

**JULY 6 2017**

## **DISCUSSION PAPER TO COMMITTEE BIRDLIFE SHOALHAVEN**

**Chris Grounds Conservation Officer BirdLife Shoalhaven**

### **SHOALHAVEN HEADS AS A KBA [Incorporating Seven Mile Beach N P, Comerong Island N R, Shoalhaven Heads Inlet and Estuary]**

#### **1.0 INTRODUCTION**

**1.1.1** BirdLife Australia is involved in the international development of **Key Biodiversity Areas as biodiversity “Hot Spots” basing these on the prior Important Bird Areas [IBAs] and Important Biodiversity Areas.**

**1.1.2** An important area of Biodiversity not classified as a KBA but known to NPWS, Research Consultants, BLS, other local and regional birding groups and Gerroa Environment Protection Society is the Shoalhaven Heads area and it is proposed that

**A PROCESS SHOULD BE INSTIGATED TO HAVE THIS AREA RECOGNIZED AS A KBA.**

#### **1.1.3 Background: Important Bird Areas and National Parks. [BirdLife Shoalhaven]**

The Shoalhaven contains a number of **Important Bird Areas (IBA)** identified by BirdLife International, including Barren Grounds, Jervis Bay, Lake Wollumboola and the Ulladulla to Merimbula IBA, as well as a number of national parks. The Jervis Bay National Park on both sides of Jervis Bay have been identified as an IBA because the coastal heathland supports a population of the endangered Eastern Bristlebird. Lake Wollumboola is a coastal lake north of Jervis Bay, part of Jervis Bay National Park, which often supports over 1% of the world population of Black Swans, especially in drought years. The Budderoo and Barren Grounds Important Bird Area on the northern boundary of the Shoalhaven contains the endangered Eastern Bristlebird, Ground Parrots and Pilotbirds. The Ulladulla to Merimbula Important Bird Area comprises a strip of coastal land stretching from the Shoalhaven south, and is an important site for Swift Parrots as well as endangered shorebirds.

**1.1.4** The suggested area as defined embraces :

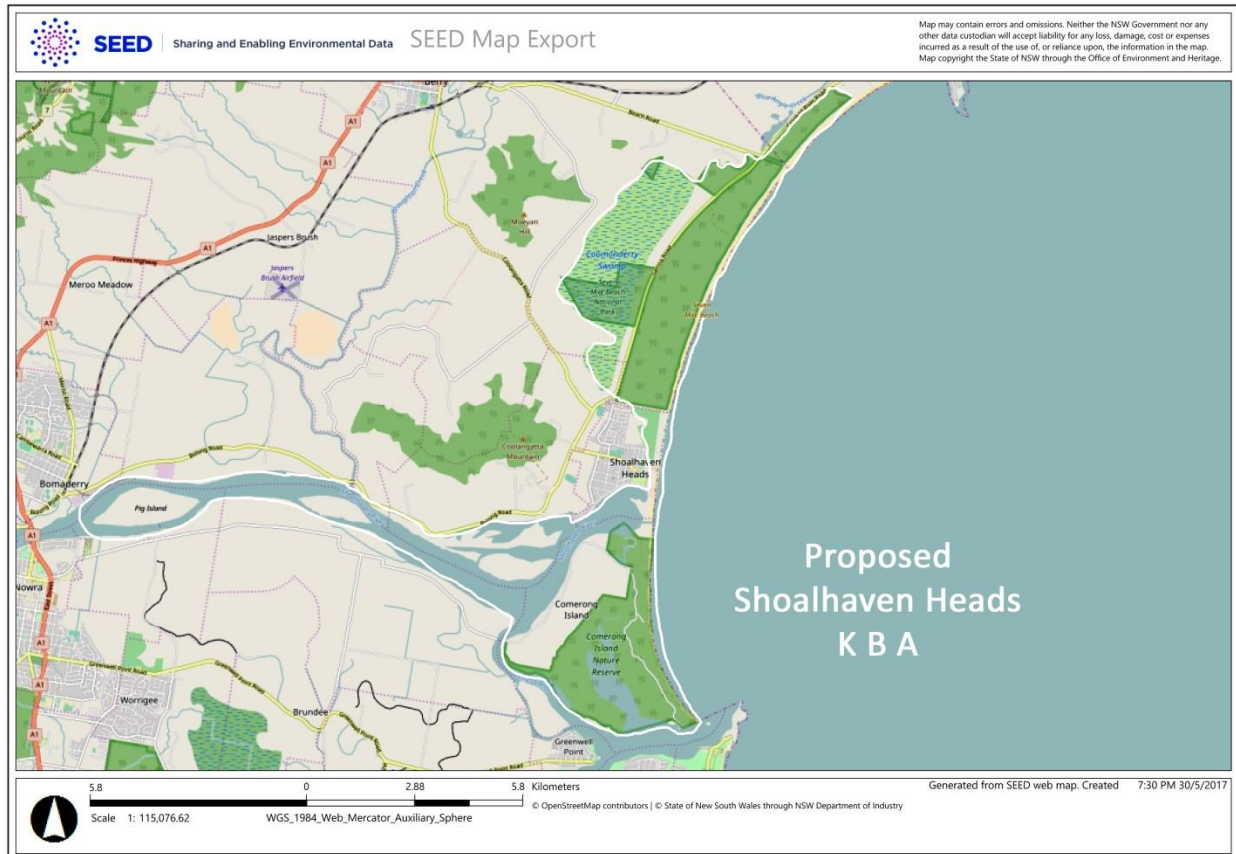
**Seven Mile Beach N P as this includes portion of Coomonderry Swamp**

**Shoalhaven Inlet & Estuary**

**Comerong Island N R**

Each of these areas has documented high value biodiversity and significant Threatened Species.

## See following Map: Proposed Shoalhaven Heads K B A



### 1.2.1 KBAs

At the World Conservation Congress in 2016, 11 leading nature conservation organizations launched the new Global Standard for the Identification of Key Biodiversity Areas (KBAs), which employs agreed scientific criteria and was launched in Australia in September 2016.

