



BOHAI BAY NORTHWARD MIGRATION REPORT APRIL & MAY 2010

Introduction

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 by two subspecies *piersmai* and *rogersi*, they 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) 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 northward migration period and her work shows 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. Due to the work by YHY and CH a further visit was made to the study area in May 2009 by CH and Adrian Boyle (AB) to join YHY during her spring field work. CH and AB concentrated on searching for individually marked birds and had remarkable success. 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 in 2010 and beyond. Here we report on what we achieved in April-May 2010.

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.

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.



The image shows the 3 study sites and the Caofeidian Industrial Park. The mudflats of the 3 sites are 25km long and 1-3km wide on the lowest tides. The mudflats are separated by a man-made seawall from the Bei Pu Salt Ponds. Reputedly 'the largest salt works in Asia'.

Marking of shorebirds

Shorebirds captured throughout the EAAF are marked with either plain coloured flags, engraved leg flags (ELF) or 4 colour-bands and 1 flag. Each capture location has its own coloured flag and/or position of the flag on its leg. The focus of our study is the individually colour-banded birds from Roebuck Bay, Broome NW Australia, but we record every single flag we see during our field work thereby documenting the importance of this area to birds from throughout the flyway.



Colour-banded Red Knot, © I Southey



Engraved flagged Great Knot, © A Boyle

Human use of the mudflats

The mudflats are used by local people for seafood collection. Long nets are strung over the flats on poles to catch fish and many people search for shellfish, either by hand or by a 'suction pump' method. The hand searching causes relatively little disturbance to the birds and the nature of the work means that, despite the number of people involved, the amount of mudflat turned over is probably not a major problem for the shorebirds. However since 2009 the new 'pump method' of shell-fishing employed by some workers has increased the amount of shell fish taken and the damage to the upper layers of the mudflat. Also this method allows the fisherman to work when the tide is in thereby increasing the amount of time the mudflats are under pressure and damage to the upper layers of the mud-flat. The shells that are taken by the fishermen are not food for the shorebirds but it is assumed that the method of pumping the mud and all the associated benthos through the pumping machine would have a negative effect on the food sources that the shorebirds rely on.



Hand searching for shellfish, © A Boyle



Pumps, © T Piersma



Net line, © A Boyle



Dead red Knot in net, © A Boyle

Field work in 2010

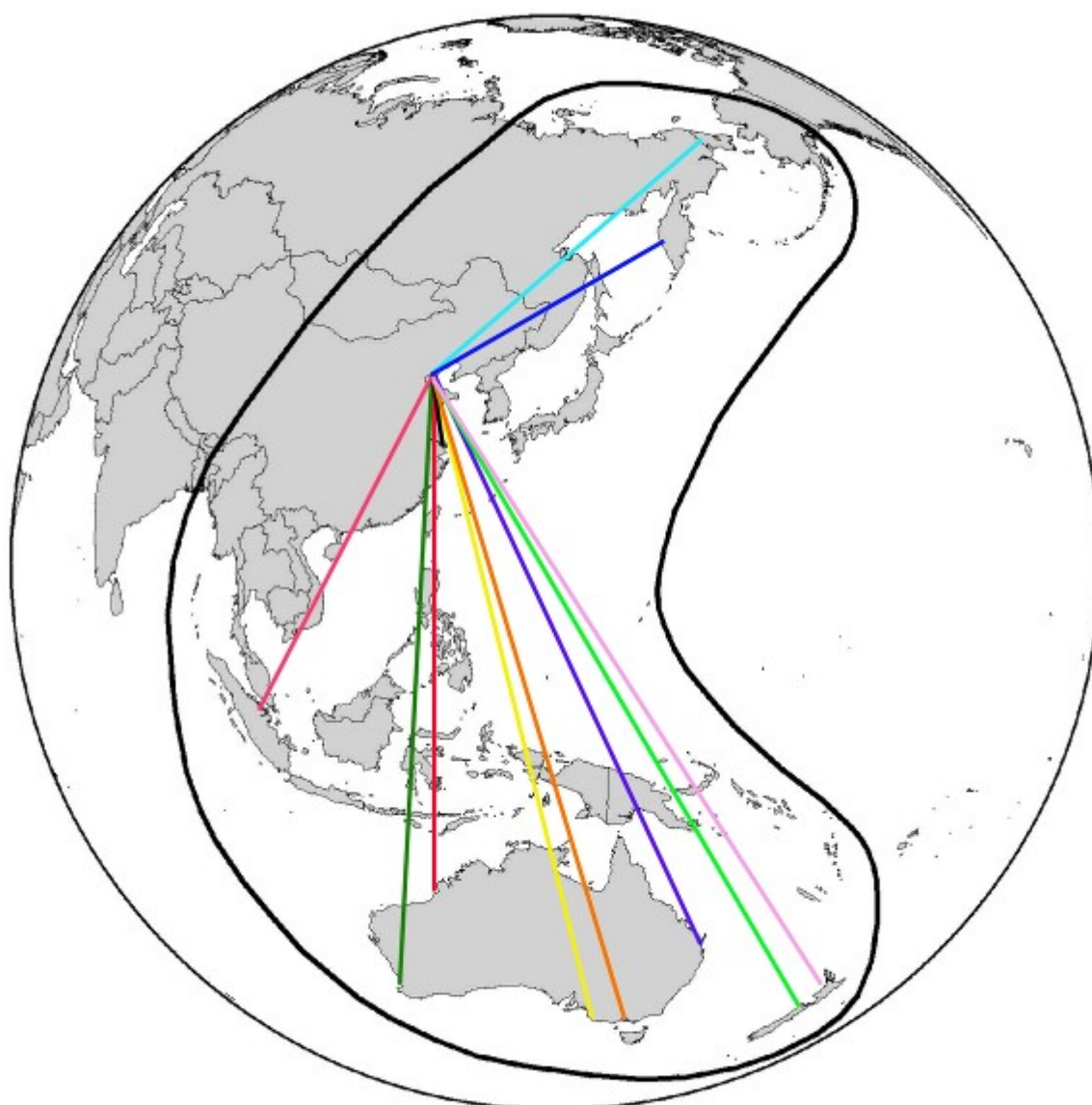
In 2010 the fieldwork program was expanded to cover the entire stop-over period during which birds use the study sites. AB and Matt Slaymaker (MS) arrived at the site on 2 April. Some species of shorebird had already arrived from their more southerly non-breeding areas but the focus species, Red Knot, were only present in tiny numbers, 8 individuals were counted on 2 April. This rapidly increased to 800 by 14 April and the peak of 64,958 were present during the count on 2-4 May. The scanning of resting flocks at roost sites and foraging birds on the inter-tidal mudflats occupied the majority of our time and a remarkable haul of sightings was compiled. Table 1 below shows the totals of migratory shorebirds (plus 1 gull) recorded during the field work and the location they were originally marked at. The birds with plain flags just indicating the original banding location can not be identified to the individual level. The colour-banded birds and the engraved leg lags (ELF) can be attributed to individual birds and these birds with numerous sightings show very interesting 'life histories' (see appendix 2). As the team were seeing individually marked birds that were 'new' to the area late in to 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 seen are still a good reflection of the numbers of flagged birds present.

