



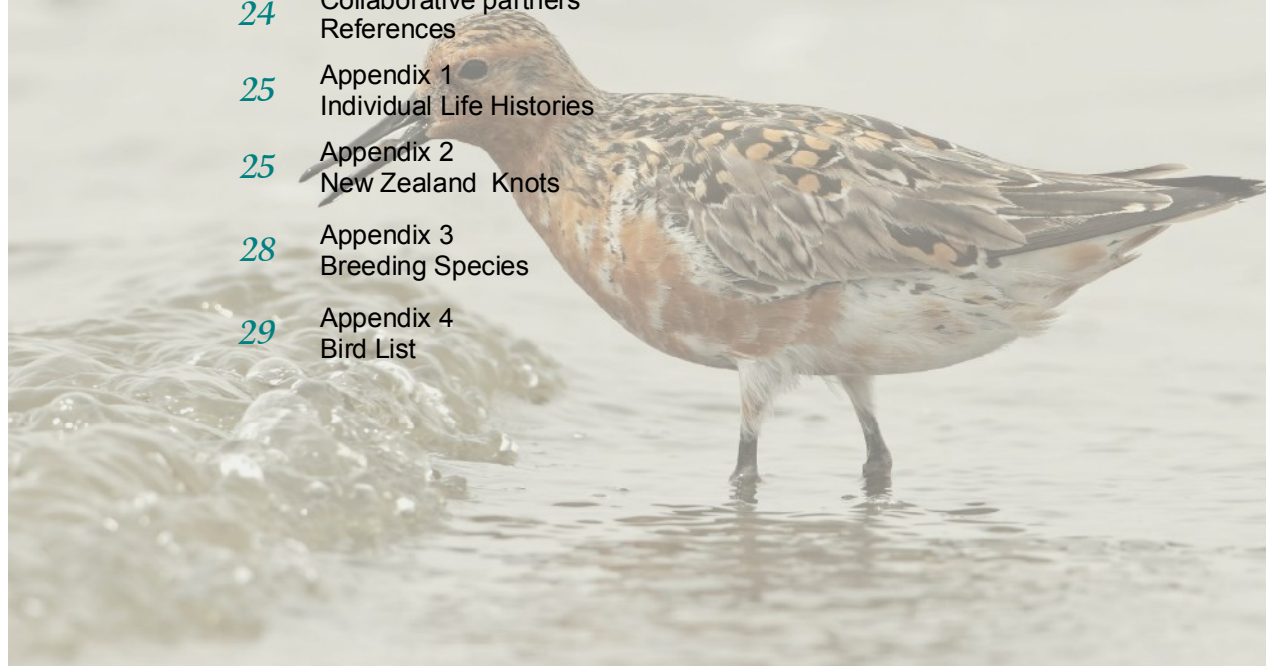
RED KNOT NORTHWARD MIGRATION THROUGH BOHAI BAY, CHINA, FIELD TRIP REPORT APRIL - JUNE 2015

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Summary

This year's fieldwork season commenced on 11 April and finished on 6 June 2015.

We recorded 4,151 marked shorebirds from throughout the East Asian-Australasian Flyway (EAAF). Amongst these there were 914 that can be identified to an individual bird by the relevant banding scheme. 423 were individually recognisable as birds from the Global Flyway Network (GFN) colour-banding project in north west Australia NWA. This was of course dominated by Red Knot *Calidris canutus* with 387 individuals identified, then Great Knot *Calidris tenuirostris* 30 and Bar-tailed Godwit *Limosa lapponica*, 6. As in previous years, this reflects the vital importance of the area for Red Knot. Most researchers would be thrilled with this result if they saw this number of 'their' birds at the marking location. GFN are recording these birds some 6,400km away from where the birds were originally captured!

The importance of the vast area of commercial salt ponds adjacent to the inter-tidal area has been well documented from our previous year's work. This year the use of salt ponds by shorebirds was very different. The salt ponds very rarely held significant numbers of birds. This was probably due to the high water levels in the ponds and therefore the diminished accessibility of food for the birds. Over the years large areas of salt ponds have been lost to industrial development particularly at Zuidong. In addition to that loss over the years, this year a road is being built through the ponds that have previously been the most suitable for shorebirds. This road, while not huge, runs directly through the pond that had a count of 96,000 mixed species on 19 May 2013. This pond also had significant numbers in 2014. However this year the water level was constantly too deep for any of the small to medium shorebirds to use it to forage in.

We only saw small numbers of Pied Avocets *Recurvirostra avosetta* and Black-tailed Godwits *Limosa limosa* using that pond. The big count of Black-tailed Godwits that we recorded this year (14,040) was recorded on the mudflats which is an unusual sight for the Luannan Coast as in previous years Black-tailed Godwits have always favoured the salt pond habitat. This single count represents 9% of the EAAF population.

We recorded our biggest ever count of Great Knot, 10,270 on 2 May 2015 this represents 4% of the EAAF population (see Great Knot section for discussion.)

As in 2012, 2013 and 2014 we estimated that a minimum of 40,000 White-winged Black Terns *Chlidonias leucopterus* are using the Luannan Coast and salt pond area at any one time. The population estimate for this species in the flyway is vague, but 40,000 would constitute anything from 4 to 40% of the EAAF population. All of these figures could be much higher if turnover of migrants was taken into consideration. It appeared this year 2015 that there were fewer White-winged Black Terns in the study area but it should be noted that it is impossible to cover all the salt ponds at any one time. The salt works area, including ponds used for shrimp production, hosts all the migrant birds at high tide when the mudflats are inundated by the sea making the area a critical component of the Luannan Coast Shorebird Site. The salt and shrimp ponds should be included in any conservation initiatives.

A table of species recorded in internationally important numbers has been compiled from GFN studies over the previous 8 northward migration seasons. It is an effective way to give an indication of the immense importance of the Luannan Coast Shorebird Site.

The continuing pressures on the inter-tidal area are obvious with the development of industrial and housing areas adjacent to and on reclaimed mudflats. The direct destruction of the inter-tidal area has slowed in the last three years but huge building projects are taking place in former salt pond habitat and mudflat

areas reclaimed in recent years. A six lane highway is part way along our study site, bridges are in place and the new road through the salt ponds is under construction. It would only take an upturn in the world, Chinese or local economies to see renewed expansion and loss of mudflats in this critically important area. However set against this is that some moves have been made towards establishing a nature reserve (see section in report).

We do our best to enable studies at the site to be continued. At the very least GFN will continue to document the fates of four shorebird species at their non-breeding sites in NWA and throughout the flyway with an emphasis on the Luannan Coast, 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 Department of Conservation - New Zealand, WWF-China, and Wetlands International-China. Tamar Lok, a postdoctoral researcher employed by the University of Groningen and a PhD student, Miss Ying-Chi Chan, will analyse GFN data under the supervision of Theunis Piersma, all work in close cooperation with Beijing Normal University and Fudan University.



Spotted Redshank *Tringa erythropus* © Adrian Boyle

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 because 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 into 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. The attachment of geolocators to Red Knot in Roebuck Bay NWA, New Zealand and Chukotka, north east Siberia will hopefully help us unravel this piece of the Red Knot jigsaw.

In concert with the work by YHY, studies by GFN have continued during the northward migration seasons of 2009 to this year, 2015. 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 this area that is the single most important staging area for two subspecies of Red Knot in the EAAF, encompassing all Red Knots wintering in Australia and New Zealand, it seemed of utmost importance to continue the survey work. This need was recognised by WWF-Netherlands and WWF-China who have funded GFN fieldwork in China through to 2013. The research effort in China builds on the research efforts in northwest Australia that from 2007 to 2013 was supported by BirdLife-Netherlands. BirdLife Netherlands and WWF-Netherlands have continued to financially support Theunis Piersma as the Chair in Global Flyway Ecology at the University of Groningen through which the analytic and data-processing work by Dr Tamar Lok was made possible. In 2015 most costs were paid from the 2014 Spinoza Prize to Theunis Piersma from the Netherlands Organization for Scientific Research (NWO), with additional support from Beijing Normal University. Here we report on what we have achieved in April - June 2015.

All the migratory birds mentioned in this report are covered by the China-Australia Migratory Bird Agreement (CAMBA).

The data in this report confirm the importance of the Luannan Coast site for migratory birds and the priority for both Australia and China to advance their actions to protect this site for the future of migratory birds.



Bob Loos at the Nanpu Seawall © Adrian Boyle

The Study Site

The centre of the study site is situated at 39° 03' 35"N 118° 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.

