RED KNOT NORTHWARD MIGRATION THROUGH BOHAI BAY, CHINA, FIELD TRIP REPORT APRIL & MAY 2011

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Colour-banded Red Knot, © I Southey

Contents

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 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, Beijing Normal University) commenced a PhD project on the food, foraging and stopover ecology of Red Knots in the area. She has been conducting regular counts since 2003 during the spring period of northward migration and her work shows that numbers of birds in the study area have increased over the years, presumably due to habitat destruction elsewhere and consequently birds moving in to the study site (Yang *et al*. 2011). It is clear from our current knowledge this site is the single most important site for Red Knot on northward migration in the EAAF. The southward migration route of Red Knot is still a relative mystery to us.

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

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

The Study Site

The centre of the study site is situated at 39^{o} 03’ 35”N 118^{o} 12’ 33”E.
It is near Nan Pu Development City, situated on the edge of Bohai Bay, 190 km south east of Beijing, China see figure 1 below.

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

The image shows the 3 study sites and the Caofeidian New Area Industrial Park. This enormous area will have destroyed 142km^2 of inter-tidal mudflat at its completion in 2020 (Yang *et al.* 2011). It has already covered >75% of its planned area. The mudflats of the 3 study sites used to give a 25km long and 1-3km wide (on the lowest tides) foraging area for shorebirds. This is no longer the case as most of the Zuidong mudflats have been claimed for industry and the remaining flats at the Zuidong site seem to get little use by shorebirds (see details further in the report). The mudflats are separated by a man-made seawall from the Bei Pu Salt Ponds. These are reputedly 'the largest salt works in Asia'. This area, that is adjacent to the mudflats, is also good habitat for birds to forage and roost but is also being lost to industry.

Marking of Shorebirds

Shorebirds captured throughout the EAAF are marked with plain coloured flags, engraved leg flags (ELF), or combinations of 4 colour-bands and 1 flag. Each bird also has a metal band placed on it supplied by The Australian Bird and Bat Banding scheme (ABBBS). 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 NW Australia, but we record every single flag we see during our field work thereby documenting the importance of this area to various species from throughout the flyway.

Colour-banded Red Knot from NWA, © A Boyle

Engraved flagged Great Knot, © A Boyle

Human Use of the Mudflats

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

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

Pumps, © T Piersma

Field work in 2011

In 2011 the fieldwork program started just 7 days later (9 April) and finished 2 days later (30 May) than the 2010 work. There were not significant numbers of Red Knot in the study area during the first week of April. When Adrian Boyle (AB) and Matt Slaymaker (MS) arrived at the site some species of shorebird had already arrived in good numbers from their southerly non-breeding areas, but there were only 52 Red Knot present. Numbers rapidly increased to >1700 by 14 April and the peak of 66,500 were present during the count on 13 May. This peak of 66,500 Red Knot is the biggest count in the study site. It is only a small increase on the 2010 peak number but is considerably higher than 2009 and a full 63% increase on the peak of 2008. This would suggest that the destruction of surrounding mudflats is compressing the Red Knot populations using Bohai Bay in to an ever decreasing area that is our study site. Table 1 below shows the increase in peak counts.

Table 1. The increase in peak counts of Red Knot at our study sites between May 2008 and May 2011 (Yang *et al*. 2011 in and unpublished data.)

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

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 were recorded (see Table 2). There were some differences from the previous year. In 2009 and 2010 many birds choose to roost in salt ponds in close proximity to the mudflats and consequently the majority of our observations were

done on the roosts. The roosts are relatively undisturbed (compared to our other study site at Roebuck Bay), and although migrating raptors and salt pond workmen do cause some disturbance, it is not significant. However, this year, particularly later in to May, the majority of Red Knot flew many kilometres inland at or close to high tide. We were able to follow their flights with binoculars and telescopes but not on foot or with our vehicle. The area of salt ponds and therefore roosting opportunities is vast, stretching 10km inland and across the entire 20km, from east to west, of our study sites (see Fig 1, study site image). It is unfeasible to access the majority of this area. We did find some roosts and foraging Red Knot as we drove to and from the core area of our study site but the roosting birds were always distant and often in shallow water so we rarely got the opportunity to scan them at these sites. The myriad roosting opportunities is a positive for the birds but, of course, if there are no productive foraging opportunities then all the safe roosting sites in the world won't be any use. Due to the birds roosting at inaccessible locations we concentrated our resighting efforts out on the mudflats more so than in previous years. This proved successful when big numbers of birds were present but the tides also need to be suitable.

Table 2 below shows the totals of all migratory shorebirds (plus 2 gulls and 1 tern) 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 flags (ELF) can be attributed to individual birds and these birds with numerous sightings show very interesting 'life histories' (see appendix 1). As the team were seeing individually marked birds that were 'new' to the area late into the field work period, it is not unreasonable to assume that plain-flagged birds were also still arriving or had escaped our attention previously while others will have moved on. So while some will undoubtedly be multiple sightings the numbers seen appear to be a good reflection of the numbers of flagged birds present.