### 1.2.2 An Outline of KBA criteria [ SEE ATTACHMENTS A-SUMMARY & B – FULL VERSION ]

KBA designation is based on five criteria described in The Global Standard for the Identification of Key Biodiversity Areas. A simplified list of criteria as they apply to Australian KBAs identified for the bird values is below.

#### A. Threatened Biodiversity

KBA supports more than a threshold proportion of a species listed by IUCN as globally Vulnerable (threshold 1%), Endangered (threshold 0.5%) or Critically Endangered (threshold 0.5%).

#### B. Geographically Restricted Biodiversity

This applies to species or assemblages and requires a threshold of 10 per cent of a single species or 1 per cent for each species in assemblages of restricted range species.

### **C. Ecological Integrity**

A site is the sole or one of two sites with a specific ecological community wholly intact.

### **D. Biological Processes**

A site predictably holds congregations representing  $\geq 1$  per cent of the global population of a species.

### **E. Irreplaceability through quantitative analysis**

Level of irreplaceability  $\geq 0.90$  (on a 0–1 scale), measured by quantitative spatial analysis

## **BIODIVERSITY VALUES – PROPOSED KBA**

### **2.0 COOMONDERRY WETLAND**

#### **2.1 AUSTRALASIAN BITTERN**

**2.1.1.a Conservation Status : Federal Endangered NSW Endangered.**

#### **2.1.3.b *Botaurus poiciloptilus***

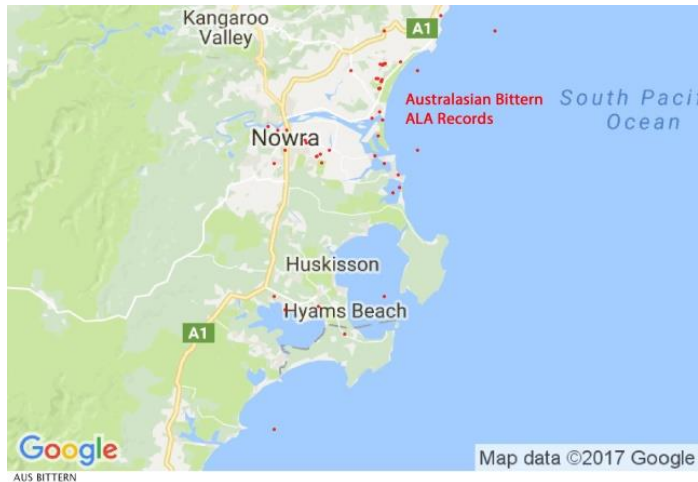
Australasian Bitterns specialise in living in dense beds of reeds and rushes, where they are surprisingly difficult to see, as they are particularly well camouflaged. Added to this, when alarmed, they stand still with neck stretched upwards and bill pointing skywards. Sometimes they even sway in the breeze, in time with the surrounding reeds. This combination makes them blend in remarkably well with the surrounding vegetation. It is hardly surprising that the species is seldom recorded.

**Description:** The Australasian Bittern is heavy-set, partially nocturnal heron, upperparts patterned dark brown, buff and black, and underparts streaked brown and buff. The eyebrow and throat are pale, and the side of the neck is dark brown. The bill is brown and the legs are greenish.

**Distribution:** is found in coastal and sub-coastal areas of south-eastern and south-western mainland Australia, and the eastern marshes of Tasmania.

**Habitat:** frequents reedbeds, and other vegetation in water such as cumbungi, lignum and sedges .

ALA Australasian Bittern record [includes Birddata records]



## 2.2. COOMONDERRY WETLAND

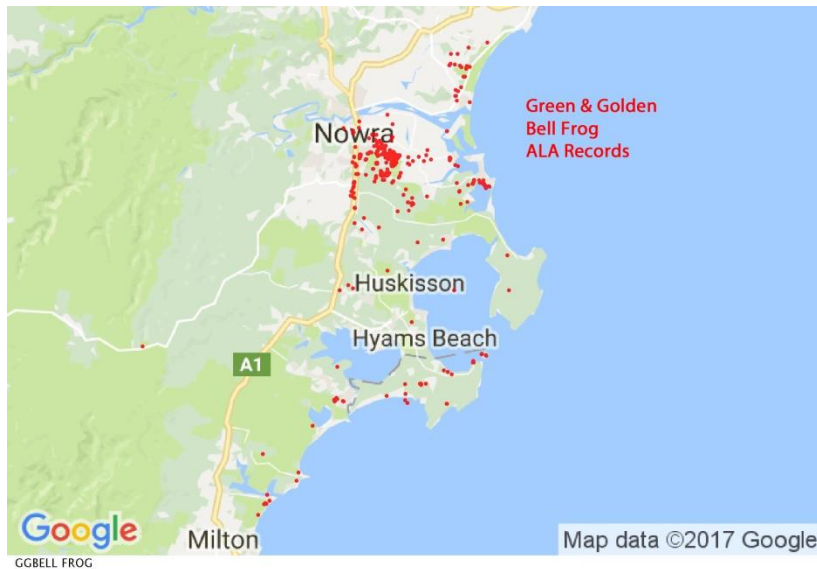
Department of Environment and Climate Change (NSW) [May 2007]

**2.2.1** It is a wetland of national importance (ANCA 1996) being the largest semi-permanent freshwater swamp on the New South Wales coast (Figure 2) and represents 34 percent of this type of wetland in the State (Goodrick 1970). It is fed largely by ground water (Mitchell McCotter 1992). The swamp is a gazetted wetland (No. 370) under State Environmental Planning Policy (SEPP) No. 14 and 169 hectares of it (25 per cent) lie within Seven Mile Beach National Park (Mitchell McCotter 1992). This is one of the few national parks where GGBFs are known to occur.

**2.2.2** The Illawarra Regional Landscape and Environment Study (Department of Environment and Planning 1981) categorises the wetland as IIc-Priority Protection requiring protection against polluting land uses.

**2.2.3.a** The Green and Golden Bell Frog (GGBF) is listed as an endangered species under Schedule 1 of the NSW Threatened Species Conservation Act 1995 (TSC Act). At the national level, the species is listed as Vulnerable under Schedule 1 Part 2 of the Environment Protection and Biodiversity Conservation Act 1999 and IUCN Vulnerable. Coomonderry Swamp is significant for GGBF because it is the most extensive wetland in which the frog has yet been discovered in New South Wales.

