INFORME TECNICO

Ser. Cient. INACH 36: 177-184, 1987

Analysis of Antarctic Conservation Areas with Emphasis on Marine Areas[1]

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ABSTRACT

Present conservation areas within the Antarctic Treaty System (ATS) are analyzed by numerical classification. Emphasis is placed on the problem of generating marine conservation areas. The classification is based on 12 objective variables for both the Specially Protected Areas (SPAs) and the Sites of Special Scientific Interest (SSSIs). Jaccard's qualitative index of similarity and the unweighted arithmetic average clustering are applied. Results reveal important inconsistencies in the system of generating conservation areas in the Antarctic, particularly as regards areas with marine components. Corrections are suggested.

Análisis de las áreas de conservación antárticas con énfasis en las áreas marinas[1]

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RESUMEN

Se analizan, mediante clasificación numérica, las actuales áreas de conservación existentes en el Sistema del Tratado Antártico con especial énfasis en el problema de la generación de áreas de conservación marinas. La clasificación se basa en 12 variables objetivas correspondientes a las Areas Especialmente Protegidas (AEPs) y a los Sitios de Especial Interés Científico (SEICs). Se utiliza el índice cualitativo de similitud de Jaccard y el método de la media aritmética no ponderada en el clustering.

Los resultados revelan importantes inconsecuencias en el sistema de generacion de áreas de conservación en la Antártica, particularmente en relación con las áreas con componentes marinos. Se sugieren correcciones.

INTRODUCTION

The Antarctic Treaty System (ATS) is becoming increasingly rich in conservation measures. A review of the these is presented by Heap and Holdgate (1986). Critical in generating conservation areas have been the so-called "Agreed Measures for the Conservation of Antarctic Fauna and Flora" of 1964. These have allowed the designation of Specially Protected Areas (SPas) associated with full protection of fauna and flora in them. Considering, among other reasons, that scientific research could be hampered in some areas, and therefore required some measure of protection, the Sites of Special Scientific Interest (SSSIs) were created by the ATs in 1972. Later, in 1974, the Scientific Committee on Antarctic Research (SCAR) invited the National Committees of the Consultative Parties to propose Marine SPAs and SSSIs.

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To date the ATS recognizes 17 SPAs and 21 SSSIs (Tables 1 and 2). Also, three other SSSIs, one partly terrestrial and partly marine (South Bay, Doumer Island) and two fully in the marine environment (Chile Bay, Greenwich Island and Port Foster, Deception Island) have been approved by SCAR but not by the Treaty (Table 3).

The South Bay site proposal was considered at the XII ATCM, and although not designated, the Meeting "agreed that offices responsible for Antarctic programs operating in the vicinity of South Bay, Doumer Island, should be asked to draw attention of their ship masters to the scientific work proceeding in South Bay", and published both, its management plan and chart (ICSU/SCAR 1984).

Furthermore, both at the XII and the XIII ATCM the view was held that consideration of all three sites "should be defferred until such time as SCAR has approved SSSIs partly or wholly in the marine environment" (Anon. 1985).

The underlying working hypothesis for this study is that the present mechanism of conservation area designation whithin the ATS contains inconsistencies. To test this hypothesis an objective numerical classification analysis of the two types of conservation areas - SPAs and SSSIs - is applied.

MATERIAL AND METHODS

Descriptions of areas used are those published by Bonner and Lewis Smith (1985). For newly designated areas descriptions as reported by SCAR (1986) and the XIII ATCM of Brussels (Anon. 1985), are obseved.

The numerical classificatory analysis was done on the binary values of 12 variables separately applied to each series of conservation areas (Table 4).

Tables 5 and 6 contain the binary values of previously listed variables for each of the conservation areas or sites.

Data matrices were treated with Jaccard's Index of similarity (Clifford and Stephenson 1975) and the arithmetic average clustering in its unweighted form (UPGMA) (Sneath and Sokal 1973).

RESULTS

The cluster diagram for SPAs (Figure 1) shows that at the lowest level of similarity they separate into two major groups. One is formed by SPA 18 alone and the other by the rest. SPA 18 (North Coronation Island) was created at the last (XIII) ATCM (Brussels 1985). It is unique in that it contains littoral and sublittoral zones, and a sea area. In fact, it amounts almost to a Marine SPA.