These records represent 18 different marking areas in the EAAF. In relation to the total number of sightings this is a 9.6% increase compared to 2010 (3146). Records of individually colour-banded birds from NWA increased by 27%; in relation to the 2010 total. GFN and AWSG had a good marking season of colour-banded Red Knot in North West Australia from August 2010 to April 2011 and that cohort of birds undoubtedly increased our sightings.

Table 2. Totals of marked birds recorded during 52 days of field work 9 April to 30 May 2011.

Flagged in	Number of Sightings	Known Individuals	Flagged in	Number of Sightings	Known Individuals
Bohai Bay	97	0	NWA PLAIN	482	0
Chongming Dontang ELF	114	37	NZ COLOUR BAND	230	102
Chongming Dontang Plain	340	0	NZ ELF	375	138
Chukotka	32	11	NZ PLAIN	175	0
Danny NWA	36	1	Queensland	7	1
Hong Kong	23	7	Sakhalin	4	4
Japan	7	0	Saunders Gull ELF	9	2
Kamchatka	3	0	Sumatra	4	0
King Island	2	0	South Australia	35	0
New South Wales	2	0	Thailand	47	0
NWA COLOUR BAND	452	190	Victoria	654	0
NWA ELF	319	102			
			Total	**3449**	**493**

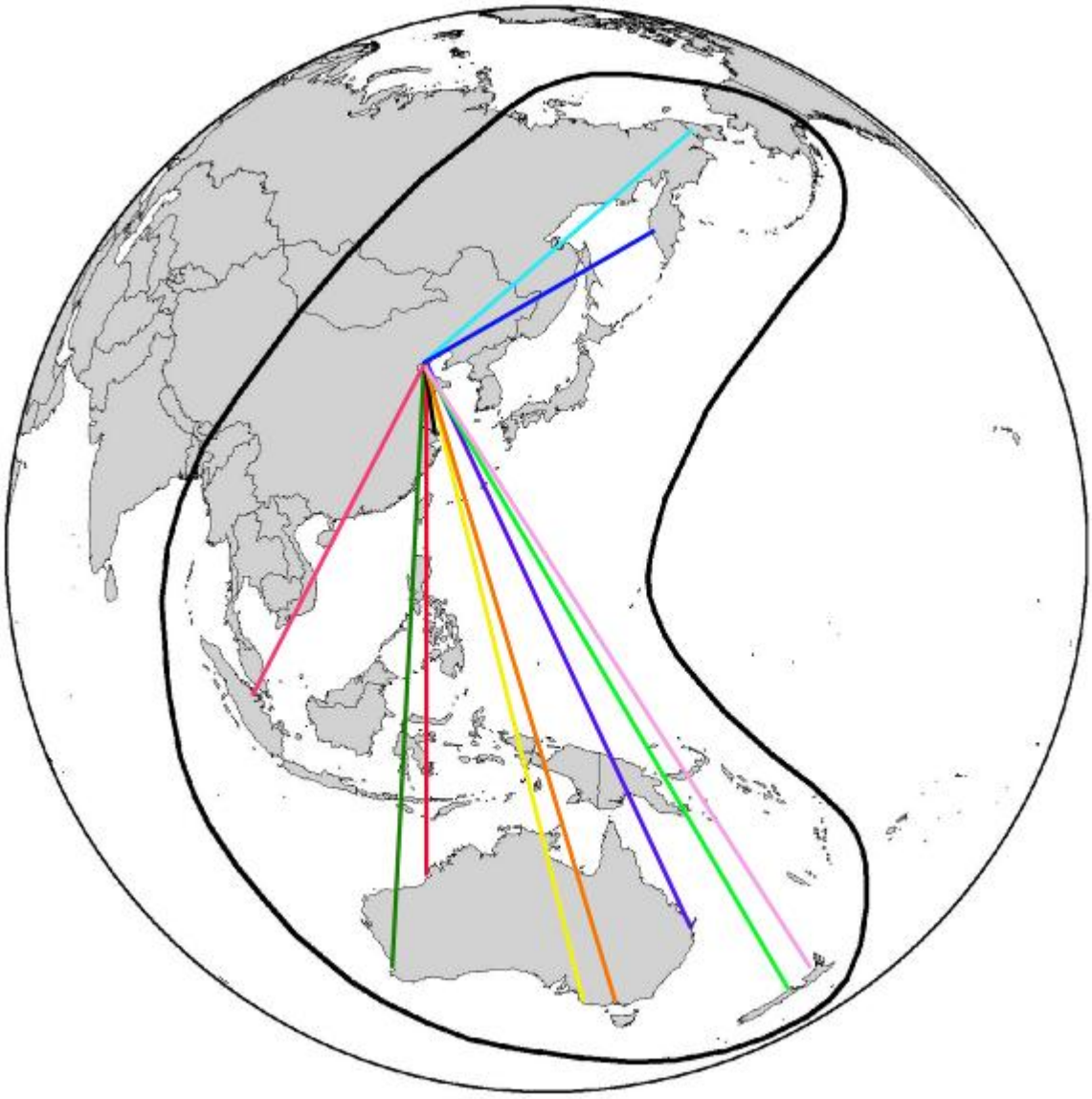

Figure 2. The map to the right shows the different banding areas that we recorded Red Knot from during both 2010 and 2011. Due to the size of the map not every one can be seen. We recorded Red Knot at Bohai from Chukotka, Kamchatka, Sumatra, Chongming Dongtan (China), 3 areas in Australia and both north and south islands of New Zealand.

