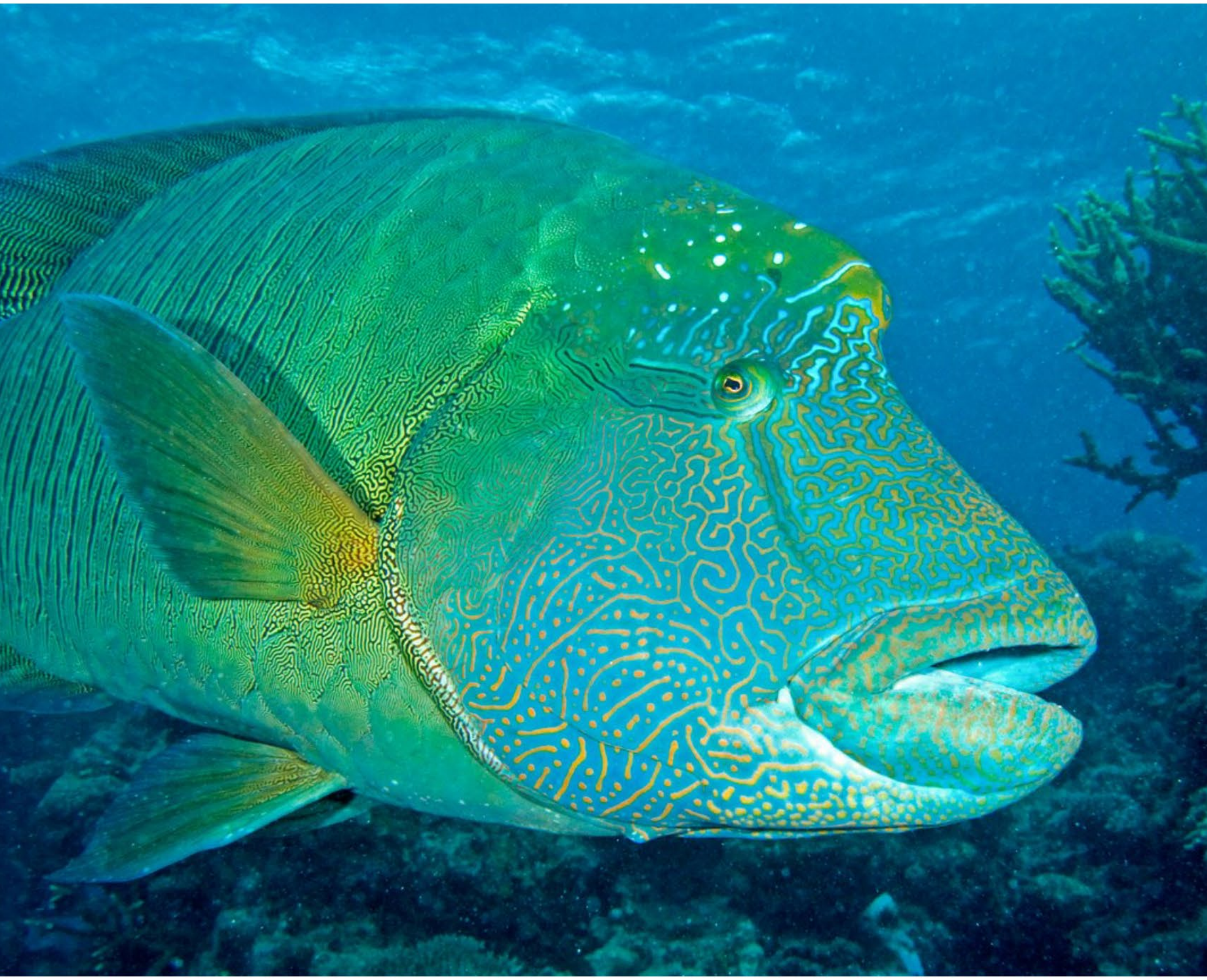
Guidelines for using *A Global Standard for the Identification of Key Biodiversity Areas*

Version 1.0



Guidelines for using

A Global Standard for the Identification of Key Biodiversity Areas

Prepared by the KBA Standards and Appeals Committee of the IUCN Species Survival Commission and IUCN World Commission on Protected Areas.

Version 1.0

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These guidelines are also freely available online at the Key Biodiversity Areas website (www.keybiodiversityareas.org). The guidelines are conceived as a “living document” and will be updated periodically. Please submit comments and suggestions to chair.sac@keybiodiversityareas.org.

Contents

Acknowledgements

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Abbreviations

AOO	Area of occupancy
AZE	Alliance for Zero Extinction
CR	Critically Endangered
CR(PE)	Critically Endangered (Possibly Extinct)
DD	Data Deficient
EBSA	Ecologically and Biologically Significant Area
EEZ	Exclusive Economic Zone
EOO	Extent of occurrence
EN	Endangered
ESH	Extent of suitable habitat
EW	Extinct in the Wild
FPIC	Free, Prior and Informed Consent
GIS	Geographic information system
GPS	Global positioning system
IBA	Important Bird and Biodiversity Area
ILK	Indigenous and Local Knowledge
IMMA	Important Marine Mammal Area
IPA	Important Plant Area
IUCN	International Union for Conservation of Nature
KBA	Key Biodiversity Area
NCG	National Coordination Group
RFP	Regional Focal Point
RLE	Red List of Ecosystems

VU	Vulnerable
WDKBA	World Database of Key Biodiversity Areas

Foreword

Purpose of the KBA Guidelines

Key Biodiversity Areas (KBAs) are sites that contribute significantly to the global persistence of biodiversity. *A Global Standard for the Identification of Key Biodiversity Areas* (IUCN, 2016, hereafter the KBA Standard) provides quantitative criteria and associated thresholds for identifying KBAs in an objective, repeatable and transparent way.

The purpose of the "Guidelines for using *A Global Standard for the Identification of Key Biodiversity Areas*" (hereafter the KBA Guidelines) is to ensure that KBA identification is based on consistent, scientifically rigorous yet practical methods. The KBA Guidelines provide an overview of the steps for identifying and delineating KBAs, together with explanation of how the KBA criteria, thresholds and delineation procedures should be applied in practice. The primary audience for the KBA Guidelines includes individuals or organisations interested in proposing or reviewing KBAs (i.e. KBA proposers), KBA National Coordination Groups (NCGs) and KBA Regional Focal Points (RFPs).

It is important that the KBA Standard remains stable for a period of time to enable comparisons of sites identified as KBAs across regions and over time. The KBA Guidelines, on the other hand, will be reviewed and amended periodically, with frequent updates anticipated in the initial years as experience in applying the KBA Standard grows. We expect these updates will be mostly clarifications and additions of detail rather than substantial changes, with the exception of a few sections clearly identified in the text below. We value input from users – suggestions on how to improve the KBA Guidelines may be submitted to chair.sac@keybiodiversityareas.org at any time. We especially welcome additional KBA identification and delineation case studies and examples that illustrate application of the KBA criteria, thresholds and delineation procedures.

How to use the KBA Guidelines

The KBA Guidelines should be used in close conjunction with the KBA Standard, which is available in English, French and Spanish.

The introduction to the KBA Guidelines provides background information essential for applying the KBA criteria, thresholds and delineation procedures. We recommend that users read the introductory chapter in full before initiating any KBA identification process.

Five chapters provide guidelines on applying species-based criteria (and their associated assessment parameters), ecosystem-based criteria and criteria based on ecological integrity and quantitative analysis of irreplaceability (in preparation). These chapters start with an overview section including a flowchart that summarises the steps. Detailed guidance for each step is provided in a frequently-asked-questions format. Further chapters cover delineation procedures, stakeholder consultation and involvement, data availability, quality and uncertainty and reassessment.

Note that this version of the KBA Guidelines does not include guidance on the following:

(a) the use of distinct genetic diversity as an assessment parameter (Criteria A1, B1, B2);

(b) the use of globally most important 5% of occupied habitat (Criterion B3c);

(c) the use of irreplaceability through quantitative analysis (Criterion E).

Guidance on these is in development and will appear in later versions of the KBA Guidelines.

Definitions of terms used in the KBA Standard are provided in Appendix I. A one-page summary of the KBA criteria and thresholds is provided in Appendix II.

Detailed supplementary guidance on documentation and the process of submitting a KBA proposal to the World Database of Key Biodiversity Areas (WDKBA) is provided in the Guidance on the process of Proposing, Reviewing, Nominating and Confirming Key Biodiversity Areas and the Documentation and Mapping Standards.

The KBA Guidelines are designed for use in electronic or printed form. Terms defined in Appendix I are highlighted in blue; related documents or web resources available online are highlighted in purple (see Appendix V for links).

1. Introduction

1.1 Key Biodiversity Areas

Key Biodiversity Areas (KBAs) are sites that contribute significantly to the global persistence of biodiversity. The criteria used to identify KBAs incorporate elements of biodiversity across genetic, species and ecosystem levels, and are applicable to terrestrial, freshwater, marine and subterranean systems. KBAs have delineated boundaries and are actually or potentially manageable as a unit. However, the process of KBA identification and delineation does not include steps to advance management activity and does not imply that any specific conservation action, such as protected area designation, is required.

1.2 A Global Standard for the Identification of Key Biodiversity Areas

The KBA Standard (IUCN, 2016) defines a set of criteria and associated quantitative thresholds for identifying KBAs in an objective, repeatable and transparent way. The general approach for identifying KBAs was informed by the IUCN Red List of Threatened Species (IUCN, 2012a, hereafter the IUCN Red List) and by the IUCN Red List of Ecosystems (IUCN, 2017, hereafter the IUCN RLE), which use quantitative criteria and thresholds to identify threatened species and ecosystem types respectively. Development of the KBA criteria, thresholds and delineation procedures was informed by decades of experience identifying important sites for biodiversity, including Alliance for Zero Extinction (AZE) sites (Ricketts et al., 2005), Important Bird and Biodiversity Areas (IBAs, Donald et al., 2018), Important Fungus Areas (Evans et al., 2001), Important Plant Areas (IPAs, Plantlife International, 2004; Darbyshire et al., 2017), previous iterations of Key Biodiversity Areas (Eken et al., 2004; Langhammer et al., 2007), Prime Butterfly Areas (van Swaay & Warren, 2006), Ramsar sites (Ramsar, 2008), Special Protection Areas (Stroud et al., 1990) and Ecologically and Biologically Significant Areas (EBSAs, Dunn et al., 2014). The KBA criteria, thresholds and delineation procedures were subject to extensive consultation. The KBA Standard has been approved by the International Union for Conservation of Nature (IUCN) Council and was launched at the World Conservation Congress in Hawai'i in 2016.

1.3 Criteria and subcriteria for identifying Key Biodiversity Areas

The KBA criteria are explicitly designed to cover all levels of ecological organisation, including genetic diversity, species and ecosystems. The KBA criteria include both species-based criteria similar to those used in the above-mentioned schemes (e.g., AZE sites, IBAs), and ecosystem-based criteria designed to identify sites that are important for biodiversity at the ecosystem level. Genetic diversity is addressed through its inclusion in assessment parameters used to identify sites under several of the species-based criteria.

The eleven criteria are grouped into five high-level criteria (A-E). A site must contribute significantly to the global persistence of at least one of the following to qualify as a KBA:

A. Threatened biodiversity (Criteria A1-2)

B. Geographically restricted biodiversity (Criteria B1-4)

C. Ecological integrity (Criterion C)

D. Biological processes (Criteria D1-3)

or, it must have:

E. Very high irreplaceability, as determined through quantitative analysis (Criterion E).

The **threatened biodiversity** criterion (A) identifies sites contributing significantly to the global persistence of *threatened species* (A1) or *threatened ecosystem types* (A2).

The **geographically restricted biodiversity** criterion (B) identifies sites contributing significantly to the global persistence of *individual geographically restricted species* (B1), *co-occurring geographically restricted species* (B2), *geographically restricted assemblages* (B3), or *geographically restricted ecosystem types* (B4).

The **ecological integrity** criterion (C) identifies sites that contribute significantly to the global persistence of wholly *intact ecological communities* with supporting large-scale ecological processes.

The **biological processes** criterion (D) identifies sites contributing significantly to the global persistence of demographic *aggregations* (D1), *ecological refugia* (D2), or *recruitment sources* (D3).

The **irreplaceability through quantitative analysis** criterion (E) identifies sites that have very high *irreplaceability* for the global persistence of biodiversity as determined through a complementarity-based quantitative analysis of irreplaceability.

Many of the criteria include subcriteria (e.g., a, b, …) that describe explicitly how the site contributes to the global persistence of biodiversity (Appendix II). A site that qualifies as a KBA under Criterion A1 (threatened species) subcriterion b, for example, supports ≥ 1% of the global population size and ≥ 10 reproductive units of a species listed as Vulnerable (VU) on the IUCN Red List (Fig. 1.3). Recognition that a site meets KBA thresholds may be based on one or more assessment parameters. A site may be recognised as meeting the thresholds for subcriterion A1b, for example, based on the assessment parameters (ii) area of occupancy and (iii) extent of suitable habitat (Fig. 1.3). This site would then be listed as a KBA under Criterion A1b(ii, iii).

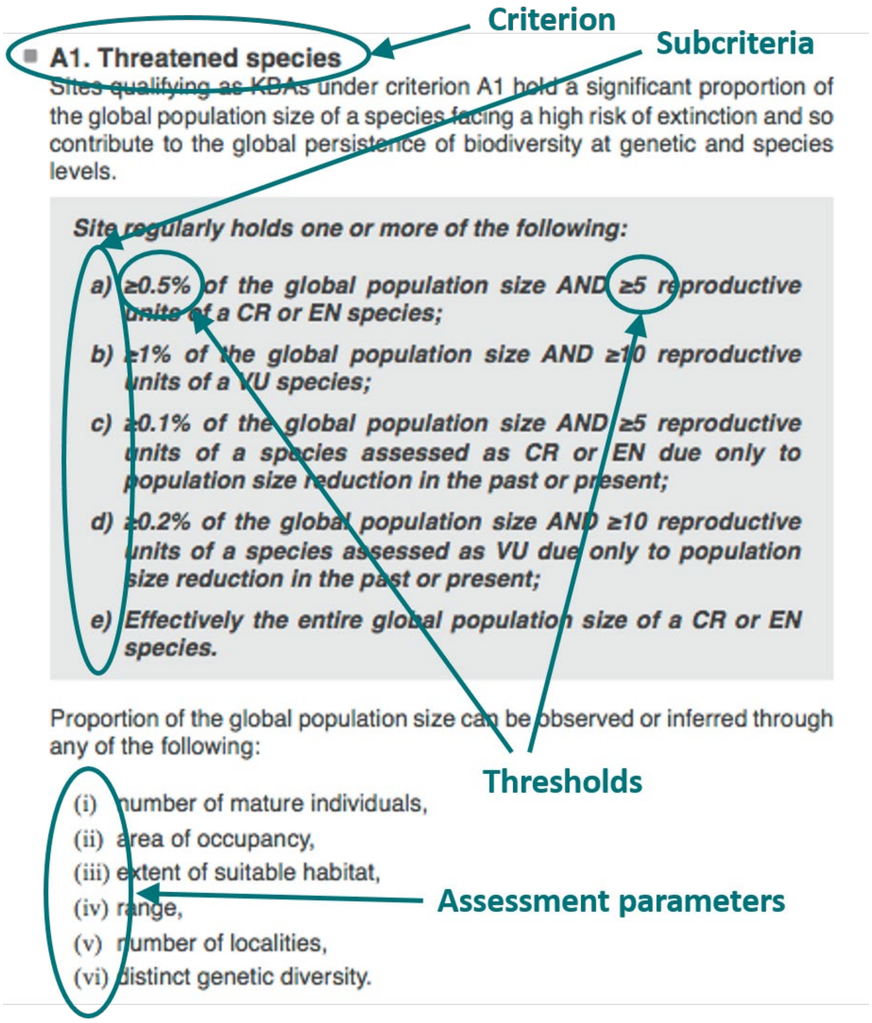

Figure 1.3 Criteria, subcriteria, thresholds and assessment parameters

A site needs to meet the thresholds for only one criterion or subcriterion to qualify as a KBA, but all sites should be assessed against as many KBA criteria and for as many taxonomic groups and ecosystem types as possible, given available data. Assessing sites against multiple criteria and for multiple biodiversity elements will strengthen the robustness of KBA identification to changes in the status of particular trigger species, assemblages, or ecosystem types. For example, if a KBA is identified for both a globally threatened species of mammal (under Criterion A1) and an aggregation of fish (under Criterion D1), the site would remain a KBA even if the mammal is down-listed so that it is not globally threatened. Assessing sites against multiple criteria and for multiple biodiversity elements may be an iterative process.

1.4 Thresholds for identifying Key Biodiversity Areas

The KBA criteria have quantitative thresholds to ensure that KBA identification is objective, repeatable and transparent. The thresholds in the KBA Standard are designed to identify sites that contribute significantly to the global persistence of biodiversity under each of the KBA criteria. These thresholds were developed through a series of technical workshops and subsequently refined through wide expert consultation and testing with datasets covering diverse taxonomic groups, regions and environments. Guidelines for national or regional application of the KBA criteria and thresholds will be developed in due course.

The KBA thresholds have been developed to apply to all macroscopic species (i.e. excluding micro-organisms) and ecosystem types in terrestrial, freshwater, marine and subterranean systems. The need to define criteria and thresholds that can be applied consistently across biodiversity elements and systems meant that some complexity was unavoidable.

Many KBA thresholds are based on proportions of a species' global population size or an ecosystem's extent. For example, a site would qualify as a KBA under Criterion A1b if it holds ≥1% of the global population of a Vulnerable species (Fig. 1.3), or under Criterion B4 if it holds 20% or more of the global extent of an ecosystem type (Appendix II). The use of percentage thresholds avoids the challenge of identifying fixed numeric thresholds (such as a pre-defined number of mature individuals or ecosystem extent) that would be appropriate across all taxonomic groups or ecosystem types.

The KBA Standard is designed to be flexible to enable assessment of species for which there is limited information on population sizes. There is therefore a range of assessment parameters that can be used to estimate the proportion of the global population size at a site if estimates of the number of mature individuals are not available. These assessment parameters include area of occupancy (AOO), extent of suitable habitat (ESH), range, number of localities and distinct genetic diversity.

Differences in species characteristics are accounted for in parameter definitions that incorporate life-history traits. Population size, for example, is measured in terms of mature individuals, where the definition of mature individuals can be adapted for different life forms, such as clonal colonial organisms. The thresholds are thus based on specific parameter definitions presented in the KBA Standard and the KBA Guidelines; many of these definitions are the same as for the IUCN Red List.

1.5 Confirmed presence of biodiversity elements in Key Biodiversity Areas

KBA identification requires the confirmed presence at the site of one or more biodiversity elements (e.g., species, species assemblage, or ecosystem type) that trigger one or more of the KBA criteria. Many species-based criteria have two thresholds, one relating to the percentage of the global population held by the site, the other relating to the number of reproductive units present at the site. This second threshold is designed to ensure that the species is documented at the site in sufficient numbers that the population is capable of maintaining itself beyond the current generation. In the case of Criterion C, a site evaluation should be conducted to verify that ecological communities at each proposed site are intact.

1.6 Climate and environmental change

Sites that do not currently meet the criteria and thresholds cannot be identified as KBAs based on predictions that they will do so in the future as a result of climate change. Models that predict the future locations of biodiversity elements under specific climate-change scenarios may be important in national and regional conservation planning exercises but cannot be used to identify KBAs that do not currently meet the criteria and thresholds.

Likewise, the predicted loss of biodiversity elements at sites that currently meet the KBA criteria and thresholds due to climate or other environmental change does not preclude its identification as a KBA.

1.7 Delineating Key Biodiversity Areas

Delineation is the process of defining the geographic boundaries of a KBA and is a required step in the KBA identification process. The aim is to derive site boundaries that are ecologically relevant and provide a basis for potential management activities. Delineation is an iterative process that typically involves assembling spatial datasets (Section 7.1), deriving initial KBA boundaries based on ecological data (Section 7.2), refining the ecological boundaries to yield practical KBA boundaries (Section 7.3) and documenting delineation precision (see the Documentation and Mapping Standards).

1.8 Stakeholder consultation and involvement

KBAs should not overlap. If a new site proposed as a KBA intersect with an existing KBA (including AZE sites, IBAs and KBAs identified under previous initiatives), then consensus-building with proposers of the existing KBA is required before the boundaries of any existing KBA are modified (see Section 8.2).

The process of KBA identification and delineation does not include steps to advance management activity. It is recognized that involvement of those who hold rights to terrestrial, freshwater, marine or subterranean resources is strongly recommended before any action that might affect their rights to those resources (see Section 8.3). In particular, the Free, Prior and Informed Consent (FPIC) of indigenous peoples or other natural resource dependent communities is required when contemplating actions or decisions that could affect rights to lands, territories or resources (IUCN Standard on Indigenous Peoples).

1.9 Data availability, quality and uncertainty

KBA identification should be based on a compilation of the most comprehensive and up-to-date available data and the best available methods for quantitative analysis. Nonetheless, it is recognised that the availability of high quality data and quantitative analysis differs significantly among taxonomic groups and ecosystems. (See Section 9 for further guidelines on data availability, quality and uncertainty.)

Site assessments that are not based on the best available data may be vulnerable to challenge through an Appeal. KBA proposers must assess whether the data supporting a site's qualification as a KBA are reasonable and defensible. KBA proposals will be reviewed during the submission process (see Guidance on the process of Proposing, Reviewing, Nominating and Confirming Key Biodiversity Areas).

1.10 Reassessment of sites as Key Biodiversity Areas

Confirmed KBAs should be reassessed against the KBA criteria and thresholds at least once every 8-12 years, with more frequent monitoring of biodiversity elements that triggered KBA qualification recommended where possible. Both genuine status changes and new information about the biodiversity element(s) triggering KBA criteria and thresholds may affect the status of a site as a KBA. Previously confirmed KBAs that no longer meet any criteria will no longer be considered global KBAs, unless there is reasonable expectation that the site will requalify in the near future (see Section 10 for further guidelines on reassessment of sites as KBAs). However, such sites may still meet thresholds for regional significance, once these thresholds have been developed.

1.11 Definitions

Important terms used in the KBA criteria, thresholds, assessment parameters and delineation procedures have specific definitions, as set out in the KBA Standard and reproduced and expanded in Appendix I to the KBA Guidelines.

The KBA Standard uses several assessment parameters that are also used in IUCN Red List or IUCN RLE assessments (e.g., "mature individuals", "AOO"). The KBA Guidelines therefore make frequent reference to the Guidelines for using the IUCN Red List Categories and Criteria (IUCN SPSC, 2017) and the Guidelines for the application of IUCN RLE Categories and Criteria (IUCN, 2017), which provide more detailed discussion of these parameters.

1.12 Documentation

Sites will only be accepted as KBAs if they are adequately documented, and following review by independent reviewers. All required documentation should be compiled prior to review. Documentation provides information to reviewers on the justification for identifying a site as a KBA and to decision-makers on why each KBA is important. Documentation also enables analysis of KBA data across species, ecosystem types and countries. (See the Documentation and Mapping Standards for further guidance.)

2. Identifying Key Biodiversity Areas using species-based criteria (A1, B1-3, D1-3)

Criterion E is also based on species but is covered separately in Section 6 because the identification process differs substantially from that used for Criteria A1, B1-3 and D1-3.

2.1 Overview

NCGs and/or KBA proposers are encouraged to conduct a comprehensive scoping analysis (Steps 1-4 in Fig. 2.1) to identify all potential KBA trigger biodiversity elements and potential KBAs in the region of interest for which there are adequate data.

For species-based criteria (A1, B1-3, D1-3), this may be implemented by taxonomic group. NCGs or KBA proposers may choose to start by compiling data for a few taxonomic groups in existing KBAs, other sites of importance for biodiversity, and protected or conserved areas. However, for each country, the aim should be to conduct inventories and compile locality data for as many taxa as possible to improve data availability for lesser-known biodiversity elements (e.g., some invertebrates, fungi). Assessing sites against multiple criteria and biodiversity elements will strengthen the robustness of KBAs to changes in the status of particular trigger species.

In practice, the process of KBA identification is likely to vary greatly between countries. Some KBA proposers may wish to focus on identifying KBAs for a particular species or taxonomic group; whereas others may be primarily interested in a particular site and prefer to start by conducting an inventory of biodiversity elements that may meet KBA criteria and thresholds at the site. However, all sites must meet the criteria and thresholds in the KBA Standard, consistent with the KBA Guidelines, to be accepted as KBAs.

This chapter includes a section for each of the species-based criteria, except Criterion E. The section for each criterion includes a complete set of steps, so that it stands alone, with the result that some text is repeated under some or all criteria.

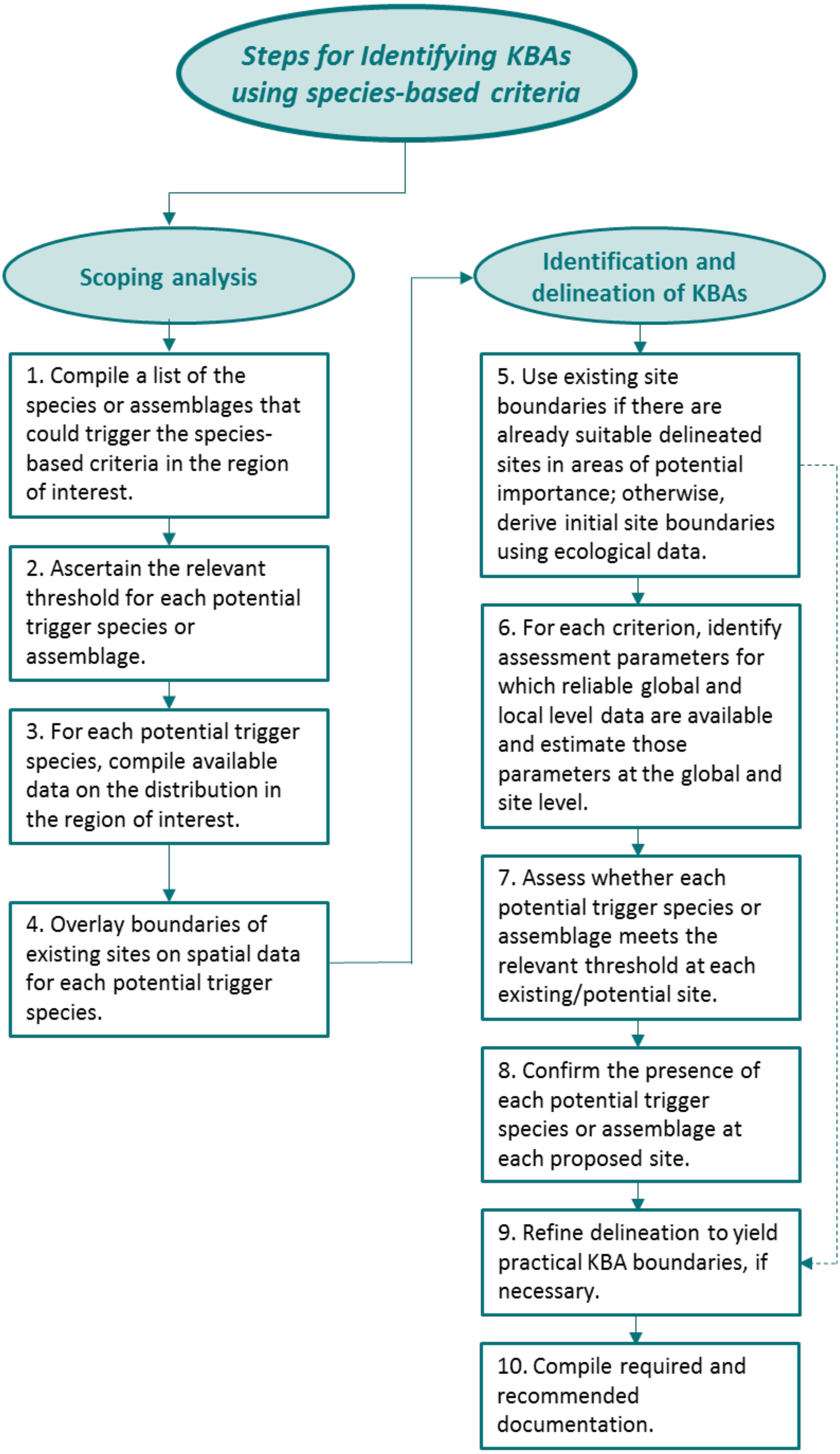

Figure 2.1 Overview of possible workflow for applying Criteria A1, B1-3, D1-3.

2.2 Identifying species that might trigger KBAs

2.2.1 Taxonomy

What taxonomy should be used for species that have been assessed for the IUCN Red List?

The taxonomy used for KBA identification needs to be consistent with the taxonomy used in IUCN Red List assessments. For species that have been assessed on the IUCN Red List, KBA proposers should follow the taxonomy used in the IUCN Red List, even if it differs from the taxonomy used for the national Red List. If new information on taxonomy is available, the IUCN Red List account must be updated first, before a KBA can be confirmed based on the new information.

What taxonomy should be used for species that have not been assessed on the IUCN Red List?

For species that have not been assessed on the IUCN Red List but fall under the remit of an IUCN Red List Authority, KBA identification should follow the taxonomy used by the IUCN Red List Authority. In many cases, this taxonomic information is available online. KBA proposers should check with the relevant IUCN Red List Authority where there is uncertainty (for example, regarding the status of any recently published species).

For taxonomic groups that do not have a designated IUCN Red List Authority, KBA proposers should liaise with their RFP or the KBA Secretariat, if an RFP has not been appointed), who will ask the IUCN Red List Unit whether there is an approved checklist (e.g., Catalogue of Life, World Register of Marine Species) or relevant expert group (e.g., an IUCN Species Survival Commission subcommittee) who can advise on taxonomy. The final decision on which taxonomy to follow rests with the IUCN Red List Unit.

Can KBAs be identified for undescribed species?

Undescribed species cannot trigger KBAs unless the species has been assessed on the IUCN Red List (see IUCN Red List Guidelines; IUCN SPSC, 2017, Section 2.1.1 for conditions under which undescribed species may be listed). In the case of species that are in the process of being formally described through a scientific article that has not yet been published, the site will not be confirmed for that species until the article has been published and the species has been accepted be the IUCN Red List Authority or relevant expert group.

Can KBAs be identified for subspecies or varieties?

The thresholds associated with the species-based criteria (i.e. A1, B1-3, D1-3 and E) are designed to be applied at the species level. Subspecies, evolutionarily significant units, or varieties cannot trigger global KBAs. However, a site may qualify under Criterion A1, B1 or B2 because it holds a threshold proportion of distinct genetic diversity for a species.

Guidelines for regional application of the KBA criteria and thresholds, when developed, may include provision for sites that are important for the persistence of subspecies or varieties.

Can KBAs be identified for extinct species?

No. But see Section 2.3.1 for species that are listed on the IUCN Red List as Critically Endangered (Possibly Extinct), or as Extinct in the Wild (EW) that are in the process of reintroduction.

2.2.2 Species only known from their type locality

Can species known only from their type locality trigger a KBA?

Critically Endangered (CR) or Endangered (EN) species known only from their type locality can trigger Criterion A1e if the species is assessed as unlikely to occur beyond the site. This information should be available in the IUCN Red List account.

Generally, species known only from their type locality should not be automatically assumed to trigger KBA Criteria B1, B2, or B3, without further assessment of whether the species might occur beyond the site. For species that have been assessed for the IUCN Red List, this information should be available in the IUCN Red List account.

The distribution of species listed as Data Deficient (DD) on the IUCN Red List may be poorly known. For DD species and other species with limited data, proposers should consult with relevant experts (e.g., IUCN Red List assessors) to evaluate whether the species is likely to occur more widely and, hence, would likely fail to trigger KBA Criterion B if its distribution was well known. If this consultation reveals that the species is likely to occur more widely, this information should be forwarded to the KBA Secretariat, which will forward new information to relevant Red List Authorities on a periodic basis.

