

## Catch up and History of Red Knots on the Luannan Coast, Bohai Bay

Back in late 2005, Professor Theunis Piersma, leader of the Global Flyway Network (GFN), proposed setting up a long term monitoring project in North West Australia to complement the already established studies being conducted by the Australian Wader Studies Group (AWSG). Initially the chosen study species was Red Knots, Great Knots and Bar-tailed Godwits. Black-tailed Godwits were added in 2008. The main study site was Roebuck Bay, Broome, Western Australia. The main funding source was Birdlife-Netherlands.

The project involved catching these species and attaching colourband combinations to enable individual recognition. The second and critical part (sometimes underestimated in other studies!) was to conduct intensive re-sighting effort over many years, to build up a picture of how these three species were faring through annual survival analysis. Chris Hassell was employed full-time to conduct the research, with Birdlife-Netherlands funding. The same colour marking method used by Professor Piersma on the East Atlantic Flyway, to allow survival on a different flyway to be compared with here and the East Asian-Australasian Flyway.

Things started off well, with the first birds banded in December 2005 and regular re-sighting scans underway in Roebuck Bay. Fairly soon it became clear we weren't getting as many records of Red Knots as we were of Great Knots and Bar-tailed Godwits. The latter two species are highly site faithful, but not so Red Knots, who only use Roebuck Bay temporarily. Lots of Red Knot that are caught in Roebuck Bay as first year birds, move on during their first year to other sites ranging from 'just down the coast' 165km south west to Eighty Mile Beach of Broome or all the way to New Zealand 5,400km away. This was not entirely new information, we knew about this from recoveries of metal bands and flag sightings, but with individually marked birds we were 'fine-tuning' our knowledge. This posed an issue for analysis of the data. If a considerable proportion of the marked population were not site faithful, even mathematics couldn't come up with accurate annual survival estimates.



There is a good chance of marked birds being seen at Eighty Mile Beach as both GFN and AWSG work there and scan the flocks, and in New Zealand there are some skilled and dedicated scanners. But that still leaves the rest of the EAAF and particularly during the migration season even with some dedicated scanners in China, the enormous Yellow Sea coastline gets little attention. After phone calls with Mark Barter and others and reading a few papers, we knew we needed to be in northern Bohai Bay in May to see if 'our' birds were there on northward migration. PhD student Yang Hong Yan was studying on the Luannan Coast and Chris visited her study area for seven days in 2007. Despite the brevity of the visit, seeing a flock of 9,900 Red Knots loafing on the mudflats just off the seawall with the two subspecies side by side was enough to convince Chris that GFN needed to spend more time here. Soon a plan was hatched to visit this site yearly when the knots were present in large numbers to look for colour banded birds. That way it wasn't so critical if we missed birds during the non-breeding season in areas with little or no resighting work, as we could see them when they pass through Bohai Bay in China.

So how many colourbands do we record whilst working in Bohai? Each year we seem to be getting more and more sightings. This is not surprising as we have been putting more and more combinations on. For example during the 2014 season we made 920 Broome colourband sightings which comprised 345 individuals. In addition to this are all the other flags we record and in 2014 we saw in total 5018 banded/flagged birds. With still over two weeks to go it looks like we are on track to record more than that this season.

In the East Asian-Australasian Flyway there are two subspecies of Red Knot spending the non-breeding season and migrate within it (a third breed in the EAAF but to our knowledge migrate exclusively to the America's). In non-breeding plumage the Red Knot subspecies are inseparable, however in breeding plumage they can be separated reliably in most cases. We assess the subspecies on all the banded and flagged Red Knot we see, not just the GFN colour banded birds, and this increases our knowledge of where these two subspecies spend the non-breeding season and the areas they pass through to get to the breeding grounds based on their banding locations.