Table 1. Totals of marked birds recorded during 56 days of field work April 2nd to May 28th 2010.

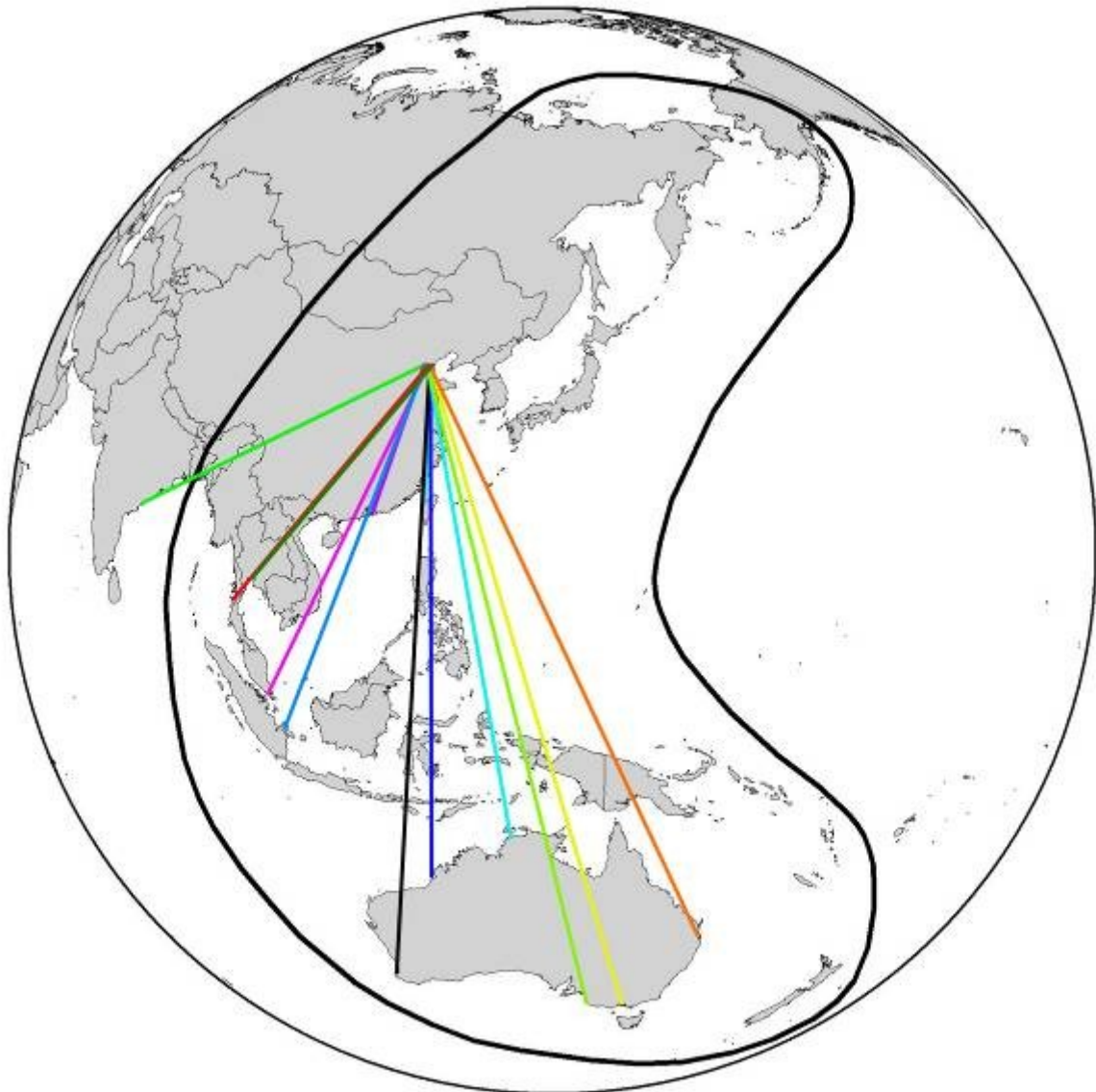
FLAGGED IN	NUMBER OF SIGHTINGS	KNOWN INDIVIDUALS
BOHAI (LOCAL)	122	0
CHONGMING DONTANG PLAIN	273	0
CHONGMING DONTANG ELF	48	21
CHUKOTKA	1	0
HONG KONG	5	0
INDIA	1	0
JAPAN	1	0
JAVA	1	0
KAMCHATKA	1	0
NORTHERN TERRITORY AUSTRALIA	3	0
NW AUSTRALIA AGE COHORT STUDY	28	0
NW AUSTRALIA COLOUR BAND	317	108
NW AUSTRALIA ELF	305	97
NW AUSTRALIA PLAIN	577	0
NW AUSTRALIA TRACKING 2000	2	0
NEW ZEALAND ELF	243	82
NEW ZEALAND PLAIN	186	0
NEW ZEALAND COLOUR BAND	171	76
QUEENSLAND, AUSTRALIA ELF	1	1
QUEENSLAND, AUSTRALIA	6	0
SAUNDERS GULL ELF	1	1
SINGAPORE	1	0
SOUTH AUSTRALIA	12	0
SUMATRA	12	0
SW WESTERN AUSTRALIA	6	6
TASMANIA (KING ISLAND) ELF	3	1
TAIWAN ELF	2	1
TAIWAN PLAIN	2	0
THAILAND	66	0
UNKNOWN	3	0
VICTORIA, AUSTRALIA	746	0
Total	3146	394