2.2.3 Migratory species

How are KBAs identified for migratory species?

For migratory species with well defined spatially segregated life-cycle processes, such as breeding, feeding and migration, Criteria A1, B1-3, D1a and D2 can be triggered separately by mature individuals in each spatially segregated life function.

For example, a CR migratory species may trigger subcriterion A1e if a single site holds effectively the entire global population size of breeding adults during the breeding season, even if no mature individuals are found at the site during the non-breeding season. The same species could also trigger a separate KBA under subcriterion A1a if the site regularly holds ≥0.5% of the population size and ≥5 reproductive units in the non-breeding season. (See Section 3.3 for guidance on reproductive units for migratory species.)

2.2.4 Managed and introduced populations

Can KBAs be identified for managed populations?

Only populations that are considered "wild", following the guidance provided in the IUCN Red List Guidelines (IUCN SPSC, 2017, Section 2.1.4), can trigger a KBA. There is a continuum of management intensities from captive populations (e.g., in zoos, aquaria and greenhouses) to populations not benefiting from any conservation measure. Many populations are dependent on anthropogenic ecosystems (e.g., reservoirs or grazed ecosystems) and/or conservation measures (e.g., protected areas) – these populations are generally considered wild. Captive animal populations and cultivated plant populations are not considered wild. In general, classification as wild should be based on the intensity of management and the expected viability of the population without intensive management. For example, an unmanaged population of a plant species in a botanical garden may be considered wild, whereas a population dependent on heated greenhouses would not. For further guidance, please refer to the IUCN Red List Guidelines (IUCN SPSC, 2017, Section 2.1.4).

Can KBAs be identified for introduced populations?

A site that supports an introduced population outside its natural range and that is considered wild may be identified as a KBA only if all the following conditions are met:

(a) The known or likely intent of the introduction was to reduce the extinction risk of the introduced species;

(b) The site is geographically close to the natural range of the taxon (see IUCN SPSC, 2017, Section 2.1.3 for definition of "geographically close");
(c) The introduced population has produced viable offspring at the site; and
(d) At least five years have passed since introduction.

Please see the IUCN Red List Guidelines (IUCN SPSC, 2017, Section 2.1.3) for further details.

2.3 Applying Criterion A1 to identify KBAs for threatened species

2.3.1 Identify the globally threatened species in the taxonomic group(s) of interest that may trigger Criterion A1 in the region of interest.

The list of globally threatened species that may trigger Criterion A1 in each country will be provided automatically through the WDKBA when it is fully functional. Until then, this information can be found on the IUCN Red List by searching for species assessed as Critically Endangered (CR), Endangered (EN), or Vulnerable (VU) that occur in each country.

How are globally threatened species identified for the purposes of applying KBA Criterion A1?

The IUCN Red List is the global standard for species threat assessments despite its taxonomic and geographic gaps (Stuart et al., 2010) and using it as the authority for threatened species increases the rigour and transparency of the KBA identification process. Species that can trigger KBA Criterion A1 are:

- species assessed as globally threatened (i.e. CR, EN or VU) on the IUCN Red List; and
- species that (a) have not been assessed globally and (b) are endemic to the region/country in question and (c) have been assessed as regionally/nationally threatened using the Guidelines for Application of IUCN Red List Criteria at Regional and National Levels (IUCN, 2012b)[1] or equivalent systems[2]. A repository

[1] National Red Lists that are based on the Guidelines for Application of IUCN Red List Criteria at Regional and National Levels will be flagged. Please email info@nationalredlist.org with any questions.
[2] For example, for species endemic to Canada and/or the USA, species assessed as possibly extinct (GH), possibly extinct in the wild (GHC), critically imperiled (G1) or imperiled (G2) using NatureServe global conservation status ranks (Master et al., 2012) can trigger KBA Criterion A1. For the purposes of KBA identification, species listed as GH, GHC or G1 are considered equivalent in status to species listed as CR or EN on the IUCN Red List; whereas species listed as G2 are considered approximately equivalent in status to species listed as VU on the IUCN Red List (Master et al., 2012). Rounded NatureServe global ranks should be used when a species has been assigned a range rank (e.g., G1G3 would be rounded to G2). Species assessed over 8-12 years ago should be reassessed prior to being used to identify KBAs.

of species assessed at national levels can be found at www.nationalredlist.org. KBA proposers should consult with their RFP (if appointed) or the KBA Secretariat before using equivalent systems.

If a species' IUCN Red List threat category has been proposed but not yet accepted or is in revision, the site will not be confirmed as a KBA for the species under the new threat category until after the new IUCN Red List account is published.

The KBA Standard does not specify any particular version of the IUCN Red List Criteria (IUCN, 2016, p. 16), but the most recent assessment must be used for each species. Species assessed as globally CR, EN or VU under previous versions of the IUCN Red List Criteria that have not been updated may trigger KBA Criterion A1, but it is strongly recommended that such species are reassessed prior to KBA identification to confirm that they fall into the same categories under the current criteria.

Can species assessed as Critically Endangered (Possibly Extinct) trigger a KBA?

For species listed as CR (PE), only the site at which the species is most likely to occur (if it still exists) can trigger KBA Criterion A1, under subcriterion A1e. For many species listed as CR(PE), this corresponds to the location of the last recorded population. There is no reproductive-unit threshold for Criterion A1e.

Can species assessed as Extinct in the Wild (EW) trigger a KBA?

Sites that hold populations of species listed on the IUCN Red List as EW that are in the process of reintroduction within their natural range may trigger KBA Criterion A1a, c, or e, as appropriate. Reintroduction efforts should either be underway at the time of the KBA assessment or planned to take place within the next two years. (If reintroduction is not yet underway, the site will be flagged as "restoration dependent" in the WDKBA and the site's status will be revisited in two years.)

2.3.2 Ascertain the relevant population-size threshold for each potential trigger species given its threat category.

For each species that can trigger Criterion A1, the relevant threshold depends on its category on the IUCN Red List (e.g., CR, EN, VU). A site qualifies as a KBA under Criterion A1 because it regularly holds one or more of the following:

a) ≥0.5% of the global population size AND ≥5 reproductive units of a CR or EN species;

b) ≥1% of the global population size AND ≥10 reproductive units of a VU species;

c) ≥0.1% of the global population size AND ≥5 reproductive units of a species assessed as CR or EN due only to population size reduction in the past or present (as indicated by the IUCN Red List assessment);

d) ≥0.2% of the global population size AND ≥10 reproductive units of a species assessed as VU due only to population size reduction in the past or present (as indicated by the IUCN Red List assessment);

e) Effectively the entire global population size of a CR or EN species.

KBA subcriteria A1a and A1b are intended for general applicability across all globally threatened species. KBA subcriteria A1c and A1d are intended for limited application to species that have experienced, or are currently experiencing, rapid decline in population size. KBA subcriteria A1c and A1d apply only to species listed as CR, EN, or VU under IUCN Red List Criterion A only; and only to species listed under IUCN Red List subcriteria A1, A2, and/or A4, and not under A3. (For example, KBA subcriterion A1c would apply to a species listed as CR A2, but not to a species listed as CR A2+3+4 and not to a species listed as CR A2; C2; D.)

What is meant by "effectively the entire global population size" in KBA subcriterion A1e?

A site is considered to hold "effectively" the entire global population size of a CR or EN species if it holds more than 95% of the global population size. This is the threshold used in identifying AZE sites (Ricketts et al., 2005). The entire global population refers to the population in the wild, not including individuals in captivity.

2.3.3 For each potential trigger species, compile readily available data on the distribution in the region of interest.

Locality data may be found through a literature search, online databases, museum/herbarium records, and direct contact with biodiversity knowledge-holders. Some of these data may need to be digitised for use in a geographic information system (GIS). ESH maps already developed for birds, mammals and amphibians, and AOO for some species, will be provided through the WDKBA, when it is fully functional. Range maps for many globally threatened species can be downloaded from the IUCN Red List.[3]

[3] Individual range maps can be downloaded from IUCN Red List species accounts; whole groups may be downloaded from http://www.iucnredlist.org/technical-documents/spatial-data; and custom-built sets using a free Red List user account.

2.3.4 Overlay boundaries of existing sites on spatial data for each potential trigger species.

Using a GIS, boundaries of existing sites (e.g., existing KBAs, other sites of importance for biodiversity, protected or conserved areas) can be overlaid on areas that are important for globally threatened species to generate a list of existing sites that might qualify as KBAs under Criterion A1. (See the WDKBA, Plantlife IPA Database, Ramsar Sites Information Service, and the Protected Planet Database for GIS data on existing sites.)

2.3.5 If there are no suitable delineated sites in areas of potential importance, derive initial KBA boundaries using ecological data.

In some cases, the scoping analysis may reveal areas of potential importance where there are no existing KBAs, other recognised sites of importance for biodiversity, or protected or conserved areas. In this case, initial boundaries for potential KBAs may be based on ecological considerations (see Section 7.2). These boundaries may need to be refined later to yield practical KBA boundaries (see Section 7.3).

2.3.6 Identify assessment parameters for which reliable global and local level data are available, and estimate these parameters at the global and site level.

For each potential trigger species, review the available data at global and local levels and decide which assessment parameters to use, then estimate global and site-level values for those parameters.

For Criterion A1, the proportion of the global population size at a site can be observed or inferred through any of the following:

(i) number of mature individuals,
(ii) area of occupancy,
(iii) extent of suitable habitat,
(iv) range,
(v) number of localities,
(vi) distinct genetic diversity.

See Section 3.1 for guidelines on selecting among assessment parameters.

2.3.7 Assess whether each potential trigger species meets the relevant population-size threshold at each existing/potential site.

For each globally threatened species, the proportion of the global population that regularly occurs at a site will be calculated in the WDKBA based on the estimated global and site-level values entered or selected for each assessment parameter by the proposer, and then compared to the relevant population-size threshold for the species given its threat category.

2.3.8 Confirm the presence of each potential trigger species that meets the relevant population-size threshold at each proposed site.

The final step in assessing a site against KBA Criterion A1 is to confirm the presence of each potential trigger species at the site by reviewing recent data or conducting new field surveys if necessary. For subcriteria A1a-d, the species must be regularly present in numbers that meet or exceed the relevant reproductive-unit threshold. There is no reproductive-unit requirement for subcriterion A1e. Nevertheless, it is still necessary to confirm that the species regularly occurs at the site (see Section 9.2.3).

2.3.9 Refine ecological boundaries, if necessary, to yield practical KBA boundaries.

KBA delineation is not complete until ecological boundaries have been evaluated and refined, if necessary, to yield a manageable site or sites (see Section 7.3 for further guidelines).

2.3.10 Compile required and recommended documentation under Criterion A1.

See the Documentation and Mapping Standards for required and recommended documentation for Criterion A1.

2.4 Applying Criterion B1 to identify KBAs for individual geographically restricted species

2.4.1 Identify the species in the taxonomic group(s) of interest that may trigger Criterion B1 in the region of interest.

Any site containing a species whose population or distribution is so concentrated that 10% or more of the global population size regularly falls within the site can qualify as a KBA under B1. As part of the scoping analysis, NCGs or KBA proposers are encouraged to identify species that are geographically concentrated in existing sites (e.g., existing KBAs, other sites of importance for biodiversity, protected or conserved areas) or in other areas that have the potential to be delineated as sites.

How are geographically restricted species identified for the purposes of applying KBA Criterion B1?

For the purpose of identifying KBAs under Criterion B1, any species is considered geographically restricted if it meets the threshold for B1, regardless of whether the species is identified as restricted-range (as per Criterion B2) restricted to an ecoregion or bioregion (as per Criterion B3), ecoregion, and regardless of whether it is globally threatened. Some species with broad global distributions have many individuals concentrated in just a few areas within their range limits and may therefore trigger Criterion B1. Any species whose population or distribution is so concentrated in certain places that ≥ 10% of the global population size regularly occurs in a single site may trigger a KBA under Criterion B1.

Can migratory species trigger Criterion B1?

The KBA Standard states that "the regular occurrence of all life stages of a species at a site distinguishes Criterion B1 from Criterion D1" (IUCN, 2016, p. 18). Here, the KBA Guidelines clarify that Criterion B1 may apply to resident or migratory species as long as at least 10% of the global population size and at least 10 reproductive units of the species regularly occur at the site. The criterion should be applied separately to each spatially segregated life-cycle process. For example, a migratory species may be geographically restricted in its breeding range, but not in its non-breeding range, or *vice versa*. In contrast, Criterion D1 is intended to apply solely to highly mobile species (e.g., migratory or nomadic species) that aggregate at particular sites at high densities that make them especially vulnerable to over-exploitation or other threats.

2.4.2 Ascertain the relevant population-size threshold for each potential trigger species.

A site qualifies as a KBA under Criterion B1 because it regularly holds ≥10% of the global population size AND ≥10 reproductive units of a species.

2.4.3 For each potential trigger species, compile readily available data on the distribution in the region of interest.

Locality data may be found through a literature search, online, museum/herbarium records, and direct contact with biodiversity knowledge-holders. Some of these data may need to be digitised for use in a GIS. ESH maps already developed for birds, mammals and amphibians, and AOO for some species, will be provided through the WDKBA, when it is fully functional. Range maps for many globally threatened species can be downloaded from the IUCN Red List.[4]

2.4.4 Overlay boundaries of existing sites on spatial data for each potential trigger species.

Using a GIS, boundaries of existing sites (e.g., existing KBAs, other sites of importance for biodiversity, protected or conserved areas) can be overlaid on areas that are important for individual geographically restricted species to generate a list of existing sites that might qualify as KBAs under Criterion B1. (See the WDKBA, Plantlife IPA

[4] Individual range maps can be downloaded from IUCN Red List species accounts; whole groups may be downloaded from http://www.iucnredlist.org/technical-documents/spatial-data; and custom-built sets using a free Red List user account.

Database, Ramsar Sites Information Service, and the Protected Planet Database for GIS data on existing sites.)

2.4.5 If there are no suitable delineated sites in areas of potential importance, derive initial KBA boundaries using ecological data.

In some cases, the scoping analysis may reveal areas of potential importance where there are no existing KBAs, other recognised sites of importance for biodiversity, or protected or conserved areas. In this case, initial boundaries for potential KBAs may be based on ecological considerations (see Section 7.2). These boundaries may need to be refined later to yield practical KBA boundaries (see Section 7.3).

2.4.6 Identify assessment parameters for which reliable global and local level data are available, and estimate these parameters at the global and site level.

For each potential trigger species, review the available data at global and local levels and decide which assessment parameters to use, then estimate global and site-level values for those parameters.

For Criterion B1, the proportion of the global population size at a site can be observed or inferred through any of the following:

(i) number of mature individuals,
(ii) area of occupancy,
(iii) extent of suitable habitat,
(iv) range,
(v) number of localities,
(vi) distinct genetic diversity.

See Section 3.1 for guidelines on selecting among assessment parameters.

2.4.7 Assess whether each potential trigger species meets the relevant population-size threshold at each existing/potential site.

For each potential trigger species, the proportion of the global population that regularly occurs at a site will be calculated in the WDKBA based on the estimated global and site-level values entered or selected for each assessment parameter by the proposer, and then compared to the population-size threshold for Criterion B1.

2.4.8 Confirm the presence of each potential trigger species that meets the relevant population-size threshold at each proposed site.

The final step in assessing a site against KBA Criterion B1 is to confirm the presence of each potential trigger species at the site in numbers that meet or exceed the relevant reproductive-unit threshold by reviewing recent data or conducting new field surveys if necessary.

2.4.9 Refine ecological boundaries, if necessary, to yield practical KBA boundaries.

KBA delineation is not complete until ecological boundaries have been evaluated and refined, if necessary, to yield a manageable site or sites (see Section 7.3 for further guidelines).

2.4.10 Compile required and recommended documentation under Criterion B1.

See the Documentation and Mapping Standards for guidance on required and recommended documentation for Criterion B1.

2.5 Applying Criterion B2 to identify KBAs for co-occurring geographically restricted species

2.5.1 Identify the species in the taxonomic group(s) of interest that could trigger Criterion B2 in the region of interest.

The first step in applying Criterion B2 is to identify the appropriate taxonomic rank for applying this criterion for each taxonomic group. Please see recommended taxonomic ranks for applying Criteria B2 and B3. For taxonomic groups without a recommended taxonomic rank, KBA proposers are encouraged to review the guidelines below and consult with the RFP (if appointed) or the KBA Secretariat, who will consult with IUCN Red List Authorities and other relevant experts, as appropriate, before proceeding with site assessments. For each taxonomic group, the same taxonomic rank should be used to apply Criteria B2 and B3 globally.

The second step in applying Criterion B2 is to compile a list of restricted-range species for each taxonomic group. For taxonomic groups that have been comprehensively assessed on the IUCN Red List at the recommended taxonomic rank (e.g., mammals, birds and amphibians) or previously assessed against Criterion B2, a list of restricted-range species will be provided through the WDKBA. For other taxonomic groups, KBA proposers are encouraged to review the guidelines below and consult with the RFP (if appointed) or the KBA Secretariat before proceeding with site assessments.

Site analysis should be conducted separately for each taxonomic group (i.e. geographically restricted species from different taxonomic groups cannot be combined to meet the Criterion B2).

How is the appropriate taxonomic rank for applying Criterion B2 determined?

Criterion B2 may be based on any taxonomic rank above species (IUCN, 2016, p. 19). KBA proposers are encouraged to use the most inclusive rank for which range size data are available for all species. In the case of birds, for example, it would be inappropriate to determine the number of restricted-range species in a genus of birds, given that range sizes are known for all birds; rather, the number of restricted-range birds should be determined from the entire Class. For highly speciose taxa (such as the Order Lepidoptera, which includes approximately 180,000 species), it may be more appropriate to work at a lower taxonomic rank than Class, such as Family. It is worth noting that working at a lower taxonomic rank will make it less likely that 2 or more potential trigger species co-occur at the same site, as required by the threshold.

How are restricted-range species identified for the purposes of applying KBA Criterion B2?

For the purpose of identifying KBAs under Criterion B2, the KBA Standard defines restricted-range species as species having a global range size less than or equal to the 25th percentile of range-size distribution in a taxonomic group for which all species have been mapped globally (i.e. the quarter of species in the taxonomic group with the smallest ranges), up to a maximum of 50,000 km^2. If the 25th percentile of range-size distribution for a taxonomic group falls below 10,000 km^2, restricted range should be defined as having a global range size less than or equal to 10,000 km^2 (i.e. all species with global range size less than or equal to 10,000 km^2 are considered restricted-range). If the 25th percentile of range-size distribution is unknown for a taxonomic group, restricted range should be defined as having a global range size less than or equal to 10,000 km^2.

For coastal, riverine and other species with linear distributions that do not exceed 200 km width at any point, restricted range is defined as having a global range less than or equal to 500 km linear geographic span (i.e. the distance between occupied locations furthest apart). Species known only from their type locality should not automatically be assumed to have a restricted range, since this may be indicative of under-sampling, especially for DD species.

Can KBA Criterion B2 be applied to migratory species?

The KBA Standard does not comment on the applicability of Criterion B2 to migratory species. The criterion should be applied separately to each spatially segregated life-cycle process. For example, a migratory species that is restricted-range in its breeding range, but not in its non-breeding range, could only trigger KBAs under Criterion B2 in its breeding range; whereas a migratory species that is restricted-range in its breeding and its non-breeding range, could trigger KBAs in its breeding range and its non-breeding range.

2.5.2 Ascertain the relevant species threshold for each taxonomic group and population-size threshold for each potential trigger species.

A site qualifies as a KBA under Criterion B2 because it regularly holds ≥1% of the global population size of each of a number of restricted-range species in a taxonomic group, determined as either ≥2 species OR 0.02% of the global number of species in the taxonomic group, whichever is larger. For example, if the total number of species in the taxonomic group is 20,000, the threshold number is 4.

For each taxonomic group that has been comprehensively assessed for the IUCN Red List at the recommended taxonomic rank (e.g., amphibians, birds, mammals) or previously assessed for Criterion B2, the global number of species in the taxonomic group will be provided through the WDKBA, together with the threshold number of restricted-range species that must co-occur at a site to trigger a KBA under Criterion B2.

For taxonomic groups that have not been comprehensively assessed for the IUCN Red List or previously assessed for Criterion B2, KBA proposers should estimate the global number of species in the taxonomic group. Note that an exact number may not be required. If that number is less than 15,000, then the species threshold is 2 restricted-range species. Conversely, if that number is greater or equal to 15,000, then the species threshold is 0.02% of the global number of species in the taxonomic group (for example, a taxonomic group containing 15,000-19,999 species would require 3 restricted-range species in the taxonomic group to co-occur at the site).

2.5.3 For each taxonomic group, overlay distribution data for restricted-range species to identify areas where they co-occur in the region of interest.

Locality data may be found through a literature search, online, museum/herbarium records, and direct contact with biodiversity knowledge-holders. Some of these data may need to be digitised for use in a GIS. ESH maps already developed for birds, mammals and amphibians, and AOO for some species, will be provided through the WDKBA, when it is fully functional. Range maps for many globally threatened species can be downloaded from the IUCN Red List.[5]

Distribution data may be overlaid in a GIS to identify areas where restricted-range species (identified following guidelines in Section 2.5.1) in the same taxonomic group co-occur.

[5] Individual range maps can be downloaded from IUCN Red List species accounts; whole groups may be downloaded from http://www.iucnredlist.org/technical-documents/spatial-data; and custom-built sets using a free Red List user account.

2.5.4 Overlay boundaries of existing sites on spatial data for each potential trigger species.

Using a GIS, boundaries of existing sites (e.g., existing KBAs, other sites of importance for biodiversity, protected or conserved areas) can be overlaid on areas that are important for co-occurring geographically restricted species to generate a list of existing sites that might qualify as KBAs under Criterion B2. (See the WDKBA, Plantlife IPA Database, Ramsar Sites Information Service, and the Protected Planet Database for GIS data on existing sites.)

2.5.5 If there are no suitable delineated sites in areas of potential importance, derive initial KBA boundaries using ecological data.

In some cases, the scoping analysis may reveal areas of potential importance where there are no existing KBAs, other recognised sites of importance for biodiversity, or protected or conserved areas. In this case, initial boundaries for potential KBAs may be based on ecological considerations (see Section 7.2). These boundaries may need to be refined later to yield practical KBA boundaries (see Section 7.3).

2.5.6 Identify assessment parameters for which reliable global and local level data are available, and estimate these parameters at the global and site level.

For each potential trigger species, review the available data at global and local levels and decide which assessment parameters to use, then estimate global and site-level values for those parameters.

For Criterion B2, the proportion of the global population size at a site can be observed or inferred through any of the following:

(i) number of mature individuals,
(ii) area of occupancy,
(iii) extent of suitable habitat,
(iv) range,
(v) number of localities,
(vi) distinct genetic diversity.

See Section 3.1 for guidelines on selecting among assessment parameters.

2.5.7 Assess whether each potential trigger species meets the relevant population-size threshold at each existing/potential site.

For each potential trigger species, the proportion of the global population that regularly occurs at a site will be calculated in the WDKBA based on the estimated global and site-level values entered or selected for each assessment parameter by the proposer, and then compared to the population-size threshold for Criterion B2. The number of species that meet the population-size threshold at the site will then be compared to the species threshold for Criterion B2, given the global number of species in the taxonomic group.

2.5.8 Confirm the presence of each potential trigger species that meets the relevant population-size threshold at each proposed site.

The final step in assessing a site against KBA Criterion B2 is to confirm the presence of each potential trigger species at the site by reviewing recent data, or conduct new field surveys if necessary.

How can species presence be confirmed at a site for Criterion B2 given that there is no reproductive-unit threshold?

While there is no explicit reproductive-unit threshold for Criterion B2, numbers and densities of mature individuals should be sufficient to support reproduction at sites used for breeding. KBA proposers are encouraged to confirm the presence of potential trigger species at the site in terms of reproductive units, where this information is readily available (using the 10 reproductive-unit threshold for Criterion B1, for example).

2.5.9 Refine ecological boundaries, if necessary to yield practical KBA boundaries.

KBA delineation is not complete until ecological boundaries have been evaluated and refined, if necessary, to yield a manageable site or sites (see Section 7.3 for further guidelines).

2.5.10 Compile required and recommended documentation under Criterion B2.

See the Documentation and Mapping Standards for guidance on required and recommended documentation for Criterion B2.

2.6 Applying Criterion B3 to identify KBAs for geographically restricted assemblages

2.6.1 Identify the species in the taxonomic group(s) of interest that may trigger Criterion B3 in the region of interest.

The first step in applying Criterion B3 is to identify the appropriate taxonomic rank for applying this criterion for each taxonomic group. Please see recommended taxonomic ranks for applying Criteria B2 and B3. For taxonomic groups without a recommended taxonomic rank, KBA proposers are encouraged to review the guidelines below and consult with the RFP (if appointed) or the KBA Secretariat, who will consult with IUCN Red List Authorities and other relevant experts, as appropriate, before proceeding with site assessments. For each taxonomic group, the same taxonomic rank should be used to apply Criteria B2 and B3 globally.

The second step is to determine whether subcriterion B3a or B3b is applicable to each taxonomic group. For taxonomic groups that have been comprehensively assessed on the IUCN Red List at the recommended taxonomic level or previously been assessed under Criterion B3, this information will be provided through the WDKBA. For other taxonomic groups, KBA proposers are encouraged to review the guidelines below and consult with RFP (if appointed) or the KBA Secretariat before proceeding with site assessments.

The third step in applying subcriterion B3a or B3b is to identify ecoregion-restricted species (for B3a) or bioregion-restricted species (for B3b). For taxonomic groups that have been comprehensively assessed on the IUCN Red List or previously been assessed under Criterion B3, a list of ecoregion- or bioregion-restricted species, as appropriate, will be provided through the WDKBA. For other taxonomic groups, KBA proposers should follow the guidelines below.

How is the appropriate subcriterion (B3a or B3b) determined?

The KBA Standard states that Criterion B3a is applicable to taxonomic groups for which the global median range size is <25,000 km^2, while B3b is applicable to taxonomic groups with a global median range size ≥25,000 km^2 (IUCN 2016, p. 19).

The first step in determining whether Criterion B3a or B3b is applicable is to check whether the ranges of all species in the taxonomic group, or a representative sample have been mapped globally using a consistent methodology. If so, then these data can be used to estimate median range size. If not, then proposers should default to subcriterion B3a if ecoregion-restricted species can be identified, or subcriterion B3c otherwise (guidelines in preparation).

For example, B3a is applicable to amphibians (median range size: 4,607 km^2), and B3b is applicable to mammals (median range size: 193,305 km^2) and birds (median range size: 471,617 km^2).

What about subcriterion B3c?

[Note. Guidelines on subcriterion B3c are in preparation and will be included in the next version of the KBA Guidelines. In the meantime, please contact chair.sac@keybiodiversityareas.org with comments or questions.]

How are ecoregion-restricted assemblages identified under subcriterion B3a?

Links to ecoregion shapefiles are provided in Appendix V. These are ecoregions mapped by Dinerstein et al. (2017) for terrestrial systems (updating Olson et al., 2001)), by Abell et al. (2008) for freshwater systems, and by Spalding et al. (2007) for nearshore marine systems. Ecoregions have not yet been defined for the open ocean, but for most taxonomic groups that include pelagic species, subcriterion B3b rather than B3a is likely to be applicable.

KBA proposers interested in developing a new list of ecoregion-restricted species for a taxonomic group are asked to contact the KBA Secretariat first to avoid duplication of effort. KBA proposers should use the best available data (range or ESH) for each species (not necessarily the same data type for all species) to produce the list of ecoregion-restricted species for each taxonomic group, if such lists are not already available in the WDKBA. Ecoregion-restricted species need to be restricted to the ecoregion throughout their range, not just in the country or region of interest. For a species to be considered ecoregion-restricted, at least 95% of the global population should be confined to a single ecoregion (see definition of assemblage).

How are bioregion-restricted assemblages identified under subcriterion B3b:

Links to bioregion shapefiles will be provided in Appendix V, when available. These may be based on an intersection of terrestrial biomes and biogeographic realms defined by Dinerstein *et al.* (2017) in terrestrial systems (for example, bioregion would equal a terrestrial biome within a particular biogeographic realm), and the marine provinces defined by Spalding et al. (2007) and Spalding et al. (2012) in marine systems.

KBA proposers interested in developing a new list of bioregion-restricted species for a taxonomic group are asked to contact the KBA Secretariat first to avoid duplication of effort. KBA proposers should use the best available data (range or ESH) for each species (not necessarily the same data type for all species) to produce the list of bioregion-restricted species for each taxonomic group, if such lists are not already available in the WDKBA. Bioregion-restricted species need to be restricted to the ecoregion throughout their range, not just in the country or region of interest. For a species to be considered bioregion-restricted, at least 95% of the global population should be confined to a single bioregion (see definition of assemblage).

Can geographically restricted assemblages be identified across ecoregion or bioregion boundaries under B3a or B3b?

Criterion B3 applies to individual ecoregions or bioregions. Geographically restricted assemblages cannot be combined across ecoregion or bioregion boundaries to meet the thresholds.

Can KBA Criterion B3 be applied to migratory species?

The KBA Standard does not comment on the applicability of Criterion B3 to migratory species. The criterion should be applied separately to each spatially segregated life-cycle process. For example, a migratory species may be ecoregion- or bioregion-restricted in its breeding range, but not in its non-breeding range, in which case it can only trigger a KBA under Criterion B3 in its breeding range.

2.6.2 Ascertain the relevant species threshold for each taxonomic group and population-size threshold for each potential trigger species.

A site qualifies as a KBA under Criterion B3 because it regularly holds one or more of the following:

a) ≥0.5% of the global population size of each of a number of ecoregion-restricted species within a taxonomic group, determined as either ≥5 species OR 10% of the species restricted to the ecoregion, whichever is larger;

b) ≥5 reproductive units of ≥5 bioregion-restricted species OR ≥5 reproductive units of 30% of the bioregion-restricted species known from the country, whichever is larger, within a taxonomic group;

c) Part of the globally most important 5% of occupied habitat for each of ≥5 species within a taxonomic group.

Subcriterion B3a:

For each combination of ecoregion and taxonomic group that has been comprehensively assessed for the IUCN Red List or previously assessed for Criterion B3a, the number of ecoregion-restricted species at the appropriate taxonomic rank for applying Criterion B3 will be provided through the WDKBA, together with the number of ecoregion-restricted species that must co-occur at a site to trigger a KBA under Criterion B3a.

For other taxonomic groups, proposers should estimate the number of species restricted to the ecoregion. Note that an exact number may not be required. If the number is less than 60, then the threshold is simply 5 ecoregion-restricted species. Conversely, if the number is greater than or equal to 60 then the species threshold is 10% of the number of species restricted to the ecoregion.

Subcriterion B3b:

For each combination of bioregion and taxonomic group, KBA proposers should estimate the number of species within the taxonomic group that are both restricted to the bioregion and known from the country (i.e. the number known from the country is per bioregion not for a combination of bioregions). Note that an exact number may not be required. If the number is less than 20, then the threshold is simply 5 bioregion-restricted species. Conversely, if the number is greater than or equal to 20 then the species threshold is 30% of the number of species restricted to the bioregion that are known from the country.

"Known from the country" requires regular occurrence, and cannot be based on vagrants. For marine species "known from the country" refers to the Exclusive Economic Zone (EEZ).

Subcriterion B3c:

[Note. Guidelines on subcriterion B3c are in preparation and will be included in the next version of the KBA Guidelines.]