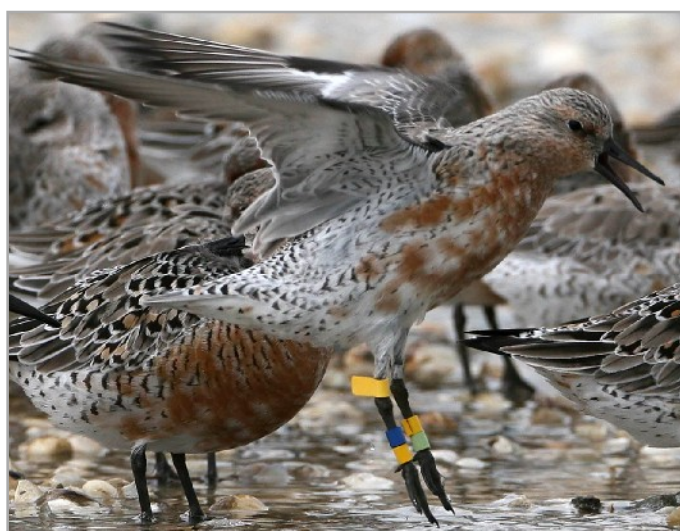
The image shows the 4 study sites and the Caofeidian New Area Industrial Park. This enormous area will have destroyed 142km² of inter-tidal mudflat at its completion in 2020 (Yang *et al.* 2011). It has already covered >75% of its planned area. The mudflats of the 4 study sites previously exposed a 25km 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. The mudflats are separated by a man-made seawall from the Nanpu Salt Ponds. These are reputedly 'the largest salt works in Asia'. This area, that is adjacent to the mudflats, is also critical habitat for birds to forage and roost, but some areas are also being lost to industrial development.



Fig 1. The Study Site

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 marked bird we see during our fieldwork thereby documenting the importance of this area to various species from throughout the flyway.



Colour-banded Red Knot © Ian Southey

Human Use of the Mudflats

The birds share the mudflats and food resources with the human population. The professional shell-fishers are able to harvest huge amounts of bivalves from the highly productive mudflats that comprise our study site. This method for harvest ranges from searching by hand with small rakes to pumping equipment powered by generators mounted on large floating tyre tubes. The economic benefit to the local communities is in the region of 10 million RMB per annum (A\$1.7 million) (Yang, pers.comm 2009) and as the mudflats are gradually destroyed their livelihood is threatened. The tidal-flats are worked for about 6 months each year (Yang, pers.comm.). It is a very profitable industry for the local operators and will be into the future if it is being managed sustainably (this we do not know). The harvest is loaded on to boats that are anchored close to the working parties and brought in to the seawall. Here the shellfish are unloaded onto a large truck and taken to Beijing and other large cities to be sold in restaurants. This season we watched some boats being unloaded. The first three bags from each boat are weighed and then all the bags are put on to the truck. One bag weighs 30kg and we did some simple arithmetic and came up with a truck load carrying 32.4 tonnes of shellfish! It's amazing just how productive the mudflat can be for both the local economy and the migrant birds. We hope that the local shell fishers will want to see a reserve that allows them access because good healthy shorebird habitat, without industrial complexes built on it, is good for the local economy and shorebirds. Overall the activity on the mudflats has decreased as only shell-fishers are currently operating on the mudflats. It appears that fishing has been stopped, we saw no fishing nets or activity this season.



Shellfish loaded for transportation to Beijing © Bob Loos

Fieldwork in 2015

The fieldwork program for 2015 started on 11 April and finished on 6 June, this is 57 continuous days of fieldwork with two to five observers in the field daily. Upon arrival at the study site the numbers of shorebirds present was lower than in previous years. Usually when we first arrive the mudflats have hundreds of Dunlin, Eurasian Curlews and Grey Plovers feeding there but in the very first days there were very few to be found. The first 3 days were spent checking all the usual mudflat and salt pond areas that usually have shorebirds but we had no luck. Then on the 15 April they arrived 'en masse' and soon we had hundreds of birds to scan. Grey Plover *Pluvialis squatarola*, Eurasian Curlew *Numenius arquata* and Dunlin *Calidris alpina* were all numerous and made up the bulk of the birds recorded.

It still took several more days for the first large numbers of Red Knots to arrive on 12 April we recorded just 200 but on 18 April that number had risen to 6,000. Very close to 100% of these were of the *rogersi* subspecies, as we have come to expect from previous observations (see Figure 3). Great Knot were also present, numbering about 6,600, other species recorded in smaller numbers included Bar-tailed Godwit, Curlew Sandpiper *Calidris ferruginea* and Sanderling *Calidris alba*. This pattern of species abundance is similar to previous years.

Table 1 documents the evolution of our studies at Bohai Bay as our understanding of the importance of the site became clear to us. We started with a preliminary visit in 2007 leading to the complete and continuous coverage of northward migration from 2010 – 2015. During northward migration season 2008 CH and Adrian Boyle (AB) were conducting shorebird studies in South Korea.

Table 1. Days of observation at the Luannan study site.

| | Days of Observation | Total Flag Sightings | Total Individually recognisable Birds | Total colour-banded Red Knot from NWA |
|------|---------------------|----------------------|---------------------------------------|---------------------------------------|
| 2007 | 7 | 49 | 3 | 0 |
| 2008 | 0 | 0 | 0 | 0 |
| 2009 | 19 | 859 | 143 | 76 |
| 2010 | 57 | 3,143 | 394 | 106 |
| 2011 | 52 | 3,336 | 493 | 170 |
| 2012 | 53 | 4,503 | 691 | 279 |
| 2013 | 59 | 4,616 | 859 | 269 |
| 2014 | 57 | 5,018 | 920 | 345 |
| 2015 | 57 | 4,151 | 929 | 387 |

Total sightings of all marked birds were down on 2015. Lower than usual catch totals for two main study areas in New Zealand and Victoria, Australia are the likely reasons for this decrease. Individually marked birds and colour-banded Red Knot from NWA were all similar to 2105. This result is probably because the use of plain flags as a marking method is gradually being replaced by the use of ELF's.

One change from last year's field work was how often we walked out on to the mudflats to scan birds while they foraged. We used this tactic much less than in the previous two years. The tidal regime this season enabled us to do most of our scanning from the seawall on both outgoing and incoming tides. This means we can cover a much greater area of coast and therefore more birds. The negative was it meant more 3:30AM wake-up alarms than is ideal! Scanning birds on the mudflats can be very productive. Getting close to a big flock of birds in good light and wind conditions gives fantastic views but also presents

challenges with birds often feeding in shallow water making recording colour-bands on the tarsi difficult. If the birds fly away from the observer to a new feeding patch it can mean a walk of one or two kilometres to get close enough to start scanning birds again and scanning time can be severely reduced. However we did not abandon scanning on the mud completely and late in the season often had one person on the mud and two on the seawall or in the salt ponds to maximise our coverage.

Despite the salt ponds being used less this season than in previous years both the salt works and the adjacent inter-tidal mudflats of the Luannan Coast are vital components of the area for shorebird conservation.

The scanning of foraging birds from the seawall, on the inter-tidal mudflats and exploration of the salt ponds occupied the majority of our time. We recorded the usual excellent haul of sightings (see Table 3). 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 (especially early in the season), but as with previous years, by early May most birds flew many kilometres from the mudflats to their salt pond roost sites. This change in roost preference seems to happen every year. The reasons are not obvious to us. The area of salt ponds and therefore roosting opportunities is vast, stretching 10km inland and across the entire 20km, from south east to North 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. 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 remaining inter-tidal mudflats at Zuidong, Nanpu and Beipu remains of greatest conservation importance enabling the huge numbers of migrant birds using the area to fatten up, continue their migrations to their breeding grounds and to breed successfully.



