

# Information Sheet on EAA Flyway Network Sites (SIS) – 2017 version

Available for download from <http://www.eaaflyway.net/about/the-flyway/flyway-site-network/>

*Categories approved by Second Meeting of the Partners of the East Asian-Australasian Flyway Partnership in Beijing, China 13-14 November 2007 - Report (Minutes) Agenda Item 3.13*

## Notes for compilers:

1. The management body intending to nominate a site for inclusion in the East Asian - Australasian Flyway Site Network is requested to complete a Site Information Sheet. The Site Information Sheet will provide the basic information of the site and detail how the site meets the criteria for inclusion in the Flyway Site Network. When there is a new nomination or an SIS update, the following sections with an asterisk (\*), from Questions 1-14 and Question 30, must be filled or updated at least so that it can justify the international importance of the habitat for migratory waterbirds.
2. The Site Information Sheet is based on the Ramsar Information Sheet. If the site proposed for the Flyway Site Network is an existing Ramsar site then the documentation process can be simplified.
3. Once completed, the Site Information Sheet (and accompanying map(s)) should be submitted to the Flyway Partnership Secretariat. Compilers should provide an electronic (MS Word) copy of the Information Sheet and, where possible, digital versions (e.g. shapefile) of all maps.

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## 1. Name and contact details of the compiler of this form \*:

Full name:

EAAF SITE CODE FOR OFFICE USE ONLY:

Institution/agency: Office of Natural Resources and Environmental Policy and Planning

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**2. Date this sheet was completed \*:**

DD/MM/YYYY

9<sup>th</sup> November 2005

**3. Country \*:**

Thailand

**4. Name of the Flyway Network site \*:**

Accepted English transcription of the Site's name.

