Global Flyway Network

The shorebird ecological demographics & conservation initiative

AWSG

Australasian Wader Studies Group

RED KNOT NORTHWARD MIGRATION THROUGH BOHAI BAY, CHINA, FIELD TRIP REPORT APRIL & MAY 2012

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Summary

The fieldwork season commenced on April 11th and finished on June 2nd 2012.

We recorded a minimum of 4,493 marked shorebirds, including 691 that we could identify to an individual bird, from throughout the EAAF. Within these numbers there were 904 sightings of colourbanded birds from NWA, the main focus of this study, and this gave us 308 individually recognizable individuals. This was of course dominated by Red Knot with 287 individuals, Great Knot 17 and Bar-tailed Godwit 4. This reflects the vital importance of the area for the Red Knot *piersmai* subspecies. Most avian studies would be thrilled with this result if they saw this number of 'their' birds at the marking location. GFN are recording these birds some 6400km away from where the birds were marked!

The importance of the vast area of commercial salt ponds adjacent to the inter-tidal area was again evident with a single count from just 2 ponds combined on May 15 2012 of 22,610 Curlew Sandpipers this is 10.8% of the EAAF estimated population. The salt works area holds significant numbers of Marsh Sandpipers during spring migration. This species peaks a little earlier than most with the highest numbers occurring in late April. In 2012, in excess of 10,000 (1% Ramsar criteria in the EAAF) were recorded daily from 26th April into early May. The highest count of Black-tailed Godwit was on 30th April when 4,100 (2.6% Ramsar criteria in the EAAF) were present. We estimate that up to 40,000 White-winged Black Terns could be in the area at any one time. The estimate for this species in the EAAF is not very accurate but 40,000 would equate to anything from 4 to 40% of the EAAF population!

The continuing pressures on the inter-tidal area are obvious with the continuing development of industrial and housing areas adjacent to and on the inter-tidal area. The direct destruction of the inter-tidal area had slowed this season but huge building projects are taking place in former salt pond habitat.

Collaborative conservation efforts by various NGO's spearheaded by WWF-China Beijing office continued with a 'gathering for shorebirds and coastal wetlands'. It was very well attended and received heavy media coverage.

A double page, colour spread about the Luanan Wetlands and the work GFN, BNU and others are doing there was also published in the China Daily.

Future studies at the site will continue with GFN continuing to document the fates of four shorebird species at their non-breeding' sites in NWA and throughout the flyway with an emphasis on Bohai Bay. From this work we will be able to assess the effects of human induced habitat change through survival analysis and statistical work. GFN will continue conservation efforts at Bohai Bay in conjunction with WWF-China and other organisations. A Masters student, Miss Ying Chi Chan, will analyse GFN data under the supervision of Theunis Piersma and a postdoctoral researcher will commence sophisticated analyses on the GFN data in early 2013 with the aim to publish papers in high-end biological journals.

Introduction

The ecology of the enigmatic long-distance migratory shorebird Red Knot *Calidris canutus*, despite a lot of study, is still not fully understood in the East Asian-Australasian Flyway (EAAF). It is represented in this flyway by three subspecies *piersmai, rogersi* and *roselaari (*the latter is not part of this study as it only breeds on Wrangel Island and migrates to the Americas) *piersmai* and *rogersi* breed in different locations in the Siberian Arctic and share non-breeding locations in Australasia (Rogers *et al.* 2010). One

of the mysteries of the species was where they stop-over during their northward migration. Surveys of the Yellow Sea by Mark Barter and Chinese colleagues failed to find significant numbers of the species despite extensive searching. They did record 14,277 in the NW Bohai Bay region during spring migration 2002 (Barter *et al.* 2003). During a brief 6-day visit in late April 2007 Chris Hassell (CH) from Global Flyway Network (GFN) counted a single flock of 10,650 Red Knot in the same region. In September 2007 Yang Hong-Yan (YHY, Beijing Normal University) commenced a PhD project on the food, foraging and stopover ecology of Red Knots in the area. She has been conducting regular counts since 2003 during the spring period of northward migration and her work shows that numbers of birds in the study area have increased over the years, presumably due to habitat destruction elsewhere and consequently birds moving in to the study site (Yang *et al*. 2011). It is clear from our current knowledge this site is the single most important site for Red Knot on northward migration in the EAAF. The southward migration route of Red Knot is still a relative mystery to us.

Along with the work by YHY, studies by GFN have continued during the northward migration seasons of 2009, 2010, 2011 and 2012. These field studies have concentrated on searching for individually marked birds and have been remarkably successful. In view of the many human-related threats to what would seem to be the single most important staging area for two subspecies of Red Knot, encompassing all Red Knots wintering in Australia and New Zealand, it seemed of utmost importance to continue the survey work. This need was recognized by WWF-Netherlands and WWF-China who have continued to fund the field work in 2012 through their association with GFN (CH remains supported by Vogelbescherming-Netherlands). Beijing Normal University also funded aspects of the project. Here we report on what we have achieved in April-May 2012.

All the migratory birds mentioned in this report are covered by the China-Australia Migratory Bird Agreement (CAMBA) and it should be a source of embarrassment to both governments that this destruction of critical habitat to migratory birds is happening unregulated and unabated.

The Study Site

The centre of the study site is situated at 39^{o} 03’ 35”N 118^{o} 12’ 33”E.

It is near Nan Pu Development City, situated on the edge of Bohai Bay, 190 km south east of Beijing, China see figure 1 below.

Figure 1. Interpreted satellite image of Bohai Bay, China.

The image shows the 3 study sites and the Caofeidian New Area Industrial Park. This enormous area will have destroyed 142km^2 of inter-tidal mudflat at its completion in 2020 (Yang *et al.* 2011). It has already covered >75% of its planned area. The mudflats of the 3 study sites used to give a 25km long and 1-3km wide (on the lowest tides) foraging area for shorebirds. This is no longer the case as most of the Zuidong mudflats have been claimed for industry and the remaining flats at the Zuidong

site seem to get little use by shorebirds (see details further in the report). The mudflats are separated by a man-made seawall from the Bei Pu Salt Ponds. These are reputedly 'the largest salt works in Asia'. This area, that is adjacent to the mudflats, is also good habitat for birds to forage and roost but is also being lost to industry.

Marking of Shorebirds

Shorebirds captured throughout the EAAF are marked with plain coloured flags, engraved leg flags (ELF), or combinations of 4 colour-bands and 1 flag. Each bird also has a metal band placed on it supplied by the country's relevant banding scheme. Each capture location has its own coloured flag and/or position of the flag on the birds' leg. The focus of our study is the individually colour-banded birds from Roebuck Bay, Broome and 80 Mile Beach, NW Australia, but we record every single flag we see during our field work thereby documenting the importance of this area to various species from throughout the flyway.

Colour-banded Red Knot from NWA, © A Boyle

Human Use of the Mudflats

The birds share the mudflats and food resources with the human population. The shell-fishers are able to harvest huge amounts of bivalves from the highly productive mudflats that comprise our study site. This economic benefit to local people is very real, the income is in the region of 10 million RMB (A$1.4 million) (Yang, pers.comm.) and as the mudflats are gradually destroyed their livelihood is threatened. We recorded a team of 18 men with 7 pumps bringing in a minimum of 100 sacks of shells (a minimum of 5 tonnes) returning from work on a single tide-cycle on 17 May. This productivity seemed to last throughout our 7 week study period and the tidal-flats are worked for about 6 months each year (Yang, pers.comm.).

Shell-fishers with the day's catch, © M Slaymaker

Field work in 2012

The fieldwork program for 2012 started on April 11 and finished June 2, this is 54 continuous days of field work. There were already significant numbers of Red Knot (>3,000) in the study area when Matt Slaymaker arrived. This is in contrast to 2011 when <100 Red Knot were present on the same date. Great Knot were

also present in the 1000's. Ruddy Turnstone, Curlew and Sharp-tailed Sandpipers were also seen and all of these species were 4-5 days earlier than in 2011. We don't know why these species had apparently left from their southerly non-breeding areas a little earlier than usual.

The peak count of Red Knot this spring (2012) recorded on the inter-tidal flats was 37,600 this is considerably lower than last year's total (2011) of 66,500. We did not feel that the population was actually that much lower in the whole area. We saw the usual large congregations of Red Knot feeding at Nanpu often with >20,000 birds spread between a few flocks all within a 3km area of mudflat. Our resighting rate of flagged and banded birds was very similar to other years. The obvious difference this year was that Red Knot were feeding in large numbers in the salt ponds. This area, in the past has been used more for roosting but this year we witnessed a lot of foraging Red Knot in the ponds in addition to the usual suite of species that feed there (Marsh, Curlew and Sharp-tailed Sandpipers, Dunlin, Red-necked Stint, Sanderling, Black-tailed Godwit). We speculate that the birds were moving more regularly between the inter-tidal flats and the salt ponds on all stages of the tide whereas in previous years they have tended to stay on the mudflats until high tide. Initial analysis of the benthos abundance by YHY showed there was no reduction in suitable sized shellfish (Potamocorbula laevis) prey. So presumably there were good feeding opportunities in the ponds this season that the knots were exploiting. From our observations the knots fuelled up for migration on time and data on abdominal profile scores shows in the data collected (see later). However the salt ponds are not an alternative for mudflat-specialists such as the Red Knot.

Table 1. The increase in peak counts on the inter-tidal flats to 2011 and the decrease for 2012 but see above for discussion. (Yang et al. 2011 and Yang unpublished data)

	2008	2009	2010	2011	2012
Red Knot	24,608	46,325	64,958	66,500	37,600

The scanning of foraging birds on the inter-tidal mudflats occupied the majority of our time with additional resighting scans done in the salt ponds when tides were not suitable to work on the mud. We recorded a remarkable haul of sightings (see Table 2). All shorebirds that forage on the mudflats leave the mud at high tide as the sea reaches the seawall, and fly to roost in salt ponds. Some roost in close proximity to the mudflats but as with last year most birds flew many kilometres from the mudflats to inaccessible roost sites. Two observers did spend a few days over the field work season trying to track where these birds were going to. We were able to follow their flights with binoculars and telescopes but rarely on foot or with our vehicle. The area of salt ponds and therefore roosting opportunities is vast, stretching 10km inland and across the entire 20km, from east to west, of our study sites (see Fig 1, study site image). The roosts we could access are relatively undisturbed (compared to our other study site at Roebuck Bay), and although migrating raptors and salt pond workers do cause some disturbance, it is not significant. We did manage to record some individually marked knots in the salt ponds. All of these we also recorded on the mudflats giving more credence to our thoughts that it was good foraging opportunities in the ponds rather that poor foraging on the mud that led to the unusual distribution and low count of knots this year. We also found some roosts and foraging Red Knot as we drove to and from the core area of our study site but the roosting birds were always distant and often in shallow water so we rarely got the opportunity to scan them at these sites. The myriad roosting opportunities are a positive for the birds but the foraging opportunities for Red Knots do not appear to be constant in the ponds. Thus the retention of the inter-tidal mudflats remaining at Zuidong, Nanpu and Beipu remains of greatest conservation importance to enable the huge numbers of migrant birds using the area to fatten up, continue their migrations to their breeding grounds and to be able to breed successfully.