2.6.3 For each taxonomic group, overlay distribution data for geographically restricted species to identify areas where they co-occur in the region of interest.

Locality data may be found through a literature search, online databases, museum/herbarium records, and direct contact with biodiversity knowledge-holders. Some of these data may need to be digitised for use in a GIS. ESH maps already developed for birds, mammals and amphibians, and AOO for some species, will be provided through the WDKBA, when it is fully functional. Range maps for many globally threatened species can be downloaded from the IUCN Red List.[6]

For each taxonomic group, global or country-level distribution data may be overlaid in a GIS to identify areas where geographically restricted species (identified following guidelines in Section 2.6.1) in the same taxonomic group co-occur.

2.6.4 Overlay boundaries of existing sites on spatial data for each potential trigger species.

Using a GIS, boundaries of existing sites (e.g., existing KBAs, other sites of importance for biodiversity, protected or conserved areas) can be overlaid on areas that are important for geographically restricted assemblages to generate a list of existing sites that might qualify as KBAs under Criterion B3. (See the WDKBA, Plantlife IPA Database, Ramsar Sites Information Service, and the Protected Planet Database for GIS data on existing sites.)

[6] Individual range maps can be downloaded from IUCN Red List species accounts; whole groups may be downloaded from http://www.iucnredlist.org/technical-documents/spatial-data; and custom-built sets using a free Red List user account.

2.6.5 If there are no suitable delineated sites in areas of potential importance, derive initial KBA boundaries using ecological data.

In some cases, the scoping analysis might reveal areas of potential importance where there are no existing KBAs, other recognised sites of importance for biodiversity, or protected or conserved areas. In this case, initial boundaries for new potential KBAs should be based on ecological considerations (see Section 7.2). These boundaries may need to be refined later to yield practical KBA boundaries (see Section 7.3).

2.6.6 Identify assessment parameters for which reliable global and local level data are available, and estimate these parameters at the global and site level.

Subcriterion B3a:

For each proposed site, first assess whether the threshold number of ecoregion-restricted species co-occurs at the site. For each potential trigger species, review the available data at global and local levels and decide which assessment parameters to use, then estimate global and site-level values for those parameters. Under subcriterion B3a, the proportion of the global population size can be observed or inferred through any of the following:

(i) number of mature individuals,
(ii) area of occupancy,
(iii) extent of suitable habitat,
(iv) range,
(v) number of localities.

See Section 3.1 for guidelines on selecting among assessment parameters.

Subcriterion B3b:

For each proposed site, first assess whether the threshold number of bioregion-restricted species co-occurs at the site. For subcriterion B3b, the threshold is defined in terms of reproductive units. Note that the 5 reproductive-unit threshold applies regardless of whether the species threshold is 5 bioregion-restricted species or 30% of bioregion-restricted species known from the country.

[Note. Guidelines on subcriterion B3c are in preparation and will be included in the next version of the KBA Guidelines.]

2.6.7 Assess whether each potential trigger species meets the relevant population-size threshold at each existing/potential site.

For each potential trigger species under subcriterion B3a, the proportion of the global population that regularly occurs at a site will be calculated in the WDKBA, based on the estimated global and site-level values entered or selected for each assessment parameter by the proposer, and then compared to the population-size threshold for subcriterion B3a. The number of species that meet the population-size threshold at the site will then be compared to the species threshold for subcriterion B3a, given the number of species in the taxonomic group restricted to the ecoregion.

For each potential trigger species under subcriterion B3b, the number of reproductive units that regularly occurs at the site will be compared in the WDKBA to the reproductive-unit threshold. The number of species that meet the population-size threshold at the site will then be compared to the species threshold for subcriterion B3b, given the number of species in the taxonomic group restricted to the bioregion and known from the country.

2.6.8 Confirm the presence of each potential trigger species that meets the relevant population-size threshold at each proposed site.

The final step in assessing a site against KBA Criterion B3 is to confirm the presence of each potential trigger species at the site by reviewing recent data or conducting new field surveys if necessary.

For subcriterion B3b, the species must be regularly present in numbers that meet or exceed the relevant reproductive-unit threshold.

While there is no explicit reproductive-unit threshold for subcriteria B3a and B3c, numbers and densities of mature individuals should be sufficient to support reproduction at sites used for breeding. KBA proposers are encouraged to confirm the presence of potential trigger species at the site in terms of reproductive units, where this information is readily available, using the 5 reproductive-unit threshold for Criterion B3b, for example).

2.6.9 Refine ecological boundaries, if necessary, to yield practical KBA boundaries.

KBA delineation is not complete until ecological boundaries have been evaluated and refined, if necessary, to yield a manageable site or sites (see Section 7.3 for further guidelines).

2.6.10 Compile required and recommended documentation under Criterion B3.

See the Documentation and Mapping Standards for guidance on required and recommended documentation for Criterion B3.

2.7 Applying Criterion D1 to identify KBAs for demographic aggregations

2.7.1 Identify the species in the taxonomic group(s) of interest that may trigger Criterion D1 in the region of interest.

For each taxonomic group of interest, proposers should compile a list of species that might trigger Criterion D1 in the region of interest, i.e. species that aggregate at highly localized relative abundances, typically during a specific life-cycle process. Relevant information will most likely be found through a literature search or expert knowledge.

How are demographic aggregations identified for the purposes of applying KBA Criterion D1?

An aggregation is defined in the KBA Standard as: "A geographically restricted clustering of individuals that typically occurs during a specific life-cycle process such as breeding, feeding or migration. This clustering is indicated by highly localised relative abundance, two or more orders of magnitude larger than the species' average recorded numbers or densities at other stages during its life-cycle." (IUCN, 2016, p. 11)

The KBA Standard refers to a difference in relative abundance of two or more orders of magnitude, but this is advisory rather than required. The intention is to ensure that sites identified as KBAs under Criterion D1 support much higher levels of abundance than other areas where the species occurs. Sites that support ≥1% of the global population size of a species but where the species is not aggregated at much higher than average densities do not qualify as KBAs under Criterion D1. For example, almost the entire global population of Kirtland's Warbler (*Setophaga kirtlandii*, NT) breeds in a very limited area in north and central Michigan (USA), but does not aggregate to breed, so does not trigger D1. It could, however, trigger KBAs under B1 for any site that regularly holds ≥10% of the global population size and ≥10 reproductive units of the species.

For migratory species, KBAs should be identified at key stop-over or bottleneck sites rather than for entire migratory corridors. These sites should be manageable units, as with all sites proposed as KBAs.

Can Criterion D1 be applied to non-migratory species?

The KBA Standard states that "Criterion D1 is not meant to identify sites that hold all key stages of a species' life-cycle; those sites may be triggered by criteria A1, B1, B2 or B3." Thus, Criterion D1 is not generally intended to apply to resident species or the resident components of partially migratory species, although it may be triggered by resident species that aggregate in specific areas within their range for specific life-cycle processes (e.g., at lekking areas or in spawning areas).

Can KBA Criterion D1 be applied to aggregations of juveniles or other life stages?

KBA Criterion D1 applies to sites that support threshold numbers of mature individuals as the threshold is defined in terms of mature individuals.

2.7.2 Ascertain the relevant population-size threshold for each potential trigger species given its threat category.

A site qualifies as a KBA under Criterion D1 because it predictably holds one or more of the following:

a) An aggregation representing ≥1% of the global population size of a species, over a season, and during one or more key stages of its life cycle;
b) A number of mature individuals that ranks the site among the largest 10 aggregations known for the species.

The term "life-history stage" is intended to be synonymous with life-cycle process (e.g., breeding, feeding, or migration) and does not refer to developmental stage (e.g., pup, juvenile, adult).

For subcriterion D1b, proposers should estimate the aggregation size at sites that host the largest aggregations of the species globally, with the number of sites sufficient to demonstrate clearly that any proposed KBAs rank among the largest 10 aggregations.

2.7.3 For each potential trigger species, compile readily available data on the distribution in the region of interest.

Relevant data on species' aggregations will most likely be found through a literature search or expert knowledge, or possibly online databases. Some of these data may need to be digitised for use in a GIS.

2.7.4 Overlay boundaries of existing sites on spatial data for each potential trigger species.

Using a GIS, boundaries of existing sites (e.g., existing KBAs, other sites of importance for biodiversity, protected or conserved areas) can be overlaid on areas that are important for demographic aggregations in a GIS to generate a list of existing sites that might qualify as KBAs under Criterion D1. (See the WDKBA, Plantlife IPA Database, Ramsar Sites Information Service, and the Protected Planet Database for GIS data on existing sites.)

What does "over a season" mean in the threshold for D1a?

"Over a season, and during one or more key stages of its life cycle" refers to a specific period of the year when some or all members of a population predictably aggregate to perform some specific life-cycle processes, such as breeding, moulting, or over-wintering. A migratory stopover or bottleneck site that supports ≥1% of the global population size over the course of the migratory season would qualify under subcriterion D1a even if the estimated number of individuals present does not exceed 1% of the global population size at any point in time. Discriminating migratory or bottleneck sites may be challenging for species that do not fly. Individuals are expected to accumulate in such sites because the movement process slows, so stopover and bottleneck sites may be distinguished by higher than average densities along a migratory corridor. In such cases, it is important to provide supporting evidence to show that the cumulative total of individuals during a season meets the threshold (e.g., through individual mark-recapture data).

Can subcriterion D1b be applied separately to aggregations for specific functions?

The D1b threshold (i.e., the largest 10 aggregations known for the species) applies across all life-cycle processes rather than separately for specific functions (e.g., breeding or feeding). Thus, if a species forms aggregations at one time of year for breeding and aggregations at another time of year for feeding, only the ten largest aggregations across both seasons would qualify.

2.7.5 If there are no suitable delineated sites in areas of potential importance, derive initial KBA boundaries using ecological data.

In some cases, the scoping analysis might reveal areas of potential importance where there are no existing KBAs, other recognised sites of importance for biodiversity, or protected or conserved areas. In this case, initial boundaries for new potential KBAs should be based on ecological considerations (see Section 7.2). These boundaries may need to be refined later to yield practical KBA boundaries (see Section 7.3).

2.7.6 Identify assessment parameters for which reliable global and local level data are available, and estimate these parameters at the global and site level.

For Criterion D1, the proportion of the global population size at a site can be observed or inferred through the following:

(i) number of mature individuals.

For many species, the global number of mature individuals will be provided through the WDKBA.

For Criterion D1, a site predictably holds a species if the species is known to have occurred at the site in at least two thirds of the relevant seasons for which adequate data are available; the total number of seasons being not less than three. For example, a site would qualify if a species occurs there at threshold numbers in 7 out of 10 years. This is consistent with the definition of "regularly" in the application of Ramsar Criteria 5 and 6 (Ramsar, 2008).

For some species, numbers of individuals in large aggregations are extremely hard to estimate, but the densities of individuals in aggregations of the same type may be relatively consistent (e.g., seabirds nest pecking-distance apart). In this case, the size (i.e. area or volume) of the aggregation may be used to infer whether a site ranks among the largest 10 aggregations known for the species under Criterion D1b.

2.7.7 Assess whether each potential trigger species meets the relevant population-size threshold at each existing/potential site.

For each potential trigger species under subcriterion D1a, the proportion of the global population that occurs in seasonal aggregations at a site will be calculated in the WDKBA based on the estimated global and site-level values entered or selected for each assessment parameter by the proposer, and then compared to the population-size threshold for subcriterion D1a.

2.7.8 Confirm the seasonal presence of each potential trigger species that meets the relevant population-size threshold at each proposed site.

The final step in assessing a site against KBA Criterion D1 is to confirm the seasonal presence of each potential trigger species at each proposed site by reviewing recent data or conducting new field surveys if necessary.

What is necessary to confirm seasonal presence at a site for Criterion D1 given that there are no reproductive-unit thresholds?

While there is no explicit reproductive-unit threshold for Criterion D1, KBA proposers are encouraged to confirm the presence of potential trigger species at the site in terms of reproductive units, where appropriate (using the 10 reproductive-unit threshold for Criterion B1, for example). This is most relevant for spawning aggregations that are severely depleted but trigger Criterion D1b.

2.7.9 Refine ecological boundaries, if necessary, to yield practical KBA boundaries.

KBA delineation is not complete until ecological boundaries have been evaluated and refined, if necessary, to yield a manageable site or sites (see Section 7.3 for further guidelines).

2.7.10 Compile required and recommended documentation under Criterion D1.

See the Documentation and Mapping Standards for guidance on required and recommended documentation for Criterion D1.

2.8 Applying Criterion D2 to identify KBAs for ecological refugia

2.8.1 Identify the species in the taxonomic group(s) of interest that may trigger Criterion D2 in the region of interest.

Compile a list of species that may trigger Criterion D2 in the region of interest, i.e. species that become concentrated during periods of environmental stress. Relevant information will most likely be found through a literature search or expert knowledge.

2.8.2 Ascertain the relevant population-size threshold for each potential trigger species given its threat category.

A site qualifies as a KBA under Criterion D2 because it supports ≥10% of the global population size of one or more species during periods of environmental stress, for which historical evidence shows that it has served as an ecological refuge in the past and for which there is evidence to suggest it would continue to do so in the foreseeable future.

2.8.3 For each potential trigger species, compile readily available data on the distribution in the region of interest.

Relevant data on species' distribution patterns during periods of environmental stress will most likely be found through a literature search and expert knowledge. Some of these data may need to be digitised for use in a GIS.

2.8.4 Overlay boundaries of existing sites on spatial data for each potential trigger species.

Using a GIS, boundaries of existing sites (e.g., existing KBAs, other sites of importance for biodiversity, protected or conserved areas) can be overlaid on areas where species become concentrated during periods of environmental stress in a GIS, to generate a list of existing sites that might qualify as KBAs under Criterion D2. (See the WDKBA, Plantlife IPA Database, Ramsar Sites Information Service, and the Protected Planet Database for GIS data on existing sites.)

2.8.5 If there are no suitable delineated sites in areas of potential importance, derive initial KBA boundaries using ecological data.

In some cases, the scoping analysis might reveal areas of potential importance where there are no existing KBAs, other recognised sites of importance for biodiversity, or protected or conserved areas. In this case, initial boundaries for new potential KBAs should be based on ecological considerations (see Section 7.2). These boundaries may need to be refined later to yield practical KBA boundaries (see Section 7.3).

2.8.6 Identify assessment parameters for which reliable global and local level data are available, and estimate these parameters at the global and site level.

For Criterion D2, the proportion of the global population size at a site can be observed or inferred through the following:

(i) number of mature individuals.

For each potential trigger species, proposers should estimate the global population size and the number of mature individuals that occur at each proposed site during periods of environmental stress. (For many species, the global number of mature individuals will be provided through the WDKBA.)

The term "predictably" is not used in Criterion D2, but consistent with D1 and D3, a site may be considered to hold a species during periods of environmental stress if the species is known to have occurred at the site in at least two thirds of the periods of environmental stress for which adequate data are available. (There is no minimum number of periods of environmental stress given here, as these are assumed to be rare events.)

2.8.7 Assess whether each potential trigger species meets the relevant population-size threshold at each existing/potential site.

For each potential trigger species under Criterion D2, the proportion of the global population that occurs at the site during periods of environmental stress will be calculated in the WDKBA, based on the estimated global and site-level values entered or selected for the assessment parameter by the proposer, and then compared to the population-size threshold for Criterion D2.

2.8.8 Confirm that conditions at each proposed site remain suitable for supporting each potential trigger species.

In addition to historical evidence showing that the site has served as an ecological refuge in the past, review recent data or conduct new field surveys if necessary, to evaluate evidence that it would continue to do so in the foreseeable future.

2.8.9 Refine ecological boundaries, if necessary to yield practical KBA boundaries.

KBA delineation is not complete until ecological boundaries have been evaluated and refined, if necessary, to yield a manageable site or sites (see Section 7.3 for further guidelines).

2.8.10 Compile required and recommended documentation under Criterion D2.

See the Documentation and Mapping Standards for guidance on required and recommended documentation for Criterion D2.

2.9 Applying Criterion D3 to identify KBAs for recruitment sources

2.9.1 Identify the species in the taxonomic group(s) of interest that may trigger Criterion D3 in the region of interest.

Compile a list of species that may trigger Criterion D3, i.e. species whose ecologies are characterised by recruitment source sites that produce propagules, larvae or juveniles that make a large contribution to the recruitment of mature individuals elsewhere. Any species with these characteristics, including many plants, fungi, marine invertebrates and fishes, can trigger Criterion D3. Recruitment sources include sites where plants or fungi produce a large number of seeds or spores that have a high probability of dispersing, germinating, and surviving to maturity; sites where adults deposit a large number of eggs that have a high probability of producing larvae that survive to maturity; and nursery sites where large numbers of larvae settle and have a high probability of growing into juveniles that survive to maturity. Relevant information will most likely be found through a literature search and or expert knowledge.

2.9.2 Ascertain the relevant population-size threshold for each potential trigger species given its threat category.

A site qualifies as a KBA under Criterion D3 because it predictably produces propagules, larvae, or juveniles that maintain ≥10% of the global population size of a species.

2.9.3 For each potential trigger species, compile readily available data on the distribution in the region of interest.

Relevant data on important source sites will most likely be found through a literature search, expert knowledge, or possibly online databases. Some of these data may need to be digitised for use in a GIS.

2.9.4 Overlay boundaries of existing sites on spatial data for each potential trigger species.

Using a GIS, boundaries of existing sites (e.g., existing KBAs, other sites of importance for biodiversity, protected or conserved areas) can be overlaid on areas that are important for recruitment in a GIS to generate a list of existing sites that might qualify as KBAs under Criterion D3. (See the WDKBA, Plantlife IPA Database, Ramsar Sites Information Service, and the Protected Planet Database for GIS data on existing sites.)

2.9.5 If there are no suitable delineated sites in areas of potential importance, derive initial KBA boundaries using ecological data.

In some cases, the scoping analysis might reveal areas of potential importance where there are no existing KBAs, other recognised sites of importance for biodiversity, or protected or conserved areas. In this case, initial boundaries for new potential KBAs should be based on ecological considerations (see Section 7.2). These boundaries may need to be refined later to yield practical KBA boundaries (see Section 7.3).

2.9.6 Identify assessment parameters for which reliable global and local level data are available, and estimate these parameters at the global and site level.

For Criterion D3, the proportion of the global population size at a site can be observed or inferred through the following:

(i) number of mature individuals.

A significant proportion of the global population of a species may be produced at sites identified under Criterion D3 even though there may be only a few mature individuals at the site at any given time. Hence, the threshold is based on the global population size of mature individuals produced by the site, rather than the number of immature individuals within the site. Proposers should estimate the global population size and the number of mature individuals that are produced by each proposed site.

For Criterion D3, a site predictably produces propagules, larvae, or juveniles that maintain ≥10% of the global population size of a species if it produces them in at least two thirds of the recruitment cycles for which adequate data are available; the total number of recruitment cycles being not less than three.

How can the number of mature individuals produced by a site be estimated?

Estimating the proportion of the global population size of mature individuals that is produced by a site will often be challenging.

For most species, it is not feasible to tag or track propagules, larvae, or juveniles from recruitment to maturity. Exceptions may include anadromous fish species with high site-fidelity (e.g., salmon), or species that produce large juveniles (e.g., sharks and rays). For some species (e.g., corals), genetic markers have been used to identify recruitment sources.

Recruitment models that include the transport or dispersal of propagules, larvae, or juveniles from recruitment sources to final settlement sites have also been developed for some species (e.g, fungi, plants, corals, benthic invertebrates), but are often complex and difficult to validate.

Identification of recruitment sources may therefore be based on the simplifying assumption that survival from proposed recruitment source habitat to maturity is uniform, unless reliable data or models are available to quantify an alternative distribution. Hence, in most cases, it will be sufficient to estimate the relative density of propagules, larvae, juveniles and use this information to identify recruitment sources that produce ≥10% of propagules, larvae, or juveniles, under the assumption that these recruitment sources also produce ≥10% of mature individuals. This can be achieved through direct sampling throughout the range or, more likely, a combination of sampling and spatial density modelling (see Appendix III.4).

2.9.7 Assess whether each potential trigger species meets the relevant population-size threshold at each existing/potential site.

For each potential trigger species under Criterion D3, the proportion of the global population size that is produced by each proposed site will be calculated in the WDKBA, based on the estimated global and site-level values entered or selected for the assessment parameter by the proposer, and then compared to the population-size threshold for Criterion D3.

2.9.8 Confirm that each proposed site produces recruits in numbers consistent with the population-size threshold.

Review recent data or conduct new field surveys if necessary to verify that each proposed site produces recruits in numbers consistent with the population-size threshold for each proposed trigger species.

2.9.9 Refine ecological boundaries, if necessary, to yield practical KBA boundaries.

KBA delineation is not complete until ecological boundaries have been evaluated and refined, if necessary, to yield a manageable site or sites (see Section 7.3 for further guidelines).

2.9.10 Compile required and recommended documentation under Criterion D3.

See the Documentation and Mapping Standards for guidance on required and recommended documentation for Criterion D3.

3. Thresholds and assessment parameters for species-based criteria (A1, B1-3, D1-3 and E)

Only populations considered "wild" should be included in estimates of assessment parameters (see Section 2.2.4).

3.1 Selecting assessment parameters

Which assessment parameters provide the best indication of the proportion of the global population size at a site?

Under KBA Criteria A1, B1-2 and B3a, the proportion of the global population size at a site can be observed or inferred through any of the following:

(i) number of mature individuals,

(ii) area of occupancy,

(iii) extent of suitable habitat,

(iv) range,

(v) number of localities,

(vi) distinct genetic diversity (except for Criterion B3a).

For each species, the best information available should be used to determine the proportion of the global population size held by the site. The same assessment parameter must be used at both the global and site levels, so the quality of data at both global and site levels needs to be considered. This may often be a matter of compromise; it is better to use an assessment parameter for which reliable estimates are available at global and site levels than one for which the site estimate is very reliable and the global estimate is unreliable, or vice versa. An assessment parameter may be unreliable if the only available data are old, the sampling strategy was not representative, or analytical methods were inappropriate.

If equally reliable data are available for both number of mature individuals and one or more of the area-based assessment parameters (i.e. ii-iv), number of mature individuals should generally be used as it provides a direct rather than indirect representation of the population's distribution. However, in some species, the number of mature individuals may fluctuate substantially among years, and area-based parameters may provide a more stable assessment parameter.

If reliable data are not available for number of mature individuals, then area-based assessment parameters may be used. For example, a 1% threshold can typically be inferred where the site contains at least 1% of a species' AOO, ESH, or range. However, these assessment parameters should be used cautiously, given that species are generally unevenly distributed across their range, suitable habitat, or AOO. An overview of area-based parameters is provided in Section 3.4. If reliable data are not available for number of mature individuals, each species should ideally be assessed using as many of the area-based assessment parameters as possible in order to develop multiple lines of evidence, although it is recognised that there will often be insufficient data to allow this.

Locality information is typically most useful for species with fragmented populations, but should only be used to infer the proportion of the global population size at a site if sampling has been sufficient to represent the range and AOO of the species.

Proposers are encouraged to provide information on all assessment parameters for which reliable data are available at both global and site levels, as this may increase the resilience and credibility of site identification and will facilitate comparison across sites.

What happens if different assessment parameters point to different conclusions?

Where different assessment parameters point to different conclusions, proposers should use the best available information and justify that choice (see Section 9.2 for further guidance). For example, consider a species for which there is reliable information at global and site levels on both ESH and AOO, with AOO providing the more accurate and precise indicator of the population's distribution. If a site does not exceed relevant thresholds based on ESH but does based on AOO, then the site will qualify as a KBA because AOO provides better information on the population's distribution. Conversely, if a site exceeds relevant thresholds based on ESH but not based on AOO, then the site will not qualify as a KBA, for the same reason. Alternatively, consider a species with reliable information at global and site levels on ESH, but out-of-date and questionable data on AOO. In this case, site assessment should be based on ESH.

The better the data available on distribution patterns, the more likely it is that a site that actually qualifies as a KBA will meet the thresholds. Site assessments that are not based on the best available data may be vulnerable to challenge through an Appeal.

Can different estimation methods be used at the global and site level?

For each species, the same assessment parameter must be used at the global and site levels, and estimation methods should be the same or as consistent as possible to ensure that population size estimates at the global and site levels are directly comparable and enable calculation of the proportion of the global population size held at the site (see Section 9.3.2 for further guidance).

For multi-species criteria (i.e. B2, B3), does the same parameter need to be used for all species at a proposed site?

When determining whether a species is restricted-range for Criterion B2 or estimating the median range size for assessing which subcriterion to apply under Criterion B3, range (not ESH) must be used for all species. The median range size can be estimated from a representative sample of species, so data on range are not required for the entire taxonomic group.

However, when determining either the proportion of the global population size at the site, or whether a species is ecoregion- or bioregion-restricted, the proposer should use the assessment parameter that provides the best available data for each individual species.

What if assessment parameters derived from the IUCN Red List account need updating?

When assessment parameters derived from the IUCN Red List, such as global population size, range, or AOO, are out-of-date, new estimates may be used in the KBA proposal but must be flagged for expert review when the KBA proposal is submitted to the WDKBA. The KBA Secretariat will forward new information to the relevant Red List Authority for review on a periodic basis.

3.2 Number of mature individuals (Criteria A1, B1-3, D1-3, E)

For Criteria A1, B1-3, D1-3 the proportion of the global population size can be observed or inferred through any of the following:

(i) number of mature individuals.

Number of mature individuals is also used in Criterion E.

Why focus on mature individuals?

The global population size and population size at a site are both measured in terms of mature individuals because this can be measured more consistently across species than the total number of individuals, given the wide variation in life history strategies and life forms.

How are mature individuals defined?

The definition of mature individuals in the KBA Standard (IUCN, 2016) is consistent with the definition used in IUCN Red List assessments: "The number of individuals known, estimated or inferred to be capable of reproduction as defined in IUCN (2012a)."

For species that have been assessed for the IUCN Red List, proposers should use the definition of mature individuals in the IUCN Red List assessment. For species from taxonomic groups that have not yet been assessed for the IUCN Red List (or for which the above information is unavailable), proposers should follow the detailed guidance on defining mature individuals in the IUCN Red List Guidelines (IUCN SPSC, 2017). The guidance below is extracted from the IUCN Red List Guidelines (IUCN SPSC, 2017, Section 4.3.1) and repeated here for convenience.

When determining the number of mature individuals, the following points should be borne in mind:

- "Reproduction" means production of offspring (not just mating or displaying other reproductive behaviour).
- Mature individuals that will never produce new recruits should not be counted (e.g., densities are too low for fertilisation).
- In the case of populations with biased adult or breeding sex ratios, it is appropriate to use lower estimates for the number of mature individuals, which take this into account.
- Reproducing units within a clone should be counted as individuals, except where such units are unable to survive alone (e.g., corals).
- In the case of taxa that naturally lose all or a subset of mature breeding individuals at some point in their life cycle, the estimate should be made at the appropriate time, when mature individuals are available for breeding.
- Reintroduced individuals must have produced viable offspring before they are counted as mature individuals. (IUCN, 2001, 2012).

For each species, information on how the number of mature individuals was determined should be noted in the documentation, including a brief explanation for any species that has not been assessed for the IUCN Red List, or species for which the IUCN Red List account does not quantify mature individuals).

For each species, the method used to determine the number of mature individuals should be consistent between the global and site levels.

What if juveniles cannot be easily distinguished from mature individuals?

When the mature/ immature ratio is similar at global and site levels, then the proportion of all individuals at a site should provide a reasonable approximation of the proportion of mature individuals at a site. For example, if the mature/ immature ratio is 50/50 at both global and site levels, a site that holds 10% of global population size of all individuals would be expected to hold 10% of the global population size of mature individuals.

In contrast, if the species distribution is characterised by spatial segregation of life stages (e.g., juveniles vs mature individuals) or the mature/ immature ratio is known to differ at global and site levels, then proposers should account for this information.

What if the sex ratio is imbalanced?

If the sex ratio is imbalanced but similar at global and site levels, then proposers may use mature individuals of either or both sexes as the basis for estimating the proportion of the global population size at a site.

However, if the sex ratio is known to differ at global and site levels, then proposers should focus on the limiting sex and use a ratio-based approach when estimating population size at both global and site levels. For species in which females bear and raise young, the limiting sex will generally be females, unless males are severely under-represented. For example, for a species with a global population of 1,200 mature individuals, with an imbalanced sex ratio in which females are the limiting sex and represent approximately 1/3 of the total population (i.e. 400 mature females total), then a site that holds 100 mature individuals (i.e. < 10% of mature individuals) but 50 mature females (i.e. 12.5% of all mature females) might be proposed as a KBA based on the 10% threshold in Criterion B1.

Where can proposers find information on the number of mature individuals at the global or site level?

For species that have been assessed for the IUCN Red List, estimates of global population size included in the IUCN Red List account will be provided through the WDKBA. However, this information is not available for all species assessed for the IUCN Red List.

For species that have not yet been assessed for the IUCN Red List, or for which this information is unavailable, other sources of information on the number of mature individuals at the global level include IUCN Red List Authorities, NatureServe, national authorities, and scientific literature.

How can proposers estimate the number of mature individuals at the global or site level?

It is beyond the scope of the KBA Guidelines to provide detailed guidelines on how to estimate the number of mature individuals at the global or site level, given the wide range of valid methods available.

Methods should be applied consistently at the global and site levels, and should be scientifically valid and appropriate for the taxon (i.e. should be acceptable for publication in the peer-reviewed literature).

In a very few cases, it may be possible to make a direct count of all mature individuals at a site. More often, estimates of population size will be based on sampling, such as counts of the number of individuals in representative samples of the habitat (e.g., point counts, transects quadrats); estimates of the number of individuals in representative samples of the habitat using distance sampling (Buckland et al., 2001), individual mark-recapture (Amstrup et al., 2010), or other methods that account for imperfect detection; or methods based on indirect indicators of abundance, such as scat or footprint surveys (e.g., Jachmann, 2012).

Methods that do not involve a count of the entire population size (at the global or site level) should take account of habitat suitability, where possible, rather than assume that densities are uniform across the site or AOO, ESH, or range.

If population estimates have not been published at the global or site level, then a full account of the methods needs to be provided in the documentation.

What if the number of mature individuals at the global or site level is uncertain?

See Section 9.3.2 on dealing with uncertainty.

What if the number of mature individuals at the global or site level is characterised by significant fluctuations?

See Section 9.3.2 on dealing with uncertainty.

What if the number of mature individuals at the global or site level is known to be increasing or decreasing over time?

KBAs should be identified on the basis of the current presence of biodiversity elements, according to the KBA Standard (IUCN, 2016). If the number of mature individuals at the global or site level is known to be increasing or decreasing over time, then past data on global or site-level population size should be projected forward to the current time. This is especially important if these data were collected more than 8-12 years before the assessment (see Section 9.2).

3.3 Reproductive units (Criteria A1, B1, B3, E)

Why are reproductive units included in the thresholds for some species-based criteria?

Reproductive units are included in the thresholds for some species-based criteria to ensure that the species is documented at the site in sufficient numbers that the population is capable of maintaining itself beyond the current generation. The reproductive-unit threshold is especially important where population size is inferred through area-based assessment parameters because it provides confirmation that the species is actually present at the site.

How are reproductive units defined?

The KBA Standard defines reproductive units as: "The minimum number and combination of mature individuals necessary to trigger a successful reproductive event at a site (Eisenberg 1977). Examples of five reproductive units include five pairs, five reproducing females in one harem, and five reproductive individuals of a plant species."