Use of the Mudflats and Resighting Coverage

The use of the 3 study sites (see Fig. 1, Study Site image) has changed from our first visit in 2007. The Zuidong area is now >50% destroyed by mud pumping and the construction of sea walls. These walls still contain sea water but the 'tide' does not come and go to reveal the mud the birds need to forage on. Although the remaining tidal flats at Zuidong are still open to the sea and have a 'normal' tidal regime, the mudflats are used by a fraction of the birds from previous years. The method of pumping the mud over the sea wall into the adjacent salt ponds and then letting the water drain back out leads to huge volumes of water and anaerobic mud washing back over the 'healthy' mudflats and rendering them very poor quality habitat for shorebirds. Presumably the anaerobic mud settles on the top of the mud and suffocates much of the benthos. The favoured food of Red Knot, a bivalve, *Potamocorbula laevis,* feeds on algae on the mud surface and this algal layer is destroyed by anaerobic mud. In addition to this issue, at least one of the pumping boats were working only 800m from the seawall which is right in the preferred zone for Red Knots

to forage (at about one kilometre from the seawall. Our records of marked birds and the general populations this season showed that when birds arrived in the study site they did forage at Zuidong, but quickly abandoned it; presumably due to a lack of available and suitable food .A very simple but very stark example of the poor quality of the Zuidong mudflat in 2011 is shown below (YHY unpublished data) in table 3.

Table 3. Peak numbers of all shorebirds and Red Knot using the Zuidong mudflats during 2009 - 11.

	10/5/2009	6/5/2010	3/5/2011
All shorebirds	25,222	26,911	889
Red Knot	18,770	18,470	570

In 2007 and 2009 we recorded the majority of our marked birds from this area, Zuidong. In 2011 we record almost none.
© A Boyle

The destruction of the mudflats at Beipu, the most westerly of our study sites, started in March 2011. For the whole 7 weeks we were in the field, the Beipu seawall was very busy with trucks, large machinery cars and construction workers. It was often impassable to our vehicle and while we did manage a few resighting scans at this site, eventually on 23 May, we were requested by a manager of one of the development companies not to access the mudflats. We managed one more count from the seawall, but with small numbers of Red Knot present it became counter-productive to go there.

The Nanpu mudflats are still relatively undisturbed. They have had some pumping done a few years ago (2006) and artificial islands have been built close off-shore for oil drilling and oil tanker loading but the mudflats abutting the seawall are still good areas for shorebird foraging. However, we did see birds with oil contamination on their feathers during our telescope scans and small amounts of oil washed up on the sea wall.

The source of this is likely to be the nearby oil derricks and tankers, but in July 2010 there was huge oil spill from an explosion in an oil pipeline in Dalian 280km east of our study sites. In June and July 2011 there was another large oil spill at sea on the ConocoPhillips/China National Petroleum Corporation, Penglai Rig 170 km east of our study sites. These industrial accidents affect the whole biodiversity of the area and highlight the immense pressure on the entire Yellow Sea eco-region from human impact.

Pipes heading to Beipu © A Boyle

The Nanpu mudflat is where most of the birds congregate and subsequently where the vast majority of our field work was done this year. Viewing can be done from the seawall during the smaller tides and out on the flats during the spring tides. However, even after 7 weeks the birds were still a little unpredictable and would sometimes leave the mudflats a full 4 hours before high tide even when there appeared to be large areas of suitable mud available for them to feed on. Despite this we had great success and during the last three days of field work we recorded 26, 40 and 50 individually colour-banded Red Knot from NWA. This is in addition to everything else we saw and remember 6400km away from the marking site of these birds! All these resightings were on the mudflat. We did not know where the birds were roosting during these final days but it appeared to be well inland.

One issue with the field work in 2011 was that we left the study site too soon. In our previous experience the vast majority of Red Knot have left Bohai by 30 May. This was not the case this year with a minimum of 7420 still present on 31 May Yang unpubl. data), a day after our last day in the field.