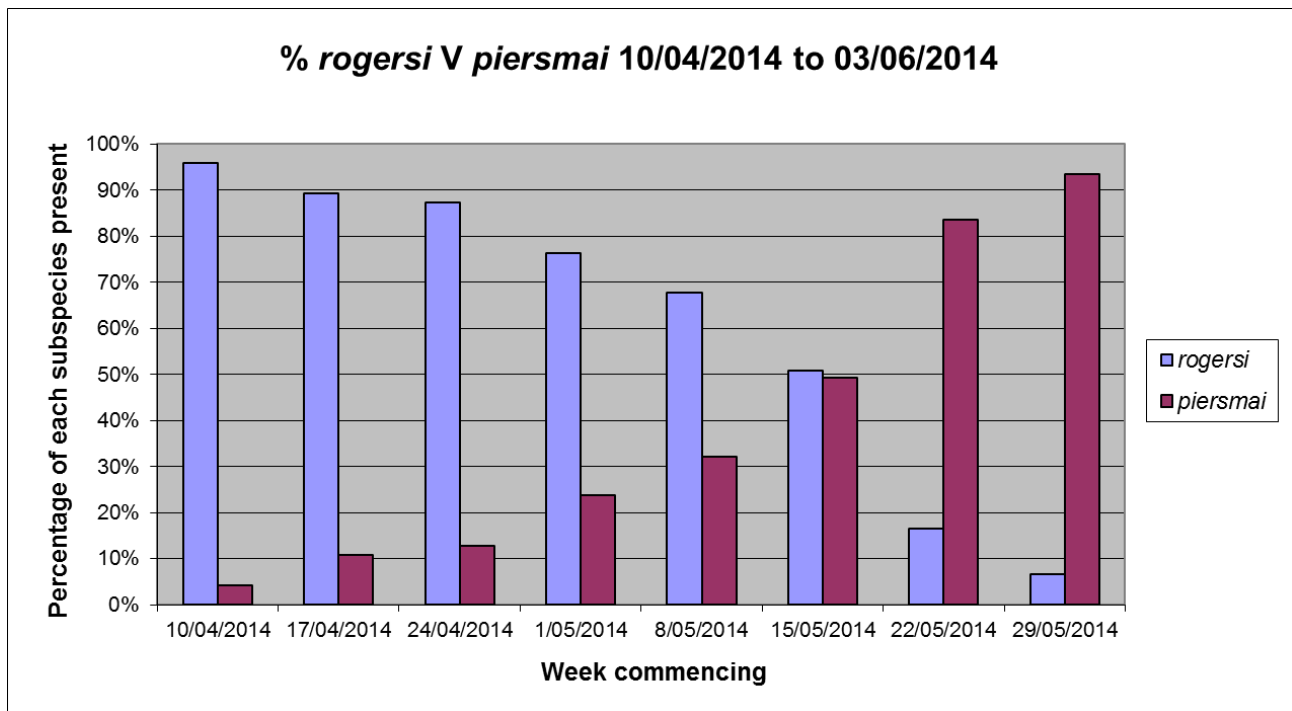
We also do daily scans of around 1,000 individuals randomly amongst the flocks, to assess subspecies percentages. This informs us of the timing of the migration of each subspecies through Bohai Bay, and when multiplied into our counts, this gives us an idea of the two populations of both subspecies using this area.



A large flock of knots flying over the Nanpu mudflat. © Adrian Boyle



The *rogersi* subspecies arrives in large numbers first and are the most numerous of the two subspecies during April and into mid-May. Then the *piersmai* start to arrive and around the same time the *rogersi* subspecies start to head further north to their breeding grounds and so the *piersmai* become the dominant proportions of the flocks. This pattern is shown well in the graph below from 2014.



A nice dark *piersmai*.



A much paler *rogersi*.

What numbers of knots are we talking about that are using Bohai Bay?

Well if you ask us its pretty much all of our flyways population. The highest count for our survey site was in May 2011 with a total of 66,500 knots. Like any large site with big tidal movements and here in Bohai Bay the huge area of salt ponds, getting accurate counts is challenging. The 66,500 is 50% of the EAAF flyway population during one count! More birds were probably present in the salt ponds. The total number of Red Knot using the area is obviously much higher when the turnover of birds migrating through is taken in to account. Our biggest count this season is 47,500, but that was earlier in the season and before the *piersmai* subspecies had arrived in peak numbers.

Why are the knots gathered in such large numbers on the Luannan Coast?

There are two main reasons;

Large scale habitat destruction elsewhere in the EAAF, particularly on the Yellow Sea coast line. Historically the Luannan Coast may not have been the only major feeding site for Red Knots, but due to mudflat destruction on a massive scale in the past decade, the area available for shorebirds to feed has been greatly reduced. Luckily this super-productive piece of mudflat has remained intact and still supports impressive numbers of Red Knots (and many other species).

Red Knots are very specialised feeders when they are on mudflats. Red Knots feed on very small bivalves and the Luannan Coast has a huge volume of suitable sized prey for them. This particular bivalve is *Potamocorbula laevis* (Pots). Mud samples taken at other mudflats where Red Knots don't occur reveal that this small bivalve is absent, or in low numbers. One of the reasons why this particular bivalve is so common on the Luannan Coast may be due to one of the bivalves main predators, a large shrimp species that has been over-fished and now 'Pots' have been able to increase their population.