The site is important for a number of species during spring migration. Red knot and Curlew Sandpiper are two of the very obvious species with a minimum of 30% of the EAAF populations of Curlew Sandpiper using the area during northward migration. For Red Knot during the 2009 study this was 45.6% of the migrating population, mature adults, as opposed to the entire EAAF population which includes immature birds that stay on their non-breeding grounds during their first northern summer (Rogers *et al* 2010).

The map below shows the different banding areas that we recorded Red Knot from. Due to the size of the map not every one can be seen. We recorded Red Knot at Bohai from Chukotka, Kamchatka, Sumatra, Chongming Dongtan (China), 5 sites in Australia and both north and south islands of New Zealand.



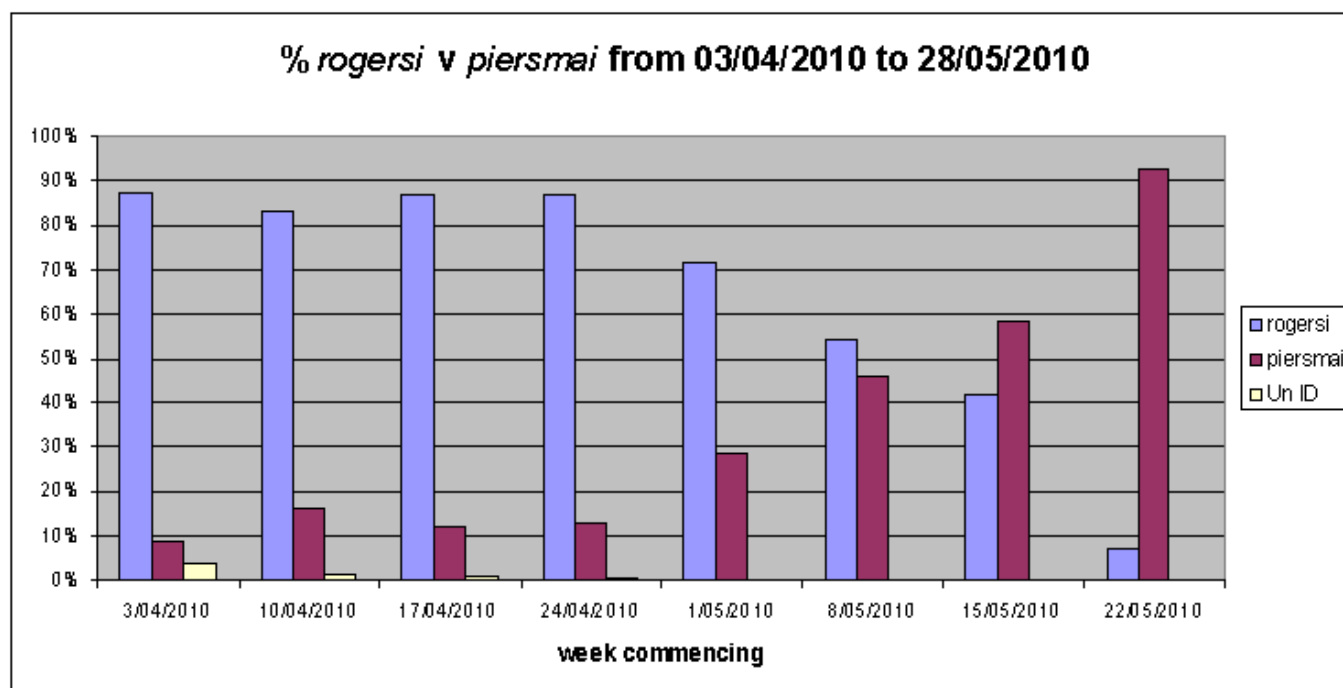
The map below shows the different banding areas that we recorded Curlew Sandpipers from. Due to the size of the map not every one can be seen. We recorded Curlew Sandpipers at Bohai from India, 2 sites in Thailand, Singapore, Sumatra, Chongming Dongtan (China), Taiwan and 6 sites in Australia.