**2.2.3.b** The fact that part of Coomonderry Swamp is a National Park is significant. In New South Wales, GGBF are only known from twelve areas within the reservation system: Ben Boyd NR, Brundee Swamp NR (Gaia Research 2006), Murramarang NP, Kooragang, Homebush, Kurnell, Yuraygir NP (Clancy 1995), Meroo NP (Daly in press), Nadgee Nature Reserve (Daly and Senior 2000), Hat Head NP, Myall Lakes NP, and Seven Mile Beach NP.



Green & Golden Bell Frog ALA Record

## 2.3 NPWS PLAN OF MANAGEMENT : Biological Values of the National Park NSW NATIONAL PARKS AND WILDLIFE SERVICE FEBRUARY 1998

**2.3.1** Coomonderry Swamp is the only large semi-permanent freshwater wetland on the south coast and protects approximately one third of this type of habitat within NSW. It is an important drought refuge when smaller coastal wetlands and inland wetlands are dry and supports a diverse range of bird species and large populations of such species as purple swamphen *Porphyrio porphyrio*, Eurasian coot *Fulica atra*, Pacific black duck *Anas superciliosa*, hardhead *Aythya australis*, hoary-headed grebe *Poliiocephalus poliocephalus* and black swan *Cygnus atratus*. It is a breeding area for several species.

**2.3.2** The swamp is a valuable scientific resource as much of the coastal freshwater wetland in NSW has been cleared and drained.

**2.3.3** The swamp contains a diverse array of plant communities including the largest area of freshwater sedgeland/reedland in the region. Several plants are regionally rare or at the limits of their ranges. The swamp contains a very large population, possibly the largest in NSW, of the uncommon plant *Villarsia reniformis* (Mitchell McCotter, 1991) Eucalyptus robusta swamp forest, which occurs along the eastern edge of the swamp, is uncommon and restricted in distribution in the state.

**2.3.4** The swamp has a large population of the threatened green and golden bell frog *Litoria aurea* and is the most extensive wetland in which the frog has been discovered in NSW (Daly, 1996). Other threatened fauna recorded at Coomonderry Swamp include the Australasian Bittern *Botaurus poiciloptilus* and black-necked stork *Ephippiorhynchus asiaticus*.

## 3.0 Seven Mile Beach National Park other than Coomonderry Swamp NPWS PLAN OF MANAGEMENT : Biological Values of the National Park

## NSW NATIONAL PARKS AND WILDLIFE SERVICE FEBRUARY 1998

**3.1.1** Seven Mile Beach National Park contains one of the largest areas of natural coastal dune vegetation on the central part of the NSW coastline. Elsewhere, sand barriers have been extensively cleared for urban development. The uncommon orchid *Dipodium hamiltonianum* occurs on sandy soils near the southern end of the national park.

**3.2.1** Threatened species recorded elsewhere in the national park include the tiger quoll *Dasyurus maculatus*, yellow-bellied sheath-tail-bat *Saccolaimus flaviventris*, greater broad-nosed bat *Scoteanax rueppellii*, swift parrot *Lathamus discolor*, olive whistler *Pachycephala olivacea*, regent honeyeater *Xanthomyza phrygia*, masked owl *Tyto novaehollandiae* and powerful owl *Ninox strenua*.

**3.3.1** The national park has a high density of small mammals and a high number of reptile and frog species for its relatively small area.

### 3.4.1 Gerroa Environment Protection Society

The **Endangered Ecological Communities [EECs]** found at Seven Mile Beach, listed under the NSW Threatened Species Conservation Act, include:

1. Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions
2. Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions
3. Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions
4. Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions
5. Bangalay Sand Forest of the Sydney Basin and South East Corner bioregions
6. Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions.

## 4.0 COMERONG ISLAND NATURE RESERVE BIOLOGICAL VALUES

NPWS PLAN OF MANAGEMENT : Biological Values of the National Park  
NSW NATIONAL PARKS AND WILDLIFE SERVICE FEBRUARY 1998

**4.1.1** The nature reserve protects one of the few large naturally vegetated delta systems in NSW. It contains an important sample of three major habitat types - tidal shallows, mangrove swamp and littoral forest - which are not well represented in other conservation areas on the south coast.

**4.2.1** Comerong Island also has a well developed area of littoral rainforest. It is the largest remaining area of littoral rainforest on the south coast and is towards the southern limit of littoral rainforest in Australia (Mills, 1988). It is therefore of considerable scientific

**importance.** The Comerong Island rainforest supports one of the few known grey-headed flying fox *Pteropus poliocephalus* colonies in southern NSW.

**4.3.1** The nature reserve provides habitat for a large number of waterbirds and shorebirds listed in the Threatened Species Act including the hooded plover *Charadrius rubricollis*, Mongolian plover *Charadrius mongolus*, large sand plover *Charadrius leschenaultii*, beach thick-knee *Esacus magnirostris*, sooty oystercatcher *Haematopus fuliginosus*, pied oystercatcher *Haematopus longirostris*, little tern *Sterna albifrons*, terek sandpiper *Tringa terek*, broad-billed sandpiper *Limicola falcinellus*, great knot *Calidris tenuirostris*, blue billed duck *Oxyura australis*, black-tailed godwit *Limosa limosa* and black bittern *Ixobrychus flavicollis*.

**4.4.1** The nature reserve is the southern limit of occurrence of the bar-shouldered dove *Geopelia humeralis* and the main southern extent of the black bittern.