Adrian heading in to the salt ponds © Bob Loos

Table 2 below shows the totals of all marked migratory shorebirds recorded during the fieldwork and the location they were originally marked. The birds with plain flags just indicate the original banding location and cannot 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. As the team were seeing individually marked birds that were 'new' to the area late into the fieldwork period, it is not unreasonable to assume that plain-flagged birds were also still arriving while others will have moved through the site. 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 fieldwork 2010 to 2015.

| Marked at | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | Total 2010-2014 | Individuals 2015 |
|--------------------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------------|---------------------|
| Bohai Bay, China | 122 | 96 | 129 | 125 | 108 | 55 | 635 | 2 |
| Chongming Dontang, China ELF | 48 | 114 | 104 | 103 | 190 | 188 | 747 | 63 |
| Chongming Dontang, China Plain | 273 | 333 | 461 | 449 | 489 | 322 | 2,327 | 0 |
| Chukotka, Russia | 1 | 32 | 43 | 50 | 62 | 38 | 226 | 15 |
| Hong Kong | 5 | 23 | 19 | 44 | 39 | 20 | 150 | 9 |
| India | 1 | 0 | 0 | 0 | 0 | 4 | 5 | 1 |
| Japan | 1 | 7 | 10 | 5 | 9 | 9 | 41 | 0 |
| Java, Indonesia | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| Kamchatka, Russia | 1 | 3 | 4 | 1 | 0 | 6 | 15 | 0 |
| King Island, Australia | 3 | 2 | 4 | 0 | 1 | 5 | 15 | 3 |
| New South Wales, Australia | 0 | 2 | 0 | 1 | 0 | 1 | 4 | 0 |
| Northern Territory, Australia | 3 | 0 | 0 | 1 | 0 | 4 | 8 | 3 |
| NWA Colour Band, Australia | 317 | 412 | 904 | 613 | 922 | 1221 | 4,389 | 423 |
| NWA ELF, Australia | 305 | 312 | 592 | 642 | 891 | 670 | 3,412 | 246 |
| NWA Plain, Australia | 605 | 503 | 574 | 411 | 331 | 366 | 2,79 | 0 |
| NWA Tracking 2000, Australia | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| New Zealand Colour-band | 171 | 228 | 171 | 177 | 144 | 102 | 993 | 27 |
| New Zealand ELF | 243 | 374 | 340 | 511 | 442 | 274 | 2,184 | 84 |
| New Zealand Plain | 186 | 175 | 198 | 205 | 174 | 97 | 1,035 | 0 |
| Phillipines | 0 | 0 | 0 | 1 | 1 | 0 | 2 | 0 |
| Queensland, Australia | 7 | 7 | 8 | 27 | 12 | 4 | 65 | 2 |
| Sakhalin, Russia | 0 | 4 | 5 | 48 | 52 | 44 | 153 | 0 |
| Saunder's Gull, China | 1 | 9 | 0 | 1 | 1 | 7 | 19 | 4 |
| Singapore | 1 | 0 | 0 | 1 | 1 | 0 | 3 | 0 |
| South Australia, Australia | 12 | 35 | 62 | 73 | 54 | 31 | 267 | 4 |
| South Korea | 0 | 0 | 0 | 0 | 8 | 12 | 20 | 0 |
| Sumatra, Indonesia | 12 | 4 | 5 | 8 | 7 | 6 | 42 | 0 |
| SW Western Australia | 6 | 0 | 0 | 1 | 4 | 3 | 14 | 0 |
| Taiwan | 4 | 0 | 2 | 3 | 2 | 4 | 15 | 1 |
| Thailand | 66 | 47 | 70 | 129 | 213 | 148 | 673 | 0 |
| Victoria, Australia | 746 | 644 | 776 | 910 | 755 | 379 | 4,21 | 0 |
| Victoria, Australia ELF | 0 | 0 | 22 | 75 | 103 | 128 | 328 | 42 |
| Yalujiang, China | 0 | 0 | 0 | 1 | 3 | 3 | 7 | 0 |
| Totals | 3,143 | 3,366 | 4,503 | 4,616 | 5,018 | 4,151 | 24,797 | 929 |
| Number of Species | | 14 | 13 | 18 | 17 | 18 | | |

These records (2010-2015) represent 26 different marking areas in 13 countries and territories within the EAAF highlighting the importance of these mudflats, not only to birds from NWA, but from throughout the entire EAAF.

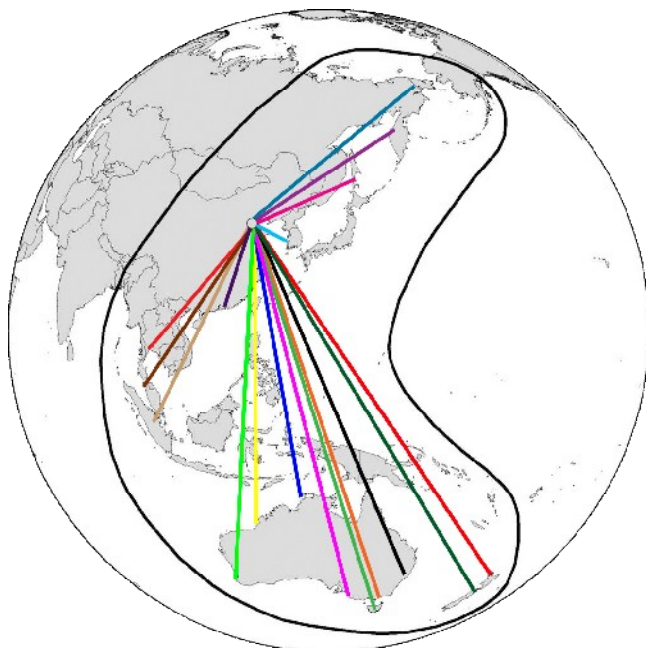


Figure 2. Between 2009 and 2015 we have recorded Red Knot from 17 different banding locations throughout the EAAF. The map above is a representation of some of these sites.

Table 3 shows records of individually colour-banded birds from NWA recorded on the Luannan Coast for the years 2010 to 2015. The 423 of this year is 18% higher than the 345 of 2014. This rise is possibly due to the good scanning from the seawall enabling us to cover more area and more birds than in previous years. It is also likely to be a consequence of habitat loss elsewhere leading to birds looking for alternative site to the ones they have traditionally used. The GFN project is getting 1,000's of resightings in Roebuck Bay and 80 Mile Beach in NWA in addition to this set of data that is compiled from resighting work 6,400km distant from the marking location. This huge dataset, with such a high number of records of individually marked birds, is very valuable for learning about survival and movements of these shorebird.

Table 3. Totals of individually colour-banded birds from the GFN project recorded at the Luanan coast, Bohai Bay in 2010 to 2015

| Broome colour-banded individuals | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|----------------------------------|------------|------------|------------|------------|------------|------------|
| Bar-tailed Godwit | 3 | 2 | 4 | 3 | 5 | 6 |
| Great Knot | 6 | 20 | 17 | 12 | 11 | 30 |
| Red Knot | 106 | 170 | 287 | 272 | 329 | 387 |
| | 115 | 192 | 308 | 287 | 345 | 423 |



Red Knot marked at Chongming Dongtan © Adrian Boyle

Internationally Important Counts

During the 9 years GFN have been visiting the Luannan Coast we have been doing regular counts. The importance of the site is not in any doubt. The table below shows clearly the immense importance of these mudflats and salt ponds to shorebirds from the EAAF. All counts are minimum counts as the vast area can never be completely covered with our current resources. Three counts from 2015 are updated in table 4 below. The count of 14,040 Black-tailed Godwits, 1,686 Eurasian Curlews both from 19 April and 10,270 Great Knot on 4 May. We also had significant counts of various species during the field work season but none were higher than those shown in Table 4.