Table 2 below shows the totals of all marked migratory shorebirds recorded during the field work and the location they were originally marked at. The birds with plain flags just indicate the original banding location and can not be identified to a specific individual. The colour-banded birds, the engraved leg flagged birds (ELF) and some birds with unique positioning of flags on their legs can be attributed to individual birds when close views are obtained. The closely monitored colour-banded birds from NWA show some very interesting 'life histories' (see appendix 1). As the team were seeing individually marked birds that were 'new' to the area late into the field work period, it is not unreasonable to assume that plain-flagged birds were also still arriving or had escaped our attention previously while others will have moved on. So while some will undoubtedly be multiple sightings the numbers in the table appear to be a good reflection of the numbers of flagged birds present during the study period.

Table 2. Totals of marked birds recorded during 54 days of field work April 11 to June 2 2012.

Marked at	Marking Type	Number of Sightings	Known Individuals
Bohai Bay, China	plain flags	118	0
Bohai Bay, China	unique colour bands	4	4
Chongming Dontang, Shanghai China	engraved leg flags	104	27
Chongming Dontang, Shanghai China	plain flags	461	0
Chukotka, Russia	plain flags, some with unique positioning	43	13
Hong Kong	engraved leg flags	5	4
Hong Kong	plain flags	14	0
Japan	plain flags	10	0
Kamchatka, Russia	plain flags	4	0
King Island, Australia	engraved leg flags	4	1
North West Australia	single colour band	44	0
North West Australia	unique colour bands	904	308
North West Australia	engraved leg flags	592	151
North West Australia	plain flags	529	0
New Zealand	unique colour bands	171	60
New Zealand	engraved leg flags	340	108
New Zealand	plain flags	198	0
Queensland, Australia	plain flags	8	0
Sakhalin, Russia	plain flags	5	0
Sumatra, Indonesia	plain flags	5	0
South Australia, Australia	engraved leg flags	13	8
South Australia, Australia	plain flags	48	0
Taiwan	engraved leg flags	2	1
Thailand	plain flags	70	0
Victoria, Australia	engraved leg flags	21	6
Victoria, Australia	plain flags	776	0
	Totals 2012	**4493**	**691**
	Totals 2011	**3449**	**493**

These records represent 16 different marking areas in the EAAF highlighting the importance of these mudflats, not only to birds from NWA, but from throughout the entire EAAF. The total number of sightings for 2012 (4,493) represents a 30.3% increase compared to 2011 (3449). Reasons for this big increase are that we had an extra observer with us in the field, weather conditions were generally good and with 4 years experience of the site we have a better understanding of how to work the area.

Records of individually colour-banded birds from NWA (300 total, 287 Red Knot, 17 Great Knot, 4 Bar-tailed Godwit) increased by 51% in relation to the 2011 total (190). 811 Red Knots have been individually colour-banded since the commencement of the project in 2006. So this is a remarkable set of data. Most ornithological studies would be thrilled if they were to record this many individually marked birds at the initial marking site. The GFN project is getting 1,000's of resightings in Roebuck Bay and 80 Mile Beach in addition to this set of data complied from resighting work 6,400km distant from the marking location.

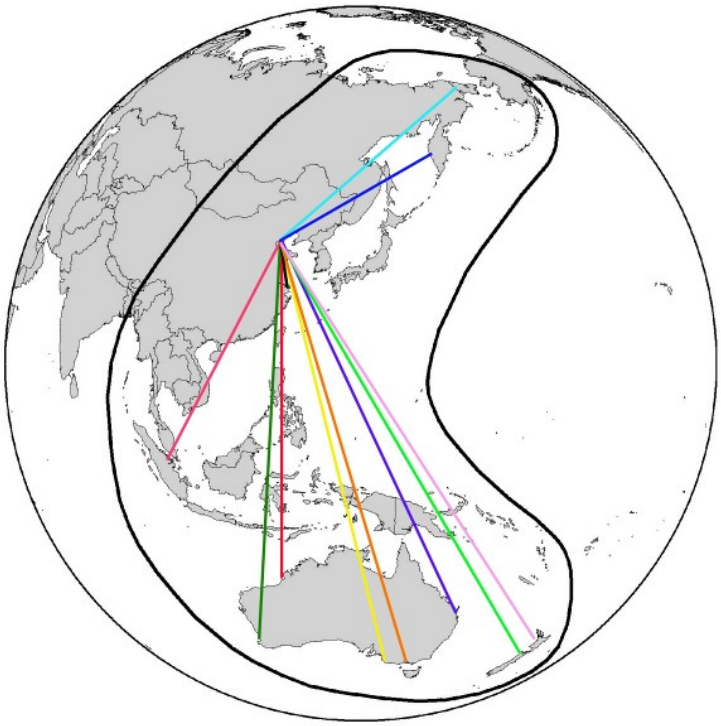


Figure 2. Red Knot were recorded from 13 different banding locations throughout the EAAF during the 2012 fieldwork season. The map above is a representation of some of these sites.

Use of the Mudflats and Resighting Coverage

The use of the 3 study sites (see Fig. 1, Study Site image) has changed from our first visit in 2007. The Zuidong area available to knots for foraging is now about 30% reduced having been destroyed by mud pumping and the construction of sea walls. These walls still contain sea water but the 'tide' does not come and go to reveal the mud the birds need to forage on. The adjacent salt ponds have been destroyed and are being developed for industry and housing. The remaining tidal flats at Zuidong are still open to the sea and have a 'normal' tidal regime. During our field work in 2011 the mudflats were used by a fraction of the birds from previous years. The method of pumping the mud over the sea wall into the adjacent salt ponds and then letting the water drain back out leads to huge volumes of water and anaerobic mud washing back over the 'healthy' mudflats and rendering them very poor quality habitat for shorebirds. Presumably the anaerobic mud settles on the top of the mud and suffocates much of the benthos. The favoured food of Red Knot, a bivalve, Potamocorbula laevis, feeds on algae on the mud surface and this algal layer is destroyed by anaerobic mud. Since our previous visit in 2011 this area had, to some degree, rehabilitated naturally, presumably due to 'new' silt brought in by the large tides and reasonable numbers of birds were using the area again. However the numbers were not back to those of 2009 and 2010. A very simple but very stark example of the changing quality of the Zuidong mudflat as a foraging site for shorebirds (Red Knot are used as an example) between 2009 and 2012 is shown below (YHY and GFN unpublished data) in table 3. Both GFN and Yan Hong Yan did much less observations and counts at Zuidong due to the difficulty of access due to the large volume of heavy trucks using the seawall and the extremely rough access track that our vehicle was unable to traverse. We did sometimes walk in to the site to conduct scans and counts.

The destruction of the mudflats at Beipu, the most northerly of our study sites, started in March 2011. For the whole 7 weeks we were in the field during 2011 the Beipu seawall was very busy with trucks, large

Table 3. Peak numbers of all shorebirds and Red Knot using the Zuidong mudflats during 2009 - 2012.

	10/05/2009	06/05/2010	03/05/2011	25/05/2012
All shorebirds	25,222	26,911	889	no count
Red Knot	18,770	18,470	570	4,900

machinery cars and construction workers. It was often impassable to our vehicle and we only managed a few resighting scans at this site. Eventually, on 23 May 2011, we were requested by a manager of one of the development companies not to access the mudflats. This situation had changed dramatically in 2012. There had been a dispute between the development companies and the pumping companies and the mud and the seawall was completely clear of any signs of the work being done in 2011. However, despite this, the Beipu mudflats held almost no birds for most of their area. The birds were only using the southern Beipu mudflats, not surprisingly this is the area that had not been pumped and had the least fishing nets on it. The lack of foraging birds may be due to the same reasons discussed above with anaerobic mud coating the surface or it may have been due to a big increase in fishing in the area. This meant many more nets and many more fishermen spread out over the mudflats. It seems that once the mudflats start to be destroyed that the fishermen and shellfishers up their activity at that area in anticipation of it being lost to them for good. This has repercussions for the birds that have to share the mudflat area with more nets and people. The highest single count of Red Knot at Beipu On 05/05/ 2011 was 23,500 and 6,300 in 1/05/2012.

Development pressure at Zuidong © A Boyle

Where fishing activity is at a reasonable level the birds and the fishermen share the mudflats. © Ying Chi Chan

The Nanpu mudflat is where most of the birds congregate and subsequently where the vast majority of our field work is done. Viewing can be done from the seawall during the smaller tides and out on the flats during the spring tides. The Nanpu mudflats are still relatively undisturbed and undoubtedly the most important of the remaining mudflats in the area. They have had some pumping done in 2006 and artificial islands have been built close off-shore for oil drilling and oil

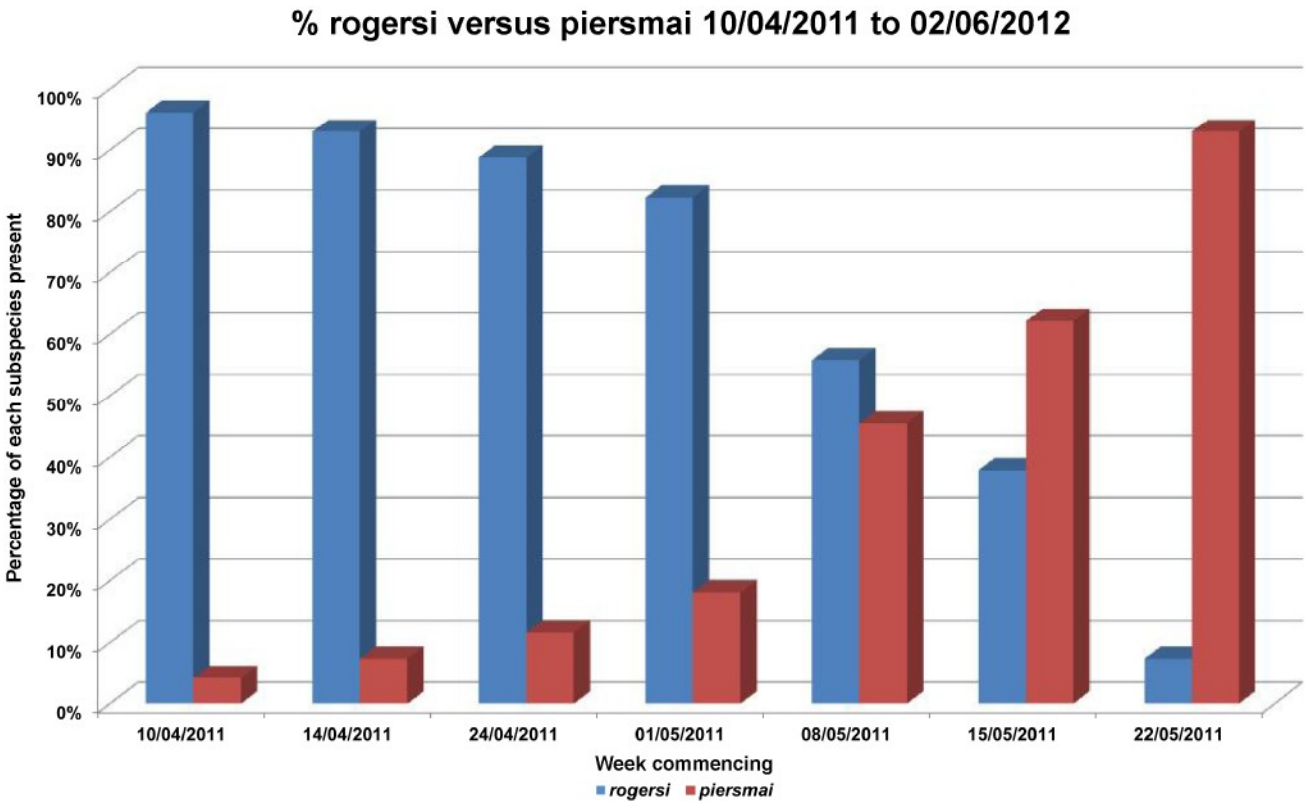
tanker loading but the mudflats abutting the seawall are still excellent areas for shorebird foraging. This is the area that must be saved and given Nature Reserve status to enable the Red Knot and many other species of migrant shorebird of the EAAF to maintain sustainable population levels.

