Agreement on the Conservation of Albatrosses and Petrels

Joint Fourth Meeting of Breeding Sites Working Group (BSWG4) and Sixth Meeting of Status and Trends WG (STWG6)

Guayaquil, Ecuador, 25-26 August 2011

Important Bird Areas in Antarctica

Harris, C.M., Carr, R., Lorenz, K. & Jones, S.

(Submitted by BirdLife International)

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The full version of this report, including site accounts and maps of the IBAs identified, is available from:
http://www.era.gs/resources/iba/index.shtml

Important Bird Areas in Antarctica

Antarctic Peninsula
South Shetland Islands
South Orkney Islands

FINAL REPORT

Foreign & Commonwealth Office

BirdLife INTERNATIONAL

era

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Preface

This project has its origins in an initiative taken more than ten years ago by BirdLife International and the Bird Biology Sub-committee of the Scientific Committee on Antarctic Research (SCAR) to identify sites within the Antarctic region that meet the criteria defined by BirdLife for internationally Important Bird Areas (IBAs). This initiative consulted widely within the Antarctic scientific community and held several workshops, resulting in an initial list of sites meeting the criteria. A number of gaps remained in the analysis, for example because data were not available at the time for several species, and after a hiatus the project was re-initiated by BirdLife with a view to completing the list for the Antarctic.

As an important step towards that goal, this project has assembled the best available data to derive a list of Important Bird Areas for the Antarctic Peninsula, South Shetland Islands and South Orkney Islands region. In order to ensure that the list of IBAs for this region was as robust and complete as possible, the project has updated data by researching the latest published literature and through consultations with scientific experts. Species for which data were available with regional coverage were Emperor (*Aptenodytes* forsteri), Adélie (*Pygoscelis adeliae*), Chinstrap (*Pygoscelis antarctica*), Gentoo (*Pygoscelis papua*), and Macaroni (*Eudyptes chrysolophus*) penguins, and Southern Giant Petrel (*Macronectes giganteus*), Snow Petrel (*Pagodroma nivea*) and Imperial (Antarctic) Shag (*Phalacrocorax* [atriceps] *bransfieldensis*). Data on other species were more patchy, although where available were included for the species Cape Petrel (*Daption capense*), Wilson's Storm-petrel (*Oceanites oceanicus*), Black-bellied Storm-petrel (*Fregetta tropica*), Antarctic Prion (*Pachyptila desolata*), Greater Sheathbill (*Chionis alba*), Brown Skua (*Catharacta* [antarctica] *lonnbergi*), South Polar Skua (*Catharacta maccormicki*), Southern Fulmar (*Fulmarus glacialoides*), Light-mantled Sooty Albatross (*Phoebetria palpebrata*), Kelp Gull (*Larus dominicanus*) and Antarctic Tern (*Sterna vittata*). Antarctic Petrel (*Thalassoica Antarctica*) are not known to breed within the region covered by this report.

It was considered necessary to develop a clear and repeatable methodology for IBA identification in order to ensure that sites were not omitted or included without an explicit justification. Considerable effort was therefore invested in establishing the site identification methodology, and the rationale for the approach taken. Our goal has been to develop a method that defines the criteria used explicitly, allowing the exercise to be repeated in the future when new data become available. This is particularly important in an environment that is changing rapidly in response to regional and global warming, with its implications and biological consequences. Alternative methods are possible: for example, larger units of spatial aggregation could be defined and these could be applied to the data if these were considered preferable.

In the course of this project, two separate reports were prepared to address methodological aspects relating to site selection. These reports are included in this Final Report under their respective titles of 'IBA Identification Analysis' and 'Defining Model Bird Foraging Areas'. The Final Report then proceeds to define the adopted 'IBA Selection Criteria' that were then used to analyse the data. The results of the analysis are then presented in tabular form, which identifies 101 Important Bird Areas throughout the region. Brief accounts have been prepared to describe the identified sites, detailing the information currently available on species and numbers breeding, as well as the broad characteristics of the habitat at these locations. Inevitably, some accounts are more detailed than others as a result of data availability, which is strongly influenced by their accessibility and the extent to which scientific research has been conducted at the sites.

In the course of this project a derived list of IBAs was distributed to a wide range of individuals in the Antarctic ornithological research community who were offered the opportunity to comment. Updates were made to the data as a result of comments received, and further refinements were made to the analysis. The circulation of the results was facilitated in particular by Dr Richard Phillips (British Antarctic Survey), the Convenor for the Working Group on Breeding Sites for the Agreement on Conservation of Antarctic Petrels. The list of individuals to whom the draft list was distributed is included in Appendix A at the end of this report.

Acknowledgements

ERA gratefully acknowledges the input, data and advice received from numerous individuals and organisations in the course of preparing this report. In particular, ERA wishes to acknowledge funding provided by BirdLife International and the Polar Regions Unit of the Foreign & Commonwealth Office (UK) to complete the work. At BirdLife, John Croxall, Lincoln Fishpool and Ben Lascelles have played a key role in the project, while at the Polar Regions Unit Jane Rumble and Rob Bowman have been most supportive.

ERA wishes to acknowledge the excellent work put in by the SCAR Bird Biology Sub-committee that laid the foundation for the original results on which this project has further built, in particular John Cooper, Jan van Franeker, Yves le Maho and Eric Woehler, and the participants in the workshops organised by SCAR on the topic. SCAR is also thanked for kind permission to use the Antarctic Digital Database as the map base for the site maps included within this report.

The Secretariat of the Agreement on Conservation of Petrels was most helpful in reviewing results compiled for petrels, in particular Warren Papworth and Wiesława Misiak.

Richard Phillips and Norman Ratcliffe from the British Antarctic Survey provided valuable feedback on the methodological aspects and critical comments on the data and results. Other commentators and contributors included: Nestor Coria, Ruben Fijn, Bill Fraser, Mike Goebel, Heather Lynch, Ron Naveen and Donna Patterson-Fraser.

Special thanks to Sally Poncet for allowing continued access to data she and Jérôme Poncet collected on Imperial (Antarctic) Shags (*Phalacrocorax* [atriceps] *bransfieldensis*) and Southern Fulmars (*Fulmarus glacialoides*), which were also used in the FCO Wildlife Awareness Manual for the region.

Finally, it should be remembered that numerous researchers from many countries have spent countless hours over many years tirelessly documenting and cataloguing the wildlife records on which this assessment is based: without their efforts this analysis and report would be impossible, and we all owe a great debt of gratitude for their dedication and to the programs that supported their work.

Colin Harris
Cambridge
June 2011

Identification of Important Bird Areas in the Antarctic

Analysis to inform IBA project for BirdLife International and the United Kingdom Foreign & Commonwealth Office

Antarctic Shag, South Orkney Islands (C.Harris)

Environmental Research & Assessment

Foreign & Commonwealth Office

BirdLife INTERNATIONAL

environmental research & assessment era

Preface

ERA has assessed the initial list of Important Bird Areas compiled by BirdLife International and the Scientific Committee on Antarctic Research. It was noted that some bird colonies that appear to satisfy IBA selection criteria were not included in the existing list of IBA sites. Moreover, it also appeared that some sites on the list no longer meet the IBA selection criteria.

ERA has noted that there are no definitive rules to determine the spatial extent of each IBA. As such, the existing list contains sites of variable size, some of which are single colonies while others are areas that group a number of colonies together into one IBA. The exact criteria by which colonies are grouped are not explicit, raising a specific methodological difficulty known as the Modifiable Areal Unit Problem (MAUP).

MAUP is a recognised difficulty in spatial analysis, and arises when "the areal units … used in … geographical studies are arbitrary, modifiable, and subject to the whims and fancies of whoever is doing, or did, the aggregating." (Openshaw, 1984). That is, results can be skewed by the particular choice of spatial unit used.

The Modifiable Areal Unit Problem (MAUP) in the context of Antarctic IBAs is pertinent because the choice of IBA boundaries is being made on the basis of aggregations that are not based on an explicit methodology that takes into account the spatial component. This affects the number, size and distribution of IBAs selected, and also which sites become included within the spatial partitions (thus, the 'areal units' are 'modifiable'). Moreover, this method of selection / aggregation is not objective and repeatable such that the results can be verified independently.

The method used to select the IBAs is of fundamental concern because it forms the basis for identification of which areas are considered important, and if the method is not robust then there is a danger that sites identified, and their size, can be criticised as being arbitrary. For example, it is entirely possible to define the entire Antarctic Peninsula as an IBA, or King George Island, or a particular colony on King George Island, depending on which level of spatial aggregation is selected. From the point of view of long-term management, and considering in time some of these sites might be chosen as protected areas, there is a need to ensure the final list of IBAs is defensible and stands up to scrutiny.

With this in mind, we have attempted to undertake an objective analysis of the most recent bird colony data on the Peninsula in order to supplement the existing list of IBAs and ensure the final IBA network is as comprehensive and robust as possible.

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Important Bird Areas in the Antarctic

Introduction

Experts from SCAR and BirdLife International identified a list of suggested Antarctic Important Bird Areas (IBAs) in 2002 based on knowledge of bird concentrations across the Antarctic and following a well-established set of IBA designation criteria (Table 1). Whilst many important bird breeding sites are included in this list, new species data has since become available and a preliminary analysis showed this has affected the distribution of sites qualifying for IBA status in the Peninsula region. In addition, the IUCN Red List category for Southern Giant Petrels (*Macronectes giganteus*) has recently been downgraded from Vulnerable to Least Concern, removing this species from the list of birds to which IBA criteria A1 (threatened and near-threatened bird species) applies. As a result, a number of sites based on the A1 criterion in the SCAR / BirdLife list no longer qualify for IBA status.

IBA site boundaries are usually determined based on environmental, administrative, and practical factors (Fishpool & Evans, 2001). As such, there are no definitive rules to determine the spatial extent of each IBA site, and therefore no clear guidelines on how to aggregate breeding sites to determine whether an area meets the IBA selection criteria. The spatial unit used to define an IBA site can theoretically be chosen at any size and clearly the larger the area included, the more likely the population thresholds for IBA site designation will be reached.

High-quality species data are available for seven of the approximately 20 bird species breeding in the Antarctic Peninsula region. Location centroids and population numbers are available for these seven species in a GIS database. For the remaining 13 species, locations and censuses are approximate, aggregated and / or unavailable in GIS format.

In Part I of this report, we propose a method for selecting IBAs based on the high-quality species data available for the Antarctic Peninsula region. Spatial units of varying size, ranging from point-level (individual colony centroids) to 1 km, 2 km, 5 km and 10 km grid cells, are overlaid on colony centroids for each of the seven species for which GIS data are available to ERA. Data within each spatial unit are analysed to determine whether one or more of the IBA criteria are satisfied. IBAs derived from the grid-based approach are compared against the original IBA list to assess the effect of using the different IBA-selection methods. All IBAs derived from census data representing individual breeding sites are included in a list of suggested 'Confirmed IBAs'[1]. All other grid-derived IBAs are included in a list of suggested 'Potential IBAs'.

Part II of this report identifies additional IBA sites based on a review of published sources covering 20 bird species breeding in the Antarctic Peninsula region. Individual breeding sites at which species numbers are known or thought to exceed A1, A4i or A4ii population thresholds are suggested as Confirmed IBAs. Sites at which census data are available but it is unclear whether or not population thresholds for IBA criteria A1, A4i or A4ii are exceeded at individual breeding sites are suggested as 'Potential IBAs'.

In addition, sites satisfying solely criteria A4iii for seabirds are suggested as Potential IBAs.

Part III synthesises the results of Part I and II in an attempt to derive a draft comprehensive list of Confirmed and Potential IBA sites. The Confirmed IBA list includes sites identified by BirdLife / SCAR, supplemented by results from the present report, and this could be used as the core basis of the Antarctic Peninsula IBA network. It is suggested that sites in the Potential IBA list will be put forward for consultation with experts to establish which of these are justified for inclusion on the Confirmed IBA list.

[1] The term 'Confirmed IBA' is used to indicate a site found to satisfy the IBA criteria in this report. Use of this term does not necessarily indicate the site will be accepted for inclusion in the final Antarctic IBA network, which remains a decision for BirdLife and others as appropriate.

Definitions of IBA selection criteria

The global (Level A) IBA criteria are used to identify IBAs in this report. There criteria were standardised for global application following extensive consultation amongst experts in the BirdLife International Partnership and related fields (Fishpool & Evans, 2001). It is intended that supplementary criteria based on regional sites of ornithological importance may be nested within the global IBA criteria.

The following definitions of the IBA selection criteria are extracted from Fishpool & Evans (2001):

A1: Globally threatened species.
"The site regularly holds significant numbers of a globally threatened species or other species of global concern." This includes species classified on the IUCN red list as 'Critical', 'Endangered' and 'Vulnerable'

A2: Restricted range species.
"The site is known or thought to hold a significant component of a group of species whose breeding distributions define an Endemic Bird Area (EBA) or a Secondary Area."

A3: Biome-restricted assemblages.
"The site is known or thought to hold a significant component of the group of species whose distributions are largely or wholly confined to one biome."

A4: Globally important congregations.

A4i: "The site is known or thought to hold, on a regular basis, 1% or more of a biogeographic population of a congregatory waterbird species."

A4ii: "The site is known or thought to hold, on a regular basis, 1% or more of the global population of a congregatory seabird or terrestrial species."

A4iii: "The site is known or thought to hold, on a regular basis, at least 20,000 waterbirds, or at least 10,000 pairs of seabirds, of one or more species."

A4iv: "The site is known or thought to be a bottleneck site where at least 20,000 pelicans and / or storks and / or raptors and/ or cranes pass regularly during spring and / or autumn migration."

Table 1: Antarctic Peninsula breeding birds: population thresholds required for IBA site designation

Name	Latin Name	Red List Status	IBA Criteria	Pop Threshold (pairs)[2]
Emperor Penguin	*Aptenodytes forsteri*	LC	A4ii	1350
Adélie Penguin	*Pygoscelis adeliae*	LC	A4ii	20,000
Chinstrap Penguin	*Pygoscelis antarctica*	LC	A4ii	40,000
Gentoo Penguin	*Pygoscelis papua*	NT	A1	3000
Macaroni Penguin	*Eudyptes chrysolophus*	VU	A1	1500
Southern Giant Petrel	*Macronectes giganteus*	LC	A4ii	485
Antarctic Petrel	*Thalassoica antarctica*	LC	A4ii	150,000
Cape Petrel	*Daption capense*	LC	A4ii	6700
Snow Petrel	*Pagodroma nivea*	LC	A4ii	13,000
Wilson's Storm Petrel	*Oceanites oceanicus*	LC	A4ii	70,000
Black-bellied Storm Petrel	*Fregetta tropica*	LC	A4ii	1600
Antarctic Prion	*Pachyptila desolata*	LC	A4ii	166,000
Greater Sheathbill	*Chionis alba*	LC	A4ii	100
Brown Skua	*Catharacta* [antarctica] *lonnbergi*	LC	A4ii	75
South Polar Skua	*Catharacta maccormicki*	LC	A4ii	50
Southern Fulmar	*Fulmarus glacialoides*	LC	A4ii	10,000
Light-mantled Sooty Albatross	*Phoebetria palpebrata*	NT	A1	10
Imperial (Antarctic) Shag	*Phalacrocorax* [atriceps] *bransfieldensis*	LC	A4i	133
Kelp Gull	*Larus dominicanus*	LC	A4i	150
Antarctic Tern	*Sterna vittata*	LC	A4i	336
Seabirds (including all species of penguin, petrel, fulmar, sheathbill and skua)			A4iii	10,000
Waterbirds (including all species of cormorant, gull and tern)			A4iii	10,000

[2] Population thresholds for each species vary according to which IBA selection criteria is being applied. Table 1 shows the minimum population threshold needed to satisfy one of the IBA criteria for each species, excluding the thresholds required to satisfy criterion A4iii. If criterion A4iii were considered, the threshold for species of Chinstrap and Adélie penguin, Snow petrel, Wilson's storm petrel, Antarctic petrel and Antarctic prion would fall to 10,000 pairs.

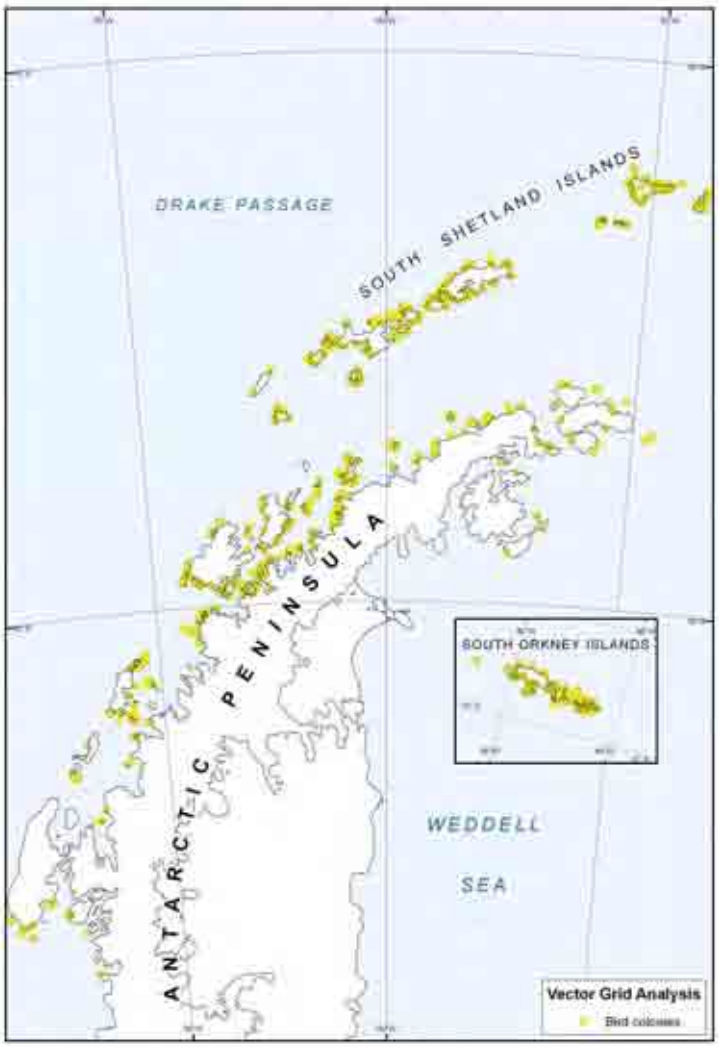
PART I: Grid-analysis to derive Antarctic IBAs

Objectives

The objectives of Part I are to:

- Assess the effect of using different spatial units to identify sites across the Antarctic Peninsula region satisfying the Important Bird Area site-designation criteria for the seven species where GIS data are available to ERA;
- To use the results to update the suggested IBA list compiled by SCAR and BirdLife International in 2002.

Map A shows bird breeding colonies across the Antarctic Peninsula region for which ERA has data and therefore over which the analysis in Part I was applied.



Map A: Distribution of bird breeding sites across the Antarctic Peninsula region for species included in Part I of this report.

Methods

Bird census data in a GIS-compatible format are available for Emperor (*Aptenodytes forsteri*), Adélie (*Pygoscelis adeliae*), Chinstrap (*Pygoscelis antarctica*), Gentoo (*Pygoscelis papua*) and Macaroni (*Eudyptes chrysolophus*) penguins, Antarctic Shag (*Phalacrocorax* [atriceps] *bransfieldensis*) and Southern Giant Petrel (*Macronectes giganteus*) in the Antarctic Peninsula region. These data are compiled as counts aggregated into 'colonies', the location of which are defined as point entities in ERA's spatial database. The species counts are based on censuses published prior to 2007.

A grid overlay method was developed to analyse concentrations of birds across the Antarctic Peninsula region. A pre-defined regular grid was overlaid onto colony centroids for each bird species, and the numbers of breeding pairs located within each grid cell was calculated using the point-in-polygon tool in ArcGIS. The results were used to identify grid cells within which the number of nesting birds exceeded the IBA criteria population threshold. The analysis was repeated using four different grid cell sizes to test the sensitivity of the results to cell-size variations (1 x 1 km, 2 x 2 km, 5 x 5 km and 10 x 10 km).