Table 4. Internationally Important Counts at Luannan Coast 2008 to 2015

| Species | Scientific Name | Date recorded | Count = c Estimate = e | % of EAAF Population present | EAAF Population (Bamford 2008) except *, **, ***, **** | 1% Criteria |
|-------------------------|---------------------------------|---------------|---------------------------|------------------------------------|--|----------------|
| Black-winged Stilt | <i>Himantopus himantopus</i> | 30/04/2008 | 653 c | 2,6 | 25,000-100,000 | 250 |
| Pied Avocet | <i>Recurvirostra avosetta</i> | 30/04/2008 | 712 c | 2,8 | 25,000-100,000 | 250 |
| Grey Plover | <i>Pluvialis squatarola</i> | 30/04/2008 | 3,455 c | 2,8 | 125,000 | 1,250 |
| Asian Dowitcher | <i>Limnodromus semipalmatus</i> | 13/05/2008 | 755 c | 3,3 | 23,000 | 230 |
| Black-tailed Godwit | <i>Limosa limosa</i> | 19/04/2015 | 14,040c | 10,1 | 139,000 **** | 1,390 |
| Eurasian Curlew | <i>Numenius arquata</i> | 19/04/2015 | 1,686c | 1,1 | 40,000 | 400 |
| Spotted Redshank | <i>Tringa erythropus</i> | 16/05/2013 | 660 c | 2,6 | 25,000-100,000 | 250 |
| Marsh Sandpiper | <i>Tringa stagnatilis</i> | 26/04/2012 | >10,000 e | 10 | 100,000-1,000,000 | 1,000 |
| Nordmann's Greenshank | <i>Tringa nebularia</i> | 09/05/2012 | 10 c | 1 | 1,000 | 10 |
| Great Knot | <i>Calidris tenuirostris</i> | 04/05/2015 | 10,270c | 3,5 | 290,000 **** | 2,900 |
| Red Knot | <i>Calidris canutus</i> | 13/05/2011 | 66,500 c | 63,3 | 104,986 * | 1,050 |
| Sanderling | <i>Calidris alba</i> | 29/05/2012 | 2,430 c | 11 | 22,000 | 220 |
| Red-necked Stint | <i>Calidris ruficollis</i> | 16/05/2013 | 20,587 e | 6,3 | 325,000 | 3,250 |
| Sharp-tailed Sandpiper | <i>Calidris acuminata</i> | 29/04/2009 | 5,242 c | 3,3 | 160,000 | 1,600 |
| Curlew Sandpiper | <i>Calidris feruginea</i> | 11/05/2010 | 80,000 e | 44,4 | 180,000 | 1,800 |
| Dunlin | <i>Calidris alpina</i> | 29/04/2009 | 9,950 c | 1 | 950,000 | 9,500 |
| Spoon-billed Sandpiper | <i>Eurynorhynchus pygmeus</i> | 28/05/2013 | 2 c | 0,5 | 400 ** | 4 |
| Broad-billed Sandpiper | <i>Limicola falcinellus</i> | 25/05/2009 | 6,000 c | 24 | 25,000 | 250 |
| White-winged Black Tern | <i>Chlidonias leucopterus</i> | var. dates | 40,000 e | 40 | 100,000-1,000,000 *** | 1,000 |

* Rogers et al 2010

** Zöckler, C., Syroechkovskiy, E. & Atkinson, P.W. 2010a

*** Delany & Scott 2006

**** Conklin, J., Verkuil, Y., Smith, B. 2014



Red Knot flock © Adrian Boyle

Use of the mudflats and resighting coverage

The use of the study site (see Fig. 1, Study Site image) has changed from our first visit in 2007 and changes each year as local conditions change and affects the suitability of different areas for the birds (particularly Red Knot our focus species and a 'specialised feeder'). We now have four major mudflat sites within the study area and also the salt ponds. This year we once again worked regularly at Zuidong, particularly early in the season when large numbers of Great Knot were using the mudflats there. The mudflats there have 'improved' since the reclamation works in 2009-2011 and when we were scanning there we saw Great Knots and Red Knots taking bivalve prey. However the thick green algal covering of 2013 and 2014 was present for some of the season and restricts easy foraging. This site is now adjacent to a six-lane highway and construction sites. This makes it easily accessible to people and during late May and early June up to 1,300 people are on the mudflats on weekends and Public Holidays collecting shellfish. It's not surprising that no birds are there then!

The North Beipu site that we worked at quite a lot in 2014 was visited a little less in 2015. We did still scan in the adjacent shrimp ponds. But we know from previous years and this year's records that birds that we see at North Beipu we also record at Beipu Mudflats and at Nanpu in the same season. As it is relatively unproductive to scan the shrimp ponds they are not a priority. We do however scan there when tides are not suitable to scan the mudflats.

Another potential threat to the mudflat foraging area is the establishment of small areas of Smooth Cordgrass *Spartina alterniflora*. Currently the patches are small, but this is a highly invasive, non-native species and has caused huge problems in other important shorebird sites in the Yellow Sea, most notably at Chongming Dongtan National Nature Reserve where a multi-million dollar project is underway to mitigate the problem. If this area is given Nature Reserve status *Spartina* control will need to be a high priority management action.



Spartina starting to get established at Nanpu Mudflat © Bob Loos

The Nanpu mudflat is usually where most of the birds congregate and subsequently where the vast majority of our fieldwork is done. This was no different during the 2015 season. One major change to the Nanpu mudflats has been that there are no longer any fishing nets close to the sea wall where the birds feed so cutting down on the potential for birds to get entangled in nets at night and die. The mechanical shell-fishing operation is still working the Nanpu mud flats. It is unclear if this operation has any effect on the birds. Reasonable levels of fishing activity appear not to concern the birds. 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. There has been some pumping for small-scale reclamation done in 2006 and artificial islands have been built close off-shore for oil extraction, but the mudflats abutting the seawall are still excellent shorebird foraging grounds. This is the area that must be saved and given Nature Reserve status to enable the Red Knot and many other migratory shorebird species of the EAAF to maintain sustainable population levels.

The mudflats at Beipu are 4.5km long and approximately 4km wide, at the lowest tide. The flats here have undergone many changes since our first visit in 2009. During our field work in 2009 and 2010 we were regularly scanning at Beipu with thousands or tens of thousands of Red Knots frequenting the site. However soon after our field work season finished in 2010 work started and was still going on during our 2011 season. This was the 'usual' method of many large industrial mud-pumping ships pumping mud out of the mudflats and over the seawall in to the adjacent salt ponds. So it damages two shorebird habitats in the one process. The mud is extracted up to a depth of 15m. This brings up anaerobic sediments. The heavy sediments settle and remain in the ponds while the finer sediment and water run back out of sluice gates placed in the seawall for this purpose. As the fine black water and sediments run out back over the mudflats we think they smother it and cause the benthos to 'suffocate'. This is what we saw happen at our southern-most study site of Zuidong. The destruction of the mudflats at Beipu ceased prior to our 2012 season due to 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. This situation has remained the same up to this 2015 season with no mud pumping or development work being done on the Beipu mud flats for 4 years. However, the salt pans immediately inland from the mudflats at the northern end that had mud pumped into them in 2011 are dry mud and offer no feeding opportunities for birds. Due to this reclamation work the Beipu mudflats held almost no birds for most of their area during both 2012 and 2013 but in 2014 small numbers of birds had started to forage there again. This year, 2105, that changed very dramatically. When we are scanning at the northern section of Nanpu we always look across the creek to assess the numbers of birds on Beipu. For the first weeks on the season there were reasonable numbers but they were all adjacent to the creek and we could scan them easily from the seawall that delineates Nanpu from Beipu. However on 20 May this season when we looked across we could see many thousands of Red Knots there. It was too late that day to get to them as the tide was receding but it was very obvious where we needed to be at dawn the next day. Over the next 5 mornings of scanning we recorded 328 individually marked Red Knot from NWA and of those 89 of were 'new', we had not recorded them before during this season.



Sanderling catching prey in the salt ponds © Adrian Boyle

It has taken a few years for the Beipu mudflat to be suitable for birds again but this season shows it can be a favoured feeding site when the Red Knot numbers are at the peak and a large area of mud is required to feed them all adequately so they can fatten up for the flight to their breeding grounds. It would seem mudflat habitat can cope with small amounts of change and rehabilitate itself to a degree. However it was only luck that saw the development at Beipu stop and if it had gone under concrete we wouldn't have this story to tell. However as with all our sites there is still no protection for this area and each year we visit we are unsure if this habitat will exist. Further north, adjacent to Beipu a 2 square km area of mudflat is currently being destroyed for aquaculture ponds.

Nature Reserve Status

The data presented here and in previous surveys on the Luannan Coast show that this part of the Yellow Sea supports internationally significant numbers of 18 populations (1% Ramsar criteria) of migratory shorebirds. For some species the data show that the Luannan Coast is of critical importance as a stop-over site on northward migration. 7 species have an absolute minimum of 10% of their entire EAAF population passing through the Luannan Coast site during northward migration (see Table 4.)

The continuing pressures on the inter-tidal area are detailed elsewhere in this and previous reports with the development of industry and housing areas adjacent to and on reclaimed mudflats and the associated loss of foraging habitat the major factor. While the direct reclamation of the intertidal area has slowed since 2012, now huge building projects are taking place in former salt pond habitat and areas reclaimed in recent years. A six lane highway is part way along our study site, bridges are in place and the new road through the salt ponds is under construction. It would only take an upturn in the world, Chinese economy or local economy to see renewed expansion and loss of mudflats in this critically important area.

“In June 2015 the Committee of the People's Government of Hebei Province published a list of the 12 most important wetlands in Hebei province. The Luannan Coast (Caofeidian south Wetland) is one of these 12 sites.

The basis on which the wetland were included in the list are:

- Representativeness and uniqueness
- Wildlife offspring areas, winter hiding or migration staying over habitats
- Ecological, hydrological importance for scientific research
- Ecological function importance or historical culture significance.

