

The nature and extent of terrestrial protected area coverage on the UK's Overseas Territories

THEMATIC SECTION
Humans and Island
Environments

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SUMMARY

Signatories to the Convention on Biological Diversity (CBD) agreed to the effective protection of at least 17% of the terrestrial environment by 2020 (Aichi Target 11). Here, we assess the coverage of terrestrial protected areas (land protected by legislation) on the UK's Overseas Territories. These 14 Territories are under the sovereignty of the UK, a signatory of the CBD, and are particularly biodiverse. Eight Territories have protected areas covering 17% or more of their land, but the extent of protection across these Territories as a whole is low, with only 4.8% of this land designated as protected. This protection covered 51% of sites already identified as of conservation importance (Important Bird and Biodiversity Areas), although only 8% of the area of these sites was protected. The expansion of effective protection to meet the 17% target provides an opportunity to capture the most important sites for conservation. Locally led designation will require an improvement in knowledge of the distribution and density of species. This, together with measures to ensure that the protection is enforced and effective, will require provision of resources. This should be seen as an investment in the UK meeting its obligations to Aichi Target 11.

Keywords: site conservation, IBAs, UKOTs, Aichi targets, CBD, ecoregions

INTRODUCTION

It is estimated that site-based approaches to conservation are appropriate for the long-term maintenance of *c.* 80% of species of mammals, birds and reptiles (Boyd *et al.* 2008). Protected areas, which are areas of land or sea with some degree of legislative protection, are cornerstones of international conservation (Chape *et al.* 2005), although other approaches,

such as community management, also have a role to play in site conservation (Butchart *et al.* 2015). The importance of site-based conservation is acknowledged in Aichi Target 11 of the Convention on Biological Diversity (CBD), which requires world governments to effectively protect at least 17% of terrestrial and inland water and 10% of coastal and marine areas by 2020 (CBD 2011). In addition, and among other things, Target 11 emphasizes the need for this protection to encompass 'areas of particular importance for biodiversity and ecosystem services' and to be 'ecologically representative' (CBD 2011). Assessments of progress towards this target for terrestrial protected areas (Tittensor *et al.* 2014; Butchart *et al.* 2015) suggest that, while many countries have met or are on target to protect over 17% of their land with protected areas, most (62%) would not meet the target of coverage by 2020, and there is a particular need to expand coverage to protect the most valuable sites.

The UK government is a signatory of the CBD, and this extends to the UK's Overseas Territories (UKOTs), for which it is the 'overarching signatory'. The UKOTs are dispersed islands (except Gibraltar) that support high numbers of globally threatened species (Churchyard *et al.* 2016) that are particularly at risk because islands are highly vulnerable to invasive species, development and climate change impacts (Dawson *et al.* 2015). Although the full range of taxa remains unknown, these Territories are estimated to hold over 100,000 native island species and 3300 single-island endemics (Churchyard *et al.* 2016). Approximately 75% of the species within the UKOTs, for which an International Union for Conservation of Nature (IUCN) Red List of Threatened Species assessment has been carried out, are globally threatened (Churchyard *et al.* 2016). By comparison, the global figure is *c.* 30% (IUCN 2016). The protected area coverage of the most important sites for biodiversity in the UKOTs is unknown, but, given the high conservation value of these islands, this is vital information if the UK's contribution to Aichi Target 11 is to be understood and fulfilled.

The CBD has been officially extended to six Overseas Territories (OTs; British Virgin Islands, Cayman Islands, Falkland Islands, Gibraltar, Saint Helena, Ascension and Tristan da Cunha, South Georgia and the South Sandwich Islands). Under the 2001 Environment Charters (agreements