For each species, the definition of reproductive units should be consistent with the definition of mature individuals. See IUCN Red List Guidelines (IUCN SPSC, 2017, Section 4.3.1) for detailed discussion of several special cases including clonal colonial organisms and sex-changing organisms. Additional examples of 5 reproductive units include:

- birds: 5 pairs, or 5 females and at least 1 male in lekking species,
- non-social insects: 5 females and at least 1 male,
- social insects: 5 colonies with single reproducing queen each,
- parthenogenetic insects: 5 reproductive females,
- fungi: 5 mature individuals,
- plants: 5 mature individuals for hermaphroditic or self-fertilising species,
- clonal species: 5 distinct clones.

As with mature individuals, reproductive units should be capable of reproduction. Individuals that will never produce new recruits (for example, because densities are too low for fertilisation) should not be counted.

What if males and females cannot be readily distinguished?

For species in which males and females cannot be readily distinguished, the reproductive-unit threshold should be translated into the equivalent number of mature individuals (e.g., if 10 reproductive units = 10 pairs, this is equivalent to 20 mature individuals). However, if there is evidence of a severely imbalanced sex ratio, proposers should increase efforts to assess whether the minimum number of reproductive units does indeed occur at the site.

What about sites at which breeding does not occur?

"Breeding" here refers to mating and other processes that require reproductive units, such as incubation and chick-rearing in many bird species. For sites at which breeding does not occur, the reproductive-unit threshold should be translated into the equivalent number of mature individuals (e.g., if 10 reproductive units = 10 pairs, this is equivalent to 20 mature individuals; for sexually segregated species, this may be 20 mature females or 20 mature males). Densities do not need to be sufficient to enable reproduction in this context.

How is the reproductive-unit threshold applied to species listed as Critically Endangered (Possibly Extinct)?

See Section 2.3.8.

What about species-based criteria that do not have reproductive units included in the threshold?

Some species-based criteria (i.e. A1e, B2, B3a, B3c, D) do not include a reproductive-unit threshold. For non-threatened species, it is likely that a site that meets the population-size threshold would hold at least 10 reproductive units. Nevertheless, proposers should confirm the regular or predictable presence of each trigger species at sites proposed under these criteria (see Section 9.2.3). In sites where breeding occurs, numbers and densities should be sufficient to support successful reproduction and proposers are encouraged to confirm presence in terms of reproductive units if possible (e.g., at least 10 reproductive units).

What types of evidence may be used to assess whether the reproductive units threshold is met?

Wherever possible, the reproductive-unit threshold should be observed based on direct observations of the required number of individuals. (Animal tracking data collected using geolocators with high location accuracy (e.g., global positioning system, GPS) are considered equivalent to direct observations.) Where this is not possible, the reproductive-unit threshold may be inferred based on indirect evidence indicating presence of the required number of individuals (e.g., active burrows indicating the threshold number of breeding pairs).

The reproductive-unit threshold cannot be inferred based on a sample that does not meet the threshold. For example, if the reproductive-unit threshold is 10 breeding pairs, it is not sufficient to sample 10% of the habitat and find 1 breeding pair; direct observations or indirect evidence of at least 10 breeding pairs would be required, so the sampling area may need to be expanded. The reproductive-unit threshold cannot be inferred from the presence of suitable habitat, or habitat maps or models.

Evidence should be recent, ideally collected within 8-12 years (see Section 9.2.3). If the species has suffered population declines at the site or the site has suffered habitat loss during that period, more recent evidence of presence should be provided.

3.4 Overview of area-based assessment parameters (A1, B1-3, E)

Figure 3.4 provides a schematic demonstrating the range, ESH, AOO, and localities or occurrences. Range defines the geographic space within the major system(s) in which a species occurs, after removing areas of unsuitable habitat, climate or physical geography (e.g., altitude, bathymetry, hydrology). ESH refers to the extent of habitat available to a species within its range, and thus is a refinement of range that takes additional environmental conditions and habitat information into account. For some species, range may approximate ESH. AOO is a further refinement of range and ESH, and is restricted to the area of suitable habitat that is presently occupied by the species, based on known, inferred and projected occurrences. Known localities are the specific points, defined by latitude and longitude, where a species is known to occur. Inferred/projected occurrences are locations (e.g., grid cells) where the species is inferred/projected to occur. (See Appendix I for complete definitions.)

For example, a freshwater invertebrate occurs in shallow sandy habitat in freshwater lakes (Fig. 3.4). A single locality, in a distant lake with no shallow sandy habitat, is assumed to be a vagrant occurrence (perhaps dropped by a bird). All other known localities occur within a single large lake. Additional occurrences are inferred for shallow sandy habitat in the same lake as known localities, and projected for similar habitats in a neighbouring lake without known localities. The range comprises all freshwater lakes with known, inferred, or projected occurrences, and excludes terrestrial areas. The ESH comprises all shallow sandy habitats within the range. The AOO comprises 2 x 2 km grid cells with known, inferred, or projected occurrences. A few areas of shallow sandy habitat within the range are currently occupied by voracious predatory fish – the freshwater invertebrate does not occur in these areas, so they are included in ESH but not in AOO.

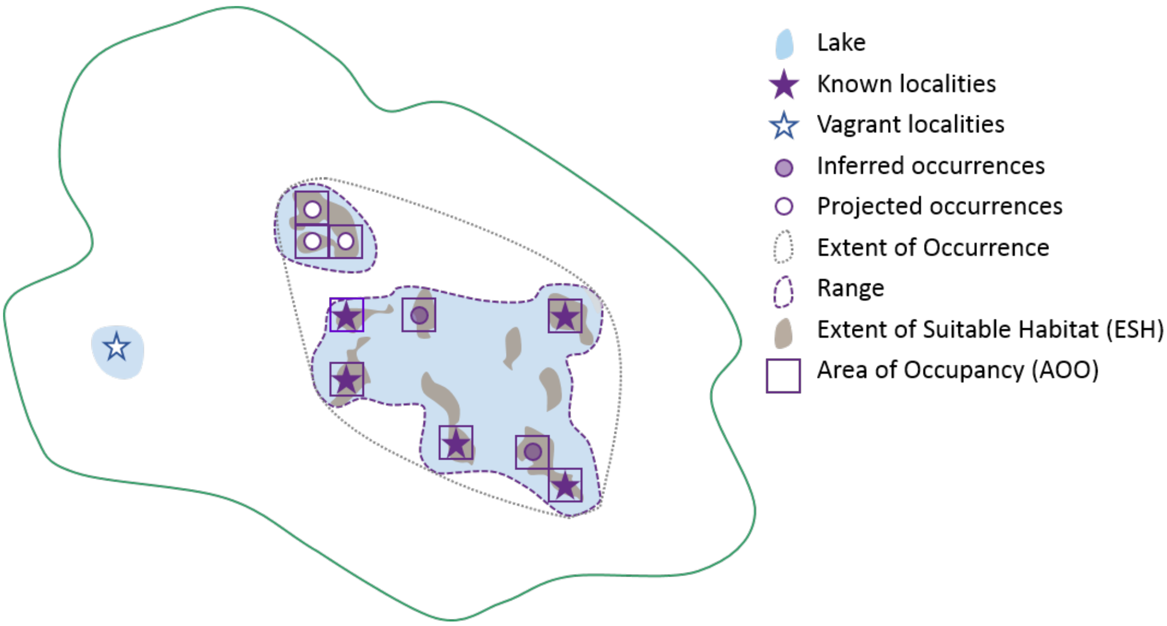

Figure 3.4 Schematic demonstrating localities, extent of occurrence (EOO), range, ESH and AOO.

How can area-based assessment parameters be applied to migratory species?

For migratory species, estimates of known localities, AOO, ESH, or range at the global and site levels must be calculated separately for each season, such that percentages of the global population in the site can be inferred for the relevant season or phase in migration. For example, a species will trigger a KBA if the ESH in its breeding range at the site exceeds the threshold percentage of the global ESH in its breeding range.

Can area-based assessment parameters be applied to species with spatially dynamic habitats?

For species with spatially dynamic habitats, including many pelagic marine species, AOO and ESH are seasonally and interannually variable at both global and site levels. AOO and ESH will not generally provide a reliable basis for inference about the proportion of the global population size at a site in this context, and should not be used.

3.5 Range (Criteria A1, B1-3, E)

How is range defined?

The KBA Standard (IUCN, 2016) defines range as: "The current known limits of distribution of a species, accounting for all known, inferred or projected sites of occurrence (IUCN, 2012a), including conservation translocations outside native habitat (IUCN SPSC, 2014) but not including vagrancies (species recorded once or sporadically but known not to be native to the area)." For the purposes of the KBA criteria, range should not include areas where the species no longer exists (i.e. range refers to the current distribution, rather than the historic distribution, IUCN, 2016). This definition is consistent with the use of "range" in IUCN Red List assessments.

Range generally excludes large areas of unsuitable habitat, and may be represented by a set of polygons rather than a single polygon. Note that "range" differs from EOO (Fig. 3.4). EOO is used in IUCN Red List assessments as a measure of the spatial spread of risk. It may include large areas of unsuitable habitat (including marine areas in the case of terrestrial species and vice versa), and is not used in KBA identification.

Where can proposers find data on range?

For species that have been assessed for the IUCN Red List, proposers should use the extant range map (code = 1) included in the IUCN Red List account, which will be provided through the WDKBA.

If no range map exists, proposers seeking to use range as an assessment parameter should follow the guidance in the IUCN Red List Mapping Standards on developing distribution maps for estimating range. The resulting range map must be flagged for expert review when the KBA proposal is submitted to the WDKBA.

When is it inappropriate to use range?

For species that occur patchily within their range, ESH or AOO may provide better information on the distribution of the global population.

When is it important to use consistent range maps for entire taxonomic groups?

Consistent range maps are important for identifying restricted-range species within a taxonomic group for Criterion B2.

Consistent range maps are also important as a basis for estimating the median range size for a taxonomic group for Criterion B3. However, the median range size can be estimated from a representative sample of species, so data on range are not required for the entire taxonomic group.

When determining either the proportion of the global population size at the site, or whether a species is restricted to an ecoregion or bioregion, proposers should use the best available data for each individual species (see Section 3.1 on selecting assessment parameters.) This may be ESH rather than range, if ESH is available and provides better information on an individual species' distribution.

3.6 Extent of suitable habitat (ESH, Criteria A1, B1-3)

How is ESH defined?

The KBA Standard (IUCN, 2016) defines ESH as: "The area of potentially suitable ecological conditions, such as vegetation or substrate types within the altitudinal or depth, and temperature and moisture preferences, for a given species (Beresford et al., 2011)."

ESH refers to the extent of habitat available to a species within its range and cannot extend beyond the range (Fig. 3.4). ESH is a refinement of range – for example, a range polygon may be clipped to exclude areas that do not contain suitable habitat, or the range may be converted into grid cells and cells that do not contain suitable habitat may be removed. For some species, range and ESH may be similar. Unlike AOO, ESH may include unoccupied suitable habitat within the species' range.

Note that ESH is directly equivalent to "area of habitat. However, as the term "extent of suitable habitat" is established in the KBA Standard (IUCN, 2016), it is also used in the KBA Guidelines for consistency.

Where can proposers find data on ESH?

Maps of ESH are available for several taxonomic groups, including birds, mammals, amphibians and some reptiles. Available ESH maps will be provided through the WDKBA.

If no ESH map exists, proposers seeking to use ESH as an assessment parameter should follow the guidance in Appendix III to develop an ESH map. The resulting ESH map must be flagged for expert review when the KBA proposal is submitted to the WDKBA.

When is it inappropriate to use ESH?

For species that occur patchily within their ESH, AOO may provide better information on the distribution of the global population.

3.7 Area of occupancy (AOO, Criteria A1, B1-3, E)

How is AOO defined?

The KBA Standard (IUCN, 2016) defines AOO as: "The area within the range of a species that is actually occupied (IUCN, 2012a)." AOO is typically a refinement of ESH and range. It includes inferred or projected occurrences, but does not include cases of vagrancy (Fig. 3.4). The IUCN Red List Guidelines (IUCN SPSC, 2017) strongly recommend a reference resolution of 2 x 2 km for all species when measuring AOO, and this is also recommended for KBA assessments.

Where can proposers find data on AOO?

For species that have been assessed for the IUCN Red List, AOO may have been defined and mapped already. In this case, AOO maps will be provided through the WDKBA.

If no map of AOO exists, proposers seeking to use AOO as an assessment parameter should follow the guidance in the IUCN Red List Mapping Standards on estimating AOO. The resulting AOO map must be flagged for expert review when the KBA proposal is submitted to the WDKBA.

When is it inappropriate to use AOO?

Proposers should avoid using AOO when there is insufficient information to distinguish occupied and unoccupied habitat (see Appendix III.4). In this situation, ESH may provide better information on the distribution of the global population size, even if occupation of suitable habitat is patchy.

The standard resolution for AOO is 2 x 2 km grid cells (IUCN SPSC, 2017). Proposers should avoid using AOO when species are distributed on very fine scales such that the standard 2 x 2 km is likely to significantly overestimate the area of occupied habitat. Number of localities may be a more appropriate assessment parameter in this context.

3.8 Number of localities (Criteria A1, B1-3)

How are localities defined and identified?

The KBA Standard (IUCN, 2016) defines localities as follows: "A sampling locality is a point indicated by specific coordinates of latitude and longitude. Note that the term 'locality', as defined here, is fundamentally and conceptually different from the term 'location' used in the IUCN Red List (IUCN, 2012a)."

Known localities refer to known points of occurrence, and do not include inferred or projected occurrences. For the purposes of KBA identification, old records from areas where the species no longer occurs and vagrancies (i.e. records from areas where the species has only been recorded sporadically and is not known to be native) are excluded from known localities.

Where can locality data be found?

Sources of locality data include museums, herbaria, the Global Biodiversity Information Facility, Global Seabird Tracking Database, Ocean Biogeographic Information System and NatureServe's National Species Dataset (for the US and Canada). Locality data should be checked by an appropriate species expert to ensure that the taxonomy is up-to-date and erroneous records are removed.

How are thresholds applied to locality data?

Each locality should represent a discrete population, to the extent this can be inferred, given the degree of habitat fragmentation and what is known about the dispersal capabilities of the species. Observations that clearly represent multiple replicates of the same population should be treated as a single locality. Where the threshold is ≥ 1%, a site qualifies as a KBA if it represents one of 100 or fewer localities; where the threshold is ≥ 20%, a site qualifies as a KBA if it represents one of 5 or fewer localities.

Localities may be weighted by estimated population size (e.g., based on the relative size of habitat patches) given that abundance may vary considerably across localities.

When is it inappropriate to use number of localities?

Generally, number of localities should only be used where there are insufficient data to develop reliable maps of range, ESH or AOO. Locality information is typically most useful for species that occur patchily within suitable habitat or AOO and have been well sampled.

Number of localities should only be used as the basis for KBA identification if sampling intensity has been sufficiently high that the known localities can be assumed to represent adequately the range, ESH and AOO of the species (IUCN, 2016). Locality information should not be used if the only sampling effort has been opportunistic, such that known localities provide a poor representation of the species distribution. The judgement that sampling effort has been adequate should be justified in the documentation.

3.9 Relative density or abundance of mature individuals (Criterion B3)

Under subcriterion B3c, "most important occupied habitat" can be observed or inferred through the following assessment parameters:

(i) density of mature individuals.

(ii) relative abundance of mature individuals.

[Note. The remainder of this section is in preparation and will be included in the next version of the KBA Guidelines. In the meantime, please contact chair.sac@keybiodiversityareas.org with comments or questions.]

3.10 Distinct genetic diversity (Criteria A1, B1-2)

How is distinct genetic diversity defined?

The KBA Standard defines distinct genetic diversity as follows: "The proportion of a species' genetic diversity that is encompassed by a particular site. It can be measured using Analysis of Molecular Variance or similar technique that simultaneously captures diversity and distinctiveness (frequency of alleles and the genetic distinctiveness of those alleles)."

How is distinct genetic diversity used to identify sites under Criteria A1, B1 and B2?

Distinct genetic diversity differs from the other assessment parameters in that it refers to the proportion and unique nature of a species' genetic diversity that is encompassed by a particular area. A site holding more than the threshold proportion of a species' global genetic diversity can qualify as a KBA, even if the proportion of the species' global population size at the site is insufficient to trigger KBA identification.

[Note. The remainder of this section is in preparation and will be included in the next version of the KBA Guidelines. In the meantime, please contact chair.sac@keybiodiversityareas.org with comments or questions.]

4. Identifying Key Biodiversity Areas using ecosystem-based criteria (A2, B4)

4.1 Overview

NCGs and/or KBA proposers are encouraged to conduct a comprehensive scoping analysis (Steps 1-4 in Fig. 4.1) to identify potential trigger ecosystem types and potential KBAs in the region of interest for which there are adequate data. Assessing sites against multiple criteria and biodiversity elements will strengthen the robustness of KBAs to changes in the status of particular trigger species.

For KBA Criterion A2 (threatened ecosystem types), the first major step in the scoping analysis will be to check whether there are any globally threatened ecosystem types in the region of interest. For KBA Criterion B4 (geographically restricted ecosystem types), the first major step in the scoping analysis will be to identify an appropriate ecosystem classification for the region of interest (see Section 4.2.1).

In practice, the process of KBA identification is likely to vary greatly between countries. Some KBA proposers may wish to focus on identifying KBAs for a particular ecosystem type or ascertain whether a particular site qualifies as a KBA under Criterion A2 or B4. In this case, KBA proposers should check the list of globally threatened ecosystem types and consult with the NCG (if one exists) or RFP and the IUCN RLE team to identify an appropriate ecosystem classification in the region of interest (see Section 4.2.1).

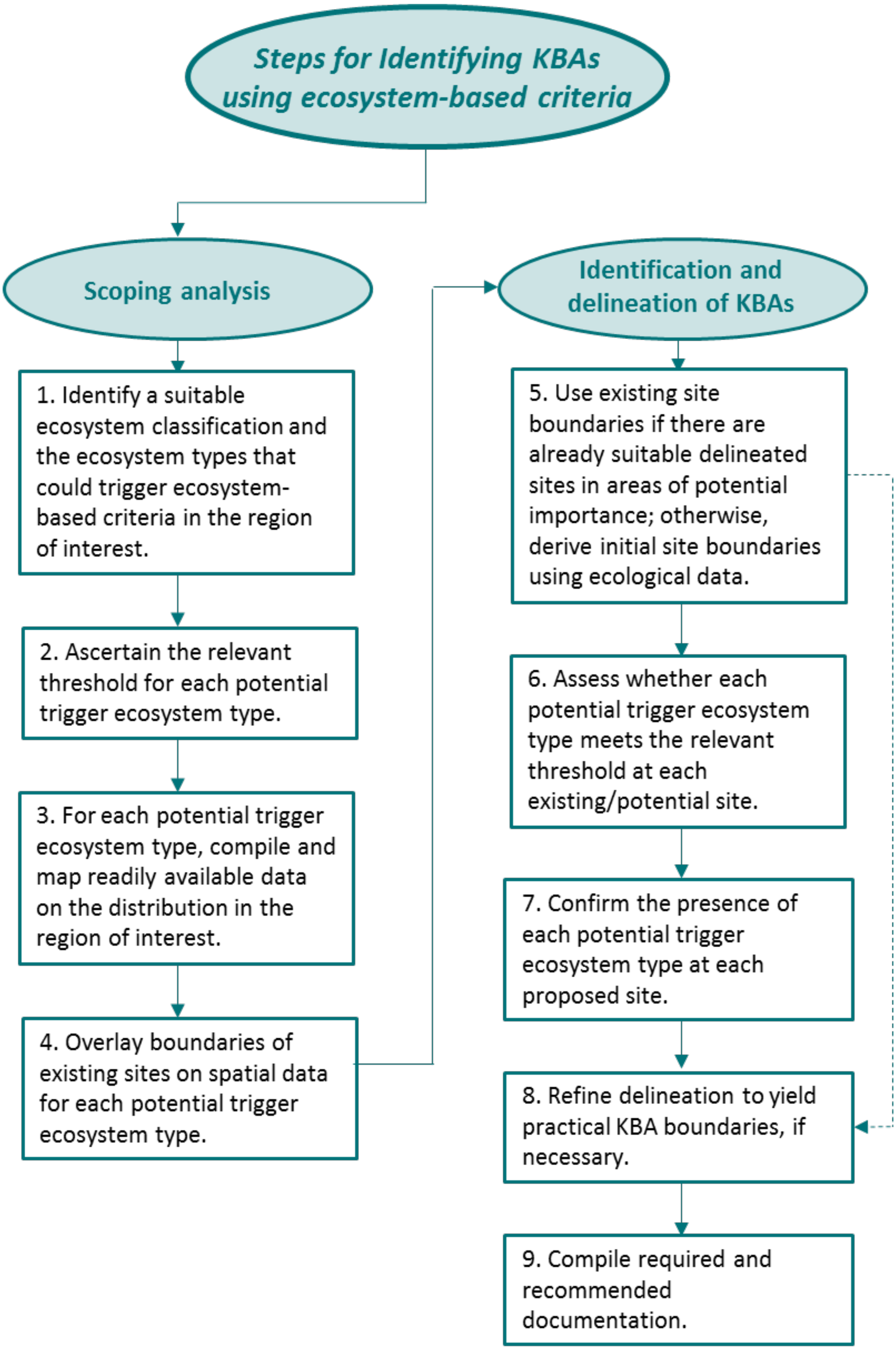

Figure 4.1 Overview of possible workflow for applying Criteria A2 and B4.

4.2 Identifying ecosystem types

4.2.1 Ecosystem classification

The KBA Standard (IUCN, 2016, pp. 17, 20) states that Criterion A2 and B4 should be applied to ecosystem types "at an intermediate level in a globally consistent ecosystem classification hierarchy". The IUCN RLE team is currently working to develop a hierarchy for terrestrial, freshwater and marine systems (Table 4.1). In this hierarchy, biogeographic functional ecotypes (Level 4) and ecosystem types (Level 5) are the intermediate levels that may be used for KBA identification.

In the meantime, NCGs or KBA proposers should investigate whether some other suitable ecosystem classification exists for the region, in consultation with the IUCN RLE team. If an appropriate ecosystem classification does not yet exist for the region of interest, then NCGs or KBA proposers may consider developing such a classification in consultation with the IUCN RLE team. (Please see the IUCN RLE Guidelines (IUCN, 2017) for further information.) Note that the global geographic distribution of any ecosystem types used for KBA identification must be mapped; for ecosystems that extend beyond national boundaries, for example, a national map is insufficient.

Alternatively, NCGs or KBA proposers interested in identifying KBAs using ecosystem-based KBA criteria will need to wait until an appropriate ecosystem classification has been developed for the region of interest.

4.2.2 Local ecosystems

As stated in the KBA Standard (IUCN, 2016), the thresholds associated with the ecosystem-based criteria (i.e. both A2 and B4) are designed to be applied at intermediate levels in a globally consistent ecosystem classification hierarchy. Lower level ecosystem types (e.g., local ecosystem types in Table 4.1) cannot trigger global KBAs. Sites that are important for the persistence of local ecosystems may be identified as regional KBAs following guidelines for regional application of the KBA criteria and thresholds, when developed.

Table 4.1 Ecosystem classification hierarchy used in the IUCN RLE

Level	Definition
L1: Realm	One of three component media within the biosphere: marine; freshwaters & saline wetlands; and terrestrial, recognising transitional zones among them.
L2: Biome	A globally distributed segment of the biosphere united by major functional traits and common macro-environmental features within a realm.
L3: Functional group	A group of related ecosystems within a biome (Level 2) with shared ecological traits structured by common ecological processes (ecosystem drivers), such that their responses may be represented by the same generic models of ecosystem dynamics.
L4: Biogeographic functional type	An ecoregion-based proxy for compositionally different expressions of ecosystems within a functional group. These may be delineated by an intersection of functional groups with an appropriate ecoregionalisation, which is assumed to be a proxy for biotic composition. Level 4 units may be regarded as a top-down coarse approximation of Level 5 units.
L5: Ecosystem type	A complex of organisms, their interactions and physical environment, and distributed within a landscape/seascape or groups of related landscapes/seascapes. Ecosystem types are discriminated bottom-up (i.e. from observational data) explicitly by their composition and serve as operational units of assessment for the global RLE. Level 5 units may not be strictly nested within Level 4 units and are referenced to a unique Functional group (Level 3).
L6: Local ecosystem type	Any subunit or nested group of subunits within an ecosystem type (Level 5) that serves as an operational unit for a subglobal (e.g., national) RLE.

Source: IUCN RLE team

4.3 Applying Criterion A2 to identify KBAs for threatened ecosystem types

4.3.1 Identify the globally threatened ecosystem types that could trigger Criterion A2 in the region of interest.

The list of globally threatened ecosystem types that have been assessed for the IUCN RLE (IUCN, 2017) and may trigger KBA Criterion A2 in each country will be provided automatically through the WDKBA when it is fully functional. In the meantime, this information can be found on the IUCN RLE website.

How are globally threatened ecosystem types identified for the purposes of applying KBA Criterion A2?

Ecosystem types that have been assessed as globally CR or EN or VU using the IUCN RLE Guidelines (IUCN, 2017) can trigger KBA Criterion A2. Given that a relatively small number of the world's ecosystems have been assessed to date, in many cases, the first step in identifying KBAs under Criterion A2 will be to assess candidate ecosystem types using the IUCN RLE Guidelines (IUCN, 2017). NCGs or KBA proposers interested in assessing ecosystems for the IUCN RLE should consult with the IUCN RLE team.

4.3.2. Ascertain the relevant threshold for each potential trigger ecosystem type given its threat category.

A site qualifies as a KBA under Criterion A2 because it holds one or more of the following:

a) ≥5% of the global extent of a globally CR or EN ecosystem type;

b) ≥10% of the global extent of a globally VU ecosystem type.

How is the global extent of an ecosystem type defined?

In the context of KBA identification, "extent of an ecosystem type" refers to the current geographic distribution of an ecosystem type, representing all spatial occurrences of an ecosystem type (IUCN, 2017, p. ix). KBA identification is based on geographic distribution maps, not the extent of ecosystem occurrence or the area occupied by the ecosystem (see IUCN, 2017, p. 57 for comparison).

4.3.3 For each potential trigger ecosystem type, compile readily available data on the ecosystem's global distribution and distribution in the region of interest.

Where can proposers find data on the global extent of an ecosystem type?

Available information on the extent of globally threatened ecosystem types will be provided through the WDKBA when it is fully functional. In the meantime, available information can be found on the IUCN RLE website.

4.3.4 Overlay boundaries of existing sites on spatial data for each potential trigger ecosystem type.

Boundaries of existing sites (e.g., existing KBAs, other sites of importance for biodiversity, protected or conserved areas) can be overlaid on spatial data for each potential trigger ecosystem type in a GIS to generate a table of potential trigger ecosystem types and the existing sites where they might trigger a KBA (i.e. a preliminary version of Table 4.3.6). (See the WDKBA, Plantlife IPA Database, Ramsar Sites Information Service, and the Protected Planet Database for GIS data on existing sites.)

4.3.5 If there are areas of potential importance with no existing sites, derive initial KBA boundaries using ecological data.

If scoping analysis reveals areas of potential importance where there are no existing KBAs, other recognised sites of importance for biodiversity, or protected or conserved areas, initial boundaries for potential KBAs should be based on ecological considerations (see Section 7.2). These boundaries may need to be refined later to yield practical KBA boundaries (see Section 7.3).

4.3.6 Assess whether each potential trigger ecosystem type meets the relevant threshold at each existing/potential site given its threat category.

For any ecosystem type that has been assessed for the IUCN RLE, proposers should use the same geographic distribution map as in the IUCN RLE account. The IUCN RLE Guidelines encourage assessors to deposit ecosystem maps in a suitable online repository (IUCN, 2017). If a geographic distribution map is not available for an ecosystem type, KBA proposers may follow the guidelines in Appendix IV on mapping ecosystem extent.

Existing or potential sites may be overlaid on an ecosystem map in a GIS to estimate the percentage of the ecosystem type's global extent that lies within each site's boundaries. This can then be compared to the relevant threshold for the ecosystem type given its threat category (see Table 4.3.6 for example).

Table 4.3.6 Example of KBA assessment using Criteria A2 or B4 taking IUCN RLE category into account. Cells that trigger qualification of sites as KBAs under Criterion A2 or B4 are highlighted.

	IUCN RLE category	Criterion	Threshold (%)	Ecosystem extent (km²)					
				Global extent	Threshold	Site 1	Site 2	Site 3	Site 4
Criterion A2:									
Ecosystem type 1	CR	A2a	5%	2,000	100	500			
Ecosystem type 2	EN	A2a	5%	20,000	1,000		5	1,500	
Ecosystem type 3	VU	A2b	10%	20,000	2,000	1,500		1,000	4,000
Criterion B4:									
Ecosystem type 5		B4	20%	2,000	400	500			
Ecosystem type 6		B4	20%	20,000	4,000		500	1,500	
Ecosystem type 7		B4	20%	20,000	4,000	1,500		1,000	4,000

4.3.7 Confirm the presence of each potential ecosystem type at each proposed site.

The final step in assessing a site against KBA Criterion A2 or B4 is to confirm the presence of the potential trigger ecosystem type at the site.

How is the presence of an ecosystem at a site confirmed?

Most ecosystems are relatively stationary, at least in the 8-12 year time-frame for KBA reassessment.

KBA proposers may overlay a validated or peer-reviewed map of the trigger ecosystem type on recent high-resolution satellite imagery to confirm presence of the ecosystem type within the proposed KBA boundaries. In the case of a forest ecosystem type, for example, KBA proposers should confirm that the forest ecosystem type is still present within the KBA and has not been converted to other types of land cover, such as pasture or crops. This can be done using open access tools such as Google Earth.

More subtle distinctions or transformations, such as forest types or the degradation of arid shrublands by overgrazing, may require targeted field-based sampling or other recent documentation.

4.3.8 Refine ecological boundaries, if necessary, to yield practical KBA boundaries.

KBA delineation is not complete until ecological boundaries have been evaluated and refined, if necessary, to yield a manageable site or sites (see Section 7.3 for further guidelines).

4.3.9 Compile required and recommended documentation.

See the Documentation and Mapping Standards for guidance on required and recommended documentation for Criterion A2 or B4.

4.4 Applying Criterion B4 to identify KBAs for geographically restricted ecosystem types

4.4.1 Identify an appropriate ecosystem classification in the region of interest and the ecosystem types that could trigger Criterion B4 in the region of interest.

Once the RLE team has developed a globally consistent ecosystem classification hierarchy, the list of ecosystem types that may trigger Criterion B4 in each country will be provided automatically through the WDKBA. In the meantime, alternative suitable ecosystem classifications may be used for KBA identification.

What types of ecosystem classification are appropriate for KBA Criterion B4?

See Section 4.2.1.

How are geographically restricted ecosystem types identified for the purposes of applying KBA Criterion B4?

The definition of geographically restricted given in the KBA Standard (IUCN, 2016) is indicative rather than prescriptive. For the purpose of identifying KBAs under Criterion B4, an ecosystem type is considered geographically restricted if there is at least one site that holds ≥20% of the global ecosystem extent.

4.4.2. Ascertain the relevant threshold for each potential trigger ecosystem type.

A site qualifies as a KBA under Criterion B4 because it holds ≥20% of the global extent of an ecosystem type, regardless of whether the ecosystem type is globally threatened.

How is the global extent of an ecosystem type defined?

See Section 4.3.2.

4.4.3 For each potential trigger ecosystem type, compile and map readily available data on the ecosystem's global distribution and distribution in the region of interest.

See Section 4.3.3.

4.4.4 Overlay boundaries of existing sites on spatial data for each potential trigger ecosystem type.

See Section 4.3.4.

4.4.5 If there are areas of potential importance with no existing sites, derive initial KBA boundaries using ecological data.

See Section 4.3.5.

4.4.6 Assess whether each potential trigger ecosystem type meets the relevant threshold at each existing/potential site.

See Section 4.3.6.

