



**JNCC Report
No. 679**

**25 Year Environment Plan Outcome Indicator K4:
Extent of Protected Areas in the UK Overseas Territories**

Hugh Wright and Helen Woods

June 2021

© JNCC, Peterborough 2021

ISSN 0963 8091

For further information please contact:

Joint Nature Conservation Committee
Monkstone House
City Road
Peterborough PE1 1JY
<https://jncc.gov.uk/>

This report should be cited as:

Wright, H.L. & Woods, H.J. 2021. 25 Year Environment Plan Outcome Indicator K4: Extent of Protected Areas in the UK Overseas Territories. *JNCC Report No. 679*, JNCC, Peterborough, ISSN 0963-8091.

JNCC EQA statement:

This report is compliant with JNCC's Evidence Quality Assurance Policy
<https://jncc.gov.uk/about-jncc/corporate-information/evidence-quality-assurance/>

Acknowledgments:

The authors are hugely grateful to the UKOT Governments/Administrations and representatives of the UK Overseas Territories Association who shared advice, provided protected area data, ran area calculations and answered queries, which has all been fundamental to the development of indicator K4.

We are also very grateful to Defra's 25 Year Environment Plan Outcome Indicators Team and Defra's Soils, Peatlands and Landscapes team for guidance throughout the development of the indicator and to FCDO, Defra International Marine Environment team, the Great British Oceans coalition, IUCN, RSPB and UNEP-WCMC for their comments which helped shape the indicator.

We also thank Simon Hatfield (Defra) for developing the results graphic, the UK Hydrographic Office Law of the Sea team for maritime boundary data and valuable technical advice, and Cefas and the Marine Management Organisation for data and technical support. Finally, thank you to Charlie Howarth and Tom Tangye (JNCC) for technical support and Elly Hill, Pete Chaniotis, Jane Hawkrige and James Williams (JNCC) for review and advice.

At a glance - indicator K4 on the extent of protected areas in the UK Overseas Territories

The 25 Year Environment Plan outlines the UK Government's aspirations to help our environment "regain and retain good health" (Defra 2018). Accompanying the plan is a comprehensive set of 66 indicators – the Outcome Indicator Framework – which will show how the environment is changing and whether our interventions are effective (Defra 2019). Four of these indicators relate to Defra's international ambitions to reduce the UK's global footprint and support overseas countries to protect and improve the environment.

The UK Overseas Territories (UKOTs) support a highly diverse range of terrestrial and marine species, habitats and ecosystems. Protected areas and other effective area-based conservation measures (OECMs) are key tools for conserving this biodiversity, much of which is endemic and globally threatened. 25 Year Environment Plan Outcome Indicator K4 measures the extent and condition of terrestrial and marine protected areas in the UKOTs.

Indicator K4 is currently under development. While work to progress the protected area condition aspect of this indicator is ongoing, Defra commissioned JNCC to deliver a first set of UKOT protected area extent statistics, using 2020 as a baseline for an interim K4 indicator. This report presents the results of this work and technical background information to accompany the publication of indicator K4 protected area extent statistics in the [Outcome Indicator Framework 2021 Update report](#).

JNCC collated protected area extent figures from UKOT Governments to ensure that this new indicator maintained consistency with UKOTs' own statistics and policy interpretations. JNCC only undertook area calculations on behalf of the UKOTs when requested, using UKOT Governments' official sources of protected area data. Seven UKOTs supplied their own protected area extent figures, five UKOTs asked JNCC to calculate protected area extent figures on their behalf and one UKOT took a mixed approach.

Indicator K4 focuses on spatially defined, formally designated measures for biodiversity conservation. However, decisions on which sites to report were made by the UKOT Governments alone, in line with their responsibilities for the environment. In addition to protected areas, indicator K4 statistics included OECMs where these were considered to deliver biodiversity conservation outcomes by virtue of a long-term management regime.

In 2020, protected areas and OECMs covered nearly two thirds (63%) of the UKOTs' marine environment but a much smaller proportion of the terrestrial environment (4.7%). Marine protected areas covered a total of 3,621,391km², compared to 832km² in terrestrial protected areas (noting that UKOTs' waters, at approximately 5,748,600km², are over 300 times larger than the UKOTs' combined land area of 17,738km²).

There were marked differences in protected area coverage between regions. The greatest extent of protection to the marine environment occurred in the Indian and Pacific Ocean UKOTs (nearly 100%) and South Atlantic UKOTs (63.9%), compared to 18.7% and 0.1% for the Mediterranean and wider Caribbean UKOTs, respectively. Terrestrial protected area coverage was also greatest in the Indian and Pacific Ocean UKOTs (60.6%), compared to the Mediterranean (38.1%), wider Caribbean (14.8%) and South Atlantic (3.1%) UKOTs.

These UKOT protected area extent statistics will inform 25 Year Environment Plan reporting and a number of other UK Government policy areas, including the 30by30 initiative and Blue Belt Programme. JNCC hope that these statistics will also be useful in supporting the work of UKOT Governments, as well as informing non-governmental stakeholders and the wider public. Indicator K4 has been published as an 'experimental statistic' in 2021 so that users and stakeholders can be involved in assessing the suitability and quality of the UKOT protected area extent statistics. JNCC and Defra welcome feedback and suggestions on any aspect of the newly developed indicator K4 via 25YEPindicators@defra.gov.uk.

Contents

1	Introduction to 25 Year Environment Plan Outcome Indicator K4	1
1.1	The 25 Year Environment Plan Outcome Indicator Framework	1
1.2	Indicator K4 – protected areas in the UK Overseas Territories	1
1.3	Assessing protected area extent	1
2	Extent of protected areas in the UK Overseas Territories: results	3
2.1	Extent of protected areas in the UKOTs combined	4
2.2	Extent of UKOT protected areas by region	4
2.3	Confidence in the protected area extent statistics	5
3	Technical background	7
3.1	Geographic scope	7
3.2	Data collation	8
3.3	Identifying protected areas and other effective area-based conservation measures	9
3.4	Terrestrial and marine protected area categorisation	10
3.5	Calculating protected area extent	10
3.6	Land and sea extent	10
3.7	Coordinate reference systems	11
3.8	Aggregating extent figures	11
3.9	Confidence, uncertainty and variability	11
3.10	Constraints	13
3.11	Quality control and quality assurance	14
3.12	Update frequency and revisions	14
	References	15

1 Introduction to 25 Year Environment Plan Outcome Indicator K4

1.1 The 25 Year Environment Plan Outcome Indicator Framework

The 25 Year Environment Plan is a UK governmental action plan aspiring to help our environment “regain and retain good health” (Defra 2018). Safeguarding biodiversity is one of 10 goals in a plan that addresses a broad array of environmental threats and management issues. The 25 Year Environment Plan also sets out the UK Governments’ international ambitions, such as leaving a lighter footprint on the global environment, showing international leadership on issues such as climate change, and supporting overseas countries to protect and improve the environment.

