Far Eastern Curlew Report for the EAAFP

Nial Moores & Jason Loghry, November 26th 2017

Birds Korea is a legally-registered, fully independent South Korean bird conservation NGO which has actively contributed to the work of the East Asian-Australasian Flyway Partnership (EAAFP) since its foundation, e.g. working with partner organisations on waterbird and shorebird surveys and contributing to Single Species Action Plans for Scaly-sided Merganser *Mergus squamatus*, Baer's Pochard *Aythya baeri*, Spoon-billed Sandpiper *Eurynorhynchus pygmeus* and Far Eastern Curlew *Numenius madagascariensis*.

The following report provides count data and information on primary moult in Far Eastern Curlew on Yubu Island in the Geum Estuary on 11 dates between late June and mid-August 2017, presented here in order to support the work of the Far Eastern Curlew Task Force and those involved in conservation work for the Geum Estuary.

1. Introduction

1.1 Project Rationale

The Far Eastern Curlew *Numenius madagascariensis* is endemic to the East Asian-Australasian Flyway (EAAF) with a global population estimated at between 32,000 (Wetlands International 2017) and 35,000 individuals (Hansen et al. 2016), and a population decline estimated at between 30-49% over three generations (30 years) indicated by non-breeding surveys in Australia (Garnett et al. 2011) or of 81% over 30 years (EAAFP 2017). The species is therefore currently listed as Endangered by BirdLife International on behalf of the IUCN because "it is undergoing a very rapid population decline which is suspected to have been primarily driven by habitat loss and deterioration in the Yellow Sea region" (BirdLife International 2017). The species is now the focus of a dedicated EAAF Partnership Task Force and a Single Species Action Plan which identifies five main actions, including managing remaining sites; monitoring the species' population trend; and determining key demographic parameters to support population modelling (EAAFP 2017).

In the Republic of Korea (ROK) the Far Eastern Curlew is a tidal-flat obligate species, with most individuals concentrated in two discrete areas of the west coast: (1) the Geum Estuary (and before seawall closure in 2006, the adjacent Saemangeum Estuarine System); and (2) Gyeonggi Bay, including the remaining tidal-flats of Ganghwa Island, Yeongjong Island, Song Do, Namyang Bay/ Hwaseong and Asan Bay (e.g. Long et al. 1988; Barter 2002; Moores et al. 2008; Shorebird Network Korea 2011, 2013, 2014, 2016). The species is therefore one of the main foci of an ongoing conservation initiative for shorebirds in the Geum Estuary, including Yubu Island, led by BirdLife International and Seocheon County. In addition to being the most important remaining shorebird site in the ROK following the loss of Saemangeum to reclamation (Moores et al. 2008; Moores 2012; Moores et al. 2016), the Geum Estuary is currently also the most important site in the ROK for the Far Eastern Curlew, with >5,000 recorded during southward migration in 2011 and 2012 (Lee et al. 2017).

Based on current understanding, the Far Eastern Curlew is entirely migratory in the ROK, with the largest number of birds recorded during the main migration periods in late March-April (e.g. Moores 2012) and again in August (e.g. Lee et al. 2017); with perhaps 1-3 birds overwintering annually (although to date there are perhaps fewer than 10 adequately documented records from the boreal mid-winter period: Moores et al. 2014). The peak dates and migration periods accord well with current knowledge of migration timing of Far Eastern Curlew between Australian non-breeding areas (where > 70% of the population is considered to spend the boreal winter: Conklin et al. 2014); Yellow Sea staging areas; and Chinese and Russian breeding grounds as outlined by e.g. Ueta (2004), Choi et al. (2016) and EAAFP (2017). Moreover, there are records of at least some Australian-banded birds in the ROK, including five recorded in Saemangeum and the Geum Estuary during northward migration in 2006-2008 (Moores 2012) and more recently one individually-marked bird, banded as a 3+ Calendar-year individual in Broome on February 22nd 2016, seen by the authors during survey work at Namyang Bay (37.054, 126.752) on July 15th 2017.

