SOBA 4.5: BIODIVERSITY OF THE AYEYARWADY BASIN

AYEYARWADY STATE OF THE BASIN ASSESSMENT (SOBA)

Status: FINAL
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Disclaimer
"The Ayeyarwady State of the Basin Assessment (SOBA) study is conducted within the political boundary of Myanmar, where more than 93% of the Basin is situated."

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LIST OF ABBREVIATIONS

ADPA	Ayeyarwady Dolphin Protected Area
ARC	Ayeyarwady River Corridor
AZE	Alliance for Zero Extinction
BANCA	Biodiversity and Nature Conservation Association
CR	critically endangered
DD	data deficient
DoF	Department of Fisheries
EBA	Endemic Bird Area
EIA	Environmental Impact Assessment
EN	endangered
EW	extinct in the wild
EX	extinct
FAO	Food and Agriculture Organization of the United Nations
FD	Forest Department
FFI	Fauna and Flora International
GIS	Geographic Information System
ha	hectare
ICEM	International Centre for Environmental Management
IUCN	International Union for Conservation of Nature
IUCN RL	International Union for Conservation of Nature Red List
KBA	Key Biodiversity Area
LC	least concern
m	metres
mm	millimetres
MOECAF	Ministry of Environmental Conservation and Forestry
NE	not evaluated
NT	near-threatened
NWRC	National Water Resources Committee
OECD	Organization for Economic Cooperation and Development
SOBA	State of the Basin Assessment
SOBA 4-05	*State of the Basin Assessment (SOBA) 4-05: Biodiversity of the Ayeyarwady Basin*
VU	vulnerable
WET	Wetland Extent Trend Index
WCS	Wildlife Conservation Society
WWF	World Wildlife Fund

EXECUTIVE SUMMARY

The Ayeyarwady Basin is a vast area of more than 410,000 square kilometers, covering a total of 12 diverse eco-regions – from Hkakabo Razi Mountain at 5,881 metres (m) with its alpine shrub and meadow system dropping down to the delta mangroves and mudflats at sea level.

The Ayeyarwady Basin is one of the most diverse biological regions in the world. It is the 19th richest region in bird diversity globally. It is home to 1,400 mammal, bird, and reptile species of which more than 100 species are globally threatened. At least 388 fish species are known to occur in this region, but the total is estimated to be nearer 550 once most of the areas have been surveyed. For most taxa, the current knowledge is very scarce and scattered. Amphibians and many invertebrates are little studied. This report focusses on wetland and riverine habitats and the biodiversity that is relatively well-studied.

The analysis of the biodiversity in the basin is a sobering account of a wide-spread and systemic degradation of the basin's species, habitats, and ecosystem functions. The findings in this assessment confirm a wide-spread decline in almost all taxa and across almost all regions. Several vertebrate species among the mammals, birds, and reptiles have already disappeared from the Ayeyarwady Basin, and many others are likely to follow suit if conservation actions are not taken seriously and supported with proper resources. The declines are pronounced and sharp, in particular for comparatively well-monitored water birds on many river stretches and lakes. A few species are increasing. Yet the vast majority is declining and, in some areas or regions, sharply, creating a sense of urgency to protect the characteristic, yet fragile biodiversity of the Ayeyarwady Basin. The riverine breeding birds, such as terns, skimmers, and lapwings, are most affected alongside the fast disappearing freshwater turtles, reflecting the overall precarious situation in the river and its wetlands. The threats and reasons for the declines are variable and far ranging, including large-scale industrial development, flyway-related issues among the migratory birds, small-scale but increasing sand and mineral mining, precipitious hunting, and poaching across the entire basin.

The fragile river system and its wetlands are under enormous and increasing pressure from hydropower development, sand, pebble extraction, mining for gold and other minerals, and over-exploitation of its biological resources. It is a unique ecosystem and a lifeline for millions of people living in the center of the country. It deserves full protection and strict control over its resource management.

Rapid changes in social and economic conditions will likely occur across Myanmar in the near future as annual rates for economic growth are expected to be as high as 8% and tightly linked to natural resource exploitation. Overall, Myanmar is close to a market of more than half a billion people. This creates new and additional challenges for people and biodiversity, which are already under enormous environmental stress. This could be addressed through policy and institutional reform and the integration of environmental safeguards into economic development planning. Some of these safeguards must be a comprehensive network of protected areas and a sustainable resource management that is negotiated and led by communities and supervised by an Integrated River Basin Management Committee and local subsidiaries. A resource management plan for entire rivers and adjacent wetlands needs to be established that includes no-take zones free of any fishing, mining, and dredging.

In total approximately 90 key biodiversity areas have been identified, including 6 new areas based on the findings of this analysis. Only approximately 50% of these areas are included in a Protected Areas system. However, progress has been made recently, and two new Ramsar Sites have been designated.

The Ayeyarwady River is unique. Its is one of the largest rivers in Asia that has not been fragmented by dams. It is largely unconstrained in its hydrology, sediment, and nutrient flow and still hosts a unique suite of biodiversity of international importance. Its scenery with quaint villages and pagodas, impressive sandbars, and gorges is unique and beautiful. It would certainly qualify as a World Heritage Site under natural criteria and possibly also for cultural criteria. This would not only boost the conservation of the region's rich cultural and natural history but also provide a long-term vision for the local communities that builds their livelihoods and promotes a viable economy through eco-tourism and sustainable use of the river's natural resources.

Water birds have been well-studied, and long-term trend data are already available and have been analysed. These groups of birds are proposed as biodiversity indicators, and a suite of monitoring sites is proposed to monitor the health of the wetland ecosystems in the basin.

In addition to the water birds and freshwater turtles, the river dolphins act as key sentinels for the health of the river ecosystem. The Irrawaddy River dolphin population is in a critical but stable state. The Yangtze Dolphin is extinct, and the Mekong River population of the Irrawaddy Dolphin is on the brink of extinction due to human impacts on the river ecosystem. Myanmar has the choice to either follow the destructive path of the Yangtze and Mekong Rivers, where biodiversity has suffered and the dolphins have been lost (Yangtze) or almost lost (Mekong), or opt for sustainable development in balance with biodiversity and people.



1 INTRODUCTION

The Ayeyarwady Basin is a vast network of tributaries and provides a host of ecosystem services to the population as it flows through the country. It is the most important waterway in Myanmar covering 61% of the country. With a total of 413,674 square kilometers, it encompasses 12 eco-regions as defined by World Wildlife Fund (WWF, 2017), from Hkakabo Razi Mountain with an elevation of 5,881 metres (m) and its alpine shrub and meadow system to the delta mangroves at sea level. The basin can be described in three parts: 1) the mountainous Upper Ayeyarwady catchment that extends to the Himalayas, 2) the hilly and flood plain zone in the Middle Ayeyarwady, and 3) the delta landscape of the Lower Ayeyarwady. The Chindwin Basin, feeding the Ayeyarwady, also has a diversity of ecosystems shaped largely by elevation and geology. The eco-regions are distributed as follows in Table 1.1 (WWF, 2017; International Centre for Environmental Management [ICEM], 2017a).

Table 1.1 - Ecoregion representation in the Ayeyarwady Basin (ICEM, 2017a)

Ecoregions	Basin area coverage (%)
Chin Hills-Arakan Yoma montane forests	2.8
Eastern Himalayan alpine shrub and meadows	2.0
Ayeyarwady dry forests	11.4
Ayeyarwady freshwater swamp forests	4.3
Ayeyarwady moist deciduous forests	31.1
Mizoram-Manipur-Kachin rainforests	7.7
Myanmar coast mangroves	3.0
Myanmar coastal rainforests	3.1
Northern Indochina subtropical forests	18.2
Northern Triangle subtropical forests	12.1
Northern Triangle temperate forests	2.3
Nujiang Langcang Gorge alpine conifer and mixed forests	1.7
Total Values (<0.1% omitted)	**99.8**

The Upper Ayeyarwady is home to some of the least-travelled and scientifically researched territory worldwide. The region's remoteness, inaccessible terrain, and intact forests, including uncharted mountain forest to high alpine habitats, explain its rich species diversity. Nearly 300 mammalian species, including the threatened Asian elephant, tiger, red panda, and leopard, range across the Northern Triangle Subtropical Forest Eco-region. The Upper Ayeyarwady has the largest Protected Area and forest complex in Myanmar. Even with the region's inaccessibility, however, deforestation, shifting cultivation, and mining are reducing forest area and quality.

The Middle Ayeyarwady is substantially deforested. Large mammals have almost been fully extirpated from the region. Remaining intact forest pockets are found in the Pegu-Yoma Mountain Range, but limited wildlife is found outside of Protected Areas.

The Lower Ayeyarwady has seen a general decline in biodiversity due to agricultural conversion. Much of the area has been converted to agriculture. The Myanmar Coast Mangroves Eco-Region, for example, is endangered as a result of agricultural and aquaculture encroachment, urban expansion, and timber harvesting for fuelwood. The Irrawaddy freshwater swamp forests are listed as endangered and the Myanmar coastal rainforests are vulnerable.

This report aims to provide a comprehensive summary of our current knowledge of the status, trends, and threats to biodiversity in the Ayeyarwady Basin. It adds to the recent compilations for the *National Biodiversity Strategy Action Plan* (Ministry of Environmental Conservation and Forestry [MOECAF], 2015). It

focuses primarily on wetland habitats and species but also includes biodiversity of wider interest when information is available, such as for birds, most mammals, and selected reptiles. It contains a section on habitats and species, their distribution, abundance, and status. It lists hotspots (Section 3) and Key Biodiversity Areas (KBAs) (Section 4), but it also has a section on trends and threats (Section 6). The basin has been divided into the following four sub-basins (see map):

1- Upper Ayeyarwady
2- Middle Ayeyarwady
3- Lower Ayeyarwady = Delta
4- Chindwin Basin

Figure 1.1 - The Ayeyarwady Basin outline with four different sub-basins

2 DISTRIBUTION, ABUNDANCE, AND STATUS OF SPECIES

The following section describes the distribution and status of selected taxa within the Ayeyarwady Basin. Wetland and riverine species have been given a particular focus, but other species are listed and mentioned particularly when globally threatened, range-restricted, or of high conservation value.

However, data on biodiversity are scattered or, in many cases, non-existing. For most taxa, little information is available on a basin-wide scale. The best-studied groups are birds, mammals, reptiles, and fish. But even in those taxa, many important gaps have been identified and an overall summary needs to be interpreted in the context of geographically incomplete or outdated surveys. For some reptiles (e.g., freshwater turtles) status data are relatively good. For some taxa, the occurrence by sub-basin is assessed, where possible, but for most groups, this is difficult or incomplete. Information on invertebrates is scarce and not existing for many taxa, such as *Odonata*. Previous assessments (e.g., by Allen et al., 2010) focused more on the Himalayan region, band the large majorioty of the Ayeyarwady Basin was not included. IUCN kindly provided access to its species distribution data, which included almost all vertebrates (except many reptiles) and many invertebrate taxa. These data have been used in combination with other published information to display the distribution for some species and create the hotspot maps.

The IUCN Red List (RL) is a comprehensive inventory of the global conservation status of species. Species are classified by the IUCN RL into the following nine groups:

1. Extinct (EX) – No known individuals remaining.
2. Extinct in the wild (EW) – Known only to survive in captivity or as a naturalised population outside its historic range.
3. Critically endangered (CR) – Extremely high risk of exctinction in the wild.
4. Endangered (EN) – High risk of endangerment in the wild.
5. Vulnerable (VU) – Vulnerable to endangerement in the wild.
6. Near threatened (NT) – Likely to become endangered in the near future.
7. Least concern (LC) – Lowest risk, does not qualify for a more at-risk category. Widespread and abundant taxa are included in this category.
8. Data deficient (DD) – Not enough data to make an assessment of its risk of extinction.
9. Not evaluated (NE) – Has not been evaluated against the criteria.

With regard to the IUCN RL, the term 'threatened' refers to a grouping of three categories: Critically Endangered, Endangered, and Vulnerable.

2.1 Mammals

There are more than 300 species of mammals recorded in Myanmar (IUCN 2015, 2017). The majority of these are also present in the Ayeyarwady Basin (see Annex 1). Several species have not been recorded recently despite modern camera trap technology. They include two rhinoceros species (*Dicerorhinus spec.*) and the wild water buffalo (*Bubalus arnee*). Others are rare and their status in the Ayeyarwady Basin is uncertain. In total 47 species have been listed as globally threatened in Myanmar. In the Ayeyarwady Basin, a total of approximately 280 to 300 mammal species can still be expected. At least 5 endemic mammal species can be found in the Ayeyarwady Basin. These are Anthony's pipistrelle (*Hypsugo anthonyi*), Joffre's pipistrelle

(*Hypsugo lophurus*), and the popa soft-furred Rat (*Millardia kathleenae*). The central Myanmar Basin also has the largest remaining population of the endangered Eld's deer (*Rucervus eldii*).

According to the IUCN RL (IUCN, 2017), a total of 41 mammal species are listed as globally threatened in the Ayeyarwady Basin. For each of these species a distribution range is provided (IUCN, 2017) and some are illustrated. Some of the threatened species are just on the margins but likely to occur in the Ayeyarwady Basin. Table 2.1 lists all of them and their RL status. The last column shows the number of KBAs where at least the species has been recorded (see also Section 4 on KBAs).

Table 2.1 - Globally threatened mammals in the Ayeyarwady Delta: Ranked by RL status and occurrence in KBAs, some presence might be outdated

	Common name	*Scientific name*	RL	No. KBAs
1	Myanmar snub-nosed monkey	*Rhinopithecus strykeri*	CR	2
2	Chinese pangolin	*Manis pentadactyla*	CR	10
3	Sunda pangolin	*Manis javanica*	CR	4
4	Asian elephant	*Elephas maximus*	EN	16
5	Banteng	*Bos javanicus*	EN	5
6	Dhole	*Cuon alpinus*	EN	40
7	Eld's deer	*Rucervus eldii*	EN	4
8	Fishing cat	*Prionailurus viverrinus*	VU	2
9	Hairy-nosed otter	*Lutra sumatrana*	EN	1
10	Hog deer	*Axis porcinus*	EN	8
11	Black musk deer	*Moschus fuscus*	EN	3
12	Red panda	*Ailurus fulgens*	EN	3
13	Indian water buffalo	*Bubalus arnee*	EN	1
14	Phayre's leaf-monkey	*Trachypithecus phayrei*	EN	4
15	Shortridge's langur	*Trachypithecus shortridgei*	EN	4
16	Tiger	*Panthera tigris*	EN	2
17	Snow leopard	Panthera unca	EN	1
18	Large spotted civet	*Viverra megaspila*	EN	No data
19	Western hoolock gibbon	*Hoolock hoolock*	EN	2
20	Bengal slow loris	*Nycticebus bengalensis*	VU	12
21	Binturong	*Arctictis binturong*	VU	8
22	Capped langur	*Trachypithecus pileatus*	VU	4
23	Chinese goral	*Naemorhedus griseus*	VU	3
24	Clouded leopard	*Neofelis nebulosa*	VU	19
25	Eastern hoolock gibbon	*Hoolock leuconedys*	VU	10
26	Gaur	*Bos gaurus*	VU	24
27	Golden cat	*Catopuma temminckii*	VU	2
28	Smooth-coated otter	*Lutrogale perspicillata*	VU	1
29	Small-clawed otter	*Aonyx cinereus*	VU	1
30	Himalayan black bear	*Ursus thibetanus*	VU	26
31	Indo-Pacific finless porpoise	*Neophocaena phocaenoides*	VU	1
32	Irrawaddy dolphin	*Orcaella brevirostris*	VU (CR)	8
33	Leopard	*Panthera pardus*	VU	No data
34	Marbled cat	*Pardofelis marmorata*	VU	8
35	Northern pig-tailed macaque	*Macaca leonina*	VU	5
36	Red goral	*Naemorhedus baileyi*	VU	4
37	Sambar	*Rusa unicolor*	VU	31
38	Serow	*Capricornis sumatraensis*	VU	No data
39	Stump-tailed macaque	*Macaca arctoides*	VU	6
40	Sun bear	*Helarctos malayanus*	VU	11
41	Takin	*Budorcas taxicolor*	VU	3

Many large mammals may either have disappeared or declined significantly. Most of them are listed in Table 2.1. Some selected species' distribution is shown in Figure 2.1. (such as the charismatic tiger, *Panthera tigris;* the Asian Elephant, *Elephas maximus,* and the threatened but still wide-spread dhole, *Cuon alpinus,* and clouded leopard, *Neofelis nebulosa*).

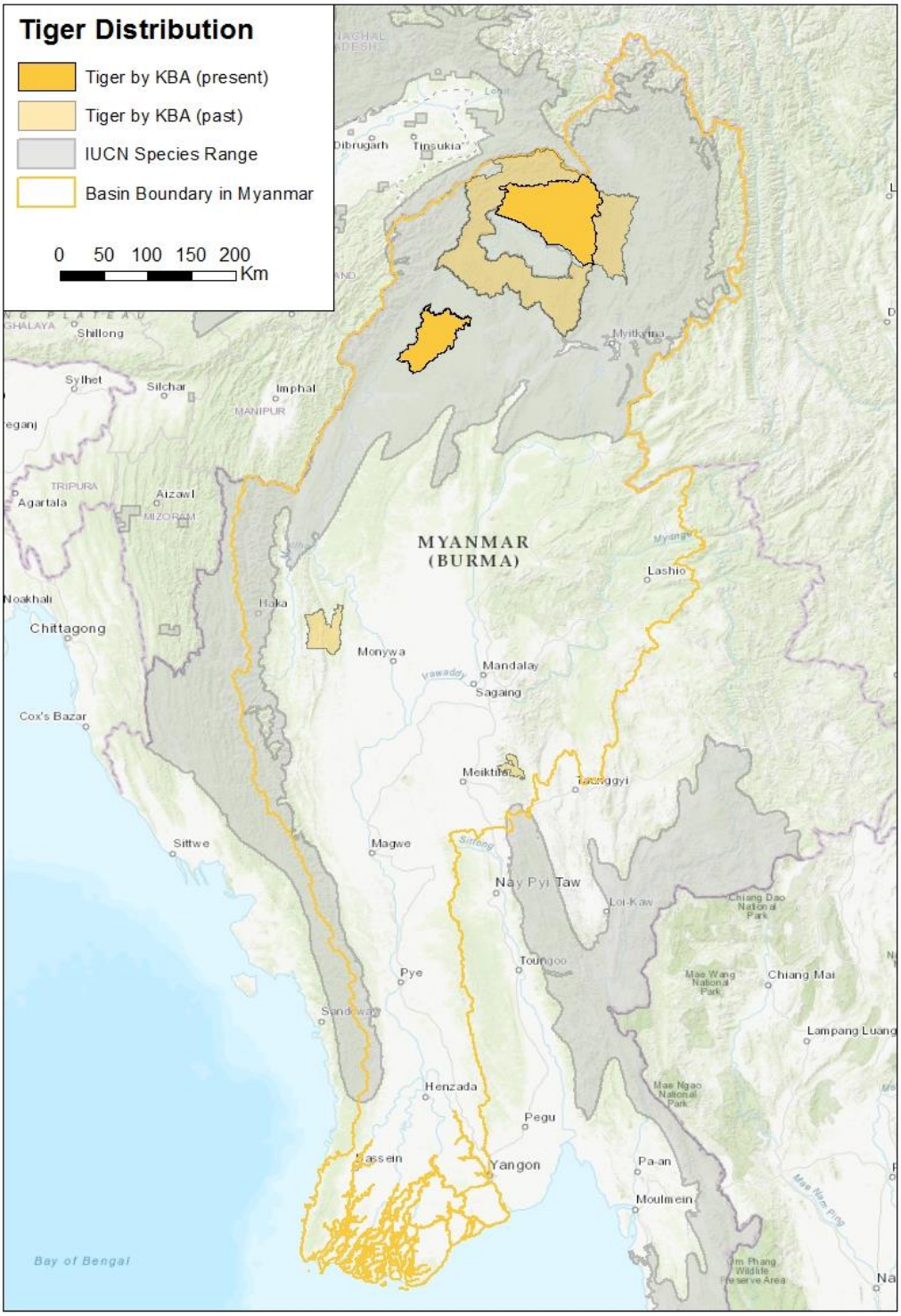


Figure 2.1 - Distribution of the tiger, *Panthera tigris* (IUCN light grey), and KBAs with current tiger presence

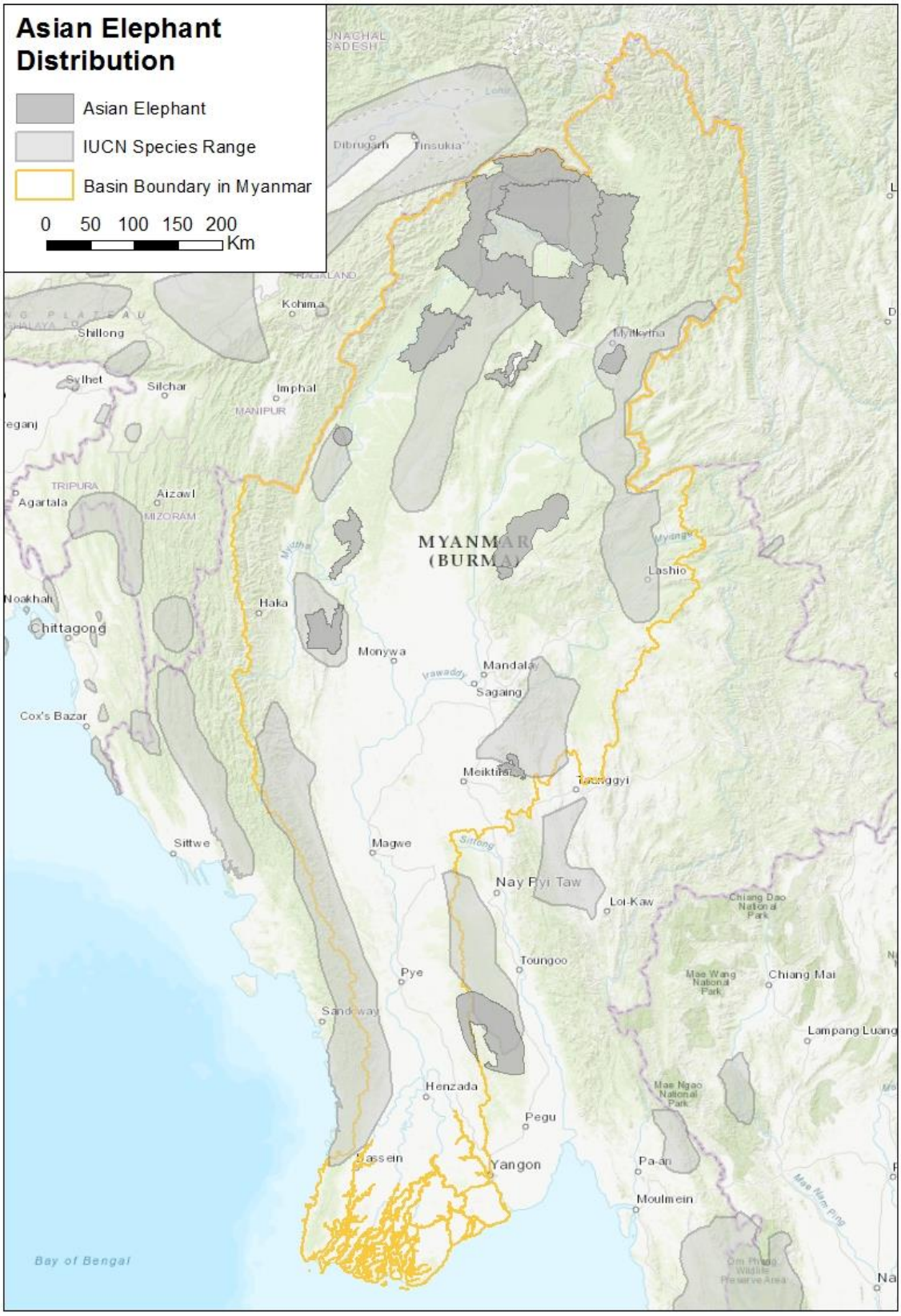


Figure 2.2- Distribution of the Asian elephant, *Elephas maximus* (IUCN light grey), and KBAs with current elephant presence

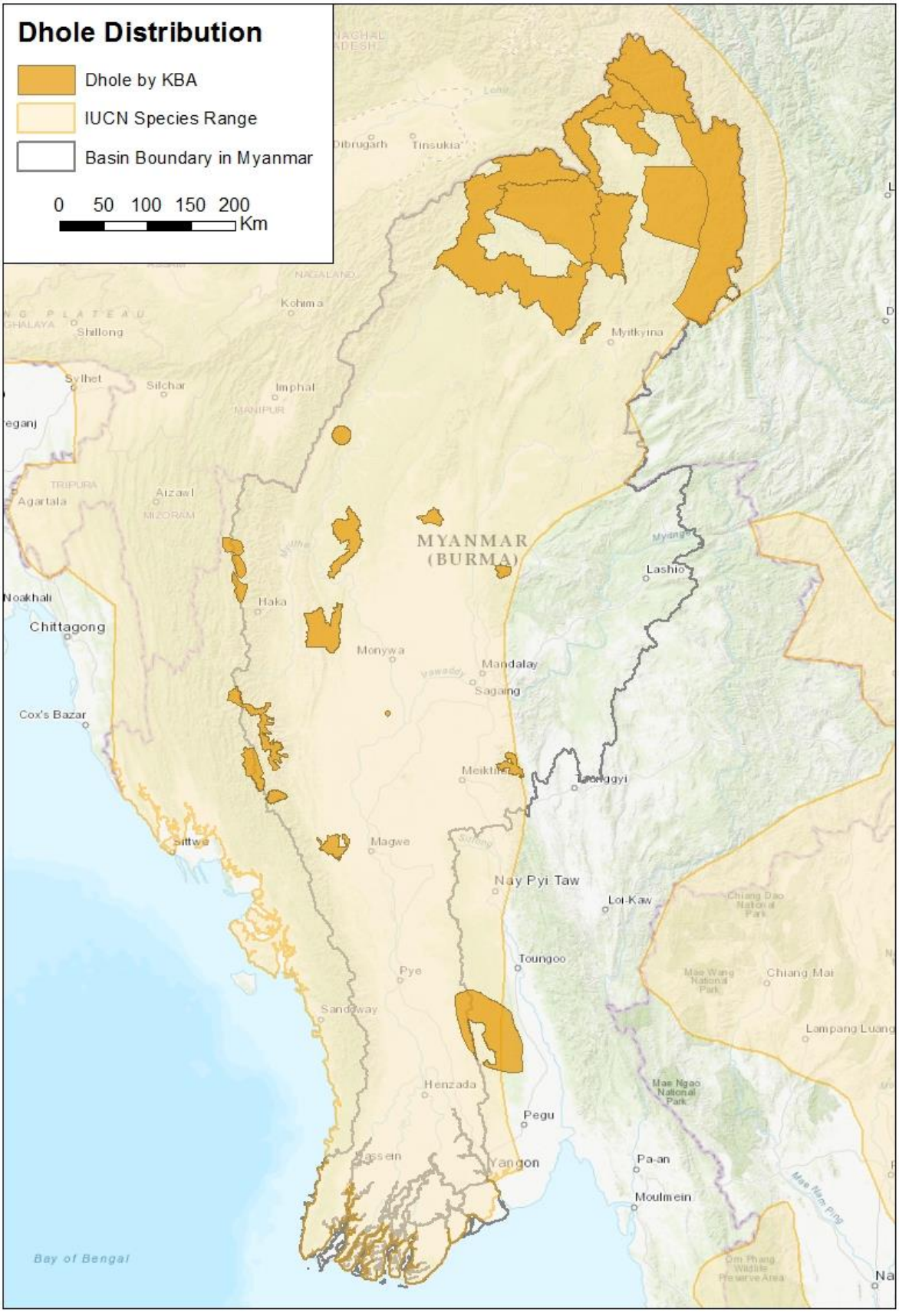


Figure 2.3 - Distribution of the dhole, *Cuon alpinus* (IUCN), and KBAs with current dhole presence

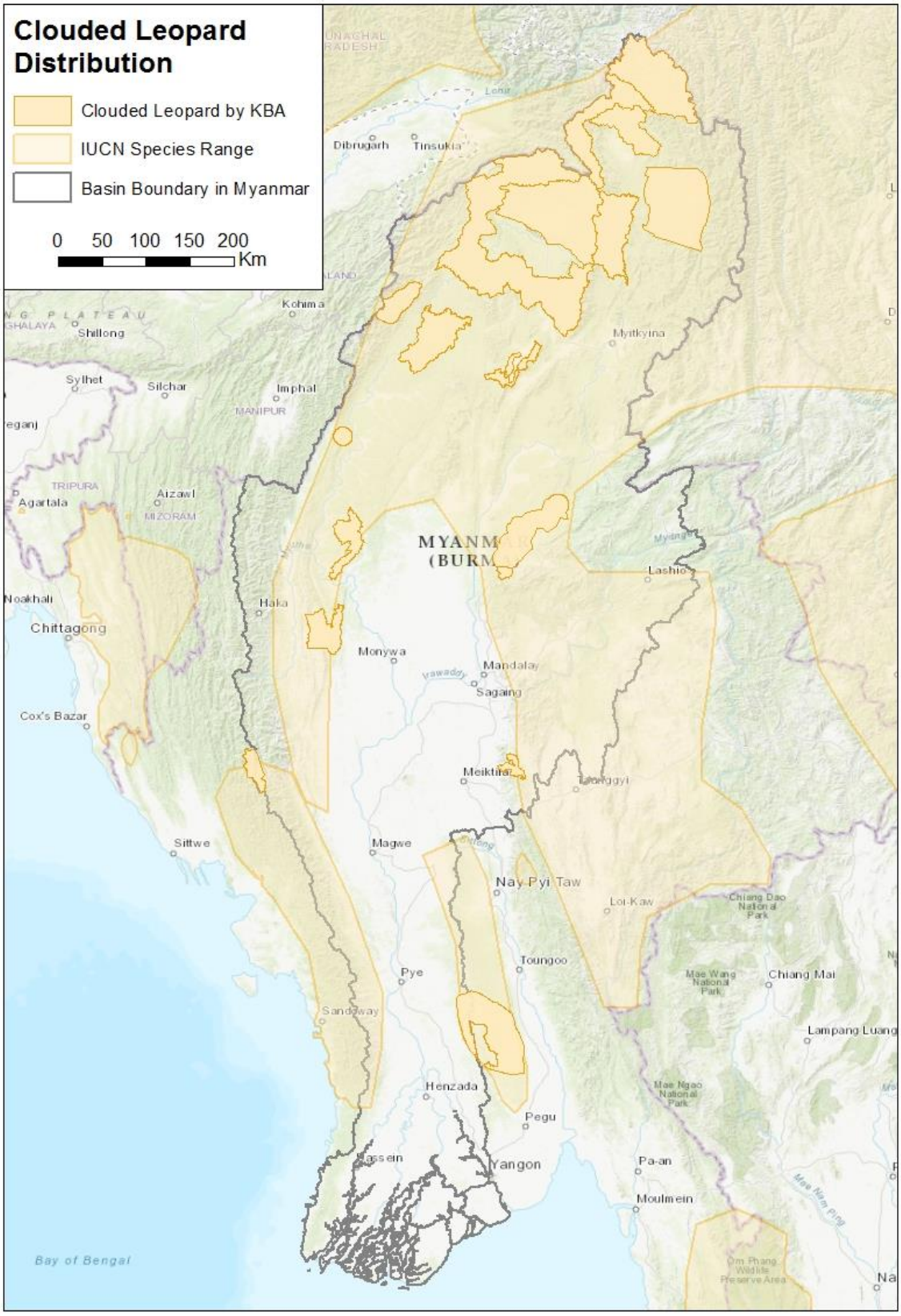


Figure 2.4 - Distribution of the clouded leopard, *Neofelis nebulosa* (IUCN), and KBAs with clouded leopard presence

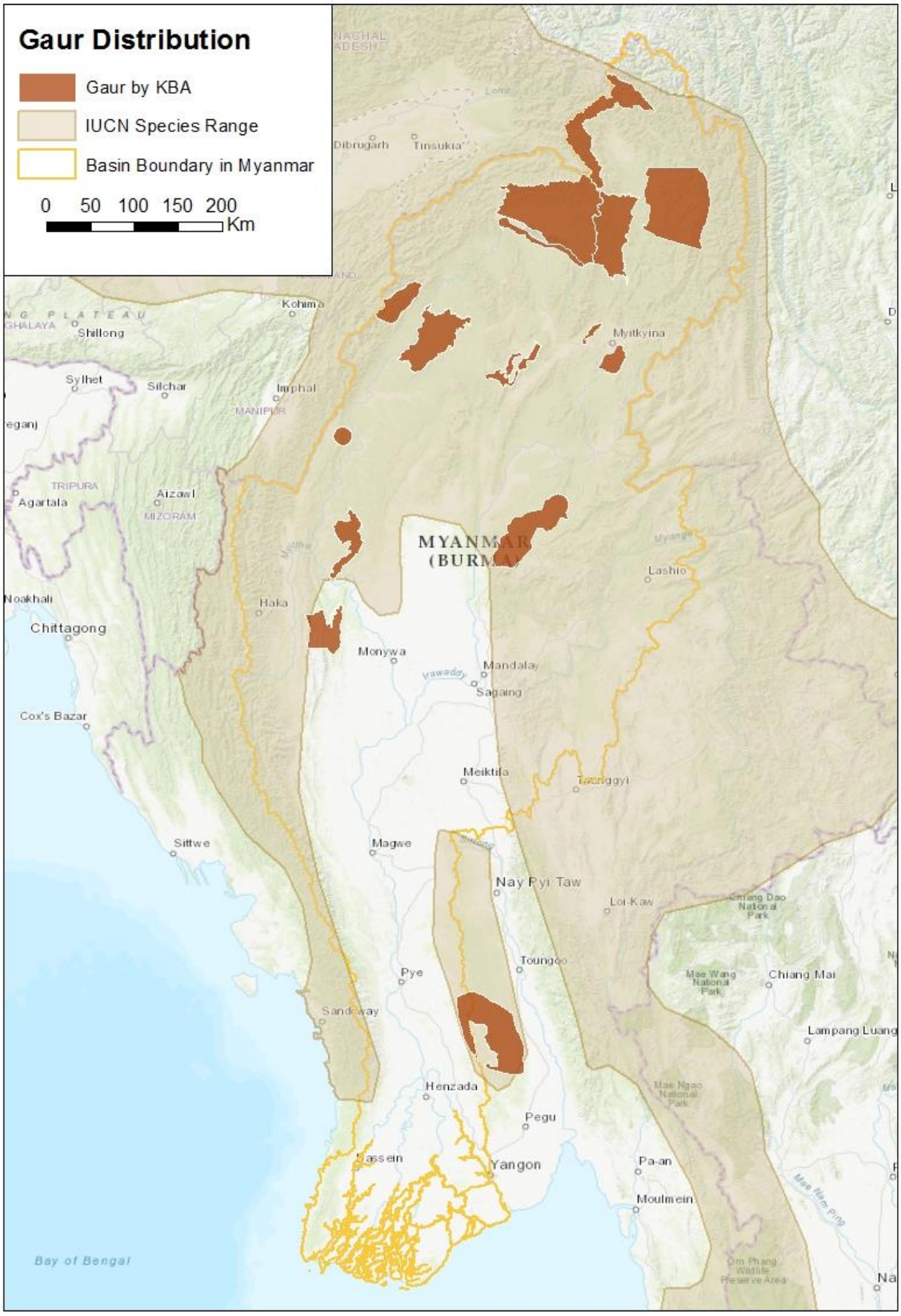


Figure 2.5 - Distribution of the gaur, *Bos gaurus* (IUCN), and KBAs with gaur presence: *Recent data for many sites are missing. Some areas near Myitkyina and in the Middle Ayeyarwady might no longer host the gaur.*

Below is a list of selected species that are discussed in more detail because they are either have a globally threatened status, are near extinction, or have a distinct affinity for wetland habitats.

Sumatran Rhinoceros ***(Dicerorhinus sumatrensis)***
Status: Critically Endangered A2abd; C1+2a (i) ver 3.1
Population trend: decreasing

The sub-species **Dicerorhinus sumatrensis lasiotis** formerly occurred in India, Bhutan, Bangladesh, and Myanmar. The sub-species is extinct in the three former countries, but there is a slim possibility that populations remain in northern Myanmar (van Strien et al., 2008).

At its inception in 1918, the Shwe U Daung Wildlife Sanctuary (KBA) was home to a wide range of large mammal species, including the Sumatran rhinoceros (*Dicerorhinus sumatrensis*). Twelve to 15 rhinoceros were thought to occupy the sanctuary in 1939 (Tun Yin, 1954). In 1980, population estimates were still two to four animals (Salter, 1983; IUCN, 1987). Without a doubt, they have now all been extirpated (Saw Tun Khaing, 1998) and, thus, are not listed in Table 2.1.

Hairy-Nosed Otter ***(Lutra sumatrana)***
Status: Endangered A2cde ver 3.1
Population trend: decreasing

The hairy-nosed otter is listed as still distributed in the Upper Chindwin (Aadrean et al., 2015) based on a record from Duckworth and Hills (2008), but no recent record is known. The species is heavily persecuted. Recently during surveys of the wildlife trade in the town of Mong La, Shan State, outside the Ayeyarwady Basin, three species of otters were observed, including a skin of a hairy-nosed otter. This observation constitutes the first record of hairy-nosed otter in trade in Myanmar (Shepherd and Nijman, 2014).

Extensive camera-trapping was conducted in the general area of the only historic record from the Ayeyarwady Basin, the Hukaung Valley. It did not find the species, but camera-traps were not set to target this species, so it is unclear whether it persists there (Than Zaw et al., 2014).

Wild Water Buffalo ***(Bubalus arnee)***
Status: Endangered A2cde+3cde+4cde; C1 ver 3.1
Population trend: decreasing

There are no population estimates for Myanmar, reflecting a paucity of recent surveys. The extent of suitable habitat means the species could be still extant. A few wild-living animals, independent of human husbandry, live in the Hukaung Valley of Kachin State (Hedges et al., 2008). Pending further information, these buffalo should be seen as likely to be genuinely wild stock or at least, if feral, of archaic origin. In either case, these buffalo are of conservation significance (Hedges et al., 2008).

Gaur ***(Bos gaurus)***
Status: Vulnerable A2cd+3cd+4cd ver 3.1
Population trend: decreasing

In Myanmar, the status of gaur is poorly known (Duckworth et al., 2016). A March 1994 survey of the Htamanthi Wildlife Sanctuary, Myanmar's largest Protected Area, estimated that 100 to 200 gaurs remained and that they were in danger of being extirpated from the area if current levels of poaching

continued (Rabinowitz et. al., 1995). A national tiger survey camera-trapped gaur in 11 of 15 camera-trapped sites (Lynam, 2003). These sites were selected for their chances of holding tigers, so, because the two species face similar threats, it may present the most positive picture of gaur occurrence in the country (Duckworth et al., 2016).

Fishing Cat (*Prionailurus viverrinus*)
Status: Vulnerable A2cd+3cd+4cd ver 3.1
Population trend: decreasing

The change in RL category from EN (2010) to VU is a non-genuine change, reflecting the recent increase in information quality. It does not indicate an improved conservation status for the species since the last assessment (Mukherjee et al., 2016).

In the Ayeyarwady Basin, this rare cat is only present in the delta. It was recorded in the Meinmahla Kyun Wildlife Sanctuary in 2013 and following years (Saw Moses and Zöckler, 2014), and its presence in the Ayeyarwady Delta in Myanmar also confirmed by forest rangers. There is no indication, however, of the population's size, although local forest rangers estimate that given the extent of the habitat it could be large. The Biodiversity and Nature Conservation Association (BANCA, 2009) mentioned an old skin from the Mali Kha area, but no recent records are known.

Asian Small-Clawed Otter (*Aonyx cinereus*)
Status: Vulnerable A2acde ver 3.1
Population trend: decreasing

There is distributed in the north of the Ayeyarwady Basin, but no estimates on number or more detailed information is available (Wright et al., 2015).

In the last few decades, the range of the Asian small-clawed otter has shrunk particularly in its western range, as evident from published literature. Given the extent of loss of habitat that is occurring in the south and Southeast Asia and the intensity of poaching, the reduction in population has been observed in many parts of its range (Wright et al., 2015). There are only a few recent records in the Ayeyarwady Basin. BANCA (2009) had several otters at their survey sites in the May Kha River (KBA, 126), which are almost all attributed to this species.

Smooth-Coated Otter (*Lutrogale perspicillata*)
Status: Vulnerable A2cde ver 3.1
Population trend: decreasing

Figure 2.6 - Female smooth-coated otter in southern Myanmar (Photo credit: C. Zöckler)

The smooth-coated otter is still widely distributed across the southern Ayeyarwady Basin and only missing in the Upper Ayeyarwady and Chindwin Basin (de Silva et al., 2015). For many inland sites, information on occurrence or trends is missing or scattered at least.

Eurasian Otter ***(Lutra lutra)***
Status: Near Threatened ver 3.1
Population trend: decreasing

This otter species is wide-spread across Eurasia and occurs in northern Myanmar in the Upper Ayeyarwady. It is rare and little information is available. It is listed as EN in Myanmar (Roos et al., 2015).

Indo-Pacific Finless Porpoise ***(Neophocaena phocaenoides)***
Status: Vulnerable A2cde ver 3.1
Population trend: decreasing

Finless porpoises are widely distributed along the coasts of Myanmar, including the delta area (Wang and Reeves, 2012). No recent records have been obtained from the delta area.

Irrawaddy Dolphin ***(Orcaella brevirostris)***
Status: Vulnerable A4cd ver 3.1
Population trend: decreasing

Figure 2.7 - Irrawaddy dolphin in Ayeyarwady River near Khatta (Photo credit: C. Zöckler)

There is a healthy coastal population of Irrawaddy dolphin in the Ayeyarwady Delta. Numbers around Meinmahla Kyun Wildlife Sanctuary accumulate to 12 to 20 (FD rangers' pers. comm). The species is considered VU in the IUCN RL due to an estimated 30% or more reduction in the range-wide population. Five demographically isolated populations are considered CR due to low population sizes (<50 mature individuals), including the Ayeyarwady River population (Reeves et al., 2008). At present, the river population is estimated at approximately 60 to 70 animals (Naing Lin, 2017) (see Table 2.2), indicating that the population at present might be stable. Figure 2.8 shows the current distribution.

Table 2.2 - Historic counts of Irrawaddy dolphins in the Ayeyarwady River (Naing Lin, 2017)

Year	Count	Remarks
2002	37	First experience for range-wide survey
2003	59	Winter season (water level low)
2004	72	Winter season (water level low)
2005	-	Education period for protected area nomination
2006	58	Winter season (water level low)
2007	31	Rainy season (water level height/wide)
2008	-	Education program between Mandalay and Bamaw
2009	-	Education program between Mandalay and Bamaw
2010	69	Winter season (water level low)
2011	72	Winter season (water level low)
2012	67	Winter season (water level low)
2013	51	Could not survey around Bamaw Area (armed conflict)
2014	63	Winter season (water level low)
2015	58	Winter season (water level low)
2016	65	Winter season (water level low)

Aung Myo Chit (2016) also reported of a new sighting of a dolphin south of Bagan between Chauk and Salay. This solitary dolphin is the first record in this area after 139 years and confirms the original range of the Irrawaddy dolphin, including the Lower Mandalay Region. According to Aung Myo Chit (2016), local experienced fishermen along this river stretch stated that a group of 3 to 4 Irrawaddy dolphins could be seen only a decade ago but none could claim any sightings in recent days. Fishermen thought that the dolphin must have moved to upstream areas. One fisherman did confirm that groups of dolphins were seen more than 4 to 5 days successively near Min Bu in 2014.

It is vitally important for the isolated river population to maintain occasional demographic interaction with other groups for long-term persistence. This has important implications, because groups can become completely isolated if others located in between are extirpated, with potential cascading conservation impacts for the species or populations (Smith, 2017). This is particularly valid for the isolated river populations of the Irrawaddy dolphin as well as for other taxa in the Ayeyarwady River.

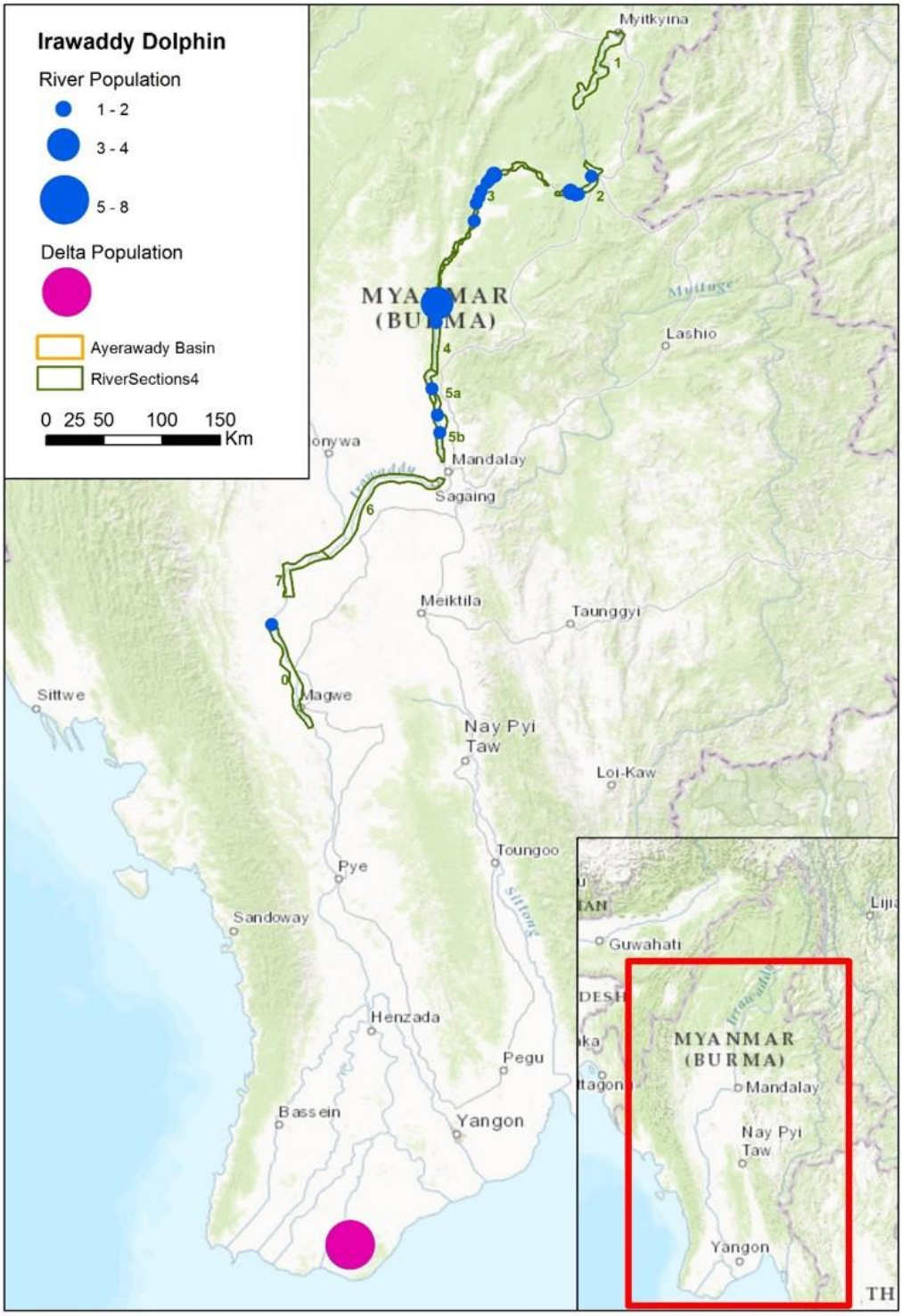


Figure 2.8 - Distribution of the Irrawaddy dolphin in the Ayeyarwady Basin: (Blue = river population (CR) and pink = coastal population (VU) of 10 to 20 animals. Based on Wildlife Conservation Society [WCS], 2008; Aung, 2016; Zöckler and Thant Zin, 2017; Moses and Zöckler, 2015)

2.2 Birds

Birds have been comparatively well-studied and for this group a wealth of data are available. In total, 906 bird species have been recorded in the Ayeyarwady Basin (see list in Annex 2). This is a huge number compared to many other countries or regions. There are only 18 countries globally that list more species than the Ayeyarwady Basin (BirdLife International, 2016), but 58 countries that are larger than the basin. Four of these species have not been recorded for some time and are feared as locally and one even globally extinct (see Table 2.4). Most of them (662 or 73%) are resident birds that breed or have bred until recently in the Ayeyarwady Basin. But 242 species, or 27%, are migrants, including 38 vagrants that spend the winter here, migrating from as far north as the Russian Arctic and Alaska or from Eastern China and west from Central Asia, Pakistan, and Mongolia (see Annex 2 for details and Figure 2.9. for some flyway examples). Some are only stopping over on their migration further afield, like the Amur falcon. Most are migrants from higher altitudes in the Himalayas. Some are migrating within the basin, but 73% of the species are not migratory. Annex 1 indicates their migratory and RL status in the basin. A total of 38 species have been listed as rare visitors and vagrants with less than 10 records in the country (see Annex 2).

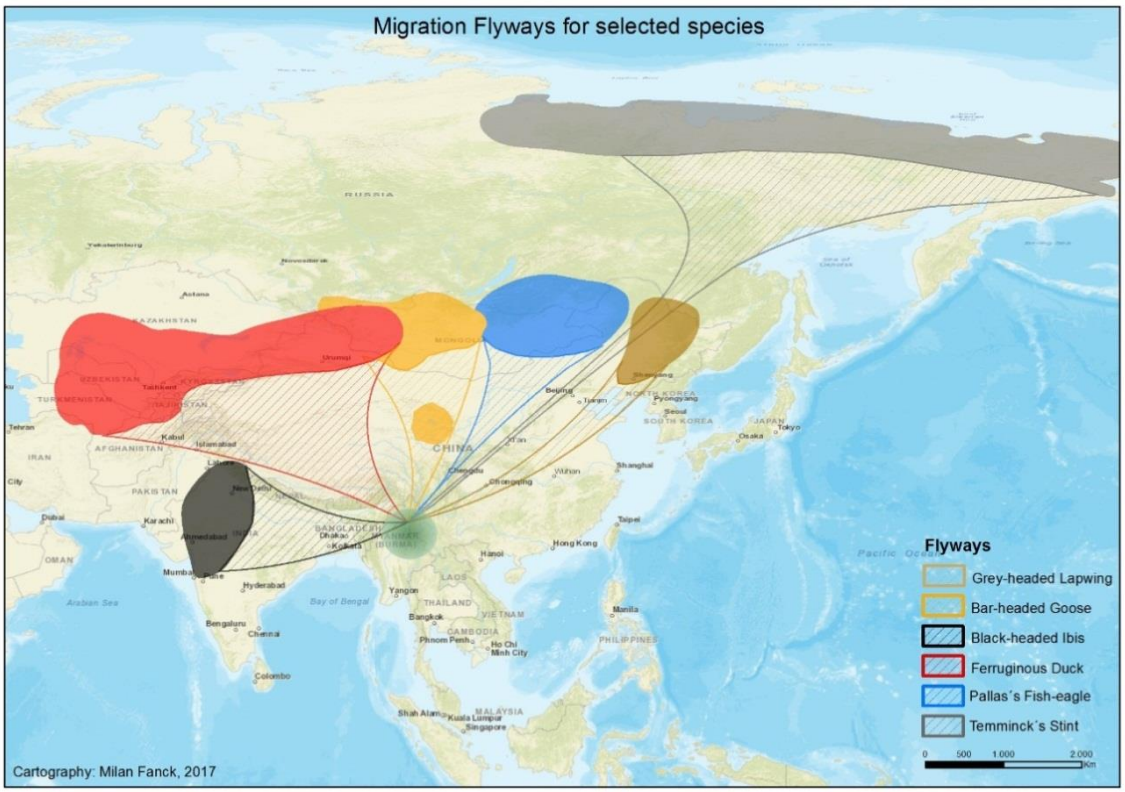


Figure 2.9 - Different flyways of a few selected species living in the Ayeyarwady Basin: (Solid = breeding areas or over-summering as in the example of Pallas's fish eagle)

A total of 173 waterbirds have been recorded in the Ayeyarwady Basin. Depending on wetland habitats, these birds include waterfowl, divers, grebes, cormorants, shorebirds, egrets, and related birds that depend on wetland and riverine habitats (see Annex 2.1). For this subgroup of birds that live on or near river and wetland habitats, a fair amount of distributional and, in some cases, trend data are available. Therefore, this group has been looked at in more depth. However, other species from different families are mentioned, especially when globally threatened or range restricted.

Myanmar includes, within its political boundaries, four Endemic Bird Areas (EBAs). These include the Andaman Islands (EBA125), the Eastern Himalayas (EBA130), the Ayeyarwady Plains (EBA132), and the Yunnan Mountains (EBA139) (Stattersfield et al., 1998). The latter three's boundaries are at least partly or in

full in the Ayeyarwady Basin. There are nine bird species endemic to Myanmar. Seven of these are also endemic to the Ayeyarwady Basin, including two species recently split (2.2).

In addition, Myanmar has two secondary areas, one of which lies in the Ayeyarwady Basin: the Northern Myanmar Lowlands (s079) are defined by the range of chestnut-backed laughing thrush, *Garrulax nuchalis humilis.* EBA130 is ranked 17th in global importance out of the world's 218 EBAs in terms of the total number of threatened restricted-range species (Stattersfield et al., 1998). EBA132 lies entirely within Myanmar and is home to two endemics: the white-throated babbler, *Chatarrhaea gularis,* and the hooded treepie, *Crypsirina cucullata*. It also supports more widespread threatened species, primarily confined to wetland habitats: the white-winged duck, white-bellied heron, spot-billed pelican, lesser adjutant, greater adjutant, Pallas's fish eagle, Sarus crane, indian skimmer, and Jerdon's babbler.

Table 2.3 - Bird species endemic to the Ayeyarwady Basin

Common name	*Scientific name*	RL	Comment
Burmese collared dove	*Streptopelia xanthocycla*	LC	Recently split from *S. decaocto*
White-browed nuthatch	*Sitta victoriae*	EN	
Burmese tit	*Aegithalos sharpei*	DD	
Jerdon's minivet	*Pericrocotus albifrons*	NT	
Hooded treepie	*Crypsirina cucullata*	NT	
Burmese bushlark	*Mirafra microptera*	LC	
Pale-eyed bulbul	*Pycnonotus davisoni*	LC	Recently split from *P. finlaysoni*

Figure 2.10 - Pale-eyed bulbul, *Pycnonotus davisoni, is* considered a separate species from *P. finalysoni* (del Hoyo and Collar, 2016) and is endemic to the Ayeyarwady Basin (Photo credit: C. Zöckler)

Of the 906 bird species, 41 (4.8%) are listed as globally threatened. Table 2.4 lists all globally threatened species recorded at present with their RL status and their occurrence in KBAs. A total of eight globally CR (including 2 possibly locally extirpated species), 11 EN (including 1 locally extirpated species), and 24 globally VU (of which one has not been seen since 2013). Another 46 species are classified as globally near-threatened, indicating that approximately 10% of the bird species are globally in danger, which is just a little bit below the global average of 12% (BirdLife International, 2017). These levels are still worrying as many of these birds have shown a declining trend (see also Section 5 on trends).