The specific method used to identify IBAs was as follows:

1. A vector grid with a regular cell size (1km x 1km) was created over the Antarctic Peninsula;
2. This grid was overlaid on point data showing the approximate location of bird colony centroids for:
   i. each bird species (Adélie, Chinstrap, Emperor, Gentoo and Macaroni penguins, Southern Giant Petrel, Antarctic Shag);
   ii. all seabirds (Adélie, Chinstrap, Emperor, Gentoo and Macaroni penguins, and Southern Giant Petrel).

   Note: Waterbirds were not analysed as a separate category because only one Antarctic species for which data are available is classified as a waterbird (i.e. Imperial (or Antarctic) Shag (*Phalacrocorax* [atriceps] *bransfieldensis*), and all IBA sites triggered solely by this species were identified in part (2i) above;
3. A point in polygon test was conducted to identify which points were situated within each grid cell;
4. The total number of breeding pairs for individual bird species and for all seabirds were calculated for each grid cell;
5. The results of part (4) were analysed against IBA bird population thresholds (see Table 1) to identify those grid cells containing populations exceeding the criteria;
6. The total number of IBAs derived from part (5) were recorded for each bird species and for all seabirds (see *Results*). In addition, tables were compiled showing the geographic location, bird population, previous IBA site number (if applicable) and grid cell size for each IBA. This information is separated into IBA sites already on the SCAR / BirdLife IBA list and newly identified sites (see Annexes A, B and D);
7. Steps 1-6 were repeated for different grid sizes (2k x 2km, 5km x 5km, 10km x 10km).

In addition, the point file showing approximate colony centroids and individual species counts was analysed to assess where bird populations at each point satisfy one or more of the IBA site designation criteria.

Results

Table 2 illustrates the effect of increasing grid cell size on the number of individual bird colonies that are contained within a grid cell. For each bird species, the table shows the number of breeding colonies (points) present within each grid cell. As the number of colonies per spatial unit increases, the population threshold for IBA site designation is more likely to be met.

Table 2: Maximum number of points meeting IBA site designation criteria per bird species per grid:

	Maximum number of bird colonies (points) in one grid cell				
	Point	1km Grid	2km Grid	5km Grid	10km Grid
Adélie Penguin	1	2	4	8	8
Chinstrap Penguin	1	4	8	10	23
Emperor Penguin	1	1	1	1	1
Gentoo Penguin	1	2	4	4	4
Macaroni Penguin	1	1	1	2	3
Antarctic Shag	1	2	3	3	4
Southern Giant Petrel	1	6	10	16	29
Seabirds	1	7	12	20	35

Table 3 displays the key results of the analysis, showing the number of sites satisfying the IBA site designation criteria for each grid cell size. More detailed information on the list of derived IBAs (inc. location, species present, and whether or not the site is already included in the SCAR / BirdLife IBA site list) are presented in Annexes A to C.

Table 3: Number of IBA sites identified per bird species per grid:

	Number of sites satisfying the IBA site designation criteria (Total number of grid cells containing colonies of each species)				
	Point	1km Grid	2km Grid	5km Grid	10km Grid
Adélie Penguin	12 (109)	12 (100)	11 (87)	12 (86)	11 (76)
Chinstrap Penguin	11 (402)	11 (357)	11 (301)	14 (223)	15 (151)
Emperor Penguin	1 (2)	1 (2)	1 (2)	1 (2)	1 (2)
Gentoo Penguin	9 (87)	8 (82)	8 (78)	8 (70)	9 (57)
Macaroni Penguin	2 (13)	2 (13)	2 (13)	3 (12)	3 (11)
Antarctic Shag	23 (198)	24 (190)	24 (182)	26 (168)	33 (136)
Southern Giant Petrel	3 (128)	4 (92)	4 (77)	4 (61)	7 (44)
Seabirds	61 (741)	68 (558)	76 (461)	73 (337)	67 (225)

For most species of penguin, with the exception of the Chinstrap, the number of IBA sites triggered is similar irrespective of the cell size used to aggregate data. For Chinstrap Penguins, more IBA sites are identified

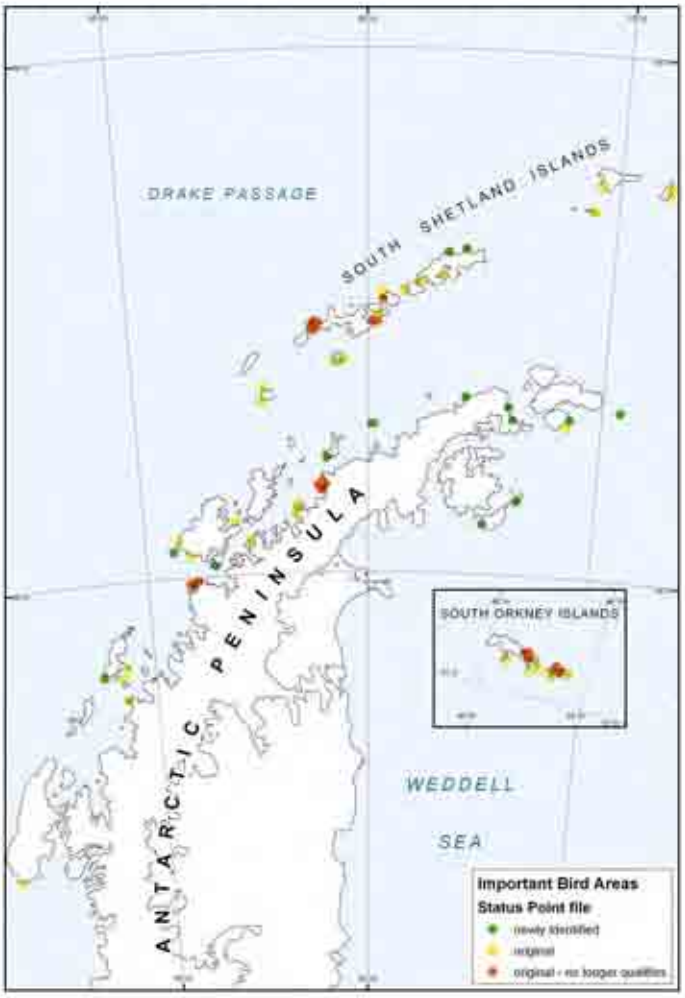
when data are aggregated into grid cells of 5 or 10 km. Similarly, the number of IBAs identified increases with grid cell size for the two other bird species (Antarctic Shag and Southern Giant Petrel). For seabirds, the number of IBAs identified increases slightly as grid cell size is increased.

Analysis of IBAs for Individual Bird Species

For individual points

A total of 43 IBAs were identified on analysis of the point data. In six of these IBAs, more than one bird species was present. The majority of the IBAs were triggered by populations of Antarctic Shags exceeding the A4i criteria population threshold (>133 pairs). In total, 23 IBAs triggered by Antarctic Shags were identified. Three sites were triggered by the presence of Southern Giant Petrels satisfying the A4ii criteria (> 485 pairs present). A further 12 IBAs were triggered by Adélie Penguins, 11 by Chinstrap Penguins, eight by Gentoo Penguins, two by Macaroni Penguins and one by Emperor Penguins, meeting either the A1 or A4ii criterion.

Map B shows how these sites compare to the SCAR / BirdLife IBA site list. In total, 28 of the original IBA sites were in the same location as sites derived using the point data, whilst eight sites no longer meet the IBA criteria. Significantly, 15 new IBA sites were identified.

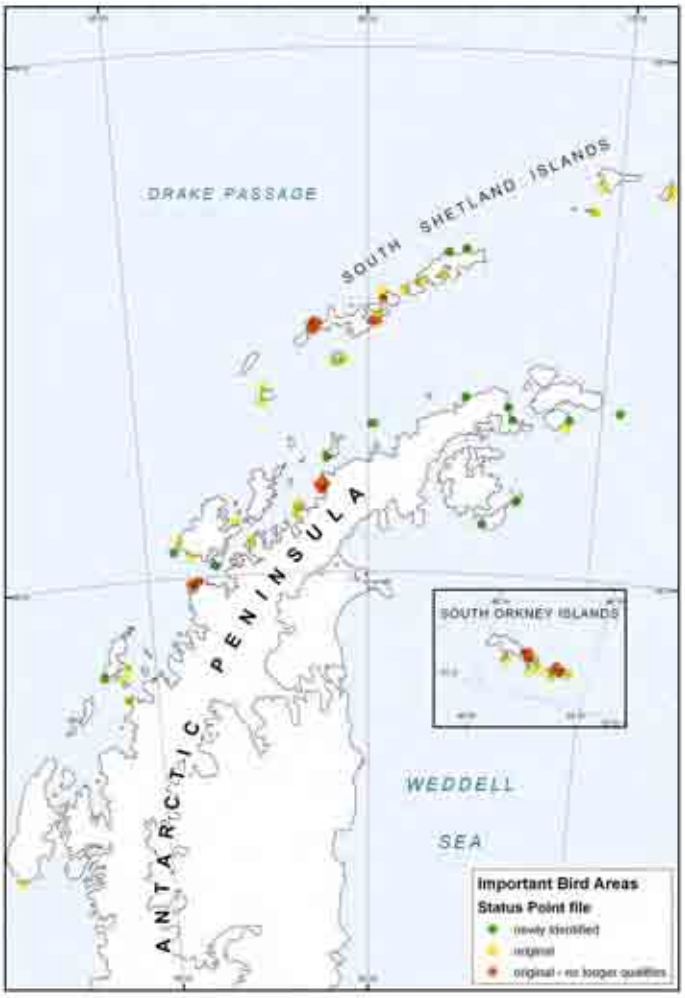


Map B: Point analysis

For a grid cell size of 1km^2

A total of 44 IBAs were identified using a grid cell size of 1 x 1 km. In six of these IBAs more than one bird species was present. The majority of the IBAs were triggered by populations of Antarctic Shags exceeding the A4i criteria population threshold (133 pairs). In total, 24 IBAs triggered by Antarctic Shags emerge using the 1km grid. Four locations were triggered by the presence of Southern Giant Petrels satisfying the A4ii criteria (485 pairs). Regarding penguin populations, 12 IBAs were triggered by Adélie Penguins, 11 by Chinstrap Penguins, eight by Gentoo Penguins two by Macaroni Penguins and one by Emperor Penguins, meeting either the A1 or A4ii criterion.

Map C shows how these sites compare to the original IBA site list. In total 28 of the original IBA sites matched the sites derived using 1 km^2 grid cells, eight sites no longer satisfied the IBA criteria, and 16 new sites were identified.

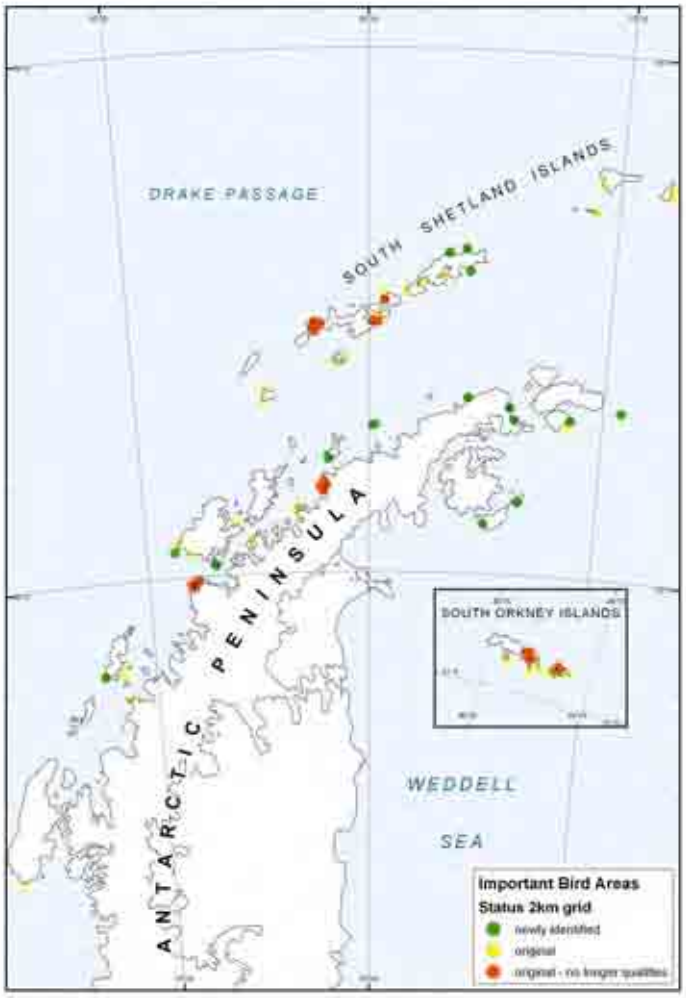


Map C: 1 km grid analysis

For a grid cell size of 2km^2

Increasing the grid cell size to 2 x 2 km resulted in no substantial differences. Again, a total of 44 IBAs were identified with seven locations containing more than one bird species. The only difference observed was in sites triggered by Adélie Penguins, which diminished by one, down to 11 sites. Using grid cells of 1km^2, two IBA sites were identified on the northern and southern part of Ferrier Peninsula, Laurie Island. These two sites were merged into one site, triggered by Adélie Penguins, using the grid with 2 km^2 cells.

Map D shows how the grid-derived IBA sites compare to the SCAR / BirdLife IBA site list. In total 28 of the original IBA sites were identified as IBAs using grid cells of 2 km^2, eight were not, and 16 new sites emerged.



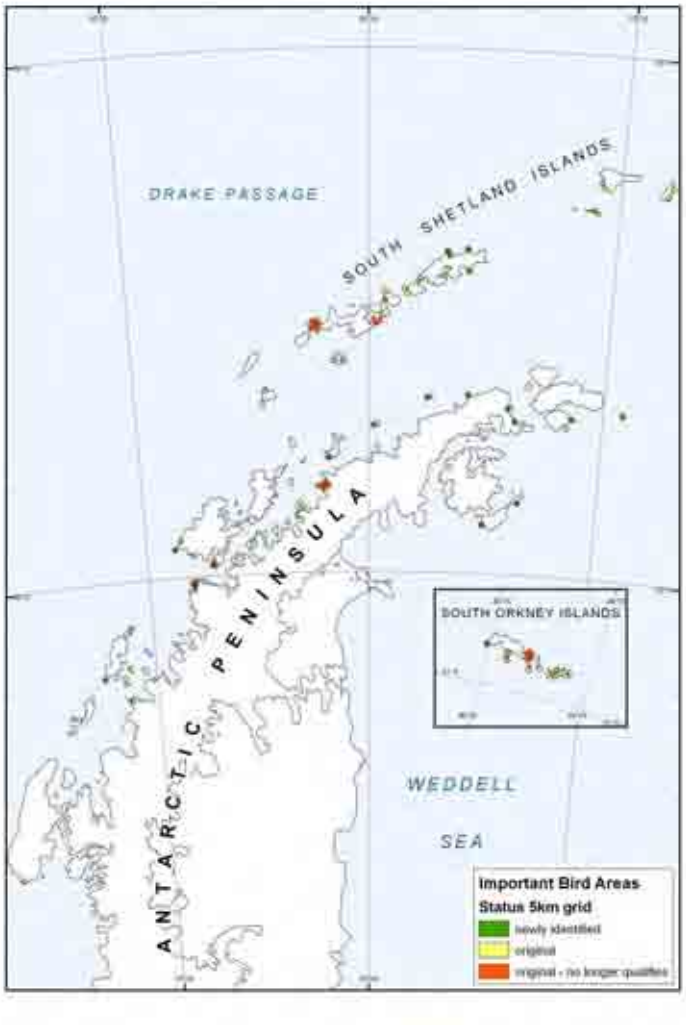
Map D: 2 km grid analysis

For a grid cell size of 5km^2

With a grid cell of 5 x 5 km the total number of IBAs identified increased to 48. In nine of these locations, more than one bird species was present. Populations of Antarctic Shag exceeding the A4i criteria were the trigger for 26 of the IBA sites. This represents an increase of two locations triggered by Antarctic Shags, compared to the 1km and 2km grids. For sites triggered by populations of Southern Giant Petrel, the number of locations remained at four. For the penguins, slight changes could be observed for sites triggered by populations of Chinstrap and Macaroni penguins.

The Adélie Penguins trigger IBA sites at 12 locations, as with the 1km^2 grid cells. The number of sites triggered by Chinstrap penguins increased to 14 when the 5 km x 5 km grid overlay was used, representing an increase of three sites compared to the 1km and 2km grid cells. For the Emperor and Gentoo penguins the total numbers of sites were the same as when the 1km^2 and 2km^2 grid cells were used. The number of sites triggered by populations of Macaroni Penguins increased by one compared to the 1km and 2km grid.

Map E shows how these sites compare to the original IBA site list. In total 29 of the SCAR / BirdLife IBA sites were derived using 5 km^2 grid cells, seven sites did not qualify for IBA status, and 19 new sites were identified.

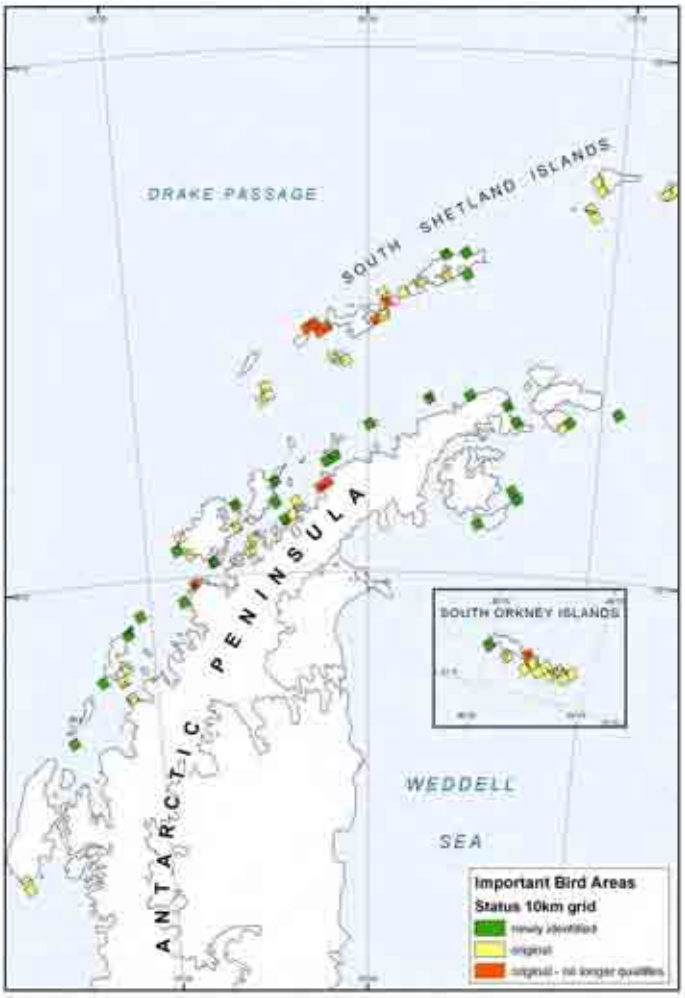


Map E: 5 km grid analysis

For a grid cell size of 10km^2

A total of 54 IBAs were identified using a grid cell size of 10 x 10 km. In 15 of these IBAs, more than one bird species was present. The sites triggered by Antarctic Shags increased from 26 to 33 sites. The sites triggered by Southern Giant Petrels almost doubled from four to seven locations. For sites derived by Chinstrap Penguins, an increase of one IBA is observed on comparison to the 5km grid, and by four compared to the 1km and 2km grids. The number of sites triggered by Emperor Penguins is stable throughout the analysis with only one site emerging, triggered by populations exceeding the A4ii threshold (1350 pairs). The number of sites triggered by Gentoo Penguins rises from eight to nine compared to grids with smaller cell sizes. For the Macaroni Penguins, no change can be observed between the 5 and 10 km grid squares, with the same three sites emerging.

