

## THE IMPORTANCE OF THE MYANMAR COAST FOR WATER BIRDS

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Surveys of water birds at eight sites along the 3000 km long coast of Myanmar from 2008-2013 have shown that the country hosts a number of significant intertidal mudflat areas. It regularly provides home to more than 150,000 wintering and migrating water birds of 80 different species. The large majority of these birds occur in the Gulf of Mottama and in the adjacent Ayeyarwaddy Delta. Together with other sites, the Myanmar coast proved to be important for many water birds, and included a total of 10 globally threatened species. The waders were most prominent with 39 species being recorded. Among those was the Critically Endangered Spoon-billed Sandpiper (*Calidris pygmeus*) for which coastal habitats in Myanmar hold more than 50% of the world population. Also, the Endangered Nordmann's Greenshank (*Tringa guttifer*) has been found in significant numbers and is one of 24 species where at least 1% of the global population is occurring on Myanmar's coast. Often, the combination of the intertidal mudflats with adjacent mangroves proved to be crucial for several water bird species, as shown in the case of the Vulnerable Lesser Adjutant Stork. (*Leptoptilos javanicus*) Despite the significance of this coastline for water birds, hardly any of the intertidal sites or adjacent mangroves has any formal protection. With rapid coastal development threatening most of the sites, the protection of the most important of these sites is of high priority.

### INTRODUCTION

Myanmar is the largest country in mainland south-east Asia and has a continuous coastline of almost 3,000 km extending along the Bay of Bengal and the Andaman Sea. In the coastal zone, besides mangroves, coral reefs, sea grass beds, sandy beaches there are many intertidal mudflats. These are home to many globally threatened water bird species, such as the Spoon-billed Sandpiper (*Calidris pygmeus*) Nordmann's Greenshank (*Tringa guttifer*) and Lesser Adjutant Stork (*Leptoptilos javanicus*), among others (Ministry of Environmental Conservation and Forestry 2011), but also water birds in internationally important numbers. However, very little is known on the distribution and numbers of these water bird species in Myanmar. Thet (2006), Thet & Veen (2008) summarised observations from the Ayeyarwaddy Delta, but no information has been published from other coastal sites.

The Myanmar coastal zone is also important for fish stocks, which support artisanal fishery, and other livelihoods for local people. Rapid and often unsustainable development (Zöckler *et al.* 2013) is beginning to jeopardise the fragile relationship between these crucial habitats and the livelihoods of rural people who make up a high proportion of the population of Myanmar.

The aim of this paper is to summarise the surveys of water birds and their numbers and distribution in coastal Myanmar, and highlight

threats and conservation issues. This is based on survey data collected from 2008-2013 across eight sites along the Myanmar coast, documenting the status and threatening processes at these sites.

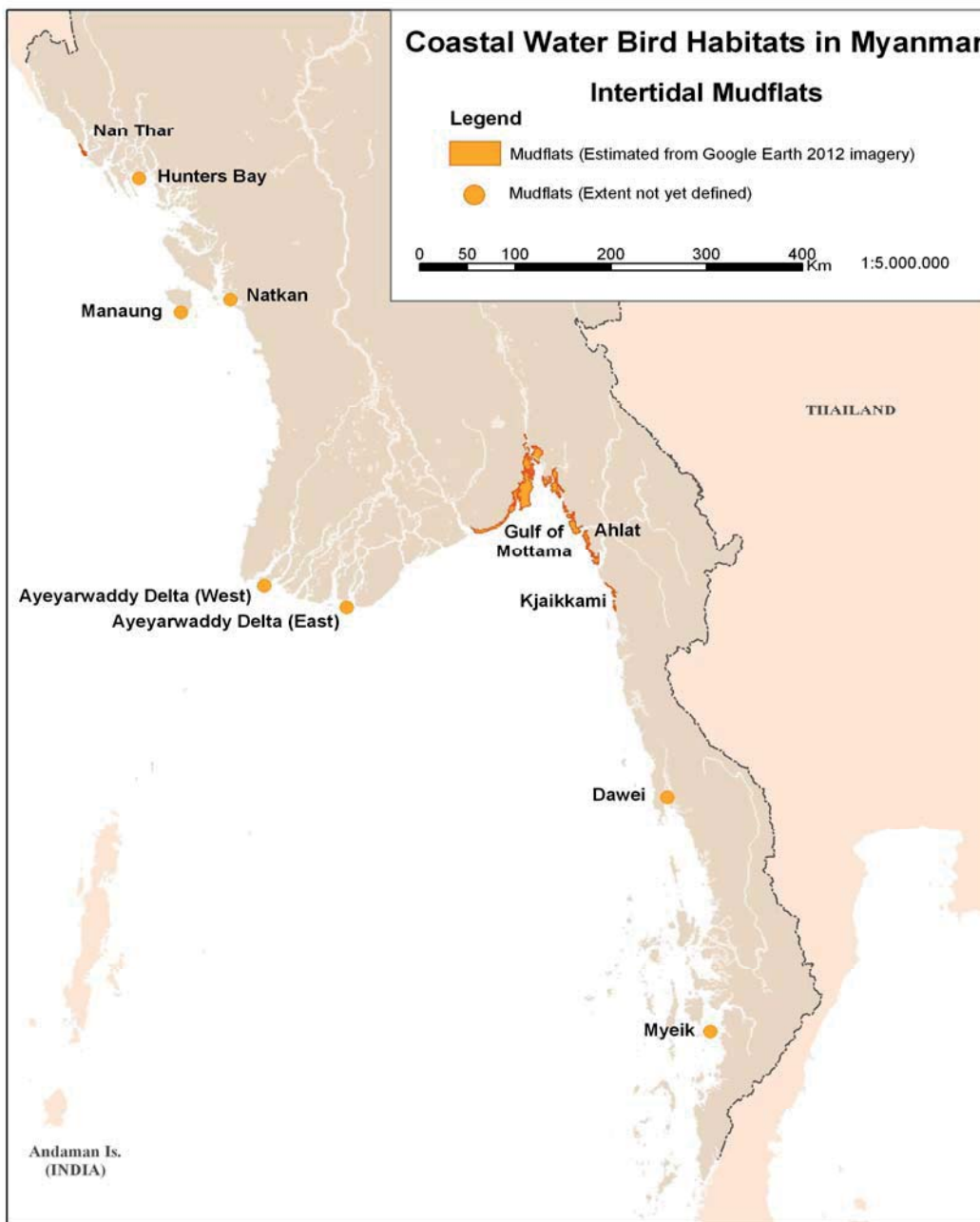
### METHODS

#### Site descriptions

Nine major intertidal mudflat complexes in Myanmar were identified as large enough in size to potentially qualify as sites of international and national importance for migratory and non-breeding water birds (see Figure 1). These are from north to south: Nan Thar Island, Hunters Bay, Natkan, the Ayeyarwaddy Delta (East and West), the area around the outer islands, the Gulf of Mottama, Ahlat and the mudflats around Bilugyun Island and in the south the Dawei River mouth and mudflats south of Myeik in Tanintharyi. These locations cover all coastal provinces, including Rakhine in the north, Ayeyarwaddy in the delta area, Yangon, Bago and Mon State in central Myanmar and Tanintharyi Region in the south. Sites were selected using satellite images on the basis of existing extensive intertidal mud and sandflats that are considered essential habitats for large numbers of waders and other water birds.