4.4.7 Confirm the presence of each potential ecosystem type at each proposed site.

See Section 4.3.7.

4.4.8 Refine ecological boundaries, if necessary, to yield practical KBA boundaries.

See Section 4.3.8.

4.4.9 Compile required and recommended documentation.

See Section 4.3.9.

5. Identifying Key Biodiversity Areas based on ecological integrity (Criterion C)

5.1 Defining ecological integrity

How is ecological integrity defined?

The KBA Standard defines ecological integrity as "A condition that supports intact species assemblages and ecological processes in their natural state" (IUCN, 2016, p. 12). Intact species assemblages or intact ecological communities have "the complete complement of species known or expected to occur in a particular site or ecosystem, relative to a regionally appropriate historical benchmark, which will often correspond to pre-industrial times" (IUCN, 2016, p. 13). Ecological processes include species' natural movement patterns and natural disturbance regimes; their natural state is defined relative to the same regionally appropriate benchmark (see Stoddard et al., 2006 and Woodley, 2010 for a discussion of reference conditions and measurement of ecological integrity).

Sites qualifying under Criterion C represent outstanding examples of ecological integrity at the global scale, where all ecosystem components (including highly mobile predators and herbivores and long-lived structural plant species) can still be found fulfilling their functional roles in the ecosystem. Sites qualifying under Criterion C are also characterised by contiguous natural habitat with minimal post-industrial anthropogenic disturbance, and are large enough to maintain their ecological communities through most natural disturbance events and accommodate most broad-scale ecological processes (Janzen, 1986; Newmark et al., 1995; Balmford et al., 1998; Scott et al., 1999; Laurance et al., 2002; Leroux et al., 2007; Woodley, 2010).

How is ecological integrity measured?

Ecological integrity is a multidimensional concept that is difficult to measure directly. For the purposes of identifying sites qualifying under Criterion C, ecological integrity should be observed or, more likely, inferred from a structured set of evidence based on both:

(1) direct measures of species composition and abundance/biomass/density across taxonomic groups (particularly for species indicative of long-term structural stability and functionality or those known to be highly sensitive to human impact);

AND

(2) absence (or very low levels) of direct industrial human impact, as quantified by appropriate indices at the scale of interest and verified on the ground or in the water.

Measures of species composition and abundance/biomass/density across taxonomic groups may be based on indicator species (see Section 5.2.3).

Absence, or very low levels, of direct industrial human impact does not necessarily imply absence, or even low densities, of human inhabitants. Rather, for a site to qualify as a KBA under Criterion C, human impact must not have eroded ecological integrity (see Section 5.2.1). Some sites with outstanding ecological integrity have been used by indigenous peoples for millennia.

Information on additional indicators of ecological integrity (e.g., patch size and fragmentation for forests, coral cover for coral reefs, and water quality for rivers and lakes) may be provided as supporting evidence, but are not a substitute for (1) or (2). Use of such indicators should be accompanied by explanations of why they are relevant as indicators of ecological integrity in the ecoregion in question.

5.2 Applying Criterion C to identify KBAs with outstanding ecological integrity

A site qualifies as a KBA under Criterion C because it is "one of ≤2 per ecoregion characterised by wholly intact ecological communities, comprising the composition and abundance of native species and their interactions" (IUCN, 2016, p. 21).

Ecoregions provide the units of analysis for the assessment of Criterion C. An ecoregion is a "relatively large unit of land (or water) containing a distinct assemblage of natural communities and species with boundaries that approximate the original extent of natural communities prior to major land-use change" (Olson et al., 2001; IUCN, 2016, p. 12). Ecoregions have been mapped for terrestrial (Olson et al., 2001; Dinerstein et al., 2017), freshwater (Abell et al., 2008) and near-shore marine (Spalding et al., 2007) environments and are nested within bioregions or provinces. Ecoregions have not yet been defined for the high seas; pelagic marine provinces (Spalding et al., 2012) may be used as the unit of analysis for the high seas.

It should be noted that many ecoregions of the world will not have any remaining areas of the size and ecological integrity required to qualify as a KBA under Criterion C.

5.2.1 Conduct a scoping analysis to identify ecoregions with potential for sites that could trigger Criterion C.

In many cases, it will be useful to identify Criterion C KBAs through a step-based process, beginning with regional scoping and following with site evaluation and selection within ecoregions (Fig. 5.3).

Identification of potential areas of outstanding ecological integrity will usually start with a preliminary scoping analysis to identify ecoregions, or areas within ecoregions, with low levels of industrial human impact using readily available global and/or regional-level "human footprint" type datasets (e.g., roads and infrastructure). This analysis can then be refined using additional data at the ecoregion level, where available.

Assessments of species composition and abundance/biomass/densities will generally be focused on particular sites (see Section 5.2.3).

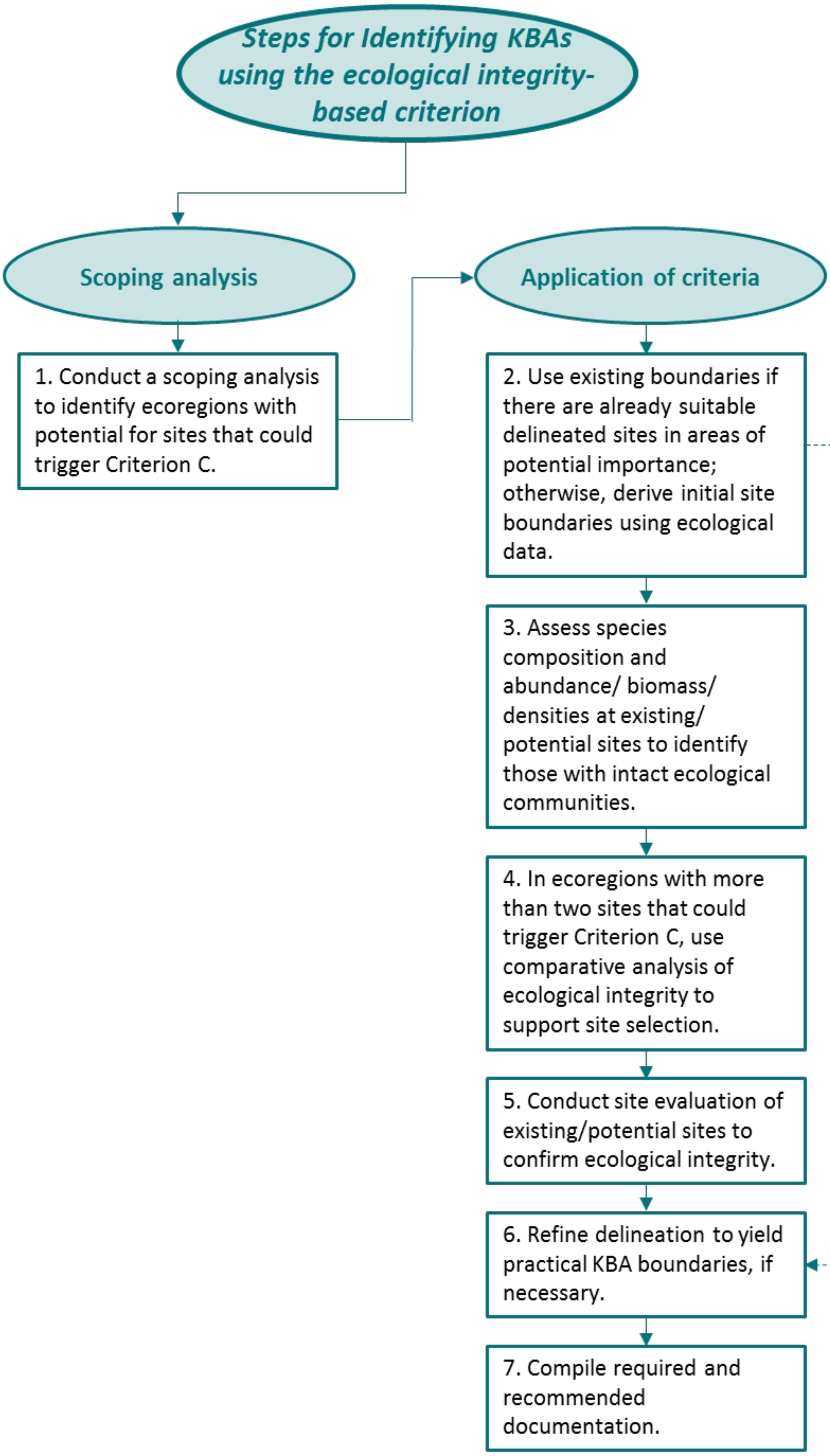

Figure 5.3 Overview of possible workflow for applying Criterion C.

How is absence (or very low levels) of human impact measured?

Understanding the key drivers of change within the ecoregion or across similar ecoregions can help to identify the most appropriate datasets and indicators for identifying areas with low levels of direct anthropogenic disturbance. Some types of infrastructure have different levels of impact in different regions.

KBA proposers may develop quantitative indices based on global/regional/ecoregional datasets and analyse the cumulative impacts of these pressures to identify sites with very low levels of direct industrial human impact. Pervasive global-scale threats that affect all marine and/or terrestrial areas (e.g., climate change, ocean acidification, overharvest of cetaceans) should not be included as binary factors in this analysis (i.e. as a simple yes/no layer) but may be included as relative factors (e.g., high/moderate/low impact), as no sites would be identifiable under Criterion C otherwise.

In regions where indicators of human impact are similar across adjacent ecoregions, the same indices may serve for multiple ecoregions. But, in other regions, ecoregion-specific indices of human impact may be appropriate, especially where more detailed or up-to-date information is available than in global or regional datasets.

For a site to qualify as a KBA under Criterion C, human impact must not have eroded ecological integrity, as characterised by intact ecological communities and ecological processes in their natural state (especially ecological processes characteristic of the region, which the native flora and fauna are adapted to, such as wildfire in boreal forest or flooding patterns in the Amazon basin).

5.2.2 If there are no suitable delineated sites in areas of potential importance, derive initial KBA boundaries using ecological data.

Some large existing KBAs and other sites of importance for biodiversity may qualify under Criterion C. (See the WDKBA, Plantlife IPA Database, Ramsar Sites Information Service, and the Protected Planet Database for GIS data on existing sites.) Scoping analysis may also reveal areas of potential importance where there are no existing KBAs, other recognised sites of importance for biodiversity, or protected or conserved areas. In this case, initial boundaries for potential KBAs may be based on ecological considerations (see Section 7.2). These boundaries may need to be refined later to yield practical KBA boundaries (see Section 7.3).

Are there any special considerations for delineating sites under Criterion C?

KBAs identified under Criterion C should ideally be delineated to be at least 10,000 km^2 in size, within the confines of manageability. Large size is a characteristic of ecological integrity, except on isolated islands with intact ecological communities. KBA size should be sufficient to sustain the life-cycle processes and natural movement patterns of area-demanding species and other species that are sensitive to human disturbance, and to accommodate natural disturbance regimes (see the concept of minimum dynamic area; Pickett & Thompson, 1978; Leroux et al., 2007). Criterion C KBAs should be large enough to be resilient to edge effects where appropriate and delineation should minimise the edge:area ratio to the extent possible. The requirement that all KBAs should be manageable as a unit will constrain the upper size limit of Criterion C KBAs.

In some ecoregions, initial KBA boundaries will be clear because areas with ecological integrity are bounded by areas that clearly do not qualify; whereas, in others, large portions of the ecoregion may exhibit high levels of ecological integrity. (See Section 7.3.3 for guidance in this context.)

Where potential sites are located on both sides of an ecoregion boundary, a single site may be delineated, while recognising that the site on each side of the ecoregion boundary would need to meet the Criterion C threshold in its own right to qualify as a KBA under Criterion C.

5.2.3 Assess species composition and abundance/biomass/densities at existing/potential sites to identify those with intact ecological communities.

A site qualifies as a KBA under Criterion C because it is "one of ≤2 per ecoregion characterised by wholly intact ecological communities, comprising the composition and abundance of native species and their interactions" (IUCN, 2016, p. 21).

How can areas with intact ecological communities be identified?

An ecological community is a complex of native plants, animals and other organisms that interact together within an ecosystem (Smith, 1992). Ecological communities are complex and constantly changing due to both natural processes and anthropogenic changes, compounded by climate change. Intactness must be evaluated in this context. Assessments of species composition and abundance/biomass/densities are essential for the identification of sites under Criterion C. Nevertheless, it is recognised that comprehensive assessments will be impractical in many areas with high ecological integrity, especially in remote ecoregions with few human settlements and limited road access. Ecological assessments may therefore be focused on a set of species indicative of intact ecological communities. The set of indicator species should include species indicative of long-term structural stability and functionality (e.g., top predators, other keystone and foundation species; Paine, 1969; Dayton, 1972; and species sensitive to broad scale ecological processes such as fire, flood, grazing and predation; Carignan & Villard, 2002), area-demanding species (e.g., low density and highly mobile species; Boyd et al., 2008; Didier et al., 2009), species that are sensitive to human impact (e.g., all large hunted and harvested species; Redford, 1992; Thiollay, 1992), and species that indicate ecological condition (e.g., limnic invertebrates that indicate water quality; Karr, 1981). The set of indicator species must be accompanied by a documented justification of why such species are appropriate and sufficient to infer intactness of ecological communities. It is important to note that species richness is not a surrogate for ecological integrity.

A Criterion C site should contain designated indicator species at ecologically functional densities (Soulé et al., 2003). A simple presence/absence assessment against a list of expected species at the site is not adequate for assessing ecological integrity, as species may be present at levels well below ecologically functional densities (Soulé et al., 2003).

Given that natural ecosystems are dynamic, assessments of ecological integrity should take into account the expected range of variability in ecosystem composition, structure, and function under natural environmental conditions and phases of natural disturbance (e.g., a site in a fire-adapted ecosystem should not be excluded because it has relatively few fire-intolerant seedlings immediately following a natural fire).

If an indicator species has been extirpated through overexploitation, invasive alien species, or disease but the required habitat/ ecosystem conditions still exist at the site, such that the species would be expected to thrive if reintroduced and threats addressed, then the site would not qualify as a Criterion C site now but would have the potential to qualify under Criterion C in the future.

In addition, assessments of ecological integrity should investigate the occurrence of invasive alien species and other species associated with anthropogenic disturbance, as these species may indicate a loss of ecological integrity.

5.2.4 In ecoregions with more than two sites that could trigger Criterion C, use comparative analysis of ecological integrity to support site selection.

Sites qualifying under Criterion C represent truly outstanding examples of ecological integrity at the global scale. The maximum number of sites that can qualify under Criterion C is two per ecoregion. In ecoregions with more than two potential sites that could trigger Criterion C, site selection will likely be an iterative process, involving a comparative analysis of factors contributing to ecological integrity (e.g., intactness, size and shape) and manageability based on a combination of desk-based analysis of remotely sensed data, published field surveys and museum records, and site evaluation involving biodiversity knowledge-holders (see Section 5.3.5).

How are sites selected when there are more than two potential sites that could trigger Criterion C is an ecoregion?

In ecoregions with more than two potential sites that could trigger Criterion C, site selection should be based on a comparative analysis of factors contributing to ecological integrity (e.g., intactness, size and shape) and manageability.

(i) Intactness: Criterion C is based on absolute rather than relative integrity; nevertheless, there may be greater confidence in the intactness of ecological communities at some potential sites than others.

(ii) Size and shape: Large unfragmented areas are generally better able to support highly mobile species, better able to persist through most natural disturbance events, and are more resilient to edge effects. Other factors relating to ecological condition may also be taken into consideration.

(iii) Global biodiversity: Other factors relating to the importance for the global persistence of biodiversity may also be taken into consideration (for example, some sites may support greater diversity of intact ecological communities than others; sites that encompass elevational gradients may facilitate species range shifts in response to climate change; Elsen et al., 2018), but are not a substitute for ecological integrity.

(iv) Manageability: As with all KBAs, sites qualifying under Criterion C should be manageable as a unit (see Section 7.3 on delineation).

The spatial relationship to existing KBAs should also be taken into consideration, bearing in mind that KBAs boundaries may need to be resolved to avoid overlap.

5.2.5 Conduct site evaluation of existing/potential sites to confirm ecological integrity.

Site evaluation should be conducted prior to proposing any site as a KBA to confirm the presence of intact ecological communities by reviewing recent data or conducting new field surveys if necessary. For Criterion C, KBA proposers should verify information gained from remotely sensed datasets, as well as information that cannot be inferred from remotely sensed data, such as overexploitation, presence of invasive alien species, and water quality. Evidence may come from workshops or interviews with biodiversity knowledge-holders, including taxonomic experts, biologists, and holders of Indigenous and local Knowledge (ILK, see below and Section 8.1), recently collected data, or new field surveys.

If assessments of species composition and abundance/ biomass/ densities are based on field surveys that may be out-of-date, site evaluation should include interviews with local knowledge-holders and/or new field surveys. (No specific time limit is proposed here given that sites that might qualify under Criterion C are generally remote and difficult to survey.) Interviews and field surveys may be conducted by local experts other than the KBA proposer, but must be documented (see Section 9.2 on data quality).

In ecoregions with more than two candidate sites, site evaluation should be designed to support comparative analysis of ecological integrity based on consistent parameters across candidate sites (see Section 5.3.4).

What is the role of Indigenous and Local Knowledge (ILK) in site evaluation ?

Many sites that may qualify as KBAs under Criterion C will coincide with indigenous territories and local communities, and Indigenous and Local Knowledge (ILK) will play an important role in all aspects of site evaluation and delineation in this context. For example, ILK can be applied in assessing species composition, abundance and distribution, and in discovering the extent of natural resource use and exploitation over time. Note that any KBA proposal based on data derived from previously unpublished ILK should be flagged during the submission process (see the Guidance on the process of Proposing, Reviewing, Nominating and Confirming Key Biodiversity Areas). Free, Prior and Informed Consent (FPIC) is required prior to the publication or display of previously unpublished ILK. (See Section 8.1 for further guidelines).

5.2.6 Refine ecological boundaries, if necessary, to yield practical KBA boundaries.

KBA delineation is not complete until ecological boundaries have been evaluated and refined, if necessary, to yield a manageable site or sites (see Section 7.3 for further guidelines). See Section 8 for guidelines on consultation and involvement of customary rights-holders and other stakeholders.

5.2.7 Compile required and recommended documentation under Criterion C.

See the Documentation and Mapping Standards for guidelines on required and recommended documentation for Criterion C.

6. Identifying Key Biodiversity Areas based on quantitative analysis of irreplaceability (Criterion E)

[Note. This section is in preparation and will be included in the next version of the KBA Guidelines. In the meantime, please contact chair.sac@keybiodiversityareas.org with comments or questions.]

7. Delineation procedures

Delineation is the process of defining the geographic boundaries of a KBA and is a required step in the KBA identification process. The aim is to derive site boundaries that are ecologically relevant and provide a basis for potential management activities. More specifically, the objective is to provide the best conditions for the persistence of the biodiversity elements for which the site is important, dependent on their ecological requirements and the socio-cultural, economic and management context, within the constraint that the final delineated site meets the threshold for at least one KBA criterion.

Delineation is an iterative process that typically involves assembling spatial datasets (Section 7.1), mapping the distribution of trigger biodiversity elements and deriving initial boundaries based on ecological data (Section 7.2), refining ecological boundaries to yield practical KBA boundaries (Section 7.3), and documenting delineation (see the Documentation and Mapping Standards).

Stakeholder consultation and involvement is an essential element of the delineation process (see Section 8 for detailed guidelines). In particular, consultation with a range of knowledge holders is recommended when assembling spatial datasets, mapping the distributions of biodiversity elements, delineating ecological boundaries, and refining ecological boundaries if necessary to yield practical KBA boundaries (Section 8.1). Consensus-building with proposers of existing KBAs (including AZE sites, IBAs and KBAs identified under previous initiatives) is required before any existing KBA boundaries are modified and to avoid overlapping KBAs (Section 8.2). Involvement of customary rights-holders is recommended and involvement of legal rights-holders is encouraged during the delineation process (Section 8.3). Once KBA identification and delineation are complete, additional consultation and involvement will generally be required before advancing any form of conservation or management action that might affect indigenous peoples or other natural resource dependent communities (Section 8.4).

Is there a minimum or maximum size requirement for a KBA?

There is no absolute minimum or maximum size requirement for a KBA. The size of a KBA will depend on the ecological requirements of the biodiversity elements triggering the criteria, and consideration of site manageability (see Section 7.3). The size distribution of existing protected or conserved areas may provide some guidance on the practical scale of management in each region.

Sites identified under Criterion C are likely to be larger on average than sites identified under other KBA criteria, as are those in the open ocean compared with ones on land (see Section 5.3.2).

Why do KBAs need to be manageable as a unit and what does this mean?

The KBA Standard defines "site" as: "A geographical area on land and/or in water with defined ecological, physical, administrative or management boundaries that is actually or potentially manageable as a single unit (e.g., a protected area or other managed conservation unit)…" (IUCN, 2016, p. 7).

The KBA Standard defines "manageability" as: "The possibility of some type of effective management across the site. Being a manageable site implies that it is possible to implement actions locally to ensure the persistence of the biodiversity elements for which a KBA has been identified. This requires that KBA delineation consider relevant aspects of the socio-economic context of the site (e.g., land tenure, political boundaries) in addition to the ecological and physical aspects of the site (e.g., habitat, size, connectivity) …" (IUCN, 2016, p. 13).

Taking site manageability into account during delineation will enhance the prospects for biodiversity persistence because conservation actions are more likely to be undertaken. However, the process of KBA identification and delineation does not include steps to advance management activity and does not imply that any specific form of conservation action, such as protected area designation, is required (IUCN, 2016, p. 8).

A KBA should be a *manageable* unit, but does not need to be a single *management* unit. Rather, there needs to be scope for effective management across the site. For example, a site that comprises several different ownership or management units (e.g. a protected area and adjacent private reserve) may be proposed as a single KBA if management can be coordinated across the site. Where a proposed KBA comprises multiple management units, KBA proposers should make the case that there is scope for some type of effective management across the site to support the persistence of trigger biodiversity elements. (See the Documentation and Mapping Standards for guidance on documentation).

Can the boundaries of KBAs overlap one another?

KBA boundaries should not overlap. KBAs with clear, non-overlapping boundaries are much easier to communicate to end-users than a set of overlapping sites that are important for different biodiversity elements and meet different KBA criteria.

In many areas, the distribution of biodiversity elements that have not previously been considered will overlap with existing KBAs (including AZE sites, IBAs and KBAs identified under previous initiatives). Many of these existing KBAs have national recognition, active conservation and monitoring initiatives and/or are linked to legislative and policy processes. KBA proposers should work to harmonise proposed KBA boundaries with existing ones through consensus-building and agreement with the proposers of existing KBAs (see Section 8.2). (See Resolving complex boundary overlaps for further guidance.)

Can KBAs have dynamic boundaries?

KBAs should have fixed boundaries because sites displayed in the WDKBA must be stable. Where dynamic features are important, as for many marine species and freshwater/terrestrial species that depend on dynamic or ephemeral habitats, KBAs should be large enough to encompass those features, as long as there is scope for effective management at that scale.

KBAs that support trigger biodiversity elements seasonally (e.g., KBAs that support seasonal aggregations under Criterion D1) are also displayed with fixed boundaries in the WDKBA.

7.1 Assembling spatial datasets

What types of spatial datasets are useful for KBA delineation?

A range of different types of data may be useful for KBA delineation (see Table 7.1 for examples). Data layers should be of an appropriate resolution to form the basis for delineating manageable KBAs.

Table 7.1 Spatial datasets that may be useful for KBA delineation

Ecological datasets
Species data: • locality data, including information on localities known to be important for specific life-cycle processes (e.g., breeding or moulting) or as ecological refugia (e.g., deep pools in rivers); • tracking and movement data, including information on migratory bottlenecks; • validated habitat maps (see Appendix III.4). Ecosystem data: • topographic data (e.g., elevation, bathymetry, slope, sub-catchments, ridges, rivers, seamounts, outer reef passages); • boundaries of land cover and benthic habitat classes; • ecosystem type boundaries; • ecoregion and bioregion boundaries. Existing sites of biodiversity importance: • boundaries of any existing KBAs (e.g., AZE sites, IBAs and KBAs identified under previous criteria); • boundaries of other sites of biodiversity importance (e.g., IPAs, Important Marine Mammal Areas (IMMAs)) and designated biodiversity conservation sites (e.g., natural World Heritage sites, Ramsar sites, EBSAs).
Socio-economic datasets
Management data: • customary indigenous and community lands (both informal and formally recognised); • other management units (e.g., private lands and concessions); • other protected or conserved areas; • administrative boundaries. Human use data: • human use areas (e.g., such as agricultural areas, fishing areas); • infrastructure, including cities, ports, roads, shipping lanes.

7.2 Deriving initial KBA boundaries based on ecological data

The boundaries of a KBA should always be based on ecological considerations, with adjustments for manageability as required.

7.2.1 Distribution maps for individual KBA trigger biodiversity elements

Separate distribution maps are not necessary for biodiversity elements that align with existing KBA boundaries (section 7.3.1) or the boundaries of other sites of biodiversity importance (section 7.3.2). This may well be the case where existing sites encompass remaining areas of natural habitat. However, distribution maps of biodiversity elements are a useful starting point for delineation where there are no existing sites in the area of interest, or biodiversity elements overlap with existing sites but do not align with their boundaries.

For well sampled KBA trigger biodiversity elements, it may be possible to derive distribution maps that represent the known local geographic extent from observed locality data. In contrast, for elements with relatively few sampling localities, it may be necessary to infer the approximate geographic extent using knowledge of habitat requirements combined with maps of remaining habitat or by using habitat models. Distribution maps should contain enough of each trigger biodiversity element to meet KBA thresholds.

For trigger biodiversity elements that do not occupy a whole KBA, maps showing their distribution within the KBA should be submitted with the KBA proposal, where possible, to support monitoring, potential targeted management actions and possible re-delineation in the future. These will be visible in the WDKBA when it is fully functional.

7.2.2 Deriving initial KBA boundaries based on ecological data

Where there is no existing site, initial KBA boundaries can be derived that encompass the distribution of overlapping trigger biodiversity elements. These initial KBA boundaries should generally be delineated so that the area contained within them is distinct from surrounding areas in terms of importance for the trigger biodiversity elements or habitat, while minimising the inclusion of land or water that is not relevant to the trigger biodiversity elements.

In addition to habitat, it is advisable to consider the spatial aspects of ecological boundaries, including size, edge and connectivity with other natural areas. In particular, delineating boundaries that align with natural topographic or habitat features may enhance prospects for the persistence of trigger biodiversity elements.

If distribution maps of KBA trigger biodiversity elements are clipped during this process, it is important to check that the initial KBA boundaries still contain enough of each potential trigger biodiversity element to meet relevant KBA criteria and thresholds.

Does the area contained within a KBA need to support a minimum viable population of each trigger species?

No. Populations of trigger species within KBAs may form part of a larger meta-population and so do not need to be self-sustaining. The area contained within ecological boundaries needs to meet the relevant KBA thresholds, including the threshold number of reproductive units (if applicable). It should be sufficient to sustain the threshold population size and number of reproductive units during the relevant seasons of the annual life-cycle (e.g., year-round for resident species and seasonally for migratory species), although it is recognised that this information will be unavailable for many species.

How can ecological boundaries be defined in wilderness areas?

KBA delineation may be challenging in areas of continuous habitat, such as wilderness areas (Upgren et al., 2009). Data on species distributions are often lacking and data on remaining habitat may be of limited use because much of the habitat still remains. Over the long-term, the best approach may be to generate predictive maps of species distributions through habitat modelling, validated by additional surveys (see Section 3.11). In the meantime, topographic and environmental data such as elevation, bathymetry, ridgelines, seamounts, geological features and other identifiable elements of the land/seascape may be used to delineate provisional ecological boundaries that can be refined using additional data to yield practical KBA boundaries (see Section 7.3.3).

7.3 Refining ecological boundaries to yield practical KBA boundaries

KBA delineation is not complete until ecological boundaries are evaluated for their manageability and refined, if necessary, to yield a manageable site or sites. Initial ecological boundaries based on the trigger biodiversity element should be retained for future reference, even if they do not become the final KBA delineated boundary.

Refining ecological boundaries to yield practical KBA boundaries will generally involve additional information (e.g., on land/resource tenure considerations) as well as stakeholder input.

Once practical KBA boundaries have been delineated, KBA proposers should check that these contain enough of each KBA trigger biodiversity element to meet relevant KBA thresholds.

7.3.1 Refining boundaries with respect to existing KBAs

KBA delineation must take into account the boundaries of existing KBAs (including AZE sites, IBAs and KBAs identified under previous criteria). Many of these sites have national recognition, active conservation and monitoring initiatives and/or are linked to legislative and policy processes. This provides an opportunity for reassessment of existing KBAs for the original trigger biodiversity elements (especially if these have not yet been assessed based on the KBA Standard) and a review of manageability. Any reassessment should involve consensus-building with proposers of the existing KBA(s). The boundaries of an existing global KBA may not be modified in such a way that the site no longer qualifies as a KBA for its original trigger biodiversity element(s). See Figure 7.3.1 for an overview.

Delineation with respect to other sites of biodiversity importance and to protected or conserved areas is treated separately (see Section 7.3.2).

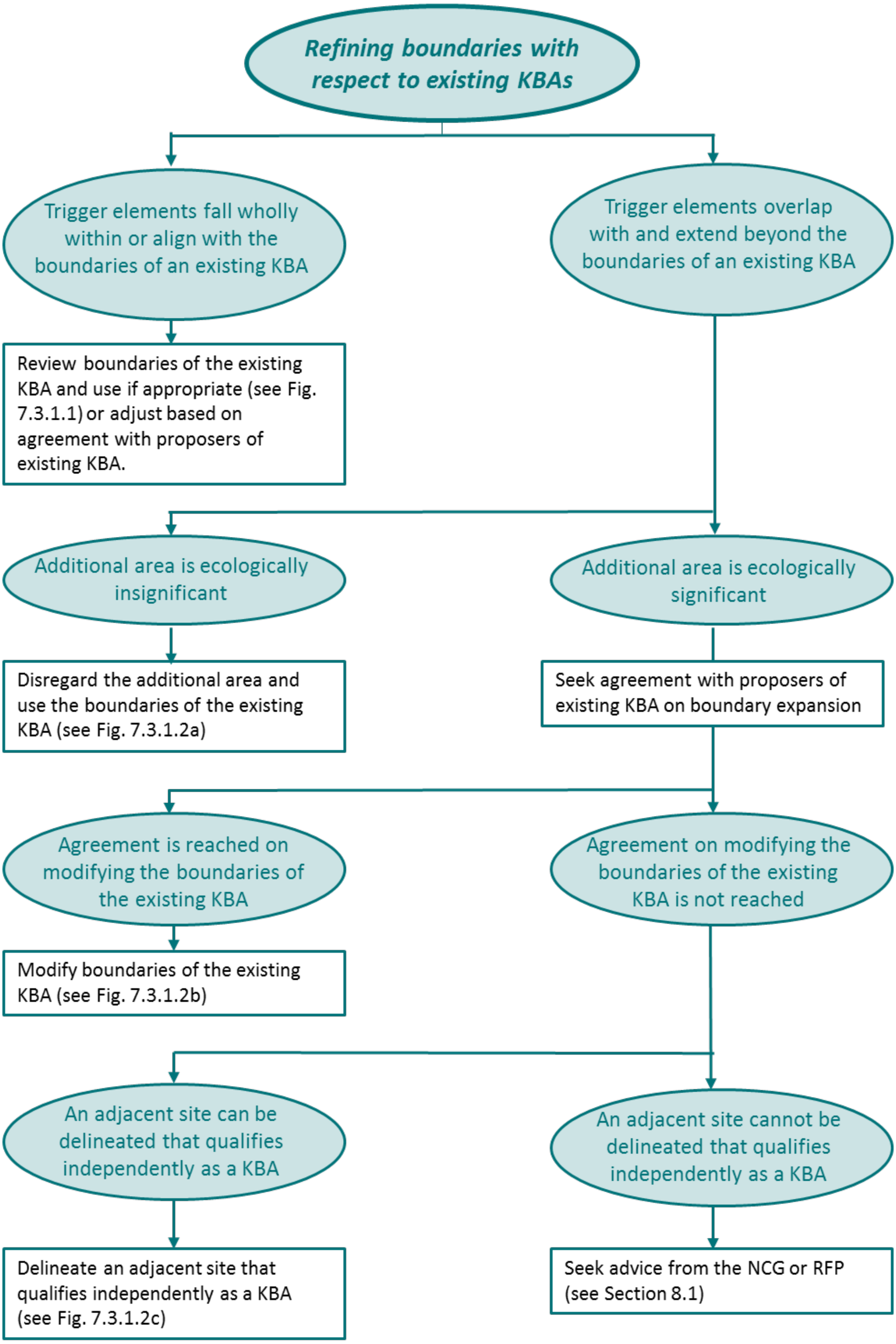

Figure 7.3.1. Refining boundaries with respect to existing KBAs (see text for further details).