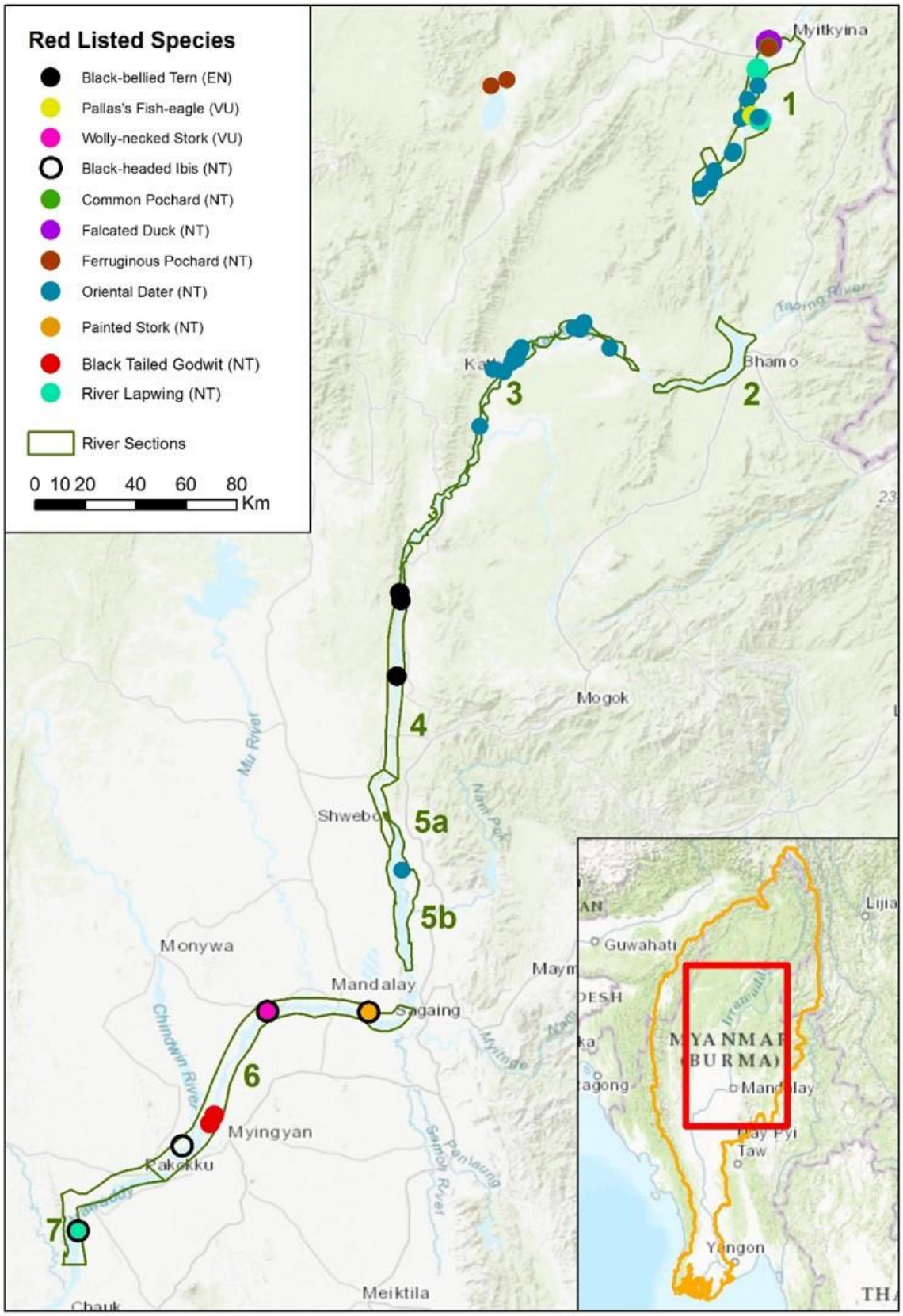


Figure 2.11 - Distribution of red-listed water bird species observed on the Ayeyarwady River between Myitkyina and Bagan in Feb 2017

Table 2.4 - RL bird species in the Ayeyarwady Basin: (Species shaded grey are already extirpated from the Ayeyarwady Basin; EN = globally endangered, VU = vulnerable, and NT= near threatened water and wetland dependant birds (IUCN, 2017); for a full list of species see Annex 2)

	Species	*Scientific name*	RL	Year last recorded	Comment
1	Pink-headed duck	*Rhodonessa caryophyllacea*	CR	1910	Wetlands near Singu (Tordoff et al., 2008)
2	White-shouldered ibis	*Pseudibis davisoni*	CR	1940s	?
3	Greater adjutant stork	*Leptoptilos dubius*	EN	2003, 2006	Thet Zaw Naing pers. comm.; G. Chunkino (in litt.)
4	Indian skimmer	*Rhynchops albicollis*	VU	2013	Chindwin River, WCS
5	White-bellied heron	*Ardea insignis*	CR	2012	Thet Zaw Naing per.comm.
6	Baer's pochard	*Aythya baeri*	CR	2017	Paleik Inn (Aung et al., 2017)
7	White-rumped vulture	*Gyps bengalensis*	CR	2017	Lake Indawgyi
8	Slender-billed vulture	*Gyps tenuirostris*	CR	2017	Lake Indawgyi - decline
9	Red-headed vulture	*Aegypius calvus*	CR	?	No recent data
10	Spoon-billed sandpiper	*Calidris pygmeus*	CR	2016	Nga Mann Thaung Zöckler 2016a
11	White-winged duck	*Asarcornis scutulata*	EN	2009?	No recent data
12	Masked finfoot	*Heliopais personata*	EN	2006	Tordoff et al., 2008
13	Steppe eagle	*Aquila nipalensis*	EN	?	No data
14	Green peafowl	*Pavo muticus*	EN	?	
15	Black-bellied tern	*Sterna acuticauda*	EN	2017	Strong decline
16	Nordmann's greenshank	*Tringa guttifer*	EN	2016	Zöckler, 2016a
17	Great knot	*Calidris tenuirostris*	EN	2016	Zöckler, 2016a
18	Yellow-breasted bunting	*Emberiza aureola*	EN	2017	Bagan - Lay Win pers. comm.
35	Giant nuthatch	*Sitta magna*	EN	2016	F. Momberg pers. comm.
19	White-browned nuthatch	*Sitta victoriae*	EN	2017	WCS records
20	Lesser adjutant stork	*Leptoptilos javanicus*	VU	2017	Ngwe Lwin pers. comm
21	Wholly-necked stork	*Ciconia episcopus*	VU	2017	Zöckler and Thant Zin, 2017
22	Lesser white-fronted goose	*Anser erythropus*	VU	?	?
23	Common pochard	*Aythya ferina*	VU	2017	Strong decline in river, but increase at Lake Indawgyi
24	Blyth's tragopan	*Tragopan blythii*	VU	?	
25	Sclater's monal	*Lophophodrus sclateri*	VU	?	
23	Pallas' fish-eagle	*Haliaeetus leucoryphus*	VU	2017	Very rare (Zöckler and Thant Zin, 2017) WCS records
26	Greater spotted eagle	*Aquila clanga*	VU	2017	Ngwe Lwin pers. comm
27	Indian spotted eagle	*Aquila hastata*	VU	2015	Zöckler and Lay Win, 2015
28	Eastern imperial eagle	*Aquila heliaca*	VU	?	
29	Lesser kestrel	*Falco naumanni*	VU	?	Vagrant
30	Sarus crane	*Antigone antigone*	VU	2017	WCS, Ngwe Lwin pers. comm
31	Wood snipe	*Gallinago nemoricola*	VU	2015	Zöckler and Lay Win 2015
32	Pale-capped pigeon	*Columba punicea*	VU	2017	
33	Rufous-necked hornbill	*Aceros nipalensis*	VU	?	
34	Great slaty woodpecker	*Mulleripicus pulverlintus*	VU	2015	Indawgyi Wildlife Sanctuary (Zöckler 2016b)
36	Beautiful nuthatch	*Sitta formosa*	VU	2016	
37	Grey-sided thrush	*Turdus feae*	VU	?	

	Species	*Scientific name*	RL	Year last recorded	Comment
38	Jerdon's babbler	*Chrysomma altirostre*	VU	2017	WCS
39	Snowy-throated babbler	*Stachyris oglei*	VU	?	
40	Naung Mung wren-babbler	*Rimator naungmungensis*	VU		Newly described (Rappole et al., 2005)
41	Manchurian reed-warbler	*Acrocephalus tangorum*	VU	?	
42	Black-necked stork	*Ephippiorhynchus asiaticus*	NT	2013	Ngwe Lwin pers. comm
43	Spot-billed pelican	*Pelecanus philippensis*	NT	2017	Ngwe Lwin pers. comm
44	Great thick-knee	*Esacus recurvirostris*	NT	2016	H. Thiessen in Zöckler (2016b)
45	River tern	*Sterna aurantia*	NT	2017	Strong decline
46	Falcated duck	*Anas falcata*	NT	2017	First record since 2001
47	Ferruginous pochard	*Aythya nyroca*	NT	2017	Strong decline
48	Painted stork	*Mycteria leucocephala*	NT	2017	Stable
49	Black-headed ibis	*Threskiornis melanocephalus*	NT	2017	Stable
50	Oriental darter	*Anhinga melanogaster*	NT	2017	Strong decline
51	River lapwing	*Vanellus duvaucelii*	NT	2017	Decline
52	Black-tailed dodwit	*Limosa limosa*	NT	2017	Stable?
53	Brown-winged kingfisher	*Pelargopsis amauroptera*	NT	2017	Declining
54	Blyth's kingfisher	*Alcedo hercules*	NT	2009	No data
55	Mangrove pitta	*Pitta megarhyncha*	NT	2017	Still common in Meinmahla Kyun Wildlife Sanctuary
56	Asian golden weaver	*Ploceus hypoxanthus*	NT	2017	Stable
57	Small pratincole	*Glareola lactea*	LC	2017	Decline
58	Comb duck	*Sarkidiornis melanotos*	LC	2017	Decline

Many of the waterbirds are still common and widespread and can be found in a variety of habitats and KBAs. However, a number of rare species are restricted to only a few sites. The following list is a documentary of the local extinctions and severe declines of many waterbirds. A few selected species are rare and specialized and others are common waterbird species that are characteristic of the Ayeyarwady River and its wetland habitats.

Pink-Headed Duck *(Rhodonessa caryophyllacea)*
Status: Critically Endangered D ver 3.1
Population trend: unknown

This species has not been recorded reliably since 1948 and is widely believed to be extinct. Myanmar has always been known as a former breeding ground and suspected as an area where the last remnants could still survive. Hence, recent search efforts have been focused on several areas within the Ayeyarwady Basin. From 2003 to 2005, several expeditions took place in the Upper Chindwin, Lake Indawgyi, neighboring wetlands, and the Bhamo wetlands near the middle reaches of the Ayeyarwady River. Even though there were two possible sightings, these were eventually not accepted by all expedition members (Tordoff et al., 2008). Any rediscovery in the world would be most likely in the Ayeyarwady Basin, and the Upper Chindwin Basin has the most suitable habitats and is poorly surveyed (Tordoff et al., 2008).

Indian Skimmer *(Rynchops albicollis)*
Status: Vulnerable A2cde+3cde+4cde ver 3.1
Population trend: decreasing

It is always difficult to define and verify the last recording of a species for a region as large as the Ayeyarwady Basin, but there is no doubt among the Myanmar birdwatching community and tour guides that the Indian Skimmer is gone and has not been seen reliably for several years. There has never been a breeding record in Myanmar and it remained unclear if the Indian Skimmer has ever bred on the rivers of the Ayeyarwady and Chindwin or was it always just a winter visitor, as recorded in most records from the winter period. The disappearance of the skimmers from the Ayeyarwady Basin should be reason for concern and possible declining wintering numbers in Bangladesh (Mohsanin, 2014) contribute to those concerns. The species might need a revision in its current RL status.

Figure 2.12 - Indian Skimmer at the Rakhine Coast in 2010 (Photo credit: C. Zöckler)

Greater Adjutant Stork *(Leptoptilos dubius)*
Status: Endangered A2bcd+3bcd+4bcd; C2a (ii) ver 3.1
Population trend: decreasing

According to BirdLife International (2016a), huge numbers of the greater adjutant stork once bred in Myanmar, but there have been just three recent reports from Meinmahla Kyun in 2003, Whettikan Lake, and a site in Kachin State in 2006 (G. Chunkino in litt., 2006). It is not clear where in Kachin State this last observation was. The last record for this species in the Ayeyarwady Basin was in 2003. Interestingly, greater adjutant storks were observed in two places that year: Whettikan Lake Wildlife Sanctuary near Magwe in the Lower Ayeyarwady. Two birds were still present in the Meinmahla Kyun Wildlife Sanctuary (Thet Zaw Naing in litt.). For the 1980s, Salter (1983b) reports two birds in the Kadonkalay Reserve Forest, west of the Meinmahla Kyun Wildlife Sanctuary, but these populations are long gone. By the early 2000s, the birds were restricted to the Meinmahla Kyun Wildlife sanctuary (Thet Zaw Naing in litt.).

White-Bellied Heron (*Ardea insignis*)
Status: Critically Endangered C2a(i) ver 3.1
Population trend: decreasing

This large heron is restricted to small and large rivers with sand and gravel bars, mostly the Eastern Himalayan foothills. In Myanmar, the species was more widely distributed into the Middle Ayeyarwady Basin and the Upper Chindwin. Thet Zaw Naing (pers. comm.) reported the last sighting of white-bellied heron in the Bhamo wetlands in 2012 and suspects that the species might still survive there. Further north, in the Upper Chindwin and Upper Ayeyarwady, the heron still occurs in 6 KBAs but has not been seen in the last four surveys to confirm their continued presence (see Figure 2.13).

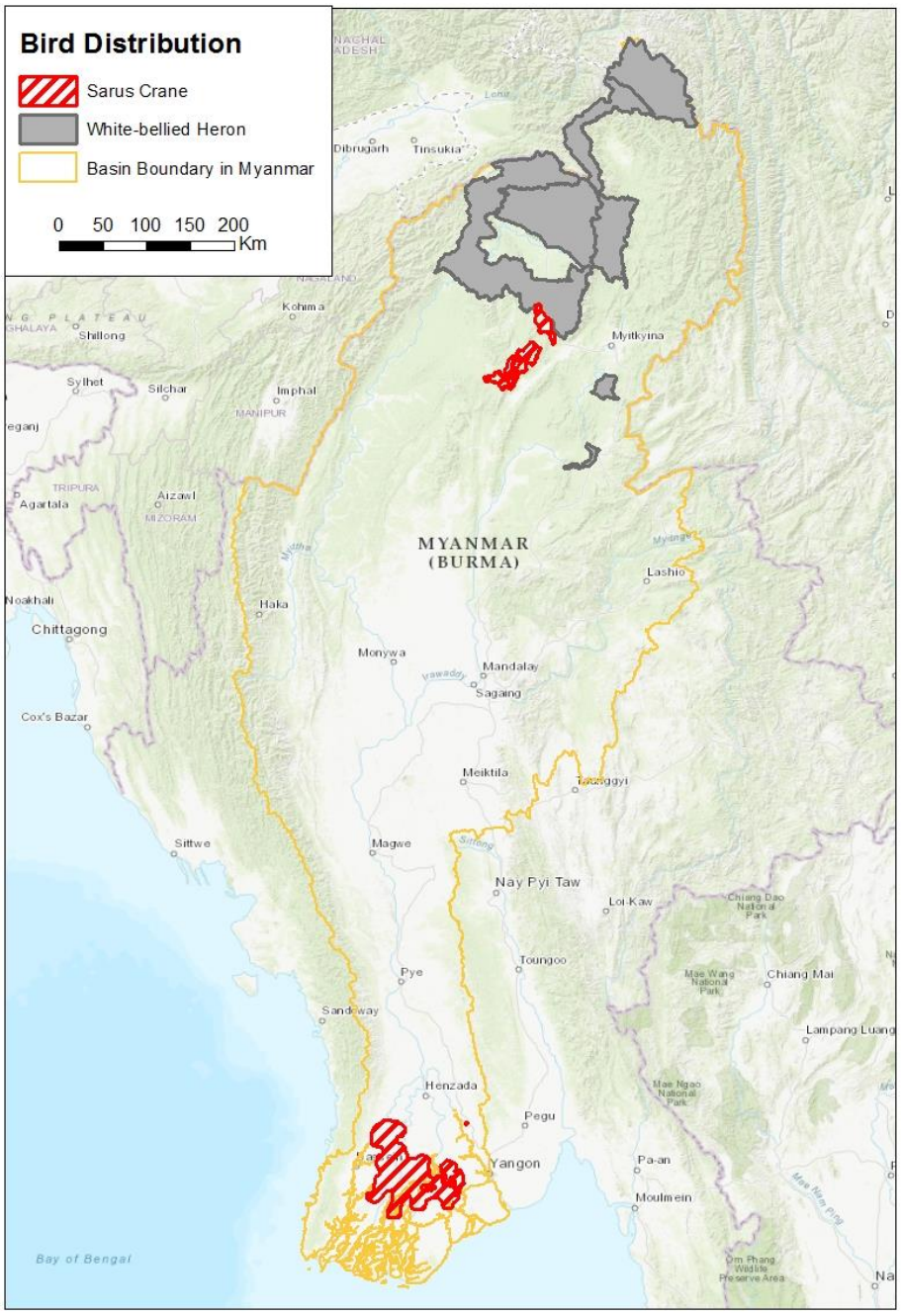


Figure 2.13 - Distribution of white-bellied heron (CR), grey, and Sarus crane (VU), red, in the Ayeyarwady Basin based on KBA data.

Some of the data are outdated and require new information. The two most southern KBA sites, in particular, might not have any white-bellied heron populations, and there are areas in the Upper Chindwin that have not been surveyed for the past 8 years.

Baer's Pochard (***Aythya baeri***)
Status: Critically Endangered A2cd+3cd+4cd ver 3.1
Population trend: decreasing

Baer's pochard is breeding in southern Russia and northern China and winters regularly in the Ayeyarwady Basin. Their numbers have declined dramatically in recent decades. The global population is estimated at 250 to 1,000 birds in total (Wetlands International, 2017). Its wintering distribution was contracting to small areas, and the species was heading toward global extinction (Wang et al., 2012; Hearn et al., 2013). In 2012, the species was uplisted to CR status. BANCA organised a winter survey in 2016 (Aung et al., 2016) and discovered the duck at only two sites near Mandalay: 12 birds were observed at Pyu Lake, 3 birds at Kaung Hein Inn near Htamati, and 1 bird was observed in Lake Indawgyi (Nyein Chen pers. comm.). In 2001, 2 birds were seen in Taung Kan (Davies et al., 2004) and 60 at Kyee-Ni lake, which was found dried out in 2016 (Aung et al., 2016). Table 2.5 illustrates the strong decline from approximately 1,000 birds in the 1990s to only 131 in 2001 and now only 16. The wetlands in the Ayeyarwady Basin are of utmost importance for the survival of this critically endangered species.

Table 2.5 - Trends in Baer's pochard (*Aythya baeri*) (Observations between 1991 and 2016 based on data from Than Nwai, 1994; * = doubtful record. Sources: Asian Waterbird Counts – Wetlands International, 2017; Li and Mundkur, 2004 and 2007; Davies et al., 2004; Aung et al., 2016 and 2017.)

Baer's Pochard

Wetland site	1991	1992	1993	1995	1997	2001	2002	2015/16	2017
Indawgyi					(1,000)*	67	2	1	0
Ayeyarwady near Naung						2		0	0
Pyu Lake								12	3
Paleik								0	2
Kyee-Ni Lake						60		0	0
Kaung Hein Inn								3	0
Mobye Dam Monpai Lake				150				0	
Nyanung Yan Lake		5	134					0	
Yawei Lake	512	405	300			0		0	0
Yit Lake			19					0	0
Taung Kan						2		0	
Total	**512+**	**410+**	**453+**		**1,000***	**131**	**4***	**16**	**5**

Spoon-Billed Sandpiper (***Calidris pygmaea***)
Status: Critically Endangered A2abcd+3bcd+4abcd; C2a (i) ver 3.1
Population trend: decreasing

This globally CR sandpiper has its most important wintering sites in Myanmar (Zöckler et al., 2016). The majority winters in the Gulf of Mottama, east of the delta area. In January 2010, for the first time, one spoon-billed sandpiper was located on the Saka Khaing Gyi, a sandy island in the Western Ayeyarwady Delta (Archipov and Morozov in litt.). In December 2015, one bird was observed again on Phone Taw Paej Beach (prop KBA) opposite that island (Saw Moses and Zöckler, 2016). Subsequent searches in 2016 could not repeat the observation. Another regular site is the Outer Delta Islands in the Eastern Ayeyarwady Delta, where in 2013, 2014, and 2016 one to two birds each were observed on the mudflats of Nga Man Thaung Island (Zöckler, 2016). The area around Letkokkon, at the eastern most edge of the delta, has been surveyed

irregularly since the 1880s when Armstrong (1886) shot a female bird near Elephant Point on 1 December 1885. Since 2008, BANCA and international teams have surveyed Letkokkon and other areas further east, but no spoon-billed sandpiper was observed again on these mudflats, although mudflats close by in the Yangon District of the Gulf of Mottama host spoon-billed sandpipesr regularly (Zöckler et al., 2014)

Figure 2.14 - Spoon-billed sandpiper in winter plumage (Photo credit: G. Vyn)

White-Winged Duck *(Asarcornis scutulata)*
Status: Endangered A2cd+3cd+4cd; C2a (i) ver 3.1
Population trend: decreasing

This secretive duck with a global population of no more than 1,000 birds (BirdLife International, 2017a) is distributed in the Upper Chindwin and Upper Ayeyarwady Basin in Myanmar. Here, it is locally common on ox-bow lakes within the Chindwin Basin (Tordoff et. al., 2007). It inhabits stagnant or slow-flowing natural and artificial wetlands, within or adjacent to evergreen, deciduous, or swamp forests on which it depends for roosting and nesting, usually in tree-holes. Although lowlands (below c.200 m) provide optimum habitat, it occurs up to 1,400 m, especially on plateaux-supporting, sluggish perennial rivers and pools (Birdlife International, 2017). It is thought to be still in healthy populations in some sites in the north of the country and present in seven KBAs in the north (see also Figure 2.15).

Further south the species was more wide-spread but lost most of its territory due to habitat degradation and poaching. Khin Ghee Maung (2005) mentioned the white-winged duck as still present in the Whettikan Lake Reserve but did not give any numbers. Thet Zaw Naing (in litt) listed 18 individuals for the reserve, according to the Asian Waterbird Count (AWC) in 2003. No subsequent counts from this area are available. Davies et al., (2004) also mentioned sitings of the white-winged duck in Nga Yant In, which is close to the Htamanti Wildlife Sanctuary. For this site, 6 individuals are listed in the AWC in 2003 (Li and Mundkur, 2007).

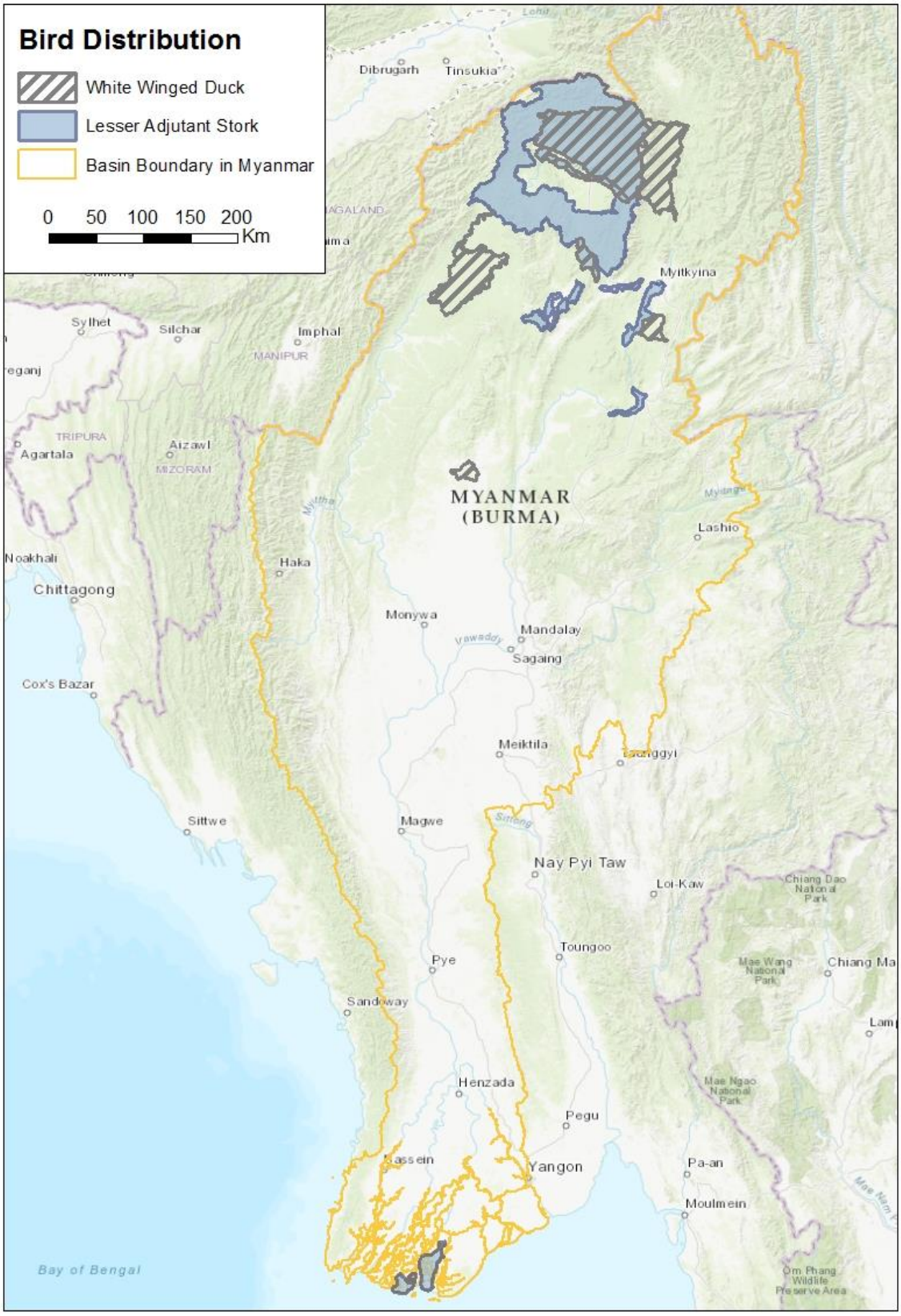


Figure 2.15 - Distribution of the white-winged duck (CR) and lesser adjutant stork in the Ayeyarwady Basin based on KBA data. Some data needs updating.

Masked Finfoot ***(Heliopais personatus)***
Status: Endangered A2cd+3cd+4cd; C2a (i) ver 3.1
Population trend: decreasing

The masked finfoot appears to have declined dramatically and is now known from comparatively few sites, occurring at low densities everywhere. The global population may now number as low as 1,000 individuals, and the Ayeyarwady Basin is considered the species' stronghold (BirdLife International, 2016b). However, little and hardly any recent information is available. Tordoff et al. (2007; 2008) reported the species during a search of wetlands in the Upper Chindwin area. This secretive bird has been recorded from four sites (KBAs) in the Upper Chindwin and near Kamaing along the Mogaung River, a tributary of the Ayeyarwady in the Kachin State. We do not know if any of these sites still hold the species. No records have been reported since 2006 (Saw Moses pers.comm.).
Spotted Greenshank ***(Tringa guttifer)***
Status: Endangered C2a(i) ver 3.1
Population trend: decreasing

Figure 2.16 - Nordmann's greenshank (Photo credit: S. Pfützke)

This EN shorebird is confined to coastal habitats only. It prefers intertidal mudflats as wintering habitat, often adjacent to mangroves. At present, Nga Man Thaung Island, east of Gadongalay in the Eastern Outer Delta Islands in the Ayeyarwady Delta, is the most important wintering site in Myanmar with a maximum of 48 individuals, approximately 5% of the global population (Zöckler et al., 2014; Zöckler 2016) and one of the few key wintering sites in Southeast Asia (Zöckler et al., in prep). The area is now, together with Meinmahla Kyun (in 2017), designated as a Ramsar Site. Figure 2.17 shows the trend in numbers at Nga Man Thaung Island.

The species is also known to inhabit the Letkokkon Mudflats in the eastern fringes of the delta, where in 2011 at least 2 birds were observed (Zöckler and Ngwe Lwin pers. obs.). Interestingly, Letkokkon is also the site where Armstrong (1876) is thought to have described the species for the first time. Nordmann's or spotted greenshank is also referred to as Armstrong's sandpiper (Smythies, 1953; Hayman et al., 1986), but Nordmann described the species first, in 1935, on its breeding grounds in the Sea of Ochotsk when it was in breeding plumage, which is understandably different than the plainer winter plumage that Armstrong described. He already noted that the species was rare, and he did not observe more than two individuals 130 years ago. Surveys further west in the delta did not reveal any additional sites for this endangered wader species.

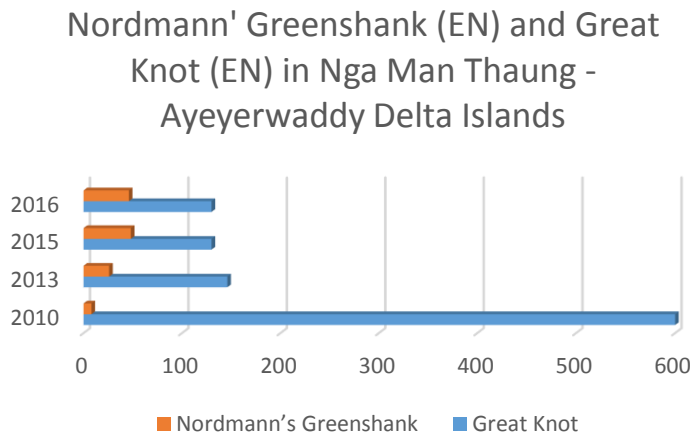


Figure 2.17 - Trends of two globally endangered wader species (Nordmann's greenshank and the great knot) at Nga Man Thaung in the Outer Delta Islands (Zöckler, 2016)

The trends shown in Figure 2.17 are stark for the great knot that has been declining sharply all over its range and hence was uplisted recently to EN (BirdLife International, 2017). However, Nordmann's greenshank's population\ is still believed to be approximately 1,000 birds only (Zöckler et al., in prep). With the designation of this area and Meinmahla Kyun Mangrove Forest as a Ramsar Site in 2017, the site is officially protected.

Black-Bellied Tern (*Sterna acuticauda*)
Status: Endangered A2cde+3cde+4cde ver 3.1
Population trend: decreasing

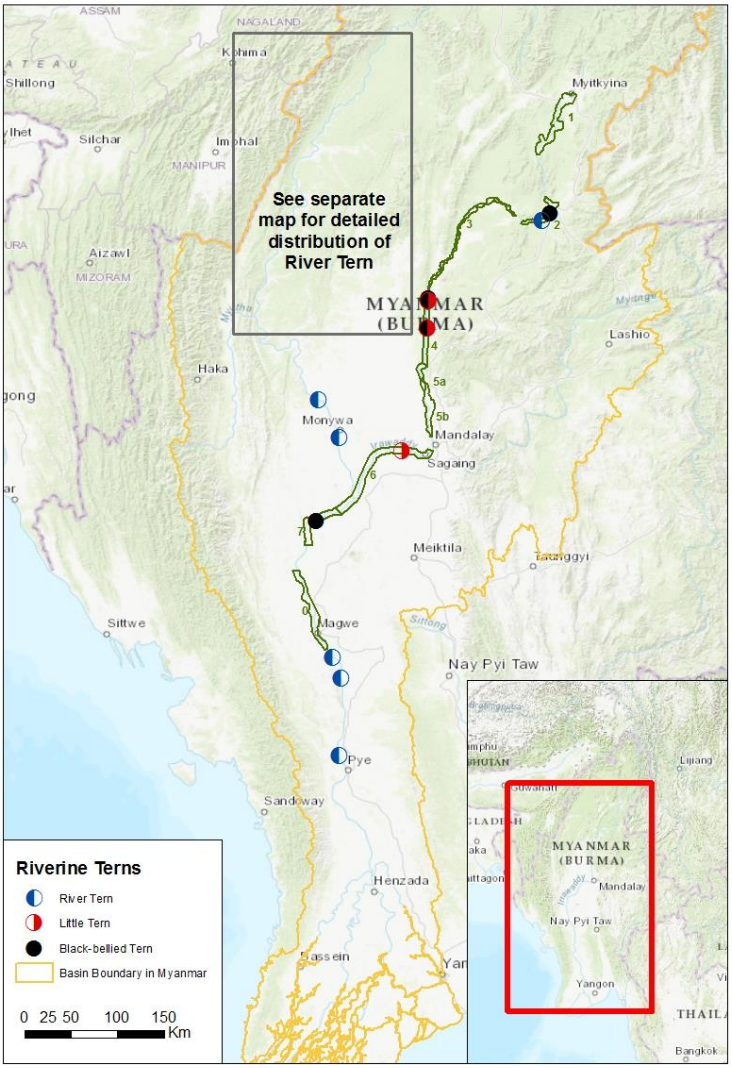
Figure 2.18 - Black-bellied tern, *Sterna acuticauda*, chick (Photo credit: Thet Zaw Naing)

The black-bellied tern is exclusively distributed along large rivers consisting of extensive sand bars. Today, the species is confined to only three to four sites in the Ayeyarwady River (see Figure 2.19). It has been declining strongly and disappeared from many regions. In 2001 and 2002, it also was recorded from Lake Indawgyi (AWC) but not since. It disappeared from Mekong, South China and Nepal (BirdLife International, 2017d) and is currently listed as EN. Kabir et al., (2016) found three pairs breeding at one site at the Padma River in Bangladesh. The terns are ground nesting species, laying nests on sand bars and are vulnerable to human disturbance, egg collecting, and habitat conversion. In December 2001, 13 black-bellied terns occupied the river stretch between Tagaung and Thabeikkyin (Davies et al., 2004), whereas in February 2017, only 3 (including one pair) were recorded (Zöckler and Thant Zin, 2017). Naing Lin and team members of the

Wildlife Conservation Society (WCS) (Naing Lin pers.comm.) observed an additional pair near Bagan and another single bird in the Bhamo area (see Figure 2.19).

River Tern (*Sterna aurantia)*
Status: Near Threatened ver 3.1
Population trend: decreasing

The river tern like the black-bellied tern is almost exclusively distributed along rivers. Both tern species are not migratory, reside on the large rivers, and are rarely seen in other wetland habitats. The river tern, *S. aurantia,* is slightly more eurytopic and has been observed at lakes and wetlands far from the rivers. Their distribution is largely confined to large rivers in South and Southeast Asia but, in contrast to the black-bellied tern, the river tern also inhabits some inland lakes and reservoirs. The species has been abundant along both the Ayeyarwady and Chindwin Rivers, but today has largely disappeared from the Ayeyarwady River. Interestingly, it is still widely distributed along the Chindwin River (Naing Lin in litt, see Figure 2.19). In 2016 and 2017, only few sites still hosted this riverine tern (see Figure 2.19).



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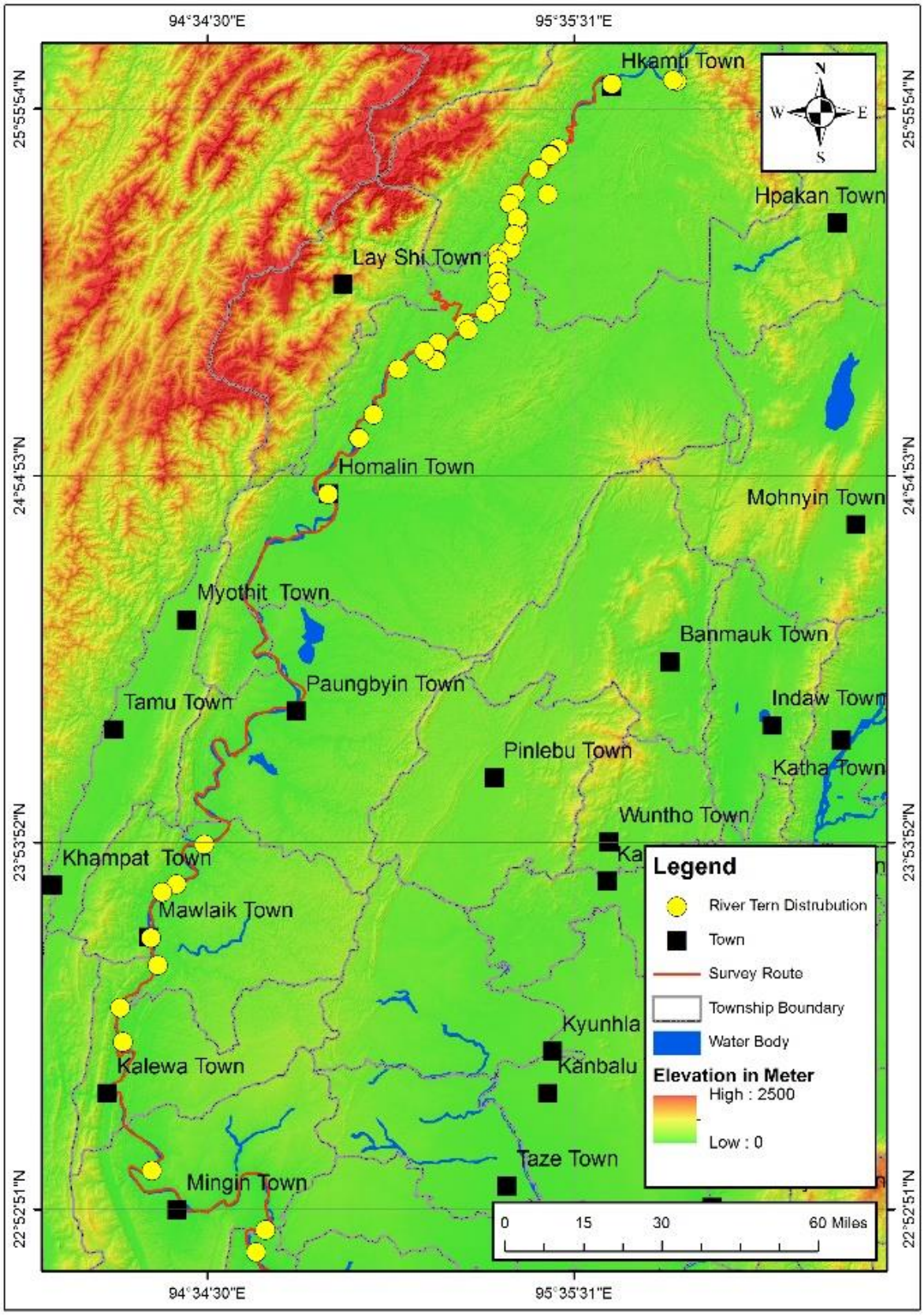


Figure 2.19a and inset (b) - Distribution of three riverine terns in the Ayeyarwady Basin, based on field survey data in 2016 and 2017 (WCS; Naing Lin and A. Diment pers. comm.; Zöckler and Thant Zin, 2017) with an inset (b) for more detailed information of the Chindwin Basin for the river tern, *S. aurantia*, Naing Lin in litt.)

Lesser Adjutant Stork ***(Leptoptilos javanicus)***
Status: Vulnerable A2cd+3cd+4cd ver 3.1
Population trend: decreasing

This stork species is still relatively abundant with an estimated 5,000 to 10,000 individuals globally. The species has declined dramatically, however, across its range and is currently listed as globally VN (BirdLife International, 2017b). In Myanmar, the species is restricted to a few mostly coastal wetlands, and the Meinmahla Kyun Wildlife Sanctuary (KBA and Ramsar Site) has been the last stronghold with 6 individuals and breeding confirmed (Forest Department, Zöckler et al., 2014, Zöckler, 2016a). Yet this is still a decline compared to 10 in 2006 (Thet Zaw Naing, 2006).

Another important inland wetland that regularly holds lesser adjutant storks is Lake Indawgyi Wildelife Sanctuary (KBA and Ramsar Site), but the numbers here are dwindling too. In 2016, only 2 to 4 birds were seen (Zöckler and Lay Win, 2016). The actual lake is not visisted much by the species. The Indaw Chaung, the river that flows from the north into the lake, and the Naung Khuin wetland, northwest of the lake, seem to hold a few lesser adjutant storks that also might breed there (Zöckler and Lay Win 2016). Davies et al., (2004) still had 17 lesser adjutant storks at Lake Indawgyi, indicating that the species at this protected inland lake has declined. Likewise, 14 lesser adjutant storks were counted between Myitkyina and Sinbo in 2003 (Davies et al., 2004) and still one bird in 2007 (van der Ven and Thet Zaw Naing, 2008). None were observed 14 years later in 2017 (Zöckler and Thant Zin, 2017). Davies et al., (2004) observed the species in five other sites in 2003, and the AWC lists three further sites in the Kachin State for 2004 with a total of 29 birds (Li and Mundkur, 2007). Van der Ven and Thet Zaw Naing (2008) also observed two lesser adjutant storks in Byee Lake in the Kachin State in 2007. Most of these sites no longer host the stork, and Figure 2.15 shows the present distribution compared with the former occupied KBA sites.

Pallas's Fish Eagle ***(Haliaeetus leucoryphus)***
Status: Vulnerable C2a(ii) ver 3.1
Population trend: decreasing

This wetland dependent fish eagle is breeding widely across Central and Eastern Asia, but its status as breeding bird in Myanmar and the Ayeyarwady Basin is not clear. The species is rarely observed in Myanmar. Davies et al., (2004) mentions only single birds from Lake Indawgyi from where also, most recently (2014), a few unconfirmed records have been reported (Ngwe Lwin pers. comm.). In April 2009, one bird was observed near Lasa in the Upper Basin (BANCA, 2009). Recent records only exist from the Ayeyarwady River near Talaw Gyi in River Section I (see Figure 2.17) from February 2017 (Zöckler and Thant Zin, 2017) and the Ayeyarwady Delta (Thet Zaw Naing pers. comm.). Interestingly, one juvenile bird with a satellite device attached travelled from Mongolia to Myanmar in three consecutive winters (M. Steele *in litt*.). The species is currently still classified as VU by BirdLife International (2016e), but recent declines across almost all key breeding areas in Mongolia, Nepal, India, and Bangladesh strongly suggests that an uplisting to EN is inevitable (see BirdLife International RL discussion forum). In Mongolia, during surveys in summer 2009, it was noted that two recently completed hydroelectric dams were severely disrupting water levels in the affected drainage basins and could potentially affect all sites where the species occurs in the Great Lake Basin (Gilbert et al., 2014).

Sarus Crane (*Antigone antigone*)
Status: Vulnerable A2cde+3cde+4cde ver 3.1
Population trend: decreasing

Figure 2.20 - Sarus crane in the Ayeyarwady Delta (Photo credit: C. Zöckler)

The Sarus crane is globally VU due to its restricted range and continuous decline (BirdLife International, 2016c). The situation in Myanmar and in the Ayeyarwady Basin appears to be still stable. In the Ayeyawady Basin, there are two main breeding sites for the crane remaining. In Lake Indawgyi and neighboring wetlands, such as Naung Khuin, one or two pairs are breeding. In spring 2017, a nesting pair was found on the west side of the lake near Lonton (Ngwe Lwin pers. comm.). The stronghold for the crane is in the Ayeyarwady Delta. WCS dispatched a team working on surveying and protecting a population of an estimated 54 pairs in the delta area (A. Diment in litt.), which is proposed to become protected and is listed as a KBA.

In winter up to eight Sarus cranes are regularly visiting the marshes on the western side of Lake Indawgyi periodically. At times, the number increases up to 22 birds (Zöckler, 2015).

Black-Necked Stork (*Ephippiorhynchus asiaticus*)
Status: Near Threatened ver 3.1
Population trend: decreasing

Although globally still comparatively common and widespread (BirdLife International, 2016d), the bird is rare in Myanmar. The status of this stork in Myanmar and the Ayeyarwady Basin is not clear. Recent observations only refer to Lake Indawgyi, but several areas in the Kachin State, mostly in the Upper and Chindwin Basin have not been surveyed since 2009 due to military conflict. Davies et al., (2004) mentioned that there were 15 birds in the Myitkyina - Sinbo River section in 2002, but none were observed in 2017, the previous years (Zöckler and Thant Zin, 2017), or at any other sites. Li and Mundkur (2004) mentioned at least five sites in the Upper and Chindwin Basin for this stork species in the late 1990s. Tordoff et al., (2008) also mentioned several sites in the Kachin State where the species was present in 2003 to 2005. Tizard (pers. comm.) mentioned two pairs breeding with nests and young in the Hukaung Valley in 2009. The latest report of black-necked storks is from Lake Indawgyi in December 2013 (Ngwe Lwin pers. comm.). Urgent surveys of northern sites are needed to establish the present status and trends of this species in the Ayeyarwady Basin.

Figure 2.21 - Black-necked stork at Lake Indawgyi (Photo credit: B. Olesen)

Ferruginous Duck ***(Aythya nyroca)***
Status: Near Threatened ver 3.1
Population trend: decreasing

The species is a regular winter visitor in Myanmar, migrating from Central Asia and southern Mongolia to the Upper Ayeyarwady Basin (see Figure 2.9). The species occurs at several sites, small and large lakes, but also along the Ayeyarwady River. The overall wintering population is now estimated at 1,500 to 2,500 birds, of which the large majority winters in Lake Indawgyi (AWC, Zöckler, 2015; Zöckler and Lay Win, 2016). The population at Lake Indawgyi is stable at approximately 700 to 900 individuals. However, the Ayeyarwady River population has completely vanished. In 2017, only a few scattered birds were observed in Myitkyina-Sinbo (Zöckler and Thant Zin, 2017). Only 10 years earlier, there were 1,500 ducks on the river (Thet Zaw Naing, 2008). On other river stretches between Thabeikkyin and Singu, where Davies et al., (2004) observed 45 ferruginous ducks in 2003, none were present in 2017 (Zöckler and Thant Zin, 2017). A further 45 ferruginous ducks were observed in several small lakes in the Mandalay area. Compared to the Asian Waterbird Count (AWC) results from 1991 to 1993, these are a 20- to 40-fold decline from at least 800 and 1,480 birds at two or three of these lakes counted during the AWC in the early 1990s (Li and Mundkur, 2004; Davies et al., 2004). The duck was still observed at Indaw Lake in 2003 but no longer in 2017 (AWC, Zöckler, 2017). Numbers at Lake Indawgyi seem to be stable over the past 10 years (see Figure 4.2).

Rusty-bellied shortwing ***(Brachypteryx hyperythra)***
Status: Near Threatened ver 3.1
Population trend: decreasing

This small chat-like bird with rufous-orange throat and underparts was not recorded in the Ayeyarwady Basin until 1999. It is endemic to the Eastern Himalayas, occurring at elevations from 450 to 3,000 m in thickets near broadleaf evergreen forest, although it may go lower in the winter time. More records in 2006 from the Htamanti Wildlife Sanctuary showed that the bird was seen at lower elevations in tall grassy habitats (BANCA, 2006). These observations led to the conclusion that more research is necessary to understand the global threat level. The bird has been downgraded from VU to an NT, but considering the little research and knowledge and the small range that this bird lives in, it is likely that this species might need to be re-classified again.

Jerdon's Babbler (*Chrysomma altirostre*)
Status: Vulnerable A2c+3c+4c ver 3.1
Population trend: decreasing

Figure 2.22 - Jerdon's babbler, *Chrysomma altirostre*, in the Ayeyarwady Delta (Photo credit: C. Zöckler)

The species is scarcely distributed along wetlands near rivers from Pakistan to Myanmar in the east. The global population is estimated to be only in the margin of 3,500 to 15,000 individuals (BirdLife International, 2017c). For many years the species was not recorded and was considered extirpated in Myanmar, when in 2014, a small population was rediscovered in the Ayeyarwady Delta (Rheindt et al., 2014). The species is range-restricted and only inhabits grasslands with tall grasses that extend over large areas. As these habitats are diminishing and being replaced by agricultural encroachment, the species is declining alongside this process.

Jerdon's Bushchat (*Saxicola jerdoni*)
Status: Least Concern ver 3.1
Population trend: stable

Figure 2.23 - Jerdon's bushchat in the Ayeyarwady Basin near Kattha (Photo credit: C. Zöckler, 2017)

This range-restricted species is only distributed in grasslands in the Himalayan foothills, central Myanmar, Northern Laos, and Tonkin. It lives in reedbeds, tall grass in wetlands, and along large rivers, such as Lake Indawgyi. Even though not quite unexpected, it was surprising to find this species still common among the tall reedbeds accompanying the river channels in Section III (see also Figure 2.24).

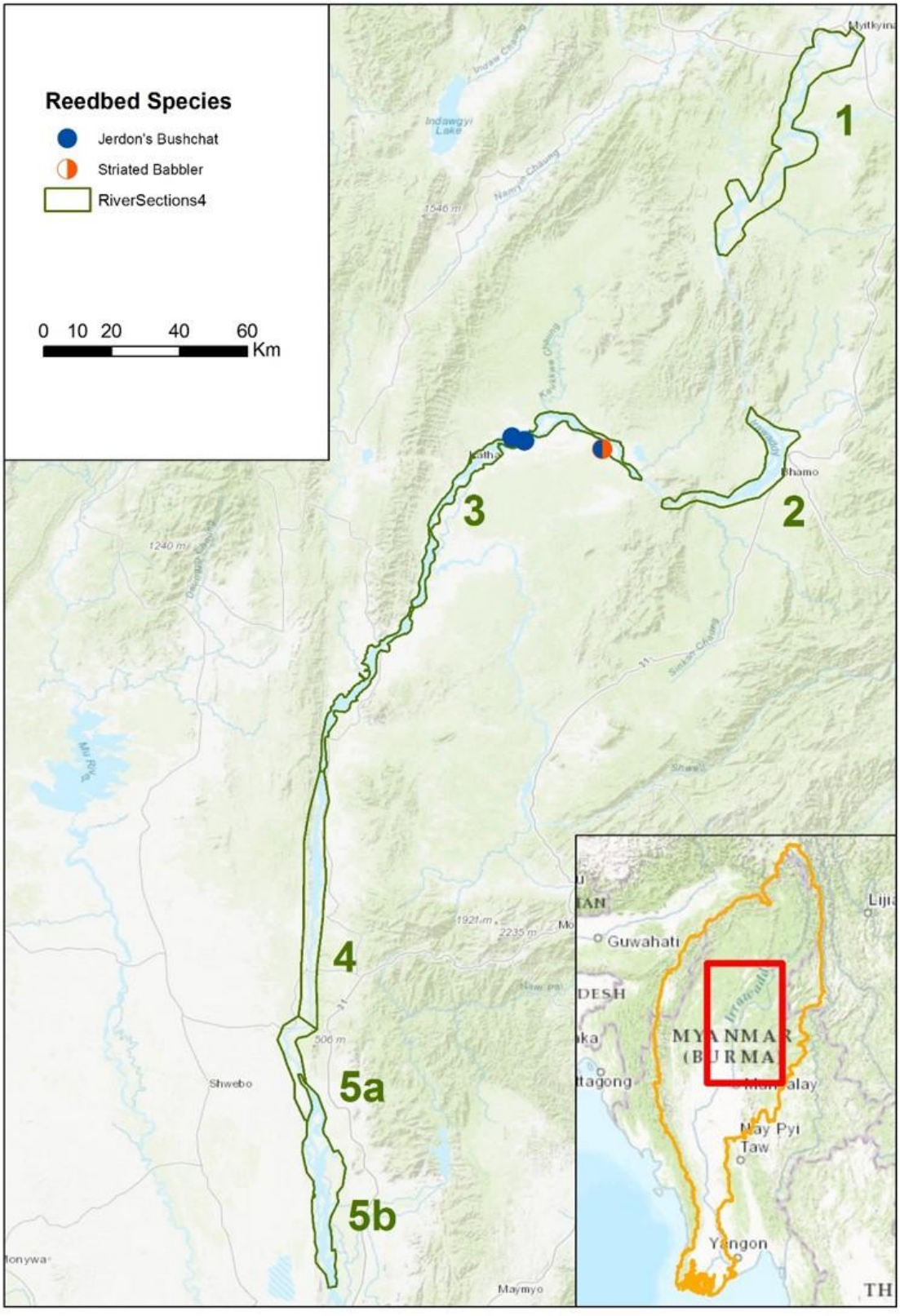


Figure 2.24 - Distribution of two selected range-restricted and rare reedbed breeding birds (Jerdon's babbler, *Chrysomma altirostre*, and striated babbler, *Argya earlei*) along the Ayeyarwady River

2.3 Not Globally Threatened Waterbirds

Waterbird counts between the years at selected river stretches allow comparisons for more common species. The following section provides some focus and insight on the abundance and distribution of some more common waterbirds on the river. The ruddy shelduck and the small pratincole are characteristic, dominant waterbirds of the Ayeyarwady and Chindwin Rivers. The bar-headed goose is characteristic and predominantly roosting along these large river banks and adjacent fields. Table 2.6 summarises the count data for most waterbirds during the February 2017 survey compared with previous counts (Davies et al., 2004).

Table 2.6 - Overall abundance of selected characteristic waterbirds on the Ayeyarwady River between Myitkyina and Bagan in 2017 (Zöckler and Thant Zin, 2017) and comparison with data from the 2001 to 2003 surveys for some species, where data are available Davies et al., 2004; Wetlands International, 2017

* = counts incomplete or not available for all sections

Species	*Scientific name*	2017	2001 to 2003
Cormorant	*Phalacrocorax carbo*	1,375	1,645*
Little Cormorant	*Phalacrocorax niger*	720	
Darter	*Anhingamelanogaster*	39	88*
Black Stork	*Ciconia nigra*	75	233
Asian Openbill	*Anastomus oscitans*	725	
Grey Heron	*Ardea cinerea*	442	
Great Egret	*Ardea alba*	192	
Little Egret	*Egretta garzetta*	816	
Cattle Egret	*Bubulcus coromandus*	989	
Bar-headed Goose	*Anser indicus*	106	3,300
Greylag Goose	*Anser anser*	156	
Ruddy Shelduck	*Tadorna ferruginea*	7,865	8,804
Gadwall	*Anas strepera*	651	2,364*
Spot-billed Duck	*Anas poecilorhyncha*	3741	1,388*
Mallard	*Anas platyrhynchos*	746	
Pintail	*Anas acuta*	031	240*
Small Pratincole	*Glareola lactea*	5,920	7,785
Pacific Golden Plover	*Pluvialis fulva*	336	
Eurasian Crane	*Grus grus*	425	1481
Northern Lapwing	*Vanellus vanellus*	63	
River Lapwing	*Vanellus tectus*	13	58*
Kentish Plover	*Charadrius alexandrinus*	359	
Lesser Sandplover	*Charadrius mongolus*	164	
Little Ringed Plover	*Charadrius dubius*	295	
Greenshank	*Tringa nebularia*	87	66*
Spotted Redshank	*Tringa ochropus*	314	
Temminck's Stint	*Calidris temminckii*	615*	178*
Dunlin	*Calidris alpina*	41	
Brown-headed Gull	*Chroicocephalus brunnicephala*	196	

Ruddy Shelduck ***(Tadorna ferruginea)***
Status: Least Concern ver 3.1
Population trend: unknown

Figure 2.25 - Male (background) and female ruddy shelduck near Myitkyina (Photo credit: C. Zöckler)

In total, more than 7,860 birds of this species were recorded between Myitkyina and Bagan during the field trip in February 2017 (Zöckler and Thant Zin, 2017). The ruddy shelduck is the most abundant waterbird on the river. Most of the birds are migratory and visit the river in the winter months between October and March. They originate from lakes in the Himalayas and Central Asian Steppes. Some local resident shelducks breed in the Upper Ayeyarwady at higher elevations in the north. Only a few birds prefer the area north of Myitkyina (Li and Mundkur, 2007). Figure 2.26 shows the winter distribution and abundance in the survey area. The distribution is believed to be more widely distributed further south along the river up to Magwae and in the Chindwin River, but not so much in the delta area.

In many river sections, the number of ruddy shelducks observed were declining compared to surveys of previous years. In river Section 1 (Figure 2.26), between Myitkyina and Simbo, the number of ruddy shelducks declined since 2003 by 76.3% and by 75% in Section 2. For a few river sections, data from the 1993 AWC (Wetlands International, 2017) are available for comparison, indicating that the species might have been even more abundant in the early 1990's (see Figure 5.4 and Figure 5.3 in the trend section). In some sections, as in Section 3, the numbers seem to be higher than in 2003, suggesting redistribution. Section 6 is another site suggesting redistribution, where it had its highest count of birds, approximately 3,000, in February 2017. Overall, a small decline of at least 11 to 12% is noted (see Table 2.6). It is not clear what has caused the decline, but hunting and a loss of riverine habitats might be a major contributor.

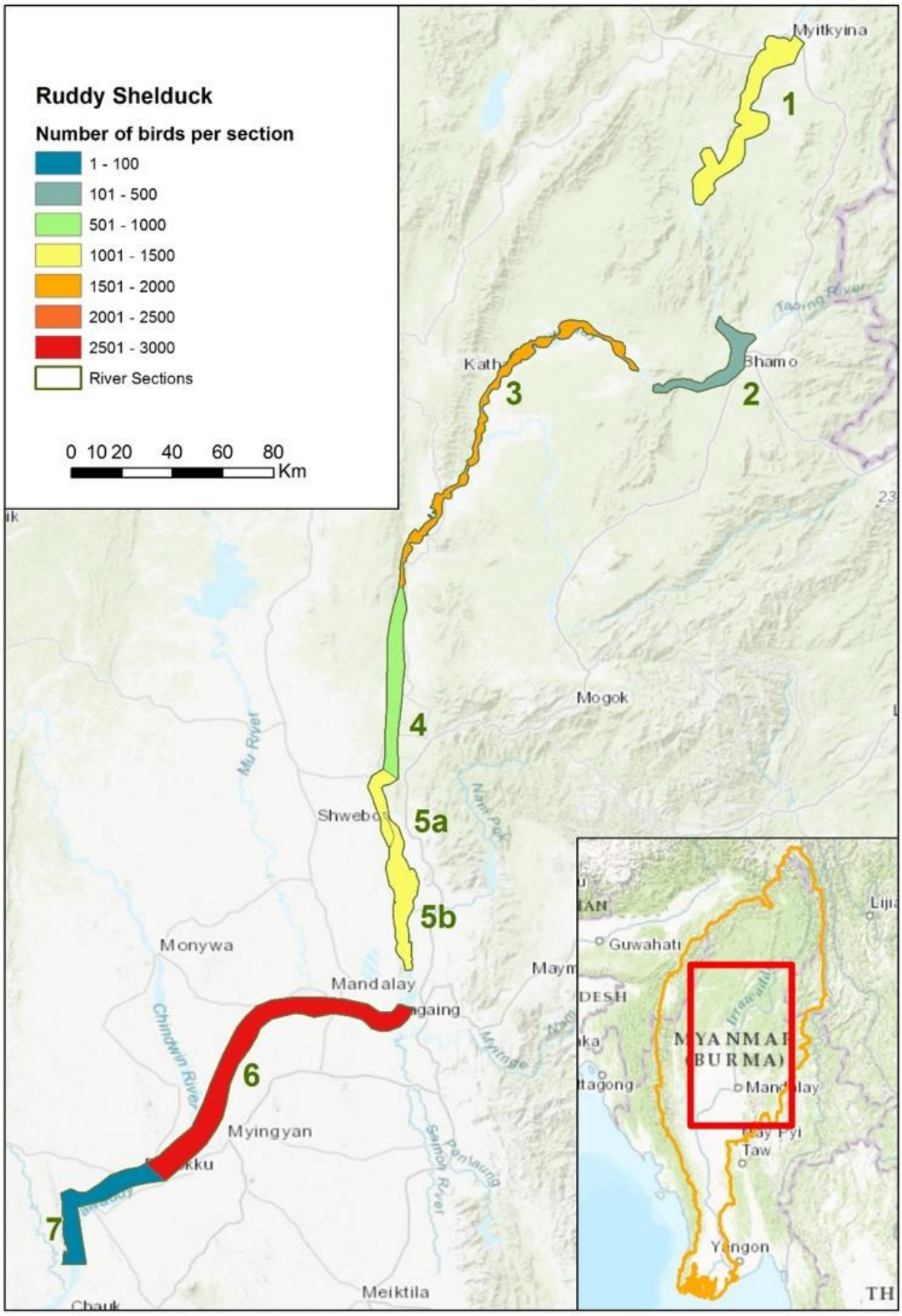


Figure 2.26 - Distribution patterns of ruddy shelduck, *Tadorna ferruginea*, across the different Ayeyarwady River sections The species is more widely distributed further north and south of these sections but has its stronghold in this part of the river.

Bar-Headed Goose (*Anser indicus*)
Status: Least Concern ver 3.1
Population trend: decreasing

Figure 2.27 - Bar-headed geese, *Anser indicus*, in Myitkyina (Photo credit: C. Zöckler)

This charismatic goose species is intrinsically linked with the Ayeyawady River. Every winter, these geese are migrating from the Himalayan Plateau, northern China, and Mongolia to the Ayeyarwady River, where they are roosting predominantly on the river and feeding in the fields nearby. Van der Ven and Thet Zaw Naing were observing more than 3,000 geese in the river between Myitkyina and Sinbo in 2001 (Van der Ven and Thet Zaw Naing, 2008). The AWC recorded more than 3,000 geese in 1993, and Davies et al. (2004) mentioned more than 3,000 individuals in 2003. The population gradually declined in numbers, however, to as low as 100 individuals by 2017. The survey in 2017 might have missed some birds, but Figure 2.28 clearly shows a strong and steady decline since 2003.