#### Nan Thar Island

Nan Thar Island (Rakhine Province) is about 120 km south of the Myanmar-Bangladesh border off the mouth of the Kaladan River and harbours about 300 ha of intertidal sand and mudflats encircled by



**Figure 1.** Distribution of intertidal mud and sand flats in Myanmar (Zöckler *et al.* 2013, see also Table 1) circled areas have not yet been delineated.

a set of sandy islands. It has a small fishing community of about 150 people. Nan Thar has been visited annually since 2008.

*Hunters Bay*

The area around Hunters Bay (Rakhine Province) was visited in January 2009 and the most important mudflats for Spoon-billed Sandpiper and other water birds were determined. The area is an estimated 1000 ha, but much of the area is less suitable for large flocks of water birds due to deep mud and adjacent mangroves.

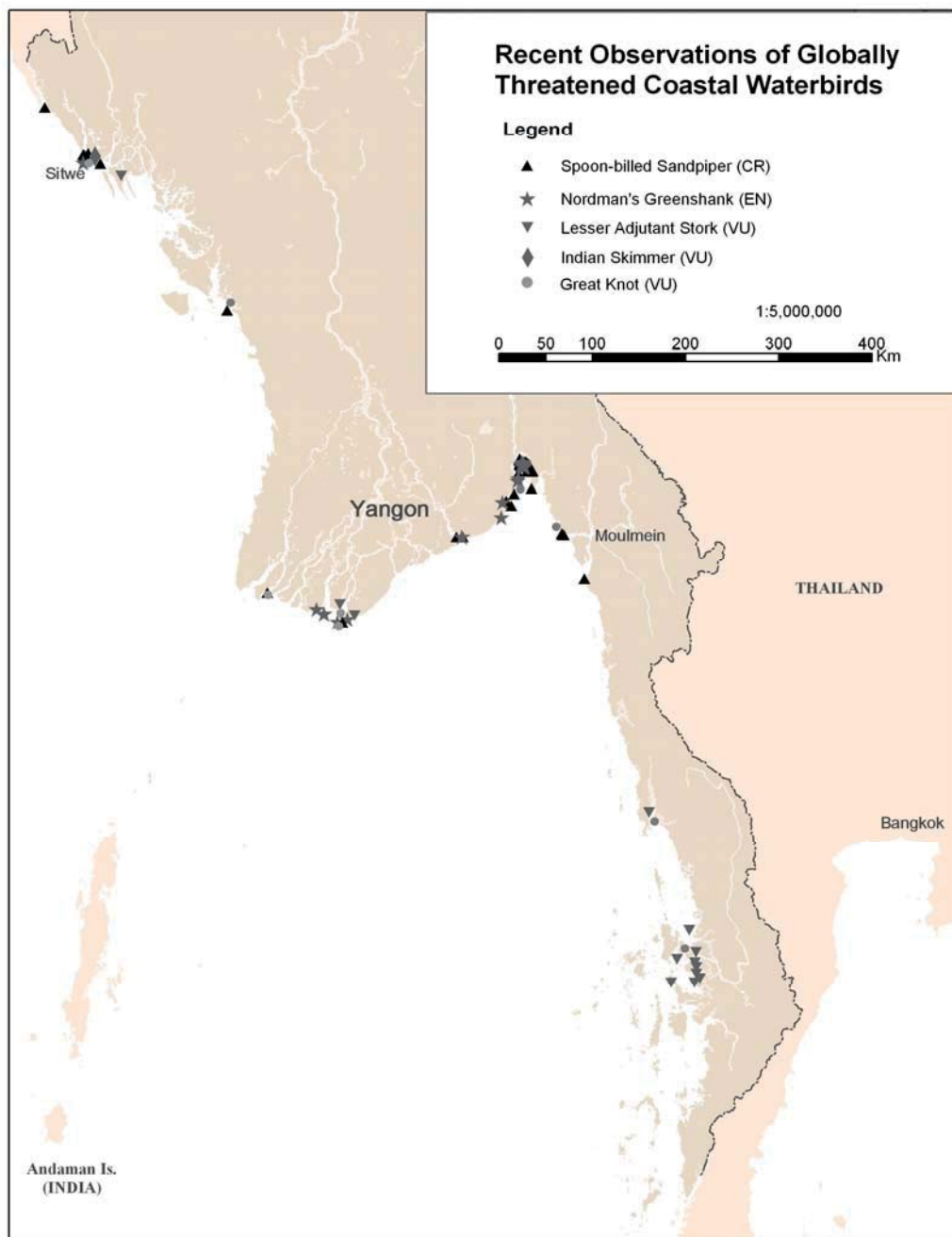
*Natkan*

South of Hunters Bay lies Natkan (Rakhine Province), a small but potentially important mudflat area for water birds, approximately 200 ha

in size, and surrounded by extensive agricultural fields with mangroves to the north. The site was only surveyed once in January 2009.

*Ayeyarwaddy Delta*

The Ayeyarwaddy Delta (Ayeyarwaddy Province) stretches over 140 km from west to east with many huge mudflats scattered along the coast often accompanied by outer islands, especially at the western and eastern edges of the delta. As the area is very large, not all potential sites have been visited. The western and eastern areas, covering an estimated 5000 – 6000 ha, were visited in 2010 and the eastern part again in 2013. Some areas in the eastern part have been surveyed previously in 2003 and 2006 (Thet & Veen 2008).



**Figure 2.** Observations of selected Globally Threatened coastal water birds recorded by these expeditions.

*Gulf of Mottama*

The Gulf of Mottama or Martaban has the most extensive intertidal mudflats in Myanmar and is one of the largest of its type in south-east Asia (Figure 1). It is formed by the delta of the Sittaung River, which is in turn supported by smaller rivers such as the Bilin River. It is also fed by the large Salween River from the east and is clearly influenced by the gigantic Ayeyarwaddy River from the west. The Sittuang and Bilin River have no in-stream dams and the Salween and Ayeyarwaddy have only a few dams. All contribute massive quantities of crucial sediments, creating vast and productive mudflats, stretching across the Yangon, Bago and Mon State provinces, covering an area of over 4000 km<sup>2</sup>. The

funnel shaped geomorphology of the Gulf and the relatively low physical disruption to the flow of its major contributing rivers, makes the Gulf a very special site for water birds and other biota. At spring tides, the regular occurrence of huge tidal bores results in high turbidity in the system, creating a dynamic flow of sediments and nutrients within the Gulf that supports a wide density of benthos for water birds to thrive on (Z. Lunn *in litt.*). The Gulf has been visited annually from 2008-2012, mostly in January and February. It is impossible to survey the vast mudflats entirely but in January 2010 at least the eastern part have been surveyed almost completely, while in previous years the focus was more on the western part.