Another Salt Pond Roost and foraging area goes under water adjacent to the Beipu mudflats as water and silt runs in to it from pumping activities.
© M. Slaymaker

Presence of *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 subspecies are side by side as is the case in our study site. We did random counts of flocks of Red Knots (totaling 71,129 birds) regularly throughout 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 identifying all birds to one or other subspecies. The *rogersi* birds, predominately from SE

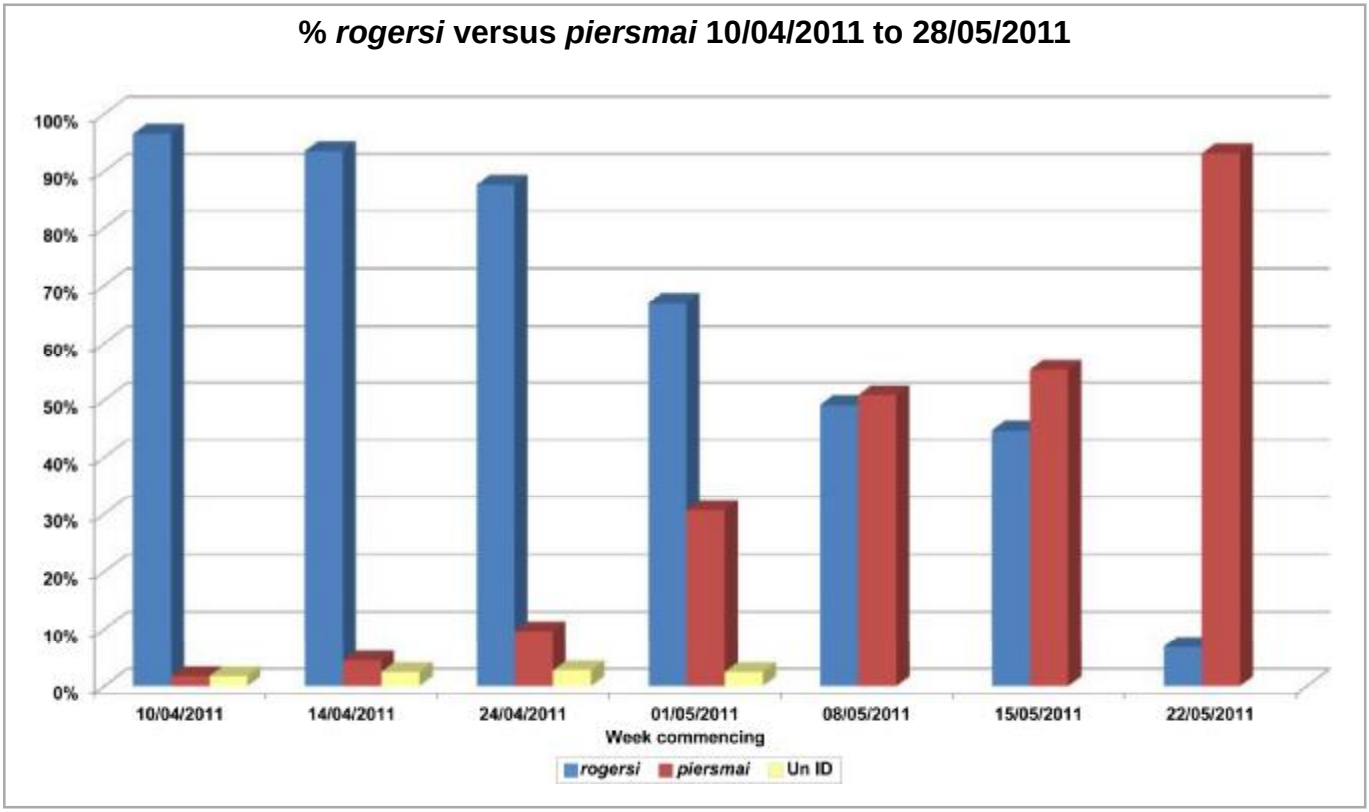

Figure 3. 71,129 Red Knot were scanned during the study period and assigned to the *rogersi* or *piersmai* sub-species on the basis of plumage characteristics. The results show that the *rogersi* birds arrive earlier than *piersmai* birds and leave for the breeding grounds earlier. The composition of the two sub-species is almost exactly mirrored at the beginning and end of the study period.

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. This is consistent with the patterns from previous seasons see figure 3.

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 Fig. 4.