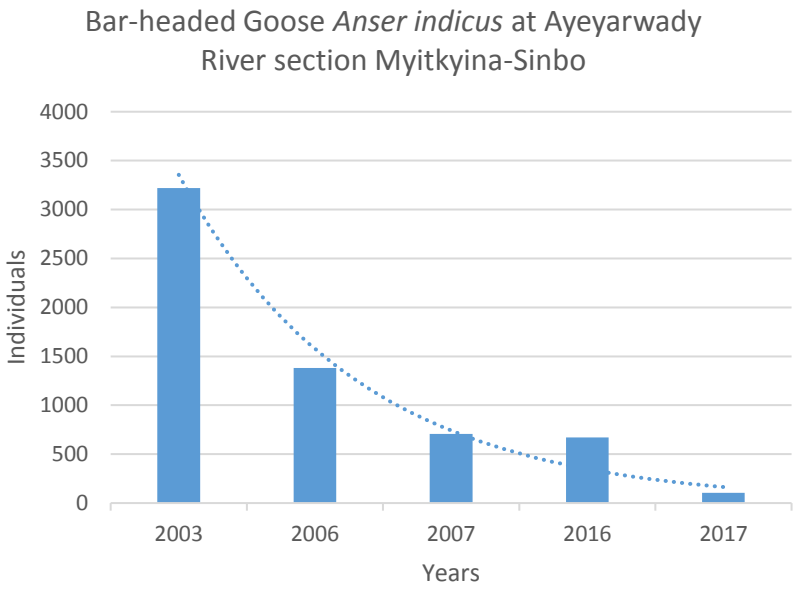


Figure 2.28 -Trend in the bar-headed geese population at the Ayeyarwady River section between Myitkyina and Sinbo (Davies et al., 2004; Thet 2006 and 2007; Zöckler and Thant Zin, 2017)

Further south few bar-headed geese were observed and none were recorded in 2017. Some birds spread as far as Lake Indawgyi, but the large majority prefer the river and, in particular, the section between Myitkyina and Sinbo.

Small Pratincole (Glareola lactea)
Status: Least Concern ver 3.1
Population trend: unknown

Figure 2.29 - Small Pratincole, *Glareola lacteal*, near Sinbo

(Photo credit: C. *Zöckler*)

Figure 2.30 - Small pratincole, *Glareola lacteal*, camouflaged between the pebbles in the Ayeyarwady River gravel bank (Photo credit: C. Zöckler)

This species is difficult to survey as the small shorebird is well camouflaged between the pebbles on the sandbanks and has most certainly been underestimated previously. However, due to their vocal display, larger colonies are less likely missed. Figure 2.31 shows the distribution of the small pratincole. The small pratincole resides and breeds on the river sand and gravel banks. It is not clear how many migrants will join from other regions nearby and add to the resident population in the winter. In total, the river stretch between Myitkyina and Bagan holds a population of approximately 6,000 birds. Further south, there might be another 1,000 birds, and the Chindwin River has held large populations in the past of approximately 1,800 birds (Li and Mundkur, 2007), suggesting a total estimate of approximately 9,000 to 10,000 birds might still be present in the Ayeyarwady Basin.

The largest colony found consisted of approximately 800 birds. Even though still approximately 6,000 birds were recorded in total during the survey in February 2017 (Zöckler and Thant Zin, 2017), the overall number seems to have declined by approximately 25% in the past 14 years (Davies et al., 2004; see Table 2.6). Count data, however, from Sections 6 and 7 might have been underestimated. Likewise, counts in previous years were incomplete and also underestimated the bird's population (Davies et al., 2004) so that the scale of decline cannot be fully established but is likely higher than 25%. Yet, there is little doubt that the species has declined significantly across all river sections. Considering this decline across one of the species' main distribution areas in the Ayeyarwady Basin, a listing of the species to globally NT or even VU is proposed, taking into account that the population has declined by more than 10% in 10 years, which is one criteria for listing a species to VU. Further assessments across the distribution of the species from other areas, such as Bangladesh, India, and Nepal, might be required.

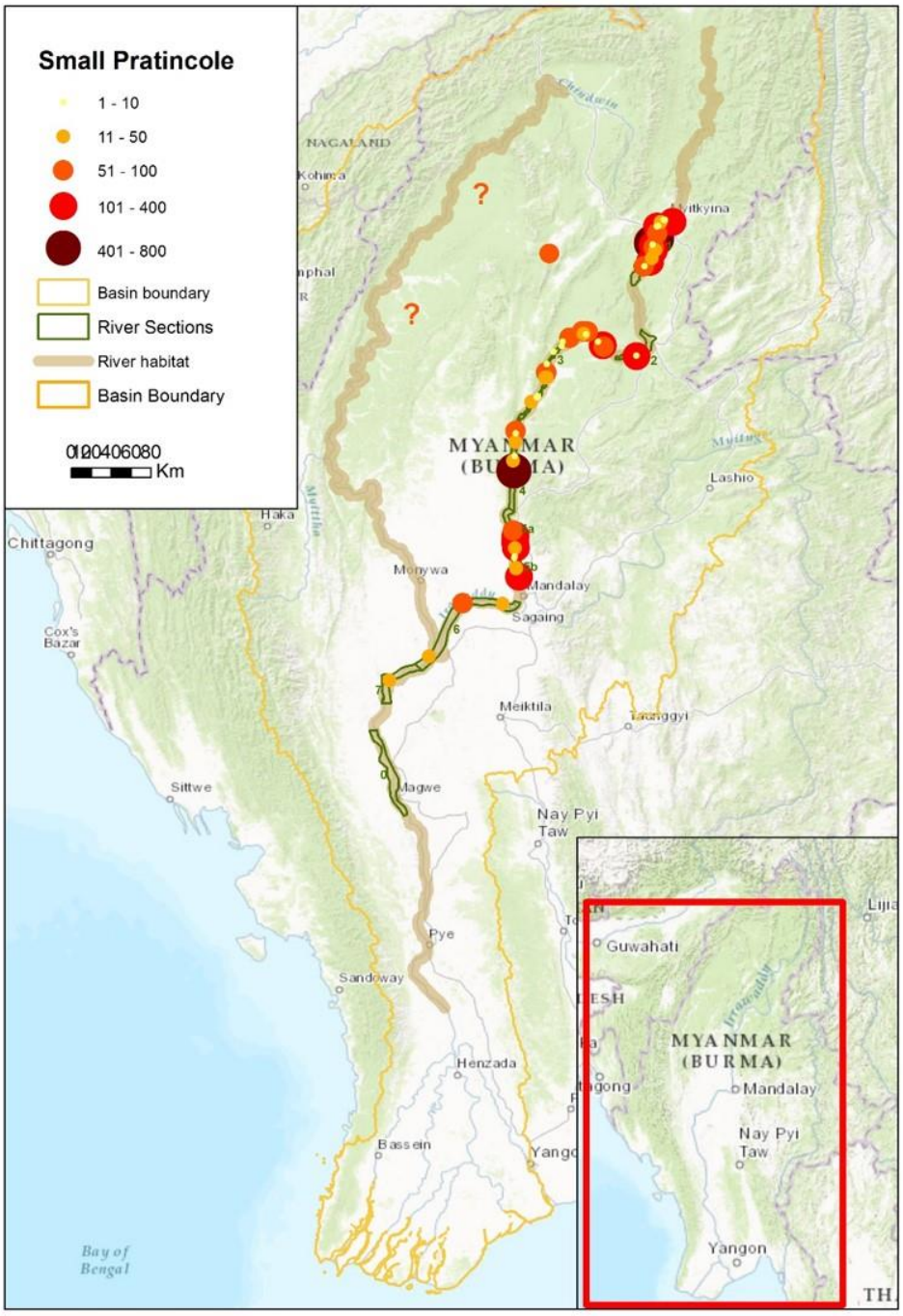


Figure 2.31 - Breeding distribution of the small pratincole, *Glareola lacteal*, in the Ayeyarwady Basin in 2017
Beige = river distribution, with detailed information on the river between Myitkyina and Bagan, unknown range of distribution and abundance.

2.3.1 *Riverine shorebirds*

Interestingly, the Ayeyarwady River is home to a large number of waders. Most of these waders are Arctic and subarctic migrants. Among these is the Temminck's stint, *Calidris temminckii,* most characteristic and wide-spread across the river's shores and adjacent wetlands. It rarely congregates in large numbers. The entire surveyed river stretches between Myitkyina and Bagan, making these large river sandbars and river banks the most important wintering sites for this tundra breeding species. The river between Mandalay and

Bagan, however, was not surveyed for Temminck's stint (see Figure 2.32). Therefore, the total of 615 birds between Myitkyina and Mandalay (Table 2.6) is likely to be an underestimate. The river is likely to host more than 1,000 of these birds.

Dunlins, *Calidris alpine,* were also quite numerous (Figure 2.32). This species is rare along the coastal wetlands of Myanmar (Zöckler et al., 2014), and it seems to have reached its most southern wintering range along the middle stretches of the Ayeyarwady River. It is not clear from where the total of 41 wintering dunlins originated. This sandpiper is circumarctic distributed and likely originating from the Russian tundra. It also has a sub-species that breeds further south in the Russian Far East, as far south as Sakhalin and the coastal Sea of Okhotsk (Zöckler, 1998). The ruff, *Philomachus pugnax,* is a rare visitor to southeast Asia and Myanmar. It was only observed once during the 2017 field survey (Figure 2.32) but was recorded in double figures in 2003 (Davies et al., 2004).

Common greenshank, *Tringa nebularia,* and common sandpiper, *Actitis hypoleuca*, have been numerous. They are both migrants from the boreal region in Russia. Interestingly, 338 Pacific golden plovers, *Pluvialis fulva,* were recorded. These migrants from the Russian Arctic tundra are often disguised by their habits to roost among the paddy fields, with a notable preference for buffalo and cattle pastures as well as peanut fields.

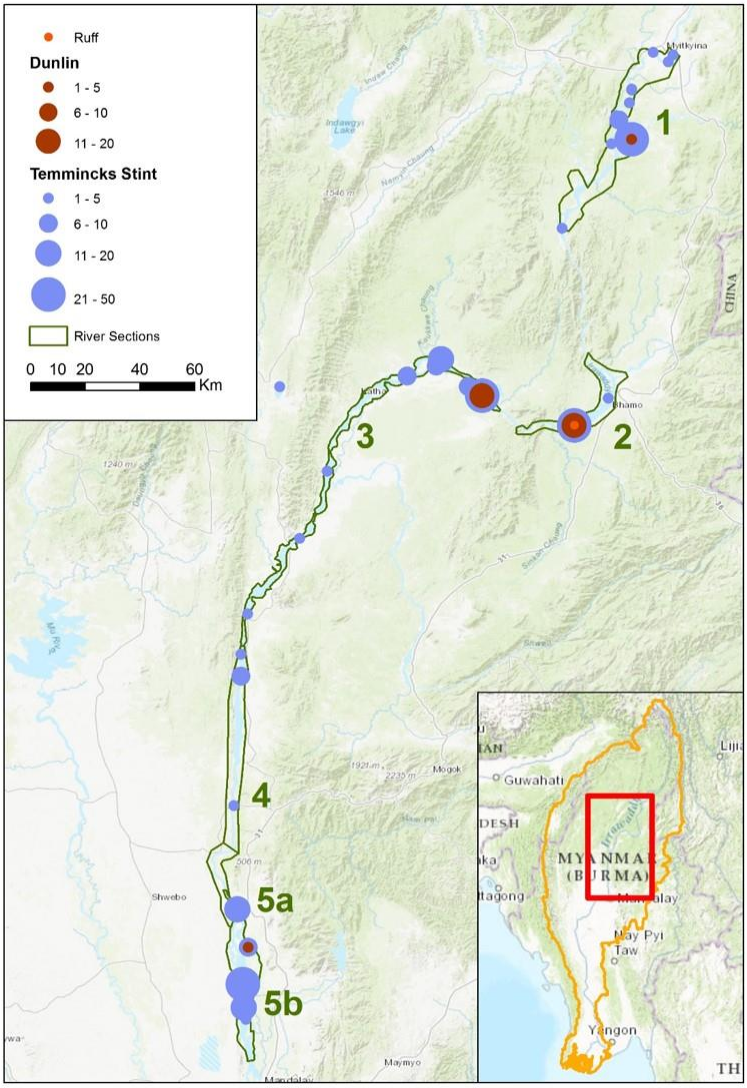


Figure 2.32 - Distribution of dunlins sandpiper, *Calidris alpine,* wintering on the Ayeyarwady River between Myitkyina and Mandalay

River Lapwing (*Vanellus duvaucelii*)
Status: Near Threatened ver 3.1
Population trend: decreasing

Figure 2.33 - River lapwing in Bagan (Photo credit: C. Zöckler)

Among the globally threatened or near-threatened riverine shorebirds is the river lapwing, *Vanellus duvaucelii,* which has been observed at only three locations in Sections 1 and 7 (see Figure 2.11). This bird is characteristic of small and large riverine wetlands, and its lack of wide-spread occurrence is concerning. It is also distributed outside the surveyed area. Davies et al. (2004) mentioned the river lapwing as widespread across the Ayeyarwady River, the Mogaung Chaung Tributary, and several lakes, such as Oat Ma In, the Tapain Chaung Oxbow, and the Wa Shaung Dam. Davies et al. (2004) lists the Bagan area as the most southern distributed site for the river lapwing known for Myanmar, but its distribution is now known to extend a little further south to the Magway area. The Chindwin River and sites in the Upper Ayeyarwady Basin at higher latitudes are listed by Li and Mundkur (2007). Thet (2006) also noted eight the river lapwing for Lake Indawgyi in December 2005. More recent records include two birds at Toung Thanman Inn near Mandalay in February 2016 (Aung et al., 2016).

Great Thick-Knee (*Esacus recurvirostris*)
Status: Near Threatened ver 3.1
Population trend: decreasing

Great thick-knees are linked with sand bars on the river and along the coasts. As ground nesting birds, they are sensitive to disturbance and prone to regular predation and egg collecting by local people. These large birds are surprisingly and notoriously difficult to spot on the sand bars. They were not observed during the field survey in February 2017 and have not been reported recently by other observers from locations in Bagan that are regularly visited. Therefore, it must be feared that the great thick-knees are locally extirpated along the river between Myitkyina and Bagan. There have been older records from this river stretch, but never large numbers. Davies et al. (2004) mentions three great thick-knees on the river between Myitkyina and Sinbo (Section I), singles from Naung U near Bagan and the Mogaung Chaung Tributary, and 11 birds flying together at Nyang Yan Lake. Li and Mundkur (2007) list a few sites with records for great thick-knees also in

the Chindwin Tributary. The sites along the Ayeyarwady River might have been vacated, and no record has been known for several years. More recent data include a pair at Chindwin River near Linpha (Naing Lin pers. comm) and an observation of one bird at Nga Mann Thaung in the Outer Delta Islands by H. Thiessen (Zöckler, 2016).

2.4 Reptiles

There have been 291 different reptiles recorded in Myanmar (Ministry of Environmental Conservation and Forestry [MOECAF], 2015). An exact number of species in the Ayeyarwady Basin is not available as the distribution for only 134 species is known in the Ayeyarwady Basin from ditgitised distribution data provided by the IUCN (see Annex 3). However, many reptiles are not digitized, but the estimated total is approximately 200 species for the Ayeyarwady Basin.

It is important to distinguish between several groups of reptiles living in the Ayeyarwady Basin. There are 172 snakes (almost entirely terrestrial), 87 lizards (all terrestrial), 32 turtles and tortoises, and 4 crocodiles recorded in Myanmar. Of these, 21 species are endemic to Myanmar and 27 are red-listed (IUCN, 2017). Table 2.7 lists all 24 globally threatened species, 1 near-threatened turtle, 1 least concern saltwater crocodile of the Ayeyarwady Basin, their RL status, and their occurrence in KBAs.

Table 2.7 - Globally threatened reptile species, their RL status, and their occurrence in KBAs in the Ayeyarwady Basin

	Common name	Scientific name	RL	No. of KBAs
1	Burmese star tortoise	*Geochelone platynota*	CR	3
2	Burmese narrow headed softshell turtle	*Chitra vandiyki*	CR	12
3	Mangrove terrapin	*Batagur baska*	CR	
4	Hawksbill turtle	*Eretmochelys imbricata*	CR	
5	Arakan forest turtle	*Heosemys depressa*	CR	1
6	Keeled box turtle	*Cuora mouhotii*	EN	
7	Yellow tortoise	*Indotestudo elongata*	EN	Mount Popa
8	Big-headed turtle	*Platysternon megacephalum*	EN	
9	Burmese mountain tortoise	*Manouria emys*	EN	
10	Burmese peacock softshell turtle	*Nilssonia formosa*	EN	18
11	Burmese roofed turtle	*Batagur trivittata*	EN	1
12	Green turtle	*Chelonia mydas*	EN	
14	Voris's water snake	*Enhydris vorosei*	EN	1
15	Asiatic softshell turtle	*Amyda cartilaginea*	VU	
16	Impressed tortoise	*Manouria impressa*	VU	5
17	King cobra	*Ophiophagus hannah*	VU	
18	Asian box turtle	*Cuora amboinensis*	VU	
19	Black marsh turtle	*Siebenrockiella crassicollis*	VU	
20	Burmese eyed turtle	*Morenia ocellata*	VU	
21	Olive Ridley turtle	*Lepidochelys olivacea*	VU	
22	Leatherback	*Dermochelys coriacea*	VU	
23	Malayan box turtle	*Cuora amboinensis*	VU	
24	Loggerhead turtle	*Caretta caretta*	VU	
25	Giant Asian pond turtle	*Heosemys grandis*	VU	
26	Asian leaf turtle	*Cyclemys dentata*	NT	
27	Salt water crocodile	Crocodylus porosus	LC	

Only a few reptiles are wetland species that rely on wetland habitats. Several globally threatened reptile species occur in the Ayeyarwady Basin and are discussed in more detail below:

Burmese Star Tortoise ***(Geochelone platynota)***
Status: Critically Endangered A1cd+2cd, C2a ver 2.3
(needs status updating)

The Burmese star tortoise is endemic to the dry zone of Central Myanmar. Formerly much more widely distributed, it is now found in only three sites (Platt et al., 2011). The turtle also has been found north in the Chindwin Basin (Platt et al., 2013), but the authors conclude that the existing populations at these sites are not viable and that the species is ecologically extinct as a result of historic long-term subsistence harvesting and, more recently, for supplying the illegal, international pet and food market (Platt et al., 2011).

Arakan Forest Turtle ***(Heosemys depressa)***
Status: Critically Endangered A2cd; B1+2c ver 2.3
(needs status updating)

The Arakan forest turtle was rediscovered in 2009, after more than 120 years, outside the Ayeyarwady Basin in the Northern Rakhine Yoma Range (Platt et al., 2010). In subsequent years, searches found the globally threatened turtle in the southern Chin Hills on the western margins of the Ayeyarwady Basin (Platt and Platt, 2016). Even though a survey in the northern Chin Hills did not confirm the presence of the species in the Natmataung Reserve, there is still a slight possibility that this elusive and endemic forest turtle might be found in Ayeyarwady Basin.

2.4.1 *Snakes and Crocodiles*

Among the snakes, the king cobra, the Burmese spitting cobra, and the Burmese python are classified as VN and Vorei's water snake as classified as EN.

Vorei's Water Snake ***(Enhydris vorisi)***
Status: Endangered B2ab(iii) ver 3.1
Population trend: Unknown

This saltwater snake is endemic to the Ayeyarwady Delta in Myanmar, although it is only found in the vicinity of Mawbin, Yangon District, and has an estimated area of occupancy of less than 500 square kilometres. It is threatened throughout its restricted range by extensive habitat decline due to human development, pollution, and dredging. It is listed as EN. There is little information on the distribution, ecology, and threats to this species, and further study is recommended (Murphy, 2010).

Burmese Spitting Cobra ***(Naja mandalayensis)***
Status: Vulnerable B1ab(iii,v) ver 3.1
Population trend: Decreasing

Even though it is not dependent on wetland habitat, the Burmese spitting cobra is endemic to Myanmar and the Ayeyarwady Basin. It has only been described recently by Slowinski and Wüster (2000) and is restricted to the Central Dry Zone. It is only known from 20 specimens and under pressure from snake collectors (Wogan and Stuart, 2012).

Saltwater Crocodile ***(Crocodylus porosus)***
Status: Lower Risk/Least Concern ver 2.3
(needs updating)

The saltwater crocodile, *Crocodylus porosus,* is currently listed at low risk or Least Concern, but the last IUCN assessment was in 1996, and it might need uplisting with a re-assessment. This crocodile is widely distributed

between southern India, along the northern Indian Ocean Coast, up to northern Australia. In Myanmar, the crocodile is restricted to the delta area. Here, a viable population thrives in the Meinmahla Kyun Wildlife Sanctuary with support of the Forest Department. The population has been estimated to be of fewer than 100 individuals and no more than 10 breeding females. The adjacent Pindaye and Kadonkalay areas have been vacant since the early 2000s (Thorbjanarson et al., 2006).

Figure 2.34 - Saltwater crocodile, *Crocodylus porosus*, in the Meinmahla Kyun Wildlife Sanctuary (Photo credit: C. Zöckler)

2.4.2 *Marine turtles*

According to Thorbjarnarson et al. (2000c), five species of marine turtles are known to nest in Myanmar at well-known islands and mainland beaches, known locally as 'turtle-banks.' These marine turtles include the Olive Ridley, *Lepidochelys olivacea*; loggerhead, *Caretta caretta*; green turtle, *Chelonia mydas*; hawksbill, *Eretmochelys imbricate;* and the leatherback, *Dermochelys coriacea*. The latter two species, of which the hawksbill is considered CR, were already considered extremely rare in 1999 (Thorbjarnarson et al., 2000c). The green turtle is considered EN by the IUCN RL, while the other three species are VU (see Table 2.7).

Maxwell (1911) conducted an extensive investigation of the turtle-banks of coastal Myanmar, as part of a review for the *Burma Fisheries Act of 1902*. At that time, turtles nested on Thamihla Kyun Island (KBA and protected area at the mouth of the Pathein River), Kaingthaung Kyun (KBA but not officially protected), and the outer islands at the mouths of the Ayeyarwady and Bogale Rivers (proposed KBAs). These beaches were leased by the Colonial Administration to local businessmen, who harvested and sold eggs. Approximately 1.5 million Olive Ridley turtle eggs and 1.6 million green turtle eggs were harvested annually. Based on this egg harvest and several assumptions regarding female fecundity, Maxwell (1911) estimated a nesting population of 5,000 green turtles and 3,750 Olive Ridley turtles.

According to the Myanmar Fisheries Department, the total number of nests in the region is currently approximately 300 annually, indicating a drastic reduction in regional turtle populations during this century. Most nesting is by Olive Ridley turtles (70%), loggerhead turtles (20%), and green turtles (10%).

At the time of Maxwell's report, the only islands in existence were Kadonkalay Kyun (15° 49' N 95°13' E), a recently formed sandbar, and Kaing Thaung Kyun. Human settlement began around 1980 (Thorbjarnarson et al., 2000c), and today both islands are densely populated. A series of outer islands have formed at the

mouth of the Ayeyarwady Delta, which today form the Outer Islands KBA, Ramsar Site, and Meinmahla Kyun Wildlife Sanctuary. Approximately 180 turtle nests were found each year along the eastern shore in 1999 (Thorbjarnarson et. al., 2000c), but according to Phone Maw (pers. comm) from DoF, the number dropped to less than 20 turtles in 2016. Today, only the Olive Ridley turtle, *Lepidochelys olivacea,* is nesting on these islands. In 2016/2017, only 9 nests were recorded in Kadongalay and 10 nests in Gayet Gyi and Ngamann Thaung.

Approximately 80 turtle nests are found annually in the 1990s on Gaye Gyi (15° 41' N 95° 16' E), a smaller island (ca. 1 km^2) located east of Kadonkalay. An additional 10 nests per year occur on Nga Mann Thaung, a small island that began forming east of Gayetgyi in the late 1980s. In 1999, only 1 to 2 turtles a year nest on Kaing Thaung Island, and no nesting occurs at Thaungkadon Kyun (Thorbjarnarson et al., 2000c).

The largest concentration of nesting in 1999 occurred on Thamihla Kyun (Diamond Island), a protected beach where, according to DoF, approximately 27,000 to 45,000 turtle eggs (mostly green and Olive Ridley turtles) were found (Thorbjarnarson et al., 2000c).

Prior to 1986, beaches were leased by DoF to the highest bidder, and virtually all eggs were collected. From 1986 to 1996, the egg collection program was run through local fishing communities, who were required to leave 33% of the eggs to hatch. However, we were told by local fishermen that compliance with these regulations was almost non-existent. After 1997, DoF fully protected all offshore turtle nesting beaches and established a conservation program (Thorbjarnarson et al., 2000c) that is still active today. The program involves nest-monitoring, establishment of hatcheries to incubate transplanted nests that are threatened by flooding, engagement with local communities, and even the relocation of villages to reduce the impact on nesting turtles (Phone Maw pers. comm). In addition to egg collection, the rapid increase in fish trawling poses a major threat that strangles many marine turtles in the nests.

2.4.3 *Freshwater turtles*

The WCS has an active turtle and tortoise conservation programme (WCS Turtle and Tortoise Programme). WCS reports that there are at least 27 species of freshwater turtles and tortoises known to occur in Myanmar, including eight endemic forms. Eighteen of these are known to occur in the Ayeyarwady Basin. Despite such high levels of diversity, the chelonians (turtles) of Myanmar are among the least studied and poorly known in the world; even basic distributional and life history information is unavailable for many species. This situation is especially alarming given the threats faced by turtle populations throughout the Ayeyarwady Basin from rampant commercial and subsistence harvesting and habitat destruction.

As a result of these combined threats, chelonian populations in many areas are now severely depleted, and some species are approaching ecological or biological extinction.

The IUCN RL assessed freshwater turtles in 2000 only, and no recent updates are available. Of those 20 species assessed that occur in the Ayeyarwady Basin, three are CR, three are EN, and five are VU. Several species would likely be uplisted in a new assessment. The distribution of these turtles in Myanmar and the Ayeyarwady Basin is still uncertain. Based on KBA information, the distribution for some freshwater turtles and one land based turtle (Asian box turtle) are shown in Figure 2.35 and Figure 2.36. Noting the gaps in this distribution, it is clear that the important turtle areas have not been comprehensively identified.

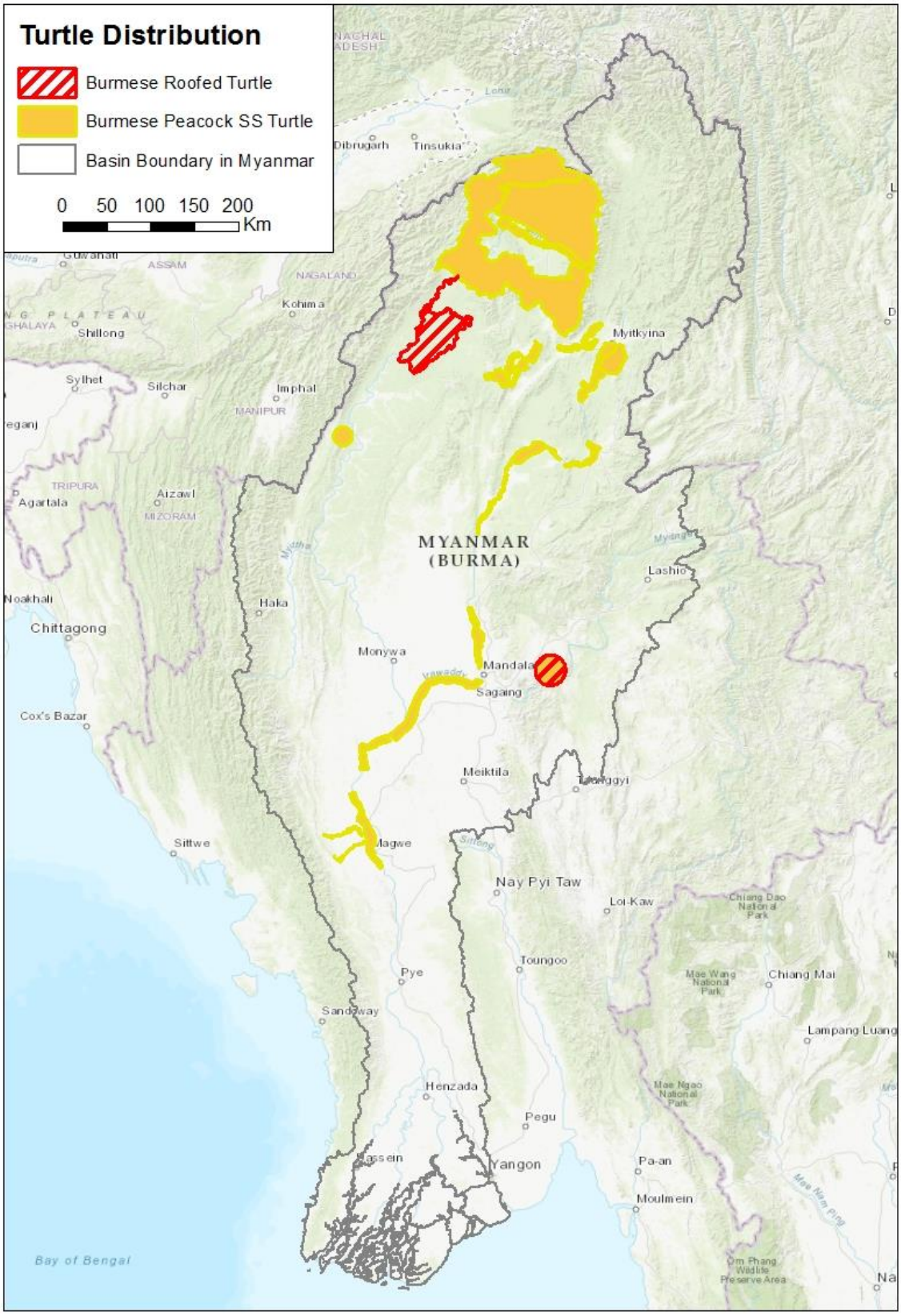


Figure 2.35 - Distribution of the Burmese roofed turtle, *Batagur trivittata* (EN), and the Burmese peacock softshell turtle, *Nilssonia formosa* (VU), based on KBA information and Platt and Platt (2016)

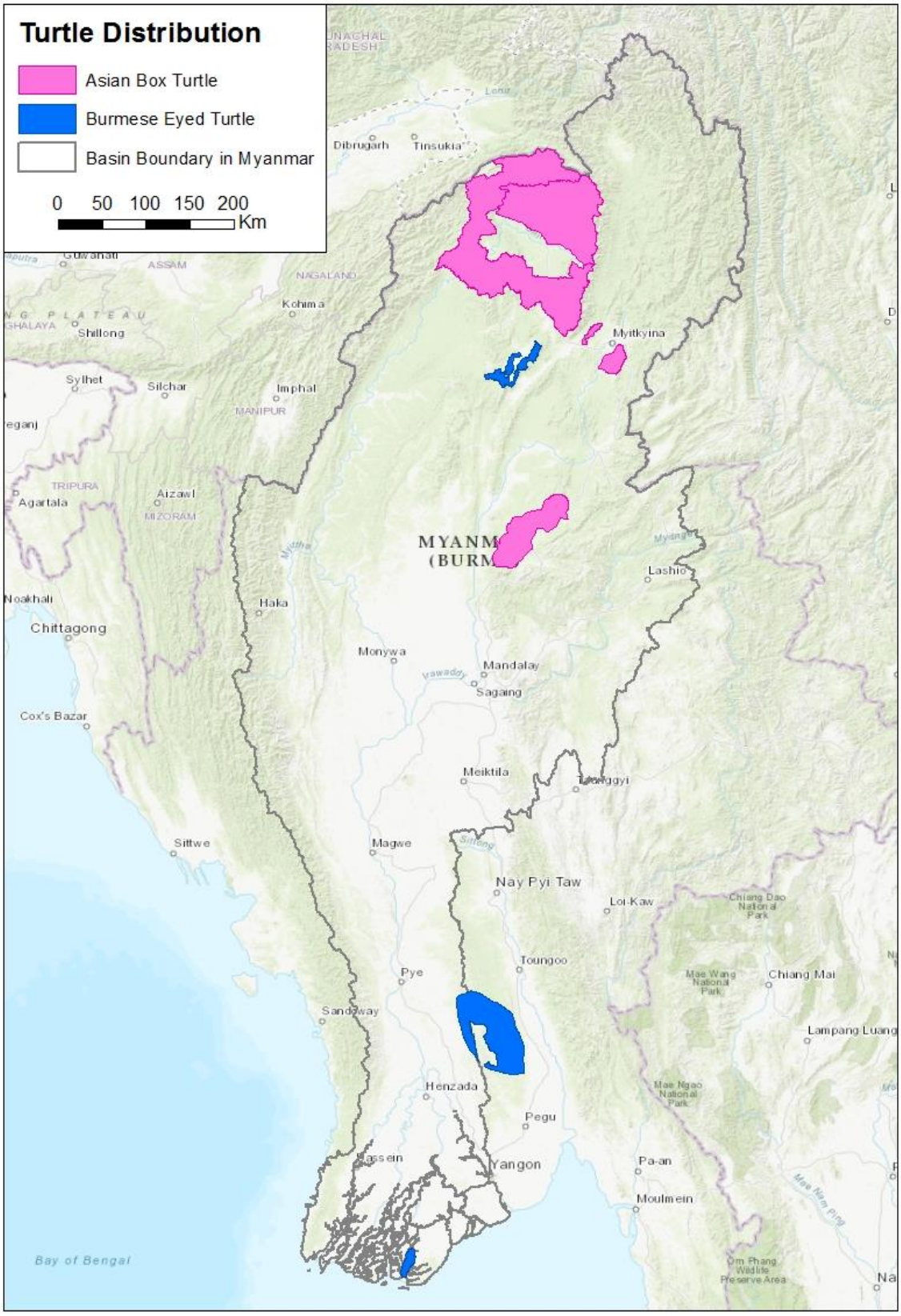


Figure 2.36 - Distribution of the Asian box turtle, *Cuora amboinensis* (VU), and the Burmese eyed turtle, *Morenia ocellata* (VU), based on KBA information

KBAs in Myanmar that include the presence of turtle species as one of their designation criteria are shown in Table 2.7.

In addition, and as part of the above KBAs, the following stretches of rivers have been identified as being of particular importance for turtle conservation (but some may no longer qualify after human interference by damming and other activities):

1. Dokthawady River, near Hsipaw (Shan State)
2. Upper Chindwin, from Htamanthi to Hkamti, including Limpha village
3. Nam Thalet Chaung Tributary to the Upper Chindwin

The following text discusses some of the most threatened freshwater turtles.

Northern River Terrapin or Mangrove Terrapin (*Batagur baska*)
Status: Critically Endangered A1cd ver 2.3
(needs updating)

The Mangrove terrapin (*Batagur baska*) is now almost certainly extinct in Myanmar and in the Ayeyarwady Basin. Most of the population crashed after heavy hunting and egg collection (Thjorbanarson et al., 2000b). Recent surveys in January 2004 discovered some remnant populations or individuals. Platt et al. (2008) conclude that small populations of the Mangrove terrapin persist in the coastal regions of Rakhine and Mon States and the Ayeyarwady and Tanintharyi Regions of Myanmar. Although the large population that once nested at the mouth of the Ayeyarwady River was decimated by the late 1980s (van Dijk, 1997; Thorbjarnarson et. al., 2000b), Platt et. al., (2008) suggest that small numbers remain in the Tha Baung River and its tributaries in the western delta. Given the intense levels of fishing activity in this river and the risk of drowning associated with the widespread use of fishing nets (Platt et al., 2003), the viability of this population must be considered tenuous at best (Platt et. al., 2008).

Burmese Roofed Turtle (*Batagur trivittata*)
Status: Endangered A1c ver 2.3
(status needs updating)

The Burmese roofed turtle (*Batagur trivittata*) was once an endemic species to the large rivers in Myanmar (only in the Ayeyarwady and Chindwin Rivers) and outside the Ayeyarwady Basin in the Sittaung and Lower Thanlwin Rivers, where it was historically reported to be common. However, rampant egg collection, conversion of nesting beaches to seasonal agricultural fields, and chronic over-harvesting of adults by fishermen led to long-term population declines. By the 1970s, the Burmese roofed turtle was assumed to be extinct.

The species was rediscovered in the Dokthawady River in Shan State (which flows into the Myitinge River and thence into the Ayeyarwady) during a 2001 WCS expedition (Platt et. al., 2005). Recent genetic analyses at the National University of Singapore suggest that as few as 10 breeding adults remain in the wild with only one or two males in the group. There is no doubt that the Burmese roofed turtle would have gone extinct if WCS had not intervened with effective in and ex situ conservation measures in 2006 (Platt and Platt, 2016). An assurance colony at the Mandalay Zoo, combined with an egg collection and headstarting program along the Upper Chindwin River, slowly and surely has halted an inexorable slide toward extinction of this once common turtle. In a landmark event, 60 Burmese roofed turtles, headstarted from eggs collected in the wild, were released into the Chindwin River in 2015.

Today, the Burmese roofed turtle is one of the most endangered turtles in the world, with the only surviving wild population restricted to a remote stretch of the Upper Chindwin River in the Htamanti Wildlife

Sanctuary (KBA, see also Figure 2.35). It was considered possibly CR or even EX, considering that no animals have been reliably recorded since 1935 despite mass trade of riverine turtles from Myanmar to China (Asian Turtle Trade Working Group conclusions in 2000, see www.iucn-tftsg.org), but it is now likely to be re-assessed as CR.

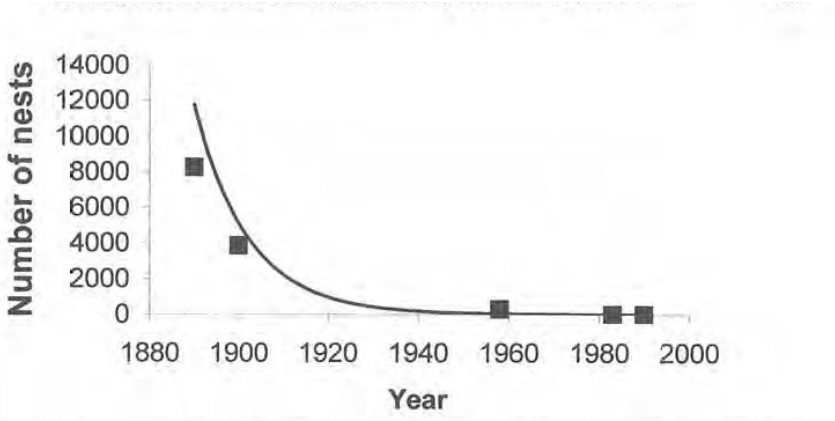


Figure 2.37 - Decline of *Batagur baska* and *Batugar trivittata* nesting at the mouth of the Ayeyarwady Delta Based on Maxwell (1911), Salter (1983), Van Dijk (1997), and Thorbjarnarson et al., (2000b)

SOFTSHELL TURTLES

Five species of softshell turtles are known to occur in Myanmar (*Amyda cartilaginea, Nilssonia Formosa, Chitra vandijki, Dogania subplana, Lissemys scutata*), and three of these are endemic (*N. Formosa, C. vandijki,* and *L. scutata*). A. *cartilaginea, N. Formosa,* and *C. vandijkii* are declining rapidly and will likely become CR within the coming decade.

Burmese Narrow-Headed Softshell Turtle (*Chitra vandijki*)
Status: proposed Critically Endangered A1cd; B1+2c (Platt *et al.,* 2014)
(not assessed by IUCN)

The Burmese narrow-headed softshell turtle, *Chitra vandijki* (Family Trionychidae), is a large (carapace length at least 1,000 millimetres [mm]), wholly aquatic freshwater turtle endemic to the Ayeyarwady and Chindwin River drainages of Myanmar that has only been found in three sites in the past 15 years. While only single turtles are caught by fishermen in the Ayeyarwady River, individual fishermen along the Chindwin tributaries reported catching 20 to 25 *C. vandijki* every season (Kuchling et al., 2004). Little is known concerning the ecology of *C. vandijki* in the wild. Populations are believed to be declining dramatically as a result of widespread over-harvesting to meet the demands of markets in southern China (Platt et. al., 2014).

Burmese Peacock Softshell *(Nilssonia formosa)*
Status: Endangered A1cd+2cd ver 2.3
(needs updating)

The Burmese peacock softshell turtle (*Nilssonia formosa)* is endemic to Myanmar and largely confined to the Ayeyarwady and Chindwin Rivers (Platt and Platt 2016). It has been listed for 18 KBAs (see Figure 2.35, WCS Turtle and Tortoise Programme), but information for several sites might need updating. The turtle is likely to be less widely distributed than previously.

Burmese Flapshell Turtle *(Lissemys scutata)*
Status: Data Deficient ver 2.3
(needs updating)

The Burmese flapshell turtle *(Lissemys scutata)* is another endemic softshell turtle that has been classified as data deficient and needs updating. It is still widely distributed and, despite wide-spread, intense harvesting, it is still common, if not abundant, in the Central Dry Zone (Platt et al. 2010).

2.5 Amphibians

According to the IUCN (MOECAF, 2015), there are approximately 120 amphibian species occurring in Myanmar. There are 116 frogs and toads, two caecilians, and two salamanders. For the Ayeyarwady Basin, there are still 102 species (see Annex 4 for a species list). This list is likely to be an underestimate of the real diversity of the amphibians present, considering the number of other vertebrate taxa recorded.

Two of the frogs and toads are classified as EN, and they also occur in the Ayeyarwady Basin. A further three of four NT occur in the Ayeyarwady Basin, 57 are LC and 14 DD. The EN species of frogs and toads include the following:
Frogs

(Leptobrachium rakhinensis)
Endangered B1ab (iii) ver 3.1
Population trend: decreasing

This species is currently only found in the Protected Area of the Rakhine Yoma Elephant Sanctuary on the eastern margins of the Ayeyarwady Basin. This species inhabits low elevation hills and evergreen rainforest in monsoon areas. It is associated with thick leaf litter on the forest floor as well as small streams and waterfalls. Habitat degradation associated with increasing agriculture and logging in the Rakhine Mountain Range (Geissmann et al., 2009) is likely to be affecting this species in its Myanmar locality (IUCN, 2015)

Yunnan Spiny Frog *(Nanorana yunnanensis)*
Status: Endangered A2acd ver 3.1
(needs updating)
Population trend: decreasing

This endangered frog was believed to occur only in China (Lu et al., 2004) but has been found recently to be present in the forest streams of the Upper Ayeyarwady in the Lasa and Myitsone area (BANCA, 2009).

The three NT species of frogs and toads include the following:

- ***Bufo pageoti*** - NT ver 3.1; Population trend: decreasing; restricted to forested mountain areas in the Upper Ayeyarwady. The toad lives on mountain streams and in Protected Areas.
- ***Glyphoglossus molossus*** - Blunt-headed burrowing frog; NT ver 3.1; Population trend: decreasing; widely distributed in Upper and Middle Ayeyarwady.
- ***Nanorana arnoldi*** - NT ver 3.1; Population trend: decreasing; the species is restricted to forest streams in the Upper Ayeyarwady.

CAECILIANS AND SALAMANDERS

There are two salamander and two caecilian species that have been assessed as LC in Myanmar.

Some of the NT species, listed above might need to be uplisted or re-classified. There might be more amphibians classified as globally threatened, because this group has not been re-assessed since 2004 (IUCN, 2015).

The Ayeyarwady Basin might also hold a much higher number of globally threatened amphibians, but this group has not been properly surveyed and assessed in the country and most of the Ayeyarwady Basin. It is, for example, likely that the globally EN Yunnan spiny frog (*Nanorana yunnanesis*) is more widely spread across the Upper Ayeyarwady (and is not limited in its distribution to the Chinese-Myanmar border along the entire Kachin State) and some areas in Myanmar. The same might be true for the VU *Scutiger gongshanensis* and five more amphibian species classified as NT.

2.6 Fish

Information on fish diversity, distribution, and numbers is scattered for the Ayeyarwady Basin. Kottelat (2017) summarises the current state of knowledge of the Ayeyarwady Basin in this section.

The overall number of fish recorded in the Ayeyarwady Basin, including the stretches in India and China, is 388 (Table 2.8). Of these, 311 are present in the Myanmar portion of the basin (see Annex 5), representing 55% of the total freshwater fish diversity of Myanmar. Of the remaining species, 49 are present only in the part of the basin in India and 30 in China; some of these species are expected to be present in Myanmar at least close to the border. The geographic coverage is fragmentary because of limited research, security issues, and travel difficulties. The total for the Ayeyarwady Basin is likely to be in the order of 500 to 550 (Kottelat, 2017).

A minimum of 564 fish species are recorded from Myanmar. Of them, 227 are presently known to be endemic to Myanmar. Among the 388 fish species recorded from the Ayeyarwady Basin, 193 (50%) are endemic to the basin, and 100 (26%) of the endemics are presently known only from Myanmar. Of the remaining endemics, 49 are present only in the part of the basin in India and 30 in China. Some of these species are expected to be present in Myanmar at least close to the border.

The following numbers are based on a critical review of the scientific literature by Kottelat (2017). Only a few Environmental Impact Assessments (EIA) and other reports were available, and the distribution and presence of data were used only when they seemed likely, when there were confirmed by photographs, or when the source of identification seemed reliable. Photographs from various sources were also used when reliable locality information was available and when the fish were unambiguously identifiable. Information on the Chindwin fish fauna in India is based on Vishwanath et al. (2007) and Shangningam and Vishwanath (2015). Information on the fauna of the Ayeyarwady tributaries in China is based on Yang et al. (2016). Taxonomy and nomenclature follows the most recent catalogue of *The Fishes of Inland Waters of Southeast Asia* (Kottelat, 2013).

Three hundred and eighty-eight fish species are known from the Ayeyarwady Basin (Table 2.8). Of this total, 309 (80%) are present in Myanmar. Of the remaining species, 49 are present only in the part of the basin in India and 30 in China; some of these species are expected to be present in Myanmar at least close to the border. Among the 388 fish species recorded in the whole Ayeyarwady Basin, 193 (50%) are endemic to the basin (i.e. found nowhere else in the world), and 100 (26%) of these 193 Ayeyarwady endemics are presently known only from Myanmar.

2.6.1 *Diversity at the sub-basin level*

Of the 388 fish species known from the Ayeyarwady Basin (Table 2.8), only 10 are recorded in all sub-basins. None of these 10 are endemic. All are species widely distributed outside the Ayeyarwady Basin (e.g., *Xenentodon cancila*, *Puntius chola*, *Heteropneustes fossilis*).

The 177 species in the Middle Ayeyarwady are greater than in all the other sub-basins, which is expected considering that it has the largest area. The Lower Ayeyarwady has the second most diverse fish fauna with 159 species. This high number partly results from the presence of several species that move from the sea to more or less brackish water. The Chindwin has almost the same number of species (155) but this is because it includes a mix of species equivalent to the Upper and Middle Ayeyarwady. The Upper Ayeyarwady has only 105 recorded species.

Although the areas for which data are available represent only a small part of the Upper Ayeyarwady, it is clear that the fauna known from upstream of Myitkyina is quite different from that of downstream. Out of a total of 105 species, only 41 are shared by the Upper and Middle Ayeyarwady. This means that 64 (61%) of the 105 species recorded in Upper Ayeyarwady do not occur downstream, and 136 (77%) of the 178 species recorded from the Middle Ayeyarwady do not occur upstream. The upstream fauna is characterised by a number of genera and species typical of rivers with high gradient, fast waters, rapids, and waterfalls (e.g., *Garra*, *Oreinus*, *Semiplotus*, *Schistura*, *Balitora*, *Exostoma*, *Glaridoglanis*, *Glyptosternon*, *Glyptothorax*, *Oreoglanis*, *Pseudecheneis*). They have developed extremely specialised morphological features, such as suckers, adhesive pads, and flat bodies, that allow them to survive in extreme currents. They are unable to survive in the lowland habitats. The same or similar genera (but different species) are found in the upper reaches of streams in all river basins in the south and the mainland of Southeast Asia and southern China. Two genera (*Malihkaia*, *Glaridoglanis*) are presently known only in the Upper Ayeyarwady.

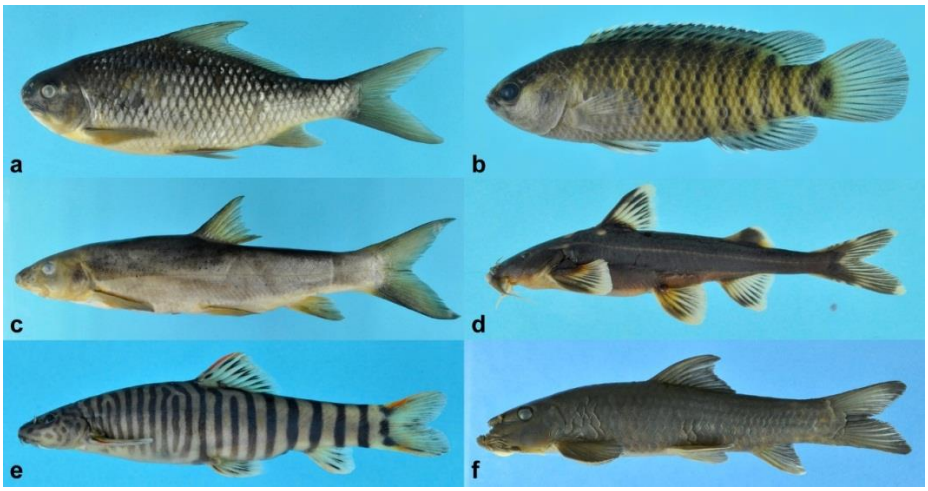


Figure 2.38 - Some of the fish species endemic to the Upper Ayeyarwady : a. *Semiplotus cirrhosus*; b. *Badis pyema*, first described in 2002; c. *Oreinus* cf. *meridionalis* (snow trout); d. *Glyptothorax longicauda*; e. *Schistura wanlainensis*, discovered in 2015; f. *Garra* sp. (Kottelat, 2017)

It is noteworthy that out of the 64 species of the Upper Ayeyarwady not occuring downstream, 57 (89%) are endemic to the Upper Ayeyarwady. Among them, 18 are endemic to the Mali Hka and Nmai Hka, and 34 of the 64 species are known only from the Upper Taping and Shweli and are absent from the Mali Hka and Nmai Hka. This shows that few species are distributed throughout the sub-basin, that the endemicity rate is higher than in the rest of the basin, and that most species have smaller distribution ranges than the lowland species.

In the Middle Ayeyarwady, the gorges between Sinbo and Bhamo remain virtually unsampled. It should be expected that some of the species adapted to the fast water habitats of the Upper Ayeyarwady (or related species) will occur there too. It seems that no sampling has ever been done in the main river between Simbo and Bhamo. In 2017 field work, two samples obtained from small tributaries included 30 species, of which 4 are apparently new to science.

Very little information is available on fish distribution in the Chindwin outside India, especially in the upper parts. Of the 155 species recorded in this sub-basin, 54 (35%) seem endemic, all from the upper part of the sub-basin. Of them, 49 are still known only from India. It is expected that a number of them will be found in

adjacent waters in Myanmar, but few are likely to be also present in the lower part of the sub-basin. This shows that the Upper Chindwin, like the Upper Ayeyarwady and the Upper Shweli, has a distinctive fauna, composed for 33% of endemics. Like the the Upper Ayeyarwady, the endemic fauna belongs to the genera and species typical of rivers with high-gradient rapids (e.g., *Garra*, *Oreinus*, *Schistura*, *Balitora*, *Glaridoglanis*, *Glyptothorax*, *Oreoglanis*, *and Pseudecheneis*). To date, there does not seem to be any genus endemic to the Chindwin.

The Middle Ayeyarwady is better known. It has a larger fish fauna, presently with 177 species. This reflects the large size of the sub-basin, which shows a variety of habitats – from the flood plain and marshes in the lowland to streams in low altitude hills. The fauna is relatively uniform in the floodplain, and it is the first one to have been studied, starting in the 1830s. Attention was first paid to larger-size species, and those of smaller size have usually been overlooked. Among the 90 species collected during the June 2017 survey, at least 5 species new to science were collected and several more could not be identified with certainty and might also be new to science. All have a small size (5 centimetres long). One of the newly-discovered species was observed in almost all sites between Shwegu and Mandalay. It was even a significant constituent of the catches in traps in freshly flooded lakes.

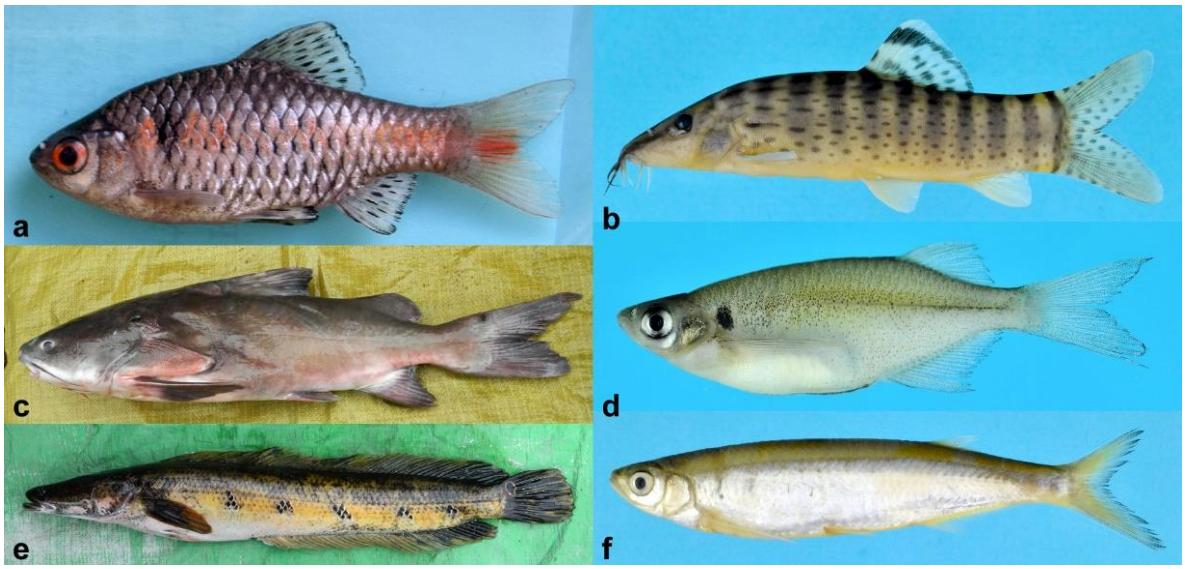


Figure 2.39 - Representative fish of the Middle Ayeyarwady : a. *Pethia padamya*; b. *Syncrossus berdmorei*; c. *Rita sacerdotum*; d. *Laubuka fulvescens*; e. *Channa marulius*; f. *Salmostoma sladeni* (Kottelat, 2017)

Out of the 177 species of the Ayeyarwady sub-basin, 48 (27%) are endemic to the sub-basin, and almost all of the endemics are known from the northern part of the sub-basin, especially between Mandalay, Lake Indawgyi, and Mogaung. This reflects a greater research activity, resulting from ease of access. Also, this area is in low altitude hills, and the species in these habitats have a smaller range, which results in higher endemicity. Most of these endemics were first reported in the last 20 years. It is predictable that surveys in other lowland hill areas along the edges of the sub-basin will result in the discovery of a greater number of species. Three genera (*Danionella*, *Pillaia*, and *Pillaiabrachia*) are endemic to the northernmost part of the Middle Ayeyarwady.

Lake Indawgyi is located in the northern part of the Middle Ayeyarwady sub-basin. It has a single species that is apparently endemic (*Mastacembelus pantherinus*). A few other species have been discovered in the basin of the lake, but with the total absence of information on the fish fauna outside the lake's basin, it is premature to speculate on possible endemics.

To date, 157 species have been recorded in the Lower Ayeyarwady. This sub-basin includes various habitats from permanently fresh to marine water, under tidal influence or not, often with daily to annual cycles of

salinity variation. This partly explains the high diversity. Still, the number of species is underestimated. Recent scientific literature reporting on the fish fauna of the Lower Ayeyarwady is scarce. Many species have been recorded in estuaries in India and Thailand or Malaysia that are expected to be present in the Ayeyarwady Delta. These are mainly small-sized species, which probably explains why they have been overlooked.

Of the 157 species, 88 are not found in the other sub-basins of the Ayeyarwady; of which, 80 are shared with the estuaries of some other rivers between India and Indonesia. This leaves 8 species endemic to the Lower Ayeyarwady. Two of the endemics are of small size and are found in permanent freshwater and in swamps. Three are from hill streams on the eastern slope of the Rakhine Range. The remaining 3 are from the river. One genus (*Ayarnangra*) is endemic to this sub-basin in the main river.