*Ahlat*

Ahlat (Mon State) is situated at the southern edge of the Gulf of Mottama at the Salween-Thanlwin River Mouth. It is connected with the Gulf of Mottama by a long stretch of mudflats but a distinct area by the river mouth of the Salween River mouth. It hosts big flocks of water birds that do not intermingle with flocks occurring in the central Gulf. The area has been surveyed annually from 2010-2013.

*Kjaikkami*

Further south the mudflats around the Island of Bi lu Gyun and south near Kjaikkami in Mon State are known to hold big flocks of waders. Most of these mudflats have not been surveyed so counts presented here are probably an underestimate of the site's population.

*Dawei River estuary*

Further south in the Tanintharyi Province lies the Dawei River estuary, close to the regional capital Dawei. This is another big mudflat area adjacent to mangroves with many water birds. The mudflats extend south of Dawei 30 miles to the village of Kennet Thiri, covering about 2,500 ha of mudflats. The site has been visited only once in 2011.

*Myeik mudflats*

In the most southern of the Tanintharyi Region south of the town Myeik is the huge area of mudflats, approximately 4,000 ha in size, surrounded by mature mangroves. About one thousand hectares of mudflats north of the town were included in the survey in December 2013, but extensive areas to the south have not been surveyed and could host more water birds.

**Water bird surveys**

Seven different expeditions were carried out between 2008 and 2013 by the authors during the dry season between November and March, but mostly in mid-winter in January and February. The prime purpose of the search was to locate globally threatened Spoon-billed Sandpiper, but numbers of all water birds were also recorded, when possible. Binoculars and telescopes with at least 30-60x magnification were required to identify all water birds to species level.

Many sites could be accessed by boat and on foot. Where boat-based surveys were carried out, boats small enough to negotiate the shallow intertidal waters were used. Often larger boats were needed to cover longer distances and smaller boats were carried and used to explore areas at the sites. This approach was not always possible and also took time to develop, meaning that many areas, especially in the Gulf of Mottama, were not accessible for a long time. Thus, they were overlooked in some years. In addition, vast areas of mudflats in the Myeik Archipelago were not

surveyed due to long distances, difficult access and permit restrictions.

Most sites were visited on only one or two (and sometimes three) days. Some sites have been visited multiple times, but at different times of the year and by different teams. At sites with more than one count from more than one year, the maximum number observed was included. The difference in survey effort prevented an analysis of species trend at individual sites. For the Ayeyarwaddy Delta, count data from years prior to 2008 was made available (Thet & Veen 2008) and has been included into our survey results.

It was not possible to obtain complete counts of the extensive intertidal area in the Gulf of Mottama in any survey year. Several teams covered different parts of the Gulf in different years. The area is extremely difficult to access and only special boats and fishermen with local knowledge of the intertidal areas can negotiate the difficult tidal waters. The best coverage was achieved in 2010, when over a period of 12 days a total of three teams covered most of the sites along the eastern side of the Gulf, and the crucial central part that hosts the majority of small calidrid waders and small plovers (comprising more than 50% of the mudflats). The central mudflat area was repeatedly surveyed in 2011 and 2012 for Spoon-billed Sandpipers, but in those years very few additional numbers for other water birds were obtained. In 2008 and 2009 different areas of the western and central part were covered, but with some overlap in both years. The 2008 counting sites were entirely different from those counted in 2010.

In both the Gulf of Mottama and Ayeyarwaddy there was a high risk of double-counting birds. In order to avoid this, we took a very cautious and conservative approach to tallying counts from different mudflat areas. Congregations in the Ayeyarwaddy Delta were distinctly spatially separated and there was very little risk of double-counting, thus we summed counts across areas. In the Gulf, there is more mixing amongst birds but having covered almost all mudflats in at least one year, we know roughly about the uneven distribution of the water birds and the estimated totals are more a conservative estimate. Counts that originated from areas or from a different survey period, potentially too close to other sites, were not included in the total. Using this conservative approach, some counts were discounted and therefore, the overall total is likely to be an underestimate.

Total figures for the Gulf of Mottama were generated by calculating numbers from surveyed areas, taking unsurveyed sites into account when they were spatially distinct. The 2008 counts were added to those from 2010 due to the counting sites being different, providing the minimum in le 2. Using the conservative approach outlined above,

the 2009 results were not be added, as we observed much movement between mudflat areas within and between the years, due to large shifts in sediments. Counts from 2012 we only added to the totals for the Gulf when previous maxima from other parts of the gulf were surpassed. However, it is likely that this approach is underestimating the total numbers and counts from 2009 indicate potentially much higher numbers for some species and higher totals for the Gulf of Mottama.

### Estimate of Spoon-billed Sandpiper numbers

Small calidrids, namely Spoon-billed Sandpipers and small plovers, were mixed in huge flocks of 30,000 – 40,000 birds at high tide roosts. From there they would scatter to feed in smaller flocks on the receding tides. Surveyors estimated numbers of small wader species by counting several sample wader flocks of varying sizes (ranging from 100 to almost 2000 birds, also called flock counts) in the same area, and determining the proportion of Spoon-billed Sandpipers and other species within each. This was modelled for the Spoon-billed Sandpiper to give an estimate with confidence limits of the total number of individuals in an area at the time of the survey (for details see Zöckler *et al.* 2010). For this purpose, among several observers more than 100 flock counts were available. The total number of Spoon-billed sandpiper and other small waders was estimated by multiplying the average proportion of Spoon-billed Sandpipers observed in the small flocks by an estimate of the total number of small waders in the mudflats present. For further details of the calculations and statistics see Zöckler *et al.* (2010). This method has also been applied to other small calidrids like the Broad-billed Sandpiper (*Limicola falcinellus*). The more common species in the flocks were also estimated based on the average proportion from the multiple flock counts.

## RESULTS

### Water bird abundance and distribution

The Gulf of Mottama (Figure 1) is clearly the most extensive and also the most significant intertidal site for water birds with more than 120,000 individuals being recorded. Other mudflat areas were smaller and often associated with adjacent mangroves, and generally hosted much fewer water birds (Table 1).

In total 80 species of water birds were recorded along the entire coast. The majority consisted of waders numbering 39 species and an estimated total of 140,000-160,000 individuals, followed by 12 gulls and tern species of approximately 30,000 individuals, 11 duck and goose species and seven heron and egrets. The Gulf of Mottama and Ahlat and almost all the other sites feature in importance for at least in one or more species. Below we list the highlights of the most important and globally threatened species at each site.