Map F shows how these sites compare to the original IBA site list. In total 29 of the original IBA sites were identified using the 10 km grid square, seven sites on the original list were not identified, and 25 new sites emerged.

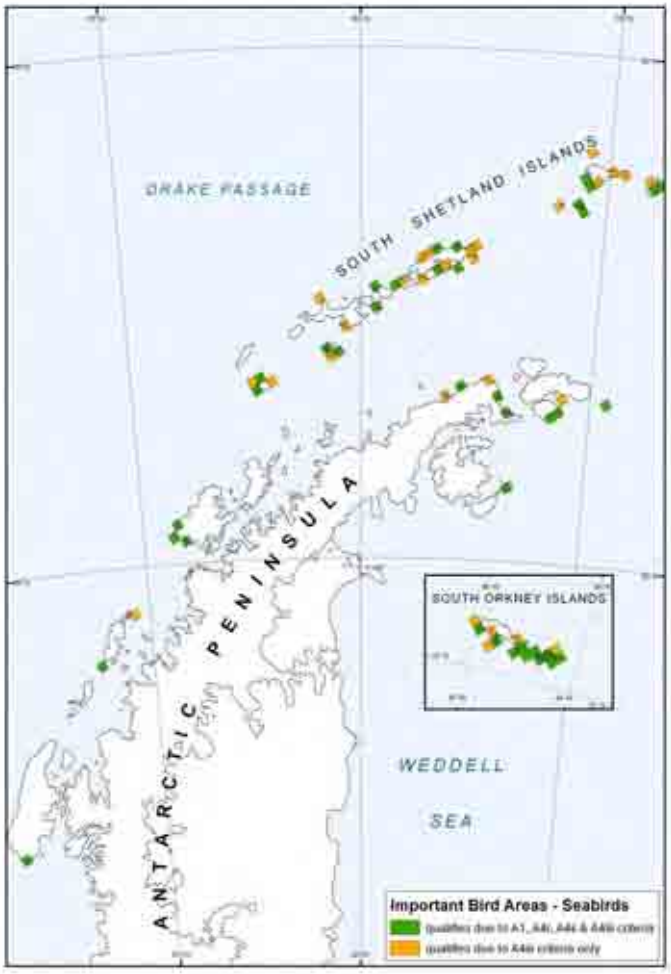


Map F: 10 km grid analysis

Analysis of IBAs derived from concentrations of seabirds

The analysis of seabirds meeting the IBA A4iii criterion population threshold (>10,000 pairs) resulted in 56 IBAs being identified at the highest level of data aggregation (i.e. aggregating over 10 km^2 grid cells). Thirty-eight of these IBAs correspond with the ones found in the analysis of individual bird species, whilst 28 sites qualify solely due to the A4iii criterion. A full list of IBA sites triggered by seabirds meeting the A4iii criterion at different grid cell sizes is provided in Annex B.

Map G shows the distribution of the 56 sites triggered by the A4iii criteria for seabirds (>10,000 pairs), derived using 10km^2 grid cells. A distinction is made between sites triggered solely by the A4iii criterion, and sites triggered by the A1, A4I or A4ii criteria in addition to A4iii.



Map G: Sites qualifying due to the A4iii criteria for seabirds

PART II: IBAs derived from a review of bird species census data

Objectives

The aims of Part II are to analyse published datasets for all bird species breeding in the Antarctic Peninsula region to identify:

1. Breeding sites known or thought to meet the IBA criteria based on census data for the 13 species not analysed in Part I of this report;
2. Updates to bird species census data published since 2007 resulting in changes to the IBAs identified in Part I;
3. Breeding sites at which the IBA criteria may be satisfied but census data are in a form that makes it difficult to be sure this is the case.

Methods

Breeding localities and census data for 20 bird species breeding in the Antarctic Peninsula region were retrieved by conducting a thorough review of published literature. Updates on the census data for the seven species included in Part I, and census data for the other 13 species considered in this report, were compiled and compared against the IBA selection criteria species population thresholds. Individual breeding sites for which census data are available and bird populations exceed thresholds for IBA selection criteria A1, A4i or A4ii were designated as suggested Confirmed IBAs. Sites at which it is unclear whether or not IBA thresholds are exceeded but it is possible that they are, or for which bird populations exceed the IBA selection criteria thresholds only when data are aggregated between breeding sites, were denoted Potential IBAs. This includes:

- census study areas containing several breeding sites, for which the species count across the whole census area exceeds IBA selection criteria thresholds, but it is not known whether individual breeding sites within the area exceed IBA selection criteria thresholds;
- breeding populations exceeding IBA thresholds only if the maximum count of a min / max estimate of the bird population is used;
- sites where census data between two or more species are combined and together exceed the IBA selection criteria threshold for at least one of the species, but individual species data are unavailable.

In addition, sites qualifying solely due to the A4iii criterion were included in the list of Potential IBAs.

Results

A substantial number of confirmed and potential IBA sites emerged from the literature review. The table in **Annex D** shows adjustments to IBA sites resulting from census updates for all species considered in Part I of this report. Significant results were:

- A decrease in breeding numbers of Adélie Penguins (*Pygoscelis adeliae*) at Tay Head (Antarctic Peninsula) resulted in this site no longer meeting the IBA criterion. This site was removed from the list of Confirmed IBAs;
- New data on Adélie Penguins breeding at D'Urville Monument (Antarctic Peninsula) and at Marshall Bay (Antarctic Peninsula) resulted in these two sites exceeding the threshold for the A4iii criterion, but falling below the A4ii criterion threshold. Therefore these sites were added to the list of Potential IBAs;
- New data on Antarctic Shags (*Phalacrocorax atriceps*) resulted in Stonington Island (Antarctic Peninsula) satisfying IBA criterion A4i. Stonington Island was added to the list of Confirmed IBAs.

Annex E indicates sites at which bird breeding populations exceed the IBA thresholds for each of 12 additional species breeding across the Antarctic Peninsula, South Shetland Islands and South Orkney Islands. Key results were:

- One new Confirmed IBA site was identified in the northeast of Half Moon Island;

- 23 Potential IBAs were identified. Of these, 10 sites had already been identified as Confirmed IBAs in the grid analysis of Part I, so that at these locations the analysis of Part II identified new probable trigger species rather than new Potential IBAs. Two of the 23 Potential IBA sites – Fildes Peninsula and Elephant Island – each have smaller grid-derived Confirmed and Potential IBAs contained within them. Some of these sites would be merged if IBA boundaries were delineated around the whole of Fildes Peninsula and the whole of Elephant Island. Finally, 11 of the 23 Potential IBA sites were not included in the list of sites on the gird-derived Confirmed IBA list. These 11 sites were: Inaccessible Islands, Byers Peninsula, Cierva Point, Sandefjord Bay, Argentine Islands, Astrolabe Island, Pourquoi Pas Island, NW coast of Anvers Island, Davis Island, Otter Rock (off Trinity Peninsula), and Admiralty Bay (excluding the western shoreline, which is a designated protected area). However, Astrolabe Island and Davis Island were also identified as Potential IBAs in Part I.

PART III: Confirmed and Potential IBAs

Objectives

The aim of this section is to compile lists of suggested Confirmed and Potential IBAs based on sites identified in Part I and Part II of this report.

Methods

IBA sites identified using the lowest level of data aggregation (i.e. point level) in Part I were added to a list of Confirmed IBAs (Table 6). Where two points are close together and both qualify for IBA status, they are listed as separate sites in Table 6. This differs from the way in which points representing IBA sites are displayed in Part I, where sites close together have been combined within an IBA in Annex A.

Where a site was previously included in the BirdLife / SCAR IBA list, the original IBA number is listed in Table 6. The trigger species and IBA criteria satisfied at each site is also shown alongside the data source[3].

Sites derived only at higher levels of aggregation (i.e. using 1 km^2, 2 km^2, 5 km^2 or 10 km^2 grid cells) in Part I were added to the Potential IBA list.

Potential and Confirmed IBAs derived in Part II were added to the appropriate IBA list. For any site in the Potential IBA list, a note is provided explaining why experts should be consulted prior to including the site in the Antarctic IBA network.

In addition, sites qualifying solely due to the A4iii criterion for seabirds in either Part I or Part II are added to the Potential IBA list. This follows BirdLife Policy that 'where quantitative data are good enough to permit the application of A4i or A4ii, the use of [criterion A4iii] is discouraged (http://www.birdlife.org/datazone/sites/global_criteria.html; accessed 22/04/2010).

Results

Confirmed IBAs

The table below shows the list of Confirmed IBAs emerging from the analysis conducted in Part I and II of this report. Accordingly, this list contains only those locations at which census data for individual breeding sites are available and bird populations at these sites satisfy the A1, A4i or A4ii IBA criteria.

In total, the list contains 42 sites: 30 of which are on the Antarctic Peninsula or offshore islands, eight in the South Shetland Islands, and four in the South Orkney Islands.

[3] Incomplete due to time constrains; data sources for individual censuses are available from ERA on request.

Table 6: Confirmed IBAs

Antarctic Peninsula

Location	Trigger species (breeding pairs)	IBA criteria	Data source	Original IBA number	Notes
Avian Island	Adélie Penguin (35,600), Antarctic Shag (670), South Polar Skua (880), Southern Giant Petrel (197)	A4i, A4ii, A4iii	South Polar Skua: count in 2004; W. Fraser pers comm in Ritz et al. (2005). Southern Giant Petrel: counted in 1979 on Avian Island, Patterson et al. (2008). Adélie Penguins: counted in 1978, Woehler (1993).	Part of Ant04	
Dion Islands	Adélie Penguin (700), Antarctic Shag (500)	A4i	Antarctic Shag: 1980s, S & J Poncet pers comm. Adélie Penguins: counted in 1983, Woehler (1993).	Part of Ant04	
Ginger Island	Adélie Penguin (3000), Antarctic Shag (275)	A4i	Antarctic Shag: 1980s, S & J Poncet pers comm.	Part of Ant04	
Dodman Island North	Antarctic Shag (183)	A4i	Antarctic Shag: counted 1984, S & J Poncet unpub.	Ant06	
Cape Evensen	Antarctic Shag (180)	A4i	Antarctic Shag: counted 1990, S & J Poncet unpub.	Ant07	
Bates Island	Antarctic Shag (150)	A4i	Antarctic Shag: counted 1986, S & J Poncet unpub.	Ant08	
Point south of Gerlache Island	Gentoo Penguin (3000)	A1	Gentoo Penguin: count made in 1987, in Woehler (1993).	Ant09	Would be incorporated in 'Gerlache Island and area to the south' IBA if the latter is designated as an IBA (see Potential IBA list)
Cormorant Island, north coast (Palmer area)	Antarctic Shag (729)	A4i	Antarctic Shag: count on Cormorant Island from 1985, Morton & Heimark pers. comm.	Part of Ant10	
Guepratte Island	Antarctic Shag (220)	A4i	Antarctic Shag: counted 1987, S & J Poncet unpub.	Ant12	
Cuverville Island	Gentoo Penguin (4818)	A1, A4ii	Gentoo Penguin: Count made in 1994, recorded by A. Nimon	Part of Ant13	

Location	Trigger species (breeding pairs)	IBA criteria	Data source	Original IBA number	Notes
Beneden Head	Antarctic Shag (180)	A4i, A4ii	Antarctic Shag: 20 pairs at Beneden Head counted on 30/12/1989 in Lynch et al. (2008); 160 pairs counted on 22/11/2006 in S & J Poncet unpub.	Part of Ant13	
Eckener Point	Antarctic Shag (180)	A4i	Antarctic Shag: counted 1987, S & J Poncet unpub.	Ant15	
Murray Island	Antarctic Shag (180)	A4i	Antarctic Shag: counted 1989; S & J Poncet unpub.	Ant16	
Paulet Island	Adélie Penguin (95,000 at 3 colonies), Antarctic Shag (465)	A4i, A4ii, A4iii	Antarctic Shag: counted on 18/02/2007 in Lynch et al. (2008).	Ant28	
Snow Hill Island	Emperor Penguin (4200)	A4ii	Emperor Penguin: Count made in 2004, in Todd et al. (2004)		
Duroch Islands	Gentoo Penguin (3500), Chinstrap Penguin (9400 at c.10 colonies), Adélie Penguin (800)	A1, A4ii, A4iii	Penguins: S & J Poncet pers comm.		Gentoo are located on diff island to other penguins. Only inlude Chinstraps and Adélies as trigger species if all islands are grouped.
Cockburn Island	Antarctic Shag (800)	A4i	Antarctic Shag: counted 19/11/2006 in Lynch et al. (2008).		
Penguin Point, Seymour Island	Adélie Penguin (26,400)	A4ii, A4iii	Adélies: 26,400 pairs (N4) counted on 22/12/2006 in Lynch et al. (2008).		
Northern islet of Joubin Islands	Antarctic Shag (250 in two groups on north coast of an islet)	A4i	Antarctic Shag: counted 1987, S & J Poncet, unpub.		
Trundle Island	Antarctic Shag (140)	A4i	Antarctic Shag: counted 1989, S & J Poncet, unpub.		
Uruguay Island	Antarctic Shag (203)	A4i	Antarctic Shag: counted 1986, S & J Poncet, unpub.		
Pearl Rocks	Antarctic Shag (310)	A4i	Antarctic Shag: counted 1987, S & J Poncet, unpub.		
Trinity Island	Antarctic Shag (218 in 3	A4i	Antarctic Shag: counted 1986, S & J		

Location	Trigger species (breeding pairs)	IBA criteria	Data source	Original IBA number	Notes
southwest	colonies with 145, 50 and 23 pairs each)		Poncet, unpub.		
Pursuit Point, Wiencke Island	Antarctic Shag (140)	A4i	Antarctic Shag: 140 pairs recorded on 06/02/1987 by Poncet & Poncet (unpub.)		
Hope Bay	Adélie Penguin (123,850)	A4ii, A4iii	Adelies: counted in 1985, in Woehler (1993)		
Brown Bluff	Adélie Penguin (20,000), Gentoo Penguin (483)	A4ii, A4iii	Adélies and Gentoos: 1996 (?) in Naveen (2003).		
Armstrong Reef	Adélie Penguin (12,800), Antarctic Shag (633)	A4i, A4iii	Adélies: 1984 in Woehler (1993); Antarctic Shag: 1989-90 in S & J Poncet (unpub).		
Eden Rocks (off E coast of Dundee Island)	Adélie Penguin (44,249 – 49,460)	A4ii, A4iii	Naveen (2003)		
Heroina Island, Danger Islands	Adélie Penguin (~295,000)	A4ii, A4iii	Adélies: btw 285,115 and 305,165 pairs recorded in 1996 in Naveen (2003).		
Stonington Island	Antarctic Shag (135)	A4i	Antarctic Shag: 135 pairs recorded in 06/02/2007 by Lynch et al. (2008)		

South Shetland Islands

Location	Trigger species (breeding pairs)	IBA criteria	Data source	Original IBA number	Notes
Penguin Island	Southern Giant Petrel (634)	A4ii	Southern Giant Petrel: counted Dec 1999, in Naveen (2000)		
Yankee Harbour, Greenwich Island	Gentoo Penguin (4918)	A1, A4ii	Gentoo Penguins counted in 2003, Lynch et al. (2008)	Ant22	
Heywood Island	Chinstrap Penguin (90,000), seabirds (>10,000)	A4ii, A4iii	Chinstraps: counted 1987, Poncet & Poncet unpub.	Ant23	
False Round Point, King George Island	Chinstrap Penguin (49,870),	A4ii, A4iii	Chinstraps: in Woehler (1993)	Part of Ant26	
Pottinger Point, King George Island	Chinstrap Penguin (55,861), seabirds (>10,000)	A4ii, A4iii	Chinstraps: counted 1980 in Woehler (1993).	Part of Ant26	
Clarence Island (Fur Seal Point)	Chinstrap Penguin (57,500)	A4ii, A4iii	Croxall & Kirkwood (1979).	Part of Ant32	
Clarence Island (Pink Pool Pt)	Chinstrap Penguin (58,500)	A4ii, A4iii	Croxall & Kirkwood (1979).	Part of Ant32	
Half Moon Island (NE)	South Polar Skua (51)	A4ii	51 pairs recorded in NE, 103 pairs on whole island, in 1995/96 by Garcia Esponda (2000).	Part of Ant21	

South Orkney Islands

Location	Trigger species (breeding pairs)	IBA criteria	Data source	Original IBA number	Notes
Shagnasty Islet, Signy Island	Antarctic Shag (729)	A4i	WAM data - Rootes (1988) (?)	Part of Ant33	Would be incorporated in Signy Island IBA if whole island is designated as an IBA (see Potential IBA list)
Atriceps Island, Robertson Islands	Antarctic Shag (524)	A4i, A4iii	WAM data – ref 62.	Ant35	
Cape Davidson, Laurie Island	Antarctic Shag (225)	A4i	Antarctic Shag: counted 1983, S & J Poncet unpub.	Part of Ant40	
Graptolite Island (Laurie Island)	Adélie Penguin (30,000)	A4ii, A4iii	Woehler (1993).	Ant41, part of Ant40	

Potential IBAs

A sizeable number of sites in the analysis emerged as Potential IBAs and are documented in the table below. In total, the list of Potential IBAs contains 61 sites: 24 of which are on the Antarctic Peninsula or offshore islands, 23 in the South Shetland Islands, and 14 in the South Orkney Islands.