Despite strong evidence of a rapid decline in the global population (based primarily on analysis of long-term datasets from Australia: Clemens et al. 2016), Lee et al. (2017), including multiple authors who work in the National Institute of Biological Resources (NIBR), state that the species has increased

remarkably in the Geum Estuary in recent years, especially during southward migration. This increase, the authors suggest, is likely "due to influxes from other stopover sites in China, North Korea, or South Korea, or simply to an increase in the Far Eastern Curlew population itself." An alternative hypothesis is that because of the rapid and extensive loss and degradation of tidal-flats in the Yellow Sea, at least some of the recent increase in the Far Eastern Curlew – a long-lived species – that has been recorded in the ROK might instead be due to an increasing number of birds suspending migration and / or returning early from the breeding grounds. This would result in a greater overlap and concentration of birds, leading to increased interference and a further increase in the proportion of birds failing to breed and migrate "traditionally" (e.g. p. 276, Moores 2012). Support for this hypothesis might include evidence of a change in migration timing in the short term (e.g. a later peak count during northward migration, large numbers of birds present through the boreal summer and an earlier peak during southward migration); a reduced number of immatures in the total population; and a strong decline in the total population over the mid-long term as fewer birds are able to breed, as perhaps already suggested by the recent rapid rate of decline observed in Australia. Although rather few counts have been made outside of the two main migration periods, large numbers of Far Eastern Curlew have been found in the ROK and in coastal China during the boreal summer this century (e.g. Moon et al. 2013; Zhang 2016; EAAFP 2017). In addition, pioneering research has detected primary moult in a substantial proportion of these birds at Yalu Jiang, Liaoning, China in July and August, potentially involving hundreds or even thousands of birds (Bai unpublished data; Bai in EAAFP 2017)**.** Importantly, these birds are thought not to return to Australia for the boreal winter, as available evidence suggests that Far Eastern Curlew in Australia initiate moult post-arrival in August / September; and there is not a single record of a Far Eastern Curlew showing evidence of suspended moult among 900+ records of primary moult collected by the Victoria Wader Studies Group in Australia (Danny Rogers in lit. November 2017). It is therefore plausible that many of these birds might instead spend the boreal winter in coastal China (where 3,000 are already estimated to overwinter: EAAFP 2017) or instead disperse throughout coastal Asia (as suggested by the records generated by the Asian Waterbird Census: Mundkur et al. 2017). The presence of such birds also suggests either that primary moult in the Yellow Sea has been an overlooked part of a traditional migration strategy of this species, suggesting greater diversity within the species than generally understood (and perhaps also that the total population might be slightly higher than estimates based on declines in Australia suggest); or that it is instead a more recent adaptation to a rapid deterioration in conditions encountered by the birds during migration through the Yellow Sea.

Counts from outside the main migration periods and determination of moult state in birds in the ROK in July and August were therefore considered by the authors to be potentially helpful in interpreting count data; and in supporting population modelling.

1.2 Aims and Methods

The present project, supported by a small grant of 1.55 million Korean won from the EAAFP with the support of the Far Eastern Curlew Task Force, aimed to generate count data and to improve current understanding of the sex and age structure of the population of Far Eastern Curlew on Yubu Island in July and early August, outside of the main migration period. An additional (unfulfilled) research aim was to

identify main prey items taken by feeding birds, to inform assumptions made in research on the feeding ecology of Far Eastern and Eurasian Curlews *Numenius arquata* at Gangwha Island (Moon et al, 2013).

In addition to counts made by the authors in the Geum Estuary on June 22nd and on Yubu Island on 24th (funded through SBS in China by National Geographic Grant # GEFC21-16, and as presented in Moores 2017), repeat counts of Far Eastern Curlew and the rather similar-looking Eurasian Curlew were made for the present project each day by a single observer (Jason Loghry) on Yubu Island on a further ten dates over two spring-tide cycles during July 27th-July 31st and August 10th-14th (Table 1).