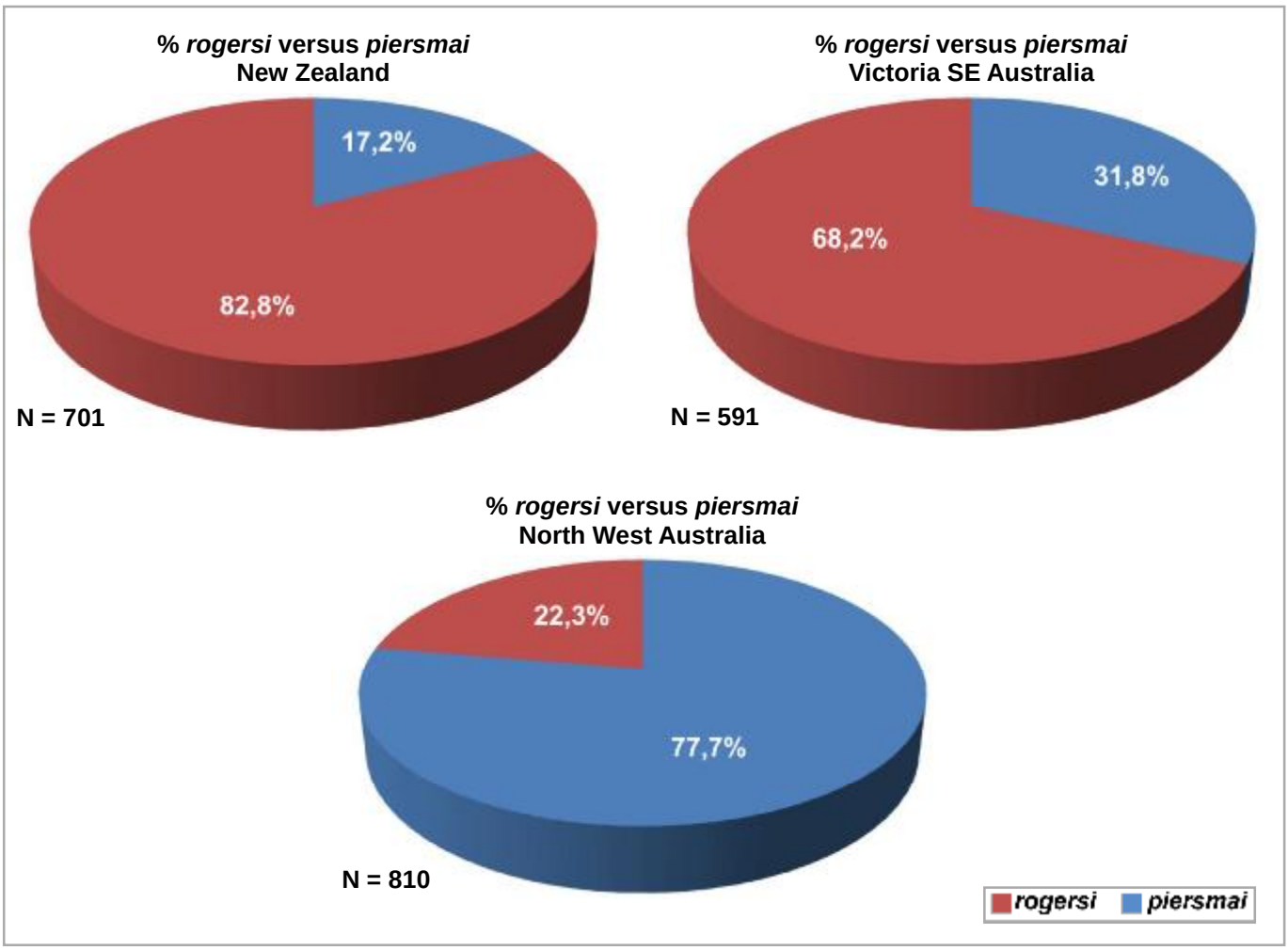

Figure 4. The proportions of the two subspecies of Red Knot marked in each of the three main non-breeding locations in Australasia from colour flagged or individually marked birds. Resightings from 2011.

The results are similar to 2010; a comparison is in Table 4 below.

Table 4. Comparison between 2010 and 2011 of resightings of Red Knot subspecies recorded in Bohai Bay in relation to their marking area.

	Marked in NW Australia		Marked in Victoria		Marked in New Zealand	
	2010	**2011**	**2010**	**2011**	**2010**	**2011**
piersmai	79.5%	77.7%	24.0%	31.8%	18.7%	17.2%
rogersi	20.5%	22.3%	76.0%	68.2%	81.3%	82.8%
n =	761	810	580	591	539	701

Abdominal Profiles

In the absence of mass data from captured birds it is possible to score the abdominal profile (AP) of birds in the field from telescope observations (Wiersma & Piersma 1995). We record abdominal profile on all birds when we get a suitable view. A side on view of the bird is needed for an accurate assessment. A factor the observer has to take in to account is if the bird is 'fluffed-up' due to cold weather. This can mislead the observer in to thinking the bird is 'fatter' than it really is. This can certainly be a problem but the experienced observers 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 seems that Red Knot are still able to reach adequate weights to continue their migration to the breeding grounds.

It would seem that *piersmai* are arriving at Bohai in slightly better condition than *rogersi*, while no birds are arriving at Bohai in very poor condition (AP 1). This would suggest that they are stopping or staging between their Australian and New Zealand non-breeding sites. This is one piece of the Red Knot migration question that we are attempting to answer with various methods; a preliminary satellite transmitter project and by putting out information and asking for such in return to the entire research and bird-watching community throughout the EAAF. We are doing this via the GFN and various other ornithological websites, through personal contacts and an article in BirdingAsia the bulletin of the Oriental Bird Club.

The abundant food source of the bivalve *Potamocorbula laevis* still seemed to be satisfying large numbers of hungry knots. On some days the birds leave the mudflats to roost some 4 hours before the peak of high tide, when there are still huge areas of mudflat for them to exploit. However we have a real concern that a 'tipping point' can not be far away as the area of mudflat taken for industrial development increases and consequently the foraging area available to the bird is reduced.