Table 7: Potential IBAs

Antarctic Peninsula

Location	Trigger species (breeding pairs)	Potential IBA criteria	Data source	Reason for consultation
Wiencke Island (inc. Damoy Point, Goudier Island and Pursuit Point) & Doumer Island	Gentoo Penguin (4032), Antarctic Shag (174)	A1, A4i	Gentoo Penguins: 1684 pairs at Port Lockroy counted 2007 and recorded in Lynch et al. (2008); 648 pairs recorded on Goudier Island in 2004 by Dowling, Port Lockroy wildlife report 2004-05; 1500 pairs recorded at Doumer Island and 200 pairs at Pursuit Point in 1983 in Woehler (1993). Antarctic Shag: 26 pairs at Jougla Point / Port Lockroy recorded in 2007 and 8 pairs on Priest Island recorded in 2001 in Lynch et al. (2008); 140 pairs recorded at Pursuit Point in 1987 in Poncet & Poncet (unpub.).	Large area: criteria satisfied only if species numbers are aggregated over 10 km x 10 km area. Note: Pursuit Point is already an IBA and would be absorbed into this IBA. Note: Port Lockroy Station (GB) lies in this area.
Davis Island, Harry Island	Antarctic Shag (150), Southern Fulmar (c. 5000 with estimate min 1000, max 10,000 pairs)	A4i, A4ii, A4iii	Southern Fulmar: Poncet & Poncet unpub. in Cuewels et al. (2007)	Antarctic Shag species satisfy A4i criteria only if aggregated over 10 km x 10 km area. Southern Fulmar data satisfies A4ii criteria only if max count estimate used.
Bell Island, Hunt Island	Antarctic Shag (162)	A4i		Criteria satisfied only if species numbers are aggregated over 10 km x 10 km area
Gaston Islands, Jaques Peaks	Antarctic Shag (246)	A4i		Criteria satisfied only if species numbers are aggregated over 10 km x 10 km area
Barcroft Islands	Antarctic Shag (145)	A4i		Criteria satisfied only if species numbers are aggregated over 5 km x 5 km area

Location	Trigger species (breeding pairs)	Potential IBA criteria	Data source	Reason for consultation
Argentine Islands (Vernadsky)	South Polar Skua (50)	A4ii	50 pairs recorded in 2003 by V. Bezrukov pers comm in Ritz et al. (2005)	Posn of breeding site(s) not given. Consult experts to decide whether to include Argentine Islands in IBA list.
Gerlache Island and area to the south	Antarctic Shag (148), Gentoo Penguin (4500), Chinstrap Penguin (7000), Adélie Penguin (171)	A1, A4i, A4ii, A4iii	Antarctic Shag: counted 1987, S & J Poncet unpub.. Penguins: Woehler (1993).	Data aggregated over 10 km area. Note: Incorporates 'Point south of Gerlache Island' IBA.
Astrolabe Island	Antarctic Shag (154), Southern Fulmar (c. 5000 with estimate of min 1000, max 10,000 pairs)	A4i, A4ii, A4iii	Southern Fulmar: Poncet & Poncet unpub. in Creuwels et al. (2007)	Criteria satisfied for Antarctic Shag only if species numbers are aggregated over 5 km x 5 km area. Criteria satisfied for southern fulmar only if max estimate used.
Pickwick Island, Patrick Island	Antarctic Shag (172)	A4i		Criteria satisfied only if species numbers are aggregated over 10 km x 10 km area
Tetrad Island, Chionis Island (very close to Trinity Island southwest)	Antarctic Shag (222)	A4i		Criteria satisfied only if species numbers are aggregated over 10 km x 10 km area
Melchior Islands	Antarctic Shag (135)	A4i		Criteria satisfied only if species numbers are aggregated over 10 km x 10 km area
Tupinier Islands	Chinstrap Penguin (12,750)	A4iii		Satisfied for A4iii criterion only. Criteria satisfied only if species numbers are aggregated over 10 km x 10 km area

Location	Trigger species (breeding pairs)	Potential IBA criteria	Data source	Reason for consultation
Pitt Islands	Adélie Penguin (15,600)	A4iii		Criteria satisfied only if species numbers are aggregated over 10 km x 10 km area
Litchfield Island (Palmer area)	South Polar Skua (up to 50 pairs)	A4ii	South polar skua: up to 50 pairs breeding according to ASPA No. 113 management plan (with confirmation on estimates given by Fraser, pers comm. 2009), although 'the number of breeding pairs fluctuates widely from year to year'.	Count is total for whole island – counts for individual breeding sites unknown. Note: Part of Ant10.
Palmer Station area, Anvers Island	Antarctic Shag (729 on Cormorant Island and 18 on Christine Island), Southern Giant Petrel (499 – total for multiple islands), seabirds (>10,000 if data aggregated over 5 km^2), South Polar Skua (Litchfield Island, up to 50 pairs)	A4i, A4ii, A4iii	South Polar Skua: up to 50 pairs breeding according to ASPA No. 113 management plan. Antarctic Shag: count on Cormorant Island from 1985, S & J Poncet unpub. in Morton & Heimark pers. comm; count from Christine Island made in 1985, S Poncet pers. comm. (2005).	Whole area only meets IBA criteria if multiple islands are grouped across 8km x 4km area. Note: originally Ant10.
Pourquoi Pas Island	Southern Fulmar (c.7500)	A4ii, A4iii	Southern Fulmar: c.7500 listed Poncet & Poncet unpub. in Creuwels (2007) with estimates of between 5000 and 10,000 pairs.	Criteria satisfied only if max count estimate used and data aggregated over whole island.
NW coast Anvers Island, c.15km NE of Rosenthal Islands	Southern Fulmar (c.7500)	A4ii, A4iii	Southern Fulmar: c.5000 recorded (Poncet & Poncet unpub. in Creuwels (2007)) with estimates of btw 1000 and 10,000 pairs.	Criteria satisfied only if max count estimate used.

Location	Trigger species (breeding pairs)	Potential IBA criteria	Data source	Reason for consultation
D'Urville Point, Joinville Island	Adélie Penguins (~ 10,000)	A4iii	Adélie Penguin: 10,000 pairs estimated on 24/01/2006 in Lynch et al. (2008)	Count approximate. Single species satisfying A4iii criterion only.
Otter Rock, north of Notter Point on Trinity Peninsula	Southern Fulmar (c.5000)	A4ii, A4iii	Southern Fulmar: c.5000 pairs recorded (Poncet & Poncet, unpub. in Cruewels et al. (2007)) with estimates of btw 1000 and 10,000 pairs.	Criteria satisfied only if max count estimate used.
Trinity Island	Southern Fulmar (10,000 with min 2000 and max 20,000)	A4ii, A4iii	Southern Fulmar: recorded in1987 by Poncet & Poncet unpub., listed in Creuwels (2007) with estimates of btw 2000 and 20,000 pairs.).	Data aggregated over whole island. Note: southwest Trinity Island already on Confirmed IBA list.
Cierva Point	South Polar Skua (93)	A4ii	93 pairs recorded in 1996 in Quintana et al. (2000)	Data aggregated over Cierva Point. Counts for individual breeding sites unknown but locations given in more detail in Quintana et al. (2000) (not point level). Note: originally Ant19.
Heroina Island, Danger Islands	Adélie Penguin (285,115)	A4ii, A4iii	Adélie Penguin: counted in 2006, in Naveen (2003)	Data may be for Heroina Island or may be aggregated over Danger Islands group.
Gourdin Island (off Trinity Peninsula)	Adélie Penguin (14,334), Chinstrap Gentoo Penguins (568)	A4iii	Naveen (2003)	Satisfied for A4iii criterion only if data are aggregated over island.

South Shetland Islands

Location	Trigger species (breeding pairs)	Potential IBA criteria	Data source	Reason for consultation
Admiralty Bay (excluding western shore of Admiralty Bay)	South Polar Skua & Brown Skua (total 338)	A4ii	338 pairs of *Catharacta maccormicki, C. antarctica lonnbergi* and hybrids combined, breeding in Ezcurra Inlet, MacKellar Inlet, Martel Inlet and on Vaureal Peak, i.e. north and east Admiralty Bay, Sanders et al. (2005))	Criteria met only if data aggregated over 15 km x 15 km area. Note: could merge with western shore of Admiralty Bay IBA.
Cape Shirreff	Chinstrap Penguin (10,400), Gentoo Penguin (300)	A4iii	Chinstraps and Gentoos: counted in 1987 in Woehler (1993).	Satisfied for A4iii criterion only and if data are aggregated over peninsula at Cape Shirreff. Note: part of Ant26.
Seal Islands	Chinstrap Penguin (~20,000), Macaroni Penguin (194), Southern Giant Petrel (25), Antarctic Shag (40)	A4iii	Chinstraps, Macaroni Penguins: 1988-89, Bengtson pers comm. Southern Giant Petrel: counted 1971 in Patterson et al. (2008). Antarctic Shag: counted 1971 in Bruce & Furse (1973)	Satisfied for A4iii criterion only.
Lions Rump, King George Island	Chinstrap Penguin (10), Gentoo Penguin (1105), Adélie Penguin (12,345)	A4iii	Woehler (1993)	Satisfied for A4iii criterion only. Note: part of Ant26.
Milosz Point, Emerald Cove, King George Island	Chinstrap Penguin (17,150)	A4iii	Woehler (1993)	Satisfied for A4iii criterion only. Note: part of Ant26.
North Foreland, Taylor Point, King George Island	Chinstrap Penguin (23,286), Southern Giant Petrel (248)	A4iii	Chinstrap: Woehler (1993). Southern giant petrel: counted in 1966, in Patterson et al. (2008).	Satisfied for A4iii criterion only. Note: part of Ant26.
Stigant Point, King George	Adélie Penguin (10,893)	A4iii	Adélie Penguin: count in 1980 in Woehler (1993).	Satisfied for A4iii criterion only. Note: part of Ant26.

Location	Trigger species (breeding pairs)	Potential IBA criteria	Data source	Reason for consultation
Island				
Stranger Point, Potter Peninsula, King George Island	Adélie Penguin (14,554), Gentoo Penguin (2584), Chinstrap Penguin (259), South Polar Skua (63 on Potter Peninsula)	4ii, A4iii	South Polar Skua: count from 2002 in Ritz et al. (2005). Penguins: data from Woehler (1993).	Note: Part of Ant26. Penguins all breeding at Stranger Point. Posn of breeding sites for South Polar skua unknown – only list as trigger species if all of Potter Peninsula is designated an IBA.
Western Shore of Admiralty Bay	Gentoo Penguin (1510 at Llano Pt, 623 at Point Thomas), Southern Giant Petrel (567 if data aggregated over 10 km^2), seabirds (>10,000),	A1, A4ii, A4iii	Penguins: Woehler (1993), Gentoo penguins: 2287 counted in 1994/1995 taken from ASPA No. 128 management plan	Note: Ant27, part of Ant26
Davey Point, King George Island	Chinstrap Penguin (19,690), Antarctic Shag (7)	A4iii	Chinstraps: Woehler (1993). Antarctic Shag: counted in 1988, in Shuford & Spear (1989).	Satisfied for A4iii criterion only. Note: part of Ant26.
Cape Melville, King George Island	Chinstrap Penguin (16,278)	A4iii	Chinstrap: count in 1980 in Woehler (1993)	Criteria satisfied only if species numbers are aggregated over 5 km x 5 km area
Byers Peninsula, Livingston Island	Antarctic Tern (1760), Kelp Gull (449)	A4i	Antarctic Tern: 1760 pairs recorded at Byers Peninsula in 1965 (White (1965) in Croxall – BAS Internal Records – in ASPA No. 126 management plan). Kelp Ggull: 449 pairs recorded at Byers Peninsula in 1965 (White (1965) in Croxall – BAS Internal Records – in ASPA No. 126 management plan)	Data aggregated over Byers Peninsula. Individual breeding site data may be available in original publication – check White (1965) prior to consultation. Note: originally Ant17.
Barnard Point, Miers Bluff, Livingston Island	Chinstrap Penguin (12,500), Gentoo Penguin (600), Southern Giant Petrel (30)	A4iii	Penguins: count in 1987, S & J Poncet, pers comm. SGP: count in 1986, Patterson et al. (2008).	Satisfied for A4iii criterion only.

Location	Trigger species (breeding pairs)	Potential IBA criteria	Data source	Reason for consultation
Gibbs Island site 1	Seabirds (Chinstrap & Macaroni Penguins) (14672), Southern Fulmar (18,830 over whole island)	A1, A4ii, A4iii	Southern Fulmar: Gibbs Island (18,830 pairs counted in 1977 by Furse, (1978) listed in Creuwels (2007)). Macaroni and Chinstrap Penguins: Croxall & Kirkwood (1979).	Note: originally Ant30. Data aggregated over central Gibbs Island. Southern Fulmar data aggregated over whole of Gibbs Island. Original data may contain individual breeding site censuses - check. If not, consult experts to determine whether to include Ssouthern Fulmar as trigger species (A4ii and A4iii) at Gibbs Island.
Gibbs Island site 2	Macaroni Penguin (1672 most at 2 colonies with 502 and 1150 birds each), seabirds (Chinstrap & Macaroni Penguins) (29,362), Southern Fulmar (18,830 over whole island)	A1, A4ii, A4iii	Southern Fulmar: Gibbs Island (18,830 pairs counted in 1977 by Furse, (1978) listed in Creuwels (2007)). Macaroni and Chinstrap Penguins: count from 1977 in Croxall & Kirkwood (1979).	Note: originally Ant30. Data aggregated over east of Gibbs Island. Southern fulmar data aggregated over whole of Gibbs Island. Original data may contain individual breeding site censuses - check. If not, consult experts to determine whether to include southern fulmar as trigger species (A4ii and A4iii) at Gibbs Island. Macaroni Penguins breed at several sites on island with 2 largest sites c. 2 km apart. Count for each site falls below IBA thresholds.
Aspland Island, Eadie Island & O'Brian Island	Chinstrap Penguin (8650 on Aspland, 5150 on Eadie Island, 21,400 on O'Brian), Macaroni Penguin (21 on Aspland), Southern Fulmar (c.9800 on Aspland, c.8500 on Eadie, c.7880 on O'Brian)	A4ii, A4iii	Southern Fulmar: count made in 1977; Furse (1978) in Creuwels et al. (2007). Penguins: count from 1977 in Croxall & Kirkwood (1979).	Site covers three islands which are 1 – 2km apart. Each island does not meet IBA criteria on its own (except for A4iii criterion, which is satisfied when data are aggregated over each island).

Location	Trigger species (breeding pairs)	Potential IBA criteria	Data source	Reason for consultation
Clarence Island (all of island)	Chinstrap Penguin (194,320), Macaroni Penguin (3350 if data aggregated over 5 km^2), seabirds (>10,000 **at 3 sites < 10km apart**), Southern Fulmar (25,475)	A1, A4ii, A4iii	Fulmars: recorded in Furse (1978). Penguins: Croxall & Kirkwood (1979).	Data aggregated over whole island. Site qualifies for A4iii criterion at three locations (SW, Pink Pool Pt & Fur Seal Pt). Note: originally Ant32.
Fildes Peninsula, King George Island	Gentoo Penguin (3410), Southern Giant Petrel (246 if data aggregated over 10 km^2), South Polar Skua (176), Brown Skua (76)	A1, A4ii	South Polar Skua: count from 2001 in Ritz et al. (2005).	Data aggregated over whole of Fildes Peninsula. Ant29, part of Ant26
Ardley Island (near Fildes Peninsula)	Gentoo Penguin (3410)	A1, A4ii	Gentoos: from 1987-88, J. Valencia pers comm.	Data aggregated over whole island.
Low Island	Chinstrap Penguin (260,000), seabirds (>10,000 **at 4 separate sites < 10 km apart**)	A4ii, A4iii		Note: originally Ant14. Four separate sites on Low Island qualify for IBA status due to A4iii criterion.
Deception Island	Chinstrap Penguin (175,000), seabirds (>10,000 **at 3 separate sites < 10km apart**)	A4ii, A4iii		Note: originally Ant20. Three sites on Deception Island qualify for IBA status due to A4iii criterion. Split site?

Location	Trigger species (breeding pairs)	Potential IBA criteria	Data source	Reason for consultation
Harmony Point, Nelson Island	Chinstrap Penguin (89,685), Gentoo Penguin (3347), Southern Giant Petrel, seabirds (>10,000 **at 2 separate sites < 5km apart)**	A1, A4ii, A4iii		Ant25. Two sites on Harmony Point qualify for IBA status due to A4iii criterion. Split site?
Elephant Island	Chinstrap Penguin (~123,070 split btw numerous sites), Southern Giant Petrel (845 over whole island), seabirds (Chinstrap Penguin, Gentoo Penguin, Southern Giant Petrel) (>10,000 **at 5 sites < 50 km apart**), Brown Skua (190), Gentoo Penguin (3913 split btw 3 sites)	A4ii, A4iii	Chinstrap: C & K (1979) with updates for one area by Lynch et al. (2008). Southern Giant Petrel: Patterson et al. (2008). Brown Skua: count made in 1983 by M. Sanders; pers comm in Ritz et al. (2005).	Data aggregated over whole island. Site qualifies for A4iii criterion only at 5 sites (Cape Lookout, Cape Wild, Cape Belsham, Mount Elder, and Stinker Pt / Wordie Pt). Note: originally Ant31.

South Orkney Islands

Location	Trigger species (breeding pairs)	Potential IBA criteria	Data source	Reason for consultation
Pirie Peninsula (Laurie Island)	Chinstrap Penguin (14,277), Antarctic Shag (176)	A4i, A4iii		Criteria satisfied only if species numbers are aggregated over 5 km x 5 km area.
Ferrier Peninsula (Laurie Island)	Adélie Penguin (61,000 at 2 colonies)	A4ii, A4iii	Adélie Penguin: Poncet & Poncet (1985) in Woehler (1993).	Data aggregated over Ferrier Peninsula. Note: originally part of Ant40.
Point Martin (Laurie Island)	Adélie Penguin (26,038), Antarctic Shag (225), Chinstrap Penguin (13,394)	A4i, A4ii, A4iii	Penguins: N R Coria.	Note: originally part of Ant40
Watson Peninsula (Laurie Island)	Adélie Penguin (462), Chinstrap Penguin (10,893), Gentoo Penguin (10), Southern Giant Petrel (170)	A4iii	Penguins: count in 1994, from NR Coria.; posn from Poncet & Poncet 1985. SGP: count in 1995, in Patterson et al. (2008).	A4iii criterion only. Criteria satisfied only if species numbers are aggregated over 2 km x 2 km area. Note: if this site is explanded to include Cape Geddes, Fraser Point (c.5 km apart on either side of Watson Peninsula), Chinstraps > 40,000 (satisfying A4ii criterion). Note: part of Ant40.
Cape Bennett & Gibbon Bay, Coronation Island	Chinstrap Penguin (23,172)	A4iii		Criteria satisfied only if species numbers are aggregated over 10 km x 10 km area
Cape Robertson to Cape Davidson (Laurie Island)	Chinstrap Penguin (43,545), Antarctic Shag (225 at islet off Cape Davidson)	A4i, A4ii, A4iii		Criteria for this area satisfied only if species numbers are aggregated over 10 km x 10 km area. Note: criteria satisfied at point level at islet off of Cape Davidson – make this the IBA? Note: part of Ant40
Marshall Bay, Coronation	Adélie Penguin	A4iii	Adélies (13,381 pairs): counted on 17/12/2003 in Lynch et al. (2008)	Satisfied for A4iii criterion only.

Location	Trigger species (breeding pairs)	Potential IBA criteria	Data source	Reason for consultation
Island	(13,381)			
Christofferson & Fredriksen Island	Gentoo Penguin (8057), Antarctic Shag (144), seabirds (>10,000 **at 2 separate sites <5km apart**)	A1, A4i, A4ii, A4iii		Ant36/37. Two sites qualify for IBA status due to the A4iii criterion .
Larsen Islands, Monroe Island, Moreton Point, Return Pt, Cheal Pt (west Coronation Island)	Chinstrap Penguin (128,300 with 24,000 – 38,000 each at Monroe Island, Moreton Pt, Return Pt / Cheal Pt, and opposite Monroe Island), Southern Fulmar (c. 7500 with min 5000, max 10,000).	A4ii, A4iii	Chinstraps: Woehler (1993). Southern Fulmar: counted in 1984, recorded in Cruewels et al. (2007).	Total distance across IBA 8.5 km – data aggregated over c.10km^2 area. Includes marine areas. Monroe Island on its own, and a smaller area within this IBA, both meet IBA criteria A4ii if data aggregated over 5 km^2. Could split into 2 IBAs? Or could merge with Sandefjord Bay IBA (lies between Larsen Islands & west Coronation Island)?
Signy Island	Adélie Penguin (37,200), Chinstrap Penguin (64,626 if data aggregated over 5 km^2 inc. 10,964 pairs at Moe Island), Antarctic Shag (801), Southern Giant Petrel (1040), Wilson's Storm Petrel (~200,000), Brown Skua (>100)	A4i, A4ii, A4iii	Brown Skua: BAS unpublished data, count conducted in 2003-05, reported in Ritz et al. (2005). Wilson's Storm Petrel: 200,000 pairs estimated in 1968, recorded in Beck & Brown (1972), breeding in holes and btw boulders all around ice-free areas of island.	Data aggregated over Signy Island and Moe Island (ASPA No. 129). Note: originally Ant33.
Inaccessible Islands	Southern Fulmar (c.50,000)	A4ii, A4iii	Southern Fulmar: c.50,000 pairs recorded by Poncet & Poncet, upub. in Creuwels et al. (2007).	Data aggregated over whole of Inaccessible Islands.

Location	Trigger species (breeding pairs)	Potential IBA criteria	Data source	Reason for consultation
Sandefjord Bay, Coronation Island	Southern Fulmar (c.15,000 with min 10,000 and max 20,000)	A4ii, A4iii	c15,000 recorded by Poncet & Poncet, unpub. (Creuwels, 2007).	Data aggregated over whole of Sandefjord Bay.
Stene Point & Cape Vik, Coronation Island	Chinstrap Penguin (9040), Adélie Penguin (1500)	A4iii		Criteria satisfied only if species numbers are aggregated over 10 km x 10 km area.

Discussion

Grid analysis

It is evident from the result of the grid-analysis in Part I that an increase in grid cell size did not substantially alter the position and number of IBA sites triggered for some bird species whilst for other species the effect was more noticeable. Our results show that for the Adélie, Gentoo, Macaroni and Emperor penguin species, none of the grid cell sizes substantially affect the list of IBAs identified. For these species, IBA selection is less sensitive to aggregation effects (Part 1, Table 2). Therefore for the IBA selection method under discussion, using the point file to determine the number and locations of IBA sites for these species may be the most suitable approach, ensuring all areas important for these birds are likely to be included in at least one IBA.