rogersi and *piersmai* subspecies

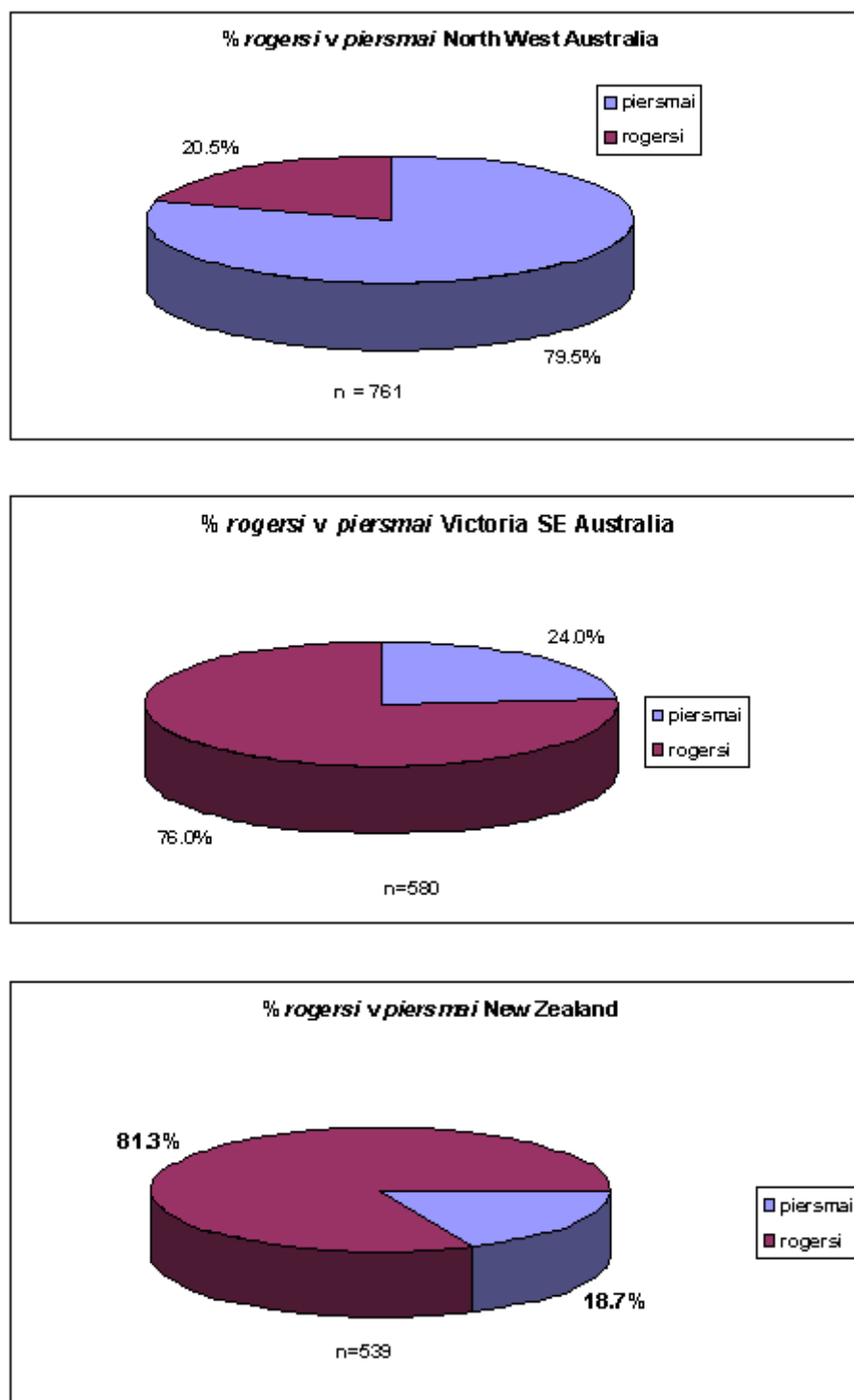
The two subspecies of Red Knot using the EAAF can be distinguished, when in fresh, full or near-full breeding plumage on the basis of that breeding plumage. This is particularly noticeable when the two sub-species are side by side as is the case in our study site. We did random counts of flocks of Red Knots totaling 62,495 during the study period. We assigned each bird to a subspecies on the basis of plumage. Early in the study period some individuals were not in sufficient plumage to be fully confident of assigning a subspecies but as time went on all birds were in enough breeding plumage to be confident of assigning all birds to one or other subspecies. 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 and breeding on the New Siberian Islands. See figure 1.

Fig. 1. 62,495 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.



The percentage of the two subspecies marked at the three main locations in Australasia was estimated by taking each bird that was positively identified from that region, by its flag and/or colour combination, and that was then positively identified to sub-specific level on the basis of breeding plumage. As expected; *rogersi* dominated in the more southerly non-breeding locations. See figure 2.

Fig. 2. The proportions of the two subspecies of Red Knot marked in each of the three main non-breeding locations in Australasia from colour flagged or individually marked birds.



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 are one Red Knot and one Great Knot marked in Roebuck Bay and seen at Bohai and subsequently back at their regular non-breeding site of Roebuck Bay.

Summary of sightings

Red Knot

Banding/Recapture	2BRLB
07/06/2009 Richards Point, Roebuck Bay, Broome (-18.00, 122.37) Australia 05254347 (2BRLB) Aged 1	
Resighting	2BRLB
15/01/2010 Simpson's Beach, Broome (-17.99, 122.21) Australia Grant Morton & Clare Morton	
30/01/2010 Simpson's Beach, Broome (-17.99, 122.21) Australia Grant Morton & Clare Morton	
05/02/2010 Tattler Rocks, Roebuck Bay, Broome (-17.92, 122.58) Australia Chris Hassell & Petra de Goeij	
07/03/2010 Simpson's Beach, Broome (-17.99, 122.21) Australia Grant Morton & Clare Morton	
19/03/2010 Two Dog Hermit beach, Roebuck Bay, Broome (-18.00, 122.37) Australia Chris Hassell	
26/05/2010 ZUIDONG BOHAI (SHUANG LONG HE MOUTH) (39.04, 118.36) China (mainland) Bohai Team 2010	
28/05/2010 ZUIDONG BOHAI (SHUANG LONG HE MOUTH) (39.04, 118.36) China (mainland) Bohai Team 2010	
16/08/2010 Campsite Beach, Roebuck Bay, Broome (-17.98, 122.31) Australia Chris Hassell & Clare Morton	