Presence of *rogersi* and *piersmai* subspecies

Red Knots stream back to the Nanpu mudflats as the tide recedes. © M. Slaymaker

The majority of the two subspecies of Red Knot using the EAAF can be distinguished, when in fresh, full or near-full breeding plumage on the basis of the colour and pattern of that breeding plumage. This is particularly noticeable when the two subspecies are side by side as is the case in our study site. We did random counts of flocks of Red Knots regularly throughout the study period totaling 85,276 birds. We assigned each bird to a subspecies on the basis of plumage characteristics. The rogersi birds, predominately from SE Australia and New Zealand, arrived first and left for their eastern Siberian breeding grounds earlier than the piersmai birds, predominately from NW Australia, which breed in more northerly latitudes, on the New Siberian Islands. This is consistent with the patterns from previous seasons see figure 3.

Figure 3. 85,276 Red Knot were scanned during the study period and assigned to the rogersi or piersmai sub-species on the basis of plumage characteristics. The results show that the rogersi birds arrive earlier than piersmai birds and leave for the breeding grounds earlier. The composition of the two sub-species is almost exactly mirrored at the beginning and end of the study period.



A 'typical' rogersi (left) and piersmai (right) ©I. Southey and A Boyle

Abdominal Profiles

In the absence of mass data from captured birds it is possible to score the abdominal profile (AP) of birds in the field from telescope observations (Wiersma & Piersma 1995). We record abdominal profile on all birds when we got a suitable view. A side on view of the bird is needed for an accurate assessment. A factor the observer has to take in to account is if the bird is 'fluffed-up' due to cold weather. This can mislead the observer in to thinking the bird is 'fatter' than it really is. This can certainly be a problem but the experienced observers of GFN are aware of this and so all observers are scoring under the same criteria. The scores range from 1-skinny to 5-obese. A bird scored as 1 looks unhealthy and a bird scored at 5 can hardly walk!

It would seem that piersmai are arriving at Bohai in slightly better condition than rogersi, while no birds are arriving at Bohai in very poor condition (AP 1). This might mean that they are stopping or staging between their Australian and New Zealand non-breeding sites. This is however one piece of the Red Knot migration question that we are still attempting to answer with various methods; we conducted satellite transmitter projects in 2010 and 2011 and currently have 42 geolocators deployed with the hope that we will re-catch some of these birds in October 2012 and beyond to try and gain further insight in to the migration strategy of Red Knot from NWA. GFN also published an article on this topic (see appendix 2).

The abundant food source of the bivalve Potamocorbula laevis still seemed to be satisfying large numbers of hungry knots. It seems that Red Knot are still able to reach adequate weights to continue their migration to the breeding grounds on time. In 2012 the peak abdominal profiles were in fact slightly elevated over 2011. However we have a real concern that a 'tipping point' can not be far away as the area of mudflat taken for industrial development increases and consequently the foraging area available to the birds is reduced. This is why we continue in conjunction with WWF-China and others to try and reserve, at the very least, the Nanpu mudflats.

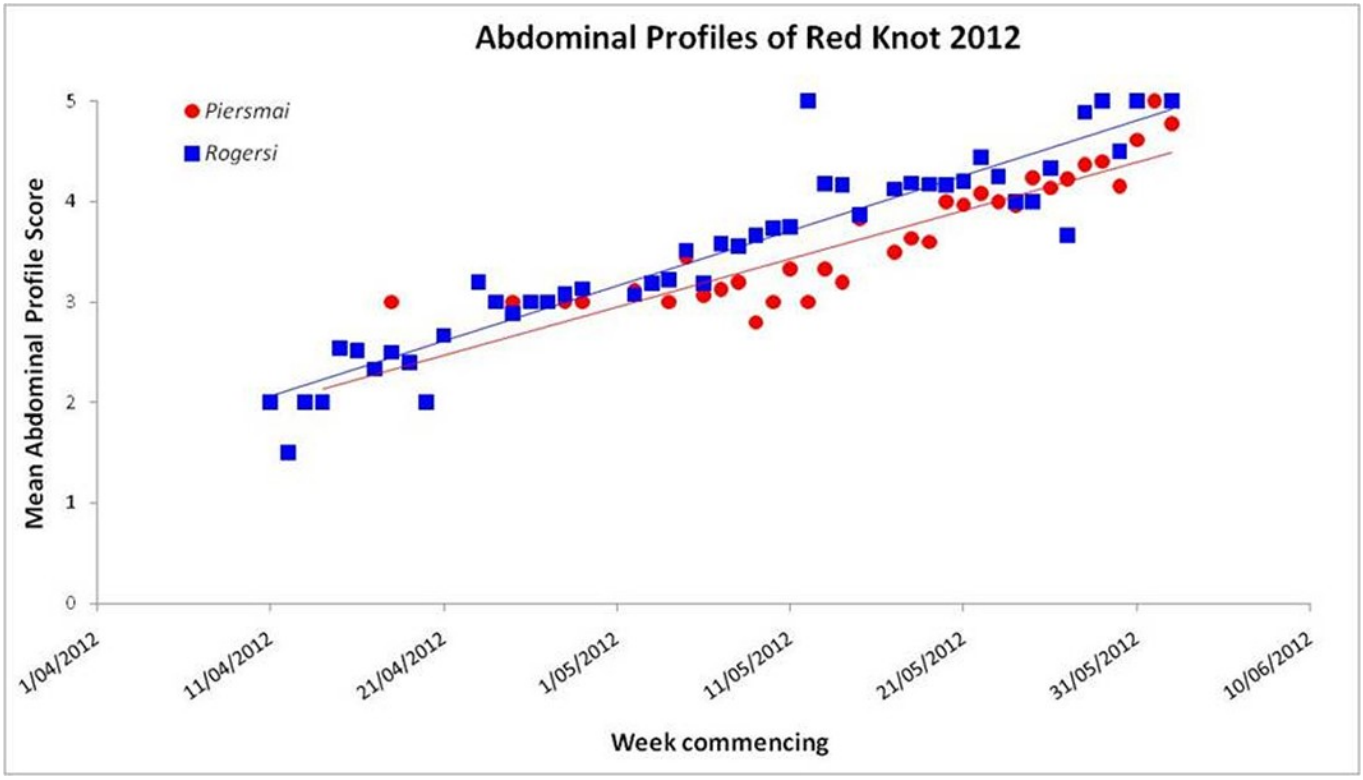


Figure 4. The graphs below shows the increase in AP, over time, for the two subspecies of Red Knot in 2012.

Habitat Destruction

The field work at the study sites is challenging, not so much from a practical point of view as there are good roads towards the sites and accessible tracks along the sea wall, but it is mentally challenging to work in an area that is having prime shorebird habitat destroyed as we watch the birds. The sense of a rapidly growing economy (progress or destruction?) is palpable.

This year the destruction of the inter-tidal flats themselves had slowed due to the dispute between companies. However the development adjacent to the mudflats was still in full-swing with a six-lane highway being constructed, huge apartment blocks being built and land readied for industry. The race to

conserve the area is still on. It is assumed that the dispute with the mud-pumping companies will be resolved and once more precious, bio-diverse mud will start to be pumped from the inter-tidal area over the seawall into the salt ponds thereby damaging 2 habitats in one process. Enormous areas of inter-tidal mud flats have been converted to industrial land in this way. Between 1994 and 2009, approximately 453 km2 of sea area in Bohai Bay including 156 km2 of intertidal mudflats have been destroyed, a 36% loss of the total area of 428 km2 mudflats (Yang et al 2010).

Large flocks of Red Knot still use the heavily disturbed habitat © A Boyle

The China Marine Environment Monitoring Centre states that the Bohai Sea is the most polluted sea in the world and absorbs nearly 5.7 billion tonnes of sewage and 2 million tonnes of solid waste each year. 43 of the 52 rivers that flow into it are heavily polluted (the China Marine Environment Monitoring Centre website). The latest study by the IUCN states that 'at least 24 species of shorebirds from the EAAF are heading towards extinction, with many others facing exceptionally rapid losses of 5–9 % per year' MacKinnon et al (2012).

Salt Ponds

Our field work is focused on Red Knots using the intertidal habitat, but the salt ponds that are adjacent to the mudflats are important habitats in their own right. Red Knots use them to roost in and occasionally to forage in when strong winds move the shallow water over the larger ponds thus exposing wet, soft sediments that can be exploited by numerous 'tidal-flat species'. This year we tried to make a more accurate assessment of the use of the salt ponds and numbers of birds within them. This is very difficult due to the vast size and lack of access but a short report on what we were able to establish of this little known but important area for shorebirds and the local economy is presented in appendix 3.

Nordmann's Greenshank *Tringa guttifer*

Nordmann's Greenshank is an endangered shorebird (IUCN 2001) with a continuing decline in its population. During our field work we saw up to a minimum of 10 on any one day. Nordmann's Greenshanks were recorded on 24 days between April 16 and May 15. We saw them feeding on the mudflats and feeding and roosting in the adjacent salt pans.

Nordmann's Greenshank *Tringa guttifer* (left) roosting in a salt pond © A Boyle

Spoon-billed Sandpiper *Eurynorhynchus pygmeus*

A single bird of this species was seen during our field work see appendix 4.