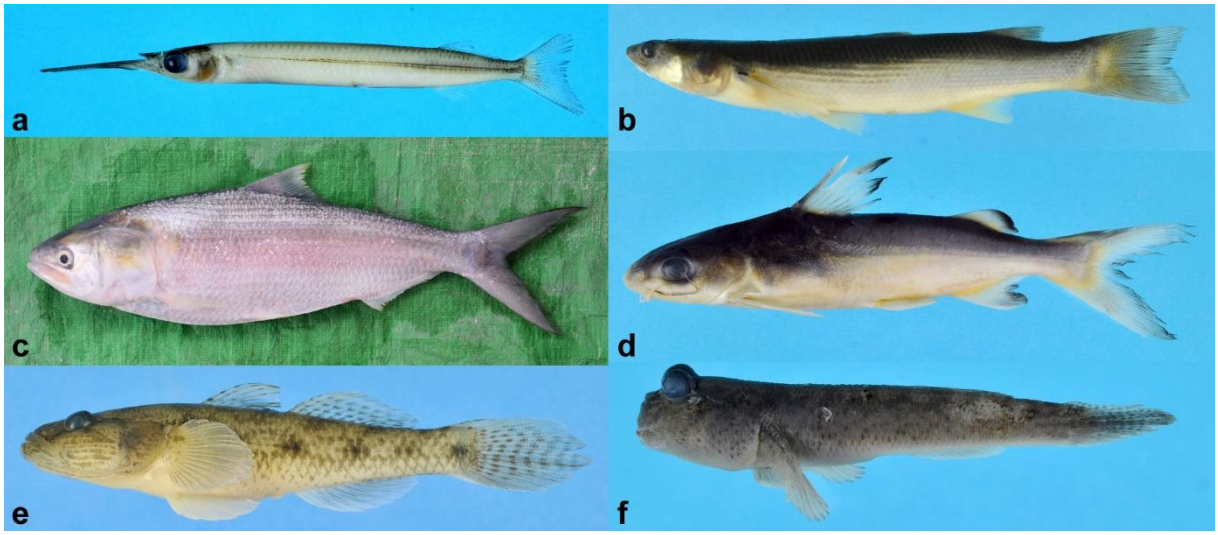


Figure 2.38 - Representative fish of the Lower Ayeyarwady : a. *Hyporhamphus limbatus*; b. *Rhinomugil corsula*; c. *Tenualosa ilisha* (ilisha); d. *Cephalocassis jatius*; e. *Glossogobius giuris*; f. *Periophthalmodon septemradiatus* (freshwater mudskipper) (Photo credit: M. Kottelat)

2.6.2 *Endemic, range-restricted, and threatened species*

Determining the endemism status of a species is important – first, because endemics with small distribution ranges deserve more careful attention, and second, because erroneously treating a species as endemic that later turns out to be widely distributed could mean that resources have been wasted for a species of lesser priority.

The probability that a species, known from a single or a few sites in a poorly known area, effectively is endemic to that area can be inferred from its ecological and the local topography, based on related species in areas with similar geomorphological and ecological settings. For example, experience with the more than 100 species of *Nemacheilidae* (small-sized fish with a benthic life in hill streams with moderate-to-fast current in northern Thailand and Laos) suggests that most species of the family in the area of Putao are likely to have a wider range in the Mali Hka Watershed. Some could be shared with Hmai Hka. Few are likely to be present outside the Upper Ayeyarwady, and some might be present only in a subset of the tributaries of the Mali Hka. The largest species and those living in the largest waterbodies, or those living in sluggish streams, are likely to have a wider distribution than the smallest ones, living in smaller streams with a steeper gradient.

Out of the 104 species recorded in the Upper Ayeyarwady, 63 (61%) species are apparently endemic. Of them, 18 are endemic to the Mali Hka and N'mai Hka. Twenty (41%) of the 49 endemic of the Middle Ayeyarwady are presently known only from the area of Myitkyina and the Mogaung Watershed (including the basin of Lake Indawgyi).

It is expected that most of the fast water endemics from Mali Hka and N'mai Hka will remain endemic to this area and will not be observed further downstream (except possibly between Simbo and Bhamo). Similar habitats in the upper part of other watersheds will be occupied by other species of the same genera, themselves likely endemic to these other watersheds. Also, it is likely that the endemics of the Mali Hka and N'mai Hka will not be equally distributed and that some will end up being endemic to only a part of the total sub-basin.

While the endemicity rate is high in the Upper Ayeyarwady and in the upper part of the Chindwin (with a small total number of species in any stream), the situation is different in the northern part of the Middle Ayeyarwady. In medium altitude areas and less steep hills (piedmont), the endemicity rate is lower, but with a higher total number of species in any stream, this low endemicity rate, in fact, still means a greater number of small-range species and endemics in any stream. In fact, most of the species new to science discovered in recent years have been obtained in this landscape (but there is also a sampling bias). Considering that only the small area between Myitkyina, Indawgyi, and Mogaung has retained some attention, a great number of additional small-range species must be expected when piedmont streams in other areas will be sampled. This applies to the the piedmont hill areas in the Chindwin, the norther part of the Middle Ayeyarwady, and the western and eastern edges of the Middle and Lower Ayeyarwady.

It is expected that a number of the endemics from the northern part of the Middle Ayeyarwady will be present further downstream or in similar habitats in the Chindwin. Those of very small size (e.g., *Danionella*), or with specialised habitats (e.g., *Chaudhuriidae*, most *Sisoridae*, *Nemacheilidae*), are likely to be represented by different congeners further downstream or in the Upper Chindwin.

2.6.3 *Endemism in Lake Indawgyi*

In the past, a number of species had been considered endemic to Lake Indawgyi, but this was mainly due to the fact that the lake was one of the few areas in the Ayeyarwady Basin to have been reasonably well surveyed and reported (Prashad and Mukerji, 1929) and that no similar work had been conducted elsewhere in the basin since. It now appears that most of the 'old' endemic species have been found elsewhere in the Ayeyarwady Basin, especially in the Mogaung Watershed to which the lake belongs. Since 2000, a number of additional species (new to science) have been discovered in the lake's basin. Of them, *Mastacembelus pantherinus* is the only one to reach a reasonable size (up to approximately 50 centimetres). It is widespread and abundant in the lake and its tributaries and has not been recorded outside the lake. That a large fish, abundant, easily identifiable, of a genus frequently seen on markets, has not been recorded outside the lake suggests it is potentially endemic to the lake.

Chaudhuria cf. *caudata* and *Lepidocephalichthys* sp. (apparently two unnamed species) are found only in the mud, dense vegetation, and leaf litter in the outlet and lower parts of some tributaries (those with deep water). They may or may not be present in similar habitats (if such exist) further downstream in the Indaw Chaung of Mogaung Watersheds. *Amblyceps* sp., *Physoschistura* sp., *Schistura* sp. and *Pterocryptis* sp. have all been discovered by surveys conducted in 2013 and 2014 (Kottelat, 2015a). They are not present in the lake but in small tributaries. They are likely to be more wide-spread in the basin and are expected to be found outside the basin too. They have escaped attention because of their small size, secretive habits, and habitats difficult to access and sample.

2.6.4 *Species of conservation concern*

In the context of the present report, species of conservation concern are species that are endemic to the Ayeyarwady Basin are are globally threatened species. Of the 388 species recorded in the Ayeyarwady Basin, 254 have been assessed in IUCN RL. The remaining 134 species have not yet been assessed, because they were discovered only recently.

The species below are listed according to their RL status in order of severity of threat. However, it should be understood that many fish known from the Ayeyarwady were assessed for the RL as part of the Eastern Himalayas Freshwater Biodiversity Assessment (Allen et al., 2010). Many more were assessed as part of the Indian National Assessment, which could have distorted the assessment. Out of the 254 assessed, 28 (11%) of the speces are threatened (2 CR, 6 EN, 20 VU) and 20 (8%) are near threatened.

Table 2.8 - Fishes of the Ayeyarwady Basin : Conservation status according to IUCN RL. Only species with a threatened status are listed: CR, Critically Endangered; EN, Endangered; VU, Vulnerable; NT, Near Threatened

	CR	EN	VU	NT
Total	2	7	20	20
Order Carcharhiniformes **Family Carcharhinidae**				
Glyphis glyphis	x			
Order Pristiformes **Family Pristidae**				
Pristis pristis	x			
Order Myliobatiformes **Family Dasyatididae**				
Makararaja chindwinensis				
Order Anguilliformes **Family Anguillidae**				
Anguilla bengalensis				x
Anguilla bicolor				x
Order Clupeiformes **Family Clupeidae**				
Tenualosa ilisha				
Order Cypriniformes **Family Cyprinidae**				
Brachydanio kyathit				x
Cirrhinus cirrhosus			x	
Devario acuticephalus			x	
Devario naganensis			x	
Devario yuensis			x	
Garra bispinosa			x	
Garra compressa			x	
Garra elongata				x
Garra gravelyi				x
Garra litanensis			x	
Garra nambulica			x	
Garra paralissorhynchus			x	
Garra poecilura				x
Garra spilota				x
Morulius nandina				x
Neolissochilus baoshanensis				
Neolissochilus compressus				
Neolissochilus heterostomus				
Neolissochilus hexastichus (?)				x
Neolissochilus qiaojiensis				
Opsarius dogarsinghi			x	
Osteobrama belangeri				x
Pethia atra			x	
Pethia khugae			x	

	CR	EN	VU	NT
Pethia manipurensis		x		
Pethia ornata			x	
Pethia tiantian				x
Pethia yuensis			x	
Rasbora ornata			x	
Tor putitora (?)		x		
Tor yingjiangensis				
Family Psilorhynchidae				
Psilorhynchus microphthalmus		x		
Family Botiidae				
Syncrossus berdmorei				x
Family Nemacheilidae				
Physoschistura prashadi			x	
Physoschistura tigrina		x		
Schistura kangjupkhulensis		x		
Schistura khugae			x	
Schistura manipurensis				x
Schistura nagaensis			x	
Schistura reticulata		x		
Order Siluriformes **Family Sisoridae**				
Bagarius bagarius				x
Bagarius yarrelli				x
Myersglanis jayarami			x	
Pseudecheneis ukhrulensis			x	
Family Siluridae				
Ompok pabda				x
Ompok pabo				x
Wallago attu				x
Order Perciformes **Family Ambassidae**				
Parambassis lala				x
Family Gobiidae				
Papillogobius reichei				x

CRITICALLY ENDANGERED

Two species are listed as CR in the Ayeyarwady Basin – the river shark and the sawfish.

Glyphis gangeticus (river shark) – This species was long-listed under the name *G. siamensis* as endemic to the mouth of the Ayeyarwady (despite its name). It had been known from a single specimen collected in the 1890s, and no additional material has been reported since in scientific literature. A recent study has shown that this individual cannot be distinguished from the Ganges river shark, *G. gangeticus* (Li et al., 2015). The species is apparently marine, coastal, and it is assumed that the young grow up in large rivers, which they ascend for some distance. They have been recorded in the Indus, Ganges, Ayeyarwady, Java, and Borneo Rivers. The species is still listed under both names in the Red List, both as CR. All species of *Glyphis* seem to be rare. They ascend rivers for some distance.

Pristis pristis (sawfish) – This species was known in Southeast Asia and Australia as *P. microdon*. It is presently considered that *P. microdon* is the same species as *P. pristis* (Faria et al., 2013; Last et al., 2016). *P. pristis* has a wide distribution in tropical coastal areas of all oceans (except the American coast of the Pacific Ocean) and is globally threatened by overfishing. It is an occasional visitor in estuaries.

ENDANGERED

Six species are listed as EN in the Ayeyarwady Basin. All are known from the Manipur Region only, and some are not expected to be present in Myanmar. For some, a reassessment could mean a down-listing.

VULNERABLE

Twenty species are listed as VU. Many of them are only described from Manipur in India and might not occur in the delta at all or, if recorded, in higher numbers and no longer qualify as VU.

Cirrhinus cirrhosus – Needs to be re-assessed. The assessment is based on wild stocks in India only, potentially DD. The species is reportedly widely distributed in India, Bangladesh, and Myanmar, but there has not been a detailed comparison of the various populations. It should be investigated whether they are all conspecific. Besides, the species is widely cultivated (often under the name *C. mrigala*, a synonym [Roberts, 1997]; called mrigal in aquaculture), and the assessment applies to the wild populations in India. The status of the wild population in Myanmar is not known as well the extant of aquaculture and potential for escapes. Because of the taxonomic uncertainties and the large range, the species does not seem to qualify for VU globally. It is possibly more objectively evaluated as DD.

Devario acuticephalus – Small known range in Manipur. Not expected in Myanmar.

Devario naganensis – Small known range in Manipur. Possibly present in Myanmar. If present in Myanmar, will need to be assessed for global threat.

Devario yuensis – Small known range in Manipur, near border. Expected to occur in Myanmar. If present in Myanmar, will need to be assessed for global threat.

Garra bispinosa – Seems to have been assessed as VU only on the basis of being known from a single locality in China at the border with Myanmar. This certainly does not allow an assessment as VU. It should have been DD.

Garra compressa – Small known range in Manipur, near the border. Expected to occur in Myanmar. If present in Myanmar, will need to be assessed for global threat.

Garra litanensis – Small known range in Manipur. Not expected in Myanmar.

Garra nambulica – Small known range in Manipur. Not expected in Myanmar.

Garra paralissorhynchus – Small known range in Manipur. Not expected in Myanmar.

Myersglanis jayarami – Small known range in Manipur. Not expected in Myanmar.

Opsarius dogarsinghi – Small known range in Manipur, near the border. Expected to occur in Myanmar. If present in Myanmar, will need to be assessed for global threat.

Pethia atra – Small known range in Manipur. Not expected in Myanmar.

Pethia khugae – Small known range in Manipur. Not expected in Myanmar.

Pethia ornata – Small known range in Manipur, near the border. Expected to occur in Myanmar. If present in Myanmar, will need to be assessed for global threat.

Pethia yuensis – Small known range in Manipur, near the border. Expected to occur in Myanmar. If present in Myanmar, will need to be assessed for global threat.

Physoschistura prashadi – Small known range in Manipur. Not expected in Myanmar.

Pseudecheneis ukhrulensis – Small known range in Manipur. Possibly present in Myanmar. If present in Myanmar, will need to be assessed for global threat.

Rasbora ornata – Original assessment based on populations in Manipu, and has since been recorded in Myanmar in the Middle Ayeyarwady. If identification is confirmed, the species then has a wide range and probably does not qualify as VU anymore, but probably LC.

Schistura khugae – Small known range in Manipur. Not expected in Myanmar.

Schistura nagaensis – Small known range in Manipur. Not expected in Myanmar.

Schistura sp. 'Sinbo', 34 mm SL

Schistura sp. 'Ayeyarwady', 40 mm SL

Figure 2.41 – Two of the newly discovered species in the Ayeyarwady River: (Photo credit: Kottelat, 2017)

NEAR THREATENED

Twenty species are listed as NT. Most of these species have been assessed on the basis of data from India and need to be re-assessed for global threat. Several are likely to become LC once global data are considered (mainly because of the much larger distribution and the lower pressure in Myanmar). Four species are known only from Myanmar. All should be re-assessed.

Figure 2.42 - *Anguilla bengalensis* (NT), Ayeyarwady River, approximately 600 mm SL (Photoi credit: Nyein Chan)

Anguilla bengalensis – Widely distributed around the Indian Ocean. Spawns at sea and migrates to freshwater until headwaters. Needs to be re-assessed for global threat.

Anguilla bicolor – Widely distributed around the Indian Ocean. Spawns at sea and migrates to freshwater until headwaters. Needs to be re-assessed for global threat.

Bagarius bagarius – Assessment apparently based only on data from India, but the species has a wider distribution. Needs to be re-assessed for global threat.

Bagarius yarrelli – Assessment apparently based only on data from India, but the species has a wider distribution. Needs to be re-assessed for global threat.

Brachydanio kyathit – Endemic to Myanmar. Justification to assess as NT is weak. The assessment should be updated and will probably be LC or DD.

Garra elongata – Small known range in Manipur, near the border. Expected to occur in Myanmar. If present in Myanmar, it will need to be assessed for global threat.

Garra gravelyi – Originally described from He-Ho (Salween Basin) and reported from Manipur. Assessed as NT because of it severely fragmented distribution. The 'severe fragmention' seems to simply reflect the simple absence of any sampling in intermediate areas or that the samples from Manipur are a distinct species.

Garra poecilura – Endemic to Myanmar. Presently known from a single site in the Rakhine Range.

Garra spilota – Endemic to Myanmar. Presently known from a single site in the Rakhine Range.

Morulius nandina – Assessment apparently based only on data from India, but the species has a wider distribution. Needs to be re-assessed for global threat.

Neolissochilus hexastichus – Needs to be re-assessed. It seems that the populations to which this name has been applied in the Ayeyarwady Basin are really conspecific with the Ganges-Brahmaputra one. Two or more species of *Neolissochilus* are known in Ayeyarwady Basin. The genus is in need of taxonomic revision (more below).

Ompok pabda – Assessment apparently based only on data from India, but the species has a wider distribution. Needs to be re-assessed for global threat. The Myanmar populations are possibly a distinct species.

Ompok pabo – Assessment apparently based only on data from India, but the species has a wider distribution. Needs to be re-assessed for global threat. The Myanmar populations are possibly a distinct species.

Osteobrama belangeri – Assessment apparently based only on data from India, but the species has a wider distribution. Needs to be re-assessed for global threat.

Papillogobius reichei – Widely distributed in estuaries in Indo-West Pacific Oceans. There does not seem to be any justification to assess as NT. Needs to be re-assessed for global threat.

Parambassis lala – Assessment apparently based only on data from India, but the species has a wider distribution. Needs to be re-assessed for global threat.

Pethia tiantian – Endemic to Myanmar. Justification to assess as NT is weak. The species is widely distributed on the Putao Plain. The assessment should be updated and will probably be LC.

Schistura manipurensis – Small known range in Manipur. Not expected in Myanmar.

Syncrossus bermorei – Assessment apparently based only on data from India, but the species has a wider distribution. Needs to be re-assessed for global threat.

Wallago attu – Assessment apparently based only on data from India, but the species has a wider distribution. Needs to be re-assessed for global threat.

NOT EVALUATED

In addition to the above, 134 species have not yet been assessed for the RL. Some of these cannot be assessed yet, because they are known from a few individuals only, from a single sampling, or because the taxa need higher level taxonomic revision before the true identity of the local populations can be known. It might be possible to assess the others, although, realistically, they are likely to be assessed as DD.

SPECIAL CASES

Schizothgorax grahami – BANCA (2009) reported the presence of *Schizothorax grahami* in the Mali Hka and N'mai Hka. The species is assessed as CR on the RL. This species is endemic to Lake Dianchi (Kunming) in Yunnan, where it is effectively CR. There are no data to support this identification, and there is no reason to believe it. There is no reason to imagine that a species endemic to a lake in the Yangtze Basin, unknown elsewhere in the Yangtze, in the Mekong, and the Salween Basins would be present in the Upper Ayeyarwady.

Several species of the genera (*Tor*, *Neolissochilus*, *Bangana,* and *Labeo)* reach a large size and are important food fish, which makes them targets for anglers. They are known or suspected migrators. They need critical reassessment, but this is presently not possible because their taxonomy is chaotic, and the limited data cannot be unambiguously linked to valid names. Some species (not all) exhibit morphological variability, depending on size, locality, and reported feeding habits. They have been the subject of numerous taxonomic studies, often uncritical, geographically limited, and/or sometimes limited to re-hashing earlier studies with only limited new data. The result is that many of these studies make the situation more confusing.

In recent years, molecular studies (e.g., Laskar et al., 2013; Khare et al., 2014; Zheng et al., 2016; Walton et al., 2016) tried to bring clarification on the status of a few species but added more confusion. Two distinct issues are often treated together in fuzzy discussions that, instead, should be treated separately and in a logical sequence: (1) How many species are present at a given site, in a given drainage? (2) Are some of them present in adjacent basins? Each species must be considered individually. The observations and conclusions on one species cannot be automatically transposed to all others.

To understand the intra- and inter-specific variability, numerous individuals at various sizes are needed. Since these species reach large sizes, this means handling and transporting numerous large samples, which requires time and funding.

2.6 Other Aquatic Fauna

2.6.1 *Freshwater molluscs*

The Ayeyarwady and Chindwin Basins are considered to have between 85 to 101 freshwater mollusc species with the greater species richness in the Upper Chindwin and northern Rakhine (Budha et al, 2012). These richer areas are also considered to have the highest rate of endemic species. Budha et al., (2012) mention 8 to 9 endemic molluscs for the Ayeyarwady Basin. Among them are the bivalve mussles, *Solenaia soleniformes,* and several species each of the genus *Parreysia* and *Pseudodon*. However, one third of the Eastern Himalayan freshwater molluscs are considered to be DD. There is one VU gastropod species that occurs in the Chindwin Basin – *Lymnaea ovalior,* which probably occurs in 24 sub-basins. Allen et al. (2010) mentions that *L. ovalior* currently occurs in Loktak Lake in Manipur, which is impacted by settlements around the edge of the lake, especially sedimentation and siltation, and from the effects of the Loktak hydropower plant on the Manipur River.

Figure 2.43 - Shells of *Lamellidens savadiensis (Unionidae)* in an oxbow lake near Tagaung (Photo credit: C. Zöckler)

Within the Ayeyarwady and Chindwin Basins, 137 species of mollusc occur, with 50 bivalve and 87 gastropod species. Of these, there is 1 VU species (*Lamellidens savadiensis*), 1 NT (*Sphaerium austeni*), 100 LC, and 35 DD species (ICEM, 2017b; IUCN species database).

Bolotov et al. (2017a) investigated the freshwater family of Unionidae across Asia and identified the highest number among the western Indo-China Region in the Ayeyarwady River, with 41 species out of a total of 271 unionid mussel species. However, the river was not the main focus of their investigation, and the Ayeyarwady Basin might contain many more species of this freshwater family. Bolotov et al. (2017b) found seven new species of this family in the neighboring Sittaung River, indicating the potential for a high biodiversity in the Ayeyarwady River and its little surveyed tributaries. On 10 February 2017, approximately 190 Asian openbill storks, *Anastomus Occitans,* were feeding extensively on unionid mussels, *Lamellidens savadiensis,* in an oxbow lake near Tagaung.

Among the 2,306 freshwater molluscs that have been assessed worldwide, 45% have been identified as globally threatened. It is likely that similar levels of threat status are dominant among the molluscs in the Ayeyarwady Basin.

2.6.2 *Freshwater crabs and crustaceans (Malacostraca)*

There is a total of 24 species endemic to Myanmar, and one of these is globally threatened.

In Allen et. al., (2012), it is reported that Myanmar, outside the Ayeyarwady Basin, has 23 species of freshwater crab, in 16 genera and 2 families, out of the 173 species of freshwater crab described for the Indo-Burma Region. The five countries in the Indo-Burma hotspot have a rich, highly diverse, and distinctly recognizable freshwater crab fauna that changes from basin-to-basin and vegetation cover. Freshwater crabs appear to be noticeably more abundant in rainforest, especially in highland regions, and fewest in lowland ecosystems. Most of the threatened species described below are restricted-range species that have been found in neighbouring countries. It is assumed that the Ayeyarwady Basin has a similar set of freshwater crab diversity, but this has not been investigated yet. The IUCN species distribution list only provides some selected distribution data for 62 species.

In the Chindwin, there is one VU freshwater crab species – *Liotelphusa quadrata*. This species is listed as VU, because its extent of occurrence is estimated to be approximately 20,000 square kilometres, and it is only known from five localities in Nagaland and Meghalaya, India, (i.e., adjacent to the Upper Chindwin). There is a continuing decline in the extent and quality of its habitat due to human induced degradation driven by population increases and industrial and agrarian development. However, the threats to the species are not well-known, and its proximity to human habitations may well indicate that it is robust and resistant to human-led disruption of habitat. More information is needed, but if this is the case, then the species could be downgraded to LC.

In the Ayeyarwady/Chindwin Basins, there are 62 species of crustacea, made up of 3 Atyid shrimps, 16 Palaemonid prawns, and 43 crab species. In addition to the one VU species of crab, there are two NT crabs, 31 LC, and 28 DD crustacean species.

Brackish and marine crabs have not been assessed and are not included in this assessment but appeared to be prevalent in the mangroves of the delta region.

2.6.3 *Dragonflies and damselflies (Odonata)*

Figure 2.44 – *Orthetrum sabina* (LC), delta region (Photo credit: C. Zöckler)

As part of the *Eastern Himalayan Assessment of Freshwater Biodiversity*, Mitra et. al. (2010) assessed the dragonflies and damselflies (Odonata). They noted a pronounced gap in knowledge of Odonata for much of the region, including Myanmar and the Ayeyarwady Basin. Most data derive from the period before 1940. They conclude further that the lack of recent good quality data presents a barrier for reliably assessing the threats facing Odonata.

IUCN has assessed 367 species in the region, and according to their distribution data, at least 149 of these occur in the Ayeyarwady Basin (see species list in the annex). According to Mitra et al. (2010), at least six, and possibly another five, species are endemic to the Ayeyarwady Basin (see also species list in annex). This seems to be widely underestimated, considering that Reels et al. (2012) identified approximately 160 endemic species in the neighbouring Indo-Burma Region to the east. All of the 11 endemic species are listed

in the RL as DD. In total, 30 species have not been sufficiently assessed for RL status and are classified as DD. Only one species, *Asiagomphus personatus,* is listed as globally NT.

However, considering the lack of knowledge and surveys in the Ayeyarwady Basin, one can assume that the species list is much higher, and the list of potentially globally threatened species equally high and similar to those of the much better-studied vertebrates.

2.7 Plants

A total of 61 globally threatened plant species have been recorded in Myanmar. Of these, 16 are considered CR and 24 EN (MOECAF, 2015). The majority, though, has not been assessed yet. Considering that, to date, approximately 18,000 (MOECAF, 2015) plant species have been recorded in Myanmar, it is likely that the number of RL species will increase considerably when properly assessed. Orchids are among a numerous plant group, with 800 species known for Myanmar, that are threatened by unregulated collecting and trade. No details are available for the distribution of the species in the Ayeyarwady Basin.

AQUATIC PLANTS

There is no threatened aquatic plant species recorded in the IUCN freshwater database for the Ayeyarwady and Chindwin Basins. Out of the total 130 species, there are 68 species of water lillies, *Liliopsida*; 57 species of magnolias, *Magnoliopsida*; and 5 species of *Polypodiopsida* ferns. One of the *Liliopsida* species is NT, 124 species of the plants are LC, and 5 of them are DD.

3 AREAS OF HIGH BIODIVERSITY VALUES

3.1 Hotspots of Biodiversity Distribution

3.1.1 *Mammals*

There are approximately 300 mammal species within the Ayeyarwady Basin. The distribution of almost all has been digitised. Figure 3.1 shows the hotspots for this group.

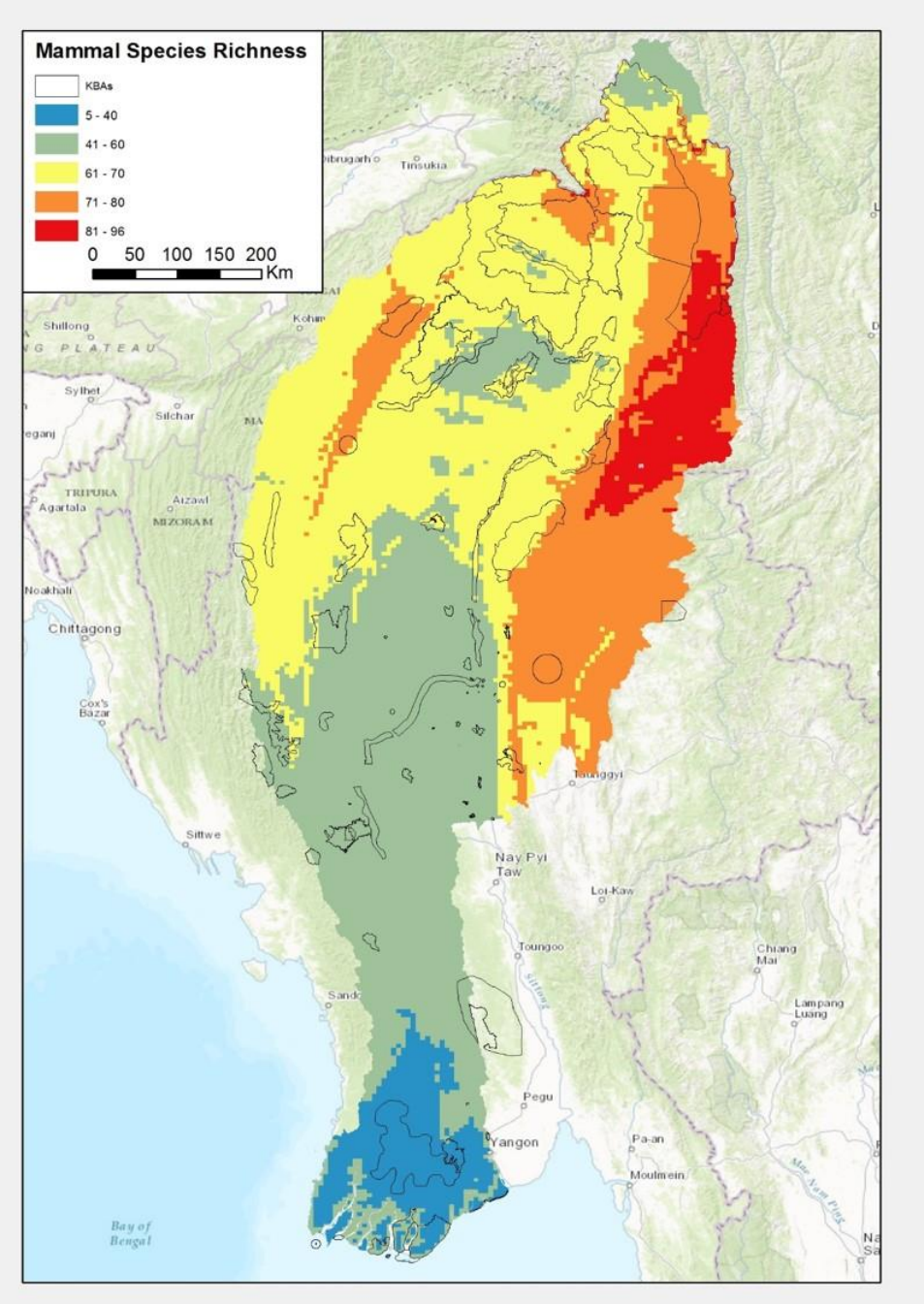


Figure 3.1 - Mammal species richness within the Ayeyarwady Basin based on 300 species ranges (IUCN) and combined with KBAs (transparent)

3.1.2 *Birds*

There have been 906 bird species recorded in the Ayeyarwady Basin. The distribution of most species has been digitized and has been used for this hotspot analysis (see Figure 3.2)

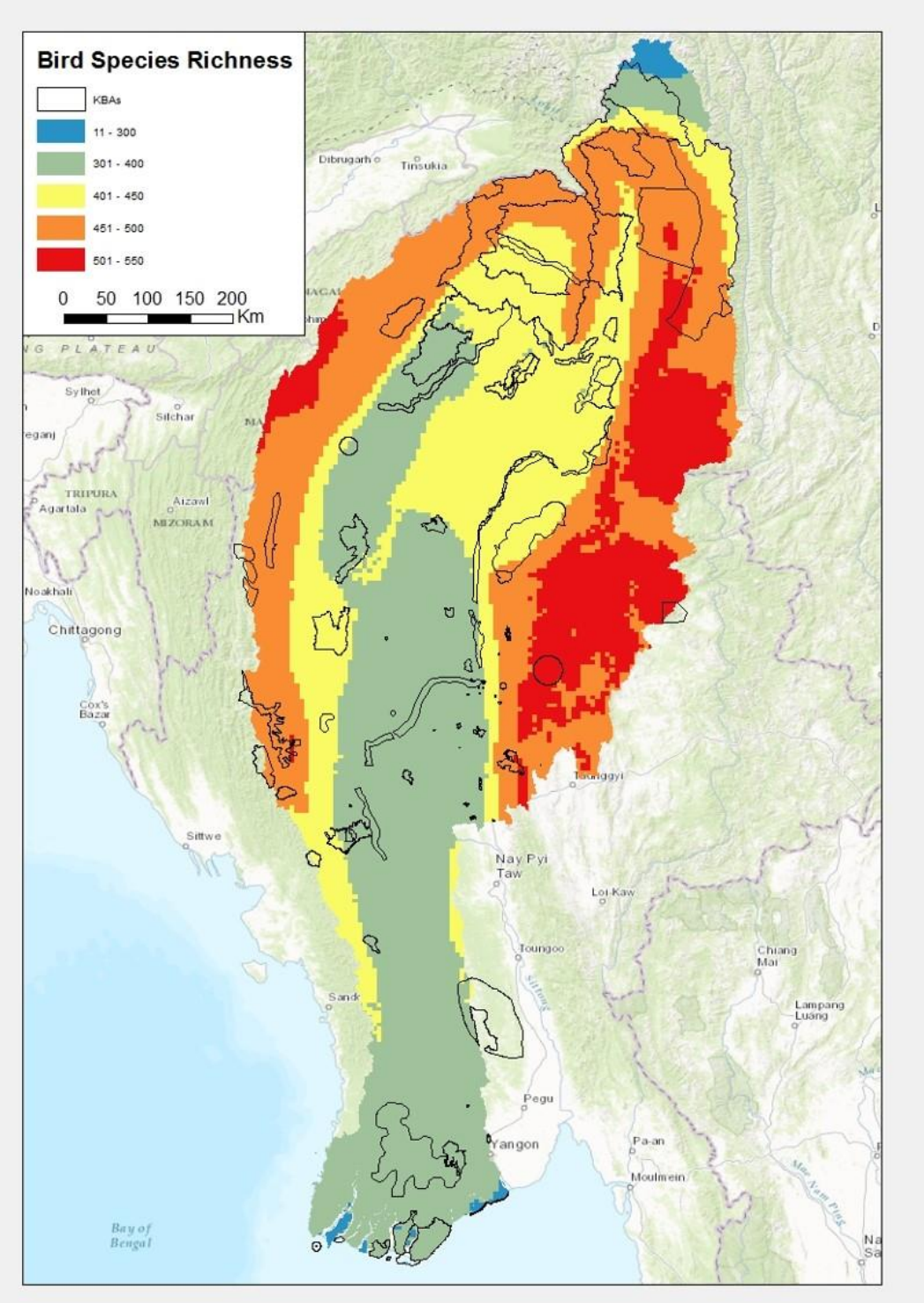


Figure 3.2 - Hotspots of bird distribution in the Ayeyarwady Basin based on 900 species ranges (IUCN) and combined with KBAs (transparent)

3.1.3 *Reptiles*

IUCN has digitized the distribution of 134 of the approximately 200 reptile species that occur in the Ayeyarwady Basin. Figure 3.3 shows the hotspots of their distribution and the KBA layer on top. It is unfortunate that the freshwater turtles have not been digitized in their ranges and cannot be taken into account. As the freshwater turtles are the most globally threatened species within the reptiles (26 species), at least 25 of those species classified as CR, EN, and VU have been included in the KBA assessment.

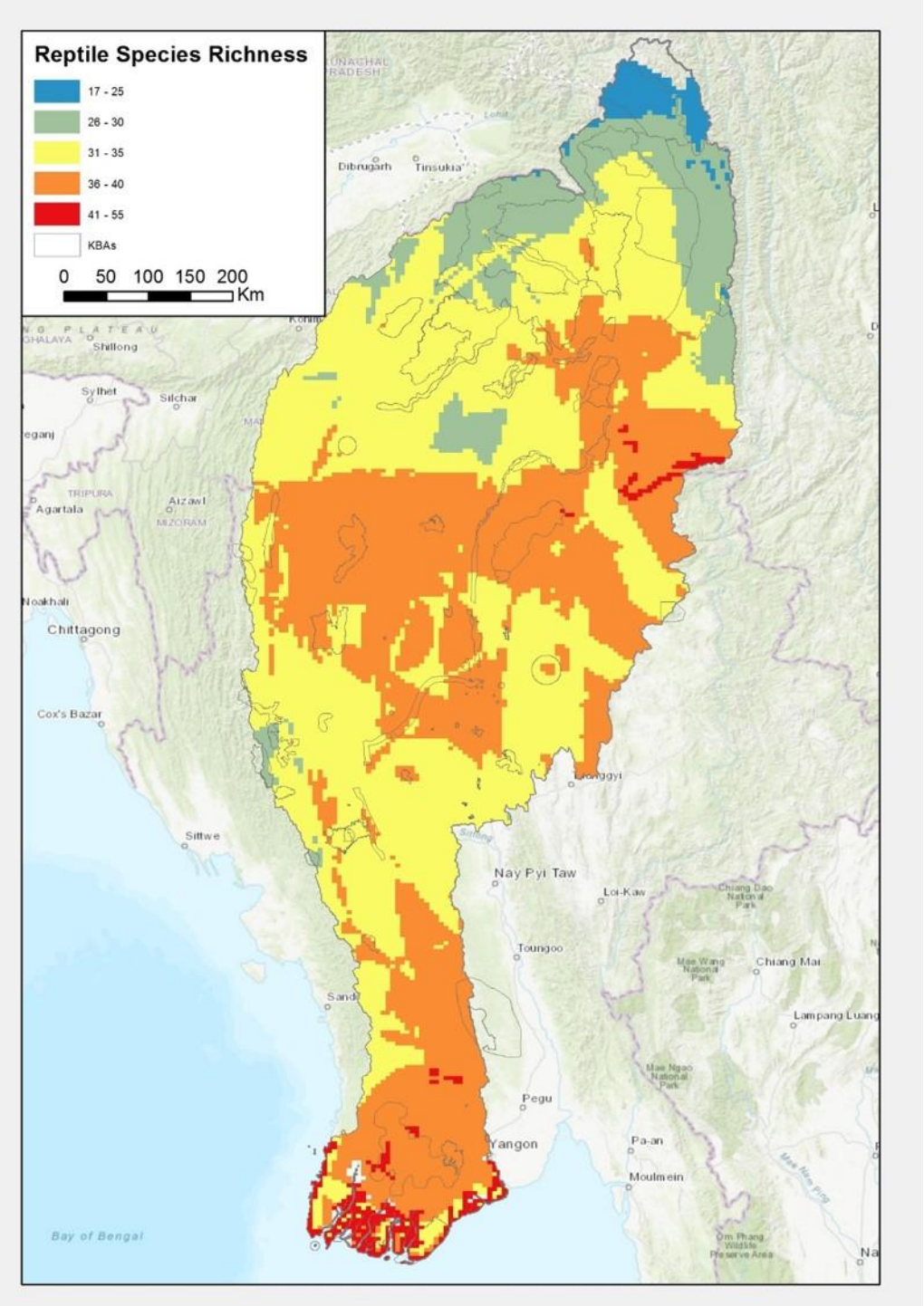


Figure 3.3 - Hotspots of reptile distribution in the Ayeyarwady Basin based on 134 species ranges (IUCN) and combined with KBAs (transparent)

There are two distinct areas with a high occurrence of reptile species: 1) the coastal area with marine turtles, and 2) the many snakes and other mangrove species in the delta area. However, the eastern areas of the Middle Ayeyarwady in the Shan State warrant further investigation. Even though 134 species have been identified, the distribution ranges are quite broad, are outdated in many cases, and only give a rough indication of where future surveys should focus. The red grid areas in the Shan State, though, seem intriguing and might warrant better protection.

There is a clear gradient of species diveristy from low levels at the coast to a richer diversity at higher elevations, both in birds and mammals. It is striking, though, to see the high diversity in the eastern area of the basin for mammals and birds with a pronounced lower diversity for reptiles. The KBA layer can be seen in all three maps, and hardly any of these hotspot areas are included in the KBA networks yet. This might be a result of species range mapping, but considering that all three taxa point in this direction, it is less likely. It is highly recommended to investigate this area further to obtain more details about potential future KBAs.

3.1.4 *Fish*

Fish have hardly been assessed, and many areas have not been surveyed. Hardly any distribution maps are available. Many new species have been found only recently during surveys in Lake Indawgyi (18) and the Mali Kha River (16) in the Upper Ayeyarwady near Putao (Kottelat 2015a, b), with many more new fish likely to be identified in unsurveyed areas. One important ecological area for fish is areas of endemism.

3.2 Areas of Fish Species Endemism

Endemism is particularly pronounced among the fish species of the Ayeyarwady Basin. Whereas mammals, birds, and reptiles together have no more than 20 endemic species, 50% (193) of all 388 fish species in the Ayeyarwady Basin are endemic to the basin (Kottelat, 2017). Areas of aquatic species endemism, especially fish, are important ecologically. Aquatic endemism usually occurs where the rivers (or stretches of rivers) are relatively isolated, such as by sharp water divides, steep gradients, rapids, and waterfalls (isolating species living in slow flowing habitats) or by extensive areas of lowland (isolating species specialised for fast flowing habitats). Isolation and the mosaic distribution of different types of habitats in hilly areas are the key factors driving endemism in freshwater fish. Endemism is usually higher in small-size species than in larger ones. However, despite its large area, with half of the fish fauna endemic, the Ayeyarwady Basin, as a whole, is a broad area of high endemism. Further surveys are required to ensure a comprehensive understanding of the endemic fish, aquatic molluscs, and odonata and their distribution.

In the Ayeyarwady Basin, the highest level of endemism is found in its mountain tributaries along the Rakhine Yoma and Chin Hills, the Bago Yoma and its northern third (Allen at al, 2010). Recent ichthyological surveys around Indawgyi Lake (possibly the best and oldest documented area of ichthyologically in the country) observed 78 species in the basin of the lake, 18 recorded for the first time, which brings the number of fish species now known in the basin to 95 (Kottelat, 2015a). Six days of field work in the Putao Region observed 42 species, bringing the total known species of the region to 46, with 16 (38%) species recorded for the first time. Of these, 1 genus and approximately 5 species were new to science (Kottelat, 2015b; 2017).

3.3 Key Biodiversity Areas (KBAs)

KBAs are areas considered important for biodiversity, based on an international agreed set of criteria. KBAs were initially developed for birds (Important Bird Areas) but are now being slowly expanded to include all species (IUCN, 2016). The criteria are based on globally threatened species as well as range-restricted species. These criteria have been applied, and a total list of 83 sites has been identified. Six sites have been added, based on new information gathered through this assessment, and proposed as new KBAs within the Ayeyarwady Basin. Figure shows all 89 sites and their coverage by Protected Areas. The new sites include a stretch in the river that is the last remaining hotspot for the EN black-bellied tern and provides several sightings of Irrawaddy dolphins. Another small site is Pyu Lake, a small lake in the Sagaing Region, just south of Mandalay, that regularly hosts the remaining wintering numbers of Baer's pochard, *Aythya baeri* (CR).

In the delta region, a huge KBA is proposed to save the marshlands for the stronghold of breeding sarus cranes, *Grus Antigone* (VU). In addition, three sites are listed in the Outer Delta that are of importance for globally threatened shorebirds, such as the spoon-billed sandpiper, *Calidris pygmaea*; Nordmann's greenshank, *Tringa guttifer;* and the great knot, *Calidris tenuirostris;* as well as threatened mangrove species and marine turtles.

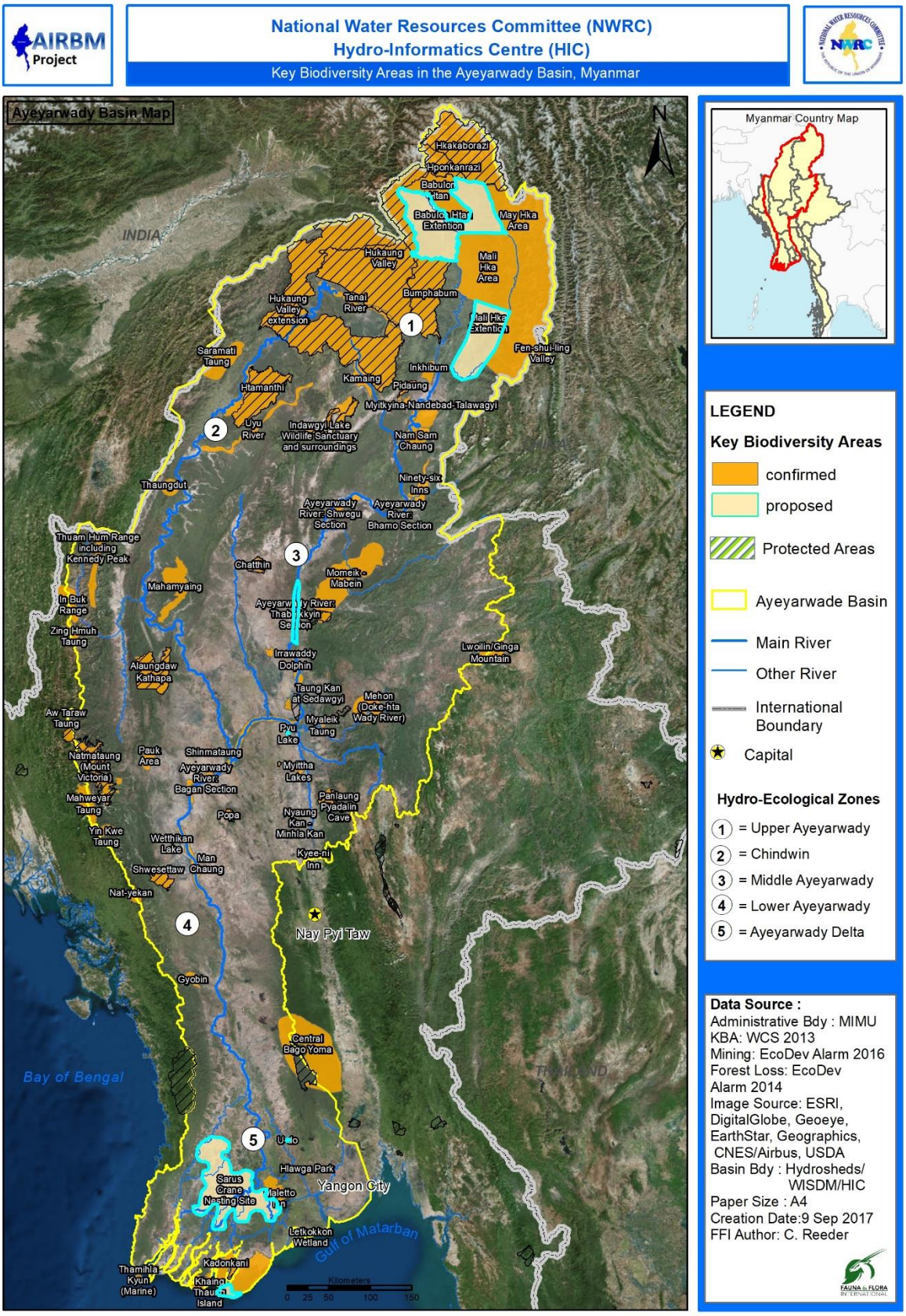


Figure 3.4 - KBAs in the Ayeyarwady Basin, Protected Areas (hashed), and newly added proposed KBA sites (torqoise)

The level of protection is approximately 50%. While the Upper Chindwin Basin is relatively well protected, the Upper Ayeyarwady is less protected, although recent new sites, such as Imawbum, are not included in the

map. Of the new KBAs, the Outer Islands in the delta area are already designated as a Ramsar Site and protected, but all other new proposed KBAs, alongside several of the older KBAs, still need formal protection.

Despite its type, the Indawgyi grassland/Indawchaung wetland KBA covers just the terrestrial marshy area north of Indawgyi Lake. This KBA should, in fact, include Indawgyi Lake itself. It should also extend to the high watershed to the east and a bit further north to the Upper Mogaung Chaung Basin KBA.

Two Freshwater KBAs are proposed on the basis of a high proportion of endemic and range-restricted fish. This would be consistent with the Criterion and Threshold B1 in *A Global Standard for the Identification of Key Biodiversity Areas* (IUCN, 2016).

Table 3.1 - KBAs ranked by number of globally threatened vertebrate species (mammals, birds, and reptiles) Only those listed with more than 10 points, each point weighted by RL status: CR = 3, EN = 2, VU = 1 (see also Figure 4.2)

KBA name	KBA status	Reptiles	Birds	Mammals	Spp. total
Hukaung Valley	confirmed	7	24	31	62
Hukaung Valley extension	confirmed	11	26	24	61
Htamanthi	confirmed	9	19	23	51
Indawgyi Lake Wildlife Sanctuary and surroundings	confirmed	4	26	16	46
Bumphabum	confirmed	5	9	26	40
Hkakaborazi	confirmed	0	13	19	32
Alaungdaw Kathapa	confirmed	2	5	24	31
Mahamyaing	confirmed	2	5	24	31
Kamaing	confirmed	3	25	2	30
Central Bago Yoma	confirmed	4	0	26	30
Hponkanrazi	confirmed	0	13	14	27
Tanai River	confirmed	3	19	3	25
May Hka Area	confirmed	2	6	17	25
Panlaung Pyadalin Cave	confirmed	0	2	20	22
Pidaung	confirmed	12	0	10	22
Upper Chindwin River: Kaunghein to Padumone Section	confirmed	9	5	4	18
Babulon Htan	confirmed	0	3	15	18
Outer Delta Islands	proposed	5	10	2	17
Mali Hka Area	confirmed	0	4	13	17
Upper Mogaung Chaung basin	confirmed	3	14	0	17
Myitkyina-Nandebad-Talawagyi	confirmed	4	8	4	16
Saramati Taung	confirmed	2	3	10	15
Thaungdut	confirmed	3	0	11	14
Shwe U Daung	confirmed	5	0	8	13
Lwoilin/Ginga Mountain	confirmed	0	12	1	13
Nam Sam Chaung	confirmed	3	10	0	13
Ayeyarwady River: Bhamo Section	confirmed	3	7	2	12
Shwesettaw	confirmed	5	2	5	12
Momeik - Mabein	confirmed	4	0	8	12
Chatthin	confirmed	3	2	6	11
Ayeyarwady River: Shwegu Section	confirmed	3	6	2	11
Uyu River	confirmed	1	10	0	11
Natmataung (Mount Victoria)	confirmed	0	5	5	10
Ayeyarwady River: Myitkyina to Sinbo Section	confirmed	3	7	0	10

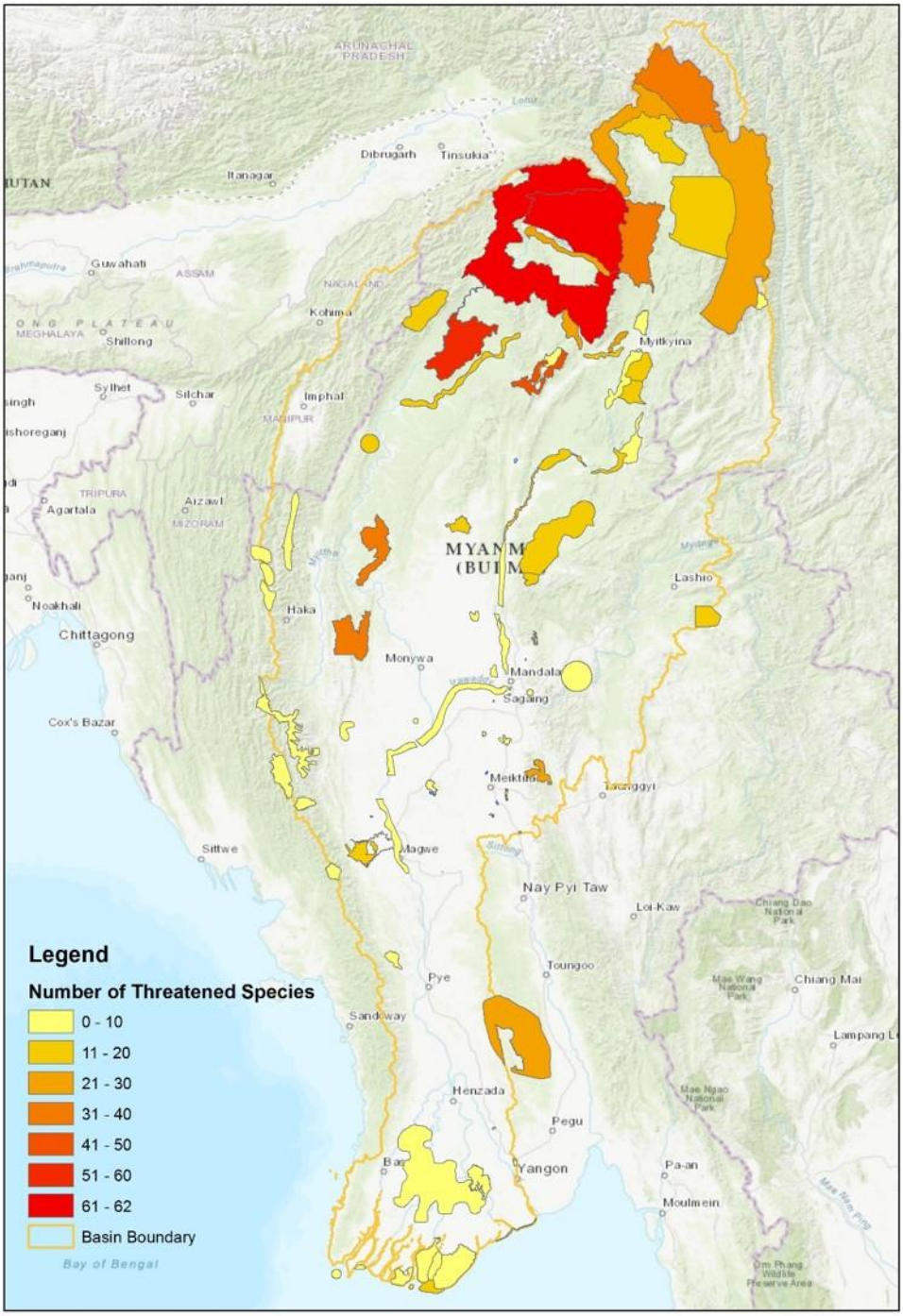


Figure 3.5 - KBAs in the Ayeyarwady Basin ranked by richness of globally threatened vertebrate species (mammals, birds, and reptiles) The RL categories are weighted as follows: CR = 3, EN = 2, VU = 1. The results reflect priority areas of KBAs but also include a survey bias. Some data behind the analysis are also outdated.

3.4 Wetlands of International Importance (Ramsar Sites)

The international Ramsar Convention on the Protection of Wetlands defines wetlands of international importance by a set of nine criteria. Many of these criteria are based on wetland species. Sites that fulfil these criteria are considered of exceptional and global importance and are included in the global list of representative wetland sites. A survey by Davies et al., (2004) across Myanmar and the Ayeyarwady Basin identified seven such sites within the Ayeyarwady Basin based largely on birds alone. Fourteen years later, some sites regarded as KBA, but might no longer fulfil the Ramsar criteria (www.ramsar.org), and others have been newly recognised and added to a new proposed list of sites (see Table 3.2). Two sites, Lake Indawgyi (2016) and Meinmahla Kyun and the Outer Islands (2017) have been added to Myanmar's list of designated Ramsar Sites, which now totals four sites.

Table 3.2 -Potential qualification of KBA sites as Ramsar Sites

No	KBA site	Important taxa	Qualified (2004)	Qualified (2017)	Ramsar Site by 2017
1	Ayeyarwady River: Singu Section	Dolphins, waterbirds	x	x	
2	Ayeyarwady River: Sinbyugyun to Minbu Section	Dolphins, waterbirds,	x		
3	Ayeyarwady River: Bagan Section	Waterbirds	x	-	
4	Ayeyarwady River: Bhamo Section	Dolphins, waterbirds	x	x	
5	Ayeyarwady River: Myitkyina to Sinbo Section	Waterbirds	x	-	
6	Upper Mogaung Chaung Basin	Waterbirds, endemic fish	x	?	
7	Myitkyina-Nandebad-Talawagyi	Waterbirds	x	-	
8	Indawgyi Lake Wildlife Sanctuary and surroundings	Waterbirds, endemic fish	x	x	x
9	Hukaung Valley	Waterbirds, water buffalo	x	?	
10	Ayeyarwady River: Shwegu Section	Waterbirds, freshwater turtles	x	-	
11	Paleik Inn	Waterbirds	x	x	
12	Kyee-ni Inn	Waterbirds	x	-	
13	Wetthikan Lake	Waterbirds	x	?	
14	Saurus Crane Nesting Site	Waterbirds	-	x	
15	Ayeyarwady River: Thabeikkyin Section	Dolphins, waterbirds	-	x	
16	Ayeyarwady River: Mandalay to Naung U	Waterbirds	x	x	
17	Meinmahla Kyun Wildlife Sanctuary	Dolphins, fishing cat, waterbirds, crocodiles, freshwater turtles	x	x	x
18	Pyu Lake	Waterbirds	-	x	
19	Outer Delta Islands	Waterbirds, marine turtles	-	x	x
20	Htamanthi	Waterbirds, freshwater turtles	x	x	

4 TRENDS AMONG SELECTED GROUPS OF BIODIVERSITY

The overall trend in biodiversity is that it is declining, and in some areas, it is declining rapidly. Many species of all taxa have been lost already. Trend data in population sizes are not available for most taxa. Declines are almost exclusively illustrated by the vacancy or loss of a species or species group, in some cases, rather than the decline in population size.

The declines are wide-spread and across all taxa. They are attrinbuted to several different phases of, more or less, intensive exploitation of riverine and wetland species. As a result, many species were pushed to extinction, local extirpation, or left with only small and localized populations (see Table 4.1,

Table 4.2). Information on population trend is almost exclusively available only for water birds.

Table 4.1 - Species extirpated or lost from the Ayeyarwady Basin and their last sightings/records

Common name	Scientific name	RL	Last observation	Comment
Sumatran rhinoceros	*Dicerorhinus sumatrensis*	CR	1980	Shwe U Daung Wildlife Sanctuary (Salter, 1983a)
Hairy-nosed otter	*Lutra sumatrana*	EN	2008	Hukaung Valley; (Duckworth and Hills, 2008)
Greater adjutant stork	*Leptoptilos dubius*	EN	2003, 2006	Thet Zaw Naing pers. comm., Chunkino in litt.
Pink-headed duck	*Rhodonessa caryophyllacea*	CR	1910	Singu wetlands (Tordoff et al., 2008)
Indian skimmer	*Rhynchops albicollis*	VU	2013	Ayeyarwady near Bagan
Gharial	*Gavialis gangeticus*	CR	1927	Shweli River (Barton, 1928; Scott 1989)
Mangrove terrapin	*Batagur baska*	CR	2004	Chindwin Basin (Platt et al., 2008)
Vorei's water snake	*Enhydris voreisi*	EN	2010	Murphy (2010)
Irrawaddy river shark*	*Glyphis gangeticus*	EN	1896	Yangon River (Steindachner, 1896)

*= Earlier recorded as *G. siamensis*. Supposed endemic, but genetic analyses suggest it is the same as the species from Ganges Basin (Li et al., 2015), yet the river shark has not been recorded in Myanmar since 1896.