Accompanying the 25 Year Environment Plan is a comprehensive set of 66 environmental indicators, known as the Outcome Indicator Framework, which are designed and being built to show how the environment is changing over time (Defra 2019). This framework will help Government, stakeholders and the wider public to assess the effectiveness of interventions and track progress towards improving the environment over the 25-year lifespan of the plan. Although the 25 Year Environment Plan does not set specific goals for the UK Government’s international ambitions, the Outcome Indicator Framework includes four international indicators to demonstrate the scale of the UK’s impact on the environment, the status of biodiversity and the progress of conservation efforts overseas.

1.2 Indicator K4 – protected areas in the UK Overseas Territories

The 25 Year Environment Plan recognises the global significance of biodiversity in the UK Overseas Territories (UKOTs) and the reliance of UKOT communities on the natural environment. The UK Government is committed to supporting the UKOTs in protecting their environmental assets (including biodiversity), and protected areas (PAs) are a key measure for conserving vulnerable ecosystems and species, many of which are endemic to the UKOTs.

25 Year Environment Plan Outcome Indicator K4 will measure the extent and condition of terrestrial and marine protected areas in the UK Overseas Territories.

PA extent provides a simple and accessible metric for assessing the UKOTs’ progress in establishing PA networks for biodiversity conservation. Evaluating the condition of habitats and species in PAs will provide evidence on the state of protected features, impacts from pressures, and the ecological functions of PAs. However, building this indicator in the context of the UKOTs’ diverse environments, varied environmental policies and varying data availability, will be very challenging, especially for PA condition. Defra therefore commissioned JNCC to deliver statistics on UKOT PA extent in 2020 as a first development phase and interim indicator for K4.

1.3 Assessing protected area extent

This report presents key results and technical background information to accompany the first iteration of indicator K4 UKOT PA extent statistics, as published in the [Outcome Indicator Framework 2021 Update report](#) (Defra 2021). Working closely with, and using data from, the UKOT Governments, JNCC have developed statistics that quantify the UKOTs’ collective progress in implementing PAs and other effective area-based conservation measures (OECMs) in terrestrial and marine environments. These statistics establish a baseline from which indicator K4 can track change in the total area and percent coverage of UKOT PAs and OECMs from 2020 through to 2043.

As well as assessing progress in the context of 25 Year Environment Plan aspirations, these statistics inform a number of UK Government international policy areas including: the 30by30 initiative; Blue Belt Programme; Convention on Biological Diversity (CBD) post-2020 framework targets and the 2030 UN Sustainable Development Goals. Integrating the indicator across multiple policy areas will help to improve consistency in the use of PA statistics, such as for international reporting of UKOT PAs.

The PA extent statistics will also help to inform UKOT Governments' work at national and regional levels, supporting them in prioritising where further development of PA networks would be beneficial for biodiversity conservation. Beyond these governmental applications, JNCC hope that indicator K4 will also be valuable to civil society stakeholders and the wider public, to communicate the progress being made to conserve UKOT biodiversity.

The 25 Year Environment Plan Outcome Indicators are voluntarily compliant with the UK's [Code of Practice for Statistics](#), which advocates that users' interests should be at the core of indicator development. The newly developed indicator K4 PA extent statistics have been assigned 'experimental statistic' status in the Outcome Indicator Framework 2021 Update report, providing users and stakeholders with an opportunity to assess the suitability, quality and usefulness of the statistics. JNCC and Defra therefore welcome feedback on any aspect of the indicator K4 PA extent statistics, from users across the UKOTs and the metropolitan UK, via 25YEPindicators@defra.gov.uk.

2 Extent of protected areas in the UK Overseas Territories: results

Indicator K4 statistics on the extent and percent coverage of PAs and OECMs in the UKOTs are presented in Figure 1 (as published in the 25 Year Environment Plan [Outcome Indicator Framework 2021 Update](#)) and Table 1. These results present the scale of UKOT PA networks as at the end of 2020.