At the next step two main subgroups are formed, one with SPAs 19 (Lagotellerie Island, Marguerite Bay), 5 (Beaufort Island), and 2 (Rookery Island), all islands where birds are important. They presumably include littoral zones. The other subgroup is further subdivided into a small one with SPAs 20 (New College Valley) and 7 (Cape Hallett), both without a littoral zone, and a larger one consisting of SPAs with littoral zones but which show differences in other features.

The cluster diagram for SSSIs (Figure 2) shows also two major groups at the lowest level of similarity. The group formed by SSSIs 1 (Cape Royds, as amended at the XIII ATCM), C (South Bay), A (Port Foster), and B (Chile Bay), includes sites with a strong marine character. Among these are the only two fully marine SSSIs of the system (A - Port Foster and B - Chile (Discovery) Bay, which have been approved by SCAR but not designated by the Antarctic Treaty (AT). SSSI C (South Bay) partly marine and partly terrestrial, also approved by SCAR, has not been designated by the AT, although it is similar to the recently amended SSS 1 (Cape Royds).

Table 1

LIST OF SPECIALLY PROTECTED AREAS

SPA	1	Taylor Rookery, Mac.Robertson Land.
SPA	2	Rookery Islands, Holme Bay (Mawson Coast).
SPA	3	Ardery Island and Odbert Island, Budd Coast.
SPA	4	Sabrina Islet, Balleny Islands.
SPA	5	Beaufort Island, Ross Sea.
SPA	6	Cape Crozier (now SSSI 4).
SPA	7	Cape Hallett, Victoria Land.
SPA	8	Dion Islands, Marguerite Bay.
SPA	9	Green Island, Berthelot Islands
SPA	10	Byers Peninsula (now SSSI 6).
SPA	11	Cape Shirreff, Livingston Island.
SPA	12	Fildes Peninsula (now SSSI 5).
SPA	13	Moe Island, South Orkney Islands.
SPA	14	Lynch Island, South Orkney Islands.
SPA	15	Southern Powell Island and adjacent islands, South Orkney Islands.
SPA	16	Coppermine Peninsula, Robert Island.
SPA	17	Litchfield Island, Arthur Harbour, Anvers Island.
SPA	18	North Coronation Island, South Orkney Islands.
SPA	19	Lagotellerie Island, Marguerite Bay.
SPA	20	"New College Valley", Caughley Beach, Cape Bird, Ross Island.

Table 2

LIST OF SITES OF SPECIAL SCIENTIFIC INTEREST

SSSI	Nº	1	Cape Royds, Ross Island.
SSSI	Nº	2	Arrival Heights, Hut Point Peninsula, Ross Island.
SSSI	Nº	3	Barwick Valley, Victoria Land.
SSSI	Nº	4	Cape Crozier, Ross Island.
SSSI	Nº	5	Fildes Peninsula, King George Island, South Shetland Islands.
SSSI	Nº	6	Byers Peninsula, Livingston Island, South Shetland Islands.
SSSI	Nº	7	Haswell Island, Queen Mary Land.
SSSI	Nº	8	Western Shore of Admiralty Bay, King George Island, South Shetland Islands.
SSSI	Nº	9	Rothera Point, Adelaide Island.
SSSI	Nº	10	Caughley Beach, Cape Bird, Ross Island.
SSSI	Nº	11	Tramway Ridge, Mount Erebus, Ross Island.
SSSI	Nº	12	Canada Glacier, Lake Fryxell, Taylor Valley, Victoria Land.
SSSI	Nº	13	Potter Peninsula, King George Island, South Shetland Islands.
SSSI	Nº	14	Harmony Point, Nelson Island, South Shetland Islands.
SSSI	Nº	15	Cierva Point and nearby islands, Danco Coast, Antarctic Peninsula.
SSSI	Nº	16	Bailey Peninsula, Budd Coast, Wilkes Land.
SSSI	Nº	17	Clark Peninsula, Budd Coast, Wilkes Land.
SSSI	Nº	18	White Island, McMurdo Sound.
SSSI	Nº	19	Linnaeus Terrace, Asgaard Range, Victoria Land.
SSSI	Nº	20	Biscoe Point, Anvers Island, Palmer Archipelago.
SSSI	Nº	21	Shores of Port Foster, Deception Island, South Shetland Islands.