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between the UK and OT Governments), the UK has a responsibility to ‘help to ensure that the Overseas Territories have the legislation, institutional capacity and mechanisms needed to meet international obligations’ (DEFRA 2009). This UK responsibility is further extended in the UK Government’s UK Overseas Territories Biodiversity Strategy (DEFRA 2009), which states that the relevant UK Government departments ‘will provide effective, co-ordinated UK Government support for the conservation and sustainable use of biodiversity in the Territories.’ The extent to which the Aichi Targets apply to individual UKOTs therefore varies, and in some cases is still under discussion, but the 17% terrestrial protection target is still held to be useful as an overall indicator of ambition. The majority of previous studies of progress towards Aichi Target 11 have concentrated upon the global (e.g. Tittensor *et al.* 2014) or regional (Beresford *et al.* 2016) coverage of the protected area network (but see Mallari *et al.* 2016 on the Philippines). Global or regional assessments might be useful for describing the broad patterns of progress towards CBD targets, but they cannot inform priorities at a smaller geographic scale. It will be at these smaller geographic scales, especially nationally, that information is needed in terms of setting priorities and targeting resources. Such assessments are particularly important on small islands that hold a disproportionately large proportion of the world’s threatened species, the distributions of which remain poorly documented (Kingsford *et al.* 2009) and where the balancing of conservation priorities, environmental protection and economic development is particularly challenging (Teelucksingh *et al.* 2013).

Here, in order to inform on progress towards the CBD and the implementation of UK Government biodiversity conservation support, we examine patterns in the coverage of terrestrial protected areas in the UKOTs. We quantify the current level of protection afforded to the terrestrial areas, the extent to which this captures areas currently identified as being of high biodiversity importance and the extent to which the protected areas contribute to an ecologically representative global network. To assess protected area coverage with respect to sites of high biodiversity importance, we quantify their overlap with Important Bird and Biodiversity Areas (IBAs; e.g. Fishpool & Evans 2001). IBAs are a global network of over 10,000 sites of a size amenable to management that are identified based on a semi-objective assessment of their importance for the long-term conservation of birds, but many of which are also important for other taxa (e.g. Pain *et al.* 2005). They have been identified based on capturing populations of globally threatened species, assemblages of range-restricted species, assemblages of biome-restricted species and sites that are important for congregations of populations or species. IBAs are widely used as a measure of biodiversity value elsewhere (e.g. Beresford *et al.* 2013). IBAs form the only network of sites of conservation importance to have been identified across all UKOTs, in contrast, for example, with Important Plant Areas that exist for UKOTs in the South Atlantic only. To determine whether the protected



Figure 1 Location of the UK’s Overseas Territories where protected area coverage was assessed. 1: Anguilla; 2: Ascension Island; 3: Bermuda; 4: British Indian Ocean Territory; 5: British Virgin Islands; 6: Cayman Islands; 7: Cyprus Sovereign Base Areas; 8: Falkland Islands; 9: Gibraltar; 10: Montserrat; 11: Pitcairn Islands; 12: Saint Helena; 13: South Georgia and the South Sandwich Islands; 14: Tristan da Cunha; 15: Turks and Caicos Islands.

area coverage is ecologically representative, we quantify their overlap with World Wide Fund for Nature (WWF) ecoregions (Olsen *et al.* 2001), a classification that, like IBAs, has been used in previous studies (e.g. Tear *et al.* 2014). These ecoregions are much more extensive than IBAs and represent areas with geographically distinct assemblages of species, natural communities and environmental conditions (Olsen *et al.* 2001). The results of our analysis will provide a transparent and consistent basis to implementing improvements in biodiversity protection on the UKOTs, particularly as new data become available.

METHODS

We consider 15 UKOT jurisdictions (Fig. 1). Although Ascension Island, Saint Helena and Tristan da Cunha are one administrative unit, we have treated each separately because each island group is biogeographically different. We exclude the British Antarctic Territory, as this Territory falls under the auspices of the Antarctic Treaty system and thereby operates under a different international governance framework. Where available, Territory boundaries of the UKOTs were obtained from UKOT administrations, or National Trusts representing each island (eight Territories). Otherwise, Territory boundaries were obtained from the Global Island Database (six Territories; <http://glispa.org/>) and the Global Administrative Areas database (one Territory; GADM 2015). Where possible, the accuracy of boundaries was improved through visual inspection of high-resolution satellite images in Google Earth (Dawson *et al.* 2015). In general, Territory land areas calculated using our digitized boundaries compared favourably with published estimates (mean difference = 1.3%), except for four Territories where this difference exceeded 10% (Anguilla: 13%; British Indian

Ocean Territory: 17%; Gibraltar: 12%; Turks and Caicos Islands: 15%).