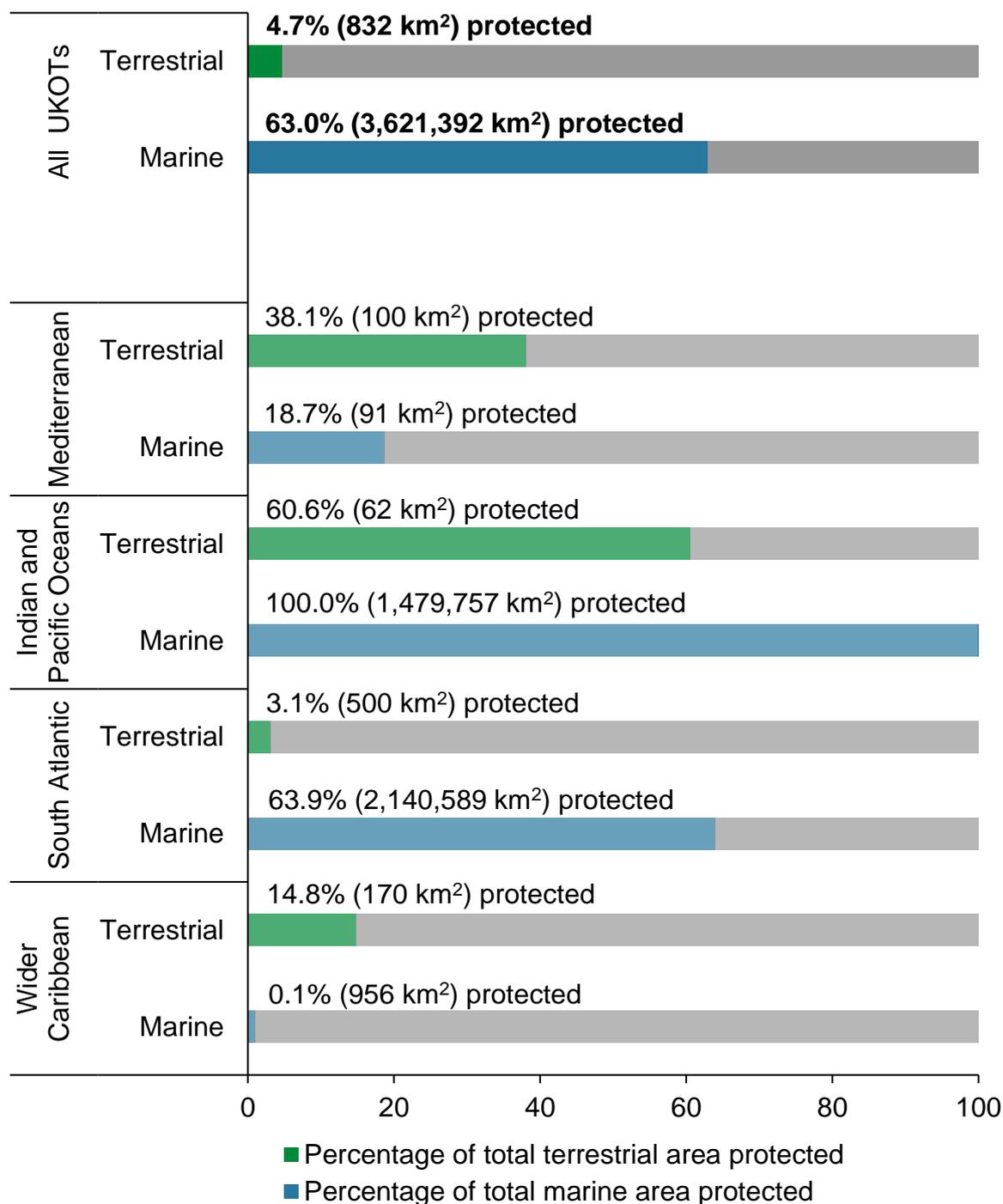


Figure 1. Percent coverage of terrestrial and marine protected areas and other effective area-based conservation measures, in total (across thirteen UK Overseas Territories) and by region, in 2020.

Table 1. Extent and percent coverage of terrestrial and marine protected areas and other effective area-based conservation measures in the UK Overseas Territories in 2020 (in total and by region), relative to the Territories' combined land and approximate sea areas.

	Terrestrial			Marine		
	Area of land (km ²)	Area of PAs (km ²)	% coverage	Area of sea (km ²)	Area of PAs (km ²)	% coverage
All UKOTs	17,738	832	4.7	5,748,643	3,621,391	63.0
Mediterranean	261	100	38.1	484	91	18.7
Indian and Pacific Oceans	102	62	60.6	1,480,020	1,479,757	100.0
South Atlantic	16,225	500	3.1	3,349,026	2,140,589	63.9
Wider Caribbean	1,149	170	14.8	919,113	956	0.1

A brief description of the statistics is provided in the sections below and we refer to the CBD Aichi Biodiversity Target 11 to consider the PA extent statistics in a global conservation context. However, it must be noted that the CBD has only been extended to a subset of the UKOTs and the 25 Year Environment Plan does not set any targets for PA coverage; environmental management, designation of PAs and target setting is the responsibility of the UKOT Governments.

2.1 Extent of protected areas in the UKOTs combined

PAs and OECMs covered nearly two thirds of the UKOTs' marine environment (Figure 1), far exceeding the CBD's [Aichi Biodiversity Target 11](#) which aimed for 10% protection of coastal and marine areas by 2020. In contrast, PAs covered a much smaller proportion of the UKOTs' terrestrial environment and less than the 17% goal for terrestrial protection set out in Aichi Biodiversity Target 11. The UKOTs' combined marine area is more than 300 times larger than the UKOTs' combined land area; correspondingly, the extent of marine protection was four orders of magnitude larger than for the terrestrial environment (Table 1).

In November 2020, the Tristan da Cunha Government announced a [new Marine Protection Zone](#) covering more than 90% (687,223km²) of the Tristan da Cunha Exclusive Economic Zone. This PA was not included in the 2020 indicator K4 statistics as it has yet to be legislated, but once formally designated it will be included in a future iteration.

2.2 Extent of UKOT protected areas by region

UKOTs were grouped into four broad regions to demonstrate differences in PA and OECM extent across contrasting environmental, socio-economic and geographic contexts (Figure 1). The characteristics of these four regions are briefly outlined in Box 1.

There were marked differences in PA and OECM coverage between regions. The Indian and Pacific Ocean UKOTs (British Indian Ocean Territory and Pitcairn Islands group, collectively) had the greatest percent coverage of PAs in the terrestrial environment, compared to the other three regions (Table 1). Terrestrial PA coverage was much lower for the three South Atlantic UKOTs collectively, where the majority of the UKOTs' combined landmass occurs.

The Indian and Pacific Ocean UKOTs also had the greatest PA coverage of the marine environment, collectively protecting very nearly 100% of their waters. The South Atlantic UKOTs have also protected large areas of ocean equating to nearly two-thirds of their

waters. The Indian and Pacific Oceans, South Atlantic and Mediterranean UKOTs have all exceeded the CBD's target for 10% protection of coastal and marine areas by 2020.

Box 1. Socio-economic and geographic characteristics of the UKOTs by region

The Mediterranean region comprises two UKOTs: Sovereign Base Areas of Akrotiri and Dhekelia (SBAs) and Gibraltar. These UKOTs have contrasting human population density, with approximately 50 people/km² in the SBAs (SBA Administration 2019) compared to 5,000 people/km² in Gibraltar's very small land area (Government of Gibraltar 2020). The SBA economy is centred on military activity while Gibraltar has strong service and tourism sectors. These are the only UKOTs with international land borders and so they have immediate proximity to other nations.