Table 3

LIST OF SSSIs APPROVED BY SCAR BUT NOT RECOGNIZED BY THE TREATY

- Port Foster, Deception Island, South Shetland Islands (proposed as Marine SSSI - fully in the marine environment).
- Chile Bay, Greewich Island, South Shetland Islands (proposed as Marine SSSI - fully in the marine environment).
- South Bay, Doumer Island, South Shetland Islands (proposed as simple SSSI - partly terrestrial and partly marine).

Note: All are intended only to provide protection to the benthic environment and do not affect the status of overlying waters.

Table 4

CODE OF VARIABLES

1	Littoral zone.
2	Sea area.
3	Sublittoral zone.
4	Birds.
5	Mammals.
6	Island (s).
7	Portion of a greater land area.
8	Mosses.
9	Lichens.
10	Terrestrial invertebrates.
11	Terrestrial and fresh-water algae.
12	Permanent fresh-water bodies.

Table 5

MATRIX FOR SPECIALLY PROTECTED AREAS. NUMBERS OF THE AREAS ARE THOSE OFFICIALLY USED BY THE ATS AND LISTED IN TABLE 1.
(1 = Presence, applicable or important, according to descriptions; 0 = absence, not applicable, or not important, according to descriptions)

		VARIABLES											
		1	2	3	4	5	6	7	8	9	10	11	12
	1	1	0	0	1	0	0	1	1	1	0	1	0
	2	1	0	0	1	0	1	0	0	0	0	1	0
	3	1	0	0	1	0	1	0	1	1	0	1	0
	4	1	0	0	1	1	1	0	0	1	1	1	0
S	5	1	0	0	1	0	1	0	0	0	0	0	0
	7	0	0	0	1	0	0	1	1	1	1	1	0
	8	1	0	0	1	1	1	0	1	1	1	1	0
P	9	1	0	0	1	0	1	0	1	1	0	1	0
	11	1	0	0	1	1	0	1	1	1	1	1	0
	13	1	0	0	1	1	1	0	1	1	1	1	0
A	14	1	0	0	1	1	1	0	1	1	1	1	0
	15	1	0	0	1	1	1	1	1	1	1	1	0
	16	1	0	0	1	1	0	1	1	1	1	1	0
	17	1	0	0	1	1	1	0	1	0	1	1	1
	18	1	1	1	1	0	0	1	0	1	0	0	0
	19	1	0	0	1	0	1	0	1	0	1	0	0
	20	0	0	0	0	0	0	1	1	1	0	1	0

Table 6

MATRIX FOR SITES OF SPECIAL SCIENTIFIC INTEREST. NUMBERS OF SITES AS OFFICIALLY USED BY THE ATS.
A – B area used for convenience to identify
A – Port Foster, B - Chile (Discovery) Bay, and
C – South Bay sites. Binary code as in Table 4.

		VARIABLES											
		1	2	3	4	5	6	7	8	9	10	11	12
	1	1	1	1	1	0	0	1	0	0	0	0	0
	2	0	0	0	0	0	0	1	0	0	0	0	0
	3	0	0	0	0	0	0	1	0	1	0	1	1
	4	1	0	0	1	0	0	1	1	1	1	1	0
	5	1	0	0	1	1	0	1	1	1	0	0	1
	6	1	0	0	1	1	0	1	1	1	1	1	1
	7	1	0	0	1	1	1	0	0	0	0	1	1
S	8	1	0	0	1	1	0	1	1	1	1	1	1
	9	1	0	0	0	0	0	1	1	1	1	1	0
S	10	0	0	0	1	0	0	1	1	1	1	1	1
	11	0	0	0	0	0	0	1	1	1	0	1	0
S	12	0	0	0	0	0	0	1	1	1	0	1	1
	13	1	0	0	1	1	0	1	0	0	0	0	0
S	14	1	0	0	1	1	0	1	1	1	0	0	0
	15	1	0	0	1	1	1	1	1	1	1	1	1
I	16	1	0	0	0	0	0	1	1	1	1	0	1
	17	1	0	0	1	0	0	1	1	1	0	0	1
	18	0	0	0	0	1	0	1	0	0	0	0	0
	19	0	0	0	0	0	0	1	0	1	0	1	0
	20	1	1	1	1	1	1	1	1	1	1	0	0
	21	1	0	0	0	0	0	1	1	1	0	1	1
	A	0	1	1	0	0	0	0	0	0	0	0	0
	B	0	1	1	0	0	0	0	0	0	0	0	0
	C	1	1	1	0	0	0	1	0	0	0	0	0