For the Chinstrap Penguin, Southern Giant Petrel and the Antarctic Shag, our results indicate that aggregating colonies within larger spatial units has an influence over the number and locations of the resulting IBAs. This effect is more pronounced for Southern Giant Petrels and Antarctic Shags. The reason for this may be in part due to the breeding patterns of these birds, which differ from the breeding patterns of penguins. For example, Antarctic Shags tend to breed in small numbers on rocky outcrops or perhaps groups of small islands. Their breeding pattern and the low population threshold (Table 1) required for IBA criterion A4ii to be reached, may explain why a strong aggregation influence can be observed on the outcome of the analysis for these two bird species. These factors suggest there could be merit in selecting IBAs for these species based on aggregations within larger spatial units, although the selection of an optimal spatial unit would require specialist advice from those with knowledge of the breeding biology of these species.

Comparing the IBAs derived from the grid-approach to the original list of IBAs shows that:

- 15 new IBAs were identified from the analysis of point-level data
- a further one new IBA is identified at a grid cell size of 1 km^2;
- no additional IBAs are identified at a grid cell size of 2km^2;
- three additional IBAs are identified at a grid cell size of 5 km^2 ; and
- another six new IBAs are identified at a grid cell size of 10km^2.

Interestingly, the new IBAs emerging from the point, one and two km grids are triggered by a range of bird species, whereas the IBAs emerging from the five and ten km grids were triggered by Chinstrap Penguins and Antarctic Shags.

In addition, it should be noted that the method of compiling data for the point files is likely to have affected the results for some species. For the Southern Giant Petrel, the number of breeding pairs is usually aggregated across island groups and the colony centroid is placed in the centre of the area. However, in some instances this is not the case, e.g. in the Palmer Station area where colonies on distinct islands were not pre-aggregated. This impacts the likelihood of populations of Southern Giant Petrels meeting the IBA criteria. At Palmer Station, only the 10 km grid resulted in this area being identified as an IBA based on Southern Giant Petrel numbers.

Analysing census data for seven species using a grid-based approach resulted in the identification of only a partial list of IBAs for the Antarctic Peninsula region. Furthermore, the data used for the grid analysis were based on data published prior to 2007 and several subsequent species counts needed to be taken into account to complete the IBA list. These points were dealt with in Part II of the report.

Potential and confirmed IBAs

The list of suggested Confirmed IBAs presented in this report provides a comprehensive set of breeding sites meeting the global IBA criteria in the Antarctic Peninsula region. Sites considered for inclusion on this list are confined to those at which bird census data are available in published sources. The methodical approach to IBA selection, in both the grid-analysis and species by species census data review, should ensure no individual breeding sites satisfying IBA criteria A1, A4i or A4ii are omitted from the Antarctic Peninsula IBA network if the Confirmed IBA list is implemented.

In previous IBA networks, natural linear features have been used to help delineate the IBA boundary. In Antarctica, administrative boundaries, limits of infrastructure, land ownership and other linear features are not commonplace. Features potentially available to assist IBA boundary delineation in Antarctica include: breeding colony extents, coastlines, the limit of ice-free areas, contours and Protected Area boundaries. Using bird breeding colony extents to define each IBA boundary possibly represents the best of these options. This would ensure nesting areas for bird populations meeting the IBA criteria are recognised in the IBA network and the inclusion of extraneous regions is minimised. However, current bird breeding colony extents are not well-documented and would need to be derived using recent aerial imagery. Where no aerial imagery is available, other methods of IBA boundary delineation will need to be implemented.

The high number of sites on the Potential IBA list is partly due to the inclusion of sites satisfying solely the A4iii criterion for seabirds. Accepting sites qualifying solely due to the A4iii criteria (> 10,000 seabirds) into the Antarctic IBA network would lead to 17 additional IBAs. At nine of these sites, only one breeding bird species is present. Where this is the case, clearly the species count is lower than required to satisfy the threshold for criterion A4i or A4ii (individual species thresholds) and this implies the threshold of 10,000 pairs 'overrides' the individual species threshold. A decision needs to be made on whether to include none, some or all of these sites in the Antarctic IBA network.

The remaining sites on the Potential IBA list consist almost entirely of data aggregated over the area contained by grid cells in Part I or over the area within which census data are aggregated in published literature. Data aggregation represents a challenge for IBA boundary delineation. Where data are aggregated over several breeding sites it is often not possible not discern which breeding sites contain bird populations exceeding IBA criteria thresholds. Therefore, large areas may be designated as IBAs whilst the extent of the breeding site for birds triggering the IBA may be relatively small. The priority for creating an Antarctic IBA network is to highlight areas of ornithological importance. Designating large areas as IBAs might ensure more breeding sites satisfying the IBA criteria are included in at least one IBA. However, if large areas of little ornithological importance are included in the IBA network, this is somewhat misleading and could cause the IBA system to lose credibility. Sites on the Potential IBA list should perhaps best be considered on a site by site basis and, where informed discussion brings a consensus on where an IBA boundary should lie, the site could be included in the IBA network.

Conclusion

The grid analysis proved a promising method of selecting IBAs in the Antarctic context. Our results suggest that the methodical nature of the grid approach yields a comprehensive set of IBAs for the dataset analysed and reduces the chance of some IBA sites being overlooked. The number of IBAs identified in addition to those already included in the BirdLife / SCAR IBA list suggests there may be merit in applying a grid-based approach to future studies aimed at identifying IBAs, where individual species data are available.

However, there is limited material with which to build an argument for choosing one method of spatial data aggregation over another based on the results of the grid analysis. In addition, point level data representing breeding site centroids is not available for every bird breeding site in the Antarctic and estimating the position of the site centroids could produce misleading results in any subsequent analysis to derive IBAs. For this reason, our study indicates that a grid-based approach should not attempt to replace the process of expert consultation, but rather should be used as an initial building block from which to commence this consultation process.

Combining results of the species literature review and grid analysis indicates there are 42 sites qualifying for IBA status in the Antarctic Peninsula region, 30 of which are on the Antarctic Peninsula or offshore islands, eight in the South Shetland Islands, and four in the South Orkney Islands. These sites are suggested as Confirmed IBAs in Part III, Table 6. Each site satisfies at least one of criterion A1, A4i or A4ii. Some of these sites could be split or merged depending on how the boundary of each IBA is defined.

Four sites in the original IBA list should be considered for removal, as these sites do not presently meet the IBA selection criteria. Annex C lists the sites proposed for removal.

In addition, 61 sites were identified as Potential IBAs, 24 of which are on the Antarctic Peninsula or offshore islands, 23 in the South Shetland Islands and 14 in the South Orkney Islands. 17 of these sites qualify solely due to criterion A4iii for seabirds (>10,000 pairs), whilst the majority of sites meet the IBA criteria only when data are aggregated over several breeding sites. It is suggested that these sites are put forward as candidate IBAs and experts are consulted to assess the merit of including each site in the IBA network. It should be noted that some sites on the Confirmed IBA list would be contained within sites on the Potential IBA list if the latter are adopted as IBAs.

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Annex A: List of grid-derived IBAs based on criteria A1, A4i and A4ii

The following tables list the locations of IBA sites triggered by IBA criteria A1, A4i or A4ii in Part I of the present report. Where a site was also present in the BirdLife / SCAR IBA site list, the original IBA number is stated. The field 'Grid' states which grids (1km, 2km, 5km and 10km) have been used to identify each IBA.

Antarctic Peninsula

Location	Species	Breeding Pairs	IBA number	Grids
Avian, Ginger & Dion Islands	Adélie Penguin	35600	Ant04	all
	Antarctic Shag	1445	Ant04	all
Dodman Island North	Antarctic Shag	183	Ant06	all
Cape Evensen	Antarctic Shag	180	Ant07	all
Bates Island	Antarctic Shag	150	Ant08	all
Rosenthal Islands (Gerlache Island) & Island to the south of the coast	Gentoo Penguin	4500	Ant09	all
	Antarctic Shag	148	Ant09	2km / 5km / 10km
Palmer, Anvers Island	Antarctic Shag	747	Ant10	all
	Southern Giant Petrel	499	Ant10	10km
Guepratte Island	Antarctic Shag	220	Ant12	all
Cuverville Island, Beneden Head)	Gentoo Penguin	4818	Ant13	all
	Antarctic Shag	160	Ant13	10km
Eckener Point	Antarctic Shag	180	Ant15	all
Murray Island	Antarctic Shag	180	Ant16	all
Paulet Island	Adélie Penguin	95000	Ant28	all
	Antarctic Shag	260	Ant28	all
Eden Rocks	Adélie Penguin	44249		all
Hope Bay	Adélie Penguin	123850		all
Danger Islands	Adélie Penguin	285115		all
Snow Hill Island	Emperor Penguin	4200		all
Wiencke & Doumer Island	Gentoo Penguin	3904		10km
	Antarctic Shag	230		all
Duroch Islands	Gentoo Penguin	3500		all
Cockburn Island	Antarctic Shag	560		all
Armstrong Reef	Antarctic Shag	633		all

Location	Species	Breeding Pairs	IBA number	Grids
Brown Bluff	Adélie Penguin	20000		all
Penguin Point, Seymour Island	Adélie Penguin	21954		all
Davis Island, Harry Island	Antarctic Shag	150		10km
Joubin Islands	Antarctic Shag	251		all
Bell Island, Hunt Island	Antarctic Shag	162		10km
Gaston Islands, Jaques Peaks	Antarctic Shag	246		10km
Trundle Island	Antarctic Shag	140		1km / 2km / 5km / 10km
Uruguay Island	Antarctic Shag	203		all
Barcroft Islands	Antarctic Shag	145		5km / 10km
Pearl Rocks	Antarctic Shag	310		all
Trinity Island southwest	Antarctic Shag	218		all
Astrolabe Island	Antarctic Shag	154		5km / 10km
Pickwick Island, Patrick Island	Antarctic Shag	172		10km
Tetrad Island, Chionis Island (very close to Trinity Island southwest)	Antarctic Shag	222		10km
Melchior Islands	Antarctic Shag	135		10km

South Shetland Islands

Location	Species	Breeding Pairs	IBA number	Grids
Low Island	Chinstrap Penguin	260000	Ant14	all
Deception Island	Chinstrap Penguin	175000	Ant20	all
Yankee Harbor, Greenwich Island	Gentoo Penguin	9199	Ant22	all
Heywood Island	Chinstrap Penguin	93110	Ant23	all
Harmony Point, Nelson Island	Chinstrap Penguin	89685	Ant25	all
	Gentoo Penguin	3347	Ant25	all
	Southern Giant Petrel	746	Ant25	all
False Round Point	Chinstrap Penguin	50326	Part of Ant 26	all
Kellick Island, Tartar Island, Pottinger Point	Chinstrap Penguin	124796	Part of Ant 26	all
Western Shore of Admirality Bay				
	Southern Giant Petrel	567	Ant27, Part of Ant 26	10km
Fildes Peninsula	Gentoo Penguin	3410	Ant29, Part of Ant26	all
	Southern Giant Petrel	646	Ant29, Part of Ant26	10km
Gibbs Island (2 locations)	Macaroni Penguin	2344	Ant30	all
Elephant Island	Chinstrap Penguin	123070	Ant31	all
	Southern Giant Petrel	555	Ant31	all
Clarence Island	Chinstrap Penguin	194320	Ant32	all
	Macaroni Penguin	3105	Ant32	5km / 10km
Penguin Island	Southern Giant Petrel	849		all

South Orkney Islands

Location	Species	Breeding Pairs	IBA number	Grids
Signy Island	Adélie Penguin	37200	Ant33	all
	Chinstrap Penguin	64626	Ant33	5km / 10km
	Antarctic Shag	801	Ant33	all
	Southern Giant Petrel	1040	Ant33	all
Atriceps Island, Robertson Islands	Antarctic Shag	729	Ant35	all
Christofferson, Fredriksen Island	Gentoo Penguin	8057	Ant36/37	all
	Antarctic Shag	144	Ant36/37	all
Pirie Peninsula, Cape Mabel (Laurie Island)	Chinstrap Penguin	47892	Ant39, Part of Ant40	10km
	Antarctic Shag	176	Ant39, Part of Ant40	5km / 10km
Graptolite Island (Laurie Island)	Adélie Penguin	30000	Ant41, Part of Ant40	all
Point Martin (Laurie Island)	Adélie Penguin	26038	Part of Ant40	all
	Antarctic Shag	225	Part of Ant40	all
Ferrier Peninsula (Laurie Island)	Adélie Penguin	61000	Part of Ant40	all
Cape Robertson (Laurie Island)	Chinstrap Penguin	43545	Part of Ant40	10km
Larsen Island, Monroe Island, Moreton Point	Chinstrap Penguin	73058	5km / 10km	

Annex B: List of grid-derived IBAs based on criterion A4iii

The following tables list the locations of IBA sites triggered by IBA criterion A4iii for different grid sizes. Where a site was also present in the BirdLife / SCAR IBA site list, the original IBA number is stated. The field 'Grid' states which grids (1km, 2km, 5km and 10km) have been used to identify each IBA.

Antarctic Peninsula:

Location	Species	Breeding Pairs	IBA number	Grids
Avian & Ginger Islands	Adélie Penguin, Southern Giant Petrel	38795	Ant04	all
Gerlache Island	Adélie, Chinstrap, Gentoo Penguins, Southern Giant Petrel	11676	Ant09	10km
Palmer Station	Adélie, Macaroni Penguins, Southern Giant Petrel	14670	Ant10	5km / 10km
Paulet Island	Adélie Penguin	95000	Ant28	all
Joubin Island	Adélie, Chinstrap, Gentoo Penguins, Southern Giant Petrel	13033		all
Tupinier Islands	Chinstrap Penguin	12750		5km / 10km
Duroch Islands	Adélie, Chinstrap, Gentoo Penguins	13700		all
Gourdin Island	Adélie, Chinstrap, Gentoo Penguins,	18534		all
Hope Bay	Adélie Penguin	123850		all
Brown Bluff	Adélie, Gentoo Penguin	20716		all
Pitt Islands	Adélie Penguin	15600		5km / 10km
Armstrong Reef	Adélie Penguin, Antarctic Shag	12800		
Tay Head, Joinville Island	Adélie Penguin	15000		all
Eden Rocks	Adélie Penguin	44249		all
Heroina Island, Danger Islands	Adélie, Gentoo Penguins	285330		all
Penguin Point, Seymour Island	Adélie Penguin	21954		all

South Shetland Islands:

Location	Species	Breeding Pairs	IBA number	Grid
Low Island (site 1)	Chinstrap, Gentoo Penguins	150250	Ant14	all
Low Island (site 2)	Chinstrap Penguin	25000	Ant14	all
Low Island (site 3)	Chinstrap Penguin	110000	Ant14	all
Low Island (site 4)	Chinstrap Penguin	10000	Ant14	all
Deception Island (site 1)	Chinstrap Penguin	75000	Ant20	all
Deception Island (site 2)	Chinstrap Penguin	11500	Ant20	10km
Deception Island (site 3)	Chinstrap Penguin	100000	Ant20	all
Yankee Harbour, Fort Point, Greenwich Island	Chinstrap, Gentoo, Macaroni Penguins	10253	Ant22	10km
Heywood Island	Chinstrap Penguin, Southern Giant Petrel	93331	Ant23	all
Harmony Point	Chinstrap, Gentoo Penguins, Southern Giant Petrel	93778	Ant25	all
The Tor, part of ASPA133 Harmony Point	Chinstrap Penguin, Southern Giant Petrel	11124	Ant25	all
Stigant Point, KGI north coast	Chinstrap Penguin	11343	part of Ant26	all
Davey Point, KGI north	Chinstrap Penguin	19690	part of Ant26	all
False Round Point, KGI	Chinstrap Penguin	50326	part of Ant26	all
Stranger Pt, Barton Peninsula, Potter Peninsula	Adélie, Chinstrap, Gentoo Penguins, Southern Giant Petrel	24015	part of Ant26	all
Lions Rump (ASPA 151)	Adélie, Chinstrap, Gentoo Penguins,	13460	part of Ant26	all
Milosz Point, Emerald Cove, KGI	Chinstrap Penguin	17150	part of Ant26	all
North Foreland, Taylor Point, KGI	Chinstrap Penguin, Southern Giant Ppetrel	24132	part of Ant26	all
Cape Melville, KGI	Chinstrap Penguin	16278	part of Ant26	5km / 10km
western shore of Admiralty Bay	Adélie, Chinstrap, Gentoo Penguins, Southern Giant Petrel	29859	Ant27	all
Gibbs Island (site 1)	Chinstrap , Macaroni Penguins	29362	Ant30	all
Gibbs Island (site 2)	Chinstrap, Macaroni Penguins	14672	Ant30	all
Elephant Island (site 1)	Chinstrap, Gentoo,	124565	Ant31	all

Location	Species	Breeding Pairs	IBA number	Grid
	Macaroni Penguins, Southern Giant Petrel			
Elephant Island (site 2)	Chinstrap Penguin	37415	Ant31	all
Elephant Island (site 3)	Chinstrap Penguin	22610	Ant31	all
Elephant Island (site 4)	Chinstrap Penguin	37950	Ant31	2km / 5km 10km
Elephant Island (site 5)	Chinstrap Penguin, Southern Giant Petrel	13010	Ant31	all
Clarence Island (site 1)	Chinstrap, Macaroni Penguins	21521	Ant32	all
Clarence Island (site 2)	Adélie, Chinstrap, Macaroni Penguins,	127094	Ant32	all
Clarence Island (site 3)	Chinstrap, Macaroni Penguins	71485	Ant32	all
Cape Shirreff	Chinstrap, Gentoo Penguins	10700		all
Kellick & Tartar Island, Pottinger Point	Chinstrap Penguin	124796		all
Seal Island	Chinstrap, Macaroni Penguins, Southern Giant Petrel	20219		all
Barnard Point, Miers Bluff	Chinstrap, Gentoo Penguins, Southern Giant Petrels	15240		all
Penguin Island	Adélie, Chinstrap Penguins, Southern Giant Petrel	17541		2km / 5km / 10km
Aspland, Eadie, O'Brian islands	Chinstrap, Macaroni Penguins	34921		all

South Orkney Islands:

Location	Species	Breeding Pairs	IBA number	Grid
Signy Island	Adélie, Chinstrap, Gentoo, Macaroni Penguins, Southern Giant Petrel	130780	Ant33	all
Cape Bennet, Gibbon Bay	Chinstrap Penguin	23172	Ant34	10km
Robertson Islands	Chinstrap Penguin	13958	Ant35	2km / 5km / 10km
Christofferson & Fredrikson Island (site 1)	Adélie, Chinstrap, Gentoo Penguins, Southern Giant Petrel	51151	Ant36/37	2km / 5km / 10km
Christofferson & Fredrikson Island (site 2)	Chinstrap Penguins, Southern Giant Petrel	34294	Ant36/37	all
Pirie Peninsula, Watson Peninsula	Adélie, Chinstrap, Gentoo Penguins, Southern Giant Petrel	50512	Ant39, part of Ant40	2km / 5km / 10km
Cape Robertson, Laurie Island	Chinstrap Penguin	43545	part of Ant40	all
Point Martin, Laurie Island	Adélie, Chinstrap Penguins	41830	part of Ant40	all
Watson Peninsula, Fraser Point	Chinstrap Penguin, Southern Giant Petrel	39060	part of Ant40	all
Ferrier Peninsula	Adélie, Chinstrap, Gentoo Penguins,	76200	part of Ant40	all
Graptolite Island, South Coast Laurie Island	Adélie, Chinstrap, Gentoo Penguins	53580	Ant41, part of Ant40	all
Larsen Islands, Monroe Island	Chinstrap Penguin	37999		2km / 5km / 10km
Moreton Pt, Return Pt, Cheal Pt	Adélie, Chinstrap, Gentoo Penguins	81263		all
Stene Pt, Cape Vik	Adélie, Chinstrap Penguins	10540		10km
Moe Island	Chinstrap Penguin	14878		2km / 5km / 10km

Annex C: List of IBA sites proposed for removal from the BirdLife / SCAR IBA site list

The following tables list the locations of sites on the BirdLife / SCAR IBA list which have not met IBA criteria A1, A4i or A4ii in the present analysis. The original IBA site number is stated.