Table 4.2 - List of bird species not found in 2017, of which most are believed to be locally extirpated in the river stretch between Myitkyina and Bagan

Common name	Scientific name	RL Status	Year of last record	Number	Reference
Red-crested pochard	*Rhodonessa rufina*	LC	2016	5	Zöckler pers. Obs.
Baer's pochard	*Aythya baeri*	CR	2001	2	AWC, Wetlands International, 2017
Comb duck	*Sarkidiornis melanotos*	LC	2015	14 in 2003 in Section IV, 2 birds near Mandalay	Davies et al., 2004; Harrison Institute, 2015
Cotton pygmy goose	*Nettapus coromandelianus*	LC	2003	>100	AWC, Davies et al., 2004
White-bellied heron	*Ardea insignis*	CR	1939, 2012		Stanford and Ticehurst, 1939; Thet Zaw Naing (pers. comm.)
Indian cormorant	*Phalacrocorax fuscicollis*	LC	2003		Davies et al., 2004
White-billed diver	*Gavia adamsii*	NT	2001	1	Van der Ven and Thet, 2008
Black-necked grebe	*Podiceps nigricollis*	LC	2016	2	Lay Win pers. comm.
Horned grebe	*Podiceps auritus*	LC	2016	1	Zöckler per. obs
Black-necked stork	*Ephippiorhynchus asiaticus*	EN	2003	15	Ngwe Lwin pers. comm.
Lesser adjutant stork	*Leptoptilos javanicus*	VU	2003, 2007	14, 1	Davies et al., 2004; Van der Ven and Thet, 2008
Spot-billed pelican	*Pelecanus philippensis*	NT	2007	70	Van der Ven and Thet, 2008
Great thick-knee	*Esacus recurvirostris*	NT	2001	3 +2+2	Davies et al., 2004, IWC
Long-billed plover	*Charadrius placidus*	LC	2008	10	Thet, 2009
Eurasian curlew	*Numenius arquata*	NT	2006	1	Thet and Lwin, 2006
Indian skimmer	*Rhynchops albicollis*	EN	1995	3	Robson et al., 1998
Greater spotted eagle	*Aquila clanga*	VU	2001	1 Pakokku	IWC
White-tailed eagle	*Haliaetus albicilla*	LC	2007	2	Thet 2007
White-rumped vulture	*Gyps bengalensis*	CR	2001	50 to 60	Davies et al., 2004; Htin Hla et al., 2010
Slender-billed vulture	*Gyps tenuirostris*	CR	2006	1	Thet and Lwin, 2006

Several other species have declined considerably and are likely candidates to follow suit if no further drastic action for conservation is implemented in the Ayeyarwady Basin. Table 4.3 shows species that have declined sharply in the range and are extremely sensitive to ongoing human disturbance.

Table 4.3 - Rare and globally threatened vertebrate species with considerable range contraction over the past 10 to 15 years and actually present in fewer than 5 KBAs in the Ayeyarwady Basin

Common name	Scientific name	RL	Last record	Number of KBAs/ind.	Reference
Mammals					
Fishing cat	*Prionailurus viverrinus*	EN	2016	4(2)	FD Rangers
Tiger	*Panthera tigris*	EN		2	Goodrich et al., 2015
Red panda	*Ailurus fulgens*	EN		3	WCS
Black musk deer	*Moschus fuscus*	EN		3	
Eld's deer	*Rucervus eldii*	EN		4	Gray et al., 2015
Sunda pangolin	*Manis javanica*	CR		4	WCS
Birds					
White-bellied heron	*Ardea insignis*	CR	2012	3	The Zaw Naing per.comm.
Baer's pochard	*Aythya baeri*	CR	2017	3	IWC; Wetlands International., 2017
White-winged duck	*Asarcornis scutulata*	EN	?		
Masked finfoot	*Heliopais personatus*	EN	2005		
Comb duck	*Sarkidiornis melanotos*	LC	2015	14 ind. 2003 in Ayeyarwady River, 2 birds near Mandalay	Davies et al., 2004; Harrison Institute, 2015
Black-necked stork	*Ephippiorhynchus asiaticus*	EN	2017	2	Ngwe Lwin pers. comm.
Lesser adjutant stork	*Leptoptilos javanicus*	VU	2003, 2007	4	Davies et al., 2004; Van der Ven and Thet, 2008
Spot-billed pelican	*Pelecanus philippensis*	VU	2017	4	
Great thick-knee	*Esacus recurvirostris*	NT	2016		Thiessen pers. comm, WCS
White-rumped vulture	*Gyps bengalensis*	CR	2001	50 to 60 ind.	Davies et al., 2004; Htin Hla et al., 2010
Slender-billed vulture	*Gyps tenuirostris*	CR	2006	1	Thet and Lwin., 2006
Black-bellied tern	*Sterna acuticauda*	EN	2017	1	WCS; Zöckler and Thant Zin, 2017
River tern	*Sterna aurantia*	NT	2017	2	Zöckler and Thant Zin, 2017
Turtles					
Mangrove turtle	*Batagur baska*	CR	2008	-	Platt et al., 2011
Burmese roofed turtle	*Batagur trivittata*	EN	2015	Released in the wild	Platt and Platt 2016

4.1 Trends in Waterbirds

Waterbirds have been monitored irregularly but again and again over a period of 30 years. Although the data have not always been collected systematically, waterbird counts and trends are an ideal indicator to show the state of the wetland in the Ayeyarwady Basin. The scale, detail, and frequency of the monitoring varies. Unfortunately, only a few sites have been regularly monitored, and most sites have infrequent or random monitoring, varying in scale and expertise.

Even then, it is not always possible to compare the counts, because the survey areas might be different between survey years, the survey periods (month) might differ, there can be observer bias and weather can impact a survey's result. Birds also behave differently at different times of the day. All this creates uncertainties and limits the analysis of trends. However, some of these errors can be diminished by comparing several years with each other and also looking at similar patterns in neighboring sites and different species. It is, therefore, advantageous to have many different sites and many years to choose from.

For several sites, the monitoring data allow a limited, but conclusive, trend analyses. In Table 4.4 and Table 4.5, the monitoring data from different years are summarized for two different sites, both in the Middle Ayeyarwady, reflecting corresponding trends and suggesting potential shifts. In addition, for selected and mostly rare species, additional monitoring data from different sites are available and have been consulted for comparisons and to underpin the observed trends in the Ayeyarwady Basin.

For any trend analyses, it is crucially important to understand the migratory status and origin of the species involved. Figure 2.9 illustrates the wide range of possible origins and potential causes for the observed trend. Last, but not least, it is also important to understand the seasonal changes of waterbirds. These can be quite subtle and not obvious to any observers, even the most experienced, as the example of the European wigeon (*Anas Penelope*) can demonstrate (see Table 4.4). For two columns in 2013 and 2016, the birds were counted in February instead of midwinter (in December and January). While the numbers of the midwinter counts remain rather stable over the past 10 years, at approximately 15 to 20 birds, both February counts peak much higher at approximately 65 to 70 birds. This suggests that, quite likely, the birds started moving in early February and assembled at Lake Indawgyi. This might also be true for other ducks, like ferruginous pochard (*Aythya nyroca*, NT), which peaked at unusually high numbers in February 2016 (see Table 4.4).

Table 4.4 – Trends in waterbirds at Lake Indawgyi from 2001-2017: (AWC, Wetlands International, 2017; Van der Ven and Thet Zaw Naing, 2008*; AWC^, Zöckler, 2015; Zöckler and Lay Win, 2016 ^* = joint survey); DEC = declining, INC = increasing, STA = stable, n/r = not recorded, n/a = not assessed, column shaded light blue = February counts

Common name	Scientific name	RL	2001	2002	2003	2005	2007*	2012^	Feb-2013^	2013/14^*	2014/15**	Feb-2016**	2017^	trend
Lesser whistling-duck	*Dendrocygna javanica*		3,215	2,671	2,991	4,939	3,300 +	5712	11,730	3215	2,020	1,818	1,866	DEC
Greylag goose	*Anser anser*		390	227	450	64	350+	497	139	138	200	476	449	STA
Bar-headed goose	*Anser indicus*		4		70	150	2	24	32	0	0	18	21	DEC
Ruddy shelduck	*Tadorna ferruginea*		300	154		970	144	358	169	121	102	159	505	INC
Cotton pygmy-goose	*Nettapus coromandelianus*		79	35	116	23	141	134	nr	250	265	109	102	DEC?
Gadwall	*Anas strepera*		1,744		751	305	1,032	614	545	140	250	167	193	DEC
Eurasian wigeon	*Anas penelope*		26	68	15	3	15	18	65	15	20	69	28	STA
Mallard	*Anas platyrhynchos*				3	0	2	5	0	0	10	20	6	INC
Chinese spot-billed duck	*Anas zonorhyncha*			1,564		20	66	12	0	0	6	2	10	?
Northern shoveler	*Anas clypeata*		719	204	91	4	13	150	136	0	6	109	17	DEC
Northern pintail	*Anas acuta*		1,240		700	128	2	111	18	3	1	15	14	DEC
Garganey	*Anas querquedula*		8	8	5	0	8	1	0	n/r	12	29	10	?
Eurasian teal	*Anas crecca*			120		0	80	0	0	2	2	150	62	STA
Common pochard	*Aythya ferina*	NT	360	2,741	476	134	362	222	71	139	200	595	589	INC?
Ferruginous pochard	*Aythya nyrca*	NT	1178	3,158	606	2,383	822	750	91	290	400	892	675	DEC
Tufted duck	*Aythya fuligula*		855	2,035	1,538	3,291	1,364	2,804	788	3,303	3,040	2,301	2,897	STA
Red-crested pochard	*Netta rufina*		22		15	10	40	15	0	4	8	3	0	DEC
Spot-billed pelican	*Pelicanus philippensis*		1		20	5	29	14	5	0	0	8		DEC
Little grebe	*Tachybaptus ruficollis*		62	30	24		21	298	11	80	72	113	116	INC
Asian openbill	*Anastomus oscitans*		20		60	7	90	235	73	50	61	55	59	DEC
Black stork	*Ciconia nigra*				3		2	1	0	4	1	2	1	STA
Lesser adjutant	*Leptoptilos javanicus*	VU	16	12	12	5	6	1		17	2	5	6	STA

Common name	Scientific name	RL	2001	2002	2003	2005	2007*	2012^	Feb-2013^	2013/14^**	2014/15**	Feb-2016**	2017^	trend
Woolly-necked stork	*Ciconia episcopus*	VU	5	3	31	5	9	6	0	2	4	4	0	DEC
Glossy ibis	*Plegadis falcinellus*					10	42	416	205	206	520	335	970	INC
Grey heron	*Ardea cinerea*		2	5	5	1	1	19	0	0	4	3	7	INC
Purple heron	*Ardea purpurea*		31	67	63	50	51	101	15	47	42	20	23	DEC
Great egret	*Ardea alba*		26	46	61	59	24	57	43	21	36	23	46	STA
Intermediate egret	*Mesophoyx intermedia*		48	150	118	122		208	45	217	30	129	40	STA
Little egret	*Egretta garzetta*		42	47	80	423		109	1,609	33	25	59	35	DEC
Little cormorant	*Phalacrorax niger*		437	711	1,000	474	700	869	967	885	480	531	722	DEC
Great cormorant	*Phalacrorax carbo*		104	239	300	146	177	274	59	145	90	58	109	DEC
Oriental darter	*Anhinga melanogaster*	NT	18	23	69	74	52	159	42	67	44	22	86	?
Grey-headed swamphen	*Porphyrio poliocephalus*		1094	1275	920	2,601	2,000	4,477	2,948	2,202	3,200	1,666	2,145	INC?
Common Coot	*Fulica atra*		1151		653	2869	1100+	1974	4773	2932	2000	1532	2185	DEC
Sarus crane	*Grus antigone*	VU	7	12	3		2	14	n/r	9	22	n/r	8	STA
Common crane	*Grus grus*		16		370		147		n/r	96	127	1,150	161	INC
Grey-headed lapwing	*Vanellus cinereus*		20	118	14	17	1	24	5	7	51	23	7	?
Little ringed plover	*Charadrius dubius*				1	6	8	7	n/r	n/r	23	17	32	INC
Pheasant-tailed jacana	*Hydrophasianus chirurgus*		50		8	102	36	88	72	108	300	44	39	?
Bronze-winged jacana	*Metopidicus indicus*		11	63	10	61	32	77	84	106	25	27	48	?
Wood sandpiper	*Tringa glareola*		12	8	3	43	3	10	0	26	24	30	8	?
Temminck's stint	*Calidris temminckii*			33				24	n/r	n/r	17	5	35	STA
Brown-headed gull	*Chroicocephalus brunnicephalus*		263	132	269		380	1,884	379	910	280	1750,	733	INC
Black-headed gull	*Chroicocephalus ridibundus*			157	201		56	62	206	91	1,000	500	63	INC

Taking all these caveats and limitations into account, it is still possible to determine some trends in some species (e.g., the gadwall (*Anas strepera*) is clearly declining and so, possibly, is the little cormorant (*Phalacrocorax minor*). The glossy ibis (*Plegadis falcinellus*), for example, is clearly increasing and the grey-lag goose (*Anser anser*) and common pochard (*Aythya ferina*) are possibly increasing (see Table 4.4).

For Lake Indawgyi, a total of 44 species have been assessed for trends in population over a period of 10 years, for which monitoring data for some years are available for analyses. Of these 44 species, trend information can be derived for 31 species: 11 declining, 11 increasing or possibly increasing, and 8 stable. Of the 11 declining species, the red-crested pochard has disappeared altogether and has not been seen during the 2016/17 winter. This corresponds with no signs of this duck on the Ayeyarwady River during the same period (see Table 4.5).

The continuous, sharp decline of the gadwall at both wetland sites is surprising and of concern (see also the observed decline on the Ayeyarwady River [Table 4.5 and Figure 4.1]). In contrast, the ferruginous duck is sharply declining and almost disappearing from the Ayeyarwady River but is only declining marginally or even maintaing a stable population of approximately 700 to 900 individuals in Lake Indawgyi. These observations are not considering data from the period before 2003, indicating that there are more local problems in the river than the global- or flyway-related conservation issues, which might have affected the gadwall population.

Table 4.5 (next page) - Trends in waterbirds at the Myitkyina - Sinbo River stretch from 2000 to 2017 : (Van der Ven, 2000, AWC Wetlands International, 2017; Thet Zaw Naing, 2007*; AWC^, Zöckler and Lay Win, 2016; Zöckler and Thant Zin, 2017) DEC = declining, INC = increasing, STA = stable

Species	Scientific name	2000	2001	2002	2003	2004	2006	2007	2016	2017	Trend
Cormorant	*Phalacrocorax carbo*		600	405	974		211	597		316	DEC
Little cormorant	*Phalacrocorax niger*		22	12	34		35	20		0	DEC
Darter	*Anhinga melanogaster*		51	104	65		47	35		18	DEC
Bar-headed goose	*Anser indicus*	4,070	3,085	946	3,443		1,381	708	670	106	DEC
Ruddy shelduck	*Tadorna ferruginea*		2,170	2,548	3,626	3,884	3,000	2,097		1,285	DEC
Gadwall	*Anas strepera*	2,367		1,348	1,728		1,690	1,384	365	325	DEC
Spot-billed duck	*Anas poecilorhynchus*	939	162	145	266			172		272	INC?
Ferruginous pochard	*Aythya nyroca*		26	2	26		389	1,500		1	DEC
Tufted duck	*Aythya fuligula*		50	55	176		460	130		0	DEC
Red-crested pochard	*Netta rufina*	18		6	14			16	5	0	DEC
Goosander	*Mergus merganser*		108	50	82		59	115		9	DEC
Goldeneye	*Clangula bucephala*	4	29	1	4		18	28	1	5	DEC
Small pratincole	*Glareola lactea*		2,540	1,155	7,785		2,954	2,792		3,160	DEC
Eurasian crane	*Grus grus*	2,419	1,457	757	1,503		846	165		28	DEC
Black stork	*Ciconia nigra*		80	233	163		26	27		43	DEC
Great crested grebe	*Podiceps cristatus*				20		30	36		10	DEC
Grey heron	*Ardea cinerea*		75		44			20		40	STA
Little egret	*Egretta egretta*		50	58	50			105		73	STA
Great egret	*Egretta alba*		7	9	7			9		44	INC
Mallard	*Anas platyrhynchos*	546	36	29	47		48	106		400	INC
Pintail	*Anas acuta*		38		5			6		20	STA
Teal	*Anas crecca*		20	4	16					50	?
Wigeon	*Anas penelope*		5	10	22		10	8			?
Greylag goose	*Anser anser*		379	121	31			1,958		84	DEC
Pallas' gull	*Larus ichthyaetus*		130	98	160		95	157		44	DEC
Temminck stint	*Cakidris temminckii*		38	32	31					103	STA?
Little ringed plover	*Charadrius hiaticula*		4	19	14		32	6		57	INC
River lapwing	*Vanellus tectus*		8		8		5			8	STA
Greenshank	*Tringa nebularia*		40	29	6			36		26	STA
River tern	*Sterna aurantia*		65	38	69			1		0	DEC
Wooly necked stork	*Ciconia episcopus*		1	2	2			2		0	DEC
Lesser adjutant	*Leptoptilos javanicus*			10	14			1			DEC
White-tailed eagle	*Halieatus albicollis*			5	1			3		0	DEC
Spot billed pelican	*Pelecanus philippensis*	222			12	59		70			?

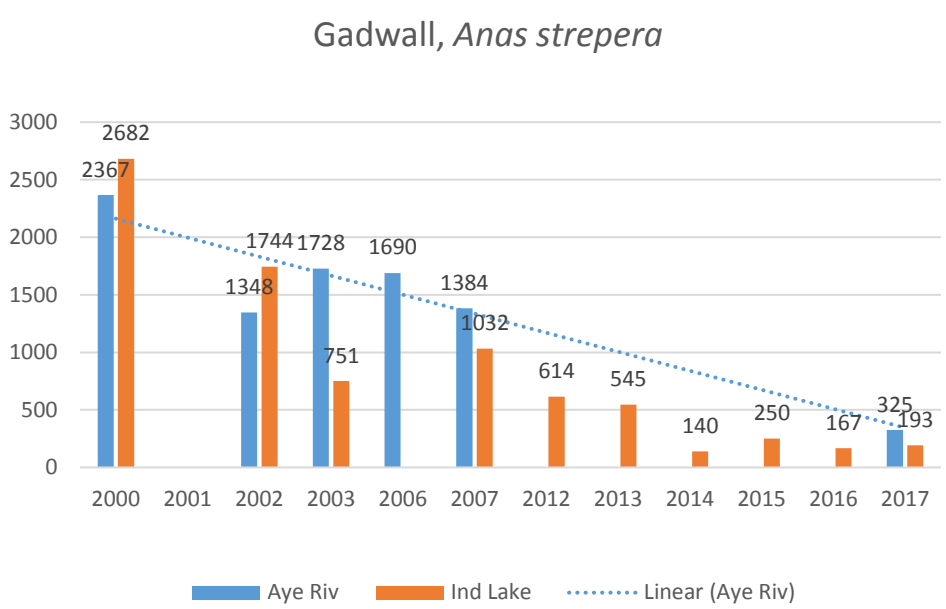


Figure 4.1 - Trends in the wintering population of gadwall, *Anas strepera* (ind.). at two different wetland types in the Ayeyarwady Basin over a period of 10 or 14 years, respectively: Blue = Population at Ayeyarwady River, Myitkyina – Sinbo; Yellow: Lake Indawgyi.

Trend line for river population based on Van der Ven, 2000; AWC, Davies et al., 2004; Thet Zaw Naing and Ngwe Lwin 2006, Thet 2007; AWC, Indawgyi Wildlife Sanctuary Forest rangers; Ngwe Lwin pers. comm.; Zöckler, 2015; Zöckler and Lay Win, 2016; Zöckler and Thant Zin, 2017

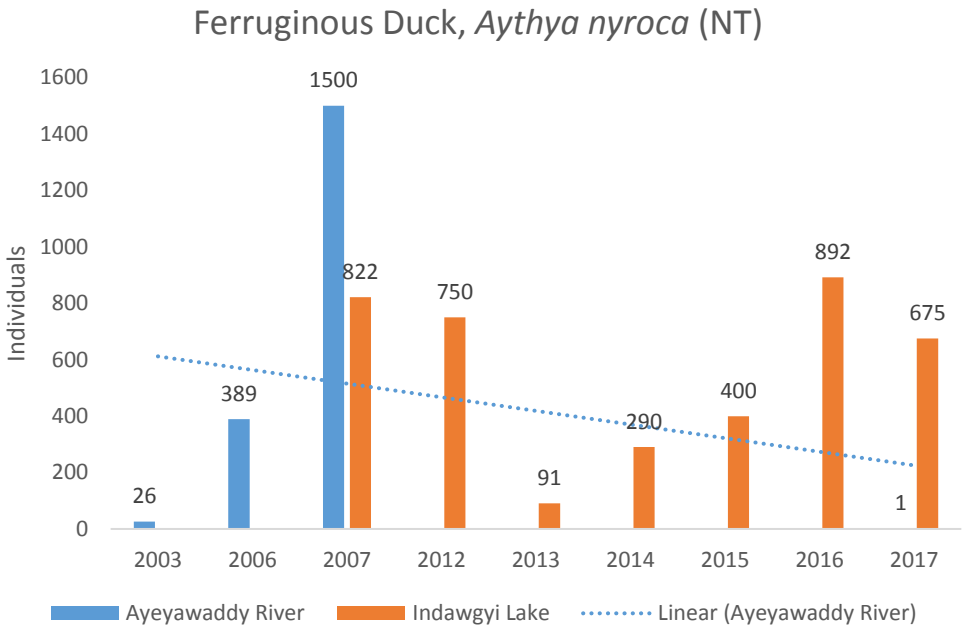


Figure 4.2 - Trends in the wintering population of ferruginous duck, *Aythya nyroca*, at two different wetland types in the Ayeyarwady Basin over a period of 10 or 14 years, respectively: Blue = Population at Ayeyarwady River, Myitkyina –Sinbo; Yellow: Lake Indawgyi

Trend line for the river's population is based on Davies et al., 2004; Thet and Ngwe, 2006, Thet 2007; AWC, Indawgyi Wildlife Sanctuary Forest rangers; Ngwe Lwin pers. comm.; Zöckler, 2015; Zöckler and Lay Win, 2016; Zöckler and Thant Zin, 2017)

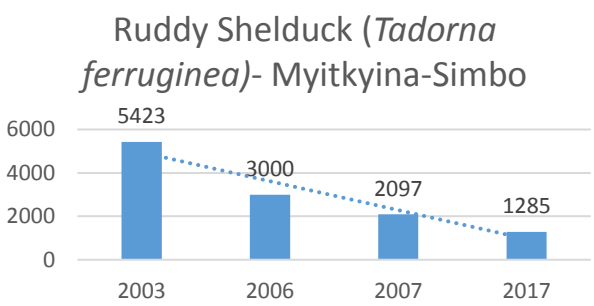
Other declines across all taxa and between different habitats, flyway origins, and routes suggest that local issues are predominant on the Ayeyarwady River. This is almost true for the entire river, considering the wide-spread decline and the disappearance of many waterbirds (see Table 4.5).

It is important to remember that evaluating only a small section or selected, often easily accessible, parts of the river might not always provide a complete picture of the trends.

Apart from the spot-billed duck, which has increased by 45% since 2003, all of the most common eight waterbirds have declined compared to the period of 2001 to 2003. The overall numbers declined fourfold, from more than 21,000 individuals to only 5,500. The declines range between the species from 59 to 98% (Table 4.5) and cover all taxa, rare and common species, and resident as well as migrant birds from different geographical regions. In this context, it is important to note that the survey could not find any spot-billed pelicans, lesser adjutant storks, black-necked storks, wholly-necked storks, any of the two jacana species, or any of the cotton pygmy geese to name a few (in contrast to three-digit figures for the latter species in 2001 to 2003). In particular, the complete lack of jacanas and cotton pygmy geese shows a strong decline and degradation of more vegetated river banks and floating vegetation at nearby wetlands in the basin. Also, the NT ferruginous duck was observed only once, while there have been more than several hundred in the same section only 10 years ago (Thet and Ngwe, 2006).

Although only 106 bar-headed geese were recorded, this would represent a sharp decline of more than 92% from 2016, which established a higher count of 670 or more birds (Zöckler and Lay Win unpubl.). Even further, back in the 1990s, geese numbers reached more than 3,200 individuals. It is not clear if the low count in 2017 is a one-time exception or a trend that might have continued since 2003, when more than 3,000 birds were counted. It is clear, however, that the species has declined, following a similar pattern of other species, but it is not sure by how much (see Figure 4.3).

a)



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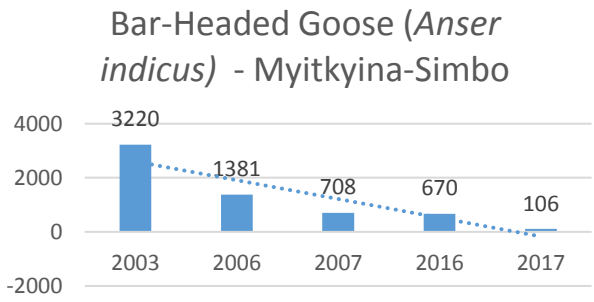

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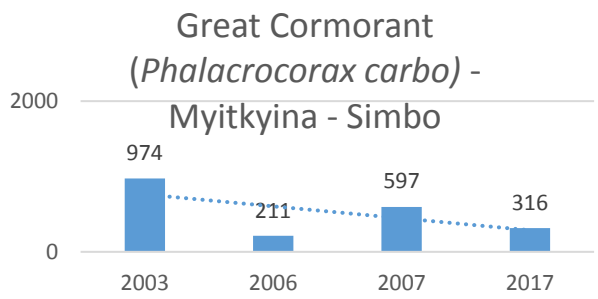

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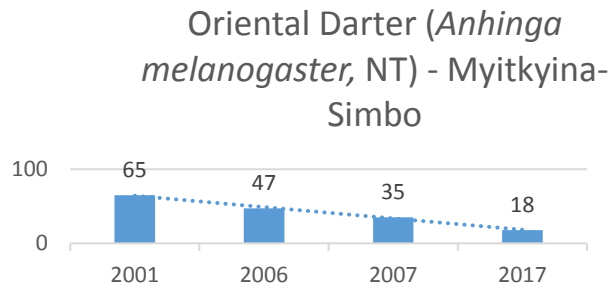

Figure 4.3 - Trends in the wintering populations of several migratory waterbirds and one resident bird (oriental darter, *Anhinga melanogaster*) : (a) Ruddy shelduck *Tadorna ferruginea*; (b) bar-headed goose, *Anser indicus*; (c) cormorant, *Phalacrocorax carbo*; and (d) oriental darter, *Anhinga melanogaster* in the Ayeyarwady River between Myitkyina and Simbo (Davies et al., 2004; Thet and Lwin, 2006; Van der Ven and Thet, 2007)

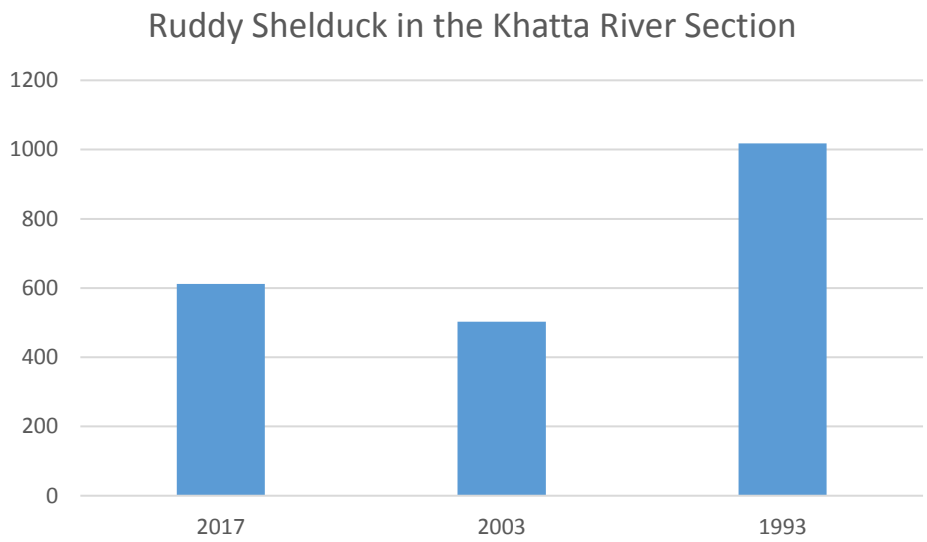

Figure 4.4 - Number of ruddy shelducks at the river section from Khatta to Tagaung at three points in time over a 25-year period: (Davies et al., 2004; Wetlands International, 2017)

4.2 Declining Riverine Terns

The black-bellied tern, *S. acuticauda,* has never been common in the Ayeyarwady Basin, and it is not clear if the species has occupied any territories in the Chindwin River. Today, only 3 to 4 territories in the Ayeyarwady remain (see Figure 2.19). While there were still 13 birds in 2001, between Tagaung and Thabeikkyin (Davies et al., 2004), the survey in 2017 could only confirm three birds (Zöckler and Thant Zin, 2017). Nine birds in Bagan decreased to only one pair in 2016 (Davies et al., 2004; Naing Lin in litt.). The black-bellied tern has already disappeared from the Mekong River (Goes et al., 2010).

It is striking to see the sharp decline in river terns, *S. aurantia,* in the Ayeyarwady from 69 in 2003 to 0 in 2017 at the river stretch between Myitkyina and Sinbo, and from 83 birds in 2006 to only 2 in 2017 along the stretch between Bhamo and Mandalay (AWC, Thet Zaw Naing and Ngwe Lwin, 2006; Zöckler and Thant Zin, 2017). The number in the Chindwin, however, still seems to be stable with 63 occurences recorded in January 2003 (AWC), with at least one bird in 43 locations in 2016 (Naing Lin in litt.).

In 2002 and 2003, the AWC (Wetlands International, 2017) recorded an additional 2 to 6 terns each at three lake sites in the Chattin Reserve, at Kye Inn and Khaung Khon Inn, but it is not known if these sites still hold river terns today. The Mekong population of the river tern has also declined by more than 75% (Bezuijen et al., 2008) and very much mirrors the situation of the Ayeyarwady population.

Alongside the river terns are the great thick-knee, the Indian thick-knee, the small pratincole, and the river lapwing. All of these species are declining and, as ground-nesting birds, face similar problems (Claassen et al., 2017). The Indian skimmer has seemingly already disappeared in the Ayeyarwady Basin and is only known to nest at some sites near the Padma River in Bangladesh (Kabir et al., 2016).

4.3 Increasing Species

In addition to the spot-billed duck, which might have increased at least in the Ayeyarwady River, another species has increased notably in recent years – the glossy ibis. Its expansion has been observed in all wetlands across Myanmar and across Southeast Asia. The observed potential increase in the oriental darter, *Anhinga melanogaster,* at Lake Indawgyi (see Table 4.1) is not clear and requires verifying during future monitoring. This would be a welcome development and may also be an early response to conservation activities on the lake (FFI and Forest Department) but, unfortunately, in contrast to the observed trends along the river stretches I – VII (see Figure 4.3d).

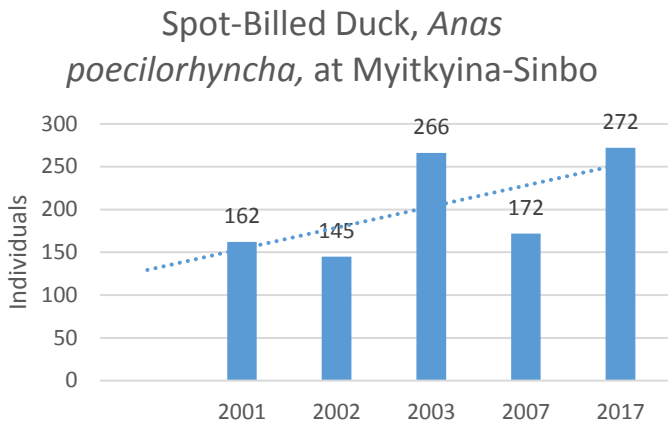

Figure 4.5 - Spot-billed duck, *Anas strepera*, one of nine waterbird species increasing at the Ayeyarwady River

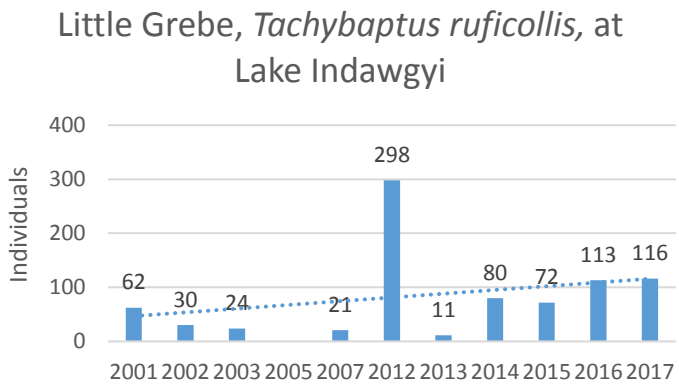

Figure 4.6 - Little grebe, *Tachybaptus ruficollis*, one of nine waterbird species increasing at Lake Indawgyi

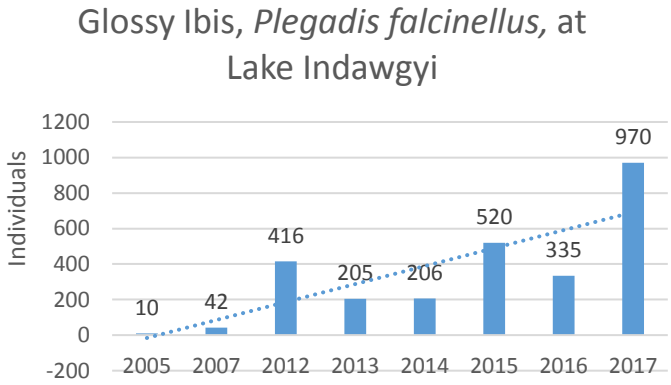

Figure 4.7 - Glossy ibis, *Plegadis falcinellus*, one of nine waterbird species increasing at Lake Indawgyi

Few further sites have been regularly monitored. One of these is the Outer Delta area and the mudflats around Nga Mann Thaung and Gayet Island, where, in the course of searching for the spoon-billed sandpiper, V. Morozov and V. Arkhipov (in litt.) first provided monitoring data in 2010. Thet Zaw Naing visited the area in 2006 and provided data for parts of the region. His data cannot be used for comparison, however, because it is not clear how much of the site was covered during his surveys (

Table 4.6 and Figure 2.17).

Table 4.6 - Waterbird numbers from 2010 to 2016 at Nga Mann Thaung intertidal mudflats: (Zöckler, 2016); globally threatened species are in bold

Species	RL	2010 (Jan)	2013 (Nov)	2015 (Dec)	2016 (Dec)
Ruddy shelduck		4	-	-	-
Lesser whistling duck				110	120
Grey heron		30	26	5 to 7	17
Great egret		70	140	110	100
Intermediate egret		16		100	100
Little egret		?	120	40	60
Black-headed ibis	NT	120	35	8	75
Grey plover		60	250	50	120
Pacific golden plover		30	3	10	10
Greater sandplover		30	1,500	150	150
Lesser sandplover		3,500	500	2,000	1,500
Kentish plover		40	20	100	1,000
Eurasian curlew	NT	190	120	105	43
Whimbrel		10	70	10	160
Black-tailed godwit	NT	400	16	-	-
Bar-tailed godwit		110	30	20	36
Asian dowitcher	NT		-	-	2
Northern greenshank		50	50	12	20
Marsh sandpiper		8	2	2	-
Common redshank		600	250	240	160
Terek sandpiper		150	30	20	30
Nordmann's greenshank	**EN**	**8**	**26**	**48**	**46**
Great knot	**EN**	**600**	**146**	**130**	**130**
Red knot	NT	120	12	5	5
Broad-billed sandpiper		200	100	350	200
Curlew sandpiper	NT	150	80	225	250
Red-necked stint	NT	90	36	50	200
Little stint*			4		
Long-toed stint		-	-	2	-
Spoon-billed sandpiper	**CR**		**1 to 2**	**-**	**1**
Sanderling		20	20	15	5
Ruddy turnstone		40	25	40	10
Pallas' gull		850	142	900	800
Heuglin's gull			2	5	5
Brown-headed gull		2,800	90	500	2,000
Gull-billed tern		2		-	-
Little tern		100	120	660	200
Common tern		10	-	-	-
Greater crested tern		170	-	-	-
Caspian tern		5	37	360	73
Whiskered tern		800	500	2,000	5
White-winged tern		-	-	-	8

*****_The little stint is hardly distinguishable in the field in winter plumage from the red-necked stint. It is likely that this small sandpiper might be equally abundant or the most abundant of the two species, but for the sake of comparison, it has been combined under ed-necked stint._

5 THREATS TO BIODIVERSITY

5.1 Hydropower and Irrigation Dams

Hydropower, irrigation dams, and any kind of interruption of water flow disrupts the hydrology, sedimentology, and ecology of the river with devastating effect for many species; for crucial components of the river ecosystems; and, ultimately, for the people that live near and whose livelihoods depend on the river. Dam construction has been mentioned in the IUCN RL as a significant threat factor for globally threatened species. The impact has been demonstrated for various taxa. Approximately 7% of the globally threatened birds are threatened by dams (BirdLife International, 2013).

MAMMALS

The IUCN RL specifically mentioned that the Irrawaddy dolphin has been affected by various dam projects in several large rivers, namely the Mekong (Smith, 2017). Major threats to Asian otter populations are loss of wetland habitats due to construction of large-scale hydroelectric projects, reclamation of wetlands for settlements, and agriculture (Badola, 1997).

BIRDS

All ground-nesting birds, such as the river terns, the great thick-knee, and more unexpectedly, Pallas's fisheagle (Gilbert et al., 2014), are affected by hydrowpower projects.

TURTLES

The recently re-discovered Burmese roofed turtle, *Batagur trivittata,* population along the Dokthawady River in the Shan State is now thought to be extinct after the construction of a hydropower dam inundated nesting beaches and allowed an influx of fishermen (Platt et al., 2005).

FISHES

Dams impact fish diversity in several ways. They block migration routes, and adult fishes are no longer able to reach their spawning sites. Different devices, such fish ladders, have been designed to allow them to pass dams, but they largely failed. Contrary to the situation in northern Europe and America, where the dams have to be passable by only a few species (like trout and salmon), in Southeast Asia, they have to allow passage to a very large number of species, each with its own requirement for flow, position in the water column, and bottom. For example, large bottom catfishes do not mix with small sardines.

Dams also block the downstream movement of the young. Floating eggs and larvae that normally should drift until metamorphosis sink to the bottom because of the lack of currents and die in the accumulating sediments. Since dams are built where there is a sharp gradient, rapids are flooded and with them disappear all the species specialised for this habitat, unable to survive in any other habitat. Important water level fluctuations create an uninhabitable zone between maximum and minimum operation levels. The flow of rivers below reservoirs is strongly reduced or even suppressed during part of the year, making more rapids uninhabitable by exposing them or reducing the speed and increasing the temperature of the water.

Schemes involving a 'cascade of dams' or a 'staircase of reservoirs' entirely eradicate the fast water fauna of a river, and, de facto, most of the native fish diversity. A number of hydropower schemes divert water from one river to another, creating faunal interchange that may result in invasion, creation of hybrids, and/or the spreading of pathogens.

Although often perceived as a minor problem, the accumulation of micro and picro hydropower (small turbines placed directly in small streams) may seriously impact small streams by creating long successions of weirs and siltated ponds

ODONATES AND OTHER INVERTEBRATES

Dam construction represents a significant threat to running water odonates in Indo-Burma (Reels at al., 2012). Damming of large rivers for hydropower generation is having an adverse impact on the odonata diversity (Mitra et al., 2010).

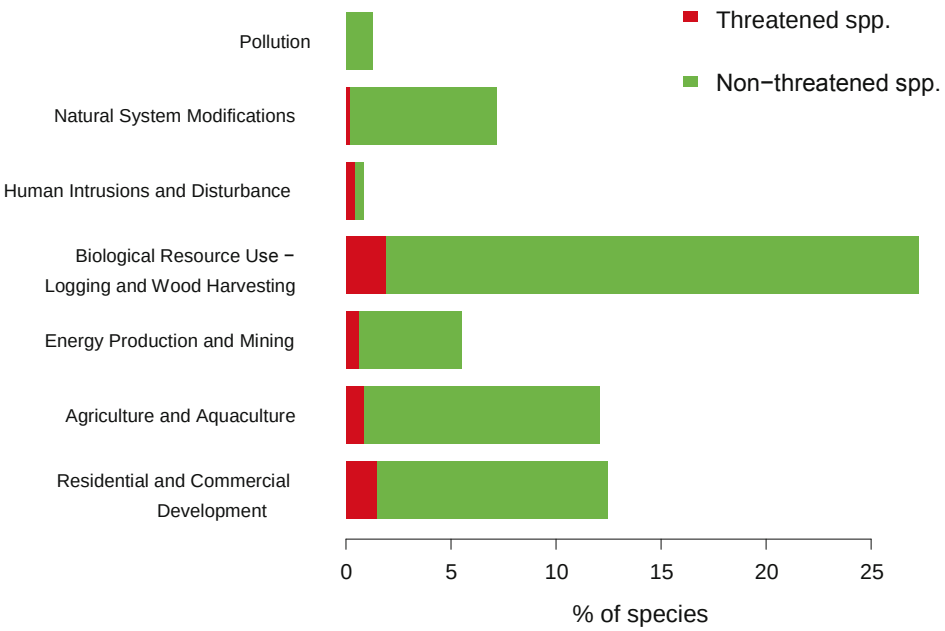

Figure 5.1 - Percentages of species affected by each threat: Note that many species have more than one threat listed (adopted from Reels et al., 2012)

The dramatic declines of bivalves and other molluscs globally have been attributed to modifications and destruction of water courses, dam construction, and channelization (Allen et al., 2010).

A more comprehensive assessment of the Indo-Burma Region established an impact of various identified threats on odonats that can likely be adopted for the Ayeyarwady Basin (see Figure 5.1).

Hydropower development along the flyway can also impact the biodiversity of migratory birds in the Ayeyarwady Basin. In Mongolia, for example, two recently completed hydroelectric dams were severely disrupting water levels in the affected drainage basins and could potentially affect all sites where several migrants from Myanmar, such as bar-headed geese, ruddy shelduck, Pallas' fisheagle, and several others, occur in the Great Lake Basin (Gilbert et al., 2014).

Figure 5.2 shows the distribution of hydroelectric dams in relation to the KBA coverage within the Ayeyarwady Basin.

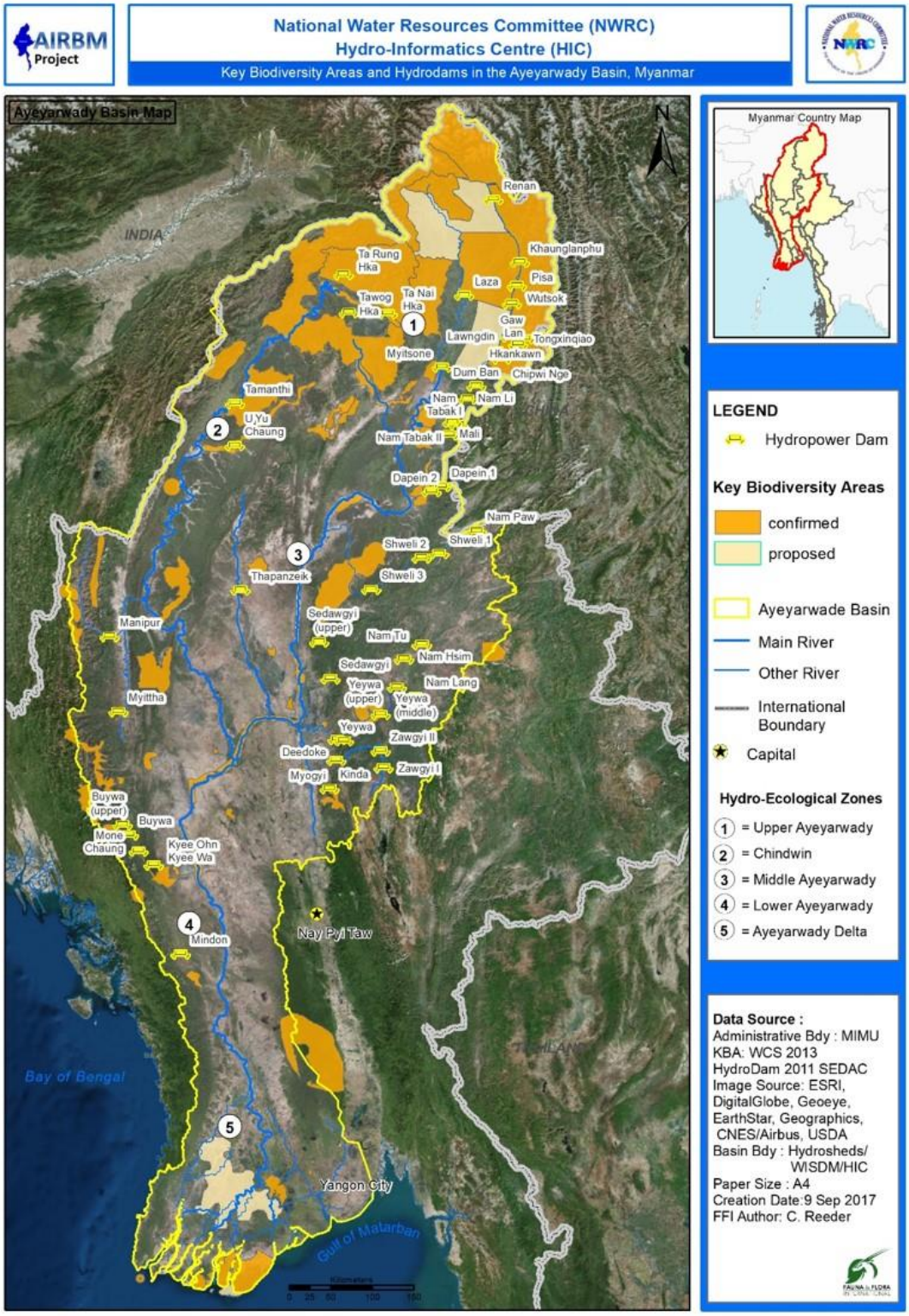

Figure 5.2 – Distrubtion of hydrodams in the Ayeyarwady Basin (courtesy of ICEM) in relation to KBA coverage

5.2 Loss of Wetlands

The loss and degradation of wetlands is a global phenomenon and not restricted to Myanmar and the Ayeyarwady Basin. Davidson (2014) analysed the global wetland loss and stated that 87% of all global wetlands have been lost since the 1800s. The rate and pace has been different between the continents, but it is concerning to see his data depicting a loss of 83% for Asia, with 66.7% since 1945. Dixon et al. (2016)

developed a global Wetland Extent Trend (WET) Index based on 1,100 global data sets. In their conclusion, Dixon et al. (2016) stated that there was a continued inland wetland loss globally of 27% between 1970 and 2008, with Asia's inland wetlands loss above global average (39%), which was the second largest loss of wetlands after Europe (51%).

Davidson (2014) concludes that the conversion and loss is continuing in all parts of the world, particularly in Asia. The fate of the world's remaining wetlands is uncertain.

There are no data to compare these figures for Myanmar and the Ayeyarwady Basin. It is likely, however, that these figures are similar, meaning that only 25 to 30% of the former wetlands still exists within the Ayeyarwady Basin. These wetlands are not only lost for the goods and services of feeding an increasing population but are vital in buffering the storm surges and extreme weather events that occur in the region and that are likely to increase in force in the future with global warming.

Some data, though, exists to underpin the previous statements. Lakes, especially in the Central Dry Zone, are exposed to increasing demands from irrigation and other human water use purposes. Water levels have fallen also in response to deforestation, as in the example of Indaw Lake (Sagaing, Middle Ayeyarwady). Several lakes diminished in size, like Indaw Lake lost approximately 10% of its coverage in the past 10 to 15 years according to local people. Aung et al. (2016) revisited 19 lakes in the basin that Davies et al. (2004) surveyed for waterbirds, and they found that two lakes had completely dried out and one was at low level with hardly any open water left. Sites, such as Yewai and Yit Lake, supported significant numbers of waterbirds and fish for local coummities until 1993, including more than 500 of the now CR threatened Baer's pochard. These sites were already completely dry when visited in 2001 (Davies et al., 2004). Although they still fill up with water during the rainy season, off-take is rapid, and the wetlands dry up by early December. Locals at Yewai mentioned that pelicans used the site every year until 1993.

Major threats to Asian otter populations are loss of wetland habitats due to construction of large-scale hydroelectric projects, reclamation of wetlands for settlements, agriculture, reduction in prey biomass, poaching, and contamination of waterways by pesticides. In most Asian countries, although there has been increased human population during the last century, inadequate and ineffective rural development programmes have not been able to address the problems of poverty, forcing people to be more and more dependent on natural resources (Badola, 1997). Consequently, most of the wetlands and waterways do not have adequate prey base for sustaining otter populations. Wetlands and waterways, also in the Ayeyarwady Basin, are polluted by eutrophication and accumulation of persistent pesticides from agricultural runoffs, such as chlorinated hydrocarbons and organophosphates. Increased pesticide use is not only regarded as a major obstacle to the development of a rice-fish culture but also poses a danger to all predators feeding on aquatic prey in the area (Melisch et al., 1996).

In the entire south and Southeast Asia, there is severe conflict between otters and humans, because poverty and the recent increase in aquaculture activities has led to the indiscriminate killing of otters. Many important habitats of the smooth otter have been lost to development activities. In Southeast Asian countries, there does not seem to be any intentional otter trapping (Melisch et al., 1996), although poaching for skins and trading has been observed in the Upper Ayeyarwady (BANCA, 2009).

Only approximately 20% of net shown area in Myanmar is irrigated (Chhor et al., 2013). Irrigation is likely to increase and has been suggested as economic advise for growth in the agricultural sector (Chhor et al., 2013). This practice will increase the pressure on the few remaining wetlands and, ultimately, jeopardise the fragile ecological balance within the Ayeyarwady Basin.

5.3 Deforestation

Deforestation is a big problem for the entire Ayeyarwady Basin, and it presents a major ongoing problem throughout the region. Figure 5.3 shows that, since 2001, the most significant forest loss has occurred in the Middle Ayeyarwady with the basin losing 5,560 km² of forests overall during a 13-year period (Hansen et al., 2013; Global Forest Watch, 2014 in ICEM, 2017). Other studies report slightly higher levels of overall forest loss at 3.6%, with forest loss as high as 22.5% in the coastal areas of the delta region (Bhagwat et al., 2016).

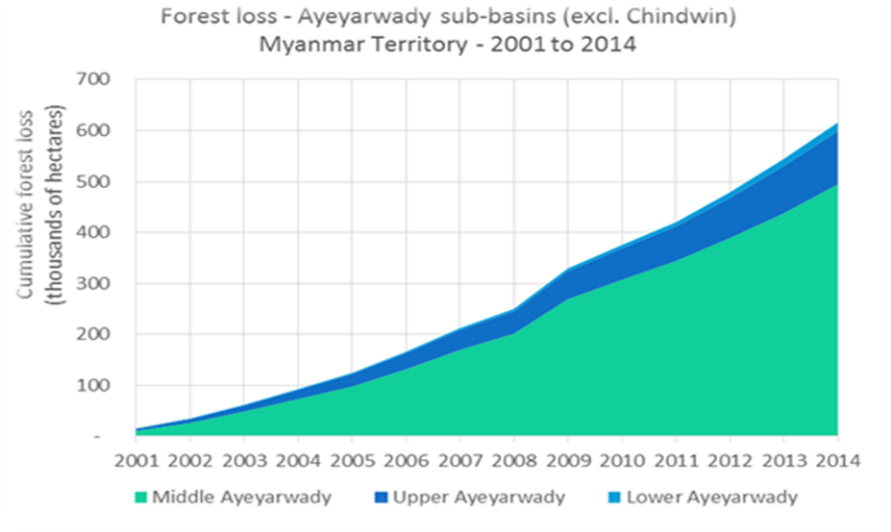

Figure 5.3 - Cumulative forest loss (of 70% canopy cover forests) in the Ayeyarwady Basin from 2001 to 2014 (Hansen et al., 2013; Global Forest Watch, 2014; in ICEM, 2017)

The situation in the Chindwin Sub-basin is similar, posing not only threats to KBAs but also to the wetlands in the drainage areas with the increase of flooding and drought events.

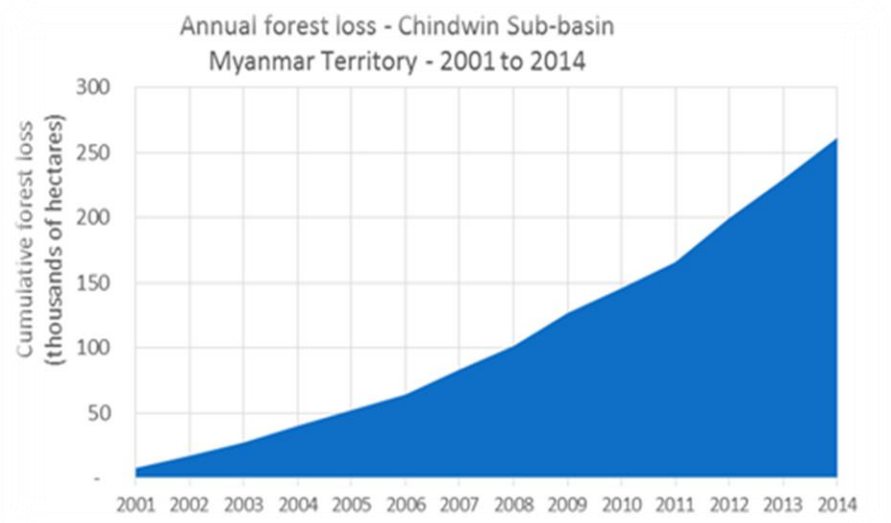

Figure 5.4 - Forest cover change in the Chindwin Sub-basin (Global Forest Watch, 2014; ICEM, 2017b)

Figure 5. shows the forest loss and the impact of mining in and outside the KBAs in the Ayeyarwady Basin.

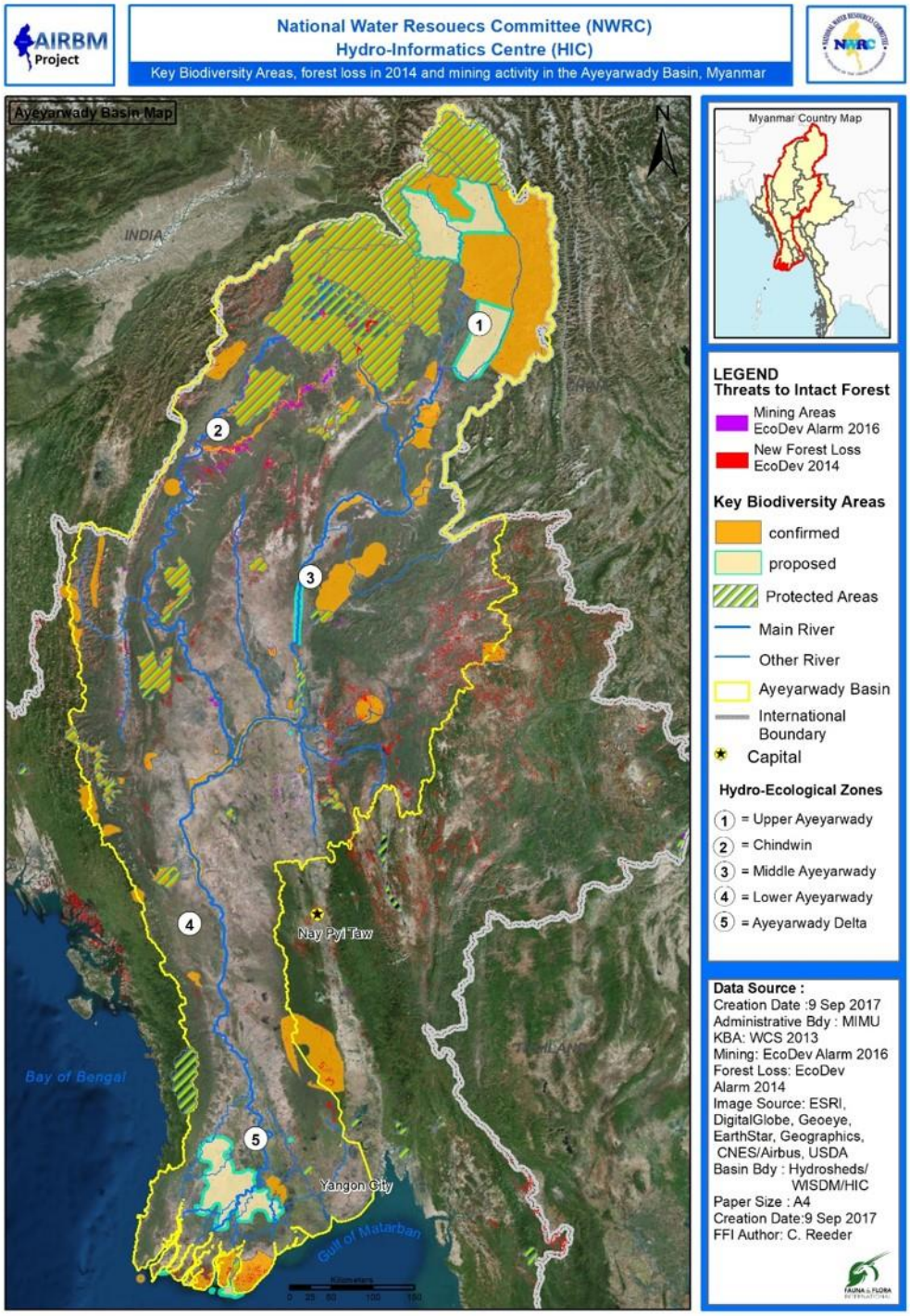

Figure 5.5 - Forest loss and key mining areas in and outside the KBAs in the Ayeyarwady Basin (Bhagwat et al., 2016)

KBAs seem to be less affected on average, but some areas still experienced a loss of up to 17% (see top most affected KBA sites in Table 5.1) and 10 KBAs are above the basin average of 2%. Even Protected Areas, like the Indawgyi Wildlife Sanctuary, experienced a 0.85% of forest loss over the past 13-year period. The remaining forest is also, in most cases, no longer intact and has been subjected to selective logging (ICEM, 2017b).