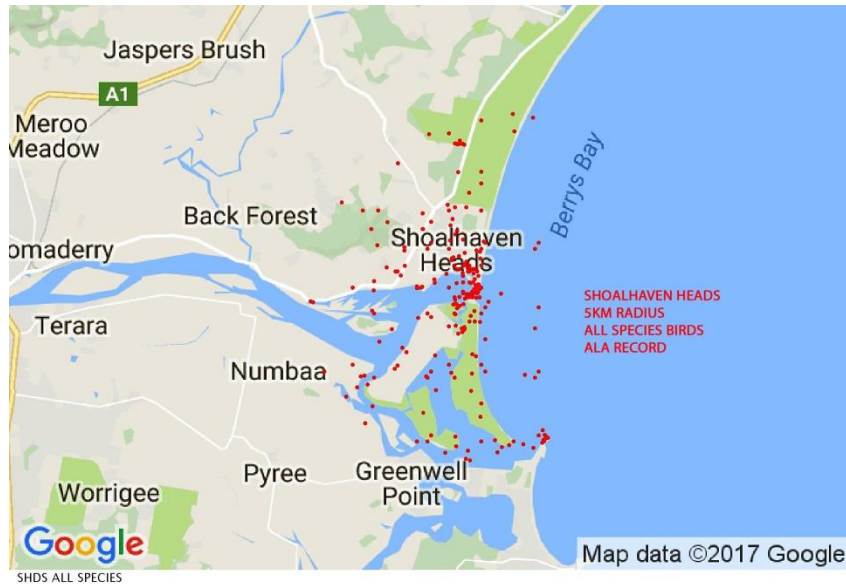
**4.5.1** The Shoalhaven Estuary, of which the nature reserve is a large proportion, is the fifth most important estuarine system for waders on the NSW coast. The others, in order of significance, are the Hunter River, Clarence River, Botany Bay and Richmond River.

**The estuary supports 90 species of shorebirds or waders, of which 27 are the subject of international agreements for protection of their habitat.** It is of international significance for the Pacific golden plover *Pluvialis dominica*, double-banded plover *Charadrius bicinctus* (a winter visitor of which the nature reserve has nearly half of the NSW population), eastern curlew *Numenius madagascariensis* and whimbrel *Numenius phaeopus*.

**4.6.1** The nature reserve is of state and national importance for the pied oystercatcher, sooty oystercatcher, ruddy turnstone *Arenaria interpres*, bar-tailed godwit *Limosa Mlapponica*, greenshank *Tringa nebularia* and red-necked stint *Calidris ruficollis* (Chafer, 1990). Up to 6000 swans and ducks use the estuary during winter when conditions on the highlands become too cold. There are also large populations of herons, ibis, egrets, cormorants and pelicans. The threatened osprey *Pandion cristatus* has been recorded in the nature reserve.

## 5.0 SHOALHAVEN HEADS – INLET / ESTUARY

**5.1.1** An Atlas of living Australia audit revealed this part of the proposed KBA area has a concentration of known local populations of many avian species, particularly shorebirds. The ALA lists 1016 species in an area of 5km radius of Shoalhaven Heads Inlet of which **280 are bird species** [see map below]. There are 539 plant species for the same area.



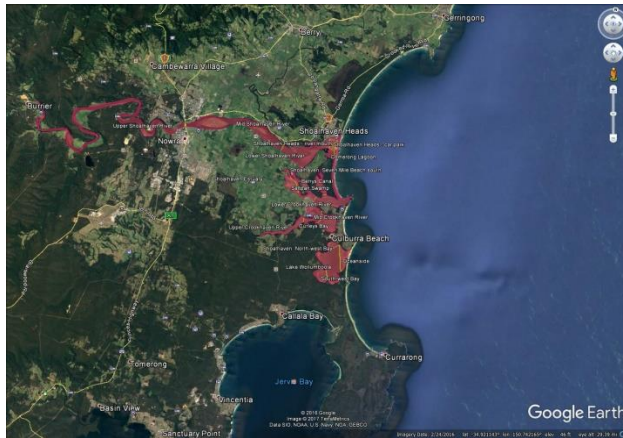
**5.1.2** CURRENT E - BIRD CATALOGUE lists 152 species 2004-2007 with 94 of these listed in 2017. The E-Bird “Hotspots” catalogue lists 155 species for Shoalhaven Heads Inlet and 151 species for Comerong Island.

### 5.1.3 South Coast Habitat Shorebird Report July 2009.

#### Shoalhaven River

The Shoalhaven River catchment drains 7250 km<sup>2</sup>. It rises near Braidwood and its major tributary is the Kangaroo River (Figure 8). The estuarine component is part of a large alluvial floodplain of 130 km<sup>2</sup> to the east of Nowra. The tidal limit at Burrier is approximately 44 river km upstream. Shoalhaven / Crookhaven Estuary - NSW08811 is listed as a wetland of national importance. **At least 52 shorebird species have been recorded in the Shoalhaven estuary, of which 11 are threatened in NSW** (Appendix 1). These include the vulnerable Lesser Sand Plover (*Charadrius mongolus*), Greater Sand Plover (*Charadrius leschenaultii*), Sanderling (*Calidris alba*), Broad-billed Sandpiper (*Limicola falcinellus*), Great Knot (*Calidris tenuirostris*), Black-tailed Godwit (*Limosa limosa*), Terek Sandpiper (*Xenus cinereus*), Sooty Oystercatcher (*Haematopus fuliginosus*), Pied Oystercatcher (*Haematopus longirostris*), endangered Little Tern (*Sternula albifrons*), and Hooded Plover (*Thinornis rubricollis*).





## Shorebird Survey Area

### 5.1.4 2016 & 2017 SHOALHAVEN RIVER ESTUARY SHOREBIRD COUNT [NPWS – Phil Craven pers.comm.]

One of the highlights is the consistent higher number of Eastern Curlew (paradoxical in an international context) at the Shoalhaven (>100 birds) over this period. Then there was the rarities that happen along every year, Inland Dotterel, Hudsonian Godwit, White-rumped Sandpiper..etc

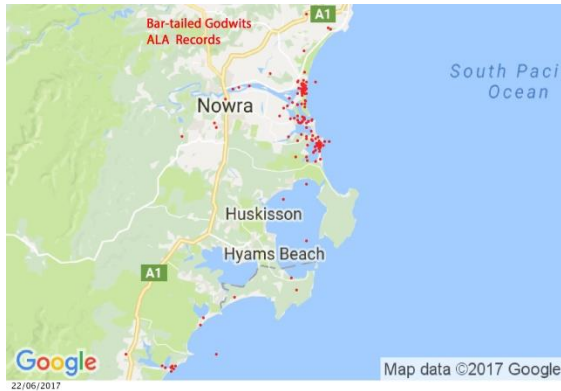
### 5.2.0 EXEMPLAR BIRD DIVERSITY & IMPORTANCE

**5.2.1** As an exemplar the Eastern Curlew, a Critically Endangered Species [EPBC Act], is known in its biggest numbers in this area. The area is an important staging point for their migration to the northern hemisphere.