We used the IUCN definition of protected areas ('A protected area is a clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values'; Dudley 2008) to identify terrestrial protected areas for inclusion. We considered all sites that met this designation, but then excluded international designations (e.g. Ramsar sites) in order to assess coverage of locally designated protected areas alone (Table S1) (available online). The latter is the approach that is generally taken by protected area studies (e.g. Jenkins & Joppa 2009, 2010). By preference, we used boundaries supplied by OT administrations. Boundary data for 184 protected areas were obtained this way, while data for a further 48 protected areas (all but five of which were entire islands) were digitized using Territory boundaries and georeferenced raster images. Boundaries were up to date as of May 2016. Boundaries for nine protected areas were obtained from the Protected Planet database (IUCN & UNEP-WCMC 2015). For 15 protected areas, the boundaries either could not be obtained (two protected areas, 6 ha and 0.8 ha; both in Montserrat) or did not exist (13 protected areas; all in Tristan da Cunha). In these cases, the sites were excluded completely.

We used the total land area of digitized Territory boundaries to calculate the percentage covered by protected areas, having first aggregated boundaries of overlapping protected areas (using the 'Dissolve' tool of ArcGIS 10.1). We overlaid protected area boundaries onto IBA boundaries from BirdLife International (2015) and calculated the percentage of IBAs covered by protected areas. To allow for discrepancies in digitizing between the IBA and protected area layers, we classified the extent of protection of IBAs using three categories, following Beresford *et al.* (2016): >98% of IBA land area under protection, 'complete'; 2–98% under protection, 'partial'; and <2% under protection, 'none'. To quantify whether the level of coverage of protected areas contributed to a globally ecologically representative network, we overlaid protected area boundaries onto WWF ecoregions (Olson *et al.* 2001).

Visual assessment indicated that 8% of IBAs and 64% of ecoregion polygons did not align with the Territory boundaries, such as coastlines. In these cases, the boundaries of the IBAs and ecoregions were aligned manually to coastlines or boundary features. Overlap of IBAs and ecoregions with protected areas was calculated for the portion overlapping Territories by clipping to Territory boundaries. For IBAs comprising both terrestrial and marine habitats, overlap with protected areas was calculated for the terrestrial component only, approximated as the portion overlapping Territory boundaries. The overall area of ecoregions for each Territory was extracted from Olsen *et al.* (2001). All spatial data were projected using the WGS84 coordinate system, and Mollweide equal area projection and analyses used ArcGIS 10.1 (ESRI 2010).

RESULTS

There were 241 protected areas in the UKOTs. These covered 847 km² in total, or 4.8% of the land area of the UKOTs. Coverage varied widely across the UKOTs (Table 1), and was highest in the Pitcairn Islands (89%). Eight Territories matched or exceeded the Aichi ambition of protecting 17% of their land. These were Ascension Island, British Indian Ocean Territory, Cyprus Sovereign Base Areas, Gibraltar, Pitcairn, Saint Helena, Turks and Caicos Islands and Tristan da Cunha. The British Virgin Islands fell just short with 16% coverage, while Montserrat had 11% coverage. There were no locally designated protected areas in the Pitcairn Islands, South Georgia and the South Sandwich Islands. The coverage of these locally designated protected areas alone exceeded the 17% Aichi ambition in seven out of 15 UKOTs (Table 1).

There were 96 entirely or partly terrestrial IBAs across the 15 UKOTs, covering an estimated 5069 km² or 29% of the land area of the UKOTs (Table 2). Protected areas overlapped 51% of terrestrial IBAs (49 out of 96 IBAs) completely or partially, but covered only 8% of their area (7% for locally designated protected areas; Table 2). Thirty-three IBAs (34% of all terrestrial IBAs) had more than 50% of their area covered by a protected area, of which the majority (24 IBAs) had more than 98% coverage (Table 2). However, almost half (49%) of all IBA sites and most (92%) of the area of IBAs have no protection. This suggests that the current protected area network does not adequately capture many areas of highest conservation importance for birds (and almost certainly other taxa) within the UKOTs.

The 15 UKOTs support 16 ecoregions. Most UKOTs fall within a single ecoregion, although four Territories in the Caribbean have two ecoregions (Anguilla, British Virgin Islands, Cayman Islands and Turks and Caicos Islands) and one Territory has three ecoregions (Montserrat). For some ecoregions, the UKOTs are of particular global importance. For example, four ecoregions occur only in the UKOTs (Ascension scrub and grasslands, Bermuda subtropical conifer forests, Saint Helena scrub and woodlands and Tristan Da Cunha–Gough Islands shrub and grasslands), and one (Scotia Sea Islands tundra) has nearly half its global extent within the UKOTs (Table 3).

