Tracking Bottlenecks in the Annual Cycles of Long-Distance Migrating Shorebirds

Theunis Piersma is driven by endless fascination for the small birds linking the wetlands of the world. As Chair in Global Flyway Ecology at the University of Groningen, research scientist at the NIOZ Royal Institute for Sea Research (Texel), and coordinator of the Global Flyway Network (an international research consortium for studies on the conservation demography of shorebirds), he spearheads 15 long-term demography programs worldwide.

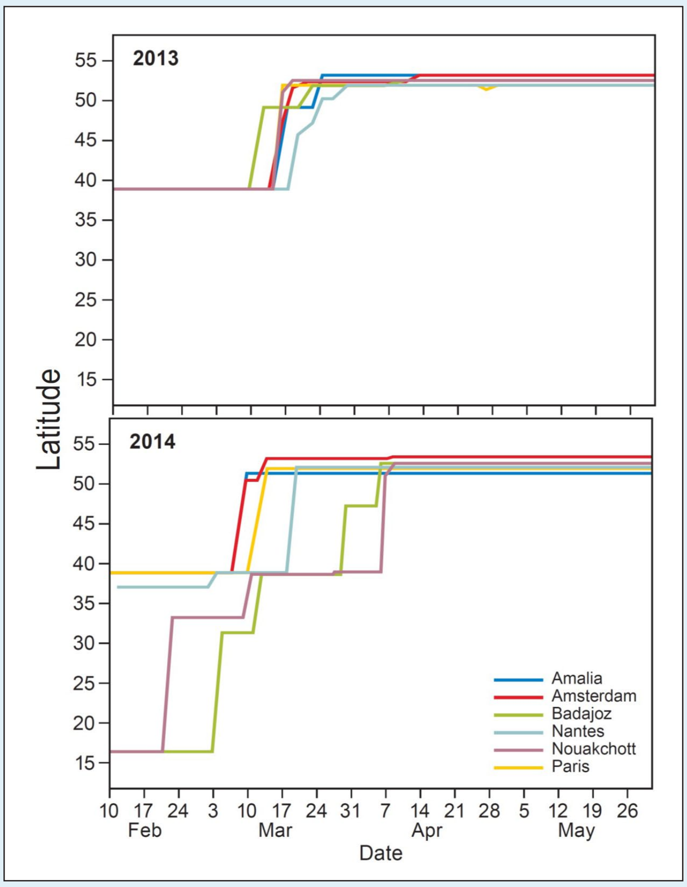
Because they are habitat specialists and because suitable habitats are often rare and far between, shorebirds have 'punctuated occurrences' in both space and time. Individuals use sequences of sites where they either feed and breed, or try to survive and prepare for the next breeding season (usually in the Far North). Such preparations may include fuelling (i.e., feeding, food processing and fat storage) for what are the longest nonstop flights known. The use of ever-smaller tracking devices has demonstrated that migration flights between 2000 and 5000 km are routine, and that nonstop flights as long as 11,000 km (such as the ones by bar-tailed godwits crossing the Pacific) are possible.

Photo by Jan van de Kam

Released black-tailed godwit in Spain.

In a world of fast and widespread losses and changes of habitat, migrating shorebirds increasingly have to 'fly the tightrope'. However, their reliance on wetlands (where humans concentrate too) and their punctuated occurrences make shorebird systems relatively tractable and their study relevant for conservation. To investigate if, when, and where populations are bottlenecked, demographic studies are underway in 15 populations of shorebirds across the world. In all these projects, we try to measure annual survival and recruitment but aim to additionally partition annual survival into as brief seasonal segments as possible. We also try to study details of ecological context wherever possible, usually with an emphasis on food availability. Knowledge about the times and the places where populations run into trouble, especially if we can also interpret such reductions in survival with reference to habitat change, provides us with in-depth knowledge on population processes. At the same time, this provides conservation organizations with strong suggestions for improved management.