### Nan Thar Island

The mudflats supported between 7,000-8,000 water birds, including the Critically Endangered (CR) Spoon-billed Sandpiper. The area is the second largest wintering site in Myanmar and possibly in the entire wintering region for the Spoon-billed Sandpiper, with a maximum of 34 (2008) recorded, and regularly holding 20 individuals (Zöckler *et al.* 2010). The area also had regular records of between three to five Nordmann's Greenshank (see Appendix 1 and Zöckler & Frew 2011) and was a night roosting site for up to 1,400 Bar-headed Geese (*Anser indicus*). In total, five species reached the 1% flyway population levels on Nan Thar. In the adjacent coastal mudflats at the Pyang Pie River mouth, up to 27 Indian Skimmers (*Rynchops albicollis*) were recorded in 2008 and nine in 2012, but none were recorded in 2013 and 2014. Appendix 1 gives a summary of all water birds counted at Nan Thar Island in the years 2008-2012.

### Hunters Bay

The species composition at Hunters Bay was slightly different from Nan Thar and only about 1,000 water birds were observed. There was one record of six Lesser Adjutant Storks as well as a breeding pair of Sarus Crane (*Grus antigone*) in the neighbouring area.

### Natkan

This area holding up to 1,000 water birds, and had at least one Spoon-billed Sandpiper and five Great Knots (*Calidris tenuirostris*) recorded in 2009. There were 750 Lesser Crested Terns (*Sterna bengalensis*) recorded at the entrance to the Sin Guang Chuang River mouth about 100 km further south.

### Ayeyarwaddy Delta

The Ayeyarwaddy Delta held tens of thousands of water birds. No detailed estimates were available, but based on counts for some parts in the eastern delta from previous surveys and our recent surveys (Thet 2006, Moses & Zöckler 2013), we estimated the total population to exceed 10,000 birds. Morozov & Archipov (2010) estimated about 4,000-5,000 birds in the western delta and 10,000-15,000 birds in the eastern part of the delta in 2010. A visit in November 2013 (Moses & Zöckler 2013) only recorded 5,000-6,000 birds, including one Spoon-billed Sandpiper and a record number of 26 Nordmann's Greenshank in the most easterly part. Both, the eastern and western part of the delta together hosts up to 800 of the globally threatened Great Knot. More intensive coverage of the delta area might reveal significant higher numbers of this globally threatened species. In addition the delta hosts the highest counts of more than 300 birds for the globally near threatened Black-headed Ibis *Threskiornis melanocephalus* (Table1, Appendix2).

**Table 1.** Numbers of water birds, counted at nine different intertidal mudflat sites on the Myanmar coast between 2008 and 2013. These are from North to south Nan Thar Island, Hunters Bay (HB), Natkan, Ayeyarwaddy Delta (east Ayey. and west Ayey.), Gulf of Mottama (GoM), Ahlat, Dawei and Myeik mudflats. The figure for each species lists the maximum number for each site recorded at any year within the period 2008-2013. For some sites, such as Nan Thar, east Ayeyarwaddy Delta, Gulf of Mottama and Ahlat multiple counts from different years are available (see appendices). IUCN status is given after latin names in first column (CR critically endangered, EN endangered, VU vulnerable, NT near threatened) Species in bold are globally threatened; numbers in bold are those reaching or surpassing the 1% of the flyway population (Wetlands International 2012). Nomenclature and taxonomy follows Waterbird Population Estimates (Delany & Scott 2006).

Species	Nan Thar	HB	Natkan	West Ayey.	East Ayey.	GoM	GoM †	Ahlat	Dawei	Myeik
Little Cormorant <i>Phalacrocorax niger</i>		250		20		40	100		30	150
Grey Heron <i>Ardea cinerea</i>	7	1	7	6	30	203	300			30
Great Egret <i>Ardea alba</i>	11	70	7	17	140	285	450	50	20	171
Intermediate Egret <i>Egretta intermedium</i>	2		3		16	370	600			2
Purple Heron <i>Ardea purpurea</i>				1		11	40			
Cattle Egret <i>Ardea ibis</i>		200	2							30
Little (Striated) Heron <i>Butorides striata</i>		2				3	10			38
Indian Pond Heron <i>Ardeola grayii</i>		20	20			140	200		30	140
Little Egret <i>Egretta garzetta</i>	31		80	60	120	150	200		45	277
Night Heron <i>Nycticorax nycticorax</i>						30	200			32
Painted Stork <i>Mycteria leucocephala</i> (NT)						<b>140</b>	<b>150</b>			
Asian Openbill <i>Anastomus oscitans</i>						10	10			
Lesser Adjutant Stork <i>Leptoptilos javanicus</i> (VU)		6			3				6	19
Black-headed Ibis <i>Threskiornis melanocephalus</i> (NT)	20	48	1	<b>200</b>	<b>120</b>	<b>133</b>	<b>200</b>	60	12	10
Glossy Ibis <i>Plegadis falcinellus</i>						80	80			
Lesser Whistling Duck <i>Denrocygna javanica</i>						2,400	2,500			2,330
White-fronted Goose <i>Anser albifrons</i>	2									
Greylag Goose <i>Anser anser</i>										
Bar-headed Goose <i>Anser indicus</i>	<b>1,400</b>	19					1			
Ruddy Shelduck <i>Tadorna ferruginea</i>	92	33		15	4	<b>950</b>	<b>1,200</b>			
Common Shelduck <i>Tadorna tadorna</i>							1			
Eurasian Wigeon <i>Anas penelope</i>	1,200					284	300			
Northern Pintail <i>Anas acuta</i>	<b>3,000</b>					80	150			
Garganey <i>Anas querquedula</i>	2									
Northern Shoveler <i>Anas clypeata</i>	10									
Tufted Duck <i>Aythya fuligula</i>	2									
Sarus Crane <i>Grus Antigone</i> (VU)		2								
Pied Avocet <i>Recurvirostra avosetta</i>						1	1			
Grey-headed Lapwing <i>Vanellus cinereus</i>		10							2	