The other large group contains subgroups as follows: (a) SSSIs 18 (N.W. White Island) and 2 (Arrival Heights), both without littoral zones; b) SSSIs 13 (Potter Peninsula) and 7 (Haswell Island), which have in common littoral zones, birds and mammals; (c) SSSIs 19 (Linnaeus Terrace), 3 (Barwick Valley), 21 (Shores of Port Foster), 12 (Canada Glacier), and 11 (Tramway Ridge), all share lichens and, excepting SSSI 21, have no littoral zones.

In the following main subgroup SSSI 20 (Biscoe Point), a site with littoral zone, mosses, lichens, and terrestrial invertebrates, stands out neatly from SSSIs 17 (Clark Peninsula), 14 (Harmony Point), and 5 (Fildes Peninsula) because it also includes a sea area and a sublittoral zone.

SSSI 20 clearly belongs to the first major group discussed. Its classification in the subgroup is probably due to the availability of comparatively more information for the pertinent terrestrial variables. For the purposes of the analysis however, this site should be considered a member of the first major group. Finally, the subgroup made up of SSSIs 16 (Bailey Peninsula), 10 (Caughley Beach), 15 (Cierva Point), 8 (W. shores of Almiralty Bay), 6 (Byers Peninsula), 9 (Rothera Point), and 4 (Cape Crozier) all have littoral zone, and except for SSSIs 8 and 4, also permanent freshwater bodies.

DISCUSSION AND CONCLUSIONS

The analysis shows that the ATS has recognized 15 SPAs and 14 SSSIs which contain littoral zones. The recently recognized SPA 18 (North Coronation Island), with terrestrial, littoral and sublittoral zones and sea area, is an extreme case. It could be almost considered a Marine SPA inadverten-