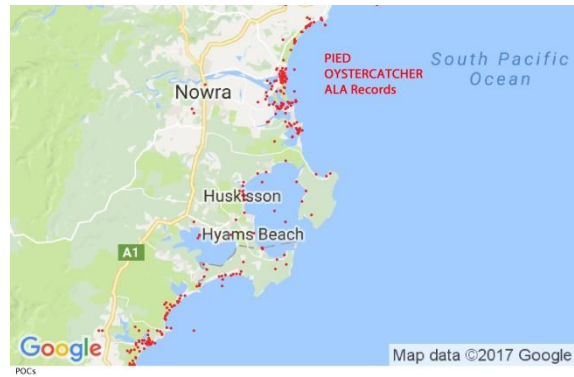
## Atlas of Living Australia Eastern Curlew Record of Reports



5.2.2 The area is also an important feeding and staging area for other migratory shorebirds including Bar-tailed Godwits and Golden Plover. [See adjoining ALA Map]



5.2.3 The Inlet sand shoals are known nesting area for the NSW Threatened Species Pied Oyster Catcher. [See adjoining ALA Map] The area has the highest observations count for the NSW Vulnerable Eastern Osprey in the Shoalhaven LGA with 16 of the total 80 Atlas Living Australia records of the species.



5.2.4 The inlet bird population includes a range of ‘bush birds’ as well as an extensive suite of shorebirds-waterbirds as Black Swans, Red-capped Plover, Red-necked Stints, Silver Gull, Crested Tern, Greater Egret, White-faced Heron, Brown Quail, and . . . . .>

### 5.2.5 South Coast Habitat Shorebird Report July 2009

5.2.5. a A number of south coast habitats where shorebirds occur are also listed as wetlands of national importance. Many of the wetlands and waterbodies identified for assessment in this project are identified in *The Directory of Important Wetlands in Australia* as wetlands of national importance<sup>6</sup>. The following estuaries in the project area that are or contain wetlands of national importance are:- Lake Illawarra, Shoalhaven River estuary, Lake Wollumboola, Moruya River estuary, Tuross River estuary, Brou Lake and Wagonga Inlet are also important estuaries for shorebirds.

## REFERENCES

**BirdLife Australia** <http://www.keybiodiversityareas.org/what-are-kbas>

**Biological values of Seven Mile Beach ecosystems in 2014** Howard H Jones  
Secretary Gerroa Environmental Protection Society © 2017

**Management Plan The Green and Golden Bell Frog Key Population at Coomonderry Swamp  
May 2007** © Department of Environment and Climate Change (NSW), 2007  
<http://www.environment.nsw.gov.au/resources/threatenedspecies/2007167CoomonderryGGBFMP.pdf>

**E-Bird** <http://ebird.org/ebird/australia/hotspots>

**South Coast Habitat Shorebird Report July 2009. OEH-NPWS**

**Seven Mile Beach National Park and Comerong Island NPWS PLAN OF MANAGEMENT :**  
NSW NATIONAL PARKS AND WILDLIFE SERVICE FEBRUARY 1998

**Atlas of Living Australia**

<http://lists.ala.org.au/iconic-species?fq=kvp+group%3ABirds>

**Directory of Important Wetlands in Australia**

<http://www.environment.gov.au/water/wetlands/australian-wetlands-database/directory-important-wetlands>

**Research and Conservation Shorebirds BirdLife Australia**

<http://www.birdlife.org.au/projects/shorebirds-2020/research-and-shorebird-conservation>

**Biodiversity Survey and Habitat Enhancement of an endangered Freshwater Wetland,  
Coomonderry Swamp, Seven Mile Beach National Park OEH NPWS**  
PHI Craven July 2016

**Habitat Mapping and Threat Assessment of Shorebird Foraging, Roosting and Breeding Sites  
on the New South Wales South Coast NPWS**  
Nigel Jackett & Phil Craven July 2009

**Management Plan The Green and Golden Bell Frog Key Population at Coomonderry Swamp  
May 2007** © Department of Environment and Climate Change (NSW), 2007

<http://www.environment.nsw.gov.au/resources/threatenedspecies/2007167CoomonderryGGBFMP.pdf>

## **ATTACHMENT A**

**CRITERIA FOR KBAs SUMMARY** [<http://www.keybiodiversityareas.org/what-are-kba>]

### **Identifying KBAs**

The KBA project in Australia was started by BirdLife Australia through its contribution to BirdLife International's Important Bird Area project. We used published literature, results from bird surveys submitted to the Birddata database and expert knowledge, and worked with volunteers in branches, affiliates and other stakeholders to identify IBAs in 2008. The data collected on birds were assessed against globally standardised, scientific criteria, and slightly modified criteria are now being used to identify KBAs. Funding for this initiative was received by Rio Tinto.

Almost all Australian IBAs qualify as KBAs, based on their bird values alone. **To qualify as a Key Biodiversity Area, a site must meet at least one of the KBA criteria.** Relevant criteria are briefly summarised below; to read a comprehensive list of the criteria refer Attachment B.

#### **KBA A1. Globally threatened species**

Site regularly holds one or more of:

- \*  $\geq 0.5\%$  of the global population size of a IUCN Critically Endangered or Endangered species
- \*  $\geq 1\%$  of the global population of a IUCN Vulnerable species

#### **KBA B1. Restricted-range species**

Site regularly holds:

- \*  $\geq 10\%$  of the global population of a species (whether it's range restricted or not)
- \*  $\geq 1\%$  of the global population of each of a number of restricted-range species in a taxonomic group, determined as either  $\geq 2$  species or  $0.02\%$  of the global number of species in the taxonomic group, whichever is larger. (In practice, birds are mostly be considered as restricted range species if their global range is  $< 50,000 \text{ km}^2$ .)

#### **KBA B3. Geographically restricted assemblages**

Site holds assemblages of species within a taxonomic group that are globally restricted.