Seminar

During our field work season WWF-China Beijing office arranged a 'Gathering for shorebirds and coastal wetlands'. GFN's field work and vigorous promotion by WWF-China of the plight of Bohai Bay, its birds and fisherfolk has raised awareness of the issue to a wide audience. A short report by WWF-China is attached in appendix 5.

Media

The fieldwork and reporting conducted by GFN, the PhD studies of Yan Hong-Yan and the work and promotion by WWF-China Beijing Office over the years have resulted in a great deal of interest in Bohai Bay, the Yellow Sea in general and the huge pressures on the inter-tidal mudflats and the bio-diverse communities of benthos, fish, people and birds that use them. This resulted this year in a number of television companies filming GFN, Yang Hong Yan, local shell-fishers and other aspects of life on the mudflats. Also the print media visited the site and interviewed various people including GFN researchers. This resulted in unprecedented coverage with a double-page story about migrant shorebirds and mudflats in The China Daily News. The fact that the Yellow Sea is now on the radar of ornithologists,

conservation NGO's and even governments from around the world is due, in our view, to the plight of the Spoon-billed Sandpiper and the breeding programme that has been initiated, and also in no small part to the work of us all at Bohai Bay. We should all feel justifiably proud of what we have achieved, accepting that there is still a long way to go before any formal protection of the Nanpu mudflats is realised. See appendix 6.

The future of research

GFN, with continued funding from Vogelbescherming-Netherlands, will continue to document the fates of four shorebird species at their non-breeding' sites in NWA applying individual colour-band combinations and conducting intensive re-sightings scans for the marked birds and building up a comprehensive database of sightings from the marking site and throughout the flyway. With the work in Bohai Bay and sightings from other shorebird colleagues throughout the flyway, particularly in New Zealand and China (Chongming Dongtan and Yalu Jiang National Nature Reserves), we will be able to assess the effects of human induced habitat change through survival analysis and statistical work. GFN will continue conservation efforts at Bohai Bay in conjunction with WWF-China and other organisations. A Masters student, Miss Ying Chi Chan, will analyse GFN data under the supervision of Theunis Piersma, and hopes to start a PhD project on the migration of Red Knots along the EAAF (contingent on securing the necessary financial support) and a postdoctoral researcher will commence sophisticated demographic analyses on the GFN data in early 2013 and work towards publishing papers in high-end biological journals.

Passerine Migration

Although the migratory shorebirds were the focus of our work, because we had a number of keen ornithologists present, whenever we weren't studying shorebirds we were looking for anything with wings! The passerine migration through the area is marked by high species diversity despite the paucity of any wooded habitat. Appendix 7 has a complete list of all the birds seen during the field work period and includes some rare and difficult to see species.

Acknowledgments

Financial support for this work comes from Birdlife-Netherlands, WWF-China, WWF-Netherlands, and Beijing Normal University. A huge thank you to Yang Hong-Yan and Mr. Zhao for their friendship and constant help during our field work. Additional contributions to the field work came from Theunis Piersma. We thank Heather Gibbs for answering many and varied questions in relation to the database and updating the database to my every whim. Thank you to all the shorebird enthusiasts throughout the EAAF who send in sightings of marked birds. Thanks you to the NWA 2012 expedition team. Thank you to the fabulous group of volunteers from the Broome community who assist with the capture of the birds. Thank you to Andreas Kim for formatting and presentation of the report. Thank you to Liz Rosenberg for editing this report. Thank you to Ian Southey for use of his image. Thank you to Kim Onton for figure 4.

More information on the GFN colour banding project can be found at:

http://www.globalflywaynetwork.com.au

Contact Chris on: turnstone@wn.com.au

Collaborative partners

- Vogelbescherming-Netherlands (main funding body)
- Australasian Wader Studies Group (AWSG)
- Beijing Normal University, China
- WWF-China
- WWF-Netherlands
- Broome Bird Observatory
- Broome Community Volunteers

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GFN team 2012 not on a mudflat!

Appendix 1

Individual Life Histories

The individual colour marking of birds allows their life histories to be built up over time, providing regular searches are made for them. The site fidelity of shorebirds makes them suitable species for such work. Below is an example from the database of a Red Knot marked in Roebuck Bay and seen at Bohai 4 years in a row and returning to Roebuck Bay each non-breeding season.

Summary of sightings

Red Knot

Banding 1BYLL

14/09/2008 Richards Point, Roebuck Bay, Broome, Australia 05241744 (1BYLL) Aged 2

Resightings of 1BYLL

06/10/2008 Stilt Viewing, Roebuck Bay, Broome, Australia
18/05/2009 Nan Pu, Bohai Bay, China
23/05/2009 Nan Pu, Bohai Bay China
25/05/2009 Nan Pu, Bohai Bay China
04/10/2009 Wader Beach, Roebuck Bay, Broome Australia
31/12/2009 Wader Beach, Roebuck Bay, Broome Australia
21/05/2010 Zuidong Bohai, China
23/05/2010 Zuidong Bohai, China
24/05/2010 Zuidong Bohai, China
27/05/2010 Zuidong Bohai, China
19/04/2011 Wader Spit, Roebuck Bay, Broome Australia
09/05/2011 Nan Pu, Bohai Bay China
16/05/2011 Nan Pu, Bohai Bay China
20/05/2011 Nan Pu, Bohai Bay China
22/05/2011 Nan Pu, Bohai Bay China
26/05/2011 Nan Pu, Bohai Bay China
27/05/2011 Nan Pu, Bohai Bay China
29/05/2011 Nan Pu, Bohai Bay China
30/05/2011 Nan Pu, Bohai Bay China
31/10/2011 Roebuck Bay, Broome , Australia
24/04/2012 Tattler Rocks, Roebuck Bay, Broome, Australia
28/05/2012 Nan Pu, Bohai Bay China
30/05/2012 Nan Pu, Bohai Bay China
31/05/2012 Nan Pu, Bohai Bay China

Appendix 2

BirdingASIA 16 (2011): 89–93

CONSERVATION WATCH

Red Knot *Calidris canutus*: subspecies and migration in the East Asian-Australasian flyway—where do all the Red Knot go?

CHRIS HASSELL, IAN SOUTHEY, ADRIAN BOYLE & HONG-YAN YANG

Introduction

The ecology of the enigmatic long-distance migratory shorebird Red Knot *Calidris canutus* is still not fully understood in the East Asian-Australasian flyway (EAAF). Two subspecies *piersmai* and *rogersi* use the EAAF; they breed in different locations in the Siberian Arctic but share non-breeding grounds in Australasia (Rogers *et al.* 2010). Progress has been made on where they stop over during their northward migration. The estimated population 15 years ago was as high as 220,000, but extensive surveys of the Yellow Sea by Mark Barter and Chinese colleagues in the late 1990s and early 2000s failed to find the species in significant numbers. They did however record 14,277 in the north-west part of Bohai Bay during northward migration in 2002 (Barter *et al.* 2003). During a six-day visit in late April 2007 CH from Global Flyway Network (GFN) counted a single flock of 10,650 Red Knot in the same area. In September 2007 HYY commenced a PhD project on the food, foraging and stopover ecology of Red Knots in the area. She has made regular counts since 2003 during northward migration and her work shows that numbers of birds in the study area have increased over the years to peak counts of 66,500 today, presumably due to habitat destruction elsewhere causing more birds to use the study area (Yang *et al.* 2011). Our current knowledge indicates that this location is the single most important site for Red Knot on northward migration. However we think that there are other sites still to be discovered or documented in the EAAF.

Alongside HYY's work, studies by GFN have continued during the northward migration in 2009, 2010 and 2011, including intensive searches for individually marked birds of our main study species Red and Great Knot *C. tenuirostris*, Bar-tailed Godwit *Limosa lapponica* and Black-tailed Godwit *L. limosa*, and recording the proportions of *rogersi* and *piersmai* subspecies in the flocks of Red Knot. These field studies have been remarkably successful and, in view of the many human-related threats to what is the single most important staging area for the two races of Red Knot that make up the entire population of the species wintering in Australasia, it is of the utmost importance that the work continues.

Figure 1. Location of the key areas for Red Knot *Calidris canutus*, Bohai Bay and Liaodong Bay.

The southward migration route of Red Knot remains a complete mystery—there are no records of marked birds and very few records of large flocks. Surprisingly, Red Knot are virtually unknown in north-west Bohai Bay on southward migration, in stark contrast to the 66,000 seen during northward migration. However, a count of 5,000 Red Knot was recorded at Nanxiaohe in the Shuangtaizi Delta National Nature Reserve in Panjin, Liaodong province, China, on 12 August 2011 (Qingquan Bai pers. comm.). This site is only 300 km from our study area in Bohai Bay (Figure 1).

Relocating marked shorebirds

Shorebirds captured throughout the EAAF are marked with plain coloured flags (Plate 1), engraved leg flags (Plate 2), or combinations of four colour-bands and one flag. Each capture location has its own coloured flag or flags and/or position of the flag on the bird's leg. The focus of our study is the individually colour-banded birds from New Zealand and Roebuck Bay, Broome, north-west Australia, but we record every marked bird we see during our fieldwork.

We are asking for the help of Oriental Bird Club members to report sightings of Red Knot in the

Plate 1. Colour flagged Red Knot *Calidris canutus* , 9 April 2009.

Plate 2. Red Knot *Calidris canutus* with engraved leg flag, 29 March 2010.

EAAF between early March and late September. The information we need is the colour and position of the flag(s) on birds' legs (including flag position on birds with four colour-bands) along with the date and location. We are also very interested to receive any old records that have not been reported to date. We are trying to find the location and relative importance of any other staging sites in the EAAF. Some earlier work suggested that subspecies *piersmai* makes a direct flight from north-west Australia to Bohai Bay (Battley *et al.* 2005) but our recent 2011 work suggests that this is not the case. No individually marked Red Knot was seen for 25 days after it was last reported at Roebuck Bay and next reported in Bohai Bay (GFN unpublished data)—a Red Knot travelling at about 50–55 km/hr in reasonable weather conditions on a direct line would take just over five days to cover the 6,400 km distance. Did severe weather make 2011 unusual or do one or both subspecies stage somewhere else on their journey to Bohai, and if so where? And what happens on southwards migration?

In addition to reports of marked birds, we hope observers will send us details of all their sightings of Red Knot throughout East Asia and Indonesia between early March and late September, including counts, one-off sightings of big flocks, observations at sites not visited before or where birds have not been seen before, as well as flag sightings and colour-band sightings.