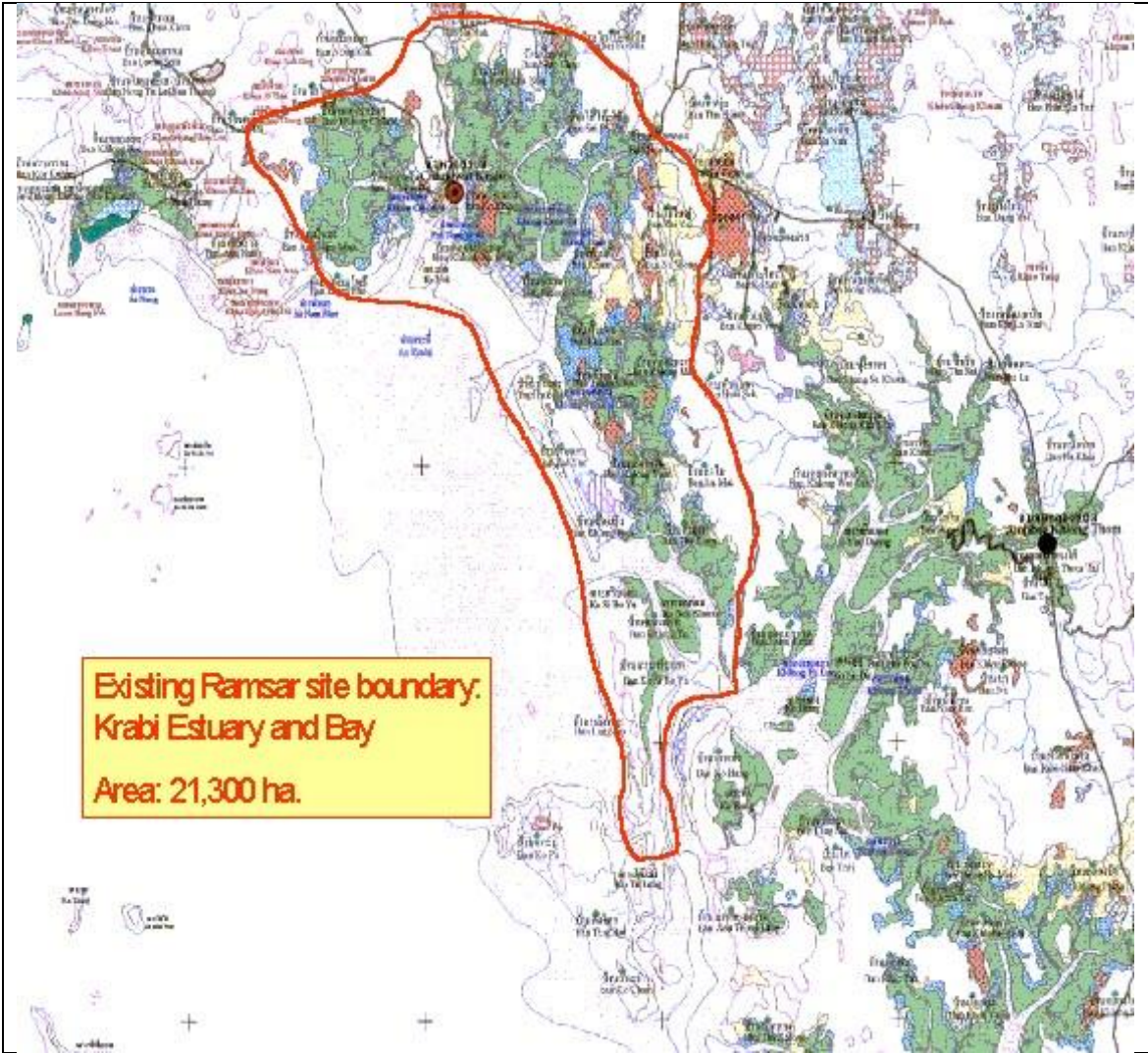
Krabi Estuary and Bay

**5. Map of site \*:**

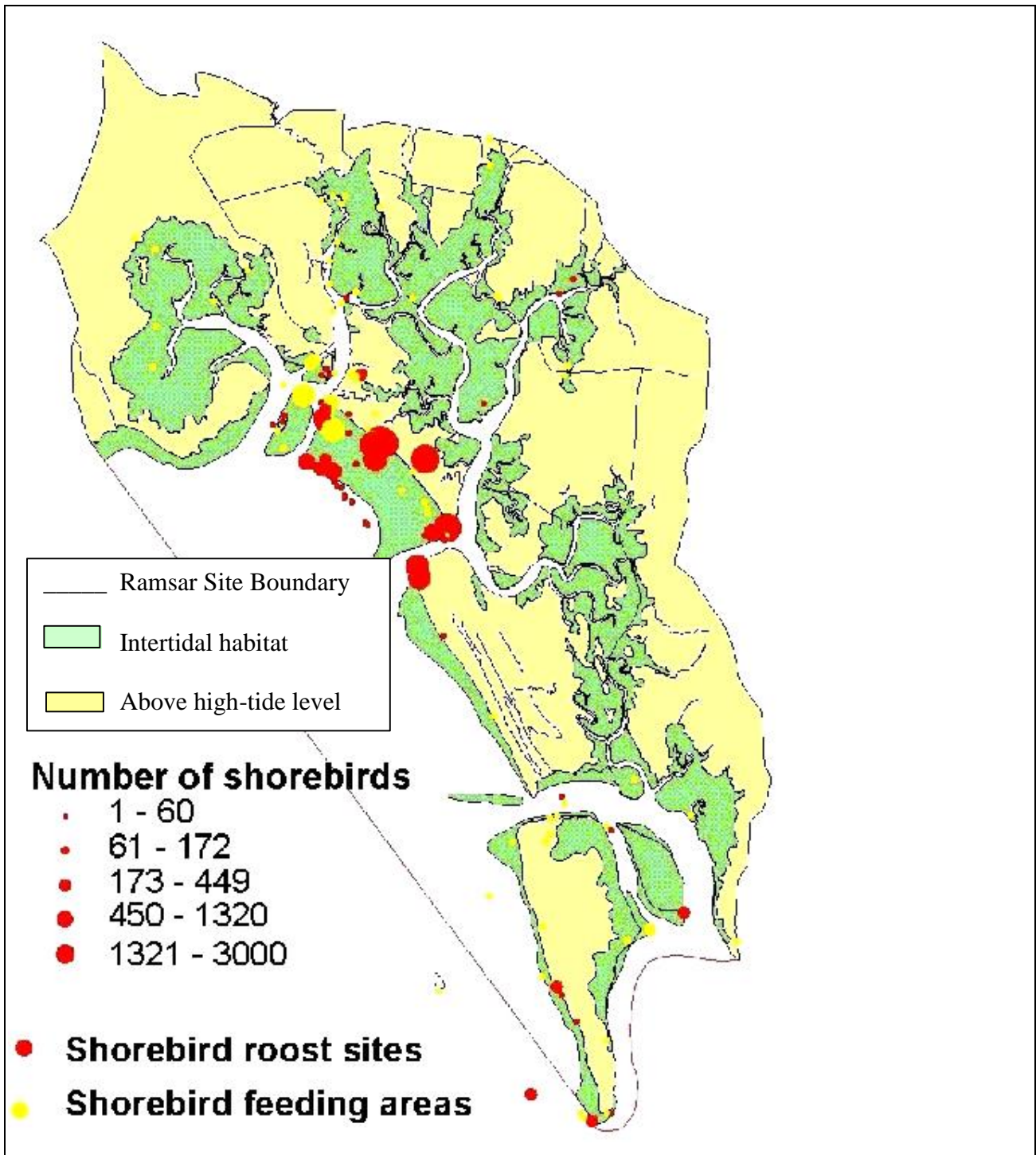
The most up-to-date available and suitable map of the wetland should be appended to the SIS (only in digital format and shape file). The map must clearly show the boundary of the site. Please refer to the "Digitising Site Boundaries in Google Earth" file linked [here](#).

(See below.)

Map 1: Boundary of the Krabi Ramsar site.



**Map 2: Most important feeding and roosting areas for shorebirds in Krabi Estuary and Bay.**



**6. Geographical coordinates (latitude/longitude, in decimal degrees) \*:**

Provide the coordinates of the approximate centre of the site and/or the limits of the site. If the site is composed of more than one separate area, provide coordinates for each of these areas.

7° 50' to 8° 05' N and 98° 48' to 99° 01' E

**7. Elevation \*:** (in metres: average and/or maximum & minimum)

Sea level

**8. Area \*:**

The total area of the site, in hectares. If the areas of discrete site units are known, please also list each of these together with the names (or labels) used to identify and differentiate these units.

21,299.14 ha

**9. General overview of the site \*:**

A brief (two sentences) summary of the site, mentioning principal physical and ecological functions, and its importance for migratory waterbirds.

Krabi Estuary and Bay is a Ramsar Wetland which includes sand beaches, mangroves and sand-flats extending from the fossil mollusc beds at Laem Pho to Khao Kanab Nam, Khao Laem Nang, east past the complex of rivers which open to the sea at Pak Nam Krabi, to the Khlong Yuan and Khlong Taling Chan, and south to Ban Laem Hin and Sriboya Island. The Ramsar site encompasses considerable areas of steep wooded cliffs and plantation agriculture (Map 1). The inter-tidal mudflats extend up to two km wide at low tide. The area of mangrove forest and mudflats are 10,212 ha and 1,200 ha respectively (Map 2). A substantial amount of fresh water enters the system as run-off via the major rivers, especially during the wet season. The sea-bed shelves fairly steeply to two metres immediately offshore, and to 6-10 m in the major estuary. The tidal amplitude at Ao Nang varies from 1m at neap tides to 3m at the highest spring tides. Important high-tide roost sites for shorebirds are on the numerous bamboo fish-traps up to 3 km offshore as well as on the sand beaches at Khlong Thalu, Laem Pho and Laem Kam.

This site was listed as a Ramsar site by the Thailand Government on 5<sup>th</sup> July 2001. Unfortunately much of the inter-tidal sandflats and all of the important fish-trap roost sites were excluded from the Ramsar site. The Danida-funded project "Implementing the Ramsar Convention in Thailand: Management and Protection of Wetlands (MPW)" made recommendations in 2002 to extend the westward boundary of the Ramsar site as far as the 5m depth contour of the sub-littoral shelf to include all shorebird roosts and the extensive sea grass beds around Sriboya and Pu islands. In the future this area will be considered for inclusion in the Ramsar site boundary as part of the shorebird management area.

**10. Justification of Flyway Site Network criteria \*:**

Please provide waterbird count information (with year of latest count) that demonstrates that the site meets the criteria of the Flyway Site Network (Annex 1). That is:

- it regularly supports > 20 000 migratory waterbirds; or,

- it regularly supports > 1 % of the individuals in a population of one species or subspecies of migratory waterbird; or,
- it supports appreciable numbers of an endangered or vulnerable population of migratory waterbird
- it is a “staging site” supporting > 5 000 waterbirds, or > 0.25% of a population stage at the site.

A listing of the populations of migratory waterbirds covered by the East Asian – Australasian Flyway Partnership and the 1% thresholds is attached (Annex 3).

The “staging site” criterion is particularly difficult to apply and application of this should be discussed with the Secretariat. Also note that some species have several populations that are very difficult to distinguish in the field.

Highest counts of shorebirds at the site are 2000+ in October 1984 by aerial survey, 1,760 during September 1988, and more recently 3,550 shorebirds in November-December 2003 and the highest count of 4,782 shorebirds recorded in March 2004.

