserved for forest logging) as well as conventional protected areas. This project has to be completed by the end of 1992.

However, their GIS approach, based as it is on a 1:1,000,000 world map, is probably better suited for large continents than small islands.

In contrast to the area-based work, the species work of WCMC is sadly still in disarray. The plants section, previously the Threatened Plants Unit, had very good data about the endemic plants on islands, contained in:

- Their bibliographic database on plant conservation, from which a listing of 10,530 entries was published in 1990 as *World Plant Conservation Bibliography* (Kew and WCMC, 645 pp.)
- The country and island datasheets that were published in 1986 as *Plants in Danger: What do we Know?*
- The species datafiles which contain the distribution and conservation status of over 50,000 named plants.

This database has not been kept fully up to date since about 1987, when it could boast that it contained a record on every known threatened plant in the world. WCMC have, however, just appointed the well-known orchid botanist and database expert, Dr Kerry Walter, to rebuild it, and this is excellent news. The database is rich in information on island endemics, and a third of the c. 19,000 threatened plants in the database are from islands.

In this survey, I have not looked into the animal work of WCMC but could do so in a second phase of the study. The animal work of WCMC has in the past concentrated more on compiling detailed datasheets on prominent endangered animals, but does have a database. The Unit's most important publication for work on islands has been Sue Wells' mammoth *Directory of Coral Reefs of the World.*

2. The IUCN/WWF Centres of Plant Diversity Project

This is being carried out by the IUCN Plants Office at Kew under Vernon Heywood, with Steve Davis as researcher. Its purpose is to identify and document c. 200 places and vegetation types around the world that, if protected, would "catch" the great majority of the world's plants. Several islands, or parts of islands, are included. Those already selected are listed in Table 5.

As mentioned above, the Centres of Plant Diversity concept is ideal for World Heritage: it is site-based, it is judgmental, it is selective and it is based on species richness. By favouring places rich in endemic plants, it reflects the World Heritage

qualities of uniqueness and universal value, rather than the Biosphere Reserve concepts of representativeness.

I myself wrote a report in summer 1990 for the British Aid Minister, Lynda Chalker, suggesting 20 of those centres where Britain could fund biodiversity projects, mainly establishment and/or consolidation of large protected areas; this report included suggestions for projects in Socotra (Yemen), Fiji and Jamaica.

Table 5

Oceanic Islands selected so far as Centres of Plant Diversity

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Indian Ocean

Sri Lanka: Sinharaja Forest, Peak Wilderness, Knuckles
Mascarene islands (mainly upland Réunion and the proposed Macabé-Black River National Park in Mauritius)
Part of Socotra
Christmas Island (Australia)

Australia and New Zealand

Chatham Islands
Lord Howe Island
Norfolk Island
Tasmania: World Heritage area and associated temperate rain forests
Atlantic Ocean
Canary Islands
Possibly the upland laurel forests of Madeira

Pacific

The rain forests of Fiji
Galápagos Islands
Hawaiian Islands
Juan Fernandez Islands
Marquesas Islands
Parts of New Caledonia
Rapa
Western Caroline Islands

Caribbean Islands

Selection more complex; will include Lesser Antilles, Hispaniola (Haiti/Dominican Republic) and Jamaica

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Note: Only covers islands under 100,000 sq. km

Source: Steve Davis, IUCN, January 1991

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3. The IUCN Islands Database

This was created by Arthur Dahl under the aegis of the Commission on Ecology and now resides at WCMC. It was created as a tool to prepare the Review of the Protected Areas System in Oceania (IUCN, 1986). Arthur Dahl has prepared a c. 20 page description of it, and I am sending a copy separately to Jim Thorsell.This lists the various fields and gives a flavour of how it works. Thanks to the kindness of Jerry Harrison and John McComb, I was able to look at the Database.

The database contains records on 1726 islands, with a potential of 1435 bytes (plus memo fields) on each record, arranged in 128 different fields—giving when complete a total of 220,928 different items of information in the database. The fields vary from counts (e.g. number of endemic birds) to statistics (e.g. GNP) to descriptions in words (e.g. on human impacts).