The coverage of ecoregions by protected areas ranged from 0% to 85%. Across all 21 UKOT–ecoregion combinations, nine (43%) had at least 17% of their area covered by protected areas (Table 3). By contrast, Bermuda subtropical conifer forest has less than 1% coverage by protected areas and Scotia Sea Islands tundra has no protected area coverage, despite having 46% of its global extent in the UKOTs. For those UKOTs supporting multiple ecoregions, protected area cover was either dominated by one ecoregion (British Virgin Islands, Montserrat and Turks and Caicos Islands) or very limited for all of the ecoregions (Anguilla and Cayman Islands). The exclusion of internationally designated protected areas affected the coverage of ecoregions in four Territories (British Indian Ocean Territory, British Virgin

Table 1 Terrestrial protected area (PA) coverage in the UK's Overseas Territories. Territories are ranked by descending percentage of total land area designated as protected. Those exceeding Aichi Target 11 (17%) are shown in bold. Land area values were calculated using digitized Territory boundaries.

<i>Overseas Territory</i>	<i>Land area (km²)</i>	<i>Local PA designation^a</i>		<i>Local and international PA designation^a</i>	
		<i>Number</i>	<i>Area (%)</i>	<i>Number</i>	<i>Area (%)</i>
Pitcairn Islands	49	0	0	1	89
Tristan da Cunha	179	2	44	6	45
Cyprus Sovereign Base Areas	257	8	39	9	39
Saint Helena	124	14	38	14	38
Gibraltar	7	3	37	3	37
British Indian Ocean Territory	50	18	31	19	32
Turks and Caicos Islands	496	26	26	27	26
Ascension Island	98	8	20	8	20
British Virgin Islands	154	34	11	35	16
Montserrat	101	2	11	2	11
Bermuda	56	78	6	85	7
Cayman Islands	270	7	3	8	4
Falkland Islands	12,013	19	3	21	3
Anguilla	79	3	<1	3	<1
South Georgia and the South Sandwich Islands	3827	0	0	0	0
Total	17,760	222	4	241	5

^aExcludes protected areas with no boundary data: two in Montserrat and 13 in Tristan da Cunha.

Table 2 Number and extent of terrestrial (or partly terrestrial) Important Bird and Biodiversity Areas (IBAs) in the UK's Overseas Territories (OTs) and degree of overlap with protected area coverage. 'Overall' includes IBAs with 'complete' (>98%) or 'partial' (2-98%) coverage; 'none' refers to sites with <2% coverage (see text for details). Figures in parentheses in the 'Overall' column are the numbers or areas of IBAs under protection when international designations are excluded.

<i>OT</i>	<i>IBAs</i>		<i>Protected area overlap of IBAs</i>				
	<i>Number</i>	<i>Area of OT (%)</i>	<i>Overall</i>		<i>Extent of protection</i>		
			<i>Number</i>	<i>Area of IBAs (%)</i>	<i>Complete</i>	<i>Partial</i>	<i>None</i>
Anguilla	16	9	1	4	1		15
Ascension Island	3	8	3	100	3		
Bermuda	1	1	1	22		1	
British Indian Ocean Territory	10	12	10	100	10		
British Virgin Islands	3	11	2	63 (27)	1	1	1
Cayman Islands	10	23	5	14	1	4	5
Cyprus Sovereign Base Areas	2	29	1	93		1	1
Falkland Islands	22	6	11 (10)	10 (9)	3	8	11
Gibraltar	1	96	1	38		1	
Montserrat	3	16	2	70	1	1	1
Pitcairn Islands	4	100	1 (0)	89 (0)	1		3
Saint Helena	6	36	4	44		4	2
South Georgia and the South Sandwich Islands	2	96	0	0			2
Tristan da Cunha	4	97	2	44	2		2
Turks and Caicos Islands	9	37	5	45	1	4	4
Total	96	29	49 (47)	8 (7)	24 (23)	25 (24)	47 (49)

Table 3 Global extent of ecoregions in UK's Overseas Territories and degree of overlap with protected area (PA) coverage. Territory–ecoregion combinations with $\geq 17\%$ of their areas protected are shown in bold.