Table 1. Dates and Tide Heights of dates with curlew counts on Yubu Island, June-August 2017

Date	Main Time of Curlew Counts	Sunrise	Sunset	High Tide Time	High Tide Height (m)
Jun 24	05:10-10:00	05:17	/	04:04	7.31
Jun 24	13:30-17:10	/	19:53	16:13	6.29
Jul 27	17:30-19:00	/	19:42	18:17	6.09
Jul 28	05:26	05:37	/	06:50	6.30
Jul 29	06:20	05:38	/	07:31	6.11
Jul 29	17:59-18:10	/	19:40	19:54	5.59
Jul 30	06:30-10:38	05:38	/	08:18	5.69
Jul 30	17:20-18:56	/	19:39	20:51	5.33
Jul 31	05:30	05:39	/	09:10	5.30
Aug 10	17:25	/	19:29	17:13	6.24
Aug 11	17:29	/	19:27	17:54	6.28
Aug 12	05:51	05:49	/	06:19	6.67
Aug 12	18:08	/	19:26	18:37	6.23
Aug 13	18:51	/	19:25	19:25	6.09
Aug 14	07:08	05:50	/	07:48	6:10
Aug 14	18:41	/	19:24	20:21	5.90

- Tides from http://tides.mobilegeographics.com, location Gunjan (Geum Estuary)
- Sunrise and sunset times from https://www.timeanddate.com/sun/south-korea/gunsan

Curlew counts were made from multiple points (with location and time recorded) through a tripod-mounted telescope on the incoming and falling tide; and digiscoped video was taken opportunistically of flocks and of single birds, especially when birds were preening, wing-stretching or in flight. As very few of the Far Eastern Curlew recorded during the present study and none of the birds captured in the video clips were marked (e.g. with individually numbered flags or unique colour band combinations) it is not possible to confirm whether or not any of the same individuals were captured more than once. To help reduce bias that might result from recording the same individuals or groups of birds multiple times, series of video clips were instead taken opportunistically at different locations, at different times and at different tide states. These video clips (n=82) were then converted to video grabs (n=392); and each video grab was examined in order to determine if there was any evidence of the start of primary moult indicated by e.g. a gap formed by one or more missing inner primaries in one or both wings. After review by Jason Loghry, 21 video grabs which contained birds showing missing feathers or particularly heavy wear were reviewed by both authors and also by David Melville, Peter Pyle and Danny Rogers - three leading experts on moult.

2. Results

2.1 Total Numbers of Curlews

A minimum 1,480 Far Eastern Curlew and 1,215 Eurasian Curlew were recorded on Yubu Island during the present survey, with the highest count of both species recorded during the afternoon high tide on August 12th (Table 2). There was substantial variation in the numbers of curlews recorded between dates and sometimes between morning and afternoon high tide states. However, we do not consider that this day-to-day variation was necessarily caused by a high turnover of migrant birds through the site between June 24th and August 14th. Instead, much of the variation could have been due to counting conditions (e.g. inclement weather) and the influence of tide heights.

Previous survey effort with larger teams of counters found that even small changes in tide height affected use of roost sites by shorebirds (Rogers et al. 2006). During neap high tides (of approximately <5.5m) open areas of tidal-flat remain throughout the tide cycle along parts of the mainland Janghang Coast and close to Daechuk Island (centred at 36.036, 126. 631), allowing curlews and godwits to roost there – out of view of Yubu Island and the mainland - instead of on Yubu Island itself. Falling high tide heights are therefore likely responsible for much of the fall in counts between July 29th and July 31st; and again between August 12th and 14th.

Table 2. Counts of curlews on Yubu Island in June, July and August 2017.