- ‘it regularly supports > 1 % of the individuals in a population of one species or subspecies of migratory shorbird’

Two migratory shorebird species have met the 1% population criteria: the Mongolian Plover (Lesser Sand Plover) and the Nordmann’s Greenshank (Table 1).

- *‘it is a “staging site” where at least 0.25% of a population stage at the site.’*

Krabi Estuary appears to be a staging site for the migratory passage of several populations of shorebirds. The site has met the selection criteria as a staging site for two species, the Greater Sand Plover and Kentish Plover (see Table 1). These species were not recorded in large numbers during the non-breeding season and as such are considered to be passage migrants.

**Table 1: Shorebirds in Krabi Estuary which meet the criteria for the East Asian-Australasian Shorebird Site Network**

Species	1% Criteria	Global status	Highest count	Recent Counts (2000-2004)	Meets 1% Criteria	Meets Staging Criteria
<b>Mongolian plover</b> <i>Charadrius mongolus</i>	<b>1,300</b>		<b>3,571</b> in March 2004, by John Howes		Yes	

Species	1% Criteria	Global status	Highest count	Recent Counts (2000-2004)	Meets 1% Criteria	Meets Staging Criteria
<b>Nordmann's Greenshank</b> <i>Tringa guttifer</i>	6	EN*	<b>40+</b> during December 1996 by E.T. Myers. <b>20</b> in March 1991, AWC data.	<b>10</b> in Jan 2001, by Phil D. Round <b>7</b> in March 2004, by John Howes	Yes	
<b>Greater Sand Plover</b> <i>Charadrius leschenaultii</i>	1,000		<b>300 on 22 April 2004</b> , by John Howes			Yes
<b>Kentish Plover</b>	1,000		<b>300 on 5 March 2004</b> , by John Howes			Yes

\* EN = Endangered under the IUCN Red List Category (2004)

- 'it supports appreciable numbers of an endangered or vulnerable population of migratory shorebird.'

The Krabi Estuary and Bay is important for Nordmann's Greenshank (Endangered species, IUCN), particularly during the winter (non-breeding season) and as a site during northward migration for birds returning from farther south. Based upon the records during 1991 to 2004 (presented in Table 2), the earliest recorded date at Krabi during the Autumn (southward migration) is 2<sup>nd</sup> November (in 2000) and the latest date during Spring (northward migration) is 9<sup>th</sup> April (in 1995). A maximum winter (non-breeding) season count of 40+ birds was recorded on 20 December 1996 by E.T. Myers. Based on these figures the Krabi Estuary and Bay was most important for Nordmann's Greenshank during the years 1996 and 1997. Many of these counts were made during high tide when the birds roost on bamboo fish-traps offshore of the actual Ramsar site.

**Table 2: Historical records of Nordmann's Greenshank at Krabi Estuary** (extracted from the AWC database and visiting birders log book for Dec 1993 – March 2001 at "May and Mark Restaurant", Krabi Town, and some survey results)

Date	Number	Observer(s) Names and Nationality
March 1991	20	AWC Volunteer
Dec 1991	3	AWC Volunteer
January 1993	5	AWC Volunteer
January 1994	4	AWC Volunteer
26 January 1994	2	G and N Find (UK)

3 April 1994	2	Brian (?) (UK)
6 March 1995	1	Felix Jackman
9 April 1995	6-8	M. Golley, C. Still, B and A Rabbit (UK)
20 November 1995	Yes	M-F Mourrain (France)
20 December 1995	1	Olaf A, and J. Pettersson, (Sweden)
28-31 January 1996	Yes	J. Rogers and T. Pallister (Australia)
27 February 1996	Minimum 2	T. Allwood and D. Bonsall (UK)
8 December 1996	<b>Ca. 35</b>	E.T. Myers
20 December 1996	<b>40+</b>	E.T. Myers, D. Judel and P. Holmes
27 November 1996	1	C. Carpenter (Nepal)
7 March 1997	21+	E.T. Myers
26 March 1997	9+	Leigh Lock (UK)
3 April 1997	15	C. Gibbons, M. Hunter, N. Antcliff, P. Cook, R. Aberdeen (UK)
3 April 1997	7	T. Palliser (Australia)
29 November 1997	4	P. Zakowski (UK)
7 December 1998	1	Brad and Jennifer (USA), Colin (UK)
1 January 1999	5	D. MacDonald (UK), P. Wessels (South Africa)
20 March 2000	2	Volker Erdelen (Germany).
2 November 2000	1	M. Green (Sweden)
25 January 2001	10	P.D. Round
11 March 2001	5	N and D Crock (USA and UK)
4-5 December 2003	2	John Howes
5 March 2004	7	John Howes

### 11. Wetland Types \*:

List the wetland types present (see Annex 2). List the wetland types in order of their area in the Flyway Network site, starting with the wetland type with the largest area.

#### **Marine and Coastal Wetlands : A, B, C, D, E, F, G, I, J**

- A Permanent shallow marine waters less than six metres deep at low tide; includes sea bays and straits.
- B Marine subtidal aquatic beds; includes kelp beds, sea-grass beds, tropical marine meadows.
- C Coral reefs.
- D Rocky marine shores; includes rocky offshore islands, sea cliffs.
- E Sand, shingle or pebble shores; includes sand bars, spits and sandy islets; includes dune systems.
- F Estuarine waters; permanent water of estuaries and estuarine systems of deltas.
- G Intertidal mud, sand or salt flats.
- H Intertidal marshes; includes salt marshes, salt meadows, saltings, raised salt marshes; includes tidal brackish and freshwater marshes.



- I Intertidal forested wetlands; includes mangrove swamps, nipah swamps and tidal freshwater swamp forests.
- J Coastal brackish/saline lagoons; brackish to saline lagoons with at least one relatively narrow connection to the sea.
- K Coastal freshwater lagoons; includes freshwater delta lagoons.

## 12. Jurisdiction \*:

Include territorial, e.g. state/region, and functional/sectoral, e.g. Ministry of Agriculture/Dept. of Environment, etc.

Most of the mangrove forests in the Krabi estuary were previously under concession for charcoal production, and this terminated in 2001. Since then the mangrove forests have been largely unmanaged and have reverted to community forestry and biodiversity conservation needs. The Khlong Chilat mangroves and the 45 million year old fossil mollusc beach at Laem Pho are part of the Had Nopparat Tara Pi Pi Island Marine National Park, which is state-owned land.

## 13. Management authority \*:

Provide the name and address of the local office(s) of the agency(ies) or organisation(s) directly responsible for managing the wetland and the title and/or name and email address/phone number of the person or persons in this office with direct responsibility for managing the wetland.