The programme is written in D'base, a widely used computer language. A trusted computer professional has described it as in general well-written but not yet fully normalized (i.e. with internal duplication). He judges that it performs well, but would need some more programming work to make it resilient enough for distribution to others.

The most important point, however, is that the database is still only a framework. Every record has the name of the island, and most have the area (1500 records), longitude, latitude and maximum altitude. Yet only a small proportion of records have environmental data; for example, 153 (out of 1726) have information on geology and soils, 279 information on protected areas, 314 an assessment of ecosystems present, and 107 an assessment of human impact. When it comes to species data, the coverage is even less: 77 island records (out of 1726) have a code indicating species richness, 55 the number of plants present, 20 the number of insects, and only one island record has data in the field on invasive species. So basically we have a shell waiting to be filled.

The first point to make is rather obvious: a database is only useful for making comparisons if all the needed data items are completed for all the records. Otherwise how can one say this island has the most plants or the most severe human impact? So if we want to use the database for international work, we have to fill it first.

I much admire the ingenuity and design of the database, but do have doubts as to whether it could ever be completed with the resources generally available for this kind of work nowadays.

It is also not very compatible with WCMC's existing operations and databases, which themselves contain much data on islands.

For example:

- The WCMC geographical system links most small islands together into clusters, e.g. Canary Islands, Fiji Islands, whereas the Islands Database gives each island a separate record. Although the latter may be more appropriate for

World Heritage work, it does lead to much duplication and makes the task of compiling the data an order of magnitude harder. Moreover, the WCMC geographical system is almost identical to the one that a world consortium of virtually all botanical organizations with databases have agreed to use for their plant records—not just endangered species but all plants.

- The WCMC system records species one by one, and, for plants at least, can then summarise the information to give the number of species on each country or island (the PLTCOUNT programme). The Islands Database just includes the totals, i.e. you enter the fact that Dominica has eight plant endemics rather than enter each of them. I prefer the WCMC approach; otherwise, when a new species is found, the compiler cannot know whether it is included in the total or not.

Other aspects that may cause difficulty in future are:

- I could see no form of data sourcing, i.e. giving the source of a piece of information. We found this to be essential in TPU, and it would be even more so in a system that has so varied a set of fields. Unless a database is completed to a consistent degree of accuracy, it cannot fulfil the function of enabling comparisons to be made from one island to another.
- It is not always possible to see if a data item is filled in or not. For example there are a series of fields on prominent ecosystems, such as Forests, Mangroves, etc. In each case "Y" means present, "N" means absent. Yet the default is also "N". So Grenada shows up as having no forest, which is clearly not true. Similarly altitudes are defaulted to zero—true for some islands but not for others.

My conclusion is that sadly at its present state of development this database will not be of great use in deciding which islands or parts of islands are of World Heritage quality. I don't believe that the database could be filled without a very large investment of time and money. In retrospect, the database should perhaps have been designed to be fully integrated with that of WCMC and tapping into the massive indexes of threatened and endemic species that WCMC's animal and plant units hold. (I realise that WCMC has not been in a position over the last few years to be a good collaborator in such projects, and this may explain why the Islands Database started as a new initiative.) If a database on islands is needed (and see ICBP's conclusion on this point below), we should encourage WCMC to complete its datafiles as far as islands are concerned and bring them back up to date. If additional data elements are needed, such as the GNP of each island, they should be added onto the WCMC system, using its agreed geographical system. Nevertheless the IUCN Islands Database as it stands at present was a very valuable pilot exercise, and many of its feature will be useful to WCMC.

4. International Council for Bird Preservation (ICBP)

ICBP started a database in 1985 on the 157 single oceanic islands that were less than 20,000 sq. km in size and had single-island endemic bird species. Various

products were prepared from it, notably the excellent book on Biodiversity and Conservation in the Caribbean (see below). Essential data on 1587 island endemic bird species will be complete by April 1991.