Antarctic Peninsula

Location	Species	Breeding Pairs	IBA number
Booth Island	Adélie Penguin	34	Ant11
	Chinstrap Penguin	24	Ant11
	Gentoo Penguin	377	Ant11
	Antarctic Shag	19	Ant11
Moss Island, Hughes Bay	Chinstrap Penguin	3600	Ant18
	Gentoo Penguin	450	Ant18
	Antarctic Shag	90	Ant18
	Southern Giant Petrel	135	Ant18

South Shetland Islands

Location	Species	Breeding Pairs	IBA number
“Triplet Hills”, Heywood Island	Southern Giant Petrel	20	Ant24

South Orkney Islands

Location	Species	Breeding Pairs	IBA number
Cape Bennet, Coronation Island	Chinstrap Penguin	9050	Ant34

Annex D: Adjustments to grid-derived IBA list based on updates to bird species data published since 2007

Table D-1: IBA list updates based on bird census data published since 2007 for the 7 species included in Part I of this report:

Species	Dataset	Confirmed IBAs	Potential IBAs	Sites no longer qualifying as IBAs	Action
Adélie Penguin (*Pygoscelis adeliae*)	ERA data included in grid analysis updated in 2007. Literature review conducted to update dataset to include data published between 2007-10.	None	D'Urville Monument, Joinville Island (10,000 pairs estimated on 24/01/2006 in Lynch et al. (2008))		Include D'Urville Monument in list of potential IBAs (A4iii)
				Tay Head, Joinville Island (6450 pairs counted on 21/12/2006 and recorded in Lynch et al. (2008) compared to 15,000-20,000 recorded in Naveen (2003))	Remove Tay Head from IBA list.
			Marshall Bay, Coronation Island (13,381 pairs (N3) counted on 17/12/2003 reported in Lynch et al. (2008)		Include Marshall Bay in list of potential IBAs (A4iii)
Chinstrap Penguin (*P. antarctica*)	ERA data included in grid analysis updated in 2007. Literature review conducted to include data published between 2007-10.	None	None	None	None
Gentoo Penguin (*P. papua*)	ERA data included in grid analysis updated in 2007. Literature review conducted to update dataset to include data published between 2007-10.	Yankee Harbour, Greenwich Island (4918 pairs recorded in Lynch et al. (2008) compared to 9199 pairs recorded previously in Naveen (2003) and Woehler (1993))	None	None	None; breeding site still meets IBA criteria A1 and A4ii.
Emperor Penguin (*Apenodytes fosteri*)	ERA data included in grid analysis updated in 2007. Literature review conducted	None	None	None	None

Species	Dataset	Confirmed IBAs	Potential IBAs	Sites no longer qualifying as IBAs	Action
	to update dataset to include data published between 2007-10.				
Macaroni Penguin (*Eudyptes chrysolophus*)	ERA data included in grid analysis updated in 2007. Literature review conducted to update dataset to include data published between 2007-10.	None	None	None	None
Antarctic Shag (*Phalacrocorax atriceps*)	ERA data included in grid analysis updated in 2007. Literature review conducted to update dataset to include data published between 2007-10.	Stonington Island (135 pairs recorded in 06/02/2007 by Lynch et al. (2008))			Include Stonington Island in IBA list (A4i)
Southern Giant Petrel (*Macronectes giganteus*)	ERA data included in grid analysis updated in 2007. Literature review conducted to update dataset to include data published between 2007-10.	None	None	None	None

Annex E: IBAs identified from a review of census data for an additional 12 bird species

Table E-1: IBA list updates based on the 12 species not analysed in Part I of this report

Species	Dataset	Confirmed IBAs	Potential IBAs	Action
Snow Petrel (*Pagodroma nivea*)	Available data in ERA database	None	None	None
Kelp Gull (*Larus dominicanus*)	Partial dataset at ERA database. Literature review conducted		449 pairs recorded at Byers Peninsula in 1965 (White (1965) in Croxall – BAS Internal Records – in ASPA No. 126 management plan).	Retrieve detailed breeding site data from original report if available. If unavailable, consult experts to determine whether whole of Byers Peninsula should be included in IBA list (for A4i criteria).
Antarctic Tern (*Sterna vittata*)	No dataset compiled at ERA to date. Literature review conducted		1760 pairs recorded at Byers Peninsula in 1965 (White (1965) in Croxall – BAS Internal Records – in ASPA No. 126 management plan)	Retrieve detailed breeding site data from original report if available. If unavailable, consult experts to determine whether whole of Byers Peninsula should be included in IBA list (for A4i criteria).
Southern Fulmar (*Fulmarus glacioloides*)	Partial dataset at ERA database. Literature review conducted		Astrolabe Island (c.5000 pairs estimated in 1987 by Poncet & Poncet (unpub.) recorded in Creuwels et al. (2007)) with estimate of min 1000, max 10,000 pairs)	Consult experts to determine whether Astrolabe Island should be include in the IBA list (A4ii and A4iii).
			Gibbs Island (18,830 pairs counted in 1977 by Furse, (1978) listed in Creuwels (2007))	Data aggregated over Gibbs Island. Consult experts to determine whether to include southern fulmar as trigger species (A4ii and A4iii) at Gibbs Island.

Species	Dataset	Confirmed IBAs	Potential IBAs	Action
			Aspland Island (9800 pairs counted in 1977 by Furse, (1978) listed in Creuwels, (2007))	Data aggregated over Aspland Island. Consult experts to determine whether to include Aspland Island on IBA list (A4ii, A4iii).
			Pourquoi Pas Island (c.7500 estimated in 1986 by Poncet & Poncet unpub., listed in Creuwels (2007) with estimates of between 5000 and 10,000 pairs.)	Data aggregated over Pourquoi Pas island. Consult experts to determine whether Pourquoi Pas Island should be included in IBA list.
			NW coast Anvers Island, c.15km NE of Rosenthal Islands (c.5000 recorded in 1987 by Poncet & Poncet unpub. listed in Creuwels (2007) with estimates of btw 1000 and 10,000 pairs.)	Consult experts to determine whether NW coast Anvers Island should be an IBA.
			Davis Island (c.5000 pairs recorded in 1987 by Poncet & Poncet unpub., listed in Creuwels (2007) with estimates of btw 1000 and 10,000 pairs)	Consult experts to determine whether to include Davis Island in IBA list. Note 150 pairs of Antarctic Shags present in area also (aggregating data over 10 km grid).
			Trinity Island (10,000 pairs recorded in1987 by Poncet & Poncet unpub., listed in Creuwels (2007) with estimates of btw 2000 and 20,000 pairs.)	Consult experts to determine whether to include fulmar as trigger species (A4ii and A4iii) at Trinity Island.
			Otter Rock, north of Notter Point on Trinity Peninsula (c.5000 pairs recorded in 1990 by Poncet & Poncet unpub., listed in Cruewels et al. (2007) with estimates of btw 1000 and 10,000 pairs.)	Consult experts to determine whether Otter Rock should be included in IBA list.
			Clarence Island (Furse, (1978) estimated 25,475 pairs in 1977)	Data aggregated over whole island. Consult experts to decide whether to include fulmars as trigger species (A4ii and A4iii) at Clarence Island.

Species	Dataset	Confirmed IBAs	Potential IBAs	Action
			Inaccessible Island (c.50,000 pairs recorded in 1987 by Poncet & Poncet, unpub., listed in Creuwels et al. (2007) with estimates of btw 10,000 and 100,000 pairs)	Data aggregated over whole island. Consult experts to decide whether to include Inaccessible Islands in IBA list (A4ii and A4iii).
			Monroe Island (c.7500 pairs recorded in 1984 by Poncet & Poncet unpub., listed in Creuwels et al. (2007) with estimates of btw 5000 and 10,000 pairs.)	Data aggregated over Monroe Island. Include fulmars as probable trigger species (A4ii and A4iii) if all of Monroe Island designated an IBA.
			Sandefjord Bay, Coronation Island (c.15,000 recorded in 1984 by Poncet & Poncet, unpub. (Creuwels, 2007) with estimates of btw 10,000 and 20,000 pairs)	Data aggregated over Sandefjord Bay. Consult experts to decide whether to include Sandefjord Bay in IBA list (for A4ii and A4iii criteria)
South Polar Skua (*Catharacta maccormicki*)	No dataset compiled at ERA to date. Literature review conducted	Half Moon Island (51 pairs in NE Half Moon Island, 103 pairs in total, recorded in 1995/96 by Garcia Esponda (2000).		Include NE Half Moon Island in IBA list (A4ii criterion met)
			Litchfield Island (up to 50 pairs breeding according to ASPA No. 113 management plan)	Data aggregated over whole of Litchfield Island. Consult experts to decide whether to include Litchfield Island as an IBA (A4ii)

Species	Dataset	Confirmed IBAs	Potential IBAs	Action
			Cierva Point (93 pairs recorded in 1996 in Quintana et al. (2000)). Note: "Most of the skuas' breeding sites were located in the large 'turf-moss' association areas with dominance of *Polytrichum alpestre*: 75.4% of the total observed nests were on extensive moss patches. For example, in habitat-type 4 (20 500 m2 of moss-turf area), an average of 29 skua nests was found (Table 1). Some skua nests, mainly of Subantarctic Skuas, were also found in small patches located on the edge of Gentoo Penguin nesting breeding areas."	Breeding sites dispersed across Cierva Point. Consult experts to decide whether to include Cierva Point in IBA list (A4ii criterion met).
			Potter Peninsula, King George Island (63 pairs recorded in 2002 in Ritz et al. (2005))	Data aggregated over Potter Peninsula. Include South Polar Skua as trigger species (A4ii) if all of Potter Peninsula designated an IBA.
			Fildes Peninsula, King George Island (176 pairs recorded in 2001 in Ritz et al. (2005))	Data aggregated over Fildes Peninsula. Include South Polar Skua as trigger species (A4ii) if all of Fildes Peninsula designated an IBA.
			Avian Island (880 pairs recorded in 2004 by W. Fraser pers comm in Ritz et al. (2005))	Data aggregated over all of Avian Island. Include South Polar Skuas as trigger species (A4ii) if whole of Avian Island designated an IBA.
			Argentine Islands at Verdansky Station (50 pairs recorded in 2003 by V. Bezrukov pers comm in Ritz et al. (2005))	Posn of breeding site(s) not given. Consult experts to decide whether to include Argentine Islands in IBA list.

Species	Dataset	Confirmed IBAs	Potential IBAs	Action
			Admiralty Bay (338 pairs of *Catharacta maccormicki, C. antarctica lonnbergi* and hybrids combined, breeding in Ezcurra Inlet, MacKellar Inlet, Martel Inlet and on Vaureal Peak, i.e. north and east Admiralty Bay, Sanders et al. (2005))	Area included in count is c.15 km across at widest point, consisting of 9 distinct breeding sites. Consult experts to determine whether whole of Admiralty Bay should be included in an IBA (instead of western shore only).
Antarctic Petrel (*Thalassoica antarctica*)	Database compiled at ERA updated in 2007 Literature review conducted to incorporate new data.	None	None	None
Cape Petrel (*Daption capense*)	No dataset compiled at ERA to date. Literature review conducted	None	None	None
Wilson's Storm Petrel (*Oceanites oceanicus*)	No dataset compiled at ERA to date. Literature review conducted	None	None	None
Black-bellied Storm Petrel (*Fregetta tropica*)	No dataset compiled at ERA to date. Literature review conducted	None	None	None
Brown Skua (*Catharacta lonnbergi*)	No dataset compiled at ERA to date. Literature review conducted		As above (for South Polar Skua entry): Admiralty Bay (338 pairs of *Catharacta maccormicki, C. antarctica lonnbergi* and hybrids combined, breeding in Ezcurra Inlet, MacKellar Inlet, Martel Inlet and on Vaureal Peak, i.e. north and east Admiralty Bay, (Sanders et al. (2005)).	As above (for South Polar Skua entry): Area included in count is c.15 km across at widest point, consisting of 9 distinct breeding sites. Consult experts to determine whether whole of Admiralty Bay should be included in an IBA (instead of western shore only).
			Signy Island (>100 pairs recorded in 2003-05 by BAS (unpublished data) in Ritz et al. (2005))	Data aggregated over all of Signy Island. Include brown skua as trigger species (A4ii) if whole of Signy Island designated an IBA.

Species	Dataset	Confirmed IBAs	Potential IBAs	Action
			Fildes Peninsula, King George Island (76 pairs recorded in 2001 by Ritz et al. (2005))	Data total for whole of Fildes Peninsula. If all of Fildes Peninsula designated an IBA, include Brown Skua as trigger species (A4ii).
			Elephant Island (190 pairs recorded in 1983 by M. Sanders; pers comm in Ritz et al. (2005))	Data aggregated over Elephant Island. If whole island designated as an IBA, include Brown Skua as trigger species (A4ii) at Elephant Island IBA.
Greater Sheathbill (*Chionis alba*)	No dataset compiled at ERA to date. Literature review conducted	None	None	None
Light-mantled Sooty Albatross (*Phoebetria palpebrata*)	No dataset compiled at ERA to date. Literature review conducted	None	None	Note: only record of this species breeding in Antarctica is on Fildes Peninsula, in Lisovski *et al.* (2009), where confirmed two nests and one possible nest were recorded.
Antarctic Prion (*Pachyptila desolata)*	No dataset compiled at ERA to date. Literature review conducted	None	None	None

Antarctic Important Bird Areas
Defining Model Bird Foraging Areas

Chinstrap penguins on Signy Island, C Harris

Environmental Research & Assessment
& BirdLife International

Foreign & Commonwealth Office

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Preface

Environmental Research & Assessment (ERA) is identifying and verifying a network of Important Bird Areas in the Antarctic Peninsula region on behalf of BirdLife International and the UK Foreign & Commonwealth Office. This project is building on earlier work initiated in coordination with the Scientific Committee on Antarctic Research, and draws on additional data and published research. The earlier work did not consider the regions within which breeding birds forage, although these are of ecological and conservation significance to the birds.

The current collaboration between ERA and BirdLife International therefore seeks to derive a method for defining bird foraging areas at Antarctic Important Bird Areas so that, where possible, these might be better taken into consideration.

Introduction

Defining the location and size of Antarctic IBAs, and associated areas that may be considered relevant, can be approached in a number of different ways, including as:

- Simple point locations with no explicit spatial extent;
- Point locations with a defined 'buffer' of some distance surrounding the point;
- Polygons defined around the perimeter of breeding sites;
- Ice-free areas surrounding breeding site locations;
- Islands or island groups on which the sites may be located;
- Existing protected areas, where these already include the IBA and have defined boundaries;
- Foraging ranges of birds breeding at IBAs.

The present paper focuses on the last of these approaches, and evaluates a method that can be applied to define a model of the spatial extent of bird-foraging areas, given available data. These model foraging areas may be designated as IBAs in their own right, may be treated as seaward extensions of terrestrial IBAs, or may be considered as associated 'dependency areas' for birds breeding at a terrestrial IBA. At this stage, we seek to define a method of defining model foraging areas that is as robust and scientifically sound as possible, without prejudgment of whether areas identified would become an integral part of any IBA. Marine areas defined, however, could be recognised at least as closely associated with specific terrestrial IBAs already identified.

The foraging range of a bird is an estimate of the distance from a breeding site the bird will travel in search of food. Data on foraging ranges for most bird species breeding in Antarctica are limited. Furthermore, those foraging range data that have been published use a variety of methods and formats, making it difficult to draw statistical comparisons. For example, data on foraging ranges are collected at different stages in the breeding season, and measured in different ways (e.g. estimates of mean or maximum foraging range).

This paper assesses the foraging range data available for bird species breeding within the Antarctic and presents a method for defining model marine foraging areas for those species for which data were considered sufficient to draw reliable conclusions.

Objective

To identify a robust approach for using bird foraging range data to define model bird foraging areas in the Antarctic IBA network.

Methods

BirdLife is compiling a database of seabird ecology and foraging ranges, and using this information to help identify marine Important Bird Areas, inform protected area designation and as input to marine spatial planning.

Of the bird species breeding in the Antarctic Peninsula region, foraging range data are available for Adélie (*Pygoscelis adeliae*), Gentoo (*P. papua*), Chinstrap (*P. antarctica*) and Macaroni (*Eudyptes chrysolophus*) penguins (90, 31, 17 and 18 estimates of foraging range respectively) as well as the Antarctic Shag (*Phalacrocorax atriceps*), Kelp Gull (*Larus dominicanus*) and Antarctic Tern (*Sterna vittata*) (seven, four and three estimates of foraging range respectively). For the latter three species, we consider data insufficient to draw reliable conclusions on foraging range trends. Therefore, only data on foraging ranges for Adélie, Gentoo, Chinstrap and Macaroni penguins are included in the present analysis.

Seabird foraging range estimates were grouped by BirdLife International according to the measure of foraging range each database entry represents (e.g. mean foraging range, maximum foraging

range). An estimate was then made of the percentage of birds likely to be found within each measure of foraging range. For example, values indicating the *mean* foraging range for a species from a breeding site were assigned '50 %', indicating 50 % of birds are likely to forage within the specified range. Estimates of foraging extents for *most* birds were assigned '65 %'; estimates of *mean maximum* foraging range were assigned '85 %'; whilst estimates of the *maximum* foraging range were assigned '95%'. Table 1 lists the percentage of birds estimated to forage as indicated by each measurement type. For each species, the greatest foraging distance recorded was used to specify the range at which 100 % of birds are expected to forage.

Table 1: Estimates of the percentage of birds referred to in different measurements of foraging range

Measurement type	Percentage of birds
Mean	50 %
Most	65 %
Mean maximum	85 %
Maximum	95 %
Greatest distance recorded	100 %

The mean of each measurement group was calculated to give the average foraging range for 50 %, 65 %, 85 % and 95 % of birds. Where specific percentages of birds foraging within a given area were noted in the database (e.g. 75% <10km) these were also used to create additional data points. These averages were plotted on a graph and joined to show the trend between 'percentage of birds' and 'distance from colony' for each species. Standard deviation error bars and curves were also plotted to indicate the variation in data along the foraging range curve.

The number of data entries available in each measurement group varies greatly. For the Chinstrap, Gentoo and Macaroni penguins, between 1 and 17 data entries were available in each of the four measurement groups (mean, most, mean maximum, maximum) used to calculate average foraging ranges. For the Adélie Penguin, between 3 and 57 data entries were available within each measurement group. Statistics derived from small sample sizes are more likely to contain errors and therefore it was recognised that, at the least, the value and variation in standard deviation along the foraging curves should be carefully considered.

Furthermore, it is noted that where only one data entry is available in a measurement group (e.g. for data on foraging ranges for 50 % or 85 % of Gentoo penguins at a breeding site), the standard deviation is 0 and consequently there is no error bar at such points on the graph. This implies the estimates of foraging range have a lower error at these points than is likely to be the case. The lack of data points, and the small number of data entries available in some of the measurement categories, explains the sharp changes in slope along the foraging range curves.

Extending foraging areas associated with an IBA to the maximum foraging range recorded would be a poor representation of the foraging area for the majority of birds, since these extremes apply to only a small percentage of birds. However, to use the available foraging range data to define the extent of model foraging areas, there is a need to select an appropriate cut-off point.

For each species considered, foraging range data entries are most abundant in the 'mean' foraging range category, with 57, 17, 9 and 7 estimates of mean foraging range for the Adélie, Chinstrap, Gentoo and Macaroni penguins respectively. For each species, using estimates of the mean foraging range to model bird foraging areas maximises the sample size and should reduce the error of statistical calculations on foraging range.