Table 1. Continued

Species	Nan Thar	HB	Natkan	West Ayey.	East Ayey.	GoM	GoM †	Ahlat	Dawei	Myeik
Red-Wattled Lapwing <i>Vanellus indicus</i>						6	6		10	
Pacific Golden Plover <i>Pluvialis fulva</i>	30	35	2	6		<b>7,726</b>	<b>9,000</b>	40	45	8
Grey Plover <i>Pluvialis squatarola</i>	195		27	4	250	224	350		50	31
Common Ringed Plover <i>Charadrius hiaticula</i>	1					12	12			
Little Ringed Plover <i>Charadrius dubius</i>	2					606	1,200	65		
Kentish Plover <i>Charadrius alexandrinus</i>	55	10	17	180	40	<b>8,131</b>	<b>15,000</b>	500	45	276
Lesser Sand Plover <i>Charadrius mongolus</i>	1,000	150	400	1,150	<b>3,500</b>	<b>18,032</b>	<b>32,000</b>	<b>1,500</b>	700	326
Greater Sand Plover <i>Charadrius leschenaultii</i>	440		100	21	<b>1,500</b>	<b>1,320</b>	<b>1,800</b>	200	500	<b>1,846</b>
Pintail Snipe <i>Gallinago stenura</i>	1								2	
Common Snipe <i>Gallinago gallinago</i>						12	12			
Long-billed Dowitcher <i>Limnodromus scolopaceus</i>						42	42			
Black-tailed Godwit <i>Limosa limosa</i> (NT)	<b>1,800</b>		1		400	<b>3,405</b>	<b>4,200</b>	57		3
Bar-tailed Godwit <i>Limosa lapponica</i>	5				110	227	300		30	150
Whimbrel <i>Numenius phaeopus</i>	10	60	14	1	70	<b>1,597</b>	<b>2,000</b>	20	170	<b>1,200</b>
Eurasian Curlew <i>Numenius arquata</i> (NT)	61	40	8		190	<b>2,141</b>	<b>3,000</b>	15	400	221
Spotted Redshank <i>Tringa erythropus</i>	5					<b>1,312</b>	<b>1,600</b>	20		
Common Redshank <i>Tringa tetanus</i>	335	300	20	19	600	<b>4,617</b>	<b>6,000</b>	20 0	45	3,400
Marsh Sandpiper <i>Tringa stagnatilis</i>	1		1	50	8	149	250	2		5
Common Greenshank <i>Tringa nebularia</i>	20	6	7	30	50	<b>1,776</b>	<b>2,000</b>	15	15	6
<b>Nordmann's Greenshank</b> <i>Tringa guttifer</i> (EN)	5					<b>26</b>	7	10		
Green Sandpiper <i>Tringa ochropus</i>						3	10			
Wood Sandpiper <i>Tringa glareola</i>	1	1		3		11	20			
Terek Sandpiper <i>Xenus cinereus</i>	85	2	53	3	150	317	400	4	280	235
Common Sandpiper <i>Actitis hypoleucos</i>		30	6	1		211	350		40	50
Ruddy Turnstone <i>Arenaria interpres</i>	35		4		40	29	50	1	100	4
Great Knot <i>Calidris tenuirostris</i> (VU)	40		5	90	600	458	600	2	6	2
Red Knot <i>Calidris canutus</i>	35			20	120	18	30	1		3
Sanderling <i>Calidris alba</i>	215					20	12	30	10	2
Red-necked/Little Stint <i>Calidris ruficollis/minutus</i>	280	10	107	200	90	<b>6,353</b>	<b>11,000</b>	120	80	96
Long-toed Stint <i>Calidris subminuta</i>						80	100			
Curlew Sandpiper <i>Calidris ferruginea</i>	150			800	150	<b>6,762</b>	<b>1,0000</b>	25	15	56
Dunlin <i>Calidris alpina</i>	2					2	2			6
<b>Spoon-billed Sandpiper</b> <i>Calidris pygmeus</i> (CR)	<b>34</b>		1	1	1	<b>75</b>	<b>180</b> <b>(140-220)</b>	4		
Broad-billed Sandpiper <i>Limicola falcinellus</i>	<b>330</b>		40	<b>600</b>	200	<b>4,000</b>	<b>4,500</b>	50	50	6

Table 1. Continued

Species	Nan Thar	HB	Natkan	West Ayey.	East Ayey.	GoM	GoM †	Ahlat	Dawei	Myeik
Ruff						33	80			
<i>Philomachus pugnax</i>										
Heuglin's Gull	1				2					
<i>Larus heuglini</i>										
Pallas's Gull	75		18		850	2,473	2,700			
<i>Larus ichthyaetus</i>										
Brown-headed Gull	340		270		2,800	667	1,800	23	300	2,700
<i>Larus brunnicephalus</i>								0		
Gull-billed Tern	130	2			2	125	200	3	3	
<i>Sterna nilotica</i>										
Caspian Tern	3	2			37	56	70			
<i>Sterna caspia</i>										
Lesser Crested Tern	20	4	750 <sup>†††</sup>						20	200
<i>Sterna bengalensis</i>										
Greater Crested Tern	35	1	1						100	280
<i>Sterna bergii</i>										
Common Tern	10	1	2			50	50			60
<i>Sterna hirundo</i>										
Little Tern	365			250	120	120	300		250	700
<i>Sterna albifrons</i>										
Whiskered Tern	200	20		700	800	7,345	12,000	20		335
<i>Chlidonias hybrida</i>								0		
White-winged Tern						3,000	4,000	60	30	34
<i>Chlidonias leucopterus</i>										
Black Tern						10	10			
<i>Chlidonias niger</i>										
Indian Skimmer	27 <sup>††</sup>									
<i>Rynchops albicollis</i>										

† extrapolated number of birds for GoM are listed in a separate column.

†† Indian Skimmer have been observed at an adjacent site 50 km near the coast,

††† a different site 100km south at Sin Gaung Chaung,

#### Gulf of Mottama

During our surveys from 2008 - 2012 an estimated 120,000 – 150,000 water birds, mostly waders, terns and egrets were regularly recorded each year in the Gulf. (Table 1, Appendix 3)

This site has previously been found to be the key wintering area for Spoon-billed Sandpiper, hosting an estimated 200 individuals (Zöckler *et al.* 2010). During our surveys it regularly held high numbers of six other globally threatened species (Painted Stork *Mycteria leucocephala*, Black-headed Ibis, Black-tailed Godwit *Limosa limosa*, Eurasian Curlew *Numenius arquata*, Nordmann's Greenshank and Great Knot), as well as regularly holding more than 1% of the flyway population of 17 other species, among them Broad-billed Sandpiper and Red-necked Stint (*Calidris ruficollis*).

#### Ahlat (Salween-Thanwlin River mouth)

Ahlat hosted large flocks of water birds. Among the estimated 4,000 small waders recorded, three to four, and possibly as many as eight Spoon-billed Sandpipers were recorded in 2012 (Appendix 4). The mudflats around the Island of Bi lu Kyun and south near Kjaikkami also supported large flocks of waders. Most of these were not surveyed and could hold many more water birds. Large waders, such as Eurasian Curlew and Whimbrel (*Numenius phaeopus*) and herons and egrets in particular were

noticed during a brief visit in 2010, but no numbers were recorded during our expeditions.

#### Dawei River estuary

The mudflats held approximately 3,000 water birds. In February 2011, six Lesser Adjutant Storks were counted. There were also high numbers of Eurasian Curlew and Whimbrel, as well as 280 Terek Sandpipers (*Xenus cinereus*).