Summary of sightings

Great Knot

Banding/Recapture	1RYLY
19/08/2007 Campsite Beach, Roebuck Bay, Broome (-18.00, 122.37) Australia 06300551 (1RYLY) Aged 3+ (F = Flew)	
Resighting	1RYLY
29/10/2007 Beaches, Crab Ck Rd, Roebuck Bay, Broome (-18.00, 122.37) Australia Alice Ewing	
19/03/2008 Nicks Beach, Roebuck Bay, Broome (-18.00, 122.37) Australia Chris Hassell	
21/09/2008 Boiler, Roebuck Bay Australia Alice Ewing	
16/10/2008 Richards Point, Roebuck Bay, Broome (-17.97, 122.33) Australia Alice Ewing	
10/02/2009 Two Dog Hermit beach, Roebuck Bay, Broome (-18.00, 122.37) Australia Chris Hassell	
11/09/2009 Richards Point, Roebuck Bay, Broome (-17.97, 122.33) Australia Adrian Boyle	
15/10/2009 Wader Beach, Roebuck Bay, Broome (-17.98, 122.33) Australia Alice Ewing	
23/12/2009 Richards Point, Roebuck Bay, Broome (-17.97, 122.33) Australia Matt Slaymaker	
30/01/2010 Simpson's Beach, Broome (-17.99, 122.21) Australia Grant Morton & Clare Morton	
08/03/2010 Wader Beach, Roebuck Bay, Broome (-17.98, 122.33) Australia Chris Hassell	
24/03/2010 Wader Beach, Roebuck Bay, Broome (-17.98, 122.33) Australia Chris Hassell	
07/04/2010 ZUIDONG BOHAI (SHUANG LONG HE MOUTH) (39.04, 118.36) China (mainland) Adrian Boyle & Matt Slaymaker	
08/04/2010 ZUIDONG BOHAI (SHUANG LONG HE MOUTH) (39.04, 118.36) China (mainland) Adrian Boyle & Matt Slaymaker	
09/04/2010 ZUIDONG BOHAI (SHUANG LONG HE MOUTH) (39.04, 118.36) China (mainland) Adrian Boyle & Matt Slaymaker	
10/04/2010 ZUIDONG BOHAI (SHUANG LONG HE MOUTH) (39.04, 118.36) China (mainland) Adrian Boyle & Matt Slaymaker	
16/08/2010 Campsite Beach, Roebuck Bay, Broome (-17.98, 122.31) Australia Chris Hassell & Clare Morton RETURN	
17/08/2010 Campsite Beach, Roebuck Bay, Broome (-17.98, 122.31) Australia Chris Hassell & Clare Morton RETURN	
27/08/2010 Bush Point, south Roebuck Bay, near Broome (-18.22, 122.18) Australia Chris Hassell RETURN	

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 site 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 study the birds. The sense of a rapidly growing economy (progress or destruction?) is palpable. The noise of large machines, pumping boats and the smell of diesel all make for a rather depressing environment. Despite all this the birds still persist and can be seen feeding in large flocks surrounded by the development pressures.



Red Knot forage amongst the pipes and pumping boats, © A Boyle

The pumping boats are pumping mud from the inter-tidal flats, to a depth of 15m, through pipes and over the seawall into the adjacent salt ponds. This is to create 'solid ground' that can then be developed with industry. At the same time new sea walls are being built around the mudflats and this area is then filled in and developed. This method of 'reclamation' is widely used in the Yellow Sea and is very effective for its purpose. Enormous areas of inter-tidal mud flats have been converted to industrial land in this way. The China Marine Environment Monitoring Centre estimates that between 2006 and 2010 1000 km² of land were reclaimed each year in China. In addition to this pressure the Bohai Sea is the most polluted sea in the world and absorbs nearly 5.7 billion tones of sewage each year. 2 million tones of solid waste. And 43 of the 52 rivers that flow into it are heavily polluted. (The China Marine Environment Monitoring Centre website)

The current study site comprises inter-tidal flats of 25km in length. 5km of this area, known to us as Zuidong, will not be available to shorebirds at all next spring migration. The images below are all from this site and the plans clearly displayed on bill boards at the site show the extent of the work. Once this area of critically important habitat is gone then presumably the developers will move westwards on to the remaining study site areas (see notes). YHY has had anecdotal evidence in conversations with shell-fishers at Bei Pu that this is indeed what is going to happen and we have seen piles of material consistent with the new construction of seawalls stacked in the Bei Pu village (see notes).



Billboard showing development of the inter-tidal mudflats
© T Piersma



A pumping boat
© A Boyle



The mud blasting over the seawall
© A Boyle



New seawall construction
© A Boyle



Machinery on the mudflats
© A Boyle



Challenging field work
© A Boyle

Discussion

Despite all the development going on at our study sites the numbers of birds there have increased in the past 4 years. This is presumably due to the destruction of nearby mudflats where the birds used to forage. The question we have now is when will the 'tipping point' be for these birds and in particular Red Knot? The smaller and smaller areas of mudflat cannot continue to support these numbers of birds. Eventually competition for the declining food resources will lead to some birds having to move away from the area, to potentially less productive sites or sites that already are 'full' of birds or to birds being unable to gain satisfactory fat reserves to fuel them on the next leg of their journey to their Arctic breeding grounds. This in turn leads to reduced breeding success and further population declines. This is over and above the birds that may actually die from lack of food or perish on migration because of lack of suitable fat reserves.

The future of research

GFN, with continued funding from BirdLife-Netherlands, continue to research the birds in Roebuck Bay north western Australia applying individual colour-bands and ELF's and conducting intensive re-sightings scans for them and building up a comprehensive database of sightings from there 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 statistical work.