- 1) Mangrove Forest Management Unit 3 and Unit 4  
Department of Marine and Coastal
  
- 2) Krabi Municipality  
Utrakij Road, Muang District, Krabi Province 81000  
Thailand.  
Tel. 66-75- 611120, Fax. 66-75-620603

## 14. Bibliographical references \*:

A list of key technical references relevant to the wetland, including management plans, major scientific reports, and bibliographies, if such exist. Please list Web site addresses dedicated to the site or which prominently feature the site, and include the date that the Web site was most recently updated. When a large body of published material is available about the site, only the most important references need be cited, with priority being given to recent literature containing extensive bibliographies.

- 1) Howes, J., Nutcharin Kleawkla, and Vitoon Sirisarntiphong. (2004). Implementation of the Ramsar Convention in Thailand: Management and Protection of Wetland Areas. Wetland Ecology Component: Ecological Characterisation of Krabi Estuary and Bay. Final Report. MPW and ONEP, Bangkok.

- 2) IUCN (2004). 2004 IUCN Red List of Threatened Species < [www.redlist.org](http://www.redlist.org) >. Downloaded on 05 Sept 2005.
- 3) Parr, John W.K.(1988). A Evaluation of Mangroves and Mudflats at Krabi, South Thailand, A Project of the Asian Wetland Bureau in co-operation with the Royal Thai Forest Department, December 1988.
- 4) National Inventory of Natural Wetland: Southern Part of Thailand, Office of Environmental Policy and Planning, Bangkok, October, 2000.
- 5) Scott, Derek A. and Jintanukul, J.(1988). A Directly of Asian Wetlands, IUCN, The World Conservation Union, p.728-729.
- 6) Bird Conservation Society of Thailand (2001). The Survey of Bird Habitat in Non-Hunting Area and Important Estuaries in the Southern Part of Thailand, Interim Report, January 2001.
- 7) AWC 1987-2001 data.

#### **15. Physical features of the site:**

Describe, as appropriate, the geology, geomorphology; origins - natural or artificial; hydrology; soil type; water quality; water depth, water permanence; fluctuations in water level; tidal variations; downstream area; general climate, etc.

Krabi Estuary consists of a low-lying coastal plain that is intersected by three main river channels and various smaller channel features. There is evidence of successive low dune formation and the western-facing coast is dominated by sandy beaches with 1-2 km wide sandy inter-tidal zones. Immediately offshore is a 6 km wide, shallow (< 5m.) in-shore shelf with some isolated islets. Altitude approx. 5 m below sea level to approx. 30 m above sea level with isolated hills at > 100 m.

The total area of the Krabi Estuary and Bay Ramsar site is 21,299 ha. Of this 7,303 ha. (ca. 34%) is inter-tidal mangrove forest and approximately 2,259 ha. (10.6%) is inter-tidal sand flat. The remainder is either water (river channels and sea) or under other land use (agriculture, towns and villages, etc) or other natural vegetation (beach forest, limestone karst forest, etc).

The coastline of the Ramsar site is dominated by three major river estuaries which empty into Krabi Bay and the Andaman Sea. These are, the combined estuary of the Khlong Chilat and Pak Nam Krabi, the Khlong Yuan and the Khlong Phela and a much smaller inlet (Khlong Thalu)

The currents, waves and sediments movements along the coast are dominated by three major estuaries that empty into the Bay (these are described above along with some details on sediments and movements). Sediment loads from the other inlets are considerably less

with minor sediment plumes up to 2 km offshore. Much of the sediment along the coast appears to have originated from the Pak Nam Krabi, as dictated by long-shore drift.

Tidal records from Krabi Bay indicate that the tidal cycle is “harmonic” in nature. The Spring Tide ranges between +2.7 and 2.8m and a Neap tide ranges between +0.83 and 0.86 m.

The freshwater drainage of Krabi Province is dominated by River Basin No. 25: Peninsula West Coast as defined by the Royal Irrigation Department, Hydrology Division, Bangkok.

The climate of the Krabi Estuary and Bay is typical of the tropical monsoon-type climate of South Thailand and South-east Asia as a whole. The region is characterised by high annual average temperatures of around 30°C with rates of relative humidity in excess of 80% and high levels of annual rainfall (around 2,000 mm per annum). Due to its coastal location, the area is heavily influenced by the West and North-east Monsoons (May-October and November-April respectively). The majority of the rainfall occurs at the end of the West Monsoon (and during the inter-monsoon period) in September and October and the strongest winds (99 knots) recorded during the NE Monsoon.

Monthly temperatures in Krabi Town range between a minimum mean of 23.3 °C and a maximum mean of 32.5 °C. March is generally the hottest month with a maximum mean of 34.6 °C whilst December and January have the coolest temperatures with a minimum mean of 22.2 °C. On the island of Ko Lanta the mean relative humidity is 80%, with a minimum of 74% in October and 86 % in January.

#### **16. Physical features of the catchment area:**

Describe the surface area, general geology and geomorphological features, general soil types, and climate (including climate type).

#### **17. Hydrological values:**

Describe the functions and values of the wetland in groundwater recharge, flood control, sediment trapping, shoreline stabilization, etc.

The principal values of Krabi Estuary are sediment trapping, transportation and maintenance of seawater quality.

#### **18. General ecological features:**

Provide further description, as appropriate, of the main habitats, vegetation types, plant and animal communities present in the Flyway Network site, and the ecosystem services of the site and the benefits derived from them.

Krabi Estuary and Bay includes a diverse array of mangrove forest communities along with inter-tidal sand-flats, limestone karst formations with evergreen forest, a fossil mollusc beach, coral reefs and seagrass meadows.

### 19. Noteworthy flora:

Provide additional information on particular species and why they are noteworthy indicating, e.g., which species/communities are unique, rare, endangered or biogeographically important, etc. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the SIS.*

(Please add here the species which do not come under sec no 14)

Six broadly characteristic types of vegetation assemblage are found in the Krabi Estuary and Bay Ramsar site. These are mangrove forests, swamp forests and sea grass beds (the major “wetland assemblages”) and limestone karst forest, beach forests and agriculture (mostly non-wetland assemblages).

Mangroves are the dominant vegetation assemblage in the Krabi Estuary and Bay. They are predominantly found throughout the shallow inter-tidal zone in areas that are influenced by the daily tidal variation. In Krabi, mangrove forests also occur along the landward margin of the inter-tidal zone in areas that are not directly affected by daily tidal fluctuations but may be during the highest tides each month – these areas are known as “back-mangal” or mangrove transition zone.

Fifty species of mangrove plants and mangrove associated plant species have been recorded in the Krabi Estuary and Bay. This includes 25 species of “true” mangroves (i.e., plant species that are fully adapted to inter-tidal ecosystems) and 26 “associated” plant species (i.e., plant species that have some adaptations to inter-tidal conditions but are not restricted to this ecotone).