The identification of Red Knot subspecies in the EAAF

The Red Knot is a circumpolar-breeding migrant shorebird, with six subspecies recognised worldwide (Figure 2). Historical information indicated that *rogersi* spent its non-breeding season

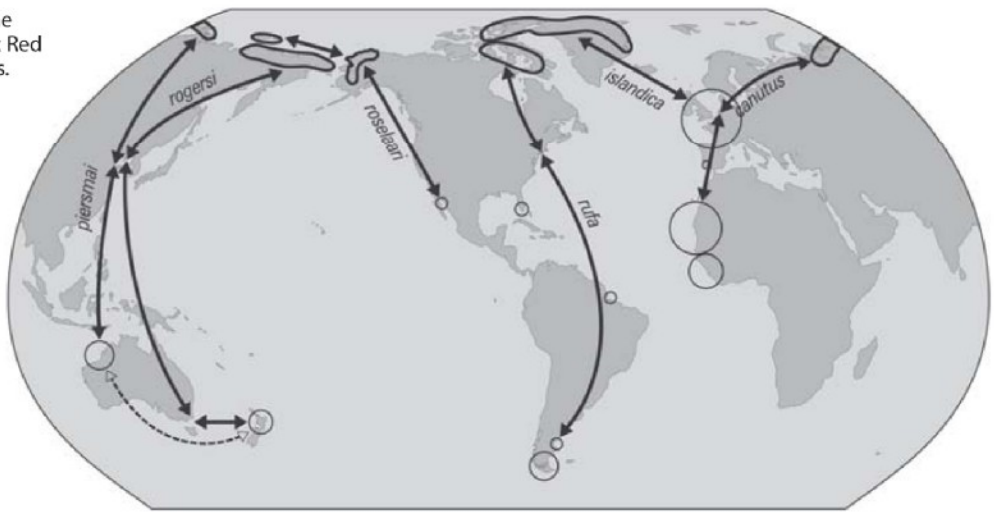

Figure 2. Map showing the migration routes of the six Red Knot *C. canutus* subspecies.

Plate 3. Red Knot *Calidris canutus rogersi* in full breeding plumage, 19 March 2007.

Plate 4. Red Knot *Calidris canutus piersmai* in full breeding plumage, 19 March 2007.

in New Zealand and south-east Australia and bred in Chukotka, Far East Russia, passing through the Yellow Sea on northward and southward migrations. *Piersmai* was only recently recognised as a valid subspecies (Tomkovich 2001). It breeds on the New Siberian Islands and spends the non-breeding season predominately in north-west Australia and uses the Yellow Sea as a major staging area on northward and probably southward migration. Tomkovich & Riegen (2000) drew attention to the occurrence of these two subspecies in New Zealand and the Gulf of Carpentaria, and the difference in their appearance is very evident when they are in full, fresh breeding plumage in April and May in Bohai Bay. Correspondence with New Zealand colleagues and study of Ian Southey's fine images has helped to clarify the identification characteristics of *rogersi* and *piersmai*, details of which follow. It is very important to remember that these characteristics are only reliable for birds in **fresh and full or near full breeding plumage**, just prior to and during northward migration. We do not believe it is reliable from the late breeding season onwards, as many important features are lost as the feathers wear. The authors use the plumage characteristics discussed in this article for 2–3 weeks before birds leave the non-breeding areas and during field work in Bohai Bay to try to gain a better understanding of the numbers and movements of both subspecies. There are no important discernible differences in male and female plumage to affect results (T. Piersma & P. Tomkovich pers. comm.) and there may be small numbers of subspecies *roselaari* and *canutus* in the EAAF, but again not enough to influence results. One result is that field observations and the many images taken by IS indicate that more *piersmai* winter in New Zealand than previously thought.

Table 1 summarises the differences between *rogersi* (Plate 3) and *piersmai* (Plate 4) in the field; *rogersi* has a paler breast with a greyer back and neck whilst *piersmai* has a richer brick-red toned breast, more boldly patterned black and red back and a red or reddish nape. The extremes are obvious and can be seen at a glance, but variation in these features is continuous and a very few individuals are so similar that they cannot be told apart in the field with confidence.

In close-up, more detailed differences may be seen. **Nape**: *rogersi* has a pale silver-grey nape with some dark streaking, and some birds may redden across the nape, whilst *piersmai* has a reddish nape with dark streaking. **Mantle and scapulars**: *rogersi* has broad silvery-grey fringes to the mantle feathers, feathers are black-centred and a few—under 25%—may have reddish edges. Scapulars tend to have a fine black centre line with a large terracotta-red spot on each side. This gives the upperparts the appearance of being sliver-grey, spangled with pale to bright terracotta-red. By contrast, *piersmai* has narrow chestnut fringes to the mantle feathers, larger black centres and small whitish tips. The scapulars have a broader black centre line and small brick-red spots. **Underparts**: *rogersi* has peachy underparts, solid to level with the legs with little, if any, peachy flecking beyond the legs, i.e. lower belly and undertail-coverts, but this feature is highly variable. In contrast, *piersmai* has brick-red underparts, the colour extending behind the white thighs with some obvious red markings on the lower belly and undertail-coverts, but this feature too is highly variable.

Why field observation is urgently needed

Much if not all of the habitat currently used by Red Knot in NW Bohai Bay will be destroyed in the foreseeable future and it is likely that the adaptable species will then use other sites, which today are visited only for short stopovers or in an emergency, as main staging sites. It is therefore of vital importance for the survival of the species that these alternative sites are identified, documented and protected from the same catastrophic change that has already occurred elsewhere in the EAAF—between 1994 and 2010, a total of 450 km^2 of offshore area, including 218 km^2 of intertidal flats (one third of the original tidal area in Bohai Bay), has been claimed in western and northern Bohai Bay for two industrial projects (Tianjin Binhai New Area and Caofeidian New Area) (Yang *et al.* 2011). Further information on the problems may be downloaded from: http://www.globalflywaynetwork.com.au/reports/GFN-Bohai-Report-2010.pdf. http://www.publish.csiro.au/paper/MU10024.htm).

Any reader who would like to help in the exploration of sites that may hold large numbers of Red Knot should contact CH for further information. The Australasian Wader Studies Group may be in a position to provide a small grant to help defray some costs.

Table 1 Comparison of main features of Red Knot races *rogersi* and *piersmai*

Race	Nape	Mantle	Overall upperparts	Breast & belly	Undertail-coverts	Overall underparts
rogersi	pale grey/silvery	pale grey/silvery	pale grey/silvery	peachy	white but highly variable	peachy & white
piersmai	brick red	brick red	brick red	red	red but highly variable	red & white

Acknowledgements

Thanks go to Birdlife-Netherlands for funding CH and for funding work in Bohai Bay together with WWF-Netherlands, WWF-China and Beijing Normal University through the National Natural Science Foundation of China-Guangdong Joint Fund (Grant No. U0833005). CH and AB thank their team of skilled and dedicated volunteers in Broome and Bohai Bay. Thanks go to Mark Barter and Stephen Holliday for comments on drafts of the article. The authors thank all those who have sent in sighting data from the EAAF in the past and those who will do so in the future.

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Appendix 3

Nanpu and Daqinghe Salt Works

Although generally referred to here as 'salt works' the area is used not just for salt production but some ponds are used for shrimp breeding and harvesting for food.

Figure 1 below shows the majority of the Nanpu Salt Works with the coloured lines indicating areas that we visited most often. Yellow lines show the roads most frequently driven, red roads were driven only occasionally. The blue boxes, labeled A, B and C, show the ponds that, in our experience, were the most productive for birds and where we conducted opportunistic shorebird counts. The entire salt works area is roughly 230km^2.

Fig A1.

To reach our primary study sites along the shoreline we travelled through the salt works on a daily basis. When conditions and time allowed we stopped at regular intervals to scan for individually marked birds and to count the birds using this area, particularly those birds utilising the more easily accessible ponds close to the roads. The salt and shrimp ponds are used throughout the spring migration season by various species of shorebirds as feeding and roosting sites. The birds move around the area as the depth and salinity of many pools varies on a regular basis due to the management of the ponds for their primary purpose, that of salt production. Ponds where the largest numbers were recorded tended to be the very large, shallow, salt ponds at B and C. With birds generally highly mobile and spread widely counting accurate totals for the whole area proved difficult. However for some species just a count of two large ponds revealed the importance of this habitat. A single count from just 2 ponds combined (Area C) conducted on the May 15 2012 recorded 22,610 Curlew Sandpipers this is 10.8% of the EAAF estimated population. In just two ponds! The salt works area holds significant numbers of Marsh Sandpipers during

spring migration. This species peaks a little earlier than most with the highest numbers occurring in late April. In 2012, in excess of 10,000 (1% of the population in the EAAF)) were recorded daily from 26th April into early May. The highest count of Black-tailed Godwit was also on 30th April when 4100 (2.6% of the population in the EAAF) were present, also utilising the shallow salt pond of area B. Another species using the salt pond habitat in large numbers is the migrant White-winged Black Tern. This species is even more difficult to monitor that the shorebirds as they are spread out over the water of the ponds in constant motion as the dip down and pick their prey from the waters surface. We estimate that up to 40,000 birds could be in the area at any one time. The estimate for this species in the EAAF is not very accurate but 40,000 would equate to anything from 4 to 40% of the EAAF population!

Many species roost in the ponds during the high tide period. Favoured roost sites change during the course of the season, for example, during April many birds; including Red Knot, roost in the small ponds immediately behind the sea wall, just a few hundred metres from the mud. During May however, these ponds become less used and the birds more spread out with some Red Knot roosting as far as 10km inland at area C. It is not clear why this change of behaviour occurs. Area A is primarily shrimp ponds and also seems to be a favoured roosting site, particularly during May but mainly used by small sandpiper species.

It is important to note that the day to day management of the salt ponds appears to be beneficial to migrant shorebirds. The movement of water from pond to pond and the changing water levels seems to give a variety of different foraging conditions that suit a variety of different species. This could lead to cooperation with the Nanpu Salt Works Company by promoting their business as good for birds and possibly lead to funding and joint promotional or educational opportunities.

The great importance of the Nanpu Salt Works is put in to context by comparison with another salt works just 40km ENE at the town of Daqinghe. It covers an area a little over 100km² and is different from the Nanpu site in several ways. As well as shrimp and salt there is also some sea cucumber production. This involves deep ponds and some basic infrastructure and the ponds are not suitable for shorebirds. The pans here are generally much smaller and seem better maintained with higher, steeper sided dividing walls. Most of the adjacent mudflats have already been lost to continuing reclamation and industrial development. On 16th May we surveyed both the inter-tidal area and the salt ponds. With the help of a knowledgeable local gentleman Mr. Tian Zhi-Wei we toured the area scanning regularly and visited ponds Mr. Tian knew were favoured by birds. Only 1830 individuals in total were recorded for the whole area however while numbers were low diversity was high at 33 species. Highest totals were Grey Plover (304), Curlew Sandpiper (282), Red Knot (256) and Sharp-tailed Sandpiper (151). 77 Pacific Golden Plover was notable as this is much higher than we have recorded elsewhere. The full count can be found at the end of the report.