The Indian and Pacific Oceans region comprises two UKOTs: British Indian Ocean Territory (BIOT) and the Pitcairn Islands group, in the tropics and sub-tropics, respectively. These UKOTs are very remote, found between 380 and 520 km from the nearest neighbouring island nation and between 1,700 and 5,000 km from the nearest major landmass. BIOT has no permanent inhabitants; the main island hosts a joint UK-US defence facility supported by military personnel and civilian contractors while all other islands are uninhabited (Nicolas *et al.* 2017). Only one island in the Pitcairn Islands group is inhabited, resulting in an overall population density of just 0.9 people/km². The Pitcairn Islands' micro-economy comprises a mix of public sector services and micro-enterprises, including a small (but economically significant) level of tourism (Avagliano *et al.* 2016).

The South Atlantic region comprises three UKOTs: Falkland Islands, St Helena, Ascension and Tristan da Cunha, and South Georgia and the South Sandwich Islands. Resident population densities are very low, ranging from 0 permanent residents to 34 people/km², and economic activity features a mix of sectors, including fisheries, military activity, tourism, agriculture and oil and gas exploration (Taylor *et al.* 2016). While the Falkland Islands are only approximately 350 km from their nearest neighbouring nations, the other islands are all in excess of 1,000 km from their nearest neighbours (2,600 km in the case of Tristan da Cunha). These UKOTs also span a very broad range of ecoregions and climates, from subtropical Ascension to the sub-polar environment of South Georgia.

The wider Caribbean region comprises six UKOTs: Anguilla, Bermuda, British Virgin Islands, Cayman Islands, Montserrat, and Turks and Caicos Islands. With the exception of Gibraltar, these are the most densely populated UKOTs, ranging from 44-699 people/km². Tourism is significant to most of these UKOTs' economies, with fisheries or financial services also important in some Caribbean Territories (Vaslet & Renoux 2016). With the exception of Bermuda (which is over 1,000 km from its nearest neighbour), these UKOTs are close to neighbouring nations, with distances ranging from 1-210 km only. Four of these UKOTs do not have fully delimited maritime boundaries with neighbouring countries.

2.3 Confidence in the protected area extent statistics

JNCC has high confidence in the indicator K4 UKOT PA extent statistics because of the predominance of official data – information gathered from government sources – used in the UKOTs' and JNCC's area calculations. In the absence of quantitative confidence intervals, JNCC qualitatively assessed the impact of data uncertainty on the aggregated PA extent statistics (Section 3.9). Although there is scope to improve some data used in this indicator, JNCC concluded that the sources of uncertainty did not significantly impact the 2020 results.

Uncertainty in PA data affected only a modest number of small-area sites, with little impact on the aggregated PA extent statistics. Similarly, coastline datasets varied in quality but improvements (such as adopting a specific tidal state) will only lead to minor change in the

overall statistics. International maritime boundaries that are not yet agreed will also be liable to change but, once the extent of UKOTs' waters is combined at regional and global levels, these boundary changes will be small in comparison to the huge area of UKOT waters that is already delimited. Finally, the impact of using UKOTs' choice of projected coordinate systems (rather than one consistent projection across all UKOTs) was quantified and found to have virtually no effect on the aggregated figures for the UKOTs combined (Section 3.7).

Comparing indicator K4 PA extent statistics with other published figures provided further validation. An RSPB study (Wilkinson *et al.* 2017) using data collated up until May 2016 found that PAs afforded 4.8% protection to the terrestrial environment in the UKOTs – very close to the 4.7% figure presented in Figure 1. UNEP-WCMC's country-specific statistics (available at [ProtectedPlanet.net](https://www.protectedplanet.net), accessed February 2021) suggest that PAs cover 7.7% of the terrestrial environment and 60.0% of the marine environment in the UKOTs; again, comparable figures given some differences in underlying PA data and calculation methods.

3 Technical background

This section provides methodological and evidence quality information to accompany the indicator K4 PA extent statistics presented in Section 2 and the Outcome Indicator Framework 2021 Update (Defra 2021).

3.1 Geographic scope

Indicator K4 includes 13 of the 14 UKOTs (Figure 2). The British Antarctic Territory was excluded given that Antarctic terrestrial and marine protection is delivered through the Antarctic Treaty System. JNCC worked with the Governments and Administrations of all 13 Territories to produce the indicator.