#### Myeik mangroves and mudflats

The mudflats held large numbers of water birds, which were widely dispersed. Mudflats north of the town Myeik hosted larger aggregations. We estimate the total number of water birds to be over 13,000. Two species, Greater Sand Plover (*Charadrius leschenaultii*) and Whimbrel reached high numbers, fulfilling the Ramsar criteria (Wetlands International 2012). Nineteen Lesser Adjutant Storks were recorded here. The extensive mudflats to the south and also north of the town have not been surveyed extensively and could host more water birds.

#### Manaung Island

A brief visit was made in 2013 to Manaung Island (constituting a tenth location and not part of the formal surveys) by one of the authors (YNS) and revealed about 1,000 water birds in parts of the island, including 14 globally near-threatened Painted Storks.



### Globally Threatened Water Birds

The selected mudflats host a range of globally threatened water bird species (ure 2) and often in significant numbers that fulfil the Ramsar criteria (Table 1). A total of ten globally threatened water bird species have been recorded, including the Spoon-billed Sandpiper (CR), Nordmann's Greenshank (EN), Lesser Adjutant Stork (VU), Sarus Crane (VU), Great Knot (VU) and a further five near-threatened species.

## DISCUSSION

### Importance of intertidal mudflats in Myanmar for migratory water birds

In this report, we emphasise the importance of the intertidal mudflats in Myanmar for water birds. These are mostly migrating and non-breeding water birds using the mudflats as feeding and roosting places on their migration routes, or during the wintering period before returning on migration to northern breeding grounds as far away as Arctic Russia, Alaska, China and Mongolia. In fact, most water birds spend more time at wintering and stopover sites in Myanmar (October – April) than in the breeding areas (June -August). First-year birds among the waders also spend their first boreal summer in or near these wintering grounds, which highlights the importance of the intertidal mudflats in Myanmar for these water birds (Zöckler *et al.* 2010).

Our surveys show that several coastal wetlands in Myanmar fulfil one or both of two criteria for internationally important wetlands under the Ramsar convention, exceeding a total of 20,000 water birds or 1% of the flyway population and a number of species (Wetlands International 2012). The most important site is the Gulf of Mottama, which hosts 120,000 - 150,000 wintering water birds and is critically important for the globally threatened Spoon-billed Sandpiper. A further 16 species reach the 1% Ramsar criterion in the Gulf of Mottama. The site is currently under government consideration to be designated as Ramsar site. At present, Myanmar has listed only one inland wetland as Ramsar site and none of several potential coastal wetlands have yet been listed.

The extensive intertidal mudflats of the Ayeyarwaddy Delta are habitat for over 10,000 water birds and are important wintering areas for the endangered Nordmann's Greenshank and the vulnerable Great Knot. The surveys only covered a small part of the delta but internationally important numbers, exceeding 1% of the flyway population were recorded for Nordmann's Greenshank and five more species in the Delta: Black-headed Ibis, Greater Sand Plover, Lesser Sand Plover, Nordmann's Greenshank and Brown-headed Gull (*Larus brunnicephalus*). On the basis of these

counts, this site also qualifies as a Ramsar Site (Wetlands International 2012). Equally, Nan Thar Island has five species reaching the 1% criterion, qualifies for Ramsar designation, including 34 Spoon-billed Sandpiper and a regular night roost for up to 1,400 Bar-headed Geese (see also Zöckler *et al.* 2012).

Some individual sites like Hunters Bay were less suitable for large flocks of water birds due to the close proximity to mangrove areas of varying extent. However, the vast expanses of intertidal mud- and sandflats along the Myanmar coast are important in their entirety, as different parts serve as feeding and roosting grounds for different water birds at different times within the lunar tidal cycle.

### Records of threatened water bird species

#### *Spoon-billed Sandpiper (CR)*

There are currently six locations that host Spoon-billed Sandpiper in Myanmar (Figure 2). However, it is likely that other sites might host single birds of this species. The majority of wintering and passage birds are found in the Gulf of Mottama and also in Nan Thar Island in the west of the country. A total of an estimated 200-250 birds are estimated to winter regularly in Myanmar (Zöckler *et al.* 2010). This is more than 50% of the total global population of this species (E.E. Syroechkovskiy *in litt.*) demonstrating that Myanmar is the most important wintering area for this species. Both the Gulf and Nan Thar Island are therefore essential for the survival of the species and require immediate protection.

#### *Nordmann's Greenshank (EN)*

Nordmann's Greenshank was recorded at three sites. Numbers exceeding eight birds or the 1% threshold, have only been recorded in the Eastern Ayeyarwaddy Delta, which appears to be a stronghold for the species in Myanmar. The total global population is estimated at around 1,000 birds (BirdLife International 2013). Tong *et al.* (2014) counted over 1,100 at stop over sites in Rudong, China suggesting the current population estimate may be too low. Regardless, the 26 individuals in 2013 the eastern delta substantially exceeds the 1% threshold for the species even taking into account a potential increase in the population estimate to reflect the Rudong count. In 2006, 23 Nordmann's Greenshank were observed at two different locations further west in the delta (Thet 2006) and considering that large areas within the delta have not been surveyed, it is likely that the total number over-wintering in the delta could be much higher. The species was widely dispersed in the Gulf of Mottama, so surveys of the vast sand and mudflats might have overlooked some individuals. Birds of this species forage in mudflats with deep sediments, and are often seen near mangroves. Its special feeding techniques allow for larger prey, including mud skimmers and

crabs that occur in deeper mud at Nan Thar (Zöckler & Frew 2011) and in the Ayeyarwaddy Delta (Zöckler *et al.* 2013). Nordmann's Greenshank is often associated with Great Knot and Grey Plovers (*Pluvialis squatarola*) when roosting.

#### *Lesser Adjutant Stork (VU)*

The Lesser Adjutant was formerly common in Myanmar (Smythies 1986) but it is now rare with only few recent records. More extensive surveys of the remaining coastal areas are needed to assess the current status of the species. This globally threatened stork species has been found widely dispersed along the coast and listed for four sites. It prefers less disturbed mangrove areas, as in the Hunters Bay area and Dawei River mouth, with six birds each, the Ayeyarwaddy Delta and Myeik mangroves and mudflats over 10 each. The stork seems to prefer wetlands for foraging and tall trees for nesting, although most of the mangrove forests are being rapidly cleared due to increased agricultural conversion, fuelwood consumption, charcoal production, commercial logging, shrimp and fish farms conversion and plantation development. These activities are, particularly noticeable and have been described for the Ayeyarwaddy Delta area (FREDA & ACTMANG 2012). In the face of these pressures, the Lesser Adjutant has almost disappeared from Myanmar as a breeding species. No breeding record has been confirmed for Myanmar since 1987 (Luthin 1987). However, in 2013, it was found breeding by the staff of Meinmahla Kyun Wildlife Sanctuary in the eastern Ayeyarwaddy delta, as it did in 2006, when a total of 10 birds were recorded at eight different sites in the delta (Thet 2006). The majority of birds were observed in the neighbourhood of mature mangroves in the Auckland Bay region south of Myeik where in total 19 birds were observed in December 2013 (see also Figure 2). Breeding is highly likely in these areas, but not yet verified.