With the technology of satellite telemetry getting smaller and lighter it is now feasible to attach satellite trackers to birds the size of Red Knots. We have tentative plans to do just this in the early spring of 2011 prior to Red Knots leaving NW Australia. Such sophisticated research is hugely expensive but would enable us to see if birds make a single direct flight between NW Australia and the Bohai Sea or if they make a short stop en-route, something that is still not clear to us. It would also help us to understand what individuals do when they arrive at Bohai Sea and find their previous mudflat sites now turned in to dry ground and unavailable to them. Do they all pack in to the remaining habitat and 'get by' on the reduced resources or do they 'roam' and look for alternative sites. This type of knowledge would be very hard to ascertain from colour-band resightings, particularly if the birds move away from our study area.

The future of conservation

We hope that some sort of reserve and study area can be established with the help of WWF-China, but the financial incentives to local governments and business to develop these same resources make this a difficult task. WWF-China is well aware of the importance of the Yellow Sea mudflats and now this area in particular and is hoping to have some success in conserving some of the remaining habitat. We would like to suggest possible ways to at least have some of these magnificent, internationally shared resources, preserved for future generations. GFN is suggesting that we can ride on the wave of 'green thinking' and involve all local stakeholders in an attempt to make the Nanpu-Beipu area an *International Shorebird Shared Resources Reserve at Bohai*.

A possible short-term solution: a Nanpu-Beipu international reserve

Right now, all mudflats of the Zuidong area #1 (in the Study Site image) are being reclaimed. This is in addition to the major reclamation of Caofeidian immediately further east that is approaching completion. Part of the seaward impoundments at the Nanpu area (#2) have already been filled in, with the mudflats offshore showing many holes from dredging. Also the Nanpu area is bordered on the east by the dam to the Nanpu Oil Field artificial island, and the island itself. The relatively least-disturbed area is Beipu (area #3) (See notes). The very muddy Beipu mudflats (home to tens of thousands Curlew Sandpipers and Red Knots in late May 2010) are harvested by the relatively affluent villagers of Beipu village. Nevertheless, rumours have it that dredging and the infilling of the seaward impoundment will also start here soon (see notes).

One could envisage that the Beipu area #3, together with the adjacent mudflats west of it and east of it (part of the Nanpu area #2) could provide the place for the establishment of an *International Shorebird Shared Resources Reserve at Bohai*. What needs to be done is to secure the adjacent mudflats and the seaward-most saltpan impoundments. The first would provide the inter-tidal area for migrant and wintering waterbirds. The second could be developed as high quality high tide roosts and breeding areas for Avocets, Black-winged Stilts and Kentish Plovers.

One could also imagine that part of the near-shore impoundment, e.g. the one that is now an oil exploitation platform, is developed into a Bohai Scientific Research Centre, which would form the base for long-term study on the Yellow Sea inter-tidal ecosystem, its resources and migratory birds.

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 species diversity despite the paucity of any wooded habitat. Appendix 3 has a complete list of all the birds seen during the field work period and includes some rare and difficult to see species. Two of the common and colourful species are shown below.



Red-flanked Bluetail, © A Boyle



Yellow-rumped Flycatcher, © A Boyle

Notes

In the last few days during the compilation of this report I have received news and images of the mudflats from the western end of Beipu and the area has started to be pumped out (YHY *pers com*). There is little time left for this site as a stopover and refueling site for thousands of migrant shorebirds all of which are covered by the Ramsar treaty and the China Australia Migratory Bird Agreement (CAMBA).

A scientific paper 'Red Knots (*Calidris canutus piersmai* and *C.c. rogersi*) depend on a small threatened staging area in Bohai Bay China' (Rogers *et al* 2010) has been accepted for publication and will appear in the next issue of *Emu* Austral Ornithology, The Journal of The Royal Australasian Ornithologists' Union.

A scientific note on the occurrence and kleptoparasitic behaviour of the rare and endangered Nordmann's Greenshank is being prepared called 'Nordmann's Greenshank *Tringa guttifer* using Kleptoparasitism as a feeding technique.' (Boyle and Slaymaker 2010).



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

Acknowledgments

Financial support for this work comes from BirdLife-Netherlands, WWF-Netherlands, Beijing Normal University, and the Australian Government via WI-Oceania and AWSG. Some participants covered their own flights, train fares etc.

A big thank you to Yang Hong-Yan, Chen Bing, Mr. Zhao and Li Jing for their constant help throughout our stay. Thank you to the research field team over the 2 months; Adrian Boyle, Steve Holliday, Li Jing, Greg Kerr, Theunis Piersma, Sytze Pruiksma and Matt Slaymaker. Thank you to all the shorebird enthusiasts throughout the EAAF who send in sightings of marked birds. Thank you to the fabulous group of volunteers from the Broome community who assist with the capture of the birds. Thank you to Clare Morton and Liz Rosenberg for editing of this report.

Particular thanks to Adrian Boyle and Theunis Piersma for constant discussion and ideas in relation to the project.

More information on the GFN colour banding project can be found at www.globalflywaynetwork.com.au/

Chris Hassell
Global Flyway Network



The author in Bohai, but looking forward to the 30oC back in Roebuck Bay,
© T Piersma

Appendix 1

The previous field work in 2009

Between 9 and 29 May 2009, Global Flyway Network, represented by CH and AB, were at the three study sites of PhD student Yang Hong-yan near Nan Pu Development City, situated on the edge of Bohai Bay, 190 km south east of Beijing China. The main aim of our visit was to find colour banded and flagged birds with attention particularly focused on Red Knots.

The area we were working in was, like much of the Yellow Sea coast, under a lot of pressure from development with large areas of mudflats destroyed and covered in industry and much more planned. Enormous mud flat areas have been changed and now have industrial sites very close-by. Also two ports and a new highway are being developed.