The ongoing development work noted above is a direct threat to these values and to the stated objective of the Peoples Government of Hebei Province to protect key important wetlands of Hebei. The proposal by the Peoples Government of Hebei Province for a Nature Reserve along the Luannan coast will result in additional evaluation work by a range of Provincial Government agencies and peer review by relevant experts, before the final approval.”

The data presented in this report further supports the establishment of a Nature Reserve along the Luannan Coast.

The migratory birds that were the subject of this report are covered by the bilateral migratory bird agreement between China and Australia. The data reported here reaffirms the international importance of the Luannan Coast site and the priority for both Australia and China to advance actions to protect these shared migratory birds. The securing of this area would make a substantial contribution to the undertakings of the bilateral agreement that China has with other flyway countries and the objectives of East Asian-Australasian Flyway Partnership.

Presence of *rogersi* and *piersmai* subspecies

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 usually the case in our study site. We did random counts of flocks of Red Knots regularly throughout the study period totalling 39,925 individuals. This number is almost identical to 2014 (39,864).

This sample size is sufficient to assess the timing of migration of the two subspecies through the site. We assigned each bird to a subspecies based on 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 observed in previous seasons (figure 3).

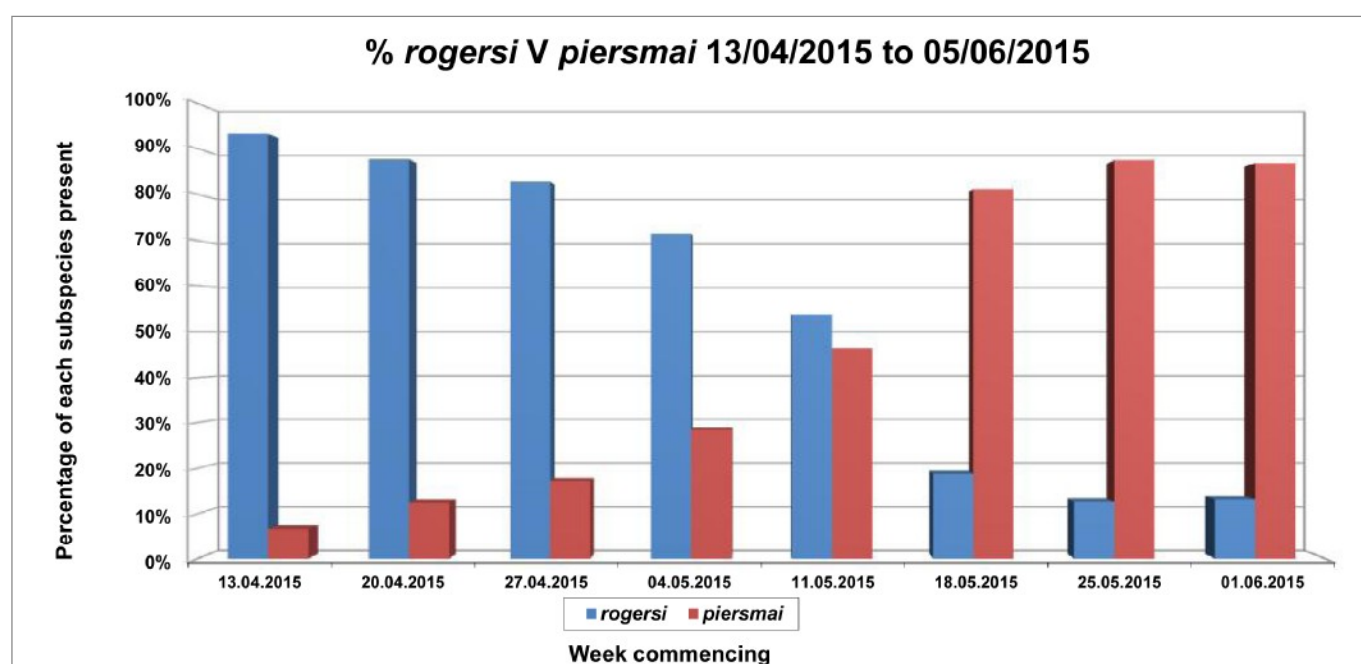


Figure 3. 39,925 Red Knot were scanned during the study period in 225 separate scans and assigned to the *rogersi* or *piersmai* sub-species on the basis of plumage characteristics. The results show that the *rogersi* birds arrive earlier than *piersmai* birds and leave for the breeding grounds earlier. The composition of the two sub-species is almost exactly mirrored at the beginning and end of the study period.



A 'typical' *piersmai* (left) and *rogersi* (right) © Adrian Boyle

Abdominal Profiles

In the absence of body 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 get a suitable view. A side-on view of the bird is needed for an accurate assessment. A factor the observer has to take into account is if the bird is 'fluffed-up' due to cold weather. This can mislead the observer into 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 both subspecies and most individuals are arriving at our Luannan Coast study site in good condition whilst almost no birds are arriving in very poor condition (AP 1). This might mean that they are staging between their Australian and New Zealand non-breeding sites. We do know that some birds stop in Hong Kong and southern China from resighting records. This is however one piece of the Red Knot migration question that we are still attempting to answer with various methods; GFN and the Australian Wader Studies Group (AWSG) currently have geolocators deployed with the hope that we will recover some of these birds in future capture events to try and gain further insight into the migration strategy of Red Knot from NWA.

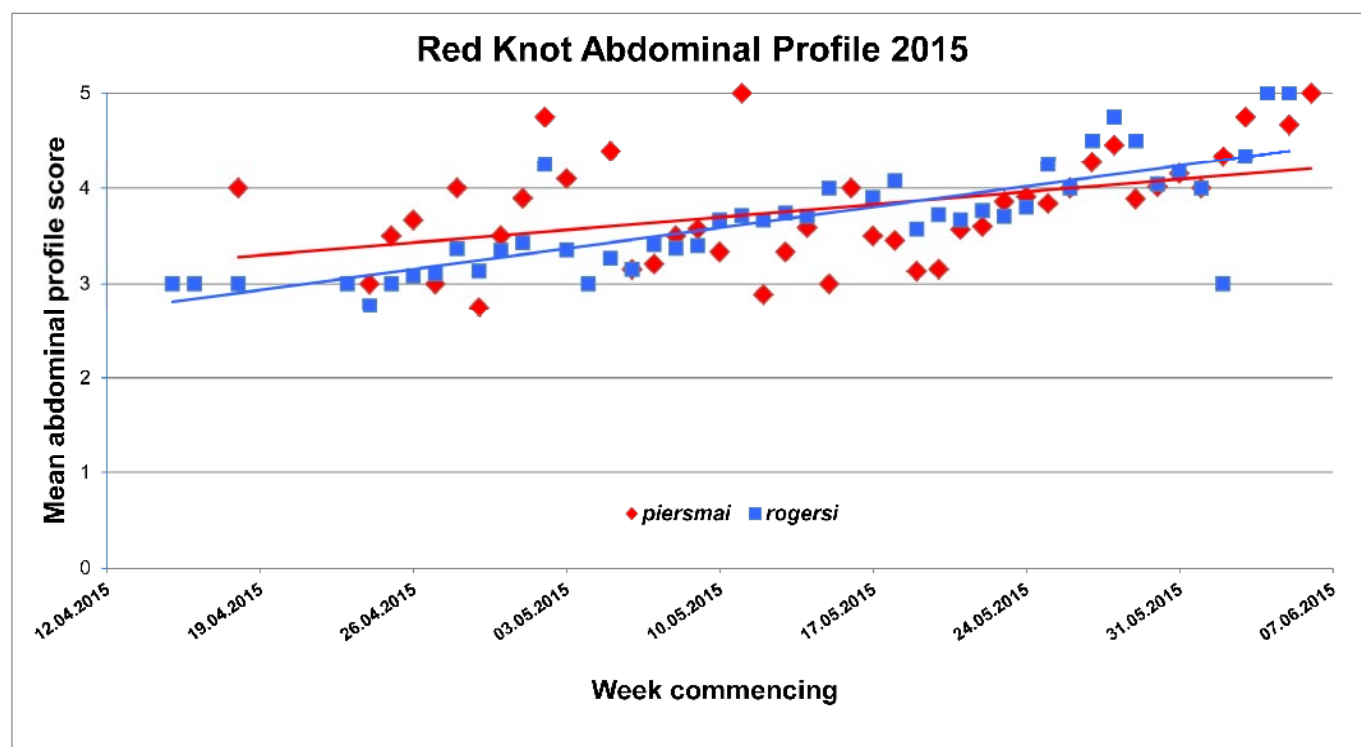


Figure 4. The graph shows the increase in AP, over time, for the two subspecies of Red Knot in 2015 using 1,398 records. This pattern is similar to previous years but the birds arrived at Luannan Coast slightly heavier than in previous years. It is unknown why this should be.