What if the ecological boundaries for new KBA trigger biodiversity elements fall wholly within, or largely follow, the boundaries of an existing KBA?

Where the ecological boundaries for a new KBA trigger biodiversity element fall wholly within or largely follow the boundary of an existing KBA (Fig. 7.3.1.1), the boundary of the existing KBA should be used for the delineation, unless reassessment of the site for the original trigger biodiversity elements or a review of manageability indicate otherwise. Data on the new trigger biodiversity element(s) should be added to the existing KBA's qualifying data (including distribution maps showing where the trigger biodiversity element occurs within the KBA, if it does not occupy the whole area, where possible). Involvement of the proposers and managers of the existing KBA is recommended, even if there are no boundary modifications, as they may have additional relevant information on the spatial extent of biodiversity elements and they may be working to conserve the site.

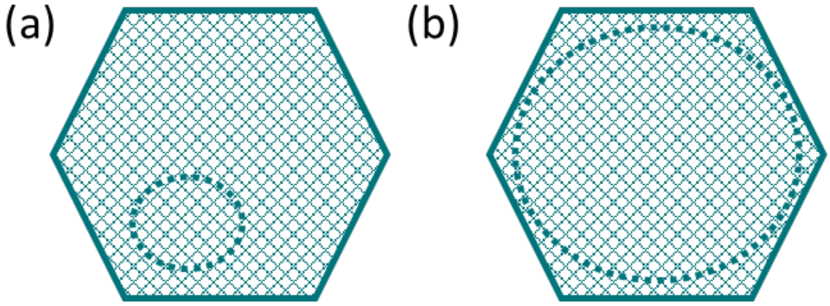

Figure 7.3.1.1 Ecological boundaries for biodiversity elements (a) fall wholly within the boundaries of an existing KBA; or (b) align with the boundaries of an existing KBA. The existing KBA is shown as a hexagon; ecological boundaries are shown as an oval; the proposed KBA is shown as the hatched area. (Note. Regular shapes are used in these cartoon examples for clarity and are not intended to suggest that KBAs are hexagons.)

What if ecological boundaries for new KBA trigger biodiversity elements extend beyond the boundaries of an existing KBA?

Where KBA trigger biodiversity elements extend beyond the boundaries of an existing KBA, the options are as follows:

- The additional area may be disregarded if it is not important for the persistence of the KBA trigger biodiversity element(s) at the site and the KBA trigger biodiversity element(s) will still meet relevant KBA thresholds if the existing boundary is adopted (Fig. 7.3.1.2a). Data on the new trigger biodiversity element(s) should be added to the existing KBA's qualifying data.

- The existing KBA boundary may be modified (Fig. 7.3.1.2b) based on consensus-building and agreement with the proposers of the existing KBA (see Section 8.2), and within the confines of manageability. The data on the new trigger biodiversity element(s) should be added to the existing KBA's qualifying data. If the change in boundary affects existing KBA trigger biodiversity elements (for example, it increases the population of a potential trigger species or extent of an ecosystem type contained within the KBA), this information also needs to be updated.
- If the proposers of the existing KBA are unwilling to modify its boundary (for example, because the site is linked to legislative or policy processes, or would no longer be a manageable unit) and the additional area is important for the persistence of the new KBA trigger biodiversity element(s), a new adjacent KBA may be delineated as long as it qualifies independently as a KBA (Fig. 7.3.1.2c). Information on biodiversity within the existing KBA boundary should also be updated. If proposers of the existing KBA are unwilling to modify its boundary and the additional area does not qualify independently, KBA proposers should seek advice from the NCG or RFP (in that order).

The choice between these options will depend on the ecological significance of the areas outside the existing KBA for relevant biodiversity elements, the scale of manageability, and consensus-building with proposers of the existing KBA (see Section 8 on stakeholder consultation and involvement, and Resolving complex boundary overlaps for further guidance). The case for modifying the existing site will generally be stronger if trigger species periodically move between the existing KBA and the additional area, such that coordinated management is required to ensure their persistence.

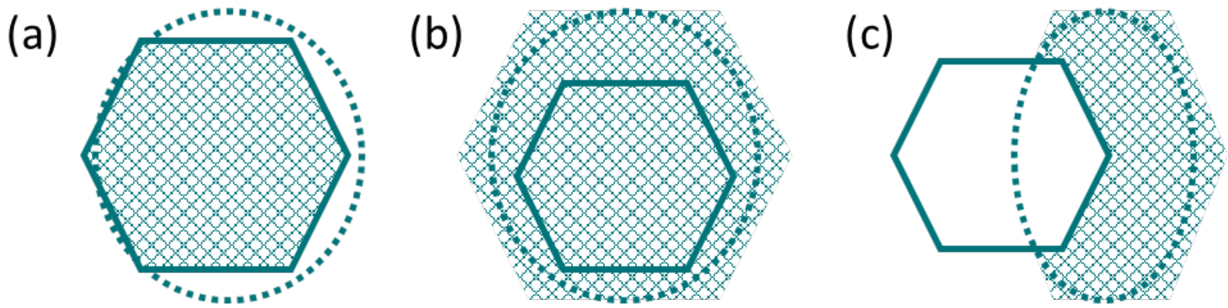

Figure 7.3.1.2 Ecological boundaries for biodiversity elements extend beyond the boundaries of an existing KBA: (a) additional area is ecologically insignificant; (b) boundary of existing KBA is modified to encompass the ecological boundaries of additional biodiversity elements; (c) a new KBA is proposed adjacent to the existing KBA. The existing KBA is shown as a hexagon; ecological boundaries are shown as an

oval; the proposed KBA is shown as the hatched area. (Note. Regular shapes are used in these cartoon examples for clarity and are not intended to suggest that KBAs are hexagons.)

7.3.2 Refining boundaries with respect to other sites of biodiversity importance, or protected or conserved areas

When a biodiversity element triggering one or more KBA criteria falls within a site of biodiversity importance not yet recognised as a KBA (such as a site identified using other criteria or processes, e.g., an IPA, IMMA) or other protected or conserved area where active management is underway, it may be advisable to use the boundary of the other site of biodiversity importance or other protected or conserved area to delineate the KBA. Like KBAs, sites of biodiversity importance identified using other criteria or processes often have national or local recognition, active conservation and monitoring initiatives, and may be linked to legislative and policy processes; and most protected or conserved areas are recognised management units with the goal of safeguarding the biodiversity contained within them. Where the boundaries of other existing sites of biodiversity importance are suitable for the biodiversity elements triggering the KBA criteria and are manageable units, conservation efforts can be strengthened by using the same boundaries for KBA delineation. The same is true for protected or conserved areas. However, if their boundaries are not suitable for KBA trigger biodiversity elements, a KBA may be proposed that overlaps with other sites of biodiversity importance, or protected or conserved areas. See Figure 7.3.2 for an overview.

Consultation with the managers of other sites of biodiversity importance or protected or conserved areas that overlap with proposed KBAs is recommended as they may have additional relevant information on the spatial extent of biodiversity elements and land/resource tenure and management in the area (see Section 8.1).

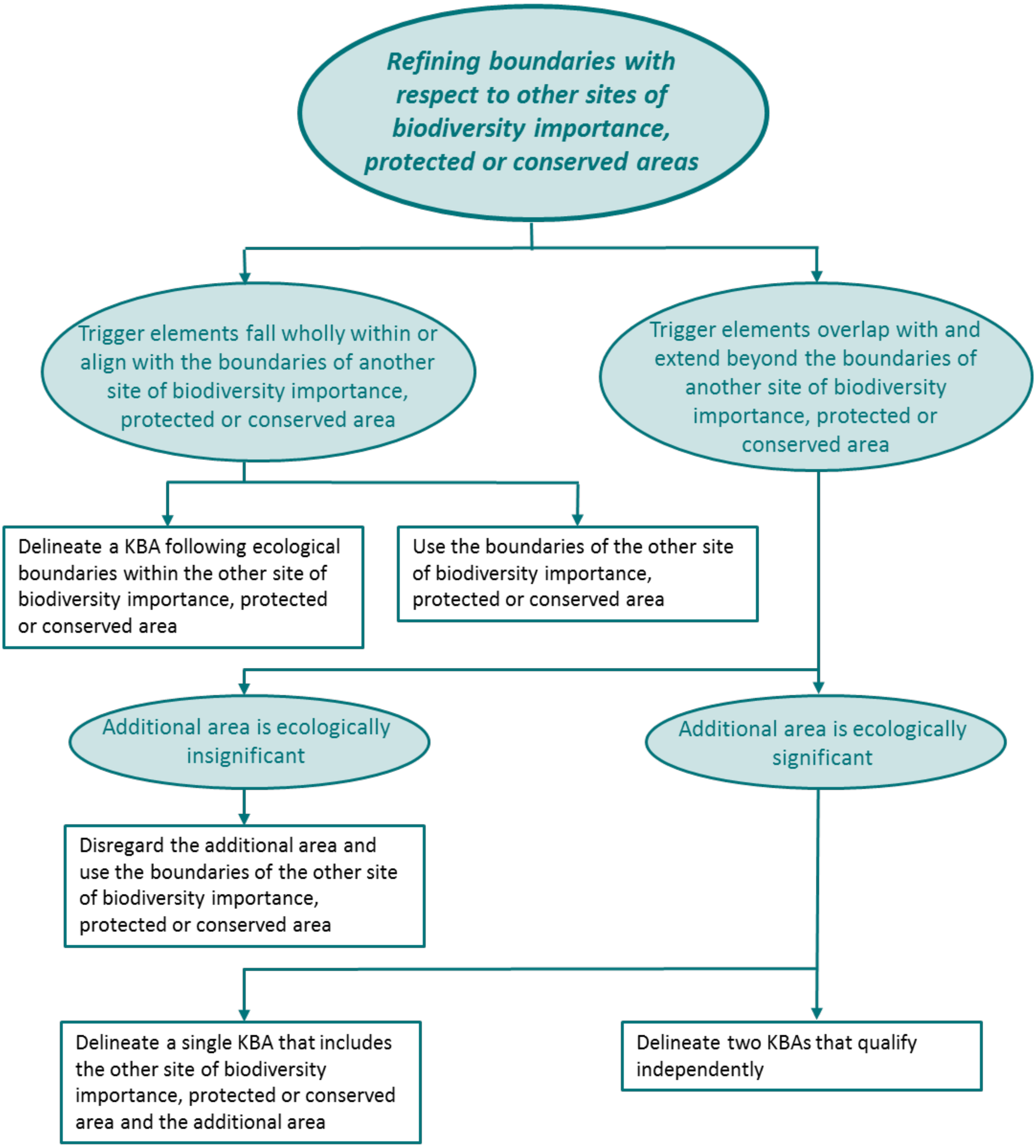

Figure 7.3.2. Refining boundaries with respect to other sites of biodiversity importance, protected or conserved areas (see text for further details).

7.3.3 Refining boundaries in the absence of existing KBAs, other sites of importance for biodiversity, or protected or conserved areas

When delineating sites that do not overlap existing KBAs, other sites of biodiversity importance, protected or conserved areas, other data on land/resource tenure and management may be used to derive practical KBA boundaries. These data may include administrative boundaries, indigenous and community lands, private lands and concessions, community fishing areas, catchments used for integrated basin management and other long-term management units (see Table 7.1). Involvement of customary and legal rights-holders is recommended and encouraged (see Section 8.3). See Figure 7.3.3 for an overview.

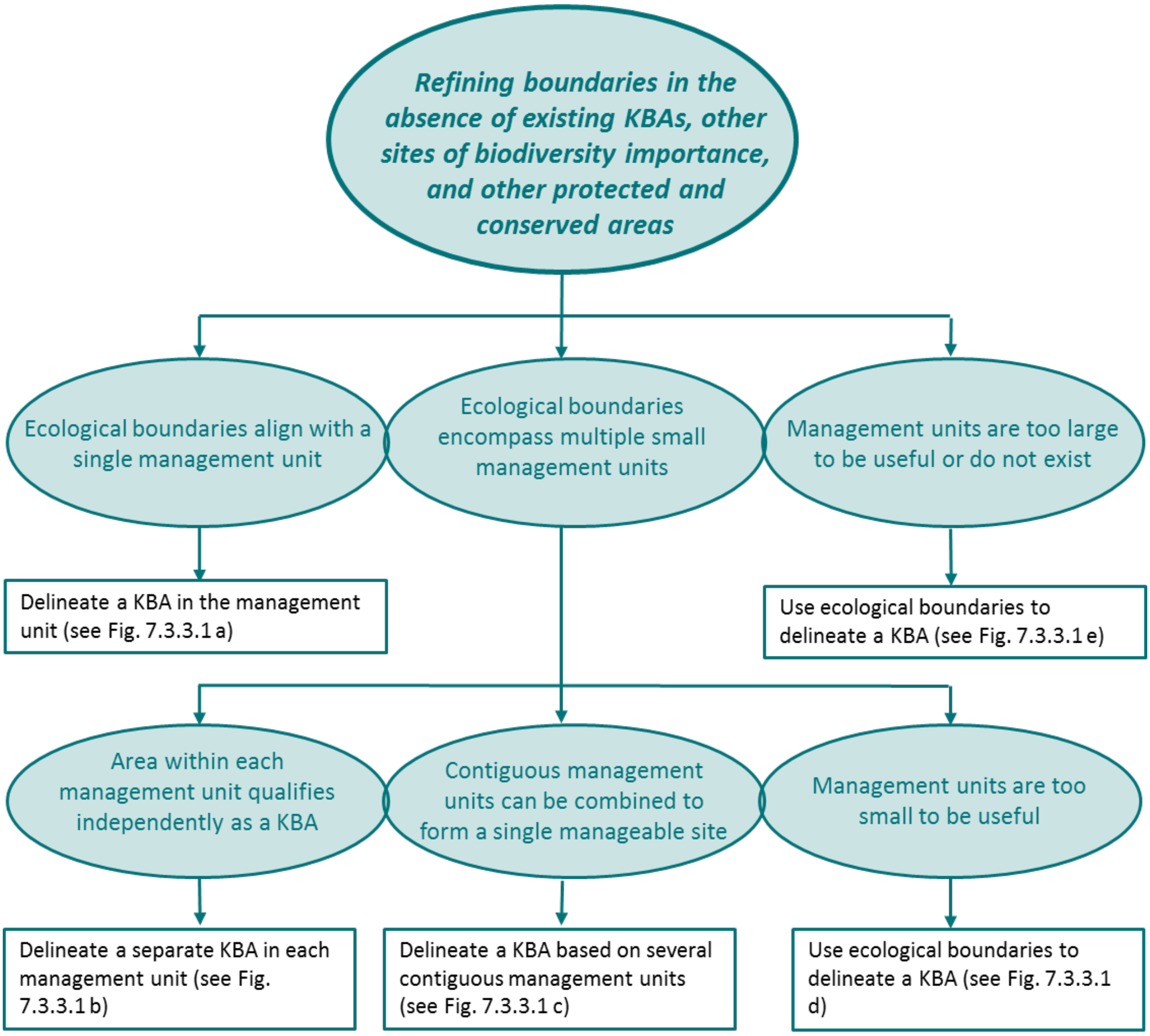

Figure 7.3.3. Refining boundaries in the absence of existing KBAs, other sites of importance for biodiversity, and protected or conserved areas (see text for further details).

What if management units are small and ecological boundaries encompass multiple distinct management units?

Ecological boundaries may encompass multiple management units or jurisdictions (e.g., landholdings, land management agencies, administrative areas). In this context, there are generally three options:

- If the area that lies within management units would qualify independently as a KBA, then identifying separate KBAs in each qualifying management unit will most likely align with the scale of practical management responsibilities and implementation (Fig. 7.3.3.1b).
- If management units would not qualify independently as KBAs, but there is scope for effective management across the site, then a KBA may be delineated based on multiple management units (Fig. 7.3.3.1c).
- If management units would not qualify independently as KBAs and are too small to provide a basis for coordinated management, then KBA delineation may be based on the ecological data used to derive initial KBA boundaries (Fig. 7.3.3.1d).

What if management units are too large to be useful or do not exist?

In some cases, management units may be too large to be useful (e.g., state/ provincial boundaries or EEZs) or may not exist (e.g., in wilderness areas or on the high seas, Fig. 7.3.3.1e). In such cases, the best approach is to base KBA delineation on the ecological data used to derive initial KBA boundaries (see Section 7.2).

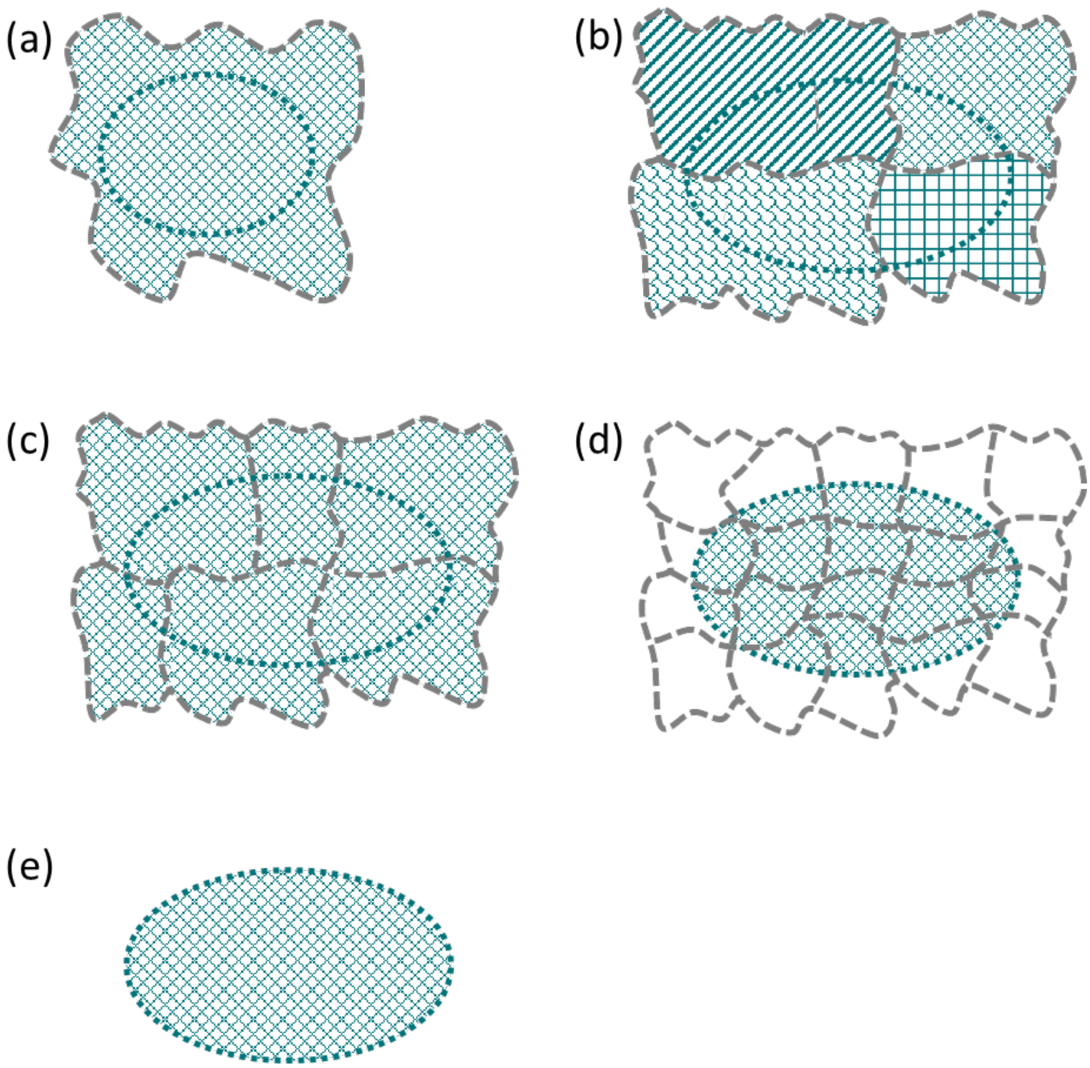

Figure 7.3.3.1 Refining boundaries in the absence of existing sites of importance for biodiversity, protected areas or other conservation areas: (a) a single management unit provides practical KBA boundaries; (b) contiguous management units qualify separately as KBAs and provide practical KBA boundaries; (c) contiguous management units are combined to form a single site with scope for effective management across the site; (d) management units do not qualify independently and are too small or heterogeneous to provide a basis for coordinated management, so ecological boundaries are used to delineate a proposed KBA as long as there is scope for effective management at this scale; (e) management boundaries are too large to provide practical KBA boundaries or do not exist, so ecological boundaries are used to delineate a proposed KBA as long as there is scope for effective management at this scale. Management units are shown as irregular shapes with a dashed boundary; ecological boundaries are shown as an oval; the proposed KBA is shown as the hatched area.

7.3.4 Additional questions

Can a KBA comprise several non-contiguous areas?

Some KBA trigger biodiversity elements have a patchy distribution such that ecological boundaries contain a number of distinct areas separated by unsuitable habitat. The decision on whether to delineate one or several KBAs depends on several factors: whether separate areas would qualify as KBAs if delineated as separate sites; and manageability, in particular whether there is scope for effective management across separate areas. The case for a single site will be stronger if non-contiguous areas fall within a single protected or conserved area (Fig. 7.3.4.1).

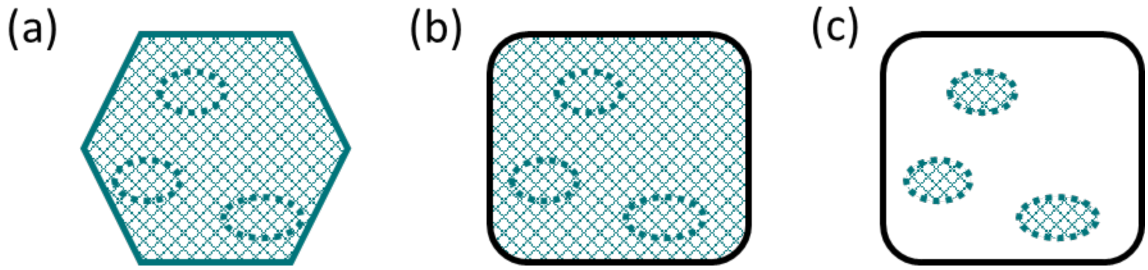

Figure 7.3.4.1 Can a KBA comprise several non-contiguous areas: (a) biodiversity elements occur in patches within an existing KBA; (b, c) biodiversity elements occur in patches within an existing manageable unit such as a protected area – the solution shown in (b) is to delineate a single KBA following the protected area boundaries; whereas the solution shown in (c) is to delineate one or more separate KBAs encompassing non-contiguous areas within a much larger manageable unit. An existing KBA is shown as a hexagon; a protected area is shown as a rectangle; ecological boundaries are shown as ovals; proposed KBAs are shown as the hatched area. (Note. Regular shapes are used in these cartoon examples for clarity and are not intended to suggest that protected areas are rectangles or KBAs are hexagons.)

Are there any special considerations for delineating sites under Criterion C?

See Section 5.3.2.

Are there any special considerations for delineating freshwater KBAs?

When delineating practical KBA boundaries for sites triggered by freshwater biodiversity, it may well be appropriate to take sub-catchments (e.g., HydroBASINS level 12) into account, if the amount of non-habitat area is relatively limited. The use of broader-scale catchment levels should be avoided. As with all KBAs, there should be scope for effective management across the site.

How can freshwater KBAs be aligned with existing terrestrial KBAs?

In many cases, freshwater biodiversity elements fall within or align with the boundaries of existing KBAs identified for terrestrial biodiversity. In some cases, however, the boundaries of existing terrestrial KBAs are inappropriate for delineating KBAs for freshwater biodiversity. For example, boundaries that follow rivers may exclude some or all of the area important for freshwater trigger biodiversity elements. Where freshwater biodiversity elements overlap with an existing KBA, KBA proposers should follow the guidelines in Section 7.3.1. Where freshwater biodiversity elements overlap with other sites of biodiversity importance, or protected or conserved areas, KBA proposers should follow the guidelines in Section 7.3.2.

What if ecological boundaries for single biodiversity elements extend to the landscape or seascape scale?

For some biodiversity elements, especially area-demanding species that occur at low densities across large areas of contiguous habitat, it may not be possible to delineate manageable sites that encompass a sufficient quantity to meet a KBA threshold. These biodiversity elements may depend primarily on conservation actions at the land-, water- or seascape scale rather than the site scale of KBAs (Boyd et al., 2008; IUCN, 2016, p. 4).

What if overlapping biodiversity elements extend to the landscape or seascape scale?

In some cases, distribution maps for different biodiversity elements yield multiple polygons that overlap in such a way that ecological boundaries surrounding them extend to the land- or seascape scale (i.e. beyond the scale that is manageable as a unit, Fig. 7.3.4.2). In this case, delineation may involve parsing the different biodiversity elements into sites that are manageable in scale. The decision on whether to combine or separate management units into one or more KBAs will depend on whether ecological boundaries for some biodiversity elements align with management boundaries, whether management units qualify independently as KBAs, and the scope for effective management across management units.

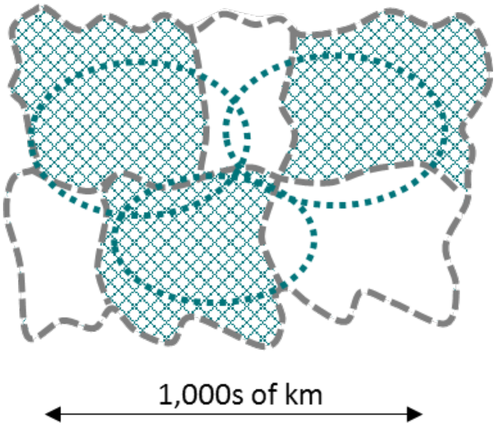

Figure 7.3.4.2 Ecological boundaries overlap and extend to the landscape or seascape scale. Management units are shown as irregular shapes with a dashed boundary; ecological boundaries are shown as ovals; proposed KBAs are shown as hatched areas.

What about transboundary areas?

Transboundary areas are an extreme example of sites where ecological boundaries extend over multiple management units (Fig. 7.3.3.1), and the principles are the same:

- If the area within each country would qualify independently as a KBA, then identifying separate KBAs in each country will most likely align with the practical division of management responsibilities and implementation.
- If the area within either country is ecologically significant (i.e. essential for the persistence of trigger biodiversity elements) but would not qualify independently as a KBA, and there is scope for effective management across the transboundary site, then a KBA may be delineated across the international boundary.
- If the area within either country is ecologically significant (i.e. essential for the persistence of trigger biodiversity elements) but would not qualify independently as a KBA, and realistically there is no scope for effective management across the transboundary site, the area may meet thresholds for national or regional significance, once these thresholds have been developed.

What if ecological boundaries encompass multiple overlapping jurisdictions?

In marine systems, different resources or activities are often managed by different agencies with spatially overlapping jurisdictions (Fig. 7.3.4.3). For example, fisheries may be managed by the fisheries management agency, shipping by the coastguard, or for oil and gas development by an energy management agency. In this context, a KBA may be delineated based on the ecological data used to derive initial KBA boundaries (see Section 7.2). These initial KBA boundaries may be refined using topographic data (e.g., bathymetry, seamounts, and other bathymetric features) as appropriate, as long as there is scope for effective management at this scale.

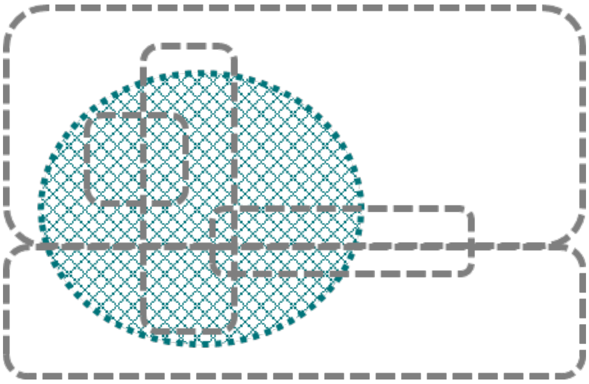

Figure 7.3.4.3. Ecological boundaries encompass multiple overlapping jurisdictions. Management jurisdictions are shown as rectangles; ecological boundaries are shown as an oval; the proposed KBA is shown as the hatched area.

8. Stakeholder consultation and involvement

The purpose of this section is to set out the stakeholder consultation and involvement that is required or recommended during the KBA identification and delineation process prior to publishing details of a confirmed KBA through the WDKBA, consistent with the KBA Standard.

The process of KBA identification and delineation by itself does not include steps to advance management activity. According to the KBA Standard, "KBAs are sites of importance for the global persistence of biodiversity. However, this does not imply that any specific conservation action, such as protected area designation, is required. Such management decisions should be based on [subsequent] conservation priority-setting exercises, which combine data on biodiversity importance with the available information on site vulnerability and the management actions needed to safeguard the biodiversity for which the site is important" (IUCN, 2016, p. 8). The KBA Guidelines on stakeholder consultation and involvement relate solely to the KBA identification and delineation process, and do not cover steps to advance management activity (but see Section 8.4 for some relevant policies).

For the purposes of KBA identification and delineation, we define key terms as follows:

- *Rights-holder:* has legal or customary tenure or use rights over land/water/resources within a proposed or confirmed KBA;
- *Stakeholder:* may affect or may be affected by the outcome of the KBA identification and delineation process; all rights-holders are stakeholders, but not all stakeholders are rights-holders;
- *Consultation:* sharing information and seeking input;
- *Involvement:* working with stakeholders to ensure their concerns and aspirations are understood, considered, and reflected in the alternatives developed;
- *Collaboration and consensus-building*: extends beyond consultation and involvement to building consensus and seeking agreement, where possible.

Stakeholder consultation and involvement are important at various stages of the KBA identification and delineation process, as summarised in Table 8.1. Three types of stakeholder consultation or involvement are considered here – these may take place simultaneously, especially if the same individuals or organisations are involved:

- consultation with knowledge-holders (Section 8.1);

- consensus-building with proposers of existing KBAs in the area of interest (Section 8.2);
- involvement of customary rights-holders (Section 8.3).