This work has now been subsumed in a more general project to map the distribution of all birds whose total distribution is less than 50,000 sq. km. About 2500 birds fit this criterion (nearly 1 in 4 of the world's total), many of which are from islands. A major synthesis from this is planned for publication by the end of 1991, on Avian Centres of Endemism. This is very parallel to IUCN/WWF's Centres of Plant Diversity (see above). Both share the fundamental premise that their job is to identify those parts of the world which, if protected, would safeguard the most threatened species, not to make socio-economic judgements on which sites should be national parks or nature reserves. A major difference, however, is that ICBP are using state-of-the-art GIS techniques, whereas IUCN/WWF are preparing datasheets. The ICBP project overlays the ESRI World Map, the WCMC Habitats Unit maps of forest extent (divided into 6 basic classes), WCMC-PADU maps of protected areas extent, and, a mass of point records for bird sightings. A pilot exercise to identify bird "hot-spots" in the Philippines, as part of this project, is described by Tim Johnson in *World Birdwatch* 12(4): 6-7.

I am inclined to agree with ICBP that a database on bird distributions is more useful to them than a database on islands. Islands come in all shapes and sizes, and some are very akin to continental areas. The same conclusion could well apply to IUCN's and WCMC's data work on islands. Under this hypothesis, IUCN and WCMC should give special emphasis to islands but should do so within the context of their existing programmmes and data-gathering operations, not as a separate enterprise.

Tim Johnson of ICBP has most kindly prepared a summary of ICBP's data holdings for this report and this is appended as an annex to this report.

Published Information on Islands of Use in World Heritage Matters

There is of course a massive literature on islands, but there are a handful of books that do provide key information on islands. They provide much of the information that the World Heritage Convention needs, but no one volume covers the issue from the perspective of the Convention. I list below some of these key works, omitting those that cover only one island or island group (e.g. *Natural History of the Canaries*, by David and Zoë Bramwell).

General

Dahl, A. (in prep.) *Island Directory.* IUCN. (Arthur Dahl has prepared an 11-page description of this project, a copy of which I have passed to Jim Thorsell. The Directory will clearly be a key work for this report, and the data it will contain will be of great value.)

On Specific Regions

Douglas, G. (1969). Draft Check List of Pacific Oceanic Islands. *Micronesica* 5(2): 327-463. (Excellent summaries of the physical character, past and present land use, and scientific knowledge on individual islands, arranged in natural groups.)

Clark, M.R. and Dingwall, P.R. (1985). *Conservation of islands in the Southern Ocean: a review of the protected areas of Insulantarctica.* CNPPA.

CNPPA, UNEP and Dahl, A. (1986). *Review of the Protected Areas System in Oceania.* IUCN. (Covers the region of the South Pacific Commission with minor additions; 226 islands are selected from 1000 as having "particular natural richnesss, endemic species or protected areas", and ranked by conservation importance).

IUCN-CMC (1987). *IUCN Directory of Afrotropical Protected Areas.* IUCN. (Covers the islands of the Western Indian Ocean, notably Comoros, Mauritius, Réunion and Seychelles, as well as the Atlantic Islands of Sao Tomé, Principe and St Helena.)

Oldfield, S. (1987). *Fragments of Paradise: A Guide for Conservation Action in the UK Dependent Territories.* Pisces Publications, Oxford. (Britain still has 17 Dependent Territories as outlined here; all but three of them—British Antarctic Territory, Gibraltar and Hong Kong—are oceanic islands.)

Johnson, T.H. (1988). *Biodiversity and Conservation in the Caribbean: Profiles of Selected Islands.* ICBP Monograph No. 1, Cambridge. (Includes considerable detail on each island, well beyond the special interest of birds, with outlines of the vegetation, land-use and of the biota, with a description of the conservation infrastructure and with recommendations for action.)

WCMC (in press for May 1991). *Directory of Protected Areas in the South Pacific.*

Derek Scott at Slimbridge, UK, is preparing an Inventory of Wetlands in Oceania, as a joint project of IWRB, the Ramsar Bureau and the Asian Wetland Bureau. It will culminate in the publication of a *Directory of Wetlands of Oceania.*

On Specific Ecosystems

Wells, S. (Ed.) (1988, 1989). *Coral Reefs of the World.* 3 vols. IUCN/UNEP. (Massive compendium of all the coral reefs of the world.)