Table 5.1 - Forest loss in the KBAs ranked by impact of forest loss in % from 2002 to 2014: Analysis based on data provided by Bhagwat et al. (2016)

No.	KBA site name	Forest loss (ha)	Forest loss %
1	Uyu River	14,688	17.40
2	Myaleik Taung	282	7.61
3	Mehon (Dokthawady River)	6,224	7.07
4	Lwoilin/Ginga Mountain	3,219	5.87
5	Upper Chindwin River: Kaunghein to Padumone Section	158	3.81
6	Ayeyarwady Delta (including Meinmahla Kyun)	21,888	3.34
7	Kennedy Peak	3,486	3.20
8	Panlaung Pyadalin Cave	921	2.64
9	Tanai River	1,419	2.23
10	Pauk Area	433	2.22
11	Paunglaung Catchment Area	4,727	1.85
12	Central Bago Yoma	7,101	1.80
13	Saramati Taung	17,978	1.69
14	Minzontaung	26	1.53
15	Upper Mogaung Chaung Basin	221	1.17
16	Kamaing	444	1.12
17	Hlawga Park	67	1.10
18	Myitkyina-Nandebad-Talawagyi	499	0.90
19	Indawgyi Lake Wildlife Sanctuary and surroundings	623	0.85
20	Zeihmu Range	63	0.78

The top three KBAs affected are also important for several globally threatened species, namely turtles, but some of the information about turtles is old. It appears that the information for the Burmese roofed turtle, Asian softshell turtle, and Burmese peacock softshell turtle for the Mehon Site is outdated, which has also been influenced by the recent construction of dams.

Forest loss is not only contributing to the loss of forest biodiversity but also to the loss of large mammals and birds, such as the green peafowl in the Mehon Area, that live and depend on these ecosystems. Intact forests both protect rivers and its biodiversity, such as fish, freshwater turtles, and invertebrates, from increased sedimentation due to erosion following exposure of soil after logging and land clearance. Forests also provide organic inputs to the rivers as fuel to drive the natural dynamics of the freshwater system. These factors emphasize the importance of maintaining the integrity of the Protected Areas in the region (Kottelat, 2015a).

5.4 Conversion to Plantations

Rubber is a rapidly expanding cash crop throughout the tropical and subtropical areas, and it can grow throughout much of Myanmar. Rubber plantation areas in the northern part of the Ayeyarwady Basin, especially in the Kachin and Shan States, cover approximately 70,000 ha (Fox et al., 2013). Myitkyina Township in Kachin experienced a large-scale change to plantations (rubber, banana, and cassava), resulting in the loss of approximately 25,000 ha of intact forest between 2002 and 2014.

5.5 Gold and Jade Mining

Myanmar accounts for 90% of the world's jade production and is among the top producers of rubies and sapphires (Chhor et al., 2013). Gold and jade mining has been widespread across the Ayeyarwady Basin and is particularly prominent in the Upper Ayeyarwady and also in the Chindwin Basin (LaJeunesse Connette et al., 2016). A large increase in mining activities in the Upper Chindwin area has also resulted in forest loss of more than 6% in the region (Bhagwat et al., 2016). Both drivers exacerbate the pressure on biodiversity in the region, which still has 68% of its forest cover. Figure 5.5 shows the distribution and, especially, the increase in mining in the Upper Chindwin.

In the north of Lake Indawgyi, the mining for gold using mercury can be very damaging to humans and needs to be properly regulated. Mercury and cyanide are used for gold mining and processing. Small operations use disproportionately larger quantities of chemicals compared to large industrial mining operations and may be damaging, and even killing, whole streams. Larger mines use larger quantities, but they may use them in a more proportionate way and are supposed to control their effluents.

Dredging the bottom of the river additionally destroys fish habitats and creates heavy sediment deposition that kills any life on the bottom of the rivers. There are other small gold mines in the Upper Ayeyarwady, upstream of the confluence with the Mogaung River. Some major jade mines contribute to the increase of sediment loads in the river and the smothering of fish and their habitats.

5.6 Pebble and Sand Mining

A typical and increasing problem for the large rivers, like the Ayeyarwady but also the Chindwin, is the dredging for minerals, mostly gold, but also pebble and sand mining. The latter is wide-spread and increasing. While this has an obvious, devastating effect on ground-nesting birds and nesting freshwater turtles, it also affects the fish community. It is a wide-spread practice and removes spawning areas and benthic fauna. It launches free sediment into the river, which can smother spawning and algae-grazing areas used by some fish species, especially rapids and riffles. It can fill deep holes and change the chemistry of the river.

Figure 5.6 – Small-scale and larger-scale hydraulic gold mining in the Upper Ayeyarwady in the Mali Kha River (BANCA, 2009)

More than 70 pebble suction motorboats were seen in the river between Pyay and Bagan (Aung Myo Chit, 2016). These are highly destructive to the river ecosystem and to the Irrawaddy dolphin, in particular, due to the extremely loud underwater noise caused by the suction pipes when sucking up everything on the riverbed floor. This kind of industrial extraction of river bed gravel changes the underwater landscape and

further clouds the already muddy water, making it impossible for the Irrawaddy dolphin and most other fish species to survive where these extraction methods are used.

Figure 5.7 - Big boats dragging pebble and sand in Ayeyarwady River near Pyay (Aung Myo Chit, 2016)

Sand and pebble mining might still not be considered a large problem, with only local issues observed as described above. In many areas, pebbles are still collected by hand before being transported by lorries for road construction.

Figure 5.8 - Pebble collection by hand near Myitkyina (Photo credit: C. Zöckler)

However, an increasing demand for construction in Myanmar, and globally, will increase the pressure on river sand, and the seemingly infinite source sand is already globally becoming scarcer (Constable, 2017). It is river and beach sand that can only be used for concrete, and that is the habitat where ground-nesting birds and sand digging marine and freshwater turtles are threatened. If this demand for sand increases further than the river itself, adjacent wetlands and people's livelihoods will be jeopardised.

5.7 Over-Fishing

MESH SIZE

A survey team witnessed extensive use of fine-weave, three-layer drift nets, traps, hooks and lines. Perhaps the most destructive was the abundant use of the highly illegal electric shock method and beach sein nets to kill all kinds of fish in various sizes (mostly fingerlings) in large quantities in a very short period of time.

Finless porpoises, Irrawaddy dolphins, and marine turtles are extremely susceptible to entanglement in gillnets. Large numbers have been, and continue to be, killed in many parts of their range (Jefferson et al., 2002). Gillnets are used extensively in Sri Lanka, Bangladesh, and Myanmar (Mohan, 1994). Since the time of these reports, gillnetting efforts certainly would have increased considerably in these and other regions, because there are few (if any) restrictions on this kind of fishing gear anywhere in the range of the species. Porpoise habitat in Myanmar is heavily fished with gillnets and other types of gear capable of taking small cetaceans incidentally (Smith and Than Tun, 2008).

ELECTROFISHING

Electro-shocking is an easy, but indiscrimate method of catching fish used for subsistence purposes and has its hardest impacts on small/young fish in shallow water. In the river section south of Bagan, the survey team of Aung Myo Chit (2016) witnessed a new type of electrical cast that is widely deployed along the river and is destroying large segments of the river's fish population through mass electrification. Though many fishermen understood their methods of catching small fish by electric fishing is drastically affecting the environment and ecosystem, they feel unable to stop unless everyone stops, because anyone utilizing these methods will out-fish those who do not. Therefore, a 'race to the bottom' situation is occurring that can only be stopped by government implementation and enforcement of strict fishing rules (Aung Myo Chit, 2016).

Aung Myo Chit (in litt. 2017) also recorded a number of dolphin carcasses found over the past 16 years. The cause of the deaths was not revealed, but in many cases, the dolphins were caught in nets and drowned.

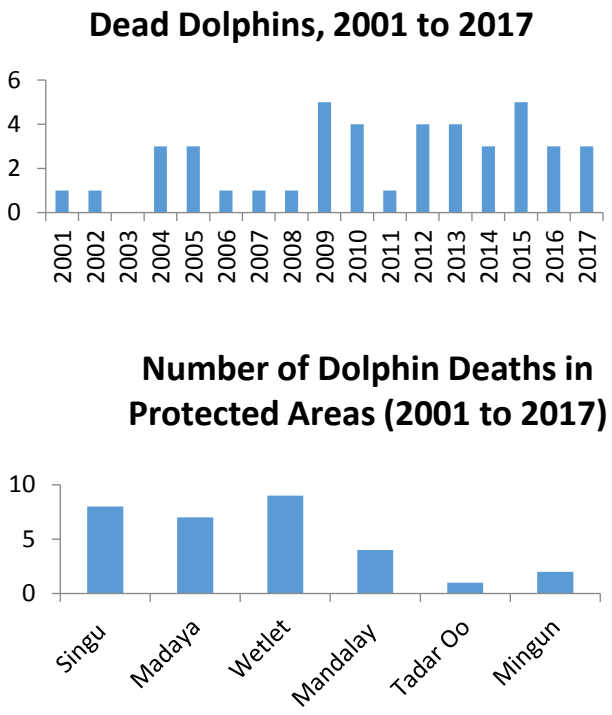

Figure 5.9 - Number of carcasses recorded at different river stretches in the Ayeyarwady River (Chit Myo Aung in litt.)

Hunting and poaching is wide-spread across the Ayeyarwady Basin and is affecting all habitats and all taxa. Almost all mammal species were found hunted, and remains, such as skins, horns, or scales, were found in villages in the Upper Chindwin area during the surveys in 2008 to 2009 (BANCA, 2009). Elephants are hunted for trading ivory and Chinese traditional medicinal purposes but also to deter them from increasingly encroaching crops on the edges of their territories (Choudhury et al., 2008). Otters have been persecuted to local extinction in many places in the belief that otters will prey on fish and on fish farms, which have increased in numbers and extent, especially in the Lower Ayeyarwady and the delta region. Davies et al. (2004) only mentioned four sites with otter records in the 2001 to 2003 period, and it is likely that those populations have also declined.

Most turtles in Myanmar have been persecuted to local extirpation and almost extinction due to subsistence hunting and collecting for illegal trade. In particular, river terrapins (like *Batagur baska* and *B. trivittata)* have suffered heavy losses, but other river turtles (like the softshell turtle, *Amyda cartilaginea)* are heavily persecuted and are predicted to be uplisted to CR in the coming decade (Platt et al., 2014).

Figure 5.10 - Villagers transporting a freshly killed softshell turtle, *Amyda cartilaginea*, in southern Myanmar – a species that is projected to become critically endangered in the coming decade (Photo credit: C. Zöckler)

5.8 Bird Hunting

Bird hunting is prevalent throughout the basin. It was observed and documented at the river during the field surveys between Myitkyina and Bagan as well as in the delta. Bird hunting for waterbirds, forest birds, and other birds (like hornbills) are hunted for food, trophies, and the wild bird trade. Even in most Protected Areas, bird hunting is still practiced and there is little law enforcement. There is hardly any wetland or reserve, protected or not, that is not subjected to persistent and heavy persecution by hunting. Mostly birds are trapped by nets or snares and, in some rare cases, poisoned by baits. Shot guns are rarely used.

Figure 5.11 - Net for trapping birds on 8-m high poles spanning a river channel on a sandbank in the Bhamo (C. Zöckler)

According to local hunters, bird trapping is common and wide-spread. Ruddy shelduck and black-crowned night heron were mentioned among the most common birds caught. Even though it is illegal, the hunters feel confident and openly talk about their hunting habits, because there is no law enforcement.

Bird hunters in Whettikan Lake Wildlife Sanctuary mostly use noose trap and cast net for hunting. Children mostly used catapult for shooting with clay pellets. (Khin Gee Maung, 2005). A few local people used air guns for shooting.

THREATS TO GROUND–NESTING BIRDS

Claassen et al (2017) summarised the causes of nest failures of ground–nesting birds in the Mekong River.

River tern nest failures (*n* = 43):

- Predation by animals (47%);
- Egg harvest by humans (26%);
- Abandonment (16% [7% due to exclosure installation]);
- Flooding (5%);
- Cracked eggs (5%);
- Trampling by water buffalo (2%).

River lapwing nest failures (*n* = 39):

- Animal predation (67%);
- Egg harvest by humans (23%);
- Inundation (5%);
- Trampling by water buffalo (3%).

Great thick-knee nest failures (*n* = 6) were caused by animal predation (100%).

Small Pratincole nest failures (*n* = 258):

- Animal predation (69%);
- Egg harvest by humans (15%);
- Abandonment (9%).

Based on our observations and reports (Thet Zaw Naing, Naing Lin pers. comm.), these findings can be easily transferred to the Ayeyarwady River.

5.9 Illegal Wildlife Trade

Uncontrolled hunting and wildlife trade occurs in approximately 70% of Protected Areas (Rao et al., 2002). Sadly, this number has not changed for the better, because large volumes of wildlife and wildlife products are transported to China's Yunnan Province and to Thailand, and some are consumed domestically. The wildlife trade is decimating most Protected Areas, particularly those along international borders, creating large regions of "silent forest," where species are being eliminated, such as elephants, Asiatic bears, sun bears, tigers, leopards, snow leopards, clouded leopards, turtles, tortoises, pangolins, and many species of birds.

Two large mammals, the Asian elephant (*Elephas maximus*) and tiger (*Panthera tigris*) are threatened, mainly due to illegal trafficking, and their populations are decreasing (MOECAF, 2015). Agriculture expansion into forests is leading to increasing human-elephant conflict, particularly in the Sago Yoma and Rakhine Yoma (MOECAF, 2015). Once wide-spread in Myanmar, tigers are now restricted to small populations in the Htmanthi and Hukaung Valley Wildlife Sanctuaries (50 tigers) (see Figure 2.1).

Black musk deer (*Moschus fuscus*), sun bears (*Helarctos malayans*), Malayan pangolins (*Manis javanica*), and Chinese pangolin (*Manis pentadactyla*) are also severely threatened by illegal trafficking.

As a group, softshell turtles are in high demand by Chinese wildlife markets. Populations of most species have been decimated throughout much of Myanmar.

5.10 Plants

Illegal logging for valuable timber species is a driver of deforestation. Rosewood species (Padauk, *Pterocarpus macrocarpus,* and Tamalan, *Dalbergia oliveri*) are highly valued and increasingly sold illegally across the border as rosewood supplies are exhausted in neighbouring countries. Orchids are also threatened by unregulated collection and sale across the borders (MOECAF, 2015).

5.11 Invasive Species

Stocked aquaculture fish have escaped. For some *Pangasius* species, it is difficult to say whether they are native or introduced stocks. Species have long been reported as native, but cultivated stocks are imported, and since nobody checked if they really are the same, this point remains unknown (some "native" species may not be totally native). Some have been introduced so long ago that people do not realise that they are not native (Kottelat in litt.)

Totally exotic species, like juveniles of tilapia, *Oreochromis nilotica,* were recorded during field surveys in June in slow flowing stretches, backwaters, and floodplain lakes. It is invasive and regularly escapes from ponds and cages. They have negative impacts as competitors and at destroying the bottom of streams. Snakeskin gourami, *Trichopodus pectoralis,* is present in swamps and ponds. More stocked than invasive, it is not very mobile (Kottelat in litt.).

The Chinese list an impressive set of introduced fish species (all known to be invasive) for the Upper Shweli that can swim downstream and invade Myanmar (Yang et al., 2016). They were likely stocked accidentally with fry and juveniles of cultivated species. Some may have been willingly introduced. This is the main pattern as what they did in reservoirs and aquaculture in the Mekong upstream of Laos. These species are now invading northern Laos and Thailand.

The first Myanmar record of *Pterygoplichthys sp. (pardalis?)*, a South American sucker catfish that is invasive everywhere, was recorded during the field survey in June 2017. In the United States, it is a threat because it digs nests in the shores of rivers and ponds that may collapse. The main vector of introduction seems to be released aquarium fish. The feral mosquitofish, *Gambusia affinis,* has not been recorded, but it is suspected to be present (Kottelat in litt.). They were introduced everywhere in the hope that they would control mosquitos. They failed, but they succeeded at becoming invasive and at threatening native species.

Another threat, which is up-and-coming, is the invasive Chinese pond mussel, *Sinanodonta woodiana*. This species has been found for the first time near Bhamo (Vikhrev pers. comm.), which is the first record for Myanmar (Vikhrev et al., in prep). The Chinese pond mussel could affect native mussel's dramaticaly as it did in Malaysia. The Myanmar freshwater mussel fauna presents a high level of endemism, so an invasion of *Sinanodonta* is potentially a big challenge.

6 RECOMMENDATIONS FOR CONSERVATION

6.1 Sustainable Development

Rapid changes in social and economic conditions will likely occur across Myanmar in the near future as annual rates for economic growth are expected to be as high as 8% and tightly linked to natural resource exploitation. Overall, Myanmar is close to a market of more than half a billion people (Chhor et al., 2013). This creates new and additional challenges for the people and biodiversity in the Ayeyarwady Basin, which is already under enormous environmental stress. This could be addressed through policy and institutional reform and the integration of environmental safeguards into economic development planning (Organization for Economic Cooperation and Development [OECD], 2013). Some of these safeguards must be a comprehensive network of Protected Areas and a sustainable resource management that is negotiated and led by communities and supervised by an Integrated River Basin Management Committee and local subsidiaries.

6.2 KBAs and Protected Areas

Only 50% of the identified KBAs are officially protected. It is highly recommended to expand the Portected Area Network and increase the level of KBA coverage of Protected Areas to at least 80% to safeguard the most precious remains of biodiversity in the basin. New forms of Protected Areas, such as Biosphere Reserves and international categories, should be more widely explored and applied, where applicable. Protected Areas on paper only do not address the pressures on biodiversity. The design and implementation of management plans, together with local communtieis, are crucial in the long-term protection of biodiversity.

The Management Plan for the Ayeyarwady Dolphin Protected Area (ADPA), prepared by the Department of Fisheries (DoF), Myanmar, in collaboration with WCS (WCS, 2008), has six major objectives. The first is to dramatically reduce or eliminate illegal fishing activities. Key activities include two regular SMART patrols per month and an education and awareness program. While SMART data are now routinely collected and cooperative patrols with community, police, townships, and regions have been undertaken, numerous challenges remain. Enforcement was particularly weak from 2010 to 2014. There is poor inter-agency cooperation, funds and equipment are limited, and there has been a surge in electrofishing. The ADPA should also be expanded to include the newly discovered dolphin population south of Bagan, where the six action points of the management plan should be equally implemented. These Protected Areas can serve as a platform for implementing conservation measures, such as no gillnet fishing zones, but also providing alternatives, such as dolphin-watching tourism.

Establishing Protected Areas along a suitable stretch of the Ayeyarwady or Chindwin River would also greatly benefit freshwater turtles, such as *C. vandijki*. Additionally, there is an urgent need to establish captive breeding colonies of *C. vandijki*, but the species has proven difficult to successfully maintain in captivity (Platt et al., 2014).

6.3 Eco-Tourism

It is encouraging to see that some organisations, such as the Harrison Institute, are promoting the idea of developing eco-tourism in the Bagan – Banmaw section (Harrison Institute, 2015). There are also increasing numbers of tourism companies visiting the Meinmahla Kyun Wildlife Sanctuary and the Outer Delta Islands as part of their Myanmar eco-tours. In 2016, for the first time, bird tour operators included visits to the Sarus Crane areas in the delta region in their programme. The potential for expansion is huge and important to provide alternative income to hunting and wildlife poaching to local communities, who can accommodate, provide transport and food, and guide tourists to wildlife destinations.

6.4 Head-Start Programme and Assurance Colonies

The Forest Department began a head-start and breeding programme for the saltwater crocodile, *Crocodylus porosus,* in the Meinmahla Kyun Wildlife Sanactuary in the delta region, releasing hatchlings back into the wild after a nursing period. This programme has been successful, and crocodiles have been breeding in the wild.

Figure 6.1 - Conservation breeding programme for crocodiles in Meinmahla Kyun Wildlife Sanctuary
Photo credit: C. Zöckler)

After years of collecting and successfully incubating eggs of Burmese roofed turtles from the handful of nests still being found along the Chindwin River, all of the eggs recovered in 2014, and again in 2015, proved infertile. WCS and the Turtle Task Force in Myanmar feared that no females remained in the wild population. Concerns abated somewhat in March 2016 when a single clutch of viable eggs – from a total of five clutches – was unearthed from a sandbank. Twenty-seven of the 30 eggs later hatched successfully, and the young turtles have been head-started for later release (Platt and Platt, 2016).

A softshell turtle assurance colony is currently being established at a Buddhist monastery near Bago, approximately 60 km north of Yangon. Ponds are fenced and fitted with artificial sandbanks to provide a nesting substrate. Seven adult softshell turtles (three narrow-headed softshell turtles (*C. vandijkii*), two Asian giant softshell turtles (*A. cartilaginea*), and two Burmese peacock softshell turtles (*N. formosa*) have been acquired for the assurance colony. These turtles were either confiscated from wildlife traffickers by the Forest Department or donated by fishermen.

In addition to collecting eggs and head-starting hatchlings along the Chindwin River, assurance colonies play a critical role in Burmese roofed turtle survival. The original assurance colony at the Mandalay Zoo continues to serve as the bulwark of the ex situ conservation effort. Another 18 hatchlings were produced this year, bringing the total captive population to more than 700 animals.

A second colony of 100 sub-adult Burmese roofed turtles, established at Lawkanandar Wildlife Sanctuary in 2011, is expected to begin reproducing within the next few years. Males and females are already exhibiting the dimorphic coloration that indicates the onset of sexual maturity.

Another assurance colony was established this year when 100 head-started turtles were transferred from the base camp at Limpha Village to a new facility constructed in the riverside hamlet of Htamanthi. In another landmark event for turtle conservation in Myanmar, 25 headstarted Burmese roofed turtles were flown to Singapore in May to establish the first out-of-country assurance colony. According to husbandry personnel at the Singapore Zoo, the turtles quickly settled into their new home and began displaying previously unobserved courtship behaviour.

6.5 Reintroduction

In the wild, we continue monitoring headstarted turtles released into the Chindwin River in 2015. Initially, the turtles remained in the vicinity of the acclimation pens, rarely straying more than a kilometer or two up- or downstream. But with the beginning of the wet season in July 2015, floodwaters surged down the rivers, flushing turtles many kilometers away from the release area and presenting logistical challenges in the attempt to find them. Several turtles fell victim to fishing nets and drowned, while others simply disappeared, most likely because their radio transmitters had malfunctioned. But other turtles remain at large in the river as attested to by villagers who occasionally see them basking or swimming. Although the outcome of this first ever reintroduction of Burmese roofed turtles remains somewhat equivocal, much has been learned that can be applied to ensure the future success of continued efforts (Platt and Platt, 2016).

6.6 Integration of Local, Cultural, and Spiritual Context into Conservation Measures

The Burmese star tortoise will only survive through a successful captive breeding and re-introduction programme. Currently several rearing facilities in Myanmar are producing offspring, but the re-introduction is hampered by the persistent and rampant poaching of the tortoise (Platt et al., 2011). It is crucial that the local communities and, more important, their traditional beliefs are incorporated in any conservation programme. The example of the Burmese star turtle has demonstrated the necessity of the inclusion of traditional belief systems. Every released turtle has been tattooed with a sign that would deter any collector by the sprits of the forest.

6.7 Bird Nest Protection Schemes

WCS has started a nest guarding scheme at two of the remaining black-bellied tern nesting sites and managed to get at least one pair to hatching stage (see Figure 2.18). Claassen et. al., (2017) implemented and monitored a ground-nesting bird guarding project on the Mekong River in Cambodia from 2010 to 2014. They also established a direct payment nest protection scheme, where nests were guarded by local community members in return for direct payment. These were often farmers or fishermen, who were involved in egg collection prior to this engagement. Claassen et al., (2017) tested and proved that the direct payment nest protection programme improved the nesting success for six sandbar-nesting bird species.

Additionally, exclosures were used to protect nests of the river tern, *S. aurantia* – the species of highest conservation concern. Nest protection improved survival rates of river tern nests and chicks as well as small pratincole, *Glareola lacteal,* nests. River tern nest success was 60% for exclosed (and guarded) nests, 29% for guarded (but unexclosed) nests, and 5% for unprotected nests. River tern fledging success was 82% for exclosed chicks, 40% for chicks that were guarded only, and 2% for unprotected chicks. Small pratincole nest success was 21% for guarded and 6% for unguarded nests. Egg harvests by humans was lower among protected nests and declined during the study period. Similar nest proection schemes could save the few remaining riverine terns.

6.8 International Conservation Agreements

RAMSAR

The Ramsar Convention is the oldest international biodiversity related agreement, founded in 1974. Myanmar is a contracting party to the convention since 2002 and designated four sites by 2017. Two of them are situated within the Ayeyarwady Basin, and several more still qualify as further Ramsar Sites (see also Table 3.1). According to our assessment and Table 3.1, seven more sites still qualify and should be included into the list of national Ramsar Sites.

ALLIANCE FOR ZERO EXTINCTION (AZE)

The Alliance for Zero Extinction (AZE) is an international effort, led by IUCN and most international organisations, to tackle the global extinction crisis and focus on areas and sites where 95% of one particular species resides or spends a large proportion of its life cycle. There have been two such sites formally defined in the Chin Hills and the Fen-shui-ling Valley. The Rakhine Yoma Elephant Sanctuary, on the western edge of the Ayeyarwady Basin, would also qualify through the frog, *Leptobrachium rakhinensis,* which occurs only in this area. This site is currently being reviewed for inclusion into the AZE.

UNESCO WORLD HERITAGE CONVENTION

Myanmar has been a member of the World Heritage Convention since 1994 and has designated one cultural World Heritage Site (Pyu ancient cities). It also has identified other sites as potential World Heritage Sites. The following natural river and wetland sites within the Ayeyarwady Basin have been included on the UNESCO World Heritage tentative list (https://aseanup.com/unesco-world-heritage-sites-myanmar/)

- **Ayeyarwady River Corridor (submitted 2014)** -The Ayeyarwady River Corridor (ARC) covers a 400 km stretch of one of the last major undammed rivers in Asia. Tributaries originating high in Myanmar's northern mountains flow south before joining northeast of Myitkyina to form the Ayeyarwady River. The river basin lies almost entirely within Myanmar and covers nearly 60% of its land surface. Above the City of Mandalay until Bhamo, the river is home to the globally VU Irrawaddy dolphin. The CR sub-population of Irrawaddy dolphin in this river is famous for its cooperative fishing behavior with humans. The Ayeyarwady provides habitat for these dolphins

and other wildlife, including the white-bellied heron and several species of globally threatened turtle. In total, the corridor covers 400 km and would protect 90,000 hectares of river and riparian habitat.

- **ARC (Lower: Mingun to Kyauk Maung Segment)** (N22 19 11, E96 0 2). The southernmost segment is the only section that is formally protected. This section coincides with the Irrawaddy dolphin Protected Area (PA). This PA was established in 2005 after surveys by DOF and WCS estimated that at least 59 dolphins were present. The area is managed by DOF, but it has yet to be formally gazetted. The PA is 72 km in length and runs from Mingun to Kyauk Myaung.

- **ARC (Middle: Moda Section, Takaung to Shwegu Segment)** (N24 1 18, E96 21 48) The middle part would extend 160 km from 9.5 km south of Takaung to 4.8 km north of Shwegu, and cover 37,200 hectares. The area provides habitat for the Irrawaddy dolphin and many fish species. Although little detailed data are available on this segment, the species composition is expected to be somewhat different from the lower and upper segments.

- **ARC (Upper: Shwegu to Bhamo Segment)** (N24 10 55, E97 7 21) The uppermost part would start 9 km to the north of the middle section and continue to the town of Bhamo, 41 km to the north, covering 19,900 hectares. Its northern extent would end at a narrow point in the river that is believed to be impassable to dolphins. Birds found here include the white-bellied heron (CR) and lesser adjutant (VU).

Even though some of the biodiversity assets described in the World Heritage tentative list might no longer apply, this effort should receive full support and should be expanded to include the river stretches to the north of Bhamo and also to the south where new dolphin sightings have been reported (Aung, 2016).

- **Lake Indawgyi Wildlife Sanctuary** (LIWS) (submitted 2014) contains Indawgyi Lake, the largest freshwater lake in Myanmar, and a substantial portion of the surrounding forested watershed. Established in 1999, LIWS covers 73,600 hectares and ranges in elevation from 169 m at the lake's surface to more than 1,400 m. The lake drains to the north and includes 12,000 hectares of open water, along with marsh, floating vegetation, and submerged macrophytes. Rice is cultivated adjacent to the lake in some low-elevation areas, while mixed deciduous forest, riverine evergreen forest, and hill pine forest cover the uplands in the watershed. Half of LIWS is forest; 33% is non-rice wetland. Species in LIWS include globally threatened waterbirds and endemic fish and turtle species.

The area was designated as a Ramsar Site in 2016, and in 2017, the area was also declared a Biosphere Reserve, which is a Protected Area programme also under UNESCO that allows and promotes the sustainable development of local communities within the Protected Area. This protection model is encouraging but affords huge commitment from the implementing agency and the national and international non-government organisations (NGOs) to fully implement a conservation and management plan for the reserve.

6.9 Biodiversity Surveys

Many areas within the Ayeyarwady Basin still have not been surveyed, and many areas have only been surveyed for the past 10 or more years. The Chindwin Basin and many sections of the Upper Ayeyarwady Basin, in particular, are undersurveyed. Surveys to investigate the current status of wild populations of water buffaloes are needed in the Hukaung Valley, Chindwin Basin. The status of the masked finfoot is unclear, and there is still hope to find the elusive and possibly extinct pink-headed duck somewhere in the Upper Chindwin Basin. Many sections and tributaries in the Middle Ayeyarwady have not been surveyed for fish and for dragonflies, and for many other freshwater invertebrates, hardly any information is available. Total species numbers have been extrapolated from existing data at marginal sites rather than from surveys within the region. Likewise, data for other taxa are widely missing. However, many of the areas in the Upper Ayeyarwady and Chindwin Basin are currently inaccessible due to insurgent activities.

6.10 Recommendation of a Biodiversity Monitoring Scheme and Indicators

Measuring ecosystem integrity requires a regular monitoring of a set of biodiversity indicators that reveal the state of the environment of the ecosystem. There are forest ecosystems with terrestrial biodiversity indicators and wetland and aquatic ecosystems that have different kinds of indicators. In this assessment, we propose a suit of indictors that can monitor the state of the biodiversity in the river basin. In an ideal world, the monitoring would encompass a large suit of indicators, ranging from chemical and physical parameters to a full range of biotic parameters. However, the capacity, resources, coverage, and scope of the monitoring determine a more focussed and down-scaled approach. Often physical and chemical parameters dominate monitoring schemes and are chosen for technical and financial reasons. However, biological indicators reveal more about the real state of the environment rather than just a random point in time. The distribution and abundance of the selected indicators is the result of multiple factors impacting these living organisms at some stage of their life cycle, and it is important to choose the right suit of species and sites to measure these indicators. Ideally, they would not only reveal the environmental stress but also how the management and conservation measures have had an effect. It is also important in the choice of indicators to allow comparison with historic data. Several water bird species have been monitored at different sites, at different levels, and at different scales in the past and are proposed as biodiversity indicators for furture monitoring.

Often observer bias, time, and frequency of the monitoring do not easily allow these comparisons. However, with increased frequency of time series, these inadequacies have been levelled out. For example, in the trend data available for waterbirds at Lake Indawgyi, a range of data and quality were provided by multiple observers and institutions with different methodologies and varying coverage. Despite these factors, it is possible to obtain an overall picture of a trend for many species and, even more important, by understanding the biology and migration behaviour, we can interpret these trends. The multitude of different species with similar ecology can reinforce the message that one species is indicating, but could also hint to look at different geographical issues. Waterbirds are also ideal in that they are indicators at the local level and through their migratory habits that varies from species to species (see Figure 2.9). However, when all waterbird species are declining, regardless of their migratory origin, as in the case of the river stretch between Myitkyina and Sinbo, the issues must be looked at locally.

It is, however, highly recommended to undertake these kinds of waterbird monitoring programmes in parallel at different sites and different habitats, but at the same time, to understand and distinguish between local, regional, and flyway issues. Ideally, those wetland areas, such as Lake Indawgyi and most, if not all, stretches along the river between Myitkyina and Bagan, should be included. The latter could also serve to monitor Irrawaddy dolphins. Some of the most important lakes in the Central Dry Zone, like Paleik Inn or Pyu Lake, should be included. Last, but not least, the intertidal mudflats of the delta region, near Nga

Mann Thaung, should also be monitored, building on the monitoring that has been started regularly now since 2013. Figure 6.2 shows all four suggested areas.

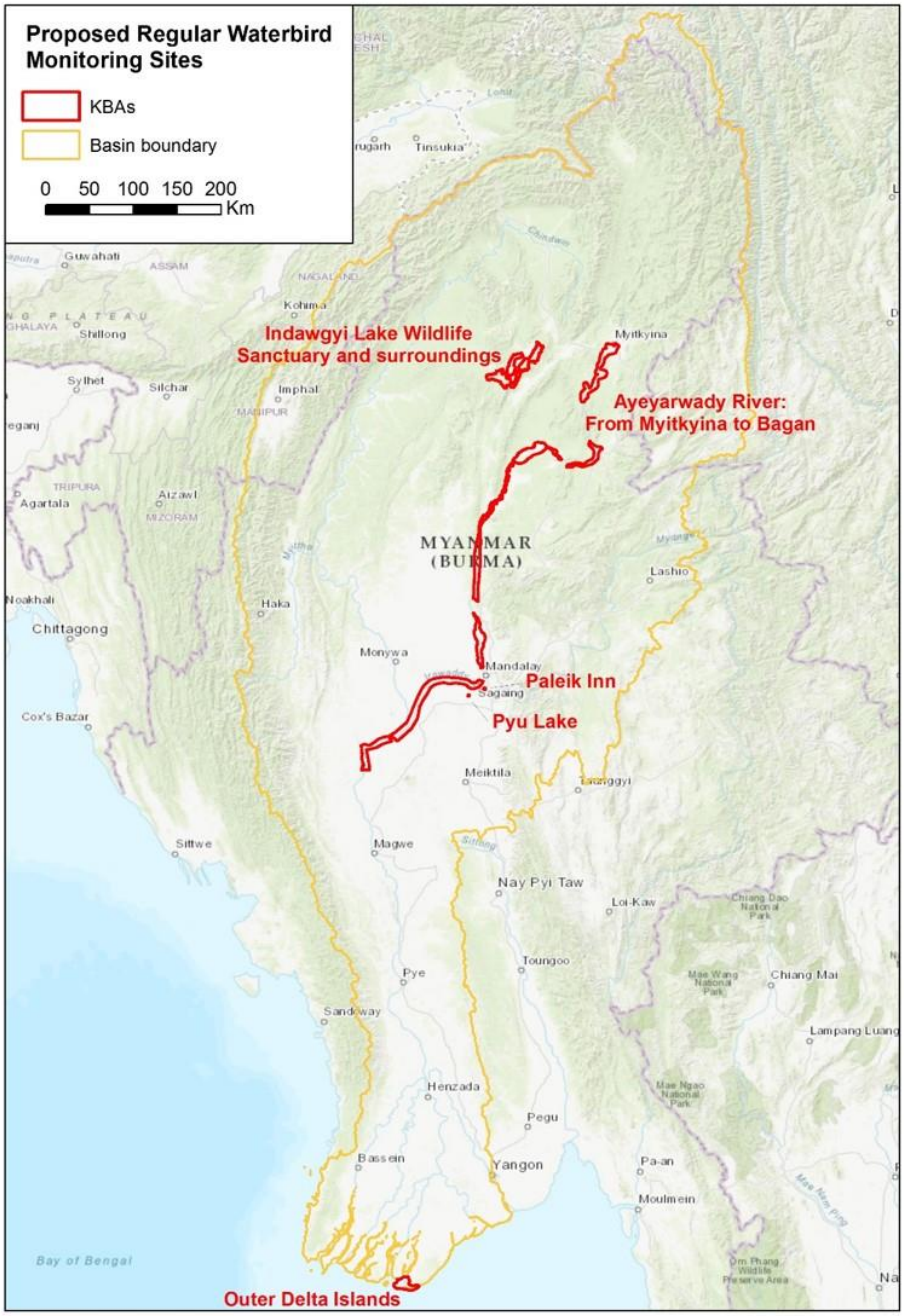

Figure 6.2 - Proposed regular waterbird monitoring sites in the Ayeyarwady Basin

These four major monitoring sites – split into several sub-sites – cover a wide geographical range and different wetland types. Although, it should be noted that, the Upper Ayeyarwady and Chindwin Basin would not be covered by the currently presented programme, because of current insurgent activities and the remoteness of these sites. Future monitoring programmes, however, should consider inclusion of suitable sites when circumstances allow. It is also important, as outlined above, that the monitoring is roughly taking part at similar periods in the year and ideally coincides with the mid-winter counts that Wetlands International organises globally.

Mammals are difficult to monitor, but the charismatic and Irrwaddy dolphin (CR) needs to be included. At least, the river stretches and the delta region proposed for waterbird monitoring could include the Irrawady dolphin into its regular monitoring programme.

It is highly recommended to include the freshwater turtles and marine turtles into a monitoring programme. The Forest Department is already regularly monitoring the saltwater crocodile and the DoF is regularly monitoring the marine turtles in the Outer Delta area. However, most freshwater turtles have become so rare that a meaningful monitoring programme is hardly possible. WCS is ready and equipped to undertake regular monitoring of selected sites, especially the release sites for globally threatened species in the Chindwin Basin.

It is crucially important to add fish diversity to the monitoring programmes. Currently, the state of fish knowledge within the basin is still too fragmented to make definite suggestions, but future programmes should aim to include fish diversity.

Table 6.2 – Priorities in recommendations

No.	Recommendation	Priority
1	Sustainable economic development	Urgent
2	KBA and Protected Area development	Urgent
3	Eco-tourism development	High
4	Head-starting in globally threatened species	High
5	Re-introduction	Medium
6	Integration of local spritual beliefs	Medium
7	Bird nest protection schemes	High
8	Law enforcement against poaching and hunting	High
9	Mematorium of gold washing	Urgent
10	Sustainable sand and pebble mining	High
11	Sustainable fishing	High
12	Ramsar Site designation	High
13	World Heritage nominations	High
14	Biological surveys	High
15	Waterbird monitoring	High

7 CONCLUSIONS

HIGH BIODIVERSITY VALUE FOR MAMMALS, BIRDS, FISH, AND REPTILES

The Ayeyarwady Basin is one of the biologically, most diverse regions in the world. It is the 19th richest region in bird diversity globally. It is home to 1,400 mammal, bird, and reptile species of which more than 100 species are globally threatened. At least 388 fish species are known to occur in the region, but the total is estimated to be closer to 550 when all areas have been surveyed. Similarly, amphibians and many invertebrates are little studied and might mirror the more well-studied taxa in numbers.

DRAMATIC DECLINE IN BIODIVERSITY

The findings in this assessment confirm a wide-spread decline in almost all taxa and across almost all regions. Several vertebrate species among the mammals, birds, and reptiles have already disappeared from the Ayeyarwady Basin, and many others are following suit if conservation actions are not taken seriously and with proper resources. The declines are pronounced and sharp, in particular,r for comparatively well monitored waterbirds on many river stretches and lakes. The threats and reasons for the declines are variable and include large-scale industrial ventures, increasing sand and mineral mining, and precipitious hunting and poaching across the entire basin.

PROTECTION

In total, the Ayeyarwady Basin hosts 89 different KBAs, highlighting the huge importance for biodiversity. Of these, only approximately 50% are officially protected. Increased efforts to enhance the Protected Area network is needed. At the same time, capacity building and training is necessary to ensure biodiversity protection in the existing Protected Areas. Also, increasing resources will need to be provided to ensure the necessary law enforcement. New forms of site protection have been introduced. The Lake Indawgyi Wildlife Sancutuary has now been recognized by UNESCO as the first Biosphere Reserve in the Ayeyarwady Basin and the second in Myanmar. There are many more candidates in the basin, and hopefully, this instrument can be expanded to cover many of the high biodiversity areas in the basin.

FRAGILE RIVER SYSTEMS NEED COMPREHENSIVE COVER PROTECTION

The fragile river system and its wetlands are under enormous and increasing pressure from hydropower development, sand, pebble extraction, mining for gold and other minerals, and over-exploitation of its biological resources. It is a unique ecosystem and a lifeline for millions of people living in the center of the country, and it deserves full protection and strict control over its resource management. No-take zones, free of any fishing, mining, and dredging, need to be established, and a resource management plan for the entire river needs to be developed as soon as possible.

WORLD HERITAGE STATUS

The World Heritage Convention is listing sites that have unique and exceptional cultural and natural value to the world and that encapsulates the beauty and history of both human civilisation and the planet. Sites, such as Bagan, qualify as sites of cultural distinction. The Ayeyarwady River is unique in many ways. The river is one of the largest rivers in Asia, and even in the world. It has not been fragmented by dams and is unconstrained in its hydrology, sediment, and nutrient flow. The river still hosts a unique suite of biodiversity of international importance. Its scenery with quaint villages and pagodas, impressive sandbars, and gorges is unique and beautiful. It would certainly qualify as a World Heritage Site for natural and, possibly, for cultural criteria.

Listing the river between Mytkyina and Bagan, or even further downstream, as a World Heritage Site would not only boost the conservation of the region's rich cultural and natural history, but also could protect the river in the long-term and provide a long-term vision for the local communities. This vision would build the

local communities' livelihoods on a sustainable economy that included eco-tourism as well as a sustainable use of the river's natural resources.

The river dolphins act as key sentinels for the health of the river ecosystem. The Irrawaddy dolphin's river population is in a critical, but stable state. The Yangtze dolphin is extinct, and the Mekong River population of the Irrawaddy dolphin is on the brink of extinction due to human impacts on the river ecosystem. Myanmar has the choice to either follow the destructive path of the Yangtze and Mekong River, where biodiversity has suffered and the dolphins have been lost (Yangtze) or almost lost (Mekong), or opt for sustainable development in balance with biodiversity and people.

Table 7.1 – Index of confidence in main findings: High = H, medium = M

No.	Main finding	Confidence level	Comments
1	High biodiversity value	High	
2	Dramatic decline in biodiversity	High	
3	Most freshwater turtles poached to local expirtation and near extinction	High	
4	66.7 to 75% of wetlands lost since 1945	Medium	Extrapolated from Asian-wide data
5	Deforestation at 2% over the past 15 years, in Middle Basin > 5,560 km^2	High	
6	Fragile ecosystems need protection	High	
7	Invasive fish and freshwater molluscs are invading the rivers	Medium	
8	Mining for minerals, sand, and pebbles major threats	High	
9	Hydropower and irrigation major threats to biodiversity	High	
10	89 KBAs, of which eight are new	High	
11	50% of KBAs are protected	High	Should be expanded to at least 80%
12	Eco-tourism could provide economic opportunities	Medium	
13	Resource management plan for entire basin	High	Involving local communities
14	Waterbird and dolphin monitoring as indicators for sustainable development	High	

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ANNEX 1 – MAMMAL SPECIES LIST (ACCORDING TO IUCN DISTRIBUTION MAPS)

1	*Ailurus fulgens*
2	*Anourosorex assamensis*
3	*Anourosorex squamipes*
4	*Aonyx cinereus*
5	*Apodemus agrarius*
6	*Apodemus chevrieri*
7	*Apodemus draco*
8	*Apodemus latronum*
9	*Arctictis binturong*
10	*Arctogalidia trivirgata*
11	*Arctonyx albogularis*
12	*Arctonyx collaris*
13	*Arielulus circumdatus*
14	*Aselliscus stoliczkanus*
15	*Atherurus macrourus*
16	*Axis porcinus*
17	*Balaenoptera acutorostrata*
18	*Balaenoptera edeni*
19	*Balaenoptera musculus*
20	*Bandicota bengalensis*
21	*Bandicota indica*
22	*Bandicota savilei*
23	*Barbastella leucomelas*
24	*Belomys pearsonii*
25	*Berylmys bowersi*
26	*Berylmys mackenziei*
27	*Berylmys manipulus*
28	*Biswamoyopterus biswasi*
29	*Blarinella wardi*
30	*Bos gaurus*
31	*Bos javanicus*
32	*Bubalus arnee*
33	*Budorcas taxicolor*
34	*Callosciurus erythraeus*
35	*Callosciurus finlaysonii*
36	*Callosciurus phayrei*
37	*Callosciurus pygerythrus*
38	*Callosciurus quinquestriatus*
39	*Canis aureus*
40	*Canis lupus*
41	*Cannomys badius*

42	*Capricornis milneedwardsii*
43	*Capricornis rubidus*
44	*Capricornis thar*
45	*Catopuma temminckii*
46	*Cervus canadensis*
47	*Chaerephon plicatus*
48	*Chimarrogale himalayica*
49	*Chimarrogale styani*
50	*Chiropodomys gliroides*
51	*Chodsigoa parca*
52	*Coelops frithii*
53	*Crocidura attenuata*
54	*Crocidura fuliginosa*
55	*Crocidura indochinensis*
56	*Crocidura rapax*
57	*Crocidura vorax*
58	*Cuon alpinus*
59	*Cynopterus brachyotis*
60	*Cynopterus sphinx*
61	*Dacnomys millardi*
62	*Diomys crumpi*
63	*Dremomys lokriah*
64	*Dremomys pernyi*
65	*Dremomys rufigenis*
66	*Dugong dugon*
67	*Elaphodus cephalophus*
68	*Elephas maximus*
69	*Eonycteris spelaea*
70	*Eothenomys cachinus*
71	*Eothenomys melanogaster*
72	*Eothenomys olitor*
73	*Episoriculus caudatus*
74	*Episoriculus leucops*
75	*Episoriculus macrurus*
76	*Eptesicus pachyotis*
77	*Eptesicus serotinus*
78	*Eudiscopus denticulus*
79	*Euroscaptor grandis*
80	*Euroscaptor klossi*
81	*Euroscaptor longirostris*
82	*Euroscaptor micrura*

83	*Falsistrellus affinis*
84	*Falsistrellus mordax*
85	*Felis chaus*
86	*Feresa attenuata*
87	*Globicephala macrorhynchus*
88	*Grampus griseus*
89	*Hadromys humei*
90	*Hadromys yunnanensis*
91	*Harpiocephalus harpia*
92	*Helarctos malayanus*
93	*Herpestes auropunctatus*
94	*Herpestes urva*
95	*Hipposideros armiger*
96	*Hipposideros ater*
97	*Hipposideros cineraceus*
98	*Hipposideros fulvus*
99	*Hipposideros grandis*
100	*Hipposideros larvatus*
101	*Hipposideros lylei*
102	*Hipposideros pomona*
103	*Hoolock hoolock*
104	*Hoolock leuconedys*
105	*Hylomys suillus*
106	*Hylopetes alboniger*
107	*Hylopetes phayrei*
108	*Hypsugo anthonyi*
109	*Hypsugo joffrei*
110	*Hystrix brachyura*
111	*Ia io*
112	*Indopacetus pacificus*
113	*Kerivoula hardwickii*
114	*Kerivoula kachinensis*
115	*Kerivoula picta*
116	*Kerivoula titania*
117	*Kogia breviceps*
118	*Kogia sima*
119	*Lagenodelphis hosei*
120	*Leopoldamys edwardsi*
121	*Lepus comus*
122	*Lepus oiostolus*
123	*Lepus peguensis*
124	*Lutra lutra*
125	*Lutra sumatrana*
126	*Lutrogale perspicillata*
127	*Lynx lynx*

128	*Macaca arctoides*
129	*Macaca assamensis*
130	*Macaca fascicularis*
131	*Macaca leonina*
132	*Macaca mulatta*
133	*Macroglossus sobrinus*
134	*Manis crassicaudata*
135	*Manis javanica*
136	*Manis pentadactyla*
137	*Marmota himalayana*
138	*Martes flavigula*
139	*Martes foina*
140	*Maxomys surifer*
141	*Megaderma lyra*
142	*Megaderma spasma*
143	*Megaerops ecaudatus*
144	*Megaerops niphanae*
145	*Megaptera novaeangliae*
146	*Melogale moschata*
147	*Melogale personata*
148	*Menetes berdmorei*
149	*Mesoplodon densirostris*
150	*Mesoplodon ginkgodens*
151	*Micromys minutus*
152	*Microtus clarkei*
153	*Millardia kathleenae*
154	*Miniopterus magnater*
155	*Miniopterus pusillus*
156	*Moschus berezovskii*
157	*Moschus chrysogaster*
158	*Moschus fuscus*
159	*Muntiacus gongshanensis*
160	*Muntiacus putaoensis*
161	*Muntiacus vaginalis*
162	*Murina aurata*
163	*Murina cyclotis*
164	*Murina huttoni*
165	*Murina tubinaris*
166	*Mus booduga*
167	*Mus caroli*
168	*Mus cervicolor*
169	*Mus cookii*
170	*Mus musculus*
171	*Mus pahari*
172	*Mus shortridgei*

173	*Mustela altaica*
174	*Mustela eversmanii*
175	*Mustela kathiah*
176	*Mustela sibirica*
177	*Mustela strigidorsa*
178	*Myotis annectans*
179	*Myotis chinensis*
180	*Myotis hasseltii*
181	*Myotis laniger*
182	*Myotis montivagus*
183	*Myotis muricola*
184	*Myotis siligorensis*
185	*Naemorhedus baileyi*
186	*Naemorhedus griseus*
187	*Nectogale elegans*
188	*Neodon forresti*
189	*Neodon irene*
190	*Neodon sikimensis*
191	*Neofelis nebulosa*
192	*Neophocaena phocaenoides*
193	*Neotetracus sinensis*
194	*Niviventer andersoni*
195	*Niviventer brahma*
196	*Niviventer confucianus*
197	*Niviventer eha*
198	*Niviventer excelsior*
199	*Niviventer fulvescens*
200	*Niviventer langbianis*
201	*Niviventer niviventer*
202	*Niviventer tenaster*
203	*Nyctalus plancyi*
204	*Nyctereutes procyonoides*
205	*Nycticebus bengalensis*
206	*Ochotona curzoniae*
207	*Ochotona forresti*
208	*Ochotona macrotis*
209	*Ochotona thibetana*
210	*Orcaella brevirostris*
211	*Orcinus orca*
212	*Ovis ammon*
213	*Paguma larvata*
214	*Panthera pardus*
215	*Panthera tigris*
216	*Panthera uncia*
217	*Paradoxurus hermaphroditus*
218	*Parascaptor leucura*
219	*Pardofelis marmorata*
220	*Peponocephala electra*
221	*Petaurista alborufus*
222	*Petaurista elegans*
223	*Petaurista magnificus*
224	*Petaurista petaurista*
225	*Petaurista philippensis*
226	*Petaurista xanthotis*
227	*Petinomys setosus*
228	*Physeter macrocephalus*
229	*Pipistrellus abramus*
230	*Pipistrellus cadornae*
231	*Pipistrellus ceylonicus*
232	*Pipistrellus coromandra*
233	*Pipistrellus javanicus*
234	*Pipistrellus paterculus*
235	*Pipistrellus pipistrellus*
236	*Pipistrellus pulveratus*
237	*Pipistrellus tenuis*
238	*Prionailurus bengalensis*
239	*Prionailurus viverrinus*
240	*Prionodon pardicolor*
241	*Pseudois nayaur*
242	*Pseudorca crassidens*
243	*Pteropus giganteus*
244	*Rattus andamanensis*
245	*Rattus exulans*
246	*Rattus nitidus*
247	*Rattus norvegicus*
248	*Rattus pyctoris*
249	*Rattus rattus*
250	*Rattus tanezumi*
251	*Ratufa bicolor*
252	*Rhinolophus affinis*
253	*Rhinolophus ferrumequinum*
254	*Rhinolophus lepidus*
255	*Rhinolophus luctus*
256	*Rhinolophus macrotis*
257	*Rhinolophus malayanus*
258	*Rhinolophus marshalli*
259	*Rhinolophus pearsonii*
260	*Rhinolophus pusillus*
261	*Rhinolophus rouxii*
262	*Rhinolophus shameli*

263	*Rhinolophus shortridgei*
264	*Rhinolophus sinicus*
265	*Rhinolophus stheno*
266	*Rhinolophus subbadius*
267	*Rhinolophus thomasi*
268	*Rhinolophus yunanensis*
269	*Rhinopithecus bieti*
270	*Rhinopithecus strykeri*
271	*Rhinopoma hardwickii*
272	*Rhizomys pruinosus*
273	*Rhizomys sinensis*
274	*Rhizomys sumatrensis*
275	*Rousettus amplexicaudatus*
276	*Rousettus leschenaultii*
277	*Rucervus eldii*
278	*Rusa unicolor*
279	*Saccolaimus saccolaimus*
280	*Scaptonyx fusicaudus*
281	*Sciurotamias forresti*
282	*Scotomanes ornatus*
283	*Scotophilus heathii*
284	*Scotophilus kuhlii*
285	*Sorex bedfordiae*
286	*Sorex cylindricauda*
287	*Sorex excelsus*
288	*Soriculus nigrescens*
289	*Sousa chinensis*
290	*Sphaerias blanfordi*
291	*Stenella attenuata*
292	*Stenella coeruleoalba*
293	*Stenella longirostris*

294	*Steno bredanensis*
295	*Suncus etruscus*
296	*Suncus murinus*
297	*Sus scrofa*
298	*Tadarida teniotis*
299	*Tamiops macclellandii*
300	*Tamiops swinhoei*
301	*Taphozous longimanus*
302	*Taphozous melanopogon*
303	*Taphozous theobaldi*
304	*Trachypithecus phayrei*
305	*Trachypithecus pileatus*
306	*Trachypithecus shortridgei*
307	*Trogopterus xanthipes*
308	*Tupaia belangeri*
309	*Tursiops aduncus*
310	*Tursiops truncatus*
311	*Tylonycteris pachypus*
312	*Tylonycteris robustula*
313	*Uropsilus gracilis*
314	*Uropsilus investigator*
315	*Ursus arctos*
316	*Ursus thibetanus*
317	*Vandeleuria oleracea*
318	*Vernaya fulva*
319	*Viverra megaspila*
320	*Viverra zibetha*
321	*Viverricula indica*
322	*Vulpes vulpes*
323	*Ziphius cavirostris*

ANNEX 2 –AYEYARWADY BASIN BIRD SPECIES LIST

(RL: CR=critically endangered, EN: endangered, VU=vulnerable, NT= near-threatened; Status: B= Breeding bird, M=migratory, V=Vagrant, Ex= Extirpated)

No	Family name	Common new name	*Scientific name*	RL	Status*	Delta	Middle Basin	Chindwin	Upper Basin
1	**PHASIANIDAE: Phaesants and Partridges**	Snow Partridge	*Lerwa lerwa*		B				x
2		Chinese Francolin	*Francolinus pintadeanu*		B				x
3		Common Quail	*Coturnix coturnix*		V				
4		Japanese Quail	*Coturnix japonica*	NT	M		x		
5		Rain Quail	*Coturnix coromandelica*		B		x		
6		Blue-breasted Quail	*Coturnix chinensis*		B		x	x	x
7		Hill Partidge	*Arborophila torqueola*		B		x	x	x
8		Rufous-throated Partridge	*Arborophila rufogularis*		B		x	x	x
9		White-cheeked Partridge	*Arborophila atrogularis*	NT	B		x	x	x
10		Mountain Banmboo-Partridge	*Bambusicola fytchii*		B		x		x
11		Blood Pheasant	*Ithaginis cruentus*		B				x
12		Blyth's Tragopan	*Tragopan blythii*	VU	B				x
13		Temminck's Tragopan	*Tragopan temminckii*		B				
14		Himalayan Monal	*Lophophodrus impejanus*		B				x
15		Sclater's Monal	*Lophophodrus sclateri*	VU	B				x
16		Red Junglefowl	*Gallus gallus*		B	x	x	x	x
17		Kalij Pheasant	*Lophura leucomelanos*		B		x	x	x
18		Silver Pheasant	*Lophura nycthemera*		B				x
19		Mrs Hume's Pheasant	*Syrmaticus humiae*	NT	B		x		
20		Common Pheasant	*Phasianus colchicus*		B				x
21		Lady Amherst's Pheasant	*Chrysolophus amherstiae*		B				x
22		Grey Peacock-Pheasant	*Polyplectron bicalcaratum*		B		x	x	x
23		Green Peafowl	*Pavo muticus*	EN	B		x	x	
24	**ANATIDAE: Waterfowl**	Fulvous Whistling-Duck	*Dendrocygna bicolor*		B		x	x	
25		Lesser Whistling-Duck	*Dendrocygna javanica*		B	x	x	x	x
26		Taiga Bean-Goose	*Anser fabalis*		M		x		

No	Family name	Common new name	*Scientific name*	RL	Status*	Delta	Middle Basin	Chindwin	Upper Basin
27		Greylag Goose	*Anser anser*		M	x	x	x	
28		Greater White-fronted Goose	*Anser albifrons*		M		x		
29		Lesser White-fronted Goose	*Anser erythropus*	VU	V		x		
30		Bar-headed Goose	*Anser indicus*		M		x	x	x
31		Comb Duck	*Sarkidiornis melanotos*		B	x	x	x	x
32		Common Shelduck	*Tadorna tadorna*		M	x	x	x	x
33		Ruddy Shelduck	*Tadorna ferruginea*		M	x	x	x	x
34		White-winged Duck	*Asarcornis scutulata*	EN	B		x	x	x
35		Cotton Pygmy-Goose	*Nettapus coromandelianus*		B	x	x	x	
36		Mandarin Duck	*Aix galericulata*		V		x		
37		Gadwall	*Anas strepera*		M		x	x	x
38		Falcated Duck	*Anas falcata*	NT	M		x		
39		Eurasian Wigeon	*Anas penelope*		M		x	x	
40		Mallard	*Anas platyrhynchos*		M		x	x	x
41		Indian Spot-billed Duck	*Anas poecilorhyncha*		B		x	x	x
42		Chinese Spot-billed Duck	*Anas zonorhyncha*		B		x	x	
43		Northern Shoveler	*Anas clypeata*		M		x	x	
44		Northern Pintail	*Anas acuta*		M		x	x	x
45		Garganey	*Anas querquedula*		M	x	x	x	
46		Baikal Teal	*Anas formosa*		V			x	
47	`	Eurasian Teal	*Anas crecca*		M		x	x	
48		Pink-headed Duck	*Rhodonessa caryophyllacea*	CR	Ex?		x		
49		Red-crested Pochard	*Netta rufina*		M		x		
50		Common Pochard	*Aythya ferina*	VU	M		x		
51		Baer's Pochard	*Aythya baeri*	CR	M		x		
52		Ferruginous Pochard	*Aythya nyroca*	NT	M		x		
53		Tufted Duck	*Aythya fuligula*		M		x	x	x
54		Greater Scaup	*Aythya marila*		V		x		
55		Common Goldeneye	*Bucephala clangula*		M		x		
56		Smew	*Mergellus albellus*		V				
57		Common Merganser	*Mergus merganser*		M		x		x
58		Red-breasted Merganser	*Mergus serrator*		V				
59	**GAVIIDAE: Loosns**	Yellow-Billed Loon	*Ganvia adamsii*	NT	V		x		