A brief final section (Section 8.4) addresses the statement in the KBA Standard: "As the extent to which KBA boundaries inform active management increases, more extensive consultation will be needed, for example with local and indigenous communities living in or near the site." (IUCN, 2016, p. 26)

Table 8.1 Stakeholder consultation and involvement

Who?	Type?	When?	What?
Biodiversity knowledge holders	Consultation recommended [1]	Identification process	Information on biodiversity elements (species, assemblages, ecosystem types).
Tenure knowledge holders	Consultation recommended [1]	Delineation process	Information on tenure, management, and use; manageability and boundaries.
Proposers of existing KBAs [2]	Consensus-building required prior to modifying boundaries [3, 4]	Delineation process	Boundaries
Customary rights-holders (including indigenous peoples, forest-dependent peoples, livestock-holders, fishers, etc.) [2]	Involvement recommended	Delineation process	Boundaries
Customary rights-holders (as above)	Consent required	Before publication	Use of previously unpublished Indigenous and Local Knowledge (ILK) in KBA delineation
Legal rights-holders (including land/water/resource owners, managers, and users with legal rights) [2]	Involvement encouraged	Delineation process	Boundaries
Customary rights-holders (as above)	Consensus-building required	After KBA identification and delineation	Informing active management [5]
Legal rights-holders (as above)	Consensus-building required	After KBA identification and delineation	Informing active management [5]
Additional stakeholders (including local communities, conservation and development organisations working in the region, local or national government	Involvement encouraged	After KBA identification and delineation	Informing active management [5]

agencies responsible for managing wildlife and natural areas in the region) [2]

[1] Free, prior and informed consent (FPIC) is required prior to the publication or display of information based on unpublished Indigenous and Local Knowledge (ILK).

[2] These individuals or groups may also be included in biodiversity and/or tenure knowledge holders.

[3] Involvement is recommended but consensus-building is not required prior to adding new trigger biodiversity elements to an existing KBA.

[4] If the proposer of an existing KBA is unwilling to modify boundaries so that it is not possible to delineate a KBA for additional trigger biodiversity elements or criteria without overlapping the existing KBA, then the KBA proposer should involve the NCG, RFP or KBA Secretariat (in that order) to try to find a mutually acceptable solution. If this process fails, then one or both parties may submit an Appeal to the KBA Standards and Appeals Committee for a final binding decision.

[5] While KBA identification and delineation do not include steps to advance active management, these rows are included here for consistency with the KBA Standard which states that "As the extent to which KBA boundaries inform active management increases, more extensive consultation will be needed, for example with indigenous and local communities living in or near the site" (IUCN, 2016, p. 26), as well as the Guidelines on Business and KBAs. These rows are shown in grey as a reminder that active management occurs after KBA identification and delineation and therefore falls beyond the remit of the KBA Standard and KBA Guidelines.

NCGs are expected to play an important role in facilitating stakeholder consultation and involvement at the national level, and are encouraged to build good relationships with biodiversity knowledge-holders, socio-economic and cultural knowledge-holders and national organisations representing diverse sectors of society, including indigenous peoples, local communities and resource users (e.g., forest-dependent peoples, farmers, pastoralists, fishers), and relevant government agencies.

8.1 Consultation with knowledge-holders

KBA proposers are encouraged to consult with a range of local knowledge-holders to share knowledge during KBA identification and delineation. In particular:

- It is recommended that KBA proposers invite biodiversity knowledge-holders (including taxonomic experts, biologists, and holders of ILK to contribute their knowledge of the occurrence and distribution of biodiversity elements relevant to KBA identification and delineation. In many cases, it will not be possible to identify a KBA without this knowledge.
- It is recommended that KBA proposers invite local tenure and resource management knowledge-holders (including social scientists and holders of ILK) to share their knowledge of local legal and customary tenure and resource management systems and other information relevant to the delineation of practical KBA boundaries.

KBA proposers are encouraged to contact relevant individuals and organisations directly. This may be supplemented by online consultation, where appropriate, but in many cases online consultation will not be an effective substitute for a direct approach.

What is the role of Indigenous and Local Knowledge (ILK) in KBA identification and delineation?

Integrating ILK can improve KBA identification and delineation by ensuring that these are informed by the best available information, including information on species abundance and distribution patterns. In many cases, a biodiversity element's range may fall wholly or mostly within the territory of an indigenous or local community; in others, ILK may need to be interpreted in the broader context of the species' or ecosystem's overall distribution. ILK can also play an important role in KBA delineation by ensuring that this is informed by the best available information on customary tenure and resource management systems.

Accessing ILK can be complex and will require different approaches in different communities. It is generally advisable to approach the leadership of the community first before going directly to particular knowledge holders. This should be done with an understanding of the community's cultural practices, language(s) and traditions, in order to ensure any approach to an ILK knowledge holder is done in a respectful, culturally appropriate manner, recognising they are equal partners in the information-sharing process. It is generally important to build trust with knowledge holders, be open and transparent about how the information will be used, and consider issues relating to ownership of the information and permission to use the information (see below). The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) Proposed approach to working with Indigenous and local knowledge provides further guidelines on working with ILK.

Is Free, Prior and Informed Consent (FPIC) required to display KBAs in the WDKBA?

The principle of Free, Prior and Informed Consent (FPIC) applies prior to the display of information based on previously unpublished ILK in the WDKBA. Any KBA proposal that uses data derived from unpublished ILK must be flagged for expert review when the KBA proposal is submitted to the WDKBA; FPIC should be documented (see the Documentation and Mapping Standards).

In rare cases, publication of information on KBAs could compromise the value of sacred natural sites (i.e. areas of land or water have special spiritual significance to peoples and communities, Verschuuren et al., 2010) if it encourages increased visitation. FPIC should therefore be sought prior to the publication or display of previously unpublished information regarding sacred natural sites. The location of sacred natural sites may not be widely known – it is therefore strongly recommended that KBA proposers involve relevant ILK-holders, especially when working in regions where sacred natural sites may occur, to avoid publicly revealing information on sacred natural sites inadvertently.

How is consultation with knowledge-holders documented?

Any consultation with knowledge-holders during the KBA identification and delineation process should be documented. This is especially important if FPIC is required.

8.2 Consensus-building with proposers of existing KBAs

Consensus-building with proposers of existing KBAs (including AZE sites, IBAs and KBAs identified under previous initiatives) is required before any existing KBA boundaries are modified to account for additional biodiversity elements or additional criteria (see Section 7.3.1). As outlined in the KBA Standard (IUCN 2016, p. 28), the aim is to avoid KBA boundaries that overlap with each other.

KBA proposers are also encouraged to consult with proposers and managers of existing KBAs in the area of interest, even if there is no proposed modification to the boundaries, as proposers and managers of existing KBAs may well have relevant information on the occurrence and distribution of biodiversity elements, and managers should be informed of any new KBA trigger biodiversity elements identified for the site.

What happens if proposers of existing KBAs in the area of interest cannot be contacted or do not respond?

KBA proposers are required to make a genuine attempt to build consensus with proposers of existing KBAs that may overlap with newly proposed KBAs. If efforts to contact proposers of existing KBAs directly are unsuccessful, then KBA proposers should involve the NCG or RFP (in that order).

What happens if proposers of existing KBAs in the area of interest are unwilling to modify them to accommodate additional trigger biodiversity elements or criteria?

If proposers of existing KBAs are unwilling to modify site boundaries so that it is not possible to delineate KBAs for additional KBA trigger biodiversity elements or additional criteria without overlapping an existing KBA, then KBA proposers should involve the NCG, RFP or KBA Secretariat (in that order) to try to find a mutually acceptable solution.

How is consensus-building with proposers of existing KBAs documented?

KBA proposers should provide text briefly summarising the process and outcomes of consensus-building with proposers of any existing KBAs that may overlap with a newly proposed KBA when submitting a KBA proposal (see the Documentation and Mapping Standards). This text should provide enough information for independent reviewers, the NCG, RFP and the KBA Secretariat to understand and assess the decision and rationale.

8.3 Involvement of customary rights-holders

The process of KBA identification and delineation does not directly affect the customary or legal ownership/management/use rights of any rights-holders because KBA identification and delineation does not include any steps to advance management activity.

Nonetheless, involvement of customary rights-holders is recommended during the KBA identification and delineation process because KBAs can provide the basis for future conservation and management actions. Customary rights-holders need to be in a position to shape and anticipate this momentum early on, so they can be involved as they wish in decision-making about future management activities. This is especially important in situations where customary rights do not have legal backing and/or indigenous or other natural resource-dependent communities are typically marginalised in decision-making processes. FPIC will generally be required before any steps are made to advance management activities that might affect the rights of indigenous and other natural resource-dependent communities (see Section 8.4).

Involvement of legal rights-holders (including land/water/resource owners, managers and users) is also encouraged because it engages them in the process and can help identify practical KBA boundaries.

How can involvement of customary rights-holders be achieved?

In many countries, customary rights-holders are represented at the national level by various national bodies, such as organisations or networks for indigenous or forest-dependent peoples, livestock-holders, fishers, etc. Where this is the case, involvement may be facilitated by seeking advice from representative organisations or networks, including advice on how best to reach out to customary rights-holders for particular sites.

How is involvement of customary or legal rights-holders documented?

Any involvement of customary or legal rights-holders during the KBA identification and delineation process should be documented for future reference. In each case, KBA proposers should provide text briefly summarising involvement efforts and outcomes. This text should provide enough information for the NCG, RFP and KBA Secretariat to understand and assess what was done.

8.4 Beyond KBA identification and delineation

Guidance on stakeholder consultation and involvement relating to active management falls beyond the remit of the KBA Guidelines. Here, we note that the IUCN Policy on Conservation and Human Rights for Sustainable Development includes the guiding principle that Free, Prior and Informed Consent (FPIC) is required when IUCN projects, activities, and/or initiatives take place on indigenous peoples' lands and territories and/or impact natural and cultural resources, sites, assets etc. More specifically, the IUCN Standard on Indigenous Peoples includes the following principle: "Indigenous peoples are consulted and are active and effective participants in decision-making processes relevant to them and related to conservation activities supported by IUCN. Free, Prior and Informed Consent (FPIC) is obtained for any intervention affecting their rights and access to their lands, territories, waters and resources." More generally, there is a responsibility to involve any natural resource-dependent communities, including forest-dependent peoples, farmers, pastoralists and fishers, when considering conservation or management actions that might affect their rights. The Guidelines on Business and KBAs include the following recommendation: "The establishment of an inclusive and transparent stakeholder and right-holder engagement process (including, for example, representatives of national, regional, and local government; Indigenous peoples; local communities; and other elements of civil society) in planning and decision making is recommended. International best practices for stakeholder and right-holder engagement, including a rights-based approach and Free, Prior, and Informed Consent (FPIC) for engaging with indigenous and traditional peoples and local communities, are implemented as early as possible in the project cycle and follow recognised best practices."

9. Data availability, quality and uncertainty

The KBA Standard (IUCN, 2016, p. 5) states: "The KBA criteria have quantitative thresholds to ensure that site identification is transparent, objective and repeatable. It is important to compile the best available data for KBA identification, but the availability of high quality data differs significantly between different taxonomic groups…"

The KBA Standard (IUCN, 2016, p. 7) states that: the data used to support KBA identification and delineation "…must be traceable to a reliable source and be recent enough to give confidence that the biodiversity elements are still present given the history of land use [and other types of] change in an area."

9.1 Data availability

Do data used in KBA identification and delineation need to be published?

All data used to observe or infer the proportion of the global population size or ecosystem extent at a site, or the ecological integrity of a site, must be referenced to a publication that is available in the public domain, be publicly available (e.g., in the WDKBA or through a free data-archiving service, such as the Dryad Digital Repository), or be made available on request. In the case of area-based assessment parameters, such as range, ESH, or AOO that are not derived from the IUCN Red List account and have not been published previously, KBA proposers should document how these parameters were estimated so that the method can be reviewed.

Global values of some assessment parameters will be included in the WDKBA (see the Guidance on the process of Proposing, Reviewing, Nominating and Confirming Key Biodiversity Areas).

KBA proposers are responsible for ensuring that data used to estimate site-level values of assessment parameters are referenced to a publication, are publicly available, or are made available on request. In the latter case, a brief description of the data and data source and contact details for the data-holder should be included in the KBA proposal; this information can then be cited as *in litt*. See the Documentation and Mapping Standards for more detailed guidance on required and recommendation documentation to support KBA identification and delineation.

What about sensitive data?

In rare cases, publication of KBAs or species' distribution maps in the WDKBA could put the biodiversity values of those sites at risk. For example, publication of information on the location of remaining populations of a rare species may jeopardise its conservation. The Sensitive Data Access Restrictions Policy for the IUCN Red List states that location data may be withheld for species listed as CR or EN that:
a) are listed under criteria C and D (but species assessed as CR under criteria A or B, but qualifying for EN under criteria C or D should also be highlighted);
(b) have high economic value;
(c) are threatened by trade; and
(d) have important sites that are generally not well known (i.e., an internet search engine such as Google cannot find these sites).

It is recommended that KBA proposers do not include sensitive location data in KBA proposals. If a site only qualifies as a KBA based on sensitive data, KBA proposers may consult the NCG, RFP or KBA Secretariat (in that order).

9.2 Data quality

9.2.1 Observing and inferring the proportion of the global population size at a site

For some of the species-based criteria (i.e. A1, B1-3), the proportion of the global population size at a site may be *observed* or *inferred* based on one or more assessment parameters. For D1-3, the proportion of the global population size at a site may be *observed* based on the number of mature individuals.

How can the proportion of the global population size at the site be "observed"?

The population size at a site may be *observed* from well documented recent direct observations of mature individuals (e.g., the number of sea lion females observed nursing sea lion pups at a site). This may be based on counts of all mature individuals at a site or on counts of mature individuals in sampling areas (e.g., points, transects, quadrats) together with statistical assumptions about sampling (e.g., point sampling, distance sampling). Animal tracking data collected using geolocators with high location accuracy (e.g., GPS) are considered equivalent to direct observations. Any statistical assumptions regarding the representativeness of sampling or detectability should be justified in the documentation. (Note that the definition of "observed" here is similar to the definition of "estimated" in the IUCN Red List Guidelines (IUCN SPSC 2017; Section 3.1); "estimated" is not used in the KBA Standard, except in the definition of mature individuals.)

How can the proportion of the global population size at the site be "inferred"?

The proportion of the global population size at a site may be *inferred* based on indirect evidence, such as indices of the relative abundance of mature individuals (e.g., the number of sea lion pups at a site may serve as an index of the abundance of mature individuals), or using the area-based assessment parameters (e.g., AOO, ESH, range, or number of localities), as indicated for each criterion in the KBA Standard. Inference is generally based on biological assumptions about the relationship between observed variables (e.g., sea lion pups) or modelled output (e.g., ESH) and the variable of interest (i.e. number of mature individuals). Animal tracks may be inferred from analysis of data from low-accuracy geolocators (e.g., light-level loggers). Any biological or statistical assumptions should be justified in the documentation.

How recent do data need to be when used to observe or infer the proportion of the global population size or ecosystem extent at a site, or ecological integrity?

Estimates of abundance and distribution are likely to become less accurate over time. Data that were collected more than 8-12 years before the assessment should be used cautiously and only if there is no information suggesting that there has been significant relevant change in global or site-level population size or distribution patterns (i.e. a change likely to affect KBA qualification or delineation). Thus, for example, older data may be acceptable in a remote wilderness area that has seen little change in the last 50 years, but not in one that has seen recent extensive habitat transformation, or where trigger species may have suffered significant decline due to disease, invasive species, or over-exploitation etc.

See Section 9.2.3 below for confirmation of presence.

9.2.2 Known, inferred and projected occurrences

Range is defined as the current known limits of distribution of a species, accounting for all *known*, *inferred* or *projected* sites of occurrence (IUCN 2012a).

What are "known sites of occurrence"?

"Known" sites of occurrences are known localities based on well documented recent direct observations (i.e. recent enough to give confidence that the biodiversity elements are still present, given the history of land-use change in an area, see IUCN, 2016, p 7), excluding vagrancies.

Note that the confirmed presence of the species is required for all sites identified as KBAs under species-based criteria.

What are "inferred sites of occurrence"?

"Inferred" refers to the use of information about habitat characteristics, dispersal capability, rates and effects of habitat destruction and other relevant factors (such as exploitation), based on known localities, to deduce a very high likelihood of presence (IUCN SPSC, 2017, Section 4.10.7).

Note that inferred occurrences may be used to estimate the proportion of the global population size found at a site, but a KBA must include at least one known locality (i.e. confirmed presence).

What are "projected sites of occurrence"?

"Projected" refers to spatially predicted occurrences based on habitat maps or models (IUCN SPSC, 2017, Section 4.10.7).

Any projected occurrences beyond the spatial extent of known localities (as defined by a minimum convex polygon based on known localities) should have very high likelihood of presence, based on known localities and the species' dispersal capability.

When used to estimate AOO, projected occurrences are subject to the three conditions outlined in Appendix III.4.

Note that projected occurrences may be used to estimate the proportion of the global population size found at a site, but a KBA must include at least one known locality (i.e. confirmed presence).

9.2.3 Confirmation of presence

What types of data can be used to confirm species presence?

Confirmation of species presence should, ideally, be based on direct observations of mature individuals. Animal tracking data collected using geolocators with high location accuracy (e.g., GPS) are considered equivalent to direct observations. For highly cryptic species, indirect evidence (e.g., scat, tracks, burrows, or environmental DNA that can be identified unambiguously to species) may be used to infer presence. Clear justification should be given in the documentation for using indirect evidence. With the exception of CR(PE) species, presence cannot be inferred from the presence of suitable habitat, or habitat maps or models.

In the case of CR(PE) species, the species must be very likely to occur at the proposed KBA if it still exists. KBA proposers should confirm that suitable habitat conditions persist at the site and explain why the species may have escaped detection if it still exists. For example, a reasonable case may be made for a species with cryptic morphology, ecology or behaviour making it difficult to detect (such as a plant for which viable seed may persist in the soil seed bank, or an elusive invertebrate that is adapted to a certain hostplant which is still present).

What types of data can be used to confirm presence of an ecosystem type?

See Section 4.3.7.

How recent do data need to be when used to confirm a species or ecosystem's presence at a site?

For all sites proposed as KBAs, the presence of the KBA trigger biodiversity elements at the site must be confirmed and documented (see the Documentation and Mapping Standards). This is especially important where KBA identification relies on area-based parameters (i.e. AOO, ESH, or range).

Ideally, the data used to confirm presence, including data on the number of reproductive units, where required, will have been collected within 8-12 years before KBA identification. Clear justification should be given in the documentation for using older data (up to a maximum of 50 years). This may include expert judgment that the species is still likely to be present.

Older data should not be used for species listed as globally threatened on the IUCN Red List under Criterion A2, A3 or A4, for other species known to have suffered recent population declines, or if the site has suffered significant habitat loss or other types of degradation in the intervening period.

It is recommended that presence of the KBA trigger biodiversity elements is reconfirmed during KBA reassessment (i.e. data used to confirm presence in KBA reassessments should not be older than 8-12 years, unless the justification for older data is strong and it is unlikely that the species has been extirpated).

9.3 Uncertainty

9.3.1 Types of uncertainty

There are two main types of uncertainty that may affect KBA identification:

- *Measurement uncertainty*, such as uncertainty about the true number of mature individuals at any point in time, can often be reduced by collecting more data (for example, by increasing the sample size or number of sampling occasions) using the appropriate sampling, measurement, and estimation methods.
- *Ecological variation* (often called "process variation"), such as variation in the true number of mature individuals at a site from one year to the next, can be a source

of uncertainty as to whether a site qualifies as a KBA, even if the number of mature individuals is counted precisely every year.

9.3.2 Dealing with uncertainty

In many cases, the population size at a site will be either well above or well below the threshold for qualification as a KBA. Uncertainty is only significant for KBA identification when the estimated site-level population size lies close to the relevant threshold, such that there is uncertainty about whether or not the site qualifies. For example, if the minimum site-level population size estimate exceeds the relevant threshold based on the maximum global-level population size estimate, then the site would qualify as a KBA regardless of uncertainty.

In the process of identifying sites that contribute significantly to the global persistence of biodiversity, it is important to balance the risks of omission and commission errors, i.e. the risks of failing to identify a site that actually qualifies (omission error) and the risks of identifying a site that does not actually qualify (commission error). High rates of omission error may lead to biodiversity loss, but high rates of commission error would deflate the value of identifying KBAs and may dilute conservation resources.

Note that the low thresholds for Criteria A1 and A2 relative to the other criteria provide a built-in precautionary approach to identifying sites of importance for globally threatened species and ecosystem types.

How to deal with measurement uncertainty?

The general principle for handling measurement uncertainty is to balance the risks of omission and commission error. In the context of measurement uncertainty, a site should be proposed if it is more likely than not that it meets the relevant threshold. For example, if the global population size is 10,000 mature individuals, and the site-level population size is most likely greater than 1,000 individuals, then the site population most likely exceeds a 10% threshold. In other words, the site would qualify if there was a greater than 50% chance that the site population exceeds 1,000 mature individuals. Consider the data summarised in Table 9.3.2.1 – in this case, the site would qualify because the median estimate exceeds the threshold. The determination of whether a site is more likely than not to meet the relevant threshold may be based on quantitative or qualitative analysis (e.g., a statistical analysis or an expert-based weighing of various types of evidence).

Table 9.3.2.1 Example of measurement uncertainty. The true number of individuals is not observed directly; rather, the estimated number is based on counts by three observers. The site population-size threshold in this example is 1,000 mature individuals.

	Unknown true number	True number ≥ threshold?	Observer 1	Observer 2	Observer 3	Median count	Median count ≥ threshold?
Year 1	1,100	✓	1,060	1,032	876	1,032	✓

Measurement uncertainty may occur at both global and site levels. If no global estimate of the chosen assessment parameter is provided in the WDKBA, KBA proposers will be asked to provide the best estimate of the assessment parameter at both global and site levels. The same type of estimate should be used at both levels for comparison. Where there is a choice, the order of preference is as follows: maximum likelihood estimate, median, mean, mid-point of the maximum and minimum.

If the only data available are presence/absence data, then KBA proposers will need to infer the proportion of the global population size at the site based on one of the area-based assessment parameters, which include number of localities.

How to deal with ecological variation?

Ecological variation likely occurs to some extent for all species at all sites, as well as for dynamic ecosystem types. Ecological variation is often substantial for sites important for biological processes, such as demographic aggregations (D1), ecological refugia (D2), and recruitment (D3).

The general principle for handling ecological variation is based on the application of Ramsar Criteria 5 and 6 (Ramsar, 2008). A site is considered to hold a species predictably if the species is known to have occurred at the site in at least two thirds of years for which adequate data are available for the relevant season (e.g., the breeding season in the case of a breeding aggregation). The total number of years with adequate data should not be fewer than three.

For example, adult female marine turtles return to specific nesting beaches to lay their eggs, but, in most cases, individual females do not return every year, so that the number of nesting females that use a site over a breeding season can vary substantially from one year to the next. A nesting beach that predictably holds ≥ 1% of the global population size of mature individuals of a species of marine turtle qualifies as a KBA under Criterion D1. Suppose the global population size is estimated at 100,000 mature females, the site threshold would be 1,000 mature females. In the context of ecological variation, the site would be considered to predictably hold 1,000 mature females during the nesting season if it holds 1,000 mature females in at least two thirds of nesting seasons. Consider the data set out in Table 9.3.2.2. The site would qualify under D1 because the site exceeds threshold numbers in two out of three years.

Table 9.3.2.2 Ecological variation. The site population-size threshold in this example is 1,000 mature individuals.

	True number	True number ≥ threshold?
Year 1	700	✗
Year 2	1,100	✓
Year 3	1,200	✓
Site qualifies?		✓

How to deal with ecological variation and measurement uncertainty combined?

In some cases, ecological variation is combined with measurement uncertainty. Returning to the marine turtle example, consider the data set out in Table 9.3.2.3. Based on the observer estimates, the site would be recognised as qualifying under D1, despite measurement uncertainty, because the median observer count exceeds threshold numbers in two out of three years (i.e. it is considered more likely than not the site exceeds threshold numbers in two out of three years).

Table 9.3.2.3 Ecological variation and measurement uncertainty combined. The true number of individuals is not observed directly; rather, the estimated number is based on counts by three observers. The site population-size threshold in this example is 1,000 mature individuals.

	Observer 1	Observer 2	Observer 3	Median count	Median count ≥ threshold?
Year 1	787	676	791	787	✗
Year 2	1,060	1,032	876	1,032	✓
Year 3	1,102	1,081	1,172	1,102	✓
Site qualifies?					✓

What happens if different assessment parameters point to different conclusions?

See Section 3.1.

10. Reassessment

The term "reassessment" is used synonymously with the term "re-evaluation" throughout the KBA Guidelines.

Confirmed KBAs should be reassessed against the KBA criteria and thresholds at least once every 8-12 years, although more frequent monitoring of KBAs is recommended wherever possible. If the original KBA proposer is no longer available, the NCG or RFP (in that order) may identify a group to work on reassessment.

Reassessment of sites identified as KBAs is especially important in the context of climate change, as climate change may affect biodiversity to such an extent that a site increases in importance and qualifies under additional criteria or loses importance and ceases to qualify.

10.1 Reasons for a change in KBA status

Why might the status of a confirmed KBA change?

The focus here is on changes in the status of confirmed KBAs and delisting of KBAs. KBA proposers or NCGs may also decide to reassess sites that almost qualified in previous KBA identification processes, but information on sites that do not qualify is not stored in the WDKBA, so that process is not covered here.

A site that has been confirmed as a KBA may change status for one or more of the following reasons:

A. *KBA criteria revision* (for example, a site that qualified under previous KBA criteria does not qualify under the current KBA Standard (e.g. Version 1.0);
B. *taxonomic change* (for example, a species is reclassified as a subspecies);
C. *change in threat category* (for example, a species or ecosystem type was reassessed for the IUCN Red List or IUCN RLE and is now listed under a different category or set of criteria);
D. *new or more reliable information* (for example, better estimates of a species' global population or the extent of an ecosystem type that regularly occurs at the site, including corrections to erroneous data or analysis; reclassification of a species as not restricted-range, or not ecoregion- or bioregion-restricted);
E. *genuine status change* (for example, a reduction in the proportion of a species' global population size or number of reproductive units, or the extent of an ecosystem type that regularly occurs at the site; a reduction in ecological integrity; a change in delineation or manageability).

The reasons for any change in status should be documented (see the Documentation and Mapping Standards).

10.2 Frequency of reassessment

How often should confirmed KBAs be reassessed?

The KBA Standard (IUCN, 2016, p. 7) states that sites should be reassessed against the criteria and thresholds at least once every 8-12 years. Eight years is ideal and 12 years is the maximum – a site will be retained in the WDKBA but flagged as "needs updating" after 12 years. A confirmed KBA will not lose its KBA status solely on the basis of old data or the need for reassessment. New data showing that the site does not qualify would be required in any KBA Appeals process.

Earlier reassessment is encouraged, especially in the following circumstances:

- Earlier updates to documentation, and reassessment if appropriate, is encouraged in the case of a *taxonomic change* to a trigger species; or a *change in threat category* of a trigger species or ecosystem type for a site confirmed as a KBA under Criterion A1 or A2.
- Earlier reassessment is also encouraged if *new information* becomes available, or a site suffers a catastrophic event (i.e. a *genuine change*) leading to the irreversible loss of trigger species or ecosystem type, or to loss of a site's ecological integrity).

10.3 Reassessment process

What does KBA reassessment involve?

During the reassessment process, NCGs or KBA proposers should address the following questions:

- For sites that were confirmed as a KBA under any of the species-based criteria (i.e. A1, B1-3, D1-3), check whether there have been any taxonomic changes to trigger species (see Section 2.2.1).
- For sites that were confirmed as a KBA under Criteria A1 or A2, check whether there has been any change in the threat category of the trigger species or ecosystem type, such that the site no longer qualifies as a KBA under Criteria A1 or A2.
- For each KBA trigger biodiversity element for each confirmed KBA, check whether there has been a change in the global or site-level values of assessment parameters (e.g., based on new or more reliable information), such that the biodiversity element no longer meets relevant thresholds.
- For each KBA trigger biodiversity element for each confirmed KBA, reconfirm the KBA trigger biodiversity element's presence at the site, in numbers that meet or

exceed the reproductive-unit threshold, where applicable. It is recommended that data used to confirm presence in KBA reassessments under any of the criteria should not be older than 8-12 years.

- For each confirmed KBA, check whether there have been any changes (including changes in manageability) indicating that KBA delineation should be re-visited. This is especially important for sites considered potentially rather than actually manageable as a unit during the original KBA delineation. Any outstanding overlaps with other KBAs should also be addressed during reassessment.

What happens if a KBA no longer qualifies because of a genuine increase in the global population size?

If the reassessment process indicates that a site no longer qualifies as a global KBA because of a *genuine increase* in the global population size, the site should be reassessed against all the KBA criteria to clarify its status. Any change in status will be indicated in the WDKBA after it has been reviewed and confirmed.

Effective conservation of a trigger species at a KBA may contribute to an increase in the global population size. In that case, the proportion of the global population size held at the site would be expected to increase. The KBA would only lose its status if successful conservation of a globally threatened trigger species led to its downlisting on the IUCN Red List and a change in the relevant KBA criteria or thresholds (e.g., KBA Criterion A1 no longer applies). If the site did not qualify under any KBA criteria, it would no longer be a KBA, but may be highlighted as a conservation success on the IUCN Green List (subject to meeting the IUCN Green List criteria).

What happens if a KBA no longer qualifies because of a genuine reduction in site-level population size?

If the reassessment process indicates that a site no longer qualifies as a global KBA, the site should be reassessed against all the KBA criteria to clarify its status.

In the case of a *genuine reduction* in the site-level population size that could be reversed through proposed restoration activities, the site will be flagged as "restoration dependent" in the WDKBA to allow for such restoration activities. The NCG or KBA proposer should review the site's status in 2 years; if restoration activities are not underway by that time, the site's change in status will be reviewed and confirmed. If restoration activities do not enable the site to recover its KBA status by the next reassessment (i.e. after 8-12 years), then the change in status will be reviewed and confirmed at that time.

If, however, the site no longer qualifies as a KBA and the status change is unlikely to be reversed in the next 8-12 years (i.e. before the next reassessment), the change in status will be indicated in the WDKBA immediately after it has been reviewed and confirmed.

A site that no longer qualifies as a global KBA may still qualify as a regional KBA following guidelines for regional application of the KBA criteria and thresholds (to be developed).

How should changes in the status of KBA be documented?

See the Documentation and Mapping Standards.

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Index

For each term below, the index identifies the main section(s) where the term is explained or discussed: "S" indicates Section; "A" indicates Appendix.

Appendix I: Definitions of terms used in the KBA criteria

The terms used in the KBA Standard (IUCN, 2016) must be clearly understood to ensure that the KBA criteria are applied correctly. The following terms are defined in the KBA Standard (IUCN, 2016, pp. 9-15). In the text below, definitions taken verbatim from the KBA Standard are shown in black; additional clarifications are shown in grey.

Terms used in defining KBAs

KBAs are sites contributing significantly to the global persistence of biodiversity.

Biodiversity

Biodiversity is "the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems", according to the Convention on Biological Diversity (CBD) (UN 1992).

Contributing/Contribution

The contribution of a site to the global persistence of biodiversity depends on the global distribution and the abundance of the biodiversity elements for which the site is important. Sites holding biodiversity elements that are globally restricted, or at risk of disappearing, make high contributions to the persistence of those elements. The global persistence of a biodiversity element occurring at any given KBA, unless it is entirely confined to the site, depends not only on the fate of the site itself but also on that of other sites and of the land-/seascapes where it occurs.

Global

Global implies that the contributions of a site to the persistence of a given biodiversity element are measured in relation to its worldwide population size or extent.

Persistence

Persistence of a biodiversity element means that its loss (e.g., species extinction, ecosystem collapse) or decline (e.g., of numbers of mature individuals of a species, ecosystem extent and condition) is avoided, both now and into the foreseeable future.