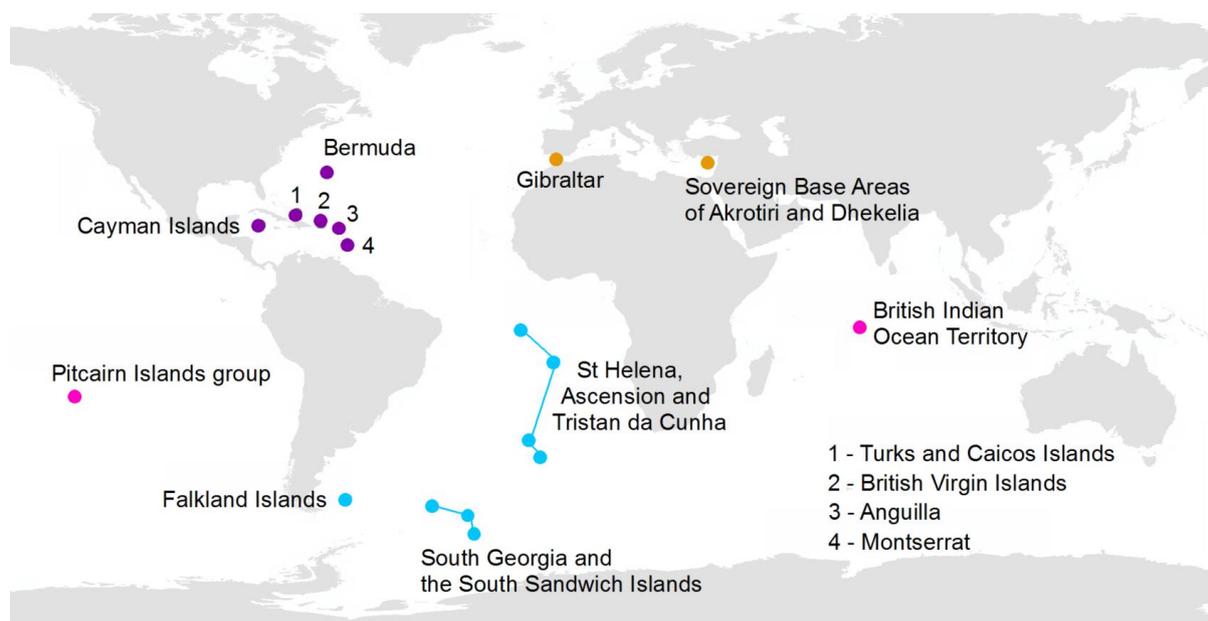


Figure 2. UK Overseas Territories (UKOTs) included in 25 Year Environment Plan Outcome Indicator K4. Regional groupings adopted for indicator K4 purposes are shown in orange for Mediterranean UKOTs, pink for Indian and Pacific Ocean UKOTs, blue for South Atlantic UKOTs and purple for wider Caribbean UKOTs.

In addition to producing statistics for all UKOTs combined, UKOTs were grouped into four broad regions (based on geographic similarities) to present PA extent statistics at a slightly finer spatial resolution. Grouping the UKOTs into Mediterranean, Indian and Pacific Oceans, South Atlantic and wider Caribbean regions (Figure 2) was useful for:

- showing the different spatial scale of PA networks established in the UKOTs;
- reflecting the different contexts in which PA designation takes place across the UKOTs;
- increasing the sensitivity of the indicator: detecting change in the extent of small-scale PAs as well as large-scale PAs, thereby enabling the indicator to demonstrate progress made by all UKOTs.

3.2 Data collation

PA extent figures were collated via two routes (Figure 3) and then aggregated across the UKOTs to produce indicator K4 statistics. Both routes used UKOT Governments' PA data.

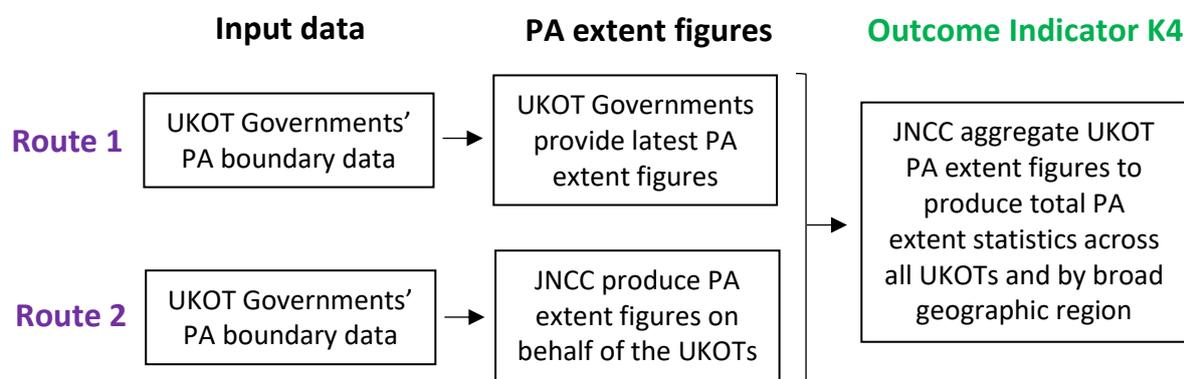


Figure 3. Process for collating or deriving UK Overseas Territory protected area (PA) extent figures from government sources and their aggregation into indicator K4 statistics.

UKOT Governments recommended in early discussions that JNCC should use data from government sources in preference to using statistics calculated by third-parties or data from secondary sources. JNCC therefore invited all UKOT Governments and Administrations to provide their own PA extent, land and sea area figures to inform the indicator (route 1, Figure 3). JNCC also encouraged this option to ensure the consistency of indicator K4 with statistics and policy interpretations at the individual UKOT level, thereby improving the value and applicability of indicator K4 for UKOTs' own purposes.

If UKOT Governments decided that route 1 was not possible or desirable, JNCC offered to undertake PA extent calculations on their behalf (route 2, Figure 3). JNCC's calculations were informed by the UKOT Governments' own official PA boundary data and PA extent figures were confirmed by the UKOT Governments before being aggregated with figures from route 1 to produce indicator K4. Digital PA data were lacking in four cases and therefore boundaries had to be digitally drawn-up by JNCC; these interim PA boundaries were aligned with UK Hydrographic Office maritime boundary data (where applicable) and confirmed with UKOT Governments before use in PA extent calculations.

Seven UKOTs opted to supply their own PA extent figures (route 1), five UKOTs asked JNCC to calculate PA extent figures on their behalf (route 2), and St Helena, Ascension and Tristan da Cunha took a mixed approach (Table 2).

Table 2. UK Overseas Territory (UKOT) adoption of two methods for supplying indicator K4 PA extent figures: supplying UKOT Governments' own figures (route 1, Figure 3), or JNCC-led calculations with subsequent confirmation by UKOT Governments (route 2, Figure 3).

UKOTs that opted for route 1 – providing their own PA extent figures	UKOTs that opted for route 2 – JNCC calculating PA extent on UKOT's behalves
Bermuda British Virgin Islands Cayman Islands Falkland Islands Gibraltar Montserrat St Helena, Ascension and Tristan da Cunha: - St Helena South Georgia and the South Sandwich Islands	Anguilla British Indian Ocean Territory Pitcairn Islands group St Helena, Ascension and Tristan da Cunha: - Ascension Island - Tristan da Cunha Sovereign Base Areas of Akrotiri and Dhekelia Turks and Caicos Islands

3.3 Identifying protected areas and other effective area-based conservation measures

Managing the environment is a devolved responsibility and UKOT Governments have adopted a variety of legislative and policy mechanisms to deliver biodiversity conservation. Establishing, recognising and reporting on area-based conservation measures is the responsibility of the individual UKOT Governments. JNCC therefore adopted the UKOT Governments' interpretations of what constitutes a PA and OECM, to ensure that indicator K4 aligns with UKOTs' domestic policy views.