“True” Mangroves include *Acanthus volubilis*, *A. ilicifolius*, *Avicennia alba*, *A. marina*, *A. officinalis*, *Lumnitzera littorea*, *L. racemosa*, *Exoecaria agallocha*, *Xylocarpus mekongensis*, *X. granatum*, *Aegiceras corniculatum*, *Nypa fruticans*, *Rhizophora apiculata*, *R. mucronata*, *Bruguiera cylindrica*, *B. gymnorrhiza*, *B. hainsii*, *B. parviflora*, *Ceriops decandra*, *C. tagal*, *Scyphiphora hydrophyllacea*, *Merope angulata*, *Sonneratia caseolaris*, *S. alba*, *Heritiera littoralis*.

“Mangrove Associates” include *Cerbera odollam*, *Finlaysonia obovate*, *Dolichandrone spathacea*, *Terminalia catappa*, *Barringtonia asiatica*, *Derris trifoliata*, *D. indica*, *Caesalpinia crista*, *C. bonduc*, *Hibiscus tiliaceus*, *Thespesia populnea*, *Phoenix paludosa*, *Acrostichum aureum*, *A. speciosum*, *Brownlowia tersa*, *Amoora (Agalaia) cucullate*, *Atalantia monophylla*, *Cordia cochinchensis*, *Eugenia furacea*, *Flagellaria indica*,

*Pentaspadon velutinus*, *Pluchea indica*, *Premna obtusifolia*, *Sesuvium portulacastrum*, *Tristellateia australasiae*

Other natural assemblages only occur in small areas or discrete zones. These include sea grass beds in the inter-tidal and sub-tidal areas, beach forest and beach vegetation along the sandy beach ridges and crests, small areas of *Melaleuca* swamp forest in Taling Chan and at Laem Pho and limestone karst forest on the numerous limestone outcrops in the area.

Most other vegetation assemblages within the site are man-made agricultural systems – rice fields, *Para* rubber plantation and oil palm plantations.

## 20. Noteworthy fauna:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in 10. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the SIS.*

(Please add here the species which do not come under sec no 14)

A full list of shorebirds species recorded at Krabi Estuary is in Table 3. Of a total 27 species of shorebirds recorded here, 25 are migratory species (Table 1).

Other waterbird species recorded include Grey Heron *Ardea cinerea*, Roseate Tern *Sterna dougallii*, Great Crested Tern *S. bergii* and Lesser Crested Tern *S. bengalensis*) A recent record of Indian Cormorant *Phalacrocorax fuscicollis*, once confirmed, would be a first for peninsular Thailand.

**Table 3: Highest counts of Shorebirds recorded in Krabi Estuary**

Species	1% Criteria	Global status	Maximum count	Recent Counts (2000-2004)
Black-winged Stilt			A pair in October 2002, John Howes	
Grey Plover	1300		150 in Mar 1991, AWC record	79 in March 2004, John Howes
Pacific Golden Plover	1,000		112 in Nov 2003, John Howes	112 in Nov 2003, John Howes
<b>Mongolian Plover</b>	<b>1,300</b>		<b>3,571</b> in March 2004, John Howes	

Species	1% Criteria	Global status	Maximum count	Recent Counts (2000-2004)
<b>Greater Sand Plover</b>	1,000		<b>300 on 22 April 2004</b> , by John Howes	
<b>Kentish Plover</b>	1,000		<b>300 on 5 March 2004</b> , by John Howes	
Bar-tailed Godwit	1,500		200 in Mar 1991, AWC record	150, October 200, John Howes
Black-tailed Godwit	1,600		60 in Jan 1994, AWC record	
Asian Dowitcher	230	NT	4 in Mar 1992, B. Barnacal	2 in November 2003, John Howes
Eurasian Curlew	350		54 in Sep 1988, AWC record	30+, May 2000, Chris Gooddie
Whimbrel	550		80 in October 2002, John Howes	
Redshank	1,000		50 in Nov 1997, Chris Gooddie	25 in November 2003, John Howes
Common Greenshank	550		120 in November 2003, John Howes	
<b>Nordmann's Greenshank</b>	<b>6</b>	<b>EN</b>	<b>40+</b> during December 1996, E.T. Myers. <b>20</b> in March 1991, AWC data.	<b>10</b> in Jan 2001, Phil D. Round <b>7</b> in March 2004, John Howes
Wood Sandpiper	1,000		2 in November 2003, John Howes	
Terek Sandpiper	500		<b>450</b> in Jan 1999, by P.D. Round	370 in March 2004, John Howes
Common Sandpiper	300		15 in Mar 1991, AWC record	5 in November 2003, John Howes
Ruddy Turnstone	1,000		60 in April 2004, John Howes	
Grey-tailed Tattler	400		1 in April 2004, John Howes	
Great Knot	3,800		105 in Nov 2003, John Howes	
Red Knot	2,200		2 in May 1996, E Cristopherson	
Red-necked Stint	3,200		100 in April 2004, John Howes	
Curlew Sandpiper	1,800		20 in Dec 1991, AWC record	
Temminck's	1,000		25 in Mar 1991, AWC	

Species	1% Criteria	Global status	Maximum count	Recent Counts (2000-2004)
Stint			record	
Sanderling	220		25 in February 2004, John Howes	
Malaysian Plover (non-migrant)	250	NT	3 in Sep 1988, AWC record	2 in November 2003, John Howes
Red-wattled lapwing (non-migrant)			A pair in October 2002 and February 2004, John Howes	

At least 222 bird species are found in the mangrove area. This includes at least 6 Globally Threatened species, Christmas Island frigate bird *Fregata andrewsi* (Critical Endangered), Nordmann's Greenshank *Tringa guttifer* (Endangered); Lesser Adjutant *Leptoptilos javanicus*, Chinese Egret *Egretta eulophotes*, black-faced spoonbill (*Platalea minor*) and Masked Finfoot *Heliopais personata* (Vulnerable), and 4 Near Threatened species Malaysian plover *Charadrius peronii*, Asian dowitcher *Limnodromus semipalmatus*, Mangrove Pitta *Pitta megarhyncha* and White-chested Babbler *Trichastoma rostratum*.

Mangrove associated species include the Mangrove pitta *Pitta megarhyncha*, Mangrove blue flycatcher *Cyornis rufigaster*, Brown-winged kingfisher *Pelargopsis amauroptera*, Ruddy kingfisher *Halcyon coromanda*, Greater flameback *Chrysocolaptes lucidus*, Streak-breasted Woodpecker *Picus viridanus*, Great tit *Parus major*, Copper-throated sunbird *Nectarinia calcostetha*, Chestnut-bellied malkoha *Phaenicophaeus sumatranus*, Mangrove whistler *Pachycephala grisola*.