Habitat Threats

This was the third year on row the destruction of the inter-tidal flats themselves had slowed. However the development adjacent to the mudflats was still in full-swing with a six-lane highway having been completed to and along half of the Zuidong seawall, this can only herald plans for further destruction of the inter-tidal areas to the north west, further into the critically important areas of the Luannan Coast Shorebird Site. Factories and apartment blocks have been and are being built on recently claimed land at Zuidong. The race to conserve the area is still on. Enormous areas of inter-tidal mud flats have been converted to industrial land at the Luannan Coast and if the area is to remain an important area for migratory shorebirds the remaining mudflats need to be given high level reserve status. Between 1994 and 2009, approximately 453 km² of sea area in Bohai Bay was lost to development. This included 156 km² of intertidal mudflats being destroyed, a 36% loss of the total area of 428 km² mudflats (Yang *et al* 2010). This is the last published data from the Luannan Coast but more shorebird habitat has been lost and is still being lost up to today. This scenario is playing out all along the Yellow Sea coast of China not just in Bohai Bay. It is a real challenge for Governments and other organisations to find a balance between development and conservation reserves before shorebird populations reach critically low levels from which they will not be able to recover.

One off massive pollution events like oil spills (e.g. ConocoPhillips June 2011) are a problem along with chronic pollution issues. 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).



New road construction through the salt ponds © Bob Loos

Oil Exploration

The Luannan Coast is very important for Oil production and China National Offshore Oil Corporation (CNOOC) operate there and have done so for many years. Generally this industry does not cause too much conservation threats to the migratory bird populations. There is the loss of some habitat for drill rigs and infrastructure but much of the exploration and infrastructure is offshore and away from the mudflats.

However some serious potential threats are inevitable with large scale oil production. An oil spill would be very serious for the Luannan coast mudflats and the associated benthos and birds. If that oil spill were to coincide with the spring migration season the effects on migratory populations could be catastrophic. Early this season 2015 CNOOC were doing exploratory work very close to the Nanpu seawall and directly on the mudflats that are prime areas for shorebirds. This involved the use of 'air boats' and setting off small explosions as part of the exploration process. This caused disturbance to the birds but luckily the work was finished by mid-April before the peak numbers of birds were using the area. It would be ideal if one of our Chinese collaborative Partners could have a meeting with CNOOC to start a dialogue regarding the shared use of the area for on-going profitable oil production and keeping the area safe for foraging migratory shorebirds. These 2 objectives can be met with good will from both sides.



CNOOC 'air boat' © Adrian Boyle

Great Knot *Calidris tenuirostris*

This season our field work recorded the biggest ever count of Great Knots for the Luannan Coast and also the most sightings of individuals marked with colour-band combinations from the GFN project. A total of 10,270 individuals from 04/05/2015 is 46.7% higher than the count of 7,000 from 14/04/2010. Also the sightings of 30 colour-banded birds from this 2015 season is 50% higher than our previous highest sightings of 20 individuals from 2011 and it is 173% higher than the 11 individuals of 2104. There was clearly an increased number of Great Knots using the Luannan Coast this season. It is possible that these birds have relocated from Yalu Jiang National Nature Reserve. Studies being conducted there by Fudan University have preliminary results that the bivalves favoured by Great Knots have dramatically decreased from the mudflats there. This might lead to Great Knots moving away from that site and seeking alternative feeding areas. Much bigger than usual aggregations of Great Knots have been recorded at Gaizhou, near Panjin, Liaoning Province. Yalu Jiang NNR is 180 km from the Gaizhou mudflats and 520 km from the Luannan Coast. These distances are easily covered by a Great Knot when fit. But to remain fit they need large areas of mudflat with suitable food and such areas are becoming very scarce in the Yellow Sea region due to industrialisation. Until Local and International Governments accept that birds cannot 'just move somewhere else' indefinitely the populations of migratory shorebirds passing through the Yellow Sea and therefore returning to their various non-breeding locations in the southern areas of the EAAF are in grave danger of diminishing to unsustainable levels.

Red Knot *Calidris canutus*

The main focus of our studies on the Luannan Coast is Red Knots. We get fabulous data each year on the individually marked birds from the GFN project.

This year the most surprising record was of a Red Knot that has managed to survive its highly demanding migratory life style to a minimum age of 26 years. So with some hard data and a little bit of speculation; this bird was born, at the latest in 1990, it likely spent 1 possible breeding season staying in Roebuck Bay and did not migrate but has migrated each year since. So first migrated in 1992 and has done 23 return migrations and 1 'half migration' its first migration back from the breeding grounds as a juvenile and one quarter this year to get to the Luannan Coast. That is 20,800 X 24, 1 X 10,400 and 1 X 6,400. That Red Knot, weighing about 180g each time it takes off on a leg of its journey, has flown 516,000km in its life time on migration alone. We recorded another bird that was a minimum of 19 years old. Such long-lived individuals are not common but make an awe-inspiring example of what some of these birds can achieve.

Another surprising record was of a bird that moved between Roebuck Bay and Luannan in just 5 days. This bird was seen in Roebuck Bay on the morning of 15 May and most likely flew north late that afternoon. It was then seen on the Beipu Mudflat during our exceptional few days scanning work there in the very early morning of 22 May. So a maximum of 6.5 days and an absolute minimum of 41km/hr assuming it flew non-stop.

We can only speculate if it did or not. Our guess is that it had a very short break somewhere along the route of 24 hours or less. From looking at the 'life histories' of the colour-banded Red Knot it would seem that very few make a quick move to Luannan with most stopping somewhere along the way for up to 2 weeks. So this bird was feeling very strong or had very favourable winds to help it with its journey see, Appendix 1.

Nordmann's Greenshank *Tringa guttifer*

Nordmann's Greenshank is an endangered shorebird (IUCN 2001) with a continuing decline in its population. During our fieldwork we saw up to a minimum of 6 on any one day. Nordmann's Greenshanks were recorded on 18 days between April 24 and May 14. The sightings were of them feeding on the mudflats at Nanpu and feeding and roosting in the adjacent salt pans. And also on June 6 we recorded 3 Nordmann's Greenshank. We have never previously seen them at this time of the season. All 3 of these birds were in complete non-breeding plumage, the 6 birds recorded early in the season all had breeding plumage. So a minimum of 9 birds used our study site in spring 2015. We do not know where these 2 birds may have come from or their age. But it is possible they were immature birds that had not gone all the way to the breeding grounds or had done so but failed to breed and were returning south.



Nordmann's Greenshank *Tringa guttifer* © Adrian Boyle

Chinese Egret *Egretta eulophotes*

Chinese Egret is a vulnerable species with a small, decreasing population with a maximum of 10,000 adults (Birdlife International). We saw this species on the Nanpu mudflats on four separate occasions. We believe these to be four separate individuals as there was always many days between each record.



Chinese Egret on the Nanpu mudflats © Adrian Boyle

Early returning birds

3 Species of shorebirds were recorded on the Nanpu mudflats in the last few days of our field work that were unexpected to us and had not been noted in previous years.

Common Redshank (*Tringa totanus*) numbers are never high but on June 5 there was a minimum of 23 birds and on June 6 a minimum of 34 individuals. These are possibly birds that have bred close to the Luannan Coast and finished breeding. Eastern Curlew (*Numenius madagascariensis*) numbers went from 1 or 2 birds per day to 19 birds on June 6. Some Eastern Curlew breed relatively close to Luannan Coast (1,500 km) and so birds that failed to breed may have returned to Luannan prior to flying to their non-breeding grounds further south in the EAAF. On June 6th we recorded 3 Nordmann's Greenshank. All of these birds were in complete non-breeding plumage, the 6 birds recorded earlier in the season all had breeding plumage.

New Zealand Red Knots

During our work at the Luannan Shorebird Site we record excellent numbers of individually marked Red Knots from New Zealand. Presented in Appendix 2 is a report from Adrian Riegen of the New Zealand Wader Studies Group.



A Red Knot *Calidris canutus* marked in New Zealand © Adrian Boyle

Breeding Birds

The Luannan Coast also hosts some breeding migratory shorebirds and terns. A short note on these is provided in Appendix 3.