- \*  $\geq 5$  reproductive units of  $\geq 5$  bioregion-restricted species or  $30\%$  of the bioregion-restricted species known from the country, whichever is larger. (This criterion has not been applied in Australia as it proved redundant once other criteria were assessed.)

#### **KBA D1. Demographic aggregations**

Site predictably holds one or more of:

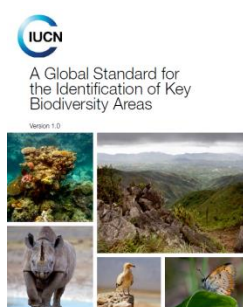
- \* a congregation representing  $\geq 1\%$  of the global population of a species, over a season, and during one or more key stages of its life cycle
- \* a number of mature individuals that ranks the site among the largest 10 congregations known for the species.

## **ATTACHMENT B**

### **CRITERIA FOR IDENTIFYING KBA FULL VERSION**

**What are KBAs & how are they identified?**

**Key Biodiversity Areas (KBA) are 'sites that contribute to the global persistence of biodiversity', including vital habitat for threatened plant and animal species in terrestrial, freshwater and marine ecosystems.**



The [Global Standard for the Identification of Key Biodiversity Areas \(IUCN 2016\)](#) sets out globally agreed criteria for the identification of KBAs worldwide. The KBA Standard establishes a consultative, science-based process for KBA identification, founded on the consistent application of global criteria with quantitative thresholds that have been developed through an extensive consultation exercise spanning several years.

Sites qualify as global KBAs if they meet one or more of 11 criteria, clustered into five categories: threatened biodiversity; geographically restricted biodiversity; ecological integrity; biological processes; and, irreplaceability. The KBA criteria can be applied to species and ecosystems in terrestrial, inland water and marine environments. Although not all KBA criteria may be relevant to all elements of biodiversity, the thresholds associated with each of the criteria may be applied across all taxonomic groups (other than micro-organisms) and ecosystems.

The KBA identification process is a highly inclusive, consultative and bottom-up exercise. Although anyone with appropriate scientific data may propose a site to qualify as a KBA, consultation with stakeholders at the national level (both non-governmental and governmental organizations) is required during the proposal process. KBA identification should build off the existing network of KBAs (including Important Bird and Biodiversity Areas and Alliance for Zero Extinction sites) and new data should seek to strengthen and expand the network of these sites. Any site proposal must undergo independent scientific review. This is followed by the official site nomination with full documentation meeting the [Documentation Standards](#) for KBAs. Sites confirmed by the KBA Secretariat to qualify as KBAs then appear on this website.

The consultation process to develop A Global Standard for the Identification of Key Biodiversity Areas was led by the IUCN WCPA-SSC Joint Task Force on Biodiversity and Protected Areas. It involved a [Framing workshop](#); technical workshops on [Criteria and Delineation](#), [quantitative Thresholds](#), and [Governance](#) of the process to identify KBAs; a second [Governance](#) meeting; 14 separate [regional consultations](#) held around the world; and interviews with [end users of KBA data](#). A [first public consultation draft](#) was posted in 2014, generating more than 1200 [comments and responses](#). The [second consultation draft](#) on the Standard was posted in 2015, generating an additional 600 [comments and responses](#). More information on the consultation process to develop the KBA Standard can be found on the [Joint Task Force website](#).

## **A Global Standard for the Identification of Key Biodiversity Areas Version 1.0**

**Prepared by the IUCN Species Survival Commission and IUCN  
World Commission on Protected Areas in association with the  
IUCN Global Species Programme  
23 March 2016**

## **IV. KBA CRITERIA AND THRESHOLDS**

### **A. THREATENED BIODIVERSITY**

#### **A1. Threatened species**

Sites qualifying as KBAs under criterion A1 hold a significant proportion of the global population size of a species facing a high risk of extinction and so contribute to the global persistence of biodiversity at genetic and species levels.

Site regularly holds one or more of the following:

- a)  $\geq 0.5\%$  of the global population size AND  $\geq 5$  reproductive units of a CR or EN species;
- b)  $\geq 1\%$  of the global population size AND  $\geq 10$  reproductive units of a VU species;
- c)  $\geq 0.1\%$  of the global population size AND  $\geq 5$  reproductive units of a species assessed as CR or EN due only to population size reduction in the past or present;
- d)  $\geq 0.2\%$  of the global population size AND  $\geq 10$  reproductive units of a species assessed as VU due only to population size reduction in the past or present;
- e) Effectively the entire global population size of a CR or EN species make a highly significant contribution to their persistence

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,
- (vi) distinct genetic diversity.

Species that can trigger criterion A1 encompass those assessed as globally CR, EN or VU on The IUCN Red List of Threatened Species (IUCN 2012a), 17 or species assessed as regionally/nationally Threatened

using the Guidelines for Application of IUCN Red List Criteria at Regional and National Levels (IUCN 2012b) where these both (a) have not been assessed globally and (b) are endemic to the region/country in question.

Criterion A1 can be triggered by migratory species in both their breeding and non-breeding range; at non-breeding sites, the reproductive units threshold can be interpreted as the number of mature individuals.

Sub-criteria A1c and A1d apply to species that have experienced, or are currently experiencing, rapid decline in population size and thus are restricted to those species qualifying only under Criterion A of the IUCN Red List Categories and Criteria, in any of sub-criteria A1, A2, or A4.

Species qualifying only under Criterion A3 of the IUCN Red List are expected to experience future rapid decline in population size but currently may still be quite abundant, and so these species are subject to the higher thresholds of KBA sub-criteria A1a and A1b.

There is no reproductive units requirement for sub-criterion A1e because sites holding all remaining mature individuals of CR or EN species make a highly significant contribution to their persistence.

## **A2. Threatened ecosystem types**

Sites qualifying as KBAs under criterion A2 hold a significant proportion of the global extent of an ecosystem type facing a high risk of collapse and so contribute to the global persistence of biodiversity at the ecosystem level.

Site holds one or more of the following:

- a)  $\geq 5\%$  of the global extent of a globally CR or EN ecosystem type;
- b)  $\geq 10\%$  of the global extent of a globally VU ecosystem type.