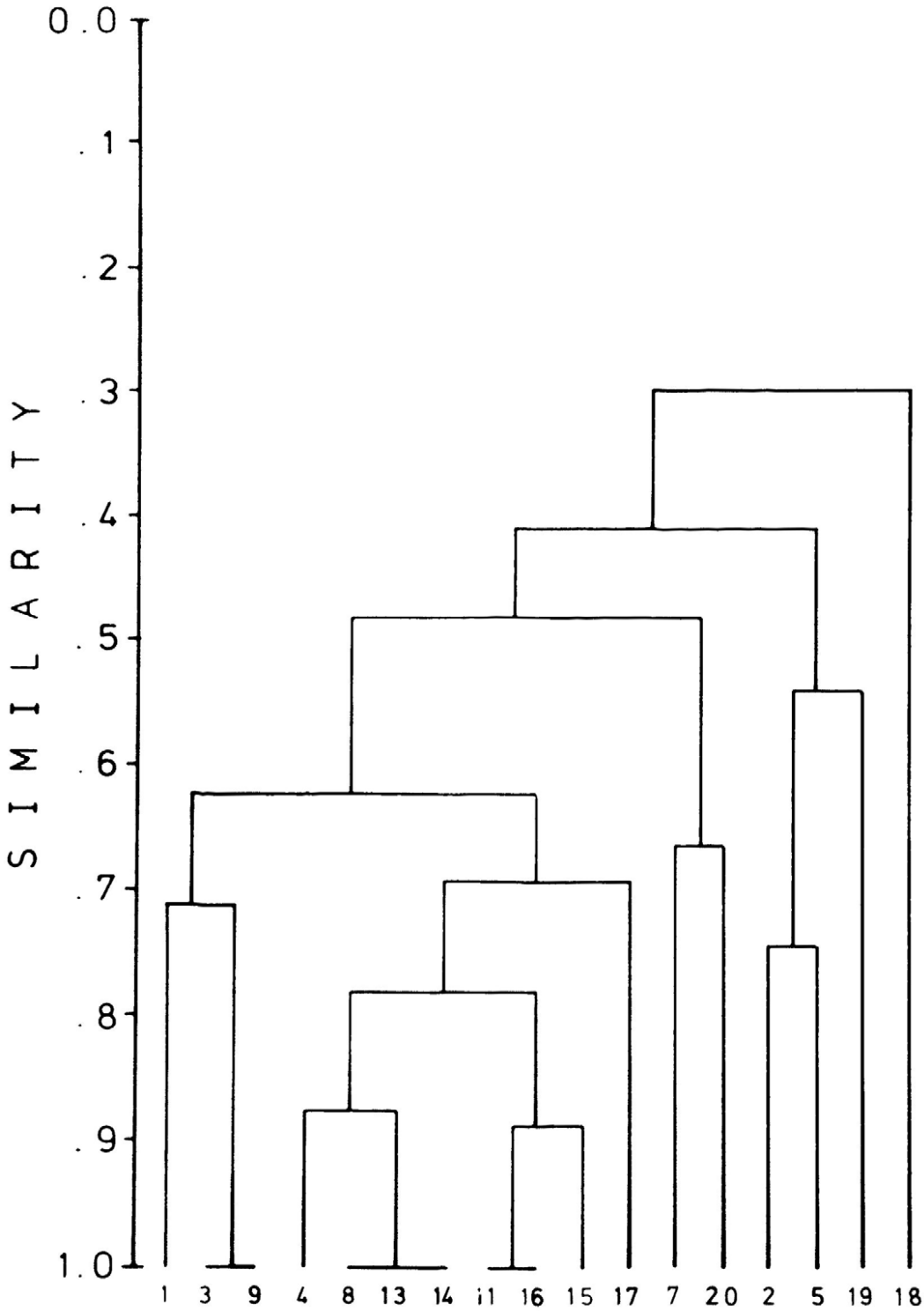

Fig. 1. **Cluster diagram for Specially Protected Areas designated by the Antarctic Treaty as of 1986.** (Numbers as officially used by the ATS)

tly recognized by the AT given its present policy on the matter, as stated in the last (XIII) ATCM (Anon. 1985, see above).

A similar phenomenon occurs with the recently amended SSSI 1 (Cape Royds) and the recently designated SSSI 20 (Biscoe Point), which now include a sea area and a sublittoral zone.

Considering the previous fate of the proposed SSSI of South Bay, which is analogous to SSSIs 1 and 20 (in that it partly terrestrial and partly marine), a major inconsistency seems to develop with these measures.