A wide variety of area-based measures have been established for biodiversity conservation across the UKOTs, ranging from no-take zones or areas with extremely limited human visitation, through to sustainable use areas where natural resource use is managed hand in hand with biodiversity conservation. A number of UKOTs have established area-based measures to address multiple, co-occurring management issues, with biodiversity conservation just one of several purposes for designation.

Indicator K4 included PAs with a primary biodiversity conservation goal and OECMs, in which nature conservation may be one of a number of objectives, or not explicitly identified as an objective but delivered incidentally as a by-product of a long-term management regime. By encompassing both the PA and OECM concepts, indicator K4 aligns with the scope of PA targets currently being negotiated for the CBD post-2020 global biodiversity framework (CBD 2020).

Although indicator K4 was designed to capture the variety of PAs and OECMs in the UKOTs, some parameters for identifying PAs and OECMs needed to be consistent to ensure that the indicator remained focussed on biodiversity conservation, temporally defined, and comparable with other related PA indicators and targets. JNCC therefore recommended that the UKOT Governments apply three key criteria when identifying spatial measures to report in indicator K4:

- 1) PAs and OECMs must be designated for an in-situ biodiversity conservation purpose and/or be delivering an in-situ biodiversity conservation outcome;
- 2) PAs and OECMs must be spatially defined; *and*
- 3) PAs and OECMs must be formally implemented (through legal or other effective means) at the time of reporting.

UKOT Governments accepted and applied these criteria for indicator K4 purposes, ensuring that sites with no relevance to biodiversity conservation, wider measures lacking a specific geographically defined area, and sites proposed or announced but not formally designated were excluded. These criteria also ensured consistency with the foci of international obligations (e.g. CBD and UN Sustainable Development Goal targets) and a broad level of comparability with associated PA and OECM guidelines (e.g. Dudley 2008; Day *et al.* 2019).

International PA designations, such as Ramsar Sites and UNESCO World Heritage Sites (where selected against natural criteria), were included in the indicator where UKOT Governments formally recognised these as part of their PA networks. PAs owned and/or managed by private or non-governmental organisations were also included where formally recognised by UKOT Governments and established through legal or other effective means.

The indicator includes large-scale marine PAs supported through the Blue Belt Programme in four of the UKOTs. These sites protect very substantial areas in the Indian, Pacific and South Atlantic Oceans, but they form only a subset of the marine PAs and OECMs implemented across the UKOTs as a whole (all of which are included in indicator K4).

3.4 Terrestrial and marine protected area categorisation

PAs and OECMs were categorised into sites protecting the terrestrial environment, the marine environment, or both, using information on their location, designation type and objectives. UKOTs were asked to confirm if sites straddling the coastline formally protected one or both the terrestrial and marine environments. Where available, mean high water (MHW) limits were used as the dividing line between terrestrial and marine environments, otherwise best available (highest resolution) coastline data were used. The Cayman Islands Government used the vegetated shoreline (beneath MHW) to align with the local legal definition of the coastline.

In some instances, sites designated for terrestrial or marine protection only were found to have boundaries that inadvertently extended above or below the coastline (possibly because they were drawn using low-resolution or misprojected coastline layers at the time of designation). To avoid exaggerating the breadth and extent of protection, these small, unprotected parts of coastline-straddling sites were excluded from extent calculations.

3.5 Calculating protected area extent

PA extent was calculated as the sum (in square kilometres) of all areas occurring within PAs and OECMs in the terrestrial and marine environments. Overlaps between site boundaries (e.g. where multiple designation types co-occur) were frequent and had to be discounted to prevent overestimating total PA extent. UKOT Governments and JNCC used a geographic information system (GIS) to dissolve boundaries into a layer of non-overlapping polygons, or subtracted overlaps to calculate unique extents per PA, before calculating total PA extent. PA boundaries straddling the coastline were split using a MHW limit (or best available coastline) to produce separate area figures for the terrestrial and marine environments.

JNCC developed an automated script to calculate PA extent for the UKOTs that opted not to provide or produce their own figures. The script joined a PA boundary layer with a list of PAs to select boundary polygons for calculation; the list contained only those sites that met the criteria described in Section 3.3 and indicated their terrestrial and/or marine status. Boundaries were dissolved to remove overlaps and intersected with MHW (or best available coastline) data to split sites into their terrestrial and marine sections. The area of terrestrial and marine PAs was then summed, excluding terrestrial/marine sections of sites where these were not the formal target of protection (see Section 3.4). The [script](#) was run for each UKOT, using R version 3.6.1 and the `rgeos` (0.5-3), `rgdal` (v1.5-12), `raster` (3.3-7) packages.

3.6 Land and sea extent

Calculating PA percent coverage required a basemap of UKOT coastlines, maritime boundaries and international land borders. UKOT Government coastline data (described in Section 3.4) and land-border data were used to calculate the total extent of the UKOTs' land area; these data were typically higher resolution than open-source global datasets of country boundaries. Coastline data are set to continue improving as some UKOTs have only been mapped using variable quality satellite images and many have not been mapped at a consistent tidal state. These improvements will increase the accuracy and precision of land and sea area figures, but are unlikely to change the indicator's PA percent coverage figures.

Publicly available maritime boundaries produced by the [UKHO](#) were used to calculate the extent of UKOTs' waters, with the exception of the Falkland Islands where Fisheries Department data were used. UKOTs' waters were defined by the outermost maritime boundaries (as mapped by the UKHO), with the exception of the Sovereign Base Areas of Akrotiri and Dhekelia (where the current 3NM limit was used) and the Falkland Islands

(where the Inner and Outer Conservation Zones were used). For the six UKOTs that do not have agreed international maritime boundaries with neighbouring countries, UKHO-calculated median lines provided an interim boundary for the purpose of calculating the approximate total extent of UKOT waters. These median lines do not represent agreed delimitations and could be subject to change if formal international maritime boundaries are negotiated in future.

Several UKOTs (listed under route 1, Table 2) provided figures for their land and sea areas. JNCC calculated land and sea areas, using the script described in Section 3.5, for the remaining UKOTs (route 2, Table 2).