Other bird species include the Ashy-throated Warbler *Phylloscopus maculipennis*, Edible-nest Swiftlet *Aerodramus fusciphagus*, Black-nest Swiftlet *A. maximus*, White-bellied Woodpecker *Dryocopus javensis* and Great Slaty Woodpecker *Muelleripicus pulverulentus*.

Krabi Estuary and Bay is of surprisingly high significance for marine mammals (cetaceans), with up to 20 species possibly occurring in the area and confirmed sightings or strandings of at least 10 species. These include IUCN "Globally Threatened" species such as Bryde's whale (*Balaenoptera edeni*), sperm whale (*Physeter macrocephalus*), false killer whale (*Pseudorca crassidens*) and killer whale (*Orcinus orca*) as well as commoner smaller cetaceans such as bottlenose dolphin (*Tursiops aduncus*), finless porpoise (*Neophocaena phocaenoides*) and hump-backed dolphin (*Sousa chinensis*).

Three species of marine turtle are regularly recorded within the Krabi Estuary and Bay, the most common of these is the IUCN “Critically Endangered” hawksbill turtle (*Eretmochelys imbricata*). The other species are the IUCN “Globally Endangered” species green sea turtle (*Chelonia mydas*) and olive-ridley turtle (*Lepidochelys olivacea*).

At least 17 species of terrestrial mammals have also been recorded at Krabi, these include wetland dependent species such as the smooth otter (*Lutrogale perspicillata*), Asian short-clawed otter (*Aonyx cinerea*), fishing cat (*Prionailurus viverrinus*) and crab-eating mongoose (*Herpestes urva*). The most dominant mammal species in the mangrove forests is the long-tailed or crab-eating macaque (*Macaca fascicularis*).

Of the 29 species of terrestrial reptiles recorded at Krabi, only four are commonly found in the mangrove forest, these are *Draco maculatus*, *Varanus salvator*, *Boiga dendrophila* and *Trimeresurus purpureomaculatus*. All other species are commonly found in the plantation and abandoned agricultural areas but will also use mangrove forests to a limited extent.

Only one species of amphibian is adapted to live in the brackish water mangrove habitat at Krabi. *Rana cancrivora* (the mangrove frog) is able to withstand the mildly saline conditions in the back mangal. The other 7 species of amphibian are all characteristic of disturbed habitats such as plantations, villages and agricultural areas. The most abundant is the common Asian toad (*Bufo melanostictus*), the common tree frog (*Rhacophorus leucomystax*), and the ox frog (*Kaloula pulchra*).

Species richness and diversity of the **fish** fauna in Krabi Estuary and Bay appears to be high. Whilst no comprehensive fish surveys have been conducted within the Krabi Estuary and Bay Ramsar site (see next paragraph), detailed fish studies and surveys have been undertaken in adjacent areas around Phuket island and in Phang-nga Bay. At least 232 species (from 69 Families) of fish have been recorded from mangrove habitats in these areas, 149 species (from 51 families) from the sea grass beds, and 233 species (from 44 Families) from coral reef habitats.

Major Fish Groups in Mangroves at Krabi include *Bathygobius fuscus*, *Ctenogobius criniger*, *Buntis buntis*, *Acentrogobius* sp., *Stigmatogobius* sp., *Epinephelus tauvina*, *Gerres oblongus*, *G. filamentosus*, *G. macrosoma*, *Hyporhamphus gaimardi*, *Hemirhamphus marginatus*, *Johnius argentatus*, *Lutjanus russelli*, *L. bindus*, *L. elongatus*, *L. johni*, *L. dussumeri*, *L. lutjanus*, *L. insidiator*, *L. fulviflamana*, *Mugil speegleri*, *M. dussumieri*, *Liza dussumerii*, *Callionymus japonicus*, *Ambanis gymnocephala*, *Ambassis urotaenia*, *Leiognathus splendens*, *Sillago sihama*, *Vespicula trachinoides*, *Atherina valenciennes*.



The most abundant and have economic value are Milkfish (*Chanos chanos*), Giant Seaperch (*Lates calcarifer*) and other species such as Indo-pacific Tarpon (*Megalops cyprinoides*), various species of Mullet (*Mugil spp.*), Perchlet (*Ambassis spp.*) and Slipmouth (*Leiognathus spp.*), etc. (Parr, W.K. Jonn, 1988).

**21. Social, economic and cultural values:**

a) Describe if the site has any general social, economic and/or cultural values e.g., fisheries production, forestry, religious importance, archaeological sites, social relations with the wetland, etc. Distinguish between historical/archaeological/religious significance and current socio-economic values:

The mud flat of Krabi estuary is one of the important sites of the southern part of Thailand for migratory birds. The (former) mangrove concessions No. 24 and 26 still have very high biodiversity – supporting high populations of mangrove birds and an abundance of aquatic animals. The site has tourism and educational values. Since the area is near to the town, it is a suitable bird-watching site for tourists, students and other interest groups.

b) Is the site considered of international importance for holding, in addition to relevant ecological values, examples of significant cultural values, whether material or non-material, linked to its origin, conservation and/or ecological functioning? (Double-click the checkbox to check and choose “Checked” under “Default Value” from “Check Box Form Field Options” window)

If yes, tick the box  and describe this importance under one or more of the following categories:

- I. Sites which provide a model of wetland wise use, demonstrating the application of traditional knowledge and methods of management and use that maintain the ecological character of the wetland:
- II. Sites which have exceptional cultural traditions or records of former civilizations that have influenced the ecological character of the wetland:
- III. Sites where the ecological character of the wetland depends on the interaction with local communities or indigenous peoples:
- IV. Sites where relevant non-material values such as sacred sites are present and their existence is strongly linked with the maintenance of the ecological character of the wetland:

**22. Land tenure/ownership:**

a) Within the Flyway Network site:

Mangrove forest, mudflats, rocky mountain, and seagrass meadow areas are state-owned.

b) In the surrounding area:

Community lands in the surrounding area are privately owned.

**23. Current land (including water) use:**

a) Within the Flyway Network site:

Fishing and harvesting of molluscs, prawns, crabs, and fin-fish is intensive (and currently unrestricted) in the mangrove estuary, tidal flats and seagrass areas. Fruits of the *Nypa* Palms are harvested for food, while the fronds are used for roof thatching. There has been quite considerable development for aquaculture ponds and this continues (2004).

b) In the surroundings/catchment:

**24. Factors (past, present or potential) adversely affecting the site's ecological character, including changes in land (including water) use and development projects:**

a) Within the Flyway Network site:

Remaining mangroves at the site are under pressure from illegal encroachment by developments, while industrialization and increased aquaculture may also pose threats in the future. There is probably some hunting of larger waterbirds (e.g., the last remaining pair of masked finfoot were shot by local policemen in 2000).

b) In the surrounding area:

The expansion of communities surrounding Krabi Estuary and the rapid growth of tourism are likely to cause water quality degradation.