Red Knots roosting in the Nanpu Salt Ponds © A Boyle

It was interesting to see the Daqinghe Salt Works as the relatively low numbers recorded here highlight the huge significance of the Nanpu Salt Works for shorebirds. The study of the Nanpu Salt Works would be a project in itself and certainly deserves a lot more time and concerted effort than GFN are able to give it due to our focus on the inter-tidal areas. With the importance of the whole area being increasingly realised then hopefully this site can have more coverage in the future. The Salt Works of Nanpu seem to be under less pressure from industrialisation due to their vast area with only the areas adjacent to the mudflats being lost to development therefore it is possible that these ponds could play an even more vital role as the loss of inter-tidal area continues. Regular and accurate monitoring could prove very interesting as these profound changes rapidly alter the dynamics of the site.

Table A1. Counts of shorebirds at Daqinghe salt works May 16 2012

Species	Latin name	# on intertidal area	# in salt ponds
Black-winged Stilt	*Himantopus himantopus*		18
Pied Avocet	*Recurvirostra avosetta*		3
Kentish Plover	*Charadrius alexandrinus*	10	77
Greater Sand Plover	*Charadrius leschenaultia*		1
Lesser Sand Plover	*Charadrius mongolus*		1
Grey Plover	*Pluvialis squatarola*	300	4
Pacific Golden Plover	*Pluvialis fulva*	8	69
Common Snipe	*Gallinago gallinago*		1
Black-tailed Godwit	*Limosa limosa*		47
Bar-tailed Godwit	*Limosa lapponica*	40	
Whimbrel	*Numenius phauopus*	1	6
Curlew sp. (Eastern/Eurasian)	*N. madagascariensis/arquata*	30	
Spotted Redshank	*Tringa totanus*		81
Marsh Sandpiper	*Tringa stagnatilis*		22
Common Greenshank	*Tringa nebularia*	100	10
Common Sandpiper	*Actitis hypoleucos*		1
Wood Sandpiper	*Tringa glareola*		7
Grey-tailed Tattler	*Tringa brivipes*	3	
Terek Sandpiper	*Xenus cinereus*	30	
Ruddy Turnstone	*Arenaria interpres*		27
Great Knot	*Calidris tenuirostris*	30	
Red Knot	*Calidris canutus*	252	4
Sanderling	*Calidris alba*		3
Red-necked Stint	*Calidris ruficollis*		71
Curlew Sandpiper	*Calidris ferruginea*		282
Dunlin	*Calidris alpina*		7
Sharp-tailed Sandpiper	*Calidris acuminate*		151
Ruff	*Philomachus pugnax*		1
Black-headed Gull	*Chroicocephalus ridibundus*		19
Common Tern	*Sterna hirundo*	1	6
Little Tern	*Sterna albifrons*	40	31
Gull-billed Tern	*Gelochelidon nilotica*	25	
White-winged Tern	*Childonias leucopterus*		10
	Totals	**870**	**960**

Appendix 4

A short note on the sighting of a Spoon-billed Sandpiper

Observers; Chris Hassell, Adrian Boyle, Ying Chi Chan, Matt Slaymaker.

On May 25th 2012, we were scanning for individually marked Red Knots at Zuidong, Bohai Bay, China 39^0 02' 15.48"N 118^0 18' 18.84"E during Global Flyway Network (GFN) field work when we saw a Spoon-billed Sandpiper.

We assessed the bird to be in 75% breeding plumage on the upperparts and 50% on the underparts. The bird had an abdominal profile of 3. We thought that while the breeding plumage was extensive on the upperparts it was not 'bright' and it was more brown/red than red on the breast.

The site was not visited on May 26th and the bird was not seen at the same site on the morning of May 27th.

The bird was seen again on May 28th and 29th when images and a short video clip were obtained (see below for image). This site was not visited after May 29th.

A Spoon-billed Sandpiper was also recorded at another of our main study sites on June 2nd roosting with Sanderling. The sites are only 6.5km apart.

We have been conducting shorebird studies at these sites for 4 years during April and May 2009 to 2012 and this is our first sighting of this species here. However with the huge areas of suitable habitat and large numbers of birds present we could easily have missed them in previous years.

Note; A Spoon-billed Sandpiper was also seen 13km NWW of this sighting on May 20th in a salt pond by a Swedish birder based in Beijing Mr. Jan-Erik Nilsen.

Spoon-billed Sandpiper *Eurynorhynchus pygmeus*, May 29th 2012. © A Boyle

Appendix 5

Internal Report about the **Bohai International Gathering for Shorebirds and Coastal Wetlands** *(May 25th-26th, 2012, Tangshan City)*

About the event

During May 25th and 26th, **WWF-CPO** co-organized an event with **Beijing Normal University** and **Beijing Jintai Art Museum**. The event includes an afternoon indoor programme of scientific lectures and performances, followed by a morning of bird watching tour to the Luannan coastal wetland.

Over 70 individuals joined the event, including representatives from government, notably SFA; NGOs such as TNC and Wetland International; scientific research groups; and private sector such as Mr. Xue Manzi, who in the mean time, is an influential opinion leader. The event was actively supported by WWF's star volunteers and there were 14 media participated in the event.

The event was planned with one single objective, which is to contribute to the protection of the Luannan coastal wetland. The wetland under concern is among the most important shorebird stopover sites in the Bohai Sea. The wetland regularly supports about 200,000 shorebirds, including over 80% of red knots using the East Asian-Australian Flyway.

The wetland is also of critical importance to the livelihood of over 300 local villagers who has legal access to its rich seafood resources. The wetland is among the few remaining ones from the coastal reclamation fad around the Bohai Sea. It is at risk of immediate loss without appropriate intervention.

The event is the first action of WWF's 2012 Wetland Ambassador Action Campaign—Migratory Birds and Wetlands. It is also a following-up action to WWF's policy advocacy work. In March, our Policy Proposal regarding conservation of the Yellow Sea Ecoregion (YSE) was submitted during the Chinese People's Political Consultative Conference (CPPCC 2012) by **Mr. Yuan Xikun**, a renowned artist and Standing Member of the National Committee of the CPPCC. Mr. Yuan's Beijing Jintai Art Museum became our co-organizer this time.

Expectation, outcomes and impacts

We expected the event to play three functions: the first is to raise the public concern of the endangered wetland supporting important wildlife and seafood resources; the second is to strengthen WWF's bond with our supporters and alliances (including local and international stakeholders); the third is to signal a polite "warning" to the local government and developers who were keen to secretively reclaim the area for their own economic and political interest.

The conservation/MTI and communication teams will jointly monitor and measure the impacts in the following days. For building alliance, the valuable experience of cooperation with the two influential co-organizers and the participation of the civil society and private sector were good indicators of success.

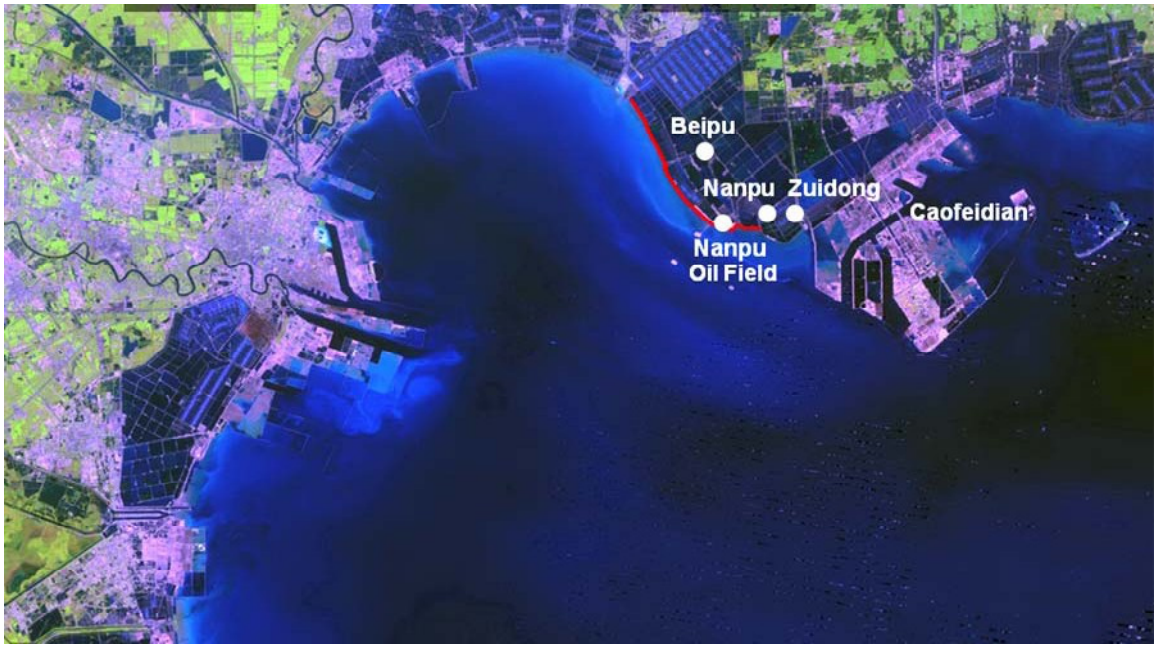
Challenges ahead

- The event is merely another step towards the ultimate outcome we want (designation of new protected area recognized as a wetland of international importance). We shall keep monitoring the local situation and continue our effort till we reach our destination. Even this turns out to be a conservation loss; we shall acknowledge it and actively use it as a negative example.

- ⌘ Communication wise, the public campaign shall be better engaged with clear message and more effective communication tools.
- ⌘ More innovative conservation and communication tools, such as pan-flyway satellite tagging and CCTV documentary series/cartoon shall be actively exploited.
- ⌘ Coordination with other WWF NOs is indispensable.