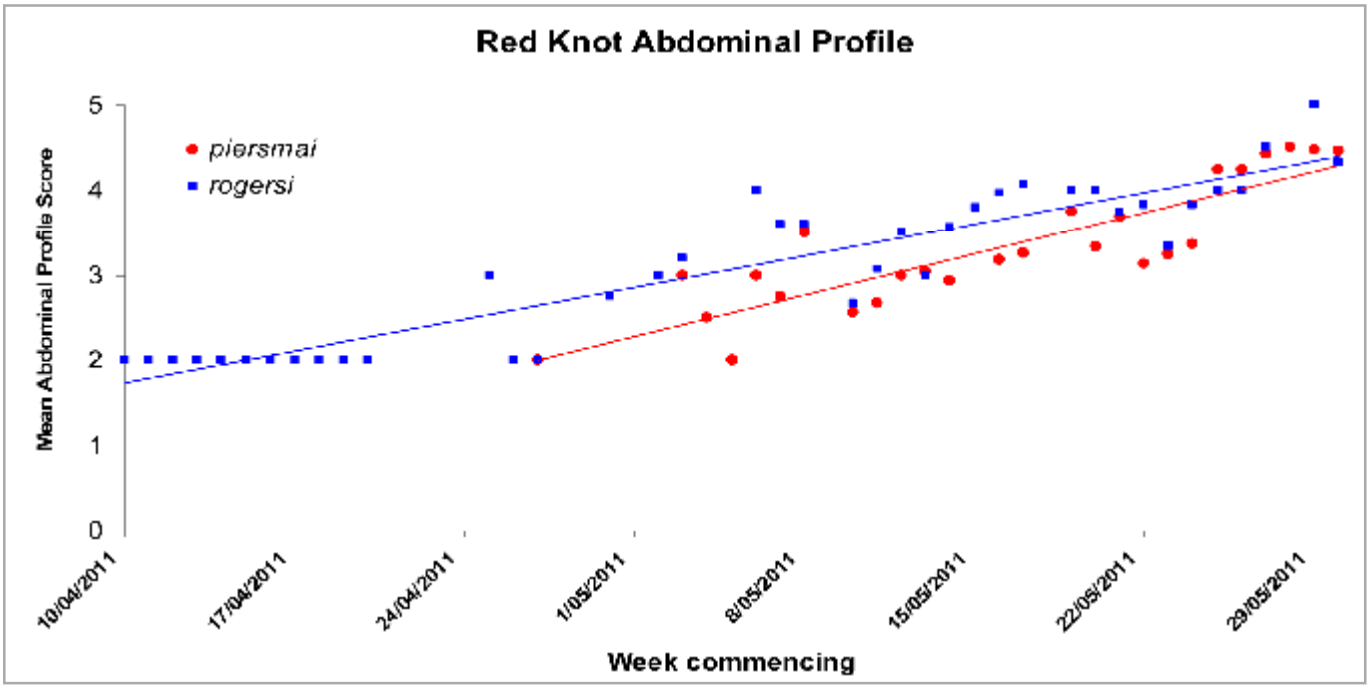

Figure 5. The graph shows the increase in AP, over time, for the two subspecies of Red Knot.

Habitat Destruction

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

The pumping boats are pumping mud from the intertidal 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 km^2 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 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).

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

Salt Ponds

Our field work is focused on Red Knots using the intertidal habitat, but the salt ponds that are adjacent to the mudflats are important habitats in their own right. Red Knots use them to roost in and occasionally to forage in when strong winds move the shallow water over the larger ponds thus exposing wet, soft sediments that can be exploited by numerous 'tidal-flat species'.

Some species notably Curlew Sandpiper *(Calidris ferruginea*), Marsh Sandpiper (*Tringa stagnatilis*) and Black-tailed Godwit (*Limosa limosa*) do most of their foraging in the salt pond habitat and rarely visit the intertidal zones. These species feed in shallow water up to their flanks or pick along the fringes of the ponds. The wind conditions make a difference to where they feed. As mentioned previously, accurate observations in these vast ponds are difficult but we see tens of thousands of Curlew and Marsh Sandpipers in the ponds and many 1000's of Black-tailed Godwit. The Black-tailed Godwits are fascinating; to our eyes they look huge in comparison to the *melanuroides* subspecies that we are familiar with in North West Australia and nearly all of them we observe are in non-breeding plumage.

A Curlew Sandpiper *Calidris ferruginea* marked in NWA in a salt pond © A Boyle

Nordmann's Greenshank *Tringa guttifer*

Nordmann's Greenshank is an endangered shorebird (IUCN 2001) with a continuing decline in its population. During our field work we saw up to a maximum of 9 on any one day. Nordmann's Greenshanks were recorded on 25 days between 22 April and 19 May. We saw them feeding on the mudflats and feeding and roosting in the adjacent salt pans.