Threatened ecosystem types include those assessed as globally CR, EN or VU under the IUCN Red List of Ecosystems Categories and Criteria (IUCN 2015) using units at an intermediate level in a globally consistent ecosystem classification hierarchy, such as macrogroup or equivalent (Faber-Langendoen et al. 2014). Ecosystem collapse is characterised by a transformation of identity, loss of defining features, and replacement by a different ecosystem type (IUCN 2015)

## **B. GEOGRAPHICALLY RESTRICTED BIODIVERSITY**

### **B1: Individual geographically restricted species**

Sites qualifying as KBAs under criterion B1 hold a significant proportion of the global population size of a geographically restricted species and so contribute significantly to the global persistence of biodiversity at the genetic and species level.

Site regularly holds  $\geq 10\%$  of the global population size AND  $\geq 10$  reproductive units of a species.

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,
- (vi) distinct genetic diversity.



In practice, many restricted-range species will trigger criterion B1, but having a restricted range is not a requirement under this criterion. Some species with large ranges may have many individuals concentrated in just a few areas within their range limits. The regular occurrence of all life stages of a species at a site distinguishes criterion B1 from criterion D1.

### **B2: Co-occurring geographically restricted species**

Sites qualifying as KBAs under criterion B2 hold a significant proportion of the global population size of multiple restricted-range species, and so contribute significantly to the global persistence of biodiversity at the genetic and species level.

Site regularly holds  $\geq 1\%$  of the global population size of each of a number of restricted-range species in a taxonomic group, determined as either  $\geq 2$  species OR  $0.02\%$  of the global number of species in the taxonomic group, whichever is larger.<sup>19</sup>

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,
- (vi) distinct genetic diversity.

Sites holding multiple restricted-range species are frequently indicative of centres of endemism.

Although criterion B2 can be applied to any taxonomic group, groups above Class and below Family are unlikely to be useful in practice.

### **B3: Geographically restricted assemblages**

Sites qualifying as KBAs under criterion B3 hold assemblages of species within a taxonomic group that are globally restricted and so contribute significantly to the global persistence of biodiversity at the genetic, species and ecosystem levels.

Site regularly holds one or more of the following:

- a)  $\geq 0.5\%$  of the global population size of each of a number of ecoregion-restricted species within a taxonomic group, determined as either  $\geq 5$  species OR  $10\%$  of the species restricted to the ecoregion, whichever is larger;
- b)  $\geq 5$  reproductive units of  $\geq 5$  bioregion-restricted species OR  $30\%$  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  $\geq 5$  species within a taxonomic group. Because bioregions are larger than and inclusive of ecoregions, either criterion B3a or B3b, but not both, should be used for a particular taxonomic group. Criterion B3a is applicable to taxonomic groups for which the global median range size is  $< 25,000 \text{ km}^2$ , while B3b is applicable to taxonomic groups with a global median range size  $\geq 25,000 \text{ km}^2$ .<sup>20</sup> Proportion of the global population size under sub-criteria B3a 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.

Under sub-criterion B3c 'most important occupied habitat' can be observed

or inferred through the following:

- (i) density of mature individuals,
- (ii) relative abundance of mature individuals.

Although criterion B3 can be applied to any taxonomic group, groups above Class and below Family are unlikely to be useful in practice. Sub-criterion B3b is formulated to account for the non-uniform way that species confined to bioregions, which are typically very large, are distributed across them.

While greater numbers of species usually co-occur at or near their geographic centres, others are confined towards their peripheries. A proportional threshold based on the assemblage of species of the bioregion as a whole therefore would mean the exclusion of such species: the modifying clause “known from the country” addresses this.

#### **B4: Geographically restricted ecosystem types**

Sites qualifying as KBAs under criterion B4 hold a significant proportion of the global extent of a geographically restricted ecosystem type and so contribute significantly to the global persistence of biodiversity at the species and ecosystem level.

Site holds  $\geq 20\%$  of the global extent of an ecosystem type.

To ensure global consistency in application of the KBA criteria, criterion B4 should be applied to units at an intermediate level in a globally consistent ecosystem classification hierarchy, such as macrogroup or equivalent (Faber-Langendoen et al. 2014), as used for the IUCN Red List of Ecosystems for global assessments.

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,
- (vi) distinct genetic diversity.

Species that can trigger criterion A1 encompass those assessed as globally CR, EN or VU on The IUCN Red List of Threatened Species (IUCN 2012a), 20

Proportion of the global population size under sub-criteria B3a 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.

Under sub-criterion B3c ‘most important occupied habitat’ can be observed or inferred through the following:

- (i) density of mature individuals,
- (ii) relative abundance of mature individuals.

Although criterion B3 can be applied to any taxonomic group, groups above Class and below Family are unlikely to be useful in practice. Sub-criterion B3b is formulated to account for the non-uniform way that species confined

to bioregions, which are typically very large, are distributed across them. While greater numbers of species usually co-occur at or near their geographic centres, others are confined towards their peripheries. A proportional threshold based on the assemblage of species of the bioregion as a whole therefore would mean the exclusion of such species: the modifying clause “known from the country” addresses this.

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To ensure global consistency in application of the KBA criteria, criterion B4 should be applied to units at an intermediate level in a globally consistent ecosystem classification hierarchy, such as macrogroup or equivalent (Faber-Langendoen et al. 2014), as used for the IUCN Red List of Ecosystems for global assessments.

## **C. ECOLOGICAL INTEGRITY**

Sites qualifying as KBAs under criterion C hold wholly intact ecological communities with supporting large-scale ecological processes and so contribute significantly to the global persistence of biodiversity at the ecosystem level.

Criterion C identifies truly outstanding examples at the global scale of still-natural and intact places that maintain fully functional ecosystem types and their Components. These sites are large and essentially undisturbed by significant industrial human influence. They maintain their full complements of species in their natural abundances or biomass, support the ability of species to engage in natural movements, and allow for the unimpeded functioning of ecological processes.

Site is one of  $\leq 2$  per ecoregion characterised by wholly intact ecological communities, comprising the composition and abundance of native species and their interactions.

Ecological integrity should be observed or inferred from both direct measures of species composition and abundance/biomass 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 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).