	High Tide	Far Eastern Curlew	Eurasian Curlew	Curlew Sp	Curlew Total
Jun 24	AM & PM	1,390	100	0	1,490
Jul 27	PM	0	0	1,900+	1,900+
Jul 28	AM	0	0	600+	600+
Jul 29	AM	0	0	1,570+	1,570+
Jul 29	PM	10	140	1,530	1,680
Jul 30	AM	0	0	1,020	1,020
Jul 30	PM	36	502	460+	998+
Jul 31	AM	0	245	738	983
Aug 10	PM	550	510	240	1,300
Aug 11	PM	1010	510	770	2,290
Aug 12	AM	1,202	858	0	2,060
Aug 12	PM	1,480	1,215	0	2,695
Aug 13	PM	1,040	840	0	1,880
Aug 14	AM	1,060	530	0	1,590
Aug 14	PM	1,080	630	46	1,756

2.2 Roosts

On June 24th, following the morning high tide of 7.31m, large numbers of Far Eastern Curlew (low 100s) were watched flying toward Yubu Island from downstream of the Geum River. These birds are assumed to have roosted within the Saemangeum reclamation area. During previous surveys between 2010 and 2013, large numbers of this species were recorded in temporarily-created non-tidal reclamation lagoons during high spring tides, generally of >7m. For example, 963 were counted flying in from the Geum River on October 6th 2013 to a lagoon close to 35.935, 126.547, c.9km to the southwest of Yubu Island (Birds Korea 2013).

During most other tides, Far Eastern Curlew apparently divided into two or three main groups. The first congregated along the main tidal-flat (close to: 35.955, 126.617); the second on the tidal-flat close to the village (at: 35.994, 126.587); and the third close to Daechuk Island (35.998, 126.628), where birds were usually too far away to count to species.

As noted during previous surveys (e.g. Moores 2012), many of the Eurasian Curlew gathered on Yubu tidal-flat on the incoming tide (often close to 36.001, 126.614), but then flew to a permanent island (at 36.035, 126.632) for roosting during the high tide.

2.3 Moult

If it is assumed that all individuals were different, then a minimum 29 out of 1,035 Far Eastern Curlew reviewed in the video grabs showed evidence of the start of primary moult in late July and mid-August, equivalent to 2-3% of birds that were captured in this way (Table 3) . Several (but not all) of the moulting birds showed features that might be expected in Second Calendar-year birds (e.g., narrow, bleached, and abraded outer primaries, rectrices, and greater coverts), an age-class that is generally considered to remain in Australia during the boreal summer. As it would be unusual for a shorebird to migrate during active primary moult, it is reasonable to assume that at least this subset of Far Eastern Curlew would have remained in the Geum Estuary between and beyond the dates of counts that we made. As noted by Peter Pyle (in lit. Nov 2017), early commencement of primary moult in this and older pre-breeding age-classes would be consistent with over-summering shorebirds, perhaps indicating that these birds had over-summered in the Geum Estuary, or at least within the Yellow Sea.

The number of Eurasian Curlew incidentally captured in the video grabs was too small to conduct a robust comparison between the two species. However, several Eurasian Curlew were in active primary moult as early as June 24th; and at least one bird in a video grab had more advanced moult than any of the Far Eastern Curlew, having already dropped p5-6 by August 14th. Although we are unaware of any prior research in the ROK on primary moult in shorebirds, several of the Eurasian Curlew at Namyang Bay seen in July and many of the Eurasian Curlew seen at the Geum Estuary and other west coast sites in August during earlier research efforts were also in active primary moult.

Table 3. Number of Far Eastern Curlew showing evidence of primary moult by date

Date	Number of individuals reviewed	Number showing evidence of Primary Moult	% With evidence of Primary Moult	Additional Individuals showing possible evidence of Primary Moult
July 27	81	1	1.23	0
July 28	67	1	1.49	1
July 29	60	1	1.67	0
July 30	227	12	5.29	1
July 31	56	0	0	0
August 11	200	3	1.5	4
August 12	189	4	2.12	1
August 13	7	0	0	0
August 14	148	7	4.73	2

2.4 Age and Sex Ratio

The quality of the images gathered during the present research were inadequate to allow any analysis of sex ratio based on bill length. However, the images did allow confirmation of field impressions that no juveniles were noted during the present research. As noted above, several images suggest the presence of different age cohorts, including at least a small proportion of Second Calendar-year birds.

2.5 Main prey items

Due to the challenges of fieldwork, including the nervousness of the species and the great distance at which most birds flushed, we were unable to gather any detailed information on prey items taken during the present research although Far Eastern Curlew were frequently seen to handle and consume unidentified species of crab.