3.7 Coordinate reference systems

PA extent, land area and sea area figures provided by UKOT Governments were calculated using a variety of native coordinate reference systems suitable for projecting areas (without distortion) at an individual UKOT-scale. All JNCC calculations were undertaken using a Lambert Azimuthal Equal Area (LAEA) projected coordinate system (and WGS 1984 datum) with latitudes of origin and central medians customised to the mid-point of each UKOT's waters. Eight different projected coordinate systems were used altogether, with area figures for six UKOTs calculated using the customised LAEA projected coordinate system.

JNCC examined the impact of projection choice on indicator K4 statistics by comparing the statistics shown in Figure 1 with an alternative set of results based entirely on the LAEA projected coordinate system. Area calculations for seven UKOTs were replicated, using the LAEA projection (customised to each UKOT) in place of the native projected coordinate systems adopted by UKOT Governments in their own calculations. Once aggregated to produce new totals for the UKOTs combined, this found less than 0.001% difference in the percent coverage of terrestrial and marine PAs, compared to the statistics presented in Figure 1.

3.8 Aggregating extent figures

JNCC aggregated PA extent, land areas and sea areas to produce the combined statistics for all UKOTs and per region (Figure 1, Table 1), as presented in indicator K4. PA percent coverages for the UKOTs combined and per region were calculated from aggregated PA extent and land/sea area figures.

3.9 Confidence, uncertainty and variability

JNCC's [Evidence Quality Assurance Policy](#) defines high confidence as "high agreement between evidence and plenty of good to high quality relevant evidence available". JNCC is highly confident that the indicator K4 statistics accurately represent the current extent of PAs in the UKOTs, since the majority of data were obtained from official sources and statistics from other sources (e.g. [ProtectedPlanet.net](#) and Wilkinson *et al.* 2017) were comparable (see Section 2.3).

Sources of uncertainty affecting the 2020 statistics (Table 3) included missing PA boundaries, use of interim (JNCC-drawn) PA boundaries and incomplete site objective information. These affected a minority of small PAs only. Coastline data were of variable quality, but the margin of error was small and not likely to impact the aggregated PA extent statistics.

The negotiation and formal delimitation of international maritime boundaries will gradually remove the need to use approximate median lines (see Section 3.6) and likely cause small-

to-moderate changes to the total area of UKOTs' waters. However, the impact on marine PA extent coverages at regional and all-UKOT scales will be minor because the potential boundary changes across the six affected UKOTs will be small relative to the huge scale of UKOTs' combined waters, the majority of which is already formally delimited. The mix of projected coordinate systems used in area calculations had virtually no effect on the aggregated statistics (see Section 3.7).

Table 3. Current sources of data uncertainty and a qualitative assessment of their potential impact on indicator K4 statistics for the UK Overseas Territories (UKOT) combined. The table presents likely impacts on *aggregated* statistics; some impacts may be more significant at the individual UKOT scale.

Current source of uncertainty	Relevance to indicator K4	Impact on PA extent	Impact on land area	Impact on sea area	Impact on PA % coverage
Missing PA/OECM boundary data	Only known to affect 8 small terrestrial sites in one UKOT	Small (terres.)	n/a	n/a	Very small (terres.)
Interim or unofficial PA boundary data (redrawn for K4 purposes)	Only known to affect a small number of PAs in 4 UKOTs	Small (marine)	n/a	n/a	Very small (marine)
Incomplete info on PA/OECM objectives (for confirming biodiversity conservation purpose)	Relevant to a small number of UKOTs. Could impact inclusion of some PAs/OECMs in K4 and the sites' terrestrial/ marine status.	Small (terres./marine)	n/a	n/a	Very small (terres./marine)
Coastline data	Coastline data vary in quality. Low-resolution and/or inconsistent tidal state data occur for multiple UKOTs.	Small (terres.) Very small (marine)	Small	Small	Small (terres.) Very small (marine)
Approximate international maritime boundaries (not formally delimited)	Formal maritime boundaries lacking or partially agreed for six UKOTs; median lines used to approximate the boundaries instead	n/a	n/a	Small-Moderate	Small impact on marine % once aggregated
Choice of projected coordinate system	Mix of projected coordinate systems in use creates minor variation in area results (see Section 3.7)	Very small (terres.) Small (marine)	Very small	Small	Very small (terres./marine)

Two additional factors could create variability in the future measurement of UKOT PA extent (Table 4). The re-evaluation of PA networks by UKOT Governments (e.g. recognising a broader range of spatial measures as OECMs) could potentially lead to variability in the UKOT PA extent trend over time and result in retrospective changes to the 2020 statistics. Overall, the current sources of uncertainty (Table 3) and drivers of variability (Table 4) are

more likely to affect PA extent statistics at an individual UKOT scale than at the aggregated scale of the UKOTs combined. These are also more likely to impact terrestrial than marine PA percent coverage statistics, given the much smaller PA sizes and land areas involved.

Table 4. Potential sources of variability and a qualitative assessment of their likelihood, frequency and potential impact on PA extent for the UKOTs combined.

Potential source of variability	Relevance to indicator K4	Likelihood /frequency	Impact on PA extent	Impact on land area	Impact on sea area	Impact on PA % coverage
Changing interpretations of PA/OECM networks and site objectives	UKOT Govs may consider OECMs in more depth in the medium term, new OECMs might be identified (potential increase in extent).	Low or medium likelihood / low frequency	Small (marine), possibly moderate (terres.)	n/a	n/a	Small (marine), possibly moderate (terres.)
Changing coastlines	Coastline change (natural and human-induced) occurs in many UKOTs but varies in scale.	High likelihood / medium frequency	Small (terres.) Very small (marine)	Small to moderate	Small	Small (terres.) Very small (marine)

3.10 Constraints

The indicator K4 PA extent statistics are a measure of the total size of PAs only, using the formal, outer boundaries of the sites. The PA extent statistics therefore do not indicate:

- whether management measures are implemented within PAs;
- the type of management occurring (or intended), nor a judgement as to the overall level of protection afforded to biodiversity;
- the extent of managed zones/areas within PAs;
- the effectiveness of the management measures in place; *or*
- the condition of the protected species, habitats or ecosystems within the PAs.