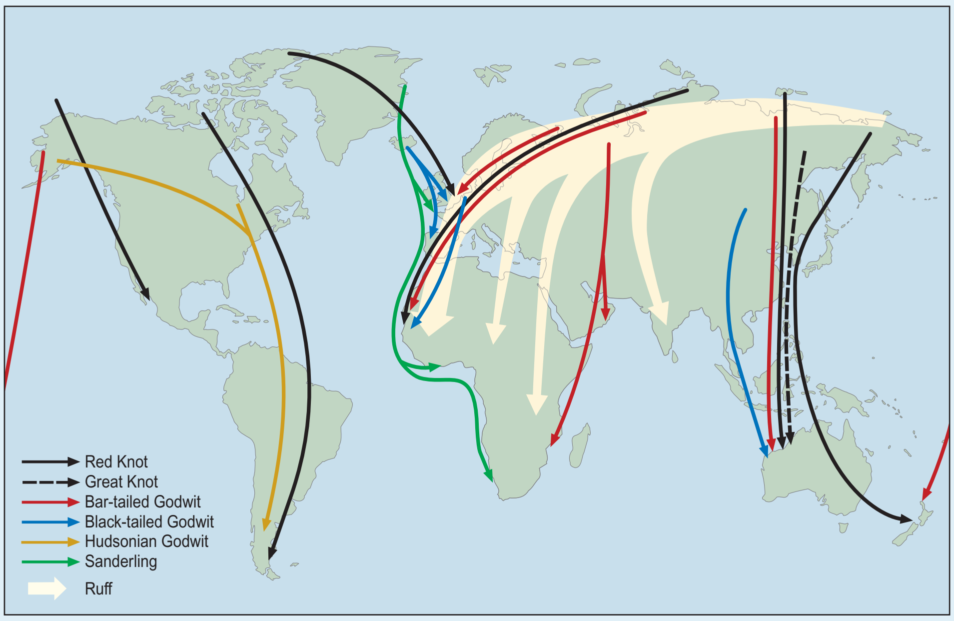
The tracking of several species and populations of godwits and knots by the Global Flyway Network consortium over the last eight years, rather than to describe their migratory movements (which are generally well-known), serves to pin-down any bottlenecks in annual cycles. We relate the use of sites with subsequent performance (i.e., timing of migration, breeding success, survival, and physical state based on visual observations). This approach is illustrated by our study on black-tailed godwits tracked during the last leg of their northward migration between the nonbreeding area in West Africa and the Dutch meadows where they breed in two contrasting springs: one of the coldest on record (in 2013) and one of the warmest (in 2014). As it happens, black-tailed godwits were able to fully behaviorally cope with the challenges imposed by atypical snow-cover and frozen ground in 2013. They interrupted their migrations and made return movements even after arrival on breeding territories. Such capacity for compensation is unlikely in situations where birds are faced with dwindling staging habitats during northward migration. This is the case for the red and great knots and the bar-tailed godwits that rely on the Yellow Sea shoreline as they migrate between coastal wetlands in Australia and New Zealand and the Siberian and Alaskan tundra breeding areas.



Northward migration timing of six black-tailed godwits (named after towns on their flyway) tracked with PTTs in both 2013 and 2014. Birds were tagged in Extremadura, Spain in February 2013. In the cold spring of 2013 (compared with the warm spring of 2014), individuals departed somewhat earlier (-5 d), made more (+1) but shorter stops (-4 d), and spent more time in transit between Spain and the Dutch breeding sites (+7 d), thus arriving marginally later (+2 d).*

*Adapted from: Senner, N.R., M.A. Verhoeven, J.M. Abad-Gómez, J.S. Gutiérrez, J.C.E.W. Hooijmeijer, R. Kentie, J.A. Masero, T.L. Tibbitts & T. Piersma (2015) When Siberia came to The Netherlands: the response of continental black-tailed godwits to a rare spring weather event. Journal of Animal Ecology, in press.

The availability of small 5g solar PTTs means that we can now also ask questions on how individual itineraries develop in individuals as they grow up. This year we begin an ambitious program of observation and experimentation on young black-tailed godwits born in The Netherlands to establish whether places used later in life represent subsets of places encountered during the first migrations. How do birds learn about seasonal sequences of places, and can we infer criteria as to why some sites are visited again whereas others are skipped? We hope that this developmental angle to the use of sequences of sites in the course of the year will also illuminate the degrees of flexibility helping shorebirds to survive rapid global change.



Parallel flyways in seven shorebird species, the majority of which are studied in intense demography and tracking programs by the Global Flyway Network consortium.