Future research

GFN will continue to document the fates of four shorebird species at their non-breeding sites in NWA by applying individual colour-band combinations and conducting intensive resighting scans for the marked birds. A comprehensive database of sightings from the marking sites in NWA and throughout the flyway is being maintained. With the work in Bohai Bay and sightings from other shorebird colleagues throughout the flyway we will be able to assess the effects of human-induced habitat change on survival rates of the populations. GFN will continue conservation efforts at Bohai Bay in conjunction with WWF-China, Wetlands International-China and Department of Conservation – New Zealand. Miss Ying-Chi Chan, a PhD student of Theunis Piersma, is currently researching migration of Bar-tailed Godwits, Great Knots and Red Knots along the EAAF, using mark-resighting data presented in this report, and other methods such as satellite telemetry and benthic sampling. Tamar Lok has started postdoctoral work on sophisticated demographic analyses on the GFN data. All this work is made possible under the Chair in Global Flyway at the University of Groningen, with support from WWF-Netherlands, WWF-China and BirdLife-Netherlands, with in-kind support of the NIOZ Royal Netherlands Institute for Sea Research and in close cooperation with Beijing Normal University.

Passerine Migration

Although the migratory shorebirds were the focus of our work, we had a number of keen ornithologists present and whenever there was an opportunity 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 4 has a complete list of all the birds seen during the fieldwork period and includes some rare and difficult to see species.

Acknowledgments

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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

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

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Bob Gill and Lee Tibbitts from Alaska scan a shorebird flock © Adrian Boyle

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 the Red Knot marked in Roebuck Bay and seen at Bohai within 6 and a half days as mentioned in the report. This life history has been edited for presentation.

Summary of sightings

Red Knot

Banding/Recapture 5YLLY

05/03/2014 80 Mile Beach 40-45KM South, Australia 05274723 (5YLLY) Aged 2+

Resightings of 5YLLY

05/03/2014 80 Mile Beach 40-45KM South, Australia 05274723 (5YLLY)
 12/04/2014 80 Mile Beach 30-35KM South, Australia
 04/12/2014 80 Mile Beach 50-55KM South, Australia
 17/04/2015 80 Mile Beach 40-45KM South, Australia
 15/05/2015 Sandy Blowout, Roebuck Bay, Broome, Australia
 15/05/2015 Wader Spit, Roebuck Bay, Broome, Australia
 22/05/2015 BeiPu Bohai Bay, China

Appendix 2

NZ knots

New Zealand Red Knot in Bohai Bay, China

A brief review to the 2015 sightings

The New Zealand Wader Study Group (NZWSG) started banding Red Knot in the mid 1980's in an effort to understand among other things, the Red Knot's migration routes. Up to 1991 only a metal band was used, which relied on someone finding the bird and returning the band, to learn anything of its movements. In the first few years about one overseas recovery for every 350 birds banded was received. There were few birdwatchers in Asia in the 1980's and even fewer looking for marked waders. Staging sites in China were generally out of bounds to foreigners and to a greater extent not even known.

In the early 1990's Mark Barter started searching the Chinese coast for wader staging sites, and in 2000 with Yang Hongyan, who was studying Red Knot in Bohai Bay, found some 25,000 along the northern shores of Bohai Bay (the Luannan Coast). At the time the estimated Red Knot population was at least 220,000, so this find amounted to around 10% of the population. Where were the rest? In 2005 the NZWSG started using white flags engraved with three black letters. It was hoped that with more birdwatchers in Asia and foreign wader people visiting East Asia, these flagged birds would be seen and thus help identify more staging sites.

Counts of Red Knot and sightings of New Zealand engraved flags show that few sites outside Bohai Bay appear to hold significant numbers of Red Knot, (see table 1). More effort does go into looking for flags in

Bohai Bay than any other part of the flyway but nevertheless some other sites are covered quite well. Yalu Jiang in particular is well surveyed but has very few Red Knots.

In 2009 the Global Flyway Network team, led by Chris Hassell started fieldwork that focused on the northwest Bohai Bay region primarily, looking for Red Knot during northward migration that they had colour-banded in NW Australia. The spin off was that they not only found many of their birds but an ever increasing number of New Zealand colour-banded and engraved flagged Red Knot as well.

The GFN team's impressive efforts over the past seven years have generated a huge amount of data and clearly shown that the small area of the northwest Bohai Bay is by far the most significant staging site for Red Knot so far known on the East Asian-Australasian Flyway during northward migration. With most of the Yellow Sea coast of China and South Korea now surveyed it seems unlikely there is another major staging site. The flyway population of Red Knot was revised down in 2010 to around 110,000, (Rogers *et al*, 2010), and it now appears that the majority of the flyway's Red Knots stage in Bohai Bay during northward migration.

What has changed since 2013 is the volume of data generated from the fieldwork. I was privileged to spend a week in Bohai Bay with the team in May 2014 and was impressed with the effort the team puts into identifying the marked birds. The following data summarises engraved flag sightings of New Zealand Red Knot along with Red Knot flagged in Victoria, Northwest Australia, Chongming Dao and Chukotka, which have been seen at least once in New Zealand.

The numbers

1,001 Red Knot have been fitted with engraved flags in New Zealand and of those 909 have been resighted in New Zealand or overseas (90.8%). A total of 5,628 sightings have been recorded with 1,342 of those being from overseas (23.8%). 530 individuals have been seen overseas, 58% of the total seen. Of the 530 individuals seen overseas 441 have been recorded in the Bohai, all but one of them on the Luannan coast. This represents 83% of all overseas sighting.

Table 1. All overseas sightings of individually identifiable, total numbers of engraved flags and plain or unread engraved flags of New Zealand Red Knot on northward and southward migration to June 2015.

| Loaction | Individuals | Total sightings of engraved flags | Plain flag sightings |
|---------------------------------------|-------------|-----------------------------------|----------------------|
| Bohai Bay - China | 441 | 1,154 | 1,241 |
| Newcastle – NSW, Australia | 30 | 111 | 33 |
| SE Queensland - Australia | 16 | 24 | 53 |
| Gulf of Carpentaria – Australia | 5 | 6 | 20 |
| Chongming Dontang, China | 4 | 5 | 1 |
| NSW (other than Newcastle), Australia | 3 | 7 | 16 |
| Japan | 3 | 7 | 5 |
| Yalu Jiang – China | 2 | 2 | 1 |
| Taiwan | 3 | 4 | 13 |
| NW Australia | 2 | 2 | 6 |
| Chukotka - Russia | 1 | 1 | 4 |
| South Korea | 1 | 1 | 10 |
| Rest of China | | | 1 |
| Norfolk Island | | | 1 |
| Northern Territory | | | 2 |
| Victoria | | | 2 |

Putting the Bohai sightings into context

The number of engraved flags seen on the Luannan coast in 2015 is the lowest since 2010, which is of concern, but could be partly due to the fact that since January 2010 only 141 new engraved flags have been deployed and only 23 since January 2013. The reduced number of Red Knot in New Zealand and their habit of regularly moving between roosting sites has made catching them much more difficult.

Chukotka, Russia

One Red Knot (CKR) flagged in Chukotka, Russia, was seen in New Zealand on 19.02.2012 and then seen in Bohai Bay on April 2012 and May 2014.

Chongming Dao

14 engraved flagged Red Knots from Chongming Dao, China were seen in the Bohai and at least once in New Zealand. 4T was seen at Karaka, Manukau Harbour eight times in 2010 and 2011 but not since but has been seen twice in Bohai Bay on 14.05.13 and 19.05.14. 9W, which was seen once in New Zealand on 20.10.13 then three times in Bohai in April 2014

Victoria

17 Orange engraved flagged Red Knot have been seen in New Zealand and Bohai. It is likely that most of these orange flagged birds are now regulars in New Zealand during the non-breeding season.

Two of these were seen at Farewell Spit in the South Island and the rest were seen in the Auckland area. Flag 64 was also seen once in the Far North of New Zealand possibly on northward migration before returning to Auckland the following October. The last sighting was 02.02.2014, it was then seen at the Luannan Coast on 25.04.2014.

Northwest Australia

Four yellow engraved flags have been seen in New Zealand prior to sighting in Bohai Bay. Of particular interest was ZPW, seen in New Zealand from December 2011 to 10.03.2013. 19 days later on 30.03.2013 it was seen in Bohai Bay. During southward migration it was seen at Newcastle, NSW between 24.10.2013 and 06.11.2013. It was not seen that summer in New Zealand but was probably there, before heading north to be seen at Bohai Bay again on 16.05.2014.

These sighting show that Bohai Bay and particularly the Luannan Coast are vitally important staging sites for birds from a variety of original sites outside New Zealand as well as birds banded in New Zealand.