2.6 Peak Counts of Additional Threatened Species

(i) Black-faced Spoonbill *Platalea minor*. Nine on June 24th; 14 on July 30th; and 37 on August 13th.

(ii) Chinese Egret *Egretta eulophotes*. Five on June 24th; seven on July 30th; 21 on August 13th.

(iii) Great Knot *Calidris tenuirostris*. Ninety on June 24th; 420+ on July 27th; and 380 on August 11th. Counts suggest that some birds over-summered or returned early from the breeding grounds and that after an arrival of birds in July numbers continued to fall steadily.

(iv) Spoon-billed Sandpiper *Eurynorhynchus pygmeus*. One on July 28th; one on August 10th; two on August 11th; two on August 12th; and one on August 13th. Based on plumage differences, it seems likely that five or possibly six different individuals were involved.

(v) Saunders's Gull *Chroicocephalus saundersi*. Five on June 24th; nine on July 30th; four on August 11th.

(vi) Styan's Grasshopper Warbler *Locustella pleskei*. Present throughout on main breeding island(s).

3. Discussion

Research conducted by the authors for Birds Korea in June, July and early August 2017 confirm that large numbers of shorebirds were present at key sites in the ROK outside of the main migration periods, including internationally important concentrations of Far Eastern Curlew.

Our counts made between June 19th and 25th (funded by National Geographic Grant # GEFC21-16 through SBS in China) found >8,400 individuals of 28 species of shorebird at 11 wetlands, including a total of 3,398 Far Eastern Curlew. Of the total number of shorebirds we recorded, 64% of these were in the Geum Estuary, including 926 Far Eastern Curlew along the mainland coast on June 22nd and 1,390 on Yubu Island on June 24th. Tide heights and the tide-related movements we observed suggested that these

birds were different, so that we consider that >2,300 Far Eastern Curlew were present in the whole estuary on those dates. This total represents c. 7% of the population estimate made in 2012 of this fast-declining species (Wetlands International 2017). Our June survey did not include the tidal-flats of Ganghwa Island, where Moon et al. (2013) recorded >1,000 Far Eastern Curlew on June 2nd 2012, and we also did not survey several other areas of potentially important tidal-flat in Gyeonggi Bay (including remaining areas of Asan Bay). It therefore seems reasonable to assume that >5,000 Far Eastern Curlew were present in the ROK in mid-late June 2017.

The survey in July and August was focused only on Yubu Island, where the peak count of 1,430 Far Eastern Curlew recorded on August 12th is remarkably similar to the number we counted there in late June (1,390). As a small percentage of these birds had started primary moult in late July, it is tempting to suggest that many of these moulting birds had over-summered in the Yellow Sea, arriving back in the Geum Estuary sometime in June. At least - perhaps because we were unable also to count along the Janghang coastline - we were unable to find any strong evidence of either mass emigration or immigration of Far Eastern Curlew between late June and mid-August,. This is in contrast to our counts of Eurasian Curlew. Our survey in June found a total of 266 Eurasian Curlew at 11 sites nationwide, including 105 in the Geum Estuary. This number had increased by the end of July to >500 on Yubu Island alone; and again to 1,215 on Yubu Island by mid-August.

The lack of increase in the number of Far Eastern Curlew we recorded between late June and mid-August was not expected. Previous count effort in the Geum Estuary (e.g. in Lee et al. 2002; Moores 2012; Moores and Zhang 2016) suggests that this species largely departs the area by mid-May but perhaps starts to return again as early as late May (perhaps mostly involving birds which are too immature to breed and early failed breeders); is present again in substantial numbers by early to mid-June (as the first early breeders also return); and increases further in July and into August, when the peak number for the southward migration period is often reached, as juveniles join adults.

In contrast to our results, Moon et al. (2013) recorded a substantial increase in number in 2012 at Ganghwa Island between June 2nd and July 8th and again between July 8th and July 24th, when their peak count of c. 2,500 was recorded, double the number recorded in early June. This number fell rapidly by August 5th, presumably due to departure of some of the adults towards non-breeding grounds, before increasing again, presumably in part due to the arrival of juveniles and perhaps other age cohorts.