This is of concern, as from our work there we have found it to be of great importance to many species. However the tidal flats that do remain in the area support huge numbers of birds, with our colleagues Yang Hong-Yan and Chen Bin counting up to 50,000 Red Knot at the three study sites during the peak time. Other outstanding records were tens of thousands of Curlew Sandpipers, a feeding flock of 450 Asian Dowitchers and a roost of 5000 Broad-billed Sandpipers. The reason for the huge numbers of birds here may be due to the destruction of nearby mudflats. The importance of this site in the East Asian-Australasian Flyway is not in doubt. It meets Ramsar status on many levels. Its central role in the flyway is also highlighted by the number of countries' birds represented here. We have seen flags from 12 banding locations in the EAAF, New Zealand, Tasmania, Victoria, South Australia, North West Australia, Northern Territory, Sumatra Thailand, Chongming Dongtan, Kamchatka, Chukotka and the Relict Gulls from Western China.

We saw 74 individually colour-banded Red Knot, from a marked population of 312. That is 23.72% and is quite remarkable; remember we didn't mark them here! We marked them in Roebuck Bay 6500km to the south.

Interestingly, the birds seemed to be doing well with the abdominal profiles (fat deposits) of birds being at 4 and 5 (on a scale of 1-5) but we are sure they are down to the minimum area such large numbers of birds would need for successful fuelling. After speaking with our hosts Yang Hong-yan and Chen Bin it seems that almost zero Red Knots use this area on southward migration so it is still a mystery as to where they stop on their journey south.

Our total of plain flag, engraved flag (ELF) and colour-band sightings are shown in the table below. These are not necessarily 865 individuals of course, as with the plain flags we can't say for sure if we see the same ones day in-day out although due to the number of new colour band birds we were seeing up to our last field visit we are almost certainly seeing new plain flags each day.

FLAGGED AT AND TYPE OF MARK	NUMBER OF SIGHTINGS	KNOWN INDIVIDUALS
CHONGMING DONTANG, CHINA ELF	12	1
CHONGMING DONTANG, CHINA PLAIN	49	
CHUKOTKA, EASTERN SIBERIA	1	
KAMCHATKA, EASTERN RUSSIA	2	
KING ISLAND, TASMANIA ELF	1	1
NEW ZEALAND COLOUR BAND	36	26
NEW ZEALAND ELF	55	22
NEW ZEALAND PLAIN	45	
NORTHERN TERRITORY	2	
NORTH WEST AUSTRALIA COLOUR BAND	139	76
NORTH WEST AUSTRALIA ELF	51	14
NORTH WEST AUSTRALIA PLAIN	216	
NORTH WEST AUSTRALIA TRACKING 2000	22	3
QUEENSLAND, AUSTRALIA PLAIN	1	
SOUTH AUSTRALIA	13	
SUMARTRA	4	
THAILAND	23	
UNKNOWN	1	
VICTORIA, AUSTRALIA	186	
Total	859	143

Appendix 2

Summary of sightings

Red Knot

Banding/Recapture 1BYLL

- 22/06/2008 Quarry Beach, Broome (-18.00, 122.37) Australia 05241744 (1BYLL) Aged 1
 14/09/2008 Richards Point, Roebuck Bay, Broome (-18.00, 122.37) Australia 05241744 (1BYLL) Aged 2

Resighting 1BYLL

- 08/07/2008 Wader Spit, Roebuck Bay, Broome (-17.98, 122.33) Australia, Chris Hassell
 09/08/2008 Wader Beach, Roebuck Bay, Broome (-17.98, 122.33) Australia, Chris Hassell
 15/08/2008 Wader Spit, Roebuck Bay, Broome (-17.98, 122.33) Australia, Chris Hassell
 17/09/2008 Sandy Blowout, Roebuck Bay, Broome (-18.00, 122.37) Australia, Alice Ewing
 29/09/2008 Tattler Rocks, Roebuck Bay, Broome (-17.92, 122.58) Australia, Alice Ewing
 06/10/2008 Stilt Viewing, Roebuck Bay, Broome (-17.98, 122.33) Australia, Chris Hassell
 18/05/2009 **NAN PU OIL RIG SITE (39.06, 118.42) China (mainland), Adrian Boyle & Chris Hassell, PMAI**
 23/05/2009 **NAN PU OIL RIG SITE (39.06, 118.42) China (mainland), Adrian Boyle & Chris Hassell, ?**
 25/05/2009 **NAN PU OIL RIG SITE (39.06, 118.42) China (mainland), Adrian Boyle & Chris Hassell, PMAI**
 04/10/2009 Wader Beach, Roebuck Bay, Broome (-17.98, 122.33) Australia, Alice Ewing
 11/10/2009 Stilt Viewing, Roebuck Bay, Broome (-17.98, 122.33) Australia, Alice Ewing
 31/12/2009 Wader Beach, Roebuck Bay, Broome (-17.98, 122.33) Australia, Matt Slaymaker
 21/05/2010 **ZUIDONG BOHAI (SHUANG LONG HE MOUTH) (39.04, 118.36) China (mainland), Bohai Team 2010, PMAI**
 23/05/2010 **ZUIDONG BOHAI (SHUANG LONG HE MOUTH) (39.04, 118.36) China (mainland), Bohai Team 2010, PMAI**
 24/05/2010 **ZUIDONG BOHAI (SHUANG LONG HE MOUTH) (39.04, 118.36) China (mainland), Bohai Team 2010, PMAI**
 27/05/2010 **ZUIDONG BOHAI (SHUANG LONG HE MOUTH) (39.04, 118.36) China (mainland), Bohai Team 2010, PMAI**