To use the data to define the extent of model bird foraging areas, we propose the following method:

- For each species, use the distance (d_m) calculated by averaging all estimates of the mean foraging range and add the standard deviation (s.d.) of d_m to this value. The resultant distance '$d = d_m$ + s.d.'[1] from a breeding site will be used to mark the limit of the area within which at least 50 % of birds are expected to forage.

This method can be further refined using the standard deviation curves on the graphs of '% of birds' / 'distance from colony' to read off the maximum percentage of birds expected to forage within *d* km of a breeding site. In this way, the percentage range of birds foraging within *d* km of a breeding site can be estimated for each species.

This methodology applies the law of diminishing returns, defining a model foraging area which includes the largest proportion of birds for the smallest area. Continuing to extend the model foraging area beyond the proposed distance would yield diminishing additional benefits, since it would include fewer and fewer additional birds.

[1] Rounded to the nearest integer.

Results

We present the most robust method identified to define the extent of model foraging areas for Adélie, Chinstrap, Gentoo and Macaroni penguin breeding sites in the Antarctic IBA network.

Figures 1 - 4 illustrate the nature of the foraging range data available for Adélie, Gentoo, Chinstrap and Macaroni penguins.

Figure 1a: Adélie foraging range estimates with standard deviation bars

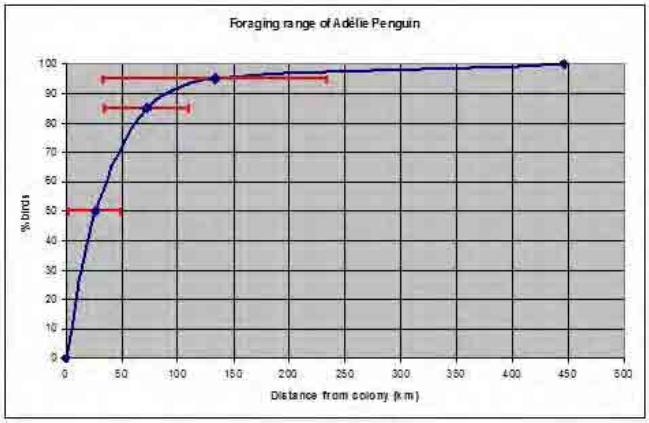

Figure 1b: Adélie foraging range estimates with standard deviation curves

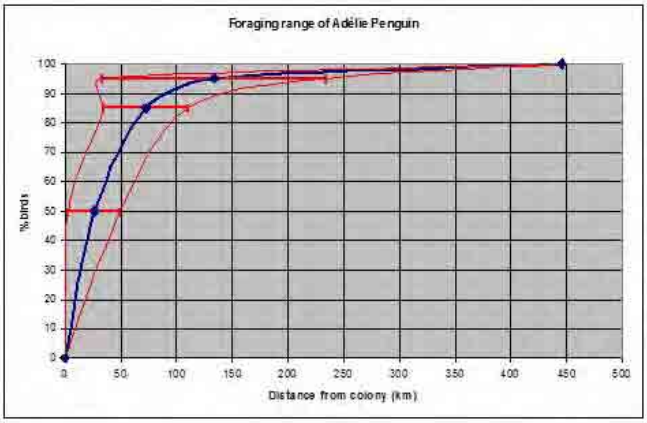

Figure 2a: Gentoo foraging range estimates with standard deviation bars

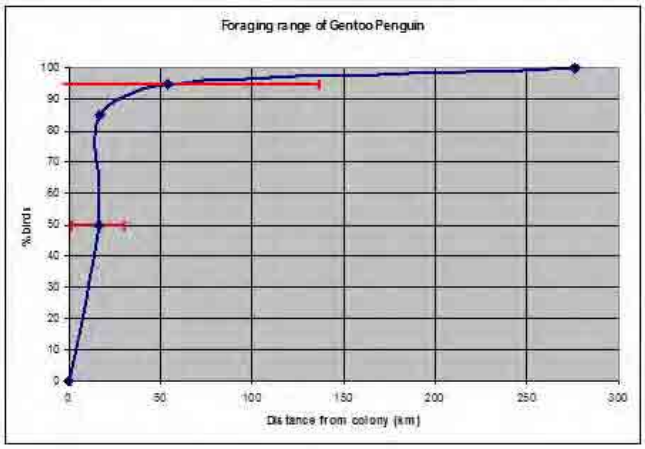

Figure 2b: Gentoo foraging range estimates with standard deviation curves

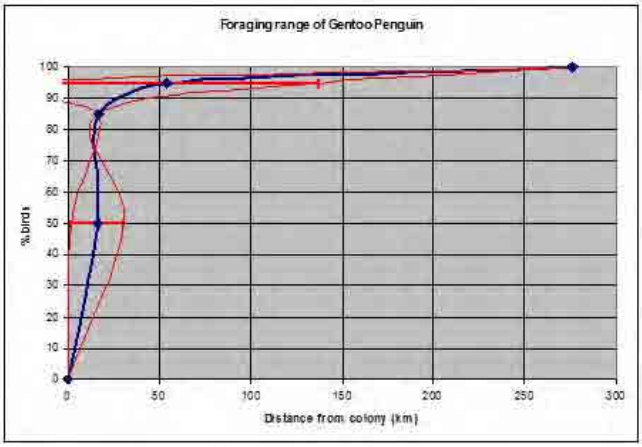

Figure 3a: Chinstrap foraging range estimates with standard deviation bars

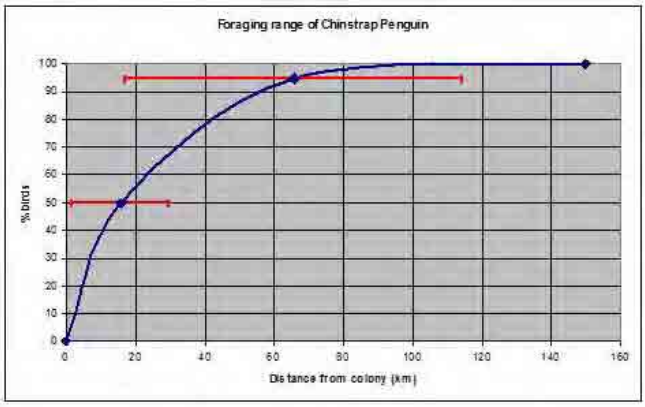

Figure 3b: Chinstrap foraging range estimates with deviation curves

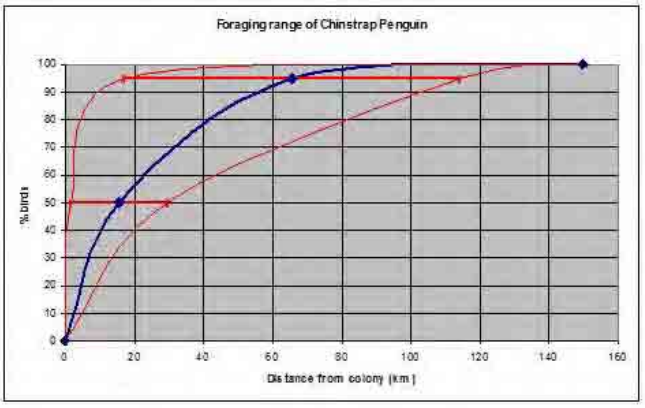

Figure 4a: Macaroni foraging range estimates with standard deviation bars

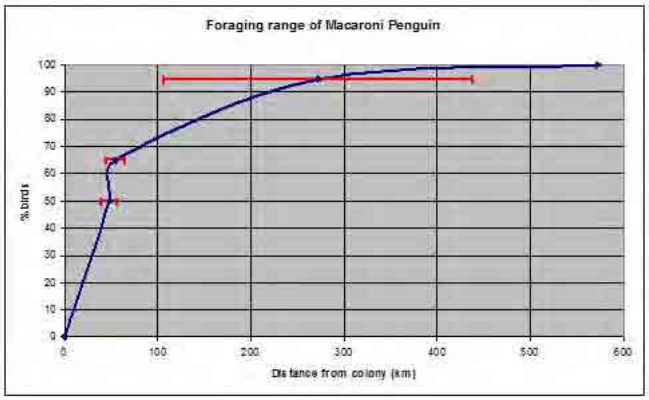

Figure 4b: Macaroni foraging range estimates with standard deviation curves

For each species, the proposed distance *d* in the table below indicates the limit of the model foraging area around a breeding site.

Table 2: Distances to define the extent of model foraging areas at IBA breeding sites.

Bird species	No. data entries on bird foraging range (total)	No. data entries on mean bird foraging range	Average of 'mean' foraging range values (distance d_m, km)	Standard deviation of d_m (km)	Proposed distance *d* to define limit of model foraging area from breeding site (km)	% of birds expected to forage within *d* km of breeding site
Adélie Penguin	90	57	26	23.5	50	50 – 95 %
Gentoo Penguin	31	17	16	14.7	31	50 – 97 %
Chinstrap Penguin	17	9	16	13.9	30	50 – 98 %
Macaroni Penguin	18	7	48	8.8	57	50 – 81 %

Discussion

The results displayed in Table 2 indicate that the data on foraging ranges for each species trigger wide variations in the estimates of birds foraging within the specified distances from a breeding site. This high level of uncertainty implies either:

- more data entries are needed, and / or;
- some of the underlying data are statistical outliers, and / or;
- the data have been combined in a way that increases the error of subsequent statistical comparisons, e.g. the data may be drawn from different stages in the breeding cycle.

To ensure the extent of model foraging areas is an accurate and reliable indicator of the foraging areas important to birds at a breeding site, it is important to take into account the variation in the underlying data. The approach put forward in this paper attempts to achieve this by adding the standard deviation to the mean foraging range for each species to derive a suggested limit for the model foraging areas.

An indication of the maximum possible extent a bird species may forage from a site could be given to ensure important foraging sites falling outside of the model foraging areas are not entirely overlooked. One approach might be to mark the area extending to proposed distance 'd' (see Table 2) from a breeding site and, from the limit of this area, show in a lighter shade the area extending to the maximum recorded foraging range for the bird species present.

Several factors relating to the collection of foraging range data should be considered when combining data for statistical comparisons. In particular, seasonal variations in the foraging distances of some bird species require consideration. Birds may forage to different distances during the pre-laying, incubation, brood-guard, crèche and pre-moult stages, and large differences between foraging range extents could induce a high variance in the foraging data for some species (Richard Phillips (BAS), pers. comm., 08/06/2010). If sufficient data were available, it might be possible to map foraging ranges to reflect variations in foraging patterns at different points in the breeding season. However, many publications do not specify the seasonal stage at which their data were collected and consequently there are only a small number of data entries that could be used for this purpose presently in the BirdLife database. Variations in foraging data also reflect the differences between bird foraging patterns at distinct breeding sites. Birds may regularly forage further afield at one site than at another depending on the availability of prey, differences in sea-ice extent, and other factors. In the context of the present paper, the standard deviation curves can be

thought to, at least partially, represent the variations in foraging ranges over a breeding cycle and at distinct colonies.

The accuracy of the percentage values assigned to measurements of the number of birds foraging within specified distances is unknown. These percentages were defined to help categorise and compare published foraging range data. However, the percentages selected may not accurately reflect foraging estimates extracted from studies where measurement types were poorly defined. This factor is likely to contribute to the degree of variation associated with average foraging range estimates for each measurement type.

Model foraging areas can indicate the regions significant to breeding birds around IBAs. It is not immediately clear whether it would be appropriate to include these foraging range areas within the area formally defined as an IBA, or identify them as a separate IBA, or designate them as an IBA 'dependency area'. However, it is important to have some appreciation of the likely regions on which IBAs depend, as these areas need to be taken into consideration when faced with key management decisions (e.g. on fishing quotas, oil spill management plans, shipping lanes, renewable energy projects etc). Therefore, it could be useful to develop an indicator of the approximate foraging areas associated with IBAs, even if these are not formally part of the designated sites. If portrayed appropriately, given the methodological limitations that exist, such marine components could help to guide management and encourage further research in order to define these areas with more certainty in the future.

For sites where more than one bird species is present, several different overlapping foraging areas may be identified. These could either be merged and displayed as one model foraging area for all species considered, or these could be displayed to show the model foraging areas pertaining to each species (overlapping foraging areas can be represented using transparent overlays). The best approach is likely to vary according to whether the marine area is being identified as an IBA, in which case the preferred BirdLife approach is that the species with the largest foraging range sets the boundary, or whether foraging areas are only indicative for each species, in which case concentric circles could be a better approach. In either case, retaining the species-specific foraging areas is likely to be prove beneficial in the event that management plans are developed, in which case it may be useful to identify the variation in distribution, threats and management needs for different species, e.g. to facilitate zoning of different activities within a site.

Conclusion

The present analysis puts forward an approach to defining model foraging areas for Adélie, Chinstrap, Gentoo and Macaroni penguins based on data compiled by BirdLife in a foraging range database. This approach uses estimates of the mean foraging range for each species to provide a percentage range of birds likely to forage within a specified distance of a breeding site. This method has limitations, such as providing only a broad percentage range of birds present within a foraging area. However, to date this represents the best method available to indicate the typical foraging ranges for the species considered within the limits of the data available.

Applying these results to the Antarctic IBA network would show the approximate foraging areas upon which breeding colonies of Adélie, Chinstrap, Gentoo or Macaroni penguins depend. At the least, this approach would help to identify the regions associated with IBAs where management should be particularly cognisant of the potential impact of human activities on birds.

Owing to budget and time limitations on this project, model foraging ranges have not yet been applied to the IBAs identified by the current analysis. This could be undertaken at a future stage should resources become available.

Identification of Important Bird Areas in the Antarctic

Final List of IBAs: Antarctic Peninsula, South Shetland Islands, South Orkney Islands

Cape Petrel chick, Signy Island (C. Harris)

17 May 2011

Foreign & Commonwealth Office

BirdLife INTERNATIONAL

era

Criteria for deriving the Final IBA List

Final identification of the IBAs requires definition of two main factors:

1. the number of birds breeding at each site and whether these exceed the BirdLife designation criteria; and
2. the spatial extent, or boundary of the IBA.

Numerical Criteria for IBA Listing

An IBA was identified where:

1. The count at an individual colony meets or exceeds the population thresholds set by BirdLife International for any of the species present at a site for any of the global Level A IBA criteria;
2. The result of summing the count at an individual colony for one or more species contained within a 5 km^2 area, or breeding on a landmass ≤ 5 km^2, exceeds the species numbers threshold for global Level A criteria A4iii.
3. Individual colonies have been defined in accordance with the definitions given in the source data.

Note:
The count for each site is based on totals given in available source data for individual colonies. In some cases individual colonies are well-known and defined within a specific location, while in others both the numbers and the spatial delineation of the colony are only poorly known. In many cases the spatial extent of the colony is not known at all. Occasionally populations have been estimated over a number of colonies which may be widely separated (e.g. by up to several kilometres), although only a total for the area is given in the source data.

Thus, in many cases data on numbers have been pre-aggregated at source, and there is no means to disaggegate according to specific colonies. Moreover, where specific colony boundaries are unknown, it has been assumed that the colony may be breeding on any part of the ice-free land available at the locality where they have been reported (with the exception of Emperor Penguins, all Antarctic birds require ice-free land on which to breed).

In addition, in many cases the mapping of sites is poor and the specific location of an outcrop or small island on which birds are breeding is poorly described or uncharted. In these cases the location has to be estimated from available evidence, such as from reports, descriptions, maps and satellite images.

In view of these difficulties, there was a need to define criteria for estimating the breeding area of colonies, and hence the boundary of the IBA.

Criteria for defining the IBA boundary

Having identified IBAs based on population criteria, further criteria are need to define the spatial extent of the IBA boundary. Particular rules were defined for IBAs that coincide with existing protected areas because these are distinct, legally agreed areas that have management plans to regulate activities within their boundaries. In the case of Antarctic Specially Protected Areas (ASPAs), permits are required for entry. In most cases where an IBA has been identified within an ASPA, the site has been desginated at least in part because of its ornithological values.

If the IBA occurs within an Antarctic Specially Protected Area (ASPA):

1. The boundary of the ASPA is used to define the IBA boundary.

If the IBA occurs within an Antarctic Specially Managed Area (ASMA):

1. Where the IBA occurs within a management zone designated by the ASMA, the boundary of the management zone is used to define the IBA boundary. For example, a number of Restricted Zones within ASMA No. 7 Palmer Basin and SW Anvers Island are identified as IBAs and the zone boundaries are used to define the IBA boundary.
2. Where the IBA occurs on distinct islands and one or more islands are contained within designated management zones, the IBA boundary is defined by the boundary of the management zones joined using the shortest practical perimeter.

If the IBA occurs outside of an ASPA or management zone within an ASMA:

1. Where data for birds triggering an IBA have been pre-aggregated over distinct islands, ice-free areas or a combination of ice-free areas and offshore islands and rocks, covering a total land area of > 5 km^2, the IBA boundary will be drawn using the shortest perimeter such that all land areas over which data are aggregated are incorporated into the IBA, adjusting the perimeter where appropriate so that it is follows the land coastline and/or limit of the ice-free areas where these features fall inside the area bounded by the shortest perimeter.
2. Where a breeding site triggering an IBA is located on a landmass not present in the Antarctic Digital Database base map, a circular limit with a 1.26 km radius around the point marking the breeding site centroid will be used to define the IBA boundary (i.e. 5 km^2);
3. Where birds triggering an IBA are known or thought to breed on an island of ≤ 5 km^2, the island coastline will define the IBA boundary;
4. Where birds triggering an IBA are known or thought to breed on distinct islands within an island group and the island group covers a land area of ≤ 5 km^2, the IBA boundary will be drawn using the shortest perimeter such that all islands within the group are incorporated into the IBA, adjusting the perimeter where appropriate so that it follows the island coastline. Note: where birds triggering an IBA breed both within an island group and on land outside of the island group, and the total land area for the island group + outside islands containing breeding birds covers ≤ 5 km^2, the island group and the islands containing breeding birds outside the island group will be included in the IBA;
5. Where birds triggering an IBA are known or thought to breed on distinct ice-free areas with a contained geographic area and the ice-free areas covers a land area of ≤ 5 km^2, the IBA boundary will be drawn using the shortest perimeter such that all ice-free areas on which birds breed are incorporated into the IBA, adjusting the perimeter where appropriate so that it follows the coastline or limit of an ice-free area;
6. Where an IBA centroid is located on an ice-covered area on an island or other landmass that is > 5 km^2, the limit of a 1.26 km radius around the IBA centroid, clipped to both the land coastline and the limit of the ice-free area, will be used to define the IBA boundary.
7. Where two or more IBAs identified by the source data were less than 500 m in distance apart, these sites were assigned to belong within a single IBA comprising all sites.

It is recognised that the criteria used can result in clusters of IBAs within ‘close’ proximity. It would be entirely possible to vary the minimum separation distance between IBAs to obtain an alternative result, for example by merging those sites that are less than 1 km, or perhaps 10 or 20 km apart. Clearly, this would result in fewer, although larger IBAs.

It is acknowledged that the 500 m threshold used as a criteria for merging sites is arbitrary. The approach taken seeks to preserve as far as practicable the results offered given the resolution of the source data, and to minimise merging. However, where two or more IBAs had been identified less than 500 m apart, there seemed little practical benefit to designating the sites separately. Practical management of the sites, should it be required, would most likely need to consider such adjacent sites as a unit. Of course, this could be argued similarly for greater separation distances: our intention is to remain faithful to the data as it exists at source, while being pragmatic, although we recognise that other minimum separation distances could be used.

If evidence is brought to light which supports the case to merge identified IBAs into larger units based on alternative criteria, then the analysis could be re-run to reflect the best scientific case for appropriate spatial units. For example, evidence for merging IBAs may appear from new studies being conducted on the genetic similarities of spatially distributed populations of the same species (T. Hart, pers. comm., 2011), and further studies on foraging ranges and identified feeding grounds out to sea, as opposed to concentrating on breeding localities, may inform alternative spatial configurations for Antarctic IBAs in the future. For the moment, however, their remains insufficient data on which to base such alternative configurations, and there is a need for further research before a practical set of IBAs boundaries could be defined that take such factors into account.