#### *Sarus Crane (VU)*

This species is usually not associated with coastal wetlands, but in Rakhine State near Hunters Bay at least two birds were observed close to mangrove areas. Also further inland and north from this area, we observed several territorial birds near coastal wetlands in the Kaladan catchment area.

#### *Great Knot (VU)*

Great Knot has been classified as 'vulnerable' due to heavy losses of the population monitored in the Yellow Sea area (Moores *et al.* 2009). The total population is estimated now at 290,000, dropping from the previous estimate of 380,000 (Barter 2002). Maximum numbers of 600 or more birds in the Ayeyarwaddy Delta and Gulf of Mottama do not reaching Ramsar 1% level (Wetlands International 2012), but demonstrate that the Myanmar coast line is on the migration route.

More surveys are required to establish a full understanding of the species' distribution in Myanmar.

#### *Indian Skimmer (VU)*

There is only one site on the coast of Myanmar for this species. In 2008, 27 birds were observed in the Pyang Pie River mouth approximately 50 km from Nan Thar Island (see Figure 2). In subsequent years the number declined steadily to only nine birds in 2011. There have been no records in 2012 and 2013 and it is believed the population may have perished, but no recent surveys have been undertaken. As this is the only known site along the Myanmar coast, it is important to continue searching for the species.

#### **Threats to water birds on the Myanmar coast**

Whilst many intertidal mudflats in most East Asian countries are threatened by coastal development (MacKinnon *et al.* 2012), Myanmar's intertidal mudflats are still largely unaffected and mostly pristine. Hunting and mist-netting are the major immediate threats to the water birds in many areas (Zöckler *et al.* 2010). Many hunting-related threats to water birds have been addressed, namely in the Gulf of Mottama and Nan Thar Island respectively (Htin Hla & Eberhardt 2011, Ren 2013). However, hunting and trapping remains an issue in many areas, especially in the Ayeyarwaddy Delta. Local people regularly hunt and poach birds using mist-nets and poison (pesticides) both for food and to trade locally. All shorebird species are legally protected under the Wildlife Act of Myanmar, which prohibits their killing or capturing. However, most people are unaware of this legislation. Consequently, local people poach birds throughout the survey area.

Intertidal mudflats are not only important as fish nurseries and as habitat for small marine invertebrates, but also play an important role in the nutrient cycle, sedimentation and the purification of near coastal, coastal, marine and estuarine waters. Fishermen regularly fish on the muddy shores at low tide, a time when waders feed. Hence low-tide harvesting activities can be a threat to foraging water birds. The degradation of mangroves, conversion into agricultural land and introduction of shrimp aquaculture is another major threat to the habitats of water birds in coastal Myanmar. These threats are not only restricted to water birds but also potentially impact other parts of the intertidal ecosystem, and ultimately threaten the local human population that rely on its ecological integrity. We recommend that awareness and education programmes should be carried out in these areas to encourage protection and discourage activities such as hunting, netting and habitat destruction. If action is not taken, it is likely that more species and habitats will be lost.

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**Appendix 1.** Water birds counted at Nan Thar island, 2008-2013 (January).

Species	2008	2009	2010	2011	2012	2013
Grey Heron		7	?			
Great Egret	6	11	?			
Intermediate Egret		2	?			
Little Egret		31	?			
Black-headed Ibis		13	20			
Bar-headed Goose	400+	1,400	900	?	1,100	
Ruddy Shelduck	2	92	4			
Eurasian Wigeon	?	1,150	1,200			
Northern Pintail	1,500	1,600	3,000			
Garganey	-	1	2			
Northern Shoveler	-	-	10			
Tufted Duck	-	-	2			
Great Thick-knee	8	-	-			-
Small Pratincole		3				14
Pacific Golden Plover	12	30	?			
Grey Plover	52	195	40			
Common Ringed Plover	1	-				
Little Ringed Plover		2	?			
Kentish Plover	55	13	?			
Greater Sand Plover	440	250	?			
Lesser Sand Plover	380	1,000	?			
Pintail Snipe		1	-			
Black-tailed Godwit	326	1,800	400			250?
Bar-tailed Godwit	4	5	2			
Whimbrel	10	10	14			
Eurasian Curlew	41	69	20			
Northern Greenshank	7	20	10			
Spotted Redshank	-	-	5			
Common Redshank	335	300	60			
Marsh Sandpiper	1	1	-			
<b>Nordmann's Greenshank</b>		<b>2</b>	<b>5</b>			<b>4</b>
Wood Sandpiper						1
Terek Sandpiper	50	85	20+			
Ruddy Turnstone	19	35				
Great Knot	13	40	-			30
Red Knot	3	8	-			35
Sanderling	90	215	20			45
Red-necked Stint	68	280	200			200
Curlew Sandpiper	87	130	150			32?
Dunlin		1	1			2
<b>Spoon-billed Sandpiper</b>	<b>34</b>	<b>14</b>	<b>14</b>	<b>22</b>	<b>25</b>	<b>20</b>
Broad-billed Sandpiper	63	330	80			100
Pallas's Gull	54	18	75			
Brown-headed Gull	50	340				
Gull-billed Tern	97	130	60			
Caspian Tern	2	1	3			
Lesser Crested Tern	2	20				
Greater Crested Tern	35	1	1			
Common Tern	1	1	10			
Little Tern	200	365	100			
Whiskered Tern	103	14	200			

**Appendix 2.** Water bird counts in Eastern Ayayewaddy Delta near Kei-ye-gy Island. And Kaing Thaug Island. in January 2010 (Morozov & Archipov 2010) and November 2013 at Kei-ye-gy Island area only (Moses & Zöckler 2013).

Species	2010 (Jan)	2013 (Nov)
Grey Heron	30	26
Great Egret	70	140
Intermediate Egret	16	
Little Egret	?	120
Black-headed Ibis	120	35
Ruddy Shelduck	4	
Pacific Golden Plover	30	3
Grey Plover	60	250
Kentish Plover	40	20
Lesser Sand Plover	3,500	500
Greater Sand Plover	30	1,500
Black-tailed Godwit	400	16
Bar-tailed Godwit	110	30
Whimbrel	10	70
Eurasian Curlew	190	120
Common Redshank	600	250
Marsh Sandpiper	8	2
Common Greenshank	50	50
<b>Nordmann's Greenshank</b>	<b>8</b>	<b>26</b>
Terek Sandpiper	150	30
Ruddy Turnstone	40	25
<b>Great Knot</b>	<b>600</b>	<b>146</b>
Red Knot	120	12
Sanderling	20	20
Red-necked Stint	90	36
Little Stint		4
Curlew Sandpiper	150	80
<b>Spoon-billed Sandpiper</b>		<b>1-2</b>
Broad-billed Sandpiper	200	100
Heuglin's Gull		2
Pallas's Gull	850	142
Brown-headed Gull	2,800	90
Gull-billed Tern	2	
Caspian Tern	5	37
Greater Crested Tern	170	
Common Tern	10	
Little Tern	100	120
Whiskered Tern	800	500

**Appendix 3.** Water bird counts at the Gulf of Martaban, 2008-2012 (January-February). Av.ann.total = Estimated average annual Total (2008-2012). Species in bold fulfil 1% Ramsar criteria.