Annex: additional information about Luannan coastal wetland

Location: Luannan, Tangshan, Hebei Province, China



Habitat Type: mainly tidal mudflat

Size: mudflat exceeding 5,500 hectares, with a coastline of around 10 kilometers

Key species of concern: Red Knot, Terek Sandpiper, Sanderling, Curlew Sandpiper, Nordmann's Greenshank and Relict Gull

Fisheries resources (contribute to local livelihood): shellfish that generates about RMB 9 million in value shared by around 300 local fishermen

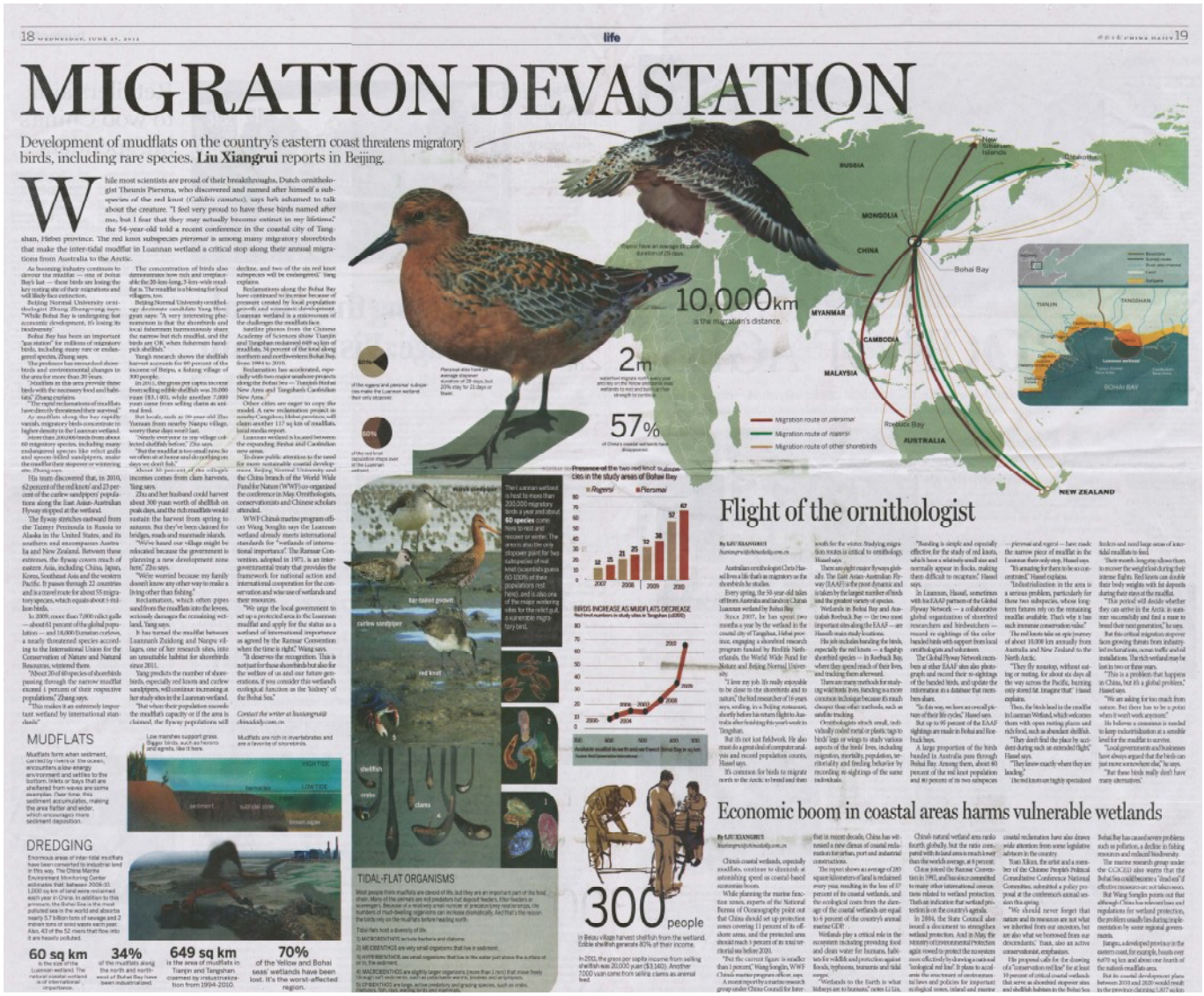
Current conservation status: Not protected

Threats: Primary threat is coastal reclamation for industry, real estate and pond-style aquaculture. Oil spill is a potential one, but avoidable.

Description: This site is the sole known major stopover site for all (100,000) migrating Red Knots between northern and far-eastern Russia and Australia/New Zealand. It is imperiled by coastal development. Loss of the remaining mudflat in Luannan would be fatal to the global populations of two subspecies of Red Knot. At current rate of development, this site may disappear entirely in just a few months.

WWF's appeal: Designate the area as stage-level Protected Areas, and then recognize it as a Ramsar Site of Wetland of International Importance.

Appendix 6 China Daily, June 27 2012



18 WEDNESDAY, JUNE 27, 2012 life CHINA DAILY 19

MIGRATION DEVASTATION

Development of mudflats on the country's eastern coast threatens migratory birds, including rare species. **Liu Xiangrui** reports in Beijing.

While most scientists are proud of their breakthroughs, Dutch ornitholo- gist Theunis Piersma, who discovered and named after himself a sub- species of the red knot (*Calidris canutus*), says he's ashamed to talk about the creature. "I feel very proud to have these birds named after me, but I fear that they may actually become extinct in my lifetime," the 54-year-old told a recent conference in the coastal city of Tangshan, Hebei province. The red knot subspecies *piersmai* is among many migratory shorebirds that make the inter-tidal mudflat in Luannan wetland a critical stop along their annual migra- tions from Australia to the Arctic.

As booming industry continues to devour the mudflat — one of Bohai Bay's last — these birds are losing the key resting site of their migrations and will likely face extinction.

Beijing Normal University ornithologist Zhang Zhengwang says: "While Bohai Bay is undergoing fast economic development, it's losing its biodiversity."

Bohai Bay has been an important "gas station" for millions of migratory birds, including many rare or endangered species, Zhang says.

The professor has researched shorebirds and environmental changes in the area for more than 20 years.

"Mudflats in this area provide these birds with the necessary food and habitats," Zhang explains.

"The rapid reclamations of mudflats have directly threatened their survival".

As mudflats along the bay rapidly vanish, migratory birds concentrate in higher density in the Luannan wetland.

More than 200,000 birds from about 60 migratory species,

Texts of the articles:

including many endangered species like relict gulls and spoon-billed sandpipers, make the mudflat their stopover or wintering site, Zhang says.

His team discovered that, in 2010, 62 percent of the red knots' and 23 percent of the curlew sandpipers' populations along the East Asian-Australian Flyway stopped at the wetland.

The flyway stretches eastward from the Taimyr Peninsula in Russia to Alaska in the United States, and its southern end encompasses Australia and New Zealand. Between these extremes, the flyway Covers much of eastern Asia, including China, Japan, Korea, Southeast Asia and the western Pacific. It passes through 22 countries and is a travel route for about 55 migratory species, which equals about 5 million birds.

In 2009, more than 7,000 relict gulls — about 61 percent of the global population — and 18,000 Eurasian curlews, a nearly threatened species according to the International Union for the Conservation of Nature and Natural Resources, wintered there.

"About 20 of 40 species of shorebirds passing through the narrow mudflat exceed 1 percent of their respective populations," Zhang says.

"This makes it an extremely important wetland by international standards."

The concentration of birds also demonstrates how rich and irreplaceable the 20-km-long, 3-km-wide mudflat is. The mudflat is a blessing for local villagers, too.

Beijing Normal University ornithology doctorate candidate Yang Hongyan says: "A very interesting phenomenon is that the shorebirds and local fishermen harmoniously share the narrow but rich mudflat, and the birds are OK when fishermen handpick shellfish."

Yangs research shows the shellfish harvest accounts for 80 percent of the income of Beipu, a fishing village of 300 people.

In 2011, the gross per capita income from selling edible shellfish was 20,000 yuan ($3,140), while another 7,000 yuan came from selling clams as animal feed.

But locals, such as 59-year-old Zhu Yunuan from nearby Nanpu village, worry these days won't last,

"Nearly everyone in my village collected shellfish before," Zhu says.

"But the mudflat is too small now. So we often sit at home and do nothing on days we don't fish."

About 30 percent of the village's income comes from clam harvests, Yang says.

Zhu and her husband could harvest about 300 yuan worth of shellfish on peak days, and the rieh mudflats would sustain the harvest from spring to autumn. But they've been claimed for bridges, roads and manmade islands.

"We've heard our village might be relocated because the government is planning a new deve-lopment zone here," Zhu says.

"We're worried because my family doesn't know any other way to make a living other than fishing."

Reclamation, which often pipes sand from the mudflats into the levees, seriously damages the remaining wetland, Yang says.

It has turned the mudflat between Luannan's Zuidong and Nanpu villages, one of her research sites, into an unsuitable habitat for shorebirds since2011.

Yang predicts the number of shorebirds, especially red knots and curlew sandpipers, will continue increasing at her study sites in the Luannan wetland.

"But when their population exceeds the mudflats capacity or if the area is claimed, the flyway populations will decline, and two of the six red knot subspecies will be endangered," Yang ex-plains.

Reclamations along the Bohai Bay have continued to increase because of pressure created by local population growth and economic development Luannan wetland is a microcosm of the challenges the mudflats face.

Satellite photos from the Chinese Academy of Sciences show Tianjin and Tangshan reclaimed 649 sq km of mudflats, 34 percent of the total along northern and northwestern Bohai Bay, from 1994 to 2010.

Reclamation has accelerated, especially with two major seashore projects along the Bohai Sea — Tianjin's Binhai New Area and Tangshan's Caofeidian New Area.

Other cities are eager to copy the model. A new reclamation project in nearby Cangzhou, Hebei province will claim another 117 sq km of mudflats, local media report.

Luannan wetland is located between the expanding Binhai and Caofeidian new areas.

To draw public attention to the need for more sustainable coastal development, Beijing Normal University and the China branch of the World Wide Fund for Nature (WWF) co-organized the conference in May. Ornithologists, conservationists and Chinese scholars attended.

WWF Chinas marine program officer Wang Songlin says the Luannan wetland already meets international Standards for "wetlands of international importance". The Ramsar Convention, adopted in 1971, is an intergovernmental treaty that provides the framework for national action and international Cooperation for the conservation and wise use of wetlands and their resour-ces.

"We urge the local government to set up a protected area in the Luannan mudflat and apply for the status as a wetland of international importance as agreed by the Ramsar Convention when the time is right," Wang says.

"It deserves the recognition. This is not just for these shorebirds but also for the welfare of us and our future generations, if you consider this wetlands ecological function as the 'kidney of the Bohai Sea."

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Flight of the ornithologist

By LIU XIANGRUI
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Australian ornithologist Chris Hassel lives a life that's as migratory as the shorebirds he studies.

Every spring, the 50-year-old takes off from Australia and lands in Chinas Luannan wetland by Bohai Bay.

Since 2007, he has spent two months a year by the wetland in the coastal city of Tangshan, Hebei province, engaging a shorebird research program funded by Birdlife Netherlands, the World Wide Fund for Nature and Beijing Normal University.

"I love my job. It's really enjoyable to be dose to the shorebirds and to nature," the bird researcher of 16 years says, smiling, in a Beijing restaurant, shortly before his return flight to Australia after finishing this year's work in Tangshan.

But it's not just fieldwork He also must do a great deal of Computer anal- ysis and record population counts, Hassel says.

It's common for birds to migrate north to the Arctic to breed and then
south for the winter. Studying migration routes is critical to ornithology, Hassel says.

There are eight major flyways globally. The East Asian-Australian Fly- way (EAAF) is the most dynamic and is taken by the largest number of birds and the greatest variety of species.

Wetlands in Bohai Bay and Australia's Roebuck Bay — the two most important sites along the EAAF—are Hassel's main study locations.

His job includes banding the birds, especially the red knots — a flagship shorebird species — in Roebuck Bay, where they spend much of their lives, and tracking them afterward

There are many methods for studying wild birds' lives. Banding is a more common technique because it's much cheaper than other methods, such as satellite tracking.