Overseas Territory	Ecoregion name	Percentage of global extent	PA overlap of ecoregions (%)	
			Local PAs	Local and international PAs
Anguilla	Caribbean shrublands	2	<1	<1
	Lesser Antillean dry forests	1	<1	<1
Ascension Island	Ascension scrub and grasslands	100	20	20
Bermuda	Bermuda subtropical conifer forests	100	5	5
British Indian Ocean Territory	Maldives–Lakshadweep–Chagos Archipelago tropical moist forests	14	69	85
British Virgin Islands	Caribbean shrublands	4	5	12
	Leeward Islands moist forests	2	2	2
Cayman Islands	Bahamian–Antillean mangroves	1	1	3
	Cuban dry forests	<1	4	4
Cyprus Sovereign Base Areas	Cyprus Mediterranean forests	3	43	43
Falkland Islands	Patagonian steppe	2	3	3
Gibraltar	Southwest Iberian Mediterranean sclerophyllous and mixed forests	<1	50	50
Montserrat	Caribbean shrublands	1	1	1
	Leeward Islands moist forests	3	25	25
	Lesser Antillean dry forests	5	8	8
Pitcairn Islands	Tuamotu tropical moist forests	5	0	90
Saint Helena	Saint Helena scrub and woodlands	100	37	37
South Georgia and the South Sandwich Islands	Scotia Sea Islands tundra	46	0	0
Tristan da Cunha	Tristan Da Cunha–Gough Islands shrub and grasslands	100	47	47
Turks and Caicos Islands	Bahamian pine mosaic	4	8	10
	Bahamian–Antillean mangroves	1	30	59

Islands, Pitcairn Islands and Turks and Caicos Islands), of which that in Pitcairn was the most notable, where Tuamotu tropical moist forests had no locally designated protected areas (Table 3).

DISCUSSION

This analysis provides the first overview and synthesis of the nature and extent of protected area coverage in the UKOTs with respect to both areas of high conservation value and representativeness of ecoregions. It provides an objective and repeatable basis for guiding and informing future terrestrial protected area designation at the UK and individual UKOT level for this geographically disparate but politically linked group of Territories. As more and better data become available, the assessment can be updated.

Overall, the extent of protected area coverage of land was generally low. A total of 4.8% (4.4% with internationally designated sites excluded) of land area was protected across all of the Territories, compared to *c.* 27% in mainland UK (based on Butchart *et al.* 2015). This low level of protection is a conservation concern because small, isolated islands,

such as the UKOTs, often support high levels of endemism (Whittaker 1998; Heaney 2000). In addition, and partly due to their wide geographic distribution and habitat types, species richness for the island suite as a whole is much greater than that of the UK mainland; for example, there are *c.* 90 endemic species in mainland UK compared to 341 known terrestrial endemics in the UKOTs (Churchyard *et al.* 2016).

Whilst the extent to which the Aichi Targets apply to individual UKOTs varies, the 17% goal is useful as an overall indicator of ambition. Eight Territory jurisdictions already exceed this level of protection. These are Ascension Island, British Indian Ocean Territory, Cyprus Sovereign Base Areas, Gibraltar, Saint Helena, Tristan da Cunha, Turks and Caicos Islands and Pitcairn Islands (the latter falls below this threshold if only locally designated sites are considered). The British Virgin Islands almost met this ambition with 16% coverage, while Montserrat had 11% coverage. Terrestrial protected area coverage is <10% on five Territories (Anguilla, Bermuda, Cayman Islands, Falkland Islands and South Georgia and the South Sandwich Islands). Protected area coverage is particularly low in the Caribbean (five of seven Territory jurisdictions with <17%). These are also the

UKOTs with the lowest levels of biodiversity knowledge (Churchyard *et al.* 2016), with perhaps the exception of Bermuda, making the targeting of protection particularly challenging and highlighting the need for better knowledge of the status and distribution of species in many Territories.