Significantly/Significant

Significant means that an outstanding proportion of a biodiversity element (e.g., species population size or ecosystem extent) occurs at the site, as defined by a quantitative threshold.

Site

A geographical area on land and/or in water with defined ecological, physical, administrative or management boundaries that is actually or potentially manageable as a single unit (e.g., a protected area or other managed conservation unit). For this reason, large-scale biogeographic regions such as ecoregions, Endemic Bird Areas and Biodiversity Hotspots, and land-/seascapes containing multiple management units, are not considered to be sites. In the context of KBAs, "site" and "area" are used interchangeably.

Terms used in the KBA criteria and delineation procedures

Aggregation (Criterion D)

A geographically restricted clustering of individuals that typically occurs during a specific life history stage or process such as breeding, feeding or migration. This clustering is indicated by highly localised relative abundance, two or more orders of magnitude larger than the species' average recorded numbers or densities at other stages during its life-cycle.

A difference in relative abundance of two orders of magnitude is advisory rather than required.

Most aggregative species, such as many shorebird species (family Scolopacidae), aggregate for specific life-history functions (e.g., during migration or on wintering grounds) and are more widely dispersed at lower densities during other seasons. A few species, such as the Lesser Flamingo (*Phoeniconaias minor*), are aggregated through most or all of their life-cycles. Criterion D1 may be applied to species that aggregate for some or all of their life-cycle (IUCN, 2016, p. 22).

Area of occupancy (Criteria A, B, E)

The area within the range of a species that is actually occupied (IUCN, 2012a).

Assemblage (Criterion B)

A set of species within a taxonomic group having: a) their ranges ≥95% predictably confined to a single ecoregion for at least one life-history stage; b) their ranges ≥95% predictably confined to a single biome for at least one life-history stage (for taxonomic groups with a global median range size >25,000 km²); or c) their most important habitats in common with multiple other species.

In the definition of "assemblage", the term "biome" should be replaced by the term "bioregion". This will be corrected in the next version of the KBA Standard.

This term "assemblage" is also used in the definition of "ecological integrity", but in a more generic sense.

Biodiversity element

Genes, species or ecosystems, as used by the Convention on Biological Diversity (CBD) definition of biodiversity (Jenkins 1988).

Biological process (Criterion D)

The demographic and life-cycle processes that maintain species such as reproduction and migration.

Bioregion (Criterion B)

Major regional terrestrial and aquatic habitat types distinguished by their climate, flora and fauna, such as the combination of terrestrial biomes and biogeographic realms (Olson et al., 2001) or marine provinces (Spalding et al., 2007, Spalding et al., 2012). These biogeographic units are typically about an order of magnitude larger in area than the ecoregions nested within them.

Complementarity (Criterion E)

A measure of the extent to which an area contains elements of biodiversity not represented, or that are underrepresented, in an existing set of areas; alternatively, the number of unrepresented or underrepresented biodiversity elements that a new area adds to a network (Margules & Pressey 2000).

Distinct genetic diversity (Criteria A, B)

The proportion of a species' genetic diversity that is encompassed by a particular site. It can be measured using Analysis of Molecular Variance or similar technique that simultaneously captures diversity and distinctiveness (frequency of alleles and the genetic distinctiveness of those alleles).

Ecological integrity (Criterion C)

A condition that supports intact species assemblages and ecological processes in their natural state, relative to an appropriate historical benchmark, and characterised by contiguous natural habitat with minimal direct industrial anthropogenic disturbance.

Ecoregion (Criteria B, C)

A "relatively large unit of land (or water) containing a distinct assemblage of natural communities and species with boundaries that approximate the original extent of natural communities prior to major land-use change" (Olson et al., 2001). Ecoregions have been mapped for terrestrial (Olson et al., 2001), freshwater (Abell et al., 2008) and near-shore marine (Spalding et al., 2007) environments and are nested within bioregions or provinces.

Ecosystem type (Criteria A, B)

A defined ecosystem unit for standard and repeatable assessment, at an intermediate level in a globally consistent ecosystem classification hierarchy such as macrogroup or equivalent (Faber-Langendoen et al., 2014). It is defined by a particular set of variables related to its characteristic native biota, an abiotic environment or complex, the interactions within and between them, and a physical space in which these operate (Keith et al., 2013, Rodríguez et al., 2015). Other terms such as "ecological communities" and "biotopes" are often considered operational synonyms of ecosystem type.

Endemic (Criteria A, E)

A species having a global range wholly restricted to a defined geographic area such as a region, country or site.

Environmental stress (Criterion D)

Natural events like floods, droughts, storms, wildfires, earthquakes as well as high or low temperature caused by global change; it can also describe the lack of food due to the bottom-up effect of environmental stress or massive die off of prey in ecosystem due to infectious disease.

Environmental stress refers to extreme environmental conditions, whether natural or anthropogenic.

Extent of suitable habitat (Criteria A, B)

The area of potentially suitable ecological conditions, such as vegetation or substrate types within the altitudinal or depth, and temperature and moisture preferences, for a given species (Beresford et al., 2011).

ESH refers to the extent of habitat available to a species within its range. ESH cannot extend beyond the range, but may include unoccupied suitable habitat within the species' range, unlike AOO. ESH is directly equivalent to Area of Habitat.

Geographically restricted (Criterion B)

A biodiversity element having a restricted global distribution, as measured by range, extent of suitable habitat or area of occupancy, and hence largely confined or endemic to a relatively small portion of the globe such as a bioregion, ecoregion or site.

Intact ecological community (Criterion C)

An ecological community having the complete complement of species known or expected to occur in a particular site or ecosystem, relative to a regionally appropriate historical benchmark, which will often correspond to pre-industrial times.

Irreplaceability (Criterion E)

Either (a) the likelihood that an area will be required as part of a system that achieves a set of targets (Ferrier et al., 2000) or (b) the extent to which the options for achieving a set of targets are reduced if the area is unavailable for conservation (Pressey et al., 1994). Irreplaceability is heavily influenced by geographically restricted biodiversity, but it is a property of an area within a network rather than of an element of biodiversity and is related to the concept of complementarity.

Locality (Criteria A, B)

A sampling locality is a point indicated by specific coordinates of latitude and longitude. Note that the term "locality", as defined here, is fundamentally and conceptually different from the term "location" used in the IUCN Red List (IUCN, 2012a).

Localities refer to known points of occurrence, and do not include inferred or projected occurrences or sampling points where the species was not found to occur. For the purposes of KBA identification, old records from areas where the species no longer occurs and vagrancies (i.e. records from areas where the species has only been recorded sporadically and is not known to be native) are excluded from known localities.

Each locality should represent a discrete population, to the extent this can be inferred, given the degree of habitat fragmentation and what is known about the dispersal capabilities of the species.

Manageability (Delineation)

The possibility of some type of effective management across the site. Being a manageable site implies that it is possible to implement actions locally to ensure the persistence of the biodiversity elements for which a KBA has been identified. This requires that KBA delineation consider relevant aspects of the socio-economic context of the site (e.g., land tenure, political boundaries) in addition to the ecological and physical aspects of the site (e.g., habitat, size, connectivity).

Mature individuals (Criteria A, B, E)

The number of individuals known, estimated or inferred to be capable of reproduction as defined in IUCN (2012a).

Population size (Criteria A, B, D)

The total, global, number of mature individuals of the species (IUCN, 2012a). Population size is used throughout the KBA Standard rather than simply "population", which IUCN (2012a) use to mean the total number of individuals of a species.

In the KBA Guidelines, the term "population size" is used to refer to the total number of individuals in a species, as in "global population size"; and for the number of individuals in a geographically or otherwise distinct group, as in the "site population size". This differs from the IUCN Red List, in which the term "subpopulation" is used to refer to a geographically or otherwise distinct group in the population (IUCN, 2012a).

Predictably (Criterion D)

An expectation of species occurrence at a site during particular seasons or at one or more stages of its life cycle, based on previous or known occurrence, such as in response to specific climate conditions.

Predictable occurrence includes both regular (seasonal) occurrence and irregular (episodic) occurrence, as long as the occurrence is a predictable response to environmental conditions.

For Criterion D1, which is based on regular (seasonal) occurrence, a site "predictably" holds a species if the species is known to have occurred at the site in at least two thirds of the relevant seasons for which adequate data are available; the total number of seasons being not less than three. This is consistent with the definition of "regularly" in the application of Ramsar Criteria 5 and 6 (Ramsar, 2008).

For Criterion D3, which is based on the production of propagules, larvae, or juveniles, a site "predictably" produces propagules, larvae or juveniles if it produces them in at least two thirds of the recruitment cycles for which adequate data are available; the total number of recruitment cycles being not less than three.

Criterion D2 is based on irregular (episodic) occurrence. The term "predictably" is not used in Criterion D2, but consistent with D1 and D3, a site may be considered to hold a species during periods of environmental stress if the species is known to have occurred at the site in at least two thirds of the periods of environmental stress for which adequate data are available. (There is no minimum number of periods of environmental stress given here, as periods of environmental stress are assumed to be rare events.)

Range (Criterion A, B, E)

The current known limits of distribution of a species, accounting for all known, inferred or projected sites of occurrence (IUCN, 2012a), including conservation translocations outside native habitat (IUCN SPSC, 2014) but not including vagrancies (species recorded once or sporadically but known not to be native to the area).

Range thus defines the geographic space in the major systems (e.g., terrestrial, freshwater, marine or subterranean) in which a species occurs.

The term "range" is not defined in the IUCN Red List Categories and Criteria (IUCN, 2012a), but the definition of "range" in the KBA Standard is consistent with the term's use in IUCN Red List assessments.

For the purposes of KBA identification, range also explicitly includes areas where species were introduced for conservation purposes outside their native habitat, as these are included in IUCN Red List assessments.

Note that IUCN SPSC (2014) has been updated to IUCN SPSC (2017).

Regularly (Criteria A, B)

The occurrence of a species is normally or typically found at the site during one or more stages of its life cycle.

A site "regularly" holds a species if the species is either continually present or occurs there on a predictable cyclical basis, typically (but not necessarily) following a seasonal pattern. In the case of seasonal occurrence, a site "regularly" holds a species if is known to have occurred there in two thirds of the relevant seasons for which adequate data are available; the total number of seasons being not less than three. This is consistent with the definition of "regularly" in the application of Ramsar Criteria 5 and 6 (Ramsar, 2008).

Reproductive unit (Criteria A, B, E)

The minimum number and combination of mature individuals necessary to trigger a successful reproductive event at a site (Eisenberg 1977). Examples of five reproductive units include five pairs, five reproducing females in one harem, and five reproductive individuals of a plant species.

Restricted range (Criterion B)

Species having a global range size less than or equal to the 25th percentile of range-size distribution in a taxonomic group within which all species have been mapped globally, up to a maximum of 50,000 km^2. If all species in a taxonomic group have not been mapped globally, or if the 25th percentile of range-size distribution for a taxonomic group falls below 10,000 km^2, restricted range should be defined as having a global range size less than or equal to 10,000 km^2. For coastal, riverine and other species with linear distributions that do not exceed 200 km width at any point, restricted range is defined as having a global range less than or equal to 500 km linear geographic span (i.e. the distance between occupied locations furthest apart). Species known only from their type locality should not automatically be assumed to have a restricted range, since this may be indicative of under-sampling.

Target (Criterion E)

A conservation target is the minimum amount of a particular biodiversity feature for which conservation is desirable through one or multiple conservation actions (Possingham et al., 2006).

Taxonomic group (Criterion B)

Taxonomic ranks above the species level.

Threatened (Criterion A)

Assessed through globally standardised methodologies as having a high probability of extinction (species) or collapse (ecosystems) in the medium-term future. Threatened species are those assessed as Critically Endangered (CR), Endangered (EN), or Vulnerable (VU) according to The IUCN Red List of Threatened Species (IUCN, 2012a). For the purposes of KBA criterion A1, Threatened also includes species assessed as regionally/nationally CR, EN or VU using the IUCN Red List Categories and Criteria (IUCN, 2012b) that (a) have not been assessed globally and (b) are endemic to the region/country in question. Threatened ecosystems are those assessed as CR, EN or VU according to the IUCN Red List of Ecosystems (IUCN, 2015).

Threshold (Criteria A-E)

Numeric or percentage minima which determine whether the presence of a biodiversity element at a site is significant enough for the site to be considered a KBA under a given criterion or subcriterion.

Trigger (Criteria A-E)

A biodiversity element (e.g., species or ecosystem) by which at least one KBA criterion and associated threshold is met.

Additional terms

The following terms defined here were not defined in the KBA Standard.

Life-history function (Criterion D)

See life-cycle process.

Life-history stage (Criterion D)

In the KBA Standard, including the definition of "aggregation", the term "life-history stage" is intended to be synonymous with "life-cycle process" and does not refer to developmental stage (e.g., egg, chick, juvenile, adult).

Life-cycle process (Criterion D)

Life-cycle process refers to a period in a species' life-cycle when some or all members of a population perform essential activities such as spawning/mating, feeding, moulting, migration, over-wintering (see also biological processes). For many species, these life-cycle processes occur at predictable sites in predictable seasons. Criterion D1 applies to species that aggregate in particular sites, generally for specific life-cycle processes during a specific season.

To reduce ambiguity, the KBA Guidelines refer to "life-cycle processes" throughout and avoid the terms "life-history function" or "life-history stage", except when quoting directly from the KBA Standard.

Micro-organisms

The KBA criteria were not designed for application to micro-organisms (IUCN, 2016, p. 4). For the purposes of KBA identification, micro-organisms are defined as unicellular organisms or organisms that form colonies of cells without specialised tissues, including archaea, bacteria, and unicellular eukaryotes.

Appendix II: Summary of the KBA criteria and thresholds

A. Threatened biodiversity		
A1 Threatened species		Assessment parameters
A1a	≥0.5% of global population size and ≥5 reproductive units (RU) of a CR/EN species	(i) no. of mature individuals (ii) area of occupancy (iii) extent of suitable habitat (iv) range (v) no. of localities (vi) distinct genetic diversity
A1b	≥1.0% of global population size and ≥10 RU of a VU species	
A1c	≥0.1% of global population size and ≥5 RU of a species listed as CR/EN due only to past/current decline [= Red List A1, A2, A4 only]	
A1d	≥0.2% of global population size and ≥10 RU of a species listed as VU due only to past/current decline [= Red List A1, A2, A4 only]	
A1e	Effectively the entire population size of a CR/EN species	
A2 Threatened ecosystem types		
A2a	≥5% of global extent of a CR or EN ecosystem type	
A2b	≥10% of global extent of a VU ecosystem type	
B. Geographically restricted biodiversity		
B1. Individual geographically restricted species	≥10% of global population size and ≥10 RU of any species	(i) no. of mature individuals (ii) area of occupancy (iii) extent of suitable habitat (iv) range (v) no. of localities (vi) distinct genetic diversity
B2. Co-occurring geographically restricted species	≥1% of global population size of each of a number of restricted range species in a taxonomic group: ≥2 species or 0.02% of the total number of species in the taxonomic group, whichever is larger	
B3. Geographically restricted assemblages		
B3a	≥0.5% of global population size of each of a number of ecoregion-restricted species in a taxonomic group: ≥5 species or 10% of the species restricted to ecoregion, whichever is larger	(i) no. of mature individuals (ii) area of occupancy (iii) extent of suitable habitat (iv) range (v) no. of localities
B3b	≥5 RU of ≥5 bioregion-restricted species or ≥5 RU of 30% of the bioregion-restricted species known from the country, whichever is larger	
B3c	Site is part of the globally most important 5% of occupied habitat for ≥5 species in the taxonomic group	(i) relative density of mature individuals (ii) relative abundance of mature individuals
B4. Geographically restricted ecosystem types		
	≥20% of the global extent of an ecosystem type	
C. Ecological integrity		
	Site is one of ≤2 per ecoregion with wholly intact ecological communities	composition and abundance of species and interactions
D. Biological processes		
D1. Demographic aggregations		
D1a	≥1% of global population size of a species, over a season, and during ≥1 key stage in life cycle	no. of mature individuals
D1b	Site is among largest 10 aggregations of the species	no. of mature individuals
D2. Ecological refugia	≥10% of global population during periods of environmental stress	no. of mature individuals
D3. Recruitment sources	Produces propagules, larvae or juveniles maintaining ≥10% of global population size	no. of mature individuals
E. Irreplaceability through quantitative analysis		

Appendix III: Estimating range, extent of suitable habitat (ESH) and area of occupancy (AOO)

Appendix III.1 provides guidelines on estimating range, Appendix III.2 on estimating extent of suitable habitat (ESH), Appendix III.3 on estimating area of occupancy (AOO), and Appendix III.4 on inference and projection using habitat maps or models.

III.1 Estimating range

Please see the IUCN Red List Mapping Standards for detailed guidelines on developing distribution maps for estimating range.

Any KBA proposals based on new range maps, not derived from the IUCN Red List account or provided through the WDKBA, must be flagged for expert review when the KBA proposal is submitted to the WDKBA. Proposers are requested to include information on datasets and mapping procedures in sufficient detail to reproduce the range map in the documentation.

III.2 Estimating extent of suitable habitat (ESH)

ESH is the area of potentially suitable ecological conditions for a species within the species' current range (see Fig. 3.4). Note that ESH is directly equivalent to "area of habitat". For species that do not yet have an ESH map, but for which proposers seek to use ESH as an assessment parameter, the first step is to map the range (see Appendix III.1).

Any KBA proposals based on new ESH maps, not provided through the WDKBA, must be flagged for expert review when the KBA proposal is submitted to the WDKBA. Proposers are requested to include information on datasets and mapping procedures in sufficient detail to reproduce the final ESH layer in the documentation.

Typically, ESH takes into account a species altitudinal/bathymetric limits, other physiological limits (e.g., temperature, salinity), and major habitat types (e.g., land cover, or benthic habitat), as appropriate. (See Appendix III.4 for a more in-depth review of methods.)

An ESH map is typically a raster (i.e. set of grid cells), but may be a polygon. Once a range map is available, ESH can be delimited as follows:

i. in a GIS, rasterise the range map into grid cells (optional);

ii. remove cells or areas that fall outside the altitudinal/bathymetric or climate/temperature/salinity/soil type limits of the species distribution;
iii. remove cells or areas that are otherwise unlikely to be suitable for the species, based on land cover or benthic habitat.

The final ESH raster or polygon(s) should, ideally, include all known, inferred or projected occurrences (see Section 9.1), including conservation translocations but excluding vagrancies, and all suitable habitat, with unsuitable areas removed. Wherever possible, ESH maps should be validated with independent occurrence data.

If ESH is based on grid cells, the proportion of a species' ESH that is found within a site will depend in part on the spatial resolution of analysis. Analysis at a finer spatial resolution (for example, using 1-km^2 or 4-km^2 grid cells rather than 100-km^2 grid cells) will generally lead to a lower global ESH and make it more likely that a site that consists solely of suitable habitat exceeds the thresholds specified in the criteria. The standard resolution for AOO is 2 x 2 km grid cells; a link to a standardised 2 x 2 km grid is provided in Appendix V. KBA proposers are encouraged to use this grid where appropriate, but may use other resolutions if the 2 x 2 km grid is not suitable given the species' distribution patterns or the resolution of available data.

III.3 Estimating area of occupancy (AOO)

Please see the IUCN Red List Mapping Standards for detailed guidelines on mapping AOO. The standard resolution for AOO is 2 x 2 km grid cells; a link to a standardised 2 x 2 km grid is provided in Appendix V.

Any KBA proposals based on new AOO maps, not derived from the IUCN Red List account or provided through the WDKBA, must be flagged for expert review when the KBA proposal is submitted to the WDKBA. Proposers are requested to include information on datasets and mapping procedures in sufficient detail to reproduce the final AOO raster in the documentation.

III.4 Using habitat maps and models to infer or project occurrences

Habitat maps show the distribution of suitable habitat for a species (e.g., ESH) and are used as the basis for estimating ESH. Habitat maps may be based primarily on expert knowledge (deductive models) or statistical analysis (inductive models). Habitat models may also be referred to as species distribution models, ecological niche models, bioclimatic models, spatial density models, etc.

Mapping suitable habitat based on published data and expert knowledge (deductive models)

ESH maps have been developed for birds (Beresford et al., 2011), mammals (Rondinini et al., 2011), and amphibians (Ficetola et al., 2015). Specifically, ESH maps have been developed by classifying topographical and environmental data layers (e.g., altitude, bathymetry, land cover and benthic habitats, distance to water bodies), using information on altitudinal limits and major or suitable habitats in IUCN Red List accounts (see IUCN Red List Habitat Classification Scheme) derived from published and unpublished literature and expert knowledge. A similar approach may be applied in marine systems, using bathymetry and other physiological limits (e.g., sea-surface temperature and salinity) together with benthic habitat classes.

This type of approach is well suited to developing consistent binary habitat maps (e.g. ESH maps) for entire taxonomic groups, including data-limited species. It is well suited to sedentary species and species with fixed breeding and/or non-breeding habitats. It is less well suited to species with spatially dynamic habitats, including many pelagic marine species.

Mapping suitable habitat based on statistical analysis (inductive models)

Habitat models may also be developed by applying statistical methods (e.g., generalized linear or additive models, classification or regression trees) to known localities and topographical and environmental covariates (Elith and Leathwick 2009; Franklin 2010).

Statistical habitat models are generally used to estimate (a) the probability of occurrence of the species, and/or (b) the expected relative densities (in terms of numbers of individuals or biomass) based on correlation between known localities and topographical/environmental covariates. A threshold may then be used to generate a binary map of suitable habitat (e.g. an ESH map) by selecting areas with high versus low probability of occurrence or high versus low expected densities.

This type of approach requires a large number of sampling localities (presence only, presence/absence, or abundance) and is usually applied to a single species or small group of species because of the data, technical, and computational demands. Statistical analysis can account for variation in detectability and spatially dynamic habitats, although the latter remains a challenge for KBA identification.

Using habitat maps and models to estimate AOO

Habitat maps and models cannot be used to estimate a species' AOO directly because they map areas of potential habitat that may presently be unoccupied (i.e. closer to

ESH than AOO). Low habitat-occupancy may result because factors other than habitat are limiting, such as exploitation, availability of prey, impacts of predators, competitors or disturbance, dispersal limitations. Habitat maps and models may need to be filtered to produce a valid depiction of AOO for use in KBA identification. In some cases, filtering out areas that are unlikely to be occupied may be fairly straight-forward. For example, projected occurrences in habitat patches that are small and distant from habitat patches with known localities may be filtered out using knowledge of the species' dispersal limitations; projected occurrences in areas close to roads or human population centres may be filtered out if hunting is a threat; areas that lack recent known occurrences and are known to have been affected by pathogens may be filtered out.

The IUCN Red List Guidelines (IUCN SPSC, 2017, Section 4.10.7) provide the following three conditions for using habitat maps or models to estimate AOO:

i) Habitat maps and models must be justified in the documentation as accurate representations of the habitat requirements of the species and validated by a means that is independent of the data used to construct them.

ii) The area of *potential* habitat must be interpreted to produce an estimate of the area of *occupied* habitat.

iii) The estimated area of occupied habitat derived from the map must be scaled to the reference scale of 2 x 2 km.

These conditions generally require observed presence/absence data in 2 x 2 km grid cells and adequate sampling intensity to be confident that the absence of records in cells represents a genuine absence of the species. Unfortunately, this information is lacking for many species.

Justification and validation of habitat maps and models used to estimate ESH and AOO

Habitat maps and models can vary widely in quality and accuracy. A map or model may not provide an accurate representation of habitat if key variables are omitted. For example, a map would overestimate the habitat of a forest-dependent montane species if it identified all forest areas as potential habitat, irrespective of altitude. Any habitat maps or models used in KBA assessments should therefore be subject to a critical evaluation based on biological and statistical considerations, where applicable. The selection of environmental covariates should be based on knowledge of the biology of the species and not simply fitted statistically from a pool of candidate variables that are conveniently available. Appropriate methods for statistical model evaluation should be employed (e.g., cross-validation using independent datasets). Habitat maps and models should be sufficiently rigorous to pass peer review.

Appendix IV: Mapping ecosystem extent

The following guidelines on estimating ecosystem extent (i.e. geographic distribution) are extracted from the IUCN Red List of Ecosystem (RLE) Guidelines (IUCN, 2017, p. 46 ff).

Remote sensing is a common approach for mapping the geographic distributions of many terrestrial and marine ecosystems. Global data sets, such as those available for forests (Hansen et al., 2013), mangroves (Giri et al., 2011), water cover (Pekel et al., 2016), and coral reefs (Andréfouët et al., 2006), may provide a useful basis for superimposing appropriate classifications of ecosystem types. Spatial proxies for ecosystem distributions, such as climate, substrate, topography, bathymetry, ocean currents, flood regimes, water cover, aquifers or some synthesis of these that can be justified in the documentation as valid representations of the distribution of ecosystem biota or its niche space may be used in some cases. Physical factors such as sea floor characteristics, ocean currents, water temperatures and water chemistry may be appropriate predictors of ecosystem distribution for marine ecosystems.

Spatial distribution models offer an additional opportunity to formally select and combine the most suitable set of spatial proxies to predict ecosystem distributions. Clark et al. (2015), for example, used bathymetric spatial data and remote sensing data on sea ice concentration to model the distribution of suitable light conditions for under-ice marine benthic invertebrate communities in Antarctic waters. When using spatial proxies or developing spatial distribution models, a mechanistic understanding of the relationship between occurrence of the ecosystem and limiting environmental factors is essential for developing a valid representation of the geographic distribution of an ecosystem type. Spatial distribution models should follow best practice recommendations for each model type and should be validated (see IUCN SPSC, 2017, p. 76).

Once the geographic distribution of an ecosystem has been assessed using the methods described above, areas that have been lost to settlement, agriculture or other forms of habitat conversion should be removed before calculating the global and site-level ecosystem extent.

The spatial resolution (e.g., pixel size) of an ecosystem map should be as fine as practical, consistent with the input data and the scale of the ecosystem (e.g., Fig. A5). Ecosystem maps will typically be at a much finer resolution than the standard 10 x 10 km grid used for estimating the area occupied by an ecosystem (see IUCN, 2017, p. 57.)

Figure A5. The geographic distribution of the Great Fish Thicket, South Africa (Mucina & Rutherford, 2006) is depicted by a raster dataset with a spatial resolution of 30 x 30 m (shown in black). As mapped, the extent of the Great Fish Thicket ecosystem type is 6,763.4 km^2. (Source: IUCN, 2017, Box 10.)

Appendix V: Links to related documents and web resources

A Global Standard for the Identification of Key Biodiversity Areas, Version 1.0
https://portals.iucn.org/library/node/46259

Bioregion shapefiles [in preparation; see www.keybiodiversityareas.org]

Catalogue of Life http://www.catalogueoflife.org/

Convention on Biological Diversity https://www.cbd.int/

Dryad Digital Repository https://datadryad.org/

Free, Prior and Informed Consent
http://www.forestpeoples.org/sites/fpp/files/publication/2010/08/fpicsynthesisjun07eng.pdf

Freshwater ecoregion shapefiles http://www.feow.org/downloadlist

Global Biodiversity Information Facility https://www.gbif.org/

Global consultation process to develop the KBA Standard
https://www.iucn.org/commissions/world-commission-protected-areas/our-work/biodiversity-and-protected-areas/key-biodiversity-areas

Global Seabird Tracking Database http://www.seabirdtracking.org/

Guidelines for the application of IUCN RLE Categories and Criteria
https://www.iucn.org/sites/dev/files/content/documents/rle_guidelines_draft_dec_2015.pdf

Guidelines for using the IUCN Red List Categories and Criteria
http://cmsdocs.s3.amazonaws.com/RedListGuidelines.pdf

Guidelines on Business and KBAs
https://portals.iucn.org/library/sites/library/files/documents/2018-005-En.pdf

HydroBASINS http://hydrosheds.org/page/hydrobasins

Indigenous and Community Conserved Areas (ICCAs)
https://www.iccaconsortium.org/

Intact Forest Landscapes http://www.intactforests.org/

Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services Proposed approach to working with Indigenous and local knowledge http://www.ipbes.net/sites/default/files/downloads/pdf/ipbes-5-4-en.pdf

IUCN Green List https://www.iucn.org/theme/protected-areas/our-work/iucn-green-list

IUCN Policy On Conservation and Human Rights for Sustainable Development https://www.ohchr.org/Documents/Issues/Environment/ImplementationReport/IUCN2.pdf

IUCN Red List Authorities https://www.iucnredlist.org/assessment/authorities

IUCN Red List of Ecosystems https://iucnrle.org/

IUCN Red List of Ecosystems team https://iucnrle.org/about-rle/how-we-work/rle-team/

IUCN Red List Habitat Classification Scheme https://www.iucnredlist.org/resources/habitat-classification-scheme

IUCN Red List of Threatened Species www.iucnredlist.org

IUCN Red List Mapping Standards http://spatial-data.s3.amazonaws.com/standards/Mapping_Standards_Version_1.16_2018.pdf

IUCN Standard on Indigenous Peoples https://cmsdata.iucn.org/downloads/iucn_standard_on_indigenous_peoples__14_november_2013_.pdf

KBA Appeals procedures http://www.keybiodiversityareas.org/kba-partnership/kba-standards-and-appeals-committee

KBA identification and delineation case studies [in preparation; see http://keybiodiversityareas.org]

KBA Documentation and Mapping Standards [in preparation; see http://keybiodiversityareas.org]

KBA Guidance on the process of Proposing, Reviewing, Nominating and Confirming Key Biodiversity Areas [in preparation; see http://keybiodiversityareas.org]

KBA proposers [in preparation; see http://keybiodiversityareas.org]

KBA Regional Focal Points http://www.keybiodiversityareas.org/kba-partners

KBA National Coordination Groups http://www.keybiodiversityareas.org/kba-partners

KBAs and protected areas [in preparation; see http://keybiodiversityareas.org]

KBA Secretariat http://www.keybiodiversityareas.org/kba-partners

KBA Standard https://portals.iucn.org/library/node/46259

KBA Standards and Appeals Committee http://www.keybiodiversityareas.org/kba-partners

KBA Technical Working Group http://www.keybiodiversityareas.org/kba-partners

KBA training materials [in preparation; see http://keybiodiversityareas.org]

Marine (nearshore) ecoregions https://databasin.org/datasets/3b6b12e7bcca419990c9081c0af254a2

NatureServe's National Species Dataset (for the US and Canada) http://www.natureserve.org/conservation-tools/national-species-dataset

Ocean Biogeographic Information System http://www.iobis.org/

Plantlife Important Plant Areas (IPA) Database http://www.plantlifeipa.org/home

Protected Planet Database https://www.protectedplanet.net/

Ramsar Sites Information Service https://rsis.ramsar.org/

Recommended taxonomic ranks for applying Criteria B2 and B3 [in preparation; see http://keybiodiversityareas.org]

Relationship between Key Biodiversity Areas (KBAs) and Protected Areas http://www.keybiodiversityareas.org/userfiles/files/KBAs%20and%20Protected%20Areas%20-%20Final.pdf

Resolving complex boundary overlaps [in preparation; see http://keybiodiversityareas.org]

Sensitive Data Access Restrictions Policy for the IUCN Red List https://cmsdocs.s3.amazonaws.com/keydocuments/Sensitive_Data_Access_Restrictions_Policy_for_the_IUCN_Red_List.pdf

South America terrestrial ecosystems https://www.arcgis.com/home/item.html?id=45764ecdc7274509be752bfebeb268e1

Terrestrial ecoregion shapefiles https://ecoregions2017.appspot.com/

Terrestrial Ecosystems of Africa and Madagascar
http://www.aag.org/cs/publications/special/map_african_ecosystems

World Database of Key Biodiversity Areas http://keybiodiversityareas.org

World Register of Marine Species http://www.marinespecies.org/