In the longer term, indicator K4 also aims to assess the condition of PAs in the UKOTs to provide a more holistic assessment of PAs' contribution to biodiversity conservation. This requires development of a metric or series of metrics that can cost-effectively evaluate, and be sensitive to, the status of ecological elements protected in PAs. This is a much more challenging subject to measure given the substantial variation in environments, ecology, PA types and purposes, and environmental policies across the UKOTs, compounded by a paucity of data for many PAs. Developing PA condition metrics will therefore take time and require close collaboration with the UKOTs, but, if feasible, will enhance the ecological meaningfulness of indicator K4 and feed into future assessments of UKOT PA effectiveness.

Further work is required to distinguish between PAs and OECMs in the UKOTs. The concept of OECMs has not yet been adopted by a number of UKOT Governments, therefore indicator K4 cannot demonstrate the relative contribution of PAs versus OECMs to terrestrial and marine protection in the UKOTs, at least in the short-term. In the meantime, the criteria adopted by JNCC (Section 3.3) are broad enough to capture the breadth of spatial measures delivering biodiversity conservation in UKOTs, while aligning with evolving global targets for biodiversity protection (such as the CBD post-2020 framework).

3.11 Quality control and quality assurance

PA extent figures provided by the UKOT Governments underwent quality control by JNCC to check that area calculations were scientifically sound. These checks identified technical issues (such as the need to discount overlaps between PAs) which were addressed by the UKOTs before area figures contributed to K4. Where JNCC calculated PA extent on the UKOTs' behalfs, JNCC replicated area calculations in a GIS (ArcGIS v10.1) to corroborate the figures produced using the automated script. JNCC did not attempt to verify the sites that UKOTs chose to report in the indicator, as formally identifying and reporting PAs is a policy decision for the UKOT Governments alone. However, correspondence with the UKOTs indicated that they had applied the three criteria outlined in Section 3.3.

The work on indicator K4 (published here and in the Outcome Indicator Framework 2021 Update) was compliant with JNCC's [Evidence Quality Assurance Policy](#). JNCC's risk assessment recognised that indicator K4 figures could have a moderate impact if used to inform UKOT policy decisions on PA designation. Accordingly, the outputs of this work were quality assured by senior JNCC colleagues and Defra's 25 Year Environment Plan Outcome Indicators team. UKOT, international marine and conservation policy leads from Defra and FCDO, plus Blue Belt Programme teams in Cefas and the Marine Management Organisation, also contributed to the review and sign-off of this work. UKOT Governments had sight of, and an opportunity to comment on, the aggregated PA extent figures before publication of indicator K4.

3.12 Update frequency and revisions

The update frequency of indicator K4 will be determined following the evaluation of this experimental statistic in 2021. Updates will also be dependent on UKOT Government capacity and willingness to engage on an ongoing basis.

Significant errors affecting key results in the annual 25 Year Environment Plan Outcome Indicator Framework report may be corrected within-year, with Defra issuing a revised report and correction notification online via the [25 Year Environment Plan progress reports webpage](#). Any statistical errors found in future updates will be corrected retrospectively with explanations given in the 25 Year Environment Plan Outcome Indicator Framework report.

References

- Avagliano, E., Artzner, F., Kape, J. & Bocquet, A. 2016. European Overseas Regional Ecosystem Profile – Pacific: Pitcairn Islands. BEST Initiative, European Commission. https://ec.europa.eu/environment/nature/biodiversity/best/regions/index_en.htm
- Convention on Biological Diversity (CBD) 2020. Update of the zero draft of the post-2020 global biodiversity framework. CBD/POST2020/PREP/2/1. <https://www.cbd.int/doc/c/3064/749a/0f65ac7f9def86707f4eaefa/post2020-prep-02-01-en.pdf>
- Day, J., Dudley, N., Hockings, M., Holmes, G., Laffoley, D., Stolton, S., Wells, S. & Wenzel, L. (eds.) 2019. *Guidelines for applying the IUCN protected area management categories to marine protected areas*. Second edition, IUCN. Gland, Switzerland: IUCN. <https://portals.iucn.org/library/node/10201>
- Defra. 2018. A Green Future: Our 25 Year Plan to Improve the Environment. <https://www.gov.uk/government/publications/25-year-environment-plan>
- Defra. 2019. Measuring environmental change: outcome indicator framework for the 25 Year Environment Plan. <https://www.gov.uk/government/publications/25-year-environment-plan-progress-reports>
- Defra. 2021. Outcome Indicator Framework for the 25 Year Environment Plan: 2021 Update. <https://www.gov.uk/government/publications/25-year-environment-plan-progress-reports>
- Dudley, N. (editor.). 2008. *Guidelines for Applying Protected Area Management Categories*. Gland, Switzerland: IUCN <https://portals.iucn.org/library/sites/library/files/documents/PAG-021.pdf>
- Government of Gibraltar. 2020. Gibraltar - Key Indicators. Available online at <https://www.gibraltar.gov.gi/statistics/key-indicators>
- Nicolas, T., Trifault, L & Legraverant, Y. 2017. Outre-mer European Profil d'Écosystème Régional – Océan Indien. BEST Initiative, European Commission. https://ec.europa.eu/environment/nature/biodiversity/best/regions/index_en.htm
- Sovereign Base Areas (SBA) Administration. 2019. Background information available online at: <https://www.sbaadministration.org/index.php/m-background>
- Taylor, M., Pelembe, T. & Brickle, P. 2016. European Overseas Regional Ecosystem Profile – South Atlantic. BEST Initiative, European Commission. https://ec.europa.eu/environment/nature/biodiversity/best/regions/index_en.htm
- Vaslet, A. & Renoux, R. 2016. European Overseas Regional Ecosystem Profile – Caribbean Region. BEST Initiative, European Commission. https://ec.europa.eu/environment/nature/biodiversity/best/regions/index_en.htm
- Wilkinson, N.I., Hall, J.G., Vickery, J.A. & Buchanan, G.M. 2017. The nature and extent of terrestrial protected area coverage on the UK's Overseas Territories. *Environmental Conservation* 44(4): 397-404.