**25. Conservation measures taken:**

**a)** List national and/or international category and legal status of protected areas, including boundary relationships with the Flyway Network site:

In particular, if the site is partly or wholly a World Heritage Site and/or a UNESCO Biosphere Reserve, please give the names of the site under these designations.

The sand beaches, rocky wooded hills, mangroves and *Melaleuca* woodland which line the shores of the bay of Ao Nang, to the west of the site east as far as Pak Nam Krabi, are included in the Hat Nopparat Thara-Mu Ko Phi Phi National Park. Areas of mangrove at the site are categorized as National Reserve Forest and can only be cut under legitimate concessions.

The site was designated as a Ramsar site of international importance in July 2001 by the Government of Thailand.

**b)** If appropriate, list the IUCN (1994) protected areas category/ies which apply to the site (tick the box or boxes as appropriate, see Annex 3):

Ia ; Ib ; II ; III ; IV ; V ; VI ; N/A

c) Does an officially approved management plan exist; and is it being implemented?:

If yes, is it being implemented?: If no, is one being planned?

d) Describe any other current management practices:

## **26. Conservation measures proposed but not yet implemented:**

e.g. management plan in preparation; official proposal as a legally protected area, etc.

The Danida-funded project “Implementing the Ramsar Convention in Thailand: Management and Protection of Wetlands (MPW)” has been developing a participatory approach to Ramsar site management planning based at Krabi. The MPW project runs until 2006 and is currently finalising the management plan which includes a series of community-driven initiatives to improve economic returns from the wetland, zoning plans to prevent further encroachment and loss of mangroves, development of tourism infrastructure, including shorebird roost platforms and observation towers and hides, and creation of better awareness of the functions and values of the site. The MPW Project has also made recommendations to extend the western boundary of the Ramsar site to include the most important off-shore roost sites for shorebirds and the extensive sea grass beds off Sriboya and Pu islands.

The area is also a focal site for the Royal Thai Government/European Union CHARM (Coastal Habitats and Resources Management) Project – developing integrated coastal zone management plans for the three provinces of Phang-nga, Krabi and Trang.

## **27. Current scientific research and facilities:**

e.g., details of current research projects, including biodiversity monitoring; existence of a field research station, etc.

Mangrove Forest Management Units 3 and 4 have on-going programmes to assess the status of mangrove forests throughout the area. The Coastal Fisheries Research Centre at Laem Pho has an active research and development programme focused on restoration of the Conch mollusc fishery and the mud-crab fishery (associated with seagrass beds and mangrove forests respectively) at Sriboya Island and the nearby Lanta Island. The Centre also has a monthly water quality monitoring programme with at least 7 stations inside the Ramsar site.

## **28. Current communications, education and public awareness (CEPA) activities related to or benefiting the site:**

e.g. visitors' centre, observation hides and nature trails, information booklets, facilities for school visits, etc.

Under the MPW Project, the Wetlands International – Thailand Programme has developed and implemented a conservation education programme focused on local communities, schools and government stakeholders.

### 29. Current recreation and tourism:

State if the wetland is used for recreation/tourism; indicate type(s) and their frequency/intensity.

The area has much recreational potential owing to its proximity to the town of Krabi. It is perhaps the most easily accessible area of species-rich mangrove for bird-watchers and naturalists in Thailand.

### 30. Threats \*:

Which of the following threats is present historically – when the threat stopped but the effects are still there (H), currently (C) or potentially (P)?

	Historically	Currently	Potentially
<b>Residential and commercial development</b>			
housing and urban areas	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
commercial and industrial areas	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
tourism and recreation areas	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Agriculture and aquaculture</b>			
annual and perennial non-timber crops	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
wood and pulp plantations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
livestock farming and ranching	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
marine and freshwater aquaculture	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Energy production and mining</b>			
oil and gas drilling	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
mining and quarrying	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
renewable energy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Transportation and service corridors</b>			
roads and railroads	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
utility and service lines	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
shipping lanes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
flight paths	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

<b>Biological resource use</b>			
hunting and collecting terrestrial animals	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
gathering terrestrial plants	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
logging and wood harvesting	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
fishing and harvesting aquatic resources	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Human intrusions and disturbance</b>			
recreational activities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
war, civil unrest and military exercises	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
work and other activities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Natural system modifications</b>			
fire and fire suppression	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
dams and water management/use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
other ecosystem modifications	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Invasive and other problematic species and genes</b>			
invasive non-native/alien species	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
problematic native species	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
introduced genetic material	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Pollution</b>			
household sewage and urban waste water	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
industrial and military effluents	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
agricultural and forestry effluents	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
garbage and solid waste	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
air-borne pollutants	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
excess energy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Geological events</b>			
volcanoes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
earthquakes/tsunamis	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
avalanches/landslides	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Climate change and severe weather</b>			
habitat shifting and alteration	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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droughts	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
temperature extremes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
storms and flooding	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Please write here any additional threats and comments/queries you have on the threats.**

## **Annex 1: Criteria for the inclusion of sites in the Flyway Site Network**

(From the Partnership Text)

To be considered for inclusion in the Flyway Site Network, this Partnership adopts the following criteria:

- a. Convention on Wetlands (Ramsar, Iran, 1971) criteria for internationally important sites for migratory waterbirds. That is:
  - Criterion 2: A wetland should be considered internationally important if it supports vulnerable, endangered, or critically endangered species or threatened ecological communities.
  - Criterion 5: A wetland should be considered internationally important if it regularly supports 20,000 or more waterbirds.
  - Criterion 6: A wetland should be considered internationally important if it regularly supports 1% of the individuals in a population of one species or subspecies of waterbird.
  
- b. The staging criteria as applied under the Asia - Pacific Migratory Waterbird Conservation Strategy. That is:
  - i. A staging site should be considered internationally important if it regularly supports 0.25% of individuals in a population of one species or subspecies of waterbirds on migration.
  - ii. A staging site should be considered internationally important if it regularly supports 5,000 or more waterbirds at one time during migration.
  
- c. Under exceptional circumstances a site can be nominated if it supports migratory waterbirds at a level or stage of their life cycle important to the maintenance of flyway populations. Justification of such nominations will be considered by the Partnership on a case by case basis.