Ornithologists attach small, individually coded metal or plastic tags to birds' legs or wings to study various aspects of the birds' lives, including migration, mortality, population, territoriality and feeding behavior by recording re-sightings of the same individuals.

"Banding is simple and especially effective. for the study of red knots, which have a relatively small size and normally appear in flocks, making them difficult to recapture," Hassel says.

In Luannan, Hassel, sometimes with his EAAF partners of the Global Flyway Network — a collaborative global **Organization** of shorebird researchers and birdwatchers — record re-sightings of the color- banded birds with support from local ornithologists and volunteers.

The Global Flyway Network members at other EAAF sites also photo- graph and record their re-sightings of the banded birds, and update the information in a database that members share.

"In this way, we have an overall picture of their life cycles," Hassel says.

But up to 95 percent of the EAAF sightings are made in Bohai and Roebuck bays.

A large proportion of the birds banded in Australia pass through Bohai Bay. Among them, about 60 percent of the red knot population and 80 percent of its two subspecies
— ***piersmai*** and ***rogersi*** — have made the narrow piece of mudflat in the Luannan their only stop, Hassel says.

"It's amazing for them to be so concentrated," Hassel explains.

"Industrialization in the area is a serious problem, particularly for these two subspecies, whose long- term futures rely on the remaining mudflat available. That's why it has such immense conservation value."

The red knots take an epic journey of about 10,000 km annually from Australia and New Zealand to the North Arctic.

"They fly nonstop, without eating or resting, for about six days all the way across the Pacific, burning only stored fat Imagine that!" Hassel explains.

Then, the birds land in the mudflat in Luannan Wetland, which welcomes them with open resting places and rich food, such as abundant shellfish.

"They don't find the place by accident during such an extended flight," Hassel says.

"They know exactly where they are landing."

The red knots are highly specialized feeders and need large areas of inter- tidal mudflats to feed.

Their month-long stay allows them to recover the weight lost during their intense flights. Red knots can double their body weights with fat deposits during their stays at the mudflat.

"This period will decide whether they can arrive in the Arctic in summer successfully and find a mate to breed their next generation," he says.

But this critical migration stopover faces growing threats from industry- led reclamations, ocean traffic and oil installations. The rich wetland may be lost in two or three years.

"This is a problem that happens in China, but it's a global problem," Hassel says.

"We are asking for too much from nature. But there has to be a point when it won't work anymore."

He believes a consensus is needed to keep industrialization at a sensible level for the mudflat to survive.

"Local governments and businesses have always argued that the birds can just move somewhere else," he says.

"But these birds really don't have many alternatives."

Economic boom in coastal areas harms vulnerable wetlands

By LIU XIANGRUI
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Chinas coastal wetlands, especially mudflats, continue to diminish at astonishing speed as coastal-based economies boom.

While planning the marine function zones, experts of the National Bureau of Oceanography point out that China should set up protection zones covering 11 percent of its off-shore areas, and the protected area should reach 5 percent of its total territorial sea before 2020.

"But the current figure is smaller than 1 percent," Wang Songlin, WWF Chinas marine program officer, says.

A recent report by a marine research group under China Council for International Cooperation on Environment and Development points out that in recent decade, China has witnessed a new climax of coastal reclamation for urban, port and industrial constructions.

The report shows an average of 285 square kilometers of land is reclaimed every year, resulting in the loss of 57 percent of its coastal wetlands, and the ecological costs from the dam-age of the coastal wetlands are equal to 6 percent of the country's annual marine GDR .

Wetlands play a critical role in the ecosystem including providing food and clean water for humans, habitats for wildlife and protection against floods, typhoons, tsunamis and tidal surges.

"Wetlands to the Earth is what kidneys are to humans," notes Li Lin, WWF's deputy chief representative to China.

Chinas natural wetland area ranks fourth globally, but the ratio com-pared with its land area is much lower than the worlds average, at 6 percent.

China joined the Ramsar Convention in 1992, and has since committed to many other international Conventions related to wetland protection. That's an indication that wetland protection is on the country's agenda.

In 2004, the State Council also issued a document to strengthen wetland protection. And in May, the Ministry of Environmental Protection again vowed to protect the ecosystem more effectively by drawing a national "ecological red line". It plans to accelerate the enactment of environmental laws and policies for important ecological zones, inland and marine regions.

The ecological costs of Chinas coastal reclamation have also drawn wide attention from some legislative advisors in the country.

Yuan Xikun, the artist and a member of the Chinese People's Political Consultative Conference National Committee, submitted a policy proposal at the conferences annual session this spring.

"We should never forget that nature and its resources are not what we inherited from our ancestors, but are also what we borrowed from our descendants," Yuan, also an active conservationist, emphasizes.

His proposal calls for the drawing of a "conservation red line" for at least 10 percent of critical coastal wetlands that serve as shorebird stopover sites and shellfish habitats in the Bohai Sea and the Yellow Sea.

The loss of coastal wetlands in the Bohai Bay has caused severe problems such as pollution, a decline in fishing resources and reduced biodiversity.

The marine research group under the CCICED also warns that the Bohai Sea could become a "dead sea" if effective measures are not taken soon.

But Wang Songlin points out that although China has relevant laws and regulations for wetland protection, the problem usually lies during implementation by some regional governments.

Jiangsu, a developed province in the eastern coast, for example, boasts over 6,670 sq km and about one fourth of the nation's mudflats area.

But its coastal development plans between 2010 and 2020 would result in the province claiming 1,817 sq km of mudflats — a detrimental move which will harm the ecosystem.

Appendix 7

The full list of the 220 species recorded April 10 to June 2 2012.

Common Shelduck
Ruddy Shelduck
Goose sp.
Mallard
Spot-billed Duck
Northern Shoveler
Northern Pintail
Mandarin Duck
Gadwall
Falcated Duck
Eurasian Wigeon
Garganey
Common Teal
Baikal Teal
Common Pochard
Tufted Duck
Common Goldeneye
Red-breasted Merganser
Eurasian Wryneck
Great-spotted Woodpecker
Rufous-bellied Woodpecker
Grey-headed Woodpecker
Common Kingfisher
Black-capped Kingfisher
Hoopoe
Common Cuckoo
Cuckoo Sp
Common Swift
Fork-tailed Swift
White-throated Needletail
Brown Hawk Owl
Grey Nightjar
Feral Pigeon
Oriental Turtle Dove
Spotted Dove
Yellow-legged Buttonquail
Japanese Quail
Common Pheasant
Moorhen
Coot
Oriental Pratincole
Grey-headed Lapwing
Common Snipe
Ruff
Black-tailed Godwit
Bar-tailed Godwit
Eastern Curlew
Eurasian Curlew
Whimbrel
Little Curlew
Grey-tailed Tattler
Asian Dowitcher
Marsh Sandpiper
Common Greenshank
Nordmann's Greenshank
Spotted Redshank
Common Redshank
Wood Sandpiper
Green Sandpiper
Common Sandpiper
Terek Sandpiper
Ruddy Turnstone
Great Knot
Red Knot
Sanderling
Sharp-tailed Sandpiper
Broad-billed Sandpiper
Curlew Sandpiper
Dunlin
Little Stint
Red-necked Stint
Spoon-billed Sandpiper
Temminck's Stint
Long-toed Stint
Eurasian Oystercatcher
Black-winged Stilt
Pied Avocet
Pacific Golden Plover
Grey Plover
Little Ringed Plover
Kentish Plover
Greater Sand-plover
Lesser Sand-plover
Oriental Plover
Black-tailed Gull
Mew (Common) Gull
Vega Gull
Heuglin's Gull
Glaucous Gull
Mongolian Gull
Slaty-backed Gull
Black-headed Gull
Saunder's Gull
Relict Gull
Common Tern
Little Tern
Caspian Tern
Gull-billed Tern
Whiskered Tern
White-winged Black Tern
Hen Harrier
Eastern Marsh Harrier
Pied Harrier
Accipiter Sp
Japanese Sparrowhawk
Eurasian Sparrowhawk
Chinese Sparrowhawk
Northern Goshawk
Common Buzzard
Grey-faced Buzzard
Osprey
Common Kestrel
Amur Falcon
Eurasian Hobby
Peregrine Falcon
Little Grebe
Great-crested Grebe
Great Cormorant
Oriental Stork
Great Egret
Little Egret
Cattle Egret
Chinese Egret
Grey Heron
Purple Heron
Chinese Pond Heron
Striated Heron
Black-crowend Night Heron
Eurasian Bittern
Yellow Bittern
Schrenk's Bittern
Eurasian Spoonbill
Brown Shrike
Black-billed Magpie
Large-billed Crow
Black-naped Oriole
Ashy Minivet
Hair-crested Drongo
Black Drongo
Blue Rock-thrush
White-throated Rock Thrush
White's Thrush
Siberian Thrush
Grey-backed Thrush
Eyebrowed Thrush
Pale Thrush
Dusky Thrush
Chinese Thrush
Red-flanked Blue-tail
Bluethroat
Siberian Rubythroat
Siberian Blue Robin
Swinhoe's (rufous-tailed) Robin
Daurian Redstart
Red-throated (Taiga) Flycatcher
Mugimaki Flycatcher
Yellow-rumped Flycatcher
Asian Brown Flycatcher
Grey-streaked Flycatcher

Dark-sided Flycatcher
Blue & White Flycatcher
Common Stonechat
Pied Wheatear
Daurian Starling
Red-billed Starling
White-cheeked Starling
Crested Myna
Yellow-bellied Tit
Chinese Penduline Tit
Sand Martin
Barn Swallow
Red-rumped Swallow
Light-vented Bulbul
Zitting Cisticola
Asian Stubtail
Lanceolated Warbler
Pallas's Grasshopper Warbler
Oriental Reed Warbler
Thick-billed Reed Warbler
Black-browed Reed Warbler
Dusky Warbler
Radde's Warbler
Eastern Crowned Warbler
Arctic Warbler
Blyths (Claudias) leaf warbler
Yellow-browed Warbler
Pallas's Leaf Warbler
Two-barred Warbler
Pale-legged Leaf Warbler
Bianchi's Warbler
Reed (Northern?) Parrotbill
Vinous-throated Parrotbill
Asian Short-toed Lark
Chestnut-flanked White-eye
Tree Sparrow
Yellow Wagtail
Citrine Wagtail
Forest Wagtail
Grey Wagtail
White Wagtail
Richard's Pipit
Blyth's Pipit
Olive-backed Pipit
Red-throated Pipit
Pechora Pipit
Buff-bellied Pipit
Chinese (Yellow-billed) Grosbeak
Siskin
Brambling
Common Rosefinch
Yellow-throated Bunting
Yellow-browed Bunting
Black-faced Bunting
Chestnut-eared Bunting
Tristam's Bunting
Little Bunting
Rustic Bunting
Chestnut Bunting
Japanese Reed Bunting
Pallas's Bunting