Why do we only visit on northward migration?

Unfortunately very little is known of Red Knot southward migration in our flyway. At the time of writing we still do not know of a site that holds large numbers of Red Knots on southward migration.

Do they stop over on their way back to their wintering grounds or fly directly back?

Geolocator studies in Russia, New Zealand and Broome indicate they do stop over, in or close to Bohai Bay. However several visits here by local birdwatchers, have yet to turn up any large numbers during that time period.

Could this mystery southward staging area be under threat also?

We assume so. Finding this site and assessing its threats is one of GFN's main priorities.



Some of the small bivalves that the Red Knots eat when in Bohai. © Jan van de Kam



*A. rogersi* feeding in the salt ponds of the Luannan Coast, Bohai Bay. © Adrian Boyle

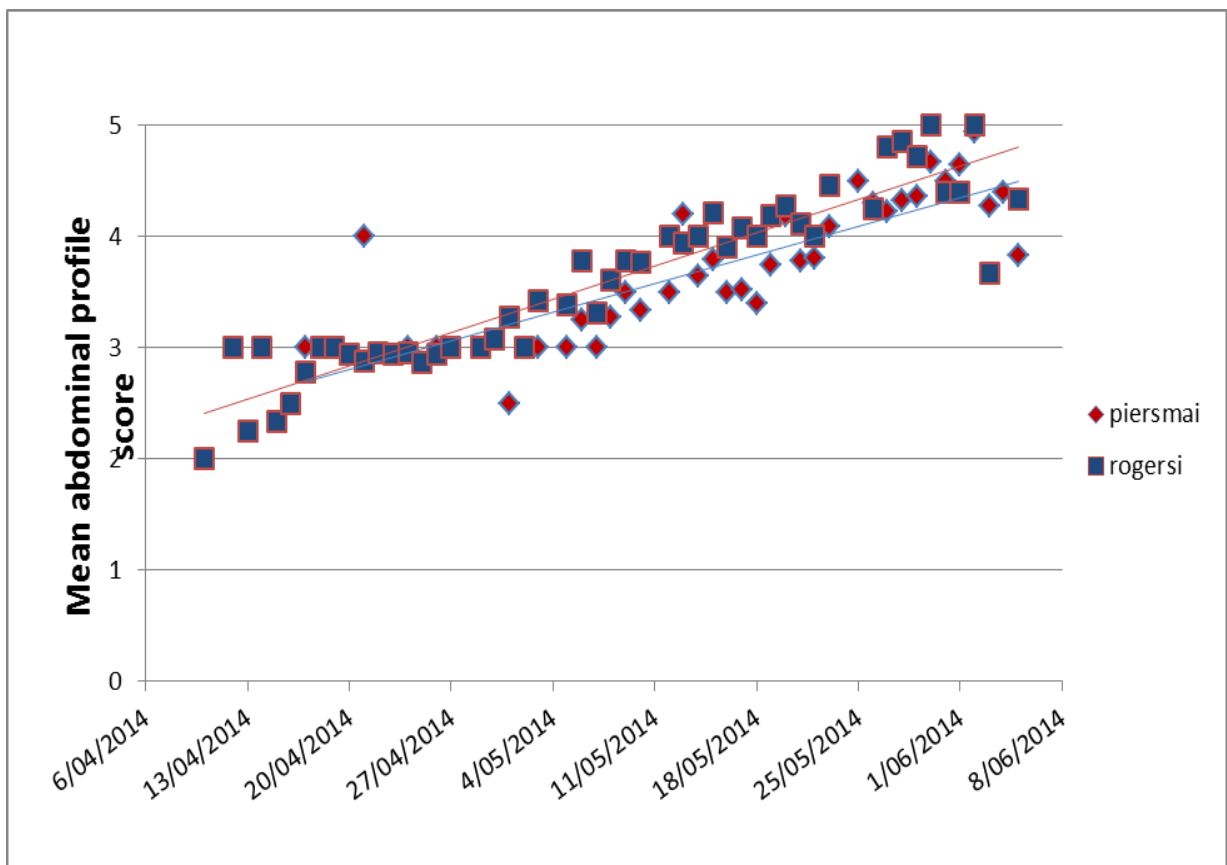
### **Abdominal Profiles**

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. 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 as 5 can hardly walk, it waddles!

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 probably means that they are stopping or 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 42 geolocators deployed with the hope that we will recover some of these birds in future capture events to gain further insight into the migration strategy of Red Knot from NWA.