Our counts of Far Eastern Curlew were also far lower than those made on Yubu Island by Lee et al. (2017) on August 4th and 31st 2011 and again on 21st August 2012, although they were higher than their count made on August 22nd 2013. We also found many more Eurasian Curlew. According to raw counts provided by the NIBR to Chris Purnell (BirdLife Australia) and reproduced here with permission, the NIBR recorded 4,802 Far Eastern Curlew and 582 Eurasian Curlew on Yubu Island in August 2011; 3,155 Far Eastern Curlew and 150 Eurasian Curlew in August 2012 (when morning and evening high tides were 6.88m and 6.71m respectively); and 1,099 Far Eastern Curlew and 719 Eurasian Curlew in August 2013 (with only one high tide during daylight hours, that of 6.63m). Although the decline in number of Far Eastern Curlew counted on Yubu Island in August between 2011 and 2013 might in part be related to these lower tide heights in the latter year, it is worth noting that the numbers they counted in the Geum Estuary as a whole also declined 23% from 4,020 in August 2011 to 3,065 in August 2013; and 17% from 2,479 counted on

September 15th-16th 2011 to 2,046 on September 23rd 2013. We did not have access to their counts from 2014-2017.

None of these counts are easy to interpret, as the count effort in the ROK and in much of the Yellow Sea has been too limited in scope (both in frequency and in the numbers of sites that have been covered), and because there has been insufficient research focused on ageing birds and on moult.

4. Recommendations

Respectfully, in order to close some of the existing information gaps and to help fulfil essential actions highlighted in the Single Species Action Plan for the Far Eastern Curlew (EAAFP 2017), the authors would therefore like to recommend that:

(i) At the Geum Estuary and other important sites for the Far Eastern Curlew in the ROK, training and workshops should be conducted to help enhance researchers' identification skills (including separation in the field of Eurasian Curlew from Far Eastern Curlew) and to help share more insights into the species' ecological requirements and conservation status.

(ii) A much more frequent counting effort should be coordinated and funded (e.g. once each spring tide cycle) of Far Eastern Curlew at selected key sites in the ROK in 2018 and / or 2019, including in June and July as well as during the main migration periods, to determine the relative importance of these sites to the species, to help identify potential population trends, and to support robust monitoring of the species as called for by EAAFP (2017).

(iii) Any increased effort in the ROK should be coordinated with an increase in similar research at known key sites in the PR China.

(iv) More support should be found to help conserve key sites in the DPRK, where internationally important concentrations of Far Eastern Curlew have been found by recent survey (Riegen et al. 2016; Riegen in lit. 2017). In accordance with essential actions to "identify, protect and manage remaining sites" highlighted in EAAFP (2017), increased support should be given to the DPRK in their efforts to join the EAAFP and to accede to the Ramsar Convention (as proposed in 2018), to help support that nation's efforts to conserve tidal-flats and shorebirds.

(v) The possibility of funding through e.g. the Ministry of Unification, Foreign Affairs and Environment (ROK) and through wider initiatives (e.g. the Yellow Sea Large Marine Ecosystem project) should also be explored, in order to support expanded survey of intertidal wetlands along the west coast of the DPRK, during both northward and southward migration periods and the boreal summer in 2019.

(vi) If successful in increasing conservation collaboration in all three Yellow Sea nations, the Far Eastern Curlew should then be used as a public awareness flagship species both for conservation of Yellow Sea tidal-flats and of tri-national collaboration for the conservation of the environmental and ecological health of the Yellow Sea Eco-region as a whole.

(vii) As part of an enhanced survey and monitoring effort, the identification and description of moult in Far Eastern Curlew (and other threatened shorebird species) by researchers at key sites in the Yellow Sea region should also be encouraged.

(viii) Also in accordance with essential actions to "identify, protect and manage remaining sites" in the Single Species Action Plan for the Far Eastern Curlew (EAAFP 2017)

employment of satellite transmitters in different parts of the breeding range should then be increased in 2019, to locate the non-breeding area of the estimated 25-30% of Far Eastern Curlew which do not regularly spend the boreal winter in Australia.