No	Family name	Common new name	*Scientific name*	RL	Status*	Delta	Middle Basin	Chindwin	Upper Basin
60	**PODICIPEDIDAE**	Little Grebe	*Tachybaptus ruficollis*		B	x	x	x	x
61		Great Crested Grebe	*Podiceps cristatus*		M		x		x
62		Horned Grebe	*Podiceps auritus*		V		x		
63		Black-necked Grebe	*Podiceps nigricollis*		M		x		
64	**THRESKIORNITHIDAE: Storks and Ibisses**	Painted Stork	*Mycteria leucocephala*	NT	B	x	x	x	
65		Asian Openbill	*Anastomus oscitans*		B	x	x	x	
66		Black Stork	*Ciconia nigra*		M		x	x	x
67		Woolly-necked Stork	*Ciconia episcopus*	VU	B		x	x	
68		Black-necked Stork	*Ephippiorhynchus asiaticus*	VU	B		x	x	
69		Lesser Adjutant	*Leptoptilos javanicus*	VU	B	x	x	x	
70		Greater Adjutant	*Leptoptios dubius*	EN	Ex?	x	x		
71		Black-headed Ibis	*Threskiornis melanocephalus*	NT	M	x	x	x	
72		White-shouldered Ibis	*Pseudibis davisoni*	CR	Ex?		x		
73		Red-naped Ibis	*Pseudibis papillosa*		V				
74		Glossy Ibis	*Plegadis falcinellus*		M	x	x	x	
75		Eurasian Spoonbill	*Platalea leucorodia*		M		x		
76	**ARDEIDAE: Herons and Egrets**	Great Bittern	*Botaurus stellaris*		M		x		
77		Yellow Bittern	*Ixobrychus sinesis*		B	x	x	x	
78		Cinnamon Bittern	*Ixobrychus cinnamomeus*		B	x	x	x	
79		Black Bittern	*Ixobrychus flavicollis*		B	x	x	x	
80		Black-crowned Night-Heron	*Nycticorax nycticorax*		B	x	x	x	x
81		Little Heron	*Butorides striata*		B	x	x	x	x
82		Indian Pond-Heron	*Ardeola grayii*		B	x	x		
83		Chinese Pond-Heron	*Ardeola bacchus*		M	x	x	x	x
84		Eastern Cattle Egret	*Bubulcus coromandus*		B	x	x	x	x
85		Grey Heron	*Ardea cinerea*		B	x	x	x	
86		White-bellied Heron	*Ardea insignis*	CR	B		x	x	x
87		Goliath Heron	*Ardea goliath*		V				
88		Purple Heron	*Ardea purpurea*		B	x	x	x	
89		Great Egret	*Ardea alba*		B	x	x	x	x
90		Intermediate Egret	*Mesophoyx intermedia*		B	x	x	x	x

No	Family name	Common new name	*Scientific name*	RL	Status*	Delta	Middle Basin	Chindwin	Upper Basin
91		Little Egret	*Egretta garzetta*		B	x	x	x	x
92		Pacific Reef-Egret	*Egretta sacra*		M	x			
93	**FREGATIDAE: Frigatebirds**	Great Frigatebird	*Fregata minor*		V	x			
94		Great White Pelican	*Pelecanus onocrotalus*		V			x	
95	**PELECANIDAE: Pelicans**	Spot-billed Pelican	*Pelecanus philippensis*	NT	B	x	x		
96	**PHALACROCORACIDAE: Cormorants**	Little Cormorant	*Phalacrocorax niger*		B	x	x	x	x
97		Indian Cormorant	*Phalacrorax fuscicollis*		M	x	x	x	
98		Great Cormorant	*Phalacrorax carbo*		M		x	x	x
99		Oriental Darter	*Anhinga melanogaster*	NT	B	x	x	x	x
100	**FALCONIDAE: Raptors**	White-rumped Pygmy-Falcon	*Polihierax insignis*	NT	B		x	x	
101		Collared Falconet	*Microhierax caerulescens*		B		x	x	x
102		Pied Falconet	*Microhierax melanoleucus*		B			x	
103		Lesser Kestrel	*Falco naumanni*	VU	V				
104		Common Kestrel	*Falco tinnunculus*		M		x	x	x
105		Amur Falcon	*Falco amurensis*		M	x	x	x	
106		Merlin	*Falco columbarius*		V				
107		Eurasian Hobby	*Falco subbuteo*		V				
108		Oriental Hobby	*Falco severus*		B		x		x
109		Laggar Falcon	*Falco jugger*	NT	B		x	x	
110		Peregrine Falcon	*Falco peregrinus*		M	x	x	x	x
111		Osprey	*Pandion haliaetus*		M	x	x	x	x
112		Jerdon's Baza	*Aviceda jerdoni*		M				x
113		Black Baza	*Aviceda leuphotes*		B	x	x	x	
114		Oriental Honey-Buzzard	*Pernis ptilorhynchus*		B	x	x	x	x
115		Black -shouldered Kite	*Elanus caeruleus*		B	x	x	x	x
116		Black Kite	*Milvus migrans*		B	x	x	x	x
117		Brahminy Kite	*Haliastur indus*		B	x			
118		White-bellied Sea-Eagle	*Haliaeetus leucogaster*		B	x			
119		Pallas's Fish-Eagle	*Haliaeetus leucoryphus*	VU	B	x	x		x
120		White-tailed Eagle	*Haliaeetus albicilla*		M		x		
121		Lesser Fish-Eagle	*Ichthophaga humilis*	NT	B		x	x	x
122		Grey-headed Fish-Eagle	*Ichthophaga ichthyaetus*	NT	B	x	x	x	x

No	Family name	Common new name	*Scientific name*	RL	Status*	Delta	Middle Basin	Chindwin	Upper Basin
123		Egyptian Vulture	*Neophron percnopterus*		V				
124		White-rumped Vulture	*Gyps bengalensis*	CR	B		x		
125		Slender-billed Vulture	*Gyps tenuirostris*	CR	B		x		
126		Himalayan Griffon	*Gyps himalayensis*	NT	B	x	x		
127		Cinereous Vulture	*Aegypius monachus*	VU	V		x		
128		Red-headed Vulture	*Aegypius calvus*	CR	V		x		x
129		Short-toed Snake-Eagle	*Circaetus gallicus*		V			x	
130		Crested Serpent-Eagle	*Spilornis cheela*		B	x	x	x	x
131		Western Marsh-Harrier	*Circus aeruginosus*		M		x		
132		Eastern Marsh-Harrier	*Circus spilonotus*		B		x	x	
133		Hen Harrier	*Circus cyaneus*		M		x	x	x
134		Pallid Harrier	*Circus macrourus*	NT	M		x		
135		Pied Harrier	*Circus melanoleuco*		M	x	x	x	
136		Montagu's Harrier	*Circus pygargus*		V				
137		Crested Goshawk	*Accipiter trivirgatus*		B		x	x	x
138		Shikra	*Accipiter badius*		B	x	x	x	x
139		Chinese Sparrowhawk	*Accipiter soloensis*		M				x
140		Besra	*Accipiter virgatus*		B	x	x	x	x
141		Eurasian Sparrowhawk	*Accipiter nisus*		M	x	x	x	x
142		Japanese Sparrowhawk	*Accipiter gularis*		M				x
143		Northern Goshawk	*Accipiter gentilis*		M		x		
144		White-eyed Buzzard	*Butastur teesa*		B		x		
145		Rufous-winged Buzzard	*Butastur liventer*		B		x	x	
146		Grey-faced Buzzard	*Butastur indicus*		M				x
147		Japanese Buzzard	*Buteo japonicus*		M		x	x	x
148		Long-legged Buzzard	*Buteo rufinus*		M		x		
149		Indian Spotted Eagle	*Aquila hastata*	VU	M		x		
150		Greater Spotted Eagle	*Aquila clanga*	VU	M	x	x	x	
151		Tawny Eagle	*Aquila rapax*		V		x		
152		Steppe Eagle	*Aquila nipalensis*	EN	M		x		
153		Eastern Imperial Eagle	*Aquila heliaca*	VU	M		x		x
154		Bonelli's Eagle	*Aquila fasciata*		B		x		
155		Booted Eagle	*Aquila pennata*		M	x	x		

No	Family name	Common new name	*Scientific name*	RL	Status*	Delta	Middle Basin	Chindwin	Upper Basin
156		Black Eagle	*Ictinaetus malayensis*		B		x		x
157		Rufous-bellied Eagle	*Lophotriorchis kienerii*		B		x	x	
158		Mountain Hawk-Eagle	*Nisaetus nipalensis*		B		x	x	x
159		Changeable Hawk-Eagle	*Nisaetus limnaeetus*		B	x	x	x	
160	**OTIDIDAE: Bustards**	Great Bustard	*Otis tarda*	NT	V		x		
161	**RALLIDAE: Rails**	Red-legged Crake	*Rallina fasciata*		B	x	x	x	
162		Slaty- legged Crake	*Rallina eurizonoides*		B	x	x	x	
163		Slaty-breasted Rail	*Gallirallus striatus*		B	x	x	x	
164		Eastern Water Rail	*Rallus indicus*		B		x		
165		White-breasted Waterhen	*Amaurornis phoenicurus*		B	x	x	x	x
166		Brown Crake	*Porzana akool*		B	x			
167		Black-tailed Crake	*Porzana bicolor*		B		x	x	x
168		Baillon's Crake	*Porzana pusilla*		M		x	x	
169		Spotted Crake	*Porzana porzana*		V				
170		Ruddy-breasted Crake	*Porzana fusca*		B	x	x	x	
171		White-browed Crake	*Porzana cinerea*		B		x		
172		Watercock	*Gallicrex cinerea*		B	x	x	x	
173		Grey-headed Swamphen	*Porphyrio poliocephalus*		B	x	x	x	
174		Common Moorhen	*Gallinula chloropus*		B	x	x	x	
175		Common Coot	*Fulica atra*		M		x		
176	**HELIORNITHIDAE: Finfoots**	Masked Finfoot	*Heliopais personatus*	EN	B			x	
177	**GRUIDAE: Cranes**	Demoiselle Crane	*Grus virgo*		V				
178		Sarus Crane	*Grus antigone*	VU	B	x	x		
179		Common Crane	*Grus grus*		M		x	x	x
180		Small Buttonquail	*Turnix sylvaticus*		B	x	x	x	x
181	**TURNICIDAE: Buttonquails**	Yellow-legged Buttonquail	*Turnix tanki*		B	x	x	x	x
182		Barred Buttonquail	*Turnix suscitator*		B	x	x	x	x
183	**Charadriiformes: Waders/Shorebirds**	Indian Thick-Knee	*Burhinus indicus*		B		x		
184		Great Thick-Knee	*Esacus recurvirostris*	NT	B	x	x	x	x
185		Black-winged Stilt	*Himantopus himantopus*		B	x	x	x	
186		Pied Avocet	*Recurvirostra avosetta*		M		x		
187		Crab-Plover	*Dromas ardeola*		V	x			

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188		Ibisbill	*Ibidorhyncha struthersii*		B		x		
189		Northern Lapwing	*Vanellus vanellus*	NT	M		x		
190		River lapwing	*Vanellus duvaucelii*	NT	B		x	x	x
191		Yellow-wattled Lapwing	*Vanellus malabaricus*		V				
192		Grey-headed Lapwing	*Vanellus cinereus*		M	x	x	x	x
193		Red-wattled Lapwing	*Vanellus indicus*		B	x	x	x	x
194		Pacific Golden Plover	*Pluvialis fulva*		M	x	x	x	
195		Grey Plover	*Pluvialis squatarola*		M	x	x		
196		Common Ringed Plover	*Charadrius hiaticula*		V				
197		Long-billed Plover	*Charadrius placidus*		M		x		
198		Little Ringed Plover	*Charadrius dubius*		B	x	x	x	x
199		Kentish Plover	*Charadrius alexandrinus*		M	x	x		
200		Lesser Sand-Plover	*Charadrius mongolus*		M	x	x		
201		Greater Sand-Plover	*Charadrius leschenaultii*		M	x	x		
202		Pheasant-tailed Jacana	*Hydrophasianus chirurgus*		B	x	x	x	
203		Bronze-winged Jacana	*Metopidicus indicus*		B	x	x	x	
204		Greater Painted-Snipe	*Rostratula benghalensis*		B	x	x	x	
205		Eurasian Woodcock	*Scolopax rusticola*		M		x		
206		Jack Snipe	*Lymnocryptes minmus*		M		x		x
207		Solitary Snipe	*Gallinago solitaria*		M				x
208		Wood Snipe	*Gallinago nemoricola*	VU	M		x		x
209		Pintail Snipe	*Gallinago stenura*		M	x	x	x	
210		Swinhoe's Snipe	*Gallinago megala*		M		x		
211		Common Snipe	*Gallinago gallinago*		M	x	x	x	
212		Black-tailed Godwits	*Limosa limosa*	NT	M	x			
213		Bar-tailed Godwit	*Limosa lapponica*	NT	M	x			
214		Asian Dowitcher	*Limnodromus semipalmatus*	NT	M	x			
215		Whimbrel	*Numenius phaeopus*		M	x			
216		Eurasian Curlew	*Numenius arquata*	NT	M	x	x		
217		Little Curlew	*Numenius minimus*		V				
218		Terek Sandpiper	*Xenus cinereus*		M	x			
219		Common Sandpiper	*Actitis hypoleucos*		M	x	x	x	x
220		Green Sandpiper	*Tringa ochropus*		M	x	x	x	

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221		Spotted Redshank	*Tringa erythropus*		M	x	x		
222		Common Greenshank	*Tringa nebularia*		M	x	x	x	x
223		Nordmann's Greenshank	*Tringa guttifer*	EN	M	x			
224		Marsh Sandpiper	*Tringa stagnatilis*		M	x	x		
225		Wood Sandpiper	*Tringa glareola*		M	x	x		
226		Common Redshank	*Tringa totanus*		M	x	x		
227		Great Knot	*Calidris tenuirostris*	EN	M	x			
228		Red Knot	*Calidris canutus*	NT	M	x			
229		Sanderling	*Calidris alba*		M	x			
230		Spoon-billed Sandpiper	*Calidris pygmeus*	CR	M	x			
231		Little Stint	*Calidris minuta*		M	x			
232		Red-necked Stint	*Calidris ruficollis*	NT	M	x	x		
233		Temminck's Stint	*Calidris temminckii*		M	x	x		
234		Long-toed Stint	*Calidris subminuta*		M	x			
235		Dunlin	*Calidris alpina*		M		x		
236		Curlew Sandpiper	*Calidris ferruginea*	NT	M	x			
237		Broad-billed Sandpiper	*Limicola falcinellus*		M	x			
238		Ruff	*Philomachus pugnax*		M		x		
239		Ruddy Turnstone	*Arenaria interpres*		M	x			
240		Oriental Pratincole	*Glareola maldivarum*		B	x	x		
241		Small Pratincole	*Glareola lactea*		B	x	x	x	x
242	**RYNCHOPIDAE: Skimmers**	Indian Skimmer	*Rynchops albicollis*	VU	B		x	x	
243	**STERNIDAE_Laridae: Gulls and terns**	Sooty Tern	*Onychoprion fuscatus*		V	x			
244		Little Tern	*Sternula albifroms*		B	x	x		
245		Gull-billed Tern	*Gelochelidon nilotica*		M	x			
246		Caspian Tern	*Hydroprohgne caspia*		M	x			
247		White-winged Tern	*Chlidonias leucopterus*		M	x			
248		Whiskered Tern	*Chlidonias hybrida*		M	x			
249		River Tern	*Sterna aurantia*	NT	B		x	x	
250		Common Tern	*Sterna hirundo*		M	x	x		
251		Black-bellied Tern	*Sterna acuticauda*	EN	B		x		
252		Lesser Crested Tern	*Thalasseus bengalensis*		M	x			

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253		Great Crested Tern	*Thalasseus bergii*		B	x			
254		Heuglin's Gull	*Larus heuglini*		M	x	x		
255		Pallas's Gull	*Larus ichthyaetus*		M	x	x	x	x
256		Brown-headed Gull	*Chroicocephalus brunnicephalus*		M	x	x	x	x
257		Black-headed Gull	*Chroicocephalus ridibundus*		M		x		
258		Slender-billed Gull	*Chroicocephalus genei*		V				
259	**COLUMBIDAE: Pigeons and doves**	Rock Pigeon	*Columba livia*		B	x	x	x	x
260		Snow Pigeon	*Columba leuconota*		B				x
261		Speckled Woodpigeon	*Columba hodgsonii*		B			x	x
262		Ashy Woodpigeon	*Columba pulchricollis*		B		x	x	x
263		Pale-capped Pigeon	*Columba punicea*	VU	B	x			
264		Oriental Turtle-Dove	*Streptopelia orientalis*		M		x	x	x
265		Burmese Collared-Dove	*Streptopelia xanthocycla*		B		x		x
266		Red Collared-Dove	*Streptopelia tranquebarica*		B	x	x	x	
267		Spotted Dove	*Streptopelia chinensis*		B	x	x	x	x
268		Barred Cuckoo-Dove	*Macropygia unchall*		B		x	x	x
269		Emerald Dove	*Chalcophaps indica*		B		x	x	x
270		Orange-breasted Green-Pigeon	*Treron bincincta*		B	x	x	x	
271		Ashy-headed Green -Pigeon	*Treron phayrei*	NT	B	x	x	x	x
272		Thick-billed Green-Pigeon	*Treron curvirostra*		B	x	x	x	x
273		Yellow-footed Green- Pigeon	*Treron phoenicopterus*		B	x	x	x	x
274		Pin-tailed Green-Pigeon	*Treron apicauda*		B		x	x	x
275		Wedge-tailed Green-pigeon	*Treron sphenura*		B				x
276		Green Imperial-Pigeon	*Ducula aenea*		B	x	x	x	x
277		Mountain Imperial-Pigeon	*Ducula badia*		B		x	x	x
278		Pied Imperial-Pigeon	*Ducula bicolor*		B	x			
279	**PSITTACIDAE: Parrots**	Vernal Hanging-Parrot	*Loriculus vernalis*		B	x	x	x	
280		Alexandrine Parakeet	*Psittinus eupatria*	NT	B	x	x	x	
281		Rose-ringed Parakeet	*Psittacula krameri*		B	x	x	x	
282		Grey-headed Parakeet	*Psittacula finschii*	NT	B		x	x	x
283		Blossom-headed Parakeet	*Psittacula roseata*	NT	B	x	x	x	

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284		Red-breasted Parakeet	*Psittacula alexandri*	NT	B	x	x	x	x
285	**CUCULIDAE: Cuckoos**	Pied Cuckoo	*Clamator jacobinus*		B		x	x	
286		Chestnut-winged Cucukoo	*Clamator coromandus*		B	x	x	x	x
287		Large Hawk-Cucukoo	*Hierococcyx sparverioides*		B		x		x
288		Common Hawk-Cucukoo	*Hierococcyx varius*		B		x		
289		Hodgson's Hawk-Cuckoo	*Hierococcyx nisicolor*		M				x
290		Indian Cuckoo	*Cuculus micropterus*		B	x	x	x	x
291		Eurasian Cuckoo	*Cuculus canorus*		B		x	x	x
292		Oriental Cuckoo	*Cuculus saturatus*		B				x
293		Lesser Cuckoo	*Cuculus poliocephalus*		B		x		x
294		Banded Bay Cuckoo	*Cacomantis sonneratii*		B	x	x	x	x
295		Grey-bellied Cuckoo	*Cacomantis passerinus*		V			x	
296		Plaintive Cuckoo	*Cacomantis merulimus*		B	x	x	x	x
297		Asian Emerald Cuckoo	*Chrysococcyx maculatus*		B	x	x	x	
298		Violet Cuckoo	*Chrysococcyx xanthorhynchus*		B	x	x		x
299		Drongo Cuckoo	*Surniculus lugubris*		B	x	x		x
300		Asian Koel	*Eudynamys scolopacaceus*		B	x	x	x	x
301		Green-billed Malkoha	*Rhopodytes tristis*		B	x	x	x	x
302		Greater Coucal	*Centropus sinensis*		B	x	x	x	x
303		Lesser Coucal	*Centropus bengalensis*		B	x	x	x	x
304	**Strigiformes: Owls**	Common Barn-Owl	*Tyto alba*		B	x	x	x	x
305		Eastern Grass-Owl	*Tyto longimembris*		B	x	x		
306		Oriental Bay Owl	*Phodilus badius*		B		x		
307		Mountain Scops-Owl	*Otus spilocephalus*		B		x		x
308		Collared Scops-Owl	*Otus lettia*		B	x	x	x	x
309		Oriental Scops-Owl	*Otus sunia*		B	x	x	x	x
310		Spot-bellied Eagle-Owl	*Bubo nipalensis*		B	x	x	x	x
311		Dusky Eagle-Owl	*Bubo coromandus*		B		x		
312		Brown Fish-Owl	*Ketupa zeylonesis*		B	x	x		
313		Buffy Fish-Owl	*Ketupa ketupa*		B	x	x		
314		Spotted Wood-Owl	*Strix seloputo*		B	x	x		
315		Brown Wood-Owl	*Strix leptogrammica*		B		x	x	x
316		Himalayan Wood-Owl	*Strix nivicola*		B				x

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317		Collared Owlet	*Glaucidium brodiei*		B		x	x	x
318		Asian Barred Owlet	*Glaucidium cuculoides*		B				x
319		Spotted Owlet	*Athene brama*		B	x	x	x	
320		Brown Boobook	*Ninox scutulata*		B	x	x	x	x
321		Long-Eared Owl	*Asio otus*		V				
322		Short-Eared Owl	*Asio flammeus*		M	x	x		
323	**CAPRIMULGIDAE:Nightjars and Frogmouths**	Hodgon's Frogmouth	*Batrachostomus hodgsoni*	NT	B		x		
324		Great Eared-Nightjar	*Eurostopodus macrotis*	NT	B		x	x	x
325		Grey Nightjar	*Caprimulgus jotaka*		B				x
326		Large-tailed Nightjar	*Carprimulgus macrurus*		B	x	x	x	x
327		Indian Nightjar	*Carprimulgus asiaticus*		B	x	x		
328		Savanna Nightjar	*Carprimulgus affinis*		B	x	x		
329	**APODIDAE: Swifts**	Himalayan Swiftlet	*Aerodramus brevirostris*		B		x	x	x
330		Germain's Swiftlet	*Aerodramus germani*		B				
331		White-throated Needletail	*Hirundapus caudacutus*		B				x
332		Brown-backed Needletail	*Hirundapus giganteus*		B	x	x	x	x
333		Asian Palm-Swift	*Cypsiurus balas*		B	x	x	x	x
334		Alpine Swift	*Tachymarptis melba*		V			x	
335		Fork-tailed Swift	*Apus pacificus*		B	x	x	x	
336		House Swift	*Apus affinis*		B	x	x	x	x
337		Crested Treeswift	*Hemiprocne coronata*		B		x	x	x
338	**TROGONIDAE: Trogons**	Red-headed Trogon	*Harpactes erythrocephalus*		B		x		x
339		Ward's Trogon	*Harpactes wardi*	NT	B				x
340	**CORACIIDAE: Rollers**	Indian Roller	*Coracias benghalensis*		B	x	x	x	x
341		Dollarbird	*Eurystomus orientalis*		B	x	x	x	x
342	**ALCEDIDAE: Kingfishers**	Banded Kingfisher	*Lacedo pulchella*		B		x		
343		Stork-billed Kingfisher	*Pelargopsis capensis*		B	x	x	x	
344		Brown-winged Kingfisher	*Pelargopsis amauroptera*	NT	B	x			
345		Ruddy Kingfisher	*Halcyon coromanda*		B	x	x	x	x
346		White-throated Kingfisher	*Halcyon smyrnensis*		B	x	x	x	x
347		Black-capped Kingfisher	*Halcyon pileata*		B	x	x		x
348		Collared Kingfisher	*Todiramphus chloris*		B	x			

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349		Black-backed Kingfisher	*Ceyx erithaca*		B	x			x
350		Blue-eared Kingfisher	*Alcedo meninting*		B	x	x	x	x
351		Common Kingfisher	*Alcedo atthis*		B	x	x	x	x
352		Blyth's Kingfisher	*Alcedo hercules*	NT	B			x	x
353		Crested Kingfisher	*Ceryle lugubris*		B			x	x
354		Pied Kingfisher	*Ceryle rudis*		B	x	x	x	x
355	**MEROPIDAE: Bee-eaters**	Blue-bearded Bee-eater	*Nyctyornis athertoni*		B		x	x	x
356		Little Green Bee-eater	*Merops orientalis*		B	x	x	x	x
357		Blue-tailed Bee-eater	*Merops philippinus*		B	x	x	x	x
358		Chestnut-headed Bee-eater	*Mecops leschenaulti*		B	x	x	x	x
359	**UPUPIDAE: Hoopoes**	Common Hoopoe	*Upupa epops*		B	x	x	x	x
360	**BUCEROTIDAE: Hornbills**	Northern Brown Hornbill	*Ptilolaemus austeni*	NT	B			x	x
361		Oriental Pied Hornbill	*Anthracoceros albirostris*		B	x	x	x	x
362		Great Hornbill	*Buceros bicornis*	NT	B				x
363		Rufous-necked Hornbill	*Aceros nipalensis*	VU	B		x	x	x
364		Wreathed Hornbill	*Aceros undulatus*		B		x	x	x
365	**RAMPHASTIDAE: Barbets**	Great Barbet	*Megalaima virens*		B		x	x	x
366		Lineated Barbet	*Megalaima lineata*		B	x	x	x	x
367		Golden-throated Barbet	*Megalaima franklinii*		B		x		x
368		Blue-throated Barbet	*Megalaima asiatica*		B	x	x	x	x
369		Blue-eared Barbet	*Megalaima australis*		B		x	x	x
370		Coppersmith Barbet	*Megalaima haemaccephala*		B	x	x	x	x
371	**INDICATORIDAE: Honeyguides**	Yellow-rumped Honeyguide	*Indicator xanthonotus*	NT	B				x
372	**PICIDAE: Woodpeckers**	Eurasian Wryneck	*Iynx torquilla*		M	x	x	x	x
373		Speckled Piculet	*Picumnus innominatus*		B		x	x	x
374		White-browed Piculet	*Sasia ochracea*		B		x	x	x
375		Rufous-bellied Woodpecker	*Hypopicus hyperythrus*		B		x		
376		Grey-capped Pygmy Woodpecker	*Dendrocopos canicapillus*		B	x	x	x	x
377		Fulvous-breasted Woodpecker	*Dendrocopos macei*		B	x		x	x
378		Spot-breasted Woodpecker	*Dendrocopos analis*		B	x	x		
379		Yellow-crowned Woodpecker	*Dendrocopos mahrattensis*		B		x		
380		Crimson-breasted Woodpecker	*Dendrocopos cathpharius*		B		x		x

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381		Darjeeling Woodpecker	*Dendrocopos darjellensis*		B				x
382		Great Spotted Woodpecker	*Dendrocopos major*		B				x
383		Rufous Woodpecker	*Micropternus brachyurus*		B	x	x	x	x
384		White-bellied Woodpecker	*Dryocopus javensis*		B	x	x	x	x
385		Greater Yellownape	*Chrysophlegma flavinucha*		B	x	x	x	x
386		Lesser Yellownape	*Picus chlorophus*		B	x	x	x	x
387		Black-naped Woodpecker	*Picus guerini*		B	x	x	x	x
388		Black-headed Woodpecker	*Picus eryhropygius*		B		x		
389		Streak-breasted Woodpecker	*Picus viridanus*		B	x	x		
390		Streak-throated Woodpecker	*Picus xanthopygaeus*		B	x	x	x	x
391		Himalayan Flameback	*Dinopium shrii*		B	x	x		x
392		Common Flameback	*Dinopium javanense*		B	x	x	x	x
393		Greater Flameback	*Chrysocolaptes lucidus*		B	x	x	x	x
394		Pale-headed Woodpecker	*Gecinulus grantia*		B			x	x
395		Bay Woodpecker	*Blythipicus pyrrhotis*		B		x		x
396		Black-And-Buff Woodpecker	*Meiglyptes jugularis*	NT	B		x	x	
397		Heart-spotted Woodpecker	*Hemicircus canente*		B		x		
398		Great Slaty Woodpecker	*Mulleripicus pulverlintus*	VU	B		x	x	
399	**EURYLAIMIDAE: Broadbills**	Long-tailed Broadbill	*Psarisomus dalhousiae*		B		x	x	x
400		Dusky Broadbill	*Corydon sumatranus*		B		x		
401		Silver-breasted Broadbill	*Serilophus lunatus*		B		x	x	x
402		Black-And-Red Broadbill	*Cymbirhynchus*		B	x			
403	**PITTIDAE: Pittas**	Hooded Pitta	*Pitta sordida*		B		x	x	x
404		Mangrove Pitta	*Pitta megarhyncha*	NT	B	x			
405		Blue Pitta	*Pitta cyanea*		B		x		
406		Rusty-naped Pitta	*Pitta oatesi*		B		x	x	
407		Blue-naped Pitta	*Pitta nipalensis*		B				x
408		Eared Pitta	*Anthocincla phayrei*		B		x		
409	**VIREONIDAE: Shrike-babbles, White-bellied Erpornis and allies**	Black-headed Shrike Babbler	*Pteruthius rufiventer*		B				x
410		White-browed Shrike-Babbler	*Pteruthius flaviscapis*		B		x		x
411		Green Shrike-Babbler	*Pteruthius xanthochlorus*		B		x		

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412		Black-eared Shrike-Babbler	*Pteruthius melanotis*		B				x
413		Chestnut-fronted Shrike-Babbler	*Pteruthius aenobarbus*		B				x
414		White-bellied Erpornis	*Erpornis zantholeuca*		B			x	
415	**CAMPEPHAGIDAE: Cuckooshriles, trillers, minivets and allies**	Large Cuckooshrike	*Coracina macei*		B	*x*	*x*	*x*	x
416		Indochinese Cuckooshrike	*Coracina polioptera*		B		*x*		x
417		Black-winged Cuckooshrike	*Coracina melaschistos*		B				x
418		Black-headed Cuckooshrike	*Coracina melanoptera*		B			x	
419		Rosy Minivet	*Pericrocotus roseus*		B	*x*	*x*	*x*	
420		Swinhoe's Minivet	*Pericrocotus cantonensis*		M	*x*	*x*		
421		Ashy Minivet	*Pericrocotus divaricatus*		B	*x*	*x*	*x*	x
422		Small Minivet	*Pericrocotus cinnamomeus*		B	*x*	*x*		
423		Jerdon's Minivet	*Pericrocotus albifrons*	NT	B		*x*		
424		Grey-chinned Minivet	*Pericrocotus solaris*		B		*x*	*x*	x
425		Long-tailed Minivet	*Pericrocotus ethologus*		B		*x*	*x*	x
426		Short-billed Minivet	*Pericrocotus brevirostris*		B		*x*	*x*	x
427		Scarlet Minivet	*Pericrocotus speciosus*		B	*x*	*x*	*x*	x
428		Mangrove Whistler	*Pachycephala grisola*		B	*x*			
429	**ORIOLIDAE: Orioles and allies**	Slender-billed Oriole	*Oriolus tenuirostris*		B		*x*	*x*	x
430		Black-naped Oriole	*Oriolus chinensis*		B	*x*	*x*		x
431		Black-hooded Oriole	*Oriolus xanthornus*		B	*x*	*x*	*x*	x
432		Maroon Oriole	*Oriolus traillii*		B		*x*	*x*	x
433	**ARTAMIDAE: Woodswallows**	Ashy Woodswallow	*Artamus fuscus*		B	*x*	*x*	*x*	x
434	**Tephrodornis and others: Woodshrikes, flycatcher-shrikes**	Large Woodshrike	*Tephrodornis gularis*		B	*x*	*x*	*x*	x
435		Common Woodshrike	*Tephrodornis pondicerianus*		B	*x*	*x*	*x*	x
436		Bar-winged Flycatcher-Shrike	*Hemipus picatus*		B		*x*	*x*	x
437	**AEGITHINIDAE: Ioras**	Common Iora	*Aegithina tiphia*		B	*x*	*x*	*x*	x
438		Great Iora	*Aegithina lafresnayei*		B	*x*	*x*		
439	**RHIPIDURIDAE: Fantails**	Yellow-bellied Fantail	*Chelidorhynx hypoxantha*		B		*x*		x

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440		White-throated Fantail	*Rhipidura albicollis*		B		x	x	x
441		White-browned Fantail	*Rhipidura aureola*		B	x	x	x	
442		Sunda Pied Fantail	*Rhipidura javanica*		B	x	x		
443	**DICRURIDAE: Drongos**	Black Drongo	*Dicrurus macrocercus*		B	x	x	x	x
444		Ashy Drongo	*Dicrurus leucophaeus*		B	x	x	x	x
445		Crow-billed Drongo	*Dicrurus annectans*		B	x	x	x	
446		Bronzed Drongo	*Dicrurus aeneus*		B	x	x	x	x
447		Lesser Racket-tailed Drongo	*Dicrurus remifer*		B	x	x	x	x
448		Greater Racket-tailed Drongo	*Dicrurus paradiseus*		B	x	x	x	x
449		Hair-crested Drongo	*Dicrurus hottentottus*		B	x	x	x	x
450	**MONARCHIDAE: Monarchs, paradise-flycatchers and allies**	Black-naped Monarch	*Hypothymis azurea*		B	x	x	x	x
451		Oriental Paradise-Flycatcher	*Terpsiphone affinis*		B	x	x	x	x
452	**CORVIDAE: Crows**	House Crow	*Corvus splendens*		B	x	x	x	x
453		Large-billed Crow	*Corvus macrorhynchos*		B	x	x	x	x
454		Spotted Nutcracker	*Nucifraga caryocatactes*		B				x
455		Eurasian Magpie	*Pica pica*		B				x
456		White-faced Jay	*Garrulus leucotis*		B		x		
457		Common Green Magpie	*Cissa chinensis*		B		x	x	x
458		Yellow-billed Blue Magpie	*Urocissa flavirostris*		B		x		x
459		Red-billed Blue Magpie	*Urocissa erythrorhyncha*		B		x	x	x
460		Rufous Treepie	*Dendrocitta vagabunda*		B		x	x	x
461		Grey Treepie	*Dendrocitta formosae*		B		x	x	x
462		Collared Treepie	*Dendrocitta fromtalis*		B				x
463		Racket-tailed Treepie	*Crypsirina temia*		B	x			
464		Hooded Treepie	*Crypsirina cucullata*	NT	B		x		
465	**LANIIDAE: Shrikes**	Brown Shrike	*Lanius cristatus*		M	x	x	x	x
466		Burmese Shrike	*Lanius collurioides*		B	x	x	x	
467		Long-tailed Shrike	*Lanius schach*		B				x
468		Grey-backed Shrike	*Lanius tephronotus*		M	x	x	x	x
469		Great Grey Shrike	*Lanius excubitor*		V				
470	**REGULIDAE: Crests and allies**	Goldcrest	*Regulus regulus*		B				x

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471	**NECTARINIIDAE: Sunbirds, spiderhunters and Flowerpeckers**	Brown-throated Sunbird	*Anthreptes malacensis*		B	x			
472		Maroon-bellied Sunbird	*Leptocoma brasiliana*		B	x	x		
473		Purple Sunbird	*Cinnyris asiaticus*		B	x	x	x	
474		Olive-backed Sunbird	*Cinnyris jugularis*		B	x	x	x	
475		Crimson Sunbird	*Aethopyga siparaja*		B		x	x	x
476		Mrs Gould's Sunbird	*Aethopyga gouldiae*		B		x	x	x
477		Green-tailed Sunbird	*Aethopyga nipalensis*		B		x	x	x
478		Black-throated Sunbird	*Aethopyga saturata*		B		x	x	x
479		Fire-tailed Sunbird	*Aethopyga ignicauda*		B		x		x
480		Ruby-cheeked Sunbird	*Chalcoparia singalensis*		B	x	x	x	x
481		Purple -naped Sunbird	*Arachnothera hypogrammicum*		B		x		
482		Streaked Spiderhunter	*Arachnothera magna*		B		x	x	x
483		Little Spiderhunter	*Arachnothera longirostra*		B	x	x	x	x
484		Thick-billed Flowerpecker	*Dicaeum agile*		B	x	x	x	
485		Yellow-bellied Flowerpecker	*Dicaeum everetti*		B		x		x
486		Yellow-vented Flowerpecker	*Dicaeum chrysorrheum*		B	x	x	x	x
487		Orang-bellied Flowerpecker	*Dicaeum trigonostigma*		B	x	x		
488		Pale-billed Flowerpecker	*Dicaeum erythrorynchos*		B		x	x	
489		Plain Flowerpecker	*Dicaeum minullum*		B		x	x	x
490		Fire-breasted Flowerpecker	*Dicaeum ignipectus*		B		x	x	x
491		Scarlet-backed Flowerpecker	*Dicaeum cruentatum*		B	x	x	x	x
492	**CHLOROPSEIDAE: Leafbirds**	Blue-winged Leafbird	*Chloropsis cochinchinesis*		B		x	x	x
493		Golden-fronted Leafbird	*Chloropsis aurifroms*		B	x	x	x	x
494		Orange-bellied Leafbird	*Chloropsis hardwickii*		B		x	x	x
495		Asian Fairy-Bluebird	*Irena puella*		B	x	x	x	x
496	**PRUNELLIDAE: Accentors**	Alpine Accentor	*Prunella collaris*		B				x
497		Rufous-breasted Accentor	*Prunella strophiata*		B				x
498		Maroon-backed Accentor	*Prunella immaculata*		B				x
499	**PLOCEIDAE: Weavers**	Streaked Weaver	*Ploceus manyar*		B	x	x	x	
500		Baya Weaver	*Ploceus philippinus*		B	x	x	x	

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501		Asian Golden Weaver	*Ploceus hypoxanthus*	NT	B	x	x		
502		Red Avadavat	*Amandava amandava*		B	x	x	x	
503		White-rumped Munia	*Lonchura striata*		B	x	x	x	x
504		Scaly-breasted Munia	*Lonchura punctulata*		B	x	x	x	x
505		Chestnut Munia	*Lonchura atricapilla*		B	x	x	x	
506		House Sparrow	*Passer domesticus*		B	x	x	x	x
507		Plain-backed Sparrow	*Passer flaveolus*		B		x		
508		Eurasian Tree-Sparrow	*Passer montanus*		B	x	x	x	x
509		Russet Sparrow	*Passer rutilans*		B		x		x
510	**MOTACILLIDAE: Wagtails and pipits**	Buff-bellied Pipit	*Anthus rubescens*		M			x	
511		Water Pipit	*Anthus spinoletta*		M			x	
512		Rosy Pipit	*Anthus roseatus*		M		x		x
513		Red-throated Pipit	*Anthus cervinus*		M	x	x	x	
514		Olive-backed Pipit	*Anthus hodgsoni*		M	x	x	x	x
515		Blyth's Pipit	*Anthus godlewskii*		M		x		
516		Richard's Pipit	*Anthus richardi*		M	x	x	x	x
517		Paddyfied Pipit	*Anthus rufulus*		B	x	x	x	x
518		Long-billed Pipit	*Anthus similis*		B		x		
519		Forest Wagtail	*Dendronanthus indicus*		M	x	x	x	
520		White Wagtail	*Motacilla alba*		M	x	x	x	x
521		Grey Wagtail	*Motacilla cinerea*		M	x	x	x	x
522		Western Yellow Wagtail	*Motacilla flava*		M			x	
523		Eastern Yellow Wagtail	*Motacilla tschutschensis*		M	x	x		
524		Citrine Wagtail	*Motacilla citreola*		M		x	x	x
525	**FRINGILLIDAE:Finches**	Tibetan Serin	*Serinus thibetana*		B				x
526		Red Crossbill	*Loxia curvirostra*		M		x		x
527		Black-Headed Greenfinch	*Chloris ambigua*		B				x
528		Yellow-breasted Greenfinch	*Chloris monguilloti*		B			x	
529		Vinaceous Rosefinch	*Carpodacus vinaceus*		B				x
530		Dark-rumped Rosefinch	*Carpodacus edwardsii*		B				x
531		Sharpe's Rosefinch	*Carpodacus verreauxii*		B				x
532		Common Rosefinch	*Carpodacus erythrinus*		M	x	x	x	x

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533		Dark-breasted Rosefinch	*Procarduelis nipalensis*		B				x
534		Red-fronted Rosefinch	*Carpodacus puniceus*		B				x
535		Long-tailed Rosefinch	*Uragus sibiricus*		B				x
536		Three banded Rosefinch	*Carpodacus trifasciatus*		B				x
537		Blanford's Rosefinch	*Agraphospiza rubescens*		B				x
538		Scarlet Finch	*Haematospoza sipahi*		B				x
539		Grey-headed Bullfinch	*Pyrrhula erythaca*		B		x		x
540		Brown Bullfinch	*Pyrrhula nipalensis*		B				x
541		Crimson-browed Finch	*Propyrrhula subhimachala*		B				x
542		Plain Mountain-Finch	*Leucosticte nemoricola*		B				x
543		Brandt's Mountain Finch or Black-headed Mountain Finch	*Leucosticte brandti*		B				x
544		Yellow-billed Grosbeak	*Eophona migratoria*		M				x
545		White -winged Grosbeak	*Mycerobas carnipes*		B				x
546		Collared Grosbeak	*Mycerobas affinis*		M		x		x
547		Spot-winged Grosbeak	*Mycerobas melanozanthos*		B		x	x	x
548		Gold-naped Finch	*Pyrrhoplectes epauletta*		B				x
549	**EMBERIZIDAE: Buntings and allies**	Crested Bunting	*Emberiza lathami*		B		x	x	
550		Chestnut-eared Bunting	*Emberiza fucata*		M		x	x	
551		Godlewski's Bunting	*Emberiza godlewskii*		B		x		x
552		Yellow-throated Bunting	*Emberiza buchanani*		B				x
553		Pallas's Bunting	*Emberiza pallasi*		V				
554		Little Bunting	*Emberiza pusillla*		M		x		x
555		Black-faced Bunting	*Emberiza spodocephala*		M		x	x	x
556		Chestnut Bunting	*Emberiza aureola*		M		x		x
557		Yellow-breasted Bunting	*Emberiza aureola*	EN	M	x	x		
558		Tristram's Bunting	*Emberiza tristrami*		M				x
559		Black- headed Bunting	*Emberiza melanocephala*		M		x		
560	**Sittidae: Nuthatches and Treecreepers**	Hodgson's Treecreeper	*Certhia hodgsoni*		B				x
561		Bar-tailed Treecreeper	*Certhia himalayana*		B		x		x
562		Rusty-flanked Treecreeper	*Certhia nipalensis*		B				x

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563		Manipur Treecreeper	*Certhia manipurensis*		B		x		
564		Beautiful Nuthatch	*Sitta formosa*	VU	B				x
565		Chestnut-vented Nuthatch	*Sitta nagaensis*		B		x		x
566		Chestnut-bellied Nuthatch	*Sitta cinnamoventris*		B		x		x
567		Velvet-fronted Nuthatch	*Sitta frontalis*		B	x	x	x	x
568		Burmese Nuthatch	*Sitta neglecta*		B		x	x	x
569		Giant Nuthatch	*Sitta magna*	EN	B		x		
570		White-tailed Nuthatch	*Sitta himalayensis*		B				x
571		White-browed Nuthatch	*Sitta victoriae*	EN	B		x		
572		Yunnan Nuthatch	*Sitta yunnanensis*		B				x
573		Wallcreeper	*Tichodroma muraria*		M				x
574		Winter Wren	*Troglodytes troglodytes*		B				x
575	**CINCLIDAE: Dippers**	White-throated Dipper	*Cinclus cinclus*		B				x
576		Brown Dipper	*Cinclus pallasii*		B		x		x
577	**STURNIDAE: Mynas, starlings and allies**	Spot-winged Starling	*Saroglossa spiloptera*		M		x	x	x
578		Crested Myna	*Acridotheres cristatellus*		B		x	x	x
579		Great Myna	*Acridotheres grandis*		B	x	x		
580		Jungle Myna	*Acridotheres fuscus*		B	x	x	x	
581		Collared Myna	*Acridotheres albocinctus*		B		x		x
582		Common Myna	*Acridotheres tristis*		B	x	x	x	x
583		Burmese Myna	*Acridotheres burmannicus*		B	x	x	x	x
584		Black-collared Starling	*Gracupica nigricollis*		B		x	x	x
585		Asian Pied Starling	*Gracupica contra*		B	x	x	x	x
586		Chestnut-tailed Starling	*Sturnus malabaricus*		B	x	x	x	x
587		Common Starling	*Sturnus vulgaris*		M		x		
588		Asian Glossy Starling	*Aplonis panayenis*		B	x			
589		Golden-crested Myna	*Ampeliceps coronatus*		B		x		
590		Common Hill-Myna	*Gracula religiosa*		B	x	x	x	x
591	**TURDIDAE: Thrushes Chats and Flycatchers**	Orange-headed Thrush	*Zoothera citrina*		B	x	x	x	x
592		Alpine Thrush	*Zoothera mollissima*		B				x
593		Long-tailed Thrush	*Zoothera dixoni*		B				x

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594		Scaly Thrush	*Zoothera dauma*		B		x		x
595		Long-billed Thrush	*Zoothera monticola*		B			x	x
596		Dark-sided Thrush	*Zoothera marginata*		B		x		x
597		White-collared Blackbird	*Turdus albocinctus*		M			x	
598		Black-breasted Thrush	*Turdus dissimilis*		B		x	x	x
599		Grey-winged Blackbird	*Turdus boulboul*		B		x	x	x
600		Chestnut Thrush	*Turdus rubrocanus*		M				x
601		Black-throated Thrush	*Turdus atrogularis*		M			x	x
602		Red-throated Thrush	*Turdus ruficollis*		M			x	
603		Naumann's Thrush	*Turdus naumanni*		M		x		
604		Dusky Thrush	*Turdus eumomus*		M		x		x
605		Grey-sided Thrush	*Turdus feae*	VU	M		x	x	
606		Eye-browed Thrush	*Turdus obscurus*		M		x	x	x
607		Purple Cochoa	*Cochoa purpurea*		B		x		
608		Green Cochoa	*Cochoa coelicolor*		B		x	x	
609		Grandala	*Grandala coelicolor*		B				x
610		Gould's Shortwing	*Brachypteryx stellata*		B				x
611		Rusty-bellied Shortwing	*Brachypteryx hyperythra*	NT	B			x	x
612		Lesser Shortwing	*Brachypteryx leucophrys*		B		x	x	x
613		Himalayan Shortwing	*Brachypteryx crualis*		B		x	x	x
614		Siberian Rubythroat	*Luscinia calliope*		M	x	x	x	x
615		Chinese Rubythroat	*Luscinia tschebaiewi*		M		x		x
616		Bluethroat	*Luscinia svecica*		M	x	x	x	
617		Firethroat	*Luscinia pectardens*		B				x
618		Indian Blue Robin	*Luscinia brunnea*		B		x		
619		Siberian Blue Robin	*Luscinia cyane*		M	x	x	x	
620		White-tailed Blue Robin	*Myiomela leucura*		B		x	x	x
621		Blue-fronted Robin	*Cinclidium frontale*		B			x	
622		Plumebeous Water-Redstart	*Rhyacornis fuliginosa*		B		x		x
623		White-capped Water-Redstart	*Chaimarrornis leucocephalus*		B		x		x
624		Hodgson's Redstart	*Phoenicurus hodgsoni*		M		x		x
625		White-throated Redstart	*Phoenicurus schisticeps*		B				x
626		Daurian Redstart	*Phoenicurus auroreus*		M		x		x

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627		Blue-fronted Redstart	*Phoenicurus frontalis*		B		x		x
628		Black Redstart	*Phoeniucrus ochruros*		M		x	x	x
629		Blue Rock-Thrush	*Monticola solitarius*		M	x	x	x	x
630		Chestnut-bellied Rock-Thrush	*Monticola rufiventris*		B		x	x	x
631		Isabelline Wheatear	*Oenanthe isabellina*		V				
632		Grey Bushchat	*Saxicola ferreus*		B		x		x
633		Eastern Stonechat	*Saxicola maurus*		B	x	x	x	x
634		White-tailed Stonechat	*Saxicola leucura*		B		x	x	
635		Pied Bushchat	*Saxicola caprata*		B		x	x	x
636		Jerdon's Bushchat	*Saxicola jerdoni*		B		x		
637		White-browed Bush-Robin	*Tarsiger indicus*		B				x
638		Rufous-breasted Bush-Robin	*Tarsiger hyperythrus*		B				x
639		Himalayan Bluetail	*Tarsiger rufilatus*		M		x	x	x
640		Red-flanked Bluetail	*Tarsiger cyanurus*		M		x		x
641		Golden Bush-Robin	*Tarsiger chrysaeus*		B		x	x	x
642		Little Forktail	*Enicurus scouleri*		B				x
643		Black-backed Forktail	*Enicurus immaculatus*		B		x	x	x
644		Slaty-backed Forktail	*Enicurus schistaceus*		B		x	x	x
645		White-crowned Forktail	*Enicurus leschenaulti*		B		x	x	x
646		Spotted Forktail	*Enicurus maculatus*		B		x	x	x
647		Blue Whistling-Thrush	*Myophonus caruleus*		B		x	x	x
648		White-bellied Redstart	*Hodgsonius phaenicuroides*		B			x	x
649		Pale Blue Flycatcher	*Cyornis unicolor*		B		x		x
650		Hill Blue Flycatcher	*Cyornis banyumas*		M		x	x	x
651		Tickell's Blue Flycatcher	*Cyornis tickelliae*		B				x
652		Hainan Blue Flycatcher	*Cyornis hainanus*		B		x		
653		Blue-throated Flycatcher	*Cyornis rubeculoides*		B	x	x	x	x
654		White-tailed Flycatcher	*Cyornis concretus*		B				x
655		Pale-chinned Flycatcher	*Cyornis poliogenys*		B		x	x	x
656		Verditer Flycatcher	*Eumyias thalassinus*		B	x	x	x	x
657		Rufous-bellied Niltava	*Niltava sundara*		B		x		x
658		Large Vivid Niltava	*Niltava oatesi*		M		x		
659		Large Niltava	*Niltava grandis*		B		x		x

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660		Small Niltava	*Niltava macgrigoriae*		B		x		x
661		Slaty-backed Flycatcher	*Ficedula erithacusi*		M		x	x	
662		Slaty-backed Flycatcher	*Ficedula hodgsonii*		M		x	x	
663		White-gorgeted Flycatcher	*Ficedula monileger*		B		x		x
664		Snowy-browed Flycatcher	*Ficedula hyperythra*		M		x		x
665		Little Pied Flycatcher	*Ficedula westermanni*		M	x	x	x	x
666		Ultramarine Flycatcher	*Ficedula superciliaris*		M		x	x	
667		Slaty Blue Flycatcher	*Ficedula tricolor*		B		x	x	x
668		Taiga Flycatcher	*Ficedula albicilla*		M	x	x	x	x
669		Sapphire Flycatcher	*Ficedula sapphira*		B		x		
670		Pygmy Blue Flycatcher	*Ficedula hodgsoni*		B				x
671		Ferruginous Flycatcher	*Muscicapa ferruginea*		B		x		x
672		Rufous-gorgeted Flycatcher	*Muscicapa strophiata*		B		x		x
673		Dark-sided Flycatcher	*Muscicapa sibirica*		M	x	x		
674		Asian Brown Flycatcher	*Muscicapa dauurica*		M	x	x		
675		Brown-breasted Flycatcher	*Muscicapa muttui*		B		x		x
676		Oriental Magpie-Robin	*Copsychus saularis*		B	x	x	x	x
677		White-rumped Shama	*Copsychus malabaricus*		B		x	x	x
678	**PARIDAE:Tits**	Black-bibbed Tit	*Poecile hypermelaena*		B		x		
679		Grey-crested Tit	*Lophophanes dichrous*		B				x
680		Coal Tit	*Periparus ater*		B		x		
681		Rufous-vented Tit	*Periparus rubidiventris*		B			x	
682		Great Tit	*Parus major*		B	x	x	x	
683		Green-backed Tit	*Parus monticolus*		B		x		x
684		Yellow-cheeked Tit	*Parus spilonotus*		B		x	x	x
685		Sultan Tit	*Melanochlora*		B		x	x	x
686		Yellow-browed Tit	*Sylviparus modestus*		B		x		x
687		Fire-capped Tit	*Cephalopyrus flammiceps*		B		x		x
688		Black-throated Tit	*Aegithalos concinnus*		B		x		x
689		Black-browed Tit	*Aegithalos bonvaloti*		B		x		x
690		Burmese Tit	*Aegithalos sharpei*		B		x		
691	**STENOSTIRIDAE: Canary-flycatchers and allies**	Grey-headed Canary-Flycatcher	*Culicicapa ceylonensis*		B	x	x	x	x

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692	**ALAUDIDAE: Larks**	Australasian Bushlark	*Mirafra javanica*		B		x		
693		Burmese Bushlark	*Mirafra microptera*		B		x		
694		Oriental Skylark	*Alauda gulgula*		B	x	x	x	x
695		Eastern Short-toed Lark	*Calandrella brachydactyla*		V				
696		Sand Lark	*Calandrella raytal*		B	x	x		
697		Lesser Short-toed Lark	*Calandrella rufescens*		V				
698	**PYCNONOTIDAE: Bulbuls**	Crested Finchbill	*Spizixos canifrons*		B		x	x	x
699		Striated Bulbul	*Pycnonotus striatus*		B		x	x	x
700		Black-headed Bulbul	*Brachypodius atriceps*		B	x	x	x	
701		Black-crested Bulbul	*Pycnonotus flaviventris*		B		x	x	x
702		Stripe-throated Bulbul	*Pycnonotus finlaysoni*		B		x		
703		Pale-eyed Bulbul	*Pycnonotus davisoni*		B	x	x		
704		Flavescent Bulbul	*Pycnonotus flavescens*		B		x	x	x
705		Streak-eared Bulbul	*Pycnonotus blanfordi*		B	x	x		
706		Red-whiskered Bulbul	*Pycnonotus jocosus*		B	x	x	x	x
707		Brown-breasted Bulbul	*Pycnonotus xanthorrhous*		B		x		x
708		Red-vented Bulbul	*Pycnonotus cafer*		B	x	x	x	x
709		Sooty-headed Bulbul	*Pycnonotus aurigaster*		B		x		
710		Olive Bulbul	*Iole virescens*		B		x		x
711		Grey-eyed Bulbul	*Iole propinqua*		B		x		
712		White-throated Bulbul	*Alophoixus flaveolus*		B		x		x
713		Grey-crowned Bulbul	*Alophoixus griseiceps*		B		x		
714		Ashy Bulbul	*Hemixos flavala*		B		x	x	x
715		Mountain Bulbul	*Ixos mcclellandii*		B		x		x
716		Himalayan Black Bulbul	*Hypsipetes leucocephalus*		B		x	x	x
717		White-headed Bulbul	*Cerasophila thompsoni*		B		x		
718		Eastern House-Martin	*Delichon lagopodum*		M		x	x	
719	**HIRUNDINIDAE: Martins, swallows**	Asian House-Martin	*Delichon dasypus*		M	x	x	x	x
720		Nepal House-Martin	*Delichon nipalense*		B			x	x
721		Common Sand-Martin	*Riparia riparia*		M	x	x		
722		Plain Sand-Martin	*Riparia diluta*		B				x
723		Asian Plain Martin	*Riparia chinesis*		B	x	x	x	

No	Family name	Common new name	*Scientific name*	RL	Status*	Delta	Middle Basin	Chindwin	Upper Basin
724		Dusky Crag-Martin	*Ptyonopropne concolor*		B		x		
725		Barn Swallow	*Hirundo rustica*		M	x	x	x	x
726		Wire-tailed Swallow	*Hirundo smithii*		B	x	x		x
727		Red-rumped Swallow	*Cecropis daurica*		M	x	x	x	x
728	**CETTIIDAE: *Bushwarblers, Grasshopper Warblers, Grassbirds***	Yellow-bellied Warbler	*Abroscopus superciliaris*		B		x	x	x
729		Rufous-faced Warbler	*Abroscopus albogularis*		B				x
730		Black-faced Warbler	*Abroscopus schisticeps*		B			x	x
731		Broad-billed Warbler	*Tickellia hodgsoni*		B				x
732		Hume's Bush-Warbler	*Horornis brunnescens*		B				x
733		Grey-sided Bush-Warbler	*Cettia brunnifrons*		B		x		x
734		Chestnut-crowned Bush-Warbler	*Cettia major*		B				x
735		Brownish-flanked Bush-Warbler	*Horornis fortipes*		B		x		x
736		Aberrant Bush-Warbler	*Horornis flavolivacea*		B			x	x
737		Pale-footed Bush-Warbler	*Hemitesia pallidipes*		B				
738		Spotted Grasshopper -Warbler	*Locustella thoracica*		B				x
739		Russet Grasshopper-Warbler	*Locustella mandelli*		B			x	x
740		Striated Grassbird	*Mengalurus palustris*		B	x	x	x	x
741		Rufous-rumped Grassbird	*Graminicola bengalensis*		B		x		
742		Pallas' Grasshopper Warbler	*Locustella certhiola*		M	x	x		
743		Lanceolated Warbler	*Locustella lanceolata*		M	x	x	x	
744		Brown Grasshopper Warbler	*Locustella luteoventris*		B		x	x	x
745		Chinese Grasshopper-Warbler	*Locustella tacsanowskia*		M	x	x		
746		Baikal Grasshopper-Warbler	*Locustella davidi*		M		x	x	
747		Grey-bellied Tesia	*Tesia cyaniventer*		B		x	x	x
748		Slaty-bellied Tesia	*Tesia olivea*		B				x
749		Chestnut-headed Tesia	*Tesia castaneoceronata*		B		x		x
750	**PHYLLOSCOPIDAE: *Seicercus and Phylloscopus* warblers**	Whistler's Warbler	*Seicercus whistleri*		B		x	x	
751		Grey-crowned Warbler	*Seicercus tephrocephalus*		B		x	x	x
752		Marten's Warbler	*Phylloscopus omeiensis*		M		x		
753		White-spectacled Warbler	*Seicercus affinis*		B		x	x	x