On Specific Biota (but arranged by island or country)

Davis, S.D. *et al.* (1986). *Plants in Danger: What do we Know?*. IUCN. (Data sheets on plant knowledge about each island group in the world; includes the numbers of plant species, of endemics and of threatened species where known. Includes references to key works on plants and vegetation (including vegetation maps). Includes cameo descriptions of vegetation and the amount of natural forests remaining.)

Royal Botanic Gardens, Kew, and Threatened Plants Unit, World Conservation Monitoring Centre (1990). *World Plant Conservation Bibliography*. 10,530 bibliographic references on plant conservation, arranged by country or island group in the WCMC geographical system.

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Strahm, W. (1989). *Plant Red Data Book for Rodrigues.* Koeltz/IUCN.

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ANNEX

INTERNATIONAL COUNCIL FOR BIRD PRESERVATION

SUMMARY OF DATA HOLDINGS

January 1991

Computerised databases

Avian centres of endemism:

A major initiative to map the distributions of all locally endemic bird species (defined as having less than 50,000 sq km global range), regardless of conservation status. Approx. 2,500 species are included (25% of all bird species); analysis will show major centres of avian endemism, which will be documented and published in early 1992.

Threatened birds of the world:

Information on 1,029 globally threatened species by geopolitical unit, with single paragraph (c. 10 lines) of text per species, including habitat, distribution, threats, and status. Lists of species available by country, region and various other parameters, options for full text on each species, and analysis of species endemic to the requested geographic division. Full database contents published as Collar, N. J. and Andrew, P. (1988) ***Birds to watch: ICBP world checklist of threatened birds.*** Cambridge, U.K.: ICBP Techn. Publ. no 8. Updated information on species status since publication also available.

Island endemic bird species:

Endemic species (1,587) by island or island group with geographic information on the island (location, area, government etc). For 157 islands with single-island endemic species, more detailed information is being collated on endemic species of other life-forms, status of important ecosystems and conservation infrastructure. Completed subsets published as Johnson, T. H. (1988) ***Biodiversity and conservation in the Caribbean.*** Cambridge, U.K.: ICBP Monogr. no. 1. and Johnson, T. H. (in prep.) ***Biodiversity and conservation in the Atlantic.***

Important bird areas in Europe:

Information on c. 150 species from 2,400 sites including breeding and non-breeding status, location of site, area, international designation of site.

CITES bird species:

Country distributions, breeding status, CITES information, threats, for all species listed on CITES Appendices as of 1 November 1986, and including all species recognised as globally threatened prior to that date. Full database contents published as Stuart, S. and Johnson, T. H. (1986) ***NCC world checklist of threatened birds.*** Peterborough, U.K.: Nature Conservancy Council. Updated in 1990 to incorporate changes to the CITES Appendices and ICBP's revision of threatened birds.

Hard-copy files

An extensive collection of books, journals, reports (both published and unpublished) is maintained. Correspondence with experts and specialists in bird conservation is maintained in a cross-referenced system. Files are organised in two major sections: by country and by threatened species. The country files contain material on general conservation issues relating to each geographic entry. Species files contain information relating to 1000+ threatened species. A series of files on conservation issues of global significance is also maintained.

Data are collected for (1) specific in-house research programmes:

* Regional Red Data Books - Africa completed, Americas in progress
* World checklist of threatened birds (see above)
* Island database (see above)
* Important bird areas in Europe
* Dispersed species in Europe
* Biodiversity Project - mapping avian centres of endemism

and (2) by field-based project investigators for ICBP's Conservation Programme. There are currently 124 projects being run in c. 70 countries. Further details of projects are given in the current ICBP Annual Report.

Access

Visitors with an appointment are generally permitted access to hard-copy files. There is currently no direct public access to computerised databases. The cost of providing small amounts of information is decided on an individual basis; if possible, it is supplied in exchange. More extensive requests are undertaken by contract.

For further information, contact:

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