Triggering Species at Each Site

Antarctic Peninsula

New IBA number	Location	Trigger species (breeding pairs)	IBA criteria satisfied	Data source
1	Stonington Island	Imperial Shag (135)	A4i	Imperial Shags: counted on 06/02/2007, Lynch et al. (2008)
2	Dion Islands	Imperial Shag (500)	A4i	Imperial Shag: counted in 1980s, S & J Poncet pers comm.
3	Avian Island	Adélie Penguin (35,600), Imperial Shag (670), South Polar Skua (880)	A4i, A4ii, A4iii	South Polar Skua: count in 2004; W. Fraser pers comm in Ritz et al. (2005). Adélie Penguins: counted in 1978, Woehler (1993).
4	Ginger Islands	Imperial Shag (275)	A4i	Imperial Shag: counted in 1980s, S & J Poncet pers comm.
5	Cape Evensen	Imperial Shag (180)	A4i	Imperial Shag: counted 1990, S & J Poncet unpub.
6	Island north of Dodman Island	Imperial Shag (183)	A4i	Imperial Shag: counted 1984, S & J Poncet unpub.
7	Armstrong Reef	Imperial Shag (525), Adélie Penguin (12,800)	Ai, A4iii	Imperial Shag: counted in 1989-90, S & J Poncet (unpub.). Adélie Penguins: counted in 1984, Woehler (1993)
8	Islet south of Bates Island	Imperial Shag (150)	A4i	Imperial Shag: counted 1986, S & J Poncet unpub.
9	Uruguay Island	Imperial Shag (203)	A4i	Imperial Shag: counted 1986, S & J Poncet, unpub.
10	Petermann Island	Gentoo Penguin (3020)	A1	Gentoo Penguins: based on N1 count made 14 Dec 2009, H. Lynch pers. comm. (2010).
11	Pursuit Point, Wiencke Island	Imperial Shag (140)	A4i	Imperial Shag: counted on 06/02/1987, Poncet & Poncet (unpub.)
12	Cormorant Island	Imperial Shag (729)	A4i	Imperial Shag: counted in 1985, Morton & Heimark pers. comm.
13	Northern Arthur Harbour area	Adélie Penguin (11,257)		Adélie Penguins: counted in 1984-85, Parmelee & Parmelee (1987) in Woehler (1993).
14	Litchfield Island	South Polar Skua (up to 50 pairs)	A4ii	South Polar Skua: up to 50 pairs breeding on Litchfield Island according to ASPA No. 113 Management Plan (with confirmation on estimates given by Fraser, pers comm. 2009), although 'the number of breeding pairs fluctuates widely from year to year'.
15	Joubin Islands	Imperial Shag (250)	A4i	Imperial Shag: counted in 1987, S & J Poncet, unpub.
16	Dream Island	Adélie Penguin (11,263),	A4iii	Adélie Penguins: counted in 1985, Parmelee & Parmelee (1987) in Woehler

New IBA number	Location	Trigger species (breeding pairs)	IBA criteria satisfied	Data source
		Chinstrap Penguin (200)		(1993). Chinstrap Penguins: counted in 1990, S & J Poncet pers. comm. in Woehler (1993).
17	Islet south of Gerlache Island	Gentoo Penguin (3000)	A1	Gentoo Penguins: counted in 1987, Woehler (1993).
18	Cuverville Island	Gentoo Penguin (6468)	A1, A4ii	Gentoo Penguins: counted 23 Dec 2009, Lynch pers. comm. (2010).
19	Islet east of Guépratte Island	Imperial Shag (220)	A4i	Imperial Shag: counted in 1987, S & J Poncet unpub.
20	Bluff Island	Imperial Shag (180)	A4i	Imperial Shag: counted in 1989; S & J Poncet unpub.
21	Cierva Point and offshore islands	South Polar Skua (93)	A4ii	South Polar Skua: counted in 1996, Quintana et al. (2000)
22	Trinity Island southwest	Imperial Shag (145)	A4i	Imperial Shag: counted in 1986, S & J Poncet, unpub.
23	Wollaston Point, Trinity Island	Southern Fulmar (10,000 with min 2000 and max 20,000)	A4ii, A4iii	Southern Fulmar: recorded in1987 by Poncet & Poncet (unpub.) breeding on NW corner of Trinity Island, listed in Creuwels et al. (2007) with estimates of btw 2000 and 20,000 pairs.).
24	Pearl Rocks	Imperial Shag (170)	A4i	Imperial Shag: counted in 1987, S & J Poncet, unpub.
25	Tupinier Islands	Chinstrap Penguin (14,130), Imperial Shag (34)	A4iii	Chinstrap Penguins and Imperial Shag: counted in 1990, S & J Poncet pers. comm.
26	Duroch Islands	Gentoo Penguin (3500)	A1, A4ii	Gentoo Penguins: counted in 1990, S & J Poncet pers comm.
27	Gourdin Island	Adélie Penguin (14,334)	A4iii	Adélie Penguins: counted in 1997, Naveen (2003)
28	Hope Bay	Adélie Penguin (123,850)	A4ii, A4iii	Adelie Penguins: counted in 1985, Woehler (1993)
29	Brown Bluff	Adélie Penguin (20,000)	A4ii, A4iii	Adélie Penguins: counted in 1996, R. Naveen pers. comm.
30	Snow Hill Island	Emperor Penguin (4200)	A4ii	Emperor Penguins: 4000-4200 estimated in 2004, Todd et al. (2004)
31	Penguin Point, Seymour Island	Adélie Penguin (16,015 +/- 10%)	A4iii	Adélie Penguins: counted on 21/12/2009, H. Lynch pers. comm. (2010).
32	Cockburn Island	Imperial Shag (800)	A4i	Imperial Shag: counted on 19/11/2006, Lynch et al. (2008).
33	Devil Island	Adélie Penguin (14,681 +/-	A4ii	Adélie Penguins: 14,681 nests counted on 12 Dec 2008, H. Lynch

New IBA number	Location	Trigger species (breeding pairs)	IBA criteria satisfied	Data source
		5%)		(Oceanites) pers. comm. (2010).
34	Paulet Island	Adélie Penguin (95,000 at 3 colonies), Imperial Shag (465)	A4i, A4ii, A4iii	Imperial Shag: counted on 18/02/2007 in Lynch et al. (2008); Adélie Penguins counted in 1999 by Naveen (2003)
35	Eden Rocks	Adélie Penguin (44,249 – 49,460)	A4ii, A4iii	Adélie Penguins: counted in 1996, Naveen (2003)
36	Danger Islands	Adélie Penguin (~295,000)	A4ii, A4iii	Adélie Penguins: c.295,000 counted on Heroina Island in 1996, Naveen (2003); unclear whether count is for Heroina Island or all of Danger Islands. Therefore, we include all of the Danger Islands (land area < 5 km^2).
37	D'Urville Monument, Joinville Island	Adélie Penguins (~ 10,000)	A4iii	Adélie Penguins: 10,000 pairs estimated on 24/01/2006 in Lynch et al. (2008)
38	Madder Cliffs	Adélie Penguin (~22,000)	A4ii	Adélie Penguin: counted on 21 Jan 2003, H. Lynch (Oceanites) pers. comm. (2010). "All we have is a very rough estimate of 22,000 nests."

South Shetland Islands

New IBA number	Location	Trigger species (breeding pairs)	IBA criteria satisfied	Data source
39	Cape Garry, Low Island	Chinstrap Penguin (110,000)	A4ii, A4iii	Chinstrap Penguins: counted in 1987, Shuford & Spear (1988) in Woehler (1993)
40	Jameson Pt, Low Island	Chinstrap Penguin (25,000)	A4iii	Chinstrap Penguins: counted in 1987, Shuford & Spear (1988) in Woehler (1993)
41	Cape Wallace, Low Island	Chinstrap Penguin (150,000)	A4ii, A4iii	Chinstrap Penguins: counted in 1987, Shuford & Spear (1988) in Woehler (1993)
42	Cape Hooker, Low Island	Chinstrap Penguin (10,000)	A4iii	Chinstrap Penguins: counted in 1987, Shuford & Spear (1988) in Woehler (1993)
43	Vapour Col, Deception Island	Chinstrap Penguin (75,000)	A4ii, A4iii	Chinstrap Penguin: counted in 1987, Shuford & Spear (1988)
44	Baily Head, Deception Island	Chinstrap Penguin (100,000)	A4ii, A4iii	Chinstrap Penguin: counted in 1989, S & J Poncet pers. comm.
45	Byers Peninsula, Livingston Island	Antarctic Tern (1760), Kelp Gull (449)	A4i	Antarctic Tern: 1760 pairs recorded at Byers Peninsula in 1965 (White (1965) in Croxall – BAS Internal Records – in ASPA No. 126 Management Plan). Kelp Gull: 449 pairs recorded at Byers Peninsula in 1965 (White (1965) in Croxall – BAS Internal Records – in ASPA No. 126 Management Plan)
46	Cape Shirreff, Livingston Island	Chinstrap Penguin (10,400)	A4iii	Chinstrap and Gentoo Penguins: counted in 1987, Shuford & Spear (1988) in Woehler (1993)
47	Barnard Point, Livingston Island	Chinstrap Penguin (13,000)	A4iii	Chinstrap Penguins: counted in 1987, S & J Poncet pers. comm. in Woehler (1993)
48	Half Moon Island	South Polar Skua (51)	A4ii	51 pairs recorded in 1995/96 by Garcia Esponda (2000).
49	Yankee Harbour, Greenwich Island	Gentoo Penguin (4918)	A1, A4ii	Gentoo Penguins: counted in 2003, Lynch et al. (2008)
50	Heywood Island	Chinstrap Penguin (90,000)	A4ii, A4iii	Chinstrap Penguins: counted in 1987, Poncet & Poncet unpub.
51	Harmony Point,	Chinstrap Penguin (100,685), Gentoo Penguin	A1, A4ii, A4iii	Gentoo Penguins & Greater Sheathbill counted in 1995-96, Silva et al. (1998). Southern Giant Petrels: Nester Coria unpub. (W. Papworth, pers.

New IBA number	Location	Trigger species (breeding pairs)	IBA criteria satisfied	Data source
	Nelson Island	(3347), Southern Giant Petrel (485), Greater Sheathbill (144)		comm., 2010). Chinstrap Penguins: 89,685 pairs counted in 1995-96 at Harmony Point, Silva et al. (1998) and 11,000 pairs counted in 1987 at The Tor, Shuford & Spear (1998) in Woehler (1993).
52	Potter Peninsula, King George Island	South Polar Skua (63), Adélie Penguin (14,554)	A4ii, A4iii	South Polar Skua: counted in 2002, Ritz et al. (2006). Adélie Penguins: counted 1987-89, Aguirre (1995).
53	Ardley Island, King George Island	Gentoo Penguin (3410)	A1	Gentoo Penguins: counted in 1986/7, J. Valencia pers. comm.
54	Stigant Point, King George Island	Chinstrap Penguin (10,893)	A4iii	Adélie Penguin: counted in 1980 in Woehler (1993).
55	Davey Point, King George Island	Chinstrap Penguin (19,690)	A4iii	Chinstrap Penguins: counted in 1980, Jablonski (1984) in Woehler (1993).
56	Tartar Island, King George Island	Chinstrap Penguin (18,640)	A4iii	Chinstrap Penguins: counted in 1980, Jablonski (1984) in Woehler (1993)
57	Kellick Island, King George Island	Chinstrap Penguin (26,890)	A4iii	Chinstrap Penguins: counted in 1980, Jablonski (1984) in Woehler (1993)
58	Owen Island, King George Island	Chinstrap Penguin (21,551)	A4iii	Chinstrap Penguins: counted in 1980, Jablonski (1984) in Woehler (1993)
59	Pottinger Point, King George Island	Chinstrap Penguin (55,861)	A4ii, A4iii	Chinstrap Penguins: counted in 1980, Jablonski (1984) in Woehler (1993).
60	False Round Point, King George Island	Chinstrap Penguin (49,870)	A4ii, A4iii	Chinstrap Penguins: counted in 1980, Jablonski (1984) in Woehler (1993)
61	Milosz Point, King George Island	Chinstrap Penguin (17,150)	A4iii	Chinstrap Penguins: counted in 1980, Jablonski (1984) in Woehler (1993)

New IBA number	Location	Trigger species (breeding pairs)	IBA criteria satisfied	Data source
62	North Foreland, King George Island	Chinstrap Penguin (23,286)	A4iii	Chinstrap Penguins: counted in 1980, Jablonski (1984) in Woehler (1993)
63	Cape Melville, King George Island	Chinstrap Penguin (16,278)	A4iii	Chinstrap Penguins: counted in 1980, Jablonski (1984) in Woehler (1993)
64	Penguin Island, King George Island	Southern Giant Petrel (634), Adélie Penguin (2441), Chinstrap Penguin (7581)	A4ii, A4iii	Southern Giant Petrels: counted Dec 1999, in Naveen (2000). Adélie Penguins: counted in 1997, Naveen (2003). Chinstrap Penguins: counted in 1980, Jablonski (1984) in Woehler (1993).
65	Lions Rump, King George Island	Adélie Penguin (12,345)	A4iii	Adélie Penguins: counted in 1980, Jablonski (1984) in Woehler (1993)
66	Western Shore of Admiralty Bay, King George Island	Adélie Penguin (15,151 nests)	A4iii	Adélie Penguins: counted in 1994-95, Management Plan for ASPA No. 128 (2000).
67	Aspland Island and Eadie Island	Chinstrap Penguin (8650), Chinstrap Penguin (5150), Southern Fulmar (c.9800) Southern Fulmar (c.8500)	A4iii	Southern Fulmar: count made in 1977; Furse (1978) in Creuwels et al. (2007). Chinstrap Penguins: counted in1977, Croxall & Kirkwood (1979).
68	O'Brien Island	Chinstrap Penguin (21,400), Southern Fulmar (c.7880)	A4iii	Southern Fulmar: count made in 1977; Furse (1978) in Creuwels et al. (2007). Chinstrap Penguins: counted in 1977, Croxall & Kirkwood (1979).
69	Gibbs Island East	Chinstrap Penguin (30,160), Macaroni Penguin (1672)	A1, A4iii	Chinstrap & Penguins: counted in 1977, Croxall & Kirkwood (1979).
70	Cape Lookout, Elephant Island	Chinstrap Penguin (11,755)	A4iii	Chinstrap Penguins: counted in 1971, Croxall & Kirkwood (1979)
71	Point Wordie, Elephant Island	Chinstrap Penguin (12,455)	A4iii	Chinstrap Penguins: counted in 1971, Croxall & Kirkwood (1979)
72	Saddleback Point, Elephant Island	Chinstrap Penguin (10,250)	A4iii	Chinstrap Penguins: counted in 1971, Croxall & Kirkwood (1979)

New IBA number	Location	Trigger species (breeding pairs)	IBA criteria satisfied	Data source
73	East of Nelly Point, Elephant Island	Chinstrap Penguin (24,430)	A4iii	Chinstrap Penguins: counted in 1971, Croxall & Kirkwood (1979)
74	Mount Elder, Elephant Island	Chinstrap Penguin (14,860)	A4iii	Chinstrap Penguins: counted in 1971, Croxall & Kirkwood (1979) (Shoreline to the east of Mount Elder)
75	Seal Islands	Chinstrap Penguin (20,000), Macaroni Penguin (194), Southern Giant Petrel (25), Imperial Shag (40)	A4iii	Chinstrap & Macaroni Penguins: counted in 1988-89, Bengtson pers comm. in Woehler (1993). Imperial Shag: counted in 1971, Bruce & Furse (1973). Southern Giant Petrel: counted in 1971, Patterson et al. (2008).
76	Cape Bowles, Clarence Island	Chinstrap Penguin (112,700)	A4ii, A4iii	Chinstrap Penguins: 33,000 counted at Cape Bowles, 58,500 at Pink Pool Point, 21,200 at Thunder Bay, in 1977, Croxall & Kirkwood (1979)
77	Craggy Point, Clarence Island	Southern Fulmar (> 10,000), Chinstrap Penguin (10,370), Macaroni Penguin (3350)	A1, A4ii, A4iii	Southern Fulmar: > 10,000 estimated to breed at Craggy Point in 1977, Furse (1978). Chinstrap & Macaroni Penguins: counted in 1977, Croxall & Kirkwood (1979).
78	Chinstrap Cove, Clarence Island	Chinstrap Penguin (20,701)	A4iii	Chinstrap Penguins: counted in 1977, Croxall & Kirkwood (1979)
79	Fur Seal Point, Clarence Island	Chinstrap Penguin (70,450), Southern Fulmar (> 10,000)	A4ii, A4iii	Chinstrap Penguins: counted in 1977, Croxall & Kirkwood (1979). Southern Fulmar: counted in 1977, Furse (1978).

South Orkney Islands

New IBA number	Location	Trigger species (breeding pairs)	IBA criteria	Data source
80	Cape Whitson, Laurie Island	Chinstrap Penguin (12,755)	A4iii	Chinstrap Penguins: counted in 1994, N. R. Coria pers. comm.
81	Point Martin, Laurie Island	Adélie Penguin (26,038), Chinstrap Penguin (13,394)	A4ii, A4iii	Chinstrap & Adélie Penguins: Adélie Penguins and Chinstrap Penguins counted in 1994, N. R. Coria pers. comm.
82	Islet SW of Cape Davidson, Laurie Island	Imperial Shag (225)	A4i	Imperial Shag: counted 1983, S & J Poncet unpub.
83	Eillium Island (off Laurie Island)	Chinstrap Penguin (21,400)	A4iii	Chinstrap Penguins: counted in 1983, Poncet & Poncet (1985) in Woehler (1993).
84	Cape Robertson, Laurie Island	Chinstrap Penguin (19,745)	A4iii	Chinstrap Penguins: counted in 1994, N. R. Coria pers. comm.
85	Pirie Peninsula, Laurie Island	Chinstrap Penguin (14,277)	A4iii	Chinstrap Penguins: counted in 1994, N. R. Coria pers. comm.
86	Ferguslie Peninsula, Laurie Island	Chinstrap Penguin (16,600)	A4iii	Chinstrap Penguins: counted in 1983, Poncet & Poncet (1985).
87	Watson Peninsula, Laurie Island	Chinstrap Penguin (10,893)	A4iii	Chinstrap Penguins: counted in 1994, N.R. Coria pers. comm.
88	Fraser Point, Laurie Island	Chinstrap Penguin (11,200)	A4iii	Chinstrap Penguins: counted in 1983, Poncet & Poncet (1985).
89	Buchanan Point, NE coast Laurie Island	Chinstrap Penguin (10,300)	A4iii	Chinstrap Penguins: counted in 1983, Poncet & Poncet (1985).
90	Ferrier Peninsula / Graptolite Island, Laurie Island	Adélie Penguin (61,000), Adélie Penguin (30,000), Chinstrap Penguins (14,200)	A4ii, A4iii	Penguins: counted in 1983, Poncet & Poncet (1985) in Woehler (1993).
91	Atriceps Island, Robertson Islands	Imperial Shag (524)	A4i	Imperial Shag: counted in 1988, ref 62 in WAM
92	Robertson Islands North	Chinstrap Penguin (34,870)	A4iii	Chinstrap Penguins: 14,750 pairs on Matthew I., 2100 on Coffers I., 11,500 on two islands South of Matthew I., 6520 on Steepholm Is & Skilling I. combined, counted in 1983, Poncet & Poncet (1985).
93	Southern Powell Island and adjacent islands	Gentoo Penguin (8057), Imperial Shag (144), Adélie Penguin (16,750), Chinstrap Penguin (28,105), Southern Giant	A1, A4i, A4ii, A4iii	Penguins: counted in 1983 in Poncet & Poncet (1985). Southern Giant Petrel: Patterson et al. (2008). Imperial Shag: counted in 1988, Rootes (1988) ? - ref 62 in WAM.