No	Family name	Common new name	*Scientific name*	RL	Status*	Delta	Middle Basin	Chindwin	Upper Basin
754		Grey-cheeked Warbler	*Seicercus poliogenys*		B				x
755		Chestnut-crowned Warbler	*Seicercus castaniceps*		B		x	x	x
756		Eastern-crowned Warbler	*Phylloscopus coronatus*		M	x			
757		Yellow-vented Warbler	*Phylloscopus cantator*		B		x	x	x
758		White-tailed Leaf-Warbler	*Phylloscopus intensior*		B		x		x
759		Grey-hooded Warbler	*Phylloscopus xanthoschistos*		B		x		x
760		Claudia's Warbler	*Phylloscopus claudiae*		M		x	x	x
761		Blyth's Leaf-Warbler	*Phylloscopus reguloides*		B		x	x	x
762		Arctic Warbler	*Phylloscopus borealis*		M	x			
763		Large-billed Leaf-Warbler	*Phylloscopus magnirostris*		M	x	x		
764		Pale-legged Leaf-Warbler	*Phylloscopus tenellipes*		M	x	x		
765		Greenish Warbler	*Phylloscopus trochiloides*		M	x	x	x	x
766		Two-barred Warbler	*Phylloscopus plumbeitarsus*		M	x	x		x
767		Ashy-throated Warbler	*Phylloscopus maculipennis*		B		x	x	x
768		Buff-barred Warbler	*Phylloscopus pulcher*		M		x		x
769		Yellow-browed Warbler	*Phylloscopus inornatus*		M	x	x	x	x
770		Hume's Warbler	*Phylloscopus humei*		M		x		
771		Lemon-rumped Warbler	*Phylloscopus chloronotus*		M		x	x	x
772		Sichuan Leaf Warbler	*Phylloscopus forresti*		M		x		x
773		Tickell's Leaf-Warbler	*Phylloscopus affinis*		M		x	x	x
774		Yellow-streaked Warbler	*Phylloscopus armandii*		M		x		
775		Dusky Warbler	*Phylloscopus fuscatus*		M	x	x	x	x
776		Buff-throated Warbler	*Phylloscopus subaffinis*		B				x
777	**ACROCEPHALIDAE: *Reed*-warblers and allies**	Black-Browed Reed-Warbler	*Acrocephalus bistrigiceps*		M	x	x	x	
778		Blyth's Reed-Warbler	*Acrocephalus dumetorum*		M	x			
779		Paddyfield Warbler	*Acrocephalus agricola*		M		x		x
780		Blunt-winged Warbler	*Acrocephalus concinens*		M		x		
781		Indian Reed-Warbler	*Acrocephalus brunnescens*		B		x		
782		Oriental Reed-Warbler	*Acrocephalus orientalis*		M				
783		Thick-billed Warbler	*Acrocephalus aedon*		M				x
784	**CISTICOLIDAE: Cisticolas, tailorbirds, prinias and allies**	Zitting Cisticola	*Cisticola juncidis*		B	x	x	x	

No	Family name	Common new name	*Scientific name*	RL	Status*	Delta	Middle Basin	Chindwin	Upper Basin
785		Golden-headed Cisticola	*Cisticola exilis*		B		x		
786		Mountain Tailorbird	*Phyllergates cucullatus*		B				x
787		Dark-necked Tailorbird	*Orthotomus atrogularis*		B	x	x	x	x
788		Common Tailordbird	*Orthotomus sutorius*		B	x	x	x	x
789		Rufescent Prinia	*Prinia rufescens*		B	x	x	x	x
790		Grey-breasted Prinia	*Prinia hodgsonii*		B	x	x	x	x
791		Yellow-bellied Prinia	*Prinia flaviventris*		B	x	x	x	x
792		Plain Prinia	*Prinia inornata*		B	x	x	x	
793		Striated Prinia	*Prinia crinigera*		B				x
794		Brown Prinia	*Prinia polychroa*		B		x		
795		Hill Prinia	*Prinia atrogularis*		B		x		x
796	**TIMALIIDAE: Babblers**	Great Parrotbill	*Conostoma oemodium*		B				x
797		Brown Parrotbill	*Cholornis unicolor*		B				x
798		Grey-headed Parrotbill	*Psittiparus gularis*		B		x		x
799		Rufous-headed Parrotbill	*Psittiparus bakeri*		B				x
800		Spot-Breasted Parrotbill	*Paradoxornis guttaicollis*		B		x		x
801		Pale-billed Parrotbill	*Chleuasicus atrosuperciliaris*		B				x
802		Brown-winged Parrotbill	*Suthora brunneus*		B				x
803		Fulvous Parrotbill	*Suthora fulbifroms*		B				x
804		Black-throated Parrotbill	*Suthora nipalensis*		B			x	
805		Jerdon's Babbler	*Chrysomma altirostre*	VU	B	x			
806		Yellow-eyed Babbler	*Chrysomma sinense*		B	x	x	x	x
807		Goldern-breasted Fulvetta	*Lioparus chrysotis*		B			x	x
808		White-browed Fulvetta	*Fulvetta vinipectus*		B				x
809		Ludlow's Fulvetta	*Fulvetta ludlowi*		B				x
810		Streak-throated Fulvetta	*Fulvetta manipurensis*		B			x	x
811		Chestnut-flanked White-Eye	*Zosterops erythropleurus*		M				x
812		Oriental White-Eye	*Zosterops palpebrosus*		B	x	x	x	x
813		Japanese White-Eye	*Zosterops japonicus*		B				x
814		Black-chinned Yuhina	*Yuhina nigrimenta*		B			x	x
815		Stripe-throated Yuhina	*Yuhina gularis*		B		x		
816		Rufous-vented Yuhina	*Yuhina occipitalis*		B				x
817		White-naped Yuhina	*Yuhina bakeri*		B				x

No	Family name	Common new name	*Scientific name*	RL	Status*	Delta	Middle Basin	Chindwin	Upper Basin
818		Whiskered Yuhina	*Yuhina flavicollis*		B		x		x
819		Burmese Yuhina	*Yuhina humilis*		B		x		
820		Striated Yuhina	*Staphida castaniceps*		B				x
821		White-bellied Yuhina	*Yuhina zantholeuca*		B		x		x
822		Grey-cheeked Fulvetta	*Alcippe fratercula*		B		x		x
823		Nepal Fulvetta	*Alcippe nipalensis*		B		x		x
824		Brown-cheeked Fulvetta	*Alcippe poioicephala*		B	x	x	x	x
825		Rufous-throated Fulvetta	*Schoeniparus rufogularis*		B		x	x	x
826		Rusty-capped Fulvetta	*Schoeniparus dubius*		B		x	x	x
827		Snowy-throated Babbler	*Stachyris oglei*	VU	B				x
828		Grey-throated Babbler	*Stachyris nigriceps*		B		x	x	x
829		Sickle-billed Scimiter-Babbler	*Xiphirhynchus superciliaris*		B		x	x	x
830		Large Scimiter-Babbler	*Pomatorhinus hypoleucos*		B		x		x
831		Rusty-cheeked Scimitar-Babbler	*Pomatorhinus erythrogenys*		B		x		
832		Spot-breasted Scimitar-Babbler	*Pomatorhinus mcclellandi*		B		x		x
833		Black-streaked Scimitar-Babbler	*Pomatorhinus gravivox*		B		x		
834		White-browed Scimitar-Babbler	*Pomatorhinus schisticeps*		B		x	x	x
835		Streak-breasted Scimitar-Babbler	*Pomatorhinus ruficollis*		B				x
836		Orange-billed Scimitar-Babbler	*Pomatorhinus ochraceiceps*		B		x	x	x
837		Coral-billed Scimitar-Babbler	*Pomatorhinus ferruginosus*		B				x
838		Chevron-breasted Babbler	*Sphenocichla roberti*		B		x	x	x
839		Bar-winged Wren-Babbler	*Spelaeornis troglodytoides*		B				x
840		Grey-bellied Wren-Babbler	*Spelaeornis reptatus*		B				x
841		Chin Hills Wren-Babbler	*Spelaeornis oatesi*		B		x		
842		Long- tailed Wren-Babbler	*Spelaeornis chocolatinus*		B				x
843		Spotted Wren-Babbler	*Elachura formosa*		B		x		x
844		Scaly-breasted Wren-Babbler	*Pnoepyga albiventer*		B				x
845		Pygmy Wren-Babbler	*Pnoepyga pusilla*		B		x		x
846		Golden Babbler	*Stachyridopsis chrysaea*		B		x	x	x
847		Rufous-capped Babbler	*Stachyridopsis ruficeps*		B				x
848		Rufous-fronted Babbler	*Sachyridopsis rufifrons*		B	x	x		x
849		Pin-Striped Tit-Babbler	*Macronus gularis*		B	x	x	x	x
850		Chestnut-capped Babbler	*Timalia pileata*		B	x	x	x	x

No	Family name	Common new name	*Scientific name*	RL	Status*	Delta	Middle Basin	Chindwin	Upper Basin
851		Rufous-rumped Grass-Babbler	*Graminicola bengalensis*		B		x	x	
852		Buff-breasted Babbler	*Trichastoma ticklli*		B		x		x
853		Puff-throated Babbler	*Pellorneum ruficeps*		B		x		x
854		Spot-throated Babbler	*Pellorneum albiventre*		B				x
855		Abbott's Babbler	*Malacocincla abbotti*		B	x			
856		Streaked Wren-Babbler	*Napothera brevicaudata*		B		x	x	
857		Eyebrowed Wren-Babbler	*Napothera epilepidota*		B				x
858		Long-billed Wren-Babbler	*Rimator malacoptilus*		B				x
859		Naung Mung Wren-Babbler	*Rimator naungmungensis*	VU	B				x
860		White-hooded Babbler	*Gampsorhynchus rufulus*		B		x	x	x
861		Yellow-throated Fulvetta	*Pseudominla cinerea*		B				x
862		Rufous-winged Fulvetta	*Pseudominla castaneceps*		B		x		x
863		White-throated Babbler	*Chatarrhaea gularis*		B		x	x	
864		Striated Babbler	*Argya earlei*		B		x		
865		Himalayan Cutia	*Cutia nipalensis*		B		x		x
866		Grey-sided Laughingthrush	*Dryonastes caerulatus*		B				x
867		Black-throated Laughingthrush	*Dryonastes chinensis*		B		x		
868		Chestnut-backed Laughingthrush	*Dryonastes nuchalis*		B				x
869		Rufous-vented Laughingthrush	*Dryonastes gularis*		B		x		x
870		Yellow-throated Laughingthrush	*Dryonastes galbanus*		B			x	
871		Rufous-necked Laughingthrush	*Dryonastes ruficollis*		B		x	x	x
872		White-crested Laughingthrush	*Garrulax leucolophus*		B	x	x	x	x
873		Lesser Necklaced Laughingthrush	*Garrulax monileger*		B		x	x	x
874		Greater Necklaced Laughingthrush	*Garrulax pectoralis*		B		x	x	x
875		Chinese Babax	*Garrulax lanceolatus*		B				x
876		Mt Victoria Babax	*Garrulax woodi*		B		x		
877		Striated Laughingthrush	*Grammatoptila striata*		B				x
878		Spot-breasted Laughingthrush	*Garrulax merulinus*		B				x
879		Striped Laughingthrush	*Strophocincla virgata*		B		x	x	
880		White-browed Laughingthrush	*Pterorhinus sannio*		B		x		x
881		Rufous-chinned Laughingthrush	*Ianthocincla rufogularis*		B		x		
882		Spotted Laughingthrush	*Ianthocincla ocellata*		B				x
883		Scaly Laughingthrush	*Trochalopteron subunicolor*		B				x

No	Family name	Common new name	*Scientific name*	RL	Status*	Delta	Middle Basin	Chindwin	Upper Basin
884		Brown-capped Laughingthrush	*Trochalopteron austeni*		B		x		
885		Blue-winged Laughingthrush	*Trochalopteron squanmatum*		B		x	x	x
886		Black-faced Laughingthrush	*Trochalopteron affine*		B				x
887		Assam Laughingthrush	*Trochalopteron chrysopterum*		B		x		x
888		Silver-eared Laughingthrush	*Trochalopteron melanostigma*		B		x		
889		Red-tailed Laughingthrush	*Trochalopteron milnei*		B		x		x
890		Crimson-faced Liocichla	*Liocichla phoenicea*		B		x		x
891		Scarlet-faced Liocichla	*Liocichla ripponi*		B		x		
892		Bar-throated Minla	*Chrysominla strigula*		B		x		x
893		Red-tailed Minla	*Minla ignotincta*		B		x		x
894		Blue-winged Siva	*Siva cyanouroptera*		B		x	x	x
895		Silver-eared Mesia	*Mesia argentauris*		B		x		x
896		Red-billed Leiothrix	*Leiothrix lutea*		B				x
897		Long-tailed Sibia	*Heteropasis picaoides*		B		x	x	x
898		Grey Sibia	*Malacias gracilis*		B		x	x	x
899		Black-headed Sibia	*Malacias desgodinsi*		B				x
900		Dark-backed Sibia	*Malacias melanoleucus*		B		x		
901		Beautiful Sibia	*Malacias pulchellus*		B			x	x
902		Rufous-backed Sibia	*Leioptila annectens*		B		x		x
903		Streak-throated Barwing	*Actinodura waldeni*		B		x		x
904		Rusty-fronted Barwing	*Actinodura egertoni*		B		x		x
905		Spectacled Barwing	*Actinodura ramsayi*		B		x		
906	**GENUS INCERTAE SEDIS: Fire-tailed Myzornis**	Fire-tailed Myzornis	*Myzornis pyrrhoura*		B				x

ANNEX 2.1 –AYEYARWADY BASIN WATER BIRD SPECIES LIST

(RL: CR=critically endangered, EN: endangered, VU=vulnerable, NT= near-threatened ;)

No	Family	Name	*Scientific name*	RL
1	ANATIDAE: Waterfowl	Fulvous Whistling-Duck	*Dendrocygna bicolor*	
2		Lesser Whistling-Duck	*Dendrocygna javanica*	
3		Taiga Bean-Goose	*Anser fabalis*	
4		Greylag Goose	*Anser anser*	
5		Greater White-fronted Goose	*Anser albifrons*	
6		Lesser White-fronted Goose	*Anser erythropus*	VU
7		Bar-headed Goose	*Anser indicus*	
8		Comb Duck	*Sarkidiornis melanotos*	
9		Common Shelduck	*Tadorna tadorna*	
10		Ruddy Shelduck	*Tadorna ferruginea*	
11		White-winged Duck	*Asarcornis scutulata*	EN
12		Cotton Pygmy-Goose	*Nettapus coromandelianus*	
13		Mandarin Duck	*Aix galericulata*	
14		Gadwall	*Anas strepera*	
15		Falcated Duck	*Anas falcata*	NT
16		Eurasian Wigeon	*Anas penelope*	
17		Mallard	*Anas platyrhynchos*	
18		Indian Spot-billed Duck	*Anas poecilorhyncha*	
19		Chinese Spot-billed Duck	*Anas zonorhyncha*	
20		Northern Shoveler	*Anas clypeata*	
21		Northern Pintail	*Anas acuta*	
22		Garganey	*Anas querquedula*	
23		Baikal Teal	*Anas formosa*	
24	`	Eurasian Teal	*Anas crecca*	
25		Pink-headed Duck	*Rhodonessa caryophyllacea*	CR
26		Red-crested Pochard	*Netta rufina*	
27		Common Pochard	*Aythya ferina*	NT
28		Baer's Pochard	*Aythya baeri*	CR
29		Ferruginous Pochard	*Aythya nyroca*	NT
30		Tufted Duck	*Aythya fuligula*	
31		Greater Scaup	*Aythya marila*	
32		Common Goldeneye	*Bucephala clangula*	
33		Smew	*Mergellus albellus*	
34		Common Merganser	*Mergus merganser*	
35		Red-breasted Merganser	*Mergus serrator*	
36	GAVIIDAE: Loosns	Yellow-Billed Loon	*Ganvia adamsii*	NT
37	PODICIPEDIDAE	Little Grebe	*Tachybaptus ruficollis*	
38		Great Crested Grebe	*Podiceps cristatus*	
39		Horned Grebe	*Podiceps auritus*	
40		Black-necked Grebe	*Podiceps nigricollis*	
41	THRESKIORNITHIDAE: Storks and Ibisses	Painted Stork	*Mycteria leucocephala*	NT
42		Asian Openbill	*Anastomus oscitans*	
43		Black Stork	*Ciconia nigra*	
44		Woolly-necked Stork	*Ciconia episcopus*	VU
45		Black-necked Stork	*Ephippiorhynchus asiaticus*	NT
46		Lesser Adjutant	*Leptoptilos javanicus*	VU
47		Greater Adjutant	*Leptoptios dubius*	EN

No	Family	Name	*Scientific name*	RL
48		Black-headed Ibis	*Threskiornis melanocephalus*	NT
49		Red-naped Ibis	*Pseudibis papillosa*	
50		Glossy Ibis	*Plegadis falcinellus*	
51		Eurasian Spoonbill	*Platalea leucorodia*	
52	ARDEIDAE: Herons and Egrets	Great Bittern	*Botaurus stellaris*	
53		Yellow Bittern	*Ixobrychus sinesis*	
54		Cinnamon Bittern	*Ixobrychus cinnamomeus*	
55		Black Bittern	*Ixobrychus flavicollis*	
56		Black-crowned Night-Heron	*Nycticorax nycticorax*	
57		Little Heron	*Butorides striata*	
58		Indian Pond-Heron	*Ardeola grayii*	
59		Chinese Pond-Heron	*Ardeola bacchus*	
60		Eastern Cattle Egret	*Bubulcus coromandus*	
61		Grey Heron	*Ardea cinerea*	
62		White-bellied Heron	*Ardea insignis*	CR
63		Great-billed Heron	*Ardea sumatrana*	
64		Goliath Heron	*Ardea goliath*	
65		Purple Heron	*Ardea purpurea*	
66		Great Egret	*Ardea alba*	
67		Intermediate Egret	*Mesophoyx intermedia*	
68		Little Egret	*Egretta garzetta*	
69		Pacific Reef-Egret	*Egretta sacra*	
70		Great White Pelican	*Pelecanus onocrotalus*	
71	PELECANIDAE: Pelicans	Spot-billed Pelican	*Pelecanus philippensis*	NT
72	PHALACROCORACIDAE: Cormorants	Little Cormorant	*Phalacrocorax niger*	
73		Indian Cormorant	*Phalacrorax fuscicollis*	
74		Great Cormorant	*Phalacrorax carbo*	
75		Oriental Dater	*Anhinga melanogaster*	NT
76	**RALLIDAE: Rails**	Red-legged Crake	*Rallina fasciata*	
77		Slaty- legged Crake	*Rallina eurizonoides*	
78		Slaty-breasted Rail	*Gallirallus striatus*	
79		Eastern Water Rail	*Rallus indicus*	
80		White-breasted Waterhen	*Amaurornis phoenicurus*	
81		Brown Crake	*Porzana akool*	
82		Black-tailed Crake	*Porzana bicolor*	
83		Baillon's Crake	*Porzana pusilla*	
84		Spotted Crake	*Porzana porzana*	
85		Ruddy-breasted Crake	*Porzana fusca*	
86		White-browed Crake	*Porzana cinerea*	
87		Watercock	*Gallicrex cinerea*	
88		Grey-headed Swamphen	*Porphyrio poliocephalus*	
89		Common Moorhen	*Gallinula chloropus*	
90		Common Coot	*Fulica atra*	
91	**HELIORNITHIDAE: Finfoots**	Masked Finfoot	*Heliopais personata*	EN
92	**GRUIDAE: Cranes**	Demoiselle Crane	*Grus virgo*	
93		Sarus Crane	*Grus antigone*	VU
94		Common Crane	*Grus grus*	
95		Small Buttonquail	*Turnix sylvaticus*	
96	**TURNICIDAE: Buttonquails**	Yellow-legged Buttonquail	*Turnix tanki*	
97		Barred Buttonquail	*Turnix suscitator*	
98	**Charadriiformes: Waders/Shorebirds**	Indian Thick-Knee	*Burhinus indicus*	
99		Great Thick-Knee	*Esacus recurvirostris*	NT

No	Family	Name	*Scientific name*	RL
100		Beach Thick-Knee	*Esacus neglectus*	NT
101		Black-winged Stilt	*Himantopus himantopus*	
102		Pied Avocet	*Recurvirostra avosetta*	
103		Eurasian Oystercatcher	*Haematopus ostralegus*	
104		Crab-Plover	*Dromas ardeola*	
105		Ibisbill	*Ibidorhyncha struthersii*	
106		Northern Lapwing	*Vanellus vanellus*	
107		River lapwing	*Vanellus duvaucelii*	NT
108		Yellow-wattled Lapwing	*Vanellus malabaricus*	
109		Grey-headed Lapwing	*Vanellus cinereus*	
110		Red-wattled Lapwing	*Vanellus indicus*	
111		Pacific Golden Plover	*Pluvialis fulva*	
112		Grey Plover	*Pluvialis squatarola*	
113		Common Ringed Plover	*Charadrius hiaticula*	
114		Long-billed Plover	*Charadrius placidus*	
115		Little Ringed Plover	*Charadrius dubius*	
116		Kentish Plover	*Charadrius alexandrinus*	
117		Lesser Sand-Plover	*Charadrius mongolus*	
118		Greater Sand-Plover	*Charadrius leschenaultii*	
119		Pheasant-tailed Jacana	*Hydrophasianus chirurgus*	
120		Bronze-winged Jacana	*Metopidicus indicus*	
121		Greater Painted-Snipe	*Rostratula benghalensis*	
122		Eurasian Woodcock	*Scolopax rusticola*	
123		Jack Snipe	*Lymnocryptes minmus*	
124		Solitary Snipe	*Gallinago solitaria*	
125		Wood Snipe	*Gallinago nemoricola*	VU
126		Pintail Snipe	*Gallinago stenura*	
127		Swinhoe's Snipe	*Gallinago megala*	
128		Great Snipe	*Gallinago media*	
129		Common Snipe	*Gallinago gallinago*	
130		Black-tailed Godwits	*Limosa limosa*	NT
131		Bar-tailed Godwit	*Limosa lapponica*	NT
132		Asian Dowitcher	*Limnodromus semipalmatus*	NT
133		Whimbrel	*Numenius phaeopus*	
134		Eurasian Curlew	*Numenius arquata*	NT
135		Little Curlew	*Numenius minimus*	

No	Family	Name	*Scientific name*	RL
136		Terek Sandpiper	*Xenus cinereus*	
137		Common Sandpiper	*Actitis hypoleucos*	
138		Green Sandpiper	*Tringa ochropus*	
139		Spotted Redshank	*Tringa erythropus*	
140		Common Greenshank	*Tringa nebularia*	
141		Nordmann's Greenshank	*Tringa guttifer*	EN
142		Marsh Sandpiper	*Tringa stagnatilis*	
143		Wood Sandpiper	*Tringa glareola*	
144		Common Redshank	*Tringa totanus*	
145		Great Knot	*Calidris tenuirostris*	EN
146		Red Knot	*Calidris canutus*	NT
147		Sanderling	*Calidris alba*	
148		Spoon-billed Sandpiper	*Calidris pygmeus*	CR
149		Little Stint	*Calidris minuta*	
150		Red-necked Stint	*Calidris ruficollis*	NT
151		Temminck's Stint	*Calidris temminckii*	
152		Long-toed Stint	*Calidris subminuta*	
153		Dunlin	*Calidris alpina*	
154		Curlew Sandpiper	*Calidris ferruginea*	NT
155		Broad-billed Sandpiper	*Limicola falcinellus*	
156		Ruff	*Philomachus pugnax*	
157		Ruddy Turnstone	*Arenaria interpres*	
158		Oriental Pratincole	*Glareola maldivarum*	
159		Small Pratincole	*Glareola lactea*	
160	**RYNCHOPIDAE: Skimmers**	Indian Skimmer	*Rynchops albicollis*	EN
161	**STERNIDAE_Laridae: Gulls and terns**	Sooty Tern	*Onychoprion fuscatus*	
162		Little Tern	*Sternula albifroms*	
163		Gull-billed Tern	*Gelochelidon nilotica*	
164		Caspian Tern	*Hydroprohgne caspia*	
165		White-winged Tern	*Chlidonias leucopterus*	

No	Family	Name	*Scientific name*	RL
166		Whiskered Tern	*Chlidonias hybrida*	
167		River Tern	*Sterna aurantia*	NT
168		Common Tern	*Sterna hirundo*	
169		Black-bellied Tern	*Sterna acuticauda*	EN
170		Lesser Crested Tern	*Thalasseus bengalensis*	
171		Great Crested Tern	*Thalasseus bergii*	
172		Heuglin's Gull	*Larus heuglini*	
173		Pallas's Gull	*Larus ichthyaetus*	
174		Brown-headed Gull	*Chroicocephalus brunnicephalus*	
175		Black-headed Gull	*Chroicocephalus ridibundus*	
176		Slender-billed Gull	*Chroicocephalus genei*	

ANNEX 3 –AYEYARWADY BASIN REPTILE SPECIES LIST

(according to incomplete range maps by IUCN)

1	Acanthosaura lepidogaster
2	Acrochordus granulatus
3	Ahaetulla fronticincta
4	Ahaetulla prasina
5	Astrotia stokesii
6	Atretium yunnanensis
7	Bitia hydroides
8	Blythia reticulata
9	Boiga walli
10	Bungarus fasciatus
11	Bungarus magnimaculatus
12	Bungarus multicinctus
13	Bungarus wanghaotingi
14	Calamaria pavimentata
15	Calliophis maculiceps
16	Calotes chincollium
17	Caretta caretta
18	Cerberus rynchops
19	Crocodylus palustris
20	Crocodylus porosus
21	Cryptelytrops albolabris
22	Cryptelytrops erythrurus
23	Cuora mouhotii
24	Cyclophiops hamptoni
25	Cylindrophis ruffus
26	Cyrtodactylus annandalei
27	Cyrtodactylus ayeyarwadyensis
28	Cyrtodactylus brevidactylus
29	Cyrtodactylus chrysopylos
30	Cyrtodactylus wakeorum
31	Dendrelaphis gorei
32	Dendrelaphis subocularis
33	Dendrelaphis walli
34	Dermochelys coriacea
35	Draco maculatus
36	Enhydrina schistosa
37	Enhydris enhydris
38	Enhydris maculosa
39	Enhydris plumbea
40	Enhydris vorisi

41	Eretmochelys imbricata
42	Euprepiophis mandarinus
43	Eutropis carinata
44	Eutropis novemcarinata
45	Fordonia leucobalia
46	Gavialis gangeticus
47	Gekko smithii
48	Gerarda prevostiana
49	Gonyosoma oxycephalum
50	Hebius bitaeniatum
51	Hebius craspedogaster
52	Hebius modestum
53	Hebius octolineatum
54	Hebius taronensis
55	Hebius venningi
56	Hemidactylus frenatus
57	Herpetoreas sieboldii
58	Homalopsis buccata
59	Hydrophis cantoris
60	Hydrophis cyanocinctus
61	Hydrophis fasciatus
62	Hydrophis gracilis
63	Hydrophis lapemoides
64	Hydrophis nigrocinctus
65	Hydrophis ornatus
66	Hydrophis spiralis
67	Japalura flaviceps
68	Kerilia jerdoni
69	Lapemis curtus
70	Laticauda colubrina
71	Laticauda laticaudata
72	Lepidochelys olivacea
73	Liopeltis frenatus
74	Liopeltis stolickzae
75	Lycodon capucinus
76	Lycodon gongshan
77	Lycodon kundui
78	Lycodon laoensis
79	Lycodon subcinctus
80	Lycodon zawi

81	Lygosoma anguinum
82	Maculophis bella
83	Naja kaouthia
84	Naja mandalayensis
85	Oligodon chinensis
86	Oligodon cinereus
87	Oligodon cruentatus
88	Oligodon cyclurus
89	Oligodon fasciolatus
90	Oligodon hamptoni
91	Oligodon planiceps
92	Oligodon splendidus
93	Oligodon theobaldi
94	Oligodon torquatus
95	Ophiophagus hannah
96	Ovophis monticola
97	Pareas hamptoni
98	Pareas margaritophorus
99	Pareas nigriceps
100	Pelamis platura
101	Phrynocephalus theobaldi
102	Plagiopholis blakewayi
103	Plagiopholis nuchalis
104	Protobothrops jerdonii
105	Protobothrops kaulbacki
106	Protobothrops mucrosquamatus
107	Protobothrops xiangchengensis
108	Psammophis condanarus
109	Psammophis indochinensis
110	Pseudoxenodon macrops
111	Ptychozoon lionotum
112	Python bivittatus
113	Ramphotyphlops albiceps
114	Rhabdophis leonardi
115	Rhabdophis nigrocinctus
116	Rhabdophis nuchalis
117	Rhabdophis subminiatus
118	Rhadinophis prasina
119	Scincella punctatolineata
120	Sibynophis bistrigatus
121	Sibynophis collaris
122	Sinonatrix percarinata
123	Sinonatrix yunnanensis
124	Takydromus sexlineatus
125	Thalassophina viperina
126	Typhlops bothriorhynchus
127	Typhlops diardii
128	Typhlops tenuicollis
129	Varanus bengalensis
130	Varanus salvator
131	Xenochrophis bellula
132	Xenochrophis flavipunctatus
133	Xenochrophis punctulatus
134	Xenopeltis unicolor

ANNEX 4 –AYEYARWADY BASIN AMPHIBIANS SPECIES LIST

(according to incomplete range maps by IUCN)

1	Amolops bellulus
2	Amolops formosus
3	Amolops gerbillus
4	Amolops kaulbacki
5	Amolops longimanus
6	Amolops marmoratus
7	Amolops monticola
8	Amolops viridimaculatus
9	Babina pleuraden
10	Brachytarsophrys carinense
11	Brachytarsophrys feae
12	Bufo andrewsi
13	Bufo pageoti
14	Chiromantis doriae
15	Chiromantis nongkhorensis
16	Duttaphrynus himalayanus
17	Duttaphrynus melanostictus
18	Duttaphrynus stuarti
19	Euphlyctis cyanophlyctis
20	Feihyla vittata
21	Fejervarya limnocharis
22	Fejervarya nepalensis
23	Fejervarya teraiensis
24	Glyphoglossus guttulatus
25	Glyphoglossus molossus
26	Gracixalus carinensis
27	Hoplobatrachus crassus
28	Hoplobatrachus rugulosus
29	Hoplobatrachus tigerinus
30	Humerana humeralis
31	Humerana oatesii
32	Hydrophylax leptoglossa
33	Hyla annectans
34	Hylarana erythraea
35	Hylarana lateralis
36	Hylarana macrodactyla
37	Hylarana margariana
38	Hylarana taipehensis
39	Hylarana tytleri
40	Ichthyophis bannanicus
41	Ingerophrynus macrotis
42	Kalophrynus interlineatus
43	Kaloula pulchra
44	Kaloula verrucosa
45	Kurixalus bisacculus
46	Kurixalus verrucosus
47	Leptobrachium chapaense
48	Leptobrachium huashen
49	Leptobrachium rakhinensis
50	Limnonectes doriae
51	Limnonectes hascheanus
52	Limnonectes kuhlii
53	Limnonectes laticeps
54	Limnonectes limborgi
55	Megophrys boettgeri
56	Megophrys glandulosa
57	Megophrys major
58	Megophrys minor
59	Megophrys parva
60	Megophrys wuliangshanensis
61	Megophrys zunhebotoensis
62	Microhyla berdmorei
63	Microhyla butleri
64	Microhyla fissipes
65	Microhyla heymonsi
66	Microhyla ornata
67	Nanorana arnoldi
68	Nanorana feae
69	Nanorana yunnanensis
70	Occidozyga lima
71	Occidozyga martensii
72	Odorrana andersonii
73	Odorrana chloronota
74	Odorrana grahami
75	Odorrana mawphlangensis
76	Philautus tytthus
77	Polypedates leucomystax
78	Polypedates mutus
79	Pterorana khare
80	Rana chaochiaoensis
81	Rana shuchinae
82	Raorchestes longchuanensis
83	Raorchestes parvulus
84	Rhacophorus bipunctatus
85	Rhacophorus dugritei
86	Rhacophorus gongshanensis
87	Rhacophorus kio
88	Rhacophorus maximus
89	Rhacophorus nigropunctatus
90	Rhacophorus rhodopus
91	Rhacophorus taronensis
92	Rhacophorus turpes
93	Scutiger adungensis
94	Scutiger gongshanensis
95	Scutiger mammatus
96	Sphaerotheca breviceps
97	Sylvirana cubitalis
98	Sylvirana nigrovittata
99	Theloderma andersoni
100	Theloderma asperum
101	Tylototriton shanjing
102	Tylototriton verrucosus

ANNEX 5 –AYEYARWADY BASIN FISH SPECIES LIST

(according to Maurice Kottelat 2017)

Annex 5: Fishes of the Ayeyarwady basin, including in India and China. Explanations: **Endemism: Myanmar,** species endemic to Myanmar; **Endemism: Ayeyarwady,** species endemic to Ayeyarwady basin, including India and China.

			Endemism			Ayeyarwady endemics			Distribution in Ayeyarwady sub-basins					Habitats							
	present in Myanmar		Myanmar	Ayeyarwady		present only in India	present only in China		Upper	Chindwin	Middle	Lower		headwater, streams	fast rivers	slow river	flood plain	lakes	swamps	tidal	mangrove
	310		29	193		49	30		105	155	177	157		149	102	117	108	63	44	126	39
Order Carcharhiniformes Family Carcharhinidae																					
Glyphis glyphis	x											x								x	x
Order Pristiformes Family Pristidae																					
Pristis pristis	x											x								x	x
Order Myliobatiformes Family Dasyatididae																					
Makararaja chindwinensis	x			x						x	x					x	x				
Order Osteoglossiformes Family Notopteridae																					
Notopterus notopterus	x									x	x	x				x	x	x	x		
Order Elopiformes																					

			Endemism			Ayeyarwady endemics			Distribution in Ayeyarwady sub-basins					Habitats							
	present in Myanmar		Myanmar	Ayeyarwady		present only in India	present only in China		Upper	Chindwin	Middle	Lower		headwater, streams	fast rivers	slow river	flood plain	lakes	swamps	tidal	mangrove
Family Megalopidae																					
Megalops cyprinoides	x											x								x	x
Order Anguilliformes Family Anguillidae																					
Anguilla bengalensis	x								x	x	x	x		x	x	x	x	x	x	x	
Anguilla bicolor	x								?	?	?	?		x	x	x	x	x	x	x	
Family Muraenidae																					
Gymnothorax tile	x											x								x	
Family Moringuidae																					
Moringua raitaborua	x											x								x	x
Order Clupeiformes Family Pristigasteridae																					
Ilisha megaloptera	x											x								x	
Ilisha novacula	x			x								x								x	
Pellona ditchela	x											x								x	
Family Engraulididae																					
Coilia dussumieri	x											x								x	
Coilia reynaldi	x											x								x	
Setipinna tenuifilis	x											x					?			x	
Setipinna wheeleri	x		x								x	x					?			x	
Family Clupeidae																					
Corica soborna	x											x					x			x	
Gudusia variegata	x			x						x	x	x				x	x	x		x	

			Endemism			Ayeyarwady endemics			Distribution in Ayeyarwady sub-basins					Habitats							
	present in Myanmar		Myanmar	Ayeyarwady		present only in India	present only in China		Upper	Chindwin	Middle	Lower		headwater, streams	fast rivers	slow river	flood plain	lakes	swamps	tidal	mangrove
Hilsa kelee	x											x								x	
Tenualosa ilisha	x									x	x	x				x	x			x	
Order Cypriniformes Family Cyprinidae																					
Amblypharyngodon atkinsonii	x		x							x	x	x				x	x	x	x	x	
Bangana devdevi	x								x	x	x				x	x	x	x			
Bengala elanga	x										x	?					x				
Brachydanio kyathit	x			x							x			x							
Brachydanio quagga	x			x						x				x							
Brachydanio tinwini	x			x							x			x							
Cabdio morar	x								x	x	x	?				x	x				
Cabdio ukhrulensis				x		x				x											
Celestichthys choprae	x			x							x			x							
Celestichthys flagrans	x			x					x					x							
Celestichthys htamanthinus	x			x						x											
Chagunius nicholsi	x			x						x	x				x	x	x				
Cirrhinus cirrhosus	x										x	x				x	x	x		x	
Danionella dracula	x			x							x			x							
Danionella mirifica	x			x							x			x							
Devario acuticephalus				x		x				x				x							
Devario apogon				x			x		x					x							

			Endemism			Ayeyarwady endemics			Distribution in Ayeyarwady sub-basins					Habitats							
	present in Myanmar		Myanmar	Ayeyarwady		present only in India	present only in China		Upper	Chindwin	Middle	Lower		headwater, streams	fast rivers	slow river	flood plain	lakes	swamps	tidal	mangrove
Devario deruptotalea				x		x				x				x							
Devario fangae	x			x					x					x	x						
Devario interruptus				x			x		x					x							
Devario kakhienensis	x			x					x					x							
Devario manipurensis				x		x				x				x							
Devario myitkyinae	x			x							x			x							
Devario naganensis				x		x				x				x							
Devario strigillifer	x			x							x			x							
Devario yuensis				x		x				x				x							
Esomus altus	x		x							x	x	x					x			x	
Esomus caudiocellatus	x			x							x			x							
Esomus danrica	x									x	x	x				x	x	x	x		
Garra abhoyai				x		x				x					x						
Garra bispinosa				x			x		x						x						
Garra chakpiensis				x		x				x				x	x						
Garra compressa				x		x				x					x						
Garra cornigera				x		x				x					x						
Garra dulongensis	x			x					x						x						
Garra elongata				x		x				x					x						
Garra gravelyi	x		x							x					x						
Garra litanensis				x		x				x					x						
Garra longchuanensis				x			x		x						x						
Garra nambulica				x		x				x					x						

			Endemism			Ayeyarwady endemics			Distribution in Ayeyarwady sub-basins					Habitats							
	present in Myanmar		Myanmar	Ayeyarwady		present only in India	present only in China		Upper	Chindwin	Middle	Lower		headwater, streams	fast rivers	slow river	flood plain	lakes	swamps	tidal	mangrove
Garra namyaensis				x		x				x					x						
Garra paralissorhynchus				x		x				x				x	x						
Garra poecilura	x			x								x		x	x						
Garra qiaojiensis	x			x					x						x						
Garra rotundinasus				x			x		x						x						
Garra salweenica	x								x		x				x						
Garra spilota	x			x								x		x	x						
Garra tengchongensis				x			x		x						x						
Garra trilobata				x		x				x					x						
Garra ukhrulensis				x		x				x					x						
Gibelion catla	x									x	x	x					x	x		x	
Gymnodiptychus integrigymnatus				x			x		x						x						
Gymnostomus inornatus	x			x							x					x	x				
Hypsibarbus myitkyinae	x			x						x	x				x	x			x		
Hypsibarbus oatesii	x		x								x				x	x			x		
Inlecypris shanensis	x			x							x			x							
Labeo angra	x								x	x	x	x				x	x	x		x	
Labeo boga	x								x	x	x					x	x	x			
Labeo curchius	x											x					x			x	
Labeo dyocheilus	x								x	x	x										
Labeo gonius	x								x	x	x	x				x	x			x	
Labeo stolizkae	x		x								x	x					x			x	

			Endemism			Ayeyarwady endemics			Distribution in Ayeyarwady sub-basins					Habitats							
	present in Myanmar		Myanmar	Ayeyarwady		present only in India	present only in China		Upper	Chindwin	Middle	Lower		headwater, streams	fast rivers	slow river	flood plain	lakes	swamps	tidal	mangrove
Laubuka fulvescens	x									x	x	?				x	x	x	x		
Microdevario gatesi	x			x								x					x				
Microdevario microphthalmus				x			x		x					x							
Morulius calbasu	x									x	x	x				x	x			x	
Morulius nandina	x									x	x	x				x	x			x	
Neolissochilus baoshanensis							x		x					x	x						
Neolissochilus compressus	x			x					x		x			x	x						
Neolissochilus heterostomus	x			x					x						x						
Neolissochilus hexastichus (?)	x														x						
Neolissochilus qiaojiensis	x			x					x						x						
Opsarius barnoides	x								x	x	x			x	x	x					
Opsarius dogarsinghi				x		x				x				x	x						
Oreichthys cosuatis	x									x	x			x					x		
Oreinus chivae				x		x				x					x						
Oreinus dulongensis				x			x		x						x						
Oreinus elongatus				x			x		x						x						
Oreinus malacathus				x			x		x						x						
Oreinus meridionalis	x			x					x						x						
Oreinus myzostomus				x			x		x						x						

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Oreinus oligolepis				x			x		x						x						
Oreinus rotundimaxillaris				x			x		x						x						
Osteobrama belangeri	x								x	x	x				x	x	x	x		x	
Osteobrama cunma	x		x							x	x					x	x	x		x	
Osteobrama feae	x								x	x	x					x	x				
Osteochilus rostellatus	x			x						x	x	x				x	x	x		x	
Pethia atra				x		x				x				x							
Pethia didi	x			x							x			x				x	x		
Pethia erythromycter	x			x							x			x				x	x		
Pethia khugae				x		x				x				x							
Pethia macrogramma	x			x							x					x	x				
Pethia manipurensis				x		x				x				x							
Pethia meingangbii				x		x				x				x							
Pethia nankyweensis	x			x							x					x	x				
Pethia ornata				x		x				x	x			x							
Pethia padamya	x			x						x	x			x		x					
Pethia thelys	x			x					x		x			x		x	x	x			
Pethia tiantian	x			x					x					x							
Pethia yuensis				x		x				x				x							
Poropuntius burtoni	x			x					x	x	x			x	x	x					
Poropuntius margarianus	x			x					x		x				x	x					
Poropuntius shanensis	x			x							x					x					
Puntius chola	x								x	x	x	x				x	x	x	x	x	

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Puntius pugio	x		x								x	x				x	x				
Puntius sophore	x									x	x	x				x	x	x	x	x	
Raiamas bola	x									?	?	?									
Raiamas guttatus	x								x	x	x	?		x	x	x	x	x			
Rasbora daniconius	x									x	x	x		x		x	x	x	x		
Rasbora ornata	x			x						x	x			x							
Rasbora rasbora	x									x	x	x		x		x	x	x	x		
Rohita rohita	x									x	x	x				x	x	x	x	x	
Salmostoma sardinella	x									?	x	x				x	x	x		x	
Salmostoma sladoni	x			x						x	x	x				x	x			x	
Schizothorax heteri				x			x		x						x						
Schizothorax leukus				x			x		x						x						
Schizothorax yunnanensis				x			x		x						x						
Semiplotus cirrhosus	x			x					x	x					x						
Systomus sewelli	x			x					x	x	x	?				x	x	x	x		
Tariqilabeo burmanicus	x								x	x	x			x	x	x					
Tor putitora (?)	x								x	x	x			x	x	x					
Tor yingjiangensis	x			x					x						x						
Family Psilorhynchidae																					
Psilorhynchus brachyrhynchus	x			x					x					x	x						
Psilorhynchus breviminor	x			x							x			x	x						
Psilorhynchus chakpiensis				x		x				x				x	x						

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Psilorhynchus gokkyi	x			x							x			x							
Psilorhynchus konemi				x		x				x				x							
Psilorhynchus maculatus				x		x				x				x							
Psilorhynchus microphthalmus				x		x				x				x							
Psilorhynchus ngathanu				x		x				x				x							
Psilorhynchus olliei	x			x							x			x							
Psilorhynchus piperatus	x			x							x			x							
Psilorhynchus rowleyi	x			x						x				x	x						
Family Botiidae																					
Botia histrionica	x		x						x	x	x	?			x	x	x				
Syncrossus berdmorei	x		x						x	x	x			x	x	x	x	x			
Family Cobitidae																					
Acantopsis spectabilis	x									x	x	?				x	x	x			
Lepidocephalichthys alkaia	x								x	x	x			x		x	x	x	x		
Lepidocephalichthys berdmorei	x								x	x	x	x		x	x	x					
Lepidocephalichthys goalparensis	x								x					x							
Lepidocephalichthys irroratus				x		x				x				x							
Lepidocephalichthys micropogon	x		x						x	x	x	x				x	x				

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Pangio lumbriciformis	x			x							x			x							
Pangio pangia	x									x	x			x		x					
Pangio signicauda	x			x							x			x							
Family Balitoridae																					
Balitora burmanica	x								x	x	x			x	x						
Hemimyzon yinjiangensis				x			x		x						x						
Homalopteroides rupicola	x			x					x	x	x			x		x		x			
Family Nemacheilidae																					
Aborichthys cf. *kempi*	x								x					x							
Acanthocobitis adelaideae	x			x					x		x			x		x					
Acanthocobitis linypha	x								x	x	x			x		x					
Acanthocobitis mandalayensis	x		x								x			x		x					
Acanthocobitis rubidipinnis	x		x								x	x				x					
Acanthocobitis zonalternans	x										x	x		x		x	x				
Malikahia aligera	x			x					x						x						
Neonoemacheilus morehensis				x		x				x				x							
Neonoemacheilus peguensis	x									x				x							
Physoschistura chindwinensis				x		x				x				x							

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Physoschistura prashadi				x		x				x				x		x					
Physoschistura tigrina				x		x				x				x							
Physoschistura yunnaniloides	x			x						x				x							
Protonemacheilus longipectoralis				x			x		x					x							
Pteronemacheilus lucidorsum	x			x							x			x							
Schistura acuticephalus	x			x							x			x							
Schistura albirostris				x			x		x					x							
Schistura callidora	x			x								x		x							
Schistura kangjupkhulensis	x			x						x				x							
Schistura khugae				x		x				x				x	x						
Schistura malaisei	x			x					x			x		x	x						
Schistura manipurensis				x		x				x				x							
Schistura megalodon				x			x		x					x							
Schistura nagaensis				x		x				x				x							
Schistura nubigena	x			x					x						x						
Schistura paucifasciata	x			x								x		x							
Schistura pawensis	x			x								x		x							
Schistura phamhringi				x		x				x				x							
Schistura polytaenia				x			x		x					x							
Schistura puncticeps	x			x								x		x							

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Schistura reticulata				x		x				x				x							
Schistura rubrimaculata	x			x							x			x							
Schistura shuensis	x			x							x			x							
Schistura sikmaiensis	x			x					x	x				x	x						
Schistura wanlainensis	x			x					x						x						
Schistura yingjiangensis				x			x		x					x							
Order Siluriformes Family Amblycipitidae																					
Amblyceps carinatum	x			x							x			x		x					
Amblyceps murraystuarti	x			x					x					x	x						
Amblyceps torrentis				x		x				x				x							
Amblyceps tuberculatum				x		x				x				x							
Amblyceps yunnanensis				x			x		x					x							
Family Akysidae																					
Akysis manipurensis				x		x				x				x							
Akysis prashadi	x			x						x	x			x		x					
Family Sisoridae																					
Ayarnangra estuarius	x			x								x								x	
Bagarius bagarius	x									x	?	?			x	x					
Bagarius yarrelli	x									x	x	x			x	x	x	x			
Creteuchiloglanis brachypterus				x			x		x						x						

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Creteuchiloglanis macropterus	x								x		x				x						
Erethistes longissimus	x			x							x					x	x				
Erethistoides longispinis	x			x						x	x			x		x					
Exostoma stuarti	x			x					x						x						
Exostoma vinciguerrae	x			x					x					x	x						
Gagata dolichonema	x									x	x	x			x	x	x			x	
Gagata melanopterus	x									x	x	x				x	x			x	
Glaridoglanis andersoni	x			x					x					x	x						
Glyptosternon malaisei	x			x					x					x							
Glyptothorax burmanicus	x			x					x	x	x			x	x	x					
Glyptothorax granulus				x		x				x					x						
Glyptothorax longicauda	x			x					x					x	x						
Glyptothorax longjiangensis				x			x		x						x						
Glyptothorax minimaculatus	x			x					x						x						
Glyptothorax ngapang	x									x	x			x	x	x					
Glyptothorax panda	x			x							x			x							
Glyptothorax senapatiensis				x		x				x				x							
Glyptothorax trilineatus	x								x	x	x				x	x	x				
Myersglanis jayarami				x		x				x				x	x						
Oreoglanis hponkanensis	x			x					x					x	x						

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Oreoglanis insignis	x			x					x					x	x						
Oreoglanis macroptera	x			x					x		x			x	x						
Pseudecheneis gracilis	x			x					x						x						
Pseudecheneis brachyurus	x			x					x						x						
Pseudecheneis stenura				x			x		x						x						
Pseudecheneis ukhrulensis				x		x				x					x						
Pseudexostoma yunnanensis				x			x		x						x						
Pseudolaguvia tuberculata	x										x			x							
Family Siluridae																					
Ompok cf. bimaculatus	x									x	x	?				x	x	x	x		
Ompok nigrescens	x		x								x					x	x				
Ompok pabda (?)(	x								x	x	x	?				x	x	x			
Ompok pabo	x									x	x	?				x	x	x			
Pterocryptis berdmorei	x								x	x	x			x	x						
Wallago attu	x									x	x	x				x	x	x		x	
Family Chacidae																					
Chaca burmensis	x		x								x	x					x				
Family Plotosidae																					
Plotosus canius	x											x								x	x
Family Clariidae																					
Clarias aff. batrachus	x									x	x	x		x		x	x	x	x	x	
Family Heteropneustidae																					

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Heteropneustes fossilis	x								x	x	x	x				x	x	x	x	x	
Family Ariidae																					
Arius arius	x											x								x	
Arius venosus	x											x								x	
Cephalocassis jatius	x										x	x					x			x	
Cochlefelis burmanicus	x											x								x	
Nemapteryx nenga	x											x								x	
Netuma bilineata	x											x								x	
Osteogeneiosus militaris	x											x								x	
Family Ailiidae																					
Clupisoma prateri	x									x	x	x				x	x				
Clupisoma roosae	x			x							x					x	x				
Eutropiichthys britzi	x		x							x	x	x				x	x				
Eutropiichthys burmannicus	x								x	x	x	x			x	x	x	x		x	
Pachypterus acutirostris	x		x							x	x	x				x	x			x	
Proeutropiichthys macropthalmos	x		x								x	x					x			x	
Silonia silondia	x										x	x					x			x	
Family Pangasiidae																					
Pangasius myanmar	x			x								x					x			x	
Pangasius pangasius	x										x	x				x	x			x	
Family Bagridae																					

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Batasio affinis	x		x							x	x			x							
Batasio dayi	x		x								x			x							
Batasio procerus	x			x					x					x	x						
Hemibagrus microphthalmus	x									x	x	x				x	x	x		x	
Hemibagrus peguensis	x		x							x	x	x				x	x			x	
Mystus cineraceus	x			x						x	x			x		x	x	x			
Mystus falcarius	x									x	x	x				x	x	x		x	
Mystus gulio	x											x								x	
Mystus leucophasis	x		x							x	x	?				x	x	x			
Mystus ngasep				x		x				x				x		x					
Mystus pulcher	x			x						x	x	x				x	x			x	
Mystus rufescens	x									x	x	x				x	x				
Olyra horae	x			x						x	x			x							
Rita sacerdotum	x									x	x	x				x	x				
Sperata acicularis	x									x	x	x				x	x	x			
Order Mugiliformes Family Mugilidae																					
Chelon macrolepis	x											x								x	
Chelon melinopterus	x											x								x	
Chelon subviridis	x											x								x	
Moolgarda malabarica	x											x								x	
Moolgarda seheli	x											x								x	

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Moolgarda speigleri	x											x								x	
Mugil cephalus	x											x								x	
Rhinomugil corsula	x									x	x	x				x	x			x	
Sicamugil hamiltonii	x		x									x								x	
Order Beloniformes Family Adrianichthyidae																					
Oryzias dancena	x											x								x	x
Oryzias uwai	x		x								x	x					x	x	x	x	
Family Hemiramphidae																					
Hyporhamphus limbatus	x											x								x	
Family Zenarchopteridae																					
Dermogenys burmanica	x		x									x								x	
Zenarchopterus ectuntio	x											x								x	x
Family Belonidae																					
Xenentodon cancila	x								x	x	x	x		x	x	x	x	x	x	x	
Order Cyprinodontiformes Family Aplocheilidae																					
Aplocheilus panchax	x										x	x					x		x	x	x
Order Gasterosteiformes Family Indostomidae																					
Indostomus paradoxus	x			x							x							x	x		
Family Syngnathidae																					

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Microphis dunckeri	x		x								x					x	x	x			
Order Synbranchiformes Family Synbranchidae																					
Monopterus cuchia	x								x	x	x	x		x		x	x	x	x	x	
Family Chaudhuriidae																					
Chaudhuria caudata	x										x							x	x		
Chaudhuria ritvae	x			x															x		
Pillaia kachinica	x			x							x			x							
Pillaiabrachia siniae	x			x							x								x		
Family Mastacembelidae																					
Macrognathus aureus	x			x							x					x	x				
Macrognathus dorsiocellatus	x		x								x	x				x	x				
Macrognathus morehensis	x			x						x	x			x		x	x	x			
Macrognathus obscurus	x			x							x					x	x				
Macrognathus zebrinus	x		x							?	x	x		x		x	x		x	x	
Mastacembelus alboguttatus	x									x	x	x			x	x	x				
Mastacembelus armatus	x								x	x	x	x		x	x	x	x	x	x	x	
Mastacembelus dayi	x			x							x						x				
Mastacembelus pantherinus	x			x							x							x			
Mastacembelus tinwini	x										x	x		x		x		x	x		

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Order Perciformes **Family Ambassidae**																					
Chanda cf. nama	x										x	x				x	x	x			
Parambassis alleni	x		x									x								x	
Parambassis lala	x										x	x					x				
Parambassis ranga	x								x	x	x			x		x	x	x	x	x	
Parambassis waikhomi				x		x				x		x		x							
Family Latidae																					
Lates calcarifer	x											x								x	x
Lates uwisara	x			x								x								x	x
Family Sillaginidae																					
Sillaginopsis domina	x											x								x	
Sillago sihama	x											x								x	
Family Lutjanidae																					
Lutjanus argentimaculatus	x											x								x	x
Family Datnioididae																					
Datnioides polota	x											x								x	
Family Gerreidae																					
Gerres filamentosus	x											x								x	
Family Sparidae																					
Acanthopagrus berda	x											x								x	
Family Sciaenidae																					
Bahaba chaptis	x											x								x	

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Johnius borneensis	x											x								x	
Johnius coitor	x										x	x					x			x	
Sciaenoides pama	x											x								x	
Pterotolithus maculatus	x											x								x	
Family Monodactylidae																					
Monodactylus argenteus	x																			x	x
Family Toxotidae																					
Toxotes chatareus	**x**											x								x	x
Toxotes jaculatrix	x											x									x
Family Terapontidae																					
Terapon jarbua	x											x								x	x
Family Eleotrididae																					
Butis gymnopomus	x											x								x	x
Eleotris melanosoma	x											x								x	x
Odonteleotris macrodon	x											x								x	x
Family Gobiidae																					
Apocryptes bato	x											x									x
Awaous grammepomus	x											x					x			x	
Bathygobius fuscus	x											x								x	x
Boleophthalmus boddarti	x											x									x
Brachygobius nunus	x											x								x	x
Drombus globiceps	x											x								x	x
Glossogobius giuris	x									x	x	x				x	x			x	

			Endemism			Ayeyarwady endemics			Distribution in Ayeyarwady sub-basins					Habitats							
	present in Myanmar		Myanmar	Ayeyarwady		present only in India	present only in China		Upper	Chindwin	Middle	Lower		headwater, streams	fast rivers	slow river	flood plain	lakes	swamps	tidal	mangrove
Gobiopterus chuno	x											x								x	
Istigobius ornatus	x											x								x	x
Oligolepis acutipennis	x											x								x	
Periophthalmodon septemradiatus	x											x								x	x
Papillogobius reichei	x											x								x	x
Pseudapocryptes elongatus	x											x									x
Pseudogobius grastrospilos	x											x								x	
Redigobius balteatus	x											x								x	x
Redigobius bikolanus	x											x								x	x
Stigmatogobius sadanundio	x											x								x	x
Yongeichthys nebulosus	x											x								x	x
Family Amblyopidae																					
Brachyamblyopus burmanicus	x											x									x
Caragobius urolepis	x											x								x	x
Odontamblyopus rubicundus	x											x									x
Odontamblyopus tenuis	**x**											x									x
Taenioides anguillaris	x											x									x

			Endemism			Ayeyarwady endemics			Distribution in Ayeyarwady sub-basins					Habitats							
	present in Myanmar		Myanmar	Ayeyarwady		present only in India	present only in China		Upper	Chindwin	Middle	Lower		headwater, streams	fast rivers	slow river	flood plain	lakes	swamps	tidal	mangrove
Taenioides buchanani	x											x									x
Family Kurtidae																					
Kurtus indicus	x											x								x	
Family Scatophagidae																					
Scatophagus argus	x																			x	x
Family Nandidae																					
Nandus nandus	x									x	x					x	x		x		
Family Badidae																					
Badis corycaeus	x			x							x			x		x					
Badis ferrarisi	x			x						x				x							
Badis kyar	x			x							x	x				x		x			
Badis pyema	x			x					x					x							
Badis ruber	x										x			x					x		
Dario dayingensis				x			x		x			x		x							
Dario hysginon	x			x							x	x		x				x	x		
Family Anabantidae																					
Anabas testudineus	x									x	x	x					x	x	x	x	
Family Osphronemidae																					
Parasphaerichthys lineatus	x			x															x		
Parasphaerichthys ocellatus	x			x							x	?							x		
Trichogaster labiosa	x			x						x	x					x	x	x	x	x	
Family Channidae																					

			Endemism			Ayeyarwady endemics			Distribution in Ayeyarwady sub-basins					Habitats							
	present in Myanmar		Myanmar	Ayeyarwady		present only in India	present only in China		Upper	Chindwin	Middle	Lower		headwater, streams	fast rivers	slow river	flood plain	lakes	swamps	tidal	mangrove
Channa burmanica	x			x					x			x		x							
Channa gachua	x								x	x	x	x		x	x	x					
Channa marulius	x									x	x	x				x	x	x	x		
Channa panaw	x			x						x	x	x				x	x	x	x		
Channa striata	x									x	x	x				x	x	x	x	x	
Order Pleuronectiformes Family Soleidae																					
Brachirus orientalis	x											x								x	
Order Tetraodontiformes Family Tetraodontidae																					
Chonerhinos naritus	x																			x	
Dichotomyctere fluviatilis	x																			x	x
Leiodon cutcutia	x									x	x					x	x	x	x	x	