Species	2008	2009	2010	2011	2012	Av.ann.total
Little Cormorant			40			40-100
Grey Heron	4	203	20			200-400
Great Egret	3	285	120			300-600
Intermediate Egret		10	370			400-800
Purple Heron			11			40
Little (Striated) Heron			3			10
Indian Pond Heron	13	11	140			150-300
Little Egret	5	150	140			150-300
Night Heron		6	30			200
<b>Painted Stork</b>	<b>140</b>			<b>4</b>	<b>4</b>	<b>150</b>
Asian Openbill		2				10
<b>Black-headed Ibis</b>		<b>133</b>	<b>6</b>			<b>150-300</b>
Glossy Ibis					80	80
Lesser Whistling Duck			2,400			2,400
Bar-headed Goose			1			1
<b>Ruddy Shelduck</b>	<b>950</b>	<b>118</b>	<b>24</b>			<b>1,200</b>
Common Shelduck		1				
Eurasian Wigeon		284				300
Northern Pintail	80		60			150
Pied Avocet		1				-
Small Pratincole	145	123				120-250
Red-Wattled Lapwing	6	1				-
<b>Pacific Golden Plover</b>	<b>1,013</b>	<b>7,726</b>	<b>250</b>			<b>9,000-10,000</b>
Grey Plover	9	224	220			250-500

## Appendix 3. Continued

Species	2008	2009	2010	2011	2012	Av.ann.total
Common Ringed Plover	1	12	1	1		1
Little Ringed Plover	348	606	8			800-1,000
<b>Kentish Plover</b>	<b>2,504</b>	<b>8,131</b>	<b>7,193</b>			<b>10,000-20,000</b>
<b>Lesser Sand Plover</b>	<b>8,963</b>	<b>18,032</b>	<b>13,850</b>			<b>23,000-40,000</b>
<b>Greater Sand Plover</b>	<b>1,320</b>	<b>418</b>	<b>1,102</b>			<b>1,300-2,500</b>
Common Snipe	12					
Long-billed Dowitcher		42				40
<b>Black-tailed Godwit</b>	<b>252</b>	<b>3,405</b>				<b>3,500-5,000</b>
Bar-tailed Godwit	136	227				250-400
<b>Whimbrel</b>	<b>1,597</b>	<b>969</b>	<b>140</b>			<b>1,500-2,500</b>
<b>Eurasian Curlew</b>	<b>965</b>	<b>2,141</b>	<b>770</b>			<b>2,200-4,000</b>
<b>Spotted Redshank</b>		<b>1,312</b>	<b>190</b>			<b>1,400-2,000</b>
<b>Common Redshank</b>	<b>1,958</b>	<b>4,617</b>	<b>640</b>		<b>1,800</b>	<b>4,500-8,000</b>
Marsh Sandpiper	70	149	40		100	150-300
<b>Common Greenshank</b>	<b>372</b>	<b>1,776</b>	<b>90</b>			<b>2,000-3,500</b>
Nordmann's Greenshank	2	7	1	1		7-20
Green Sandpiper	3	3	1			10
Wood Sandpiper	12	11	6			20
Terek Sandpiper	317	316	1			320-600
Common Sandpiper	211	43	152			300-400
Ruddy Turnstone	17	29				30-60
Great Knot		458				500-1,000
Red Knot	3	18	2			20-40
Sanderling	12	12				20-40
<b>Red-necked Stint</b>	<b>4,245</b>	<b>6,353</b>	<b>4,801</b>			<b>9,000-13,000</b>
Temminck's Stint	8	23	8			40-100
Long-toed Stint		4			80	100
<b>Curlew Sandpiper</b>	<b>2,323</b>	<b>6,762</b>	<b>5,728</b>			<b>8,000-12,000</b>
Dunlin		2	2		1	2
<b>Spoon-billed Sandpiper</b>	<b>48</b>	<b>75</b>	<b>74</b>	<b>33</b>	<b>53</b>	<b>180</b>
			(140-220)			
<b>Broad-billed Sandpiper</b>	<b>1,734</b>	<b>1,224</b>	<b>2,121</b>		<b>4,000</b>	<b>4,000-5,000</b>
Ruff		33	6			50-100
<b>Pallas's Gull</b>	<b>2,473</b>	<b>521</b>	<b>405</b>			<b>2,500-3,000</b>
Brown-headed Gull	43	667	250			1,000-2,500
Gull-billed Tern		125	15			130-250
Caspian Tern	25	56	15			60-80
Lesser Crested Tern						
Greater Crested Tern						
Common Tern			50			50
Little Tern		68	120		10	250-400
Whiskered Tern	715	7,345	615	4,000	4,000	7,500-12,000
White-winged Tern		2,815	225		3,000	3,000-5,000
Black Tern			10			10

**Appendix 4.** Water bird counts at Ahlat, Salween River mouth (January), 2010-2013.

<b>Species</b>	<b>2010</b>	<b>2012</b>	<b>2013</b>
Grey Heron	29		
Great Egret	50		50
Intermediate Egret			
Purple Heron	1		
Little Egret			
Black-headed Ibis	53	60	
Grey headed Lapwing			2
Pacific Golden Plover			40
Grey Plover			
Little Ringed Plover	35		65
Kentish Plover		500	500
Lesser Sand Plover		300	1,500
Greater Sand Plover			200
Black-tailed Godwit	10	33	57
Bar-tailed Godwit			
Whimbrel	20		20
Eurasian Curlew	125		15
Spotted Redshank			20
Common Redshank	220		200
Marsh Sandpiper			2
Common Greenshank	8	35	15
Terek Sandpiper			4
Ruddy Turnstone			1
Great Knot			2
Red Knot			1
Sanderling			10
Red-necked Stint			120
Curlew Sandpiper			25
<b>Spoon-billed Sandpiper</b>	<b>?</b>	<b>4-8</b>	<b>3</b>
Broad-billed Sandpiper			50
Pallas's Gull			
Brown-headed Gull			230
Gull-billed Tern	1		3
Greater Crested Tern			
Common Tern			
Little Tern			
Whiskered Tern	45		200
White-winged Tern			60