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Being at the right place at the right time

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Summary

Samenvatting

Zusammenfassung

Résumé

صخلم

Резюме

SUMMARY

This thesis describes the possible selection pressures acting on survival and, indirectly, on reproduction of Afro-Siberian red knots *Calidris canutus canutus* while wintering and migrating. Afro-Siberian red knots are long-distance migrants. They travel between the West African wintering areas and the High Arctic Siberian breeding grounds in two non-stop flights of 4000-5000 kilometres each during spring and autumn. The Schleswig-Holstein Wadden Sea, Germany, is the key staging area during northward migration: it is assumed that the entire population fuels there during the second half of May. To maximize reproductive success, red knots have to time their arrival on the tundra such that food peaks when growing chicks need it most. However, the timing of arrival in the Siberian Arctic may be constrained by events along the way or in West-African wintering areas, thousands of kilometres and months away.

About 75% of the Afro-Siberian red knot population winters on tropical Banc d'Arguin, Mauritania, where most of the field studies were carried out. The red knots wintering in this tropical environment showed high site fidelity and small home ranges (Chapter 2), in contrast to red knots that winter in temperate areas in both the northern and the southern hemisphere. At Banc d'Arguin red knots could avoid browsing larger areas and thus save on flight costs, because both weather and foraging conditions are more predictable than e.g. in the northern temperate Wadden Sea. This remarkable small-scale habitat use was not the only contrast I detected between red knots wintering on the Banc d'Arguin, and red knots wintering in other parts of their distribution range. Independently from where they spend the non-breeding period, red knots have been described as a gregarious, flock-feeding species with no obvious hierarchical structuring. Yet, during our study period, we observed a persistent small-scale demographic structuring at Banc d'Arguin, with the larger sex and age-classes (females and adults) occupying better quality foraging sites (Chapter 3). Individuals that settled in these better foraging sites also experienced a slightly higher annual survival. Further research will reveal which mechanisms govern and sustain this unexpected structuring. Using new tracking tools to follow individuals throughout the year is needed to identify whether the differences in habitat quality translate e.g. into individual differences in timing during northward migration and breeding success.

At the end of the winter, many red knots depart from Banc d'Arguin with seemingly insufficient fuel stores to reach the German Wadden Sea non-stop, and so the birds depend on favourable wind conditions en route. However, tail winds happens to be an unpredictable 'resource'. Red knots get away with this because of a safety net in the form of (emergency) staging habitats in western France. The French intertidal areas provide a back up in years when tailwinds are rare (Chapters 4 & 5). While the French staging sites enable red knots to survive their journey (in some years more than 20% of the population make use of these sites), we still have to assess the knock-on consequences of such an additional stopover, e.g. causing delays in migration which could negatively affect the subsequent breeding season.

The main staging area during northward migration is the Schleswig-Holstein Wadden Sea where the intertidal mudflats need to provide adequate fuelling conditions to prepare for the ultimate flight north. Earlier studies described that Afro-Siberian red knots were mainly concentrated in the more southern areas along the coast of Dithmarschen, Germany, just north the river Elbe mouth. These areas offered relatively high densities of the Baltic Tellin *Macoma balthica*, the favourite prey of fuelling red knots. Though, we observed that food availability in these areas varied largely from year to year between 2006 and 2009 and was lower in the later

years (Chapter 6). Yet, longer time-series with a higher spatial resolution would be needed to assess whether food availability generally is declining. Recruitment processes may enclose cycles longer than four years, or settlement of both bivalves and worms may happen over a larger area than we could sample during this project. We also have found evidence that peregrine falcons *Falco peregrinus* that breed in the vicinity of the mudflats may affect the area used by red knots. Red knots potentially have to trade off foraging needs with safety, especially when they get close to departure and body stores make them less manoeuvrable when being attacked. This increased predation risk might have been an influential factor leading thousands of red knots to depart "ahead of schedule": Shorebirds generally depart in the evening hours. If weather conditions do not allow so, as on the evening of 3 June 2008, one would expect the birds to postpone departure to the following evening. Yet, in the morning hours of 4 June 2008, thousands of red knots and other shorebird species advanced their departed, presumably in an attempt to avoid being predated (Chapter 7).

After the breeding season the red knots return to the Banc d'Arguin. If the quality of the wintering habitat affects subsequent northward migration and breeding success, we would expect strategies that ensure that one settles at a good site. Red knots show a differential arrival at the Banc d'Arguin, with adult females returning first, followed by adult males, and juveniles arrive last. Given that in our study area at Banc d'Arguin adults and females occupy the better areas (Chapter 3), and given that they are also the first returnees, arrival timing in the wintering grounds might determine where birds settle. If timing of arrival on the wintering grounds determines winter habitat quality interesting cross-seasonal interactions may arise. Females are known to make one stopover during southward migration, but later migrating males have been notably absent at staging sites in autumn and we therefore suggest that they may advance their arrival on Banc d'Arguin by making a single non-stop journey from Siberia to Banc d'Arguin (Chapter 3). Upon arrival in the wintering grounds red knots not only have to establish themselves on a good home range, they also have to cope with changes in diet and water demands during a time of the year when it is particularly hot and when the complete feather moult is carried out. We demonstrate that, unlike earlier claims for intercontinental migrants, this is also the time of the year when most mortality takes place, and not during migration (Chapter 8). Whether this is due to intraspecific competition during settling, physiological stress or whether carry-over effects from the previous migration and breeding period remains subject to scrutiny.

Published sources identify the Schleswig-Holstein Wadden Sea as key fuelling site for northward migrating Afro-Siberian red knots. Even more so, we could confirm earlier observations that Afro-Siberian red knots tend to concentrate on the more southern parts just north of the river Elbe mouth, along the Dithmarschen coast. A rough calculation suggests that about 300,000 individuals should be seen in the Schleswig-Holstein Wadden Sea during May, yet neither could we see that many red knots, nor are they registered during the regular fortnightly high-tide counts carried out by volunteers, that cover all important sites along the German Wadden Sea coast. The fact that we don't know where the Afro-Siberian red knots are, is disturbing as conservation measures depend on the knowledge of the whereabouts of this protected species. Yet, it also reveals that our knowledge is still relatively poor and we still cannot answer some basic biological and ecological questions: maybe individual Afro-Siberian red knots have different migration strategies, and thus use different (additional?) staging sites, and/or spend a shorter time in the Wadden Sea? As in many other shorebirds species, Afro-Siberian red knot numbers are declining. If we are to protect this species, we need to implement projects that help answering these questions. Finding out where they are and where they go would be a good start.