The graph below shows the increase in AP, over time, for the two subspecies of Red Knot in 2014. The dip in the last week of sightings is probably because most of the 'fat' birds have left leaving a lighter cohort behind.

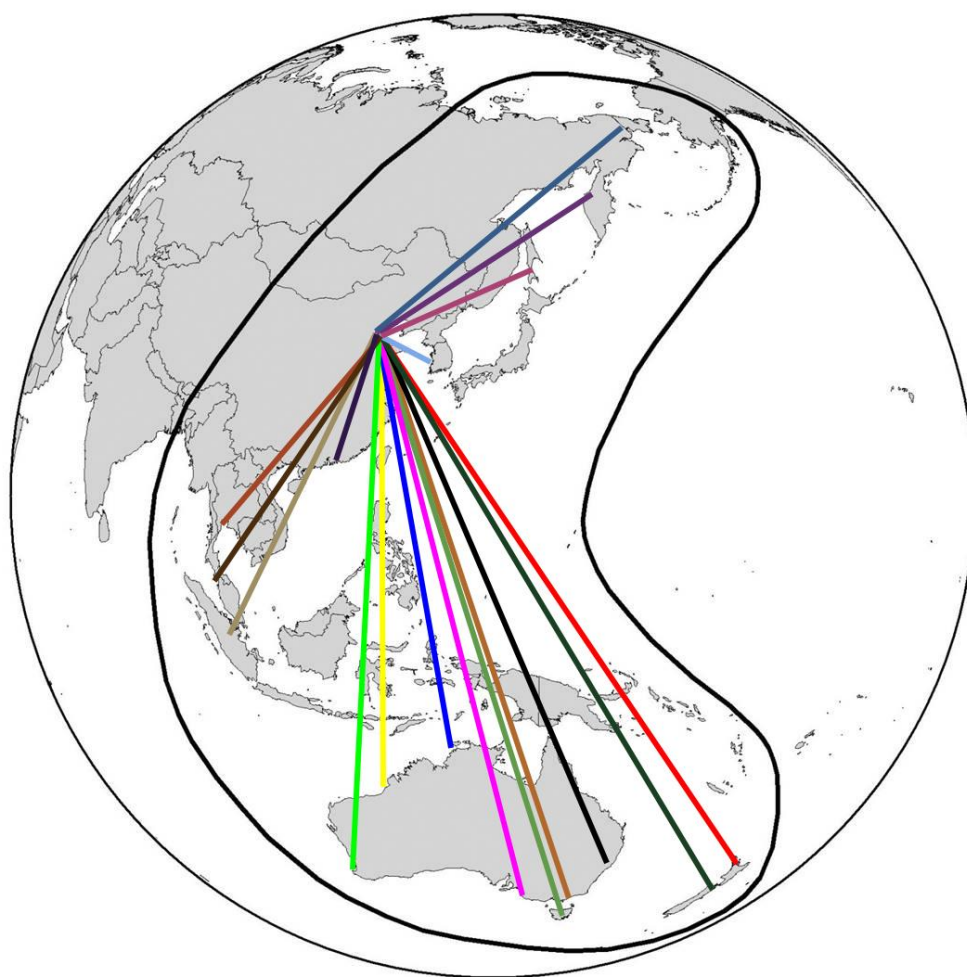




A *rogersi* subspecies of Red Knot with an abdominal profile score of 5. This individual is surely ready to head further north any day now. © Adrian Boyle

Not only is Bohai Bay important for Broome's Red Knots but practically all the Red Knots in our flyway. We have recorded banded Red Knots from 19 banding localities at Bohai Bay. **So if this small remaining piece of mudflat is destroyed it will affect Red Knots throughout the flyway.**

Below is a representative map showing most of the Red Knot banding locations seen in Bohai. Some have been left out due to them not being able to be seen under all the others!



It's been a busy 10 days since the last update.

We have now recorded 3152 flags and band sightings from 28 banding regions on 12 different species. This includes a total of 699 Broome colourband sightings.

Total bird species recorded 203

Erratum!

Did anyone spot the deliberate mistake in the last issue?

If anyone did they were too polite to tell us. Or no one reads our updates carefully! However Kate did put us straight.

It should have read;

*Kate is a Polish Graduate and is Leiming's 'right-hand woman' and helps him with everything except sorting out our phone calls! Kate studied introduced mammals (Raccoon Dog and American Mink (not Pine Marten they're not introduced) in Poland for her undergraduate degree and Red-backed Shrike for her Master's Degree. She is now learning the joys (?) of shorebird research in the Yellow Sea.*