(ix) Increased effort should also be made by participants in the Asian Waterbird Census to confirm the identification of Far Eastern Curlew during the boreal mid-winter, to confirm the accuracy and usefulness of the range maps of the two large curlews presented in Mundkur et al. (2017).

(x) Following this enhanced research effort, skype meetings and national/ regional workshops should be held in 2020 to harness the expertise of the Far Eastern Curlew Task Force and of researchers with experience of the species to help review all materials so that possible differences in migration strategies can be identified; and the population estimate can be revised, if necessary, in accordance with Objective 6.1.2 of the Single Species Action Plan (EAAFP 2017); and so that the threat assessment of the Far Eastern Curlew (and perhaps other Numeniini populations: see Pearce-Higgins et al. 2017) in the ROK and along the EAAF can be revised and remaining information gaps identified.

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REFERENCES

Barter, M. 2002. Shorebirds of the Yellow Sea: Importance, threats and conservation status. Wetlands International Global Series 9, International Wader Studies 12, Canberra, Australia.

BirdLife International. 2017. IUCN Red List for birds. Downloaded from http://www.birdlife.org in November 2017.

Birds Korea. 2013. Birds Korea and The Spoon-billed Sandpiper Mini-Documentary Project. Accessed in November 2017 at: http://www.birdskorea.org/Birds/Key_Species/BK-KS-Spoon-billed-Sandpiper-Mini-Documentary.shtml

Choi C-Y., Rogers, K., Gan X.J., Clemens, R., Bai Q.Q., Lilleyman, A., Lindsey, A., Milton, D., Phil Straw, P., Yu Y-T., J, Battley, P., Fuller, R. & and Rogers, D. 2016. Phenology of southward migration of shorebirds in the East Asian–Australasian Flyway and inferences about stop-over strategies. *Emu*, 2016, 116, 178–189 http://dx.doi.org/10.1071/MU16003.

Clemens,R.S.,Rogers,D.I.,Hansen,B.D.,Gosbell,K.,Minton,C.,Straw,P.,Bamford, M.,Woehler, E.J.,

Milton, D., Weston, M.A., Venables,B., Weller, D., Hassell, C. J., Rutherford, B., Onton, K., Herrod, A., Studds, C. E., Choi, C.-Y., Dhanjal-Adams, K., Skilleter, G., and Fuller, R. A. 2016.Continental-scale decreases in shorebird populations in Australia. *Emu* 116, 119–135. doi:10.1071/MU15056

Conklin, J.,Verkuil,Y. &Smith, B. 2014. Prioritizing migratory shorebirds for conservation action on the East Asian–Australasian Flyway. WWF-Hong Kong, Hong Kong.

EAAFP. 2017. East Asian-Australasian Flyway Partnership International Single Species Action Plan for the conservation of Far Eastern Curlew (*Numenius madagascariensis*). As adopted by the 9th Meeting of Partners, Singapore, 11-15 January 2017.

Garnett, S., J. Szabo & G. Dutson. 2011. *Action Plan for Australian Birds 2010*. CSIRO, Collingwood.

Hansen, B., Fuller, R., Watkins, D., Rogers, D., Clemens, R., Newman, M., Woehler, E. & Weller, D. 2016. Revision of the East Asian-Australasian Flyway Population Estimates for 37 listed Migratory Shorebird Species. Prepared for Australian Government Department of the Environment. Unpublished report for the Department of the Environment. BirdLife Australia, Melbourne.

Lee J.K., Chung O-S., Park J-Y., Kim H-J., Hur W-H., Kim S-H. & Kim J-H. 2017. Effects of the Saemangeum Reclamation Project on migratory shorebird staging in the Saemangeum and Geum estuaries, South Korea. Bird Conservation International 2017. doi:10.1017/S0959270916000605

Lee H-S., Yi J-Y., Kim H-C, Lee S-W. & Paek W-K. 2002. Yubu Island, the Important Waterbird Habitat on the West Coast of Korea and Its Conservation. *Ocean and Polar Research*. Vol 24(1): 115-121.