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

Seminar

On 18 and 19 May WWF-China had organized a Seminar on 'Shorebirds and Coastal Wetlands Conservation in the Yellow Sea Eco-region'. The aim was to gather together concerned parties from China and further afield to discuss the conservation implications of the industrial development of the area and try to find realistic solutions. Other participants included an advisor to the Chinese Government from the Academy of Sciences, various staff from WWF-China, various State Government officials, various biologists from Chinese Universities including Miss Yan Hong Yang (whom we work so closely with), Theunis Piersma (GFN), Bob Gill (USGS) and Phil Battley (Massey University, New Zealand) as well as several media types. Day one was spent listening to talks from the many and varied participants about the area and shorebird research, while the second morning was spent in the field giving the participants the opportunity to see the site. After a brief stop in the saltpans to see impressive flocks of Curlew and Sharp-tailed Sandpipers we went to Nanpu to view birds feeding on the mudflats. As well as the 1000's of Red Knots, we saw a single Nordmann's Greenshank and, to the delight of the delegates from WWF-Hong Kong, a Curlew Sandpiper with white over yellows flags which had been marked in WWF's Mai Po Marshes Reserve. From here we went to Zuidong to see the continuing devastation and the mud-pumping boats, the sea-wall building and the 'desert' of dry mud that was once salt pans with feeding and roosting shorebirds. The two days seemed to go well and we hope that some of the ideas raised can be acted upon before it's too late … time will tell. . We also had a famous Friesian musician with us, Sytze Pruiksma. He performed his original compositions and was extremely popular with the audience. I would like to reiterate how important this meeting was and thank WWF-China for their hard work in bringing us together.

The Future of Research

GFN, with continued funding from BirdLife-Netherlands, will continue to document the fates of several shorebirds at their 'wintering' destination in Roebuck Bay, northwestern Australia, applying individual colour-band combinations and ELF's and conducting intensive re-sightings scans for the marked birds and building up a comprehensive database of sightings from the marking site and throughout the flyway. With the work in Bohai Bay and sightings from other shorebird colleagues throughout the flyway, particularly in New Zealand and China (Chongming Dongtan and Yalu Jiang National Nature Reserves), we will be able to assess the effects of human induced habitat change through survival analysis statistical work.

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.

Male Siberian Stonechat *Saxicola maurus* © A Boyle

Radde's Warbler *Phylloscopus schwarzi* © A Boyle

Acknowledgments

Financial support for this work comes from BirdLife-Netherlands, WWF-Netherlands/WWF-China and Beijing Normal University. A huge thank you to Yang Hong-Yan, Chen Bing and Mr. Zhao for their friendship and constant help during our field work. Additional contributions to the field work came from Theunis Piersma, Sytze Pruiksma, Bob Gill and Lei Ming. We thank Heather Gibbs for answering many and varied questions in relation to the database and updating the database to my every whim. Thank you to all the shorebird enthusiasts throughout the EAAF who send in sightings of marked birds. Thanks you to the NWA 2011 expedition team, in particular Joop van Eerbeek and Mo Verhoeven. Thank you to the fabulous group of volunteers from the Broome community who assist with the capture of the birds. Thank you to Liz Rosenberg and Clare Morton for editing this report. Thank you to Ian Southey for use of his image. Thanks to Kim Onton for figure 5 and Andreas Kim for formatting and presentation.

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

http://www.globalflywaynetwork.com.au

Contact Chris on: turnstone@wn.com.au

Chris Hassell at work. © M Slaymaker

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 of one Red Knot marked in Roebuck Bay and seen at Bohai 3 years in a row. I have edited the full resighting history for ease of interpretation. There are many such individual birds that we have tracked to Bohai.

Summary of sightings

Red Knot

Banding 1BYLL

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

Resightings of 1BYLL

06/10/2008 Stilt Viewing, Roebuck Bay, Broome, Australia
06/10/2008 Stilt Viewing, Roebuck Bay, Broome, Australia

18/05/2009 Nan Pu, Bohai Bay, China
23/05/2009 Nan Pu, Bohai Bay China
25/05/2009 Nan Pu, Bohai Bay China
04/10/2009 Wader Beach, Roebuck Bay, Broome Australia
31/12/2009 Wader Beach, Roebuck Bay, Broome Australia

21/05/2010 Zuidong Bohai, China
23/05/2010 Zuidong Bohai, China
24/05/2010 Zuidong Bohai, China
27/05/2010 Zuidong Bohai, China

19/04/2011 Wader Spit, Roebuck Bay, Broome Australia
09/05/2011 Nan Pu, Bohai Bay China
16/05/2011 Nan Pu, Bohai Bay China
20/05/2011 Nan Pu, Bohai Bay China
22/05/2011 Nan Pu, Bohai Bay China
26/05/2011 Nan Pu, Bohai Bay China
27/05/2011 Nan Pu, Bohai Bay China
29/05/2011 Nan Pu, Bohai Bay China
30/05/2011 Nan Pu, Bohai Bay China

Appendix 2

List of all birds recorded during the field work season April 9 to May 30.