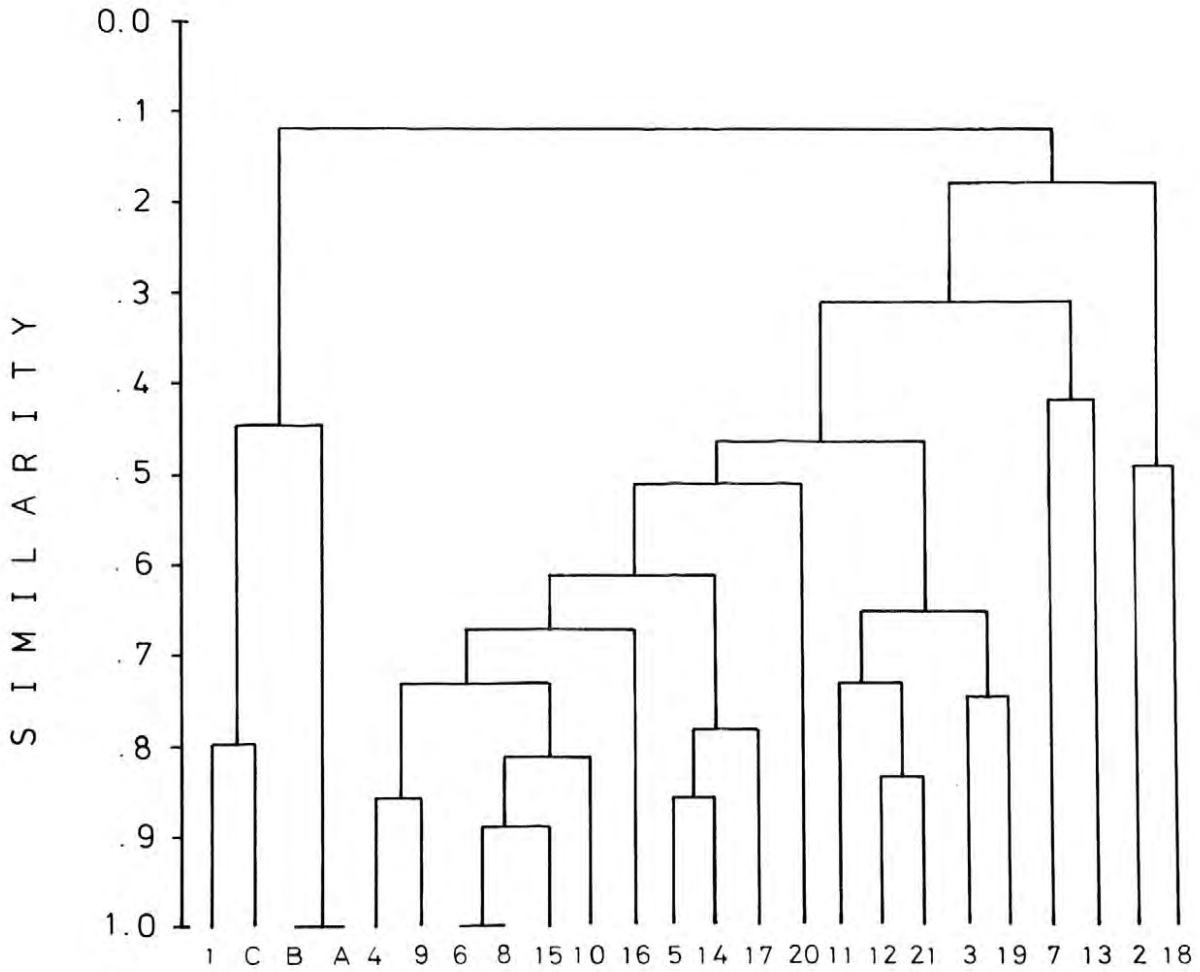

Fig. 2. Cluster diagram for Sites of Special Scientific Interest, designated under the Antarctic Treaty System as of 1986. Numbers as officially used by the ATS. Letters A-C as in Table 2. (These sites have only been approved by SCAR).

The sites at Port Foster and Chile (Discovery) Bay are so far the only fully marine SSSIs proposed within the ATS. These have been approved by SCAR but repeatedly rejected by the ATCMs. Given the ATS' policy on the matter of marine conservation areas (see above), another important inconsistency develops in this connection. These areas had been approved by SCAR, prior to the XII and XIII ATCM, where this condition was established. Moreover, the ATS itself at its last (XIII) ATCM recognised conservation areas which include portions of sea and sublittoral zones, i.e. SPA 18 and SSSIs 1 and 20.

It should be also noted there are both SPAs and SSSIs for which it is dubious, from their published descriptions and maps, whether or not they include elements of the marine ecosystem. This is the case with SPAs 2 and 15, and SSSIs 4, 14, 15 and 20. SPAs fully in the marine environment have not been proposed so far.

The above results show that in its present state the mechanism of generating SPAS and SSSIs within the ATS is inconsistent. This situation could be corrected in future ATCMs by recognizing the South Bay proposal as a regular SSSI, and the Port Foster and Chile Bay proposals, as Marine SSSIs. The maintenance of the noted inconsistencies could not only endanger the present mechanism of Antarctic conservation area designation but contribute to affect the credibility of the ATS as management system.

ACKNOWLEDGEMENTS

The author acknowledges the support given by the Instituto Antártico Chileno, the Alfred-Wegener-Institut fur Polar-und Meeresforschung of Bremerhaven, F.R.G. and the Universidad de Concepción. Gratitude is expressed to W.N. Bonner, Deputy Director of the British Antarctic Survey, for revising the manuscript, encouragement and guidance and to Prof. Franklin D. Carrasco of the Departamento de Oceanología of the Universidad de Concepción, for the computer program used in the analysis.

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Recibido: 24.02.87. Aprobado: 24.07.87