Long, A., Poole, C., Eldridge, M., Won P-O & Lee K-S. 1988. *A Survey of Coastal wetlands and Shorebirds in South Korea, Spring 1988*. Asian Wetland Bureau, Kuala Lumpur.

Moon Y-M., Kim K-M. & Yoo J-C. 2013. Bird-days carrying capacity estimation of the curlews stopping over in the southern intertidal zone of Kanghwa Island. *Journal of Wetlands Research*, Vol. 15, No.2, pp 281-288. (In Korean with English abstract).

Moores, N. 2012. The distribution, abundance and conservation of avian biodiversity in Yellow Sea habitats in the Republic of Korea. Ph.D. Thesis, University of Newcastle, NSW, Australia.

Moores, N. 2017. Shorebird Survey, Republic of Korea, June 19th – 25th 2017. Internal Report for SBS in China, as part of project # GEFC21-16.

Moores, N., Kim, A. & R. Kim. 2014. *Status of Birds, 2014*. Birds Korea report on Bird Population Trends and Conservation Status in the Republic of Korea. Published by Birds Korea, September 2014.

Moores, N., Rogers D., Kim R-H, Hassell C., Gosbell K., Kim S-N & Park M-N. 2008. The 2006-2008 Saemangeum Shorebird Monitoring Program Report. Published by Birds Korea, Busan.

Moores, N., Rogers, D.I., Rogers, K. and Hansbro, P.M. 2016. Reclamation of tidal flats and shorebird declines in Saemangeum and elsewhere in the Republic of Korea. *Emu*, 116, 2: 136-146. Published by CSIRO.

Mundkur, T., Langendoen, T. and Watkins, D. (eds.) 2017. The Asian Waterbird Census 2008-2015 –

results of coordinated counts in Asia and Australasia. .Wetlands International, Ede. Accessed in November 2017 at: http://www.eaaflyway.net/documents/resources/aewa%20ref/AWC_2008-2015_Summary_Report_31Mar17.pdf

Pearce-Higgins, J.W. & 35 authors. 2017. A global threats overview for Numeniini populations: synthesising expert knowledge for a group of declining migratory birds. *Bird Conservation International* (2017) 27:6–34. © BirdLife International, 2017

Riegen, A., Melville, D.S., Woodley, K., Postill, B., Ju, S.I., Hong, H.S., Kim, S.H. & Pak, U. 2016. Coastal shorebird surveys in the Provinces of North and South Pyongyang, The Democratic People's Republic of Korea, April 2016. *Stilt* 69-70: 36-42.

Rogers, D., Moores, N. & P.Battley. 2006a. Northwards Migration of Shorebirds through Saemangeum, the Geum Estuary and Gomso Bay, South Korea in 2006. *Stilt* 50: 73-89. Published by the Australasian Wader Studies Group

Shorebird Network Korea. 2011. Shorebird population count report of Korea (2010). Shorebird Network Korea Secretariat, Shinan County, Republic of Korea. [In Korean]

Shorebird Network Korea. 2013. Shorebird population count report of Korea (2011–2012). Shorebird Network Korea Secretariat, Shinan County, Republic of Korea. [In Korean]

Shorebird Network Korea. 2014. Shorebird population count report of Korea (2013). Shorebird Network Korea Secretariat, Shinan County, Republic of Korea. [In Korean]

Shorebird Network Korea. 2016. Shorebird population count report of Korea (2014). Shorebird Network Korea Secretariat, Shinan County, Republic of Korea. [In Korean]

Ueta M. 2004. Eastern Curlew Horoku-Shigi (Jpn) Numenius madagascariensis. *Bird Research News* Vol.1 No.3: 5-6.

Wetlands International. 2017. *"Waterbird Population Estimates"*. Retrieved from wpe.wetlands.org on Tuesday 27 Jun 2017

Zhang L. 2016. Over-summering waders in Dongtai-Rudong area, Jiangsu Province, China.*Tattler* 40:6.