Species	Species	Species	Species
Amur Falcon	Common Snipe	Heuglin's Gull	Red-rumped Swallow
Arctic Warbler	Common Stonechat	Hoopoe	Red-throated (Taiga) Flycatcher
Ashy Minivet	Common Swift	Hume's Warbler	Red-throated Pipit
Asian Brown Flycatcher	Common Teal	Japanese Quail	Reed (Northern?) Parrotbill
Asian Dowitcher	Common Tern	Japanese Sparrowhawk	Relict Gull
Asian House Martin	Coot	Kentish Plover	Richard's Pipit
Asian Short-toed Lark	Crag Martin	Lanceolated Warbler	Ruddy Shelduck
Baer's Pochard	Crested Myna	Large-billed Crow	Ruddy Turnstone
Barn Swallow	Curlew Sandpiper	Lesser Sand-plover	Ruff
Bar-tailed Godwit	Dark-sided Flycatcher	Light-vented Bulbul	Rufous-bellied Woodpecker
Black (eared) Kite	Daurian Redstart	Little Bunting	Sand Martin
Black Drongo	Dunlin	Little Curlew	Sanderling
Black-billed Magpie	Dusky Thrush	Little Egret	Saunder's Gull
Black-browed Reed Warbler	Dusky Warbler	Little Grebe	Sharp-tailed Sandpiper
Black-crowed Night Heron	Eastern Crowned Warbler	Little Ringed Plover	Siberian Blue Robin
Black-faced Bunting	Eastern Curlew	Little Stint	Siberian Rubythroat
Black-headed Gull	Eastern Marsh Harrier	Little Tern	Siberian Thrush
Black-naped Oriole	Eurasian Bittern	Long-billed Dowitcher	Siskin
Black-tailed Godwit	Eurasian Curlew	Mallard	Slaty-backed Gull
Black-tailed Gull	Eurasian Hobby	Mandarin Duck	Smew
Black-winged Stilt	Eurasian Oystercatcher	Marsh Sandpiper	Snipe SP not common
Blue & White Flycatcher	Eurasian Skylark	Merlin	Spot-billed Duck
Blue Rock-thrush	Eurasian Sparrowhawk	Mew (Common) Gull	Spotted Dove
Bluethroat	Eurasian Spoonbill	Mongolian Lark	Spotted Redshank
Blyth's (Claudia's) leaf warbler	Eurasian Wigeon	Moorhen	Steppe Eagle
Blyth's Pipit	Eurasian Wryneck	Mugimaki Flycatcher	Striated Heron
Brambling	Eyebrowed Thrush	Naumann's Thrush	Temminck's Stint
Broad-billed Sandpiper	Falcated Duck	Nordmann's Greenshank	Terek Sandpiper
Brown Shrike	Feral Pigeon	Northern Goshawk	Thick-billed Reed Warbler
Buff-bellied Pipit	Fork-tailed Swift	Northern Pintail	Tree Pipit
Caspian Tern	Gadwall	Northern Shoveler	Tree Sparrow
Cattle Egret	Garganey	Olive-backed Pipit	Tristam's Bunting
Chestnut Bunting	Glaucous Gull	Oriental Bush Warbler (Korean)	Tufted Duck
Chestnut-eared Bunting	Goldcrest	Oriental Honey Buzzard	Two-barred Warbler
Chestnut-flanked White-eye	Great Cormorant	Oriental Pratincole	Vega Gull
Chinese (Yellow-billed) Grosbeak	Great Egret	Oriental Reed Warbler	Vinous-throated Parrotbill
Chinese Penduline Tit	Great Knot	Oriental Turtle Dove	Whimbrel
Chinese Pond Heron	Great-crested Grebe	Osprey	Whiskered Tern
Chinese Thrush	Greater Sand-plover	Pacific Golden Plover	White Wagtail
Coal Tit	Great-spotted Woodpecker	Pale Thrush	White-cheeked Starling
Common Buzzard	Green Sandpiper	Pale-legged Leaf Warbler	White's Thrush
Common Crossbill	Grey Heron	Pallas's Bunting	White-throated Rock Thrush
Common Cuckoo	Grey Nightjar	Pallas's Leaf Warbler	White-winged Tern
Common Goldeneye	Grey Plover	Peregrine Falcon	Wood Sandpiper
Common Greenshank	Grey sided Thrush	Pied Avocet	Woodcock
Common Kestrel	Grey Wagtail	Pied Harrier	Yellow Bittern
Common Kingfisher	Grey-backed Thrush	Pied Wheatear	Yellow Wagtail
Common Merganser	Grey-headed Lapwing	Purple Heron	Yellow-bellied Tit
Common Pheasant	Grey-headed Woodpecker	Radde's Warbler	Yellow-breasted Bunting
Common Pochard	Grey-streaked Flycatcher	Red Knot	Yellow-browed Bunting
Common Redshank	Grey-tailed Tattler	Red-billed Starling	Yellow-browed Warbler
Common Rosefinch	Gull-billed Tern	Red-breasted Merganser	Yellow-rumped Flycatcher
Common Sandpiper	Hair-crested Drongo	Red-flanked Blue-tail	Yellow-throated Bunting
Common Shelduck	Hen Harrier	Red-necked Stint	Zitting Cisticola