These metrics should be contextualised by information that allows inference of the historical bounds of variation using a regionally appropriate benchmark (e.g. the past 500 years) for diversity or abundance in the ecoregion.

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 in metrics of direct industrial human impact.

**KBAs identified under criterion C should ideally be delineated to be at least 10,000 km in size**, within the confines of manageability (including for transboundary sites). Where sites straddle ecoregional boundaries, delineation should proceed without respect to ecoregional division.

## **D. BIOLOGICAL PROCESSES**

### **D1: Demographic aggregations**

Sites qualifying as KBAs under criterion D1 hold a significant proportion of the global population size of a species during one or more life history stages or processes, and so contribute significantly to the global persistence of biodiversity at the species level.

Site predictably holds one or more of the following:

- a) An aggregation representing  $\geq 1\%$  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.

Proportion of the global population size can be observed from the following:

(i) number of mature individuals.

Aggregations typically occur for breeding, feeding or during migration and are 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. 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. The concept of aggregation is broad enough, however, to include species that remain aggregated throughout most or all of their life cycles as they move between sites (e.g. some flamingo, albatross and petrel species). In sub-criterion D1b, the threshold applies across all life-history functions rather than for specific functions (e.g. breeding or feeding). Along migratory corridors, KBAs should be identified for stop-over or bottleneck sites rather than for the entire corridor.

### **D2: Ecological refugia**

Sites qualifying as KBAs under criterion D2 hold a significant proportion of the global population size of a species during periods of environmental stress, and so contribute significantly to the global persistence of biodiversity at the species level.<sup>23</sup>

Site supports  $\geq 10\%$  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 a refugium in the past and for which there is evidence to suggest it would continue to do so in the foreseeable future.

Proportion of the global population size can be observed from the following:

(i) number of mature individuals.

Species at any life stage may become concentrated in sites that maintain necessary resources, such as food and water, during periods of environmental stress, when conditions elsewhere become inhospitable. These temporary changes in climatic or ecological conditions, such as severe droughts, may concentrate individuals of a species at particular sites on the scale of multiple years or decades. This longer time horizon differentiates ecological refugia from the demographic and geographic aggregations described in criterion D1.

### **D3: Recruitment sources**

Sites qualifying as KBAs under criterion D3 are where a significant proportion of the global population size of a species is produced, and so contribute significantly to the global persistence of biodiversity at the species level. Site predictably produces propagules, larvae, or juveniles that maintain  $\geq 10\%$  of the global population size of a species.

Proportion of the global population size can be observed from the following:

(i) number of mature individuals.

Unlike sites identified under criteria D1 and D2, where individuals of a species are moving into a site at globally significant proportions, albeit at different time scales, criterion D3 applies to species where individuals disperse out of the site in globally significant proportions. These sources make a large contribution to the recruitment of a species elsewhere, even though the number of mature individuals at the site may be low or zero. Hence, the threshold is applicable to the global adult population size occurring largely outside of the site, rather than to the number of immature individuals within the site.

## **E. IRREPLACEABILITY THROUGH QUANTITATIVE ANALYSIS**

Sites qualifying as KBAs under criterion E have very high irreplaceability for the global persistence of biodiversity as identified through a complementarity-based quantitative analysis of irreplaceability.

Site has a level of irreplaceability of  $\geq 0.90$  (on a 0–1 scale), measured by quantitative spatial analysis, and is characterised by the regular presence of species with  $\geq 10$  reproductive units known to occur (or  $\geq 5$  units for EN or CR species). The irreplaceability analysis should be based on the contribution of individual sites to species persistence.

Targets for the quantitative irreplaceability analysis may be one of two types:

(a) Representing at least X mature individuals of each species, where X is the largest value among:

- i. the total number of individuals currently existing in the wild, if either: the global population size is fewer than 1,000 mature individuals; or the species' range is smaller than 1,000 km<sup>2</sup>; or the area of occupancy is smaller than 20 km<sup>2</sup>;
- ii. the population size necessary to ensure the global persistence of the species with a probability of  $\geq 90\%$  in 100 years, as measured by quantitative viability analysis;
- iii. 1,000 mature individuals;
- iv. the number of mature individuals expected to occupy, at average densities, 1,000 km<sup>2</sup> within the species' range or 20 km<sup>2</sup> within the species' area of occupancy (as appropriate);

(b) Representing at least an area of Y km<sup>2</sup> for each species, where Y is

the larger value among:

- i. the total area where the species occurs, if either: the global population size is fewer than 1,000 mature individuals; or the species' range is smaller than 1,000 km<sup>2</sup>; or the area of occupancy is smaller than 20 km<sup>2</sup>;
- ii. the area necessary to ensure the global persistence of the species with a probability of  $\geq 90\%$  in 100 years, as measured by quantitative viability analysis, up to a minimum of 10% of 25 the total species distribution (i.e. range or area of occupancy, as appropriate);
- iii. 1,000 km<sup>2</sup> within the range or 20 km<sup>2</sup> within the area of occupancy (as appropriate);
- iv. the area corresponds to the range or the area of occupancy (as appropriate) necessary to include 1,000 mature individuals.

KBA assessment to identify sites under Criterion E should be implemented through complementarity-based irreplaceability analyses. The spatial units in which the study area is subdivided should be equal-area or approximately equal-area at the scale of approximately 100–1,000 km<sup>2</sup>.

The 0.9 threshold for site irreplaceability means that, given the biodiversity elements used in the analysis, and the targets set, area X is found in 90% of all possible minimum sets of areas meeting those targets. For the same given set of targets, any one element may not point to area X as irreplaceable, but a set of all elements and their targets can make area X irreplaceable.

The irreplaceability analyses need to take into account the entire range of species, and so must either (a) be conducted at a global scale, or (b) focus only on the endemics from the region analysed, or (c) set the targets to reflect the fraction of the global population size of each species that is included in the study area. The irreplaceability analysis would not in itself identify KBA boundaries, which should be defined in a subsequent delineation process (Section V). Once delineation has been undertaken, it may be useful or necessary to repeat the analysis using delineated boundaries as the spatial units to determine the irreplaceability score of the KBA.