This is an impressive contribution to the knowledge of New Zealand Red Knots during northward migration, and the NZWSG is extremely grateful to all those involved with the GFN project and their principal funders. We hope they are able to continue this work and that the focus they have put on the area will help to save it from complete destruction. Already 50% of the Red Knot population in New Zealand has been lost over the past 15 years. It will be a tragedy if this trend continues. The importance of Bohai Bay and the Luannan Coast in particular for Red Knot cannot be overstated and without these feeding and staging grounds the outlook for their future is very bleak.

Adrian Riegen
 Convener, NZWSG
 July 2015

Table 2. Number of engraved flagged New Zealand Red Knot seen in Bohai Bay

| Year | Sightings | Number of individual Birds |
|-------------|------------|----------------------------|
| 2007 | 1 | 1 |
| 2008 | 5 | 5 |
| 2009 | 21 | 21 |
| 2010 | 90 | 79 |
| 2011 | 190 | 136 |
| 2012 | 154 | 117 |
| 2013 | 344 | 184 |
| 2014 | 249 | 115 |
| 2015 | 100 | 84 |

Appendix 3

Breeding shorebirds and terns

In addition to the migratory shorebirds and terns passing through the Luannan Coast there are 8 species we have recorded breeding and 1 we suspect to breed. Pied Avocet *Recurvirostra avosetta* is the most common species we record. They breed on the bare banks of salt ponds, on open areas of dry mud in unused or recently reclaimed salt ponds and on small islands within the salt ponds. Egg collecting for food by people and destruction of nests by stray dogs appears to be the main threats to breeding success. Black-winged Stilt *Himantopus himantopus* and Kentish Plover *Charadrius alexandrinus* breed in the same locations in good numbers. Common Redshank was confirmed as a breeding species for the first time in our study area this year. A nest was located by Katarzyna Kucharska in an unused oil pump station. Little Ringed Plover *Charadrius dubius*, are assumed to breed. We have witnessed territorial behaviour but have not actually recorded nesting. Common Tern *Sterna hirundo* breed in scattered colonies numbering from a few pairs to a few hundred pairs. The subspecies *longipennis* is the most common subspecies to breed in our study area but we have recorded and photographed birds with black-tipped red bills of the subspecies *minussensis*. Paul Holt (a Beijing-based bird tour operator) informs us that "minussensis is regular on the Hebei coast (and in Beijing) and often outnumbers longipennis. They breed in both areas too, occasionally even pairing with longipennis". Common Terns always breed on islands. Another tern species breeding on small islands within the salt ponds is Gull-billed Tern *Gelochelidon nilotica affinis* they are much less numerous than Common Terns. Little Terns *Sterna albifrons* breed in small numbers in the same habitat as the Pied Avocet.

Whiskered Terns *Chlidonias hybridus* breed in reed beds inland from the salt ponds, but are included here as they forage over the salt ponds and inter-tidal mudflats.



Black-winged Stilts during courtship © Adrian Boyle

Appendix 4

Bird List

The full list of the 208 species recorded April 14 to June 6 2015.

| | | |
|-------------------------------|------------------------|----------------------------|
| Common Shelduck | Nordmann's Greenshank | Great-crested Grebe |
| Ruddy Shelduck | Spotted Redshank | Black-necked Grebe |
| Swan Goose | Common Redshank | Great Cormorant |
| Mallard | Wood Sandpiper | Oriental Stork |
| Spot-billed Duck | Green Sandpiper | Great Egret |
| Northern Shoveler | Common Sandpiper | Little Egret |
| Eurasian Wigeon | Terek Sandpiper | Chinese Egret |
| Mandarin Duck | Ruddy Turnstone | Grey Heron |
| Gadwall | Great Knot | Purple Heron |
| Garganey | Red Knot | Chinese Pond Heron |
| Common Teal | Sanderling | Striated Heron |
| Falcated Duck | Sharp-tailed Sandpiper | Black-crowned Night Heron |
| Tufted Duck | Broad-billed Sandpiper | Eurasian Bittern |
| Red-breasted Merganser | Curlew Sandpiper | Yellow Bittern |
| Goosander | Dunlin | Eurasian Spoonbill |
| Eurasian Wryneck | Little Stint | Brown Shrike |
| Great-spotted Woodpecker | Red-necked Stint | Black-billed Magpie |
| Rufous-bellied Woodpecker | Temminck's Stint | Carion Crow |
| Common Kingfisher | Eurasian Oystercatcher | Azure-winged Magpie |
| Black-capped Kingfisher | Black-winged Stilt | Black-naped Oriole |
| Dollarbird | Pied Avocet | Ashy Minivet |
| Hoopoe | Pacific Golden Plover | Black Drongo |
| Northern (Rufous) Hawk Cuckoo | Grey Plover | Hair-crested Drongo |
| Common Cuckoo | Little Ringed Plover | Blue Rock-thrush |
| Indian Cuckoo | Kentish Plover | White-throated Rock Thrush |
| Common Swift | Greater Sand-plover | White's Thrush |
| Fork-tailed Swift | Lesser Sand-plover | Grey-backed Thrush |
| Little Owl | Red-necked Phalarope | Eurasian Blackbird |
| Feral Pigeon | Black-tailed Gull | Eyebrowed Thrush |
| Oriental Turtle Dove | Mew (Common) Gull | Naumann's Thrush |
| Spotted Dove | Glaucous Gull | Dusky Thrush |
| Eurasian Collared Dove | Black-headed Gull | Chinese Thrush |
| Japanese Quail | Saunders's Gull | Red-flanked Blue-tail |
| Common Pheasant | Relict Gull | Bluethroat |
| Moorhen | Common Tern | Siberian Rubythroat |
| Common Coot | Little Tern | Siberian Blue Robin |
| Oriental Pratincole | Caspian Tern | Rufous-tailed Robin |
| Northern Lapwing | Gull-billed Tern | Daurian Redstart |
| Grey-headed Lapwing | Whiskered Tern | Stejneger's Stonechat |
| Woodcock | White-winged Tern | Pied Wheatear |
| Common Snipe | Hen Harrier | Blue-and-white Flycatcher |
| Ruff | Pied Harrier | Taiga Flycatcher |
| Black-tailed Godwit | Chinese Sparrowhawk | Yellow-rumped Flycatcher |
| Bar-tailed Godwit | Japanese Sparrowhawk | Mugimaki Flycatcher |
| Eastern Curlew | Oriental Honey Buzzard | Asian Brown Flycatcher |
| Eurasian Curlew | Black-eared Kite | Grey-streaked Flycatcher |
| Whimbrel | Eastern Buzzard | Dark-sided Flycatcher |
| Little Curlew | Grey-faced Buzzard | White-cheeked Starling |
| Grey-tailed Tattler | Common Kestrel | Red-billed Starling |
| Asian Dowitcher | Amur Falcon | Daurian Starling |
| Long-billed Dowitcher | Eurasian Hobby | White-shouldered Starling |
| Marsh Sandpiper | Peregrine Falcon | Crested Myna |
| Common Greenshank | Little Grebe | Yellow-bellied Tit |

Chinese Penduline Tit
Sand Martin
Barn Swallow
Red-rumped Swallow
Light-vented Bulbul
Brown-eared Bulbul
Zitting Cisticola
Lanceolated Warbler
Middendorff's Warbler
Oriental Reed Warbler
Thick-billed Warbler
Black-browed Reed Warbler
Dusky Warbler
Radde's Warbler
Eastern Crowned Warbler
Arctic Warbler
Claudia's Leaf warbler

Yellow-browed Warbler
Pallas's Leaf Warbler
Two-barred Warbler
Pale-legged Leaf Warbler
Reed Parrotbill
Vinous-throated Parrotbill
Asian Short-toed Lark
Chestnut-flanked White-eye
Russet Sparrow
Tree Sparrow
Eastern Yellow Wagtail
Citrine Wagtail
Grey Wagtail
White Wagtail
Forest Wagtail
Richard's Pipit
Blyth's Pipit

Olive-backed Pipit
Red-throated Pipit
Chinese Grosbeak
Siskin
Brambling
Common Rosefinch
Yellow-throated Bunting
Yellow-browed Bunting
Black-faced Bunting
Chestnut-eared Bunting
Tristams Bunting
Little Bunting
Yellow-breasted Bunting
Chestnut Bunting
Pallas's Bunting



left top:

White-shouldered Starling

left bottom:

Chinese Pond Heron

right:

Reed Parrotbill

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