The overlap between protected areas and IBAs was also low, at 8% of IBA areas and 51% of IBA sites (7% or 49%, respectively, with internationally designated sites excluded). For comparison, *c.* 97% of IBAs in the UK are partially or wholly protected (based on data in Beresford *et al.* 2016). It is likely that at least some of the protected land outside IBAs encompasses areas of biodiversity importance, but the paucity of information on the distribution of biodiversity in the UKOTs makes this difficult to assess (Churchyard *et al.* 2016). However, of seven Alliance for Zero Extinction (AZE) sites in the UKOTs, only one (Paget Marsh Nature Reserve in Bermuda) is not also an IBA (AZE 2016).

The high biodiversity value of these islands, the threats posed by, for example, invasive species, uncontrolled development and climate change and the low level of protected area coverage suggest that increasing terrestrial protected area coverage through locally led processes should be a priority.

It is important to note that this review comes at a time when improvements to protected areas are underway in many Caribbean UKOTs. Until these changes are implemented in law and site boundaries are approved, it is not possible to include them in this analysis, but they will result in an increase in protection of important sites for biodiversity. For example, in Bermuda, the current process to approve the 2009 amendments to the National Parks Act will result in significant increases in protected area coverage in the near future. In the Turks and Caicos Islands, amendments to the National Parks Ordinance were passed in Cabinet in 2016, but are not yet formalized. In the British Virgin Islands, six additional protected areas have been scheduled (three in 2014 and three in 2016) and await formal designation, while a national initiative currently underway to identify Important Plant Areas will support subsequent designations. Finally, in the Cayman Islands, terrestrial and marine protected areas are currently being updated following the introduction of the National Conservation Law 2013.

Additionally, our study did not consider the potential contribution that could be made by privately managed areas, such as nature reserves run by non-governmental organizations or private enterprises. Until a central registrar of data on such sites is available, it will be difficult to assess the contribution that these sites make to the 17% ambition, especially, as in many cases, their permanence is unknown.

The data presented here are not adequate for prioritizing areas for the expansion of protected areas. This requires much broader considerations of the biodiversity value of sites, such as numbers of endemics and globally threatened

species, as well as threat levels and socioeconomic costs, similar to the factors considered in, for example, approaches to prioritizing OT islands for the eradication of invasive alien species (Dawson *et al.* 2015). Furthermore, formal protection might not always be the most effective approach to site conservation, and other additional approaches, such as community ownership and management, might be more appropriate in some instances.

In addition to the protection of sites of biodiversity importance, Aichi Target 11 also states that the area that is conserved should be 'ecologically representative' (CDB 2011). Coverage of ecoregions unique to the UKOTs was generally good (three out of four endemic ecoregions had protected area coverage equal to or exceeding 20%). However, protected area coverage of all UKOT–ecoregion combinations as a whole was generally low, with only 9 of 21 UKOT–ecoregion combinations having at least 17% protection. Ecoregion prioritization as a whole or individually also requires broader consideration of the biodiversity value of these ecoregions and UKOT–ecoregion combinations and the threat levels they face. Additionally, while widely used and accepted in the conservation community, the WWF ecoregions of Olsen *et al.* (2001) are just one of many ecoregion/habitat classification systems. Development of the ecosystem Red List (Keith *et al.* 2015) could help inform which ecosystems could be considered to be under particular threat and in need of conservation at a global level.

These analyses of the spatial overlap between different digital layers will be subject to the normal set of errors associated with Global Information System (GIS) data. Primary among these will be digitizing errors. Such errors cannot be accounted for in global studies, but the relatively small number of sites involved here meant we took time to match polygon boundaries as accurately as possible. In addition, by contacting local stakeholders directly, we were able to compile an accurate database of protected areas that is much more accurate than those used in global studies, and as a result, we believe these errors to have been minimized.

The UK is not alone in having Territories for which it is responsible distributed across the globe. Within the EU, Denmark, France, The Netherlands, Portugal and Spain all have such Territories. With the UK, at present, these nations are taking part in the identification of Key Biodiversity Areas under the EU's voluntary scheme entitled the Biodiversity and Ecosystem Services in Territories of European overseas initiative. This will increase the extent of areas recognized as being important for biodiversity within many OT. Some of these will undoubtedly overlap with existing protected areas, increasing the proportion of protected areas recognized as being important for biodiversity further. Despite efforts to raise awareness of these Territories' value for biodiversity, the threats they face and their limited technical and financial resources, their biodiversity levels remain poorly documented and their protection under-resourced compared to those of the responsible states.

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Supplementary material

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