Appendix 3

Mute Swan	Ruff	Black-headed Gull
Bean Goose	Black-tailed Godwit	Saunders's Gull
Common Shelduck	Bar-tailed Godwit	Relict Gull
Ruddy Shelduck	Eastern Curlew	Common Tern
Mallard	Eurasian Curlew	Little Tern
Spot-billed Duck	Whimbrel	Caspian Tern
Northern Shoveler	Little Curlew	Gull-billed Tern
Northern Pintail	Grey-tailed Tattler	Whiskered Tern
Mandarin Duck	Asian Dowitcher	White-winged Tern
Gadwall	Long-billed Dowitcher	Oriental Honey Buzzard
Falcated Duck	Marsh Sandpiper	Black (eared) Kite
Eurasian Wigeon	Common Greenshank	Hen Harrier
Garganey	Nordmann's Greenshank	Eastern Marsh Harrier
Baikal Teal	Spotted Redshank	Pied Harrier
Common Teal	Common Redshank	Accipiter Sp
Common Pochard	Wood Sandpiper	Japanese Sparrowhawk
Tufted Duck	Green Sandpiper	Eurasian Sparrowhawk
Smew	Common Sandpiper	Northern Goshawk
Common Goldeneye	Terek Sandpiper	Grey-faced Buzzard
Common Merganser	Ruddy Turnstone	Common Buzzard
Red-breasted Merganser	Great Knot	Upland Buzzard
Eurasian Wryneck	Red Knot	Osprey
Great-spotted Woodpecker	Sanderling	Steppe Eagle
Rufous-bellied Woodpecker	Sharp-tailed Sandpiper	Common Kestrel
Common Kingfisher	Broad-billed Sandpiper	Lesser Kestrel
Dollarbird	Curlew Sandpiper	Amur Falcon
Hoopoe	Dunlin	Merlin
Large Hawk Cuckoo	Little Stint	Eurasian Hobby
Common Cuckoo	Red-necked Stint	Peregrine Falcon
Cuckoo Sp	Temmincks Stint	Little Grebe
Common Swift	Long-toed Stint	Great-crested Grebe
Fork-tailed Swift	Eurasian Oystercatcher	Great Cormorant
White-throated Needletail	Black-winged Stilt	Great Egret
Oriental Scops Owl	Pied Avocet	Chinese Egret
Brown Hawk Owl	Pacific Golden Plover	Little Egret
Grey Nightjar	Grey Plover	Grey Heron
Feral Pigeon	Little Ringed Plover	Purple Heron
Oriental Turtle Dove	Kentish Plover	Oriental White Stork
Eurasian Collared Dove	Greater Sand-plover	Chinese Pond Heron
Spotted Dove	Lesser Sand-plover	Striated Heron
Japanese Quail	Oriental Plover	Black-crowned Night Heron
Moorhen	Black-tailed Gull	Eurasian Spoonbill
Coot	Mew (Common) Gull	Brown Shrike
Oriental Pratincole	Vega Gull	Black-billed Magpie
Grey-headed Lapwing	Caspian (Mongolian) Gull	Black-naped Oriole
Jack Snipe	Herring Gull	Ashy Minivet
Snipe SP not common	Heuglin's Gull	Long-tailed Minivet
Common Snipe	Glaucous Gull	Hair-crested Drongo
Ruff	Slaty-backed Gull	Black Drongo
Grey-headed Canary Flycatcher	Radde's Warbler	
Blue Rock-thrush	Yellow-streaked Warbler	
White-throated Rock Thrush	Eastern Crowned Warbler	
White's Thrush	Arctic Warbler	
Siberian Thrush	Yellow-browed Warbler	
Grey-backed Thrush	Pallas's Leaf Warbler	
Eurasian Blackbird	Two-barred Warbler	
Grey sided Thrush	Pale-legged Leaf Warbler	
Eyebrowed Thrush	Sulphur-breasted Warbler	
Pale Thrush	Winter Wren	
Dark-throated Thrush	Reed (Northern?) Parrotbill	
Dusky Thrush	Vinous-throated Parrotbill	

Chinese Thrush	Greater Short-toed Lark
Red-flanked Blue-tail	Eurasian Skylark
Bluethroat	Asian Short-toed Lark
Siberian Rubythroat	Horned Lark
Siberian Blue Robin	Mongolian Lark
Rufous-tailed (Swinhoes) Robin	Chestnut-flanked White-eye
Daurian Redstart	Japanese White-eye
Black Redstart	Tree Sparrow
Red-throated (Taiga) Flycatcher	Forest Wagtail
Mugimaki Flycatcher	Citrine Wagtail
Chinese Flycatcher	Yellow Wagtail
Yellow-rumped Flycatcher	Grey Wagtail
Asian Brown Flycatcher	White Wagtail
Grey-streaked Flycatcher	Richard's Pipit
Dark-sided Flycatcher	Blyth's Pipit
Blue & White Flycatcher	Olive-backed Pipit
Common Stonechat	Red-throated Pipit
Pied Wheatear	Pechora Pipit
Red-billed Starling	Tree Pipit
White-cheeked Starling	Water Pipit
Crested Myna	Buff-bellied Pipit
Yellow-bellied Tit	Japanese Waxwing
Chinese Penduline Tit	Grey capped Greenfinch
Sand Martin	Chinese (Yellow-billed) Grosbeak
Barn Swallow	Brambling
Red-rumped Swallow	Common Rosefinch
Asian House Martin	Pallas's Rosefinch
Light-vented Bulbul	Yellow-throated Bunting
Zitting Cisticola	Yellow-browed Bunting
Oriental Bush Warbler	Black-faced Bunting
Siberian Bush Warbler	Chestnut-eared Bunting
Lanceolated Warbler	Tristams Bunting
Locustella Sp	Little Bunting
Oriental Reed Warbler	Chestnut Bunting
Thick-billed Reed Warbler	Pallas's Bunting
Black-browed Reed Warbler	
Dusky Warbler	