## Annex 2: Ramsar Classification System for Wetland Type

The codes are based upon the Ramsar Classification System for Wetland Type as approved by Recommendation 4.7 and amended by Resolutions VI.5 and VII.11 of the Conference of the Contracting Parties. The categories listed herein are intended to provide only a very broad framework to aid rapid identification of the main wetland habitats represented at each site.

To assist in identification of the correct Wetland Types to list in section 19 of the RIS, the Secretariat has provided below tabulations for Marine/Coastal Wetlands and Inland Wetlands of some of the characteristics of each Wetland Type.

### Marine/Coastal Wetlands

- A -- **Permanent shallow marine waters** in most cases less than six metres deep at low tide; includes sea bays and straits.
- B -- **Marine subtidal aquatic beds**; includes kelp beds, sea-grass beds, tropical marine meadows.
- C -- **Coral reefs.**
- D -- **Rocky marine shores**; includes rocky offshore islands, sea cliffs.
- E -- **Sand, shingle or pebble shores**; includes sand bars, spits and sandy islets; includes dune systems and humid dune slacks.
- F -- **Estuarine waters**; permanent water of estuaries and estuarine systems of deltas.
- G -- **Intertidal mud, sand or salt flats.**
- H -- **Intertidal marshes**; includes salt marshes, salt meadows, saltings, raised salt marshes; includes tidal brackish and freshwater marshes.
- I -- **Intertidal forested wetlands**; includes mangrove swamps, nipah swamps and tidal freshwater swamp forests.
- J -- **Coastal brackish/saline lagoons**; brackish to saline lagoons with at least one relatively narrow connection to the sea.
- K -- **Coastal freshwater lagoons**; includes freshwater delta lagoons.
- Zk(a) – **Karst and other subterranean hydrological systems**, marine/coastal

### Inland Wetlands

- L -- **Permanent inland deltas.**
- M -- **Permanent rivers/streams/creeks**; includes waterfalls.
- N -- **Seasonal/intermittent/irregular rivers/streams/creeks.**
- O -- **Permanent freshwater lakes** (over 8 ha); includes large oxbow lakes.
- P -- **Seasonal/intermittent freshwater lakes** (over 8 ha); includes floodplain lakes.
- Q -- **Permanent saline/brackish/alkaline lakes.**
- R -- **Seasonal/intermittent saline/brackish/alkaline lakes and flats.**



- Sp -- **Permanent saline/brackish/alkaline marshes/pools.**
- Ss -- **Seasonal/intermittent saline/brackish/alkaline marshes/pools.**
- Tp -- **Permanent freshwater marshes/pools;** ponds (below 8 ha), marshes and swamps on inorganic soils; with emergent vegetation water-logged for at least most of the growing season.
- Ts -- **Seasonal/intermittent freshwater marshes/pools on inorganic soils;** includes sloughs, potholes, seasonally flooded meadows, sedge marshes.
- U -- **Non-forested peatlands;** includes shrub or open bogs, swamps, fens.
- Va -- **Alpine wetlands;** includes alpine meadows, temporary waters from snowmelt.
- Vt -- **Tundra wetlands;** includes tundra pools, temporary waters from snowmelt.
- W -- **Shrub-dominated wetlands;** shrub swamps, shrub-dominated freshwater marshes, shrub carr, alder thicket on inorganic soils.
- Xf -- **Freshwater, tree-dominated wetlands;** includes freshwater swamp forests, seasonally flooded forests, wooded swamps on inorganic soils.
- Xp -- **Forested peatlands;** peatswamp forests.
- Y -- **Freshwater springs; oases.**
- Zg -- **Geothermal wetlands**
- Zk(b) – **Karst and other subterranean hydrological systems, inland**

Note: “**floodplain**” is a broad term used to refer to one or more wetland types, which may include examples from the R, Ss, Ts, W, Xf, Xp, or other wetland types. Some examples of floodplain wetlands are seasonally inundated grassland (including natural wet meadows), shrublands, woodlands and forests. Floodplain wetlands are not listed as a specific wetland type herein.

#### **Human-made wetlands**

- 1 -- **Aquaculture** (e.g., fish/shrimp) **ponds**
- 2 -- **Ponds;** includes farm ponds, stock ponds, small tanks; (generally below 8 ha).
- 3 -- **Irrigated land;** includes irrigation channels and rice fields.
- 4 -- **Seasonally flooded agricultural land** (including intensively managed or grazed wet meadow or pasture).
- 5 -- **Salt exploitation sites;** salt pans, salines, etc.
- 6 -- **Water storage areas;** reservoirs/barrages/dams/impoundments (generally over 8 ha).
- 7 -- **Excavations;** gravel/brick/clay pits; borrow pits, mining pools.
- 8 -- **Wastewater treatment areas;** sewage farms, settling ponds, oxidation basins, etc.
- 9 -- **Canals and drainage channels, ditches.**
- Zk(c) -- **Karst and other subterranean hydrological systems, human-made**

## **Annex 3: IUCN Protected Areas Categories System**

IUCN protected area management categories classify protected areas according to their management objectives. The categories are recognised by international bodies such as the United Nations and by many national governments as the global standard for defining and recording protected areas and as such are increasingly being incorporated into government legislation.

### **Ia Strict Nature Reserve**

Category Ia are strictly protected areas set aside to protect biodiversity and also possibly geological/geomorphical features, where human visitation, use and impacts are strictly controlled and limited to ensure protection of the conservation values.

### **Ib Wilderness Area**

Category Ib protected areas are usually large unmodified or slightly modified areas, retaining their natural character and influence without permanent or significant human habitation, which are protected and managed so as to preserve their natural condition.

### **II National Park**

Category II protected areas are large natural or near natural areas set aside to protect large-scale ecological processes, along with the complement of species and ecosystems characteristic of the area, which also provide a foundation for environmentally and culturally compatible, spiritual, scientific, educational, recreational, and visitor opportunities.

### **III Natural Monument or Feature**

Category III protected areas are set aside to protect a specific natural monument, which can be a landform, sea mount, submarine cavern, geological feature such as a cave or even a living feature such as an ancient grove. They are generally quite small protected areas and often have high visitor value.

### **IV Habitat/Species Management Area**

Category IV protected areas aim to protect particular species or habitats and management reflects this priority. Many Category IV protected areas will need regular, active interventions to address the requirements of particular species or to maintain habitats, but this is not a requirement of the category.

### **V Protected Landscape/ Seascape**

A protected area where the interaction of people and nature over time has produced an area of distinct character with significant, ecological, biological, cultural and scenic value: and where safeguarding the integrity of this interaction is vital to protecting and sustaining the area and its associated nature conservation and other values.

### **VI Protected area with sustainable use of natural resources**

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Category VI protected areas conserve ecosystems and habitats together with associated cultural values and traditional natural resource management systems.